

Results for Scheduling Benchmark Classes

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Abstract

this reposts lists results of the *tbischeduling* tool for a number of existing benchmarks on scheduling related problems. The results indicate that depending on the problem type, only a fraction of the benchmarks are solved to optimality, while good or reasonable results are obtained by CPOptimizer of IBM.

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Chapter 1

Introduction

The results are obtained by running the TestAll main routine for the different benchmark problems, selecting the necessary parameters and limits for each benchmark type.

The detailed execution time depends on many parameters that are not well controlled in the test environment, so the results should be considered with caution. Tests were run on a Windows 11 laptop using CPOptimizer 22.1.0, and CPSat 9.11, both using their Java API.

Chapter 2

Overview

The following tables compare the results of CPOptimizer and CPSat on a number of well-known benchmark problems. Note that the programs used are the generic solutions of the problems, there was no attempt to improve lower bounds, or add redundant constraints that would improve pruning for a specific problem class. As such, the results indicate "out-of-the-box" performance of the solvers.

The comparison does not attempt to compare the solutions found to the best known results, it is only intended to compare the results of the solvers considered based on the same underlying data model, running on the same hardware, with the same time limit.

Table 2.1 shows the results for the Taillard open shop problem set. All problems are solved to optimality by both solvers, given 600 seconds timeout and 4 resp. 8 threads for the solver. The results are grouped by instances classes where x/y indicate x jobs on y machines. We compare the time taken to find and prove the optimal solution based on the virtual best solution of the faster time of the solvers. For smaller instances, CPSat seems to be faster, but for larger instances CPOptimizer finds the solution more rapidly. Given that all results are obtained in atmost a few seconds on either solver, this does not seem to be a significant difference.

Table 2.1: Comparison of CPO and CPSat for Result Groups of Taillard Open-Shop Problems

| Group | Nr | All Instances | | | | Optimal Only | | Non Optimal Only | | | |
|-------|----|------------------------------|------|-------|------|----------------|--------|------------------|-------|-----------------|-------|
| | | Optimal (% of All Instances) | | | | Time (% of VB) | | Cost (% of VB) | | Bound (% of VB) | |
| | | Both | CPO | CPSat | None | CPO | CPSat | CPO | CPSat | CPO | CPSat |
| 4/4 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 639.09 | 100.00 | n/a | n/a | n/a | n/a |
| 5/5 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 217.83 | 100.00 | n/a | n/a | n/a | n/a |
| 7/7 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 206.25 | 106.99 | n/a | n/a | n/a | n/a |
| 10/10 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 119.36 | 150.15 | n/a | n/a | n/a | n/a |
| 15/15 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 | 288.65 | n/a | n/a | n/a | n/a |
| 20/20 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 114.30 | 207.41 | n/a | n/a | n/a | n/a |

Table 2.2 compares the results for the Taillard job shop problems. Only some of the problem groups are solved to optimality. For the 10/20 set, CPOptimizer proves optimality, while CPSat finds solutions which are very close to the optimal results. The bound results for 100/20 with CPSat are incorrect, and need to be recomputed.

Table 2.2: Comparison of CPO and CPSat for Result Groups of Taillard Job-Shop Problems

| Group | Nr | All Instances Optimal (% of All Instances) | | | | Optimal Only Time (% of VB) | | Non Optimal Only Cost (% of VB) | | Non Optimal Only Bound (% of VB) | |
|--------|----|---|-------|-------|--------|--------------------------------|--------|------------------------------------|--------|-------------------------------------|--------|
| | | Both | CPO | CPSat | None | CPO | CPSat | CPO | CPSat | CPO | CPSat |
| 15/15 | 10 | 90.00 | 0.00 | 0.00 | 10.00 | 105.19 | 141.18 | 100.00 | 100.00 | 97.17 | 100.00 |
| 20/15 | 10 | 20.00 | 0.00 | 0.00 | 80.00 | 267.27 | 263.20 | 100.99 | 100.05 | 98.50 | 99.93 |
| 20/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.74 | 100.06 | 97.96 | 100.00 |
| 30/15 | 10 | 10.00 | 0.00 | 10.00 | 80.00 | 174.32 | 100.00 | 100.18 | 100.49 | 99.87 | 100.00 |
| 30/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.30 | 101.30 | 99.40 | 100.00 |
| 50/15 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 100.00 | 685.09 | n/a | n/a | n/a | n/a |
| 50/20 | 10 | 10.00 | 60.00 | 0.00 | 30.00 | 100.00 | 381.38 | 100.00 | 101.60 | 100.00 | 100.00 |
| 100/20 | 10 | 10.00 | 90.00 | 0.00 | 0.00 | 100.00 | 416.13 | 100.00 | 101.73 | 100.00 | 66.81 |

Table 2.3: Comparison of CPO and CPSat for Result Groups of Taillard Flow-Shop Problems

| Group | Nr | All Instances Optimal (% of All Instances) | | | | Optimal Only Time (% of VB) | | Non Optimal Only Cost (% of VB) | | Non Optimal Only Bound (% of VB) | |
|--------|----|---|------|-------|--------|--------------------------------|--------|------------------------------------|--------|-------------------------------------|--------|
| | | Both | CPO | CPSat | None | CPO | CPSat | CPO | CPSat | CPO | CPSat |
| 20/5 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 203.99 | 101.36 | n/a | n/a | n/a | n/a |
| 20/10 | 10 | 10.00 | 0.00 | 10.00 | 80.00 | 415.20 | 100.00 | 100.54 | 100.19 | 100.00 | 98.52 |
| 20/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 102.07 | 100.19 | 100.00 | 96.83 |
| 50/5 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 317.33 | 101.91 | n/a | n/a | n/a | n/a |
| 50/10 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 103.31 | 100.00 | 100.00 | 99.49 |
| 50/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 105.18 | 100.00 | 100.00 | 99.27 |
| 100/5 | 10 | 0.00 | 0.00 | 70.00 | 30.00 | n/a | n/a | 100.49 | 100.00 | 99.98 | 99.98 |
| 100/10 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 107.11 | 100.00 | 100.00 | 99.91 |
| 100/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 107.94 | 100.00 | 100.00 | 99.76 |
| 200/10 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 108.32 | 100.00 | 100.00 | 99.97 |
| 200/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 105.86 | 100.00 | 99.98 | 99.98 |
| 500/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 106.46 | 100.00 | 52.45 | 100.00 |

Table 2.3 shows the results for the Taillard flow shop problems. Instance sets 20/5 and 50/5 are solved to optimality by both solvers, CPOptimizer finds many optimal solutions for the 100/5 sets. There are a few optimal solutions for the 20/10 set as well. Execution times for the optimal solutions seems to be significantly higher for CPSat. Comparing the non-optimal solutions, CPOptimizer consistently finds better solutions, but on average, CPSat is within 10% of the CPOptimizer result. For the bounds, CPSat often provide slightly better lower bounds, but CPOptimizer results are pretty close. Note that for the bounds, a higher value is better, so achieving 100% of the virtual best bound is better than achieving 98%.

Table 2.4 compares the results for CPOptimizer for the regular flow shop and the permutation flow shop version on the same data. The model for the permutation flow shop is not available with CPSat. A number of instances are solved to optimality with the permutation flow shop variant, but these optimal solutions typically are not optimal for the unrestricted version. In general, it is much faster to find the optimal solution for the permutation flowshop version, and perhaps surprisingly, the results for the non-optimal instances are often superior for the permutation flowshop. The bounds for the permutation flowshop are stronger, but they are not valid bounds for the unrestricted version.

Table 2.4: Comparison of CPO for Result Groups of Permutation and Unrestricted FlowShop Problems

| Group | Nr | All Instances Optimal (% of All Instances) | | | | Optimal Only Time (% of VB) | | Non Optimal Only Cost (% of VB) Bound (% of VB) | | | |
|--------|----|---|------|-------|--------|--------------------------------|--------|---|--------|-------|--------|
| | | Both | FSS | PFSS | None | FSS | PFSS | FSS | PFSS | FSS | PFSS |
| 20/5 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 188.74 | 100.00 | n/a | n/a | n/a | n/a |
| 20/10 | 10 | 20.00 | 0.00 | 50.00 | 30.00 | 212.55 | 100.00 | 100.13 | 101.25 | 96.28 | 99.90 |
| 20/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 101.33 | 98.44 | 99.87 |
| 50/5 | 10 | 100.00 | 0.00 | 0.00 | 0.00 | 494.74 | 107.07 | n/a | n/a | n/a | n/a |
| 50/10 | 10 | 0.00 | 0.00 | 10.00 | 90.00 | n/a | n/a | 100.97 | 100.02 | 99.44 | 100.00 |
| 50/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 102.96 | 100.00 | 99.27 | 100.00 |
| 100/5 | 10 | 70.00 | 0.00 | 30.00 | 0.00 | 910.13 | 100.00 | 100.22 | 100.00 | 99.83 | 100.00 |
| 100/10 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 101.47 | 100.00 | 99.75 | 100.00 |
| 100/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 104.64 | 100.00 | 99.53 | 100.00 |
| 200/10 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 102.82 | 100.00 | 99.89 | 100.00 |
| 200/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 105.11 | 100.00 | 99.62 | 100.00 |
| 500/20 | 10 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.03 | 100.70 | 99.88 | 100.00 |

Table 2.5: Comparison of CPO and CPSat for Result Groups of SALBP-1 Problems

| Group | Nr | All Instances Optimal (% of All Instances) | | | | Optimal Only Time (% of VB) | | Non Optimal Only Cost (% of VB) Bound (% of VB) | | | |
|-------|-----|---|------|-------|--------|--------------------------------|---------|---|--------|--------|--------|
| | | Both | CPO | CPSat | None | CPO | CPSat | CPO | CPSat | CPO | CPSat |
| 20 | 525 | 99.62 | 0.00 | 0.38 | 0.00 | 1363.95 | 118.02 | 100.00 | 100.00 | 82.14 | 100.00 |
| 50 | 525 | 72.38 | 0.38 | 21.71 | 5.52 | 330.66 | 2609.56 | 100.22 | 100.05 | 92.69 | 100.00 |
| 100 | 525 | 57.14 | 0.57 | 11.43 | 30.86 | 177.94 | 499.89 | 101.17 | 100.04 | 94.77 | 100.00 |
| 1000 | 525 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.05 | 101.07 | 100.00 | 73.86 |

The results for SALBP-1 in Table 2.5 were obtained with a 30 second time-out. All of the 20 task instances were solved to optimality (some only with CPSat), while 88% of the 50 task instances were solved to optimality, but only 43% were solved by both. The time taken to find the common optimal solutions varies significantly, CPSat seems on average faster on the small instances,

Table 2.6: Comparison of CPO and CPSat for Result Groups of SALBP-1 Problems Alternative

| Group | Nr | All Instances | | | | Optimal Only | | Cost (% of VB) | Non Optimal Only | | Bound (% of VB) |
|-------|-----|------------------------------|-------|-------|--------|----------------|---------|----------------|------------------|-----------------|-----------------|
| | | Optimal (% of All Instances) | None | | | Time (% of VB) | | | Cost (% of VB) | Bound (% of VB) | |
| | | Both | CPO | CPSat | | CPO | CPSat | CPO | CPSat | CPO | CPSat |
| 20 | 525 | 88.19 | 9.71 | 0.00 | 2.10 | 100.26 | 6264.35 | 100.00 | 100.00 | 99.87 | 92.41 |
| 50 | 525 | 25.90 | 35.62 | 0.00 | 38.48 | 100.17 | 2231.63 | 100.00 | 100.75 | 99.73 | 99.62 |
| 100 | 525 | 2.10 | 8.00 | 0.00 | 89.90 | 100.00 | 550.02 | 100.01 | 101.74 | 99.95 | 99.80 |
| 1000 | 386 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 100.98 | 100.00 | 99.89 |

while CPOptimizer is faster on a larger instances, but this does not hold for all instances. For the non-optimal solutions, solution quality seems very evenly balanced.

The results for the test scheduling case study are shown in Table 2.7. Very likely the 30 second timeout is too small for the large problem instances. Optimal solutions are found by both solvers for the smaller instance sizes, CPO does find some optimal solutions even for large problem sizes. Solution quality for up to 100 tasks is very close, while results for CPSat on the 500 task problems is disappointing compared to the CPO results. Already for 100 tasks, the time needed to find the optimal solutions is much higher for CPSat, the results may improve if more time is given for both solvers.

Table 2.8 compares CPO and CPSat for the Hybrid flexible flow shop problem of the factory design case study. For the smaller problem sizes, up to 40 jobs, both system offer comparable solution quality, with significantly high run times for CPSat. Starting from the 50 job problem instances, but especially for the large 300 and 400 job problems, the solution quality of CPO is much better. Optimal solutions are found by both system up to size 30, CPSat finds more optimal solutions for the smaller problems, and CPO finds more optimal solution for larger instances (up to size 50).

While the results for CPO are clearly superior to the ones for CPSat for the 500 task problem instances, the given lower bound is very poor for CPO.

Note that there is a single 300 job instance 300.2 for which CPSat did not find any solution within the timeout, so only 24 instances are compared.

The results for the single mode RCPSP problems do not use consistent settings, the smaller (j30 and j60) instances are run with a 600 seconds timeout, the j90 instances with a 30 seconds, and the j120 instances with a 60 second timeout. These larger instances should be rerun with a 600 seconds timeout, but that will require several days of CPU time.

Overall, the results are similar to other problem sets. For all instance sets, both CPO and SPSat find and prove optimal solutions, 100% for J30 instances, 90% for j60 instances, 80% for j90 instances, but only 45% for j120 instances. While the times for the j30 instances are comparable, the overall time for the larger instances is significantly higher for CPSat. Detailed results shows that many instances are solved by both solvers in less than a second, the differences arise from relatively few instances that take much longer in CPSat, while there are only few instances where CPO takes longer than CPSat.

For all non-optimal solutions, the solution quality obtained by both solvers within the timeout is nearly identical, with a very slight advantage for CPO for both solutions found and lower bound calculated.

Table 2.7: Comparison of CPO and CPSat for Result Groups of Test Scheduling Problems

| Group | Nr | All Instances Optimal (% of All Instances) | | | | Optimal Only Time (% of VB) | | Cost (% of VB) | | Non Optimal Only Bound (% of VB) | |
|------------|----|---|-------|-------|--------|--------------------------------|---------|----------------|--------|-------------------------------------|--------|
| | | Both | CPO | CPSat | None | CPO | CPSat | CPO | CPSat | CPO | CPSat |
| 20/10/3 | 20 | 90.00 | 0.00 | 5.00 | 5.00 | 393.93 | 133.28 | 100.00 | 100.00 | 92.00 | 100.00 |
| 20/10/5 | 20 | 100.00 | 0.00 | 0.00 | 0.00 | 294.88 | 117.68 | n/a | n/a | n/a | n/a |
| 20/10/10 | 20 | 95.00 | 0.00 | 0.00 | 5.00 | 501.45 | 107.85 | 100.00 | 100.00 | 100.00 | 100.00 |
| 30/10/3 | 20 | 95.00 | 0.00 | 0.00 | 5.00 | 100.48 | 183.16 | 100.08 | 100.00 | 100.00 | 100.00 |
| 30/10/5 | 20 | 90.00 | 0.00 | 5.00 | 5.00 | 100.00 | 205.76 | 100.00 | 100.00 | 89.37 | 100.00 |
| 30/10/10 | 20 | 70.00 | 0.00 | 15.00 | 15.00 | 382.57 | 104.61 | 100.01 | 100.00 | 93.29 | 100.00 |
| 30/20/3 | 20 | 95.00 | 0.00 | 5.00 | 0.00 | 205.53 | 144.45 | 100.00 | 100.00 | 97.45 | 100.00 |
| 30/20/5 | 20 | 90.00 | 0.00 | 10.00 | 0.00 | 229.19 | 132.32 | 100.00 | 100.00 | 88.36 | 100.00 |
| 30/20/10 | 20 | 60.00 | 0.00 | 30.00 | 10.00 | 439.18 | 104.94 | 100.00 | 100.00 | 89.44 | 100.00 |
| 40/10/3 | 20 | 85.00 | 0.00 | 0.00 | 15.00 | 104.79 | 280.75 | 100.02 | 100.02 | 100.00 | 100.00 |
| 40/10/5 | 20 | 90.00 | 0.00 | 5.00 | 5.00 | 194.05 | 150.11 | 100.00 | 100.00 | 98.22 | 100.00 |
| 40/10/10 | 20 | 70.00 | 0.00 | 20.00 | 10.00 | 231.87 | 109.84 | 100.00 | 100.00 | 93.80 | 100.00 |
| 40/20/3 | 20 | 100.00 | 0.00 | 0.00 | 0.00 | 100.19 | 172.54 | n/a | n/a | n/a | n/a |
| 40/20/5 | 20 | 75.00 | 0.00 | 20.00 | 5.00 | 154.81 | 109.98 | 100.00 | 100.00 | 95.30 | 100.00 |
| 40/20/10 | 20 | 50.00 | 0.00 | 35.00 | 15.00 | 285.15 | 106.26 | 100.00 | 100.00 | 92.51 | 100.00 |
| 50/10/3 | 20 | 85.00 | 0.00 | 0.00 | 15.00 | 466.49 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 50/10/5 | 20 | 45.00 | 0.00 | 10.00 | 45.00 | 682.15 | 100.00 | 100.00 | 100.00 | 99.31 | 100.00 |
| 50/10/10 | 20 | 15.00 | 0.00 | 30.00 | 55.00 | 1381.55 | 100.00 | 100.00 | 100.00 | 98.26 | 100.00 |
| 50/20/3 | 20 | 90.00 | 0.00 | 10.00 | 0.00 | 726.25 | 100.00 | 100.00 | 100.00 | 94.42 | 100.00 |
| 50/20/5 | 20 | 60.00 | 0.00 | 0.00 | 40.00 | 573.69 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 50/20/10 | 20 | 35.00 | 0.00 | 10.00 | 55.00 | 671.58 | 100.00 | 100.00 | 100.00 | 94.08 | 100.00 |
| 100/10/3 | 20 | 90.00 | 0.00 | 0.00 | 10.00 | 100.00 | 1998.93 | 100.00 | 100.00 | 100.00 | 100.00 |
| 100/10/5 | 20 | 45.00 | 5.00 | 0.00 | 50.00 | 100.00 | 1105.69 | 100.00 | 100.14 | 100.00 | 100.00 |
| 100/10/10 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 100.23 | 100.00 | 100.00 |
| 100/20/3 | 20 | 85.00 | 0.00 | 0.00 | 15.00 | 100.00 | 1552.40 | 100.00 | 100.12 | 100.00 | 100.00 |
| 100/20/5 | 20 | 35.00 | 15.00 | 0.00 | 50.00 | 100.00 | 2147.25 | 100.00 | 100.75 | 100.00 | 100.00 |
| 100/20/10 | 20 | 5.00 | 0.00 | 0.00 | 95.00 | 100.00 | 903.53 | 100.00 | 100.83 | 100.00 | 100.00 |
| 100/50/3 | 20 | 80.00 | 10.00 | 0.00 | 10.00 | 100.00 | 1410.06 | 100.00 | 100.78 | 100.00 | 100.00 |
| 100/50/5 | 20 | 45.00 | 10.00 | 0.00 | 45.00 | 100.00 | 805.32 | 100.00 | 100.11 | 100.00 | 100.00 |
| 100/50/10 | 20 | 10.00 | 5.00 | 0.00 | 85.00 | 100.00 | 1260.03 | 100.00 | 100.63 | 100.00 | 100.00 |
| 500/10/3 | 20 | 0.00 | 5.00 | 0.00 | 95.00 | n/a | n/a | 100.00 | 227.86 | 16.72 | 100.00 |
| 500/10/5 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 226.47 | 2.06 | 100.00 |
| 500/10/10 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 226.89 | 27.57 | 100.00 |
| 500/20/3 | 20 | 0.00 | 20.00 | 0.00 | 80.00 | n/a | n/a | 100.00 | 224.93 | 22.74 | 100.00 |
| 500/20/5 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 230.90 | 2.03 | 100.00 |
| 500/20/10 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 235.16 | 2.25 | 100.00 |
| 500/50/3 | 20 | 0.00 | 5.00 | 0.00 | 95.00 | n/a | n/a | 100.00 | 234.08 | 7.58 | 100.00 |
| 500/50/5 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 240.48 | 2.09 | 100.00 |
| 500/50/10 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 241.28 | 2.31 | 100.00 |
| 500/100/3 | 20 | 0.00 | 10.00 | 0.00 | 90.00 | n/a | n/a | 100.00 | 247.90 | 12.28 | 100.00 |
| 500/100/5 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 251.03 | 2.11 | 100.00 |
| 500/100/10 | 20 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 239.37 | 2.24 | 100.00 |

Table 2.8: Comparison of CPO and CPSat for Result Groups of Factory Design Problems

| Group | Nr | All Instances Optimal (% of All Instances) | | | | Optimal Only Time (% of VB) | | Cost (% of VB) | | Non Optimal Only Bound (% of VB) | |
|-------|----|---|-------|-------|--------|--------------------------------|---------|----------------|--------|-------------------------------------|--------|
| | | Both | CPO | CPSat | None | CPO | CPSat | CPO | CPSat | CPO | CPSat |
| 20 | 25 | 76.00 | 0.00 | 20.00 | 4.00 | 100.00 | 580.71 | 100.00 | 100.00 | 96.52 | 100.00 |
| 25 | 25 | 80.00 | 0.00 | 8.00 | 12.00 | 101.65 | 238.02 | 100.00 | 100.37 | 97.67 | 100.00 |
| 30 | 25 | 60.00 | 0.00 | 4.00 | 36.00 | 100.35 | 264.69 | 100.18 | 101.05 | 100.00 | 100.00 |
| 40 | 25 | 4.00 | 16.00 | 0.00 | 80.00 | 100.00 | 2554.03 | 100.00 | 104.68 | 100.00 | 100.00 |
| 50 | 25 | 0.00 | 4.00 | 0.00 | 96.00 | n/a | n/a | 100.00 | 107.87 | 100.00 | 100.00 |
| 100 | 25 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 120.43 | 100.00 | 100.00 |
| 200 | 25 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 188.60 | 100.00 | 100.00 |
| 300 | 24 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 263.22 | 100.00 | 100.00 |
| 400 | 25 | 0.00 | 0.00 | 0.00 | 100.00 | n/a | n/a | 100.00 | 246.34 | 100.00 | 100.00 |

Table 2.9: Comparison of CPO and CPSat for Results of RCPSP

| Group | Nr | All Instances | | | | Optimal Only | | Non Optimal Only | | | |
|-------|-----|------------------------------|------|-------|-------|----------------|--------|------------------|--------|-----------------|-------|
| | | Optimal (% of All Instances) | | | | Time (% of VB) | | Cost (% of VB) | | Bound (% of VB) | |
| | | Both | CPO | CPSat | None | CPO | CPSat | CPO | CPSat | CPO | CPSat |
| 30 | 480 | 100.00 | 0.00 | 0.00 | 0.00 | 200.13 | 166.70 | n/a | n/a | n/a | n/a |
| 60 | 480 | 89.58 | 0.00 | 1.04 | 9.38 | 109.84 | 358.74 | 100.20 | 100.45 | 98.89 | 98.66 |
| 90 | 480 | 80.21 | 0.00 | 0.63 | 19.17 | 108.11 | 332.72 | 100.34 | 101.13 | 99.76 | 99.19 |
| 120 | 600 | 44.83 | 0.33 | 0.50 | 54.33 | 111.75 | 444.15 | 100.20 | 101.30 | 99.78 | 98.45 |

Chapter 3

Taillard Open Shop Problems

All problems are solved to optimality, possibly due to their small to moderate size.

3.1 Results for CPOptimizer

Table 3.1: Results for Taillard Openshop (CPO) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|---------|------|----------|---------|----------------|
| tai10 10 0.json | 10 | 10 | Optimal | 0.45 | 637 | 637.00 | 0.00 |
| tai10 10 1.json | 10 | 10 | Optimal | 0.06 | 588 | 588.00 | 0.00 |
| tai10 10 2.json | 10 | 10 | Optimal | 0.27 | 598 | 598.00 | 0.00 |
| tai10 10 3.json | 10 | 10 | Optimal | 0.05 | 577 | 577.00 | 0.00 |
| tai10 10 4.json | 10 | 10 | Optimal | 0.05 | 640 | 640.00 | 0.00 |
| tai10 10 5.json | 10 | 10 | Optimal | 0.04 | 538 | 538.00 | 0.00 |
| tai10 10 6.json | 10 | 10 | Optimal | 0.06 | 616 | 616.00 | 0.00 |
| tai10 10 7.json | 10 | 10 | Optimal | 0.11 | 595 | 595.00 | 0.00 |
| tai10 10 8.json | 10 | 10 | Optimal | 0.05 | 595 | 595.00 | 0.00 |
| tai10 10 9.json | 10 | 10 | Optimal | 0.08 | 596 | 596.00 | 0.00 |
| tai15 15 0.json | 15 | 15 | Optimal | 0.11 | 937 | 937.00 | 0.00 |
| tai15 15 1.json | 15 | 15 | Optimal | 0.11 | 918 | 918.00 | 0.00 |
| tai15 15 2.json | 15 | 15 | Optimal | 0.08 | 871 | 871.00 | 0.00 |
| tai15 15 3.json | 15 | 15 | Optimal | 0.13 | 934 | 934.00 | 0.00 |
| tai15 15 4.json | 15 | 15 | Optimal | 0.09 | 946 | 946.00 | 0.00 |
| tai15 15 5.json | 15 | 15 | Optimal | 0.08 | 933 | 933.00 | 0.00 |
| tai15 15 6.json | 15 | 15 | Optimal | 0.16 | 891 | 891.00 | 0.00 |
| tai15 15 7.json | 15 | 15 | Optimal | 0.13 | 893 | 893.00 | 0.00 |
| tai15 15 8.json | 15 | 15 | Optimal | 0.28 | 899 | 899.00 | 0.00 |
| tai15 15 9.json | 15 | 15 | Optimal | 0.17 | 902 | 902.00 | 0.00 |
| tai20 20 0.json | 20 | 20 | Optimal | 0.35 | 1155 | 1155.00 | 0.00 |

Table 3.1: Results for Taillard Openshop (CPO) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|---------|------|----------|---------|----------------|
| tai20 20 1.json | 20 | 20 | Optimal | 1.00 | 1241 | 1241.00 | 0.00 |
| tai20 20 2.json | 20 | 20 | Optimal | 0.56 | 1257 | 1257.00 | 0.00 |
| tai20 20 3.json | 20 | 20 | Optimal | 0.25 | 1248 | 1248.00 | 0.00 |
| tai20 20 4.json | 20 | 20 | Optimal | 0.19 | 1256 | 1256.00 | 0.00 |
| tai20 20 5.json | 20 | 20 | Optimal | 0.16 | 1204 | 1204.00 | 0.00 |
| tai20 20 6.json | 20 | 20 | Optimal | 0.66 | 1294 | 1294.00 | 0.00 |
| tai20 20 7.json | 20 | 20 | Optimal | 1.18 | 1169 | 1169.00 | 0.00 |
| tai20 20 8.json | 20 | 20 | Optimal | 0.17 | 1289 | 1289.00 | 0.00 |
| tai20 20 9.json | 20 | 20 | Optimal | 0.17 | 1241 | 1241.00 | 0.00 |
| tai4 4 0.json | 4 | 4 | Optimal | 0.13 | 193 | 193.00 | 0.00 |
| tai4 4 1.json | 4 | 4 | Optimal | 0.11 | 236 | 236.00 | 0.00 |
| tai4 4 2.json | 4 | 4 | Optimal | 0.08 | 271 | 271.00 | 0.00 |
| tai4 4 3.json | 4 | 4 | Optimal | 0.15 | 250 | 250.00 | 0.00 |
| tai4 4 4.json | 4 | 4 | Optimal | 0.17 | 295 | 295.00 | 0.00 |
| tai4 4 5.json | 4 | 4 | Optimal | 0.05 | 189 | 189.00 | 0.00 |
| tai4 4 6.json | 4 | 4 | Optimal | 0.10 | 201 | 201.00 | 0.00 |
| tai4 4 7.json | 4 | 4 | Optimal | 0.05 | 217 | 217.00 | 0.00 |
| tai4 4 8.json | 4 | 4 | Optimal | 0.13 | 261 | 261.00 | 0.00 |
| tai4 4 9.json | 4 | 4 | Optimal | 0.12 | 217 | 217.00 | 0.00 |
| tai5 5 0.json | 5 | 5 | Optimal | 0.18 | 300 | 300.00 | 0.00 |
| tai5 5 1.json | 5 | 5 | Optimal | 0.16 | 262 | 262.00 | 0.00 |
| tai5 5 2.json | 5 | 5 | Optimal | 0.20 | 323 | 323.00 | 0.00 |
| tai5 5 3.json | 5 | 5 | Optimal | 0.17 | 310 | 310.00 | 0.00 |
| tai5 5 4.json | 5 | 5 | Optimal | 0.27 | 326 | 326.00 | 0.00 |
| tai5 5 5.json | 5 | 5 | Optimal | 0.16 | 312 | 312.00 | 0.00 |
| tai5 5 6.json | 5 | 5 | Optimal | 0.21 | 303 | 303.00 | 0.00 |
| tai5 5 7.json | 5 | 5 | Optimal | 0.25 | 300 | 300.00 | 0.00 |
| tai5 5 8.json | 5 | 5 | Optimal | 0.17 | 353 | 353.00 | 0.00 |
| tai5 5 9.json | 5 | 5 | Optimal | 0.25 | 326 | 326.00 | 0.00 |
| tai7 7 0.json | 7 | 7 | Optimal | 0.03 | 435 | 435.00 | 0.00 |
| tai7 7 1.json | 7 | 7 | Optimal | 0.12 | 443 | 443.00 | 0.00 |
| tai7 7 2.json | 7 | 7 | Optimal | 0.31 | 468 | 468.00 | 0.00 |
| tai7 7 3.json | 7 | 7 | Optimal | 0.03 | 463 | 463.00 | 0.00 |
| tai7 7 4.json | 7 | 7 | Optimal | 0.03 | 416 | 416.00 | 0.00 |
| tai7 7 5.json | 7 | 7 | Optimal | 0.80 | 451 | 451.00 | 0.00 |
| tai7 7 6.json | 7 | 7 | Optimal | 1.10 | 422 | 422.00 | 0.00 |
| tai7 7 7.json | 7 | 7 | Optimal | 0.05 | 424 | 424.00 | 0.00 |
| tai7 7 8.json | 7 | 7 | Optimal | 0.09 | 458 | 458.00 | 0.00 |
| tai7 7 9.json | 7 | 7 | Optimal | 0.06 | 398 | 398.00 | 0.00 |

3.2 Results for CPSat

Table 3.2: Results for Taillard Openshop (CPSat) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|---------|------|----------|-------|----------------|
| tai10 10 0.json | 10 | 10 | Optimal | 0.37 | 637 | 0.00 | 0.00 |
| tai10 10 1.json | 10 | 10 | Optimal | 0.07 | 588 | 0.00 | 0.00 |
| tai10 10 2.json | 10 | 10 | Optimal | 0.16 | 598 | 0.00 | 0.00 |
| tai10 10 3.json | 10 | 10 | Optimal | 0.09 | 577 | 0.00 | 0.00 |
| tai10 10 4.json | 10 | 10 | Optimal | 0.20 | 640 | 0.00 | 0.00 |
| tai10 10 5.json | 10 | 10 | Optimal | 0.13 | 538 | 0.00 | 0.00 |
| tai10 10 6.json | 10 | 10 | Optimal | 0.10 | 616 | 0.00 | 0.00 |
| tai10 10 7.json | 10 | 10 | Optimal | 0.17 | 595 | 0.00 | 0.00 |
| tai10 10 8.json | 10 | 10 | Optimal | 0.11 | 595 | 0.00 | 0.00 |
| tai10 10 9.json | 10 | 10 | Optimal | 0.14 | 596 | 0.00 | 0.00 |
| tai15 15 0.json | 15 | 15 | Optimal | 0.31 | 937 | 0.00 | 0.00 |
| tai15 15 1.json | 15 | 15 | Optimal | 0.45 | 918 | 0.00 | 0.00 |
| tai15 15 2.json | 15 | 15 | Optimal | 0.17 | 871 | 0.00 | 0.00 |
| tai15 15 3.json | 15 | 15 | Optimal | 0.17 | 934 | 0.00 | 0.00 |
| tai15 15 4.json | 15 | 15 | Optimal | 0.27 | 946 | 0.00 | 0.00 |
| tai15 15 5.json | 15 | 15 | Optimal | 0.25 | 933 | 0.00 | 0.00 |
| tai15 15 6.json | 15 | 15 | Optimal | 0.25 | 891 | 0.00 | 0.00 |
| tai15 15 7.json | 15 | 15 | Optimal | 0.32 | 893 | 0.00 | 0.00 |
| tai15 15 8.json | 15 | 15 | Optimal | 1.27 | 899 | 0.00 | 0.00 |
| tai15 15 9.json | 15 | 15 | Optimal | 0.38 | 902 | 0.00 | 0.00 |
| tai20 20 0.json | 20 | 20 | Optimal | 1.01 | 1155 | 0.00 | 0.00 |
| tai20 20 1.json | 20 | 20 | Optimal | 2.44 | 1241 | 0.00 | 0.00 |
| tai20 20 2.json | 20 | 20 | Optimal | 0.12 | 1257 | 0.00 | 0.00 |
| tai20 20 3.json | 20 | 20 | Optimal | 0.35 | 1248 | 0.00 | 0.00 |
| tai20 20 4.json | 20 | 20 | Optimal | 0.40 | 1256 | 0.00 | 0.00 |
| tai20 20 5.json | 20 | 20 | Optimal | 0.62 | 1204 | 0.00 | 0.00 |
| tai20 20 6.json | 20 | 20 | Optimal | 0.52 | 1294 | 0.00 | 0.00 |
| tai20 20 7.json | 20 | 20 | Optimal | 2.13 | 1169 | 0.00 | 0.00 |
| tai20 20 8.json | 20 | 20 | Optimal | 0.26 | 1289 | 0.00 | 0.00 |
| tai20 20 9.json | 20 | 20 | Optimal | 0.65 | 1241 | 0.00 | 0.00 |
| tai4 4 0.json | 4 | 4 | Optimal | 0.02 | 193 | 0.00 | 0.00 |
| tai4 4 1.json | 4 | 4 | Optimal | 0.03 | 236 | 0.00 | 0.00 |
| tai4 4 2.json | 4 | 4 | Optimal | 0.01 | 271 | 0.00 | 0.00 |
| tai4 4 3.json | 4 | 4 | Optimal | 0.01 | 250 | 0.00 | 0.00 |
| tai4 4 4.json | 4 | 4 | Optimal | 0.03 | 295 | 0.00 | 0.00 |
| tai4 4 5.json | 4 | 4 | Optimal | 0.01 | 189 | 0.00 | 0.00 |
| tai4 4 6.json | 4 | 4 | Optimal | 0.01 | 201 | 0.00 | 0.00 |
| tai4 4 7.json | 4 | 4 | Optimal | 0.01 | 217 | 0.00 | 0.00 |
| tai4 4 8.json | 4 | 4 | Optimal | 0.01 | 261 | 0.00 | 0.00 |
| tai4 4 9.json | 4 | 4 | Optimal | 0.01 | 217 | 0.00 | 0.00 |
| tai5 5 0.json | 5 | 5 | Optimal | 0.06 | 300 | 0.00 | 0.00 |
| tai5 5 1.json | 5 | 5 | Optimal | 0.04 | 262 | 0.00 | 0.00 |
| tai5 5 2.json | 5 | 5 | Optimal | 0.12 | 323 | 0.00 | 0.00 |
| tai5 5 3.json | 5 | 5 | Optimal | 0.07 | 310 | 0.00 | 0.00 |
| tai5 5 4.json | 5 | 5 | Optimal | 0.16 | 326 | 0.00 | 0.00 |

Table 3.2: Results for Taillard Openshop (CPSat) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| tai5 5 5.json | 5 | 5 | Optimal | 0.07 | 312 | 0.00 | 0.00 |
| tai5 5 6.json | 5 | 5 | Optimal | 0.09 | 303 | 0.00 | 0.00 |
| tai5 5 7.json | 5 | 5 | Optimal | 0.11 | 300 | 0.00 | 0.00 |
| tai5 5 8.json | 5 | 5 | Optimal | 0.11 | 353 | 0.00 | 0.00 |
| tai5 5 9.json | 5 | 5 | Optimal | 0.11 | 326 | 0.00 | 0.00 |
| tai7 7 0.json | 7 | 7 | Optimal | 0.06 | 435 | 0.00 | 0.00 |
| tai7 7 1.json | 7 | 7 | Optimal | 0.11 | 443 | 0.00 | 0.00 |
| tai7 7 2.json | 7 | 7 | Optimal | 0.15 | 468 | 0.00 | 0.00 |
| tai7 7 3.json | 7 | 7 | Optimal | 0.06 | 463 | 0.00 | 0.00 |
| tai7 7 4.json | 7 | 7 | Optimal | 0.05 | 416 | 0.00 | 0.00 |
| tai7 7 5.json | 7 | 7 | Optimal | 0.48 | 451 | 0.00 | 0.00 |
| tai7 7 6.json | 7 | 7 | Optimal | 0.29 | 422 | 0.00 | 0.00 |
| tai7 7 7.json | 7 | 7 | Optimal | 0.04 | 424 | 0.00 | 0.00 |
| tai7 7 8.json | 7 | 7 | Optimal | 0.05 | 458 | 0.00 | 0.00 |
| tai7 7 9.json | 7 | 7 | Optimal | 0.08 | 398 | 0.00 | 0.00 |

3.3 Results for Chuffed

Table 3.3: Results for Taillard Openshop (Chuffed) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|-------|----------|-------|----------------|
| tai10 10 0.json | 10 | 10 | Solution | 30.37 | 3333 | 0.00 | 100.00 |
| tai10 10 1.json | 10 | 10 | Solution | 30.15 | 3044 | 0.00 | 100.00 |
| tai10 10 2.json | 10 | 10 | Solution | 30.16 | 3375 | 0.00 | 100.00 |
| tai10 10 3.json | 10 | 10 | Solution | 30.16 | 2922 | 0.00 | 100.00 |
| tai10 10 4.json | 10 | 10 | Solution | 30.64 | 3155 | 0.00 | 100.00 |
| tai10 10 5.json | 10 | 10 | Solution | 30.16 | 2777 | 0.00 | 100.00 |
| tai10 10 6.json | 10 | 10 | Solution | 30.73 | 3085 | 0.00 | 100.00 |
| tai10 10 7.json | 10 | 10 | Solution | 30.35 | 2814 | 0.00 | 100.00 |
| tai10 10 8.json | 10 | 10 | Solution | 30.48 | 2275 | 0.00 | 100.00 |
| tai10 10 9.json | 10 | 10 | Solution | 30.32 | 2539 | 0.00 | 100.00 |
| tai15 15 0.json | 15 | 15 | Solution | 31.03 | 8625 | 0.00 | 100.00 |
| tai15 15 1.json | 15 | 15 | Solution | 31.04 | 8960 | 0.00 | 100.00 |
| tai15 15 2.json | 15 | 15 | Solution | 31.05 | 8472 | 0.00 | 100.00 |
| tai15 15 3.json | 15 | 15 | Solution | 30.50 | 9134 | 0.00 | 100.00 |
| tai15 15 4.json | 15 | 15 | Solution | 30.30 | 8257 | 0.00 | 100.00 |
| tai15 15 5.json | 15 | 15 | Solution | 31.04 | 8782 | 0.00 | 100.00 |
| tai15 15 6.json | 15 | 15 | Solution | 31.03 | 8325 | 0.00 | 100.00 |
| tai15 15 7.json | 15 | 15 | Solution | 31.03 | 9288 | 0.00 | 100.00 |
| tai15 15 8.json | 15 | 15 | Solution | 30.31 | 8785 | 0.00 | 100.00 |
| tai15 15 9.json | 15 | 15 | Solution | 30.42 | 9097 | 0.00 | 100.00 |

Table 3.3: Results for Taillard Openshop (Chuffed) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|-------|----------|-------|----------------|
| tai20 20 0.json | 20 | 20 | Solution | 30.69 | 14845 | 0.00 | 100.00 |
| tai20 20 1.json | 20 | 20 | Solution | 31.04 | 16520 | 0.00 | 100.00 |
| tai20 20 2.json | 20 | 20 | Solution | 31.03 | 16782 | 0.00 | 100.00 |
| tai20 20 3.json | 20 | 20 | Solution | 30.62 | 15893 | 0.00 | 100.00 |
| tai20 20 4.json | 20 | 20 | Solution | 30.70 | 15745 | 0.00 | 100.00 |
| tai20 20 5.json | 20 | 20 | Solution | 31.04 | 16048 | 0.00 | 100.00 |
| tai20 20 6.json | 20 | 20 | Solution | 31.04 | 16680 | 0.00 | 100.00 |
| tai20 20 7.json | 20 | 20 | Solution | 31.05 | 16067 | 0.00 | 100.00 |
| tai20 20 8.json | 20 | 20 | Solution | 31.04 | 16624 | 0.00 | 100.00 |
| tai20 20 9.json | 20 | 20 | Solution | 31.04 | 16896 | 0.00 | 100.00 |
| tai4 4 0.json | 4 | 4 | Optimal | 0.44 | 193 | 0.00 | 100.00 |
| tai4 4 1.json | 4 | 4 | Optimal | 0.56 | 236 | 0.00 | 100.00 |
| tai4 4 2.json | 4 | 4 | Optimal | 0.52 | 271 | 0.00 | 100.00 |
| tai4 4 3.json | 4 | 4 | Optimal | 0.43 | 250 | 0.00 | 100.00 |
| tai4 4 4.json | 4 | 4 | Optimal | 0.87 | 295 | 0.00 | 100.00 |
| tai4 4 5.json | 4 | 4 | Optimal | 0.40 | 189 | 0.00 | 100.00 |
| tai4 4 6.json | 4 | 4 | Optimal | 0.42 | 201 | 0.00 | 100.00 |
| tai4 4 7.json | 4 | 4 | Optimal | 0.57 | 217 | 0.00 | 100.00 |
| tai4 4 8.json | 4 | 4 | Optimal | 0.64 | 261 | 0.00 | 100.00 |
| tai4 4 9.json | 4 | 4 | Optimal | 0.54 | 217 | 0.00 | 100.00 |
| tai5 5 0.json | 5 | 5 | Optimal | 1.44 | 300 | 0.00 | 100.00 |
| tai5 5 1.json | 5 | 5 | Optimal | 1.03 | 262 | 0.00 | 100.00 |
| tai5 5 2.json | 5 | 5 | Optimal | 2.80 | 323 | 0.00 | 100.00 |
| tai5 5 3.json | 5 | 5 | Optimal | 2.06 | 310 | 0.00 | 100.00 |
| tai5 5 4.json | 5 | 5 | Optimal | 2.21 | 326 | 0.00 | 100.00 |
| tai5 5 5.json | 5 | 5 | Optimal | 2.21 | 312 | 0.00 | 100.00 |
| tai5 5 6.json | 5 | 5 | Optimal | 1.48 | 303 | 0.00 | 100.00 |
| tai5 5 7.json | 5 | 5 | Optimal | 1.94 | 300 | 0.00 | 100.00 |
| tai5 5 8.json | 5 | 5 | Optimal | 2.21 | 353 | 0.00 | 100.00 |
| tai5 5 9.json | 5 | 5 | Optimal | 1.71 | 326 | 0.00 | 100.00 |
| tai7 7 0.json | 7 | 7 | Optimal | 12.46 | 435 | 0.00 | 100.00 |
| tai7 7 1.json | 7 | 7 | Optimal | 12.38 | 443 | 0.00 | 100.00 |
| tai7 7 2.json | 7 | 7 | Optimal | 17.21 | 468 | 0.00 | 100.00 |
| tai7 7 3.json | 7 | 7 | Optimal | 14.84 | 463 | 0.00 | 100.00 |
| tai7 7 4.json | 7 | 7 | Optimal | 10.79 | 416 | 0.00 | 100.00 |
| tai7 7 5.json | 7 | 7 | Optimal | 27.90 | 451 | 0.00 | 100.00 |
| tai7 7 6.json | 7 | 7 | Optimal | 15.15 | 422 | 0.00 | 100.00 |
| tai7 7 7.json | 7 | 7 | Optimal | 18.88 | 424 | 0.00 | 100.00 |
| tai7 7 8.json | 7 | 7 | Optimal | 15.63 | 458 | 0.00 | 100.00 |
| tai7 7 9.json | 7 | 7 | Optimal | 9.90 | 398 | 0.00 | 100.00 |

3.4 Results for Cplex

Table 3.4: Results for Taillard Openshop (Cplex) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|----------|----------|-------|----------------|
| tai10 10 0.json | 10 | 10 | Solution | 30.07 | 686 | 0.00 | 100.00 |
| tai10 10 1.json | 10 | 10 | Solution | 30.06 | 588 | 0.00 | 100.00 |
| tai10 10 2.json | 10 | 10 | Solution | 30.05 | 609 | 0.00 | 100.00 |
| tai10 10 3.json | 10 | 10 | Solution | 30.08 | 581 | 0.00 | 100.00 |
| tai10 10 4.json | 10 | 10 | Solution | 30.05 | 680 | 0.00 | 100.00 |
| tai10 10 5.json | 10 | 10 | Solution | 30.07 | 555 | 0.00 | 100.00 |
| tai10 10 6.json | 10 | 10 | Solution | 30.05 | 620 | 0.00 | 100.00 |
| tai10 10 7.json | 10 | 10 | Solution | 30.06 | 599 | 0.00 | 100.00 |
| tai10 10 8.json | 10 | 10 | Solution | 30.04 | 595 | 0.00 | 100.00 |
| tai10 10 9.json | 10 | 10 | Solution | 30.07 | 602 | 0.00 | 100.00 |
| tai15 15 0.json | 15 | 15 | Solution | 30.16 | 1401 | 0.00 | 100.00 |
| tai15 15 1.json | 15 | 15 | Solution | 30.13 | 1419 | 0.00 | 100.00 |
| tai15 15 2.json | 15 | 15 | Solution | 30.18 | 1224 | 0.00 | 100.00 |
| tai15 15 3.json | 15 | 15 | Solution | 30.18 | 1189 | 0.00 | 100.00 |
| tai15 15 4.json | 15 | 15 | Solution | 30.17 | 1290 | 0.00 | 100.00 |
| tai15 15 5.json | 15 | 15 | Solution | 30.15 | 1226 | 0.00 | 100.00 |
| tai15 15 6.json | 15 | 15 | Solution | 30.14 | 1261 | 0.00 | 100.00 |
| tai15 15 7.json | 15 | 15 | Solution | 30.12 | 1223 | 0.00 | 100.00 |
| tai15 15 8.json | 15 | 15 | Solution | 30.15 | 1296 | 0.00 | 100.00 |
| tai15 15 9.json | 15 | 15 | Solution | 30.16 | 1263 | 0.00 | 100.00 |
| tai20 20 0.json | 20 | 20 | Solution | 30.27 | 4464 | 0.00 | 100.00 |
| tai20 20 1.json | 20 | 20 | Solution | 30.29 | 5450 | 0.00 | 100.00 |
| tai20 20 2.json | 20 | 20 | Solution | 30.29 | 5121 | 0.00 | 100.00 |
| tai20 20 3.json | 20 | 20 | Unknown | 30254.00 | - | - | - |
| tai20 20 4.json | 20 | 20 | Unknown | 30253.00 | - | - | - |
| tai20 20 5.json | 20 | 20 | Solution | 30.29 | 3377 | 0.00 | 100.00 |
| tai20 20 6.json | 20 | 20 | Solution | 30.28 | 5160 | 0.00 | 100.00 |
| tai20 20 7.json | 20 | 20 | Unknown | 30257.00 | - | - | - |
| tai20 20 8.json | 20 | 20 | Solution | 30.28 | 4701 | 0.00 | 100.00 |
| tai20 20 9.json | 20 | 20 | Solution | 30.27 | 3399 | 0.00 | 100.00 |
| tai4 4 0.json | 4 | 4 | Optimal | 0.29 | 193 | 0.00 | 100.00 |
| tai4 4 1.json | 4 | 4 | Optimal | 0.31 | 236 | 0.00 | 100.00 |
| tai4 4 2.json | 4 | 4 | Optimal | 0.30 | 271 | 0.00 | 100.00 |
| tai4 4 3.json | 4 | 4 | Optimal | 0.32 | 250 | 0.00 | 100.00 |
| tai4 4 4.json | 4 | 4 | Optimal | 0.34 | 295 | 0.00 | 100.00 |
| tai4 4 5.json | 4 | 4 | Optimal | 0.29 | 189 | 0.00 | 100.00 |
| tai4 4 6.json | 4 | 4 | Optimal | 0.30 | 201 | 0.00 | 100.00 |
| tai4 4 7.json | 4 | 4 | Optimal | 0.30 | 217 | 0.00 | 100.00 |
| tai4 4 8.json | 4 | 4 | Optimal | 0.30 | 261 | 0.00 | 100.00 |
| tai4 4 9.json | 4 | 4 | Optimal | 0.30 | 217 | 0.00 | 100.00 |
| tai5 5 0.json | 5 | 5 | Optimal | 0.53 | 300 | 0.00 | 100.00 |
| tai5 5 1.json | 5 | 5 | Optimal | 0.45 | 262 | 0.00 | 100.00 |
| tai5 5 2.json | 5 | 5 | Optimal | 0.67 | 323 | 0.00 | 100.00 |
| tai5 5 3.json | 5 | 5 | Optimal | 0.60 | 310 | 0.00 | 100.00 |
| tai5 5 4.json | 5 | 5 | Optimal | 0.63 | 326 | 0.00 | 100.00 |

Table 3.4: Results for Taillard Openshop (Cplex) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|-------|----------------|
| tai5 5 5.json | 5 | 5 | Optimal | 0.63 | 312 | 0.00 | 100.00 |
| tai5 5 6.json | 5 | 5 | Optimal | 0.64 | 303 | 0.00 | 100.00 |
| tai5 5 7.json | 5 | 5 | Optimal | 0.62 | 300 | 0.00 | 100.00 |
| tai5 5 8.json | 5 | 5 | Optimal | 0.68 | 353 | 0.00 | 100.00 |
| tai5 5 9.json | 5 | 5 | Optimal | 0.56 | 326 | 0.00 | 100.00 |
| tai7 7 0.json | 7 | 7 | Solution | 30.03 | 435 | 0.00 | 100.00 |
| tai7 7 1.json | 7 | 7 | Solution | 30.04 | 443 | 0.00 | 100.00 |
| tai7 7 2.json | 7 | 7 | Optimal | 9.33 | 468 | 0.00 | 100.00 |
| tai7 7 3.json | 7 | 7 | Optimal | 13.96 | 463 | 0.00 | 100.00 |
| tai7 7 4.json | 7 | 7 | Optimal | 20.11 | 416 | 0.00 | 100.00 |
| tai7 7 5.json | 7 | 7 | Solution | 30.03 | 451 | 0.00 | 100.00 |
| tai7 7 6.json | 7 | 7 | Solution | 30.02 | 422 | 0.00 | 100.00 |
| tai7 7 7.json | 7 | 7 | Solution | 30.03 | 424 | 0.00 | 100.00 |
| tai7 7 8.json | 7 | 7 | Solution | 30.03 | 458 | 0.00 | 100.00 |
| tai7 7 9.json | 7 | 7 | Optimal | 4.62 | 398 | 0.00 | 100.00 |

3.5 Results for MiniZinc CPSat

Table 3.5: Results for Taillard Openshop (MiniZinc CPSat) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|---------|------|----------|-------|----------------|
| tai10 10 0.json | 10 | 10 | Optimal | 0.86 | 637 | 0.00 | 100.00 |
| tai10 10 1.json | 10 | 10 | Optimal | 0.33 | 588 | 0.00 | 100.00 |
| tai10 10 2.json | 10 | 10 | Optimal | 0.42 | 598 | 0.00 | 100.00 |
| tai10 10 3.json | 10 | 10 | Optimal | 0.34 | 577 | 0.00 | 100.00 |
| tai10 10 4.json | 10 | 10 | Optimal | 0.51 | 640 | 0.00 | 100.00 |
| tai10 10 5.json | 10 | 10 | Optimal | 0.34 | 538 | 0.00 | 100.00 |
| tai10 10 6.json | 10 | 10 | Optimal | 0.38 | 616 | 0.00 | 100.00 |
| tai10 10 7.json | 10 | 10 | Optimal | 0.41 | 595 | 0.00 | 100.00 |
| tai10 10 8.json | 10 | 10 | Optimal | 0.39 | 595 | 0.00 | 100.00 |
| tai10 10 9.json | 10 | 10 | Optimal | 0.40 | 596 | 0.00 | 100.00 |
| tai15 15 0.json | 15 | 15 | Optimal | 0.55 | 937 | 0.00 | 100.00 |
| tai15 15 1.json | 15 | 15 | Optimal | 0.56 | 918 | 0.00 | 100.00 |
| tai15 15 2.json | 15 | 15 | Optimal | 0.41 | 871 | 0.00 | 100.00 |
| tai15 15 3.json | 15 | 15 | Optimal | 0.46 | 934 | 0.00 | 100.00 |
| tai15 15 4.json | 15 | 15 | Optimal | 0.61 | 946 | 0.00 | 100.00 |
| tai15 15 5.json | 15 | 15 | Optimal | 0.67 | 933 | 0.00 | 100.00 |
| tai15 15 6.json | 15 | 15 | Optimal | 0.70 | 891 | 0.00 | 100.00 |
| tai15 15 7.json | 15 | 15 | Optimal | 0.55 | 893 | 0.00 | 100.00 |
| tai15 15 8.json | 15 | 15 | Optimal | 0.87 | 899 | 0.00 | 100.00 |

Table 3.5: Results for Taillard Openshop (MiniZinc CPSat) (60 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|---------|------|----------|-------|----------------|
| tai15 15 9.json | 15 | 15 | Optimal | 0.69 | 902 | 0.00 | 100.00 |
| tai20 20 0.json | 20 | 20 | Optimal | 1.35 | 1155 | 0.00 | 100.00 |
| tai20 20 1.json | 20 | 20 | Optimal | 1.89 | 1241 | 0.00 | 100.00 |
| tai20 20 2.json | 20 | 20 | Optimal | 0.50 | 1257 | 0.00 | 100.00 |
| tai20 20 3.json | 20 | 20 | Optimal | 0.69 | 1248 | 0.00 | 100.00 |
| tai20 20 4.json | 20 | 20 | Optimal | 0.78 | 1256 | 0.00 | 100.00 |
| tai20 20 5.json | 20 | 20 | Optimal | 1.14 | 1204 | 0.00 | 100.00 |
| tai20 20 6.json | 20 | 20 | Optimal | 1.02 | 1294 | 0.00 | 100.00 |
| tai20 20 7.json | 20 | 20 | Optimal | 4.83 | 1169 | 0.00 | 100.00 |
| tai20 20 8.json | 20 | 20 | Optimal | 0.48 | 1289 | 0.00 | 100.00 |
| tai20 20 9.json | 20 | 20 | Optimal | 0.84 | 1241 | 0.00 | 100.00 |
| tai4 4 0.json | 4 | 4 | Optimal | 0.28 | 193 | 0.00 | 100.00 |
| tai4 4 1.json | 4 | 4 | Optimal | 0.28 | 236 | 0.00 | 100.00 |
| tai4 4 2.json | 4 | 4 | Optimal | 0.26 | 271 | 0.00 | 100.00 |
| tai4 4 3.json | 4 | 4 | Optimal | 0.28 | 250 | 0.00 | 100.00 |
| tai4 4 4.json | 4 | 4 | Optimal | 0.28 | 295 | 0.00 | 100.00 |
| tai4 4 5.json | 4 | 4 | Optimal | 0.26 | 189 | 0.00 | 100.00 |
| tai4 4 6.json | 4 | 4 | Optimal | 0.26 | 201 | 0.00 | 100.00 |
| tai4 4 7.json | 4 | 4 | Optimal | 0.27 | 217 | 0.00 | 100.00 |
| tai4 4 8.json | 4 | 4 | Optimal | 0.28 | 261 | 0.00 | 100.00 |
| tai4 4 9.json | 4 | 4 | Optimal | 0.28 | 217 | 0.00 | 100.00 |
| tai5 5 0.json | 5 | 5 | Optimal | 0.33 | 300 | 0.00 | 100.00 |
| tai5 5 1.json | 5 | 5 | Optimal | 0.36 | 262 | 0.00 | 100.00 |
| tai5 5 2.json | 5 | 5 | Optimal | 0.35 | 323 | 0.00 | 100.00 |
| tai5 5 3.json | 5 | 5 | Optimal | 0.36 | 310 | 0.00 | 100.00 |
| tai5 5 4.json | 5 | 5 | Optimal | 0.39 | 326 | 0.00 | 100.00 |
| tai5 5 5.json | 5 | 5 | Optimal | 0.33 | 312 | 0.00 | 100.00 |
| tai5 5 6.json | 5 | 5 | Optimal | 0.35 | 303 | 0.00 | 100.00 |
| tai5 5 7.json | 5 | 5 | Optimal | 0.36 | 300 | 0.00 | 100.00 |
| tai5 5 8.json | 5 | 5 | Optimal | 0.38 | 353 | 0.00 | 100.00 |
| tai5 5 9.json | 5 | 5 | Optimal | 0.36 | 326 | 0.00 | 100.00 |
| tai7 7 0.json | 7 | 7 | Optimal | 0.36 | 435 | 0.00 | 100.00 |
| tai7 7 1.json | 7 | 7 | Optimal | 0.37 | 443 | 0.00 | 100.00 |
| tai7 7 2.json | 7 | 7 | Optimal | 0.44 | 468 | 0.00 | 100.00 |
| tai7 7 3.json | 7 | 7 | Optimal | 0.32 | 463 | 0.00 | 100.00 |
| tai7 7 4.json | 7 | 7 | Optimal | 0.33 | 416 | 0.00 | 100.00 |
| tai7 7 5.json | 7 | 7 | Optimal | 0.81 | 451 | 0.00 | 100.00 |
| tai7 7 6.json | 7 | 7 | Optimal | 0.41 | 422 | 0.00 | 100.00 |
| tai7 7 7.json | 7 | 7 | Optimal | 0.37 | 424 | 0.00 | 100.00 |
| tai7 7 8.json | 7 | 7 | Optimal | 0.33 | 458 | 0.00 | 100.00 |
| tai7 7 9.json | 7 | 7 | Optimal | 0.32 | 398 | 0.00 | 100.00 |

Chapter 4

Taillard Job Shop Problems

The results are rather confusing, as some smaller problems cannot be solved to optimality, while complete groups of larger instances can. The number of jobs clearly is not the only indicator of difficulty of these problems.

4.1 Results for CPOptimizer

Table 4.1: Results for Taillard Jobshop (CPO) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai100 20 0.json | 100 | 20 | Optimal | 444.79 | 5464 | 5464.00 | 0.00 |
| tai100 20 1.json | 100 | 20 | Optimal | 129.42 | 5181 | 5181.00 | 0.00 |
| tai100 20 2.json | 100 | 20 | Optimal | 127.22 | 5568 | 5568.00 | 0.00 |
| tai100 20 3.json | 100 | 20 | Optimal | 63.90 | 5339 | 5339.00 | 0.00 |
| tai100 20 4.json | 100 | 20 | Optimal | 224.02 | 5392 | 5392.00 | 0.00 |
| tai100 20 5.json | 100 | 20 | Optimal | 199.92 | 5342 | 5342.00 | 0.00 |
| tai100 20 6.json | 100 | 20 | Optimal | 76.52 | 5436 | 5436.00 | 0.00 |
| tai100 20 7.json | 100 | 20 | Optimal | 251.01 | 5394 | 5394.00 | 0.00 |
| tai100 20 8.json | 100 | 20 | Optimal | 108.09 | 5358 | 5358.00 | 0.00 |
| tai100 20 9.json | 100 | 20 | Optimal | 458.28 | 5183 | 5183.00 | 0.00 |
| tai15 15 0.json | 15 | 15 | Optimal | 8.67 | 1231 | 1231.00 | 0.00 |
| tai15 15 1.json | 15 | 15 | Optimal | 38.99 | 1244 | 1244.00 | 0.00 |
| tai15 15 2.json | 15 | 15 | Optimal | 22.16 | 1218 | 1218.00 | 0.00 |
| tai15 15 3.json | 15 | 15 | Optimal | 26.67 | 1175 | 1175.00 | 0.00 |
| tai15 15 4.json | 15 | 15 | Optimal | 180.42 | 1224 | 1224.00 | 0.00 |
| tai15 15 5.json | 15 | 15 | Solution | 600.02 | 1238 | 1168.00 | 5.65 |
| tai15 15 6.json | 15 | 15 | Optimal | 97.97 | 1227 | 1227.00 | 0.00 |
| tai15 15 7.json | 15 | 15 | Optimal | 117.59 | 1217 | 1217.00 | 0.00 |
| tai15 15 8.json | 15 | 15 | Optimal | 133.02 | 1274 | 1274.00 | 0.00 |
| tai15 15 9.json | 15 | 15 | Optimal | 39.26 | 1241 | 1241.00 | 0.00 |
| tai20 15 0.json | 20 | 15 | Solution | 600.02 | 1393 | 1310.00 | 5.96 |
| tai20 15 1.json | 20 | 15 | Solution | 600.02 | 1373 | 1316.00 | 4.15 |
| tai20 15 2.json | 20 | 15 | Solution | 600.02 | 1360 | 1243.00 | 8.60 |

Table 4.1: Results for Taillard Jobshop (CPO) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai20 15 3.json | 20 | 15 | Optimal | 113.40 | 1345 | 1345.00 | 0.00 |
| tai20 15 4.json | 20 | 15 | Solution | 600.02 | 1373 | 1268.00 | 7.65 |
| tai20 15 5.json | 20 | 15 | Solution | 600.02 | 1378 | 1302.00 | 5.52 |
| tai20 15 6.json | 20 | 15 | Optimal | 52.56 | 1462 | 1462.00 | 0.00 |
| tai20 15 7.json | 20 | 15 | Solution | 600.04 | 1425 | 1358.00 | 4.70 |
| tai20 15 8.json | 20 | 15 | Solution | 600.02 | 1366 | 1257.00 | 7.98 |
| tai20 15 9.json | 20 | 15 | Solution | 600.02 | 1360 | 1300.00 | 4.41 |
| tai20 20 0.json | 20 | 20 | Solution | 600.03 | 1687 | 1508.00 | 10.61 |
| tai20 20 1.json | 20 | 20 | Solution | 600.02 | 1651 | 1468.00 | 11.08 |
| tai20 20 2.json | 20 | 20 | Solution | 600.02 | 1561 | 1461.00 | 6.41 |
| tai20 20 3.json | 20 | 20 | Solution | 600.03 | 1650 | 1595.00 | 3.33 |
| tai20 20 4.json | 20 | 20 | Solution | 600.02 | 1619 | 1520.00 | 6.11 |
| tai20 20 5.json | 20 | 20 | Solution | 600.02 | 1676 | 1502.00 | 10.38 |
| tai20 20 6.json | 20 | 20 | Solution | 600.03 | 1694 | 1619.00 | 4.43 |
| tai20 20 7.json | 20 | 20 | Solution | 600.02 | 1614 | 1561.00 | 3.28 |
| tai20 20 8.json | 20 | 20 | Solution | 600.02 | 1642 | 1518.00 | 7.55 |
| tai20 20 9.json | 20 | 20 | Solution | 600.03 | 1640 | 1424.00 | 13.17 |
| tai30 15 0.json | 30 | 15 | Solution | 600.03 | 1766 | 1764.00 | 0.11 |
| tai30 15 1.json | 30 | 15 | Solution | 600.02 | 1845 | 1774.00 | 3.85 |
| tai30 15 2.json | 30 | 15 | Solution | 600.03 | 1842 | 1774.00 | 3.69 |
| tai30 15 3.json | 30 | 15 | Solution | 600.03 | 1846 | 1828.00 | 0.98 |
| tai30 15 4.json | 30 | 15 | Optimal | 17.38 | 2007 | 2007.00 | 0.00 |
| tai30 15 5.json | 30 | 15 | Solution | 600.03 | 1825 | 1819.00 | 0.33 |
| tai30 15 6.json | 30 | 15 | Solution | 600.02 | 1791 | 1771.00 | 1.12 |
| tai30 15 7.json | 30 | 15 | Solution | 600.03 | 1690 | 1673.00 | 1.01 |
| tai30 15 8.json | 30 | 15 | Solution | 600.03 | 1821 | 1795.00 | 1.43 |
| tai30 15 9.json | 30 | 15 | Solution | 600.03 | 1740 | 1631.00 | 6.26 |
| tai30 20 0.json | 30 | 20 | Solution | 600.04 | 2061 | 1857.00 | 9.90 |
| tai30 20 1.json | 30 | 20 | Solution | 600.04 | 2001 | 1867.00 | 6.70 |
| tai30 20 2.json | 30 | 20 | Solution | 600.04 | 1889 | 1809.00 | 4.24 |
| tai30 20 3.json | 30 | 20 | Solution | 600.03 | 2027 | 1923.00 | 5.13 |
| tai30 20 4.json | 30 | 20 | Solution | 600.04 | 2037 | 1996.00 | 2.01 |
| tai30 20 5.json | 30 | 20 | Solution | 600.03 | 2095 | 1940.00 | 7.40 |
| tai30 20 6.json | 30 | 20 | Solution | 600.04 | 1959 | 1781.00 | 9.09 |
| tai30 20 7.json | 30 | 20 | Solution | 600.04 | 1991 | 1905.00 | 4.32 |
| tai30 20 8.json | 30 | 20 | Solution | 600.03 | 2027 | 1903.00 | 6.12 |
| tai30 20 9.json | 30 | 20 | Solution | 600.01 | 2009 | 1806.00 | 10.10 |
| tai50 15 0.json | 50 | 15 | Optimal | 51.18 | 2760 | 2760.00 | 0.00 |
| tai50 15 1.json | 50 | 15 | Optimal | 25.88 | 2756 | 2756.00 | 0.00 |
| tai50 15 2.json | 50 | 15 | Optimal | 22.48 | 2717 | 2717.00 | 0.00 |
| tai50 15 3.json | 50 | 15 | Optimal | 12.41 | 2839 | 2839.00 | 0.00 |
| tai50 15 4.json | 50 | 15 | Optimal | 56.78 | 2679 | 2679.00 | 0.00 |
| tai50 15 5.json | 50 | 15 | Optimal | 17.82 | 2781 | 2781.00 | 0.00 |
| tai50 15 6.json | 50 | 15 | Optimal | 20.21 | 2943 | 2943.00 | 0.00 |
| tai50 15 7.json | 50 | 15 | Optimal | 10.34 | 2885 | 2885.00 | 0.00 |

Table 4.1: Results for Taillard Jobshop (CPO) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai50 15 8.json | 50 | 15 | Optimal | 65.13 | 2655 | 2655.00 | 0.00 |
| tai50 15 9.json | 50 | 15 | Optimal | 15.40 | 2723 | 2723.00 | 0.00 |
| tai50 20 0.json | 50 | 20 | Optimal | 82.49 | 2868 | 2868.00 | 0.00 |
| tai50 20 1.json | 50 | 20 | Solution | 600.10 | 2901 | 2869.00 | 1.10 |
| tai50 20 2.json | 50 | 20 | Optimal | 436.81 | 2755 | 2755.00 | 0.00 |
| tai50 20 3.json | 50 | 20 | Optimal | 250.89 | 2702 | 2702.00 | 0.00 |
| tai50 20 4.json | 50 | 20 | Optimal | 500.55 | 2725 | 2725.00 | 0.00 |
| tai50 20 5.json | 50 | 20 | Solution | 600.10 | 2881 | 2845.00 | 1.25 |
| tai50 20 6.json | 50 | 20 | Solution | 600.11 | 2826 | 2825.00 | 0.04 |
| tai50 20 7.json | 50 | 20 | Optimal | 164.25 | 2784 | 2784.00 | 0.00 |
| tai50 20 8.json | 50 | 20 | Optimal | 79.35 | 3071 | 3071.00 | 0.00 |
| tai50 20 9.json | 50 | 20 | Optimal | 386.69 | 2995 | 2995.00 | 0.00 |

4.2 Results for CPSat

Table 4.2: Results for Taillard Jobshop (CPSat) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai100 20 0.json | 100 | 20 | Solution | 600.17 | 5616 | 3654.00 | 34.94 |
| tai100 20 1.json | 100 | 20 | Solution | 600.30 | 5282 | 3437.00 | 34.93 |
| tai100 20 2.json | 100 | 20 | Optimal | 529.40 | 5568 | 5568.00 | 0.00 |
| tai100 20 3.json | 100 | 20 | Solution | 600.19 | 5356 | 3514.00 | 34.39 |
| tai100 20 4.json | 100 | 20 | Solution | 600.18 | 5656 | 3629.00 | 35.84 |
| tai100 20 5.json | 100 | 20 | Solution | 600.17 | 5411 | 3554.00 | 34.32 |
| tai100 20 6.json | 100 | 20 | Solution | 600.20 | 5473 | 3513.00 | 35.81 |
| tai100 20 7.json | 100 | 20 | Solution | 600.22 | 5431 | 3639.00 | 33.00 |
| tai100 20 8.json | 100 | 20 | Solution | 601.09 | 5409 | 3610.00 | 33.26 |
| tai100 20 9.json | 100 | 20 | Solution | 600.37 | 5288 | 3577.00 | 32.36 |
| tai15 15 0.json | 15 | 15 | Optimal | 5.32 | 1231 | 1231.00 | 0.00 |
| tai15 15 1.json | 15 | 15 | Optimal | 44.73 | 1244 | 1244.00 | 0.00 |
| tai15 15 2.json | 15 | 15 | Optimal | 18.76 | 1218 | 1218.00 | 0.00 |
| tai15 15 3.json | 15 | 15 | Optimal | 19.12 | 1175 | 1175.00 | 0.00 |
| tai15 15 4.json | 15 | 15 | Optimal | 216.74 | 1224 | 1224.00 | 0.00 |
| tai15 15 5.json | 15 | 15 | Solution | 600.10 | 1238 | 1202.00 | 2.91 |
| tai15 15 6.json | 15 | 15 | Optimal | 246.22 | 1227 | 1227.00 | 0.00 |
| tai15 15 7.json | 15 | 15 | Optimal | 186.11 | 1217 | 1217.00 | 0.00 |
| tai15 15 8.json | 15 | 15 | Optimal | 134.40 | 1274 | 1274.00 | 0.00 |
| tai15 15 9.json | 15 | 15 | Optimal | 20.74 | 1241 | 1241.00 | 0.00 |
| tai20 15 0.json | 20 | 15 | Solution | 600.11 | 1368 | 1309.00 | 4.31 |
| tai20 15 1.json | 20 | 15 | Solution | 600.10 | 1379 | 1351.00 | 2.03 |
| tai20 15 2.json | 20 | 15 | Solution | 600.10 | 1356 | 1277.00 | 5.83 |

Table 4.2: Results for Taillard Jobshop (CPSat) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai20 15 3.json | 20 | 15 | Optimal | 9.54 | 1345 | 1345.00 | 0.00 |
| tai20 15 4.json | 20 | 15 | Solution | 600.13 | 1355 | 1301.00 | 3.99 |
| tai20 15 5.json | 20 | 15 | Solution | 600.27 | 1360 | 1296.00 | 4.71 |
| tai20 15 6.json | 20 | 15 | Optimal | 153.89 | 1462 | 1462.00 | 0.00 |
| tai20 15 7.json | 20 | 15 | Solution | 600.09 | 1417 | 1359.00 | 4.09 |
| tai20 15 8.json | 20 | 15 | Solution | 600.29 | 1336 | 1297.00 | 2.92 |
| tai20 15 9.json | 20 | 15 | Solution | 600.10 | 1355 | 1315.00 | 2.95 |
| tai20 20 0.json | 20 | 20 | Solution | 600.08 | 1666 | 1572.00 | 5.64 |
| tai20 20 1.json | 20 | 20 | Solution | 600.09 | 1630 | 1524.00 | 6.50 |
| tai20 20 2.json | 20 | 20 | Solution | 600.21 | 1565 | 1491.00 | 4.73 |
| tai20 20 3.json | 20 | 20 | Solution | 600.13 | 1647 | 1611.00 | 2.19 |
| tai20 20 4.json | 20 | 20 | Solution | 600.09 | 1598 | 1524.00 | 4.63 |
| tai20 20 5.json | 20 | 20 | Solution | 600.15 | 1663 | 1557.00 | 6.37 |
| tai20 20 6.json | 20 | 20 | Solution | 600.15 | 1700 | 1621.00 | 4.65 |
| tai20 20 7.json | 20 | 20 | Solution | 600.11 | 1614 | 1585.00 | 1.80 |
| tai20 20 8.json | 20 | 20 | Solution | 600.10 | 1640 | 1529.00 | 6.77 |
| tai20 20 9.json | 20 | 20 | Solution | 600.11 | 1600 | 1478.00 | 7.63 |
| tai30 15 0.json | 30 | 15 | Solution | 600.11 | 1778 | 1764.00 | 0.79 |
| tai30 15 1.json | 30 | 15 | Solution | 600.20 | 1851 | 1774.00 | 4.16 |
| tai30 15 2.json | 30 | 15 | Solution | 600.15 | 1842 | 1783.00 | 3.20 |
| tai30 15 3.json | 30 | 15 | Solution | 600.11 | 1866 | 1828.00 | 2.04 |
| tai30 15 4.json | 30 | 15 | Optimal | 9.97 | 2007 | 2007.00 | 0.00 |
| tai30 15 5.json | 30 | 15 | Solution | 600.20 | 1828 | 1819.00 | 0.49 |
| tai30 15 6.json | 30 | 15 | Solution | 600.12 | 1815 | 1771.00 | 2.42 |
| tai30 15 7.json | 30 | 15 | Solution | 600.11 | 1704 | 1673.00 | 1.82 |
| tai30 15 8.json | 30 | 15 | Optimal | 370.42 | 1795 | 1795.00 | 0.00 |
| tai30 15 9.json | 30 | 15 | Solution | 600.09 | 1737 | 1642.00 | 5.47 |
| tai30 20 0.json | 30 | 20 | Solution | 600.13 | 2127 | 1889.00 | 11.19 |
| tai30 20 1.json | 30 | 20 | Solution | 600.13 | 2019 | 1873.00 | 7.23 |
| tai30 20 2.json | 30 | 20 | Solution | 600.12 | 1926 | 1809.00 | 6.07 |
| tai30 20 3.json | 30 | 20 | Solution | 600.10 | 2051 | 1936.00 | 5.61 |
| tai30 20 4.json | 30 | 20 | Solution | 600.12 | 2100 | 1997.00 | 4.90 |
| tai30 20 5.json | 30 | 20 | Solution | 600.10 | 2053 | 1943.00 | 5.36 |
| tai30 20 6.json | 30 | 20 | Solution | 600.11 | 1979 | 1797.00 | 9.20 |
| tai30 20 7.json | 30 | 20 | Solution | 600.12 | 2001 | 1912.00 | 4.45 |
| tai30 20 8.json | 30 | 20 | Solution | 600.13 | 2050 | 1926.00 | 6.05 |
| tai30 20 9.json | 30 | 20 | Solution | 600.11 | 1991 | 1819.00 | 8.64 |
| tai50 15 0.json | 50 | 15 | Optimal | 186.33 | 2760 | 2760.00 | 0.00 |
| tai50 15 1.json | 50 | 15 | Optimal | 155.63 | 2756 | 2756.00 | 0.00 |
| tai50 15 2.json | 50 | 15 | Optimal | 68.58 | 2717 | 2717.00 | 0.00 |
| tai50 15 3.json | 50 | 15 | Optimal | 26.60 | 2839 | 2839.00 | 0.00 |
| tai50 15 4.json | 50 | 15 | Optimal | 362.73 | 2679 | 2679.00 | 0.00 |
| tai50 15 5.json | 50 | 15 | Optimal | 249.56 | 2781 | 2781.00 | 0.00 |
| tai50 15 6.json | 50 | 15 | Optimal | 120.38 | 2943 | 2943.00 | 0.00 |
| tai50 15 7.json | 50 | 15 | Optimal | 216.50 | 2885 | 2885.00 | 0.00 |

Table 4.2: Results for Taillard Jobshop (CPSat) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai50 15 8.json | 50 | 15 | Optimal | 435.42 | 2655 | 2655.00 | 0.00 |
| tai50 15 9.json | 50 | 15 | Optimal | 217.29 | 2723 | 2723.00 | 0.00 |
| tai50 20 0.json | 50 | 20 | Solution | 600.15 | 2881 | 2868.00 | 0.45 |
| tai50 20 1.json | 50 | 20 | Solution | 600.22 | 2981 | 2869.00 | 3.76 |
| tai50 20 2.json | 50 | 20 | Solution | 600.31 | 2797 | 2755.00 | 1.50 |
| tai50 20 3.json | 50 | 20 | Solution | 600.19 | 2738 | 2702.00 | 1.31 |
| tai50 20 4.json | 50 | 20 | Solution | 600.18 | 2805 | 2725.00 | 2.85 |
| tai50 20 5.json | 50 | 20 | Solution | 600.24 | 2895 | 2845.00 | 1.73 |
| tai50 20 6.json | 50 | 20 | Solution | 600.16 | 2872 | 2825.00 | 1.64 |
| tai50 20 7.json | 50 | 20 | Solution | 600.19 | 2829 | 2784.00 | 1.59 |
| tai50 20 8.json | 50 | 20 | Optimal | 302.62 | 3071 | 3071.00 | 0.00 |
| tai50 20 9.json | 50 | 20 | Solution | 600.25 | 3046 | 2995.00 | 1.67 |

4.3 Results for Chuffed

Table 4.3: Results for Taillard Jobshop (Chuffed) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|-------|----------|-------|----------------|
| tai100 20 0.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 1.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 2.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 3.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 4.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 5.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 6.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 7.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 8.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai100 20 9.json | 100 | 20 | Unknown | 0.00 | - | - | - |
| tai15 15 0.json | 15 | 15 | Solution | 31.03 | 9418 | 0.00 | 100.00 |
| tai15 15 1.json | 15 | 15 | Solution | 30.23 | 8797 | 0.00 | 100.00 |
| tai15 15 2.json | 15 | 15 | Solution | 30.71 | 9156 | 0.00 | 100.00 |
| tai15 15 3.json | 15 | 15 | Solution | 30.31 | 8304 | 0.00 | 100.00 |
| tai15 15 4.json | 15 | 15 | Solution | 31.04 | 9176 | 0.00 | 100.00 |
| tai15 15 5.json | 15 | 15 | Solution | 31.03 | 8914 | 0.00 | 100.00 |
| tai15 15 6.json | 15 | 15 | Solution | 30.33 | 8194 | 0.00 | 100.00 |
| tai15 15 7.json | 15 | 15 | Solution | 31.05 | 8770 | 0.00 | 100.00 |
| tai15 15 8.json | 15 | 15 | Solution | 31.03 | 9923 | 0.00 | 100.00 |
| tai15 15 9.json | 15 | 15 | Solution | 30.68 | 8035 | 0.00 | 100.00 |
| tai20 15 0.json | 20 | 15 | Solution | 30.32 | 10811 | 0.00 | 100.00 |
| tai20 15 1.json | 20 | 15 | Solution | 31.04 | 12768 | 0.00 | 100.00 |
| tai20 15 2.json | 20 | 15 | Solution | 30.35 | 11324 | 0.00 | 100.00 |

Table 4.3: Results for Taillard Jobshop (Chuffed) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|-------|----------|-------|----------------|
| tai20 15 3.json | 20 | 15 | Solution | 30.30 | 11721 | 0.00 | 100.00 |
| tai20 15 4.json | 20 | 15 | Solution | 31.05 | 11651 | 0.00 | 100.00 |
| tai20 15 5.json | 20 | 15 | Solution | 31.05 | 12945 | 0.00 | 100.00 |
| tai20 15 6.json | 20 | 15 | Solution | 30.92 | 11955 | 0.00 | 100.00 |
| tai20 15 7.json | 20 | 15 | Solution | 30.73 | 12108 | 0.00 | 100.00 |
| tai20 15 8.json | 20 | 15 | Solution | 30.84 | 11810 | 0.00 | 100.00 |
| tai20 15 9.json | 20 | 15 | Solution | 30.64 | 12143 | 0.00 | 100.00 |
| tai20 20 0.json | 20 | 20 | Solution | 31.05 | 16156 | 0.00 | 100.00 |
| tai20 20 1.json | 20 | 20 | Solution | 31.05 | 16929 | 0.00 | 100.00 |
| tai20 20 2.json | 20 | 20 | Solution | 31.05 | 16304 | 0.00 | 100.00 |
| tai20 20 3.json | 20 | 20 | Solution | 30.50 | 16037 | 0.00 | 100.00 |
| tai20 20 4.json | 20 | 20 | Solution | 30.74 | 15175 | 0.00 | 100.00 |
| tai20 20 5.json | 20 | 20 | Solution | 31.05 | 17266 | 0.00 | 100.00 |
| tai20 20 6.json | 20 | 20 | Solution | 31.04 | 17621 | 0.00 | 100.00 |
| tai20 20 7.json | 20 | 20 | Solution | 31.05 | 15773 | 0.00 | 100.00 |
| tai20 20 8.json | 20 | 20 | Solution | 31.05 | 17547 | 0.00 | 100.00 |
| tai20 20 9.json | 20 | 20 | Solution | 31.05 | 16171 | 0.00 | 100.00 |
| tai30 15 0.json | 30 | 15 | Solution | 30.55 | 17886 | 0.00 | 100.00 |
| tai30 15 1.json | 30 | 15 | Solution | 30.74 | 18875 | 0.00 | 100.00 |
| tai30 15 2.json | 30 | 15 | Solution | 31.06 | 18545 | 0.00 | 100.00 |
| tai30 15 3.json | 30 | 15 | Solution | 30.57 | 17846 | 0.00 | 100.00 |
| tai30 15 4.json | 30 | 15 | Solution | 31.05 | 17984 | 0.00 | 100.00 |
| tai30 15 5.json | 30 | 15 | Solution | 30.52 | 18289 | 0.00 | 100.00 |
| tai30 15 6.json | 30 | 15 | Solution | 30.54 | 18281 | 0.00 | 100.00 |
| tai30 15 7.json | 30 | 15 | Solution | 31.05 | 17162 | 0.00 | 100.00 |
| tai30 15 8.json | 30 | 15 | Solution | 31.05 | 15933 | 0.00 | 100.00 |
| tai30 15 9.json | 30 | 15 | Solution | 30.65 | 17342 | 0.00 | 100.00 |
| tai30 20 0.json | 30 | 20 | Solution | 30.71 | 25752 | 0.00 | 100.00 |
| tai30 20 1.json | 30 | 20 | Solution | 31.07 | 25464 | 0.00 | 100.00 |
| tai30 20 2.json | 30 | 20 | Solution | 30.72 | 23352 | 0.00 | 100.00 |
| tai30 20 3.json | 30 | 20 | Solution | 31.07 | 22755 | 0.00 | 100.00 |
| tai30 20 4.json | 30 | 20 | Solution | 30.90 | 25207 | 0.00 | 100.00 |
| tai30 20 5.json | 30 | 20 | Solution | 31.06 | 25193 | 0.00 | 100.00 |
| tai30 20 6.json | 30 | 20 | Solution | 30.71 | 23771 | 0.00 | 100.00 |
| tai30 20 7.json | 30 | 20 | Solution | 31.06 | 23737 | 0.00 | 100.00 |
| tai30 20 8.json | 30 | 20 | Solution | 31.06 | 24001 | 0.00 | 100.00 |
| tai30 20 9.json | 30 | 20 | Solution | 31.07 | 25025 | 0.00 | 100.00 |
| tai50 15 0.json | 50 | 15 | Solution | 31.06 | 30383 | 0.00 | 100.00 |
| tai50 15 1.json | 50 | 15 | Solution | 31.07 | 30234 | 0.00 | 100.00 |
| tai50 15 2.json | 50 | 15 | Solution | 31.07 | 27935 | 0.00 | 100.00 |
| tai50 15 3.json | 50 | 15 | Solution | 31.06 | 27740 | 0.00 | 100.00 |
| tai50 15 4.json | 50 | 15 | Solution | 31.07 | 28759 | 0.00 | 100.00 |
| tai50 15 5.json | 50 | 15 | Solution | 31.06 | 30548 | 0.00 | 100.00 |
| tai50 15 6.json | 50 | 15 | Solution | 31.07 | 30818 | 0.00 | 100.00 |
| tai50 15 7.json | 50 | 15 | Solution | 31.08 | 31225 | 0.00 | 100.00 |

Table 4.3: Results for Taillard Jobshop (Chuffed) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|-------|----------|-------|----------------|
| tai50 15 8.json | 50 | 15 | Solution | 31.08 | 29536 | 0.00 | 100.00 |
| tai50 15 9.json | 50 | 15 | Solution | 31.07 | 30233 | 0.00 | 100.00 |
| tai50 20 0.json | 50 | 20 | Solution | 31.08 | 40459 | 0.00 | 100.00 |
| tai50 20 1.json | 50 | 20 | Solution | 31.09 | 43188 | 0.00 | 100.00 |
| tai50 20 2.json | 50 | 20 | Solution | 31.09 | 41135 | 0.00 | 100.00 |
| tai50 20 3.json | 50 | 20 | Solution | 31.08 | 40216 | 0.00 | 100.00 |
| tai50 20 4.json | 50 | 20 | Solution | 31.08 | 40058 | 0.00 | 100.00 |
| tai50 20 5.json | 50 | 20 | Solution | 31.08 | 40644 | 0.00 | 100.00 |
| tai50 20 6.json | 50 | 20 | Solution | 31.08 | 40272 | 0.00 | 100.00 |
| tai50 20 7.json | 50 | 20 | Solution | 31.08 | 39736 | 0.00 | 100.00 |
| tai50 20 8.json | 50 | 20 | Solution | 31.09 | 41170 | 0.00 | 100.00 |
| tai50 20 9.json | 50 | 20 | Solution | 31.09 | 41424 | 0.00 | 100.00 |

4.4 Results for Cplex

Table 4.4: Results for Taillard Jobshop (Cplex) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|-------|----------|-------|----------------|
| tai100 20 0.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 1.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 2.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 3.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 4.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 5.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 6.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 7.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 8.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai100 20 9.json | 100 | 20 | ToRun | 0.00 | - | - | - |
| tai15 15 0.json | 15 | 15 | Solution | 30.08 | 1291 | 0.00 | 100.00 |
| tai15 15 1.json | 15 | 15 | Solution | 30.08 | 1308 | 0.00 | 100.00 |
| tai15 15 2.json | 15 | 15 | Solution | 30.06 | 1280 | 0.00 | 100.00 |
| tai15 15 3.json | 15 | 15 | Solution | 30.07 | 1265 | 0.00 | 100.00 |
| tai15 15 4.json | 15 | 15 | Solution | 30.07 | 1310 | 0.00 | 100.00 |
| tai15 15 5.json | 15 | 15 | Solution | 30.08 | 1314 | 0.00 | 100.00 |
| tai15 15 6.json | 15 | 15 | Solution | 30.07 | 1292 | 0.00 | 100.00 |
| tai15 15 7.json | 15 | 15 | Solution | 30.07 | 1275 | 0.00 | 100.00 |
| tai15 15 8.json | 15 | 15 | Solution | 30.08 | 1381 | 0.00 | 100.00 |
| tai15 15 9.json | 15 | 15 | Solution | 30.09 | 1339 | 0.00 | 100.00 |
| tai20 15 0.json | 20 | 15 | Solution | 30.14 | 1760 | 0.00 | 100.00 |
| tai20 15 1.json | 20 | 15 | Solution | 30.15 | 1622 | 0.00 | 100.00 |
| tai20 15 2.json | 20 | 15 | Solution | 30.12 | 1698 | 0.00 | 100.00 |

Table 4.4: Results for Taillard Jobshop (Cplex) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|----------|----------|----------|-------|----------------|
| tai20 15 3.json | 20 | 15 | Solution | 30.11 | 1512 | 0.00 | 100.00 |
| tai20 15 4.json | 20 | 15 | Solution | 30.14 | 1693 | 0.00 | 100.00 |
| tai20 15 5.json | 20 | 15 | Solution | 30.13 | 1688 | 0.00 | 100.00 |
| tai20 15 6.json | 20 | 15 | Solution | 30.12 | 1755 | 0.00 | 100.00 |
| tai20 15 7.json | 20 | 15 | Solution | 30.13 | 1721 | 0.00 | 100.00 |
| tai20 15 8.json | 20 | 15 | Solution | 30.14 | 1578 | 0.00 | 100.00 |
| tai20 15 9.json | 20 | 15 | Solution | 30.15 | 1655 | 0.00 | 100.00 |
| tai20 20 0.json | 20 | 20 | Solution | 30.14 | 2049 | 0.00 | 100.00 |
| tai20 20 1.json | 20 | 20 | Solution | 30.19 | 1953 | 0.00 | 100.00 |
| tai20 20 2.json | 20 | 20 | Solution | 30.16 | 1821 | 0.00 | 100.00 |
| tai20 20 3.json | 20 | 20 | Solution | 30.17 | 1862 | 0.00 | 100.00 |
| tai20 20 4.json | 20 | 20 | Solution | 30.15 | 1915 | 0.00 | 100.00 |
| tai20 20 5.json | 20 | 20 | Solution | 30.17 | 1987 | 0.00 | 100.00 |
| tai20 20 6.json | 20 | 20 | Solution | 30.15 | 2056 | 0.00 | 100.00 |
| tai20 20 7.json | 20 | 20 | Solution | 30.16 | 1908 | 0.00 | 100.00 |
| tai20 20 8.json | 20 | 20 | Solution | 30.18 | 1937 | 0.00 | 100.00 |
| tai20 20 9.json | 20 | 20 | Solution | 30.15 | 1919 | 0.00 | 100.00 |
| tai30 15 0.json | 30 | 15 | Solution | 30.25 | 2407 | 0.00 | 100.00 |
| tai30 15 1.json | 30 | 15 | Solution | 30.27 | 2659 | 0.00 | 100.00 |
| tai30 15 2.json | 30 | 15 | Solution | 30.23 | 2610 | 0.00 | 100.00 |
| tai30 15 3.json | 30 | 15 | Solution | 30.24 | 2493 | 0.00 | 100.00 |
| tai30 15 4.json | 30 | 15 | Solution | 30.27 | 2682 | 0.00 | 100.00 |
| tai30 15 5.json | 30 | 15 | Solution | 30.27 | 2349 | 0.00 | 100.00 |
| tai30 15 6.json | 30 | 15 | Solution | 30.27 | 2465 | 0.00 | 100.00 |
| tai30 15 7.json | 30 | 15 | Solution | 30.29 | 2315 | 0.00 | 100.00 |
| tai30 15 8.json | 30 | 15 | Solution | 30.26 | 2493 | 0.00 | 100.00 |
| tai30 15 9.json | 30 | 15 | Solution | 30.19 | 2508 | 0.00 | 100.00 |
| tai30 20 0.json | 30 | 20 | Unknown | 30272.00 | - | - | - |
| tai30 20 1.json | 30 | 20 | Solution | 30.35 | 3450 | 0.00 | 100.00 |
| tai30 20 2.json | 30 | 20 | Unknown | 30286.00 | - | - | - |
| tai30 20 3.json | 30 | 20 | Unknown | 30284.00 | - | - | - |
| tai30 20 4.json | 30 | 20 | Unknown | 30281.00 | - | - | - |
| tai30 20 5.json | 30 | 20 | Unknown | 30280.00 | - | - | - |
| tai30 20 6.json | 30 | 20 | Unknown | 30298.00 | - | - | - |
| tai30 20 7.json | 30 | 20 | Solution | 30.30 | 3544 | 0.00 | 100.00 |
| tai30 20 8.json | 30 | 20 | Unknown | 30274.00 | - | - | - |
| tai30 20 9.json | 30 | 20 | Unknown | 30279.00 | - | - | - |
| tai50 15 0.json | 50 | 15 | Unknown | 30599.00 | - | - | - |
| tai50 15 1.json | 50 | 15 | Unknown | 30556.00 | - | - | - |
| tai50 15 2.json | 50 | 15 | Unknown | 30588.00 | - | - | - |
| tai50 15 3.json | 50 | 15 | Unknown | 30583.00 | - | - | - |
| tai50 15 4.json | 50 | 15 | Unknown | 30618.00 | - | - | - |
| tai50 15 5.json | 50 | 15 | Unknown | 30601.00 | - | - | - |
| tai50 15 6.json | 50 | 15 | Unknown | 30610.00 | - | - | - |
| tai50 15 7.json | 50 | 15 | Unknown | 30652.00 | - | - | - |

Table 4.4: Results for Taillard Jobshop (Cplex) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|---------|----------|----------|-------|----------------|
| tai50 15 8.json | 50 | 15 | Unknown | 30605.00 | - | - | - |
| tai50 15 9.json | 50 | 15 | Unknown | 30625.00 | - | - | - |
| tai50 20 0.json | 50 | 20 | Unknown | 30956.00 | - | - | - |
| tai50 20 1.json | 50 | 20 | Unknown | 30849.00 | - | - | - |
| tai50 20 2.json | 50 | 20 | Unknown | 30786.00 | - | - | - |
| tai50 20 3.json | 50 | 20 | Unknown | 30776.00 | - | - | - |
| tai50 20 4.json | 50 | 20 | Unknown | 30770.00 | - | - | - |
| tai50 20 5.json | 50 | 20 | Unknown | 30762.00 | - | - | - |
| tai50 20 6.json | 50 | 20 | Unknown | 30838.00 | - | - | - |
| tai50 20 7.json | 50 | 20 | Unknown | 30778.00 | - | - | - |
| tai50 20 8.json | 50 | 20 | Unknown | 30696.00 | - | - | - |
| tai50 20 9.json | 50 | 20 | Unknown | 30778.00 | - | - | - |

4.5 Results for MiniZinc CPSat

Table 4.5: Results for Taillard Jobshop (MiniZinc CPSat) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|---------|----------|----------|-------|----------------|
| tai100 20 0.json | 100 | 20 | Unknown | 30284.00 | - | - | - |
| tai100 20 1.json | 100 | 20 | Unknown | 30272.00 | - | - | - |
| tai100 20 2.json | 100 | 20 | Unknown | 30272.00 | - | - | - |
| tai100 20 3.json | 100 | 20 | Unknown | 30282.00 | - | - | - |
| tai100 20 4.json | 100 | 20 | Unknown | 30269.00 | - | - | - |
| tai100 20 5.json | 100 | 20 | Unknown | 30265.00 | - | - | - |
| tai100 20 6.json | 100 | 20 | Unknown | 30294.00 | - | - | - |
| tai100 20 7.json | 100 | 20 | Unknown | 30278.00 | - | - | - |
| tai100 20 8.json | 100 | 20 | Unknown | 30278.00 | - | - | - |
| tai100 20 9.json | 100 | 20 | Unknown | 30276.00 | - | - | - |
| tai15 15 0.json | 15 | 15 | Optimal | 7.15 | 1231 | 0.00 | 100.00 |
| tai15 15 1.json | 15 | 15 | Unknown | 30225.00 | - | - | - |
| tai15 15 2.json | 15 | 15 | Optimal | 28.71 | 1218 | 0.00 | 100.00 |
| tai15 15 3.json | 15 | 15 | Unknown | 30220.00 | - | - | - |
| tai15 15 4.json | 15 | 15 | Unknown | 30227.00 | - | - | - |
| tai15 15 5.json | 15 | 15 | Unknown | 30221.00 | - | - | - |
| tai15 15 6.json | 15 | 15 | Unknown | 30222.00 | - | - | - |
| tai15 15 7.json | 15 | 15 | Unknown | 30237.00 | - | - | - |
| tai15 15 8.json | 15 | 15 | Unknown | 30237.00 | - | - | - |
| tai15 15 9.json | 15 | 15 | Optimal | 15.42 | 1241 | 0.00 | 100.00 |
| tai20 15 0.json | 20 | 15 | Unknown | 30224.00 | - | - | - |
| tai20 15 1.json | 20 | 15 | Unknown | 30231.00 | - | - | - |

Table 4.5: Results for Taillard Jobshop (MiniZinc CPSat) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|---------|----------|----------|-------|----------------|
| tai20 15 2.json | 20 | 15 | Unknown | 30239.00 | - | - | - |
| tai20 15 3.json | 20 | 15 | Optimal | 11.66 | 1345 | 0.00 | 100.00 |
| tai20 15 4.json | 20 | 15 | Unknown | 30236.00 | - | - | - |
| tai20 15 5.json | 20 | 15 | Unknown | 30246.00 | - | - | - |
| tai20 15 6.json | 20 | 15 | Unknown | 30235.00 | - | - | - |
| tai20 15 7.json | 20 | 15 | Unknown | 30218.00 | - | - | - |
| tai20 15 8.json | 20 | 15 | Unknown | 30232.00 | - | - | - |
| tai20 15 9.json | 20 | 15 | Unknown | 30228.00 | - | - | - |
| tai20 20 0.json | 20 | 20 | Unknown | 30238.00 | - | - | - |
| tai20 20 1.json | 20 | 20 | Unknown | 30232.00 | - | - | - |
| tai20 20 2.json | 20 | 20 | Unknown | 30227.00 | - | - | - |
| tai20 20 3.json | 20 | 20 | Unknown | 30228.00 | - | - | - |
| tai20 20 4.json | 20 | 20 | Unknown | 30235.00 | - | - | - |
| tai20 20 5.json | 20 | 20 | Unknown | 30236.00 | - | - | - |
| tai20 20 6.json | 20 | 20 | Unknown | 30235.00 | - | - | - |
| tai20 20 7.json | 20 | 20 | Unknown | 30235.00 | - | - | - |
| tai20 20 8.json | 20 | 20 | Unknown | 30248.00 | - | - | - |
| tai20 20 9.json | 20 | 20 | Unknown | 30240.00 | - | - | - |
| tai30 15 0.json | 30 | 15 | Unknown | 30250.00 | - | - | - |
| tai30 15 1.json | 30 | 15 | Unknown | 30224.00 | - | - | - |
| tai30 15 2.json | 30 | 15 | Unknown | 30237.00 | - | - | - |
| tai30 15 3.json | 30 | 15 | Unknown | 30244.00 | - | - | - |
| tai30 15 4.json | 30 | 15 | Optimal | 9.88 | 2007 | 0.00 | 100.00 |
| tai30 15 5.json | 30 | 15 | Unknown | 30235.00 | - | - | - |
| tai30 15 6.json | 30 | 15 | Unknown | 30233.00 | - | - | - |
| tai30 15 7.json | 30 | 15 | Unknown | 30248.00 | - | - | - |
| tai30 15 8.json | 30 | 15 | Unknown | 30244.00 | - | - | - |
| tai30 15 9.json | 30 | 15 | Unknown | 30233.00 | - | - | - |
| tai30 20 0.json | 30 | 20 | Unknown | 30235.00 | - | - | - |
| tai30 20 1.json | 30 | 20 | Unknown | 30240.00 | - | - | - |
| tai30 20 2.json | 30 | 20 | Unknown | 30235.00 | - | - | - |
| tai30 20 3.json | 30 | 20 | Unknown | 30239.00 | - | - | - |
| tai30 20 4.json | 30 | 20 | Unknown | 30246.00 | - | - | - |
| tai30 20 5.json | 30 | 20 | Unknown | 30244.00 | - | - | - |
| tai30 20 6.json | 30 | 20 | Unknown | 30237.00 | - | - | - |
| tai30 20 7.json | 30 | 20 | Unknown | 30237.00 | - | - | - |
| tai30 20 8.json | 30 | 20 | Unknown | 30228.00 | - | - | - |
| tai30 20 9.json | 30 | 20 | Unknown | 30227.00 | - | - | - |
| tai50 15 0.json | 50 | 15 | Unknown | 30252.00 | - | - | - |
| tai50 15 1.json | 50 | 15 | Unknown | 30241.00 | - | - | - |
| tai50 15 2.json | 50 | 15 | Unknown | 30235.00 | - | - | - |
| tai50 15 3.json | 50 | 15 | Optimal | 25.02 | 2839 | 0.00 | 100.00 |
| tai50 15 4.json | 50 | 15 | Unknown | 30241.00 | - | - | - |
| tai50 15 5.json | 50 | 15 | Unknown | 30231.00 | - | - | - |

Table 4.5: Results for Taillard Jobshop (MiniZinc CPSat) (80 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------|------------|----------------|---------|----------|----------|-------|----------------|
| tai50 15 6.json | 50 | 15 | Unknown | 30239.00 | - | - | - |
| tai50 15 7.json | 50 | 15 | Unknown | 30242.00 | - | - | - |
| tai50 15 8.json | 50 | 15 | Unknown | 30247.00 | - | - | - |
| tai50 15 9.json | 50 | 15 | Unknown | 30245.00 | - | - | - |
| tai50 20 0.json | 50 | 20 | Unknown | 30252.00 | - | - | - |
| tai50 20 1.json | 50 | 20 | Unknown | 30254.00 | - | - | - |
| tai50 20 2.json | 50 | 20 | Unknown | 30244.00 | - | - | - |
| tai50 20 3.json | 50 | 20 | Unknown | 30235.00 | - | - | - |
| tai50 20 4.json | 50 | 20 | Unknown | 30242.00 | - | - | - |
| tai50 20 5.json | 50 | 20 | Unknown | 30248.00 | - | - | - |
| tai50 20 6.json | 50 | 20 | Unknown | 30255.00 | - | - | - |
| tai50 20 7.json | 50 | 20 | Unknown | 30236.00 | - | - | - |
| tai50 20 8.json | 50 | 20 | Unknown | 30249.00 | - | - | - |
| tai50 20 9.json | 50 | 20 | Unknown | 30249.00 | - | - | - |

4.6 Sample Results on Mac (CPOptimizer)

For a selected subset of the tests, we also tried running on a mac laptop, results show some good improvement of the m2 based laptop over the Intel based Windows machine, but the improvements are not consistent.

Table 4.6: Results for Taillard Jobshop (Selected Instances on Mac)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|---------|--------|----------|---------|----------------|
| tai100 20 0.json | 100 | 20 | Optimal | 143.93 | 5464 | 5464.00 | 0.00 |
| tai100 20 1.json | 100 | 20 | Optimal | 86.52 | 5181 | 5181.00 | 0.00 |
| tai100 20 2.json | 100 | 20 | Optimal | 63.63 | 5568 | 5568.00 | 0.00 |
| tai100 20 3.json | 100 | 20 | Optimal | 19.51 | 5339 | 5339.00 | 0.00 |
| tai100 20 4.json | 100 | 20 | Optimal | 174.11 | 5392 | 5392.00 | 0.00 |
| tai100 20 5.json | 100 | 20 | Optimal | 80.95 | 5342 | 5342.00 | 0.00 |
| tai100 20 6.json | 100 | 20 | Optimal | 139.30 | 5436 | 5436.00 | 0.00 |
| tai100 20 7.json | 100 | 20 | Optimal | 48.86 | 5394 | 5394.00 | 0.00 |
| tai100 20 8.json | 100 | 20 | Optimal | 82.22 | 5358 | 5358.00 | 0.00 |
| tai100 20 9.json | 100 | 20 | Optimal | 143.55 | 5183 | 5183.00 | 0.00 |

Chapter 5

Taillard Flow Shop Problems

These problems seem to be more difficult to solve to optimality. The number of stages seems to make a huge difference, we can solve the problems with five stages (machines) much more easily than the problems with 10 or twenty stages.

5.1 Results for CPOptimizer

Table 5.1: Results for Taillard Flowshop (CPO) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai100 10 0.json | 100 | 10 | Solution | 600.16 | 5813 | 5759.00 | 0.93 |
| tai100 10 1.json | 100 | 10 | Solution | 600.06 | 5438 | 5345.00 | 1.71 |
| tai100 10 2.json | 100 | 10 | Solution | 600.04 | 5800 | 5646.00 | 2.66 |
| tai100 10 3.json | 100 | 10 | Solution | 600.03 | 5942 | 5737.00 | 3.45 |
| tai100 10 4.json | 100 | 10 | Solution | 600.02 | 5586 | 5431.00 | 2.77 |
| tai100 10 5.json | 100 | 10 | Solution | 600.03 | 5425 | 5274.00 | 2.78 |
| tai100 10 6.json | 100 | 10 | Solution | 600.02 | 5712 | 5553.00 | 2.78 |
| tai100 10 7.json | 100 | 10 | Solution | 600.02 | 5835 | 5575.00 | 4.46 |
| tai100 10 8.json | 100 | 10 | Solution | 600.02 | 5960 | 5838.00 | 2.05 |
| tai100 10 9.json | 100 | 10 | Solution | 600.03 | 5964 | 5835.00 | 2.16 |
| tai100 20 0.json | 100 | 20 | Solution | 600.09 | 6926 | 5914.00 | 14.61 |
| tai100 20 1.json | 100 | 20 | Solution | 600.07 | 6750 | 6115.00 | 9.41 |
| tai100 20 2.json | 100 | 20 | Solution | 600.06 | 6911 | 6139.00 | 11.17 |
| tai100 20 3.json | 100 | 20 | Solution | 600.07 | 6719 | 6117.00 | 8.96 |
| tai100 20 4.json | 100 | 20 | Solution | 600.06 | 6926 | 6148.00 | 11.23 |
| tai100 20 5.json | 100 | 20 | Solution | 600.07 | 6947 | 6192.00 | 10.87 |
| tai100 20 6.json | 100 | 20 | Solution | 600.06 | 6765 | 6045.00 | 10.64 |
| tai100 20 7.json | 100 | 20 | Solution | 600.05 | 7236 | 6113.00 | 15.52 |
| tai100 20 8.json | 100 | 20 | Solution | 600.05 | 7082 | 6014.00 | 15.08 |
| tai100 20 9.json | 100 | 20 | Solution | 600.06 | 6841 | 6359.00 | 7.05 |

Table 5.1: Results for Taillard Flowshop (CPO) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|----------|----------------|
| tai100 5 0.json | 100 | 5 | Optimal | 111.73 | 5493 | 5493.00 | 0.00 |
| tai100 5 1.json | 100 | 5 | Optimal | 237.14 | 5257 | 5257.00 | 0.00 |
| tai100 5 2.json | 100 | 5 | Optimal | 132.33 | 5173 | 5173.00 | 0.00 |
| tai100 5 3.json | 100 | 5 | Solution | 600.11 | 4997 | 4993.00 | 0.08 |
| tai100 5 4.json | 100 | 5 | Optimal | 158.53 | 5247 | 5247.00 | 0.00 |
| tai100 5 5.json | 100 | 5 | Optimal | 248.89 | 5135 | 5135.00 | 0.00 |
| tai100 5 6.json | 100 | 5 | Optimal | 56.49 | 5232 | 5232.00 | 0.00 |
| tai100 5 7.json | 100 | 5 | Optimal | 250.86 | 5083 | 5083.00 | 0.00 |
| tai100 5 8.json | 100 | 5 | Solution | 600.13 | 5459 | 5438.00 | 0.38 |
| tai100 5 9.json | 100 | 5 | Optimal | 522.52 | 5318 | 5318.00 | 0.00 |
| tai200 10 0.json | 200 | 10 | Solution | 600.04 | 11159 | 10842.00 | 2.84 |
| tai200 10 1.json | 200 | 10 | Solution | 600.06 | 11022 | 10429.00 | 5.38 |
| tai200 10 2.json | 200 | 10 | Solution | 600.06 | 11183 | 10915.00 | 2.40 |
| tai200 10 3.json | 200 | 10 | Solution | 600.05 | 11094 | 10826.00 | 2.42 |
| tai200 10 4.json | 200 | 10 | Solution | 600.04 | 11222 | 10474.00 | 6.67 |
| tai200 10 5.json | 200 | 10 | Solution | 600.08 | 10741 | 10311.00 | 4.00 |
| tai200 10 6.json | 200 | 10 | Solution | 600.06 | 11278 | 10825.00 | 4.02 |
| tai200 10 7.json | 200 | 10 | Solution | 600.06 | 11223 | 10709.00 | 4.58 |
| tai200 10 8.json | 200 | 10 | Solution | 600.06 | 10720 | 10419.00 | 2.81 |
| tai200 10 9.json | 200 | 10 | Solution | 600.05 | 11206 | 10664.00 | 4.84 |
| tai200 20 0.json | 200 | 20 | Solution | 600.13 | 12474 | 11010.00 | 11.74 |
| tai200 20 1.json | 200 | 20 | Solution | 600.10 | 12872 | 10976.00 | 14.73 |
| tai200 20 2.json | 200 | 20 | Solution | 600.14 | 12486 | 11168.00 | 10.56 |
| tai200 20 3.json | 200 | 20 | Solution | 600.09 | 12786 | 11131.00 | 12.94 |
| tai200 20 4.json | 200 | 20 | Solution | 600.13 | 12460 | 11160.00 | 10.43 |
| tai200 20 5.json | 200 | 20 | Solution | 600.17 | 12811 | 11114.00 | 13.25 |
| tai200 20 6.json | 200 | 20 | Solution | 600.10 | 12961 | 11249.00 | 13.21 |
| tai200 20 7.json | 200 | 20 | Solution | 600.11 | 12812 | 11149.00 | 12.98 |
| tai200 20 8.json | 200 | 20 | Solution | 600.14 | 12543 | 11013.00 | 12.20 |
| tai200 20 9.json | 200 | 20 | Solution | 600.11 | 12815 | 11167.00 | 12.86 |
| tai20 10 0.json | 20 | 10 | Solution | 600.01 | 1559 | 1494.00 | 4.17 |
| tai20 10 1.json | 20 | 10 | Solution | 600.02 | 1655 | 1553.00 | 6.16 |
| tai20 10 2.json | 20 | 10 | Solution | 600.06 | 1490 | 1425.00 | 4.36 |
| tai20 10 3.json | 20 | 10 | Optimal | 213.81 | 1356 | 1356.00 | 0.00 |
| tai20 10 4.json | 20 | 10 | Solution | 600.06 | 1402 | 1353.00 | 3.50 |
| tai20 10 5.json | 20 | 10 | Solution | 600.04 | 1378 | 1344.00 | 2.47 |
| tai20 10 6.json | 20 | 10 | Solution | 600.04 | 1450 | 1388.00 | 4.28 |
| tai20 10 7.json | 20 | 10 | Solution | 600.03 | 1530 | 1440.00 | 5.88 |
| tai20 10 8.json | 20 | 10 | Optimal | 91.00 | 1586 | 1586.00 | 0.00 |
| tai20 10 9.json | 20 | 10 | Solution | 600.02 | 1579 | 1478.00 | 6.40 |
| tai20 20 0.json | 20 | 20 | Solution | 600.03 | 2309 | 1969.00 | 14.72 |
| tai20 20 1.json | 20 | 20 | Solution | 600.03 | 2110 | 1758.00 | 16.68 |
| tai20 20 2.json | 20 | 20 | Solution | 600.05 | 2330 | 1924.00 | 17.42 |
| tai20 20 3.json | 20 | 20 | Solution | 600.05 | 2222 | 1900.00 | 14.49 |
| tai20 20 4.json | 20 | 20 | Solution | 600.02 | 2267 | 1992.00 | 12.13 |

Table 5.1: Results for Taillard Flowshop (CPO) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|----------|----------------|
| tai20 20 5.json | 20 | 20 | Solution | 600.01 | 2209 | 1902.00 | 13.90 |
| tai20 20 6.json | 20 | 20 | Solution | 600.04 | 2287 | 1940.00 | 15.17 |
| tai20 20 7.json | 20 | 20 | Solution | 600.02 | 2208 | 1930.00 | 12.59 |
| tai20 20 8.json | 20 | 20 | Solution | 600.03 | 2240 | 1883.00 | 15.94 |
| tai20 20 9.json | 20 | 20 | Solution | 600.03 | 2195 | 1957.00 | 10.84 |
| tai20 5 0.json | 20 | 5 | Optimal | 2.65 | 1278 | 1278.00 | 0.00 |
| tai20 5 1.json | 20 | 5 | Optimal | 2.26 | 1358 | 1358.00 | 0.00 |
| tai20 5 2.json | 20 | 5 | Optimal | 2.94 | 1073 | 1073.00 | 0.00 |
| tai20 5 3.json | 20 | 5 | Optimal | 3.32 | 1292 | 1292.00 | 0.00 |
| tai20 5 4.json | 20 | 5 | Optimal | 4.96 | 1231 | 1231.00 | 0.00 |
| tai20 5 5.json | 20 | 5 | Optimal | 1.66 | 1193 | 1193.00 | 0.00 |
| tai20 5 6.json | 20 | 5 | Optimal | 2.21 | 1234 | 1234.00 | 0.00 |
| tai20 5 7.json | 20 | 5 | Optimal | 3.61 | 1199 | 1199.00 | 0.00 |
| tai20 5 8.json | 20 | 5 | Optimal | 1.88 | 1210 | 1210.00 | 0.00 |
| tai20 5 9.json | 20 | 5 | Optimal | 1.95 | 1103 | 1103.00 | 0.00 |
| tai500 20 0.json | 500 | 20 | Solution | 600.39 | 28702 | 25931.00 | 9.65 |
| tai500 20 1.json | 500 | 20 | Solution | 600.41 | 29015 | 26390.00 | 9.05 |
| tai500 20 2.json | 500 | 20 | Solution | 600.42 | 28835 | 26330.00 | 8.69 |
| tai500 20 3.json | 500 | 20 | Solution | 600.42 | 28890 | 26456.00 | 8.43 |
| tai500 20 4.json | 500 | 20 | Solution | 600.38 | 28809 | 26205.00 | 9.04 |
| tai500 20 5.json | 500 | 20 | Solution | 600.36 | 29034 | 26436.00 | 8.95 |
| tai500 20 6.json | 500 | 20 | Solution | 600.73 | 28713 | 26329.00 | 8.30 |
| tai500 20 7.json | 500 | 20 | Solution | 600.41 | 28882 | 26451.00 | 8.42 |
| tai500 20 8.json | 500 | 20 | Solution | 600.66 | 28099 | 25929.00 | 7.72 |
| tai500 20 9.json | 500 | 20 | Solution | 600.43 | 28721 | 26355.00 | 8.24 |
| tai50 10 0.json | 50 | 10 | Solution | 600.09 | 3126 | 2964.00 | 5.18 |
| tai50 10 1.json | 50 | 10 | Solution | 600.07 | 2929 | 2828.00 | 3.45 |
| tai50 10 2.json | 50 | 10 | Solution | 600.10 | 2959 | 2828.00 | 4.43 |
| tai50 10 3.json | 50 | 10 | Solution | 600.07 | 3108 | 3036.00 | 2.32 |
| tai50 10 4.json | 50 | 10 | Solution | 600.10 | 3041 | 2922.00 | 3.91 |
| tai50 10 5.json | 50 | 10 | Solution | 600.08 | 3045 | 2971.00 | 2.43 |
| tai50 10 6.json | 50 | 10 | Solution | 600.11 | 3142 | 3063.00 | 2.51 |
| tai50 10 7.json | 50 | 10 | Solution | 600.11 | 3067 | 3000.00 | 2.18 |
| tai50 10 8.json | 50 | 10 | Solution | 600.08 | 2950 | 2832.00 | 4.00 |
| tai50 10 9.json | 50 | 10 | Solution | 600.10 | 3150 | 3046.00 | 3.30 |
| tai50 20 0.json | 50 | 20 | Solution | 600.20 | 3977 | 3551.00 | 10.71 |
| tai50 20 1.json | 50 | 20 | Solution | 600.17 | 4021 | 3533.00 | 12.14 |
| tai50 20 2.json | 50 | 20 | Solution | 600.17 | 3855 | 3412.00 | 11.49 |
| tai50 20 3.json | 50 | 20 | Solution | 600.18 | 3898 | 3382.00 | 13.24 |
| tai50 20 4.json | 50 | 20 | Solution | 600.16 | 3885 | 3383.00 | 12.92 |
| tai50 20 5.json | 50 | 20 | Solution | 600.22 | 3889 | 3499.00 | 10.03 |
| tai50 20 6.json | 50 | 20 | Solution | 600.17 | 3887 | 3469.00 | 10.75 |
| tai50 20 7.json | 50 | 20 | Solution | 600.18 | 3951 | 3419.00 | 13.46 |
| tai50 20 8.json | 50 | 20 | Solution | 600.15 | 4015 | 3482.00 | 13.28 |
| tai50 20 9.json | 50 | 20 | Solution | 600.15 | 3896 | 3493.00 | 10.34 |

Table 5.1: Results for Taillard Flowshop (CPO) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|---------|-------|----------|---------|----------------|
| tai50 5 0.json | 50 | 5 | Optimal | 44.88 | 2724 | 2724.00 | 0.00 |
| tai50 5 1.json | 50 | 5 | Optimal | 45.78 | 2834 | 2834.00 | 0.00 |
| tai50 5 2.json | 50 | 5 | Optimal | 84.83 | 2612 | 2612.00 | 0.00 |
| tai50 5 3.json | 50 | 5 | Optimal | 12.22 | 2751 | 2751.00 | 0.00 |
| tai50 5 4.json | 50 | 5 | Optimal | 41.31 | 2853 | 2853.00 | 0.00 |
| tai50 5 5.json | 50 | 5 | Optimal | 14.30 | 2825 | 2825.00 | 0.00 |
| tai50 5 6.json | 50 | 5 | Optimal | 81.29 | 2716 | 2716.00 | 0.00 |
| tai50 5 7.json | 50 | 5 | Optimal | 82.58 | 2683 | 2683.00 | 0.00 |
| tai50 5 8.json | 50 | 5 | Optimal | 38.87 | 2545 | 2545.00 | 0.00 |
| tai50 5 9.json | 50 | 5 | Optimal | 6.54 | 2776 | 2776.00 | 0.00 |

5.2 Results for CPSat

Table 5.2: Results for Taillard Flowshop (CPSat) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai100 10 0.json | 100 | 10 | Solution | 600.16 | 6170 | 5759.00 | 6.66 |
| tai100 10 1.json | 100 | 10 | Solution | 600.16 | 5813 | 4707.00 | 19.03 |
| tai100 10 2.json | 100 | 10 | Solution | 600.31 | 6133 | 5543.00 | 9.62 |
| tai100 10 3.json | 100 | 10 | Solution | 600.14 | 6464 | 5716.00 | 11.57 |
| tai100 10 4.json | 100 | 10 | Solution | 600.19 | 6143 | 5153.00 | 16.12 |
| tai100 10 5.json | 100 | 10 | Solution | 600.21 | 5844 | 4823.00 | 17.47 |
| tai100 10 6.json | 100 | 10 | Solution | 600.21 | 5949 | 5179.00 | 12.94 |
| tai100 10 7.json | 100 | 10 | Solution | 600.17 | 6180 | 5237.00 | 15.26 |
| tai100 10 8.json | 100 | 10 | Solution | 600.18 | 6341 | 5844.00 | 7.84 |
| tai100 10 9.json | 100 | 10 | Solution | 600.35 | 6317 | 5254.00 | 16.83 |
| tai100 20 0.json | 100 | 20 | Solution | 600.28 | 7389 | 4511.00 | 38.95 |
| tai100 20 1.json | 100 | 20 | Solution | 600.23 | 7196 | 4343.00 | 39.65 |
| tai100 20 2.json | 100 | 20 | Solution | 600.21 | 7408 | 4853.00 | 34.49 |
| tai100 20 3.json | 100 | 20 | Solution | 600.22 | 7050 | 4667.00 | 33.80 |
| tai100 20 4.json | 100 | 20 | Solution | 600.21 | 7220 | 4908.00 | 32.02 |
| tai100 20 5.json | 100 | 20 | Solution | 600.28 | 7646 | 4680.00 | 38.79 |
| tai100 20 6.json | 100 | 20 | Solution | 600.24 | 7164 | 4457.00 | 37.79 |
| tai100 20 7.json | 100 | 20 | Solution | 600.22 | 7691 | 4792.00 | 37.69 |
| tai100 20 8.json | 100 | 20 | Solution | 600.24 | 7445 | 4852.00 | 34.83 |
| tai100 20 9.json | 100 | 20 | Solution | 600.22 | 7429 | 5405.00 | 27.24 |
| tai100 5 0.json | 100 | 5 | Optimal | 600.07 | 5493 | 5493.00 | 0.00 |
| tai100 5 1.json | 100 | 5 | Solution | 600.36 | 5294 | 5240.00 | 1.02 |
| tai100 5 2.json | 100 | 5 | Solution | 600.16 | 5216 | 5173.00 | 0.82 |
| tai100 5 3.json | 100 | 5 | Solution | 600.13 | 5001 | 4993.00 | 0.16 |
| tai100 5 4.json | 100 | 5 | Solution | 600.36 | 5279 | 5247.00 | 0.61 |

Table 5.2: Results for Taillard Flowshop (CPSat) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|----------|----------------|
| tai100 5 5.json | 100 | 5 | Optimal | 600.07 | 5135 | 5135.00 | 0.00 |
| tai100 5 6.json | 100 | 5 | Solution | 600.20 | 5281 | 5228.00 | 1.00 |
| tai100 5 7.json | 100 | 5 | Solution | 600.22 | 5137 | 5083.00 | 1.05 |
| tai100 5 8.json | 100 | 5 | Solution | 600.16 | 5481 | 5442.00 | 0.71 |
| tai100 5 9.json | 100 | 5 | Solution | 600.17 | 5346 | 5305.00 | 0.77 |
| tai200 10 0.json | 200 | 10 | Solution | 600.35 | 11993 | 6397.00 | 46.66 |
| tai200 10 1.json | 200 | 10 | Solution | 600.27 | 12255 | 6257.00 | 48.94 |
| tai200 10 2.json | 200 | 10 | Solution | 600.37 | 11987 | 6508.00 | 45.71 |
| tai200 10 3.json | 200 | 10 | Solution | 600.35 | 11934 | 6160.00 | 48.38 |
| tai200 10 4.json | 200 | 10 | Solution | 600.32 | 11982 | 6309.00 | 47.35 |
| tai200 10 5.json | 200 | 10 | Solution | 600.35 | 11666 | 6156.00 | 47.23 |
| tai200 10 6.json | 200 | 10 | Solution | 600.38 | 12236 | 6001.00 | 50.96 |
| tai200 10 7.json | 200 | 10 | Solution | 600.32 | 12186 | 6214.00 | 49.01 |
| tai200 10 8.json | 200 | 10 | Solution | 600.35 | 11818 | 6108.00 | 48.32 |
| tai200 10 9.json | 200 | 10 | Solution | 600.29 | 11764 | 6496.00 | 44.78 |
| tai200 20 0.json | 200 | 20 | Solution | 600.37 | 13270 | 11010.00 | 17.03 |
| tai200 20 1.json | 200 | 20 | Solution | 600.36 | 13276 | 6170.00 | 53.53 |
| tai200 20 2.json | 200 | 20 | Solution | 600.38 | 13303 | 6157.00 | 53.72 |
| tai200 20 3.json | 200 | 20 | Solution | 600.37 | 13647 | 6224.00 | 54.39 |
| tai200 20 4.json | 200 | 20 | Solution | 600.35 | 13271 | 6162.00 | 53.57 |
| tai200 20 5.json | 200 | 20 | Solution | 602.34 | 13608 | 6257.00 | 54.02 |
| tai200 20 6.json | 200 | 20 | Solution | 601.71 | 13515 | 6352.00 | 53.00 |
| tai200 20 7.json | 200 | 20 | Solution | 600.40 | 13193 | 6242.00 | 52.69 |
| tai200 20 8.json | 200 | 20 | Solution | 600.37 | 13298 | 6210.00 | 53.30 |
| tai200 20 9.json | 200 | 20 | Solution | 600.39 | 13355 | 6194.00 | 53.62 |
| tai20 10 0.json | 20 | 10 | Solution | 600.16 | 1579 | 1547.00 | 2.03 |
| tai20 10 1.json | 20 | 10 | Solution | 600.16 | 1686 | 1587.00 | 5.87 |
| tai20 10 2.json | 20 | 10 | Solution | 600.12 | 1481 | 1438.00 | 2.90 |
| tai20 10 3.json | 20 | 10 | Solution | 600.16 | 1400 | 1356.00 | 3.14 |
| tai20 10 4.json | 20 | 10 | Solution | 600.29 | 1411 | 1360.00 | 3.61 |
| tai20 10 5.json | 20 | 10 | Solution | 600.45 | 1374 | 1356.00 | 1.31 |
| tai20 10 6.json | 20 | 10 | Solution | 600.14 | 1446 | 1398.00 | 3.32 |
| tai20 10 7.json | 20 | 10 | Solution | 600.15 | 1548 | 1448.00 | 6.46 |
| tai20 10 8.json | 20 | 10 | Optimal | 600.04 | 1586 | 1586.00 | 0.00 |
| tai20 10 9.json | 20 | 10 | Solution | 600.11 | 1590 | 1529.00 | 3.84 |
| tai20 20 0.json | 20 | 20 | Solution | 600.11 | 2265 | 2047.00 | 9.62 |
| tai20 20 1.json | 20 | 20 | Solution | 600.28 | 2125 | 1844.00 | 13.22 |
| tai20 20 2.json | 20 | 20 | Solution | 600.11 | 2349 | 1993.00 | 15.16 |
| tai20 20 3.json | 20 | 20 | Solution | 600.14 | 2281 | 1957.00 | 14.20 |
| tai20 20 4.json | 20 | 20 | Solution | 600.12 | 2376 | 2058.00 | 13.38 |
| tai20 20 5.json | 20 | 20 | Solution | 600.11 | 2176 | 1974.00 | 9.28 |
| tai20 20 6.json | 20 | 20 | Solution | 600.12 | 2320 | 2001.00 | 13.75 |
| tai20 20 7.json | 20 | 20 | Solution | 600.12 | 2247 | 1982.00 | 11.79 |
| tai20 20 8.json | 20 | 20 | Solution | 600.11 | 2267 | 1960.00 | 13.54 |
| tai20 20 9.json | 20 | 20 | Solution | 600.12 | 2176 | 1971.00 | 9.42 |

Table 5.2: Results for Taillard Flowshop (CPSat) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|----------|----------------|
| tai20 5 0.json | 20 | 5 | Optimal | 409.17 | 1278 | 1278.00 | 0.00 |
| tai20 5 1.json | 20 | 5 | Optimal | 12.58 | 1358 | 1358.00 | 0.00 |
| tai20 5 2.json | 20 | 5 | Optimal | 2.90 | 1073 | 1073.00 | 0.00 |
| tai20 5 3.json | 20 | 5 | Optimal | 8.44 | 1292 | 1292.00 | 0.00 |
| tai20 5 4.json | 20 | 5 | Optimal | 56.24 | 1231 | 1231.00 | 0.00 |
| tai20 5 5.json | 20 | 5 | Optimal | 600.01 | 1193 | 1193.00 | 0.00 |
| tai20 5 6.json | 20 | 5 | Optimal | 3.20 | 1234 | 1234.00 | 0.00 |
| tai20 5 7.json | 20 | 5 | Optimal | 13.83 | 1199 | 1199.00 | 0.00 |
| tai20 5 8.json | 20 | 5 | Optimal | 8.57 | 1210 | 1210.00 | 0.00 |
| tai20 5 9.json | 20 | 5 | Optimal | 3.37 | 1103 | 1103.00 | 0.00 |
| tai500 20 0.json | 500 | 20 | Solution | 601.11 | 30220 | 13561.00 | 55.13 |
| tai500 20 1.json | 500 | 20 | Solution | 602.31 | 30765 | 13909.00 | 54.79 |
| tai500 20 2.json | 500 | 20 | Solution | 609.69 | 30517 | 13847.00 | 54.63 |
| tai500 20 3.json | 500 | 20 | Solution | 603.09 | 30572 | 13410.00 | 56.14 |
| tai500 20 4.json | 500 | 20 | Solution | 601.39 | 30483 | 13439.00 | 55.91 |
| tai500 20 5.json | 500 | 20 | Solution | 601.50 | 30843 | 13725.00 | 55.50 |
| tai500 20 6.json | 500 | 20 | Solution | 603.24 | 30714 | 13837.00 | 54.95 |
| tai500 20 7.json | 500 | 20 | Solution | 601.54 | 30625 | 13932.00 | 54.51 |
| tai500 20 8.json | 500 | 20 | Solution | 609.39 | 30367 | 13646.00 | 55.06 |
| tai500 20 9.json | 500 | 20 | Solution | 601.57 | 30643 | 13782.00 | 55.02 |
| tai50 10 0.json | 50 | 10 | Solution | 600.22 | 3162 | 2976.00 | 5.88 |
| tai50 10 1.json | 50 | 10 | Solution | 600.32 | 3048 | 2829.00 | 7.19 |
| tai50 10 2.json | 50 | 10 | Solution | 600.19 | 2962 | 2830.00 | 4.46 |
| tai50 10 3.json | 50 | 10 | Solution | 600.17 | 3166 | 3059.00 | 3.38 |
| tai50 10 4.json | 50 | 10 | Solution | 600.20 | 3093 | 2933.00 | 5.17 |
| tai50 10 5.json | 50 | 10 | Solution | 600.16 | 3155 | 2986.00 | 5.36 |
| tai50 10 6.json | 50 | 10 | Solution | 600.44 | 3201 | 3093.00 | 3.37 |
| tai50 10 7.json | 50 | 10 | Solution | 600.32 | 3184 | 3003.00 | 5.68 |
| tai50 10 8.json | 50 | 10 | Solution | 600.20 | 3004 | 2864.00 | 4.66 |
| tai50 10 9.json | 50 | 10 | Solution | 600.21 | 3192 | 3046.00 | 4.57 |
| tai50 20 0.json | 50 | 20 | Solution | 600.19 | 4301 | 3591.00 | 16.51 |
| tai50 20 1.json | 50 | 20 | Solution | 600.21 | 4085 | 3554.00 | 13.00 |
| tai50 20 2.json | 50 | 20 | Solution | 600.24 | 4227 | 3431.00 | 18.83 |
| tai50 20 3.json | 50 | 20 | Solution | 600.21 | 4203 | 3419.00 | 18.65 |
| tai50 20 4.json | 50 | 20 | Solution | 600.18 | 4100 | 3415.00 | 16.71 |
| tai50 20 5.json | 50 | 20 | Solution | 600.17 | 4109 | 3516.00 | 14.43 |
| tai50 20 6.json | 50 | 20 | Solution | 600.22 | 4079 | 3494.00 | 14.34 |
| tai50 20 7.json | 50 | 20 | Solution | 600.38 | 4129 | 3456.00 | 16.30 |
| tai50 20 8.json | 50 | 20 | Solution | 600.43 | 4143 | 3489.00 | 15.79 |
| tai50 20 9.json | 50 | 20 | Solution | 600.24 | 4300 | 3520.00 | 18.14 |
| tai50 5 0.json | 50 | 5 | Optimal | 600.05 | 2724 | 2724.00 | 0.00 |
| tai50 5 1.json | 50 | 5 | Optimal | 600.03 | 2834 | 2834.00 | 0.00 |
| tai50 5 2.json | 50 | 5 | Optimal | 166.99 | 2612 | 2612.00 | 0.00 |
| tai50 5 3.json | 50 | 5 | Optimal | 193.35 | 2751 | 2751.00 | 0.00 |
| tai50 5 4.json | 50 | 5 | Optimal | 600.03 | 2853 | 2853.00 | 0.00 |

Table 5.2: Results for Taillard Flowshop (CPSat) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|--------|----------|---------|----------------|
| tai50 5 5.json | 50 | 5 | Optimal | 600.03 | 2825 | 2825.00 | 0.00 |
| tai50 5 6.json | 50 | 5 | Optimal | 600.06 | 2716 | 2716.00 | 0.00 |
| tai50 5 7.json | 50 | 5 | Optimal | 600.03 | 2683 | 2683.00 | 0.00 |
| tai50 5 8.json | 50 | 5 | Solution | 600.20 | 2549 | 2545.00 | 0.16 |
| tai50 5 9.json | 50 | 5 | Optimal | 600.03 | 2776 | 2776.00 | 0.00 |

5.3 Results for Chuffed

Table 5.3: Results for Taillard Flowshop (Chuffed) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|-------|----------------|
| tai100 10 0.json | 100 | 10 | Solution | 601.12 | 6838 | 0.00 | 100.00 |
| tai100 10 1.json | 100 | 10 | Solution | 601.07 | 6494 | 0.00 | 100.00 |
| tai100 10 2.json | 100 | 10 | Solution | 600.80 | 6632 | 0.00 | 100.00 |
| tai100 10 3.json | 100 | 10 | Solution | 601.10 | 7049 | 0.00 | 100.00 |
| tai100 10 4.json | 100 | 10 | Solution | 600.90 | 6515 | 0.00 | 100.00 |
| tai100 10 5.json | 100 | 10 | Solution | 601.09 | 6317 | 0.00 | 100.00 |
| tai100 10 6.json | 100 | 10 | Solution | 600.88 | 6543 | 0.00 | 100.00 |
| tai100 10 7.json | 100 | 10 | Solution | 600.89 | 6759 | 0.00 | 100.00 |
| tai100 10 8.json | 100 | 10 | Solution | 601.10 | 6938 | 0.00 | 100.00 |
| tai100 10 9.json | 100 | 10 | Solution | 601.10 | 6911 | 0.00 | 100.00 |
| tai100 20 0.json | 100 | 20 | Solution | 601.16 | 7844 | 0.00 | 100.00 |
| tai100 20 1.json | 100 | 20 | Solution | 601.15 | 7687 | 0.00 | 100.00 |
| tai100 20 2.json | 100 | 20 | Solution | 601.15 | 7913 | 0.00 | 100.00 |
| tai100 20 3.json | 100 | 20 | Solution | 601.16 | 7775 | 0.00 | 100.00 |
| tai100 20 4.json | 100 | 20 | Solution | 601.15 | 7807 | 0.00 | 100.00 |
| tai100 20 5.json | 100 | 20 | Solution | 601.15 | 7846 | 0.00 | 100.00 |
| tai100 20 6.json | 100 | 20 | Solution | 601.15 | 7989 | 0.00 | 100.00 |
| tai100 20 7.json | 100 | 20 | Solution | 601.15 | 8202 | 0.00 | 100.00 |
| tai100 20 8.json | 100 | 20 | Solution | 601.16 | 7877 | 0.00 | 100.00 |
| tai100 20 9.json | 100 | 20 | Solution | 601.15 | 7934 | 0.00 | 100.00 |
| tai100 5 0.json | 100 | 5 | Solution | 600.52 | 6207 | 0.00 | 100.00 |
| tai100 5 1.json | 100 | 5 | Solution | 600.69 | 5996 | 0.00 | 100.00 |
| tai100 5 2.json | 100 | 5 | Solution | 600.33 | 5817 | 0.00 | 100.00 |
| tai100 5 3.json | 100 | 5 | Solution | 600.73 | 5653 | 0.00 | 100.00 |
| tai100 5 4.json | 100 | 5 | Solution | 600.51 | 6063 | 0.00 | 100.00 |
| tai100 5 5.json | 100 | 5 | Solution | 600.44 | 5785 | 0.00 | 100.00 |
| tai100 5 6.json | 100 | 5 | Solution | 600.80 | 6023 | 0.00 | 100.00 |
| tai100 5 7.json | 100 | 5 | Solution | 600.58 | 5736 | 0.00 | 100.00 |
| tai100 5 8.json | 100 | 5 | Solution | 600.79 | 6077 | 0.00 | 100.00 |
| tai100 5 9.json | 100 | 5 | Solution | 600.80 | 5894 | 0.00 | 100.00 |

Table 5.3: Results for Taillard Flowshop (Chuffed) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|-------|----------------|
| tai200 10 0.json | 200 | 10 | Solution | 601.15 | 11959 | 0.00 | 100.00 |
| tai200 10 1.json | 200 | 10 | Solution | 601.12 | 12350 | 0.00 | 100.00 |
| tai200 10 2.json | 200 | 10 | Solution | 601.15 | 12369 | 0.00 | 100.00 |
| tai200 10 3.json | 200 | 10 | Solution | 601.16 | 12324 | 0.00 | 100.00 |
| tai200 10 4.json | 200 | 10 | Solution | 601.15 | 12521 | 0.00 | 100.00 |
| tai200 10 5.json | 200 | 10 | Solution | 601.15 | 12196 | 0.00 | 100.00 |
| tai200 10 6.json | 200 | 10 | Solution | 601.15 | 12541 | 0.00 | 100.00 |
| tai200 10 7.json | 200 | 10 | Solution | 601.16 | 12515 | 0.00 | 100.00 |
| tai200 10 8.json | 200 | 10 | Solution | 601.18 | 12294 | 0.00 | 100.00 |
| tai200 10 9.json | 200 | 10 | Solution | 601.15 | 12378 | 0.00 | 100.00 |
| tai200 20 0.json | 200 | 20 | Solution | 601.29 | 13870 | 0.00 | 100.00 |
| tai200 20 1.json | 200 | 20 | Solution | 601.31 | 13614 | 0.00 | 100.00 |
| tai200 20 2.json | 200 | 20 | Solution | 601.30 | 13308 | 0.00 | 100.00 |
| tai200 20 3.json | 200 | 20 | Solution | 601.28 | 13695 | 0.00 | 100.00 |
| tai200 20 4.json | 200 | 20 | Solution | 601.29 | 13835 | 0.00 | 100.00 |
| tai200 20 5.json | 200 | 20 | Solution | 601.27 | 13409 | 0.00 | 100.00 |
| tai200 20 6.json | 200 | 20 | Solution | 601.29 | 13933 | 0.00 | 100.00 |
| tai200 20 7.json | 200 | 20 | Solution | 601.29 | 13773 | 0.00 | 100.00 |
| tai200 20 8.json | 200 | 20 | Solution | 601.31 | 13726 | 0.00 | 100.00 |
| tai200 20 9.json | 200 | 20 | Solution | 601.28 | 13455 | 0.00 | 100.00 |
| tai20 10 0.json | 20 | 10 | Solution | 600.21 | 1975 | 0.00 | 100.00 |
| tai20 10 1.json | 20 | 10 | Solution | 600.20 | 2045 | 0.00 | 100.00 |
| tai20 10 2.json | 20 | 10 | Solution | 600.23 | 1807 | 0.00 | 100.00 |
| tai20 10 3.json | 20 | 10 | Solution | 600.22 | 1662 | 0.00 | 100.00 |
| tai20 10 4.json | 20 | 10 | Solution | 600.18 | 1799 | 0.00 | 100.00 |
| tai20 10 5.json | 20 | 10 | Solution | 600.18 | 1591 | 0.00 | 100.00 |
| tai20 10 6.json | 20 | 10 | Solution | 600.15 | 1958 | 0.00 | 100.00 |
| tai20 10 7.json | 20 | 10 | Solution | 600.21 | 1977 | 0.00 | 100.00 |
| tai20 10 8.json | 20 | 10 | Solution | 600.21 | 1854 | 0.00 | 100.00 |
| tai20 10 9.json | 20 | 10 | Solution | 600.23 | 1974 | 0.00 | 100.00 |
| tai20 20 0.json | 20 | 20 | Solution | 600.33 | 2780 | 0.00 | 100.00 |
| tai20 20 1.json | 20 | 20 | Solution | 600.44 | 2602 | 0.00 | 100.00 |
| tai20 20 2.json | 20 | 20 | Solution | 600.45 | 2802 | 0.00 | 100.00 |
| tai20 20 3.json | 20 | 20 | Solution | 600.37 | 2782 | 0.00 | 100.00 |
| tai20 20 4.json | 20 | 20 | Solution | 600.32 | 2794 | 0.00 | 100.00 |
| tai20 20 5.json | 20 | 20 | Solution | 600.40 | 2689 | 0.00 | 100.00 |
| tai20 20 6.json | 20 | 20 | Solution | 600.43 | 2701 | 0.00 | 100.00 |
| tai20 20 7.json | 20 | 20 | Solution | 600.37 | 2739 | 0.00 | 100.00 |
| tai20 20 8.json | 20 | 20 | Solution | 600.41 | 2744 | 0.00 | 100.00 |
| tai20 20 9.json | 20 | 20 | Solution | 600.43 | 2655 | 0.00 | 100.00 |
| tai20 5 0.json | 20 | 5 | Solution | 600.12 | 1393 | 0.00 | 100.00 |
| tai20 5 1.json | 20 | 5 | Solution | 600.11 | 1529 | 0.00 | 100.00 |
| tai20 5 2.json | 20 | 5 | Solution | 600.09 | 1298 | 0.00 | 100.00 |
| tai20 5 3.json | 20 | 5 | Solution | 600.14 | 1506 | 0.00 | 100.00 |
| tai20 5 4.json | 20 | 5 | Solution | 600.11 | 1405 | 0.00 | 100.00 |

Table 5.3: Results for Taillard Flowshop (Chuffed) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| tai20 5 5.json | 20 | 5 | Solution | 600.14 | 1402 | 0.00 | 100.00 |
| tai20 5 6.json | 20 | 5 | Solution | 600.12 | 1351 | 0.00 | 100.00 |
| tai20 5 7.json | 20 | 5 | Solution | 600.10 | 1424 | 0.00 | 100.00 |
| tai20 5 8.json | 20 | 5 | Solution | 600.13 | 1415 | 0.00 | 100.00 |
| tai20 5 9.json | 20 | 5 | Solution | 600.13 | 1300 | 0.00 | 100.00 |
| tai500 20 0.json | 500 | 20 | Unknown | 554581.00 | - | - | - |
| tai500 20 1.json | 500 | 20 | Unknown | 535484.00 | - | - | - |
| tai500 20 2.json | 500 | 20 | Unknown | 570653.00 | - | - | - |
| tai500 20 3.json | 500 | 20 | Unknown | 555592.00 | - | - | - |
| tai500 20 4.json | 500 | 20 | Unknown | 541261.00 | - | - | - |
| tai500 20 5.json | 500 | 20 | Unknown | 561281.00 | - | - | - |
| tai500 20 6.json | 500 | 20 | Unknown | 580064.00 | - | - | - |
| tai500 20 7.json | 500 | 20 | Unknown | 559401.00 | - | - | - |
| tai500 20 8.json | 500 | 20 | Unknown | 568122.00 | - | - | - |
| tai500 20 9.json | 500 | 20 | Unknown | 556217.00 | - | - | - |
| tai50 10 0.json | 50 | 10 | Solution | 600.47 | 3738 | 0.00 | 100.00 |
| tai50 10 1.json | 50 | 10 | Solution | 600.33 | 3503 | 0.00 | 100.00 |
| tai50 10 2.json | 50 | 10 | Solution | 600.56 | 3829 | 0.00 | 100.00 |
| tai50 10 3.json | 50 | 10 | Solution | 600.65 | 3981 | 0.00 | 100.00 |
| tai50 10 4.json | 50 | 10 | Solution | 600.68 | 3973 | 0.00 | 100.00 |
| tai50 10 5.json | 50 | 10 | Solution | 600.72 | 3738 | 0.00 | 100.00 |
| tai50 10 6.json | 50 | 10 | Solution | 600.39 | 4038 | 0.00 | 100.00 |
| tai50 10 7.json | 50 | 10 | Solution | 600.64 | 3881 | 0.00 | 100.00 |
| tai50 10 8.json | 50 | 10 | Solution | 600.30 | 3814 | 0.00 | 100.00 |
| tai50 10 9.json | 50 | 10 | Solution | 600.51 | 3926 | 0.00 | 100.00 |
| tai50 20 0.json | 50 | 20 | Solution | 601.09 | 4874 | 0.00 | 100.00 |
| tai50 20 1.json | 50 | 20 | Solution | 601.09 | 4631 | 0.00 | 100.00 |
| tai50 20 2.json | 50 | 20 | Solution | 600.93 | 4636 | 0.00 | 100.00 |
| tai50 20 3.json | 50 | 20 | Solution | 601.09 | 4887 | 0.00 | 100.00 |
| tai50 20 4.json | 50 | 20 | Solution | 601.08 | 4455 | 0.00 | 100.00 |
| tai50 20 5.json | 50 | 20 | Solution | 601.10 | 4589 | 0.00 | 100.00 |
| tai50 20 6.json | 50 | 20 | Solution | 601.09 | 4660 | 0.00 | 100.00 |
| tai50 20 7.json | 50 | 20 | Solution | 600.63 | 5023 | 0.00 | 100.00 |
| tai50 20 8.json | 50 | 20 | Solution | 600.88 | 4811 | 0.00 | 100.00 |
| tai50 20 9.json | 50 | 20 | Solution | 601.10 | 4848 | 0.00 | 100.00 |
| tai50 5 0.json | 50 | 5 | Solution | 600.28 | 3191 | 0.00 | 100.00 |
| tai50 5 1.json | 50 | 5 | Solution | 600.24 | 3049 | 0.00 | 100.00 |
| tai50 5 2.json | 50 | 5 | Solution | 600.36 | 3154 | 0.00 | 100.00 |
| tai50 5 3.json | 50 | 5 | Solution | 600.24 | 3304 | 0.00 | 100.00 |
| tai50 5 4.json | 50 | 5 | Solution | 600.20 | 3409 | 0.00 | 100.00 |
| tai50 5 5.json | 50 | 5 | Solution | 600.26 | 3308 | 0.00 | 100.00 |
| tai50 5 6.json | 50 | 5 | Solution | 600.31 | 3097 | 0.00 | 100.00 |
| tai50 5 7.json | 50 | 5 | Solution | 600.23 | 3420 | 0.00 | 100.00 |
| tai50 5 8.json | 50 | 5 | Solution | 600.17 | 2910 | 0.00 | 100.00 |

| | | | | | | | |
|----------------|----|---|----------|--------|------|------|--------|
| tai50 5 9.json | 50 | 5 | Solution | 600.24 | 3391 | 0.00 | 100.00 |
|----------------|----|---|----------|--------|------|------|--------|

5.4 Results for Cplex

Table 5.4: Results for Taillard Flowshop (Cplex) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| tai100 10 0.json | 100 | 10 | Solution | 601.68 | 13926 | 0.00 | 100.00 |
| tai100 10 1.json | 100 | 10 | Solution | 601.76 | 13833 | 0.00 | 100.00 |
| tai100 10 2.json | 100 | 10 | Solution | 601.72 | 14051 | 0.00 | 100.00 |
| tai100 10 3.json | 100 | 10 | Solution | 601.62 | 14455 | 0.00 | 100.00 |
| tai100 10 4.json | 100 | 10 | Solution | 601.61 | 13433 | 0.00 | 100.00 |
| tai100 10 5.json | 100 | 10 | Solution | 601.63 | 13887 | 0.00 | 100.00 |
| tai100 10 6.json | 100 | 10 | Solution | 601.63 | 13754 | 0.00 | 100.00 |
| tai100 10 7.json | 100 | 10 | Solution | 601.97 | 13909 | 0.00 | 100.00 |
| tai100 10 8.json | 100 | 10 | Solution | 601.61 | 14723 | 0.00 | 100.00 |
| tai100 10 9.json | 100 | 10 | Solution | 601.62 | 14483 | 0.00 | 100.00 |
| tai100 20 0.json | 100 | 20 | Solution | 603.43 | 49943 | 0.00 | 100.00 |
| tai100 20 1.json | 100 | 20 | Solution | 603.52 | 50000 | 0.00 | 100.00 |
| tai100 20 2.json | 100 | 20 | Solution | 603.40 | 50000 | 0.00 | 100.00 |
| tai100 20 3.json | 100 | 20 | Unknown | 603286.00 | - | - | - |
| tai100 20 4.json | 100 | 20 | Solution | 603.47 | 50000 | 0.00 | 100.00 |
| tai100 20 5.json | 100 | 20 | Solution | 603.48 | 50000 | 0.00 | 100.00 |
| tai100 20 6.json | 100 | 20 | Unknown | 603276.00 | - | - | - |
| tai100 20 7.json | 100 | 20 | Solution | 603.51 | 50000 | 0.00 | 100.00 |
| tai100 20 8.json | 100 | 20 | Solution | 603.46 | 49971 | 0.00 | 100.00 |
| tai100 20 9.json | 100 | 20 | Solution | 603.39 | 50000 | 0.00 | 100.00 |
| tai100 5 0.json | 100 | 5 | Solution | 600.85 | 7467 | 0.00 | 100.00 |
| tai100 5 1.json | 100 | 5 | Solution | 600.84 | 7427 | 0.00 | 100.00 |
| tai100 5 2.json | 100 | 5 | Solution | 600.77 | 9159 | 0.00 | 100.00 |
| tai100 5 3.json | 100 | 5 | Solution | 601.87 | 7711 | 0.00 | 100.00 |
| tai100 5 4.json | 100 | 5 | Solution | 600.85 | 6494 | 0.00 | 100.00 |
| tai100 5 5.json | 100 | 5 | Solution | 600.85 | 6895 | 0.00 | 100.00 |
| tai100 5 6.json | 100 | 5 | Solution | 600.83 | 8930 | 0.00 | 100.00 |
| tai100 5 7.json | 100 | 5 | Solution | 600.84 | 8591 | 0.00 | 100.00 |
| tai100 5 8.json | 100 | 5 | Solution | 600.82 | 10484 | 0.00 | 100.00 |
| tai100 5 9.json | 100 | 5 | Solution | 600.93 | 7031 | 0.00 | 100.00 |
| tai200 10 0.json | 200 | 10 | Unknown | 607243.00 | - | - | - |
| tai200 10 1.json | 200 | 10 | Unknown | 606994.00 | - | - | - |
| tai200 10 2.json | 200 | 10 | Unknown | 606859.00 | - | - | - |
| tai200 10 3.json | 200 | 10 | Unknown | 607189.00 | - | - | - |
| tai200 10 4.json | 200 | 10 | Unknown | 607157.00 | - | - | - |
| tai200 10 5.json | 200 | 10 | Unknown | 606885.00 | - | - | - |
| tai200 10 6.json | 200 | 10 | Unknown | 606801.00 | - | - | - |
| tai200 10 7.json | 200 | 10 | Unknown | 606933.00 | - | - | - |
| tai200 10 8.json | 200 | 10 | Unknown | 606882.00 | - | - | - |

Table 5.4: Results for Taillard Flowshop (Cplex) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| tai200 10 9.json | 200 | 10 | Unknown | 607297.00 | - | - | - |
| tai200 20 0.json | 200 | 20 | Unknown | 625527.00 | - | - | - |
| tai200 20 1.json | 200 | 20 | Unknown | 625365.00 | - | - | - |
| tai200 20 2.json | 200 | 20 | Unknown | 630434.00 | - | - | - |
| tai200 20 3.json | 200 | 20 | Unknown | 624132.00 | - | - | - |
| tai200 20 4.json | 200 | 20 | Unknown | 624566.00 | - | - | - |
| tai200 20 5.json | 200 | 20 | Unknown | 627181.00 | - | - | - |
| tai200 20 6.json | 200 | 20 | Unknown | 630172.00 | - | - | - |
| tai200 20 7.json | 200 | 20 | Unknown | 628660.00 | - | - | - |
| tai200 20 8.json | 200 | 20 | Unknown | 628071.00 | - | - | - |
| tai200 20 9.json | 200 | 20 | Unknown | 625539.00 | - | - | - |
| tai20 10 0.json | 20 | 10 | Solution | 600.27 | 1830 | 0.00 | 100.00 |
| tai20 10 1.json | 20 | 10 | Solution | 600.33 | 1938 | 0.00 | 100.00 |
| tai20 10 2.json | 20 | 10 | Solution | 600.14 | 1594 | 0.00 | 100.00 |
| tai20 10 3.json | 20 | 10 | Solution | 600.12 | 1601 | 0.00 | 100.00 |
| tai20 10 4.json | 20 | 10 | Solution | 601.10 | 1676 | 0.00 | 100.00 |
| tai20 10 5.json | 20 | 10 | Solution | 600.71 | 1652 | 0.00 | 100.00 |
| tai20 10 6.json | 20 | 10 | Solution | 600.30 | 1603 | 0.00 | 100.00 |
| tai20 10 7.json | 20 | 10 | Solution | 600.72 | 1819 | 0.00 | 100.00 |
| tai20 10 8.json | 20 | 10 | Solution | 600.33 | 1774 | 0.00 | 100.00 |
| tai20 10 9.json | 20 | 10 | Solution | 600.11 | 1722 | 0.00 | 100.00 |
| tai20 20 0.json | 20 | 20 | Solution | 600.41 | 2592 | 0.00 | 100.00 |
| tai20 20 1.json | 20 | 20 | Solution | 600.19 | 2771 | 0.00 | 100.00 |
| tai20 20 2.json | 20 | 20 | Solution | 601.33 | 2946 | 0.00 | 100.00 |
| tai20 20 3.json | 20 | 20 | Solution | 600.75 | 2657 | 0.00 | 100.00 |
| tai20 20 4.json | 20 | 20 | Solution | 600.21 | 2780 | 0.00 | 100.00 |
| tai20 20 5.json | 20 | 20 | Solution | 600.36 | 2775 | 0.00 | 100.00 |
| tai20 20 6.json | 20 | 20 | Solution | 601.40 | 2654 | 0.00 | 100.00 |
| tai20 20 7.json | 20 | 20 | Solution | 600.21 | 2822 | 0.00 | 100.00 |
| tai20 20 8.json | 20 | 20 | Solution | 600.23 | 2747 | 0.00 | 100.00 |
| tai20 20 9.json | 20 | 20 | Solution | 600.24 | 3084 | 0.00 | 100.00 |
| tai20 5 0.json | 20 | 5 | Solution | 600.06 | 1297 | 0.00 | 100.00 |
| tai20 5 1.json | 20 | 5 | Solution | 600.17 | 1420 | 0.00 | 100.00 |
| tai20 5 2.json | 20 | 5 | Solution | 600.27 | 1103 | 0.00 | 100.00 |
| tai20 5 3.json | 20 | 5 | Solution | 600.25 | 1450 | 0.00 | 100.00 |
| tai20 5 4.json | 20 | 5 | Solution | 600.28 | 1276 | 0.00 | 100.00 |
| tai20 5 5.json | 20 | 5 | Solution | 600.28 | 1248 | 0.00 | 100.00 |
| tai20 5 6.json | 20 | 5 | Solution | 600.29 | 1259 | 0.00 | 100.00 |
| tai20 5 7.json | 20 | 5 | Solution | 600.07 | 1260 | 0.00 | 100.00 |
| tai20 5 8.json | 20 | 5 | Solution | 600.08 | 1271 | 0.00 | 100.00 |
| tai20 5 9.json | 20 | 5 | Solution | 600.09 | 1244 | 0.00 | 100.00 |
| tai500 20 0.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai500 20 1.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai500 20 2.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai500 20 3.json | 500 | 20 | ToRun | 0.00 | - | - | - |

Table 5.4: Results for Taillard Flowshop (Cplex) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|-------|----------------|
| tai500 20 4.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai500 20 5.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai500 20 6.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai500 20 7.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai500 20 8.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai500 20 9.json | 500 | 20 | ToRun | 0.00 | - | - | - |
| tai50 10 0.json | 50 | 10 | Solution | 600.75 | 5056 | 0.00 | 100.00 |
| tai50 10 1.json | 50 | 10 | Solution | 600.46 | 4511 | 0.00 | 100.00 |
| tai50 10 2.json | 50 | 10 | Solution | 600.50 | 4690 | 0.00 | 100.00 |
| tai50 10 3.json | 50 | 10 | Solution | 600.48 | 4585 | 0.00 | 100.00 |
| tai50 10 4.json | 50 | 10 | Solution | 600.51 | 4798 | 0.00 | 100.00 |
| tai50 10 5.json | 50 | 10 | Solution | 600.46 | 5262 | 0.00 | 100.00 |
| tai50 10 6.json | 50 | 10 | Solution | 600.57 | 5122 | 0.00 | 100.00 |
| tai50 10 7.json | 50 | 10 | Solution | 600.46 | 4647 | 0.00 | 100.00 |
| tai50 10 8.json | 50 | 10 | Solution | 601.09 | 5168 | 0.00 | 100.00 |
| tai50 10 9.json | 50 | 10 | Solution | 600.49 | 4844 | 0.00 | 100.00 |
| tai50 20 0.json | 50 | 20 | Solution | 601.18 | 6396 | 0.00 | 100.00 |
| tai50 20 1.json | 50 | 20 | Solution | 601.14 | 8176 | 0.00 | 100.00 |
| tai50 20 2.json | 50 | 20 | Solution | 600.86 | 8126 | 0.00 | 100.00 |
| tai50 20 3.json | 50 | 20 | Solution | 601.16 | 8269 | 0.00 | 100.00 |
| tai50 20 4.json | 50 | 20 | Solution | 600.82 | 8144 | 0.00 | 100.00 |
| tai50 20 5.json | 50 | 20 | Solution | 600.84 | 7754 | 0.00 | 100.00 |
| tai50 20 6.json | 50 | 20 | Solution | 600.94 | 7220 | 0.00 | 100.00 |
| tai50 20 7.json | 50 | 20 | Solution | 601.14 | 10418 | 0.00 | 100.00 |
| tai50 20 8.json | 50 | 20 | Solution | 600.86 | 7177 | 0.00 | 100.00 |
| tai50 20 9.json | 50 | 20 | Solution | 600.84 | 10276 | 0.00 | 100.00 |
| tai50 5 0.json | 50 | 5 | Solution | 600.33 | 3703 | 0.00 | 100.00 |
| tai50 5 1.json | 50 | 5 | Solution | 600.28 | 3822 | 0.00 | 100.00 |
| tai50 5 2.json | 50 | 5 | Solution | 600.24 | 3357 | 0.00 | 100.00 |
| tai50 5 3.json | 50 | 5 | Solution | 600.30 | 3573 | 0.00 | 100.00 |
| tai50 5 4.json | 50 | 5 | Solution | 600.64 | 3808 | 0.00 | 100.00 |
| tai50 5 5.json | 50 | 5 | Solution | 600.38 | 3549 | 0.00 | 100.00 |
| tai50 5 6.json | 50 | 5 | Solution | 600.26 | 3289 | 0.00 | 100.00 |
| tai50 5 7.json | 50 | 5 | Solution | 600.26 | 3704 | 0.00 | 100.00 |
| tai50 5 8.json | 50 | 5 | Solution | 600.33 | 3599 | 0.00 | 100.00 |
| tai50 5 9.json | 50 | 5 | Solution | 600.27 | 3859 | 0.00 | 100.00 |

5.5 Results for MiniZinc CPSat

Table 5.5: Results for Taillard Flowshop (MiniZinc CPSat) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| tai100 10 0.json | 100 | 10 | Unknown | 600275.00 | - | - | - |
| tai100 10 1.json | 100 | 10 | Unknown | 600233.00 | - | - | - |
| tai100 10 2.json | 100 | 10 | Unknown | 600251.00 | - | - | - |
| tai100 10 3.json | 100 | 10 | Unknown | 600247.00 | - | - | - |
| tai100 10 4.json | 100 | 10 | Unknown | 600244.00 | - | - | - |
| tai100 10 5.json | 100 | 10 | Unknown | 600221.00 | - | - | - |
| tai100 10 6.json | 100 | 10 | Unknown | 600245.00 | - | - | - |
| tai100 10 7.json | 100 | 10 | Unknown | 600245.00 | - | - | - |
| tai100 10 8.json | 100 | 10 | Unknown | 600242.00 | - | - | - |
| tai100 10 9.json | 100 | 10 | Unknown | 600249.00 | - | - | - |
| tai100 20 0.json | 100 | 20 | Unknown | 600268.00 | - | - | - |
| tai100 20 1.json | 100 | 20 | Unknown | 600279.00 | - | - | - |
| tai100 20 2.json | 100 | 20 | Unknown | 600278.00 | - | - | - |
| tai100 20 3.json | 100 | 20 | Unknown | 600276.00 | - | - | - |
| tai100 20 4.json | 100 | 20 | Unknown | 600282.00 | - | - | - |
| tai100 20 5.json | 100 | 20 | Unknown | 600273.00 | - | - | - |
| tai100 20 6.json | 100 | 20 | Unknown | 600274.00 | - | - | - |
| tai100 20 7.json | 100 | 20 | Unknown | 600261.00 | - | - | - |
| tai100 20 8.json | 100 | 20 | Unknown | 600284.00 | - | - | - |
| tai100 20 9.json | 100 | 20 | Unknown | 600258.00 | - | - | - |
| tai100 5 0.json | 100 | 5 | Optimal | 210.25 | 5493 | 0.00 | 100.00 |
| tai100 5 1.json | 100 | 5 | Unknown | 600246.00 | - | - | - |
| tai100 5 2.json | 100 | 5 | Unknown | 600223.00 | - | - | - |
| tai100 5 3.json | 100 | 5 | Unknown | 600233.00 | - | - | - |
| tai100 5 4.json | 100 | 5 | Unknown | 600234.00 | - | - | - |
| tai100 5 5.json | 100 | 5 | Optimal | 459.37 | 5135 | 0.00 | 100.00 |
| tai100 5 6.json | 100 | 5 | Unknown | 600228.00 | - | - | - |
| tai100 5 7.json | 100 | 5 | Unknown | 600236.00 | - | - | - |
| tai100 5 8.json | 100 | 5 | Unknown | 600222.00 | - | - | - |
| tai100 5 9.json | 100 | 5 | Unknown | 600232.00 | - | - | - |
| tai200 10 0.json | 200 | 10 | Unknown | 600263.00 | - | - | - |
| tai200 10 1.json | 200 | 10 | Unknown | 600276.00 | - | - | - |
| tai200 10 2.json | 200 | 10 | Unknown | 600270.00 | - | - | - |
| tai200 10 3.json | 200 | 10 | Unknown | 600271.00 | - | - | - |
| tai200 10 4.json | 200 | 10 | Unknown | 600280.00 | - | - | - |
| tai200 10 5.json | 200 | 10 | Unknown | 600267.00 | - | - | - |
| tai200 10 6.json | 200 | 10 | Unknown | 600266.00 | - | - | - |
| tai200 10 7.json | 200 | 10 | Unknown | 600252.00 | - | - | - |
| tai200 10 8.json | 200 | 10 | Unknown | 600275.00 | - | - | - |
| tai200 10 9.json | 200 | 10 | Unknown | 600280.00 | - | - | - |
| tai200 20 0.json | 200 | 20 | Unknown | 600331.00 | - | - | - |
| tai200 20 1.json | 200 | 20 | Unknown | 600316.00 | - | - | - |
| tai200 20 2.json | 200 | 20 | Unknown | 600322.00 | - | - | - |
| tai200 20 3.json | 200 | 20 | Unknown | 600325.00 | - | - | - |

Table 5.5: Results for Taillard Flowshop (MiniZinc CPSat) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| tai200 20 4.json | 200 | 20 | Unknown | 600317.00 | - | - | - |
| tai200 20 5.json | 200 | 20 | Unknown | 600314.00 | - | - | - |
| tai200 20 6.json | 200 | 20 | Unknown | 600321.00 | - | - | - |
| tai200 20 7.json | 200 | 20 | Unknown | 600309.00 | - | - | - |
| tai200 20 8.json | 200 | 20 | Unknown | 600310.00 | - | - | - |
| tai200 20 9.json | 200 | 20 | Unknown | 600315.00 | - | - | - |
| tai20 10 0.json | 20 | 10 | Unknown | 600227.00 | - | - | - |
| tai20 10 1.json | 20 | 10 | Unknown | 600228.00 | - | - | - |
| tai20 10 2.json | 20 | 10 | Unknown | 600220.00 | - | - | - |
| tai20 10 3.json | 20 | 10 | Optimal | 470.76 | 1356 | 0.00 | 100.00 |
| tai20 10 4.json | 20 | 10 | Unknown | 600225.00 | - | - | - |
| tai20 10 5.json | 20 | 10 | Unknown | 600208.00 | - | - | - |
| tai20 10 6.json | 20 | 10 | Unknown | 600218.00 | - | - | - |
| tai20 10 7.json | 20 | 10 | Unknown | 600232.00 | - | - | - |
| tai20 10 8.json | 20 | 10 | Optimal | 258.82 | 1586 | 0.00 | 100.00 |
| tai20 10 9.json | 20 | 10 | Unknown | 600215.00 | - | - | - |
| tai20 20 0.json | 20 | 20 | Unknown | 600231.00 | - | - | - |
| tai20 20 1.json | 20 | 20 | Unknown | 600233.00 | - | - | - |
| tai20 20 2.json | 20 | 20 | Unknown | 600232.00 | - | - | - |
| tai20 20 3.json | 20 | 20 | Unknown | 600230.00 | - | - | - |
| tai20 20 4.json | 20 | 20 | Unknown | 600223.00 | - | - | - |
| tai20 20 5.json | 20 | 20 | Unknown | 600222.00 | - | - | - |
| tai20 20 6.json | 20 | 20 | Unknown | 600227.00 | - | - | - |
| tai20 20 7.json | 20 | 20 | Unknown | 600229.00 | - | - | - |
| tai20 20 8.json | 20 | 20 | Unknown | 600227.00 | - | - | - |
| tai20 20 9.json | 20 | 20 | Unknown | 600232.00 | - | - | - |
| tai20 5 0.json | 20 | 5 | Optimal | 8.29 | 1278 | 0.00 | 100.00 |
| tai20 5 1.json | 20 | 5 | Optimal | 1.77 | 1358 | 0.00 | 100.00 |
| tai20 5 2.json | 20 | 5 | Optimal | 5.25 | 1073 | 0.00 | 100.00 |
| tai20 5 3.json | 20 | 5 | Optimal | 11.08 | 1292 | 0.00 | 100.00 |
| tai20 5 4.json | 20 | 5 | Optimal | 53.12 | 1231 | 0.00 | 100.00 |
| tai20 5 5.json | 20 | 5 | Optimal | 2.70 | 1193 | 0.00 | 100.00 |
| tai20 5 6.json | 20 | 5 | Optimal | 4.36 | 1234 | 0.00 | 100.00 |
| tai20 5 7.json | 20 | 5 | Optimal | 5.79 | 1199 | 0.00 | 100.00 |
| tai20 5 8.json | 20 | 5 | Optimal | 1.22 | 1210 | 0.00 | 100.00 |
| tai20 5 9.json | 20 | 5 | Optimal | 4.68 | 1103 | 0.00 | 100.00 |
| tai500 20 0.json | 500 | 20 | Unknown | 600543.00 | - | - | - |
| tai500 20 1.json | 500 | 20 | Unknown | 600539.00 | - | - | - |
| tai500 20 2.json | 500 | 20 | Unknown | 600560.00 | - | - | - |
| tai500 20 3.json | 500 | 20 | Unknown | 600564.00 | - | - | - |
| tai500 20 4.json | 500 | 20 | Unknown | 600573.00 | - | - | - |
| tai500 20 5.json | 500 | 20 | Unknown | 600587.00 | - | - | - |
| tai500 20 6.json | 500 | 20 | Unknown | 600564.00 | - | - | - |
| tai500 20 7.json | 500 | 20 | Unknown | 600549.00 | - | - | - |

Table 5.5: Results for Taillard Flowshop (MiniZinc CPSat) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| tai500 20 8.json | 500 | 20 | Unknown | 600568.00 | - | - | - |
| tai500 20 9.json | 500 | 20 | Unknown | 600582.00 | - | - | - |
| tai50 10 0.json | 50 | 10 | Unknown | 600237.00 | - | - | - |
| tai50 10 1.json | 50 | 10 | Unknown | 600227.00 | - | - | - |
| tai50 10 2.json | 50 | 10 | Unknown | 600233.00 | - | - | - |
| tai50 10 3.json | 50 | 10 | Unknown | 600239.00 | - | - | - |
| tai50 10 4.json | 50 | 10 | Unknown | 600226.00 | - | - | - |
| tai50 10 5.json | 50 | 10 | Unknown | 600227.00 | - | - | - |
| tai50 10 6.json | 50 | 10 | Unknown | 600235.00 | - | - | - |
| tai50 10 7.json | 50 | 10 | Unknown | 600229.00 | - | - | - |
| tai50 10 8.json | 50 | 10 | Unknown | 600233.00 | - | - | - |
| tai50 10 9.json | 50 | 10 | Unknown | 600231.00 | - | - | - |
| tai50 20 0.json | 50 | 20 | Unknown | 600242.00 | - | - | - |
| tai50 20 1.json | 50 | 20 | Unknown | 600240.00 | - | - | - |
| tai50 20 2.json | 50 | 20 | ToRun | 0.00 | - | - | - |
| tai50 20 3.json | 50 | 20 | ToRun | 0.00 | - | - | - |
| tai50 20 4.json | 50 | 20 | ToRun | 0.00 | - | - | - |
| tai50 20 5.json | 50 | 20 | ToRun | 0.00 | - | - | - |
| tai50 20 6.json | 50 | 20 | ToRun | 0.00 | - | - | - |
| tai50 20 7.json | 50 | 20 | ToRun | 0.00 | - | - | - |
| tai50 20 8.json | 50 | 20 | ToRun | 0.00 | - | - | - |
| tai50 20 9.json | 50 | 20 | Unknown | 600244.00 | - | - | - |
| tai50 5 0.json | 50 | 5 | Optimal | 30.36 | 2724 | 0.00 | 100.00 |
| tai50 5 1.json | 50 | 5 | Optimal | 64.92 | 2834 | 0.00 | 100.00 |
| tai50 5 2.json | 50 | 5 | Optimal | 39.20 | 2612 | 0.00 | 100.00 |
| tai50 5 3.json | 50 | 5 | Optimal | 72.59 | 2751 | 0.00 | 100.00 |
| tai50 5 4.json | 50 | 5 | Optimal | 32.99 | 2853 | 0.00 | 100.00 |
| tai50 5 5.json | 50 | 5 | Optimal | 177.75 | 2825 | 0.00 | 100.00 |
| tai50 5 6.json | 50 | 5 | Optimal | 92.69 | 2716 | 0.00 | 100.00 |
| tai50 5 7.json | 50 | 5 | Optimal | 74.88 | 2683 | 0.00 | 100.00 |
| tai50 5 8.json | 50 | 5 | Optimal | 78.04 | 2545 | 0.00 | 100.00 |
| tai50 5 9.json | 50 | 5 | Optimal | 45.14 | 2776 | 0.00 | 100.00 |

5.6 Permutation Flowshop Results for CPOptimizer

We can run the flowshop benchmarks with an additional constraint to be solved as a permutation flowshop, which dramatically reduces the sets of feasible solutions, and the search tree to be searched. This might results in improved solutions found as a larger part of that search space can be explored, but solutions can be worse than for the original problem. In particular the optimal solution for the permutation flowshop can be worse than a good feasible solution

for the unrestricted flowshop.

Table 5.6: Results for Taillard Permutation Flowshop (CPO) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|----------|----------------|
| tai100 10 0.json | 100 | 10 | Solution | 600.34 | 5789 | 5766.00 | 0.40 |
| tai100 10 1.json | 100 | 10 | Solution | 600.07 | 5391 | 5347.00 | 0.82 |
| tai100 10 2.json | 100 | 10 | Solution | 600.08 | 5691 | 5659.00 | 0.56 |
| tai100 10 3.json | 100 | 10 | Solution | 600.06 | 5860 | 5776.00 | 1.43 |
| tai100 10 4.json | 100 | 10 | Solution | 600.05 | 5513 | 5450.00 | 1.14 |
| tai100 10 5.json | 100 | 10 | Solution | 600.03 | 5308 | 5290.00 | 0.34 |
| tai100 10 6.json | 100 | 10 | Solution | 600.03 | 5647 | 5556.00 | 1.61 |
| tai100 10 7.json | 100 | 10 | Solution | 600.03 | 5689 | 5586.00 | 1.81 |
| tai100 10 8.json | 100 | 10 | Solution | 600.05 | 5903 | 5865.00 | 0.64 |
| tai100 10 9.json | 100 | 10 | Solution | 600.04 | 5860 | 5837.00 | 0.39 |
| tai100 20 0.json | 100 | 20 | Solution | 600.05 | 6526 | 5936.00 | 9.04 |
| tai100 20 1.json | 100 | 20 | Solution | 600.07 | 6390 | 6122.00 | 4.19 |
| tai100 20 2.json | 100 | 20 | Solution | 600.07 | 6481 | 6162.00 | 4.92 |
| tai100 20 3.json | 100 | 20 | Solution | 600.08 | 6463 | 6163.00 | 4.64 |
| tai100 20 4.json | 100 | 20 | Solution | 600.05 | 6497 | 6161.00 | 5.17 |
| tai100 20 5.json | 100 | 20 | Solution | 600.05 | 6554 | 6203.00 | 5.36 |
| tai100 20 6.json | 100 | 20 | Solution | 600.07 | 6483 | 6061.00 | 6.51 |
| tai100 20 7.json | 100 | 20 | Solution | 600.08 | 6670 | 6190.00 | 7.20 |
| tai100 20 8.json | 100 | 20 | Solution | 600.05 | 6577 | 6063.00 | 7.82 |
| tai100 20 9.json | 100 | 20 | Solution | 600.06 | 6684 | 6382.00 | 4.52 |
| tai100 5 0.json | 100 | 5 | Optimal | 4.06 | 5493 | 5493.00 | 0.00 |
| tai100 5 1.json | 100 | 5 | Optimal | 67.53 | 5268 | 5268.00 | 0.00 |
| tai100 5 2.json | 100 | 5 | Optimal | 7.66 | 5175 | 5175.00 | 0.00 |
| tai100 5 3.json | 100 | 5 | Optimal | 60.38 | 5014 | 5014.00 | 0.00 |
| tai100 5 4.json | 100 | 5 | Optimal | 62.17 | 5250 | 5250.00 | 0.00 |
| tai100 5 5.json | 100 | 5 | Optimal | 6.22 | 5135 | 5135.00 | 0.00 |
| tai100 5 6.json | 100 | 5 | Optimal | 9.45 | 5246 | 5246.00 | 0.00 |
| tai100 5 7.json | 100 | 5 | Optimal | 9.90 | 5094 | 5094.00 | 0.00 |
| tai100 5 8.json | 100 | 5 | Optimal | 65.13 | 5448 | 5448.00 | 0.00 |
| tai100 5 9.json | 100 | 5 | Optimal | 67.74 | 5322 | 5322.00 | 0.00 |
| tai200 10 0.json | 200 | 10 | Solution | 600.05 | 10918 | 10861.00 | 0.52 |
| tai200 10 1.json | 200 | 10 | Solution | 600.07 | 10718 | 10447.00 | 2.53 |
| tai200 10 2.json | 200 | 10 | Solution | 600.05 | 11060 | 10920.00 | 1.27 |
| tai200 10 3.json | 200 | 10 | Solution | 600.07 | 10934 | 10846.00 | 0.80 |
| tai200 10 4.json | 200 | 10 | Solution | 600.08 | 10626 | 10494.00 | 1.24 |
| tai200 10 5.json | 200 | 10 | Solution | 600.07 | 10453 | 10312.00 | 1.35 |
| tai200 10 6.json | 200 | 10 | Solution | 600.07 | 10979 | 10853.00 | 1.15 |
| tai200 10 7.json | 200 | 10 | Solution | 600.07 | 10856 | 10715.00 | 1.30 |
| tai200 10 8.json | 200 | 10 | Solution | 600.06 | 10558 | 10422.00 | 1.29 |
| tai200 10 9.json | 200 | 10 | Solution | 600.05 | 10761 | 10666.00 | 0.88 |
| tai200 20 0.json | 200 | 20 | Solution | 600.13 | 11928 | 11048.00 | 7.38 |
| tai200 20 1.json | 200 | 20 | Solution | 600.09 | 11991 | 11009.00 | 8.19 |

Table 5.6: Results for Taillard Permutation Flowshop (CPO) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|----------|----------------|
| tai200 20 2.json | 200 | 20 | Solution | 600.09 | 12248 | 11217.00 | 8.42 |
| tai200 20 3.json | 200 | 20 | Solution | 600.12 | 11967 | 11179.00 | 6.58 |
| tai200 20 4.json | 200 | 20 | Solution | 600.13 | 11915 | 11168.00 | 6.27 |
| tai200 20 5.json | 200 | 20 | Solution | 600.08 | 11923 | 11159.00 | 6.41 |
| tai200 20 6.json | 200 | 20 | Solution | 600.10 | 12205 | 11269.00 | 7.67 |
| tai200 20 7.json | 200 | 20 | Solution | 600.10 | 12221 | 11216.00 | 8.22 |
| tai200 20 8.json | 200 | 20 | Solution | 600.12 | 11991 | 11054.00 | 7.81 |
| tai200 20 9.json | 200 | 20 | Solution | 600.11 | 12022 | 11242.00 | 6.49 |
| tai20 10 0.json | 20 | 10 | Optimal | 292.19 | 1582 | 1582.00 | 0.00 |
| tai20 10 1.json | 20 | 10 | Solution | 600.02 | 1659 | 1580.00 | 4.76 |
| tai20 10 2.json | 20 | 10 | Optimal | 587.59 | 1496 | 1496.00 | 0.00 |
| tai20 10 3.json | 20 | 10 | Optimal | 62.06 | 1377 | 1377.00 | 0.00 |
| tai20 10 4.json | 20 | 10 | Optimal | 101.03 | 1419 | 1419.00 | 0.00 |
| tai20 10 5.json | 20 | 10 | Optimal | 119.12 | 1397 | 1397.00 | 0.00 |
| tai20 10 6.json | 20 | 10 | Solution | 600.02 | 1484 | 1399.00 | 5.73 |
| tai20 10 7.json | 20 | 10 | Optimal | 357.94 | 1538 | 1538.00 | 0.00 |
| tai20 10 8.json | 20 | 10 | Optimal | 31.26 | 1593 | 1593.00 | 0.00 |
| tai20 10 9.json | 20 | 10 | Solution | 600.04 | 1603 | 1492.00 | 6.92 |
| tai20 20 0.json | 20 | 20 | Solution | 600.04 | 2340 | 2010.00 | 14.10 |
| tai20 20 1.json | 20 | 20 | Solution | 600.03 | 2130 | 1823.00 | 14.41 |
| tai20 20 2.json | 20 | 20 | Solution | 600.04 | 2329 | 1945.00 | 16.49 |
| tai20 20 3.json | 20 | 20 | Solution | 600.04 | 2229 | 1933.00 | 13.28 |
| tai20 20 4.json | 20 | 20 | Solution | 600.02 | 2324 | 2034.00 | 12.48 |
| tai20 20 5.json | 20 | 20 | Solution | 600.04 | 2235 | 1967.00 | 11.99 |
| tai20 20 6.json | 20 | 20 | Solution | 600.05 | 2291 | 1976.00 | 13.75 |
| tai20 20 7.json | 20 | 20 | Solution | 600.04 | 2222 | 1936.00 | 12.87 |
| tai20 20 8.json | 20 | 20 | Solution | 600.04 | 2250 | 1909.00 | 15.16 |
| tai20 20 9.json | 20 | 20 | Solution | 600.02 | 2189 | 1954.00 | 10.74 |
| tai20 5 0.json | 20 | 5 | Optimal | 0.79 | 1278 | 1278.00 | 0.00 |
| tai20 5 1.json | 20 | 5 | Optimal | 0.39 | 1359 | 1359.00 | 0.00 |
| tai20 5 2.json | 20 | 5 | Optimal | 0.76 | 1081 | 1081.00 | 0.00 |
| tai20 5 3.json | 20 | 5 | Optimal | 1.38 | 1293 | 1293.00 | 0.00 |
| tai20 5 4.json | 20 | 5 | Optimal | 4.98 | 1235 | 1235.00 | 0.00 |
| tai20 5 5.json | 20 | 5 | Optimal | 0.45 | 1195 | 1195.00 | 0.00 |
| tai20 5 6.json | 20 | 5 | Optimal | 0.37 | 1234 | 1234.00 | 0.00 |
| tai20 5 7.json | 20 | 5 | Optimal | 1.22 | 1206 | 1206.00 | 0.00 |
| tai20 5 8.json | 20 | 5 | Optimal | 0.65 | 1230 | 1230.00 | 0.00 |
| tai20 5 9.json | 20 | 5 | Optimal | 0.58 | 1108 | 1108.00 | 0.00 |
| tai500 20 0.json | 500 | 20 | Solution | 600.40 | 28935 | 25955.00 | 10.30 |
| tai500 20 1.json | 500 | 20 | Solution | 600.21 | 29270 | 26432.00 | 9.70 |
| tai500 20 2.json | 500 | 20 | Solution | 600.25 | 28956 | 26330.00 | 9.07 |
| tai500 20 3.json | 500 | 20 | Solution | 600.21 | 28977 | 26456.00 | 8.70 |
| tai500 20 4.json | 500 | 20 | Solution | 600.23 | 28999 | 26263.00 | 9.43 |
| tai500 20 5.json | 500 | 20 | Solution | 600.28 | 28939 | 26440.00 | 8.64 |

Table 5.6: Results for Taillard Permutation Flowshop (CPO) (120 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------|------------|----------------|----------|--------|----------|----------|----------------|
| tai500 20 6.json | 500 | 20 | Solution | 600.27 | 28709 | 26362.00 | 8.18 |
| tai500 20 7.json | 500 | 20 | Solution | 600.29 | 29115 | 26514.00 | 8.93 |
| tai500 20 8.json | 500 | 20 | Solution | 600.22 | 28659 | 25952.00 | 9.45 |
| tai500 20 9.json | 500 | 20 | Solution | 600.25 | 28948 | 26429.00 | 8.70 |
| tai50 10 0.json | 50 | 10 | Solution | 600.09 | 3039 | 2967.00 | 2.37 |
| tai50 10 1.json | 50 | 10 | Solution | 600.09 | 2933 | 2829.00 | 3.55 |
| tai50 10 2.json | 50 | 10 | Solution | 600.11 | 2921 | 2828.00 | 3.18 |
| tai50 10 3.json | 50 | 10 | Optimal | 535.73 | 3063 | 3063.00 | 0.00 |
| tai50 10 4.json | 50 | 10 | Solution | 600.10 | 3021 | 2928.00 | 3.08 |
| tai50 10 5.json | 50 | 10 | Solution | 600.12 | 3050 | 2987.00 | 2.07 |
| tai50 10 6.json | 50 | 10 | Solution | 600.10 | 3124 | 3065.00 | 1.89 |
| tai50 10 7.json | 50 | 10 | Solution | 600.05 | 3040 | 3037.00 | 0.10 |
| tai50 10 8.json | 50 | 10 | Solution | 600.12 | 2902 | 2883.00 | 0.65 |
| tai50 10 9.json | 50 | 10 | Solution | 600.06 | 3121 | 3046.00 | 2.40 |
| tai50 20 0.json | 50 | 20 | Solution | 600.21 | 3931 | 3591.00 | 8.65 |
| tai50 20 1.json | 50 | 20 | Solution | 600.24 | 3812 | 3534.00 | 7.29 |
| tai50 20 2.json | 50 | 20 | Solution | 600.24 | 3756 | 3428.00 | 8.73 |
| tai50 20 3.json | 50 | 20 | Solution | 600.24 | 3817 | 3453.00 | 9.54 |
| tai50 20 4.json | 50 | 20 | Solution | 600.20 | 3736 | 3389.00 | 9.29 |
| tai50 20 5.json | 50 | 20 | Solution | 600.17 | 3784 | 3535.00 | 6.58 |
| tai50 20 6.json | 50 | 20 | Solution | 600.18 | 3799 | 3495.00 | 8.00 |
| tai50 20 7.json | 50 | 20 | Solution | 600.18 | 3836 | 3443.00 | 10.25 |
| tai50 20 8.json | 50 | 20 | Solution | 600.22 | 3908 | 3482.00 | 10.90 |
| tai50 20 9.json | 50 | 20 | Solution | 600.16 | 3857 | 3538.00 | 8.27 |
| tai50 5 0.json | 50 | 5 | Optimal | 1.24 | 2724 | 2724.00 | 0.00 |
| tai50 5 1.json | 50 | 5 | Optimal | 2.71 | 2834 | 2834.00 | 0.00 |
| tai50 5 2.json | 50 | 5 | Optimal | 32.80 | 2621 | 2621.00 | 0.00 |
| tai50 5 3.json | 50 | 5 | Optimal | 1.66 | 2751 | 2751.00 | 0.00 |
| tai50 5 4.json | 50 | 5 | Optimal | 2.22 | 2863 | 2863.00 | 0.00 |
| tai50 5 5.json | 50 | 5 | Optimal | 3.09 | 2829 | 2829.00 | 0.00 |
| tai50 5 6.json | 50 | 5 | Optimal | 14.28 | 2725 | 2725.00 | 0.00 |
| tai50 5 7.json | 50 | 5 | Optimal | 2.61 | 2683 | 2683.00 | 0.00 |
| tai50 5 8.json | 50 | 5 | Optimal | 3.82 | 2552 | 2552.00 | 0.00 |
| tai50 5 9.json | 50 | 5 | Optimal | 2.03 | 2782 | 2782.00 | 0.00 |

Chapter 6

SALBP-1 Assembly Line Balancing Problems

The assembly line balancing problems have a single cumulative and no disjunctive constraints, so the indicated number of (disjunctive) machines is zero.

The larger problem instances are still missing. For the small instances (20 tasks), only a few are not solved to optimality, for the medium sizes the number of optimal solutions found is reduced, and for larger instances, optimal solutions are rare.

6.1 Results for CPOptimizer

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 1.alb | 1 | 0 | Solution | 120.19 | 136 | 135.00 | 0.74 |
| instance n=1000 10.alb | 1 | 0 | Solution | 120.07 | 141 | 140.00 | 0.71 |
| instance n=1000 100.alb | 1 | 0 | Solution | 120.10 | 139 | 137.00 | 1.44 |
| instance n=1000 101.alb | 1 | 0 | Solution | 120.18 | 558 | 505.00 | 9.50 |
| instance n=1000 102.alb | 1 | 0 | Solution | 120.20 | 556 | 503.00 | 9.53 |
| instance n=1000 103.alb | 1 | 0 | Solution | 120.25 | 562 | 503.00 | 10.50 |
| instance n=1000 104.alb | 1 | 0 | Solution | 120.20 | 553 | 504.00 | 8.86 |
| instance n=1000 105.alb | 1 | 0 | Solution | 120.19 | 548 | 499.00 | 8.94 |
| instance n=1000 106.alb | 1 | 0 | Solution | 120.22 | 556 | 499.00 | 10.25 |
| instance n=1000 107.alb | 1 | 0 | Solution | 120.20 | 540 | 496.00 | 8.15 |
| instance n=1000 108.alb | 1 | 0 | Solution | 120.18 | 545 | 498.00 | 8.62 |
| instance n=1000 109.alb | 1 | 0 | Solution | 120.21 | 549 | 500.00 | 8.93 |
| instance n=1000 11.alb | 1 | 0 | Solution | 120.07 | 135 | 134.00 | 0.74 |
| instance n=1000 110.alb | 1 | 0 | Solution | 120.21 | 555 | 501.00 | 9.73 |
| instance n=1000 111.alb | 1 | 0 | Solution | 120.25 | 546 | 500.00 | 8.42 |
| instance n=1000 112.alb | 1 | 0 | Solution | 120.22 | 548 | 499.00 | 8.94 |
| instance n=1000 113.alb | 1 | 0 | Solution | 120.17 | 540 | 495.00 | 8.33 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 114.alb | 1 | 0 | Solution | 120.20 | 550 | 502.00 | 8.73 |
| instance n=1000 115.alb | 1 | 0 | Solution | 120.19 | 539 | 498.00 | 7.61 |
| instance n=1000 116.alb | 1 | 0 | Solution | 120.19 | 545 | 496.00 | 8.99 |
| instance n=1000 117.alb | 1 | 0 | Solution | 120.20 | 552 | 500.00 | 9.42 |
| instance n=1000 118.alb | 1 | 0 | Solution | 120.30 | 563 | 509.00 | 9.59 |
| instance n=1000 119.alb | 1 | 0 | Solution | 120.25 | 529 | 496.00 | 6.24 |
| instance n=1000 12.alb | 1 | 0 | Solution | 120.05 | 135 | 134.00 | 0.74 |
| instance n=1000 120.alb | 1 | 0 | Solution | 120.19 | 549 | 502.00 | 8.56 |
| instance n=1000 121.alb | 1 | 0 | Solution | 120.24 | 541 | 496.00 | 8.32 |
| instance n=1000 122.alb | 1 | 0 | Solution | 120.22 | 535 | 493.00 | 7.85 |
| instance n=1000 123.alb | 1 | 0 | Solution | 120.19 | 555 | 504.00 | 9.19 |
| instance n=1000 124.alb | 1 | 0 | Solution | 120.25 | 543 | 498.00 | 8.29 |
| instance n=1000 125.alb | 1 | 0 | Solution | 120.21 | 545 | 499.00 | 8.44 |
| instance n=1000 126.alb | 1 | 0 | Solution | 120.12 | 232 | 228.00 | 1.72 |
| instance n=1000 127.alb | 1 | 0 | Solution | 120.12 | 224 | 221.00 | 1.34 |
| instance n=1000 128.alb | 1 | 0 | Solution | 120.15 | 225 | 222.00 | 1.33 |
| instance n=1000 129.alb | 1 | 0 | Solution | 120.10 | 226 | 223.00 | 1.33 |
| instance n=1000 13.alb | 1 | 0 | Solution | 120.09 | 132 | 131.00 | 0.76 |
| instance n=1000 130.alb | 1 | 0 | Solution | 120.18 | 225 | 221.00 | 1.78 |
| instance n=1000 131.alb | 1 | 0 | Solution | 120.09 | 223 | 220.00 | 1.35 |
| instance n=1000 132.alb | 1 | 0 | Solution | 120.10 | 218 | 214.00 | 1.83 |
| instance n=1000 133.alb | 1 | 0 | Solution | 120.14 | 229 | 226.00 | 1.31 |
| instance n=1000 134.alb | 1 | 0 | Solution | 120.14 | 219 | 215.00 | 1.83 |
| instance n=1000 135.alb | 1 | 0 | Solution | 120.12 | 229 | 225.00 | 1.75 |
| instance n=1000 136.alb | 1 | 0 | Solution | 120.25 | 232 | 228.00 | 1.72 |
| instance n=1000 137.alb | 1 | 0 | Solution | 120.10 | 216 | 213.00 | 1.39 |
| instance n=1000 138.alb | 1 | 0 | Solution | 120.11 | 225 | 221.00 | 1.78 |
| instance n=1000 139.alb | 1 | 0 | Solution | 120.13 | 227 | 224.00 | 1.32 |
| instance n=1000 14.alb | 1 | 0 | Solution | 120.05 | 138 | 136.00 | 1.45 |
| instance n=1000 140.alb | 1 | 0 | Solution | 120.13 | 230 | 226.00 | 1.74 |
| instance n=1000 141.alb | 1 | 0 | Solution | 120.16 | 218 | 215.00 | 1.38 |
| instance n=1000 142.alb | 1 | 0 | Solution | 120.11 | 223 | 220.00 | 1.35 |
| instance n=1000 143.alb | 1 | 0 | Solution | 120.11 | 216 | 213.00 | 1.39 |
| instance n=1000 144.alb | 1 | 0 | Solution | 120.09 | 221 | 217.00 | 1.81 |
| instance n=1000 145.alb | 1 | 0 | Solution | 120.15 | 223 | 220.00 | 1.35 |
| instance n=1000 146.alb | 1 | 0 | Solution | 120.13 | 223 | 219.00 | 1.79 |
| instance n=1000 147.alb | 1 | 0 | Solution | 120.13 | 234 | 229.00 | 2.14 |
| instance n=1000 148.alb | 1 | 0 | Solution | 120.14 | 223 | 219.00 | 1.79 |
| instance n=1000 149.alb | 1 | 0 | Solution | 120.11 | 241 | 237.00 | 1.66 |
| instance n=1000 15.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 150.alb | 1 | 0 | Solution | 120.10 | 225 | 222.00 | 1.33 |
| instance n=1000 151.alb | 1 | 0 | Solution | 120.16 | 140 | 138.00 | 1.43 |
| instance n=1000 152.alb | 1 | 0 | Solution | 120.13 | 138 | 136.00 | 1.45 |
| instance n=1000 153.alb | 1 | 0 | Solution | 120.06 | 139 | 137.00 | 1.44 |
| instance n=1000 154.alb | 1 | 0 | Solution | 120.22 | 142 | 140.00 | 1.41 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 155.alb | 1 | 0 | Solution | 120.11 | 141 | 139.00 | 1.42 |
| instance n=1000 156.alb | 1 | 0 | Solution | 120.22 | 143 | 141.00 | 1.40 |
| instance n=1000 157.alb | 1 | 0 | Solution | 120.15 | 141 | 140.00 | 0.71 |
| instance n=1000 158.alb | 1 | 0 | Solution | 120.12 | 137 | 136.00 | 0.73 |
| instance n=1000 159.alb | 1 | 0 | Solution | 120.09 | 140 | 138.00 | 1.43 |
| instance n=1000 16.alb | 1 | 0 | Solution | 120.06 | 138 | 137.00 | 0.72 |
| instance n=1000 160.alb | 1 | 0 | Solution | 120.12 | 140 | 138.00 | 1.43 |
| instance n=1000 161.alb | 1 | 0 | Solution | 120.10 | 134 | 133.00 | 0.75 |
| instance n=1000 162.alb | 1 | 0 | Solution | 120.06 | 137 | 136.00 | 0.73 |
| instance n=1000 163.alb | 1 | 0 | Solution | 120.16 | 141 | 139.00 | 1.42 |
| instance n=1000 164.alb | 1 | 0 | Solution | 120.08 | 143 | 141.00 | 1.40 |
| instance n=1000 165.alb | 1 | 0 | Solution | 120.15 | 137 | 135.00 | 1.46 |
| instance n=1000 166.alb | 1 | 0 | Solution | 120.08 | 141 | 139.00 | 1.42 |
| instance n=1000 167.alb | 1 | 0 | Solution | 120.06 | 141 | 139.00 | 1.42 |
| instance n=1000 168.alb | 1 | 0 | Solution | 120.05 | 140 | 138.00 | 1.43 |
| instance n=1000 169.alb | 1 | 0 | Solution | 120.13 | 136 | 134.00 | 1.47 |
| instance n=1000 17.alb | 1 | 0 | Solution | 120.06 | 136 | 135.00 | 0.74 |
| instance n=1000 170.alb | 1 | 0 | Solution | 120.11 | 136 | 134.00 | 1.47 |
| instance n=1000 171.alb | 1 | 0 | Solution | 120.06 | 139 | 137.00 | 1.44 |
| instance n=1000 172.alb | 1 | 0 | Solution | 120.13 | 136 | 135.00 | 0.74 |
| instance n=1000 173.alb | 1 | 0 | Solution | 120.15 | 137 | 135.00 | 1.46 |
| instance n=1000 174.alb | 1 | 0 | Solution | 120.17 | 138 | 136.00 | 1.45 |
| instance n=1000 175.alb | 1 | 0 | Solution | 120.13 | 140 | 138.00 | 1.43 |
| instance n=1000 176.alb | 1 | 0 | Solution | 120.22 | 557 | 500.00 | 10.23 |
| instance n=1000 177.alb | 1 | 0 | Solution | 120.19 | 552 | 499.00 | 9.60 |
| instance n=1000 178.alb | 1 | 0 | Solution | 120.22 | 566 | 506.00 | 10.60 |
| instance n=1000 179.alb | 1 | 0 | Solution | 120.24 | 564 | 505.00 | 10.46 |
| instance n=1000 18.alb | 1 | 0 | Solution | 120.07 | 135 | 134.00 | 0.74 |
| instance n=1000 180.alb | 1 | 0 | Solution | 120.20 | 559 | 503.00 | 10.02 |
| instance n=1000 181.alb | 1 | 0 | Solution | 120.24 | 561 | 505.00 | 9.98 |
| instance n=1000 182.alb | 1 | 0 | Solution | 120.24 | 557 | 502.00 | 9.87 |
| instance n=1000 183.alb | 1 | 0 | Solution | 120.21 | 552 | 500.00 | 9.42 |
| instance n=1000 184.alb | 1 | 0 | Solution | 120.22 | 559 | 502.00 | 10.20 |
| instance n=1000 185.alb | 1 | 0 | Solution | 120.24 | 560 | 503.00 | 10.18 |
| instance n=1000 186.alb | 1 | 0 | Solution | 120.22 | 552 | 500.00 | 9.42 |
| instance n=1000 187.alb | 1 | 0 | Solution | 120.21 | 565 | 505.00 | 10.62 |
| instance n=1000 188.alb | 1 | 0 | Solution | 120.24 | 552 | 498.00 | 9.78 |
| instance n=1000 189.alb | 1 | 0 | Solution | 120.22 | 552 | 498.00 | 9.78 |
| instance n=1000 19.alb | 1 | 0 | Solution | 120.06 | 138 | 137.00 | 0.72 |
| instance n=1000 190.alb | 1 | 0 | Solution | 120.23 | 556 | 501.00 | 9.89 |
| instance n=1000 191.alb | 1 | 0 | Solution | 120.21 | 553 | 501.00 | 9.40 |
| instance n=1000 192.alb | 1 | 0 | Solution | 120.19 | 556 | 501.00 | 9.89 |
| instance n=1000 193.alb | 1 | 0 | Solution | 120.20 | 559 | 503.00 | 10.02 |
| instance n=1000 194.alb | 1 | 0 | Solution | 120.23 | 560 | 502.00 | 10.36 |
| instance n=1000 195.alb | 1 | 0 | Solution | 120.20 | 562 | 502.00 | 10.68 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 196.alb | 1 | 0 | Solution | 120.21 | 559 | 500.00 | 10.55 |
| instance n=1000 197.alb | 1 | 0 | Solution | 120.19 | 546 | 496.00 | 9.16 |
| instance n=1000 198.alb | 1 | 0 | Solution | 120.19 | 562 | 503.00 | 10.50 |
| instance n=1000 199.alb | 1 | 0 | Solution | 120.24 | 541 | 495.00 | 8.50 |
| instance n=1000 2.alb | 1 | 0 | Solution | 120.07 | 138 | 137.00 | 0.72 |
| instance n=1000 20.alb | 1 | 0 | Solution | 120.05 | 139 | 138.00 | 0.72 |
| instance n=1000 200.alb | 1 | 0 | Solution | 120.23 | 550 | 498.00 | 9.45 |
| instance n=1000 201.alb | 1 | 0 | Solution | 120.20 | 233 | 229.00 | 1.72 |
| instance n=1000 202.alb | 1 | 0 | Solution | 120.13 | 230 | 225.00 | 2.17 |
| instance n=1000 203.alb | 1 | 0 | Solution | 120.10 | 234 | 229.00 | 2.14 |
| instance n=1000 204.alb | 1 | 0 | Solution | 120.15 | 233 | 228.00 | 2.15 |
| instance n=1000 205.alb | 1 | 0 | Solution | 120.25 | 234 | 229.00 | 2.14 |
| instance n=1000 206.alb | 1 | 0 | Solution | 120.11 | 233 | 229.00 | 1.72 |
| instance n=1000 207.alb | 1 | 0 | Solution | 120.13 | 234 | 230.00 | 1.71 |
| instance n=1000 208.alb | 1 | 0 | Solution | 120.24 | 234 | 229.00 | 2.14 |
| instance n=1000 209.alb | 1 | 0 | Solution | 120.13 | 233 | 228.00 | 2.15 |
| instance n=1000 21.alb | 1 | 0 | Solution | 120.07 | 139 | 138.00 | 0.72 |
| instance n=1000 210.alb | 1 | 0 | Solution | 120.13 | 229 | 224.00 | 2.18 |
| instance n=1000 211.alb | 1 | 0 | Solution | 120.14 | 223 | 219.00 | 1.79 |
| instance n=1000 212.alb | 1 | 0 | Solution | 120.12 | 221 | 217.00 | 1.81 |
| instance n=1000 213.alb | 1 | 0 | Solution | 120.17 | 238 | 233.00 | 2.10 |
| instance n=1000 214.alb | 1 | 0 | Solution | 120.16 | 230 | 225.00 | 2.17 |
| instance n=1000 215.alb | 1 | 0 | Solution | 120.14 | 227 | 223.00 | 1.76 |
| instance n=1000 216.alb | 1 | 0 | Solution | 120.10 | 225 | 221.00 | 1.78 |
| instance n=1000 217.alb | 1 | 0 | Solution | 120.31 | 229 | 225.00 | 1.75 |
| instance n=1000 218.alb | 1 | 0 | Solution | 120.14 | 223 | 219.00 | 1.79 |
| instance n=1000 219.alb | 1 | 0 | Solution | 120.09 | 236 | 232.00 | 1.69 |
| instance n=1000 22.alb | 1 | 0 | Solution | 120.05 | 139 | 137.00 | 1.44 |
| instance n=1000 220.alb | 1 | 0 | Solution | 120.11 | 229 | 225.00 | 1.75 |
| instance n=1000 221.alb | 1 | 0 | Solution | 120.11 | 236 | 231.00 | 2.12 |
| instance n=1000 222.alb | 1 | 0 | Solution | 120.11 | 226 | 221.00 | 2.21 |
| instance n=1000 223.alb | 1 | 0 | Solution | 120.17 | 226 | 221.00 | 2.21 |
| instance n=1000 224.alb | 1 | 0 | Solution | 120.11 | 231 | 226.00 | 2.16 |
| instance n=1000 225.alb | 1 | 0 | Solution | 120.24 | 234 | 229.00 | 2.14 |
| instance n=1000 226.alb | 1 | 0 | Solution | 120.15 | 138 | 136.00 | 1.45 |
| instance n=1000 227.alb | 1 | 0 | Solution | 120.11 | 140 | 138.00 | 1.43 |
| instance n=1000 228.alb | 1 | 0 | Solution | 120.16 | 135 | 133.00 | 1.48 |
| instance n=1000 229.alb | 1 | 0 | Solution | 120.17 | 136 | 134.00 | 1.47 |
| instance n=1000 23.alb | 1 | 0 | Solution | 120.06 | 137 | 136.00 | 0.73 |
| instance n=1000 230.alb | 1 | 0 | Solution | 120.15 | 134 | 131.00 | 2.24 |
| instance n=1000 231.alb | 1 | 0 | Solution | 120.17 | 141 | 138.00 | 2.13 |
| instance n=1000 232.alb | 1 | 0 | Solution | 120.11 | 135 | 133.00 | 1.48 |
| instance n=1000 233.alb | 1 | 0 | Solution | 120.30 | 138 | 135.00 | 2.17 |
| instance n=1000 234.alb | 1 | 0 | Solution | 120.07 | 139 | 137.00 | 1.44 |
| instance n=1000 235.alb | 1 | 0 | Solution | 120.29 | 134 | 133.00 | 0.75 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 236.alb | 1 | 0 | Solution | 120.16 | 138 | 136.00 | 1.45 |
| instance n=1000 237.alb | 1 | 0 | Solution | 120.18 | 141 | 138.00 | 2.13 |
| instance n=1000 238.alb | 1 | 0 | Solution | 120.13 | 140 | 138.00 | 1.43 |
| instance n=1000 239.alb | 1 | 0 | Solution | 120.11 | 137 | 135.00 | 1.46 |
| instance n=1000 24.alb | 1 | 0 | Solution | 120.06 | 141 | 140.00 | 0.71 |
| instance n=1000 240.alb | 1 | 0 | Solution | 120.19 | 137 | 135.00 | 1.46 |
| instance n=1000 241.alb | 1 | 0 | Solution | 120.15 | 140 | 138.00 | 1.43 |
| instance n=1000 242.alb | 1 | 0 | Solution | 120.11 | 137 | 135.00 | 1.46 |
| instance n=1000 243.alb | 1 | 0 | Solution | 120.09 | 139 | 137.00 | 1.44 |
| instance n=1000 244.alb | 1 | 0 | Solution | 120.20 | 139 | 137.00 | 1.44 |
| instance n=1000 245.alb | 1 | 0 | Solution | 120.10 | 137 | 135.00 | 1.46 |
| instance n=1000 246.alb | 1 | 0 | Solution | 120.12 | 137 | 135.00 | 1.46 |
| instance n=1000 247.alb | 1 | 0 | Solution | 120.22 | 141 | 138.00 | 2.13 |
| instance n=1000 248.alb | 1 | 0 | Solution | 120.07 | 141 | 138.00 | 2.13 |
| instance n=1000 249.alb | 1 | 0 | Solution | 120.20 | 141 | 138.00 | 2.13 |
| instance n=1000 25.alb | 1 | 0 | Solution | 120.06 | 137 | 136.00 | 0.73 |
| instance n=1000 250.alb | 1 | 0 | Solution | 120.35 | 142 | 140.00 | 1.41 |
| instance n=1000 251.alb | 1 | 0 | Solution | 120.30 | 568 | 502.00 | 11.62 |
| instance n=1000 252.alb | 1 | 0 | Solution | 120.24 | 567 | 501.00 | 11.64 |
| instance n=1000 253.alb | 1 | 0 | Solution | 120.25 | 560 | 502.00 | 10.36 |
| instance n=1000 254.alb | 1 | 0 | Solution | 120.20 | 563 | 501.00 | 11.01 |
| instance n=1000 255.alb | 1 | 0 | Solution | 120.33 | 551 | 498.00 | 9.62 |
| instance n=1000 256.alb | 1 | 0 | Solution | 120.24 | 558 | 495.00 | 11.29 |
| instance n=1000 257.alb | 1 | 0 | Solution | 120.24 | 566 | 502.00 | 11.31 |
| instance n=1000 258.alb | 1 | 0 | Solution | 120.35 | 557 | 497.00 | 10.77 |
| instance n=1000 259.alb | 1 | 0 | Solution | 120.33 | 557 | 496.00 | 10.95 |
| instance n=1000 26.alb | 1 | 0 | Solution | 120.19 | 555 | 502.00 | 9.55 |
| instance n=1000 260.alb | 1 | 0 | Solution | 120.20 | 556 | 495.00 | 10.97 |
| instance n=1000 261.alb | 1 | 0 | Solution | 120.26 | 564 | 501.00 | 11.17 |
| instance n=1000 262.alb | 1 | 0 | Solution | 120.23 | 544 | 495.00 | 9.01 |
| instance n=1000 263.alb | 1 | 0 | Solution | 120.23 | 561 | 499.00 | 11.05 |
| instance n=1000 264.alb | 1 | 0 | Solution | 120.31 | 557 | 499.00 | 10.41 |
| instance n=1000 265.alb | 1 | 0 | Solution | 120.24 | 579 | 506.00 | 12.61 |
| instance n=1000 266.alb | 1 | 0 | Solution | 120.23 | 562 | 500.00 | 11.03 |
| instance n=1000 267.alb | 1 | 0 | Solution | 120.25 | 571 | 506.00 | 11.38 |
| instance n=1000 268.alb | 1 | 0 | Solution | 120.24 | 554 | 497.00 | 10.29 |
| instance n=1000 269.alb | 1 | 0 | Solution | 120.40 | 558 | 500.00 | 10.39 |
| instance n=1000 27.alb | 1 | 0 | Solution | 120.19 | 551 | 502.00 | 8.89 |
| instance n=1000 270.alb | 1 | 0 | Solution | 120.21 | 581 | 508.00 | 12.56 |
| instance n=1000 271.alb | 1 | 0 | Solution | 120.38 | 553 | 497.00 | 10.13 |
| instance n=1000 272.alb | 1 | 0 | Solution | 120.24 | 567 | 502.00 | 11.46 |
| instance n=1000 273.alb | 1 | 0 | Solution | 120.19 | 563 | 500.00 | 11.19 |
| instance n=1000 274.alb | 1 | 0 | Solution | 120.22 | 559 | 496.00 | 11.27 |
| instance n=1000 275.alb | 1 | 0 | Solution | 120.21 | 565 | 504.00 | 10.80 |
| instance n=1000 276.alb | 1 | 0 | Solution | 120.09 | 223 | 217.00 | 2.69 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 277.alb | 1 | 0 | Solution | 120.38 | 230 | 225.00 | 2.17 |
| instance n=1000 278.alb | 1 | 0 | Solution | 120.22 | 226 | 220.00 | 2.65 |
| instance n=1000 279.alb | 1 | 0 | Solution | 120.21 | 220 | 215.00 | 2.27 |
| instance n=1000 28.alb | 1 | 0 | Solution | 120.18 | 538 | 497.00 | 7.62 |
| instance n=1000 280.alb | 1 | 0 | Solution | 120.10 | 231 | 226.00 | 2.16 |
| instance n=1000 281.alb | 1 | 0 | Solution | 120.08 | 225 | 219.00 | 2.67 |
| instance n=1000 282.alb | 1 | 0 | Solution | 120.10 | 220 | 214.00 | 2.73 |
| instance n=1000 283.alb | 1 | 0 | Solution | 120.25 | 230 | 224.00 | 2.61 |
| instance n=1000 284.alb | 1 | 0 | Solution | 120.11 | 222 | 217.00 | 2.25 |
| instance n=1000 285.alb | 1 | 0 | Solution | 120.14 | 227 | 221.00 | 2.64 |
| instance n=1000 286.alb | 1 | 0 | Solution | 120.14 | 227 | 221.00 | 2.64 |
| instance n=1000 287.alb | 1 | 0 | Solution | 120.10 | 230 | 224.00 | 2.61 |
| instance n=1000 288.alb | 1 | 0 | Solution | 120.16 | 225 | 219.00 | 2.67 |
| instance n=1000 289.alb | 1 | 0 | Solution | 120.13 | 225 | 220.00 | 2.22 |
| instance n=1000 29.alb | 1 | 0 | Solution | 120.19 | 542 | 498.00 | 8.12 |
| instance n=1000 290.alb | 1 | 0 | Solution | 120.24 | 228 | 222.00 | 2.63 |
| instance n=1000 291.alb | 1 | 0 | Solution | 120.16 | 231 | 225.00 | 2.60 |
| instance n=1000 292.alb | 1 | 0 | Solution | 120.11 | 232 | 226.00 | 2.59 |
| instance n=1000 293.alb | 1 | 0 | Solution | 120.14 | 231 | 225.00 | 2.60 |
| instance n=1000 294.alb | 1 | 0 | Solution | 120.19 | 236 | 230.00 | 2.54 |
| instance n=1000 295.alb | 1 | 0 | Solution | 120.16 | 233 | 227.00 | 2.58 |
| instance n=1000 296.alb | 1 | 0 | Solution | 120.21 | 213 | 208.00 | 2.35 |
| instance n=1000 297.alb | 1 | 0 | Solution | 120.13 | 222 | 217.00 | 2.25 |
| instance n=1000 298.alb | 1 | 0 | Solution | 120.14 | 219 | 214.00 | 2.28 |
| instance n=1000 299.alb | 1 | 0 | Solution | 120.25 | 232 | 226.00 | 2.59 |
| instance n=1000 3.alb | 1 | 0 | Solution | 120.10 | 138 | 136.00 | 1.45 |
| instance n=1000 30.alb | 1 | 0 | Solution | 120.22 | 559 | 506.00 | 9.48 |
| instance n=1000 300.alb | 1 | 0 | Solution | 120.21 | 234 | 228.00 | 2.56 |
| instance n=1000 301.alb | 1 | 0 | Solution | 120.10 | 138 | 137.00 | 0.72 |
| instance n=1000 302.alb | 1 | 0 | Solution | 120.15 | 140 | 139.00 | 0.71 |
| instance n=1000 303.alb | 1 | 0 | Solution | 120.14 | 140 | 138.00 | 1.43 |
| instance n=1000 304.alb | 1 | 0 | Solution | 120.11 | 138 | 136.00 | 1.45 |
| instance n=1000 305.alb | 1 | 0 | Solution | 120.20 | 141 | 140.00 | 0.71 |
| instance n=1000 306.alb | 1 | 0 | Solution | 120.22 | 136 | 135.00 | 0.74 |
| instance n=1000 307.alb | 1 | 0 | Solution | 120.23 | 137 | 136.00 | 0.73 |
| instance n=1000 308.alb | 1 | 0 | Solution | 120.13 | 138 | 137.00 | 0.72 |
| instance n=1000 309.alb | 1 | 0 | Solution | 120.24 | 136 | 135.00 | 0.74 |
| instance n=1000 31.alb | 1 | 0 | Solution | 120.19 | 555 | 506.00 | 8.83 |
| instance n=1000 310.alb | 1 | 0 | Solution | 120.16 | 143 | 141.00 | 1.40 |
| instance n=1000 311.alb | 1 | 0 | Solution | 120.24 | 141 | 139.00 | 1.42 |
| instance n=1000 312.alb | 1 | 0 | Solution | 120.13 | 136 | 135.00 | 0.74 |
| instance n=1000 313.alb | 1 | 0 | Solution | 120.15 | 139 | 138.00 | 0.72 |
| instance n=1000 314.alb | 1 | 0 | Solution | 120.20 | 143 | 142.00 | 0.70 |
| instance n=1000 315.alb | 1 | 0 | Solution | 120.36 | 138 | 136.00 | 1.45 |
| instance n=1000 316.alb | 1 | 0 | Solution | 120.23 | 139 | 137.00 | 1.44 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 317.alb | 1 | 0 | Solution | 120.23 | 137 | 136.00 | 0.73 |
| instance n=1000 318.alb | 1 | 0 | Solution | 120.09 | 139 | 138.00 | 0.72 |
| instance n=1000 319.alb | 1 | 0 | Solution | 120.09 | 142 | 140.00 | 1.41 |
| instance n=1000 32.alb | 1 | 0 | Solution | 120.20 | 542 | 502.00 | 7.38 |
| instance n=1000 320.alb | 1 | 0 | Solution | 120.09 | 142 | 141.00 | 0.70 |
| instance n=1000 321.alb | 1 | 0 | Solution | 120.19 | 141 | 140.00 | 0.71 |
| instance n=1000 322.alb | 1 | 0 | Solution | 120.20 | 140 | 139.00 | 0.71 |
| instance n=1000 323.alb | 1 | 0 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 324.alb | 1 | 0 | Solution | 120.11 | 141 | 140.00 | 0.71 |
| instance n=1000 325.alb | 1 | 0 | Solution | 120.11 | 140 | 138.00 | 1.43 |
| instance n=1000 326.alb | 1 | 0 | Solution | 120.35 | 541 | 496.00 | 8.32 |
| instance n=1000 327.alb | 1 | 0 | Solution | 120.22 | 552 | 503.00 | 8.88 |
| instance n=1000 328.alb | 1 | 0 | Solution | 120.18 | 545 | 500.00 | 8.26 |
| instance n=1000 329.alb | 1 | 0 | Solution | 120.27 | 554 | 502.00 | 9.39 |
| instance n=1000 33.alb | 1 | 0 | Solution | 120.18 | 548 | 501.00 | 8.58 |
| instance n=1000 330.alb | 1 | 0 | Solution | 120.23 | 538 | 498.00 | 7.43 |
| instance n=1000 331.alb | 1 | 0 | Solution | 120.22 | 547 | 498.00 | 8.96 |
| instance n=1000 332.alb | 1 | 0 | Solution | 120.25 | 535 | 495.00 | 7.48 |
| instance n=1000 333.alb | 1 | 0 | Solution | 120.22 | 553 | 499.00 | 9.76 |
| instance n=1000 334.alb | 1 | 0 | Solution | 120.27 | 540 | 498.00 | 7.78 |
| instance n=1000 335.alb | 1 | 0 | Solution | 120.21 | 544 | 496.00 | 8.82 |
| instance n=1000 336.alb | 1 | 0 | Solution | 120.47 | 534 | 497.00 | 6.93 |
| instance n=1000 337.alb | 1 | 0 | Solution | 120.22 | 551 | 501.00 | 9.07 |
| instance n=1000 338.alb | 1 | 0 | Solution | 120.23 | 553 | 502.00 | 9.22 |
| instance n=1000 339.alb | 1 | 0 | Solution | 120.35 | 555 | 500.00 | 9.91 |
| instance n=1000 34.alb | 1 | 0 | Solution | 120.19 | 563 | 507.00 | 9.95 |
| instance n=1000 340.alb | 1 | 0 | Solution | 120.46 | 563 | 505.00 | 10.30 |
| instance n=1000 341.alb | 1 | 0 | Solution | 120.25 | 552 | 503.00 | 8.88 |
| instance n=1000 342.alb | 1 | 0 | Solution | 120.20 | 549 | 500.00 | 8.93 |
| instance n=1000 343.alb | 1 | 0 | Solution | 120.29 | 554 | 500.00 | 9.75 |
| instance n=1000 344.alb | 1 | 0 | Solution | 120.26 | 545 | 500.00 | 8.26 |
| instance n=1000 345.alb | 1 | 0 | Solution | 120.27 | 552 | 502.00 | 9.06 |
| instance n=1000 346.alb | 1 | 0 | Solution | 120.25 | 551 | 501.00 | 9.07 |
| instance n=1000 347.alb | 1 | 0 | Solution | 120.37 | 547 | 498.00 | 8.96 |
| instance n=1000 348.alb | 1 | 0 | Solution | 120.33 | 566 | 506.00 | 10.60 |
| instance n=1000 349.alb | 1 | 0 | Solution | 120.42 | 558 | 503.00 | 9.86 |
| instance n=1000 35.alb | 1 | 0 | Solution | 120.19 | 544 | 501.00 | 7.90 |
| instance n=1000 350.alb | 1 | 0 | Solution | 120.18 | 534 | 496.00 | 7.12 |
| instance n=1000 351.alb | 1 | 0 | Solution | 120.19 | 231 | 227.00 | 1.73 |
| instance n=1000 352.alb | 1 | 0 | Solution | 120.13 | 231 | 227.00 | 1.73 |
| instance n=1000 353.alb | 1 | 0 | Solution | 120.12 | 221 | 217.00 | 1.81 |
| instance n=1000 354.alb | 1 | 0 | Solution | 120.24 | 226 | 222.00 | 1.77 |
| instance n=1000 355.alb | 1 | 0 | Solution | 120.29 | 224 | 220.00 | 1.79 |
| instance n=1000 356.alb | 1 | 0 | Solution | 120.13 | 230 | 226.00 | 1.74 |
| instance n=1000 357.alb | 1 | 0 | Solution | 120.26 | 217 | 213.00 | 1.84 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 358.alb | 1 | 0 | Solution | 120.12 | 223 | 219.00 | 1.79 |
| instance n=1000 359.alb | 1 | 0 | Solution | 120.11 | 226 | 222.00 | 1.77 |
| instance n=1000 36.alb | 1 | 0 | Solution | 120.19 | 538 | 497.00 | 7.62 |
| instance n=1000 360.alb | 1 | 0 | Solution | 120.35 | 233 | 229.00 | 1.72 |
| instance n=1000 361.alb | 1 | 0 | Solution | 120.11 | 219 | 215.00 | 1.83 |
| instance n=1000 362.alb | 1 | 0 | Solution | 120.13 | 226 | 223.00 | 1.33 |
| instance n=1000 363.alb | 1 | 0 | Solution | 120.10 | 218 | 215.00 | 1.38 |
| instance n=1000 364.alb | 1 | 0 | Solution | 120.29 | 225 | 221.00 | 1.78 |
| instance n=1000 365.alb | 1 | 0 | Solution | 120.30 | 231 | 227.00 | 1.73 |
| instance n=1000 366.alb | 1 | 0 | Solution | 120.48 | 232 | 228.00 | 1.72 |
| instance n=1000 367.alb | 1 | 0 | Solution | 120.11 | 231 | 227.00 | 1.73 |
| instance n=1000 368.alb | 1 | 0 | Solution | 120.21 | 230 | 226.00 | 1.74 |
| instance n=1000 369.alb | 1 | 0 | Solution | 120.29 | 224 | 220.00 | 1.79 |
| instance n=1000 37.alb | 1 | 0 | Solution | 120.18 | 559 | 506.00 | 9.48 |
| instance n=1000 370.alb | 1 | 0 | Solution | 120.20 | 227 | 223.00 | 1.76 |
| instance n=1000 371.alb | 1 | 0 | Solution | 120.31 | 223 | 220.00 | 1.35 |
| instance n=1000 372.alb | 1 | 0 | Solution | 120.35 | 234 | 230.00 | 1.71 |
| instance n=1000 373.alb | 1 | 0 | Solution | 120.24 | 223 | 219.00 | 1.79 |
| instance n=1000 374.alb | 1 | 0 | Solution | 120.19 | 222 | 219.00 | 1.35 |
| instance n=1000 375.alb | 1 | 0 | Solution | 120.30 | 231 | 227.00 | 1.73 |
| instance n=1000 376.alb | 1 | 0 | Solution | 120.19 | 134 | 132.00 | 1.49 |
| instance n=1000 377.alb | 1 | 0 | Solution | 120.22 | 138 | 137.00 | 0.72 |
| instance n=1000 378.alb | 1 | 0 | Solution | 120.24 | 136 | 134.00 | 1.47 |
| instance n=1000 379.alb | 1 | 0 | Solution | 120.09 | 139 | 137.00 | 1.44 |
| instance n=1000 38.alb | 1 | 0 | Solution | 120.20 | 557 | 504.00 | 9.52 |
| instance n=1000 380.alb | 1 | 0 | Solution | 120.17 | 136 | 134.00 | 1.47 |
| instance n=1000 381.alb | 1 | 0 | Solution | 120.21 | 140 | 138.00 | 1.43 |
| instance n=1000 382.alb | 1 | 0 | Solution | 120.28 | 133 | 131.00 | 1.50 |
| instance n=1000 383.alb | 1 | 0 | Solution | 120.19 | 141 | 138.00 | 2.13 |
| instance n=1000 384.alb | 1 | 0 | Solution | 120.48 | 141 | 139.00 | 1.42 |
| instance n=1000 385.alb | 1 | 0 | Solution | 120.15 | 137 | 135.00 | 1.46 |
| instance n=1000 386.alb | 1 | 0 | Solution | 120.08 | 141 | 139.00 | 1.42 |
| instance n=1000 387.alb | 1 | 0 | Solution | 120.07 | 139 | 137.00 | 1.44 |
| instance n=1000 388.alb | 1 | 0 | Solution | 120.06 | 138 | 137.00 | 0.72 |
| instance n=1000 389.alb | 1 | 0 | Solution | 120.34 | 138 | 136.00 | 1.45 |
| instance n=1000 39.alb | 1 | 0 | Solution | 120.21 | 560 | 507.00 | 9.46 |
| instance n=1000 390.alb | 1 | 0 | Solution | 120.27 | 138 | 136.00 | 1.45 |
| instance n=1000 391.alb | 1 | 0 | Solution | 120.27 | 137 | 135.00 | 1.46 |
| instance n=1000 392.alb | 1 | 0 | Solution | 120.15 | 137 | 136.00 | 0.73 |
| instance n=1000 393.alb | 1 | 0 | Solution | 120.17 | 138 | 136.00 | 1.45 |
| instance n=1000 394.alb | 1 | 0 | Solution | 120.52 | 140 | 138.00 | 1.43 |
| instance n=1000 395.alb | 1 | 0 | Solution | 120.25 | 141 | 139.00 | 1.42 |
| instance n=1000 396.alb | 1 | 0 | Solution | 120.21 | 138 | 136.00 | 1.45 |
| instance n=1000 397.alb | 1 | 0 | Solution | 120.29 | 142 | 140.00 | 1.41 |
| instance n=1000 398.alb | 1 | 0 | Solution | 120.19 | 136 | 134.00 | 1.47 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 399.alb | 1 | 0 | Solution | 120.30 | 140 | 139.00 | 0.71 |
| instance n=1000 4.alb | 1 | 0 | Solution | 120.09 | 139 | 138.00 | 0.72 |
| instance n=1000 40.alb | 1 | 0 | Solution | 120.17 | 531 | 496.00 | 6.59 |
| instance n=1000 400.alb | 1 | 0 | Solution | 120.45 | 142 | 140.00 | 1.41 |
| instance n=1000 401.alb | 1 | 0 | Solution | 120.26 | 554 | 497.00 | 10.29 |
| instance n=1000 402.alb | 1 | 0 | Solution | 120.35 | 559 | 500.00 | 10.55 |
| instance n=1000 403.alb | 1 | 0 | Solution | 120.23 | 555 | 500.00 | 9.91 |
| instance n=1000 404.alb | 1 | 0 | Solution | 120.25 | 555 | 500.00 | 9.91 |
| instance n=1000 405.alb | 1 | 0 | Solution | 120.29 | 564 | 501.00 | 11.17 |
| instance n=1000 406.alb | 1 | 0 | Solution | 120.40 | 547 | 495.00 | 9.51 |
| instance n=1000 407.alb | 1 | 0 | Solution | 120.39 | 559 | 498.00 | 10.91 |
| instance n=1000 408.alb | 1 | 0 | Solution | 120.32 | 564 | 501.00 | 11.17 |
| instance n=1000 409.alb | 1 | 0 | Solution | 120.32 | 565 | 504.00 | 10.80 |
| instance n=1000 41.alb | 1 | 0 | Solution | 120.20 | 543 | 500.00 | 7.92 |
| instance n=1000 410.alb | 1 | 0 | Solution | 120.46 | 575 | 505.00 | 12.17 |
| instance n=1000 411.alb | 1 | 0 | Solution | 120.31 | 559 | 498.00 | 10.91 |
| instance n=1000 412.alb | 1 | 0 | Solution | 120.24 | 558 | 499.00 | 10.57 |
| instance n=1000 413.alb | 1 | 0 | Solution | 120.25 | 564 | 503.00 | 10.82 |
| instance n=1000 414.alb | 1 | 0 | Solution | 120.29 | 558 | 501.00 | 10.22 |
| instance n=1000 415.alb | 1 | 0 | Solution | 120.23 | 559 | 501.00 | 10.38 |
| instance n=1000 416.alb | 1 | 0 | Solution | 120.24 | 564 | 502.00 | 10.99 |
| instance n=1000 417.alb | 1 | 0 | Solution | 120.33 | 585 | 512.00 | 12.48 |
| instance n=1000 418.alb | 1 | 0 | Solution | 120.24 | 558 | 501.00 | 10.22 |
| instance n=1000 419.alb | 1 | 0 | Solution | 120.27 | 579 | 510.00 | 11.92 |
| instance n=1000 42.alb | 1 | 0 | Solution | 120.19 | 533 | 497.00 | 6.75 |
| instance n=1000 420.alb | 1 | 0 | Solution | 120.18 | 561 | 501.00 | 10.70 |
| instance n=1000 421.alb | 1 | 0 | Solution | 120.21 | 556 | 499.00 | 10.25 |
| instance n=1000 422.alb | 1 | 0 | Solution | 120.25 | 552 | 495.00 | 10.33 |
| instance n=1000 423.alb | 1 | 0 | Solution | 120.36 | 562 | 500.00 | 11.03 |
| instance n=1000 424.alb | 1 | 0 | Solution | 120.34 | 550 | 495.00 | 10.00 |
| instance n=1000 425.alb | 1 | 0 | Solution | 120.26 | 565 | 504.00 | 10.80 |
| instance n=1000 426.alb | 1 | 0 | Solution | 120.10 | 229 | 224.00 | 2.18 |
| instance n=1000 427.alb | 1 | 0 | Solution | 120.15 | 235 | 229.00 | 2.55 |
| instance n=1000 428.alb | 1 | 0 | Solution | 120.14 | 228 | 224.00 | 1.75 |
| instance n=1000 429.alb | 1 | 0 | Solution | 120.12 | 240 | 235.00 | 2.08 |
| instance n=1000 43.alb | 1 | 0 | Solution | 120.17 | 534 | 496.00 | 7.12 |
| instance n=1000 430.alb | 1 | 0 | Solution | 120.34 | 224 | 220.00 | 1.79 |
| instance n=1000 431.alb | 1 | 0 | Solution | 120.21 | 234 | 230.00 | 1.71 |
| instance n=1000 432.alb | 1 | 0 | Solution | 120.15 | 232 | 227.00 | 2.16 |
| instance n=1000 433.alb | 1 | 0 | Solution | 120.16 | 234 | 229.00 | 2.14 |
| instance n=1000 434.alb | 1 | 0 | Solution | 120.40 | 215 | 212.00 | 1.40 |
| instance n=1000 435.alb | 1 | 0 | Solution | 120.40 | 232 | 227.00 | 2.16 |
| instance n=1000 436.alb | 1 | 0 | Solution | 120.13 | 231 | 226.00 | 2.16 |
| instance n=1000 437.alb | 1 | 0 | Solution | 120.44 | 226 | 222.00 | 1.77 |
| instance n=1000 438.alb | 1 | 0 | Solution | 120.13 | 226 | 221.00 | 2.21 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 439.alb | 1 | 0 | Solution | 120.20 | 229 | 225.00 | 1.75 |
| instance n=1000 44.alb | 1 | 0 | Solution | 120.16 | 550 | 502.00 | 8.73 |
| instance n=1000 440.alb | 1 | 0 | Solution | 120.56 | 230 | 225.00 | 2.17 |
| instance n=1000 441.alb | 1 | 0 | Solution | 120.20 | 226 | 221.00 | 2.21 |
| instance n=1000 442.alb | 1 | 0 | Solution | 120.12 | 235 | 230.00 | 2.13 |
| instance n=1000 443.alb | 1 | 0 | Solution | 120.34 | 222 | 217.00 | 2.25 |
| instance n=1000 444.alb | 1 | 0 | Solution | 120.23 | 227 | 222.00 | 2.20 |
| instance n=1000 445.alb | 1 | 0 | Solution | 120.28 | 235 | 229.00 | 2.55 |
| instance n=1000 446.alb | 1 | 0 | Solution | 120.35 | 232 | 228.00 | 1.72 |
| instance n=1000 447.alb | 1 | 0 | Solution | 120.14 | 227 | 221.00 | 2.64 |
| instance n=1000 448.alb | 1 | 0 | Solution | 120.22 | 226 | 222.00 | 1.77 |
| instance n=1000 449.alb | 1 | 0 | Solution | 120.25 | 238 | 232.00 | 2.52 |
| instance n=1000 45.alb | 1 | 0 | Solution | 120.18 | 524 | 492.00 | 6.11 |
| instance n=1000 450.alb | 1 | 0 | Solution | 120.33 | 225 | 220.00 | 2.22 |
| instance n=1000 451.alb | 1 | 0 | Solution | 120.23 | 140 | 136.00 | 2.86 |
| instance n=1000 452.alb | 1 | 0 | Solution | 120.10 | 134 | 132.00 | 1.49 |
| instance n=1000 453.alb | 1 | 0 | Solution | 120.41 | 141 | 138.00 | 2.13 |
| instance n=1000 454.alb | 1 | 0 | Solution | 120.19 | 142 | 139.00 | 2.11 |
| instance n=1000 455.alb | 1 | 0 | Solution | 120.68 | 139 | 136.00 | 2.16 |
| instance n=1000 456.alb | 1 | 0 | Solution | 120.14 | 138 | 135.00 | 2.17 |
| instance n=1000 457.alb | 1 | 0 | Solution | 120.11 | 140 | 137.00 | 2.14 |
| instance n=1000 458.alb | 1 | 0 | Solution | 120.26 | 137 | 135.00 | 1.46 |
| instance n=1000 459.alb | 1 | 0 | Solution | 120.33 | 140 | 137.00 | 2.14 |
| instance n=1000 46.alb | 1 | 0 | Solution | 120.19 | 538 | 498.00 | 7.43 |
| instance n=1000 460.alb | 1 | 0 | Solution | 120.13 | 141 | 138.00 | 2.13 |
| instance n=1000 461.alb | 1 | 0 | Solution | 120.34 | 140 | 137.00 | 2.14 |
| instance n=1000 462.alb | 1 | 0 | Solution | 120.59 | 139 | 136.00 | 2.16 |
| instance n=1000 463.alb | 1 | 0 | Solution | 120.10 | 138 | 136.00 | 1.45 |
| instance n=1000 464.alb | 1 | 0 | Solution | 120.30 | 141 | 138.00 | 2.13 |
| instance n=1000 465.alb | 1 | 0 | Solution | 120.42 | 141 | 138.00 | 2.13 |
| instance n=1000 466.alb | 1 | 0 | Solution | 120.39 | 137 | 133.00 | 2.92 |
| instance n=1000 467.alb | 1 | 0 | Solution | 120.20 | 140 | 138.00 | 1.43 |
| instance n=1000 468.alb | 1 | 0 | Solution | 120.27 | 139 | 137.00 | 1.44 |
| instance n=1000 469.alb | 1 | 0 | Solution | 120.55 | 140 | 137.00 | 2.14 |
| instance n=1000 47.alb | 1 | 0 | Solution | 120.19 | 542 | 499.00 | 7.93 |
| instance n=1000 470.alb | 1 | 0 | Solution | 120.17 | 138 | 135.00 | 2.17 |
| instance n=1000 471.alb | 1 | 0 | Solution | 120.36 | 138 | 135.00 | 2.17 |
| instance n=1000 472.alb | 1 | 0 | Solution | 120.19 | 142 | 140.00 | 1.41 |
| instance n=1000 473.alb | 1 | 0 | Solution | 120.14 | 138 | 135.00 | 2.17 |
| instance n=1000 474.alb | 1 | 0 | Solution | 120.10 | 139 | 136.00 | 2.16 |
| instance n=1000 475.alb | 1 | 0 | Solution | 120.41 | 139 | 136.00 | 2.16 |
| instance n=1000 476.alb | 1 | 0 | Solution | 120.22 | 574 | 503.00 | 12.37 |
| instance n=1000 477.alb | 1 | 0 | Solution | 120.34 | 586 | 507.00 | 13.48 |
| instance n=1000 478.alb | 1 | 0 | Solution | 120.29 | 596 | 510.00 | 14.43 |
| instance n=1000 479.alb | 1 | 0 | Solution | 120.20 | 579 | 503.00 | 13.13 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 48.alb | 1 | 0 | Solution | 120.20 | 565 | 508.00 | 10.09 |
| instance n=1000 480.alb | 1 | 0 | Solution | 120.19 | 566 | 498.00 | 12.01 |
| instance n=1000 481.alb | 1 | 0 | Solution | 120.30 | 581 | 504.00 | 13.25 |
| instance n=1000 482.alb | 1 | 0 | Solution | 120.21 | 596 | 505.00 | 15.27 |
| instance n=1000 483.alb | 1 | 0 | Solution | 120.33 | 569 | 499.00 | 12.30 |
| instance n=1000 484.alb | 1 | 0 | Solution | 120.21 | 589 | 508.00 | 13.75 |
| instance n=1000 485.alb | 1 | 0 | Solution | 120.21 | 586 | 505.00 | 13.82 |
| instance n=1000 486.alb | 1 | 0 | Solution | 120.21 | 571 | 500.00 | 12.43 |
| instance n=1000 487.alb | 1 | 0 | Solution | 120.22 | 584 | 502.00 | 14.04 |
| instance n=1000 488.alb | 1 | 0 | Solution | 120.28 | 572 | 502.00 | 12.24 |
| instance n=1000 489.alb | 1 | 0 | Solution | 120.43 | 568 | 498.00 | 12.32 |
| instance n=1000 49.alb | 1 | 0 | Solution | 120.19 | 544 | 500.00 | 8.09 |
| instance n=1000 490.alb | 1 | 0 | Solution | 120.52 | 573 | 501.00 | 12.57 |
| instance n=1000 491.alb | 1 | 0 | Solution | 120.36 | 575 | 500.00 | 13.04 |
| instance n=1000 492.alb | 1 | 0 | Solution | 120.40 | 585 | 509.00 | 12.99 |
| instance n=1000 493.alb | 1 | 0 | Solution | 120.27 | 561 | 495.00 | 11.76 |
| instance n=1000 494.alb | 1 | 0 | Solution | 120.31 | 571 | 500.00 | 12.43 |
| instance n=1000 495.alb | 1 | 0 | Solution | 120.23 | 587 | 507.00 | 13.63 |
| instance n=1000 496.alb | 1 | 0 | Solution | 120.20 | 553 | 495.00 | 10.49 |
| instance n=1000 497.alb | 1 | 0 | Solution | 120.25 | 566 | 499.00 | 11.84 |
| instance n=1000 498.alb | 1 | 0 | Solution | 120.23 | 588 | 506.00 | 13.95 |
| instance n=1000 499.alb | 1 | 0 | Solution | 120.27 | 566 | 499.00 | 11.84 |
| instance n=1000 5.alb | 1 | 0 | Solution | 120.07 | 136 | 135.00 | 0.74 |
| instance n=1000 50.alb | 1 | 0 | Solution | 120.15 | 526 | 493.00 | 6.27 |
| instance n=1000 500.alb | 1 | 0 | Solution | 120.23 | 571 | 503.00 | 11.91 |
| instance n=1000 501.alb | 1 | 0 | Solution | 120.23 | 234 | 227.00 | 2.99 |
| instance n=1000 502.alb | 1 | 0 | Solution | 120.29 | 232 | 224.00 | 3.45 |
| instance n=1000 503.alb | 1 | 0 | Solution | 120.69 | 233 | 224.00 | 3.86 |
| instance n=1000 504.alb | 1 | 0 | Solution | 120.44 | 236 | 227.00 | 3.81 |
| instance n=1000 505.alb | 1 | 0 | Solution | 120.24 | 219 | 213.00 | 2.74 |
| instance n=1000 506.alb | 1 | 0 | Solution | 120.26 | 230 | 223.00 | 3.04 |
| instance n=1000 507.alb | 1 | 0 | Solution | 120.18 | 228 | 220.00 | 3.51 |
| instance n=1000 508.alb | 1 | 0 | Solution | 120.36 | 226 | 219.00 | 3.10 |
| instance n=1000 509.alb | 1 | 0 | Solution | 120.13 | 232 | 225.00 | 3.02 |
| instance n=1000 51.alb | 1 | 0 | Solution | 120.13 | 229 | 226.00 | 1.31 |
| instance n=1000 510.alb | 1 | 0 | Solution | 120.43 | 235 | 226.00 | 3.83 |
| instance n=1000 511.alb | 1 | 0 | Solution | 120.13 | 237 | 230.00 | 2.95 |
| instance n=1000 512.alb | 1 | 0 | Solution | 120.27 | 226 | 219.00 | 3.10 |
| instance n=1000 513.alb | 1 | 0 | Solution | 120.15 | 227 | 219.00 | 3.52 |
| instance n=1000 514.alb | 1 | 0 | Solution | 120.14 | 233 | 226.00 | 3.00 |
| instance n=1000 515.alb | 1 | 0 | Solution | 120.18 | 228 | 221.00 | 3.07 |
| instance n=1000 516.alb | 1 | 0 | Solution | 120.47 | 237 | 229.00 | 3.38 |
| instance n=1000 517.alb | 1 | 0 | Solution | 120.17 | 229 | 221.00 | 3.49 |
| instance n=1000 518.alb | 1 | 0 | Solution | 120.48 | 226 | 220.00 | 2.65 |
| instance n=1000 519.alb | 1 | 0 | Solution | 120.34 | 229 | 221.00 | 3.49 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 52.alb | 1 | 0 | Solution | 120.09 | 231 | 228.00 | 1.30 |
| instance n=1000 520.alb | 1 | 0 | Solution | 120.33 | 234 | 226.00 | 3.42 |
| instance n=1000 521.alb | 1 | 0 | Solution | 120.25 | 236 | 229.00 | 2.97 |
| instance n=1000 522.alb | 1 | 0 | Solution | 120.21 | 221 | 215.00 | 2.71 |
| instance n=1000 523.alb | 1 | 0 | Solution | 120.23 | 228 | 220.00 | 3.51 |
| instance n=1000 524.alb | 1 | 0 | Solution | 120.26 | 232 | 226.00 | 2.59 |
| instance n=1000 525.alb | 1 | 0 | Solution | 120.36 | 229 | 221.00 | 3.49 |
| instance n=1000 53.alb | 1 | 0 | Solution | 120.09 | 230 | 227.00 | 1.30 |
| instance n=1000 54.alb | 1 | 0 | Solution | 120.10 | 223 | 219.00 | 1.79 |
| instance n=1000 55.alb | 1 | 0 | Solution | 120.10 | 220 | 217.00 | 1.36 |
| instance n=1000 56.alb | 1 | 0 | Solution | 120.08 | 232 | 228.00 | 1.72 |
| instance n=1000 57.alb | 1 | 0 | Solution | 120.08 | 227 | 224.00 | 1.32 |
| instance n=1000 58.alb | 1 | 0 | Solution | 120.11 | 227 | 224.00 | 1.32 |
| instance n=1000 59.alb | 1 | 0 | Solution | 120.11 | 226 | 223.00 | 1.33 |
| instance n=1000 6.alb | 1 | 0 | Solution | 120.08 | 143 | 141.00 | 1.40 |
| instance n=1000 60.alb | 1 | 0 | Solution | 120.08 | 233 | 230.00 | 1.29 |
| instance n=1000 61.alb | 1 | 0 | Solution | 120.11 | 233 | 229.00 | 1.72 |
| instance n=1000 62.alb | 1 | 0 | Solution | 120.08 | 226 | 223.00 | 1.33 |
| instance n=1000 63.alb | 1 | 0 | Solution | 120.10 | 230 | 227.00 | 1.30 |
| instance n=1000 64.alb | 1 | 0 | Solution | 120.11 | 233 | 229.00 | 1.72 |
| instance n=1000 65.alb | 1 | 0 | Solution | 120.11 | 227 | 225.00 | 0.88 |
| instance n=1000 66.alb | 1 | 0 | Solution | 120.08 | 230 | 227.00 | 1.30 |
| instance n=1000 67.alb | 1 | 0 | Solution | 120.08 | 226 | 223.00 | 1.33 |
| instance n=1000 68.alb | 1 | 0 | Solution | 120.11 | 230 | 226.00 | 1.74 |
| instance n=1000 69.alb | 1 | 0 | Solution | 120.11 | 227 | 224.00 | 1.32 |
| instance n=1000 7.alb | 1 | 0 | Solution | 120.07 | 138 | 136.00 | 1.45 |
| instance n=1000 70.alb | 1 | 0 | Solution | 120.11 | 231 | 228.00 | 1.30 |
| instance n=1000 71.alb | 1 | 0 | Solution | 120.09 | 233 | 230.00 | 1.29 |
| instance n=1000 72.alb | 1 | 0 | Solution | 120.08 | 225 | 222.00 | 1.33 |
| instance n=1000 73.alb | 1 | 0 | Solution | 120.12 | 224 | 221.00 | 1.34 |
| instance n=1000 74.alb | 1 | 0 | Solution | 120.14 | 231 | 227.00 | 1.73 |
| instance n=1000 75.alb | 1 | 0 | Solution | 120.10 | 230 | 227.00 | 1.30 |
| instance n=1000 76.alb | 1 | 0 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 77.alb | 1 | 0 | Solution | 120.06 | 137 | 136.00 | 0.73 |
| instance n=1000 78.alb | 1 | 0 | Solution | 120.11 | 140 | 138.00 | 1.43 |
| instance n=1000 79.alb | 1 | 0 | Solution | 120.13 | 143 | 142.00 | 0.70 |
| instance n=1000 8.alb | 1 | 0 | Solution | 120.08 | 140 | 138.00 | 1.43 |
| instance n=1000 80.alb | 1 | 0 | Solution | 120.06 | 141 | 140.00 | 0.71 |
| instance n=1000 81.alb | 1 | 0 | Solution | 120.14 | 138 | 136.00 | 1.45 |
| instance n=1000 82.alb | 1 | 0 | Solution | 120.13 | 137 | 136.00 | 0.73 |
| instance n=1000 83.alb | 1 | 0 | Solution | 120.13 | 141 | 140.00 | 0.71 |
| instance n=1000 84.alb | 1 | 0 | Solution | 120.07 | 136 | 135.00 | 0.74 |
| instance n=1000 85.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 86.alb | 1 | 0 | Solution | 120.13 | 139 | 138.00 | 0.72 |
| instance n=1000 87.alb | 1 | 0 | Solution | 120.10 | 142 | 140.00 | 1.41 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 88.alb | 1 | 0 | Solution | 120.09 | 142 | 140.00 | 1.41 |
| instance n=1000 89.alb | 1 | 0 | Solution | 120.07 | 141 | 140.00 | 0.71 |
| instance n=1000 9.alb | 1 | 0 | Solution | 120.06 | 136 | 134.00 | 1.47 |
| instance n=1000 90.alb | 1 | 0 | Solution | 120.11 | 139 | 138.00 | 0.72 |
| instance n=1000 91.alb | 1 | 0 | Solution | 120.05 | 142 | 141.00 | 0.70 |
| instance n=1000 92.alb | 1 | 0 | Solution | 120.06 | 137 | 136.00 | 0.73 |
| instance n=1000 93.alb | 1 | 0 | Solution | 120.11 | 138 | 137.00 | 0.72 |
| instance n=1000 94.alb | 1 | 0 | Solution | 120.10 | 139 | 137.00 | 1.44 |
| instance n=1000 95.alb | 1 | 0 | Solution | 120.14 | 137 | 136.00 | 0.73 |
| instance n=1000 96.alb | 1 | 0 | Solution | 120.09 | 139 | 137.00 | 1.44 |
| instance n=1000 97.alb | 1 | 0 | Solution | 120.12 | 140 | 138.00 | 1.43 |
| instance n=1000 98.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 99.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=100 1.alb | 1 | 0 | Optimal | 5.53 | 23 | 23.00 | 0.00 |
| instance n=100 10.alb | 1 | 0 | Optimal | 0.05 | 22 | 22.00 | 0.00 |
| instance n=100 100.alb | 1 | 0 | Optimal | 2.72 | 25 | 25.00 | 0.00 |
| instance n=100 101.alb | 1 | 0 | Optimal | 0.73 | 15 | 15.00 | 0.00 |
| instance n=100 102.alb | 1 | 0 | Optimal | 0.15 | 14 | 14.00 | 0.00 |
| instance n=100 103.alb | 1 | 0 | Optimal | 0.13 | 14 | 14.00 | 0.00 |
| instance n=100 104.alb | 1 | 0 | Optimal | 0.13 | 14 | 14.00 | 0.00 |
| instance n=100 105.alb | 1 | 0 | Optimal | 0.13 | 13 | 13.00 | 0.00 |
| instance n=100 106.alb | 1 | 0 | Optimal | 0.16 | 14 | 14.00 | 0.00 |
| instance n=100 107.alb | 1 | 0 | Optimal | 0.20 | 14 | 14.00 | 0.00 |
| instance n=100 108.alb | 1 | 0 | Optimal | 3.54 | 14 | 14.00 | 0.00 |
| instance n=100 109.alb | 1 | 0 | Optimal | 0.19 | 15 | 15.00 | 0.00 |
| instance n=100 11.alb | 1 | 0 | Optimal | 0.06 | 24 | 24.00 | 0.00 |
| instance n=100 110.alb | 1 | 0 | Optimal | 0.22 | 13 | 13.00 | 0.00 |
| instance n=100 111.alb | 1 | 0 | Optimal | 0.19 | 16 | 16.00 | 0.00 |
| instance n=100 112.alb | 1 | 0 | Optimal | 3.03 | 13 | 13.00 | 0.00 |
| instance n=100 113.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 114.alb | 1 | 0 | Optimal | 0.29 | 13 | 13.00 | 0.00 |
| instance n=100 115.alb | 1 | 0 | Optimal | 0.22 | 14 | 14.00 | 0.00 |
| instance n=100 116.alb | 1 | 0 | Optimal | 0.16 | 16 | 16.00 | 0.00 |
| instance n=100 117.alb | 1 | 0 | Optimal | 4.30 | 15 | 15.00 | 0.00 |
| instance n=100 118.alb | 1 | 0 | Optimal | 0.11 | 15 | 15.00 | 0.00 |
| instance n=100 119.alb | 1 | 0 | Optimal | 0.18 | 14 | 14.00 | 0.00 |
| instance n=100 12.alb | 1 | 0 | Optimal | 2.85 | 25 | 25.00 | 0.00 |
| instance n=100 120.alb | 1 | 0 | Optimal | 0.22 | 14 | 14.00 | 0.00 |
| instance n=100 121.alb | 1 | 0 | Optimal | 0.15 | 15 | 15.00 | 0.00 |
| instance n=100 122.alb | 1 | 0 | Optimal | 0.23 | 13 | 13.00 | 0.00 |
| instance n=100 123.alb | 1 | 0 | Optimal | 0.19 | 15 | 15.00 | 0.00 |
| instance n=100 124.alb | 1 | 0 | Optimal | 3.34 | 15 | 15.00 | 0.00 |
| instance n=100 125.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 126.alb | 1 | 0 | Solution | 120.01 | 51 | 49.00 | 3.92 |
| instance n=100 127.alb | 1 | 0 | Solution | 120.01 | 53 | 49.00 | 7.55 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 128.alb | 1 | 0 | Solution | 120.03 | 57 | 52.00 | 8.77 |
| instance n=100 129.alb | 1 | 0 | Solution | 120.02 | 55 | 50.00 | 9.09 |
| instance n=100 13.alb | 1 | 0 | Optimal | 0.48 | 24 | 24.00 | 0.00 |
| instance n=100 130.alb | 1 | 0 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 131.alb | 1 | 0 | Solution | 120.03 | 53 | 50.00 | 5.66 |
| instance n=100 132.alb | 1 | 0 | Solution | 120.02 | 57 | 53.00 | 7.02 |
| instance n=100 133.alb | 1 | 0 | Solution | 120.03 | 55 | 51.00 | 7.27 |
| instance n=100 134.alb | 1 | 0 | Solution | 120.03 | 54 | 51.00 | 5.56 |
| instance n=100 135.alb | 1 | 0 | Solution | 120.03 | 56 | 51.00 | 8.93 |
| instance n=100 136.alb | 1 | 0 | Solution | 120.05 | 52 | 49.00 | 5.77 |
| instance n=100 137.alb | 1 | 0 | Solution | 120.03 | 54 | 50.00 | 7.41 |
| instance n=100 138.alb | 1 | 0 | Solution | 120.02 | 56 | 52.00 | 7.14 |
| instance n=100 139.alb | 1 | 0 | Solution | 120.03 | 52 | 49.00 | 5.77 |
| instance n=100 14.alb | 1 | 0 | Optimal | 1.46 | 20 | 20.00 | 0.00 |
| instance n=100 140.alb | 1 | 0 | Solution | 120.04 | 55 | 51.00 | 7.27 |
| instance n=100 141.alb | 1 | 0 | Solution | 120.03 | 51 | 49.00 | 3.92 |
| instance n=100 142.alb | 1 | 0 | Solution | 120.03 | 55 | 50.00 | 9.09 |
| instance n=100 143.alb | 1 | 0 | Solution | 120.02 | 53 | 51.00 | 3.77 |
| instance n=100 144.alb | 1 | 0 | Solution | 120.03 | 49 | 47.00 | 4.08 |
| instance n=100 145.alb | 1 | 0 | Solution | 120.04 | 56 | 51.00 | 8.93 |
| instance n=100 146.alb | 1 | 0 | Solution | 120.03 | 53 | 50.00 | 5.66 |
| instance n=100 147.alb | 1 | 0 | Solution | 120.03 | 59 | 52.00 | 11.86 |
| instance n=100 148.alb | 1 | 0 | Solution | 120.04 | 53 | 50.00 | 5.66 |
| instance n=100 149.alb | 1 | 0 | Solution | 120.03 | 55 | 51.00 | 7.27 |
| instance n=100 15.alb | 1 | 0 | Optimal | 0.06 | 24 | 24.00 | 0.00 |
| instance n=100 150.alb | 1 | 0 | Solution | 120.03 | 58 | 51.00 | 12.07 |
| instance n=100 151.alb | 1 | 0 | Solution | 120.04 | 22 | 21.00 | 4.55 |
| instance n=100 152.alb | 1 | 0 | Optimal | 0.31 | 22 | 22.00 | 0.00 |
| instance n=100 153.alb | 1 | 0 | Optimal | 0.17 | 21 | 21.00 | 0.00 |
| instance n=100 154.alb | 1 | 0 | Optimal | 0.25 | 25 | 25.00 | 0.00 |
| instance n=100 155.alb | 1 | 0 | Optimal | 0.23 | 22 | 22.00 | 0.00 |
| instance n=100 156.alb | 1 | 0 | Optimal | 0.28 | 23 | 23.00 | 0.00 |
| instance n=100 157.alb | 1 | 0 | Optimal | 1.29 | 26 | 26.00 | 0.00 |
| instance n=100 158.alb | 1 | 0 | Optimal | 0.29 | 23 | 23.00 | 0.00 |
| instance n=100 159.alb | 1 | 0 | Optimal | 0.14 | 19 | 19.00 | 0.00 |
| instance n=100 16.alb | 1 | 0 | Optimal | 0.04 | 23 | 23.00 | 0.00 |
| instance n=100 160.alb | 1 | 0 | Optimal | 0.30 | 22 | 22.00 | 0.00 |
| instance n=100 161.alb | 1 | 0 | Optimal | 117.95 | 22 | 22.00 | 0.00 |
| instance n=100 162.alb | 1 | 0 | Solution | 120.04 | 23 | 22.00 | 4.35 |
| instance n=100 163.alb | 1 | 0 | Optimal | 0.20 | 25 | 25.00 | 0.00 |
| instance n=100 164.alb | 1 | 0 | Optimal | 0.20 | 23 | 23.00 | 0.00 |
| instance n=100 165.alb | 1 | 0 | Solution | 120.02 | 25 | 24.00 | 4.00 |
| instance n=100 166.alb | 1 | 0 | Optimal | 2.08 | 24 | 24.00 | 0.00 |
| instance n=100 167.alb | 1 | 0 | Optimal | 0.25 | 22 | 22.00 | 0.00 |
| instance n=100 168.alb | 1 | 0 | Solution | 120.05 | 22 | 21.00 | 4.55 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 169.alb | 1 | 0 | Optimal | 0.38 | 21 | 21.00 | 0.00 |
| instance n=100 17.alb | 1 | 0 | Solution | 120.02 | 22 | 21.00 | 4.55 |
| instance n=100 170.alb | 1 | 0 | Optimal | 4.00 | 24 | 24.00 | 0.00 |
| instance n=100 171.alb | 1 | 0 | Solution | 120.03 | 25 | 24.00 | 4.00 |
| instance n=100 172.alb | 1 | 0 | Optimal | 0.25 | 24 | 24.00 | 0.00 |
| instance n=100 173.alb | 1 | 0 | Solution | 120.03 | 25 | 24.00 | 4.00 |
| instance n=100 174.alb | 1 | 0 | Optimal | 4.22 | 22 | 22.00 | 0.00 |
| instance n=100 175.alb | 1 | 0 | Solution | 120.03 | 27 | 26.00 | 3.70 |
| instance n=100 176.alb | 1 | 0 | Optimal | 0.20 | 13 | 13.00 | 0.00 |
| instance n=100 177.alb | 1 | 0 | Optimal | 0.18 | 14 | 14.00 | 0.00 |
| instance n=100 178.alb | 1 | 0 | Optimal | 0.23 | 15 | 15.00 | 0.00 |
| instance n=100 179.alb | 1 | 0 | Optimal | 0.14 | 15 | 15.00 | 0.00 |
| instance n=100 18.alb | 1 | 0 | Solution | 120.01 | 20 | 19.00 | 5.00 |
| instance n=100 180.alb | 1 | 0 | Optimal | 0.22 | 15 | 15.00 | 0.00 |
| instance n=100 181.alb | 1 | 0 | Optimal | 0.22 | 13 | 13.00 | 0.00 |
| instance n=100 182.alb | 1 | 0 | Optimal | 0.23 | 15 | 15.00 | 0.00 |
| instance n=100 183.alb | 1 | 0 | Optimal | 0.20 | 14 | 14.00 | 0.00 |
| instance n=100 184.alb | 1 | 0 | Optimal | 0.28 | 14 | 14.00 | 0.00 |
| instance n=100 185.alb | 1 | 0 | Optimal | 0.26 | 15 | 15.00 | 0.00 |
| instance n=100 186.alb | 1 | 0 | Optimal | 2.05 | 14 | 14.00 | 0.00 |
| instance n=100 187.alb | 1 | 0 | Optimal | 10.45 | 13 | 13.00 | 0.00 |
| instance n=100 188.alb | 1 | 0 | Optimal | 0.26 | 16 | 16.00 | 0.00 |
| instance n=100 189.alb | 1 | 0 | Optimal | 0.23 | 14 | 14.00 | 0.00 |
| instance n=100 19.alb | 1 | 0 | Optimal | 0.43 | 23 | 23.00 | 0.00 |
| instance n=100 190.alb | 1 | 0 | Optimal | 0.26 | 13 | 13.00 | 0.00 |
| instance n=100 191.alb | 1 | 0 | Optimal | 0.23 | 14 | 14.00 | 0.00 |
| instance n=100 192.alb | 1 | 0 | Optimal | 2.87 | 13 | 13.00 | 0.00 |
| instance n=100 193.alb | 1 | 0 | Optimal | 0.38 | 15 | 15.00 | 0.00 |
| instance n=100 194.alb | 1 | 0 | Optimal | 0.30 | 15 | 15.00 | 0.00 |
| instance n=100 195.alb | 1 | 0 | Optimal | 0.23 | 15 | 15.00 | 0.00 |
| instance n=100 196.alb | 1 | 0 | Optimal | 0.28 | 15 | 15.00 | 0.00 |
| instance n=100 197.alb | 1 | 0 | Optimal | 0.17 | 15 | 15.00 | 0.00 |
| instance n=100 198.alb | 1 | 0 | Optimal | 2.85 | 13 | 13.00 | 0.00 |
| instance n=100 199.alb | 1 | 0 | Optimal | 0.25 | 14 | 14.00 | 0.00 |
| instance n=100 2.alb | 1 | 0 | Optimal | 0.05 | 21 | 21.00 | 0.00 |
| instance n=100 20.alb | 1 | 0 | Optimal | 0.04 | 21 | 21.00 | 0.00 |
| instance n=100 200.alb | 1 | 0 | Optimal | 0.22 | 15 | 15.00 | 0.00 |
| instance n=100 201.alb | 1 | 0 | Solution | 120.06 | 53 | 51.00 | 3.77 |
| instance n=100 202.alb | 1 | 0 | Solution | 120.05 | 61 | 52.00 | 14.75 |
| instance n=100 203.alb | 1 | 0 | Solution | 120.03 | 53 | 49.00 | 7.55 |
| instance n=100 204.alb | 1 | 0 | Solution | 120.05 | 51 | 48.00 | 5.88 |
| instance n=100 205.alb | 1 | 0 | Solution | 120.03 | 57 | 51.00 | 10.53 |
| instance n=100 206.alb | 1 | 0 | Solution | 120.03 | 52 | 49.00 | 5.77 |
| instance n=100 207.alb | 1 | 0 | Solution | 120.01 | 52 | 49.00 | 5.77 |
| instance n=100 208.alb | 1 | 0 | Solution | 120.03 | 57 | 51.00 | 10.53 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 209.alb | 1 | 0 | Solution | 120.07 | 55 | 51.00 | 7.27 |
| instance n=100 21.alb | 1 | 0 | Optimal | 0.45 | 21 | 21.00 | 0.00 |
| instance n=100 210.alb | 1 | 0 | Solution | 120.04 | 53 | 49.00 | 7.55 |
| instance n=100 211.alb | 1 | 0 | Solution | 120.04 | 52 | 49.00 | 5.77 |
| instance n=100 212.alb | 1 | 0 | Solution | 120.04 | 53 | 50.00 | 5.66 |
| instance n=100 213.alb | 1 | 0 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 214.alb | 1 | 0 | Solution | 120.04 | 55 | 50.00 | 9.09 |
| instance n=100 215.alb | 1 | 0 | Solution | 120.05 | 49 | 47.00 | 4.08 |
| instance n=100 216.alb | 1 | 0 | Solution | 120.01 | 53 | 50.00 | 5.66 |
| instance n=100 217.alb | 1 | 0 | Solution | 120.06 | 52 | 49.00 | 5.77 |
| instance n=100 218.alb | 1 | 0 | Solution | 120.03 | 54 | 50.00 | 7.41 |
| instance n=100 219.alb | 1 | 0 | Solution | 120.05 | 52 | 49.00 | 5.77 |
| instance n=100 22.alb | 1 | 0 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=100 220.alb | 1 | 0 | Solution | 120.04 | 54 | 50.00 | 7.41 |
| instance n=100 221.alb | 1 | 0 | Solution | 120.03 | 57 | 51.00 | 10.53 |
| instance n=100 222.alb | 1 | 0 | Solution | 120.05 | 53 | 50.00 | 5.66 |
| instance n=100 223.alb | 1 | 0 | Solution | 120.04 | 51 | 49.00 | 3.92 |
| instance n=100 224.alb | 1 | 0 | Solution | 120.05 | 56 | 51.00 | 8.93 |
| instance n=100 225.alb | 1 | 0 | Solution | 120.03 | 53 | 51.00 | 3.77 |
| instance n=100 226.alb | 1 | 0 | Solution | 120.05 | 25 | 24.00 | 4.00 |
| instance n=100 227.alb | 1 | 0 | Optimal | 82.63 | 26 | 26.00 | 0.00 |
| instance n=100 228.alb | 1 | 0 | Optimal | 8.12 | 22 | 22.00 | 0.00 |
| instance n=100 229.alb | 1 | 0 | Optimal | 0.40 | 24 | 24.00 | 0.00 |
| instance n=100 23.alb | 1 | 0 | Optimal | 0.07 | 24 | 24.00 | 0.00 |
| instance n=100 230.alb | 1 | 0 | Optimal | 19.43 | 23 | 23.00 | 0.00 |
| instance n=100 231.alb | 1 | 0 | Optimal | 28.64 | 22 | 22.00 | 0.00 |
| instance n=100 232.alb | 1 | 0 | Optimal | 0.52 | 22 | 22.00 | 0.00 |
| instance n=100 233.alb | 1 | 0 | Solution | 120.03 | 23 | 22.00 | 4.35 |
| instance n=100 234.alb | 1 | 0 | Optimal | 0.36 | 23 | 23.00 | 0.00 |
| instance n=100 235.alb | 1 | 0 | Optimal | 2.66 | 26 | 26.00 | 0.00 |
| instance n=100 236.alb | 1 | 0 | Solution | 120.03 | 23 | 22.00 | 4.35 |
| instance n=100 237.alb | 1 | 0 | Optimal | 5.82 | 23 | 23.00 | 0.00 |
| instance n=100 238.alb | 1 | 0 | Optimal | 4.46 | 23 | 23.00 | 0.00 |
| instance n=100 239.alb | 1 | 0 | Optimal | 0.31 | 21 | 21.00 | 0.00 |
| instance n=100 24.alb | 1 | 0 | Optimal | 0.07 | 24 | 24.00 | 0.00 |
| instance n=100 240.alb | 1 | 0 | Optimal | 3.22 | 22 | 22.00 | 0.00 |
| instance n=100 241.alb | 1 | 0 | Optimal | 4.17 | 22 | 22.00 | 0.00 |
| instance n=100 242.alb | 1 | 0 | Optimal | 4.05 | 23 | 23.00 | 0.00 |
| instance n=100 243.alb | 1 | 0 | Optimal | 112.03 | 23 | 23.00 | 0.00 |
| instance n=100 244.alb | 1 | 0 | Optimal | 0.38 | 21 | 21.00 | 0.00 |
| instance n=100 245.alb | 1 | 0 | Solution | 120.05 | 24 | 23.00 | 4.17 |
| instance n=100 246.alb | 1 | 0 | Optimal | 6.42 | 26 | 26.00 | 0.00 |
| instance n=100 247.alb | 1 | 0 | Optimal | 4.47 | 22 | 22.00 | 0.00 |
| instance n=100 248.alb | 1 | 0 | Optimal | 3.60 | 19 | 19.00 | 0.00 |
| instance n=100 249.alb | 1 | 0 | Optimal | 3.14 | 21 | 21.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 25.alb | 1 | 0 | Optimal | 0.52 | 22 | 22.00 | 0.00 |
| instance n=100 250.alb | 1 | 0 | Optimal | 2.48 | 24 | 24.00 | 0.00 |
| instance n=100 251.alb | 1 | 0 | Optimal | 0.19 | 15 | 15.00 | 0.00 |
| instance n=100 252.alb | 1 | 0 | Optimal | 0.48 | 14 | 14.00 | 0.00 |
| instance n=100 253.alb | 1 | 0 | Optimal | 0.20 | 14 | 14.00 | 0.00 |
| instance n=100 254.alb | 1 | 0 | Optimal | 0.23 | 14 | 14.00 | 0.00 |
| instance n=100 255.alb | 1 | 0 | Optimal | 0.20 | 14 | 14.00 | 0.00 |
| instance n=100 256.alb | 1 | 0 | Optimal | 0.30 | 15 | 15.00 | 0.00 |
| instance n=100 257.alb | 1 | 0 | Optimal | 3.57 | 12 | 12.00 | 0.00 |
| instance n=100 258.alb | 1 | 0 | Optimal | 3.55 | 14 | 14.00 | 0.00 |
| instance n=100 259.alb | 1 | 0 | Optimal | 1.84 | 15 | 15.00 | 0.00 |
| instance n=100 26.alb | 1 | 0 | Optimal | 0.55 | 14 | 14.00 | 0.00 |
| instance n=100 260.alb | 1 | 0 | Optimal | 0.31 | 15 | 15.00 | 0.00 |
| instance n=100 261.alb | 1 | 0 | Optimal | 0.35 | 14 | 14.00 | 0.00 |
| instance n=100 262.alb | 1 | 0 | Optimal | 0.28 | 14 | 14.00 | 0.00 |
| instance n=100 263.alb | 1 | 0 | Optimal | 0.39 | 14 | 14.00 | 0.00 |
| instance n=100 264.alb | 1 | 0 | Optimal | 0.28 | 15 | 15.00 | 0.00 |
| instance n=100 265.alb | 1 | 0 | Optimal | 0.39 | 14 | 14.00 | 0.00 |
| instance n=100 266.alb | 1 | 0 | Optimal | 3.19 | 13 | 13.00 | 0.00 |
| instance n=100 267.alb | 1 | 0 | Optimal | 0.35 | 13 | 13.00 | 0.00 |
| instance n=100 268.alb | 1 | 0 | Optimal | 0.28 | 15 | 15.00 | 0.00 |
| instance n=100 269.alb | 1 | 0 | Optimal | 0.33 | 15 | 15.00 | 0.00 |
| instance n=100 27.alb | 1 | 0 | Optimal | 0.32 | 13 | 13.00 | 0.00 |
| instance n=100 270.alb | 1 | 0 | Optimal | 0.46 | 13 | 13.00 | 0.00 |
| instance n=100 271.alb | 1 | 0 | Optimal | 15.96 | 13 | 13.00 | 0.00 |
| instance n=100 272.alb | 1 | 0 | Optimal | 0.26 | 14 | 14.00 | 0.00 |
| instance n=100 273.alb | 1 | 0 | Optimal | 7.35 | 13 | 13.00 | 0.00 |
| instance n=100 274.alb | 1 | 0 | Optimal | 4.30 | 13 | 13.00 | 0.00 |
| instance n=100 275.alb | 1 | 0 | Optimal | 0.43 | 13 | 13.00 | 0.00 |
| instance n=100 276.alb | 1 | 0 | Solution | 120.05 | 60 | 52.00 | 13.33 |
| instance n=100 277.alb | 1 | 0 | Solution | 120.04 | 57 | 52.00 | 8.77 |
| instance n=100 278.alb | 1 | 0 | Solution | 120.05 | 58 | 52.00 | 10.34 |
| instance n=100 279.alb | 1 | 0 | Solution | 120.06 | 54 | 51.00 | 5.56 |
| instance n=100 28.alb | 1 | 0 | Optimal | 0.40 | 14 | 14.00 | 0.00 |
| instance n=100 280.alb | 1 | 0 | Solution | 120.06 | 56 | 51.00 | 8.93 |
| instance n=100 281.alb | 1 | 0 | Solution | 120.05 | 62 | 52.00 | 16.13 |
| instance n=100 282.alb | 1 | 0 | Solution | 120.04 | 60 | 53.00 | 11.67 |
| instance n=100 283.alb | 1 | 0 | Solution | 120.07 | 55 | 51.00 | 7.27 |
| instance n=100 284.alb | 1 | 0 | Solution | 120.08 | 55 | 51.00 | 7.27 |
| instance n=100 285.alb | 1 | 0 | Solution | 120.05 | 55 | 51.00 | 7.27 |
| instance n=100 286.alb | 1 | 0 | Solution | 120.04 | 57 | 51.00 | 10.53 |
| instance n=100 287.alb | 1 | 0 | Solution | 120.04 | 54 | 50.00 | 7.41 |
| instance n=100 288.alb | 1 | 0 | Solution | 120.07 | 56 | 51.00 | 8.93 |
| instance n=100 289.alb | 1 | 0 | Solution | 120.05 | 62 | 52.00 | 16.13 |
| instance n=100 29.alb | 1 | 0 | Optimal | 0.35 | 14 | 14.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 290.alb | 1 | 0 | Solution | 120.04 | 55 | 51.00 | 7.27 |
| instance n=100 291.alb | 1 | 0 | Solution | 120.04 | 53 | 49.00 | 7.55 |
| instance n=100 292.alb | 1 | 0 | Solution | 120.05 | 58 | 51.00 | 12.07 |
| instance n=100 293.alb | 1 | 0 | Solution | 120.05 | 53 | 50.00 | 5.66 |
| instance n=100 294.alb | 1 | 0 | Solution | 120.05 | 58 | 52.00 | 10.34 |
| instance n=100 295.alb | 1 | 0 | Solution | 120.05 | 57 | 51.00 | 10.53 |
| instance n=100 296.alb | 1 | 0 | Solution | 120.06 | 55 | 51.00 | 7.27 |
| instance n=100 297.alb | 1 | 0 | Solution | 120.04 | 59 | 51.00 | 13.56 |
| instance n=100 298.alb | 1 | 0 | Solution | 120.03 | 59 | 52.00 | 11.86 |
| instance n=100 299.alb | 1 | 0 | Solution | 120.09 | 55 | 50.00 | 9.09 |
| instance n=100 3.alb | 1 | 0 | Optimal | 0.05 | 20 | 20.00 | 0.00 |
| instance n=100 30.alb | 1 | 0 | Optimal | 0.04 | 15 | 15.00 | 0.00 |
| instance n=100 300.alb | 1 | 0 | Solution | 120.04 | 54 | 50.00 | 7.41 |
| instance n=100 301.alb | 1 | 0 | Optimal | 0.49 | 23 | 23.00 | 0.00 |
| instance n=100 302.alb | 1 | 0 | Optimal | 0.39 | 24 | 24.00 | 0.00 |
| instance n=100 303.alb | 1 | 0 | Optimal | 5.07 | 24 | 24.00 | 0.00 |
| instance n=100 304.alb | 1 | 0 | Optimal | 1.82 | 21 | 21.00 | 0.00 |
| instance n=100 305.alb | 1 | 0 | Optimal | 0.31 | 22 | 22.00 | 0.00 |
| instance n=100 306.alb | 1 | 0 | Optimal | 0.50 | 24 | 24.00 | 0.00 |
| instance n=100 307.alb | 1 | 0 | Solution | 120.06 | 24 | 23.00 | 4.17 |
| instance n=100 308.alb | 1 | 0 | Solution | 120.06 | 21 | 20.00 | 4.76 |
| instance n=100 309.alb | 1 | 0 | Solution | 120.05 | 22 | 21.00 | 4.55 |
| instance n=100 31.alb | 1 | 0 | Optimal | 0.05 | 14 | 14.00 | 0.00 |
| instance n=100 310.alb | 1 | 0 | Optimal | 2.46 | 23 | 23.00 | 0.00 |
| instance n=100 311.alb | 1 | 0 | Optimal | 0.41 | 21 | 21.00 | 0.00 |
| instance n=100 312.alb | 1 | 0 | Optimal | 0.41 | 22 | 22.00 | 0.00 |
| instance n=100 313.alb | 1 | 0 | Optimal | 0.61 | 23 | 23.00 | 0.00 |
| instance n=100 314.alb | 1 | 0 | Optimal | 0.60 | 19 | 19.00 | 0.00 |
| instance n=100 315.alb | 1 | 0 | Solution | 120.07 | 23 | 22.00 | 4.35 |
| instance n=100 316.alb | 1 | 0 | Optimal | 0.38 | 24 | 24.00 | 0.00 |
| instance n=100 317.alb | 1 | 0 | Optimal | 0.43 | 26 | 26.00 | 0.00 |
| instance n=100 318.alb | 1 | 0 | Optimal | 0.41 | 21 | 21.00 | 0.00 |
| instance n=100 319.alb | 1 | 0 | Optimal | 2.56 | 23 | 23.00 | 0.00 |
| instance n=100 32.alb | 1 | 0 | Optimal | 0.04 | 14 | 14.00 | 0.00 |
| instance n=100 320.alb | 1 | 0 | Optimal | 0.30 | 22 | 22.00 | 0.00 |
| instance n=100 321.alb | 1 | 0 | Optimal | 0.42 | 26 | 26.00 | 0.00 |
| instance n=100 322.alb | 1 | 0 | Solution | 120.07 | 24 | 23.00 | 4.17 |
| instance n=100 323.alb | 1 | 0 | Optimal | 0.33 | 24 | 24.00 | 0.00 |
| instance n=100 324.alb | 1 | 0 | Optimal | 0.50 | 23 | 23.00 | 0.00 |
| instance n=100 325.alb | 1 | 0 | Solution | 120.09 | 26 | 25.00 | 3.85 |
| instance n=100 326.alb | 1 | 0 | Optimal | 0.27 | 13 | 13.00 | 0.00 |
| instance n=100 327.alb | 1 | 0 | Optimal | 0.57 | 14 | 14.00 | 0.00 |
| instance n=100 328.alb | 1 | 0 | Optimal | 17.30 | 14 | 14.00 | 0.00 |
| instance n=100 329.alb | 1 | 0 | Optimal | 0.45 | 14 | 14.00 | 0.00 |
| instance n=100 33.alb | 1 | 0 | Optimal | 0.05 | 15 | 15.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 330.alb | 1 | 0 | Optimal | 9.76 | 14 | 14.00 | 0.00 |
| instance n=100 331.alb | 1 | 0 | Optimal | 0.27 | 14 | 14.00 | 0.00 |
| instance n=100 332.alb | 1 | 0 | Optimal | 0.35 | 14 | 14.00 | 0.00 |
| instance n=100 333.alb | 1 | 0 | Optimal | 0.38 | 15 | 15.00 | 0.00 |
| instance n=100 334.alb | 1 | 0 | Optimal | 3.56 | 14 | 14.00 | 0.00 |
| instance n=100 335.alb | 1 | 0 | Optimal | 0.38 | 13 | 13.00 | 0.00 |
| instance n=100 336.alb | 1 | 0 | Optimal | 0.43 | 15 | 15.00 | 0.00 |
| instance n=100 337.alb | 1 | 0 | Optimal | 0.78 | 13 | 13.00 | 0.00 |
| instance n=100 338.alb | 1 | 0 | Solution | 120.06 | 15 | 14.00 | 6.67 |
| instance n=100 339.alb | 1 | 0 | Optimal | 0.31 | 14 | 14.00 | 0.00 |
| instance n=100 34.alb | 1 | 0 | Optimal | 0.05 | 15 | 15.00 | 0.00 |
| instance n=100 340.alb | 1 | 0 | Optimal | 0.41 | 14 | 14.00 | 0.00 |
| instance n=100 341.alb | 1 | 0 | Optimal | 0.49 | 16 | 16.00 | 0.00 |
| instance n=100 342.alb | 1 | 0 | Optimal | 2.14 | 14 | 14.00 | 0.00 |
| instance n=100 343.alb | 1 | 0 | Optimal | 0.57 | 16 | 16.00 | 0.00 |
| instance n=100 344.alb | 1 | 0 | Optimal | 0.45 | 15 | 15.00 | 0.00 |
| instance n=100 345.alb | 1 | 0 | Optimal | 0.32 | 14 | 14.00 | 0.00 |
| instance n=100 346.alb | 1 | 0 | Optimal | 0.37 | 14 | 14.00 | 0.00 |
| instance n=100 347.alb | 1 | 0 | Optimal | 0.40 | 14 | 14.00 | 0.00 |
| instance n=100 348.alb | 1 | 0 | Optimal | 0.36 | 14 | 14.00 | 0.00 |
| instance n=100 349.alb | 1 | 0 | Optimal | 0.36 | 13 | 13.00 | 0.00 |
| instance n=100 35.alb | 1 | 0 | Optimal | 0.05 | 15 | 15.00 | 0.00 |
| instance n=100 350.alb | 1 | 0 | Optimal | 0.43 | 14 | 14.00 | 0.00 |
| instance n=100 351.alb | 1 | 0 | Solution | 120.08 | 59 | 52.00 | 11.86 |
| instance n=100 352.alb | 1 | 0 | Solution | 120.07 | 63 | 52.00 | 17.46 |
| instance n=100 353.alb | 1 | 0 | Solution | 120.06 | 51 | 49.00 | 3.92 |
| instance n=100 354.alb | 1 | 0 | Solution | 120.05 | 53 | 49.00 | 7.55 |
| instance n=100 355.alb | 1 | 0 | Solution | 120.04 | 55 | 51.00 | 7.27 |
| instance n=100 356.alb | 1 | 0 | Solution | 120.09 | 61 | 53.00 | 13.11 |
| instance n=100 357.alb | 1 | 0 | Solution | 120.08 | 54 | 50.00 | 7.41 |
| instance n=100 358.alb | 1 | 0 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 359.alb | 1 | 0 | Solution | 120.07 | 54 | 50.00 | 7.41 |
| instance n=100 36.alb | 1 | 0 | Optimal | 1.95 | 14 | 14.00 | 0.00 |
| instance n=100 360.alb | 1 | 0 | Solution | 120.08 | 55 | 51.00 | 7.27 |
| instance n=100 361.alb | 1 | 0 | Solution | 120.05 | 52 | 49.00 | 5.77 |
| instance n=100 362.alb | 1 | 0 | Solution | 120.07 | 57 | 51.00 | 10.53 |
| instance n=100 363.alb | 1 | 0 | Solution | 120.09 | 53 | 50.00 | 5.66 |
| instance n=100 364.alb | 1 | 0 | Solution | 120.06 | 53 | 50.00 | 5.66 |
| instance n=100 365.alb | 1 | 0 | Solution | 120.06 | 53 | 50.00 | 5.66 |
| instance n=100 366.alb | 1 | 0 | Solution | 120.08 | 61 | 53.00 | 13.11 |
| instance n=100 367.alb | 1 | 0 | Solution | 120.05 | 56 | 51.00 | 8.93 |
| instance n=100 368.alb | 1 | 0 | Solution | 120.04 | 59 | 52.00 | 11.86 |
| instance n=100 369.alb | 1 | 0 | Solution | 120.05 | 51 | 49.00 | 3.92 |
| instance n=100 37.alb | 1 | 0 | Optimal | 0.04 | 14 | 14.00 | 0.00 |
| instance n=100 370.alb | 1 | 0 | Solution | 120.05 | 57 | 52.00 | 8.77 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 371.alb | 1 | 0 | Solution | 120.08 | 53 | 50.00 | 5.66 |
| instance n=100 372.alb | 1 | 0 | Solution | 120.04 | 49 | 47.00 | 4.08 |
| instance n=100 373.alb | 1 | 0 | Solution | 120.09 | 51 | 49.00 | 3.92 |
| instance n=100 374.alb | 1 | 0 | Solution | 120.06 | 53 | 50.00 | 5.66 |
| instance n=100 375.alb | 1 | 0 | Solution | 120.07 | 58 | 52.00 | 10.34 |
| instance n=100 376.alb | 1 | 0 | Optimal | 0.59 | 23 | 23.00 | 0.00 |
| instance n=100 377.alb | 1 | 0 | Solution | 120.10 | 21 | 20.00 | 4.76 |
| instance n=100 378.alb | 1 | 0 | Optimal | 5.15 | 22 | 22.00 | 0.00 |
| instance n=100 379.alb | 1 | 0 | Optimal | 50.33 | 23 | 23.00 | 0.00 |
| instance n=100 38.alb | 1 | 0 | Optimal | 0.05 | 14 | 14.00 | 0.00 |
| instance n=100 380.alb | 1 | 0 | Solution | 120.07 | 23 | 22.00 | 4.35 |
| instance n=100 381.alb | 1 | 0 | Optimal | 2.24 | 24 | 24.00 | 0.00 |
| instance n=100 382.alb | 1 | 0 | Optimal | 6.90 | 25 | 25.00 | 0.00 |
| instance n=100 383.alb | 1 | 0 | Optimal | 0.50 | 25 | 25.00 | 0.00 |
| instance n=100 384.alb | 1 | 0 | Optimal | 1.24 | 25 | 25.00 | 0.00 |
| instance n=100 385.alb | 1 | 0 | Optimal | 0.44 | 22 | 22.00 | 0.00 |
| instance n=100 386.alb | 1 | 0 | Optimal | 67.35 | 23 | 23.00 | 0.00 |
| instance n=100 387.alb | 1 | 0 | Optimal | 0.91 | 22 | 22.00 | 0.00 |
| instance n=100 388.alb | 1 | 0 | Solution | 120.06 | 26 | 25.00 | 3.85 |
| instance n=100 389.alb | 1 | 0 | Optimal | 0.35 | 23 | 23.00 | 0.00 |
| instance n=100 39.alb | 1 | 0 | Optimal | 0.03 | 14 | 14.00 | 0.00 |
| instance n=100 390.alb | 1 | 0 | Solution | 120.06 | 23 | 22.00 | 4.35 |
| instance n=100 391.alb | 1 | 0 | Optimal | 0.44 | 20 | 20.00 | 0.00 |
| instance n=100 392.alb | 1 | 0 | Optimal | 0.46 | 22 | 22.00 | 0.00 |
| instance n=100 393.alb | 1 | 0 | Solution | 120.06 | 24 | 23.00 | 4.17 |
| instance n=100 394.alb | 1 | 0 | Optimal | 0.64 | 22 | 22.00 | 0.00 |
| instance n=100 395.alb | 1 | 0 | Optimal | 9.99 | 24 | 24.00 | 0.00 |
| instance n=100 396.alb | 1 | 0 | Optimal | 11.36 | 20 | 20.00 | 0.00 |
| instance n=100 397.alb | 1 | 0 | Solution | 120.06 | 26 | 25.00 | 3.85 |
| instance n=100 398.alb | 1 | 0 | Solution | 120.07 | 25 | 24.00 | 4.00 |
| instance n=100 399.alb | 1 | 0 | Optimal | 1.01 | 23 | 23.00 | 0.00 |
| instance n=100 4.alb | 1 | 0 | Optimal | 0.07 | 24 | 24.00 | 0.00 |
| instance n=100 40.alb | 1 | 0 | Optimal | 0.09 | 14 | 14.00 | 0.00 |
| instance n=100 400.alb | 1 | 0 | Optimal | 4.68 | 24 | 24.00 | 0.00 |
| instance n=100 401.alb | 1 | 0 | Optimal | 0.46 | 15 | 15.00 | 0.00 |
| instance n=100 402.alb | 1 | 0 | Optimal | 0.46 | 15 | 15.00 | 0.00 |
| instance n=100 403.alb | 1 | 0 | Optimal | 0.60 | 14 | 14.00 | 0.00 |
| instance n=100 404.alb | 1 | 0 | Optimal | 0.57 | 15 | 15.00 | 0.00 |
| instance n=100 405.alb | 1 | 0 | Optimal | 0.45 | 13 | 13.00 | 0.00 |
| instance n=100 406.alb | 1 | 0 | Optimal | 0.49 | 14 | 14.00 | 0.00 |
| instance n=100 407.alb | 1 | 0 | Optimal | 0.69 | 15 | 15.00 | 0.00 |
| instance n=100 408.alb | 1 | 0 | Optimal | 0.71 | 14 | 14.00 | 0.00 |
| instance n=100 409.alb | 1 | 0 | Optimal | 0.36 | 15 | 15.00 | 0.00 |
| instance n=100 41.alb | 1 | 0 | Optimal | 0.08 | 13 | 13.00 | 0.00 |
| instance n=100 410.alb | 1 | 0 | Optimal | 0.33 | 14 | 14.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 411.alb | 1 | 0 | Optimal | 4.24 | 14 | 14.00 | 0.00 |
| instance n=100 412.alb | 1 | 0 | Optimal | 0.55 | 14 | 14.00 | 0.00 |
| instance n=100 413.alb | 1 | 0 | Optimal | 0.61 | 14 | 14.00 | 0.00 |
| instance n=100 414.alb | 1 | 0 | Optimal | 34.16 | 14 | 14.00 | 0.00 |
| instance n=100 415.alb | 1 | 0 | Optimal | 4.46 | 13 | 13.00 | 0.00 |
| instance n=100 416.alb | 1 | 0 | Optimal | 0.53 | 14 | 14.00 | 0.00 |
| instance n=100 417.alb | 1 | 0 | Optimal | 0.52 | 15 | 15.00 | 0.00 |
| instance n=100 418.alb | 1 | 0 | Optimal | 0.60 | 16 | 16.00 | 0.00 |
| instance n=100 419.alb | 1 | 0 | Optimal | 4.26 | 14 | 14.00 | 0.00 |
| instance n=100 42.alb | 1 | 0 | Optimal | 0.05 | 14 | 14.00 | 0.00 |
| instance n=100 420.alb | 1 | 0 | Optimal | 0.35 | 14 | 14.00 | 0.00 |
| instance n=100 421.alb | 1 | 0 | Optimal | 0.35 | 14 | 14.00 | 0.00 |
| instance n=100 422.alb | 1 | 0 | Optimal | 0.46 | 15 | 15.00 | 0.00 |
| instance n=100 423.alb | 1 | 0 | Optimal | 3.71 | 14 | 14.00 | 0.00 |
| instance n=100 424.alb | 1 | 0 | Optimal | 0.41 | 14 | 14.00 | 0.00 |
| instance n=100 425.alb | 1 | 0 | Optimal | 0.58 | 15 | 15.00 | 0.00 |
| instance n=100 426.alb | 1 | 0 | Solution | 120.09 | 60 | 53.00 | 11.67 |
| instance n=100 427.alb | 1 | 0 | Solution | 120.06 | 56 | 50.00 | 10.71 |
| instance n=100 428.alb | 1 | 0 | Solution | 120.07 | 55 | 51.00 | 7.27 |
| instance n=100 429.alb | 1 | 0 | Solution | 120.06 | 59 | 52.00 | 11.86 |
| instance n=100 43.alb | 1 | 0 | Optimal | 0.83 | 14 | 14.00 | 0.00 |
| instance n=100 430.alb | 1 | 0 | Solution | 120.07 | 54 | 50.00 | 7.41 |
| instance n=100 431.alb | 1 | 0 | Solution | 120.05 | 54 | 50.00 | 7.41 |
| instance n=100 432.alb | 1 | 0 | Solution | 120.03 | 56 | 51.00 | 8.93 |
| instance n=100 433.alb | 1 | 0 | Solution | 120.04 | 53 | 49.00 | 7.55 |
| instance n=100 434.alb | 1 | 0 | Solution | 120.08 | 57 | 51.00 | 10.53 |
| instance n=100 435.alb | 1 | 0 | Solution | 120.08 | 56 | 50.00 | 10.71 |
| instance n=100 436.alb | 1 | 0 | Solution | 120.09 | 52 | 48.00 | 7.69 |
| instance n=100 437.alb | 1 | 0 | Solution | 120.03 | 53 | 50.00 | 5.66 |
| instance n=100 438.alb | 1 | 0 | Solution | 120.05 | 55 | 51.00 | 7.27 |
| instance n=100 439.alb | 1 | 0 | Solution | 120.06 | 56 | 51.00 | 8.93 |
| instance n=100 44.alb | 1 | 0 | Optimal | 0.05 | 14 | 14.00 | 0.00 |
| instance n=100 440.alb | 1 | 0 | Solution | 120.08 | 53 | 49.00 | 7.55 |
| instance n=100 441.alb | 1 | 0 | Solution | 120.06 | 53 | 50.00 | 5.66 |
| instance n=100 442.alb | 1 | 0 | Solution | 120.03 | 53 | 48.00 | 9.43 |
| instance n=100 443.alb | 1 | 0 | Solution | 120.11 | 56 | 50.00 | 10.71 |
| instance n=100 444.alb | 1 | 0 | Solution | 120.07 | 54 | 50.00 | 7.41 |
| instance n=100 445.alb | 1 | 0 | Solution | 120.04 | 55 | 51.00 | 7.27 |
| instance n=100 446.alb | 1 | 0 | Solution | 120.02 | 57 | 52.00 | 8.77 |
| instance n=100 447.alb | 1 | 0 | Solution | 120.06 | 54 | 50.00 | 7.41 |
| instance n=100 448.alb | 1 | 0 | Solution | 120.09 | 56 | 51.00 | 8.93 |
| instance n=100 449.alb | 1 | 0 | Solution | 120.05 | 56 | 50.00 | 10.71 |
| instance n=100 45.alb | 1 | 0 | Optimal | 0.04 | 14 | 14.00 | 0.00 |
| instance n=100 450.alb | 1 | 0 | Solution | 120.10 | 54 | 51.00 | 5.56 |
| instance n=100 451.alb | 1 | 0 | Optimal | 3.90 | 26 | 26.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=100 452.alb | 1 | 0 | Optimal | 3.31 | 22 | 22.00 | 0.00 |
| instance n=100 453.alb | 1 | 0 | Optimal | 2.72 | 24 | 24.00 | 0.00 |
| instance n=100 454.alb | 1 | 0 | Optimal | 1.96 | 23 | 23.00 | 0.00 |
| instance n=100 455.alb | 1 | 0 | Optimal | 3.85 | 23 | 23.00 | 0.00 |
| instance n=100 456.alb | 1 | 0 | Optimal | 4.02 | 26 | 26.00 | 0.00 |
| instance n=100 457.alb | 1 | 0 | Optimal | 2.42 | 23 | 23.00 | 0.00 |
| instance n=100 458.alb | 1 | 0 | Optimal | 2.61 | 24 | 24.00 | 0.00 |
| instance n=100 459.alb | 1 | 0 | Optimal | 3.47 | 23 | 23.00 | 0.00 |
| instance n=100 46.alb | 1 | 0 | Optimal | 0.05 | 14 | 14.00 | 0.00 |
| instance n=100 460.alb | 1 | 0 | Optimal | 5.71 | 23 | 23.00 | 0.00 |
| instance n=100 461.alb | 1 | 0 | Optimal | 2.91 | 23 | 23.00 | 0.00 |
| instance n=100 462.alb | 1 | 0 | Optimal | 4.90 | 23 | 23.00 | 0.00 |
| instance n=100 463.alb | 1 | 0 | Optimal | 1.62 | 26 | 26.00 | 0.00 |
| instance n=100 464.alb | 1 | 0 | Optimal | 4.91 | 25 | 25.00 | 0.00 |
| instance n=100 465.alb | 1 | 0 | Optimal | 4.37 | 22 | 22.00 | 0.00 |
| instance n=100 466.alb | 1 | 0 | Optimal | 3.47 | 26 | 25.00 | 3.85 |
| instance n=100 467.alb | 1 | 0 | Optimal | 6.89 | 21 | 21.00 | 0.00 |
| instance n=100 468.alb | 1 | 0 | Optimal | 8.72 | 25 | 25.00 | 0.00 |
| instance n=100 469.alb | 1 | 0 | Optimal | 1.76 | 22 | 22.00 | 0.00 |
| instance n=100 47.alb | 1 | 0 | Optimal | 0.08 | 14 | 14.00 | 0.00 |
| instance n=100 470.alb | 1 | 0 | Optimal | 34.68 | 26 | 26.00 | 0.00 |
| instance n=100 471.alb | 1 | 0 | Optimal | 7.15 | 26 | 26.00 | 0.00 |
| instance n=100 472.alb | 1 | 0 | Optimal | 0.85 | 23 | 23.00 | 0.00 |
| instance n=100 473.alb | 1 | 0 | Optimal | 2.90 | 28 | 28.00 | 0.00 |
| instance n=100 474.alb | 1 | 0 | Optimal | 1.88 | 23 | 23.00 | 0.00 |
| instance n=100 475.alb | 1 | 0 | Optimal | 33.97 | 24 | 24.00 | 0.00 |
| instance n=100 476.alb | 1 | 0 | Optimal | 0.49 | 14 | 14.00 | 0.00 |
| instance n=100 477.alb | 1 | 0 | Optimal | 0.52 | 14 | 14.00 | 0.00 |
| instance n=100 478.alb | 1 | 0 | Optimal | 0.71 | 14 | 14.00 | 0.00 |
| instance n=100 479.alb | 1 | 0 | Optimal | 0.97 | 16 | 16.00 | 0.00 |
| instance n=100 48.alb | 1 | 0 | Optimal | 0.07 | 15 | 15.00 | 0.00 |
| instance n=100 480.alb | 1 | 0 | Optimal | 1.16 | 15 | 15.00 | 0.00 |
| instance n=100 481.alb | 1 | 0 | Optimal | 1.82 | 15 | 15.00 | 0.00 |
| instance n=100 482.alb | 1 | 0 | Optimal | 2.27 | 15 | 15.00 | 0.00 |
| instance n=100 483.alb | 1 | 0 | Optimal | 1.41 | 14 | 14.00 | 0.00 |
| instance n=100 484.alb | 1 | 0 | Optimal | 0.54 | 14 | 14.00 | 0.00 |
| instance n=100 485.alb | 1 | 0 | Optimal | 1.91 | 16 | 16.00 | 0.00 |
| instance n=100 486.alb | 1 | 0 | Optimal | 0.85 | 15 | 15.00 | 0.00 |
| instance n=100 487.alb | 1 | 0 | Optimal | 1.90 | 15 | 15.00 | 0.00 |
| instance n=100 488.alb | 1 | 0 | Optimal | 1.12 | 16 | 16.00 | 0.00 |
| instance n=100 489.alb | 1 | 0 | Optimal | 3.57 | 13 | 13.00 | 0.00 |
| instance n=100 49.alb | 1 | 0 | Optimal | 0.08 | 14 | 14.00 | 0.00 |
| instance n=100 490.alb | 1 | 0 | Optimal | 1.13 | 15 | 15.00 | 0.00 |
| instance n=100 491.alb | 1 | 0 | Optimal | 1.38 | 16 | 16.00 | 0.00 |
| instance n=100 492.alb | 1 | 0 | Optimal | 2.66 | 14 | 14.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 493.alb | 1 | 0 | Optimal | 1.67 | 14 | 14.00 | 0.00 |
| instance n=100 494.alb | 1 | 0 | Optimal | 0.72 | 14 | 14.00 | 0.00 |
| instance n=100 495.alb | 1 | 0 | Optimal | 1.54 | 15 | 15.00 | 0.00 |
| instance n=100 496.alb | 1 | 0 | Optimal | 1.23 | 14 | 14.00 | 0.00 |
| instance n=100 497.alb | 1 | 0 | Optimal | 0.52 | 13 | 13.00 | 0.00 |
| instance n=100 498.alb | 1 | 0 | Optimal | 1.04 | 14 | 14.00 | 0.00 |
| instance n=100 499.alb | 1 | 0 | Optimal | 1.26 | 14 | 14.00 | 0.00 |
| instance n=100 5.alb | 1 | 0 | Optimal | 0.08 | 22 | 22.00 | 0.00 |
| instance n=100 50.alb | 1 | 0 | Optimal | 0.06 | 14 | 14.00 | 0.00 |
| instance n=100 500.alb | 1 | 0 | Optimal | 0.70 | 14 | 14.00 | 0.00 |
| instance n=100 501.alb | 1 | 0 | Solution | 120.09 | 63 | 58.00 | 7.94 |
| instance n=100 502.alb | 1 | 0 | Solution | 120.08 | 64 | 61.00 | 4.69 |
| instance n=100 503.alb | 1 | 0 | Solution | 120.06 | 60 | 55.00 | 8.33 |
| instance n=100 504.alb | 1 | 0 | Solution | 120.06 | 60 | 58.00 | 3.33 |
| instance n=100 505.alb | 1 | 0 | Solution | 120.07 | 61 | 55.00 | 9.84 |
| instance n=100 506.alb | 1 | 0 | Solution | 120.08 | 58 | 53.00 | 8.62 |
| instance n=100 507.alb | 1 | 0 | Solution | 120.05 | 59 | 55.00 | 6.78 |
| instance n=100 508.alb | 1 | 0 | Optimal | 118.93 | 56 | 56.00 | 0.00 |
| instance n=100 509.alb | 1 | 0 | Solution | 120.11 | 57 | 54.00 | 5.26 |
| instance n=100 51.alb | 1 | 0 | Solution | 120.03 | 51 | 48.00 | 5.88 |
| instance n=100 510.alb | 1 | 0 | Solution | 120.05 | 58 | 55.00 | 5.17 |
| instance n=100 511.alb | 1 | 0 | Solution | 120.08 | 60 | 57.00 | 5.00 |
| instance n=100 512.alb | 1 | 0 | Solution | 120.09 | 60 | 58.00 | 3.33 |
| instance n=100 513.alb | 1 | 0 | Solution | 120.10 | 62 | 56.00 | 9.68 |
| instance n=100 514.alb | 1 | 0 | Solution | 120.04 | 58 | 55.00 | 5.17 |
| instance n=100 515.alb | 1 | 0 | Solution | 120.10 | 61 | 56.00 | 8.20 |
| instance n=100 516.alb | 1 | 0 | Solution | 120.09 | 70 | 60.00 | 14.29 |
| instance n=100 517.alb | 1 | 0 | Solution | 120.10 | 62 | 57.00 | 8.06 |
| instance n=100 518.alb | 1 | 0 | Solution | 120.05 | 57 | 53.00 | 7.02 |
| instance n=100 519.alb | 1 | 0 | Solution | 120.07 | 61 | 58.00 | 4.92 |
| instance n=100 52.alb | 1 | 0 | Solution | 120.01 | 53 | 50.00 | 5.66 |
| instance n=100 520.alb | 1 | 0 | Solution | 120.03 | 60 | 56.00 | 6.67 |
| instance n=100 521.alb | 1 | 0 | Solution | 120.06 | 70 | 61.00 | 12.86 |
| instance n=100 522.alb | 1 | 0 | Solution | 120.11 | 59 | 55.00 | 6.78 |
| instance n=100 523.alb | 1 | 0 | Solution | 120.10 | 55 | 53.00 | 3.64 |
| instance n=100 524.alb | 1 | 0 | Solution | 120.10 | 59 | 55.00 | 6.78 |
| instance n=100 525.alb | 1 | 0 | Solution | 120.08 | 62 | 56.00 | 9.68 |
| instance n=100 53.alb | 1 | 0 | Solution | 120.00 | 52 | 50.00 | 3.85 |
| instance n=100 54.alb | 1 | 0 | Solution | 120.01 | 51 | 49.00 | 3.92 |
| instance n=100 55.alb | 1 | 0 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 56.alb | 1 | 0 | Solution | 120.01 | 52 | 50.00 | 3.85 |
| instance n=100 57.alb | 1 | 0 | Solution | 120.01 | 55 | 51.00 | 7.27 |
| instance n=100 58.alb | 1 | 0 | Solution | 120.01 | 57 | 52.00 | 8.77 |
| instance n=100 59.alb | 1 | 0 | Solution | 120.02 | 57 | 51.00 | 10.53 |
| instance n=100 6.alb | 1 | 0 | Optimal | 0.36 | 22 | 22.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 60.alb | 1 | 0 | Solution | 120.01 | 54 | 51.00 | 5.56 |
| instance n=100 61.alb | 1 | 0 | Solution | 120.02 | 54 | 51.00 | 5.56 |
| instance n=100 62.alb | 1 | 0 | Solution | 120.01 | 52 | 49.00 | 5.77 |
| instance n=100 63.alb | 1 | 0 | Solution | 120.01 | 61 | 52.00 | 14.75 |
| instance n=100 64.alb | 1 | 0 | Solution | 120.00 | 57 | 51.00 | 10.53 |
| instance n=100 65.alb | 1 | 0 | Solution | 120.03 | 62 | 53.00 | 14.52 |
| instance n=100 66.alb | 1 | 0 | Solution | 120.01 | 52 | 49.00 | 5.77 |
| instance n=100 67.alb | 1 | 0 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 68.alb | 1 | 0 | Solution | 120.03 | 57 | 49.00 | 14.04 |
| instance n=100 69.alb | 1 | 0 | Solution | 120.02 | 53 | 51.00 | 3.77 |
| instance n=100 7.alb | 1 | 0 | Optimal | 0.05 | 26 | 26.00 | 0.00 |
| instance n=100 70.alb | 1 | 0 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 71.alb | 1 | 0 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 72.alb | 1 | 0 | Solution | 120.03 | 54 | 50.00 | 7.41 |
| instance n=100 73.alb | 1 | 0 | Solution | 120.03 | 56 | 52.00 | 7.14 |
| instance n=100 74.alb | 1 | 0 | Solution | 120.03 | 52 | 49.00 | 5.77 |
| instance n=100 75.alb | 1 | 0 | Solution | 120.03 | 55 | 51.00 | 7.27 |
| instance n=100 76.alb | 1 | 0 | Optimal | 0.15 | 23 | 23.00 | 0.00 |
| instance n=100 77.alb | 1 | 0 | Optimal | 0.13 | 20 | 20.00 | 0.00 |
| instance n=100 78.alb | 1 | 0 | Optimal | 3.36 | 21 | 21.00 | 0.00 |
| instance n=100 79.alb | 1 | 0 | Optimal | 0.14 | 21 | 21.00 | 0.00 |
| instance n=100 8.alb | 1 | 0 | Optimal | 0.09 | 24 | 24.00 | 0.00 |
| instance n=100 80.alb | 1 | 0 | Optimal | 2.20 | 22 | 22.00 | 0.00 |
| instance n=100 81.alb | 1 | 0 | Optimal | 2.78 | 20 | 20.00 | 0.00 |
| instance n=100 82.alb | 1 | 0 | Optimal | 0.87 | 21 | 21.00 | 0.00 |
| instance n=100 83.alb | 1 | 0 | Optimal | 0.12 | 22 | 22.00 | 0.00 |
| instance n=100 84.alb | 1 | 0 | Solution | 120.03 | 27 | 26.00 | 3.70 |
| instance n=100 85.alb | 1 | 0 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=100 86.alb | 1 | 0 | Optimal | 0.34 | 23 | 23.00 | 0.00 |
| instance n=100 87.alb | 1 | 0 | Optimal | 0.13 | 22 | 22.00 | 0.00 |
| instance n=100 88.alb | 1 | 0 | Solution | 120.01 | 24 | 23.00 | 4.17 |
| instance n=100 89.alb | 1 | 0 | Optimal | 1.33 | 24 | 24.00 | 0.00 |
| instance n=100 9.alb | 1 | 0 | Optimal | 24.45 | 23 | 23.00 | 0.00 |
| instance n=100 90.alb | 1 | 0 | Solution | 120.03 | 21 | 20.00 | 4.76 |
| instance n=100 91.alb | 1 | 0 | Optimal | 0.17 | 25 | 25.00 | 0.00 |
| instance n=100 92.alb | 1 | 0 | Optimal | 0.12 | 24 | 24.00 | 0.00 |
| instance n=100 93.alb | 1 | 0 | Optimal | 5.69 | 27 | 27.00 | 0.00 |
| instance n=100 94.alb | 1 | 0 | Optimal | 4.16 | 22 | 22.00 | 0.00 |
| instance n=100 95.alb | 1 | 0 | Optimal | 1.53 | 21 | 21.00 | 0.00 |
| instance n=100 96.alb | 1 | 0 | Optimal | 1.63 | 21 | 21.00 | 0.00 |
| instance n=100 97.alb | 1 | 0 | Optimal | 0.99 | 22 | 22.00 | 0.00 |
| instance n=100 98.alb | 1 | 0 | Optimal | 0.29 | 22 | 22.00 | 0.00 |
| instance n=100 99.alb | 1 | 0 | Optimal | 0.15 | 22 | 22.00 | 0.00 |
| instance n=20 1.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 10.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 100.alb | 1 | 0 | Optimal | 0.38 | 11 | 11.00 | 0.00 |
| instance n=20 101.alb | 1 | 0 | Optimal | 4.28 | 13 | 13.00 | 0.00 |
| instance n=20 102.alb | 1 | 0 | Optimal | 0.82 | 13 | 13.00 | 0.00 |
| instance n=20 103.alb | 1 | 0 | Optimal | 0.25 | 12 | 12.00 | 0.00 |
| instance n=20 104.alb | 1 | 0 | Optimal | 0.25 | 11 | 11.00 | 0.00 |
| instance n=20 105.alb | 1 | 0 | Optimal | 0.24 | 12 | 12.00 | 0.00 |
| instance n=20 106.alb | 1 | 0 | Optimal | 0.08 | 10 | 10.00 | 0.00 |
| instance n=20 107.alb | 1 | 0 | Optimal | 2.06 | 14 | 14.00 | 0.00 |
| instance n=20 108.alb | 1 | 0 | Optimal | 3.49 | 15 | 15.00 | 0.00 |
| instance n=20 109.alb | 1 | 0 | Optimal | 0.56 | 12 | 12.00 | 0.00 |
| instance n=20 11.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 110.alb | 1 | 0 | Optimal | 0.24 | 11 | 11.00 | 0.00 |
| instance n=20 111.alb | 1 | 0 | Optimal | 0.58 | 13 | 13.00 | 0.00 |
| instance n=20 112.alb | 1 | 0 | Optimal | 0.27 | 11 | 11.00 | 0.00 |
| instance n=20 113.alb | 1 | 0 | Optimal | 0.64 | 12 | 12.00 | 0.00 |
| instance n=20 114.alb | 1 | 0 | Optimal | 0.88 | 13 | 13.00 | 0.00 |
| instance n=20 115.alb | 1 | 0 | Optimal | 0.16 | 11 | 11.00 | 0.00 |
| instance n=20 116.alb | 1 | 0 | Optimal | 0.09 | 5 | 5.00 | 0.00 |
| instance n=20 117.alb | 1 | 0 | Optimal | 0.09 | 5 | 5.00 | 0.00 |
| instance n=20 118.alb | 1 | 0 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 119.alb | 1 | 0 | Optimal | 0.12 | 6 | 6.00 | 0.00 |
| instance n=20 12.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 120.alb | 1 | 0 | Optimal | 0.08 | 6 | 6.00 | 0.00 |
| instance n=20 121.alb | 1 | 0 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 122.alb | 1 | 0 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=20 123.alb | 1 | 0 | Optimal | 0.10 | 5 | 5.00 | 0.00 |
| instance n=20 124.alb | 1 | 0 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 125.alb | 1 | 0 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 126.alb | 1 | 0 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 127.alb | 1 | 0 | Optimal | 0.09 | 4 | 4.00 | 0.00 |
| instance n=20 128.alb | 1 | 0 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 129.alb | 1 | 0 | Optimal | 0.09 | 5 | 5.00 | 0.00 |
| instance n=20 13.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 130.alb | 1 | 0 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=20 131.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=20 132.alb | 1 | 0 | Optimal | 0.06 | 4 | 4.00 | 0.00 |
| instance n=20 133.alb | 1 | 0 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 134.alb | 1 | 0 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 135.alb | 1 | 0 | Optimal | 0.08 | 6 | 6.00 | 0.00 |
| instance n=20 136.alb | 1 | 0 | Optimal | 0.39 | 6 | 6.00 | 0.00 |
| instance n=20 137.alb | 1 | 0 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 138.alb | 1 | 0 | Optimal | 0.16 | 5 | 5.00 | 0.00 |
| instance n=20 139.alb | 1 | 0 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 14.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 140.alb | 1 | 0 | Optimal | 0.09 | 5 | 5.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=20 141.alb | 1 | 0 | Optimal | 0.07 | 3 | 3.00 | 0.00 |
| instance n=20 142.alb | 1 | 0 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 143.alb | 1 | 0 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 144.alb | 1 | 0 | Optimal | 0.09 | 4 | 4.00 | 0.00 |
| instance n=20 145.alb | 1 | 0 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 146.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 147.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 148.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 149.alb | 1 | 0 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 15.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 150.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 151.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 152.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 153.alb | 1 | 0 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 154.alb | 1 | 0 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 155.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 156.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 157.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 158.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 159.alb | 1 | 0 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 16.alb | 1 | 0 | Optimal | 0.36 | 12 | 12.00 | 0.00 |
| instance n=20 160.alb | 1 | 0 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 161.alb | 1 | 0 | Optimal | 0.07 | 3 | 3.00 | 0.00 |
| instance n=20 162.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 163.alb | 1 | 0 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 164.alb | 1 | 0 | Optimal | 0.08 | 4 | 4.00 | 0.00 |
| instance n=20 165.alb | 1 | 0 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 166.alb | 1 | 0 | Optimal | 5.90 | 12 | 12.00 | 0.00 |
| instance n=20 167.alb | 1 | 0 | Optimal | 2.21 | 11 | 11.00 | 0.00 |
| instance n=20 168.alb | 1 | 0 | Optimal | 0.36 | 10 | 10.00 | 0.00 |
| instance n=20 169.alb | 1 | 0 | Optimal | 0.91 | 11 | 11.00 | 0.00 |
| instance n=20 17.alb | 1 | 0 | Optimal | 0.04 | 10 | 10.00 | 0.00 |
| instance n=20 170.alb | 1 | 0 | Optimal | 0.26 | 11 | 11.00 | 0.00 |
| instance n=20 171.alb | 1 | 0 | Optimal | 71.31 | 13 | 13.00 | 0.00 |
| instance n=20 172.alb | 1 | 0 | Optimal | 0.35 | 11 | 11.00 | 0.00 |
| instance n=20 173.alb | 1 | 0 | Optimal | 0.10 | 11 | 11.00 | 0.00 |
| instance n=20 174.alb | 1 | 0 | Optimal | 1.84 | 12 | 12.00 | 0.00 |
| instance n=20 175.alb | 1 | 0 | Optimal | 0.10 | 10 | 10.00 | 0.00 |
| instance n=20 176.alb | 1 | 0 | Optimal | 1.66 | 11 | 11.00 | 0.00 |
| instance n=20 177.alb | 1 | 0 | Optimal | 2.55 | 10 | 10.00 | 0.00 |
| instance n=20 178.alb | 1 | 0 | Optimal | 0.30 | 11 | 11.00 | 0.00 |
| instance n=20 179.alb | 1 | 0 | Optimal | 0.17 | 11 | 11.00 | 0.00 |
| instance n=20 18.alb | 1 | 0 | Optimal | 0.35 | 11 | 11.00 | 0.00 |
| instance n=20 180.alb | 1 | 0 | Optimal | 20.93 | 13 | 13.00 | 0.00 |
| instance n=20 181.alb | 1 | 0 | Optimal | 0.31 | 11 | 11.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=20 182.alb | 1 | 0 | Optimal | 3.31 | 11 | 11.00 | 0.00 |
| instance n=20 183.alb | 1 | 0 | Optimal | 15.45 | 13 | 13.00 | 0.00 |
| instance n=20 184.alb | 1 | 0 | Optimal | 2.65 | 12 | 12.00 | 0.00 |
| instance n=20 185.alb | 1 | 0 | Optimal | 25.00 | 15 | 15.00 | 0.00 |
| instance n=20 186.alb | 1 | 0 | Optimal | 17.88 | 14 | 14.00 | 0.00 |
| instance n=20 187.alb | 1 | 0 | Optimal | 0.12 | 10 | 10.00 | 0.00 |
| instance n=20 188.alb | 1 | 0 | Optimal | 0.73 | 11 | 11.00 | 0.00 |
| instance n=20 189.alb | 1 | 0 | Optimal | 3.72 | 13 | 13.00 | 0.00 |
| instance n=20 19.alb | 1 | 0 | Optimal | 3.65 | 14 | 14.00 | 0.00 |
| instance n=20 190.alb | 1 | 0 | Optimal | 69.35 | 15 | 15.00 | 0.00 |
| instance n=20 191.alb | 1 | 0 | Optimal | 0.14 | 4 | 4.00 | 0.00 |
| instance n=20 192.alb | 1 | 0 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 193.alb | 1 | 0 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 194.alb | 1 | 0 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=20 195.alb | 1 | 0 | Optimal | 0.12 | 6 | 6.00 | 0.00 |
| instance n=20 196.alb | 1 | 0 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 197.alb | 1 | 0 | Optimal | 0.16 | 4 | 4.00 | 0.00 |
| instance n=20 198.alb | 1 | 0 | Optimal | 0.15 | 6 | 6.00 | 0.00 |
| instance n=20 199.alb | 1 | 0 | Optimal | 0.15 | 5 | 5.00 | 0.00 |
| instance n=20 2.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 20.alb | 1 | 0 | Optimal | 0.25 | 11 | 11.00 | 0.00 |
| instance n=20 200.alb | 1 | 0 | Optimal | 0.13 | 6 | 6.00 | 0.00 |
| instance n=20 201.alb | 1 | 0 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 202.alb | 1 | 0 | Optimal | 0.58 | 4 | 4.00 | 0.00 |
| instance n=20 203.alb | 1 | 0 | Optimal | 0.14 | 4 | 4.00 | 0.00 |
| instance n=20 204.alb | 1 | 0 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 205.alb | 1 | 0 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 206.alb | 1 | 0 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 207.alb | 1 | 0 | Optimal | 0.16 | 6 | 6.00 | 0.00 |
| instance n=20 208.alb | 1 | 0 | Optimal | 0.16 | 5 | 5.00 | 0.00 |
| instance n=20 209.alb | 1 | 0 | Optimal | 0.13 | 4 | 4.00 | 0.00 |
| instance n=20 21.alb | 1 | 0 | Optimal | 1.87 | 14 | 14.00 | 0.00 |
| instance n=20 210.alb | 1 | 0 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 211.alb | 1 | 0 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 212.alb | 1 | 0 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 213.alb | 1 | 0 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 214.alb | 1 | 0 | Optimal | 0.10 | 5 | 5.00 | 0.00 |
| instance n=20 215.alb | 1 | 0 | Optimal | 0.10 | 5 | 5.00 | 0.00 |
| instance n=20 216.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 217.alb | 1 | 0 | Optimal | 0.20 | 4 | 4.00 | 0.00 |
| instance n=20 218.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 219.alb | 1 | 0 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 22.alb | 1 | 0 | Optimal | 0.53 | 12 | 12.00 | 0.00 |
| instance n=20 220.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 221.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=20 222.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 223.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 224.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 225.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 226.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 227.alb | 1 | 0 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 228.alb | 1 | 0 | Optimal | 0.06 | 2 | 2.00 | 0.00 |
| instance n=20 229.alb | 1 | 0 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 23.alb | 1 | 0 | Optimal | 12.65 | 13 | 13.00 | 0.00 |
| instance n=20 230.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 231.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 232.alb | 1 | 0 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 233.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 234.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 235.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 236.alb | 1 | 0 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 237.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 238.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 239.alb | 1 | 0 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 24.alb | 1 | 0 | Optimal | 0.10 | 11 | 11.00 | 0.00 |
| instance n=20 240.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 241.alb | 1 | 0 | Optimal | 0.86 | 13 | 13.00 | 0.00 |
| instance n=20 242.alb | 1 | 0 | Optimal | 0.52 | 12 | 12.00 | 0.00 |
| instance n=20 243.alb | 1 | 0 | Optimal | 0.53 | 10 | 10.00 | 0.00 |
| instance n=20 244.alb | 1 | 0 | Optimal | 0.47 | 11 | 11.00 | 0.00 |
| instance n=20 245.alb | 1 | 0 | Optimal | 0.47 | 13 | 13.00 | 0.00 |
| instance n=20 246.alb | 1 | 0 | Optimal | 1.38 | 13 | 13.00 | 0.00 |
| instance n=20 247.alb | 1 | 0 | Optimal | 0.33 | 11 | 11.00 | 0.00 |
| instance n=20 248.alb | 1 | 0 | Optimal | 0.47 | 11 | 11.00 | 0.00 |
| instance n=20 249.alb | 1 | 0 | Optimal | 1.32 | 13 | 13.00 | 0.00 |
| instance n=20 25.alb | 1 | 0 | Optimal | 0.19 | 11 | 11.00 | 0.00 |
| instance n=20 250.alb | 1 | 0 | Optimal | 0.15 | 10 | 10.00 | 0.00 |
| instance n=20 251.alb | 1 | 0 | Optimal | 0.49 | 12 | 12.00 | 0.00 |
| instance n=20 252.alb | 1 | 0 | Optimal | 1.19 | 11 | 11.00 | 0.00 |
| instance n=20 253.alb | 1 | 0 | Optimal | 1.37 | 13 | 13.00 | 0.00 |
| instance n=20 254.alb | 1 | 0 | Optimal | 0.50 | 12 | 12.00 | 0.00 |
| instance n=20 255.alb | 1 | 0 | Optimal | 2.09 | 13 | 13.00 | 0.00 |
| instance n=20 256.alb | 1 | 0 | Optimal | 0.97 | 14 | 14.00 | 0.00 |
| instance n=20 257.alb | 1 | 0 | Optimal | 0.11 | 10 | 10.00 | 0.00 |
| instance n=20 258.alb | 1 | 0 | Optimal | 0.88 | 13 | 13.00 | 0.00 |
| instance n=20 259.alb | 1 | 0 | Optimal | 0.50 | 13 | 13.00 | 0.00 |
| instance n=20 26.alb | 1 | 0 | Optimal | 0.99 | 12 | 12.00 | 0.00 |
| instance n=20 260.alb | 1 | 0 | Optimal | 1.71 | 12 | 12.00 | 0.00 |
| instance n=20 261.alb | 1 | 0 | Optimal | 0.99 | 12 | 12.00 | 0.00 |
| instance n=20 262.alb | 1 | 0 | Optimal | 0.57 | 11 | 11.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=20 263.alb | 1 | 0 | Optimal | 0.93 | 12 | 12.00 | 0.00 |
| instance n=20 264.alb | 1 | 0 | Optimal | 0.88 | 12 | 12.00 | 0.00 |
| instance n=20 265.alb | 1 | 0 | Optimal | 0.52 | 12 | 12.00 | 0.00 |
| instance n=20 266.alb | 1 | 0 | Optimal | 0.66 | 5 | 5.00 | 0.00 |
| instance n=20 267.alb | 1 | 0 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 268.alb | 1 | 0 | Optimal | 0.16 | 6 | 6.00 | 0.00 |
| instance n=20 269.alb | 1 | 0 | Optimal | 0.71 | 7 | 7.00 | 0.00 |
| instance n=20 27.alb | 1 | 0 | Optimal | 3.25 | 13 | 13.00 | 0.00 |
| instance n=20 270.alb | 1 | 0 | Optimal | 0.69 | 7 | 7.00 | 0.00 |
| instance n=20 271.alb | 1 | 0 | Optimal | 0.66 | 6 | 6.00 | 0.00 |
| instance n=20 272.alb | 1 | 0 | Optimal | 0.15 | 5 | 5.00 | 0.00 |
| instance n=20 273.alb | 1 | 0 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 274.alb | 1 | 0 | Optimal | 0.69 | 6 | 6.00 | 0.00 |
| instance n=20 275.alb | 1 | 0 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 276.alb | 1 | 0 | Optimal | 0.17 | 4 | 4.00 | 0.00 |
| instance n=20 277.alb | 1 | 0 | Optimal | 0.13 | 4 | 4.00 | 0.00 |
| instance n=20 278.alb | 1 | 0 | Optimal | 0.76 | 6 | 6.00 | 0.00 |
| instance n=20 279.alb | 1 | 0 | Optimal | 0.17 | 6 | 6.00 | 0.00 |
| instance n=20 28.alb | 1 | 0 | Optimal | 2.05 | 12 | 12.00 | 0.00 |
| instance n=20 280.alb | 1 | 0 | Optimal | 0.17 | 5 | 5.00 | 0.00 |
| instance n=20 281.alb | 1 | 0 | Optimal | 0.13 | 4 | 4.00 | 0.00 |
| instance n=20 282.alb | 1 | 0 | Optimal | 0.21 | 4 | 4.00 | 0.00 |
| instance n=20 283.alb | 1 | 0 | Optimal | 0.17 | 5 | 5.00 | 0.00 |
| instance n=20 284.alb | 1 | 0 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 285.alb | 1 | 0 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 286.alb | 1 | 0 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 287.alb | 1 | 0 | Optimal | 0.16 | 5 | 5.00 | 0.00 |
| instance n=20 288.alb | 1 | 0 | Optimal | 0.16 | 6 | 6.00 | 0.00 |
| instance n=20 289.alb | 1 | 0 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 29.alb | 1 | 0 | Optimal | 0.03 | 10 | 10.00 | 0.00 |
| instance n=20 290.alb | 1 | 0 | Optimal | 0.17 | 5 | 5.00 | 0.00 |
| instance n=20 291.alb | 1 | 0 | Optimal | 0.24 | 3 | 3.00 | 0.00 |
| instance n=20 292.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 293.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 294.alb | 1 | 0 | Optimal | 0.24 | 3 | 3.00 | 0.00 |
| instance n=20 295.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 296.alb | 1 | 0 | Optimal | 0.13 | 3 | 3.00 | 0.00 |
| instance n=20 297.alb | 1 | 0 | Optimal | 0.19 | 3 | 3.00 | 0.00 |
| instance n=20 298.alb | 1 | 0 | Optimal | 0.19 | 3 | 3.00 | 0.00 |
| instance n=20 299.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 3.alb | 1 | 0 | Optimal | 0.04 | 3 | 3.00 | 0.00 |
| instance n=20 30.alb | 1 | 0 | Optimal | 14.70 | 16 | 16.00 | 0.00 |
| instance n=20 300.alb | 1 | 0 | Optimal | 0.16 | 4 | 4.00 | 0.00 |
| instance n=20 301.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 302.alb | 1 | 0 | Optimal | 0.21 | 3 | 3.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 303.alb | 1 | 0 | Optimal | 0.19 | 3 | 3.00 | 0.00 |
| instance n=20 304.alb | 1 | 0 | Optimal | 0.19 | 3 | 3.00 | 0.00 |
| instance n=20 305.alb | 1 | 0 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 306.alb | 1 | 0 | Optimal | 0.13 | 3 | 3.00 | 0.00 |
| instance n=20 307.alb | 1 | 0 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 308.alb | 1 | 0 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 309.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 31.alb | 1 | 0 | Optimal | 0.56 | 12 | 12.00 | 0.00 |
| instance n=20 310.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 311.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 312.alb | 1 | 0 | Optimal | 0.19 | 4 | 4.00 | 0.00 |
| instance n=20 313.alb | 1 | 0 | Optimal | 0.18 | 3 | 3.00 | 0.00 |
| instance n=20 314.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 315.alb | 1 | 0 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 316.alb | 1 | 0 | Optimal | 0.17 | 10 | 10.00 | 0.00 |
| instance n=20 317.alb | 1 | 0 | Optimal | 1.81 | 10 | 10.00 | 0.00 |
| instance n=20 318.alb | 1 | 0 | Optimal | 0.30 | 10 | 10.00 | 0.00 |
| instance n=20 319.alb | 1 | 0 | Optimal | 19.16 | 14 | 14.00 | 0.00 |
| instance n=20 32.alb | 1 | 0 | Optimal | 15.54 | 13 | 13.00 | 0.00 |
| instance n=20 320.alb | 1 | 0 | Optimal | 2.91 | 12 | 12.00 | 0.00 |
| instance n=20 321.alb | 1 | 0 | Solution | 120.04 | 14 | 11.00 | 21.43 |
| instance n=20 322.alb | 1 | 0 | Optimal | 21.71 | 12 | 12.00 | 0.00 |
| instance n=20 323.alb | 1 | 0 | Optimal | 15.25 | 13 | 13.00 | 0.00 |
| instance n=20 324.alb | 1 | 0 | Optimal | 0.57 | 9 | 9.00 | 0.00 |
| instance n=20 325.alb | 1 | 0 | Solution | 120.04 | 14 | 12.00 | 14.29 |
| instance n=20 326.alb | 1 | 0 | Optimal | 40.65 | 14 | 14.00 | 0.00 |
| instance n=20 327.alb | 1 | 0 | Optimal | 42.57 | 13 | 13.00 | 0.00 |
| instance n=20 328.alb | 1 | 0 | Optimal | 28.06 | 13 | 13.00 | 0.00 |
| instance n=20 329.alb | 1 | 0 | Optimal | 0.33 | 10 | 10.00 | 0.00 |
| instance n=20 33.alb | 1 | 0 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=20 330.alb | 1 | 0 | Optimal | 21.95 | 12 | 12.00 | 0.00 |
| instance n=20 331.alb | 1 | 0 | Optimal | 40.32 | 13 | 13.00 | 0.00 |
| instance n=20 332.alb | 1 | 0 | Optimal | 6.12 | 13 | 13.00 | 0.00 |
| instance n=20 333.alb | 1 | 0 | Optimal | 1.48 | 11 | 11.00 | 0.00 |
| instance n=20 334.alb | 1 | 0 | Optimal | 0.21 | 10 | 10.00 | 0.00 |
| instance n=20 335.alb | 1 | 0 | Solution | 120.05 | 14 | 11.00 | 21.43 |
| instance n=20 336.alb | 1 | 0 | Optimal | 1.06 | 11 | 11.00 | 0.00 |
| instance n=20 337.alb | 1 | 0 | Optimal | 0.18 | 10 | 10.00 | 0.00 |
| instance n=20 338.alb | 1 | 0 | Optimal | 27.74 | 14 | 14.00 | 0.00 |
| instance n=20 339.alb | 1 | 0 | Optimal | 35.97 | 13 | 13.00 | 0.00 |
| instance n=20 34.alb | 1 | 0 | Optimal | 1.17 | 12 | 12.00 | 0.00 |
| instance n=20 340.alb | 1 | 0 | Optimal | 2.52 | 11 | 11.00 | 0.00 |
| instance n=20 341.alb | 1 | 0 | Optimal | 0.17 | 6 | 6.00 | 0.00 |
| instance n=20 342.alb | 1 | 0 | Optimal | 0.18 | 6 | 6.00 | 0.00 |
| instance n=20 343.alb | 1 | 0 | Optimal | 0.19 | 6 | 6.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 344.alb | 1 | 0 | Optimal | 0.17 | 6 | 6.00 | 0.00 |
| instance n=20 345.alb | 1 | 0 | Optimal | 0.26 | 4 | 4.00 | 0.00 |
| instance n=20 346.alb | 1 | 0 | Optimal | 0.32 | 5 | 5.00 | 0.00 |
| instance n=20 347.alb | 1 | 0 | Optimal | 0.27 | 6 | 6.00 | 0.00 |
| instance n=20 348.alb | 1 | 0 | Optimal | 0.22 | 5 | 5.00 | 0.00 |
| instance n=20 349.alb | 1 | 0 | Optimal | 0.20 | 5 | 5.00 | 0.00 |
| instance n=20 35.alb | 1 | 0 | Optimal | 0.43 | 12 | 12.00 | 0.00 |
| instance n=20 350.alb | 1 | 0 | Optimal | 0.22 | 5 | 5.00 | 0.00 |
| instance n=20 351.alb | 1 | 0 | Optimal | 0.21 | 5 | 5.00 | 0.00 |
| instance n=20 352.alb | 1 | 0 | Optimal | 0.24 | 4 | 4.00 | 0.00 |
| instance n=20 353.alb | 1 | 0 | Optimal | 0.19 | 6 | 6.00 | 0.00 |
| instance n=20 354.alb | 1 | 0 | Optimal | 0.27 | 6 | 6.00 | 0.00 |
| instance n=20 355.alb | 1 | 0 | Optimal | 0.17 | 5 | 5.00 | 0.00 |
| instance n=20 356.alb | 1 | 0 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 357.alb | 1 | 0 | Optimal | 0.27 | 5 | 5.00 | 0.00 |
| instance n=20 358.alb | 1 | 0 | Optimal | 0.19 | 4 | 4.00 | 0.00 |
| instance n=20 359.alb | 1 | 0 | Optimal | 0.21 | 4 | 4.00 | 0.00 |
| instance n=20 36.alb | 1 | 0 | Optimal | 0.92 | 13 | 13.00 | 0.00 |
| instance n=20 360.alb | 1 | 0 | Optimal | 0.27 | 6 | 6.00 | 0.00 |
| instance n=20 361.alb | 1 | 0 | Optimal | 0.20 | 5 | 5.00 | 0.00 |
| instance n=20 362.alb | 1 | 0 | Optimal | 0.17 | 5 | 5.00 | 0.00 |
| instance n=20 363.alb | 1 | 0 | Optimal | 0.27 | 7 | 7.00 | 0.00 |
| instance n=20 364.alb | 1 | 0 | Optimal | 0.20 | 4 | 4.00 | 0.00 |
| instance n=20 365.alb | 1 | 0 | Optimal | 0.20 | 5 | 5.00 | 0.00 |
| instance n=20 366.alb | 1 | 0 | Optimal | 0.15 | 3 | 3.00 | 0.00 |
| instance n=20 367.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 368.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 369.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 37.alb | 1 | 0 | Optimal | 0.67 | 12 | 12.00 | 0.00 |
| instance n=20 370.alb | 1 | 0 | Optimal | 0.15 | 3 | 3.00 | 0.00 |
| instance n=20 371.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 372.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 373.alb | 1 | 0 | Optimal | 0.24 | 3 | 3.00 | 0.00 |
| instance n=20 374.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 375.alb | 1 | 0 | Optimal | 0.21 | 3 | 3.00 | 0.00 |
| instance n=20 376.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 377.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 378.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 379.alb | 1 | 0 | Optimal | 0.24 | 4 | 4.00 | 0.00 |
| instance n=20 38.alb | 1 | 0 | Optimal | 0.19 | 12 | 12.00 | 0.00 |
| instance n=20 380.alb | 1 | 0 | Optimal | 0.15 | 3 | 3.00 | 0.00 |
| instance n=20 381.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 382.alb | 1 | 0 | Optimal | 0.24 | 4 | 4.00 | 0.00 |
| instance n=20 383.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 384.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 385.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 386.alb | 1 | 0 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 387.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 388.alb | 1 | 0 | Optimal | 0.18 | 3 | 3.00 | 0.00 |
| instance n=20 389.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 39.alb | 1 | 0 | Optimal | 0.36 | 13 | 13.00 | 0.00 |
| instance n=20 390.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 391.alb | 1 | 0 | Optimal | 0.74 | 11 | 10.00 | 9.09 |
| instance n=20 392.alb | 1 | 0 | Optimal | 2.22 | 14 | 14.00 | 0.00 |
| instance n=20 393.alb | 1 | 0 | Optimal | 2.23 | 11 | 10.00 | 9.09 |
| instance n=20 394.alb | 1 | 0 | Optimal | 1.68 | 12 | 12.00 | 0.00 |
| instance n=20 395.alb | 1 | 0 | Optimal | 0.72 | 12 | 12.00 | 0.00 |
| instance n=20 396.alb | 1 | 0 | Optimal | 2.73 | 13 | 13.00 | 0.00 |
| instance n=20 397.alb | 1 | 0 | Optimal | 0.94 | 10 | 10.00 | 0.00 |
| instance n=20 398.alb | 1 | 0 | Optimal | 0.68 | 11 | 11.00 | 0.00 |
| instance n=20 399.alb | 1 | 0 | Optimal | 1.61 | 13 | 13.00 | 0.00 |
| instance n=20 4.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 40.alb | 1 | 0 | Optimal | 1.37 | 12 | 12.00 | 0.00 |
| instance n=20 400.alb | 1 | 0 | Optimal | 1.55 | 12 | 12.00 | 0.00 |
| instance n=20 401.alb | 1 | 0 | Optimal | 1.60 | 12 | 12.00 | 0.00 |
| instance n=20 402.alb | 1 | 0 | Optimal | 0.82 | 12 | 12.00 | 0.00 |
| instance n=20 403.alb | 1 | 0 | Optimal | 1.63 | 12 | 12.00 | 0.00 |
| instance n=20 404.alb | 1 | 0 | Optimal | 1.73 | 10 | 10.00 | 0.00 |
| instance n=20 405.alb | 1 | 0 | Optimal | 1.63 | 12 | 12.00 | 0.00 |
| instance n=20 406.alb | 1 | 0 | Optimal | 5.09 | 14 | 14.00 | 0.00 |
| instance n=20 407.alb | 1 | 0 | Optimal | 0.24 | 10 | 10.00 | 0.00 |
| instance n=20 408.alb | 1 | 0 | Optimal | 3.75 | 14 | 14.00 | 0.00 |
| instance n=20 409.alb | 1 | 0 | Optimal | 1.19 | 12 | 12.00 | 0.00 |
| instance n=20 41.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 410.alb | 1 | 0 | Optimal | 1.26 | 11 | 11.00 | 0.00 |
| instance n=20 411.alb | 1 | 0 | Optimal | 7.00 | 15 | 15.00 | 0.00 |
| instance n=20 412.alb | 1 | 0 | Optimal | 0.99 | 11 | 11.00 | 0.00 |
| instance n=20 413.alb | 1 | 0 | Optimal | 0.25 | 10 | 10.00 | 0.00 |
| instance n=20 414.alb | 1 | 0 | Optimal | 3.08 | 12 | 12.00 | 0.00 |
| instance n=20 415.alb | 1 | 0 | Optimal | 0.19 | 10 | 10.00 | 0.00 |
| instance n=20 416.alb | 1 | 0 | Optimal | 0.24 | 6 | 6.00 | 0.00 |
| instance n=20 417.alb | 1 | 0 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 418.alb | 1 | 0 | Optimal | 0.19 | 6 | 6.00 | 0.00 |
| instance n=20 419.alb | 1 | 0 | Optimal | 0.19 | 4 | 4.00 | 0.00 |
| instance n=20 42.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 420.alb | 1 | 0 | Optimal | 0.27 | 5 | 5.00 | 0.00 |
| instance n=20 421.alb | 1 | 0 | Optimal | 0.25 | 6 | 6.00 | 0.00 |
| instance n=20 422.alb | 1 | 0 | Optimal | 0.17 | 4 | 4.00 | 0.00 |
| instance n=20 423.alb | 1 | 0 | Optimal | 0.20 | 6 | 6.00 | 0.00 |
| instance n=20 424.alb | 1 | 0 | Optimal | 0.31 | 5 | 5.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 425.alb | 1 | 0 | Optimal | 0.27 | 6 | 6.00 | 0.00 |
| instance n=20 426.alb | 1 | 0 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 427.alb | 1 | 0 | Optimal | 0.20 | 6 | 6.00 | 0.00 |
| instance n=20 428.alb | 1 | 0 | Optimal | 0.22 | 5 | 5.00 | 0.00 |
| instance n=20 429.alb | 1 | 0 | Optimal | 0.22 | 4 | 4.00 | 0.00 |
| instance n=20 43.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 430.alb | 1 | 0 | Optimal | 0.28 | 5 | 5.00 | 0.00 |
| instance n=20 431.alb | 1 | 0 | Optimal | 0.28 | 6 | 6.00 | 0.00 |
| instance n=20 432.alb | 1 | 0 | Optimal | 0.17 | 5 | 5.00 | 0.00 |
| instance n=20 433.alb | 1 | 0 | Optimal | 0.22 | 5 | 5.00 | 0.00 |
| instance n=20 434.alb | 1 | 0 | Optimal | 0.21 | 5 | 5.00 | 0.00 |
| instance n=20 435.alb | 1 | 0 | Optimal | 1.18 | 7 | 7.00 | 0.00 |
| instance n=20 436.alb | 1 | 0 | Optimal | 0.20 | 5 | 5.00 | 0.00 |
| instance n=20 437.alb | 1 | 0 | Optimal | 0.27 | 5 | 5.00 | 0.00 |
| instance n=20 438.alb | 1 | 0 | Optimal | 0.22 | 6 | 6.00 | 0.00 |
| instance n=20 439.alb | 1 | 0 | Optimal | 0.20 | 5 | 5.00 | 0.00 |
| instance n=20 44.alb | 1 | 0 | Optimal | 0.04 | 5 | 5.00 | 0.00 |
| instance n=20 440.alb | 1 | 0 | Optimal | 0.22 | 5 | 5.00 | 0.00 |
| instance n=20 441.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 442.alb | 1 | 0 | Optimal | 0.23 | 3 | 3.00 | 0.00 |
| instance n=20 443.alb | 1 | 0 | Optimal | 0.20 | 3 | 3.00 | 0.00 |
| instance n=20 444.alb | 1 | 0 | Optimal | 0.24 | 3 | 3.00 | 0.00 |
| instance n=20 445.alb | 1 | 0 | Optimal | 0.18 | 3 | 3.00 | 0.00 |
| instance n=20 446.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 447.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 448.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 449.alb | 1 | 0 | Optimal | 0.25 | 3 | 3.00 | 0.00 |
| instance n=20 45.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=20 450.alb | 1 | 0 | Optimal | 0.24 | 3 | 3.00 | 0.00 |
| instance n=20 451.alb | 1 | 0 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 452.alb | 1 | 0 | Optimal | 0.20 | 3 | 3.00 | 0.00 |
| instance n=20 453.alb | 1 | 0 | Optimal | 0.23 | 3 | 3.00 | 0.00 |
| instance n=20 454.alb | 1 | 0 | Optimal | 0.20 | 3 | 3.00 | 0.00 |
| instance n=20 455.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 456.alb | 1 | 0 | Optimal | 0.17 | 4 | 4.00 | 0.00 |
| instance n=20 457.alb | 1 | 0 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 458.alb | 1 | 0 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 459.alb | 1 | 0 | Optimal | 0.19 | 3 | 3.00 | 0.00 |
| instance n=20 46.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 460.alb | 1 | 0 | Optimal | 0.25 | 3 | 3.00 | 0.00 |
| instance n=20 461.alb | 1 | 0 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 462.alb | 1 | 0 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 463.alb | 1 | 0 | Optimal | 0.19 | 3 | 3.00 | 0.00 |
| instance n=20 464.alb | 1 | 0 | Optimal | 0.19 | 3 | 3.00 | 0.00 |
| instance n=20 465.alb | 1 | 0 | Optimal | 0.16 | 3 | 3.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 466.alb | 1 | 0 | Optimal | 1.11 | 13 | 13.00 | 0.00 |
| instance n=20 467.alb | 1 | 0 | Optimal | 1.08 | 14 | 14.00 | 0.00 |
| instance n=20 468.alb | 1 | 0 | Optimal | 1.15 | 13 | 13.00 | 0.00 |
| instance n=20 469.alb | 1 | 0 | Optimal | 0.86 | 14 | 14.00 | 0.00 |
| instance n=20 47.alb | 1 | 0 | Optimal | 0.04 | 4 | 4.00 | 0.00 |
| instance n=20 470.alb | 1 | 0 | Optimal | 1.19 | 12 | 12.00 | 0.00 |
| instance n=20 471.alb | 1 | 0 | Optimal | 1.01 | 12 | 12.00 | 0.00 |
| instance n=20 472.alb | 1 | 0 | Optimal | 0.97 | 13 | 13.00 | 0.00 |
| instance n=20 473.alb | 1 | 0 | Optimal | 1.08 | 10 | 10.00 | 0.00 |
| instance n=20 474.alb | 1 | 0 | Optimal | 1.07 | 14 | 14.00 | 0.00 |
| instance n=20 475.alb | 1 | 0 | Optimal | 1.13 | 11 | 11.00 | 0.00 |
| instance n=20 476.alb | 1 | 0 | Optimal | 1.00 | 11 | 11.00 | 0.00 |
| instance n=20 477.alb | 1 | 0 | Optimal | 1.13 | 11 | 11.00 | 0.00 |
| instance n=20 478.alb | 1 | 0 | Optimal | 1.29 | 12 | 12.00 | 0.00 |
| instance n=20 479.alb | 1 | 0 | Optimal | 1.15 | 13 | 13.00 | 0.00 |
| instance n=20 48.alb | 1 | 0 | Optimal | 0.05 | 5 | 5.00 | 0.00 |
| instance n=20 480.alb | 1 | 0 | Optimal | 1.15 | 13 | 13.00 | 0.00 |
| instance n=20 481.alb | 1 | 0 | Optimal | 0.94 | 13 | 13.00 | 0.00 |
| instance n=20 482.alb | 1 | 0 | Optimal | 1.30 | 13 | 13.00 | 0.00 |
| instance n=20 483.alb | 1 | 0 | Optimal | 1.07 | 12 | 12.00 | 0.00 |
| instance n=20 484.alb | 1 | 0 | Optimal | 1.15 | 13 | 13.00 | 0.00 |
| instance n=20 485.alb | 1 | 0 | Optimal | 0.99 | 15 | 15.00 | 0.00 |
| instance n=20 486.alb | 1 | 0 | Optimal | 1.14 | 11 | 11.00 | 0.00 |
| instance n=20 487.alb | 1 | 0 | Optimal | 1.23 | 12 | 12.00 | 0.00 |
| instance n=20 488.alb | 1 | 0 | Optimal | 1.10 | 15 | 15.00 | 0.00 |
| instance n=20 489.alb | 1 | 0 | Optimal | 1.04 | 12 | 12.00 | 0.00 |
| instance n=20 49.alb | 1 | 0 | Optimal | 0.03 | 4 | 4.00 | 0.00 |
| instance n=20 490.alb | 1 | 0 | Optimal | 1.22 | 12 | 12.00 | 0.00 |
| instance n=20 491.alb | 1 | 0 | Optimal | 0.23 | 6 | 6.00 | 0.00 |
| instance n=20 492.alb | 1 | 0 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 493.alb | 1 | 0 | Optimal | 0.27 | 5 | 5.00 | 0.00 |
| instance n=20 494.alb | 1 | 0 | Optimal | 0.22 | 6 | 6.00 | 0.00 |
| instance n=20 495.alb | 1 | 0 | Optimal | 0.27 | 6 | 6.00 | 0.00 |
| instance n=20 496.alb | 1 | 0 | Optimal | 0.27 | 5 | 5.00 | 0.00 |
| instance n=20 497.alb | 1 | 0 | Optimal | 0.25 | 6 | 6.00 | 0.00 |
| instance n=20 498.alb | 1 | 0 | Optimal | 0.39 | 6 | 6.00 | 0.00 |
| instance n=20 499.alb | 1 | 0 | Optimal | 0.25 | 5 | 5.00 | 0.00 |
| instance n=20 5.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 50.alb | 1 | 0 | Optimal | 0.05 | 4 | 4.00 | 0.00 |
| instance n=20 500.alb | 1 | 0 | Optimal | 1.33 | 8 | 8.00 | 0.00 |
| instance n=20 501.alb | 1 | 0 | Optimal | 0.28 | 5 | 5.00 | 0.00 |
| instance n=20 502.alb | 1 | 0 | Optimal | 0.19 | 4 | 4.00 | 0.00 |
| instance n=20 503.alb | 1 | 0 | Optimal | 0.24 | 6 | 6.00 | 0.00 |
| instance n=20 504.alb | 1 | 0 | Optimal | 0.28 | 6 | 6.00 | 0.00 |
| instance n=20 505.alb | 1 | 0 | Optimal | 0.36 | 6 | 6.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 506.alb | 1 | 0 | Optimal | 0.31 | 5 | 5.00 | 0.00 |
| instance n=20 507.alb | 1 | 0 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 508.alb | 1 | 0 | Optimal | 0.28 | 5 | 5.00 | 0.00 |
| instance n=20 509.alb | 1 | 0 | Optimal | 0.20 | 4 | 4.00 | 0.00 |
| instance n=20 51.alb | 1 | 0 | Optimal | 0.03 | 4 | 4.00 | 0.00 |
| instance n=20 510.alb | 1 | 0 | Optimal | 0.25 | 5 | 5.00 | 0.00 |
| instance n=20 511.alb | 1 | 0 | Optimal | 0.44 | 5 | 5.00 | 0.00 |
| instance n=20 512.alb | 1 | 0 | Optimal | 0.31 | 5 | 5.00 | 0.00 |
| instance n=20 513.alb | 1 | 0 | Optimal | 0.27 | 5 | 5.00 | 0.00 |
| instance n=20 514.alb | 1 | 0 | Optimal | 0.22 | 5 | 5.00 | 0.00 |
| instance n=20 515.alb | 1 | 0 | Optimal | 1.67 | 6 | 6.00 | 0.00 |
| instance n=20 516.alb | 1 | 0 | Optimal | 0.36 | 3 | 3.00 | 0.00 |
| instance n=20 517.alb | 1 | 0 | Optimal | 0.31 | 3 | 3.00 | 0.00 |
| instance n=20 518.alb | 1 | 0 | Optimal | 0.35 | 3 | 3.00 | 0.00 |
| instance n=20 519.alb | 1 | 0 | Optimal | 0.35 | 3 | 3.00 | 0.00 |
| instance n=20 52.alb | 1 | 0 | Optimal | 0.05 | 4 | 4.00 | 0.00 |
| instance n=20 520.alb | 1 | 0 | Optimal | 0.39 | 3 | 3.00 | 0.00 |
| instance n=20 521.alb | 1 | 0 | Optimal | 0.36 | 3 | 3.00 | 0.00 |
| instance n=20 522.alb | 1 | 0 | Optimal | 0.30 | 3 | 3.00 | 0.00 |
| instance n=20 523.alb | 1 | 0 | Optimal | 0.28 | 3 | 3.00 | 0.00 |
| instance n=20 524.alb | 1 | 0 | Optimal | 0.33 | 3 | 3.00 | 0.00 |
| instance n=20 525.alb | 1 | 0 | Optimal | 0.35 | 3 | 3.00 | 0.00 |
| instance n=20 53.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 54.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 55.alb | 1 | 0 | Optimal | 0.04 | 5 | 5.00 | 0.00 |
| instance n=20 56.alb | 1 | 0 | Optimal | 0.03 | 4 | 4.00 | 0.00 |
| instance n=20 57.alb | 1 | 0 | Optimal | 0.03 | 4 | 4.00 | 0.00 |
| instance n=20 58.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 59.alb | 1 | 0 | Optimal | 0.04 | 4 | 4.00 | 0.00 |
| instance n=20 6.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 60.alb | 1 | 0 | Optimal | 0.05 | 6 | 6.00 | 0.00 |
| instance n=20 61.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=20 62.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 63.alb | 1 | 0 | Optimal | 0.05 | 5 | 5.00 | 0.00 |
| instance n=20 64.alb | 1 | 0 | Optimal | 0.04 | 5 | 5.00 | 0.00 |
| instance n=20 65.alb | 1 | 0 | Optimal | 0.04 | 5 | 5.00 | 0.00 |
| instance n=20 66.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 67.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 68.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 69.alb | 1 | 0 | Optimal | 0.01 | 2 | 2.00 | 0.00 |
| instance n=20 7.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 70.alb | 1 | 0 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 71.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 72.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 73.alb | 1 | 0 | Optimal | 0.01 | 2 | 2.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 74.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 75.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 76.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 77.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 78.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 79.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 8.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 80.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 81.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 82.alb | 1 | 0 | Optimal | 0.05 | 4 | 4.00 | 0.00 |
| instance n=20 83.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 84.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 85.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 86.alb | 1 | 0 | Optimal | 0.04 | 3 | 3.00 | 0.00 |
| instance n=20 87.alb | 1 | 0 | Optimal | 0.04 | 3 | 3.00 | 0.00 |
| instance n=20 88.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 89.alb | 1 | 0 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 9.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 90.alb | 1 | 0 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 91.alb | 1 | 0 | Optimal | 0.20 | 11 | 11.00 | 0.00 |
| instance n=20 92.alb | 1 | 0 | Optimal | 0.26 | 11 | 11.00 | 0.00 |
| instance n=20 93.alb | 1 | 0 | Optimal | 0.36 | 13 | 13.00 | 0.00 |
| instance n=20 94.alb | 1 | 0 | Optimal | 0.06 | 10 | 10.00 | 0.00 |
| instance n=20 95.alb | 1 | 0 | Optimal | 0.23 | 12 | 12.00 | 0.00 |
| instance n=20 96.alb | 1 | 0 | Optimal | 0.22 | 10 | 10.00 | 0.00 |
| instance n=20 97.alb | 1 | 0 | Optimal | 2.52 | 15 | 15.00 | 0.00 |
| instance n=20 98.alb | 1 | 0 | Optimal | 0.54 | 13 | 13.00 | 0.00 |
| instance n=20 99.alb | 1 | 0 | Optimal | 0.59 | 12 | 12.00 | 0.00 |
| instance n=50 1.alb | 1 | 0 | Optimal | 0.02 | 8 | 8.00 | 0.00 |
| instance n=50 10.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 100.alb | 1 | 0 | Optimal | 0.07 | 7 | 7.00 | 0.00 |
| instance n=50 101.alb | 1 | 0 | Solution | 120.02 | 30 | 27.00 | 10.00 |
| instance n=50 102.alb | 1 | 0 | Solution | 120.02 | 32 | 28.00 | 12.50 |
| instance n=50 103.alb | 1 | 0 | Solution | 120.04 | 29 | 26.00 | 10.34 |
| instance n=50 104.alb | 1 | 0 | Solution | 120.03 | 27 | 25.00 | 7.41 |
| instance n=50 105.alb | 1 | 0 | Optimal | 93.42 | 24 | 24.00 | 0.00 |
| instance n=50 106.alb | 1 | 0 | Solution | 120.04 | 28 | 26.00 | 7.14 |
| instance n=50 107.alb | 1 | 0 | Solution | 120.02 | 28 | 27.00 | 3.57 |
| instance n=50 108.alb | 1 | 0 | Solution | 120.02 | 30 | 27.00 | 10.00 |
| instance n=50 109.alb | 1 | 0 | Solution | 120.04 | 30 | 26.00 | 13.33 |
| instance n=50 11.alb | 1 | 0 | Optimal | 0.02 | 7 | 7.00 | 0.00 |
| instance n=50 110.alb | 1 | 0 | Solution | 120.02 | 26 | 25.00 | 3.85 |
| instance n=50 111.alb | 1 | 0 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 112.alb | 1 | 0 | Solution | 120.03 | 27 | 25.00 | 7.41 |
| instance n=50 113.alb | 1 | 0 | Solution | 120.03 | 28 | 26.00 | 7.14 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 114.alb | 1 | 0 | Solution | 120.03 | 27 | 25.00 | 7.41 |
| instance n=50 115.alb | 1 | 0 | Solution | 120.03 | 28 | 26.00 | 7.14 |
| instance n=50 116.alb | 1 | 0 | Solution | 120.03 | 32 | 29.00 | 9.38 |
| instance n=50 117.alb | 1 | 0 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 118.alb | 1 | 0 | Solution | 120.03 | 29 | 26.00 | 10.34 |
| instance n=50 119.alb | 1 | 0 | Optimal | 5.79 | 25 | 25.00 | 0.00 |
| instance n=50 12.alb | 1 | 0 | Optimal | 0.05 | 6 | 6.00 | 0.00 |
| instance n=50 120.alb | 1 | 0 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=50 121.alb | 1 | 0 | Solution | 120.02 | 32 | 27.00 | 15.63 |
| instance n=50 122.alb | 1 | 0 | Solution | 120.02 | 29 | 28.00 | 3.45 |
| instance n=50 123.alb | 1 | 0 | Solution | 120.02 | 32 | 27.00 | 15.63 |
| instance n=50 124.alb | 1 | 0 | Solution | 120.02 | 29 | 27.00 | 6.90 |
| instance n=50 125.alb | 1 | 0 | Solution | 120.02 | 33 | 28.00 | 15.15 |
| instance n=50 126.alb | 1 | 0 | Optimal | 0.10 | 12 | 12.00 | 0.00 |
| instance n=50 127.alb | 1 | 0 | Optimal | 0.09 | 14 | 14.00 | 0.00 |
| instance n=50 128.alb | 1 | 0 | Optimal | 0.42 | 12 | 12.00 | 0.00 |
| instance n=50 129.alb | 1 | 0 | Optimal | 0.11 | 13 | 13.00 | 0.00 |
| instance n=50 13.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=50 130.alb | 1 | 0 | Optimal | 0.11 | 13 | 13.00 | 0.00 |
| instance n=50 131.alb | 1 | 0 | Optimal | 0.11 | 12 | 12.00 | 0.00 |
| instance n=50 132.alb | 1 | 0 | Optimal | 1.44 | 12 | 12.00 | 0.00 |
| instance n=50 133.alb | 1 | 0 | Optimal | 0.07 | 12 | 12.00 | 0.00 |
| instance n=50 134.alb | 1 | 0 | Optimal | 1.10 | 14 | 14.00 | 0.00 |
| instance n=50 135.alb | 1 | 0 | Optimal | 0.47 | 13 | 13.00 | 0.00 |
| instance n=50 136.alb | 1 | 0 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=50 137.alb | 1 | 0 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=50 138.alb | 1 | 0 | Optimal | 0.10 | 12 | 12.00 | 0.00 |
| instance n=50 139.alb | 1 | 0 | Optimal | 3.67 | 11 | 11.00 | 0.00 |
| instance n=50 14.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 140.alb | 1 | 0 | Optimal | 0.20 | 12 | 12.00 | 0.00 |
| instance n=50 141.alb | 1 | 0 | Optimal | 0.17 | 13 | 13.00 | 0.00 |
| instance n=50 142.alb | 1 | 0 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=50 143.alb | 1 | 0 | Optimal | 0.28 | 12 | 12.00 | 0.00 |
| instance n=50 144.alb | 1 | 0 | Optimal | 0.23 | 13 | 13.00 | 0.00 |
| instance n=50 145.alb | 1 | 0 | Optimal | 0.25 | 10 | 10.00 | 0.00 |
| instance n=50 146.alb | 1 | 0 | Optimal | 0.20 | 13 | 13.00 | 0.00 |
| instance n=50 147.alb | 1 | 0 | Optimal | 0.29 | 13 | 13.00 | 0.00 |
| instance n=50 148.alb | 1 | 0 | Optimal | 0.17 | 10 | 10.00 | 0.00 |
| instance n=50 149.alb | 1 | 0 | Optimal | 0.18 | 12 | 12.00 | 0.00 |
| instance n=50 15.alb | 1 | 0 | Optimal | 0.02 | 8 | 8.00 | 0.00 |
| instance n=50 150.alb | 1 | 0 | Optimal | 0.14 | 11 | 11.00 | 0.00 |
| instance n=50 151.alb | 1 | 0 | Optimal | 0.14 | 7 | 7.00 | 0.00 |
| instance n=50 152.alb | 1 | 0 | Optimal | 0.10 | 7 | 7.00 | 0.00 |
| instance n=50 153.alb | 1 | 0 | Optimal | 0.56 | 7 | 7.00 | 0.00 |
| instance n=50 154.alb | 1 | 0 | Optimal | 0.12 | 8 | 8.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 155.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 156.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 157.alb | 1 | 0 | Optimal | 0.10 | 8 | 8.00 | 0.00 |
| instance n=50 158.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 159.alb | 1 | 0 | Optimal | 0.12 | 7 | 7.00 | 0.00 |
| instance n=50 16.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 160.alb | 1 | 0 | Optimal | 0.11 | 8 | 8.00 | 0.00 |
| instance n=50 161.alb | 1 | 0 | Optimal | 0.13 | 7 | 7.00 | 0.00 |
| instance n=50 162.alb | 1 | 0 | Optimal | 0.11 | 8 | 8.00 | 0.00 |
| instance n=50 163.alb | 1 | 0 | Optimal | 0.11 | 7 | 7.00 | 0.00 |
| instance n=50 164.alb | 1 | 0 | Optimal | 0.12 | 7 | 7.00 | 0.00 |
| instance n=50 165.alb | 1 | 0 | Optimal | 0.13 | 8 | 8.00 | 0.00 |
| instance n=50 166.alb | 1 | 0 | Optimal | 0.12 | 8 | 8.00 | 0.00 |
| instance n=50 167.alb | 1 | 0 | Optimal | 0.60 | 7 | 7.00 | 0.00 |
| instance n=50 168.alb | 1 | 0 | Optimal | 0.69 | 8 | 8.00 | 0.00 |
| instance n=50 169.alb | 1 | 0 | Optimal | 0.10 | 8 | 8.00 | 0.00 |
| instance n=50 17.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 170.alb | 1 | 0 | Optimal | 0.38 | 7 | 7.00 | 0.00 |
| instance n=50 171.alb | 1 | 0 | Optimal | 0.12 | 8 | 8.00 | 0.00 |
| instance n=50 172.alb | 1 | 0 | Optimal | 0.12 | 7 | 7.00 | 0.00 |
| instance n=50 173.alb | 1 | 0 | Optimal | 0.36 | 7 | 7.00 | 0.00 |
| instance n=50 174.alb | 1 | 0 | Optimal | 0.13 | 7 | 7.00 | 0.00 |
| instance n=50 175.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 176.alb | 1 | 0 | Solution | 120.03 | 27 | 25.00 | 7.41 |
| instance n=50 177.alb | 1 | 0 | Solution | 120.03 | 28 | 26.00 | 7.14 |
| instance n=50 178.alb | 1 | 0 | Solution | 120.05 | 28 | 26.00 | 7.14 |
| instance n=50 179.alb | 1 | 0 | Solution | 120.03 | 27 | 25.00 | 7.41 |
| instance n=50 18.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 180.alb | 1 | 0 | Solution | 120.02 | 26 | 25.00 | 3.85 |
| instance n=50 181.alb | 1 | 0 | Solution | 120.04 | 29 | 27.00 | 6.90 |
| instance n=50 182.alb | 1 | 0 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 183.alb | 1 | 0 | Solution | 120.03 | 29 | 26.00 | 10.34 |
| instance n=50 184.alb | 1 | 0 | Solution | 120.02 | 38 | 29.00 | 23.68 |
| instance n=50 185.alb | 1 | 0 | Solution | 120.03 | 27 | 25.00 | 7.41 |
| instance n=50 186.alb | 1 | 0 | Solution | 120.03 | 26 | 25.00 | 3.85 |
| instance n=50 187.alb | 1 | 0 | Solution | 120.03 | 26 | 25.00 | 3.85 |
| instance n=50 188.alb | 1 | 0 | Solution | 120.05 | 25 | 24.00 | 4.00 |
| instance n=50 189.alb | 1 | 0 | Solution | 120.03 | 26 | 25.00 | 3.85 |
| instance n=50 19.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 190.alb | 1 | 0 | Solution | 120.03 | 30 | 26.00 | 13.33 |
| instance n=50 191.alb | 1 | 0 | Solution | 120.02 | 28 | 26.00 | 7.14 |
| instance n=50 192.alb | 1 | 0 | Solution | 120.02 | 27 | 26.00 | 3.70 |
| instance n=50 193.alb | 1 | 0 | Solution | 120.02 | 28 | 27.00 | 3.57 |
| instance n=50 194.alb | 1 | 0 | Solution | 120.03 | 28 | 26.00 | 7.14 |
| instance n=50 195.alb | 1 | 0 | Solution | 120.05 | 28 | 26.00 | 7.14 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 196.alb | 1 | 0 | Solution | 120.03 | 27 | 26.00 | 3.70 |
| instance n=50 197.alb | 1 | 0 | Solution | 120.03 | 28 | 27.00 | 3.57 |
| instance n=50 198.alb | 1 | 0 | Solution | 120.03 | 28 | 26.00 | 7.14 |
| instance n=50 199.alb | 1 | 0 | Solution | 120.04 | 29 | 27.00 | 6.90 |
| instance n=50 2.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=50 20.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 200.alb | 1 | 0 | Solution | 120.03 | 25 | 24.00 | 4.00 |
| instance n=50 201.alb | 1 | 0 | Optimal | 0.20 | 13 | 13.00 | 0.00 |
| instance n=50 202.alb | 1 | 0 | Optimal | 0.47 | 9 | 9.00 | 0.00 |
| instance n=50 203.alb | 1 | 0 | Optimal | 0.37 | 11 | 11.00 | 0.00 |
| instance n=50 204.alb | 1 | 0 | Optimal | 1.01 | 10 | 10.00 | 0.00 |
| instance n=50 205.alb | 1 | 0 | Optimal | 0.20 | 13 | 13.00 | 0.00 |
| instance n=50 206.alb | 1 | 0 | Optimal | 13.25 | 11 | 11.00 | 0.00 |
| instance n=50 207.alb | 1 | 0 | Optimal | 0.13 | 10 | 10.00 | 0.00 |
| instance n=50 208.alb | 1 | 0 | Optimal | 0.32 | 13 | 13.00 | 0.00 |
| instance n=50 209.alb | 1 | 0 | Optimal | 0.22 | 11 | 11.00 | 0.00 |
| instance n=50 21.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=50 210.alb | 1 | 0 | Optimal | 0.25 | 13 | 13.00 | 0.00 |
| instance n=50 211.alb | 1 | 0 | Optimal | 0.14 | 12 | 12.00 | 0.00 |
| instance n=50 212.alb | 1 | 0 | Optimal | 0.18 | 10 | 10.00 | 0.00 |
| instance n=50 213.alb | 1 | 0 | Optimal | 0.15 | 13 | 13.00 | 0.00 |
| instance n=50 214.alb | 1 | 0 | Optimal | 0.14 | 11 | 11.00 | 0.00 |
| instance n=50 215.alb | 1 | 0 | Optimal | 0.23 | 11 | 11.00 | 0.00 |
| instance n=50 216.alb | 1 | 0 | Optimal | 0.41 | 12 | 12.00 | 0.00 |
| instance n=50 217.alb | 1 | 0 | Optimal | 1.16 | 13 | 13.00 | 0.00 |
| instance n=50 218.alb | 1 | 0 | Optimal | 0.12 | 12 | 12.00 | 0.00 |
| instance n=50 219.alb | 1 | 0 | Optimal | 0.20 | 11 | 11.00 | 0.00 |
| instance n=50 22.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 220.alb | 1 | 0 | Optimal | 0.14 | 11 | 11.00 | 0.00 |
| instance n=50 221.alb | 1 | 0 | Optimal | 1.02 | 11 | 11.00 | 0.00 |
| instance n=50 222.alb | 1 | 0 | Optimal | 0.16 | 14 | 14.00 | 0.00 |
| instance n=50 223.alb | 1 | 0 | Optimal | 1.67 | 11 | 11.00 | 0.00 |
| instance n=50 224.alb | 1 | 0 | Optimal | 0.12 | 11 | 11.00 | 0.00 |
| instance n=50 225.alb | 1 | 0 | Optimal | 0.20 | 12 | 12.00 | 0.00 |
| instance n=50 226.alb | 1 | 0 | Optimal | 0.14 | 7 | 7.00 | 0.00 |
| instance n=50 227.alb | 1 | 0 | Optimal | 0.22 | 6 | 6.00 | 0.00 |
| instance n=50 228.alb | 1 | 0 | Optimal | 0.21 | 6 | 6.00 | 0.00 |
| instance n=50 229.alb | 1 | 0 | Optimal | 0.16 | 6 | 6.00 | 0.00 |
| instance n=50 23.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 230.alb | 1 | 0 | Optimal | 0.24 | 7 | 7.00 | 0.00 |
| instance n=50 231.alb | 1 | 0 | Optimal | 0.28 | 7 | 7.00 | 0.00 |
| instance n=50 232.alb | 1 | 0 | Optimal | 0.98 | 7 | 7.00 | 0.00 |
| instance n=50 233.alb | 1 | 0 | Optimal | 0.20 | 6 | 6.00 | 0.00 |
| instance n=50 234.alb | 1 | 0 | Optimal | 0.22 | 8 | 8.00 | 0.00 |
| instance n=50 235.alb | 1 | 0 | Optimal | 0.26 | 7 | 7.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 236.alb | 1 | 0 | Optimal | 0.48 | 7 | 7.00 | 0.00 |
| instance n=50 237.alb | 1 | 0 | Optimal | 0.20 | 8 | 8.00 | 0.00 |
| instance n=50 238.alb | 1 | 0 | Optimal | 0.26 | 7 | 7.00 | 0.00 |
| instance n=50 239.alb | 1 | 0 | Optimal | 0.36 | 7 | 7.00 | 0.00 |
| instance n=50 24.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 240.alb | 1 | 0 | Optimal | 0.14 | 7 | 7.00 | 0.00 |
| instance n=50 241.alb | 1 | 0 | Optimal | 0.19 | 7 | 7.00 | 0.00 |
| instance n=50 242.alb | 1 | 0 | Optimal | 0.24 | 8 | 8.00 | 0.00 |
| instance n=50 243.alb | 1 | 0 | Optimal | 0.17 | 7 | 7.00 | 0.00 |
| instance n=50 244.alb | 1 | 0 | Optimal | 0.55 | 7 | 7.00 | 0.00 |
| instance n=50 245.alb | 1 | 0 | Optimal | 0.30 | 7 | 7.00 | 0.00 |
| instance n=50 246.alb | 1 | 0 | Optimal | 0.21 | 8 | 8.00 | 0.00 |
| instance n=50 247.alb | 1 | 0 | Optimal | 0.24 | 7 | 7.00 | 0.00 |
| instance n=50 248.alb | 1 | 0 | Optimal | 0.13 | 7 | 7.00 | 0.00 |
| instance n=50 249.alb | 1 | 0 | Optimal | 0.54 | 7 | 7.00 | 0.00 |
| instance n=50 25.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=50 250.alb | 1 | 0 | Optimal | 0.18 | 7 | 7.00 | 0.00 |
| instance n=50 251.alb | 1 | 0 | Solution | 120.03 | 27 | 26.00 | 3.70 |
| instance n=50 252.alb | 1 | 0 | Solution | 120.05 | 32 | 28.00 | 12.50 |
| instance n=50 253.alb | 1 | 0 | Solution | 120.03 | 28 | 26.00 | 7.14 |
| instance n=50 254.alb | 1 | 0 | Solution | 120.05 | 30 | 28.00 | 6.67 |
| instance n=50 255.alb | 1 | 0 | Solution | 120.05 | 29 | 27.00 | 6.90 |
| instance n=50 256.alb | 1 | 0 | Solution | 120.04 | 30 | 28.00 | 6.67 |
| instance n=50 257.alb | 1 | 0 | Solution | 120.05 | 33 | 29.00 | 12.12 |
| instance n=50 258.alb | 1 | 0 | Solution | 120.03 | 28 | 27.00 | 3.57 |
| instance n=50 259.alb | 1 | 0 | Solution | 120.04 | 31 | 26.00 | 16.13 |
| instance n=50 26.alb | 1 | 0 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 260.alb | 1 | 0 | Solution | 120.05 | 29 | 27.00 | 6.90 |
| instance n=50 261.alb | 1 | 0 | Solution | 120.05 | 28 | 27.00 | 3.57 |
| instance n=50 262.alb | 1 | 0 | Solution | 120.04 | 31 | 26.00 | 16.13 |
| instance n=50 263.alb | 1 | 0 | Optimal | 118.45 | 29 | 29.00 | 0.00 |
| instance n=50 264.alb | 1 | 0 | Solution | 120.04 | 27 | 26.00 | 3.70 |
| instance n=50 265.alb | 1 | 0 | Solution | 120.05 | 27 | 26.00 | 3.70 |
| instance n=50 266.alb | 1 | 0 | Optimal | 89.34 | 29 | 29.00 | 0.00 |
| instance n=50 267.alb | 1 | 0 | Solution | 120.04 | 28 | 27.00 | 3.57 |
| instance n=50 268.alb | 1 | 0 | Solution | 120.04 | 29 | 27.00 | 6.90 |
| instance n=50 269.alb | 1 | 0 | Optimal | 37.05 | 26 | 26.00 | 0.00 |
| instance n=50 27.alb | 1 | 0 | Solution | 120.01 | 30 | 27.00 | 10.00 |
| instance n=50 270.alb | 1 | 0 | Solution | 120.04 | 28 | 27.00 | 3.57 |
| instance n=50 271.alb | 1 | 0 | Solution | 120.04 | 31 | 29.00 | 6.45 |
| instance n=50 272.alb | 1 | 0 | Solution | 120.03 | 27 | 26.00 | 3.70 |
| instance n=50 273.alb | 1 | 0 | Solution | 120.04 | 27 | 26.00 | 3.70 |
| instance n=50 274.alb | 1 | 0 | Solution | 120.04 | 29 | 27.00 | 6.90 |
| instance n=50 275.alb | 1 | 0 | Optimal | 7.83 | 27 | 27.00 | 0.00 |
| instance n=50 276.alb | 1 | 0 | Optimal | 0.88 | 12 | 12.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 277.alb | 1 | 0 | Optimal | 0.16 | 13 | 13.00 | 0.00 |
| instance n=50 278.alb | 1 | 0 | Optimal | 0.63 | 12 | 12.00 | 0.00 |
| instance n=50 279.alb | 1 | 0 | Optimal | 0.16 | 11 | 11.00 | 0.00 |
| instance n=50 28.alb | 1 | 0 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 280.alb | 1 | 0 | Optimal | 0.19 | 13 | 13.00 | 0.00 |
| instance n=50 281.alb | 1 | 0 | Optimal | 0.36 | 11 | 11.00 | 0.00 |
| instance n=50 282.alb | 1 | 0 | Optimal | 4.74 | 12 | 12.00 | 0.00 |
| instance n=50 283.alb | 1 | 0 | Optimal | 0.50 | 12 | 12.00 | 0.00 |
| instance n=50 284.alb | 1 | 0 | Optimal | 0.20 | 11 | 11.00 | 0.00 |
| instance n=50 285.alb | 1 | 0 | Optimal | 0.76 | 13 | 13.00 | 0.00 |
| instance n=50 286.alb | 1 | 0 | Optimal | 0.94 | 11 | 11.00 | 0.00 |
| instance n=50 287.alb | 1 | 0 | Optimal | 0.91 | 12 | 12.00 | 0.00 |
| instance n=50 288.alb | 1 | 0 | Optimal | 0.49 | 10 | 10.00 | 0.00 |
| instance n=50 289.alb | 1 | 0 | Optimal | 0.79 | 11 | 11.00 | 0.00 |
| instance n=50 29.alb | 1 | 0 | Solution | 120.01 | 29 | 25.00 | 13.79 |
| instance n=50 290.alb | 1 | 0 | Optimal | 0.52 | 14 | 14.00 | 0.00 |
| instance n=50 291.alb | 1 | 0 | Optimal | 0.20 | 12 | 12.00 | 0.00 |
| instance n=50 292.alb | 1 | 0 | Optimal | 0.17 | 13 | 13.00 | 0.00 |
| instance n=50 293.alb | 1 | 0 | Optimal | 0.20 | 12 | 12.00 | 0.00 |
| instance n=50 294.alb | 1 | 0 | Optimal | 0.20 | 13 | 13.00 | 0.00 |
| instance n=50 295.alb | 1 | 0 | Optimal | 1.49 | 16 | 16.00 | 0.00 |
| instance n=50 296.alb | 1 | 0 | Optimal | 0.24 | 13 | 13.00 | 0.00 |
| instance n=50 297.alb | 1 | 0 | Optimal | 0.24 | 13 | 13.00 | 0.00 |
| instance n=50 298.alb | 1 | 0 | Optimal | 0.55 | 11 | 11.00 | 0.00 |
| instance n=50 299.alb | 1 | 0 | Optimal | 2.84 | 12 | 12.00 | 0.00 |
| instance n=50 3.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 30.alb | 1 | 0 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 300.alb | 1 | 0 | Optimal | 0.25 | 12 | 12.00 | 0.00 |
| instance n=50 301.alb | 1 | 0 | Optimal | 0.33 | 6 | 6.00 | 0.00 |
| instance n=50 302.alb | 1 | 0 | Optimal | 0.23 | 7 | 7.00 | 0.00 |
| instance n=50 303.alb | 1 | 0 | Optimal | 0.20 | 8 | 8.00 | 0.00 |
| instance n=50 304.alb | 1 | 0 | Optimal | 0.20 | 7 | 7.00 | 0.00 |
| instance n=50 305.alb | 1 | 0 | Optimal | 0.20 | 8 | 8.00 | 0.00 |
| instance n=50 306.alb | 1 | 0 | Optimal | 0.28 | 7 | 7.00 | 0.00 |
| instance n=50 307.alb | 1 | 0 | Optimal | 0.27 | 7 | 7.00 | 0.00 |
| instance n=50 308.alb | 1 | 0 | Optimal | 0.40 | 8 | 8.00 | 0.00 |
| instance n=50 309.alb | 1 | 0 | Optimal | 0.49 | 7 | 7.00 | 0.00 |
| instance n=50 31.alb | 1 | 0 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 310.alb | 1 | 0 | Optimal | 0.20 | 8 | 8.00 | 0.00 |
| instance n=50 311.alb | 1 | 0 | Optimal | 0.20 | 8 | 8.00 | 0.00 |
| instance n=50 312.alb | 1 | 0 | Optimal | 0.22 | 6 | 6.00 | 0.00 |
| instance n=50 313.alb | 1 | 0 | Optimal | 0.20 | 8 | 8.00 | 0.00 |
| instance n=50 314.alb | 1 | 0 | Optimal | 0.22 | 7 | 7.00 | 0.00 |
| instance n=50 315.alb | 1 | 0 | Optimal | 0.30 | 8 | 8.00 | 0.00 |
| instance n=50 316.alb | 1 | 0 | Optimal | 0.17 | 8 | 8.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 317.alb | 1 | 0 | Optimal | 0.17 | 6 | 6.00 | 0.00 |
| instance n=50 318.alb | 1 | 0 | Optimal | 0.33 | 8 | 8.00 | 0.00 |
| instance n=50 319.alb | 1 | 0 | Optimal | 0.20 | 7 | 7.00 | 0.00 |
| instance n=50 32.alb | 1 | 0 | Optimal | 2.07 | 25 | 25.00 | 0.00 |
| instance n=50 320.alb | 1 | 0 | Optimal | 0.22 | 8 | 8.00 | 0.00 |
| instance n=50 321.alb | 1 | 0 | Optimal | 0.28 | 6 | 6.00 | 0.00 |
| instance n=50 322.alb | 1 | 0 | Optimal | 0.20 | 7 | 7.00 | 0.00 |
| instance n=50 323.alb | 1 | 0 | Optimal | 0.27 | 7 | 7.00 | 0.00 |
| instance n=50 324.alb | 1 | 0 | Optimal | 0.30 | 7 | 7.00 | 0.00 |
| instance n=50 325.alb | 1 | 0 | Optimal | 0.19 | 7 | 7.00 | 0.00 |
| instance n=50 326.alb | 1 | 0 | Solution | 120.04 | 33 | 28.00 | 15.15 |
| instance n=50 327.alb | 1 | 0 | Solution | 120.06 | 28 | 25.00 | 10.71 |
| instance n=50 328.alb | 1 | 0 | Solution | 120.04 | 32 | 28.00 | 12.50 |
| instance n=50 329.alb | 1 | 0 | Solution | 120.03 | 25 | 24.00 | 4.00 |
| instance n=50 33.alb | 1 | 0 | Solution | 120.00 | 25 | 24.00 | 4.00 |
| instance n=50 330.alb | 1 | 0 | Solution | 120.04 | 29 | 25.00 | 13.79 |
| instance n=50 331.alb | 1 | 0 | Solution | 120.05 | 29 | 27.00 | 6.90 |
| instance n=50 332.alb | 1 | 0 | Solution | 120.03 | 25 | 24.00 | 4.00 |
| instance n=50 333.alb | 1 | 0 | Solution | 120.06 | 28 | 26.00 | 7.14 |
| instance n=50 334.alb | 1 | 0 | Solution | 120.06 | 29 | 25.00 | 13.79 |
| instance n=50 335.alb | 1 | 0 | Solution | 120.05 | 27 | 26.00 | 3.70 |
| instance n=50 336.alb | 1 | 0 | Solution | 120.03 | 26 | 25.00 | 3.85 |
| instance n=50 337.alb | 1 | 0 | Solution | 120.04 | 26 | 25.00 | 3.85 |
| instance n=50 338.alb | 1 | 0 | Solution | 120.05 | 27 | 26.00 | 3.70 |
| instance n=50 339.alb | 1 | 0 | Solution | 120.05 | 27 | 26.00 | 3.70 |
| instance n=50 34.alb | 1 | 0 | Solution | 120.01 | 30 | 27.00 | 10.00 |
| instance n=50 340.alb | 1 | 0 | Solution | 120.03 | 28 | 26.00 | 7.14 |
| instance n=50 341.alb | 1 | 0 | Solution | 120.05 | 27 | 25.00 | 7.41 |
| instance n=50 342.alb | 1 | 0 | Solution | 120.05 | 28 | 26.00 | 7.14 |
| instance n=50 343.alb | 1 | 0 | Solution | 120.04 | 27 | 25.00 | 7.41 |
| instance n=50 344.alb | 1 | 0 | Solution | 120.06 | 30 | 27.00 | 10.00 |
| instance n=50 345.alb | 1 | 0 | Solution | 120.03 | 29 | 27.00 | 6.90 |
| instance n=50 346.alb | 1 | 0 | Solution | 120.06 | 27 | 25.00 | 7.41 |
| instance n=50 347.alb | 1 | 0 | Solution | 120.06 | 26 | 25.00 | 3.85 |
| instance n=50 348.alb | 1 | 0 | Solution | 120.06 | 30 | 25.00 | 16.67 |
| instance n=50 349.alb | 1 | 0 | Solution | 120.06 | 28 | 26.00 | 7.14 |
| instance n=50 35.alb | 1 | 0 | Solution | 120.00 | 32 | 27.00 | 15.63 |
| instance n=50 350.alb | 1 | 0 | Solution | 120.03 | 24 | 23.00 | 4.17 |
| instance n=50 351.alb | 1 | 0 | Optimal | 0.19 | 12 | 12.00 | 0.00 |
| instance n=50 352.alb | 1 | 0 | Optimal | 3.50 | 10 | 10.00 | 0.00 |
| instance n=50 353.alb | 1 | 0 | Optimal | 0.42 | 13 | 13.00 | 0.00 |
| instance n=50 354.alb | 1 | 0 | Solution | 120.04 | 14 | 13.00 | 7.14 |
| instance n=50 355.alb | 1 | 0 | Optimal | 0.27 | 11 | 11.00 | 0.00 |
| instance n=50 356.alb | 1 | 0 | Optimal | 0.20 | 15 | 15.00 | 0.00 |
| instance n=50 357.alb | 1 | 0 | Optimal | 0.24 | 12 | 12.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 358.alb | 1 | 0 | Optimal | 0.25 | 11 | 11.00 | 0.00 |
| instance n=50 359.alb | 1 | 0 | Optimal | 0.24 | 10 | 10.00 | 0.00 |
| instance n=50 36.alb | 1 | 0 | Solution | 120.01 | 31 | 27.00 | 12.90 |
| instance n=50 360.alb | 1 | 0 | Optimal | 0.61 | 12 | 12.00 | 0.00 |
| instance n=50 361.alb | 1 | 0 | Optimal | 0.25 | 11 | 11.00 | 0.00 |
| instance n=50 362.alb | 1 | 0 | Optimal | 0.32 | 10 | 10.00 | 0.00 |
| instance n=50 363.alb | 1 | 0 | Solution | 120.05 | 12 | 11.00 | 8.33 |
| instance n=50 364.alb | 1 | 0 | Optimal | 0.19 | 13 | 13.00 | 0.00 |
| instance n=50 365.alb | 1 | 0 | Optimal | 0.28 | 11 | 11.00 | 0.00 |
| instance n=50 366.alb | 1 | 0 | Optimal | 0.27 | 13 | 13.00 | 0.00 |
| instance n=50 367.alb | 1 | 0 | Optimal | 0.25 | 12 | 12.00 | 0.00 |
| instance n=50 368.alb | 1 | 0 | Optimal | 0.27 | 12 | 12.00 | 0.00 |
| instance n=50 369.alb | 1 | 0 | Optimal | 0.58 | 12 | 12.00 | 0.00 |
| instance n=50 37.alb | 1 | 0 | Solution | 120.01 | 32 | 27.00 | 15.63 |
| instance n=50 370.alb | 1 | 0 | Optimal | 0.33 | 12 | 12.00 | 0.00 |
| instance n=50 371.alb | 1 | 0 | Optimal | 2.56 | 11 | 11.00 | 0.00 |
| instance n=50 372.alb | 1 | 0 | Optimal | 1.71 | 10 | 10.00 | 0.00 |
| instance n=50 373.alb | 1 | 0 | Optimal | 0.22 | 12 | 12.00 | 0.00 |
| instance n=50 374.alb | 1 | 0 | Optimal | 0.27 | 11 | 11.00 | 0.00 |
| instance n=50 375.alb | 1 | 0 | Optimal | 1.08 | 13 | 13.00 | 0.00 |
| instance n=50 376.alb | 1 | 0 | Optimal | 0.28 | 7 | 7.00 | 0.00 |
| instance n=50 377.alb | 1 | 0 | Optimal | 0.21 | 7 | 7.00 | 0.00 |
| instance n=50 378.alb | 1 | 0 | Optimal | 0.21 | 8 | 8.00 | 0.00 |
| instance n=50 379.alb | 1 | 0 | Optimal | 0.25 | 7 | 7.00 | 0.00 |
| instance n=50 38.alb | 1 | 0 | Solution | 120.00 | 31 | 28.00 | 9.68 |
| instance n=50 380.alb | 1 | 0 | Optimal | 0.30 | 7 | 7.00 | 0.00 |
| instance n=50 381.alb | 1 | 0 | Optimal | 0.33 | 8 | 8.00 | 0.00 |
| instance n=50 382.alb | 1 | 0 | Optimal | 0.25 | 6 | 6.00 | 0.00 |
| instance n=50 383.alb | 1 | 0 | Optimal | 0.25 | 7 | 7.00 | 0.00 |
| instance n=50 384.alb | 1 | 0 | Optimal | 1.32 | 8 | 8.00 | 0.00 |
| instance n=50 385.alb | 1 | 0 | Optimal | 0.22 | 7 | 7.00 | 0.00 |
| instance n=50 386.alb | 1 | 0 | Optimal | 0.33 | 7 | 7.00 | 0.00 |
| instance n=50 387.alb | 1 | 0 | Optimal | 0.27 | 8 | 8.00 | 0.00 |
| instance n=50 388.alb | 1 | 0 | Optimal | 0.30 | 7 | 7.00 | 0.00 |
| instance n=50 389.alb | 1 | 0 | Optimal | 0.24 | 8 | 8.00 | 0.00 |
| instance n=50 39.alb | 1 | 0 | Solution | 120.00 | 29 | 26.00 | 10.34 |
| instance n=50 390.alb | 1 | 0 | Optimal | 1.56 | 7 | 7.00 | 0.00 |
| instance n=50 391.alb | 1 | 0 | Optimal | 0.30 | 7 | 7.00 | 0.00 |
| instance n=50 392.alb | 1 | 0 | Optimal | 0.22 | 8 | 8.00 | 0.00 |
| instance n=50 393.alb | 1 | 0 | Optimal | 0.30 | 7 | 7.00 | 0.00 |
| instance n=50 394.alb | 1 | 0 | Optimal | 0.29 | 8 | 8.00 | 0.00 |
| instance n=50 395.alb | 1 | 0 | Optimal | 0.27 | 7 | 7.00 | 0.00 |
| instance n=50 396.alb | 1 | 0 | Optimal | 0.39 | 8 | 8.00 | 0.00 |
| instance n=50 397.alb | 1 | 0 | Optimal | 0.22 | 7 | 7.00 | 0.00 |
| instance n=50 398.alb | 1 | 0 | Optimal | 0.96 | 6 | 6.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 399.alb | 1 | 0 | Optimal | 2.02 | 7 | 7.00 | 0.00 |
| instance n=50 4.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 40.alb | 1 | 0 | Solution | 120.00 | 26 | 25.00 | 3.85 |
| instance n=50 400.alb | 1 | 0 | Optimal | 0.24 | 8 | 8.00 | 0.00 |
| instance n=50 401.alb | 1 | 0 | Solution | 120.04 | 28 | 26.00 | 7.14 |
| instance n=50 402.alb | 1 | 0 | Solution | 120.04 | 27 | 26.00 | 3.70 |
| instance n=50 403.alb | 1 | 0 | Solution | 120.06 | 34 | 30.00 | 11.76 |
| instance n=50 404.alb | 1 | 0 | Solution | 120.07 | 31 | 26.00 | 16.13 |
| instance n=50 405.alb | 1 | 0 | Solution | 120.05 | 27 | 26.00 | 3.70 |
| instance n=50 406.alb | 1 | 0 | Solution | 120.06 | 32 | 30.00 | 6.25 |
| instance n=50 407.alb | 1 | 0 | Solution | 120.06 | 29 | 26.00 | 10.34 |
| instance n=50 408.alb | 1 | 0 | Optimal | 37.74 | 26 | 26.00 | 0.00 |
| instance n=50 409.alb | 1 | 0 | Solution | 120.07 | 33 | 27.00 | 18.18 |
| instance n=50 41.alb | 1 | 0 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 410.alb | 1 | 0 | Solution | 120.05 | 28 | 26.00 | 7.14 |
| instance n=50 411.alb | 1 | 0 | Solution | 120.06 | 29 | 27.00 | 6.90 |
| instance n=50 412.alb | 1 | 0 | Optimal | 109.80 | 26 | 26.00 | 0.00 |
| instance n=50 413.alb | 1 | 0 | Solution | 120.07 | 30 | 26.00 | 13.33 |
| instance n=50 414.alb | 1 | 0 | Solution | 120.05 | 27 | 25.00 | 7.41 |
| instance n=50 415.alb | 1 | 0 | Solution | 120.07 | 28 | 26.00 | 7.14 |
| instance n=50 416.alb | 1 | 0 | Solution | 120.10 | 27 | 26.00 | 3.70 |
| instance n=50 417.alb | 1 | 0 | Solution | 120.06 | 30 | 27.00 | 10.00 |
| instance n=50 418.alb | 1 | 0 | Solution | 120.07 | 27 | 25.00 | 7.41 |
| instance n=50 419.alb | 1 | 0 | Solution | 120.08 | 33 | 28.00 | 15.15 |
| instance n=50 42.alb | 1 | 0 | Solution | 120.00 | 24 | 23.00 | 4.17 |
| instance n=50 420.alb | 1 | 0 | Solution | 120.05 | 28 | 26.00 | 7.14 |
| instance n=50 421.alb | 1 | 0 | Solution | 120.06 | 34 | 29.00 | 14.71 |
| instance n=50 422.alb | 1 | 0 | Solution | 120.05 | 29 | 26.00 | 10.34 |
| instance n=50 423.alb | 1 | 0 | Solution | 120.03 | 29 | 26.00 | 10.34 |
| instance n=50 424.alb | 1 | 0 | Solution | 120.05 | 27 | 26.00 | 3.70 |
| instance n=50 425.alb | 1 | 0 | Solution | 120.07 | 34 | 30.00 | 11.76 |
| instance n=50 426.alb | 1 | 0 | Optimal | 1.30 | 11 | 11.00 | 0.00 |
| instance n=50 427.alb | 1 | 0 | Optimal | 0.37 | 12 | 12.00 | 0.00 |
| instance n=50 428.alb | 1 | 0 | Optimal | 0.31 | 13 | 13.00 | 0.00 |
| instance n=50 429.alb | 1 | 0 | Optimal | 0.31 | 11 | 11.00 | 0.00 |
| instance n=50 43.alb | 1 | 0 | Optimal | 1.60 | 25 | 25.00 | 0.00 |
| instance n=50 430.alb | 1 | 0 | Optimal | 1.26 | 14 | 14.00 | 0.00 |
| instance n=50 431.alb | 1 | 0 | Optimal | 0.36 | 11 | 11.00 | 0.00 |
| instance n=50 432.alb | 1 | 0 | Optimal | 1.30 | 12 | 12.00 | 0.00 |
| instance n=50 433.alb | 1 | 0 | Optimal | 0.35 | 12 | 12.00 | 0.00 |
| instance n=50 434.alb | 1 | 0 | Optimal | 0.57 | 11 | 11.00 | 0.00 |
| instance n=50 435.alb | 1 | 0 | Optimal | 0.32 | 11 | 11.00 | 0.00 |
| instance n=50 436.alb | 1 | 0 | Optimal | 0.24 | 11 | 11.00 | 0.00 |
| instance n=50 437.alb | 1 | 0 | Optimal | 6.40 | 12 | 12.00 | 0.00 |
| instance n=50 438.alb | 1 | 0 | Optimal | 4.98 | 10 | 10.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 439.alb | 1 | 0 | Optimal | 2.31 | 12 | 12.00 | 0.00 |
| instance n=50 44.alb | 1 | 0 | Solution | 120.00 | 25 | 24.00 | 4.00 |
| instance n=50 440.alb | 1 | 0 | Optimal | 8.07 | 13 | 13.00 | 0.00 |
| instance n=50 441.alb | 1 | 0 | Optimal | 0.28 | 11 | 11.00 | 0.00 |
| instance n=50 442.alb | 1 | 0 | Optimal | 0.64 | 12 | 12.00 | 0.00 |
| instance n=50 443.alb | 1 | 0 | Optimal | 1.42 | 11 | 11.00 | 0.00 |
| instance n=50 444.alb | 1 | 0 | Optimal | 0.36 | 12 | 12.00 | 0.00 |
| instance n=50 445.alb | 1 | 0 | Optimal | 0.40 | 12 | 12.00 | 0.00 |
| instance n=50 446.alb | 1 | 0 | Optimal | 0.71 | 12 | 12.00 | 0.00 |
| instance n=50 447.alb | 1 | 0 | Optimal | 0.61 | 13 | 13.00 | 0.00 |
| instance n=50 448.alb | 1 | 0 | Optimal | 7.05 | 12 | 12.00 | 0.00 |
| instance n=50 449.alb | 1 | 0 | Optimal | 0.42 | 11 | 11.00 | 0.00 |
| instance n=50 45.alb | 1 | 0 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 450.alb | 1 | 0 | Optimal | 0.33 | 11 | 11.00 | 0.00 |
| instance n=50 451.alb | 1 | 0 | Optimal | 0.53 | 8 | 8.00 | 0.00 |
| instance n=50 452.alb | 1 | 0 | Optimal | 0.28 | 8 | 8.00 | 0.00 |
| instance n=50 453.alb | 1 | 0 | Optimal | 0.37 | 7 | 7.00 | 0.00 |
| instance n=50 454.alb | 1 | 0 | Optimal | 1.08 | 8 | 8.00 | 0.00 |
| instance n=50 455.alb | 1 | 0 | Optimal | 0.37 | 6 | 6.00 | 0.00 |
| instance n=50 456.alb | 1 | 0 | Optimal | 0.46 | 8 | 8.00 | 0.00 |
| instance n=50 457.alb | 1 | 0 | Optimal | 0.49 | 8 | 8.00 | 0.00 |
| instance n=50 458.alb | 1 | 0 | Optimal | 0.60 | 7 | 7.00 | 0.00 |
| instance n=50 459.alb | 1 | 0 | Optimal | 0.50 | 7 | 7.00 | 0.00 |
| instance n=50 46.alb | 1 | 0 | Solution | 120.02 | 28 | 26.00 | 7.14 |
| instance n=50 460.alb | 1 | 0 | Optimal | 0.53 | 7 | 7.00 | 0.00 |
| instance n=50 461.alb | 1 | 0 | Optimal | 0.60 | 6 | 6.00 | 0.00 |
| instance n=50 462.alb | 1 | 0 | Optimal | 0.33 | 7 | 7.00 | 0.00 |
| instance n=50 463.alb | 1 | 0 | Optimal | 0.44 | 8 | 8.00 | 0.00 |
| instance n=50 464.alb | 1 | 0 | Optimal | 0.50 | 6 | 6.00 | 0.00 |
| instance n=50 465.alb | 1 | 0 | Optimal | 0.41 | 8 | 8.00 | 0.00 |
| instance n=50 466.alb | 1 | 0 | Optimal | 0.63 | 7 | 7.00 | 0.00 |
| instance n=50 467.alb | 1 | 0 | Optimal | 1.20 | 9 | 9.00 | 0.00 |
| instance n=50 468.alb | 1 | 0 | Optimal | 0.41 | 7 | 7.00 | 0.00 |
| instance n=50 469.alb | 1 | 0 | Optimal | 0.48 | 8 | 8.00 | 0.00 |
| instance n=50 47.alb | 1 | 0 | Solution | 119.99 | 28 | 26.00 | 7.14 |
| instance n=50 470.alb | 1 | 0 | Optimal | 0.36 | 8 | 8.00 | 0.00 |
| instance n=50 471.alb | 1 | 0 | Optimal | 0.46 | 7 | 7.00 | 0.00 |
| instance n=50 472.alb | 1 | 0 | Optimal | 0.38 | 8 | 8.00 | 0.00 |
| instance n=50 473.alb | 1 | 0 | Optimal | 0.47 | 7 | 7.00 | 0.00 |
| instance n=50 474.alb | 1 | 0 | Optimal | 0.47 | 7 | 7.00 | 0.00 |
| instance n=50 475.alb | 1 | 0 | Optimal | 1.04 | 6 | 6.00 | 0.00 |
| instance n=50 476.alb | 1 | 0 | Optimal | 1.13 | 28 | 28.00 | 0.00 |
| instance n=50 477.alb | 1 | 0 | Optimal | 7.35 | 29 | 29.00 | 0.00 |
| instance n=50 478.alb | 1 | 0 | Optimal | 10.16 | 32 | 32.00 | 0.00 |
| instance n=50 479.alb | 1 | 0 | Optimal | 0.75 | 28 | 28.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 48.alb | 1 | 0 | Solution | 120.02 | 27 | 26.00 | 3.70 |
| instance n=50 480.alb | 1 | 0 | Optimal | 1.32 | 34 | 34.00 | 0.00 |
| instance n=50 481.alb | 1 | 0 | Optimal | 2.48 | 28 | 28.00 | 0.00 |
| instance n=50 482.alb | 1 | 0 | Optimal | 1.79 | 27 | 27.00 | 0.00 |
| instance n=50 483.alb | 1 | 0 | Optimal | 6.74 | 30 | 30.00 | 0.00 |
| instance n=50 484.alb | 1 | 0 | Optimal | 1.87 | 32 | 32.00 | 0.00 |
| instance n=50 485.alb | 1 | 0 | Optimal | 2.69 | 31 | 31.00 | 0.00 |
| instance n=50 486.alb | 1 | 0 | Optimal | 1.51 | 32 | 31.00 | 3.13 |
| instance n=50 487.alb | 1 | 0 | Optimal | 2.58 | 31 | 31.00 | 0.00 |
| instance n=50 488.alb | 1 | 0 | Optimal | 6.63 | 31 | 31.00 | 0.00 |
| instance n=50 489.alb | 1 | 0 | Optimal | 5.94 | 35 | 35.00 | 0.00 |
| instance n=50 49.alb | 1 | 0 | Solution | 120.02 | 25 | 24.00 | 4.00 |
| instance n=50 490.alb | 1 | 0 | Optimal | 2.56 | 29 | 29.00 | 0.00 |
| instance n=50 491.alb | 1 | 0 | Optimal | 70.18 | 35 | 35.00 | 0.00 |
| instance n=50 492.alb | 1 | 0 | Optimal | 7.01 | 29 | 29.00 | 0.00 |
| instance n=50 493.alb | 1 | 0 | Optimal | 6.23 | 30 | 30.00 | 0.00 |
| instance n=50 494.alb | 1 | 0 | Optimal | 3.77 | 32 | 32.00 | 0.00 |
| instance n=50 495.alb | 1 | 0 | Optimal | 3.83 | 34 | 34.00 | 0.00 |
| instance n=50 496.alb | 1 | 0 | Optimal | 3.96 | 29 | 29.00 | 0.00 |
| instance n=50 497.alb | 1 | 0 | Optimal | 5.59 | 30 | 30.00 | 0.00 |
| instance n=50 498.alb | 1 | 0 | Optimal | 1.51 | 30 | 30.00 | 0.00 |
| instance n=50 499.alb | 1 | 0 | Optimal | 1.72 | 33 | 33.00 | 0.00 |
| instance n=50 5.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 50.alb | 1 | 0 | Solution | 120.00 | 27 | 25.00 | 7.41 |
| instance n=50 500.alb | 1 | 0 | Optimal | 3.03 | 34 | 34.00 | 0.00 |
| instance n=50 501.alb | 1 | 0 | Optimal | 1.21 | 12 | 12.00 | 0.00 |
| instance n=50 502.alb | 1 | 0 | Optimal | 0.85 | 10 | 10.00 | 0.00 |
| instance n=50 503.alb | 1 | 0 | Optimal | 1.21 | 13 | 13.00 | 0.00 |
| instance n=50 504.alb | 1 | 0 | Optimal | 0.97 | 11 | 11.00 | 0.00 |
| instance n=50 505.alb | 1 | 0 | Optimal | 0.94 | 12 | 12.00 | 0.00 |
| instance n=50 506.alb | 1 | 0 | Optimal | 0.39 | 11 | 11.00 | 0.00 |
| instance n=50 507.alb | 1 | 0 | Optimal | 0.64 | 13 | 13.00 | 0.00 |
| instance n=50 508.alb | 1 | 0 | Optimal | 1.02 | 14 | 14.00 | 0.00 |
| instance n=50 509.alb | 1 | 0 | Optimal | 0.36 | 13 | 13.00 | 0.00 |
| instance n=50 51.alb | 1 | 0 | Optimal | 0.05 | 12 | 12.00 | 0.00 |
| instance n=50 510.alb | 1 | 0 | Optimal | 1.22 | 11 | 11.00 | 0.00 |
| instance n=50 511.alb | 1 | 0 | Optimal | 1.35 | 13 | 13.00 | 0.00 |
| instance n=50 512.alb | 1 | 0 | Optimal | 1.16 | 13 | 13.00 | 0.00 |
| instance n=50 513.alb | 1 | 0 | Optimal | 0.60 | 12 | 12.00 | 0.00 |
| instance n=50 514.alb | 1 | 0 | Optimal | 1.32 | 12 | 12.00 | 0.00 |
| instance n=50 515.alb | 1 | 0 | Optimal | 1.21 | 11 | 11.00 | 0.00 |
| instance n=50 516.alb | 1 | 0 | Optimal | 0.88 | 13 | 13.00 | 0.00 |
| instance n=50 517.alb | 1 | 0 | Optimal | 0.88 | 14 | 14.00 | 0.00 |
| instance n=50 518.alb | 1 | 0 | Optimal | 1.19 | 11 | 11.00 | 0.00 |
| instance n=50 519.alb | 1 | 0 | Optimal | 0.42 | 12 | 12.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 52.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 520.alb | 1 | 0 | Optimal | 0.57 | 11 | 11.00 | 0.00 |
| instance n=50 521.alb | 1 | 0 | Optimal | 0.33 | 10 | 10.00 | 0.00 |
| instance n=50 522.alb | 1 | 0 | Optimal | 0.47 | 11 | 11.00 | 0.00 |
| instance n=50 523.alb | 1 | 0 | Optimal | 1.01 | 11 | 11.00 | 0.00 |
| instance n=50 524.alb | 1 | 0 | Optimal | 1.04 | 14 | 14.00 | 0.00 |
| instance n=50 525.alb | 1 | 0 | Optimal | 1.29 | 11 | 11.00 | 0.00 |
| instance n=50 53.alb | 1 | 0 | Solution | 120.01 | 13 | 12.00 | 7.69 |
| instance n=50 54.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 55.alb | 1 | 0 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=50 56.alb | 1 | 0 | Optimal | 0.06 | 11 | 11.00 | 0.00 |
| instance n=50 57.alb | 1 | 0 | Optimal | 0.06 | 13 | 13.00 | 0.00 |
| instance n=50 58.alb | 1 | 0 | Optimal | 0.06 | 11 | 11.00 | 0.00 |
| instance n=50 59.alb | 1 | 0 | Optimal | 0.06 | 11 | 11.00 | 0.00 |
| instance n=50 6.alb | 1 | 0 | Optimal | 0.05 | 6 | 6.00 | 0.00 |
| instance n=50 60.alb | 1 | 0 | Optimal | 0.23 | 12 | 12.00 | 0.00 |
| instance n=50 61.alb | 1 | 0 | Optimal | 0.05 | 13 | 13.00 | 0.00 |
| instance n=50 62.alb | 1 | 0 | Optimal | 0.06 | 13 | 13.00 | 0.00 |
| instance n=50 63.alb | 1 | 0 | Optimal | 0.05 | 12 | 12.00 | 0.00 |
| instance n=50 64.alb | 1 | 0 | Optimal | 0.05 | 13 | 13.00 | 0.00 |
| instance n=50 65.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 66.alb | 1 | 0 | Optimal | 0.25 | 12 | 12.00 | 0.00 |
| instance n=50 67.alb | 1 | 0 | Optimal | 0.37 | 12 | 12.00 | 0.00 |
| instance n=50 68.alb | 1 | 0 | Optimal | 0.08 | 12 | 12.00 | 0.00 |
| instance n=50 69.alb | 1 | 0 | Optimal | 0.29 | 12 | 12.00 | 0.00 |
| instance n=50 7.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 70.alb | 1 | 0 | Optimal | 0.06 | 10 | 10.00 | 0.00 |
| instance n=50 71.alb | 1 | 0 | Optimal | 0.09 | 13 | 13.00 | 0.00 |
| instance n=50 72.alb | 1 | 0 | Optimal | 0.07 | 11 | 11.00 | 0.00 |
| instance n=50 73.alb | 1 | 0 | Optimal | 0.07 | 11 | 11.00 | 0.00 |
| instance n=50 74.alb | 1 | 0 | Optimal | 0.06 | 12 | 12.00 | 0.00 |
| instance n=50 75.alb | 1 | 0 | Optimal | 0.74 | 11 | 11.00 | 0.00 |
| instance n=50 76.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 77.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 78.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 79.alb | 1 | 0 | Optimal | 0.20 | 8 | 8.00 | 0.00 |
| instance n=50 8.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 80.alb | 1 | 0 | Optimal | 0.08 | 7 | 7.00 | 0.00 |
| instance n=50 81.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 82.alb | 1 | 0 | Optimal | 0.08 | 6 | 6.00 | 0.00 |
| instance n=50 83.alb | 1 | 0 | Optimal | 0.08 | 8 | 8.00 | 0.00 |
| instance n=50 84.alb | 1 | 0 | Optimal | 0.08 | 7 | 7.00 | 0.00 |
| instance n=50 85.alb | 1 | 0 | Optimal | 0.08 | 8 | 8.00 | 0.00 |
| instance n=50 86.alb | 1 | 0 | Optimal | 0.08 | 7 | 7.00 | 0.00 |
| instance n=50 87.alb | 1 | 0 | Optimal | 0.08 | 8 | 8.00 | 0.00 |

Table 6.1: Results for SALBP-1 Problems (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=50 88.alb | 1 | 0 | Optimal | 0.08 | 8 | 8.00 | 0.00 |
| instance n=50 89.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 9.alb | 1 | 0 | Optimal | 0.03 | 9 | 9.00 | 0.00 |
| instance n=50 90.alb | 1 | 0 | Optimal | 0.42 | 7 | 7.00 | 0.00 |
| instance n=50 91.alb | 1 | 0 | Optimal | 0.08 | 7 | 7.00 | 0.00 |
| instance n=50 92.alb | 1 | 0 | Optimal | 0.08 | 7 | 7.00 | 0.00 |
| instance n=50 93.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 94.alb | 1 | 0 | Optimal | 0.11 | 7 | 7.00 | 0.00 |
| instance n=50 95.alb | 1 | 0 | Optimal | 0.08 | 7 | 7.00 | 0.00 |
| instance n=50 96.alb | 1 | 0 | Optimal | 0.10 | 7 | 7.00 | 0.00 |
| instance n=50 97.alb | 1 | 0 | Optimal | 0.22 | 7 | 7.00 | 0.00 |
| instance n=50 98.alb | 1 | 0 | Optimal | 0.11 | 8 | 8.00 | 0.00 |
| instance n=50 99.alb | 1 | 0 | Optimal | 0.11 | 7 | 7.00 | 0.00 |

6.2 Results for CPSat

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 1.alb | 1 | 0 | Solution | 120.07 | 136 | 135.00 | 0.74 |
| instance n=1000 10.alb | 1 | 0 | Solution | 120.08 | 141 | 140.00 | 0.71 |
| instance n=1000 100.alb | 1 | 0 | Solution | 120.08 | 139 | 137.00 | 1.44 |
| instance n=1000 101.alb | 1 | 0 | Solution | 120.17 | 554 | 430.00 | 22.38 |
| instance n=1000 102.alb | 1 | 0 | Solution | 120.18 | 556 | 446.00 | 19.78 |
| instance n=1000 103.alb | 1 | 0 | Solution | 120.23 | 560 | 469.00 | 16.25 |
| instance n=1000 104.alb | 1 | 0 | Solution | 120.16 | 550 | 439.00 | 20.18 |
| instance n=1000 105.alb | 1 | 0 | Solution | 120.16 | 545 | 439.00 | 19.45 |
| instance n=1000 106.alb | 1 | 0 | Solution | 120.19 | 552 | 432.00 | 21.74 |
| instance n=1000 107.alb | 1 | 0 | Solution | 120.14 | 540 | 444.00 | 17.78 |
| instance n=1000 108.alb | 1 | 0 | Solution | 120.13 | 543 | 461.00 | 15.10 |
| instance n=1000 109.alb | 1 | 0 | Solution | 120.19 | 546 | 427.00 | 21.79 |
| instance n=1000 11.alb | 1 | 0 | Solution | 120.08 | 135 | 134.00 | 0.74 |
| instance n=1000 110.alb | 1 | 0 | Solution | 120.18 | 557 | 430.00 | 22.80 |
| instance n=1000 111.alb | 1 | 0 | Solution | 120.13 | 544 | 449.00 | 17.46 |
| instance n=1000 112.alb | 1 | 0 | Solution | 120.18 | 549 | 449.00 | 18.21 |
| instance n=1000 113.alb | 1 | 0 | Solution | 120.16 | 537 | 459.00 | 14.53 |
| instance n=1000 114.alb | 1 | 0 | Solution | 120.13 | 548 | 425.00 | 22.45 |
| instance n=1000 115.alb | 1 | 0 | Solution | 120.16 | 541 | 430.00 | 20.52 |
| instance n=1000 116.alb | 1 | 0 | Solution | 120.17 | 543 | 449.00 | 17.31 |
| instance n=1000 117.alb | 1 | 0 | Solution | 120.17 | 548 | 443.00 | 19.16 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 118.alb | 1 | 0 | Solution | 120.13 | 564 | 452.00 | 19.86 |
| instance n=1000 119.alb | 1 | 0 | Solution | 120.14 | 534 | 424.00 | 20.60 |
| instance n=1000 12.alb | 1 | 0 | Solution | 120.07 | 135 | 134.00 | 0.74 |
| instance n=1000 120.alb | 1 | 0 | Solution | 120.15 | 549 | 466.00 | 15.12 |
| instance n=1000 121.alb | 1 | 0 | Solution | 120.15 | 543 | 470.00 | 13.44 |
| instance n=1000 122.alb | 1 | 0 | Solution | 120.16 | 533 | 465.00 | 12.76 |
| instance n=1000 123.alb | 1 | 0 | Solution | 120.15 | 556 | 441.00 | 20.68 |
| instance n=1000 124.alb | 1 | 0 | Solution | 120.20 | 543 | 452.00 | 16.76 |
| instance n=1000 125.alb | 1 | 0 | Solution | 120.16 | 545 | 440.00 | 19.27 |
| instance n=1000 126.alb | 1 | 0 | Solution | 120.15 | 232 | 228.00 | 1.72 |
| instance n=1000 127.alb | 1 | 0 | Solution | 120.09 | 224 | 221.00 | 1.34 |
| instance n=1000 128.alb | 1 | 0 | Solution | 120.11 | 225 | 222.00 | 1.33 |
| instance n=1000 129.alb | 1 | 0 | Solution | 120.12 | 226 | 223.00 | 1.33 |
| instance n=1000 13.alb | 1 | 0 | Solution | 120.08 | 132 | 131.00 | 0.76 |
| instance n=1000 130.alb | 1 | 0 | Solution | 120.09 | 225 | 221.00 | 1.78 |
| instance n=1000 131.alb | 1 | 0 | Solution | 120.10 | 224 | 220.00 | 1.79 |
| instance n=1000 132.alb | 1 | 0 | Solution | 120.09 | 218 | 214.00 | 1.83 |
| instance n=1000 133.alb | 1 | 0 | Solution | 120.11 | 229 | 226.00 | 1.31 |
| instance n=1000 134.alb | 1 | 0 | Solution | 120.12 | 219 | 215.00 | 1.83 |
| instance n=1000 135.alb | 1 | 0 | Solution | 120.13 | 229 | 225.00 | 1.75 |
| instance n=1000 136.alb | 1 | 0 | Solution | 120.11 | 232 | 228.00 | 1.72 |
| instance n=1000 137.alb | 1 | 0 | Solution | 120.09 | 216 | 213.00 | 1.39 |
| instance n=1000 138.alb | 1 | 0 | Solution | 120.12 | 225 | 221.00 | 1.78 |
| instance n=1000 139.alb | 1 | 0 | Solution | 120.09 | 228 | 224.00 | 1.75 |
| instance n=1000 14.alb | 1 | 0 | Solution | 120.08 | 138 | 136.00 | 1.45 |
| instance n=1000 140.alb | 1 | 0 | Solution | 120.11 | 230 | 226.00 | 1.74 |
| instance n=1000 141.alb | 1 | 0 | Solution | 120.10 | 219 | 215.00 | 1.83 |
| instance n=1000 142.alb | 1 | 0 | Solution | 120.09 | 224 | 220.00 | 1.79 |
| instance n=1000 143.alb | 1 | 0 | Solution | 120.10 | 217 | 213.00 | 1.84 |
| instance n=1000 144.alb | 1 | 0 | Solution | 120.11 | 220 | 217.00 | 1.36 |
| instance n=1000 145.alb | 1 | 0 | Solution | 120.10 | 223 | 220.00 | 1.35 |
| instance n=1000 146.alb | 1 | 0 | Solution | 120.11 | 223 | 219.00 | 1.79 |
| instance n=1000 147.alb | 1 | 0 | Solution | 120.13 | 233 | 229.00 | 1.72 |
| instance n=1000 148.alb | 1 | 0 | Solution | 120.37 | 223 | 219.00 | 1.79 |
| instance n=1000 149.alb | 1 | 0 | Solution | 120.10 | 241 | 237.00 | 1.66 |
| instance n=1000 15.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 150.alb | 1 | 0 | Solution | 120.09 | 225 | 222.00 | 1.33 |
| instance n=1000 151.alb | 1 | 0 | Solution | 120.08 | 140 | 138.00 | 1.43 |
| instance n=1000 152.alb | 1 | 0 | Solution | 120.07 | 138 | 136.00 | 1.45 |
| instance n=1000 153.alb | 1 | 0 | Solution | 120.08 | 139 | 137.00 | 1.44 |
| instance n=1000 154.alb | 1 | 0 | Solution | 120.10 | 142 | 140.00 | 1.41 |
| instance n=1000 155.alb | 1 | 0 | Solution | 120.08 | 141 | 139.00 | 1.42 |
| instance n=1000 156.alb | 1 | 0 | Solution | 120.10 | 143 | 141.00 | 1.40 |
| instance n=1000 157.alb | 1 | 0 | Solution | 120.09 | 142 | 140.00 | 1.41 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 158.alb | 1 | 0 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 159.alb | 1 | 0 | Solution | 120.09 | 139 | 138.00 | 0.72 |
| instance n=1000 16.alb | 1 | 0 | Solution | 120.09 | 138 | 137.00 | 0.72 |
| instance n=1000 160.alb | 1 | 0 | Solution | 120.08 | 140 | 138.00 | 1.43 |
| instance n=1000 161.alb | 1 | 0 | Solution | 120.08 | 134 | 133.00 | 0.75 |
| instance n=1000 162.alb | 1 | 0 | Solution | 120.09 | 137 | 136.00 | 0.73 |
| instance n=1000 163.alb | 1 | 0 | Solution | 120.09 | 141 | 139.00 | 1.42 |
| instance n=1000 164.alb | 1 | 0 | Solution | 120.09 | 143 | 141.00 | 1.40 |
| instance n=1000 165.alb | 1 | 0 | Solution | 120.09 | 137 | 135.00 | 1.46 |
| instance n=1000 166.alb | 1 | 0 | Solution | 120.08 | 141 | 139.00 | 1.42 |
| instance n=1000 167.alb | 1 | 0 | Solution | 120.11 | 140 | 139.00 | 0.71 |
| instance n=1000 168.alb | 1 | 0 | Solution | 120.09 | 140 | 138.00 | 1.43 |
| instance n=1000 169.alb | 1 | 0 | Solution | 120.10 | 136 | 134.00 | 1.47 |
| instance n=1000 17.alb | 1 | 0 | Solution | 120.09 | 136 | 135.00 | 0.74 |
| instance n=1000 170.alb | 1 | 0 | Solution | 120.08 | 136 | 134.00 | 1.47 |
| instance n=1000 171.alb | 1 | 0 | Solution | 120.09 | 138 | 137.00 | 0.72 |
| instance n=1000 172.alb | 1 | 0 | Solution | 120.09 | 136 | 135.00 | 0.74 |
| instance n=1000 173.alb | 1 | 0 | Solution | 120.10 | 136 | 135.00 | 0.74 |
| instance n=1000 174.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 175.alb | 1 | 0 | Solution | 120.09 | 140 | 138.00 | 1.43 |
| instance n=1000 176.alb | 1 | 0 | Solution | 120.11 | 562 | 322.00 | 42.70 |
| instance n=1000 177.alb | 1 | 0 | Solution | 120.09 | 563 | 326.00 | 42.10 |
| instance n=1000 178.alb | 1 | 0 | Solution | 120.11 | 567 | 325.00 | 42.68 |
| instance n=1000 179.alb | 1 | 0 | Solution | 120.11 | 571 | 315.00 | 44.83 |
| instance n=1000 18.alb | 1 | 0 | Solution | 120.08 | 135 | 134.00 | 0.74 |
| instance n=1000 180.alb | 1 | 0 | Solution | 120.11 | 567 | 317.00 | 44.09 |
| instance n=1000 181.alb | 1 | 0 | Solution | 120.16 | 567 | 320.00 | 43.56 |
| instance n=1000 182.alb | 1 | 0 | Solution | 120.11 | 565 | 315.00 | 44.25 |
| instance n=1000 183.alb | 1 | 0 | Solution | 120.11 | 554 | 317.00 | 42.78 |
| instance n=1000 184.alb | 1 | 0 | Solution | 120.14 | 561 | 317.00 | 43.49 |
| instance n=1000 185.alb | 1 | 0 | Solution | 120.13 | 557 | 319.00 | 42.73 |
| instance n=1000 186.alb | 1 | 0 | Solution | 120.12 | 562 | 325.00 | 42.17 |
| instance n=1000 187.alb | 1 | 0 | Solution | 120.13 | 565 | 331.00 | 41.42 |
| instance n=1000 188.alb | 1 | 0 | Solution | 120.12 | 555 | 332.00 | 40.18 |
| instance n=1000 189.alb | 1 | 0 | Solution | 120.12 | 555 | 317.00 | 42.88 |
| instance n=1000 19.alb | 1 | 0 | Solution | 120.08 | 138 | 137.00 | 0.72 |
| instance n=1000 190.alb | 1 | 0 | Solution | 120.11 | 563 | 313.00 | 44.40 |
| instance n=1000 191.alb | 1 | 0 | Solution | 120.11 | 560 | 328.00 | 41.43 |
| instance n=1000 192.alb | 1 | 0 | Solution | 120.13 | 563 | 326.00 | 42.10 |
| instance n=1000 193.alb | 1 | 0 | Solution | 120.08 | 568 | 327.00 | 42.43 |
| instance n=1000 194.alb | 1 | 0 | Solution | 120.13 | 568 | 319.00 | 43.84 |
| instance n=1000 195.alb | 1 | 0 | Solution | 120.08 | 568 | 315.00 | 44.54 |
| instance n=1000 196.alb | 1 | 0 | Solution | 120.11 | 560 | 320.00 | 42.86 |
| instance n=1000 197.alb | 1 | 0 | Solution | 120.12 | 546 | 336.00 | 38.46 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 198.alb | 1 | 0 | Solution | 120.13 | 567 | 318.00 | 43.92 |
| instance n=1000 199.alb | 1 | 0 | Solution | 120.12 | 547 | 328.00 | 40.04 |
| instance n=1000 2.alb | 1 | 0 | Solution | 120.07 | 138 | 137.00 | 0.72 |
| instance n=1000 20.alb | 1 | 0 | Solution | 120.09 | 139 | 138.00 | 0.72 |
| instance n=1000 200.alb | 1 | 0 | Solution | 120.09 | 556 | 322.00 | 42.09 |
| instance n=1000 201.alb | 1 | 0 | Solution | 120.09 | 233 | 215.00 | 7.73 |
| instance n=1000 202.alb | 1 | 0 | Solution | 120.11 | 230 | 188.00 | 18.26 |
| instance n=1000 203.alb | 1 | 0 | Solution | 120.09 | 234 | 210.00 | 10.26 |
| instance n=1000 204.alb | 1 | 0 | Solution | 120.10 | 232 | 218.00 | 6.03 |
| instance n=1000 205.alb | 1 | 0 | Solution | 120.10 | 234 | 188.00 | 19.66 |
| instance n=1000 206.alb | 1 | 0 | Solution | 120.10 | 233 | 192.00 | 17.60 |
| instance n=1000 207.alb | 1 | 0 | Solution | 120.10 | 235 | 197.00 | 16.17 |
| instance n=1000 208.alb | 1 | 0 | Solution | 120.12 | 234 | 226.00 | 3.42 |
| instance n=1000 209.alb | 1 | 0 | Solution | 120.11 | 232 | 194.00 | 16.38 |
| instance n=1000 21.alb | 1 | 0 | Solution | 120.10 | 139 | 138.00 | 0.72 |
| instance n=1000 210.alb | 1 | 0 | Solution | 120.11 | 229 | 205.00 | 10.48 |
| instance n=1000 211.alb | 1 | 0 | Solution | 120.10 | 224 | 189.00 | 15.63 |
| instance n=1000 212.alb | 1 | 0 | Solution | 120.10 | 221 | 182.00 | 17.65 |
| instance n=1000 213.alb | 1 | 0 | Solution | 120.12 | 238 | 211.00 | 11.34 |
| instance n=1000 214.alb | 1 | 0 | Solution | 120.10 | 230 | 206.00 | 10.43 |
| instance n=1000 215.alb | 1 | 0 | Solution | 120.07 | 227 | 218.00 | 3.96 |
| instance n=1000 216.alb | 1 | 0 | Solution | 120.27 | 225 | 190.00 | 15.56 |
| instance n=1000 217.alb | 1 | 0 | Solution | 120.10 | 229 | 191.00 | 16.59 |
| instance n=1000 218.alb | 1 | 0 | Solution | 120.09 | 223 | 212.00 | 4.93 |
| instance n=1000 219.alb | 1 | 0 | Solution | 120.10 | 237 | 223.00 | 5.91 |
| instance n=1000 22.alb | 1 | 0 | Solution | 120.09 | 139 | 137.00 | 1.44 |
| instance n=1000 220.alb | 1 | 0 | Solution | 120.09 | 229 | 200.00 | 12.66 |
| instance n=1000 221.alb | 1 | 0 | Solution | 120.10 | 236 | 211.00 | 10.59 |
| instance n=1000 222.alb | 1 | 0 | Solution | 120.12 | 226 | 212.00 | 6.19 |
| instance n=1000 223.alb | 1 | 0 | Solution | 120.10 | 226 | 205.00 | 9.29 |
| instance n=1000 224.alb | 1 | 0 | Solution | 120.11 | 231 | 219.00 | 5.19 |
| instance n=1000 225.alb | 1 | 0 | Solution | 120.11 | 234 | 210.00 | 10.26 |
| instance n=1000 226.alb | 1 | 0 | Solution | 120.10 | 138 | 136.00 | 1.45 |
| instance n=1000 227.alb | 1 | 0 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 228.alb | 1 | 0 | Solution | 120.09 | 135 | 133.00 | 1.48 |
| instance n=1000 229.alb | 1 | 0 | Solution | 120.11 | 136 | 134.00 | 1.47 |
| instance n=1000 23.alb | 1 | 0 | Solution | 120.35 | 137 | 136.00 | 0.73 |
| instance n=1000 230.alb | 1 | 0 | Solution | 120.09 | 133 | 131.00 | 1.50 |
| instance n=1000 231.alb | 1 | 0 | Solution | 120.11 | 140 | 138.00 | 1.43 |
| instance n=1000 232.alb | 1 | 0 | Solution | 120.10 | 135 | 133.00 | 1.48 |
| instance n=1000 233.alb | 1 | 0 | Solution | 120.13 | 137 | 135.00 | 1.46 |
| instance n=1000 234.alb | 1 | 0 | Solution | 120.10 | 139 | 137.00 | 1.44 |
| instance n=1000 235.alb | 1 | 0 | Solution | 120.09 | 134 | 133.00 | 0.75 |
| instance n=1000 236.alb | 1 | 0 | Solution | 120.10 | 138 | 136.00 | 1.45 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 237.alb | 1 | 0 | Solution | 120.08 | 140 | 138.00 | 1.43 |
| instance n=1000 238.alb | 1 | 0 | Solution | 120.12 | 139 | 138.00 | 0.72 |
| instance n=1000 239.alb | 1 | 0 | Solution | 120.09 | 136 | 135.00 | 0.74 |
| instance n=1000 24.alb | 1 | 0 | Solution | 120.07 | 141 | 140.00 | 0.71 |
| instance n=1000 240.alb | 1 | 0 | Solution | 120.09 | 137 | 135.00 | 1.46 |
| instance n=1000 241.alb | 1 | 0 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 242.alb | 1 | 0 | Solution | 120.21 | 137 | 135.00 | 1.46 |
| instance n=1000 243.alb | 1 | 0 | Solution | 120.10 | 139 | 137.00 | 1.44 |
| instance n=1000 244.alb | 1 | 0 | Solution | 120.12 | 138 | 137.00 | 0.72 |
| instance n=1000 245.alb | 1 | 0 | Solution | 120.09 | 137 | 135.00 | 1.46 |
| instance n=1000 246.alb | 1 | 0 | Solution | 120.10 | 137 | 135.00 | 1.46 |
| instance n=1000 247.alb | 1 | 0 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 248.alb | 1 | 0 | Solution | 120.13 | 141 | 138.00 | 2.13 |
| instance n=1000 249.alb | 1 | 0 | Solution | 120.09 | 140 | 138.00 | 1.43 |
| instance n=1000 25.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 250.alb | 1 | 0 | Solution | 120.09 | 142 | 140.00 | 1.41 |
| instance n=1000 251.alb | 1 | 0 | Solution | 120.18 | 577 | 445.00 | 22.88 |
| instance n=1000 252.alb | 1 | 0 | Solution | 120.17 | 569 | 453.00 | 20.39 |
| instance n=1000 253.alb | 1 | 0 | Solution | 120.18 | 577 | 403.00 | 30.16 |
| instance n=1000 254.alb | 1 | 0 | Solution | 120.17 | 568 | 409.00 | 27.99 |
| instance n=1000 255.alb | 1 | 0 | Solution | 120.16 | 556 | 440.00 | 20.86 |
| instance n=1000 256.alb | 1 | 0 | Solution | 120.16 | 561 | 427.00 | 23.89 |
| instance n=1000 257.alb | 1 | 0 | Solution | 120.17 | 571 | 407.00 | 28.72 |
| instance n=1000 258.alb | 1 | 0 | Solution | 120.15 | 562 | 423.00 | 24.73 |
| instance n=1000 259.alb | 1 | 0 | Solution | 120.20 | 561 | 444.00 | 20.86 |
| instance n=1000 26.alb | 1 | 0 | Solution | 120.14 | 554 | 316.00 | 42.96 |
| instance n=1000 260.alb | 1 | 0 | Solution | 120.16 | 556 | 437.00 | 21.40 |
| instance n=1000 261.alb | 1 | 0 | Solution | 120.18 | 566 | 420.00 | 25.80 |
| instance n=1000 262.alb | 1 | 0 | Solution | 120.19 | 554 | 441.00 | 20.40 |
| instance n=1000 263.alb | 1 | 0 | Solution | 120.16 | 564 | 443.00 | 21.45 |
| instance n=1000 264.alb | 1 | 0 | Solution | 120.18 | 560 | 434.00 | 22.50 |
| instance n=1000 265.alb | 1 | 0 | Solution | 120.17 | 580 | 429.00 | 26.03 |
| instance n=1000 266.alb | 1 | 0 | Solution | 120.12 | 560 | 416.00 | 25.71 |
| instance n=1000 267.alb | 1 | 0 | Solution | 120.15 | 584 | 413.00 | 29.28 |
| instance n=1000 268.alb | 1 | 0 | Solution | 120.14 | 558 | 444.00 | 20.43 |
| instance n=1000 269.alb | 1 | 0 | Solution | 120.20 | 564 | 434.00 | 23.05 |
| instance n=1000 27.alb | 1 | 0 | Solution | 120.13 | 554 | 314.00 | 43.32 |
| instance n=1000 270.alb | 1 | 0 | Solution | 120.16 | 590 | 440.00 | 25.42 |
| instance n=1000 271.alb | 1 | 0 | Solution | 120.16 | 555 | 410.00 | 26.13 |
| instance n=1000 272.alb | 1 | 0 | Solution | 120.16 | 577 | 430.00 | 25.48 |
| instance n=1000 273.alb | 1 | 0 | Solution | 120.15 | 566 | 428.00 | 24.38 |
| instance n=1000 274.alb | 1 | 0 | Solution | 120.15 | 566 | 429.00 | 24.20 |
| instance n=1000 275.alb | 1 | 0 | Solution | 120.16 | 571 | 445.00 | 22.07 |
| instance n=1000 276.alb | 1 | 0 | Solution | 120.12 | 222 | 217.00 | 2.25 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 277.alb | 1 | 0 | Solution | 120.12 | 230 | 225.00 | 2.17 |
| instance n=1000 278.alb | 1 | 0 | Solution | 120.11 | 225 | 220.00 | 2.22 |
| instance n=1000 279.alb | 1 | 0 | Solution | 120.11 | 220 | 215.00 | 2.27 |
| instance n=1000 28.alb | 1 | 0 | Solution | 120.10 | 541 | 300.00 | 44.55 |
| instance n=1000 280.alb | 1 | 0 | Solution | 120.09 | 230 | 226.00 | 1.74 |
| instance n=1000 281.alb | 1 | 0 | Solution | 120.09 | 224 | 219.00 | 2.23 |
| instance n=1000 282.alb | 1 | 0 | Solution | 120.11 | 219 | 214.00 | 2.28 |
| instance n=1000 283.alb | 1 | 0 | Solution | 120.12 | 229 | 224.00 | 2.18 |
| instance n=1000 284.alb | 1 | 0 | Solution | 120.11 | 222 | 217.00 | 2.25 |
| instance n=1000 285.alb | 1 | 0 | Solution | 120.10 | 225 | 221.00 | 1.78 |
| instance n=1000 286.alb | 1 | 0 | Solution | 120.21 | 226 | 221.00 | 2.21 |
| instance n=1000 287.alb | 1 | 0 | Solution | 120.11 | 229 | 224.00 | 2.18 |
| instance n=1000 288.alb | 1 | 0 | Solution | 120.14 | 224 | 219.00 | 2.23 |
| instance n=1000 289.alb | 1 | 0 | Solution | 120.15 | 225 | 220.00 | 2.22 |
| instance n=1000 29.alb | 1 | 0 | Solution | 120.09 | 544 | 317.00 | 41.73 |
| instance n=1000 290.alb | 1 | 0 | Solution | 120.10 | 227 | 222.00 | 2.20 |
| instance n=1000 291.alb | 1 | 0 | Solution | 120.11 | 230 | 225.00 | 2.17 |
| instance n=1000 292.alb | 1 | 0 | Solution | 120.13 | 231 | 226.00 | 2.16 |
| instance n=1000 293.alb | 1 | 0 | Solution | 120.10 | 231 | 225.00 | 2.60 |
| instance n=1000 294.alb | 1 | 0 | Solution | 120.09 | 235 | 230.00 | 2.13 |
| instance n=1000 295.alb | 1 | 0 | Solution | 120.14 | 233 | 227.00 | 2.58 |
| instance n=1000 296.alb | 1 | 0 | Solution | 120.12 | 212 | 208.00 | 1.89 |
| instance n=1000 297.alb | 1 | 0 | Solution | 120.13 | 221 | 217.00 | 1.81 |
| instance n=1000 298.alb | 1 | 0 | Solution | 120.10 | 219 | 214.00 | 2.28 |
| instance n=1000 299.alb | 1 | 0 | Solution | 120.12 | 231 | 226.00 | 2.16 |
| instance n=1000 3.alb | 1 | 0 | Solution | 120.09 | 138 | 136.00 | 1.45 |
| instance n=1000 30.alb | 1 | 0 | Solution | 120.11 | 570 | 314.00 | 44.91 |
| instance n=1000 300.alb | 1 | 0 | Solution | 120.11 | 234 | 228.00 | 2.56 |
| instance n=1000 301.alb | 1 | 0 | Solution | 120.11 | 138 | 137.00 | 0.72 |
| instance n=1000 302.alb | 1 | 0 | Solution | 120.09 | 140 | 139.00 | 0.71 |
| instance n=1000 303.alb | 1 | 0 | Solution | 120.09 | 140 | 138.00 | 1.43 |
| instance n=1000 304.alb | 1 | 0 | Solution | 120.08 | 138 | 136.00 | 1.45 |
| instance n=1000 305.alb | 1 | 0 | Solution | 120.11 | 141 | 140.00 | 0.71 |
| instance n=1000 306.alb | 1 | 0 | Solution | 120.09 | 136 | 135.00 | 0.74 |
| instance n=1000 307.alb | 1 | 0 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 308.alb | 1 | 0 | Solution | 120.12 | 139 | 137.00 | 1.44 |
| instance n=1000 309.alb | 1 | 0 | Solution | 120.10 | 136 | 135.00 | 0.74 |
| instance n=1000 31.alb | 1 | 0 | Solution | 120.10 | 556 | 317.00 | 42.99 |
| instance n=1000 310.alb | 1 | 0 | Solution | 120.10 | 143 | 141.00 | 1.40 |
| instance n=1000 311.alb | 1 | 0 | Solution | 120.09 | 140 | 139.00 | 0.71 |
| instance n=1000 312.alb | 1 | 0 | Solution | 120.09 | 136 | 135.00 | 0.74 |
| instance n=1000 313.alb | 1 | 0 | Solution | 120.08 | 139 | 138.00 | 0.72 |
| instance n=1000 314.alb | 1 | 0 | Solution | 120.09 | 143 | 142.00 | 0.70 |
| instance n=1000 315.alb | 1 | 0 | Solution | 120.09 | 138 | 136.00 | 1.45 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 316.alb | 1 | 0 | Solution | 120.10 | 138 | 137.00 | 0.72 |
| instance n=1000 317.alb | 1 | 0 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 318.alb | 1 | 0 | Solution | 120.09 | 139 | 138.00 | 0.72 |
| instance n=1000 319.alb | 1 | 0 | Solution | 120.09 | 142 | 140.00 | 1.41 |
| instance n=1000 32.alb | 1 | 0 | Solution | 120.11 | 554 | 318.00 | 42.60 |
| instance n=1000 320.alb | 1 | 0 | Solution | 120.09 | 143 | 141.00 | 1.40 |
| instance n=1000 321.alb | 1 | 0 | Solution | 120.07 | 141 | 140.00 | 0.71 |
| instance n=1000 322.alb | 1 | 0 | Solution | 120.09 | 140 | 139.00 | 0.71 |
| instance n=1000 323.alb | 1 | 0 | Solution | 120.09 | 139 | 138.00 | 0.72 |
| instance n=1000 324.alb | 1 | 0 | Solution | 120.11 | 141 | 140.00 | 0.71 |
| instance n=1000 325.alb | 1 | 0 | Solution | 120.12 | 139 | 138.00 | 0.72 |
| instance n=1000 326.alb | 1 | 0 | Solution | 120.11 | 551 | 304.00 | 44.83 |
| instance n=1000 327.alb | 1 | 0 | Solution | 120.12 | 564 | 325.00 | 42.38 |
| instance n=1000 328.alb | 1 | 0 | Solution | 120.14 | 553 | 322.00 | 41.77 |
| instance n=1000 329.alb | 1 | 0 | Solution | 120.11 | 565 | 324.00 | 42.65 |
| instance n=1000 33.alb | 1 | 0 | Solution | 120.13 | 551 | 322.00 | 41.56 |
| instance n=1000 330.alb | 1 | 0 | Solution | 120.12 | 545 | 319.00 | 41.47 |
| instance n=1000 331.alb | 1 | 0 | Solution | 120.11 | 550 | 318.00 | 42.18 |
| instance n=1000 332.alb | 1 | 0 | Solution | 120.10 | 543 | 323.00 | 40.52 |
| instance n=1000 333.alb | 1 | 0 | Solution | 120.10 | 555 | 318.00 | 42.70 |
| instance n=1000 334.alb | 1 | 0 | Solution | 120.11 | 544 | 332.00 | 38.97 |
| instance n=1000 335.alb | 1 | 0 | Solution | 120.12 | 548 | 307.00 | 43.98 |
| instance n=1000 336.alb | 1 | 0 | Solution | 120.16 | 544 | 328.00 | 39.71 |
| instance n=1000 337.alb | 1 | 0 | Solution | 120.18 | 554 | 312.00 | 43.68 |
| instance n=1000 338.alb | 1 | 0 | Solution | 120.14 | 554 | 320.00 | 42.24 |
| instance n=1000 339.alb | 1 | 0 | Solution | 120.12 | 557 | 309.00 | 44.52 |
| instance n=1000 34.alb | 1 | 0 | Solution | 120.11 | 575 | 325.00 | 43.48 |
| instance n=1000 340.alb | 1 | 0 | Solution | 120.10 | 567 | 318.00 | 43.92 |
| instance n=1000 341.alb | 1 | 0 | Solution | 120.17 | 555 | 313.00 | 43.60 |
| instance n=1000 342.alb | 1 | 0 | Solution | 120.15 | 552 | 312.00 | 43.48 |
| instance n=1000 343.alb | 1 | 0 | Solution | 120.13 | 552 | 328.00 | 40.58 |
| instance n=1000 344.alb | 1 | 0 | Solution | 120.15 | 552 | 318.00 | 42.39 |
| instance n=1000 345.alb | 1 | 0 | Solution | 120.11 | 560 | 315.00 | 43.75 |
| instance n=1000 346.alb | 1 | 0 | Solution | 120.12 | 550 | 316.00 | 42.55 |
| instance n=1000 347.alb | 1 | 0 | Solution | 120.18 | 549 | 316.00 | 42.44 |
| instance n=1000 348.alb | 1 | 0 | Solution | 120.14 | 570 | 321.00 | 43.68 |
| instance n=1000 349.alb | 1 | 0 | Solution | 120.13 | 559 | 335.00 | 40.07 |
| instance n=1000 35.alb | 1 | 0 | Solution | 120.13 | 544 | 321.00 | 40.99 |
| instance n=1000 350.alb | 1 | 0 | Solution | 120.14 | 539 | 307.00 | 43.04 |
| instance n=1000 351.alb | 1 | 0 | Solution | 120.12 | 232 | 216.00 | 6.90 |
| instance n=1000 352.alb | 1 | 0 | Solution | 120.10 | 231 | 208.00 | 9.96 |
| instance n=1000 353.alb | 1 | 0 | Solution | 120.09 | 220 | 210.00 | 4.55 |
| instance n=1000 354.alb | 1 | 0 | Solution | 120.11 | 226 | 212.00 | 6.19 |
| instance n=1000 355.alb | 1 | 0 | Solution | 120.08 | 224 | 220.00 | 1.79 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 356.alb | 1 | 0 | Solution | 120.10 | 230 | 221.00 | 3.91 |
| instance n=1000 357.alb | 1 | 0 | Solution | 120.10 | 216 | 121.00 | 43.98 |
| instance n=1000 358.alb | 1 | 0 | Solution | 120.09 | 223 | 218.00 | 2.24 |
| instance n=1000 359.alb | 1 | 0 | Solution | 120.10 | 226 | 215.00 | 4.87 |
| instance n=1000 36.alb | 1 | 0 | Solution | 120.12 | 547 | 316.00 | 42.23 |
| instance n=1000 360.alb | 1 | 0 | Solution | 120.11 | 233 | 215.00 | 7.73 |
| instance n=1000 361.alb | 1 | 0 | Solution | 120.11 | 219 | 215.00 | 1.83 |
| instance n=1000 362.alb | 1 | 0 | Solution | 120.11 | 227 | 204.00 | 10.13 |
| instance n=1000 363.alb | 1 | 0 | Solution | 120.09 | 219 | 206.00 | 5.94 |
| instance n=1000 364.alb | 1 | 0 | Solution | 120.12 | 224 | 220.00 | 1.79 |
| instance n=1000 365.alb | 1 | 0 | Solution | 120.11 | 231 | 217.00 | 6.06 |
| instance n=1000 366.alb | 1 | 0 | Solution | 120.10 | 231 | 214.00 | 7.36 |
| instance n=1000 367.alb | 1 | 0 | Solution | 120.13 | 231 | 217.00 | 6.06 |
| instance n=1000 368.alb | 1 | 0 | Solution | 120.11 | 230 | 219.00 | 4.78 |
| instance n=1000 369.alb | 1 | 0 | Solution | 120.11 | 224 | 181.00 | 19.20 |
| instance n=1000 37.alb | 1 | 0 | Solution | 120.14 | 566 | 314.00 | 44.52 |
| instance n=1000 370.alb | 1 | 0 | Solution | 120.10 | 227 | 210.00 | 7.49 |
| instance n=1000 371.alb | 1 | 0 | Solution | 120.15 | 223 | 215.00 | 3.59 |
| instance n=1000 372.alb | 1 | 0 | Solution | 120.10 | 234 | 208.00 | 11.11 |
| instance n=1000 373.alb | 1 | 0 | Solution | 120.09 | 222 | 215.00 | 3.15 |
| instance n=1000 374.alb | 1 | 0 | Solution | 120.10 | 222 | 219.00 | 1.35 |
| instance n=1000 375.alb | 1 | 0 | Solution | 120.11 | 230 | 214.00 | 6.96 |
| instance n=1000 376.alb | 1 | 0 | Solution | 120.09 | 134 | 132.00 | 1.49 |
| instance n=1000 377.alb | 1 | 0 | Solution | 120.09 | 138 | 137.00 | 0.72 |
| instance n=1000 378.alb | 1 | 0 | Solution | 120.10 | 135 | 134.00 | 0.74 |
| instance n=1000 379.alb | 1 | 0 | Solution | 120.11 | 139 | 137.00 | 1.44 |
| instance n=1000 38.alb | 1 | 0 | Solution | 120.12 | 564 | 309.00 | 45.21 |
| instance n=1000 380.alb | 1 | 0 | Solution | 120.11 | 136 | 134.00 | 1.47 |
| instance n=1000 381.alb | 1 | 0 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 382.alb | 1 | 0 | Solution | 120.09 | 132 | 131.00 | 0.76 |
| instance n=1000 383.alb | 1 | 0 | Solution | 120.09 | 140 | 138.00 | 1.43 |
| instance n=1000 384.alb | 1 | 0 | Solution | 120.10 | 141 | 139.00 | 1.42 |
| instance n=1000 385.alb | 1 | 0 | Solution | 120.10 | 137 | 135.00 | 1.46 |
| instance n=1000 386.alb | 1 | 0 | Solution | 120.12 | 141 | 139.00 | 1.42 |
| instance n=1000 387.alb | 1 | 0 | Solution | 120.11 | 139 | 137.00 | 1.44 |
| instance n=1000 388.alb | 1 | 0 | Solution | 120.10 | 138 | 137.00 | 0.72 |
| instance n=1000 389.alb | 1 | 0 | Solution | 120.11 | 137 | 136.00 | 0.73 |
| instance n=1000 39.alb | 1 | 0 | Solution | 120.12 | 565 | 313.00 | 44.60 |
| instance n=1000 390.alb | 1 | 0 | Solution | 120.11 | 137 | 136.00 | 0.73 |
| instance n=1000 391.alb | 1 | 0 | Solution | 120.11 | 137 | 135.00 | 1.46 |
| instance n=1000 392.alb | 1 | 0 | Solution | 120.11 | 137 | 136.00 | 0.73 |
| instance n=1000 393.alb | 1 | 0 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 394.alb | 1 | 0 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 395.alb | 1 | 0 | Solution | 120.10 | 141 | 139.00 | 1.42 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 396.alb | 1 | 0 | Solution | 120.10 | 138 | 136.00 | 1.45 |
| instance n=1000 397.alb | 1 | 0 | Solution | 120.13 | 142 | 140.00 | 1.41 |
| instance n=1000 398.alb | 1 | 0 | Solution | 120.11 | 136 | 134.00 | 1.47 |
| instance n=1000 399.alb | 1 | 0 | Solution | 120.11 | 141 | 139.00 | 1.42 |
| instance n=1000 4.alb | 1 | 0 | Solution | 120.10 | 139 | 138.00 | 0.72 |
| instance n=1000 40.alb | 1 | 0 | Solution | 120.11 | 529 | 318.00 | 39.89 |
| instance n=1000 400.alb | 1 | 0 | Solution | 120.11 | 142 | 140.00 | 1.41 |
| instance n=1000 401.alb | 1 | 0 | Solution | 120.11 | 553 | 413.00 | 25.32 |
| instance n=1000 402.alb | 1 | 0 | Solution | 120.19 | 556 | 424.00 | 23.74 |
| instance n=1000 403.alb | 1 | 0 | Solution | 120.18 | 557 | 396.00 | 28.90 |
| instance n=1000 404.alb | 1 | 0 | Solution | 120.18 | 554 | 430.00 | 22.38 |
| instance n=1000 405.alb | 1 | 0 | Solution | 120.17 | 562 | 458.00 | 18.51 |
| instance n=1000 406.alb | 1 | 0 | Solution | 120.16 | 547 | 403.00 | 26.33 |
| instance n=1000 407.alb | 1 | 0 | Solution | 120.19 | 555 | 399.00 | 28.11 |
| instance n=1000 408.alb | 1 | 0 | Solution | 120.18 | 563 | 412.00 | 26.82 |
| instance n=1000 409.alb | 1 | 0 | Solution | 120.16 | 566 | 413.00 | 27.03 |
| instance n=1000 41.alb | 1 | 0 | Solution | 120.13 | 555 | 336.00 | 39.46 |
| instance n=1000 410.alb | 1 | 0 | Solution | 120.18 | 575 | 431.00 | 25.04 |
| instance n=1000 411.alb | 1 | 0 | Solution | 120.22 | 558 | 422.00 | 24.37 |
| instance n=1000 412.alb | 1 | 0 | Solution | 120.15 | 558 | 393.00 | 29.57 |
| instance n=1000 413.alb | 1 | 0 | Solution | 120.19 | 558 | 411.00 | 26.34 |
| instance n=1000 414.alb | 1 | 0 | Solution | 120.18 | 562 | 406.00 | 27.76 |
| instance n=1000 415.alb | 1 | 0 | Solution | 120.17 | 561 | 413.00 | 26.38 |
| instance n=1000 416.alb | 1 | 0 | Solution | 120.19 | 562 | 398.00 | 29.18 |
| instance n=1000 417.alb | 1 | 0 | Solution | 120.12 | 594 | 406.00 | 31.65 |
| instance n=1000 418.alb | 1 | 0 | Solution | 120.16 | 552 | 438.00 | 20.65 |
| instance n=1000 419.alb | 1 | 0 | Solution | 120.19 | 577 | 423.00 | 26.69 |
| instance n=1000 42.alb | 1 | 0 | Solution | 120.12 | 534 | 306.00 | 42.70 |
| instance n=1000 420.alb | 1 | 0 | Solution | 120.16 | 556 | 429.00 | 22.84 |
| instance n=1000 421.alb | 1 | 0 | Solution | 120.18 | 556 | 402.00 | 27.70 |
| instance n=1000 422.alb | 1 | 0 | Solution | 120.11 | 552 | 420.00 | 23.91 |
| instance n=1000 423.alb | 1 | 0 | Solution | 120.11 | 561 | 396.00 | 29.41 |
| instance n=1000 424.alb | 1 | 0 | Solution | 120.10 | 548 | 431.00 | 21.35 |
| instance n=1000 425.alb | 1 | 0 | Solution | 120.19 | 567 | 395.00 | 30.34 |
| instance n=1000 426.alb | 1 | 0 | Solution | 120.10 | 229 | 224.00 | 2.18 |
| instance n=1000 427.alb | 1 | 0 | Solution | 120.12 | 234 | 229.00 | 2.14 |
| instance n=1000 428.alb | 1 | 0 | Solution | 120.12 | 228 | 224.00 | 1.75 |
| instance n=1000 429.alb | 1 | 0 | Solution | 120.11 | 239 | 235.00 | 1.67 |
| instance n=1000 43.alb | 1 | 0 | Solution | 120.13 | 541 | 325.00 | 39.93 |
| instance n=1000 430.alb | 1 | 0 | Solution | 120.10 | 224 | 220.00 | 1.79 |
| instance n=1000 431.alb | 1 | 0 | Solution | 120.13 | 234 | 230.00 | 1.71 |
| instance n=1000 432.alb | 1 | 0 | Solution | 120.13 | 232 | 227.00 | 2.16 |
| instance n=1000 433.alb | 1 | 0 | Solution | 120.10 | 234 | 229.00 | 2.14 |
| instance n=1000 434.alb | 1 | 0 | Solution | 120.10 | 215 | 212.00 | 1.40 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 435.alb | 1 | 0 | Solution | 120.10 | 231 | 227.00 | 1.73 |
| instance n=1000 436.alb | 1 | 0 | Solution | 120.12 | 231 | 226.00 | 2.16 |
| instance n=1000 437.alb | 1 | 0 | Solution | 120.12 | 226 | 222.00 | 1.77 |
| instance n=1000 438.alb | 1 | 0 | Solution | 120.14 | 225 | 221.00 | 1.78 |
| instance n=1000 439.alb | 1 | 0 | Solution | 120.13 | 230 | 225.00 | 2.17 |
| instance n=1000 44.alb | 1 | 0 | Solution | 120.12 | 554 | 313.00 | 43.50 |
| instance n=1000 440.alb | 1 | 0 | Solution | 120.12 | 230 | 225.00 | 2.17 |
| instance n=1000 441.alb | 1 | 0 | Solution | 120.11 | 226 | 221.00 | 2.21 |
| instance n=1000 442.alb | 1 | 0 | Solution | 120.12 | 235 | 230.00 | 2.13 |
| instance n=1000 443.alb | 1 | 0 | Solution | 120.11 | 221 | 217.00 | 1.81 |
| instance n=1000 444.alb | 1 | 0 | Solution | 120.12 | 227 | 222.00 | 2.20 |
| instance n=1000 445.alb | 1 | 0 | Solution | 120.10 | 235 | 229.00 | 2.55 |
| instance n=1000 446.alb | 1 | 0 | Solution | 120.12 | 232 | 228.00 | 1.72 |
| instance n=1000 447.alb | 1 | 0 | Solution | 120.11 | 226 | 221.00 | 2.21 |
| instance n=1000 448.alb | 1 | 0 | Solution | 120.11 | 226 | 222.00 | 1.77 |
| instance n=1000 449.alb | 1 | 0 | Solution | 120.11 | 238 | 232.00 | 2.52 |
| instance n=1000 45.alb | 1 | 0 | Solution | 120.14 | 534 | 318.00 | 40.45 |
| instance n=1000 450.alb | 1 | 0 | Solution | 120.10 | 224 | 220.00 | 1.79 |
| instance n=1000 451.alb | 1 | 0 | Solution | 120.12 | 139 | 136.00 | 2.16 |
| instance n=1000 452.alb | 1 | 0 | Solution | 120.09 | 134 | 132.00 | 1.49 |
| instance n=1000 453.alb | 1 | 0 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 454.alb | 1 | 0 | Solution | 120.11 | 142 | 139.00 | 2.11 |
| instance n=1000 455.alb | 1 | 0 | Solution | 120.09 | 139 | 136.00 | 2.16 |
| instance n=1000 456.alb | 1 | 0 | Solution | 120.10 | 137 | 135.00 | 1.46 |
| instance n=1000 457.alb | 1 | 0 | Solution | 120.10 | 139 | 137.00 | 1.44 |
| instance n=1000 458.alb | 1 | 0 | Solution | 120.10 | 137 | 135.00 | 1.46 |
| instance n=1000 459.alb | 1 | 0 | Solution | 120.10 | 140 | 137.00 | 2.14 |
| instance n=1000 46.alb | 1 | 0 | Solution | 120.09 | 545 | 314.00 | 42.39 |
| instance n=1000 460.alb | 1 | 0 | Solution | 120.12 | 140 | 138.00 | 1.43 |
| instance n=1000 461.alb | 1 | 0 | Solution | 120.11 | 139 | 137.00 | 1.44 |
| instance n=1000 462.alb | 1 | 0 | Solution | 120.10 | 138 | 136.00 | 1.45 |
| instance n=1000 463.alb | 1 | 0 | Solution | 120.10 | 138 | 136.00 | 1.45 |
| instance n=1000 464.alb | 1 | 0 | Solution | 120.10 | 141 | 138.00 | 2.13 |
| instance n=1000 465.alb | 1 | 0 | Solution | 120.10 | 141 | 138.00 | 2.13 |
| instance n=1000 466.alb | 1 | 0 | Solution | 120.09 | 136 | 133.00 | 2.21 |
| instance n=1000 467.alb | 1 | 0 | Solution | 120.12 | 140 | 138.00 | 1.43 |
| instance n=1000 468.alb | 1 | 0 | Solution | 120.10 | 139 | 137.00 | 1.44 |
| instance n=1000 469.alb | 1 | 0 | Solution | 120.11 | 139 | 137.00 | 1.44 |
| instance n=1000 47.alb | 1 | 0 | Solution | 120.08 | 547 | 303.00 | 44.61 |
| instance n=1000 470.alb | 1 | 0 | Solution | 120.11 | 137 | 135.00 | 1.46 |
| instance n=1000 471.alb | 1 | 0 | Solution | 120.10 | 138 | 135.00 | 2.17 |
| instance n=1000 472.alb | 1 | 0 | Solution | 120.10 | 142 | 140.00 | 1.41 |
| instance n=1000 473.alb | 1 | 0 | Solution | 120.10 | 138 | 135.00 | 2.17 |
| instance n=1000 474.alb | 1 | 0 | Solution | 120.08 | 139 | 136.00 | 2.16 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 475.alb | 1 | 0 | Solution | 120.10 | 138 | 136.00 | 1.45 |
| instance n=1000 476.alb | 1 | 0 | Solution | 120.13 | 575 | 494.00 | 14.09 |
| instance n=1000 477.alb | 1 | 0 | Solution | 120.13 | 585 | 524.00 | 10.43 |
| instance n=1000 478.alb | 1 | 0 | Solution | 120.14 | 594 | 545.00 | 8.25 |
| instance n=1000 479.alb | 1 | 0 | Solution | 120.16 | 577 | 490.00 | 15.08 |
| instance n=1000 48.alb | 1 | 0 | Solution | 120.13 | 573 | 329.00 | 42.58 |
| instance n=1000 480.alb | 1 | 0 | Solution | 120.12 | 566 | 507.00 | 10.42 |
| instance n=1000 481.alb | 1 | 0 | Solution | 120.22 | 580 | 519.00 | 10.52 |
| instance n=1000 482.alb | 1 | 0 | Solution | 120.20 | 603 | 498.00 | 17.41 |
| instance n=1000 483.alb | 1 | 0 | Solution | 120.19 | 571 | 502.00 | 12.08 |
| instance n=1000 484.alb | 1 | 0 | Solution | 120.26 | 588 | 512.00 | 12.93 |
| instance n=1000 485.alb | 1 | 0 | Solution | 120.12 | 584 | 518.00 | 11.30 |
| instance n=1000 486.alb | 1 | 0 | Solution | 120.12 | 575 | 504.00 | 12.35 |
| instance n=1000 487.alb | 1 | 0 | Solution | 120.20 | 582 | 492.00 | 15.46 |
| instance n=1000 488.alb | 1 | 0 | Solution | 120.13 | 575 | 511.00 | 11.13 |
| instance n=1000 489.alb | 1 | 0 | Solution | 120.13 | 568 | 487.00 | 14.26 |
| instance n=1000 49.alb | 1 | 0 | Solution | 120.11 | 546 | 323.00 | 40.84 |
| instance n=1000 490.alb | 1 | 0 | Solution | 120.20 | 576 | 499.00 | 13.37 |
| instance n=1000 491.alb | 1 | 0 | Solution | 120.23 | 571 | 495.00 | 13.31 |
| instance n=1000 492.alb | 1 | 0 | Solution | 120.21 | 592 | 515.00 | 13.01 |
| instance n=1000 493.alb | 1 | 0 | Solution | 120.12 | 564 | 498.00 | 11.70 |
| instance n=1000 494.alb | 1 | 0 | Solution | 120.29 | 579 | 515.00 | 11.05 |
| instance n=1000 495.alb | 1 | 0 | Solution | 120.24 | 595 | 508.00 | 14.62 |
| instance n=1000 496.alb | 1 | 0 | Solution | 120.11 | 563 | 505.00 | 10.30 |
| instance n=1000 497.alb | 1 | 0 | Solution | 120.22 | 569 | 499.00 | 12.30 |
| instance n=1000 498.alb | 1 | 0 | Solution | 120.13 | 585 | 523.00 | 10.60 |
| instance n=1000 499.alb | 1 | 0 | Solution | 120.12 | 567 | 505.00 | 10.93 |
| instance n=1000 5.alb | 1 | 0 | Solution | 120.08 | 136 | 135.00 | 0.74 |
| instance n=1000 50.alb | 1 | 0 | Solution | 120.10 | 535 | 303.00 | 43.36 |
| instance n=1000 500.alb | 1 | 0 | Solution | 120.22 | 584 | 507.00 | 13.18 |
| instance n=1000 501.alb | 1 | 0 | Solution | 120.10 | 233 | 227.00 | 2.58 |
| instance n=1000 502.alb | 1 | 0 | Solution | 120.11 | 229 | 224.00 | 2.18 |
| instance n=1000 503.alb | 1 | 0 | Solution | 120.16 | 232 | 225.00 | 3.02 |
| instance n=1000 504.alb | 1 | 0 | Solution | 120.11 | 233 | 227.00 | 2.58 |
| instance n=1000 505.alb | 1 | 0 | Solution | 120.11 | 219 | 213.00 | 2.74 |
| instance n=1000 506.alb | 1 | 0 | Solution | 120.10 | 229 | 223.00 | 2.62 |
| instance n=1000 507.alb | 1 | 0 | Solution | 120.11 | 226 | 220.00 | 2.65 |
| instance n=1000 508.alb | 1 | 0 | Solution | 120.11 | 224 | 219.00 | 2.23 |
| instance n=1000 509.alb | 1 | 0 | Solution | 120.15 | 231 | 225.00 | 2.60 |
| instance n=1000 51.alb | 1 | 0 | Solution | 120.09 | 230 | 226.00 | 1.74 |
| instance n=1000 510.alb | 1 | 0 | Solution | 120.11 | 233 | 226.00 | 3.00 |
| instance n=1000 511.alb | 1 | 0 | Solution | 120.11 | 237 | 230.00 | 2.95 |
| instance n=1000 512.alb | 1 | 0 | Solution | 120.11 | 224 | 219.00 | 2.23 |
| instance n=1000 513.alb | 1 | 0 | Solution | 120.16 | 226 | 219.00 | 3.10 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 514.alb | 1 | 0 | Solution | 120.13 | 233 | 226.00 | 3.00 |
| instance n=1000 515.alb | 1 | 0 | Solution | 120.11 | 228 | 221.00 | 3.07 |
| instance n=1000 516.alb | 1 | 0 | Solution | 120.11 | 235 | 229.00 | 2.55 |
| instance n=1000 517.alb | 1 | 0 | Solution | 120.11 | 227 | 221.00 | 2.64 |
| instance n=1000 518.alb | 1 | 0 | Solution | 120.12 | 226 | 220.00 | 2.65 |
| instance n=1000 519.alb | 1 | 0 | Solution | 120.11 | 228 | 221.00 | 3.07 |
| instance n=1000 52.alb | 1 | 0 | Solution | 120.15 | 232 | 197.00 | 15.09 |
| instance n=1000 520.alb | 1 | 0 | Solution | 120.12 | 232 | 226.00 | 2.59 |
| instance n=1000 521.alb | 1 | 0 | Solution | 120.14 | 236 | 229.00 | 2.97 |
| instance n=1000 522.alb | 1 | 0 | Solution | 120.11 | 221 | 215.00 | 2.71 |
| instance n=1000 523.alb | 1 | 0 | Solution | 120.12 | 226 | 220.00 | 2.65 |
| instance n=1000 524.alb | 1 | 0 | Solution | 120.11 | 233 | 226.00 | 3.00 |
| instance n=1000 525.alb | 1 | 0 | Solution | 120.15 | 227 | 221.00 | 2.64 |
| instance n=1000 53.alb | 1 | 0 | Solution | 120.10 | 231 | 209.00 | 9.52 |
| instance n=1000 54.alb | 1 | 0 | Solution | 120.14 | 223 | 203.00 | 8.97 |
| instance n=1000 55.alb | 1 | 0 | Solution | 120.08 | 221 | 212.00 | 4.07 |
| instance n=1000 56.alb | 1 | 0 | Solution | 120.09 | 231 | 198.00 | 14.29 |
| instance n=1000 57.alb | 1 | 0 | Solution | 120.09 | 227 | 196.00 | 13.66 |
| instance n=1000 58.alb | 1 | 0 | Solution | 120.08 | 227 | 200.00 | 11.89 |
| instance n=1000 59.alb | 1 | 0 | Solution | 120.09 | 226 | 204.00 | 9.73 |
| instance n=1000 6.alb | 1 | 0 | Solution | 120.08 | 143 | 141.00 | 1.40 |
| instance n=1000 60.alb | 1 | 0 | Solution | 120.10 | 234 | 215.00 | 8.12 |
| instance n=1000 61.alb | 1 | 0 | Solution | 120.09 | 233 | 196.00 | 15.88 |
| instance n=1000 62.alb | 1 | 0 | Solution | 120.08 | 226 | 197.00 | 12.83 |
| instance n=1000 63.alb | 1 | 0 | Solution | 120.08 | 230 | 197.00 | 14.35 |
| instance n=1000 64.alb | 1 | 0 | Solution | 120.09 | 233 | 209.00 | 10.30 |
| instance n=1000 65.alb | 1 | 0 | Solution | 120.11 | 228 | 210.00 | 7.89 |
| instance n=1000 66.alb | 1 | 0 | Solution | 120.10 | 230 | 224.00 | 2.61 |
| instance n=1000 67.alb | 1 | 0 | Solution | 120.10 | 227 | 192.00 | 15.42 |
| instance n=1000 68.alb | 1 | 0 | Solution | 120.08 | 231 | 201.00 | 12.99 |
| instance n=1000 69.alb | 1 | 0 | Solution | 120.10 | 227 | 206.00 | 9.25 |
| instance n=1000 7.alb | 1 | 0 | Solution | 120.07 | 138 | 136.00 | 1.45 |
| instance n=1000 70.alb | 1 | 0 | Solution | 120.11 | 232 | 203.00 | 12.50 |
| instance n=1000 71.alb | 1 | 0 | Solution | 120.10 | 233 | 188.00 | 19.31 |
| instance n=1000 72.alb | 1 | 0 | Solution | 120.08 | 226 | 206.00 | 8.85 |
| instance n=1000 73.alb | 1 | 0 | Solution | 120.10 | 225 | 212.00 | 5.78 |
| instance n=1000 74.alb | 1 | 0 | Solution | 120.08 | 231 | 218.00 | 5.63 |
| instance n=1000 75.alb | 1 | 0 | Solution | 120.09 | 231 | 222.00 | 3.90 |
| instance n=1000 76.alb | 1 | 0 | Solution | 120.07 | 138 | 136.00 | 1.45 |
| instance n=1000 77.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 78.alb | 1 | 0 | Solution | 120.07 | 140 | 138.00 | 1.43 |
| instance n=1000 79.alb | 1 | 0 | Solution | 120.09 | 143 | 142.00 | 0.70 |
| instance n=1000 8.alb | 1 | 0 | Solution | 120.08 | 140 | 138.00 | 1.43 |
| instance n=1000 80.alb | 1 | 0 | Solution | 120.09 | 141 | 140.00 | 0.71 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 81.alb | 1 | 0 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 82.alb | 1 | 0 | Solution | 120.11 | 137 | 136.00 | 0.73 |
| instance n=1000 83.alb | 1 | 0 | Solution | 120.92 | 141 | 140.00 | 0.71 |
| instance n=1000 84.alb | 1 | 0 | Solution | 120.14 | 136 | 135.00 | 0.74 |
| instance n=1000 85.alb | 1 | 0 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 86.alb | 1 | 0 | Solution | 120.08 | 139 | 138.00 | 0.72 |
| instance n=1000 87.alb | 1 | 0 | Solution | 120.09 | 142 | 140.00 | 1.41 |
| instance n=1000 88.alb | 1 | 0 | Solution | 120.09 | 142 | 140.00 | 1.41 |
| instance n=1000 89.alb | 1 | 0 | Solution | 120.10 | 141 | 140.00 | 0.71 |
| instance n=1000 9.alb | 1 | 0 | Solution | 120.07 | 136 | 134.00 | 1.47 |
| instance n=1000 90.alb | 1 | 0 | Solution | 120.10 | 139 | 138.00 | 0.72 |
| instance n=1000 91.alb | 1 | 0 | Solution | 120.09 | 142 | 141.00 | 0.70 |
| instance n=1000 92.alb | 1 | 0 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 93.alb | 1 | 0 | Solution | 120.08 | 138 | 137.00 | 0.72 |
| instance n=1000 94.alb | 1 | 0 | Solution | 120.09 | 139 | 137.00 | 1.44 |
| instance n=1000 95.alb | 1 | 0 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 96.alb | 1 | 0 | Solution | 120.07 | 139 | 137.00 | 1.44 |
| instance n=1000 97.alb | 1 | 0 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 98.alb | 1 | 0 | Solution | 120.12 | 137 | 136.00 | 0.73 |
| instance n=1000 99.alb | 1 | 0 | Solution | 120.09 | 137 | 136.00 | 0.73 |
| instance n=100 1.alb | 1 | 0 | Optimal | 17.05 | 23 | 23.00 | 0.00 |
| instance n=100 10.alb | 1 | 0 | Optimal | 1.16 | 22 | 22.00 | 0.00 |
| instance n=100 100.alb | 1 | 0 | Optimal | 120.03 | 25 | 25.00 | 0.00 |
| instance n=100 101.alb | 1 | 0 | Optimal | 120.03 | 15 | 15.00 | 0.00 |
| instance n=100 102.alb | 1 | 0 | Optimal | 0.39 | 14 | 14.00 | 0.00 |
| instance n=100 103.alb | 1 | 0 | Optimal | 0.14 | 14 | 14.00 | 0.00 |
| instance n=100 104.alb | 1 | 0 | Optimal | 0.09 | 14 | 14.00 | 0.00 |
| instance n=100 105.alb | 1 | 0 | Optimal | 0.52 | 13 | 13.00 | 0.00 |
| instance n=100 106.alb | 1 | 0 | Optimal | 0.15 | 14 | 14.00 | 0.00 |
| instance n=100 107.alb | 1 | 0 | Optimal | 0.09 | 14 | 14.00 | 0.00 |
| instance n=100 108.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 109.alb | 1 | 0 | Optimal | 0.13 | 15 | 15.00 | 0.00 |
| instance n=100 11.alb | 1 | 0 | Optimal | 12.16 | 24 | 24.00 | 0.00 |
| instance n=100 110.alb | 1 | 0 | Optimal | 0.13 | 13 | 13.00 | 0.00 |
| instance n=100 111.alb | 1 | 0 | Optimal | 0.11 | 16 | 16.00 | 0.00 |
| instance n=100 112.alb | 1 | 0 | Optimal | 20.93 | 13 | 13.00 | 0.00 |
| instance n=100 113.alb | 1 | 0 | Optimal | 0.39 | 14 | 14.00 | 0.00 |
| instance n=100 114.alb | 1 | 0 | Optimal | 0.12 | 13 | 13.00 | 0.00 |
| instance n=100 115.alb | 1 | 0 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 116.alb | 1 | 0 | Optimal | 0.13 | 16 | 16.00 | 0.00 |
| instance n=100 117.alb | 1 | 0 | Optimal | 120.03 | 15 | 15.00 | 0.00 |
| instance n=100 118.alb | 1 | 0 | Optimal | 0.30 | 15 | 15.00 | 0.00 |
| instance n=100 119.alb | 1 | 0 | Optimal | 0.11 | 14 | 14.00 | 0.00 |
| instance n=100 12.alb | 1 | 0 | Optimal | 66.54 | 25 | 25.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 120.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 121.alb | 1 | 0 | Optimal | 0.14 | 15 | 15.00 | 0.00 |
| instance n=100 122.alb | 1 | 0 | Optimal | 0.26 | 13 | 13.00 | 0.00 |
| instance n=100 123.alb | 1 | 0 | Optimal | 0.13 | 15 | 15.00 | 0.00 |
| instance n=100 124.alb | 1 | 0 | Optimal | 120.01 | 15 | 15.00 | 0.00 |
| instance n=100 125.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 126.alb | 1 | 0 | Solution | 120.12 | 51 | 50.00 | 1.96 |
| instance n=100 127.alb | 1 | 0 | Solution | 120.33 | 52 | 50.00 | 3.85 |
| instance n=100 128.alb | 1 | 0 | Solution | 120.11 | 57 | 56.00 | 1.75 |
| instance n=100 129.alb | 1 | 0 | Optimal | 1.96 | 54 | 54.00 | 0.00 |
| instance n=100 13.alb | 1 | 0 | Optimal | 0.33 | 24 | 24.00 | 0.00 |
| instance n=100 130.alb | 1 | 0 | Solution | 120.12 | 55 | 52.00 | 5.45 |
| instance n=100 131.alb | 1 | 0 | Solution | 120.13 | 53 | 51.00 | 3.77 |
| instance n=100 132.alb | 1 | 0 | Solution | 120.27 | 58 | 56.00 | 3.45 |
| instance n=100 133.alb | 1 | 0 | Solution | 120.20 | 55 | 53.00 | 3.64 |
| instance n=100 134.alb | 1 | 0 | Solution | 120.13 | 54 | 52.00 | 3.70 |
| instance n=100 135.alb | 1 | 0 | Solution | 120.13 | 55 | 53.00 | 3.64 |
| instance n=100 136.alb | 1 | 0 | Solution | 120.09 | 52 | 50.00 | 3.85 |
| instance n=100 137.alb | 1 | 0 | Solution | 120.22 | 54 | 51.00 | 5.56 |
| instance n=100 138.alb | 1 | 0 | Optimal | 9.65 | 56 | 56.00 | 0.00 |
| instance n=100 139.alb | 1 | 0 | Optimal | 120.02 | 51 | 51.00 | 0.00 |
| instance n=100 14.alb | 1 | 0 | Optimal | 120.03 | 20 | 20.00 | 0.00 |
| instance n=100 140.alb | 1 | 0 | Solution | 120.45 | 55 | 54.00 | 1.82 |
| instance n=100 141.alb | 1 | 0 | Solution | 120.24 | 51 | 49.00 | 3.92 |
| instance n=100 142.alb | 1 | 0 | Solution | 120.15 | 55 | 52.00 | 5.45 |
| instance n=100 143.alb | 1 | 0 | Solution | 120.10 | 53 | 51.00 | 3.77 |
| instance n=100 144.alb | 1 | 0 | Solution | 120.09 | 49 | 47.00 | 4.08 |
| instance n=100 145.alb | 1 | 0 | Solution | 120.26 | 56 | 53.00 | 5.36 |
| instance n=100 146.alb | 1 | 0 | Optimal | 3.64 | 53 | 53.00 | 0.00 |
| instance n=100 147.alb | 1 | 0 | Solution | 120.11 | 59 | 58.00 | 1.69 |
| instance n=100 148.alb | 1 | 0 | Solution | 120.12 | 52 | 50.00 | 3.85 |
| instance n=100 149.alb | 1 | 0 | Solution | 120.12 | 55 | 54.00 | 1.82 |
| instance n=100 15.alb | 1 | 0 | Optimal | 0.08 | 24 | 24.00 | 0.00 |
| instance n=100 150.alb | 1 | 0 | Solution | 120.13 | 57 | 54.00 | 5.26 |
| instance n=100 151.alb | 1 | 0 | Solution | 120.10 | 22 | 21.00 | 4.55 |
| instance n=100 152.alb | 1 | 0 | Optimal | 0.58 | 22 | 22.00 | 0.00 |
| instance n=100 153.alb | 1 | 0 | Optimal | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 154.alb | 1 | 0 | Optimal | 0.15 | 25 | 25.00 | 0.00 |
| instance n=100 155.alb | 1 | 0 | Optimal | 0.78 | 22 | 22.00 | 0.00 |
| instance n=100 156.alb | 1 | 0 | Optimal | 0.63 | 23 | 23.00 | 0.00 |
| instance n=100 157.alb | 1 | 0 | Optimal | 0.79 | 26 | 26.00 | 0.00 |
| instance n=100 158.alb | 1 | 0 | Optimal | 0.39 | 23 | 23.00 | 0.00 |
| instance n=100 159.alb | 1 | 0 | Optimal | 0.14 | 19 | 19.00 | 0.00 |
| instance n=100 16.alb | 1 | 0 | Optimal | 120.03 | 23 | 23.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 160.alb | 1 | 0 | Optimal | 0.68 | 22 | 22.00 | 0.00 |
| instance n=100 161.alb | 1 | 0 | Solution | 120.11 | 23 | 22.00 | 4.35 |
| instance n=100 162.alb | 1 | 0 | Optimal | 120.04 | 22 | 22.00 | 0.00 |
| instance n=100 163.alb | 1 | 0 | Optimal | 0.15 | 25 | 25.00 | 0.00 |
| instance n=100 164.alb | 1 | 0 | Optimal | 0.10 | 23 | 23.00 | 0.00 |
| instance n=100 165.alb | 1 | 0 | Solution | 120.10 | 25 | 24.00 | 4.00 |
| instance n=100 166.alb | 1 | 0 | Optimal | 0.59 | 24 | 24.00 | 0.00 |
| instance n=100 167.alb | 1 | 0 | Optimal | 0.13 | 22 | 22.00 | 0.00 |
| instance n=100 168.alb | 1 | 0 | Optimal | 120.03 | 21 | 21.00 | 0.00 |
| instance n=100 169.alb | 1 | 0 | Optimal | 0.61 | 21 | 21.00 | 0.00 |
| instance n=100 17.alb | 1 | 0 | Solution | 120.08 | 22 | 21.00 | 4.55 |
| instance n=100 170.alb | 1 | 0 | Optimal | 24.40 | 24 | 24.00 | 0.00 |
| instance n=100 171.alb | 1 | 0 | Solution | 120.12 | 25 | 24.00 | 4.00 |
| instance n=100 172.alb | 1 | 0 | Optimal | 0.66 | 24 | 24.00 | 0.00 |
| instance n=100 173.alb | 1 | 0 | Solution | 120.12 | 25 | 24.00 | 4.00 |
| instance n=100 174.alb | 1 | 0 | Optimal | 120.03 | 22 | 22.00 | 0.00 |
| instance n=100 175.alb | 1 | 0 | Solution | 120.11 | 27 | 26.00 | 3.70 |
| instance n=100 176.alb | 1 | 0 | Optimal | 0.11 | 13 | 13.00 | 0.00 |
| instance n=100 177.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 178.alb | 1 | 0 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 179.alb | 1 | 0 | Optimal | 0.12 | 15 | 15.00 | 0.00 |
| instance n=100 18.alb | 1 | 0 | Solution | 120.09 | 20 | 19.00 | 5.00 |
| instance n=100 180.alb | 1 | 0 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 181.alb | 1 | 0 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=100 182.alb | 1 | 0 | Optimal | 0.12 | 15 | 15.00 | 0.00 |
| instance n=100 183.alb | 1 | 0 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 184.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 185.alb | 1 | 0 | Optimal | 26.08 | 15 | 15.00 | 0.00 |
| instance n=100 186.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 187.alb | 1 | 0 | Optimal | 66.69 | 13 | 13.00 | 0.00 |
| instance n=100 188.alb | 1 | 0 | Optimal | 0.11 | 16 | 16.00 | 0.00 |
| instance n=100 189.alb | 1 | 0 | Optimal | 6.38 | 14 | 14.00 | 0.00 |
| instance n=100 19.alb | 1 | 0 | Optimal | 120.03 | 23 | 23.00 | 0.00 |
| instance n=100 190.alb | 1 | 0 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=100 191.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 192.alb | 1 | 0 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=100 193.alb | 1 | 0 | Optimal | 40.76 | 15 | 15.00 | 0.00 |
| instance n=100 194.alb | 1 | 0 | Optimal | 0.23 | 15 | 15.00 | 0.00 |
| instance n=100 195.alb | 1 | 0 | Optimal | 0.27 | 15 | 15.00 | 0.00 |
| instance n=100 196.alb | 1 | 0 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 197.alb | 1 | 0 | Optimal | 3.96 | 15 | 15.00 | 0.00 |
| instance n=100 198.alb | 1 | 0 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=100 199.alb | 1 | 0 | Optimal | 0.11 | 14 | 14.00 | 0.00 |
| instance n=100 2.alb | 1 | 0 | Optimal | 120.04 | 21 | 21.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 20.alb | 1 | 0 | Optimal | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 200.alb | 1 | 0 | Optimal | 43.68 | 15 | 15.00 | 0.00 |
| instance n=100 201.alb | 1 | 0 | Solution | 120.11 | 53 | 52.00 | 1.89 |
| instance n=100 202.alb | 1 | 0 | Optimal | 120.06 | 61 | 61.00 | 0.00 |
| instance n=100 203.alb | 1 | 0 | Optimal | 120.04 | 52 | 52.00 | 0.00 |
| instance n=100 204.alb | 1 | 0 | Solution | 120.33 | 51 | 49.00 | 3.92 |
| instance n=100 205.alb | 1 | 0 | Solution | 120.11 | 57 | 56.00 | 1.75 |
| instance n=100 206.alb | 1 | 0 | Solution | 120.17 | 52 | 50.00 | 3.85 |
| instance n=100 207.alb | 1 | 0 | Solution | 120.12 | 51 | 50.00 | 1.96 |
| instance n=100 208.alb | 1 | 0 | Solution | 120.10 | 57 | 56.00 | 1.75 |
| instance n=100 209.alb | 1 | 0 | Solution | 120.16 | 55 | 54.00 | 1.82 |
| instance n=100 21.alb | 1 | 0 | Optimal | 0.59 | 21 | 21.00 | 0.00 |
| instance n=100 210.alb | 1 | 0 | Solution | 120.12 | 52 | 51.00 | 1.92 |
| instance n=100 211.alb | 1 | 0 | Optimal | 46.45 | 51 | 51.00 | 0.00 |
| instance n=100 212.alb | 1 | 0 | Solution | 120.12 | 52 | 51.00 | 1.92 |
| instance n=100 213.alb | 1 | 0 | Solution | 120.13 | 52 | 51.00 | 1.92 |
| instance n=100 214.alb | 1 | 0 | Solution | 120.48 | 55 | 53.00 | 3.64 |
| instance n=100 215.alb | 1 | 0 | Solution | 120.43 | 50 | 48.00 | 4.00 |
| instance n=100 216.alb | 1 | 0 | Solution | 120.12 | 52 | 51.00 | 1.92 |
| instance n=100 217.alb | 1 | 0 | Solution | 120.27 | 52 | 51.00 | 1.92 |
| instance n=100 218.alb | 1 | 0 | Solution | 120.11 | 53 | 52.00 | 1.89 |
| instance n=100 219.alb | 1 | 0 | Solution | 120.14 | 52 | 51.00 | 1.92 |
| instance n=100 22.alb | 1 | 0 | Solution | 120.09 | 25 | 24.00 | 4.00 |
| instance n=100 220.alb | 1 | 0 | Solution | 120.11 | 53 | 52.00 | 1.89 |
| instance n=100 221.alb | 1 | 0 | Solution | 120.12 | 57 | 56.00 | 1.75 |
| instance n=100 222.alb | 1 | 0 | Solution | 120.29 | 53 | 51.00 | 3.77 |
| instance n=100 223.alb | 1 | 0 | Solution | 120.13 | 51 | 50.00 | 1.96 |
| instance n=100 224.alb | 1 | 0 | Optimal | 120.06 | 55 | 55.00 | 0.00 |
| instance n=100 225.alb | 1 | 0 | Solution | 120.39 | 53 | 52.00 | 1.89 |
| instance n=100 226.alb | 1 | 0 | Solution | 120.11 | 25 | 24.00 | 4.00 |
| instance n=100 227.alb | 1 | 0 | Solution | 120.10 | 27 | 26.00 | 3.70 |
| instance n=100 228.alb | 1 | 0 | Optimal | 4.63 | 22 | 22.00 | 0.00 |
| instance n=100 229.alb | 1 | 0 | Optimal | 0.46 | 24 | 24.00 | 0.00 |
| instance n=100 23.alb | 1 | 0 | Optimal | 0.11 | 24 | 24.00 | 0.00 |
| instance n=100 230.alb | 1 | 0 | Optimal | 120.05 | 23 | 23.00 | 0.00 |
| instance n=100 231.alb | 1 | 0 | Optimal | 0.83 | 22 | 22.00 | 0.00 |
| instance n=100 232.alb | 1 | 0 | Optimal | 0.47 | 22 | 22.00 | 0.00 |
| instance n=100 233.alb | 1 | 0 | Solution | 120.10 | 23 | 22.00 | 4.35 |
| instance n=100 234.alb | 1 | 0 | Optimal | 0.48 | 23 | 23.00 | 0.00 |
| instance n=100 235.alb | 1 | 0 | Optimal | 0.64 | 26 | 26.00 | 0.00 |
| instance n=100 236.alb | 1 | 0 | Solution | 120.10 | 23 | 22.00 | 4.35 |
| instance n=100 237.alb | 1 | 0 | Optimal | 0.47 | 23 | 23.00 | 0.00 |
| instance n=100 238.alb | 1 | 0 | Optimal | 4.08 | 23 | 23.00 | 0.00 |
| instance n=100 239.alb | 1 | 0 | Optimal | 0.24 | 21 | 21.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 24.alb | 1 | 0 | Optimal | 4.05 | 24 | 24.00 | 0.00 |
| instance n=100 240.alb | 1 | 0 | Optimal | 2.53 | 22 | 22.00 | 0.00 |
| instance n=100 241.alb | 1 | 0 | Optimal | 38.36 | 22 | 22.00 | 0.00 |
| instance n=100 242.alb | 1 | 0 | Optimal | 2.22 | 23 | 23.00 | 0.00 |
| instance n=100 243.alb | 1 | 0 | Solution | 120.09 | 24 | 23.00 | 4.17 |
| instance n=100 244.alb | 1 | 0 | Optimal | 3.28 | 21 | 21.00 | 0.00 |
| instance n=100 245.alb | 1 | 0 | Solution | 120.53 | 24 | 23.00 | 4.17 |
| instance n=100 246.alb | 1 | 0 | Optimal | 1.04 | 26 | 26.00 | 0.00 |
| instance n=100 247.alb | 1 | 0 | Optimal | 12.65 | 22 | 22.00 | 0.00 |
| instance n=100 248.alb | 1 | 0 | Optimal | 34.41 | 19 | 19.00 | 0.00 |
| instance n=100 249.alb | 1 | 0 | Optimal | 1.41 | 21 | 21.00 | 0.00 |
| instance n=100 25.alb | 1 | 0 | Optimal | 120.03 | 22 | 22.00 | 0.00 |
| instance n=100 250.alb | 1 | 0 | Optimal | 0.56 | 24 | 24.00 | 0.00 |
| instance n=100 251.alb | 1 | 0 | Optimal | 0.11 | 15 | 15.00 | 0.00 |
| instance n=100 252.alb | 1 | 0 | Optimal | 0.44 | 14 | 14.00 | 0.00 |
| instance n=100 253.alb | 1 | 0 | Optimal | 0.10 | 14 | 14.00 | 0.00 |
| instance n=100 254.alb | 1 | 0 | Optimal | 0.34 | 14 | 14.00 | 0.00 |
| instance n=100 255.alb | 1 | 0 | Optimal | 0.14 | 14 | 14.00 | 0.00 |
| instance n=100 256.alb | 1 | 0 | Optimal | 34.15 | 15 | 15.00 | 0.00 |
| instance n=100 257.alb | 1 | 0 | Optimal | 120.03 | 12 | 12.00 | 0.00 |
| instance n=100 258.alb | 1 | 0 | Optimal | 3.00 | 14 | 14.00 | 0.00 |
| instance n=100 259.alb | 1 | 0 | Optimal | 0.57 | 15 | 15.00 | 0.00 |
| instance n=100 26.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 260.alb | 1 | 0 | Optimal | 5.78 | 15 | 15.00 | 0.00 |
| instance n=100 261.alb | 1 | 0 | Optimal | 0.09 | 14 | 14.00 | 0.00 |
| instance n=100 262.alb | 1 | 0 | Optimal | 0.03 | 14 | 14.00 | 0.00 |
| instance n=100 263.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 264.alb | 1 | 0 | Optimal | 2.65 | 15 | 15.00 | 0.00 |
| instance n=100 265.alb | 1 | 0 | Optimal | 0.10 | 14 | 14.00 | 0.00 |
| instance n=100 266.alb | 1 | 0 | Optimal | 0.44 | 13 | 13.00 | 0.00 |
| instance n=100 267.alb | 1 | 0 | Optimal | 0.58 | 13 | 13.00 | 0.00 |
| instance n=100 268.alb | 1 | 0 | Optimal | 0.09 | 15 | 15.00 | 0.00 |
| instance n=100 269.alb | 1 | 0 | Optimal | 0.10 | 15 | 15.00 | 0.00 |
| instance n=100 27.alb | 1 | 0 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=100 270.alb | 1 | 0 | Optimal | 0.10 | 13 | 13.00 | 0.00 |
| instance n=100 271.alb | 1 | 0 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=100 272.alb | 1 | 0 | Optimal | 0.11 | 14 | 14.00 | 0.00 |
| instance n=100 273.alb | 1 | 0 | Optimal | 11.72 | 13 | 13.00 | 0.00 |
| instance n=100 274.alb | 1 | 0 | Optimal | 2.00 | 13 | 13.00 | 0.00 |
| instance n=100 275.alb | 1 | 0 | Optimal | 0.09 | 13 | 13.00 | 0.00 |
| instance n=100 276.alb | 1 | 0 | Solution | 120.12 | 60 | 58.00 | 3.33 |
| instance n=100 277.alb | 1 | 0 | Solution | 120.14 | 57 | 54.00 | 5.26 |
| instance n=100 278.alb | 1 | 0 | Solution | 120.13 | 57 | 55.00 | 3.51 |
| instance n=100 279.alb | 1 | 0 | Solution | 120.11 | 53 | 52.00 | 1.89 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 28.alb | 1 | 0 | Optimal | 0.44 | 14 | 14.00 | 0.00 |
| instance n=100 280.alb | 1 | 0 | Solution | 120.11 | 55 | 52.00 | 5.45 |
| instance n=100 281.alb | 1 | 0 | Solution | 121.37 | 62 | 60.00 | 3.23 |
| instance n=100 282.alb | 1 | 0 | Solution | 120.14 | 60 | 57.00 | 5.00 |
| instance n=100 283.alb | 1 | 0 | Solution | 120.14 | 55 | 53.00 | 3.64 |
| instance n=100 284.alb | 1 | 0 | Solution | 120.12 | 55 | 54.00 | 1.82 |
| instance n=100 285.alb | 1 | 0 | Solution | 120.13 | 55 | 52.00 | 5.45 |
| instance n=100 286.alb | 1 | 0 | Solution | 120.16 | 56 | 55.00 | 1.79 |
| instance n=100 287.alb | 1 | 0 | Optimal | 9.49 | 54 | 54.00 | 0.00 |
| instance n=100 288.alb | 1 | 0 | Solution | 120.35 | 56 | 53.00 | 5.36 |
| instance n=100 289.alb | 1 | 0 | Optimal | 45.20 | 62 | 62.00 | 0.00 |
| instance n=100 29.alb | 1 | 0 | Optimal | 74.27 | 14 | 14.00 | 0.00 |
| instance n=100 290.alb | 1 | 0 | Solution | 120.12 | 54 | 52.00 | 3.70 |
| instance n=100 291.alb | 1 | 0 | Solution | 120.11 | 52 | 49.00 | 5.77 |
| instance n=100 292.alb | 1 | 0 | Solution | 120.12 | 57 | 55.00 | 3.51 |
| instance n=100 293.alb | 1 | 0 | Solution | 120.14 | 52 | 50.00 | 3.85 |
| instance n=100 294.alb | 1 | 0 | Solution | 120.12 | 57 | 54.00 | 5.26 |
| instance n=100 295.alb | 1 | 0 | Solution | 120.12 | 56 | 55.00 | 1.79 |
| instance n=100 296.alb | 1 | 0 | Solution | 120.11 | 55 | 53.00 | 3.64 |
| instance n=100 297.alb | 1 | 0 | Optimal | 93.01 | 58 | 58.00 | 0.00 |
| instance n=100 298.alb | 1 | 0 | Solution | 120.22 | 58 | 57.00 | 1.72 |
| instance n=100 299.alb | 1 | 0 | Solution | 120.13 | 55 | 54.00 | 1.82 |
| instance n=100 3.alb | 1 | 0 | Optimal | 0.33 | 20 | 20.00 | 0.00 |
| instance n=100 30.alb | 1 | 0 | Optimal | 120.03 | 15 | 15.00 | 0.00 |
| instance n=100 300.alb | 1 | 0 | Solution | 120.14 | 54 | 51.00 | 5.56 |
| instance n=100 301.alb | 1 | 0 | Optimal | 120.03 | 23 | 23.00 | 0.00 |
| instance n=100 302.alb | 1 | 0 | Optimal | 0.56 | 24 | 24.00 | 0.00 |
| instance n=100 303.alb | 1 | 0 | Optimal | 120.04 | 24 | 24.00 | 0.00 |
| instance n=100 304.alb | 1 | 0 | Optimal | 0.48 | 21 | 21.00 | 0.00 |
| instance n=100 305.alb | 1 | 0 | Optimal | 63.57 | 22 | 22.00 | 0.00 |
| instance n=100 306.alb | 1 | 0 | Optimal | 1.61 | 24 | 24.00 | 0.00 |
| instance n=100 307.alb | 1 | 0 | Solution | 120.09 | 24 | 23.00 | 4.17 |
| instance n=100 308.alb | 1 | 0 | Optimal | 120.07 | 20 | 20.00 | 0.00 |
| instance n=100 309.alb | 1 | 0 | Solution | 120.10 | 22 | 21.00 | 4.55 |
| instance n=100 31.alb | 1 | 0 | Optimal | 0.10 | 14 | 14.00 | 0.00 |
| instance n=100 310.alb | 1 | 0 | Optimal | 0.15 | 23 | 23.00 | 0.00 |
| instance n=100 311.alb | 1 | 0 | Optimal | 2.57 | 21 | 21.00 | 0.00 |
| instance n=100 312.alb | 1 | 0 | Optimal | 120.03 | 22 | 22.00 | 0.00 |
| instance n=100 313.alb | 1 | 0 | Optimal | 27.59 | 23 | 23.00 | 0.00 |
| instance n=100 314.alb | 1 | 0 | Optimal | 0.59 | 19 | 19.00 | 0.00 |
| instance n=100 315.alb | 1 | 0 | Optimal | 120.03 | 22 | 22.00 | 0.00 |
| instance n=100 316.alb | 1 | 0 | Optimal | 120.04 | 24 | 24.00 | 0.00 |
| instance n=100 317.alb | 1 | 0 | Optimal | 0.26 | 26 | 26.00 | 0.00 |
| instance n=100 318.alb | 1 | 0 | Optimal | 0.24 | 21 | 21.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 319.alb | 1 | 0 | Optimal | 0.43 | 23 | 23.00 | 0.00 |
| instance n=100 32.alb | 1 | 0 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 320.alb | 1 | 0 | Optimal | 0.11 | 22 | 22.00 | 0.00 |
| instance n=100 321.alb | 1 | 0 | Optimal | 3.31 | 26 | 26.00 | 0.00 |
| instance n=100 322.alb | 1 | 0 | Solution | 120.11 | 24 | 23.00 | 4.17 |
| instance n=100 323.alb | 1 | 0 | Optimal | 13.16 | 24 | 24.00 | 0.00 |
| instance n=100 324.alb | 1 | 0 | Optimal | 0.11 | 23 | 23.00 | 0.00 |
| instance n=100 325.alb | 1 | 0 | Optimal | 120.08 | 25 | 25.00 | 0.00 |
| instance n=100 326.alb | 1 | 0 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=100 327.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 328.alb | 1 | 0 | Solution | 120.18 | 15 | 14.00 | 6.67 |
| instance n=100 329.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 33.alb | 1 | 0 | Optimal | 1.81 | 15 | 15.00 | 0.00 |
| instance n=100 330.alb | 1 | 0 | Optimal | 39.16 | 14 | 14.00 | 0.00 |
| instance n=100 331.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 332.alb | 1 | 0 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 333.alb | 1 | 0 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 334.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 335.alb | 1 | 0 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=100 336.alb | 1 | 0 | Optimal | 120.03 | 15 | 15.00 | 0.00 |
| instance n=100 337.alb | 1 | 0 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=100 338.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 339.alb | 1 | 0 | Optimal | 6.68 | 14 | 14.00 | 0.00 |
| instance n=100 34.alb | 1 | 0 | Optimal | 29.63 | 15 | 15.00 | 0.00 |
| instance n=100 340.alb | 1 | 0 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 341.alb | 1 | 0 | Optimal | 120.01 | 16 | 16.00 | 0.00 |
| instance n=100 342.alb | 1 | 0 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 343.alb | 1 | 0 | Optimal | 120.03 | 16 | 16.00 | 0.00 |
| instance n=100 344.alb | 1 | 0 | Optimal | 57.97 | 15 | 15.00 | 0.00 |
| instance n=100 345.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 346.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 347.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 348.alb | 1 | 0 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 349.alb | 1 | 0 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=100 35.alb | 1 | 0 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 350.alb | 1 | 0 | Optimal | 27.41 | 14 | 14.00 | 0.00 |
| instance n=100 351.alb | 1 | 0 | Solution | 120.11 | 59 | 58.00 | 1.69 |
| instance n=100 352.alb | 1 | 0 | Optimal | 0.14 | 63 | 63.00 | 0.00 |
| instance n=100 353.alb | 1 | 0 | Solution | 120.25 | 52 | 50.00 | 3.85 |
| instance n=100 354.alb | 1 | 0 | Solution | 120.12 | 52 | 51.00 | 1.92 |
| instance n=100 355.alb | 1 | 0 | Solution | 120.56 | 55 | 53.00 | 3.64 |
| instance n=100 356.alb | 1 | 0 | Solution | 120.15 | 60 | 59.00 | 1.67 |
| instance n=100 357.alb | 1 | 0 | Optimal | 120.07 | 53 | 53.00 | 0.00 |
| instance n=100 358.alb | 1 | 0 | Solution | 120.12 | 52 | 51.00 | 1.92 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 359.alb | 1 | 0 | Solution | 120.11 | 53 | 52.00 | 1.89 |
| instance n=100 36.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 360.alb | 1 | 0 | Optimal | 46.00 | 54 | 54.00 | 0.00 |
| instance n=100 361.alb | 1 | 0 | Solution | 120.12 | 52 | 50.00 | 3.85 |
| instance n=100 362.alb | 1 | 0 | Optimal | 120.07 | 57 | 57.00 | 0.00 |
| instance n=100 363.alb | 1 | 0 | Solution | 120.11 | 53 | 51.00 | 3.77 |
| instance n=100 364.alb | 1 | 0 | Solution | 120.14 | 52 | 51.00 | 1.92 |
| instance n=100 365.alb | 1 | 0 | Solution | 120.13 | 53 | 52.00 | 1.89 |
| instance n=100 366.alb | 1 | 0 | Optimal | 120.03 | 61 | 61.00 | 0.00 |
| instance n=100 367.alb | 1 | 0 | Optimal | 120.06 | 55 | 55.00 | 0.00 |
| instance n=100 368.alb | 1 | 0 | Optimal | 120.05 | 58 | 58.00 | 0.00 |
| instance n=100 369.alb | 1 | 0 | Solution | 120.12 | 51 | 50.00 | 1.96 |
| instance n=100 37.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 370.alb | 1 | 0 | Solution | 120.12 | 57 | 56.00 | 1.75 |
| instance n=100 371.alb | 1 | 0 | Solution | 120.13 | 53 | 51.00 | 3.77 |
| instance n=100 372.alb | 1 | 0 | Solution | 120.13 | 49 | 48.00 | 2.04 |
| instance n=100 373.alb | 1 | 0 | Solution | 120.53 | 51 | 50.00 | 1.96 |
| instance n=100 374.alb | 1 | 0 | Solution | 120.12 | 52 | 51.00 | 1.92 |
| instance n=100 375.alb | 1 | 0 | Optimal | 120.03 | 57 | 57.00 | 0.00 |
| instance n=100 376.alb | 1 | 0 | Optimal | 0.21 | 23 | 23.00 | 0.00 |
| instance n=100 377.alb | 1 | 0 | Solution | 120.39 | 21 | 20.00 | 4.76 |
| instance n=100 378.alb | 1 | 0 | Optimal | 13.14 | 22 | 22.00 | 0.00 |
| instance n=100 379.alb | 1 | 0 | Optimal | 120.03 | 23 | 23.00 | 0.00 |
| instance n=100 38.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 380.alb | 1 | 0 | Solution | 120.10 | 23 | 22.00 | 4.35 |
| instance n=100 381.alb | 1 | 0 | Optimal | 0.59 | 24 | 24.00 | 0.00 |
| instance n=100 382.alb | 1 | 0 | Optimal | 120.03 | 25 | 25.00 | 0.00 |
| instance n=100 383.alb | 1 | 0 | Optimal | 0.23 | 25 | 25.00 | 0.00 |
| instance n=100 384.alb | 1 | 0 | Optimal | 1.10 | 25 | 25.00 | 0.00 |
| instance n=100 385.alb | 1 | 0 | Optimal | 0.10 | 22 | 22.00 | 0.00 |
| instance n=100 386.alb | 1 | 0 | Solution | 120.10 | 24 | 23.00 | 4.17 |
| instance n=100 387.alb | 1 | 0 | Optimal | 0.11 | 22 | 22.00 | 0.00 |
| instance n=100 388.alb | 1 | 0 | Optimal | 94.23 | 25 | 25.00 | 0.00 |
| instance n=100 389.alb | 1 | 0 | Optimal | 1.34 | 23 | 23.00 | 0.00 |
| instance n=100 39.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 390.alb | 1 | 0 | Optimal | 26.72 | 22 | 22.00 | 0.00 |
| instance n=100 391.alb | 1 | 0 | Optimal | 0.45 | 20 | 20.00 | 0.00 |
| instance n=100 392.alb | 1 | 0 | Optimal | 0.12 | 22 | 22.00 | 0.00 |
| instance n=100 393.alb | 1 | 0 | Solution | 120.10 | 24 | 23.00 | 4.17 |
| instance n=100 394.alb | 1 | 0 | Optimal | 0.58 | 22 | 22.00 | 0.00 |
| instance n=100 395.alb | 1 | 0 | Optimal | 2.06 | 24 | 24.00 | 0.00 |
| instance n=100 396.alb | 1 | 0 | Optimal | 75.42 | 20 | 20.00 | 0.00 |
| instance n=100 397.alb | 1 | 0 | Solution | 120.14 | 26 | 25.00 | 3.85 |
| instance n=100 398.alb | 1 | 0 | Optimal | 120.04 | 25 | 25.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 399.alb | 1 | 0 | Optimal | 1.48 | 23 | 23.00 | 0.00 |
| instance n=100 4.alb | 1 | 0 | Optimal | 1.52 | 24 | 24.00 | 0.00 |
| instance n=100 40.alb | 1 | 0 | Optimal | 1.30 | 14 | 14.00 | 0.00 |
| instance n=100 400.alb | 1 | 0 | Optimal | 0.56 | 24 | 24.00 | 0.00 |
| instance n=100 401.alb | 1 | 0 | Optimal | 0.09 | 15 | 15.00 | 0.00 |
| instance n=100 402.alb | 1 | 0 | Optimal | 0.57 | 15 | 15.00 | 0.00 |
| instance n=100 403.alb | 1 | 0 | Optimal | 0.97 | 14 | 14.00 | 0.00 |
| instance n=100 404.alb | 1 | 0 | Optimal | 0.09 | 15 | 15.00 | 0.00 |
| instance n=100 405.alb | 1 | 0 | Optimal | 1.16 | 13 | 13.00 | 0.00 |
| instance n=100 406.alb | 1 | 0 | Optimal | 0.10 | 14 | 14.00 | 0.00 |
| instance n=100 407.alb | 1 | 0 | Optimal | 0.16 | 15 | 15.00 | 0.00 |
| instance n=100 408.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 409.alb | 1 | 0 | Optimal | 0.10 | 15 | 15.00 | 0.00 |
| instance n=100 41.alb | 1 | 0 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=100 410.alb | 1 | 0 | Optimal | 0.10 | 14 | 14.00 | 0.00 |
| instance n=100 411.alb | 1 | 0 | Optimal | 5.46 | 14 | 14.00 | 0.00 |
| instance n=100 412.alb | 1 | 0 | Optimal | 0.11 | 14 | 14.00 | 0.00 |
| instance n=100 413.alb | 1 | 0 | Optimal | 0.29 | 14 | 14.00 | 0.00 |
| instance n=100 414.alb | 1 | 0 | Optimal | 120.04 | 14 | 14.00 | 0.00 |
| instance n=100 415.alb | 1 | 0 | Optimal | 15.44 | 13 | 13.00 | 0.00 |
| instance n=100 416.alb | 1 | 0 | Optimal | 0.23 | 14 | 14.00 | 0.00 |
| instance n=100 417.alb | 1 | 0 | Optimal | 0.11 | 15 | 15.00 | 0.00 |
| instance n=100 418.alb | 1 | 0 | Optimal | 0.11 | 16 | 16.00 | 0.00 |
| instance n=100 419.alb | 1 | 0 | Optimal | 1.55 | 14 | 14.00 | 0.00 |
| instance n=100 42.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 420.alb | 1 | 0 | Optimal | 0.11 | 14 | 14.00 | 0.00 |
| instance n=100 421.alb | 1 | 0 | Optimal | 1.01 | 14 | 14.00 | 0.00 |
| instance n=100 422.alb | 1 | 0 | Optimal | 0.10 | 15 | 15.00 | 0.00 |
| instance n=100 423.alb | 1 | 0 | Optimal | 1.00 | 14 | 14.00 | 0.00 |
| instance n=100 424.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 425.alb | 1 | 0 | Optimal | 39.57 | 15 | 15.00 | 0.00 |
| instance n=100 426.alb | 1 | 0 | Solution | 120.12 | 60 | 58.00 | 3.33 |
| instance n=100 427.alb | 1 | 0 | Solution | 120.13 | 55 | 54.00 | 1.82 |
| instance n=100 428.alb | 1 | 0 | Solution | 120.13 | 55 | 54.00 | 1.82 |
| instance n=100 429.alb | 1 | 0 | Solution | 120.12 | 58 | 57.00 | 1.72 |
| instance n=100 43.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 430.alb | 1 | 0 | Solution | 120.13 | 53 | 52.00 | 1.89 |
| instance n=100 431.alb | 1 | 0 | Solution | 120.13 | 54 | 52.00 | 3.70 |
| instance n=100 432.alb | 1 | 0 | Solution | 120.11 | 56 | 54.00 | 3.57 |
| instance n=100 433.alb | 1 | 0 | Optimal | 62.53 | 52 | 52.00 | 0.00 |
| instance n=100 434.alb | 1 | 0 | Solution | 120.14 | 56 | 55.00 | 1.79 |
| instance n=100 435.alb | 1 | 0 | Solution | 121.23 | 56 | 52.00 | 7.14 |
| instance n=100 436.alb | 1 | 0 | Solution | 120.11 | 52 | 49.00 | 5.77 |
| instance n=100 437.alb | 1 | 0 | Solution | 120.15 | 53 | 51.00 | 3.77 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 438.alb | 1 | 0 | Solution | 120.36 | 55 | 52.00 | 5.45 |
| instance n=100 439.alb | 1 | 0 | Solution | 120.38 | 55 | 54.00 | 1.82 |
| instance n=100 44.alb | 1 | 0 | Optimal | 0.09 | 14 | 14.00 | 0.00 |
| instance n=100 440.alb | 1 | 0 | Solution | 120.24 | 53 | 51.00 | 3.77 |
| instance n=100 441.alb | 1 | 0 | Solution | 120.13 | 52 | 51.00 | 1.92 |
| instance n=100 442.alb | 1 | 0 | Solution | 120.11 | 52 | 49.00 | 5.77 |
| instance n=100 443.alb | 1 | 0 | Solution | 120.14 | 55 | 53.00 | 3.64 |
| instance n=100 444.alb | 1 | 0 | Solution | 120.14 | 54 | 50.00 | 7.41 |
| instance n=100 445.alb | 1 | 0 | Solution | 120.13 | 55 | 54.00 | 1.82 |
| instance n=100 446.alb | 1 | 0 | Solution | 120.15 | 57 | 54.00 | 5.26 |
| instance n=100 447.alb | 1 | 0 | Solution | 120.39 | 54 | 52.00 | 3.70 |
| instance n=100 448.alb | 1 | 0 | Solution | 120.19 | 55 | 54.00 | 1.82 |
| instance n=100 449.alb | 1 | 0 | Solution | 120.15 | 55 | 52.00 | 5.45 |
| instance n=100 45.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 450.alb | 1 | 0 | Solution | 121.22 | 53 | 52.00 | 1.89 |
| instance n=100 451.alb | 1 | 0 | Optimal | 0.19 | 26 | 26.00 | 0.00 |
| instance n=100 452.alb | 1 | 0 | Optimal | 0.45 | 22 | 22.00 | 0.00 |
| instance n=100 453.alb | 1 | 0 | Optimal | 0.40 | 24 | 24.00 | 0.00 |
| instance n=100 454.alb | 1 | 0 | Optimal | 0.15 | 23 | 23.00 | 0.00 |
| instance n=100 455.alb | 1 | 0 | Optimal | 0.51 | 23 | 23.00 | 0.00 |
| instance n=100 456.alb | 1 | 0 | Optimal | 0.39 | 26 | 26.00 | 0.00 |
| instance n=100 457.alb | 1 | 0 | Optimal | 0.38 | 23 | 23.00 | 0.00 |
| instance n=100 458.alb | 1 | 0 | Optimal | 0.18 | 24 | 24.00 | 0.00 |
| instance n=100 459.alb | 1 | 0 | Optimal | 0.31 | 23 | 23.00 | 0.00 |
| instance n=100 46.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 460.alb | 1 | 0 | Optimal | 0.16 | 23 | 23.00 | 0.00 |
| instance n=100 461.alb | 1 | 0 | Optimal | 1.55 | 23 | 23.00 | 0.00 |
| instance n=100 462.alb | 1 | 0 | Optimal | 0.32 | 23 | 23.00 | 0.00 |
| instance n=100 463.alb | 1 | 0 | Optimal | 0.68 | 26 | 26.00 | 0.00 |
| instance n=100 464.alb | 1 | 0 | Optimal | 0.14 | 25 | 25.00 | 0.00 |
| instance n=100 465.alb | 1 | 0 | Optimal | 0.65 | 22 | 22.00 | 0.00 |
| instance n=100 466.alb | 1 | 0 | Optimal | 0.40 | 26 | 26.00 | 0.00 |
| instance n=100 467.alb | 1 | 0 | Optimal | 1.69 | 21 | 21.00 | 0.00 |
| instance n=100 468.alb | 1 | 0 | Optimal | 0.58 | 25 | 25.00 | 0.00 |
| instance n=100 469.alb | 1 | 0 | Optimal | 0.14 | 22 | 22.00 | 0.00 |
| instance n=100 47.alb | 1 | 0 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 470.alb | 1 | 0 | Optimal | 1.43 | 26 | 26.00 | 0.00 |
| instance n=100 471.alb | 1 | 0 | Optimal | 0.55 | 26 | 26.00 | 0.00 |
| instance n=100 472.alb | 1 | 0 | Optimal | 0.24 | 23 | 23.00 | 0.00 |
| instance n=100 473.alb | 1 | 0 | Optimal | 0.48 | 28 | 28.00 | 0.00 |
| instance n=100 474.alb | 1 | 0 | Optimal | 0.44 | 23 | 23.00 | 0.00 |
| instance n=100 475.alb | 1 | 0 | Optimal | 1.21 | 24 | 24.00 | 0.00 |
| instance n=100 476.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 477.alb | 1 | 0 | Optimal | 0.11 | 14 | 14.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 478.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 479.alb | 1 | 0 | Optimal | 0.30 | 16 | 16.00 | 0.00 |
| instance n=100 48.alb | 1 | 0 | Optimal | 120.03 | 15 | 15.00 | 0.00 |
| instance n=100 480.alb | 1 | 0 | Optimal | 0.09 | 15 | 15.00 | 0.00 |
| instance n=100 481.alb | 1 | 0 | Optimal | 0.13 | 15 | 15.00 | 0.00 |
| instance n=100 482.alb | 1 | 0 | Optimal | 0.46 | 15 | 15.00 | 0.00 |
| instance n=100 483.alb | 1 | 0 | Optimal | 0.18 | 14 | 14.00 | 0.00 |
| instance n=100 484.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 485.alb | 1 | 0 | Optimal | 1.44 | 16 | 16.00 | 0.00 |
| instance n=100 486.alb | 1 | 0 | Optimal | 0.09 | 15 | 15.00 | 0.00 |
| instance n=100 487.alb | 1 | 0 | Optimal | 0.19 | 15 | 15.00 | 0.00 |
| instance n=100 488.alb | 1 | 0 | Optimal | 0.41 | 16 | 16.00 | 0.00 |
| instance n=100 489.alb | 1 | 0 | Optimal | 0.67 | 13 | 13.00 | 0.00 |
| instance n=100 49.alb | 1 | 0 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 490.alb | 1 | 0 | Optimal | 0.10 | 15 | 15.00 | 0.00 |
| instance n=100 491.alb | 1 | 0 | Optimal | 1.63 | 16 | 16.00 | 0.00 |
| instance n=100 492.alb | 1 | 0 | Optimal | 0.48 | 14 | 14.00 | 0.00 |
| instance n=100 493.alb | 1 | 0 | Optimal | 0.34 | 14 | 14.00 | 0.00 |
| instance n=100 494.alb | 1 | 0 | Optimal | 0.09 | 14 | 14.00 | 0.00 |
| instance n=100 495.alb | 1 | 0 | Optimal | 0.09 | 15 | 15.00 | 0.00 |
| instance n=100 496.alb | 1 | 0 | Optimal | 0.24 | 14 | 14.00 | 0.00 |
| instance n=100 497.alb | 1 | 0 | Optimal | 0.11 | 13 | 13.00 | 0.00 |
| instance n=100 498.alb | 1 | 0 | Optimal | 0.10 | 14 | 14.00 | 0.00 |
| instance n=100 499.alb | 1 | 0 | Optimal | 0.13 | 14 | 14.00 | 0.00 |
| instance n=100 5.alb | 1 | 0 | Optimal | 0.10 | 22 | 22.00 | 0.00 |
| instance n=100 50.alb | 1 | 0 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 500.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=100 501.alb | 1 | 0 | Optimal | 1.75 | 62 | 62.00 | 0.00 |
| instance n=100 502.alb | 1 | 0 | Optimal | 0.37 | 64 | 64.00 | 0.00 |
| instance n=100 503.alb | 1 | 0 | Optimal | 1.27 | 60 | 60.00 | 0.00 |
| instance n=100 504.alb | 1 | 0 | Optimal | 9.11 | 60 | 60.00 | 0.00 |
| instance n=100 505.alb | 1 | 0 | Optimal | 0.40 | 61 | 61.00 | 0.00 |
| instance n=100 506.alb | 1 | 0 | Optimal | 0.67 | 57 | 57.00 | 0.00 |
| instance n=100 507.alb | 1 | 0 | Optimal | 4.43 | 59 | 59.00 | 0.00 |
| instance n=100 508.alb | 1 | 0 | Optimal | 2.32 | 56 | 56.00 | 0.00 |
| instance n=100 509.alb | 1 | 0 | Optimal | 0.98 | 57 | 57.00 | 0.00 |
| instance n=100 51.alb | 1 | 0 | Solution | 120.12 | 50 | 49.00 | 2.00 |
| instance n=100 510.alb | 1 | 0 | Optimal | 5.09 | 58 | 58.00 | 0.00 |
| instance n=100 511.alb | 1 | 0 | Optimal | 3.50 | 59 | 59.00 | 0.00 |
| instance n=100 512.alb | 1 | 0 | Optimal | 0.33 | 60 | 60.00 | 0.00 |
| instance n=100 513.alb | 1 | 0 | Optimal | 6.71 | 62 | 62.00 | 0.00 |
| instance n=100 514.alb | 1 | 0 | Optimal | 4.16 | 58 | 58.00 | 0.00 |
| instance n=100 515.alb | 1 | 0 | Optimal | 5.58 | 61 | 61.00 | 0.00 |
| instance n=100 516.alb | 1 | 0 | Optimal | 0.13 | 70 | 70.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 517.alb | 1 | 0 | Optimal | 1.97 | 62 | 62.00 | 0.00 |
| instance n=100 518.alb | 1 | 0 | Optimal | 1.34 | 57 | 57.00 | 0.00 |
| instance n=100 519.alb | 1 | 0 | Optimal | 0.83 | 61 | 61.00 | 0.00 |
| instance n=100 52.alb | 1 | 0 | Solution | 120.29 | 53 | 52.00 | 1.89 |
| instance n=100 520.alb | 1 | 0 | Optimal | 5.41 | 60 | 60.00 | 0.00 |
| instance n=100 521.alb | 1 | 0 | Optimal | 0.94 | 70 | 70.00 | 0.00 |
| instance n=100 522.alb | 1 | 0 | Optimal | 10.23 | 59 | 59.00 | 0.00 |
| instance n=100 523.alb | 1 | 0 | Optimal | 4.62 | 55 | 55.00 | 0.00 |
| instance n=100 524.alb | 1 | 0 | Optimal | 3.83 | 59 | 59.00 | 0.00 |
| instance n=100 525.alb | 1 | 0 | Optimal | 5.42 | 62 | 62.00 | 0.00 |
| instance n=100 53.alb | 1 | 0 | Optimal | 25.98 | 52 | 52.00 | 0.00 |
| instance n=100 54.alb | 1 | 0 | Optimal | 120.05 | 51 | 51.00 | 0.00 |
| instance n=100 55.alb | 1 | 0 | Solution | 120.10 | 53 | 52.00 | 1.89 |
| instance n=100 56.alb | 1 | 0 | Solution | 120.12 | 52 | 51.00 | 1.92 |
| instance n=100 57.alb | 1 | 0 | Solution | 120.11 | 54 | 53.00 | 1.85 |
| instance n=100 58.alb | 1 | 0 | Solution | 120.11 | 57 | 56.00 | 1.75 |
| instance n=100 59.alb | 1 | 0 | Optimal | 120.05 | 57 | 57.00 | 0.00 |
| instance n=100 6.alb | 1 | 0 | Optimal | 120.04 | 22 | 22.00 | 0.00 |
| instance n=100 60.alb | 1 | 0 | Solution | 120.18 | 54 | 53.00 | 1.85 |
| instance n=100 61.alb | 1 | 0 | Solution | 120.09 | 55 | 54.00 | 1.82 |
| instance n=100 62.alb | 1 | 0 | Solution | 120.17 | 52 | 50.00 | 3.85 |
| instance n=100 63.alb | 1 | 0 | Optimal | 120.05 | 61 | 61.00 | 0.00 |
| instance n=100 64.alb | 1 | 0 | Solution | 120.20 | 56 | 55.00 | 1.79 |
| instance n=100 65.alb | 1 | 0 | Solution | 120.11 | 62 | 61.00 | 1.61 |
| instance n=100 66.alb | 1 | 0 | Solution | 120.66 | 51 | 50.00 | 1.96 |
| instance n=100 67.alb | 1 | 0 | Solution | 120.14 | 55 | 54.00 | 1.82 |
| instance n=100 68.alb | 1 | 0 | Optimal | 0.23 | 57 | 57.00 | 0.00 |
| instance n=100 69.alb | 1 | 0 | Optimal | 120.03 | 53 | 53.00 | 0.00 |
| instance n=100 7.alb | 1 | 0 | Optimal | 6.66 | 26 | 26.00 | 0.00 |
| instance n=100 70.alb | 1 | 0 | Solution | 120.11 | 53 | 51.00 | 3.77 |
| instance n=100 71.alb | 1 | 0 | Solution | 120.11 | 53 | 52.00 | 1.89 |
| instance n=100 72.alb | 1 | 0 | Solution | 120.16 | 53 | 52.00 | 1.89 |
| instance n=100 73.alb | 1 | 0 | Solution | 120.12 | 56 | 55.00 | 1.79 |
| instance n=100 74.alb | 1 | 0 | Solution | 120.12 | 51 | 50.00 | 1.96 |
| instance n=100 75.alb | 1 | 0 | Optimal | 120.05 | 54 | 54.00 | 0.00 |
| instance n=100 76.alb | 1 | 0 | Optimal | 0.10 | 23 | 23.00 | 0.00 |
| instance n=100 77.alb | 1 | 0 | Optimal | 0.67 | 20 | 20.00 | 0.00 |
| instance n=100 78.alb | 1 | 0 | Optimal | 3.46 | 21 | 21.00 | 0.00 |
| instance n=100 79.alb | 1 | 0 | Optimal | 0.47 | 21 | 21.00 | 0.00 |
| instance n=100 8.alb | 1 | 0 | Optimal | 0.40 | 24 | 24.00 | 0.00 |
| instance n=100 80.alb | 1 | 0 | Optimal | 120.05 | 22 | 22.00 | 0.00 |
| instance n=100 81.alb | 1 | 0 | Optimal | 46.05 | 20 | 20.00 | 0.00 |
| instance n=100 82.alb | 1 | 0 | Optimal | 0.12 | 21 | 21.00 | 0.00 |
| instance n=100 83.alb | 1 | 0 | Optimal | 35.51 | 22 | 22.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 84.alb | 1 | 0 | Solution | 120.07 | 27 | 26.00 | 3.70 |
| instance n=100 85.alb | 1 | 0 | Solution | 120.06 | 25 | 24.00 | 4.00 |
| instance n=100 86.alb | 1 | 0 | Optimal | 0.71 | 23 | 23.00 | 0.00 |
| instance n=100 87.alb | 1 | 0 | Optimal | 0.54 | 22 | 22.00 | 0.00 |
| instance n=100 88.alb | 1 | 0 | Solution | 120.08 | 24 | 23.00 | 4.17 |
| instance n=100 89.alb | 1 | 0 | Optimal | 9.69 | 24 | 24.00 | 0.00 |
| instance n=100 9.alb | 1 | 0 | Optimal | 23.46 | 23 | 23.00 | 0.00 |
| instance n=100 90.alb | 1 | 0 | Solution | 120.06 | 21 | 20.00 | 4.76 |
| instance n=100 91.alb | 1 | 0 | Optimal | 0.50 | 25 | 25.00 | 0.00 |
| instance n=100 92.alb | 1 | 0 | Optimal | 0.12 | 24 | 24.00 | 0.00 |
| instance n=100 93.alb | 1 | 0 | Optimal | 120.03 | 27 | 27.00 | 0.00 |
| instance n=100 94.alb | 1 | 0 | Optimal | 120.04 | 22 | 22.00 | 0.00 |
| instance n=100 95.alb | 1 | 0 | Optimal | 2.14 | 21 | 21.00 | 0.00 |
| instance n=100 96.alb | 1 | 0 | Optimal | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 97.alb | 1 | 0 | Optimal | 0.55 | 22 | 22.00 | 0.00 |
| instance n=100 98.alb | 1 | 0 | Optimal | 15.98 | 22 | 22.00 | 0.00 |
| instance n=100 99.alb | 1 | 0 | Optimal | 0.51 | 22 | 22.00 | 0.00 |
| instance n=20 1.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 10.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 100.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 101.alb | 1 | 0 | Optimal | 0.29 | 13 | 13.00 | 0.00 |
| instance n=20 102.alb | 1 | 0 | Optimal | 0.12 | 13 | 13.00 | 0.00 |
| instance n=20 103.alb | 1 | 0 | Optimal | 0.12 | 12 | 12.00 | 0.00 |
| instance n=20 104.alb | 1 | 0 | Optimal | 0.01 | 11 | 11.00 | 0.00 |
| instance n=20 105.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 106.alb | 1 | 0 | Optimal | 0.13 | 10 | 10.00 | 0.00 |
| instance n=20 107.alb | 1 | 0 | Optimal | 0.06 | 14 | 14.00 | 0.00 |
| instance n=20 108.alb | 1 | 0 | Optimal | 0.02 | 15 | 15.00 | 0.00 |
| instance n=20 109.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=20 11.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 110.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 111.alb | 1 | 0 | Optimal | 0.04 | 13 | 13.00 | 0.00 |
| instance n=20 112.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 113.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 114.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 115.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 116.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 117.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 118.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 119.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 12.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 120.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=20 121.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 122.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 123.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 124.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 125.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 126.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 127.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 128.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 129.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 13.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 130.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 131.alb | 1 | 0 | Optimal | 0.02 | 7 | 7.00 | 0.00 |
| instance n=20 132.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 133.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 134.alb | 1 | 0 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 135.alb | 1 | 0 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 136.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 137.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 138.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 139.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 14.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 140.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 141.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 142.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 143.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 144.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 145.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 146.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 147.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 148.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 149.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 15.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 150.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 151.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 152.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 153.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 154.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 155.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 156.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 157.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 158.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 159.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 16.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 160.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 161.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 162.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 163.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 164.alb | 1 | 0 | Optimal | 0.11 | 4 | 4.00 | 0.00 |
| instance n=20 165.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 166.alb | 1 | 0 | Optimal | 0.13 | 12 | 12.00 | 0.00 |
| instance n=20 167.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 168.alb | 1 | 0 | Optimal | 0.02 | 10 | 10.00 | 0.00 |
| instance n=20 169.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 17.alb | 1 | 0 | Optimal | 0.03 | 10 | 10.00 | 0.00 |
| instance n=20 170.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 171.alb | 1 | 0 | Optimal | 0.16 | 13 | 13.00 | 0.00 |
| instance n=20 172.alb | 1 | 0 | Optimal | 0.01 | 11 | 11.00 | 0.00 |
| instance n=20 173.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=20 174.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=20 175.alb | 1 | 0 | Optimal | 0.11 | 10 | 10.00 | 0.00 |
| instance n=20 176.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 177.alb | 1 | 0 | Optimal | 0.36 | 10 | 10.00 | 0.00 |
| instance n=20 178.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 179.alb | 1 | 0 | Optimal | 0.01 | 11 | 11.00 | 0.00 |
| instance n=20 18.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 180.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 181.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 182.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 183.alb | 1 | 0 | Optimal | 0.12 | 13 | 13.00 | 0.00 |
| instance n=20 184.alb | 1 | 0 | Optimal | 0.01 | 12 | 12.00 | 0.00 |
| instance n=20 185.alb | 1 | 0 | Optimal | 0.02 | 15 | 15.00 | 0.00 |
| instance n=20 186.alb | 1 | 0 | Optimal | 0.82 | 14 | 14.00 | 0.00 |
| instance n=20 187.alb | 1 | 0 | Optimal | 0.03 | 10 | 10.00 | 0.00 |
| instance n=20 188.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=20 189.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 19.alb | 1 | 0 | Optimal | 0.05 | 14 | 14.00 | 0.00 |
| instance n=20 190.alb | 1 | 0 | Optimal | 0.05 | 15 | 15.00 | 0.00 |
| instance n=20 191.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 192.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 193.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 194.alb | 1 | 0 | Optimal | 0.04 | 6 | 6.00 | 0.00 |
| instance n=20 195.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 196.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 197.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 198.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 199.alb | 1 | 0 | Optimal | 0.10 | 5 | 5.00 | 0.00 |
| instance n=20 2.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 20.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 200.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 201.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 202.alb | 1 | 0 | Optimal | 0.10 | 4 | 4.00 | 0.00 |
| instance n=20 203.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 204.alb | 1 | 0 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 205.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 206.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 207.alb | 1 | 0 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 208.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 209.alb | 1 | 0 | Optimal | 0.03 | 4 | 4.00 | 0.00 |
| instance n=20 21.alb | 1 | 0 | Optimal | 0.02 | 14 | 14.00 | 0.00 |
| instance n=20 210.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 211.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 212.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 213.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 214.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 215.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 216.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 217.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 218.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 219.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 22.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 220.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 221.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 222.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 223.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 224.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 225.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 226.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 227.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 228.alb | 1 | 0 | Optimal | 0.01 | 2 | 2.00 | 0.00 |
| instance n=20 229.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 23.alb | 1 | 0 | Optimal | 0.09 | 13 | 13.00 | 0.00 |
| instance n=20 230.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 231.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 232.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 233.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 234.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 235.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 236.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 237.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 238.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 239.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 24.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 240.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 241.alb | 1 | 0 | Optimal | 0.10 | 13 | 13.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 242.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 243.alb | 1 | 0 | Optimal | 0.11 | 10 | 10.00 | 0.00 |
| instance n=20 244.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 245.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 246.alb | 1 | 0 | Optimal | 0.03 | 13 | 13.00 | 0.00 |
| instance n=20 247.alb | 1 | 0 | Optimal | 0.12 | 11 | 11.00 | 0.00 |
| instance n=20 248.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 249.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 25.alb | 1 | 0 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=20 250.alb | 1 | 0 | Optimal | 0.02 | 10 | 10.00 | 0.00 |
| instance n=20 251.alb | 1 | 0 | Optimal | 0.01 | 12 | 12.00 | 0.00 |
| instance n=20 252.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 253.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 254.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=20 255.alb | 1 | 0 | Optimal | 0.03 | 13 | 13.00 | 0.00 |
| instance n=20 256.alb | 1 | 0 | Optimal | 0.02 | 14 | 14.00 | 0.00 |
| instance n=20 257.alb | 1 | 0 | Optimal | 0.10 | 10 | 10.00 | 0.00 |
| instance n=20 258.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 259.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 26.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 260.alb | 1 | 0 | Optimal | 0.01 | 12 | 12.00 | 0.00 |
| instance n=20 261.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=20 262.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 263.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=20 264.alb | 1 | 0 | Optimal | 0.10 | 12 | 12.00 | 0.00 |
| instance n=20 265.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 266.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 267.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 268.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 269.alb | 1 | 0 | Optimal | 0.10 | 7 | 7.00 | 0.00 |
| instance n=20 27.alb | 1 | 0 | Optimal | 0.03 | 13 | 13.00 | 0.00 |
| instance n=20 270.alb | 1 | 0 | Optimal | 0.10 | 7 | 7.00 | 0.00 |
| instance n=20 271.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 272.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 273.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 274.alb | 1 | 0 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=20 275.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 276.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 277.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 278.alb | 1 | 0 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=20 279.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 28.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 280.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 281.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 282.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 283.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 284.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 285.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 286.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 287.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 288.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 289.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 29.alb | 1 | 0 | Optimal | 0.05 | 10 | 10.00 | 0.00 |
| instance n=20 290.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 291.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 292.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 293.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 294.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 295.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 296.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 297.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 298.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 299.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 3.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 30.alb | 1 | 0 | Optimal | 0.04 | 16 | 16.00 | 0.00 |
| instance n=20 300.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 301.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 302.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 303.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 304.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 305.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 306.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 307.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 308.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 309.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 31.alb | 1 | 0 | Optimal | 0.07 | 12 | 12.00 | 0.00 |
| instance n=20 310.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 311.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 312.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 313.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 314.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 315.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 316.alb | 1 | 0 | Optimal | 0.06 | 10 | 10.00 | 0.00 |
| instance n=20 317.alb | 1 | 0 | Optimal | 0.06 | 10 | 10.00 | 0.00 |
| instance n=20 318.alb | 1 | 0 | Optimal | 0.02 | 10 | 10.00 | 0.00 |
| instance n=20 319.alb | 1 | 0 | Optimal | 0.18 | 14 | 14.00 | 0.00 |
| instance n=20 32.alb | 1 | 0 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=20 320.alb | 1 | 0 | Optimal | 0.01 | 12 | 12.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 321.alb | 1 | 0 | Optimal | 1.08 | 14 | 14.00 | 0.00 |
| instance n=20 322.alb | 1 | 0 | Optimal | 0.31 | 12 | 12.00 | 0.00 |
| instance n=20 323.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 324.alb | 1 | 0 | Optimal | 0.07 | 9 | 9.00 | 0.00 |
| instance n=20 325.alb | 1 | 0 | Optimal | 0.02 | 14 | 14.00 | 0.00 |
| instance n=20 326.alb | 1 | 0 | Optimal | 0.53 | 14 | 14.00 | 0.00 |
| instance n=20 327.alb | 1 | 0 | Optimal | 1.12 | 13 | 13.00 | 0.00 |
| instance n=20 328.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 329.alb | 1 | 0 | Optimal | 0.06 | 10 | 10.00 | 0.00 |
| instance n=20 33.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 330.alb | 1 | 0 | Optimal | 0.09 | 12 | 12.00 | 0.00 |
| instance n=20 331.alb | 1 | 0 | Optimal | 0.08 | 13 | 13.00 | 0.00 |
| instance n=20 332.alb | 1 | 0 | Optimal | 0.05 | 13 | 13.00 | 0.00 |
| instance n=20 333.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 334.alb | 1 | 0 | Optimal | 0.07 | 10 | 10.00 | 0.00 |
| instance n=20 335.alb | 1 | 0 | Optimal | 0.02 | 14 | 14.00 | 0.00 |
| instance n=20 336.alb | 1 | 0 | Optimal | 0.01 | 11 | 11.00 | 0.00 |
| instance n=20 337.alb | 1 | 0 | Optimal | 0.05 | 10 | 10.00 | 0.00 |
| instance n=20 338.alb | 1 | 0 | Optimal | 0.10 | 14 | 14.00 | 0.00 |
| instance n=20 339.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 34.alb | 1 | 0 | Optimal | 0.11 | 12 | 12.00 | 0.00 |
| instance n=20 340.alb | 1 | 0 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=20 341.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 342.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 343.alb | 1 | 0 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 344.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 345.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 346.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 347.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 348.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 349.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 35.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=20 350.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 351.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 352.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 353.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 354.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 355.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 356.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 357.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 358.alb | 1 | 0 | Optimal | 0.03 | 4 | 4.00 | 0.00 |
| instance n=20 359.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 36.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 360.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 361.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 362.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 363.alb | 1 | 0 | Optimal | 0.92 | 7 | 7.00 | 0.00 |
| instance n=20 364.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 365.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 366.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 367.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 368.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 369.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 37.alb | 1 | 0 | Optimal | 0.01 | 12 | 12.00 | 0.00 |
| instance n=20 370.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 371.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 372.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 373.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 374.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 375.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 376.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 377.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 378.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 379.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 38.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 380.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 381.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 382.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 383.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 384.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 385.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 386.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 387.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 388.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 389.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 39.alb | 1 | 0 | Optimal | 0.05 | 13 | 13.00 | 0.00 |
| instance n=20 390.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 391.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 392.alb | 1 | 0 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=20 393.alb | 1 | 0 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=20 394.alb | 1 | 0 | Optimal | 0.12 | 12 | 12.00 | 0.00 |
| instance n=20 395.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 396.alb | 1 | 0 | Optimal | 0.10 | 13 | 13.00 | 0.00 |
| instance n=20 397.alb | 1 | 0 | Optimal | 0.11 | 10 | 10.00 | 0.00 |
| instance n=20 398.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 399.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 4.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 40.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 400.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=20 401.alb | 1 | 0 | Optimal | 0.12 | 12 | 12.00 | 0.00 |
| instance n=20 402.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 403.alb | 1 | 0 | Optimal | 0.01 | 12 | 12.00 | 0.00 |
| instance n=20 404.alb | 1 | 0 | Optimal | 0.10 | 10 | 10.00 | 0.00 |
| instance n=20 405.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 406.alb | 1 | 0 | Optimal | 0.01 | 14 | 14.00 | 0.00 |
| instance n=20 407.alb | 1 | 0 | Optimal | 0.03 | 10 | 10.00 | 0.00 |
| instance n=20 408.alb | 1 | 0 | Optimal | 0.11 | 14 | 14.00 | 0.00 |
| instance n=20 409.alb | 1 | 0 | Optimal | 0.10 | 12 | 12.00 | 0.00 |
| instance n=20 41.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 410.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 411.alb | 1 | 0 | Optimal | 0.11 | 15 | 15.00 | 0.00 |
| instance n=20 412.alb | 1 | 0 | Optimal | 0.12 | 11 | 11.00 | 0.00 |
| instance n=20 413.alb | 1 | 0 | Optimal | 0.03 | 10 | 10.00 | 0.00 |
| instance n=20 414.alb | 1 | 0 | Optimal | 0.11 | 12 | 12.00 | 0.00 |
| instance n=20 415.alb | 1 | 0 | Optimal | 0.02 | 10 | 10.00 | 0.00 |
| instance n=20 416.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 417.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 418.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 419.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 42.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 420.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 421.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=20 422.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 423.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 424.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 425.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 426.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 427.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 428.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 429.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 43.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 430.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 431.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 432.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 433.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 434.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 435.alb | 1 | 0 | Optimal | 0.01 | 7 | 7.00 | 0.00 |
| instance n=20 436.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 437.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 438.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 439.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 44.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 440.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 441.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 442.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 443.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 444.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 445.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 446.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 447.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 448.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 449.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 45.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=20 450.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 451.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 452.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 453.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 454.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 455.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 456.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 457.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 458.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 459.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 46.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 460.alb | 1 | 0 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 461.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 462.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 463.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 464.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 465.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 466.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 467.alb | 1 | 0 | Optimal | 0.01 | 14 | 14.00 | 0.00 |
| instance n=20 468.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 469.alb | 1 | 0 | Optimal | 0.02 | 14 | 14.00 | 0.00 |
| instance n=20 47.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 470.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 471.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 472.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 473.alb | 1 | 0 | Optimal | 0.01 | 10 | 10.00 | 0.00 |
| instance n=20 474.alb | 1 | 0 | Optimal | 0.02 | 14 | 14.00 | 0.00 |
| instance n=20 475.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 476.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 477.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 478.alb | 1 | 0 | Optimal | 0.01 | 12 | 12.00 | 0.00 |
| instance n=20 479.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 48.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 480.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 481.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 482.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 483.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 484.alb | 1 | 0 | Optimal | 0.01 | 13 | 13.00 | 0.00 |
| instance n=20 485.alb | 1 | 0 | Optimal | 0.02 | 15 | 15.00 | 0.00 |
| instance n=20 486.alb | 1 | 0 | Optimal | 0.02 | 11 | 11.00 | 0.00 |
| instance n=20 487.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 488.alb | 1 | 0 | Optimal | 0.01 | 15 | 15.00 | 0.00 |
| instance n=20 489.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 49.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 490.alb | 1 | 0 | Optimal | 0.02 | 12 | 12.00 | 0.00 |
| instance n=20 491.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 492.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 493.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 494.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 495.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 496.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 497.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 498.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=20 499.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 5.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 50.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 500.alb | 1 | 0 | Optimal | 0.02 | 8 | 8.00 | 0.00 |
| instance n=20 501.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 502.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 503.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 504.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 505.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 506.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 507.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 508.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 509.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 51.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 510.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 511.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 512.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 513.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 514.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 515.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=20 516.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 517.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 518.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 519.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 52.alb | 1 | 0 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 520.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 521.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 522.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 523.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 524.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 525.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 53.alb | 1 | 0 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 54.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 55.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 56.alb | 1 | 0 | Optimal | 0.03 | 4 | 4.00 | 0.00 |
| instance n=20 57.alb | 1 | 0 | Optimal | 0.01 | 4 | 4.00 | 0.00 |
| instance n=20 58.alb | 1 | 0 | Optimal | 0.10 | 5 | 5.00 | 0.00 |
| instance n=20 59.alb | 1 | 0 | Optimal | 0.11 | 4 | 4.00 | 0.00 |
| instance n=20 6.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 60.alb | 1 | 0 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 61.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=20 62.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 63.alb | 1 | 0 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 64.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 65.alb | 1 | 0 | Optimal | 0.02 | 5 | 5.00 | 0.00 |
| instance n=20 66.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 67.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 68.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 69.alb | 1 | 0 | Optimal | 0.01 | 2 | 2.00 | 0.00 |
| instance n=20 7.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 70.alb | 1 | 0 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 71.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 72.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 73.alb | 1 | 0 | Optimal | 0.01 | 2 | 2.00 | 0.00 |
| instance n=20 74.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 75.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 76.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 77.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 78.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 79.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 8.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 80.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 81.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 82.alb | 1 | 0 | Optimal | 0.03 | 4 | 4.00 | 0.00 |
| instance n=20 83.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 84.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 85.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 86.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 87.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 88.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 89.alb | 1 | 0 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 9.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 90.alb | 1 | 0 | Optimal | 0.01 | 3 | 3.00 | 0.00 |
| instance n=20 91.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=20 92.alb | 1 | 0 | Optimal | 0.01 | 11 | 11.00 | 0.00 |
| instance n=20 93.alb | 1 | 0 | Optimal | 0.04 | 13 | 13.00 | 0.00 |
| instance n=20 94.alb | 1 | 0 | Optimal | 0.03 | 10 | 10.00 | 0.00 |
| instance n=20 95.alb | 1 | 0 | Optimal | 0.10 | 12 | 12.00 | 0.00 |
| instance n=20 96.alb | 1 | 0 | Optimal | 0.02 | 10 | 10.00 | 0.00 |
| instance n=20 97.alb | 1 | 0 | Optimal | 0.10 | 15 | 15.00 | 0.00 |
| instance n=20 98.alb | 1 | 0 | Optimal | 0.02 | 13 | 13.00 | 0.00 |
| instance n=20 99.alb | 1 | 0 | Optimal | 0.12 | 12 | 12.00 | 0.00 |
| instance n=50 1.alb | 1 | 0 | Optimal | 0.15 | 8 | 8.00 | 0.00 |
| instance n=50 10.alb | 1 | 0 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 100.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 101.alb | 1 | 0 | Optimal | 17.99 | 30 | 30.00 | 0.00 |
| instance n=50 102.alb | 1 | 0 | Optimal | 78.08 | 32 | 32.00 | 0.00 |
| instance n=50 103.alb | 1 | 0 | Optimal | 0.17 | 29 | 29.00 | 0.00 |
| instance n=50 104.alb | 1 | 0 | Optimal | 1.29 | 27 | 27.00 | 0.00 |
| instance n=50 105.alb | 1 | 0 | Optimal | 23.50 | 24 | 24.00 | 0.00 |
| instance n=50 106.alb | 1 | 0 | Optimal | 18.60 | 28 | 28.00 | 0.00 |
| instance n=50 107.alb | 1 | 0 | Optimal | 4.01 | 28 | 28.00 | 0.00 |
| instance n=50 108.alb | 1 | 0 | Optimal | 0.72 | 30 | 30.00 | 0.00 |
| instance n=50 109.alb | 1 | 0 | Optimal | 0.12 | 30 | 30.00 | 0.00 |
| instance n=50 11.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 110.alb | 1 | 0 | Optimal | 0.44 | 26 | 26.00 | 0.00 |
| instance n=50 111.alb | 1 | 0 | Optimal | 0.31 | 28 | 28.00 | 0.00 |
| instance n=50 112.alb | 1 | 0 | Optimal | 1.07 | 27 | 27.00 | 0.00 |
| instance n=50 113.alb | 1 | 0 | Optimal | 11.14 | 28 | 28.00 | 0.00 |
| instance n=50 114.alb | 1 | 0 | Optimal | 0.68 | 27 | 27.00 | 0.00 |
| instance n=50 115.alb | 1 | 0 | Optimal | 109.51 | 28 | 28.00 | 0.00 |
| instance n=50 116.alb | 1 | 0 | Optimal | 0.31 | 32 | 32.00 | 0.00 |
| instance n=50 117.alb | 1 | 0 | Optimal | 19.30 | 27 | 27.00 | 0.00 |
| instance n=50 118.alb | 1 | 0 | Optimal | 0.74 | 29 | 29.00 | 0.00 |
| instance n=50 119.alb | 1 | 0 | Optimal | 0.33 | 25 | 25.00 | 0.00 |
| instance n=50 12.alb | 1 | 0 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=50 120.alb | 1 | 0 | Optimal | 1.71 | 27 | 27.00 | 0.00 |
| instance n=50 121.alb | 1 | 0 | Optimal | 8.70 | 32 | 32.00 | 0.00 |
| instance n=50 122.alb | 1 | 0 | Optimal | 20.50 | 29 | 29.00 | 0.00 |
| instance n=50 123.alb | 1 | 0 | Optimal | 2.65 | 32 | 32.00 | 0.00 |
| instance n=50 124.alb | 1 | 0 | Optimal | 1.25 | 29 | 29.00 | 0.00 |
| instance n=50 125.alb | 1 | 0 | Optimal | 0.08 | 33 | 33.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=50 126.alb | 1 | 0 | Optimal | 0.07 | 12 | 12.00 | 0.00 |
| instance n=50 127.alb | 1 | 0 | Optimal | 0.27 | 14 | 14.00 | 0.00 |
| instance n=50 128.alb | 1 | 0 | Optimal | 0.37 | 12 | 12.00 | 0.00 |
| instance n=50 129.alb | 1 | 0 | Optimal | 0.09 | 13 | 13.00 | 0.00 |
| instance n=50 13.alb | 1 | 0 | Optimal | 0.63 | 6 | 6.00 | 0.00 |
| instance n=50 130.alb | 1 | 0 | Optimal | 0.17 | 13 | 13.00 | 0.00 |
| instance n=50 131.alb | 1 | 0 | Optimal | 0.07 | 12 | 12.00 | 0.00 |
| instance n=50 132.alb | 1 | 0 | Optimal | 0.80 | 12 | 12.00 | 0.00 |
| instance n=50 133.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 134.alb | 1 | 0 | Optimal | 0.13 | 14 | 14.00 | 0.00 |
| instance n=50 135.alb | 1 | 0 | Optimal | 0.22 | 13 | 13.00 | 0.00 |
| instance n=50 136.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 137.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 138.alb | 1 | 0 | Optimal | 0.05 | 12 | 12.00 | 0.00 |
| instance n=50 139.alb | 1 | 0 | Optimal | 3.70 | 11 | 11.00 | 0.00 |
| instance n=50 14.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 140.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=50 141.alb | 1 | 0 | Optimal | 0.61 | 13 | 13.00 | 0.00 |
| instance n=50 142.alb | 1 | 0 | Optimal | 0.12 | 11 | 11.00 | 0.00 |
| instance n=50 143.alb | 1 | 0 | Optimal | 0.08 | 12 | 12.00 | 0.00 |
| instance n=50 144.alb | 1 | 0 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=50 145.alb | 1 | 0 | Optimal | 0.24 | 10 | 10.00 | 0.00 |
| instance n=50 146.alb | 1 | 0 | Optimal | 0.12 | 13 | 13.00 | 0.00 |
| instance n=50 147.alb | 1 | 0 | Optimal | 0.26 | 13 | 13.00 | 0.00 |
| instance n=50 148.alb | 1 | 0 | Optimal | 0.04 | 10 | 10.00 | 0.00 |
| instance n=50 149.alb | 1 | 0 | Optimal | 0.08 | 12 | 12.00 | 0.00 |
| instance n=50 15.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 150.alb | 1 | 0 | Optimal | 0.07 | 11 | 11.00 | 0.00 |
| instance n=50 151.alb | 1 | 0 | Optimal | 0.12 | 7 | 7.00 | 0.00 |
| instance n=50 152.alb | 1 | 0 | Optimal | 0.71 | 7 | 7.00 | 0.00 |
| instance n=50 153.alb | 1 | 0 | Optimal | 1.28 | 7 | 7.00 | 0.00 |
| instance n=50 154.alb | 1 | 0 | Optimal | 0.06 | 8 | 8.00 | 0.00 |
| instance n=50 155.alb | 1 | 0 | Optimal | 0.02 | 7 | 7.00 | 0.00 |
| instance n=50 156.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 157.alb | 1 | 0 | Optimal | 0.72 | 8 | 8.00 | 0.00 |
| instance n=50 158.alb | 1 | 0 | Optimal | 5.39 | 7 | 7.00 | 0.00 |
| instance n=50 159.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 16.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 160.alb | 1 | 0 | Optimal | 0.11 | 8 | 8.00 | 0.00 |
| instance n=50 161.alb | 1 | 0 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 162.alb | 1 | 0 | Optimal | 57.69 | 8 | 8.00 | 0.00 |
| instance n=50 163.alb | 1 | 0 | Optimal | 5.10 | 7 | 7.00 | 0.00 |
| instance n=50 164.alb | 1 | 0 | Optimal | 0.28 | 7 | 7.00 | 0.00 |
| instance n=50 165.alb | 1 | 0 | Optimal | 0.22 | 8 | 8.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 166.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 167.alb | 1 | 0 | Optimal | 2.69 | 7 | 7.00 | 0.00 |
| instance n=50 168.alb | 1 | 0 | Optimal | 0.59 | 8 | 8.00 | 0.00 |
| instance n=50 169.alb | 1 | 0 | Optimal | 6.11 | 8 | 8.00 | 0.00 |
| instance n=50 17.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 170.alb | 1 | 0 | Optimal | 2.96 | 7 | 7.00 | 0.00 |
| instance n=50 171.alb | 1 | 0 | Optimal | 1.73 | 8 | 8.00 | 0.00 |
| instance n=50 172.alb | 1 | 0 | Optimal | 0.23 | 7 | 7.00 | 0.00 |
| instance n=50 173.alb | 1 | 0 | Optimal | 0.59 | 7 | 7.00 | 0.00 |
| instance n=50 174.alb | 1 | 0 | Optimal | 4.45 | 7 | 7.00 | 0.00 |
| instance n=50 175.alb | 1 | 0 | Optimal | 0.93 | 7 | 7.00 | 0.00 |
| instance n=50 176.alb | 1 | 0 | Optimal | 21.25 | 27 | 27.00 | 0.00 |
| instance n=50 177.alb | 1 | 0 | Solution | 120.13 | 28 | 27.00 | 3.57 |
| instance n=50 178.alb | 1 | 0 | Solution | 120.12 | 28 | 27.00 | 3.57 |
| instance n=50 179.alb | 1 | 0 | Optimal | 9.31 | 26 | 26.00 | 0.00 |
| instance n=50 18.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 180.alb | 1 | 0 | Optimal | 0.44 | 26 | 26.00 | 0.00 |
| instance n=50 181.alb | 1 | 0 | Optimal | 3.32 | 29 | 29.00 | 0.00 |
| instance n=50 182.alb | 1 | 0 | Optimal | 120.05 | 26 | 26.00 | 0.00 |
| instance n=50 183.alb | 1 | 0 | Optimal | 29.62 | 28 | 28.00 | 0.00 |
| instance n=50 184.alb | 1 | 0 | Optimal | 0.06 | 38 | 38.00 | 0.00 |
| instance n=50 185.alb | 1 | 0 | Optimal | 41.90 | 26 | 26.00 | 0.00 |
| instance n=50 186.alb | 1 | 0 | Optimal | 0.94 | 26 | 26.00 | 0.00 |
| instance n=50 187.alb | 1 | 0 | Solution | 120.79 | 26 | 25.00 | 3.85 |
| instance n=50 188.alb | 1 | 0 | Solution | 121.18 | 25 | 24.00 | 4.00 |
| instance n=50 189.alb | 1 | 0 | Solution | 120.15 | 26 | 25.00 | 3.85 |
| instance n=50 19.alb | 1 | 0 | Optimal | 0.19 | 8 | 8.00 | 0.00 |
| instance n=50 190.alb | 1 | 0 | Optimal | 1.72 | 30 | 30.00 | 0.00 |
| instance n=50 191.alb | 1 | 0 | Solution | 121.36 | 28 | 27.00 | 3.57 |
| instance n=50 192.alb | 1 | 0 | Optimal | 2.66 | 27 | 27.00 | 0.00 |
| instance n=50 193.alb | 1 | 0 | Optimal | 38.33 | 28 | 28.00 | 0.00 |
| instance n=50 194.alb | 1 | 0 | Optimal | 23.55 | 28 | 28.00 | 0.00 |
| instance n=50 195.alb | 1 | 0 | Optimal | 2.55 | 28 | 28.00 | 0.00 |
| instance n=50 196.alb | 1 | 0 | Optimal | 31.41 | 27 | 27.00 | 0.00 |
| instance n=50 197.alb | 1 | 0 | Optimal | 120.03 | 28 | 28.00 | 0.00 |
| instance n=50 198.alb | 1 | 0 | Optimal | 0.08 | 28 | 28.00 | 0.00 |
| instance n=50 199.alb | 1 | 0 | Optimal | 0.09 | 29 | 29.00 | 0.00 |
| instance n=50 2.alb | 1 | 0 | Optimal | 67.63 | 6 | 6.00 | 0.00 |
| instance n=50 20.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 200.alb | 1 | 0 | Solution | 121.04 | 25 | 24.00 | 4.00 |
| instance n=50 201.alb | 1 | 0 | Optimal | 0.04 | 13 | 13.00 | 0.00 |
| instance n=50 202.alb | 1 | 0 | Optimal | 1.56 | 9 | 9.00 | 0.00 |
| instance n=50 203.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 204.alb | 1 | 0 | Optimal | 0.99 | 10 | 10.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=50 205.alb | 1 | 0 | Optimal | 0.04 | 13 | 13.00 | 0.00 |
| instance n=50 206.alb | 1 | 0 | Optimal | 120.06 | 11 | 11.00 | 0.00 |
| instance n=50 207.alb | 1 | 0 | Optimal | 0.65 | 10 | 10.00 | 0.00 |
| instance n=50 208.alb | 1 | 0 | Optimal | 0.23 | 13 | 13.00 | 0.00 |
| instance n=50 209.alb | 1 | 0 | Optimal | 1.16 | 11 | 11.00 | 0.00 |
| instance n=50 21.alb | 1 | 0 | Optimal | 120.03 | 6 | 6.00 | 0.00 |
| instance n=50 210.alb | 1 | 0 | Optimal | 0.04 | 13 | 13.00 | 0.00 |
| instance n=50 211.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=50 212.alb | 1 | 0 | Optimal | 0.08 | 10 | 10.00 | 0.00 |
| instance n=50 213.alb | 1 | 0 | Optimal | 0.04 | 13 | 13.00 | 0.00 |
| instance n=50 214.alb | 1 | 0 | Optimal | 4.68 | 11 | 11.00 | 0.00 |
| instance n=50 215.alb | 1 | 0 | Optimal | 0.06 | 11 | 11.00 | 0.00 |
| instance n=50 216.alb | 1 | 0 | Optimal | 0.30 | 12 | 12.00 | 0.00 |
| instance n=50 217.alb | 1 | 0 | Optimal | 0.84 | 13 | 13.00 | 0.00 |
| instance n=50 218.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 219.alb | 1 | 0 | Optimal | 0.28 | 11 | 11.00 | 0.00 |
| instance n=50 22.alb | 1 | 0 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 220.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 221.alb | 1 | 0 | Optimal | 2.64 | 11 | 11.00 | 0.00 |
| instance n=50 222.alb | 1 | 0 | Optimal | 0.29 | 14 | 14.00 | 0.00 |
| instance n=50 223.alb | 1 | 0 | Optimal | 0.28 | 11 | 11.00 | 0.00 |
| instance n=50 224.alb | 1 | 0 | Optimal | 0.09 | 11 | 11.00 | 0.00 |
| instance n=50 225.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=50 226.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 227.alb | 1 | 0 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=50 228.alb | 1 | 0 | Optimal | 0.04 | 6 | 6.00 | 0.00 |
| instance n=50 229.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=50 23.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 230.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 231.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 232.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 233.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=50 234.alb | 1 | 0 | Optimal | 0.09 | 8 | 8.00 | 0.00 |
| instance n=50 235.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 236.alb | 1 | 0 | Optimal | 0.40 | 7 | 7.00 | 0.00 |
| instance n=50 237.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 238.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 239.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 24.alb | 1 | 0 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 240.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 241.alb | 1 | 0 | Optimal | 0.08 | 7 | 7.00 | 0.00 |
| instance n=50 242.alb | 1 | 0 | Optimal | 0.07 | 8 | 8.00 | 0.00 |
| instance n=50 243.alb | 1 | 0 | Optimal | 0.12 | 7 | 7.00 | 0.00 |
| instance n=50 244.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=50 245.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 246.alb | 1 | 0 | Optimal | 0.22 | 8 | 8.00 | 0.00 |
| instance n=50 247.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 248.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 249.alb | 1 | 0 | Optimal | 0.18 | 7 | 7.00 | 0.00 |
| instance n=50 25.alb | 1 | 0 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=50 250.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 251.alb | 1 | 0 | Optimal | 1.08 | 27 | 27.00 | 0.00 |
| instance n=50 252.alb | 1 | 0 | Optimal | 4.59 | 32 | 32.00 | 0.00 |
| instance n=50 253.alb | 1 | 0 | Optimal | 4.81 | 28 | 28.00 | 0.00 |
| instance n=50 254.alb | 1 | 0 | Optimal | 0.06 | 30 | 30.00 | 0.00 |
| instance n=50 255.alb | 1 | 0 | Optimal | 0.59 | 29 | 29.00 | 0.00 |
| instance n=50 256.alb | 1 | 0 | Optimal | 0.39 | 30 | 30.00 | 0.00 |
| instance n=50 257.alb | 1 | 0 | Optimal | 3.78 | 33 | 33.00 | 0.00 |
| instance n=50 258.alb | 1 | 0 | Optimal | 4.75 | 28 | 28.00 | 0.00 |
| instance n=50 259.alb | 1 | 0 | Optimal | 3.69 | 31 | 31.00 | 0.00 |
| instance n=50 26.alb | 1 | 0 | Optimal | 83.72 | 27 | 27.00 | 0.00 |
| instance n=50 260.alb | 1 | 0 | Optimal | 0.73 | 29 | 29.00 | 0.00 |
| instance n=50 261.alb | 1 | 0 | Optimal | 2.79 | 28 | 28.00 | 0.00 |
| instance n=50 262.alb | 1 | 0 | Optimal | 0.92 | 31 | 31.00 | 0.00 |
| instance n=50 263.alb | 1 | 0 | Optimal | 0.92 | 29 | 29.00 | 0.00 |
| instance n=50 264.alb | 1 | 0 | Optimal | 2.51 | 27 | 27.00 | 0.00 |
| instance n=50 265.alb | 1 | 0 | Optimal | 0.81 | 27 | 27.00 | 0.00 |
| instance n=50 266.alb | 1 | 0 | Optimal | 4.79 | 29 | 29.00 | 0.00 |
| instance n=50 267.alb | 1 | 0 | Optimal | 5.15 | 28 | 28.00 | 0.00 |
| instance n=50 268.alb | 1 | 0 | Optimal | 6.11 | 29 | 29.00 | 0.00 |
| instance n=50 269.alb | 1 | 0 | Optimal | 0.56 | 26 | 26.00 | 0.00 |
| instance n=50 27.alb | 1 | 0 | Optimal | 13.18 | 30 | 30.00 | 0.00 |
| instance n=50 270.alb | 1 | 0 | Optimal | 0.31 | 28 | 28.00 | 0.00 |
| instance n=50 271.alb | 1 | 0 | Optimal | 2.56 | 31 | 31.00 | 0.00 |
| instance n=50 272.alb | 1 | 0 | Optimal | 2.09 | 27 | 27.00 | 0.00 |
| instance n=50 273.alb | 1 | 0 | Optimal | 5.52 | 27 | 27.00 | 0.00 |
| instance n=50 274.alb | 1 | 0 | Optimal | 0.07 | 29 | 29.00 | 0.00 |
| instance n=50 275.alb | 1 | 0 | Optimal | 0.87 | 27 | 27.00 | 0.00 |
| instance n=50 276.alb | 1 | 0 | Optimal | 0.06 | 12 | 12.00 | 0.00 |
| instance n=50 277.alb | 1 | 0 | Optimal | 0.08 | 13 | 13.00 | 0.00 |
| instance n=50 278.alb | 1 | 0 | Optimal | 0.10 | 12 | 12.00 | 0.00 |
| instance n=50 279.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 28.alb | 1 | 0 | Optimal | 0.08 | 28 | 28.00 | 0.00 |
| instance n=50 280.alb | 1 | 0 | Optimal | 0.09 | 13 | 13.00 | 0.00 |
| instance n=50 281.alb | 1 | 0 | Optimal | 0.08 | 11 | 11.00 | 0.00 |
| instance n=50 282.alb | 1 | 0 | Optimal | 3.49 | 12 | 12.00 | 0.00 |
| instance n=50 283.alb | 1 | 0 | Optimal | 0.27 | 12 | 12.00 | 0.00 |
| instance n=50 284.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 285.alb | 1 | 0 | Optimal | 0.20 | 13 | 13.00 | 0.00 |
| instance n=50 286.alb | 1 | 0 | Optimal | 0.32 | 11 | 11.00 | 0.00 |
| instance n=50 287.alb | 1 | 0 | Optimal | 0.96 | 12 | 12.00 | 0.00 |
| instance n=50 288.alb | 1 | 0 | Optimal | 0.06 | 10 | 10.00 | 0.00 |
| instance n=50 289.alb | 1 | 0 | Optimal | 0.24 | 11 | 11.00 | 0.00 |
| instance n=50 29.alb | 1 | 0 | Optimal | 0.04 | 29 | 29.00 | 0.00 |
| instance n=50 290.alb | 1 | 0 | Optimal | 0.09 | 14 | 14.00 | 0.00 |
| instance n=50 291.alb | 1 | 0 | Optimal | 0.09 | 12 | 12.00 | 0.00 |
| instance n=50 292.alb | 1 | 0 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=50 293.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 294.alb | 1 | 0 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=50 295.alb | 1 | 0 | Optimal | 0.09 | 16 | 16.00 | 0.00 |
| instance n=50 296.alb | 1 | 0 | Optimal | 0.15 | 13 | 13.00 | 0.00 |
| instance n=50 297.alb | 1 | 0 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=50 298.alb | 1 | 0 | Optimal | 0.07 | 11 | 11.00 | 0.00 |
| instance n=50 299.alb | 1 | 0 | Optimal | 2.00 | 12 | 12.00 | 0.00 |
| instance n=50 3.alb | 1 | 0 | Optimal | 0.31 | 8 | 8.00 | 0.00 |
| instance n=50 30.alb | 1 | 0 | Optimal | 120.06 | 26 | 26.00 | 0.00 |
| instance n=50 300.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 301.alb | 1 | 0 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=50 302.alb | 1 | 0 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=50 303.alb | 1 | 0 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 304.alb | 1 | 0 | Optimal | 0.47 | 7 | 7.00 | 0.00 |
| instance n=50 305.alb | 1 | 0 | Optimal | 120.03 | 8 | 8.00 | 0.00 |
| instance n=50 306.alb | 1 | 0 | Optimal | 36.00 | 7 | 7.00 | 0.00 |
| instance n=50 307.alb | 1 | 0 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 308.alb | 1 | 0 | Optimal | 2.72 | 8 | 8.00 | 0.00 |
| instance n=50 309.alb | 1 | 0 | Optimal | 1.61 | 7 | 7.00 | 0.00 |
| instance n=50 31.alb | 1 | 0 | Solution | 120.15 | 28 | 27.00 | 3.57 |
| instance n=50 310.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 311.alb | 1 | 0 | Optimal | 9.54 | 8 | 8.00 | 0.00 |
| instance n=50 312.alb | 1 | 0 | Optimal | 0.26 | 6 | 6.00 | 0.00 |
| instance n=50 313.alb | 1 | 0 | Optimal | 120.03 | 8 | 8.00 | 0.00 |
| instance n=50 314.alb | 1 | 0 | Optimal | 17.64 | 7 | 7.00 | 0.00 |
| instance n=50 315.alb | 1 | 0 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 316.alb | 1 | 0 | Optimal | 0.70 | 8 | 8.00 | 0.00 |
| instance n=50 317.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=50 318.alb | 1 | 0 | Optimal | 0.16 | 8 | 8.00 | 0.00 |
| instance n=50 319.alb | 1 | 0 | Optimal | 0.22 | 7 | 7.00 | 0.00 |
| instance n=50 32.alb | 1 | 0 | Optimal | 26.75 | 25 | 25.00 | 0.00 |
| instance n=50 320.alb | 1 | 0 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 321.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=50 322.alb | 1 | 0 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 323.alb | 1 | 0 | Optimal | 120.02 | 7 | 7.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 324.alb | 1 | 0 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 325.alb | 1 | 0 | Optimal | 0.24 | 7 | 7.00 | 0.00 |
| instance n=50 326.alb | 1 | 0 | Optimal | 0.65 | 33 | 33.00 | 0.00 |
| instance n=50 327.alb | 1 | 0 | Optimal | 113.77 | 28 | 28.00 | 0.00 |
| instance n=50 328.alb | 1 | 0 | Optimal | 0.47 | 32 | 32.00 | 0.00 |
| instance n=50 329.alb | 1 | 0 | Solution | 120.13 | 25 | 24.00 | 4.00 |
| instance n=50 33.alb | 1 | 0 | Solution | 120.15 | 25 | 24.00 | 4.00 |
| instance n=50 330.alb | 1 | 0 | Optimal | 0.07 | 29 | 29.00 | 0.00 |
| instance n=50 331.alb | 1 | 0 | Optimal | 120.05 | 29 | 29.00 | 0.00 |
| instance n=50 332.alb | 1 | 0 | Solution | 120.91 | 25 | 24.00 | 4.00 |
| instance n=50 333.alb | 1 | 0 | Optimal | 5.15 | 28 | 28.00 | 0.00 |
| instance n=50 334.alb | 1 | 0 | Optimal | 0.03 | 29 | 29.00 | 0.00 |
| instance n=50 335.alb | 1 | 0 | Optimal | 120.06 | 27 | 27.00 | 0.00 |
| instance n=50 336.alb | 1 | 0 | Solution | 120.11 | 26 | 25.00 | 3.85 |
| instance n=50 337.alb | 1 | 0 | Optimal | 0.42 | 26 | 26.00 | 0.00 |
| instance n=50 338.alb | 1 | 0 | Optimal | 82.25 | 26 | 26.00 | 0.00 |
| instance n=50 339.alb | 1 | 0 | Optimal | 0.08 | 27 | 27.00 | 0.00 |
| instance n=50 34.alb | 1 | 0 | Optimal | 0.11 | 30 | 30.00 | 0.00 |
| instance n=50 340.alb | 1 | 0 | Solution | 120.13 | 28 | 27.00 | 3.57 |
| instance n=50 341.alb | 1 | 0 | Optimal | 120.04 | 27 | 27.00 | 0.00 |
| instance n=50 342.alb | 1 | 0 | Solution | 121.05 | 28 | 27.00 | 3.57 |
| instance n=50 343.alb | 1 | 0 | Optimal | 120.05 | 27 | 27.00 | 0.00 |
| instance n=50 344.alb | 1 | 0 | Optimal | 2.17 | 30 | 30.00 | 0.00 |
| instance n=50 345.alb | 1 | 0 | Optimal | 120.04 | 29 | 29.00 | 0.00 |
| instance n=50 346.alb | 1 | 0 | Optimal | 5.19 | 27 | 27.00 | 0.00 |
| instance n=50 347.alb | 1 | 0 | Optimal | 110.19 | 25 | 25.00 | 0.00 |
| instance n=50 348.alb | 1 | 0 | Optimal | 0.03 | 30 | 30.00 | 0.00 |
| instance n=50 349.alb | 1 | 0 | Optimal | 0.95 | 28 | 28.00 | 0.00 |
| instance n=50 35.alb | 1 | 0 | Optimal | 9.75 | 31 | 31.00 | 0.00 |
| instance n=50 350.alb | 1 | 0 | Solution | 120.14 | 24 | 23.00 | 4.17 |
| instance n=50 351.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=50 352.alb | 1 | 0 | Optimal | 120.04 | 10 | 10.00 | 0.00 |
| instance n=50 353.alb | 1 | 0 | Optimal | 0.06 | 13 | 13.00 | 0.00 |
| instance n=50 354.alb | 1 | 0 | Solution | 120.11 | 14 | 13.00 | 7.14 |
| instance n=50 355.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=50 356.alb | 1 | 0 | Optimal | 0.05 | 15 | 15.00 | 0.00 |
| instance n=50 357.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 358.alb | 1 | 0 | Optimal | 0.17 | 11 | 11.00 | 0.00 |
| instance n=50 359.alb | 1 | 0 | Optimal | 120.04 | 10 | 10.00 | 0.00 |
| instance n=50 36.alb | 1 | 0 | Optimal | 0.26 | 31 | 31.00 | 0.00 |
| instance n=50 360.alb | 1 | 0 | Optimal | 0.05 | 12 | 12.00 | 0.00 |
| instance n=50 361.alb | 1 | 0 | Optimal | 0.27 | 11 | 11.00 | 0.00 |
| instance n=50 362.alb | 1 | 0 | Optimal | 0.04 | 10 | 10.00 | 0.00 |
| instance n=50 363.alb | 1 | 0 | Solution | 120.11 | 12 | 11.00 | 8.33 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 364.alb | 1 | 0 | Optimal | 0.55 | 13 | 13.00 | 0.00 |
| instance n=50 365.alb | 1 | 0 | Optimal | 0.38 | 11 | 11.00 | 0.00 |
| instance n=50 366.alb | 1 | 0 | Optimal | 0.03 | 13 | 13.00 | 0.00 |
| instance n=50 367.alb | 1 | 0 | Optimal | 0.17 | 12 | 12.00 | 0.00 |
| instance n=50 368.alb | 1 | 0 | Optimal | 0.05 | 12 | 12.00 | 0.00 |
| instance n=50 369.alb | 1 | 0 | Optimal | 0.41 | 12 | 12.00 | 0.00 |
| instance n=50 37.alb | 1 | 0 | Solution | 120.73 | 32 | 31.00 | 3.13 |
| instance n=50 370.alb | 1 | 0 | Optimal | 0.05 | 12 | 12.00 | 0.00 |
| instance n=50 371.alb | 1 | 0 | Optimal | 82.83 | 11 | 11.00 | 0.00 |
| instance n=50 372.alb | 1 | 0 | Optimal | 120.04 | 10 | 10.00 | 0.00 |
| instance n=50 373.alb | 1 | 0 | Optimal | 1.20 | 12 | 12.00 | 0.00 |
| instance n=50 374.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 375.alb | 1 | 0 | Optimal | 120.04 | 13 | 13.00 | 0.00 |
| instance n=50 376.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 377.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 378.alb | 1 | 0 | Optimal | 0.06 | 8 | 8.00 | 0.00 |
| instance n=50 379.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 38.alb | 1 | 0 | Optimal | 0.36 | 31 | 31.00 | 0.00 |
| instance n=50 380.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 381.alb | 1 | 0 | Optimal | 0.33 | 8 | 8.00 | 0.00 |
| instance n=50 382.alb | 1 | 0 | Optimal | 0.04 | 6 | 6.00 | 0.00 |
| instance n=50 383.alb | 1 | 0 | Optimal | 0.08 | 7 | 7.00 | 0.00 |
| instance n=50 384.alb | 1 | 0 | Optimal | 0.15 | 8 | 8.00 | 0.00 |
| instance n=50 385.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 386.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 387.alb | 1 | 0 | Optimal | 0.06 | 8 | 8.00 | 0.00 |
| instance n=50 388.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 389.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 39.alb | 1 | 0 | Solution | 120.14 | 29 | 28.00 | 3.45 |
| instance n=50 390.alb | 1 | 0 | Optimal | 0.07 | 7 | 7.00 | 0.00 |
| instance n=50 391.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 392.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 393.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 394.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 395.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 396.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 397.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 398.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=50 399.alb | 1 | 0 | Optimal | 4.46 | 7 | 7.00 | 0.00 |
| instance n=50 4.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |
| instance n=50 40.alb | 1 | 0 | Optimal | 120.04 | 26 | 26.00 | 0.00 |
| instance n=50 400.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 401.alb | 1 | 0 | Optimal | 59.04 | 28 | 28.00 | 0.00 |
| instance n=50 402.alb | 1 | 0 | Optimal | 2.01 | 27 | 27.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 403.alb | 1 | 0 | Optimal | 2.30 | 34 | 34.00 | 0.00 |
| instance n=50 404.alb | 1 | 0 | Optimal | 4.18 | 31 | 31.00 | 0.00 |
| instance n=50 405.alb | 1 | 0 | Optimal | 3.45 | 27 | 27.00 | 0.00 |
| instance n=50 406.alb | 1 | 0 | Optimal | 2.78 | 32 | 32.00 | 0.00 |
| instance n=50 407.alb | 1 | 0 | Optimal | 6.19 | 29 | 29.00 | 0.00 |
| instance n=50 408.alb | 1 | 0 | Optimal | 0.44 | 26 | 26.00 | 0.00 |
| instance n=50 409.alb | 1 | 0 | Optimal | 5.51 | 33 | 33.00 | 0.00 |
| instance n=50 41.alb | 1 | 0 | Optimal | 120.05 | 25 | 25.00 | 0.00 |
| instance n=50 410.alb | 1 | 0 | Optimal | 0.30 | 28 | 28.00 | 0.00 |
| instance n=50 411.alb | 1 | 0 | Optimal | 0.08 | 29 | 29.00 | 0.00 |
| instance n=50 412.alb | 1 | 0 | Optimal | 0.12 | 26 | 26.00 | 0.00 |
| instance n=50 413.alb | 1 | 0 | Optimal | 0.14 | 30 | 30.00 | 0.00 |
| instance n=50 414.alb | 1 | 0 | Optimal | 33.49 | 27 | 27.00 | 0.00 |
| instance n=50 415.alb | 1 | 0 | Optimal | 0.31 | 28 | 28.00 | 0.00 |
| instance n=50 416.alb | 1 | 0 | Optimal | 0.19 | 27 | 27.00 | 0.00 |
| instance n=50 417.alb | 1 | 0 | Optimal | 59.79 | 30 | 30.00 | 0.00 |
| instance n=50 418.alb | 1 | 0 | Optimal | 1.04 | 27 | 27.00 | 0.00 |
| instance n=50 419.alb | 1 | 0 | Optimal | 11.42 | 33 | 33.00 | 0.00 |
| instance n=50 42.alb | 1 | 0 | Solution | 120.98 | 24 | 23.00 | 4.17 |
| instance n=50 420.alb | 1 | 0 | Optimal | 13.02 | 28 | 28.00 | 0.00 |
| instance n=50 421.alb | 1 | 0 | Optimal | 3.69 | 34 | 34.00 | 0.00 |
| instance n=50 422.alb | 1 | 0 | Optimal | 3.03 | 29 | 29.00 | 0.00 |
| instance n=50 423.alb | 1 | 0 | Optimal | 0.24 | 29 | 29.00 | 0.00 |
| instance n=50 424.alb | 1 | 0 | Optimal | 0.80 | 27 | 27.00 | 0.00 |
| instance n=50 425.alb | 1 | 0 | Optimal | 6.30 | 34 | 34.00 | 0.00 |
| instance n=50 426.alb | 1 | 0 | Optimal | 0.30 | 11 | 11.00 | 0.00 |
| instance n=50 427.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=50 428.alb | 1 | 0 | Optimal | 0.14 | 13 | 13.00 | 0.00 |
| instance n=50 429.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 43.alb | 1 | 0 | Optimal | 1.58 | 25 | 25.00 | 0.00 |
| instance n=50 430.alb | 1 | 0 | Optimal | 1.01 | 14 | 14.00 | 0.00 |
| instance n=50 431.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 432.alb | 1 | 0 | Optimal | 0.37 | 12 | 12.00 | 0.00 |
| instance n=50 433.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 434.alb | 1 | 0 | Optimal | 0.07 | 11 | 11.00 | 0.00 |
| instance n=50 435.alb | 1 | 0 | Optimal | 0.54 | 11 | 11.00 | 0.00 |
| instance n=50 436.alb | 1 | 0 | Optimal | 0.23 | 11 | 11.00 | 0.00 |
| instance n=50 437.alb | 1 | 0 | Optimal | 1.92 | 12 | 12.00 | 0.00 |
| instance n=50 438.alb | 1 | 0 | Optimal | 1.43 | 10 | 10.00 | 0.00 |
| instance n=50 439.alb | 1 | 0 | Optimal | 0.45 | 12 | 12.00 | 0.00 |
| instance n=50 44.alb | 1 | 0 | Solution | 120.15 | 25 | 24.00 | 4.00 |
| instance n=50 440.alb | 1 | 0 | Optimal | 0.84 | 13 | 13.00 | 0.00 |
| instance n=50 441.alb | 1 | 0 | Optimal | 0.06 | 11 | 11.00 | 0.00 |
| instance n=50 442.alb | 1 | 0 | Optimal | 0.11 | 12 | 12.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 443.alb | 1 | 0 | Optimal | 0.06 | 11 | 11.00 | 0.00 |
| instance n=50 444.alb | 1 | 0 | Optimal | 0.09 | 12 | 12.00 | 0.00 |
| instance n=50 445.alb | 1 | 0 | Optimal | 0.24 | 12 | 12.00 | 0.00 |
| instance n=50 446.alb | 1 | 0 | Optimal | 0.08 | 12 | 12.00 | 0.00 |
| instance n=50 447.alb | 1 | 0 | Optimal | 0.08 | 13 | 13.00 | 0.00 |
| instance n=50 448.alb | 1 | 0 | Optimal | 0.80 | 12 | 12.00 | 0.00 |
| instance n=50 449.alb | 1 | 0 | Optimal | 0.07 | 11 | 11.00 | 0.00 |
| instance n=50 45.alb | 1 | 0 | Solution | 120.12 | 25 | 24.00 | 4.00 |
| instance n=50 450.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 451.alb | 1 | 0 | Optimal | 0.06 | 8 | 8.00 | 0.00 |
| instance n=50 452.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 453.alb | 1 | 0 | Optimal | 0.02 | 7 | 7.00 | 0.00 |
| instance n=50 454.alb | 1 | 0 | Optimal | 0.08 | 8 | 8.00 | 0.00 |
| instance n=50 455.alb | 1 | 0 | Optimal | 0.02 | 6 | 6.00 | 0.00 |
| instance n=50 456.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 457.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 458.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 459.alb | 1 | 0 | Optimal | 0.01 | 7 | 7.00 | 0.00 |
| instance n=50 46.alb | 1 | 0 | Optimal | 0.31 | 28 | 28.00 | 0.00 |
| instance n=50 460.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 461.alb | 1 | 0 | Optimal | 0.01 | 6 | 6.00 | 0.00 |
| instance n=50 462.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 463.alb | 1 | 0 | Optimal | 0.04 | 8 | 8.00 | 0.00 |
| instance n=50 464.alb | 1 | 0 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=50 465.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 466.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 467.alb | 1 | 0 | Optimal | 0.08 | 9 | 9.00 | 0.00 |
| instance n=50 468.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 469.alb | 1 | 0 | Optimal | 0.07 | 8 | 8.00 | 0.00 |
| instance n=50 47.alb | 1 | 0 | Optimal | 3.94 | 28 | 28.00 | 0.00 |
| instance n=50 470.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 471.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 472.alb | 1 | 0 | Optimal | 0.03 | 8 | 8.00 | 0.00 |
| instance n=50 473.alb | 1 | 0 | Optimal | 0.02 | 7 | 7.00 | 0.00 |
| instance n=50 474.alb | 1 | 0 | Optimal | 0.01 | 7 | 7.00 | 0.00 |
| instance n=50 475.alb | 1 | 0 | Optimal | 0.05 | 6 | 6.00 | 0.00 |
| instance n=50 476.alb | 1 | 0 | Optimal | 0.08 | 28 | 28.00 | 0.00 |
| instance n=50 477.alb | 1 | 0 | Optimal | 0.06 | 29 | 29.00 | 0.00 |
| instance n=50 478.alb | 1 | 0 | Optimal | 0.12 | 32 | 32.00 | 0.00 |
| instance n=50 479.alb | 1 | 0 | Optimal | 0.06 | 28 | 28.00 | 0.00 |
| instance n=50 48.alb | 1 | 0 | Optimal | 0.56 | 27 | 27.00 | 0.00 |
| instance n=50 480.alb | 1 | 0 | Optimal | 0.04 | 34 | 34.00 | 0.00 |
| instance n=50 481.alb | 1 | 0 | Optimal | 0.06 | 28 | 28.00 | 0.00 |
| instance n=50 482.alb | 1 | 0 | Optimal | 0.03 | 27 | 27.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 483.alb | 1 | 0 | Optimal | 0.11 | 30 | 30.00 | 0.00 |
| instance n=50 484.alb | 1 | 0 | Optimal | 0.03 | 32 | 32.00 | 0.00 |
| instance n=50 485.alb | 1 | 0 | Optimal | 0.08 | 31 | 31.00 | 0.00 |
| instance n=50 486.alb | 1 | 0 | Optimal | 0.04 | 32 | 32.00 | 0.00 |
| instance n=50 487.alb | 1 | 0 | Optimal | 0.12 | 31 | 31.00 | 0.00 |
| instance n=50 488.alb | 1 | 0 | Optimal | 0.06 | 31 | 31.00 | 0.00 |
| instance n=50 489.alb | 1 | 0 | Optimal | 0.05 | 35 | 35.00 | 0.00 |
| instance n=50 49.alb | 1 | 0 | Optimal | 0.58 | 25 | 25.00 | 0.00 |
| instance n=50 490.alb | 1 | 0 | Optimal | 0.03 | 29 | 29.00 | 0.00 |
| instance n=50 491.alb | 1 | 0 | Optimal | 0.05 | 35 | 35.00 | 0.00 |
| instance n=50 492.alb | 1 | 0 | Optimal | 0.04 | 29 | 29.00 | 0.00 |
| instance n=50 493.alb | 1 | 0 | Optimal | 0.11 | 30 | 30.00 | 0.00 |
| instance n=50 494.alb | 1 | 0 | Optimal | 0.04 | 32 | 32.00 | 0.00 |
| instance n=50 495.alb | 1 | 0 | Optimal | 0.06 | 34 | 34.00 | 0.00 |
| instance n=50 496.alb | 1 | 0 | Optimal | 0.09 | 29 | 29.00 | 0.00 |
| instance n=50 497.alb | 1 | 0 | Optimal | 0.12 | 30 | 30.00 | 0.00 |
| instance n=50 498.alb | 1 | 0 | Optimal | 0.08 | 30 | 30.00 | 0.00 |
| instance n=50 499.alb | 1 | 0 | Optimal | 0.06 | 33 | 33.00 | 0.00 |
| instance n=50 5.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 50.alb | 1 | 0 | Solution | 120.15 | 27 | 26.00 | 3.70 |
| instance n=50 500.alb | 1 | 0 | Optimal | 0.04 | 34 | 34.00 | 0.00 |
| instance n=50 501.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 502.alb | 1 | 0 | Optimal | 0.03 | 10 | 10.00 | 0.00 |
| instance n=50 503.alb | 1 | 0 | Optimal | 0.06 | 13 | 13.00 | 0.00 |
| instance n=50 504.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 505.alb | 1 | 0 | Optimal | 0.03 | 12 | 12.00 | 0.00 |
| instance n=50 506.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 507.alb | 1 | 0 | Optimal | 0.05 | 13 | 13.00 | 0.00 |
| instance n=50 508.alb | 1 | 0 | Optimal | 0.04 | 14 | 14.00 | 0.00 |
| instance n=50 509.alb | 1 | 0 | Optimal | 0.04 | 13 | 13.00 | 0.00 |
| instance n=50 51.alb | 1 | 0 | Optimal | 0.53 | 12 | 12.00 | 0.00 |
| instance n=50 510.alb | 1 | 0 | Optimal | 0.08 | 11 | 11.00 | 0.00 |
| instance n=50 511.alb | 1 | 0 | Optimal | 0.03 | 13 | 13.00 | 0.00 |
| instance n=50 512.alb | 1 | 0 | Optimal | 0.05 | 13 | 13.00 | 0.00 |
| instance n=50 513.alb | 1 | 0 | Optimal | 0.07 | 12 | 12.00 | 0.00 |
| instance n=50 514.alb | 1 | 0 | Optimal | 0.05 | 12 | 12.00 | 0.00 |
| instance n=50 515.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 516.alb | 1 | 0 | Optimal | 0.04 | 13 | 13.00 | 0.00 |
| instance n=50 517.alb | 1 | 0 | Optimal | 0.04 | 14 | 14.00 | 0.00 |
| instance n=50 518.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 519.alb | 1 | 0 | Optimal | 0.04 | 12 | 12.00 | 0.00 |
| instance n=50 52.alb | 1 | 0 | Optimal | 0.03 | 11 | 11.00 | 0.00 |
| instance n=50 520.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 521.alb | 1 | 0 | Optimal | 0.05 | 10 | 10.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 522.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 523.alb | 1 | 0 | Optimal | 0.05 | 11 | 11.00 | 0.00 |
| instance n=50 524.alb | 1 | 0 | Optimal | 0.04 | 14 | 14.00 | 0.00 |
| instance n=50 525.alb | 1 | 0 | Optimal | 0.08 | 11 | 11.00 | 0.00 |
| instance n=50 53.alb | 1 | 0 | Solution | 120.12 | 13 | 12.00 | 7.69 |
| instance n=50 54.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 55.alb | 1 | 0 | Optimal | 0.05 | 13 | 13.00 | 0.00 |
| instance n=50 56.alb | 1 | 0 | Optimal | 0.04 | 11 | 11.00 | 0.00 |
| instance n=50 57.alb | 1 | 0 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=50 58.alb | 1 | 0 | Optimal | 0.12 | 11 | 11.00 | 0.00 |
| instance n=50 59.alb | 1 | 0 | Optimal | 7.70 | 11 | 11.00 | 0.00 |
| instance n=50 6.alb | 1 | 0 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=50 60.alb | 1 | 0 | Optimal | 0.30 | 12 | 12.00 | 0.00 |
| instance n=50 61.alb | 1 | 0 | Optimal | 0.06 | 13 | 13.00 | 0.00 |
| instance n=50 62.alb | 1 | 0 | Optimal | 0.03 | 13 | 13.00 | 0.00 |
| instance n=50 63.alb | 1 | 0 | Optimal | 120.04 | 12 | 12.00 | 0.00 |
| instance n=50 64.alb | 1 | 0 | Optimal | 0.05 | 13 | 13.00 | 0.00 |
| instance n=50 65.alb | 1 | 0 | Optimal | 1.96 | 12 | 12.00 | 0.00 |
| instance n=50 66.alb | 1 | 0 | Optimal | 0.76 | 12 | 12.00 | 0.00 |
| instance n=50 67.alb | 1 | 0 | Optimal | 0.33 | 12 | 12.00 | 0.00 |
| instance n=50 68.alb | 1 | 0 | Optimal | 0.06 | 12 | 12.00 | 0.00 |
| instance n=50 69.alb | 1 | 0 | Optimal | 0.14 | 12 | 12.00 | 0.00 |
| instance n=50 7.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 70.alb | 1 | 0 | Optimal | 0.04 | 10 | 10.00 | 0.00 |
| instance n=50 71.alb | 1 | 0 | Optimal | 0.15 | 13 | 13.00 | 0.00 |
| instance n=50 72.alb | 1 | 0 | Optimal | 37.28 | 11 | 11.00 | 0.00 |
| instance n=50 73.alb | 1 | 0 | Optimal | 0.09 | 11 | 11.00 | 0.00 |
| instance n=50 74.alb | 1 | 0 | Optimal | 32.81 | 12 | 12.00 | 0.00 |
| instance n=50 75.alb | 1 | 0 | Optimal | 0.32 | 11 | 11.00 | 0.00 |
| instance n=50 76.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 77.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 78.alb | 1 | 0 | Optimal | 1.81 | 7 | 7.00 | 0.00 |
| instance n=50 79.alb | 1 | 0 | Optimal | 0.28 | 8 | 8.00 | 0.00 |
| instance n=50 8.alb | 1 | 0 | Optimal | 4.95 | 7 | 7.00 | 0.00 |
| instance n=50 80.alb | 1 | 0 | Optimal | 1.83 | 7 | 7.00 | 0.00 |
| instance n=50 81.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 82.alb | 1 | 0 | Optimal | 0.04 | 6 | 6.00 | 0.00 |
| instance n=50 83.alb | 1 | 0 | Optimal | 0.07 | 8 | 8.00 | 0.00 |
| instance n=50 84.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 85.alb | 1 | 0 | Optimal | 0.05 | 8 | 8.00 | 0.00 |
| instance n=50 86.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 87.alb | 1 | 0 | Optimal | 0.08 | 8 | 8.00 | 0.00 |
| instance n=50 88.alb | 1 | 0 | Optimal | 1.30 | 8 | 8.00 | 0.00 |
| instance n=50 89.alb | 1 | 0 | Optimal | 0.07 | 7 | 7.00 | 0.00 |

Table 6.2: Results for SALBP-1 Problems (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=50 9.alb | 1 | 0 | Optimal | 1.13 | 9 | 9.00 | 0.00 |
| instance n=50 90.alb | 1 | 0 | Optimal | 0.05 | 7 | 7.00 | 0.00 |
| instance n=50 91.alb | 1 | 0 | Optimal | 3.30 | 7 | 7.00 | 0.00 |
| instance n=50 92.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 93.alb | 1 | 0 | Optimal | 0.03 | 7 | 7.00 | 0.00 |
| instance n=50 94.alb | 1 | 0 | Optimal | 0.92 | 7 | 7.00 | 0.00 |
| instance n=50 95.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 96.alb | 1 | 0 | Optimal | 0.06 | 7 | 7.00 | 0.00 |
| instance n=50 97.alb | 1 | 0 | Optimal | 0.04 | 7 | 7.00 | 0.00 |
| instance n=50 98.alb | 1 | 0 | Optimal | 0.12 | 8 | 8.00 | 0.00 |
| instance n=50 99.alb | 1 | 0 | Optimal | 0.09 | 7 | 7.00 | 0.00 |

6.3 Results for MiniZinc/Cplex

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 1.alb | 1 | 0 | Solution | 120.54 | 24 | 0.00 | 0.00 |
| instance n=100 10.alb | 1 | 0 | Unknown | 120491.00 | - | - | - |
| instance n=100 100.alb | 1 | 0 | Unknown | 120526.00 | - | - | - |
| instance n=100 101.alb | 1 | 0 | Unknown | 120439.00 | - | - | - |
| instance n=100 102.alb | 1 | 0 | Unknown | 120532.00 | - | - | - |
| instance n=100 103.alb | 1 | 0 | Unknown | 120496.00 | - | - | - |
| instance n=100 104.alb | 1 | 0 | Unknown | 120518.00 | - | - | - |
| instance n=100 105.alb | 1 | 0 | Unknown | 120488.00 | - | - | - |
| instance n=100 106.alb | 1 | 0 | Solution | 120.53 | 41 | 0.00 | 0.00 |
| instance n=100 107.alb | 1 | 0 | Unknown | 120483.00 | - | - | - |
| instance n=100 108.alb | 1 | 0 | Unknown | 120512.00 | - | - | - |
| instance n=100 109.alb | 1 | 0 | Unknown | 120507.00 | - | - | - |
| instance n=100 11.alb | 1 | 0 | Solution | 120.52 | 53 | 0.00 | 0.00 |
| instance n=100 110.alb | 1 | 0 | Solution | 120.53 | 45 | 0.00 | 0.00 |
| instance n=100 111.alb | 1 | 0 | Unknown | 120525.00 | - | - | - |
| instance n=100 112.alb | 1 | 0 | Unknown | 120447.00 | - | - | - |
| instance n=100 113.alb | 1 | 0 | Solution | 120.52 | 34 | 0.00 | 0.00 |
| instance n=100 114.alb | 1 | 0 | Unknown | 120519.00 | - | - | - |
| instance n=100 115.alb | 1 | 0 | Solution | 120.45 | 20 | 0.00 | 0.00 |
| instance n=100 116.alb | 1 | 0 | Unknown | 120494.00 | - | - | - |
| instance n=100 117.alb | 1 | 0 | Unknown | 120501.00 | - | - | - |
| instance n=100 118.alb | 1 | 0 | Solution | 120.51 | 43 | 0.00 | 0.00 |
| instance n=100 119.alb | 1 | 0 | Unknown | 120534.00 | - | - | - |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 12.alb | 1 | 0 | Solution | 120.44 | 27 | 0.00 | 0.00 |
| instance n=100 120.alb | 1 | 0 | Unknown | 120529.00 | - | - | - |
| instance n=100 121.alb | 1 | 0 | Unknown | 120528.00 | - | - | - |
| instance n=100 122.alb | 1 | 0 | Solution | 120.55 | 41 | 0.00 | 0.00 |
| instance n=100 123.alb | 1 | 0 | Unknown | 120507.00 | - | - | - |
| instance n=100 124.alb | 1 | 0 | Unknown | 120507.00 | - | - | - |
| instance n=100 125.alb | 1 | 0 | Solution | 120.51 | 48 | 0.00 | 0.00 |
| instance n=100 126.alb | 1 | 0 | Solution | 120.46 | 77 | 0.00 | 0.00 |
| instance n=100 127.alb | 1 | 0 | Solution | 120.45 | 78 | 0.00 | 0.00 |
| instance n=100 128.alb | 1 | 0 | Solution | 120.50 | 70 | 0.00 | 0.00 |
| instance n=100 129.alb | 1 | 0 | Solution | 120.49 | 67 | 0.00 | 0.00 |
| instance n=100 13.alb | 1 | 0 | Solution | 120.52 | 25 | 0.00 | 0.00 |
| instance n=100 130.alb | 1 | 0 | Solution | 120.50 | 79 | 0.00 | 0.00 |
| instance n=100 131.alb | 1 | 0 | Solution | 120.46 | 69 | 0.00 | 0.00 |
| instance n=100 132.alb | 1 | 0 | Solution | 120.46 | 70 | 0.00 | 0.00 |
| instance n=100 133.alb | 1 | 0 | Solution | 120.46 | 86 | 0.00 | 0.00 |
| instance n=100 134.alb | 1 | 0 | Solution | 120.47 | 72 | 0.00 | 0.00 |
| instance n=100 135.alb | 1 | 0 | Solution | 120.48 | 71 | 0.00 | 0.00 |
| instance n=100 136.alb | 1 | 0 | Solution | 120.46 | 72 | 0.00 | 0.00 |
| instance n=100 137.alb | 1 | 0 | Solution | 120.48 | 75 | 0.00 | 0.00 |
| instance n=100 138.alb | 1 | 0 | Solution | 120.49 | 70 | 0.00 | 0.00 |
| instance n=100 139.alb | 1 | 0 | Solution | 120.47 | 70 | 0.00 | 0.00 |
| instance n=100 14.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 140.alb | 1 | 0 | Solution | 120.52 | 65 | 0.00 | 0.00 |
| instance n=100 141.alb | 1 | 0 | Solution | 120.50 | 70 | 0.00 | 0.00 |
| instance n=100 142.alb | 1 | 0 | Solution | 120.47 | 68 | 0.00 | 0.00 |
| instance n=100 143.alb | 1 | 0 | Solution | 120.46 | 84 | 0.00 | 0.00 |
| instance n=100 144.alb | 1 | 0 | Solution | 120.47 | 59 | 0.00 | 0.00 |
| instance n=100 145.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 146.alb | 1 | 0 | Solution | 120.46 | 63 | 0.00 | 0.00 |
| instance n=100 147.alb | 1 | 0 | Solution | 120.45 | 73 | 0.00 | 0.00 |
| instance n=100 148.alb | 1 | 0 | Solution | 120.47 | 65 | 0.00 | 0.00 |
| instance n=100 149.alb | 1 | 0 | Solution | 120.47 | 69 | 0.00 | 0.00 |
| instance n=100 15.alb | 1 | 0 | Solution | 120.51 | 93 | 0.00 | 0.00 |
| instance n=100 150.alb | 1 | 0 | Solution | 120.47 | 72 | 0.00 | 0.00 |
| instance n=100 151.alb | 1 | 0 | Unknown | 120511.00 | - | - | - |
| instance n=100 152.alb | 1 | 0 | Unknown | 120509.00 | - | - | - |
| instance n=100 153.alb | 1 | 0 | Unknown | 120490.00 | - | - | - |
| instance n=100 154.alb | 1 | 0 | Unknown | 120496.00 | - | - | - |
| instance n=100 155.alb | 1 | 0 | Unknown | 120520.00 | - | - | - |
| instance n=100 156.alb | 1 | 0 | Solution | 120.56 | 97 | 0.00 | 0.00 |
| instance n=100 157.alb | 1 | 0 | Solution | 120.42 | 60 | 0.00 | 0.00 |
| instance n=100 158.alb | 1 | 0 | Unknown | 120507.00 | - | - | - |
| instance n=100 159.alb | 1 | 0 | Unknown | 120463.00 | - | - | - |
| instance n=100 16.alb | 1 | 0 | Solution | 120.47 | 43 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 160.alb | 1 | 0 | Unknown | 120514.00 | - | - | - |
| instance n=100 161.alb | 1 | 0 | Unknown | 120488.00 | - | - | - |
| instance n=100 162.alb | 1 | 0 | Unknown | 120529.00 | - | - | - |
| instance n=100 163.alb | 1 | 0 | Unknown | 120538.00 | - | - | - |
| instance n=100 164.alb | 1 | 0 | Solution | 120.63 | 53 | 0.00 | 0.00 |
| instance n=100 165.alb | 1 | 0 | Unknown | 120518.00 | - | - | - |
| instance n=100 166.alb | 1 | 0 | Unknown | 120593.00 | - | - | - |
| instance n=100 167.alb | 1 | 0 | Unknown | 120500.00 | - | - | - |
| instance n=100 168.alb | 1 | 0 | Unknown | 120511.00 | - | - | - |
| instance n=100 169.alb | 1 | 0 | Unknown | 120601.00 | - | - | - |
| instance n=100 17.alb | 1 | 0 | Unknown | 120858.00 | - | - | - |
| instance n=100 170.alb | 1 | 0 | Solution | 120.56 | 52 | 0.00 | 0.00 |
| instance n=100 171.alb | 1 | 0 | Solution | 120.52 | 25 | 0.00 | 0.00 |
| instance n=100 172.alb | 1 | 0 | Unknown | 120501.00 | - | - | - |
| instance n=100 173.alb | 1 | 0 | Solution | 120.59 | 26 | 0.00 | 0.00 |
| instance n=100 174.alb | 1 | 0 | Unknown | 120500.00 | - | - | - |
| instance n=100 175.alb | 1 | 0 | Solution | 120.46 | 100 | 0.00 | 0.00 |
| instance n=100 176.alb | 1 | 0 | Solution | 120.52 | 14 | 0.00 | 0.00 |
| instance n=100 177.alb | 1 | 0 | Solution | 120.51 | 19 | 0.00 | 0.00 |
| instance n=100 178.alb | 1 | 0 | Unknown | 120481.00 | - | - | - |
| instance n=100 179.alb | 1 | 0 | Solution | 120.50 | 16 | 0.00 | 0.00 |
| instance n=100 18.alb | 1 | 0 | Unknown | 120510.00 | - | - | - |
| instance n=100 180.alb | 1 | 0 | Solution | 120.53 | 15 | 0.00 | 0.00 |
| instance n=100 181.alb | 1 | 0 | Solution | 120.55 | 14 | 0.00 | 0.00 |
| instance n=100 182.alb | 1 | 0 | Solution | 120.50 | 15 | 0.00 | 0.00 |
| instance n=100 183.alb | 1 | 0 | Solution | 120.60 | 31 | 0.00 | 0.00 |
| instance n=100 184.alb | 1 | 0 | Unknown | 120490.00 | - | - | - |
| instance n=100 185.alb | 1 | 0 | Unknown | 120550.00 | - | - | - |
| instance n=100 186.alb | 1 | 0 | Solution | 120.53 | 15 | 0.00 | 0.00 |
| instance n=100 187.alb | 1 | 0 | Solution | 120.51 | 14 | 0.00 | 0.00 |
| instance n=100 188.alb | 1 | 0 | Unknown | 120501.00 | - | - | - |
| instance n=100 189.alb | 1 | 0 | Unknown | 120517.00 | - | - | - |
| instance n=100 19.alb | 1 | 0 | Unknown | 120586.00 | - | - | - |
| instance n=100 190.alb | 1 | 0 | Solution | 120.58 | 14 | 0.00 | 0.00 |
| instance n=100 191.alb | 1 | 0 | Solution | 120.50 | 14 | 0.00 | 0.00 |
| instance n=100 192.alb | 1 | 0 | Solution | 120.55 | 14 | 0.00 | 0.00 |
| instance n=100 193.alb | 1 | 0 | Solution | 120.58 | 62 | 0.00 | 0.00 |
| instance n=100 194.alb | 1 | 0 | Unknown | 120489.00 | - | - | - |
| instance n=100 195.alb | 1 | 0 | Solution | 120.52 | 36 | 0.00 | 0.00 |
| instance n=100 196.alb | 1 | 0 | Solution | 120.47 | 15 | 0.00 | 0.00 |
| instance n=100 197.alb | 1 | 0 | Solution | 120.51 | 100 | 0.00 | 0.00 |
| instance n=100 198.alb | 1 | 0 | Solution | 120.43 | 37 | 0.00 | 0.00 |
| instance n=100 199.alb | 1 | 0 | Solution | 120.53 | 20 | 0.00 | 0.00 |
| instance n=100 2.alb | 1 | 0 | Unknown | 120483.00 | - | - | - |
| instance n=100 20.alb | 1 | 0 | Unknown | 120514.00 | - | - | - |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 200.alb | 1 | 0 | Unknown | 120493.00 | - | - | - |
| instance n=100 201.alb | 1 | 0 | Solution | 120.51 | 72 | 0.00 | 0.00 |
| instance n=100 202.alb | 1 | 0 | Solution | 120.45 | 100 | 0.00 | 0.00 |
| instance n=100 203.alb | 1 | 0 | Unknown | 120441.00 | - | - | - |
| instance n=100 204.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 205.alb | 1 | 0 | Solution | 120.52 | 75 | 0.00 | 0.00 |
| instance n=100 206.alb | 1 | 0 | Unknown | 120537.00 | - | - | - |
| instance n=100 207.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 208.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 209.alb | 1 | 0 | Solution | 120.49 | 73 | 0.00 | 0.00 |
| instance n=100 21.alb | 1 | 0 | Solution | 120.47 | 22 | 0.00 | 0.00 |
| instance n=100 210.alb | 1 | 0 | Solution | 120.47 | 65 | 0.00 | 0.00 |
| instance n=100 211.alb | 1 | 0 | Solution | 120.49 | 79 | 0.00 | 0.00 |
| instance n=100 212.alb | 1 | 0 | Solution | 120.60 | 69 | 0.00 | 0.00 |
| instance n=100 213.alb | 1 | 0 | Solution | 120.48 | 74 | 0.00 | 0.00 |
| instance n=100 214.alb | 1 | 0 | Solution | 120.50 | 71 | 0.00 | 0.00 |
| instance n=100 215.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 216.alb | 1 | 0 | Unknown | 120495.00 | - | - | - |
| instance n=100 217.alb | 1 | 0 | Solution | 120.49 | 70 | 0.00 | 0.00 |
| instance n=100 218.alb | 1 | 0 | Solution | 120.50 | 65 | 0.00 | 0.00 |
| instance n=100 219.alb | 1 | 0 | Solution | 120.48 | 77 | 0.00 | 0.00 |
| instance n=100 22.alb | 1 | 0 | Unknown | 120530.00 | - | - | - |
| instance n=100 220.alb | 1 | 0 | Solution | 120.48 | 88 | 0.00 | 0.00 |
| instance n=100 221.alb | 1 | 0 | Solution | 120.49 | 97 | 0.00 | 0.00 |
| instance n=100 222.alb | 1 | 0 | Solution | 120.51 | 82 | 0.00 | 0.00 |
| instance n=100 223.alb | 1 | 0 | Unknown | 120476.00 | - | - | - |
| instance n=100 224.alb | 1 | 0 | Unknown | 120479.00 | - | - | - |
| instance n=100 225.alb | 1 | 0 | Solution | 120.49 | 74 | 0.00 | 0.00 |
| instance n=100 226.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 227.alb | 1 | 0 | Unknown | 120447.00 | - | - | - |
| instance n=100 228.alb | 1 | 0 | Unknown | 120506.00 | - | - | - |
| instance n=100 229.alb | 1 | 0 | Unknown | 120506.00 | - | - | - |
| instance n=100 23.alb | 1 | 0 | Unknown | 120499.00 | - | - | - |
| instance n=100 230.alb | 1 | 0 | Unknown | 120470.00 | - | - | - |
| instance n=100 231.alb | 1 | 0 | Unknown | 120532.00 | - | - | - |
| instance n=100 232.alb | 1 | 0 | Solution | 120.45 | 99 | 0.00 | 0.00 |
| instance n=100 233.alb | 1 | 0 | Unknown | 120536.00 | - | - | - |
| instance n=100 234.alb | 1 | 0 | Unknown | 120628.00 | - | - | - |
| instance n=100 235.alb | 1 | 0 | Solution | 120.42 | 54 | 0.00 | 0.00 |
| instance n=100 236.alb | 1 | 0 | Solution | 120.53 | 25 | 0.00 | 0.00 |
| instance n=100 237.alb | 1 | 0 | Unknown | 120424.00 | - | - | - |
| instance n=100 238.alb | 1 | 0 | Unknown | 120542.00 | - | - | - |
| instance n=100 239.alb | 1 | 0 | Solution | 120.47 | 36 | 0.00 | 0.00 |
| instance n=100 24.alb | 1 | 0 | Solution | 120.53 | 42 | 0.00 | 0.00 |
| instance n=100 240.alb | 1 | 0 | Unknown | 120465.00 | - | - | - |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 241.alb | 1 | 0 | Unknown | 120512.00 | - | - | - |
| instance n=100 242.alb | 1 | 0 | Unknown | 120522.00 | - | - | - |
| instance n=100 243.alb | 1 | 0 | Unknown | 120429.00 | - | - | - |
| instance n=100 244.alb | 1 | 0 | Unknown | 120565.00 | - | - | - |
| instance n=100 245.alb | 1 | 0 | Unknown | 120493.00 | - | - | - |
| instance n=100 246.alb | 1 | 0 | Solution | 120.44 | 89 | 0.00 | 0.00 |
| instance n=100 247.alb | 1 | 0 | Unknown | 120521.00 | - | - | - |
| instance n=100 248.alb | 1 | 0 | Solution | 120.52 | 36 | 0.00 | 0.00 |
| instance n=100 249.alb | 1 | 0 | Unknown | 120506.00 | - | - | - |
| instance n=100 25.alb | 1 | 0 | Solution | 120.47 | 25 | 0.00 | 0.00 |
| instance n=100 250.alb | 1 | 0 | Unknown | 120483.00 | - | - | - |
| instance n=100 251.alb | 1 | 0 | Solution | 120.47 | 25 | 0.00 | 0.00 |
| instance n=100 252.alb | 1 | 0 | Unknown | 120954.00 | - | - | - |
| instance n=100 253.alb | 1 | 0 | Solution | 120.50 | 26 | 0.00 | 0.00 |
| instance n=100 254.alb | 1 | 0 | Solution | 120.55 | 42 | 0.00 | 0.00 |
| instance n=100 255.alb | 1 | 0 | Solution | 120.50 | 14 | 0.00 | 0.00 |
| instance n=100 256.alb | 1 | 0 | Unknown | 120522.00 | - | - | - |
| instance n=100 257.alb | 1 | 0 | Solution | 120.47 | 100 | 0.00 | 0.00 |
| instance n=100 258.alb | 1 | 0 | Unknown | 120524.00 | - | - | - |
| instance n=100 259.alb | 1 | 0 | Unknown | 120468.00 | - | - | - |
| instance n=100 26.alb | 1 | 0 | Unknown | 120493.00 | - | - | - |
| instance n=100 260.alb | 1 | 0 | Unknown | 120487.00 | - | - | - |
| instance n=100 261.alb | 1 | 0 | Solution | 120.54 | 99 | 0.00 | 0.00 |
| instance n=100 262.alb | 1 | 0 | Solution | 120.52 | 100 | 0.00 | 0.00 |
| instance n=100 263.alb | 1 | 0 | Unknown | 120491.00 | - | - | - |
| instance n=100 264.alb | 1 | 0 | Solution | 120.55 | 41 | 0.00 | 0.00 |
| instance n=100 265.alb | 1 | 0 | Solution | 120.47 | 100 | 0.00 | 0.00 |
| instance n=100 266.alb | 1 | 0 | Solution | 120.54 | 32 | 0.00 | 0.00 |
| instance n=100 267.alb | 1 | 0 | Solution | 120.47 | 25 | 0.00 | 0.00 |
| instance n=100 268.alb | 1 | 0 | Solution | 120.74 | 15 | 0.00 | 0.00 |
| instance n=100 269.alb | 1 | 0 | Unknown | 120607.00 | - | - | - |
| instance n=100 27.alb | 1 | 0 | Solution | 120.54 | 35 | 0.00 | 0.00 |
| instance n=100 270.alb | 1 | 0 | Solution | 120.49 | 99 | 0.00 | 0.00 |
| instance n=100 271.alb | 1 | 0 | Solution | 120.43 | 39 | 0.00 | 0.00 |
| instance n=100 272.alb | 1 | 0 | Unknown | 120547.00 | - | - | - |
| instance n=100 273.alb | 1 | 0 | Unknown | 120538.00 | - | - | - |
| instance n=100 274.alb | 1 | 0 | Unknown | 120500.00 | - | - | - |
| instance n=100 275.alb | 1 | 0 | Solution | 120.52 | 100 | 0.00 | 0.00 |
| instance n=100 276.alb | 1 | 0 | Solution | 120.50 | 69 | 0.00 | 0.00 |
| instance n=100 277.alb | 1 | 0 | Solution | 120.45 | 70 | 0.00 | 0.00 |
| instance n=100 278.alb | 1 | 0 | Solution | 120.46 | 67 | 0.00 | 0.00 |
| instance n=100 279.alb | 1 | 0 | Solution | 120.45 | 73 | 0.00 | 0.00 |
| instance n=100 28.alb | 1 | 0 | Solution | 120.47 | 15 | 0.00 | 0.00 |
| instance n=100 280.alb | 1 | 0 | Solution | 120.48 | 67 | 0.00 | 0.00 |
| instance n=100 281.alb | 1 | 0 | Solution | 120.47 | 85 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 282.alb | 1 | 0 | Solution | 120.48 | 71 | 0.00 | 0.00 |
| instance n=100 283.alb | 1 | 0 | Solution | 120.48 | 65 | 0.00 | 0.00 |
| instance n=100 284.alb | 1 | 0 | Solution | 120.49 | 72 | 0.00 | 0.00 |
| instance n=100 285.alb | 1 | 0 | Solution | 120.45 | 69 | 0.00 | 0.00 |
| instance n=100 286.alb | 1 | 0 | Solution | 120.48 | 77 | 0.00 | 0.00 |
| instance n=100 287.alb | 1 | 0 | Solution | 120.46 | 78 | 0.00 | 0.00 |
| instance n=100 288.alb | 1 | 0 | Solution | 120.45 | 67 | 0.00 | 0.00 |
| instance n=100 289.alb | 1 | 0 | Solution | 120.47 | 73 | 0.00 | 0.00 |
| instance n=100 29.alb | 1 | 0 | Solution | 120.48 | 16 | 0.00 | 0.00 |
| instance n=100 290.alb | 1 | 0 | Solution | 120.51 | 67 | 0.00 | 0.00 |
| instance n=100 291.alb | 1 | 0 | Solution | 120.47 | 72 | 0.00 | 0.00 |
| instance n=100 292.alb | 1 | 0 | Solution | 120.48 | 72 | 0.00 | 0.00 |
| instance n=100 293.alb | 1 | 0 | Solution | 120.50 | 63 | 0.00 | 0.00 |
| instance n=100 294.alb | 1 | 0 | Solution | 120.49 | 73 | 0.00 | 0.00 |
| instance n=100 295.alb | 1 | 0 | Solution | 120.50 | 73 | 0.00 | 0.00 |
| instance n=100 296.alb | 1 | 0 | Solution | 120.47 | 69 | 0.00 | 0.00 |
| instance n=100 297.alb | 1 | 0 | Solution | 120.45 | 68 | 0.00 | 0.00 |
| instance n=100 298.alb | 1 | 0 | Solution | 120.47 | 68 | 0.00 | 0.00 |
| instance n=100 299.alb | 1 | 0 | Solution | 120.46 | 66 | 0.00 | 0.00 |
| instance n=100 3.alb | 1 | 0 | Solution | 120.55 | 62 | 0.00 | 0.00 |
| instance n=100 30.alb | 1 | 0 | Solution | 120.55 | 71 | 0.00 | 0.00 |
| instance n=100 300.alb | 1 | 0 | Solution | 120.50 | 97 | 0.00 | 0.00 |
| instance n=100 301.alb | 1 | 0 | Solution | 120.49 | 25 | 0.00 | 0.00 |
| instance n=100 302.alb | 1 | 0 | Solution | 120.45 | 68 | 0.00 | 0.00 |
| instance n=100 303.alb | 1 | 0 | Solution | 120.53 | 56 | 0.00 | 0.00 |
| instance n=100 304.alb | 1 | 0 | Solution | 120.48 | 54 | 0.00 | 0.00 |
| instance n=100 305.alb | 1 | 0 | Unknown | 120492.00 | - | - | - |
| instance n=100 306.alb | 1 | 0 | Unknown | 120525.00 | - | - | - |
| instance n=100 307.alb | 1 | 0 | Unknown | 120539.00 | - | - | - |
| instance n=100 308.alb | 1 | 0 | Solution | 120.52 | 22 | 0.00 | 0.00 |
| instance n=100 309.alb | 1 | 0 | Unknown | 120490.00 | - | - | - |
| instance n=100 31.alb | 1 | 0 | Unknown | 120536.00 | - | - | - |
| instance n=100 310.alb | 1 | 0 | Unknown | 120478.00 | - | - | - |
| instance n=100 311.alb | 1 | 0 | Unknown | 120458.00 | - | - | - |
| instance n=100 312.alb | 1 | 0 | Solution | 120.53 | 44 | 0.00 | 0.00 |
| instance n=100 313.alb | 1 | 0 | Unknown | 120496.00 | - | - | - |
| instance n=100 314.alb | 1 | 0 | Solution | 120.53 | 100 | 0.00 | 0.00 |
| instance n=100 315.alb | 1 | 0 | Unknown | 120501.00 | - | - | - |
| instance n=100 316.alb | 1 | 0 | Unknown | 120474.00 | - | - | - |
| instance n=100 317.alb | 1 | 0 | Unknown | 120500.00 | - | - | - |
| instance n=100 318.alb | 1 | 0 | Unknown | 120429.00 | - | - | - |
| instance n=100 319.alb | 1 | 0 | Unknown | 120483.00 | - | - | - |
| instance n=100 32.alb | 1 | 0 | Solution | 120.54 | 100 | 0.00 | 0.00 |
| instance n=100 320.alb | 1 | 0 | Unknown | 120520.00 | - | - | - |
| instance n=100 321.alb | 1 | 0 | Solution | 120.53 | 53 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 322.alb | 1 | 0 | Solution | 120.54 | 46 | 0.00 | 0.00 |
| instance n=100 323.alb | 1 | 0 | Solution | 120.47 | 26 | 0.00 | 0.00 |
| instance n=100 324.alb | 1 | 0 | Unknown | 120442.00 | - | - | - |
| instance n=100 325.alb | 1 | 0 | Unknown | 120504.00 | - | - | - |
| instance n=100 326.alb | 1 | 0 | Solution | 120.47 | 14 | 0.00 | 0.00 |
| instance n=100 327.alb | 1 | 0 | Solution | 120.55 | 15 | 0.00 | 0.00 |
| instance n=100 328.alb | 1 | 0 | Solution | 120.50 | 100 | 0.00 | 0.00 |
| instance n=100 329.alb | 1 | 0 | Solution | 120.50 | 65 | 0.00 | 0.00 |
| instance n=100 33.alb | 1 | 0 | Solution | 120.56 | 93 | 0.00 | 0.00 |
| instance n=100 330.alb | 1 | 0 | Unknown | 120454.00 | - | - | - |
| instance n=100 331.alb | 1 | 0 | Solution | 120.56 | 92 | 0.00 | 0.00 |
| instance n=100 332.alb | 1 | 0 | Solution | 120.44 | 14 | 0.00 | 0.00 |
| instance n=100 333.alb | 1 | 0 | Solution | 120.52 | 49 | 0.00 | 0.00 |
| instance n=100 334.alb | 1 | 0 | Unknown | 120512.00 | - | - | - |
| instance n=100 335.alb | 1 | 0 | Solution | 120.45 | 14 | 0.00 | 0.00 |
| instance n=100 336.alb | 1 | 0 | Solution | 120.56 | 55 | 0.00 | 0.00 |
| instance n=100 337.alb | 1 | 0 | Solution | 120.56 | 14 | 0.00 | 0.00 |
| instance n=100 338.alb | 1 | 0 | Solution | 120.50 | 16 | 0.00 | 0.00 |
| instance n=100 339.alb | 1 | 0 | Solution | 120.48 | 16 | 0.00 | 0.00 |
| instance n=100 34.alb | 1 | 0 | Unknown | 120495.00 | - | - | - |
| instance n=100 340.alb | 1 | 0 | Solution | 120.51 | 15 | 0.00 | 0.00 |
| instance n=100 341.alb | 1 | 0 | Unknown | 120504.00 | - | - | - |
| instance n=100 342.alb | 1 | 0 | Solution | 120.54 | 100 | 0.00 | 0.00 |
| instance n=100 343.alb | 1 | 0 | Unknown | 120511.00 | - | - | - |
| instance n=100 344.alb | 1 | 0 | Solution | 120.52 | 100 | 0.00 | 0.00 |
| instance n=100 345.alb | 1 | 0 | Solution | 120.60 | 98 | 0.00 | 0.00 |
| instance n=100 346.alb | 1 | 0 | Solution | 120.54 | 99 | 0.00 | 0.00 |
| instance n=100 347.alb | 1 | 0 | Solution | 120.49 | 15 | 0.00 | 0.00 |
| instance n=100 348.alb | 1 | 0 | Unknown | 120508.00 | - | - | - |
| instance n=100 349.alb | 1 | 0 | Solution | 120.42 | 14 | 0.00 | 0.00 |
| instance n=100 35.alb | 1 | 0 | Solution | 120.45 | 16 | 0.00 | 0.00 |
| instance n=100 350.alb | 1 | 0 | Solution | 120.52 | 36 | 0.00 | 0.00 |
| instance n=100 351.alb | 1 | 0 | Solution | 120.47 | 98 | 0.00 | 0.00 |
| instance n=100 352.alb | 1 | 0 | Solution | 120.47 | 82 | 0.00 | 0.00 |
| instance n=100 353.alb | 1 | 0 | Unknown | 120470.00 | - | - | - |
| instance n=100 354.alb | 1 | 0 | Solution | 120.53 | 67 | 0.00 | 0.00 |
| instance n=100 355.alb | 1 | 0 | Solution | 120.47 | 68 | 0.00 | 0.00 |
| instance n=100 356.alb | 1 | 0 | Unknown | 120499.00 | - | - | - |
| instance n=100 357.alb | 1 | 0 | Solution | 120.48 | 79 | 0.00 | 0.00 |
| instance n=100 358.alb | 1 | 0 | Solution | 120.51 | 100 | 0.00 | 0.00 |
| instance n=100 359.alb | 1 | 0 | Solution | 120.48 | 99 | 0.00 | 0.00 |
| instance n=100 36.alb | 1 | 0 | Unknown | 120521.00 | - | - | - |
| instance n=100 360.alb | 1 | 0 | Unknown | 120492.00 | - | - | - |
| instance n=100 361.alb | 1 | 0 | Unknown | 120450.00 | - | - | - |
| instance n=100 362.alb | 1 | 0 | Solution | 120.47 | 98 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 363.alb | 1 | 0 | Solution | 120.47 | 65 | 0.00 | 0.00 |
| instance n=100 364.alb | 1 | 0 | Solution | 120.45 | 79 | 0.00 | 0.00 |
| instance n=100 365.alb | 1 | 0 | Solution | 120.49 | 76 | 0.00 | 0.00 |
| instance n=100 366.alb | 1 | 0 | Solution | 120.47 | 88 | 0.00 | 0.00 |
| instance n=100 367.alb | 1 | 0 | Solution | 120.49 | 82 | 0.00 | 0.00 |
| instance n=100 368.alb | 1 | 0 | Solution | 120.47 | 100 | 0.00 | 0.00 |
| instance n=100 369.alb | 1 | 0 | Unknown | 120467.00 | - | - | - |
| instance n=100 37.alb | 1 | 0 | Unknown | 120516.00 | - | - | - |
| instance n=100 370.alb | 1 | 0 | Solution | 120.47 | 91 | 0.00 | 0.00 |
| instance n=100 371.alb | 1 | 0 | Solution | 120.46 | 100 | 0.00 | 0.00 |
| instance n=100 372.alb | 1 | 0 | Unknown | 120519.00 | - | - | - |
| instance n=100 373.alb | 1 | 0 | Unknown | 120501.00 | - | - | - |
| instance n=100 374.alb | 1 | 0 | Unknown | 120502.00 | - | - | - |
| instance n=100 375.alb | 1 | 0 | Solution | 120.50 | 81 | 0.00 | 0.00 |
| instance n=100 376.alb | 1 | 0 | Unknown | 120498.00 | - | - | - |
| instance n=100 377.alb | 1 | 0 | Unknown | 120526.00 | - | - | - |
| instance n=100 378.alb | 1 | 0 | Unknown | 120512.00 | - | - | - |
| instance n=100 379.alb | 1 | 0 | Unknown | 120515.00 | - | - | - |
| instance n=100 38.alb | 1 | 0 | Solution | 120.50 | 16 | 0.00 | 0.00 |
| instance n=100 380.alb | 1 | 0 | Unknown | 120535.00 | - | - | - |
| instance n=100 381.alb | 1 | 0 | Unknown | 120527.00 | - | - | - |
| instance n=100 382.alb | 1 | 0 | Solution | 120.51 | 61 | 0.00 | 0.00 |
| instance n=100 383.alb | 1 | 0 | Solution | 120.53 | 54 | 0.00 | 0.00 |
| instance n=100 384.alb | 1 | 0 | Unknown | 120537.00 | - | - | - |
| instance n=100 385.alb | 1 | 0 | Unknown | 120436.00 | - | - | - |
| instance n=100 386.alb | 1 | 0 | Unknown | 120442.00 | - | - | - |
| instance n=100 387.alb | 1 | 0 | Unknown | 120528.00 | - | - | - |
| instance n=100 388.alb | 1 | 0 | Unknown | 120553.00 | - | - | - |
| instance n=100 389.alb | 1 | 0 | Unknown | 120497.00 | - | - | - |
| instance n=100 39.alb | 1 | 0 | Solution | 120.52 | 30 | 0.00 | 0.00 |
| instance n=100 390.alb | 1 | 0 | Solution | 120.58 | 67 | 0.00 | 0.00 |
| instance n=100 391.alb | 1 | 0 | Unknown | 120516.00 | - | - | - |
| instance n=100 392.alb | 1 | 0 | Solution | 120.57 | 47 | 0.00 | 0.00 |
| instance n=100 393.alb | 1 | 0 | Unknown | 120445.00 | - | - | - |
| instance n=100 394.alb | 1 | 0 | Unknown | 120520.00 | - | - | - |
| instance n=100 395.alb | 1 | 0 | Unknown | 120427.00 | - | - | - |
| instance n=100 396.alb | 1 | 0 | Unknown | 120519.00 | - | - | - |
| instance n=100 397.alb | 1 | 0 | Solution | 120.45 | 57 | 0.00 | 0.00 |
| instance n=100 398.alb | 1 | 0 | Unknown | 120505.00 | - | - | - |
| instance n=100 399.alb | 1 | 0 | Unknown | 120525.00 | - | - | - |
| instance n=100 4.alb | 1 | 0 | Unknown | 120478.00 | - | - | - |
| instance n=100 40.alb | 1 | 0 | Solution | 120.58 | 57 | 0.00 | 0.00 |
| instance n=100 400.alb | 1 | 0 | Solution | 120.46 | 31 | 0.00 | 0.00 |
| instance n=100 401.alb | 1 | 0 | Unknown | 120518.00 | - | - | - |
| instance n=100 402.alb | 1 | 0 | Unknown | 120505.00 | - | - | - |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 403.alb | 1 | 0 | Solution | 120.63 | 99 | 0.00 | 0.00 |
| instance n=100 404.alb | 1 | 0 | Solution | 120.49 | 56 | 0.00 | 0.00 |
| instance n=100 405.alb | 1 | 0 | Solution | 120.49 | 14 | 0.00 | 0.00 |
| instance n=100 406.alb | 1 | 0 | Solution | 120.50 | 14 | 0.00 | 0.00 |
| instance n=100 407.alb | 1 | 0 | Unknown | 120561.00 | - | - | - |
| instance n=100 408.alb | 1 | 0 | Solution | 120.51 | 90 | 0.00 | 0.00 |
| instance n=100 409.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 41.alb | 1 | 0 | Unknown | 120516.00 | - | - | - |
| instance n=100 410.alb | 1 | 0 | Unknown | 120491.00 | - | - | - |
| instance n=100 411.alb | 1 | 0 | Unknown | 120528.00 | - | - | - |
| instance n=100 412.alb | 1 | 0 | Unknown | 120447.00 | - | - | - |
| instance n=100 413.alb | 1 | 0 | Unknown | 120565.00 | - | - | - |
| instance n=100 414.alb | 1 | 0 | Solution | 120.51 | 47 | 0.00 | 0.00 |
| instance n=100 415.alb | 1 | 0 | Solution | 120.51 | 99 | 0.00 | 0.00 |
| instance n=100 416.alb | 1 | 0 | Solution | 120.52 | 52 | 0.00 | 0.00 |
| instance n=100 417.alb | 1 | 0 | Unknown | 120496.00 | - | - | - |
| instance n=100 418.alb | 1 | 0 | Unknown | 120496.00 | - | - | - |
| instance n=100 419.alb | 1 | 0 | Unknown | 120523.00 | - | - | - |
| instance n=100 42.alb | 1 | 0 | Unknown | 120529.00 | - | - | - |
| instance n=100 420.alb | 1 | 0 | Solution | 120.53 | 37 | 0.00 | 0.00 |
| instance n=100 421.alb | 1 | 0 | Solution | 120.57 | 14 | 0.00 | 0.00 |
| instance n=100 422.alb | 1 | 0 | Solution | 120.52 | 39 | 0.00 | 0.00 |
| instance n=100 423.alb | 1 | 0 | Solution | 120.52 | 42 | 0.00 | 0.00 |
| instance n=100 424.alb | 1 | 0 | Solution | 120.51 | 57 | 0.00 | 0.00 |
| instance n=100 425.alb | 1 | 0 | Solution | 120.50 | 98 | 0.00 | 0.00 |
| instance n=100 426.alb | 1 | 0 | Solution | 120.46 | 74 | 0.00 | 0.00 |
| instance n=100 427.alb | 1 | 0 | Solution | 120.48 | 78 | 0.00 | 0.00 |
| instance n=100 428.alb | 1 | 0 | Solution | 120.47 | 69 | 0.00 | 0.00 |
| instance n=100 429.alb | 1 | 0 | Solution | 120.46 | 73 | 0.00 | 0.00 |
| instance n=100 43.alb | 1 | 0 | Solution | 120.55 | 15 | 0.00 | 0.00 |
| instance n=100 430.alb | 1 | 0 | Solution | 120.48 | 68 | 0.00 | 0.00 |
| instance n=100 431.alb | 1 | 0 | Solution | 120.48 | 68 | 0.00 | 0.00 |
| instance n=100 432.alb | 1 | 0 | Solution | 120.47 | 74 | 0.00 | 0.00 |
| instance n=100 433.alb | 1 | 0 | Solution | 120.47 | 65 | 0.00 | 0.00 |
| instance n=100 434.alb | 1 | 0 | Solution | 120.45 | 70 | 0.00 | 0.00 |
| instance n=100 435.alb | 1 | 0 | Solution | 120.47 | 69 | 0.00 | 0.00 |
| instance n=100 436.alb | 1 | 0 | Solution | 120.46 | 66 | 0.00 | 0.00 |
| instance n=100 437.alb | 1 | 0 | Solution | 120.46 | 66 | 0.00 | 0.00 |
| instance n=100 438.alb | 1 | 0 | Solution | 120.47 | 66 | 0.00 | 0.00 |
| instance n=100 439.alb | 1 | 0 | Solution | 120.48 | 79 | 0.00 | 0.00 |
| instance n=100 44.alb | 1 | 0 | Solution | 120.53 | 37 | 0.00 | 0.00 |
| instance n=100 440.alb | 1 | 0 | Solution | 120.46 | 63 | 0.00 | 0.00 |
| instance n=100 441.alb | 1 | 0 | Solution | 120.44 | 66 | 0.00 | 0.00 |
| instance n=100 442.alb | 1 | 0 | Solution | 120.46 | 68 | 0.00 | 0.00 |
| instance n=100 443.alb | 1 | 0 | Solution | 120.51 | 66 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 444.alb | 1 | 0 | Solution | 120.46 | 99 | 0.00 | 0.00 |
| instance n=100 445.alb | 1 | 0 | Solution | 120.47 | 65 | 0.00 | 0.00 |
| instance n=100 446.alb | 1 | 0 | Solution | 120.48 | 73 | 0.00 | 0.00 |
| instance n=100 447.alb | 1 | 0 | Solution | 120.47 | 64 | 0.00 | 0.00 |
| instance n=100 448.alb | 1 | 0 | Solution | 120.53 | 84 | 0.00 | 0.00 |
| instance n=100 449.alb | 1 | 0 | Solution | 120.44 | 71 | 0.00 | 0.00 |
| instance n=100 45.alb | 1 | 0 | Solution | 120.52 | 95 | 0.00 | 0.00 |
| instance n=100 450.alb | 1 | 0 | Solution | 120.47 | 68 | 0.00 | 0.00 |
| instance n=100 451.alb | 1 | 0 | Solution | 120.44 | 30 | 0.00 | 0.00 |
| instance n=100 452.alb | 1 | 0 | Solution | 120.47 | 24 | 0.00 | 0.00 |
| instance n=100 453.alb | 1 | 0 | Unknown | 120528.00 | - | - | - |
| instance n=100 454.alb | 1 | 0 | Unknown | 120514.00 | - | - | - |
| instance n=100 455.alb | 1 | 0 | Unknown | 120513.00 | - | - | - |
| instance n=100 456.alb | 1 | 0 | Solution | 120.44 | 29 | 0.00 | 0.00 |
| instance n=100 457.alb | 1 | 0 | Unknown | 120449.00 | - | - | - |
| instance n=100 458.alb | 1 | 0 | Unknown | 120509.00 | - | - | - |
| instance n=100 459.alb | 1 | 0 | Unknown | 120549.00 | - | - | - |
| instance n=100 46.alb | 1 | 0 | Solution | 120.53 | 14 | 0.00 | 0.00 |
| instance n=100 460.alb | 1 | 0 | Solution | 120.43 | 26 | 0.00 | 0.00 |
| instance n=100 461.alb | 1 | 0 | Solution | 120.46 | 31 | 0.00 | 0.00 |
| instance n=100 462.alb | 1 | 0 | Unknown | 120489.00 | - | - | - |
| instance n=100 463.alb | 1 | 0 | Solution | 120.45 | 28 | 0.00 | 0.00 |
| instance n=100 464.alb | 1 | 0 | Solution | 120.43 | 31 | 0.00 | 0.00 |
| instance n=100 465.alb | 1 | 0 | Solution | 120.46 | 30 | 0.00 | 0.00 |
| instance n=100 466.alb | 1 | 0 | Solution | 120.42 | 39 | 0.00 | 0.00 |
| instance n=100 467.alb | 1 | 0 | Unknown | 120511.00 | - | - | - |
| instance n=100 468.alb | 1 | 0 | Solution | 120.43 | 32 | 0.00 | 0.00 |
| instance n=100 469.alb | 1 | 0 | Solution | 120.45 | 24 | 0.00 | 0.00 |
| instance n=100 47.alb | 1 | 0 | Unknown | 120615.00 | - | - | - |
| instance n=100 470.alb | 1 | 0 | Unknown | 120426.00 | - | - | - |
| instance n=100 471.alb | 1 | 0 | Solution | 120.44 | 88 | 0.00 | 0.00 |
| instance n=100 472.alb | 1 | 0 | Solution | 120.52 | 32 | 0.00 | 0.00 |
| instance n=100 473.alb | 1 | 0 | Unknown | 120418.00 | - | - | - |
| instance n=100 474.alb | 1 | 0 | Solution | 120.43 | 25 | 0.00 | 0.00 |
| instance n=100 475.alb | 1 | 0 | Unknown | 120446.00 | - | - | - |
| instance n=100 476.alb | 1 | 0 | Solution | 120.51 | 15 | 0.00 | 0.00 |
| instance n=100 477.alb | 1 | 0 | Unknown | 120456.00 | - | - | - |
| instance n=100 478.alb | 1 | 0 | Unknown | 120499.00 | - | - | - |
| instance n=100 479.alb | 1 | 0 | Unknown | 120487.00 | - | - | - |
| instance n=100 48.alb | 1 | 0 | Solution | 120.54 | 16 | 0.00 | 0.00 |
| instance n=100 480.alb | 1 | 0 | Unknown | 120511.00 | - | - | - |
| instance n=100 481.alb | 1 | 0 | Unknown | 120550.00 | - | - | - |
| instance n=100 482.alb | 1 | 0 | Unknown | 120552.00 | - | - | - |
| instance n=100 483.alb | 1 | 0 | Solution | 120.49 | 26 | 0.00 | 0.00 |
| instance n=100 484.alb | 1 | 0 | Unknown | 120549.00 | - | - | - |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 485.alb | 1 | 0 | Solution | 120.49 | 20 | 0.00 | 0.00 |
| instance n=100 486.alb | 1 | 0 | Unknown | 120513.00 | - | - | - |
| instance n=100 487.alb | 1 | 0 | Unknown | 120489.00 | - | - | - |
| instance n=100 488.alb | 1 | 0 | Unknown | 120486.00 | - | - | - |
| instance n=100 489.alb | 1 | 0 | Solution | 120.51 | 33 | 0.00 | 0.00 |
| instance n=100 49.alb | 1 | 0 | Solution | 120.52 | 15 | 0.00 | 0.00 |
| instance n=100 490.alb | 1 | 0 | Unknown | 120541.00 | - | - | - |
| instance n=100 491.alb | 1 | 0 | Solution | 120.50 | 28 | 0.00 | 0.00 |
| instance n=100 492.alb | 1 | 0 | Solution | 120.51 | 95 | 0.00 | 0.00 |
| instance n=100 493.alb | 1 | 0 | Unknown | 120467.00 | - | - | - |
| instance n=100 494.alb | 1 | 0 | Unknown | 120499.00 | - | - | - |
| instance n=100 495.alb | 1 | 0 | Solution | 120.51 | 18 | 0.00 | 0.00 |
| instance n=100 496.alb | 1 | 0 | Solution | 120.51 | 24 | 0.00 | 0.00 |
| instance n=100 497.alb | 1 | 0 | Solution | 120.46 | 64 | 0.00 | 0.00 |
| instance n=100 498.alb | 1 | 0 | Unknown | 120503.00 | - | - | - |
| instance n=100 499.alb | 1 | 0 | Solution | 120.53 | 25 | 0.00 | 0.00 |
| instance n=100 5.alb | 1 | 0 | Solution | 120.48 | 24 | 0.00 | 0.00 |
| instance n=100 50.alb | 1 | 0 | Solution | 120.49 | 14 | 0.00 | 0.00 |
| instance n=100 500.alb | 1 | 0 | Solution | 120.49 | 17 | 0.00 | 0.00 |
| instance n=100 501.alb | 1 | 0 | Solution | 120.46 | 67 | 0.00 | 0.00 |
| instance n=100 502.alb | 1 | 0 | Solution | 120.45 | 69 | 0.00 | 0.00 |
| instance n=100 503.alb | 1 | 0 | Solution | 120.45 | 65 | 0.00 | 0.00 |
| instance n=100 504.alb | 1 | 0 | Solution | 120.46 | 64 | 0.00 | 0.00 |
| instance n=100 505.alb | 1 | 0 | Solution | 120.47 | 63 | 0.00 | 0.00 |
| instance n=100 506.alb | 1 | 0 | Solution | 120.51 | 64 | 0.00 | 0.00 |
| instance n=100 507.alb | 1 | 0 | Solution | 120.47 | 62 | 0.00 | 0.00 |
| instance n=100 508.alb | 1 | 0 | Solution | 120.43 | 61 | 0.00 | 0.00 |
| instance n=100 509.alb | 1 | 0 | Solution | 120.47 | 63 | 0.00 | 0.00 |
| instance n=100 51.alb | 1 | 0 | Unknown | 120462.00 | - | - | - |
| instance n=100 510.alb | 1 | 0 | Solution | 120.46 | 63 | 0.00 | 0.00 |
| instance n=100 511.alb | 1 | 0 | Solution | 120.46 | 61 | 0.00 | 0.00 |
| instance n=100 512.alb | 1 | 0 | Solution | 120.45 | 66 | 0.00 | 0.00 |
| instance n=100 513.alb | 1 | 0 | Solution | 120.45 | 64 | 0.00 | 0.00 |
| instance n=100 514.alb | 1 | 0 | Solution | 120.53 | 66 | 0.00 | 0.00 |
| instance n=100 515.alb | 1 | 0 | Solution | 120.47 | 65 | 0.00 | 0.00 |
| instance n=100 516.alb | 1 | 0 | Solution | 120.47 | 78 | 0.00 | 0.00 |
| instance n=100 517.alb | 1 | 0 | Solution | 120.45 | 64 | 0.00 | 0.00 |
| instance n=100 518.alb | 1 | 0 | Solution | 121.01 | 67 | 0.00 | 0.00 |
| instance n=100 519.alb | 1 | 0 | Solution | 120.47 | 69 | 0.00 | 0.00 |
| instance n=100 52.alb | 1 | 0 | Solution | 120.50 | 71 | 0.00 | 0.00 |
| instance n=100 520.alb | 1 | 0 | Solution | 120.44 | 64 | 0.00 | 0.00 |
| instance n=100 521.alb | 1 | 0 | Solution | 120.45 | 75 | 0.00 | 0.00 |
| instance n=100 522.alb | 1 | 0 | Solution | 120.47 | 65 | 0.00 | 0.00 |
| instance n=100 523.alb | 1 | 0 | Solution | 120.46 | 61 | 0.00 | 0.00 |
| instance n=100 524.alb | 1 | 0 | Solution | 120.88 | 68 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 525.alb | 1 | 0 | Solution | 120.43 | 66 | 0.00 | 0.00 |
| instance n=100 53.alb | 1 | 0 | Solution | 120.48 | 88 | 0.00 | 0.00 |
| instance n=100 54.alb | 1 | 0 | Unknown | 120491.00 | - | - | - |
| instance n=100 55.alb | 1 | 0 | Unknown | 120513.00 | - | - | - |
| instance n=100 56.alb | 1 | 0 | Solution | 120.48 | 68 | 0.00 | 0.00 |
| instance n=100 57.alb | 1 | 0 | Solution | 120.49 | 100 | 0.00 | 0.00 |
| instance n=100 58.alb | 1 | 0 | Solution | 120.50 | 86 | 0.00 | 0.00 |
| instance n=100 59.alb | 1 | 0 | Solution | 120.46 | 84 | 0.00 | 0.00 |
| instance n=100 6.alb | 1 | 0 | Unknown | 120512.00 | - | - | - |
| instance n=100 60.alb | 1 | 0 | Unknown | 120471.00 | - | - | - |
| instance n=100 61.alb | 1 | 0 | Solution | 120.48 | 76 | 0.00 | 0.00 |
| instance n=100 62.alb | 1 | 0 | Solution | 120.48 | 100 | 0.00 | 0.00 |
| instance n=100 63.alb | 1 | 0 | Unknown | 120490.00 | - | - | - |
| instance n=100 64.alb | 1 | 0 | Solution | 120.51 | 71 | 0.00 | 0.00 |
| instance n=100 65.alb | 1 | 0 | Solution | 120.46 | 66 | 0.00 | 0.00 |
| instance n=100 66.alb | 1 | 0 | Solution | 120.46 | 78 | 0.00 | 0.00 |
| instance n=100 67.alb | 1 | 0 | Unknown | 120490.00 | - | - | - |
| instance n=100 68.alb | 1 | 0 | Solution | 120.47 | 99 | 0.00 | 0.00 |
| instance n=100 69.alb | 1 | 0 | Solution | 120.50 | 81 | 0.00 | 0.00 |
| instance n=100 7.alb | 1 | 0 | Unknown | 120435.00 | - | - | - |
| instance n=100 70.alb | 1 | 0 | Unknown | 120494.00 | - | - | - |
| instance n=100 71.alb | 1 | 0 | Solution | 120.51 | 95 | 0.00 | 0.00 |
| instance n=100 72.alb | 1 | 0 | Solution | 120.47 | 77 | 0.00 | 0.00 |
| instance n=100 73.alb | 1 | 0 | Solution | 120.49 | 71 | 0.00 | 0.00 |
| instance n=100 74.alb | 1 | 0 | Unknown | 120500.00 | - | - | - |
| instance n=100 75.alb | 1 | 0 | Solution | 120.47 | 85 | 0.00 | 0.00 |
| instance n=100 76.alb | 1 | 0 | Unknown | 120523.00 | - | - | - |
| instance n=100 77.alb | 1 | 0 | Unknown | 120516.00 | - | - | - |
| instance n=100 78.alb | 1 | 0 | Solution | 120.52 | 65 | 0.00 | 0.00 |
| instance n=100 79.alb | 1 | 0 | Unknown | 120491.00 | - | - | - |
| instance n=100 8.alb | 1 | 0 | Unknown | 120518.00 | - | - | - |
| instance n=100 80.alb | 1 | 0 | Solution | 120.44 | 99 | 0.00 | 0.00 |
| instance n=100 81.alb | 1 | 0 | Unknown | 120499.00 | - | - | - |
| instance n=100 82.alb | 1 | 0 | Unknown | 120419.00 | - | - | - |
| instance n=100 83.alb | 1 | 0 | Unknown | 120432.00 | - | - | - |
| instance n=100 84.alb | 1 | 0 | Solution | 120.48 | 45 | 0.00 | 0.00 |
| instance n=100 85.alb | 1 | 0 | Unknown | 120474.00 | - | - | - |
| instance n=100 86.alb | 1 | 0 | Unknown | 120508.00 | - | - | - |
| instance n=100 87.alb | 1 | 0 | Unknown | 120515.00 | - | - | - |
| instance n=100 88.alb | 1 | 0 | Unknown | 120470.00 | - | - | - |
| instance n=100 89.alb | 1 | 0 | Solution | 120.43 | 73 | 0.00 | 0.00 |
| instance n=100 9.alb | 1 | 0 | Solution | 120.48 | 25 | 0.00 | 0.00 |
| instance n=100 90.alb | 1 | 0 | Unknown | 120506.00 | - | - | - |
| instance n=100 91.alb | 1 | 0 | Unknown | 120527.00 | - | - | - |
| instance n=100 92.alb | 1 | 0 | Unknown | 120525.00 | - | - | - |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=100 93.alb | 1 | 0 | Unknown | 120470.00 | - | - | - |
| instance n=100 94.alb | 1 | 0 | Solution | 120.46 | 57 | 0.00 | 0.00 |
| instance n=100 95.alb | 1 | 0 | Unknown | 120429.00 | - | - | - |
| instance n=100 96.alb | 1 | 0 | Solution | 120.44 | 100 | 0.00 | 0.00 |
| instance n=100 97.alb | 1 | 0 | Unknown | 120491.00 | - | - | - |
| instance n=100 98.alb | 1 | 0 | Unknown | 120549.00 | - | - | - |
| instance n=100 99.alb | 1 | 0 | Unknown | 120507.00 | - | - | - |
| instance n=20 1.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 10.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 100.alb | 1 | 0 | Optimal | 0.38 | 11 | 0.00 | 0.00 |
| instance n=20 101.alb | 1 | 0 | Optimal | 1.07 | 13 | 0.00 | 0.00 |
| instance n=20 102.alb | 1 | 0 | Optimal | 0.55 | 13 | 0.00 | 0.00 |
| instance n=20 103.alb | 1 | 0 | Optimal | 0.49 | 12 | 0.00 | 0.00 |
| instance n=20 104.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 105.alb | 1 | 0 | Optimal | 0.38 | 12 | 0.00 | 0.00 |
| instance n=20 106.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 107.alb | 1 | 0 | Optimal | 0.37 | 14 | 0.00 | 0.00 |
| instance n=20 108.alb | 1 | 0 | Optimal | 0.41 | 15 | 0.00 | 0.00 |
| instance n=20 109.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=20 11.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 110.alb | 1 | 0 | Optimal | 0.34 | 11 | 0.00 | 0.00 |
| instance n=20 111.alb | 1 | 0 | Optimal | 0.39 | 13 | 0.00 | 0.00 |
| instance n=20 112.alb | 1 | 0 | Optimal | 0.37 | 11 | 0.00 | 0.00 |
| instance n=20 113.alb | 1 | 0 | Optimal | 0.44 | 12 | 0.00 | 0.00 |
| instance n=20 114.alb | 1 | 0 | Optimal | 0.44 | 13 | 0.00 | 0.00 |
| instance n=20 115.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 116.alb | 1 | 0 | Optimal | 0.37 | 5 | 0.00 | 0.00 |
| instance n=20 117.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 118.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 119.alb | 1 | 0 | Optimal | 0.37 | 6 | 0.00 | 0.00 |
| instance n=20 12.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 120.alb | 1 | 0 | Optimal | 0.33 | 6 | 0.00 | 0.00 |
| instance n=20 121.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 122.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 123.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 124.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 125.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 126.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 127.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 128.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 129.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 13.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 130.alb | 1 | 0 | Optimal | 0.33 | 6 | 0.00 | 0.00 |
| instance n=20 131.alb | 1 | 0 | Optimal | 0.39 | 7 | 0.00 | 0.00 |
| instance n=20 132.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 133.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 134.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 135.alb | 1 | 0 | Optimal | 0.36 | 6 | 0.00 | 0.00 |
| instance n=20 136.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 137.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 138.alb | 1 | 0 | Optimal | 0.36 | 5 | 0.00 | 0.00 |
| instance n=20 139.alb | 1 | 0 | Optimal | 0.36 | 5 | 0.00 | 0.00 |
| instance n=20 14.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 140.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 141.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 142.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 143.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 144.alb | 1 | 0 | Optimal | 0.31 | 4 | 0.00 | 0.00 |
| instance n=20 145.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 146.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 147.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 148.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 149.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 15.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 150.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 151.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 152.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 153.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 154.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 155.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 156.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 157.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 158.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 159.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 16.alb | 1 | 0 | Optimal | 0.38 | 12 | 0.00 | 0.00 |
| instance n=20 160.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 161.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 162.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 163.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 164.alb | 1 | 0 | Optimal | 0.31 | 4 | 0.00 | 0.00 |
| instance n=20 165.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 166.alb | 1 | 0 | Optimal | 0.43 | 12 | 0.00 | 0.00 |
| instance n=20 167.alb | 1 | 0 | Optimal | 0.41 | 11 | 0.00 | 0.00 |
| instance n=20 168.alb | 1 | 0 | Optimal | 0.37 | 10 | 0.00 | 0.00 |
| instance n=20 169.alb | 1 | 0 | Optimal | 0.49 | 11 | 0.00 | 0.00 |
| instance n=20 17.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 170.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 171.alb | 1 | 0 | Optimal | 0.52 | 13 | 0.00 | 0.00 |
| instance n=20 172.alb | 1 | 0 | Optimal | 0.38 | 11 | 0.00 | 0.00 |
| instance n=20 173.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 174.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=20 175.alb | 1 | 0 | Optimal | 0.38 | 10 | 0.00 | 0.00 |
| instance n=20 176.alb | 1 | 0 | Optimal | 0.44 | 11 | 0.00 | 0.00 |
| instance n=20 177.alb | 1 | 0 | Optimal | 0.69 | 10 | 0.00 | 0.00 |
| instance n=20 178.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 179.alb | 1 | 0 | Optimal | 0.53 | 11 | 0.00 | 0.00 |
| instance n=20 18.alb | 1 | 0 | Optimal | 0.45 | 11 | 0.00 | 0.00 |
| instance n=20 180.alb | 1 | 0 | Optimal | 0.46 | 13 | 0.00 | 0.00 |
| instance n=20 181.alb | 1 | 0 | Optimal | 0.52 | 11 | 0.00 | 0.00 |
| instance n=20 182.alb | 1 | 0 | Optimal | 0.38 | 11 | 0.00 | 0.00 |
| instance n=20 183.alb | 1 | 0 | Optimal | 0.48 | 13 | 0.00 | 0.00 |
| instance n=20 184.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=20 185.alb | 1 | 0 | Optimal | 0.41 | 15 | 0.00 | 0.00 |
| instance n=20 186.alb | 1 | 0 | Optimal | 0.83 | 14 | 0.00 | 0.00 |
| instance n=20 187.alb | 1 | 0 | Optimal | 0.38 | 10 | 0.00 | 0.00 |
| instance n=20 188.alb | 1 | 0 | Optimal | 0.38 | 11 | 0.00 | 0.00 |
| instance n=20 189.alb | 1 | 0 | Optimal | 0.44 | 13 | 0.00 | 0.00 |
| instance n=20 19.alb | 1 | 0 | Optimal | 0.46 | 14 | 0.00 | 0.00 |
| instance n=20 190.alb | 1 | 0 | Optimal | 0.46 | 15 | 0.00 | 0.00 |
| instance n=20 191.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 192.alb | 1 | 0 | Optimal | 0.39 | 5 | 0.00 | 0.00 |
| instance n=20 193.alb | 1 | 0 | Optimal | 0.36 | 5 | 0.00 | 0.00 |
| instance n=20 194.alb | 1 | 0 | Optimal | 0.33 | 6 | 0.00 | 0.00 |
| instance n=20 195.alb | 1 | 0 | Optimal | 0.33 | 6 | 0.00 | 0.00 |
| instance n=20 196.alb | 1 | 0 | Optimal | 0.38 | 5 | 0.00 | 0.00 |
| instance n=20 197.alb | 1 | 0 | Optimal | 0.36 | 4 | 0.00 | 0.00 |
| instance n=20 198.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 199.alb | 1 | 0 | Optimal | 0.37 | 5 | 0.00 | 0.00 |
| instance n=20 2.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 20.alb | 1 | 0 | Optimal | 0.38 | 11 | 0.00 | 0.00 |
| instance n=20 200.alb | 1 | 0 | Optimal | 0.37 | 6 | 0.00 | 0.00 |
| instance n=20 201.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 202.alb | 1 | 0 | Optimal | 0.35 | 4 | 0.00 | 0.00 |
| instance n=20 203.alb | 1 | 0 | Optimal | 0.36 | 4 | 0.00 | 0.00 |
| instance n=20 204.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 205.alb | 1 | 0 | Optimal | 0.36 | 6 | 0.00 | 0.00 |
| instance n=20 206.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 207.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 208.alb | 1 | 0 | Optimal | 0.36 | 5 | 0.00 | 0.00 |
| instance n=20 209.alb | 1 | 0 | Optimal | 0.37 | 4 | 0.00 | 0.00 |
| instance n=20 21.alb | 1 | 0 | Optimal | 0.42 | 14 | 0.00 | 0.00 |
| instance n=20 210.alb | 1 | 0 | Optimal | 0.37 | 5 | 0.00 | 0.00 |
| instance n=20 211.alb | 1 | 0 | Optimal | 0.36 | 5 | 0.00 | 0.00 |
| instance n=20 212.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 213.alb | 1 | 0 | Optimal | 0.36 | 5 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 214.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 215.alb | 1 | 0 | Optimal | 0.38 | 5 | 0.00 | 0.00 |
| instance n=20 216.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 217.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 218.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 219.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 22.alb | 1 | 0 | Optimal | 0.42 | 12 | 0.00 | 0.00 |
| instance n=20 220.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 221.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 222.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 223.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 224.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 225.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 226.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 227.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 228.alb | 1 | 0 | Optimal | 0.31 | 2 | 0.00 | 0.00 |
| instance n=20 229.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 23.alb | 1 | 0 | Optimal | 0.60 | 13 | 0.00 | 0.00 |
| instance n=20 230.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 231.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 232.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 233.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 234.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 235.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 236.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 237.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 238.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 239.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 24.alb | 1 | 0 | Optimal | 0.38 | 11 | 0.00 | 0.00 |
| instance n=20 240.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 241.alb | 1 | 0 | Optimal | 0.47 | 13 | 0.00 | 0.00 |
| instance n=20 242.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=20 243.alb | 1 | 0 | Optimal | 0.39 | 10 | 0.00 | 0.00 |
| instance n=20 244.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 245.alb | 1 | 0 | Optimal | 0.38 | 13 | 0.00 | 0.00 |
| instance n=20 246.alb | 1 | 0 | Optimal | 0.37 | 13 | 0.00 | 0.00 |
| instance n=20 247.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 248.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 249.alb | 1 | 0 | Optimal | 0.44 | 13 | 0.00 | 0.00 |
| instance n=20 25.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 250.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 251.alb | 1 | 0 | Optimal | 0.37 | 12 | 0.00 | 0.00 |
| instance n=20 252.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 253.alb | 1 | 0 | Optimal | 0.58 | 13 | 0.00 | 0.00 |
| instance n=20 254.alb | 1 | 0 | Optimal | 0.40 | 12 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 255.alb | 1 | 0 | Optimal | 0.39 | 13 | 0.00 | 0.00 |
| instance n=20 256.alb | 1 | 0 | Optimal | 0.40 | 14 | 0.00 | 0.00 |
| instance n=20 257.alb | 1 | 0 | Optimal | 0.39 | 10 | 0.00 | 0.00 |
| instance n=20 258.alb | 1 | 0 | Optimal | 0.40 | 13 | 0.00 | 0.00 |
| instance n=20 259.alb | 1 | 0 | Optimal | 0.40 | 13 | 0.00 | 0.00 |
| instance n=20 26.alb | 1 | 0 | Optimal | 0.38 | 12 | 0.00 | 0.00 |
| instance n=20 260.alb | 1 | 0 | Optimal | 0.43 | 12 | 0.00 | 0.00 |
| instance n=20 261.alb | 1 | 0 | Optimal | 0.41 | 12 | 0.00 | 0.00 |
| instance n=20 262.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 263.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=20 264.alb | 1 | 0 | Optimal | 0.41 | 12 | 0.00 | 0.00 |
| instance n=20 265.alb | 1 | 0 | Optimal | 0.44 | 12 | 0.00 | 0.00 |
| instance n=20 266.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 267.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 268.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 269.alb | 1 | 0 | Optimal | 0.38 | 7 | 0.00 | 0.00 |
| instance n=20 27.alb | 1 | 0 | Optimal | 0.49 | 13 | 0.00 | 0.00 |
| instance n=20 270.alb | 1 | 0 | Optimal | 0.35 | 7 | 0.00 | 0.00 |
| instance n=20 271.alb | 1 | 0 | Optimal | 0.33 | 6 | 0.00 | 0.00 |
| instance n=20 272.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 273.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 274.alb | 1 | 0 | Optimal | 0.38 | 6 | 0.00 | 0.00 |
| instance n=20 275.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 276.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 277.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 278.alb | 1 | 0 | Optimal | 0.37 | 6 | 0.00 | 0.00 |
| instance n=20 279.alb | 1 | 0 | Optimal | 0.36 | 6 | 0.00 | 0.00 |
| instance n=20 28.alb | 1 | 0 | Optimal | 0.43 | 12 | 0.00 | 0.00 |
| instance n=20 280.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 281.alb | 1 | 0 | Optimal | 0.34 | 4 | 0.00 | 0.00 |
| instance n=20 282.alb | 1 | 0 | Optimal | 0.34 | 4 | 0.00 | 0.00 |
| instance n=20 283.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 284.alb | 1 | 0 | Optimal | 0.35 | 5 | 0.00 | 0.00 |
| instance n=20 285.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 286.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 287.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 288.alb | 1 | 0 | Optimal | 0.33 | 6 | 0.00 | 0.00 |
| instance n=20 289.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 29.alb | 1 | 0 | Optimal | 0.39 | 10 | 0.00 | 0.00 |
| instance n=20 290.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 291.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 292.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 293.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 294.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 295.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 296.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 297.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 298.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 299.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 3.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 30.alb | 1 | 0 | Optimal | 0.54 | 16 | 0.00 | 0.00 |
| instance n=20 300.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 301.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 302.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 303.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 304.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 305.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 306.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 307.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 308.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 309.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 31.alb | 1 | 0 | Optimal | 0.41 | 12 | 0.00 | 0.00 |
| instance n=20 310.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 311.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 312.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 313.alb | 1 | 0 | Optimal | 0.35 | 3 | 0.00 | 0.00 |
| instance n=20 314.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 315.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 316.alb | 1 | 0 | Optimal | 0.41 | 10 | 0.00 | 0.00 |
| instance n=20 317.alb | 1 | 0 | Optimal | 0.44 | 10 | 0.00 | 0.00 |
| instance n=20 318.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 319.alb | 1 | 0 | Optimal | 0.51 | 14 | 0.00 | 0.00 |
| instance n=20 32.alb | 1 | 0 | Optimal | 0.42 | 13 | 0.00 | 0.00 |
| instance n=20 320.alb | 1 | 0 | Optimal | 0.44 | 12 | 0.00 | 0.00 |
| instance n=20 321.alb | 1 | 0 | Optimal | 0.55 | 14 | 0.00 | 0.00 |
| instance n=20 322.alb | 1 | 0 | Optimal | 0.43 | 12 | 0.00 | 0.00 |
| instance n=20 323.alb | 1 | 0 | Optimal | 0.43 | 13 | 0.00 | 0.00 |
| instance n=20 324.alb | 1 | 0 | Optimal | 0.49 | 9 | 0.00 | 0.00 |
| instance n=20 325.alb | 1 | 0 | Optimal | 0.44 | 14 | 0.00 | 0.00 |
| instance n=20 326.alb | 1 | 0 | Optimal | 0.55 | 14 | 0.00 | 0.00 |
| instance n=20 327.alb | 1 | 0 | Optimal | 0.55 | 13 | 0.00 | 0.00 |
| instance n=20 328.alb | 1 | 0 | Optimal | 0.43 | 13 | 0.00 | 0.00 |
| instance n=20 329.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 33.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 330.alb | 1 | 0 | Optimal | 0.44 | 12 | 0.00 | 0.00 |
| instance n=20 331.alb | 1 | 0 | Optimal | 0.40 | 13 | 0.00 | 0.00 |
| instance n=20 332.alb | 1 | 0 | Optimal | 0.38 | 13 | 0.00 | 0.00 |
| instance n=20 333.alb | 1 | 0 | Optimal | 0.49 | 11 | 0.00 | 0.00 |
| instance n=20 334.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 335.alb | 1 | 0 | Optimal | 0.45 | 14 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 336.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 337.alb | 1 | 0 | Optimal | 0.38 | 10 | 0.00 | 0.00 |
| instance n=20 338.alb | 1 | 0 | Optimal | 0.54 | 14 | 0.00 | 0.00 |
| instance n=20 339.alb | 1 | 0 | Optimal | 0.46 | 13 | 0.00 | 0.00 |
| instance n=20 34.alb | 1 | 0 | Optimal | 0.70 | 12 | 0.00 | 0.00 |
| instance n=20 340.alb | 1 | 0 | Optimal | 0.70 | 11 | 0.00 | 0.00 |
| instance n=20 341.alb | 1 | 0 | Optimal | 0.36 | 6 | 0.00 | 0.00 |
| instance n=20 342.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 343.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 344.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 345.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 346.alb | 1 | 0 | Optimal | 0.41 | 5 | 0.00 | 0.00 |
| instance n=20 347.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 348.alb | 1 | 0 | Optimal | 0.39 | 5 | 0.00 | 0.00 |
| instance n=20 349.alb | 1 | 0 | Optimal | 0.39 | 5 | 0.00 | 0.00 |
| instance n=20 35.alb | 1 | 0 | Optimal | 0.45 | 12 | 0.00 | 0.00 |
| instance n=20 350.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 351.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 352.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 353.alb | 1 | 0 | Optimal | 0.38 | 6 | 0.00 | 0.00 |
| instance n=20 354.alb | 1 | 0 | Optimal | 0.37 | 6 | 0.00 | 0.00 |
| instance n=20 355.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 356.alb | 1 | 0 | Optimal | 0.39 | 5 | 0.00 | 0.00 |
| instance n=20 357.alb | 1 | 0 | Optimal | 0.39 | 5 | 0.00 | 0.00 |
| instance n=20 358.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 359.alb | 1 | 0 | Optimal | 0.31 | 4 | 0.00 | 0.00 |
| instance n=20 36.alb | 1 | 0 | Optimal | 0.43 | 13 | 0.00 | 0.00 |
| instance n=20 360.alb | 1 | 0 | Optimal | 0.36 | 6 | 0.00 | 0.00 |
| instance n=20 361.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 362.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 363.alb | 1 | 0 | Optimal | 0.37 | 7 | 0.00 | 0.00 |
| instance n=20 364.alb | 1 | 0 | Optimal | 0.31 | 4 | 0.00 | 0.00 |
| instance n=20 365.alb | 1 | 0 | Optimal | 0.39 | 5 | 0.00 | 0.00 |
| instance n=20 366.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 367.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 368.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 369.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 37.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=20 370.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 371.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 372.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 373.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 374.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 375.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 376.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 377.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 378.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 379.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 38.alb | 1 | 0 | Optimal | 0.41 | 12 | 0.00 | 0.00 |
| instance n=20 380.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 381.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 382.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 383.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 384.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 385.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 386.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 387.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 388.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 389.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 39.alb | 1 | 0 | Optimal | 0.42 | 13 | 0.00 | 0.00 |
| instance n=20 390.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 391.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 392.alb | 1 | 0 | Optimal | 0.38 | 14 | 0.00 | 0.00 |
| instance n=20 393.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 394.alb | 1 | 0 | Optimal | 0.42 | 12 | 0.00 | 0.00 |
| instance n=20 395.alb | 1 | 0 | Optimal | 0.40 | 12 | 0.00 | 0.00 |
| instance n=20 396.alb | 1 | 0 | Optimal | 0.44 | 13 | 0.00 | 0.00 |
| instance n=20 397.alb | 1 | 0 | Optimal | 0.38 | 10 | 0.00 | 0.00 |
| instance n=20 398.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 399.alb | 1 | 0 | Optimal | 0.42 | 13 | 0.00 | 0.00 |
| instance n=20 4.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 40.alb | 1 | 0 | Optimal | 0.38 | 12 | 0.00 | 0.00 |
| instance n=20 400.alb | 1 | 0 | Optimal | 0.41 | 12 | 0.00 | 0.00 |
| instance n=20 401.alb | 1 | 0 | Optimal | 0.46 | 12 | 0.00 | 0.00 |
| instance n=20 402.alb | 1 | 0 | Optimal | 0.46 | 12 | 0.00 | 0.00 |
| instance n=20 403.alb | 1 | 0 | Optimal | 0.42 | 12 | 0.00 | 0.00 |
| instance n=20 404.alb | 1 | 0 | Optimal | 0.49 | 10 | 0.00 | 0.00 |
| instance n=20 405.alb | 1 | 0 | Optimal | 0.40 | 12 | 0.00 | 0.00 |
| instance n=20 406.alb | 1 | 0 | Optimal | 0.41 | 14 | 0.00 | 0.00 |
| instance n=20 407.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 408.alb | 1 | 0 | Optimal | 0.52 | 14 | 0.00 | 0.00 |
| instance n=20 409.alb | 1 | 0 | Optimal | 0.46 | 12 | 0.00 | 0.00 |
| instance n=20 41.alb | 1 | 0 | Optimal | 0.36 | 6 | 0.00 | 0.00 |
| instance n=20 410.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 411.alb | 1 | 0 | Optimal | 0.53 | 15 | 0.00 | 0.00 |
| instance n=20 412.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 413.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 414.alb | 1 | 0 | Optimal | 0.50 | 12 | 0.00 | 0.00 |
| instance n=20 415.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 416.alb | 1 | 0 | Optimal | 0.36 | 6 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 417.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 418.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 419.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 42.alb | 1 | 0 | Optimal | 0.39 | 5 | 0.00 | 0.00 |
| instance n=20 420.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 421.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 422.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 423.alb | 1 | 0 | Optimal | 0.39 | 6 | 0.00 | 0.00 |
| instance n=20 424.alb | 1 | 0 | Optimal | 0.36 | 5 | 0.00 | 0.00 |
| instance n=20 425.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=20 426.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 427.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 428.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 429.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 43.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 430.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 431.alb | 1 | 0 | Optimal | 0.38 | 6 | 0.00 | 0.00 |
| instance n=20 432.alb | 1 | 0 | Optimal | 0.35 | 5 | 0.00 | 0.00 |
| instance n=20 433.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 434.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 435.alb | 1 | 0 | Optimal | 0.38 | 7 | 0.00 | 0.00 |
| instance n=20 436.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 437.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 438.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 439.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 44.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 440.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 441.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 442.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 443.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 444.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 445.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 446.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 447.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 448.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 449.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 45.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 450.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 451.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 452.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 453.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 454.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 455.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 456.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 457.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 458.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 459.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 46.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 460.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 461.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 462.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 463.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 464.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 465.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 466.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=20 467.alb | 1 | 0 | Optimal | 0.33 | 14 | 0.00 | 0.00 |
| instance n=20 468.alb | 1 | 0 | Optimal | 0.37 | 13 | 0.00 | 0.00 |
| instance n=20 469.alb | 1 | 0 | Optimal | 0.36 | 14 | 0.00 | 0.00 |
| instance n=20 47.alb | 1 | 0 | Optimal | 0.31 | 4 | 0.00 | 0.00 |
| instance n=20 470.alb | 1 | 0 | Optimal | 0.37 | 12 | 0.00 | 0.00 |
| instance n=20 471.alb | 1 | 0 | Optimal | 0.36 | 12 | 0.00 | 0.00 |
| instance n=20 472.alb | 1 | 0 | Optimal | 0.35 | 13 | 0.00 | 0.00 |
| instance n=20 473.alb | 1 | 0 | Optimal | 0.32 | 10 | 0.00 | 0.00 |
| instance n=20 474.alb | 1 | 0 | Optimal | 0.34 | 14 | 0.00 | 0.00 |
| instance n=20 475.alb | 1 | 0 | Optimal | 0.33 | 11 | 0.00 | 0.00 |
| instance n=20 476.alb | 1 | 0 | Optimal | 0.35 | 11 | 0.00 | 0.00 |
| instance n=20 477.alb | 1 | 0 | Optimal | 0.34 | 11 | 0.00 | 0.00 |
| instance n=20 478.alb | 1 | 0 | Optimal | 0.33 | 12 | 0.00 | 0.00 |
| instance n=20 479.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=20 48.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 480.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=20 481.alb | 1 | 0 | Optimal | 0.34 | 13 | 0.00 | 0.00 |
| instance n=20 482.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=20 483.alb | 1 | 0 | Optimal | 0.36 | 12 | 0.00 | 0.00 |
| instance n=20 484.alb | 1 | 0 | Optimal | 0.38 | 13 | 0.00 | 0.00 |
| instance n=20 485.alb | 1 | 0 | Optimal | 0.34 | 15 | 0.00 | 0.00 |
| instance n=20 486.alb | 1 | 0 | Optimal | 0.33 | 11 | 0.00 | 0.00 |
| instance n=20 487.alb | 1 | 0 | Optimal | 0.34 | 12 | 0.00 | 0.00 |
| instance n=20 488.alb | 1 | 0 | Optimal | 0.39 | 15 | 0.00 | 0.00 |
| instance n=20 489.alb | 1 | 0 | Optimal | 0.35 | 12 | 0.00 | 0.00 |
| instance n=20 49.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 490.alb | 1 | 0 | Optimal | 0.35 | 12 | 0.00 | 0.00 |
| instance n=20 491.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 492.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 493.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 494.alb | 1 | 0 | Optimal | 0.33 | 6 | 0.00 | 0.00 |
| instance n=20 495.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 496.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 497.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 498.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 499.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 5.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 50.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 500.alb | 1 | 0 | Optimal | 0.32 | 8 | 0.00 | 0.00 |
| instance n=20 501.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 502.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 503.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 504.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 505.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 506.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 507.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 508.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 509.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 51.alb | 1 | 0 | Optimal | 0.35 | 4 | 0.00 | 0.00 |
| instance n=20 510.alb | 1 | 0 | Optimal | 0.36 | 5 | 0.00 | 0.00 |
| instance n=20 511.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 512.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 513.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 514.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 515.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 516.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 517.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 518.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 519.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 52.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 520.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 521.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 522.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 523.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 524.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 525.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 53.alb | 1 | 0 | Optimal | 0.34 | 5 | 0.00 | 0.00 |
| instance n=20 54.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 55.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 56.alb | 1 | 0 | Optimal | 0.33 | 4 | 0.00 | 0.00 |
| instance n=20 57.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 58.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 59.alb | 1 | 0 | Optimal | 0.36 | 4 | 0.00 | 0.00 |
| instance n=20 6.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 60.alb | 1 | 0 | Optimal | 0.36 | 6 | 0.00 | 0.00 |
| instance n=20 61.alb | 1 | 0 | Optimal | 0.38 | 7 | 0.00 | 0.00 |
| instance n=20 62.alb | 1 | 0 | Optimal | 0.37 | 5 | 0.00 | 0.00 |
| instance n=20 63.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 64.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 65.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=20 66.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 67.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 68.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 69.alb | 1 | 0 | Optimal | 0.30 | 2 | 0.00 | 0.00 |
| instance n=20 7.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 70.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 71.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 72.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 73.alb | 1 | 0 | Optimal | 0.30 | 2 | 0.00 | 0.00 |
| instance n=20 74.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 75.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 76.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 77.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 78.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 79.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 8.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 80.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 81.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 82.alb | 1 | 0 | Optimal | 0.32 | 4 | 0.00 | 0.00 |
| instance n=20 83.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 84.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 85.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 86.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 87.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 88.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 89.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 9.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 90.alb | 1 | 0 | Optimal | 0.33 | 3 | 0.00 | 0.00 |
| instance n=20 91.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 92.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=20 93.alb | 1 | 0 | Optimal | 0.38 | 13 | 0.00 | 0.00 |
| instance n=20 94.alb | 1 | 0 | Optimal | 0.38 | 10 | 0.00 | 0.00 |
| instance n=20 95.alb | 1 | 0 | Optimal | 0.41 | 12 | 0.00 | 0.00 |
| instance n=20 96.alb | 1 | 0 | Optimal | 0.40 | 10 | 0.00 | 0.00 |
| instance n=20 97.alb | 1 | 0 | Optimal | 0.63 | 15 | 0.00 | 0.00 |
| instance n=20 98.alb | 1 | 0 | Optimal | 0.42 | 13 | 0.00 | 0.00 |
| instance n=20 99.alb | 1 | 0 | Optimal | 0.41 | 12 | 0.00 | 0.00 |
| instance n=50 1.alb | 1 | 0 | Solution | 30.12 | 8 | 0.00 | 0.00 |
| instance n=50 10.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 100.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 101.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 102.alb | 1 | 0 | Solution | 30.10 | 34 | 0.00 | 0.00 |
| instance n=50 103.alb | 1 | 0 | Solution | 30.10 | 30 | 0.00 | 0.00 |
| instance n=50 104.alb | 1 | 0 | Solution | 30.10 | 29 | 0.00 | 0.00 |
| instance n=50 105.alb | 1 | 0 | Solution | 30.11 | 27 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 106.alb | 1 | 0 | Solution | 30.14 | 29 | 0.00 | 0.00 |
| instance n=50 107.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |
| instance n=50 108.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 109.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |
| instance n=50 11.alb | 1 | 0 | Solution | 30.13 | 7 | 0.00 | 0.00 |
| instance n=50 110.alb | 1 | 0 | Solution | 30.10 | 28 | 0.00 | 0.00 |
| instance n=50 111.alb | 1 | 0 | Solution | 30.10 | 29 | 0.00 | 0.00 |
| instance n=50 112.alb | 1 | 0 | Solution | 30.10 | 29 | 0.00 | 0.00 |
| instance n=50 113.alb | 1 | 0 | Solution | 30.08 | 31 | 0.00 | 0.00 |
| instance n=50 114.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 115.alb | 1 | 0 | Solution | 30.09 | 31 | 0.00 | 0.00 |
| instance n=50 116.alb | 1 | 0 | Solution | 30.10 | 34 | 0.00 | 0.00 |
| instance n=50 117.alb | 1 | 0 | Solution | 30.11 | 27 | 0.00 | 0.00 |
| instance n=50 118.alb | 1 | 0 | Solution | 30.09 | 32 | 0.00 | 0.00 |
| instance n=50 119.alb | 1 | 0 | Solution | 30.10 | 27 | 0.00 | 0.00 |
| instance n=50 12.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 120.alb | 1 | 0 | Solution | 30.11 | 29 | 0.00 | 0.00 |
| instance n=50 121.alb | 1 | 0 | Solution | 30.11 | 32 | 0.00 | 0.00 |
| instance n=50 122.alb | 1 | 0 | Solution | 30.09 | 32 | 0.00 | 0.00 |
| instance n=50 123.alb | 1 | 0 | Solution | 30.11 | 33 | 0.00 | 0.00 |
| instance n=50 124.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |
| instance n=50 125.alb | 1 | 0 | Solution | 30.10 | 34 | 0.00 | 0.00 |
| instance n=50 126.alb | 1 | 0 | Solution | 30.18 | 12 | 0.00 | 0.00 |
| instance n=50 127.alb | 1 | 0 | Solution | 30.10 | 14 | 0.00 | 0.00 |
| instance n=50 128.alb | 1 | 0 | Solution | 30.12 | 13 | 0.00 | 0.00 |
| instance n=50 129.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 13.alb | 1 | 0 | Solution | 30.11 | 6 | 0.00 | 0.00 |
| instance n=50 130.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 131.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 132.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 133.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 134.alb | 1 | 0 | Solution | 30.11 | 15 | 0.00 | 0.00 |
| instance n=50 135.alb | 1 | 0 | Solution | 30.10 | 14 | 0.00 | 0.00 |
| instance n=50 136.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 137.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 138.alb | 1 | 0 | Solution | 30.09 | 12 | 0.00 | 0.00 |
| instance n=50 139.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 14.alb | 1 | 0 | Solution | 30.13 | 7 | 0.00 | 0.00 |
| instance n=50 140.alb | 1 | 0 | Solution | 30.09 | 12 | 0.00 | 0.00 |
| instance n=50 141.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 142.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 143.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 144.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 145.alb | 1 | 0 | Solution | 30.10 | 10 | 0.00 | 0.00 |
| instance n=50 146.alb | 1 | 0 | Solution | 30.14 | 13 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 147.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 148.alb | 1 | 0 | Solution | 30.10 | 10 | 0.00 | 0.00 |
| instance n=50 149.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 15.alb | 1 | 0 | Solution | 30.12 | 8 | 0.00 | 0.00 |
| instance n=50 150.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 151.alb | 1 | 0 | Solution | 30.13 | 7 | 0.00 | 0.00 |
| instance n=50 152.alb | 1 | 0 | Solution | 30.12 | 7 | 0.00 | 0.00 |
| instance n=50 153.alb | 1 | 0 | Solution | 30.12 | 8 | 0.00 | 0.00 |
| instance n=50 154.alb | 1 | 0 | Solution | 30.13 | 8 | 0.00 | 0.00 |
| instance n=50 155.alb | 1 | 0 | Solution | 30.32 | 7 | 0.00 | 0.00 |
| instance n=50 156.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 157.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 158.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 159.alb | 1 | 0 | Solution | 30.08 | 7 | 0.00 | 0.00 |
| instance n=50 16.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 160.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 161.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 162.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 163.alb | 1 | 0 | Solution | 30.14 | 7 | 0.00 | 0.00 |
| instance n=50 164.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 165.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 166.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 167.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 168.alb | 1 | 0 | Solution | 30.11 | 9 | 0.00 | 0.00 |
| instance n=50 169.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 17.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 170.alb | 1 | 0 | Solution | 30.13 | 8 | 0.00 | 0.00 |
| instance n=50 171.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 172.alb | 1 | 0 | Solution | 30.07 | 7 | 0.00 | 0.00 |
| instance n=50 173.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 174.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 175.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 176.alb | 1 | 0 | Solution | 30.12 | 33 | 0.00 | 0.00 |
| instance n=50 177.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 178.alb | 1 | 0 | Solution | 30.11 | 32 | 0.00 | 0.00 |
| instance n=50 179.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 18.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 180.alb | 1 | 0 | Solution | 30.11 | 30 | 0.00 | 0.00 |
| instance n=50 181.alb | 1 | 0 | Solution | 30.12 | 33 | 0.00 | 0.00 |
| instance n=50 182.alb | 1 | 0 | Solution | 30.11 | 30 | 0.00 | 0.00 |
| instance n=50 183.alb | 1 | 0 | Solution | 30.11 | 33 | 0.00 | 0.00 |
| instance n=50 184.alb | 1 | 0 | Solution | 30.11 | 39 | 0.00 | 0.00 |
| instance n=50 185.alb | 1 | 0 | Solution | 30.12 | 32 | 0.00 | 0.00 |
| instance n=50 186.alb | 1 | 0 | Solution | 30.11 | 32 | 0.00 | 0.00 |
| instance n=50 187.alb | 1 | 0 | Solution | 30.11 | 31 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 188.alb | 1 | 0 | Solution | 30.11 | 27 | 0.00 | 0.00 |
| instance n=50 189.alb | 1 | 0 | Solution | 30.11 | 31 | 0.00 | 0.00 |
| instance n=50 19.alb | 1 | 0 | Solution | 30.13 | 8 | 0.00 | 0.00 |
| instance n=50 190.alb | 1 | 0 | Solution | 30.10 | 34 | 0.00 | 0.00 |
| instance n=50 191.alb | 1 | 0 | Solution | 30.11 | 33 | 0.00 | 0.00 |
| instance n=50 192.alb | 1 | 0 | Solution | 30.11 | 31 | 0.00 | 0.00 |
| instance n=50 193.alb | 1 | 0 | Solution | 30.10 | 35 | 0.00 | 0.00 |
| instance n=50 194.alb | 1 | 0 | Solution | 30.09 | 32 | 0.00 | 0.00 |
| instance n=50 195.alb | 1 | 0 | Solution | 30.09 | 33 | 0.00 | 0.00 |
| instance n=50 196.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 197.alb | 1 | 0 | Solution | 30.12 | 32 | 0.00 | 0.00 |
| instance n=50 198.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 199.alb | 1 | 0 | Solution | 30.09 | 34 | 0.00 | 0.00 |
| instance n=50 2.alb | 1 | 0 | Solution | 30.10 | 6 | 0.00 | 0.00 |
| instance n=50 20.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 200.alb | 1 | 0 | Solution | 30.10 | 30 | 0.00 | 0.00 |
| instance n=50 201.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 202.alb | 1 | 0 | Solution | 30.11 | 10 | 0.00 | 0.00 |
| instance n=50 203.alb | 1 | 0 | Solution | 30.12 | 12 | 0.00 | 0.00 |
| instance n=50 204.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 205.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 206.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 207.alb | 1 | 0 | Solution | 30.11 | 10 | 0.00 | 0.00 |
| instance n=50 208.alb | 1 | 0 | Solution | 30.11 | 14 | 0.00 | 0.00 |
| instance n=50 209.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 21.alb | 1 | 0 | Solution | 30.11 | 6 | 0.00 | 0.00 |
| instance n=50 210.alb | 1 | 0 | Solution | 30.11 | 14 | 0.00 | 0.00 |
| instance n=50 211.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 212.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 213.alb | 1 | 0 | Solution | 30.11 | 14 | 0.00 | 0.00 |
| instance n=50 214.alb | 1 | 0 | Solution | 30.12 | 11 | 0.00 | 0.00 |
| instance n=50 215.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 216.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 217.alb | 1 | 0 | Solution | 30.11 | 14 | 0.00 | 0.00 |
| instance n=50 218.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 219.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 22.alb | 1 | 0 | Solution | 30.12 | 7 | 0.00 | 0.00 |
| instance n=50 220.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 221.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 222.alb | 1 | 0 | Solution | 30.11 | 16 | 0.00 | 0.00 |
| instance n=50 223.alb | 1 | 0 | Solution | 30.09 | 12 | 0.00 | 0.00 |
| instance n=50 224.alb | 1 | 0 | Solution | 30.13 | 11 | 0.00 | 0.00 |
| instance n=50 225.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 226.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 227.alb | 1 | 0 | Optimal | 22.91 | 6 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 228.alb | 1 | 0 | Optimal | 9.93 | 6 | 0.00 | 0.00 |
| instance n=50 229.alb | 1 | 0 | Optimal | 9.24 | 6 | 0.00 | 0.00 |
| instance n=50 23.alb | 1 | 0 | Solution | 30.12 | 7 | 0.00 | 0.00 |
| instance n=50 230.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 231.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 232.alb | 1 | 0 | Solution | 30.09 | 8 | 0.00 | 0.00 |
| instance n=50 233.alb | 1 | 0 | Optimal | 4.03 | 6 | 0.00 | 0.00 |
| instance n=50 234.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 235.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 236.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 237.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 238.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 239.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 24.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 240.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 241.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 242.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 243.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 244.alb | 1 | 0 | Optimal | 14.63 | 7 | 0.00 | 0.00 |
| instance n=50 245.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 246.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 247.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 248.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 249.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 25.alb | 1 | 0 | Solution | 30.11 | 6 | 0.00 | 0.00 |
| instance n=50 250.alb | 1 | 0 | Solution | 30.12 | 7 | 0.00 | 0.00 |
| instance n=50 251.alb | 1 | 0 | Solution | 30.11 | 29 | 0.00 | 0.00 |
| instance n=50 252.alb | 1 | 0 | Solution | 30.10 | 35 | 0.00 | 0.00 |
| instance n=50 253.alb | 1 | 0 | Solution | 30.13 | 31 | 0.00 | 0.00 |
| instance n=50 254.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 255.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 256.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 257.alb | 1 | 0 | Solution | 30.10 | 35 | 0.00 | 0.00 |
| instance n=50 258.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 259.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 26.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 260.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 261.alb | 1 | 0 | Solution | 30.14 | 30 | 0.00 | 0.00 |
| instance n=50 262.alb | 1 | 0 | Solution | 30.09 | 31 | 0.00 | 0.00 |
| instance n=50 263.alb | 1 | 0 | Solution | 30.11 | 31 | 0.00 | 0.00 |
| instance n=50 264.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |
| instance n=50 265.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 266.alb | 1 | 0 | Solution | 30.09 | 31 | 0.00 | 0.00 |
| instance n=50 267.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 268.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 269.alb | 1 | 0 | Solution | 30.10 | 29 | 0.00 | 0.00 |
| instance n=50 27.alb | 1 | 0 | Solution | 30.10 | 35 | 0.00 | 0.00 |
| instance n=50 270.alb | 1 | 0 | Solution | 30.10 | 29 | 0.00 | 0.00 |
| instance n=50 271.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 272.alb | 1 | 0 | Solution | 30.10 | 30 | 0.00 | 0.00 |
| instance n=50 273.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 274.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 275.alb | 1 | 0 | Solution | 30.09 | 29 | 0.00 | 0.00 |
| instance n=50 276.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 277.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 278.alb | 1 | 0 | Solution | 30.09 | 13 | 0.00 | 0.00 |
| instance n=50 279.alb | 1 | 0 | Solution | 30.16 | 11 | 0.00 | 0.00 |
| instance n=50 28.alb | 1 | 0 | Solution | 30.12 | 34 | 0.00 | 0.00 |
| instance n=50 280.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 281.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 282.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 283.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 284.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 285.alb | 1 | 0 | Solution | 30.10 | 14 | 0.00 | 0.00 |
| instance n=50 286.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 287.alb | 1 | 0 | Solution | 30.12 | 13 | 0.00 | 0.00 |
| instance n=50 288.alb | 1 | 0 | Solution | 30.13 | 11 | 0.00 | 0.00 |
| instance n=50 289.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 29.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 290.alb | 1 | 0 | Solution | 30.10 | 14 | 0.00 | 0.00 |
| instance n=50 291.alb | 1 | 0 | Solution | 30.15 | 12 | 0.00 | 0.00 |
| instance n=50 292.alb | 1 | 0 | Solution | 30.12 | 13 | 0.00 | 0.00 |
| instance n=50 293.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 294.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 295.alb | 1 | 0 | Solution | 30.10 | 17 | 0.00 | 0.00 |
| instance n=50 296.alb | 1 | 0 | Solution | 30.12 | 13 | 0.00 | 0.00 |
| instance n=50 297.alb | 1 | 0 | Solution | 30.12 | 13 | 0.00 | 0.00 |
| instance n=50 298.alb | 1 | 0 | Solution | 30.13 | 11 | 0.00 | 0.00 |
| instance n=50 299.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 3.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 30.alb | 1 | 0 | Solution | 30.11 | 30 | 0.00 | 0.00 |
| instance n=50 300.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 301.alb | 1 | 0 | Solution | 30.12 | 7 | 0.00 | 0.00 |
| instance n=50 302.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 303.alb | 1 | 0 | Solution | 30.13 | 8 | 0.00 | 0.00 |
| instance n=50 304.alb | 1 | 0 | Solution | 30.13 | 7 | 0.00 | 0.00 |
| instance n=50 305.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 306.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 307.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 308.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 309.alb | 1 | 0 | Solution | 30.12 | 8 | 0.00 | 0.00 |
| instance n=50 31.alb | 1 | 0 | Solution | 30.12 | 31 | 0.00 | 0.00 |
| instance n=50 310.alb | 1 | 0 | Solution | 30.12 | 8 | 0.00 | 0.00 |
| instance n=50 311.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 312.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 313.alb | 1 | 0 | Solution | 30.12 | 8 | 0.00 | 0.00 |
| instance n=50 314.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 315.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 316.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 317.alb | 1 | 0 | Solution | 30.10 | 6 | 0.00 | 0.00 |
| instance n=50 318.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 319.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 32.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |
| instance n=50 320.alb | 1 | 0 | Solution | 30.12 | 8 | 0.00 | 0.00 |
| instance n=50 321.alb | 1 | 0 | Solution | 30.10 | 6 | 0.00 | 0.00 |
| instance n=50 322.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 323.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 324.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 325.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 326.alb | 1 | 0 | Solution | 30.09 | 36 | 0.00 | 0.00 |
| instance n=50 327.alb | 1 | 0 | Solution | 30.11 | 31 | 0.00 | 0.00 |
| instance n=50 328.alb | 1 | 0 | Solution | 30.11 | 34 | 0.00 | 0.00 |
| instance n=50 329.alb | 1 | 0 | Solution | 30.10 | 30 | 0.00 | 0.00 |
| instance n=50 33.alb | 1 | 0 | Solution | 30.10 | 28 | 0.00 | 0.00 |
| instance n=50 330.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 331.alb | 1 | 0 | Solution | 30.10 | 36 | 0.00 | 0.00 |
| instance n=50 332.alb | 1 | 0 | Solution | 30.12 | 30 | 0.00 | 0.00 |
| instance n=50 333.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 334.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 335.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 336.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |
| instance n=50 337.alb | 1 | 0 | Solution | 30.12 | 31 | 0.00 | 0.00 |
| instance n=50 338.alb | 1 | 0 | Solution | 30.10 | 34 | 0.00 | 0.00 |
| instance n=50 339.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 34.alb | 1 | 0 | Solution | 30.11 | 32 | 0.00 | 0.00 |
| instance n=50 340.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 341.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 342.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 343.alb | 1 | 0 | Solution | 30.12 | 31 | 0.00 | 0.00 |
| instance n=50 344.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 345.alb | 1 | 0 | Solution | 30.12 | 35 | 0.00 | 0.00 |
| instance n=50 346.alb | 1 | 0 | Solution | 30.11 | 30 | 0.00 | 0.00 |
| instance n=50 347.alb | 1 | 0 | Solution | 30.13 | 33 | 0.00 | 0.00 |
| instance n=50 348.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 349.alb | 1 | 0 | Solution | 30.18 | 33 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 35.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 350.alb | 1 | 0 | Solution | 30.10 | 28 | 0.00 | 0.00 |
| instance n=50 351.alb | 1 | 0 | Solution | 30.09 | 12 | 0.00 | 0.00 |
| instance n=50 352.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 353.alb | 1 | 0 | Solution | 30.11 | 14 | 0.00 | 0.00 |
| instance n=50 354.alb | 1 | 0 | Solution | 30.11 | 14 | 0.00 | 0.00 |
| instance n=50 355.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 356.alb | 1 | 0 | Solution | 30.12 | 16 | 0.00 | 0.00 |
| instance n=50 357.alb | 1 | 0 | Solution | 30.18 | 13 | 0.00 | 0.00 |
| instance n=50 358.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 359.alb | 1 | 0 | Solution | 30.10 | 10 | 0.00 | 0.00 |
| instance n=50 36.alb | 1 | 0 | Solution | 30.10 | 35 | 0.00 | 0.00 |
| instance n=50 360.alb | 1 | 0 | Solution | 30.13 | 13 | 0.00 | 0.00 |
| instance n=50 361.alb | 1 | 0 | Solution | 30.15 | 12 | 0.00 | 0.00 |
| instance n=50 362.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 363.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 364.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 365.alb | 1 | 0 | Solution | 30.09 | 11 | 0.00 | 0.00 |
| instance n=50 366.alb | 1 | 0 | Solution | 30.10 | 14 | 0.00 | 0.00 |
| instance n=50 367.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 368.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 369.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 37.alb | 1 | 0 | Solution | 30.09 | 36 | 0.00 | 0.00 |
| instance n=50 370.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 371.alb | 1 | 0 | Solution | 30.13 | 12 | 0.00 | 0.00 |
| instance n=50 372.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 373.alb | 1 | 0 | Solution | 30.09 | 13 | 0.00 | 0.00 |
| instance n=50 374.alb | 1 | 0 | Solution | 30.13 | 11 | 0.00 | 0.00 |
| instance n=50 375.alb | 1 | 0 | Solution | 30.10 | 14 | 0.00 | 0.00 |
| instance n=50 376.alb | 1 | 0 | Solution | 30.12 | 7 | 0.00 | 0.00 |
| instance n=50 377.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 378.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 379.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 38.alb | 1 | 0 | Solution | 30.10 | 35 | 0.00 | 0.00 |
| instance n=50 380.alb | 1 | 0 | Solution | 30.12 | 7 | 0.00 | 0.00 |
| instance n=50 381.alb | 1 | 0 | Solution | 30.13 | 8 | 0.00 | 0.00 |
| instance n=50 382.alb | 1 | 0 | Solution | 30.08 | 6 | 0.00 | 0.00 |
| instance n=50 383.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 384.alb | 1 | 0 | Solution | 30.09 | 9 | 0.00 | 0.00 |
| instance n=50 385.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 386.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 387.alb | 1 | 0 | Solution | 30.17 | 8 | 0.00 | 0.00 |
| instance n=50 388.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 389.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 39.alb | 1 | 0 | Solution | 30.11 | 35 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 390.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 391.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 392.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 393.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 394.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 395.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 396.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 397.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 398.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 399.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 4.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 40.alb | 1 | 0 | Solution | 30.11 | 32 | 0.00 | 0.00 |
| instance n=50 400.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 401.alb | 1 | 0 | Solution | 30.09 | 31 | 0.00 | 0.00 |
| instance n=50 402.alb | 1 | 0 | Solution | 30.10 | 30 | 0.00 | 0.00 |
| instance n=50 403.alb | 1 | 0 | Solution | 30.09 | 36 | 0.00 | 0.00 |
| instance n=50 404.alb | 1 | 0 | Solution | 30.09 | 32 | 0.00 | 0.00 |
| instance n=50 405.alb | 1 | 0 | Solution | 30.11 | 29 | 0.00 | 0.00 |
| instance n=50 406.alb | 1 | 0 | Solution | 30.09 | 36 | 0.00 | 0.00 |
| instance n=50 407.alb | 1 | 0 | Solution | 30.10 | 30 | 0.00 | 0.00 |
| instance n=50 408.alb | 1 | 0 | Solution | 30.14 | 28 | 0.00 | 0.00 |
| instance n=50 409.alb | 1 | 0 | Solution | 30.08 | 34 | 0.00 | 0.00 |
| instance n=50 41.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 410.alb | 1 | 0 | Solution | 30.08 | 30 | 0.00 | 0.00 |
| instance n=50 411.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 412.alb | 1 | 0 | Solution | 30.09 | 29 | 0.00 | 0.00 |
| instance n=50 413.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 414.alb | 1 | 0 | Solution | 30.08 | 28 | 0.00 | 0.00 |
| instance n=50 415.alb | 1 | 0 | Solution | 30.10 | 32 | 0.00 | 0.00 |
| instance n=50 416.alb | 1 | 0 | Solution | 30.09 | 29 | 0.00 | 0.00 |
| instance n=50 417.alb | 1 | 0 | Solution | 30.09 | 32 | 0.00 | 0.00 |
| instance n=50 418.alb | 1 | 0 | Solution | 30.09 | 29 | 0.00 | 0.00 |
| instance n=50 419.alb | 1 | 0 | Solution | 30.10 | 34 | 0.00 | 0.00 |
| instance n=50 42.alb | 1 | 0 | Solution | 30.11 | 31 | 0.00 | 0.00 |
| instance n=50 420.alb | 1 | 0 | Solution | 30.13 | 30 | 0.00 | 0.00 |
| instance n=50 421.alb | 1 | 0 | Solution | 30.09 | 35 | 0.00 | 0.00 |
| instance n=50 422.alb | 1 | 0 | Solution | 30.09 | 31 | 0.00 | 0.00 |
| instance n=50 423.alb | 1 | 0 | Solution | 30.09 | 31 | 0.00 | 0.00 |
| instance n=50 424.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 425.alb | 1 | 0 | Solution | 30.10 | 35 | 0.00 | 0.00 |
| instance n=50 426.alb | 1 | 0 | Solution | 30.19 | 12 | 0.00 | 0.00 |
| instance n=50 427.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 428.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 429.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 43.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 430.alb | 1 | 0 | Solution | 30.10 | 15 | 0.00 | 0.00 |
| instance n=50 431.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 432.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 433.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 434.alb | 1 | 0 | Solution | 30.14 | 11 | 0.00 | 0.00 |
| instance n=50 435.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 436.alb | 1 | 0 | Solution | 30.09 | 11 | 0.00 | 0.00 |
| instance n=50 437.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 438.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 439.alb | 1 | 0 | Solution | 30.13 | 13 | 0.00 | 0.00 |
| instance n=50 44.alb | 1 | 0 | Solution | 30.11 | 31 | 0.00 | 0.00 |
| instance n=50 440.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 441.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 442.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 443.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 444.alb | 1 | 0 | Solution | 30.11 | 12 | 0.00 | 0.00 |
| instance n=50 445.alb | 1 | 0 | Solution | 30.13 | 12 | 0.00 | 0.00 |
| instance n=50 446.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 447.alb | 1 | 0 | Solution | 30.10 | 14 | 0.00 | 0.00 |
| instance n=50 448.alb | 1 | 0 | Solution | 30.10 | 13 | 0.00 | 0.00 |
| instance n=50 449.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 45.alb | 1 | 0 | Solution | 30.11 | 28 | 0.00 | 0.00 |
| instance n=50 450.alb | 1 | 0 | Solution | 30.13 | 11 | 0.00 | 0.00 |
| instance n=50 451.alb | 1 | 0 | Optimal | 3.72 | 8 | 0.00 | 0.00 |
| instance n=50 452.alb | 1 | 0 | Optimal | 2.81 | 8 | 0.00 | 0.00 |
| instance n=50 453.alb | 1 | 0 | Optimal | 2.55 | 7 | 0.00 | 0.00 |
| instance n=50 454.alb | 1 | 0 | Optimal | 3.73 | 8 | 0.00 | 0.00 |
| instance n=50 455.alb | 1 | 0 | Optimal | 2.59 | 6 | 0.00 | 0.00 |
| instance n=50 456.alb | 1 | 0 | Optimal | 2.85 | 8 | 0.00 | 0.00 |
| instance n=50 457.alb | 1 | 0 | Optimal | 2.71 | 8 | 0.00 | 0.00 |
| instance n=50 458.alb | 1 | 0 | Optimal | 2.65 | 7 | 0.00 | 0.00 |
| instance n=50 459.alb | 1 | 0 | Optimal | 2.54 | 7 | 0.00 | 0.00 |
| instance n=50 46.alb | 1 | 0 | Solution | 30.09 | 33 | 0.00 | 0.00 |
| instance n=50 460.alb | 1 | 0 | Optimal | 3.10 | 7 | 0.00 | 0.00 |
| instance n=50 461.alb | 1 | 0 | Optimal | 2.66 | 6 | 0.00 | 0.00 |
| instance n=50 462.alb | 1 | 0 | Optimal | 3.26 | 7 | 0.00 | 0.00 |
| instance n=50 463.alb | 1 | 0 | Optimal | 2.83 | 8 | 0.00 | 0.00 |
| instance n=50 464.alb | 1 | 0 | Optimal | 2.73 | 6 | 0.00 | 0.00 |
| instance n=50 465.alb | 1 | 0 | Optimal | 2.67 | 8 | 0.00 | 0.00 |
| instance n=50 466.alb | 1 | 0 | Optimal | 2.78 | 7 | 0.00 | 0.00 |
| instance n=50 467.alb | 1 | 0 | Optimal | 5.73 | 9 | 0.00 | 0.00 |
| instance n=50 468.alb | 1 | 0 | Optimal | 2.68 | 7 | 0.00 | 0.00 |
| instance n=50 469.alb | 1 | 0 | Optimal | 2.67 | 8 | 0.00 | 0.00 |
| instance n=50 47.alb | 1 | 0 | Solution | 30.10 | 33 | 0.00 | 0.00 |
| instance n=50 470.alb | 1 | 0 | Optimal | 3.42 | 8 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 471.alb | 1 | 0 | Optimal | 2.64 | 7 | 0.00 | 0.00 |
| instance n=50 472.alb | 1 | 0 | Optimal | 2.81 | 8 | 0.00 | 0.00 |
| instance n=50 473.alb | 1 | 0 | Optimal | 2.52 | 7 | 0.00 | 0.00 |
| instance n=50 474.alb | 1 | 0 | Optimal | 2.86 | 7 | 0.00 | 0.00 |
| instance n=50 475.alb | 1 | 0 | Optimal | 2.49 | 6 | 0.00 | 0.00 |
| instance n=50 476.alb | 1 | 0 | Optimal | 9.05 | 28 | 0.00 | 0.00 |
| instance n=50 477.alb | 1 | 0 | Solution | 30.09 | 29 | 0.00 | 0.00 |
| instance n=50 478.alb | 1 | 0 | Solution | 30.09 | 32 | 0.00 | 0.00 |
| instance n=50 479.alb | 1 | 0 | Optimal | 19.68 | 28 | 0.00 | 0.00 |
| instance n=50 48.alb | 1 | 0 | Solution | 30.11 | 32 | 0.00 | 0.00 |
| instance n=50 480.alb | 1 | 0 | Optimal | 7.19 | 34 | 0.00 | 0.00 |
| instance n=50 481.alb | 1 | 0 | Solution | 30.09 | 28 | 0.00 | 0.00 |
| instance n=50 482.alb | 1 | 0 | Optimal | 5.35 | 27 | 0.00 | 0.00 |
| instance n=50 483.alb | 1 | 0 | Solution | 30.08 | 30 | 0.00 | 0.00 |
| instance n=50 484.alb | 1 | 0 | Optimal | 15.58 | 32 | 0.00 | 0.00 |
| instance n=50 485.alb | 1 | 0 | Solution | 30.09 | 31 | 0.00 | 0.00 |
| instance n=50 486.alb | 1 | 0 | Optimal | 5.60 | 32 | 0.00 | 0.00 |
| instance n=50 487.alb | 1 | 0 | Solution | 30.09 | 31 | 0.00 | 0.00 |
| instance n=50 488.alb | 1 | 0 | Solution | 30.07 | 31 | 0.00 | 0.00 |
| instance n=50 489.alb | 1 | 0 | Solution | 30.09 | 35 | 0.00 | 0.00 |
| instance n=50 49.alb | 1 | 0 | Solution | 30.10 | 31 | 0.00 | 0.00 |
| instance n=50 490.alb | 1 | 0 | Solution | 30.08 | 29 | 0.00 | 0.00 |
| instance n=50 491.alb | 1 | 0 | Solution | 30.09 | 35 | 0.00 | 0.00 |
| instance n=50 492.alb | 1 | 0 | Solution | 30.08 | 29 | 0.00 | 0.00 |
| instance n=50 493.alb | 1 | 0 | Solution | 30.08 | 30 | 0.00 | 0.00 |
| instance n=50 494.alb | 1 | 0 | Solution | 30.08 | 32 | 0.00 | 0.00 |
| instance n=50 495.alb | 1 | 0 | Solution | 30.08 | 34 | 0.00 | 0.00 |
| instance n=50 496.alb | 1 | 0 | Solution | 30.08 | 29 | 0.00 | 0.00 |
| instance n=50 497.alb | 1 | 0 | Solution | 30.10 | 30 | 0.00 | 0.00 |
| instance n=50 498.alb | 1 | 0 | Solution | 30.09 | 30 | 0.00 | 0.00 |
| instance n=50 499.alb | 1 | 0 | Solution | 30.09 | 33 | 0.00 | 0.00 |
| instance n=50 5.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 50.alb | 1 | 0 | Solution | 30.11 | 32 | 0.00 | 0.00 |
| instance n=50 500.alb | 1 | 0 | Solution | 30.09 | 34 | 0.00 | 0.00 |
| instance n=50 501.alb | 1 | 0 | Optimal | 3.41 | 12 | 0.00 | 0.00 |
| instance n=50 502.alb | 1 | 0 | Optimal | 2.80 | 10 | 0.00 | 0.00 |
| instance n=50 503.alb | 1 | 0 | Optimal | 4.21 | 13 | 0.00 | 0.00 |
| instance n=50 504.alb | 1 | 0 | Optimal | 4.68 | 11 | 0.00 | 0.00 |
| instance n=50 505.alb | 1 | 0 | Optimal | 2.81 | 12 | 0.00 | 0.00 |
| instance n=50 506.alb | 1 | 0 | Optimal | 4.35 | 11 | 0.00 | 0.00 |
| instance n=50 507.alb | 1 | 0 | Optimal | 3.36 | 13 | 0.00 | 0.00 |
| instance n=50 508.alb | 1 | 0 | Optimal | 2.87 | 14 | 0.00 | 0.00 |
| instance n=50 509.alb | 1 | 0 | Optimal | 3.42 | 13 | 0.00 | 0.00 |
| instance n=50 51.alb | 1 | 0 | Solution | 30.10 | 12 | 0.00 | 0.00 |
| instance n=50 510.alb | 1 | 0 | Optimal | 5.55 | 11 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 511.alb | 1 | 0 | Optimal | 2.96 | 13 | 0.00 | 0.00 |
| instance n=50 512.alb | 1 | 0 | Optimal | 7.95 | 13 | 0.00 | 0.00 |
| instance n=50 513.alb | 1 | 0 | Optimal | 3.73 | 12 | 0.00 | 0.00 |
| instance n=50 514.alb | 1 | 0 | Optimal | 3.78 | 12 | 0.00 | 0.00 |
| instance n=50 515.alb | 1 | 0 | Optimal | 5.82 | 11 | 0.00 | 0.00 |
| instance n=50 516.alb | 1 | 0 | Optimal | 3.69 | 13 | 0.00 | 0.00 |
| instance n=50 517.alb | 1 | 0 | Optimal | 6.75 | 14 | 0.00 | 0.00 |
| instance n=50 518.alb | 1 | 0 | Optimal | 3.19 | 11 | 0.00 | 0.00 |
| instance n=50 519.alb | 1 | 0 | Optimal | 4.24 | 12 | 0.00 | 0.00 |
| instance n=50 52.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 520.alb | 1 | 0 | Optimal | 3.62 | 11 | 0.00 | 0.00 |
| instance n=50 521.alb | 1 | 0 | Optimal | 3.39 | 10 | 0.00 | 0.00 |
| instance n=50 522.alb | 1 | 0 | Optimal | 2.92 | 11 | 0.00 | 0.00 |
| instance n=50 523.alb | 1 | 0 | Optimal | 3.05 | 11 | 0.00 | 0.00 |
| instance n=50 524.alb | 1 | 0 | Optimal | 4.63 | 14 | 0.00 | 0.00 |
| instance n=50 525.alb | 1 | 0 | Optimal | 4.64 | 11 | 0.00 | 0.00 |
| instance n=50 53.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 54.alb | 1 | 0 | Solution | 30.09 | 12 | 0.00 | 0.00 |
| instance n=50 55.alb | 1 | 0 | Solution | 30.13 | 14 | 0.00 | 0.00 |
| instance n=50 56.alb | 1 | 0 | Solution | 30.12 | 12 | 0.00 | 0.00 |
| instance n=50 57.alb | 1 | 0 | Solution | 30.12 | 15 | 0.00 | 0.00 |
| instance n=50 58.alb | 1 | 0 | Solution | 30.10 | 11 | 0.00 | 0.00 |
| instance n=50 59.alb | 1 | 0 | Solution | 30.11 | 11 | 0.00 | 0.00 |
| instance n=50 6.alb | 1 | 0 | Solution | 30.11 | 6 | 0.00 | 0.00 |
| instance n=50 60.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 61.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 62.alb | 1 | 0 | Solution | 30.11 | 14 | 0.00 | 0.00 |
| instance n=50 63.alb | 1 | 0 | Solution | 30.12 | 12 | 0.00 | 0.00 |
| instance n=50 64.alb | 1 | 0 | Solution | 30.12 | 13 | 0.00 | 0.00 |
| instance n=50 65.alb | 1 | 0 | Solution | 30.12 | 12 | 0.00 | 0.00 |
| instance n=50 66.alb | 1 | 0 | Solution | 30.12 | 14 | 0.00 | 0.00 |
| instance n=50 67.alb | 1 | 0 | Solution | 30.12 | 13 | 0.00 | 0.00 |
| instance n=50 68.alb | 1 | 0 | Solution | 30.12 | 12 | 0.00 | 0.00 |
| instance n=50 69.alb | 1 | 0 | Solution | 30.11 | 13 | 0.00 | 0.00 |
| instance n=50 7.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 70.alb | 1 | 0 | Solution | 30.11 | 10 | 0.00 | 0.00 |
| instance n=50 71.alb | 1 | 0 | Solution | 30.11 | 15 | 0.00 | 0.00 |
| instance n=50 72.alb | 1 | 0 | Solution | 30.12 | 11 | 0.00 | 0.00 |
| instance n=50 73.alb | 1 | 0 | Solution | 30.12 | 12 | 0.00 | 0.00 |
| instance n=50 74.alb | 1 | 0 | Solution | 30.12 | 12 | 0.00 | 0.00 |
| instance n=50 75.alb | 1 | 0 | Solution | 30.13 | 12 | 0.00 | 0.00 |
| instance n=50 76.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 77.alb | 1 | 0 | Solution | 30.08 | 7 | 0.00 | 0.00 |
| instance n=50 78.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 79.alb | 1 | 0 | Solution | 30.12 | 8 | 0.00 | 0.00 |

Table 6.3: Results for SALBP-1 Problems (Cplex) (1575 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 8.alb | 1 | 0 | Solution | 30.12 | 7 | 0.00 | 0.00 |
| instance n=50 80.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 81.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 82.alb | 1 | 0 | Solution | 30.11 | 6 | 0.00 | 0.00 |
| instance n=50 83.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 84.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 85.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 86.alb | 1 | 0 | Solution | 30.15 | 7 | 0.00 | 0.00 |
| instance n=50 87.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 88.alb | 1 | 0 | Solution | 30.10 | 8 | 0.00 | 0.00 |
| instance n=50 89.alb | 1 | 0 | Solution | 30.09 | 7 | 0.00 | 0.00 |
| instance n=50 9.alb | 1 | 0 | Solution | 30.12 | 9 | 0.00 | 0.00 |
| instance n=50 90.alb | 1 | 0 | Solution | 30.11 | 8 | 0.00 | 0.00 |
| instance n=50 91.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 92.alb | 1 | 0 | Solution | 30.14 | 7 | 0.00 | 0.00 |
| instance n=50 93.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 94.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 95.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 96.alb | 1 | 0 | Solution | 30.11 | 7 | 0.00 | 0.00 |
| instance n=50 97.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |
| instance n=50 98.alb | 1 | 0 | Solution | 30.16 | 8 | 0.00 | 0.00 |
| instance n=50 99.alb | 1 | 0 | Solution | 30.10 | 7 | 0.00 | 0.00 |

6.4 Results for MiniZinc/Chuffed

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 1.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 10.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 100.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 101.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 102.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 103.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 104.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 105.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 106.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 107.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 108.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 109.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 11.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 110.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 111.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 112.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 113.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 114.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 115.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 116.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 117.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 118.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 119.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 12.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 120.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 121.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 122.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 123.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 124.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 125.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 126.alb | 1 | 0 | Solution | 121.11 | 1000 | 0.00 | 0.00 |
| instance n=1000 127.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 128.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 129.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 13.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 130.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 131.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 132.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 133.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 134.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 135.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 136.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 137.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 138.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 139.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 14.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 140.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 141.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 142.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 143.alb | 1 | 0 | Solution | 121.09 | 999 | 0.00 | 0.00 |
| instance n=1000 144.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 145.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 146.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 147.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 148.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 149.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 15.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 150.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 151.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 152.alb | 1 | 0 | Solution | 121.09 | 992 | 0.00 | 0.00 |
| instance n=1000 153.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 154.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 155.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 156.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 157.alb | 1 | 0 | Solution | 121.10 | 999 | 0.00 | 0.00 |
| instance n=1000 158.alb | 1 | 0 | Solution | 121.09 | 999 | 0.00 | 0.00 |
| instance n=1000 159.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 16.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 160.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 161.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 162.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 163.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 164.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 165.alb | 1 | 0 | Solution | 121.08 | 999 | 0.00 | 0.00 |
| instance n=1000 166.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 167.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 168.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 169.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 17.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 170.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 171.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 172.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 173.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 174.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 175.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 176.alb | 1 | 0 | Solution | 121.11 | 1000 | 0.00 | 0.00 |
| instance n=1000 177.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 178.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 179.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 18.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 180.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 181.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 182.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 183.alb | 1 | 0 | Solution | 121.09 | 999 | 0.00 | 0.00 |
| instance n=1000 184.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 185.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 186.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 187.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 188.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 189.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 19.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 190.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 191.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 192.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 193.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 194.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 195.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 196.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 197.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 198.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 199.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 2.alb | 1 | 0 | Solution | 121.07 | 999 | 0.00 | 0.00 |
| instance n=1000 20.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 200.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 201.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 202.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 203.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 204.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 205.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 206.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 207.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 208.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 209.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 21.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 210.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 211.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 212.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 213.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 214.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 215.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 216.alb | 1 | 0 | Solution | 121.09 | 999 | 0.00 | 0.00 |
| instance n=1000 217.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 218.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 219.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 22.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 220.alb | 1 | 0 | Solution | 121.08 | 999 | 0.00 | 0.00 |
| instance n=1000 221.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 222.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 223.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 224.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 225.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 226.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 227.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 228.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 229.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 23.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 230.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 231.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 232.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 233.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 234.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 235.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 236.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 237.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 238.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 239.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 24.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 240.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 241.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 242.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 243.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 244.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 245.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 246.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 247.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 248.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 249.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 25.alb | 1 | 0 | Solution | 121.07 | 1000 | 0.00 | 0.00 |
| instance n=1000 250.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 251.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 252.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 253.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 254.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 255.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 256.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 257.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 258.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 259.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 26.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 260.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 261.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 262.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 263.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 264.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 265.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 266.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 267.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 268.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 269.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 27.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 270.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 271.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 272.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 273.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 274.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 275.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 276.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 277.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 278.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 279.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 28.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 280.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 281.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 282.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 283.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 284.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 285.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 286.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 287.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 288.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 289.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 29.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 290.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 291.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 292.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 293.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 294.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 295.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 296.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 297.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 298.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 299.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 3.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 30.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 300.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 301.alb | 1 | 0 | Solution | 121.07 | 999 | 0.00 | 0.00 |
| instance n=1000 302.alb | 1 | 0 | Solution | 121.10 | 999 | 0.00 | 0.00 |
| instance n=1000 303.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 304.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 305.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 306.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 307.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 308.alb | 1 | 0 | Solution | 121.08 | 998 | 0.00 | 0.00 |
| instance n=1000 309.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 31.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 310.alb | 1 | 0 | Solution | 121.08 | 999 | 0.00 | 0.00 |
| instance n=1000 311.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 312.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 313.alb | 1 | 0 | Solution | 121.09 | 999 | 0.00 | 0.00 |
| instance n=1000 314.alb | 1 | 0 | Solution | 121.10 | 999 | 0.00 | 0.00 |
| instance n=1000 315.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 316.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 317.alb | 1 | 0 | Solution | 121.10 | 999 | 0.00 | 0.00 |
| instance n=1000 318.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 319.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 32.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 320.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 321.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 322.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 323.alb | 1 | 0 | Solution | 121.10 | 999 | 0.00 | 0.00 |
| instance n=1000 324.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 325.alb | 1 | 0 | Solution | 121.09 | 989 | 0.00 | 0.00 |
| instance n=1000 326.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 327.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 328.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 329.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 33.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 330.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 331.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 332.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 333.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 334.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 335.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 336.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 337.alb | 1 | 0 | Solution | 121.10 | 998 | 0.00 | 0.00 |
| instance n=1000 338.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 339.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 34.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 340.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 341.alb | 1 | 0 | Solution | 121.10 | 999 | 0.00 | 0.00 |
| instance n=1000 342.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 343.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 344.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 345.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 346.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 347.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 348.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 349.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 35.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 350.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 351.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 352.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 353.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 354.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 355.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 356.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 357.alb | 1 | 0 | Solution | 121.08 | 999 | 0.00 | 0.00 |
| instance n=1000 358.alb | 1 | 0 | Solution | 121.08 | 999 | 0.00 | 0.00 |
| instance n=1000 359.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 36.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 360.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 361.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 362.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 363.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 364.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 365.alb | 1 | 0 | Solution | 121.09 | 999 | 0.00 | 0.00 |
| instance n=1000 366.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 367.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 368.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 369.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 37.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 370.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 371.alb | 1 | 0 | Solution | 121.10 | 999 | 0.00 | 0.00 |
| instance n=1000 372.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 373.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 374.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 375.alb | 1 | 0 | Solution | 121.11 | 1000 | 0.00 | 0.00 |
| instance n=1000 376.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 377.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 378.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 379.alb | 1 | 0 | Solution | 121.07 | 962 | 0.00 | 0.00 |
| instance n=1000 38.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 380.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 381.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 382.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 383.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 384.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 385.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 386.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 387.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 388.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 389.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 39.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 390.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 391.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 392.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 393.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 394.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 395.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 396.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 397.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 398.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 399.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 4.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 40.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 400.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 401.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 402.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 403.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 404.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 405.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 406.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 407.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 408.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 409.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 41.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 410.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 411.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 412.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 413.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 414.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 415.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 416.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 417.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 418.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 419.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 42.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 420.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 421.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 422.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 423.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 424.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 425.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 426.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 427.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 428.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 429.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 43.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 430.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 431.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 432.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 433.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 434.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 435.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 436.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 437.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 438.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 439.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 44.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 440.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 441.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 442.alb | 1 | 0 | Solution | 121.09 | 991 | 0.00 | 0.00 |
| instance n=1000 443.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 444.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 445.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 446.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 447.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 448.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 449.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 45.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 450.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 451.alb | 1 | 0 | Solution | 121.10 | 1000 | 0.00 | 0.00 |
| instance n=1000 452.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 453.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 454.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 455.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 456.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 457.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 458.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 459.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 46.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 460.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 461.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 462.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 463.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 464.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 465.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 466.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 467.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 468.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 469.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 47.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 470.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 471.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 472.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 473.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 474.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 475.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 476.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 477.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 478.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 479.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 48.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 480.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 481.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 482.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 483.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 484.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 485.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 486.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 487.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 488.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 489.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 49.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 490.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 491.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 492.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 493.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 494.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 495.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 496.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 497.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 498.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 499.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 5.alb | 1 | 0 | Solution | 121.08 | 999 | 0.00 | 0.00 |
| instance n=1000 50.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 500.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 501.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 502.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 503.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 504.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 505.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 506.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 507.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 508.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 509.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 51.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 510.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 511.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 512.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 513.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 514.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 515.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 516.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 517.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 518.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 519.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 52.alb | 1 | 0 | Solution | 121.07 | 999 | 0.00 | 0.00 |
| instance n=1000 520.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 521.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 522.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 523.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 524.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 525.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 53.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 54.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 55.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 56.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 57.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 58.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 59.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 6.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 60.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 61.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 62.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 63.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 64.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 65.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 66.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 67.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 68.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 69.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 7.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 70.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 71.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 72.alb | 1 | 0 | Unknown | 0.00 | - | - | - |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=1000 73.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 74.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 75.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 76.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 77.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 78.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 79.alb | 1 | 0 | Solution | 121.08 | 1000 | 0.00 | 0.00 |
| instance n=1000 8.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 80.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 81.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 82.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 83.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 84.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 85.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 86.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 87.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 88.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 89.alb | 1 | 0 | Solution | 121.09 | 1000 | 0.00 | 0.00 |
| instance n=1000 9.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 90.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 91.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 92.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 93.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 94.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 95.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 96.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 97.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 98.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=1000 99.alb | 1 | 0 | Unknown | 0.00 | - | - | - |
| instance n=100 1.alb | 1 | 0 | Solution | 120.13 | 78 | 0.00 | 0.00 |
| instance n=100 10.alb | 1 | 0 | Solution | 120.13 | 56 | 0.00 | 0.00 |
| instance n=100 100.alb | 1 | 0 | Solution | 120.14 | 65 | 0.00 | 0.00 |
| instance n=100 101.alb | 1 | 0 | Solution | 120.13 | 70 | 0.00 | 0.00 |
| instance n=100 102.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 103.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 104.alb | 1 | 0 | Solution | 120.13 | 83 | 0.00 | 0.00 |
| instance n=100 105.alb | 1 | 0 | Solution | 120.11 | 13 | 0.00 | 0.00 |
| instance n=100 106.alb | 1 | 0 | Solution | 120.12 | 14 | 0.00 | 0.00 |
| instance n=100 107.alb | 1 | 0 | Solution | 120.12 | 14 | 0.00 | 0.00 |
| instance n=100 108.alb | 1 | 0 | Solution | 120.14 | 15 | 0.00 | 0.00 |
| instance n=100 109.alb | 1 | 0 | Solution | 120.12 | 92 | 0.00 | 0.00 |
| instance n=100 11.alb | 1 | 0 | Solution | 120.13 | 88 | 0.00 | 0.00 |
| instance n=100 110.alb | 1 | 0 | Solution | 120.13 | 84 | 0.00 | 0.00 |
| instance n=100 111.alb | 1 | 0 | Solution | 120.13 | 98 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 112.alb | 1 | 0 | Solution | 120.14 | 14 | 0.00 | 0.00 |
| instance n=100 113.alb | 1 | 0 | Solution | 120.14 | 49 | 0.00 | 0.00 |
| instance n=100 114.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 115.alb | 1 | 0 | Solution | 120.13 | 17 | 0.00 | 0.00 |
| instance n=100 116.alb | 1 | 0 | Solution | 120.14 | 71 | 0.00 | 0.00 |
| instance n=100 117.alb | 1 | 0 | Solution | 120.12 | 78 | 0.00 | 0.00 |
| instance n=100 118.alb | 1 | 0 | Solution | 120.12 | 15 | 0.00 | 0.00 |
| instance n=100 119.alb | 1 | 0 | Solution | 120.13 | 90 | 0.00 | 0.00 |
| instance n=100 12.alb | 1 | 0 | Solution | 120.13 | 79 | 0.00 | 0.00 |
| instance n=100 120.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 121.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 122.alb | 1 | 0 | Solution | 120.12 | 19 | 0.00 | 0.00 |
| instance n=100 123.alb | 1 | 0 | Solution | 120.12 | 71 | 0.00 | 0.00 |
| instance n=100 124.alb | 1 | 0 | Solution | 120.13 | 16 | 0.00 | 0.00 |
| instance n=100 125.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 126.alb | 1 | 0 | Solution | 120.14 | 63 | 0.00 | 0.00 |
| instance n=100 127.alb | 1 | 0 | Solution | 120.14 | 53 | 0.00 | 0.00 |
| instance n=100 128.alb | 1 | 0 | Solution | 120.12 | 83 | 0.00 | 0.00 |
| instance n=100 129.alb | 1 | 0 | Solution | 120.13 | 55 | 0.00 | 0.00 |
| instance n=100 13.alb | 1 | 0 | Solution | 120.13 | 84 | 0.00 | 0.00 |
| instance n=100 130.alb | 1 | 0 | Solution | 120.13 | 56 | 0.00 | 0.00 |
| instance n=100 131.alb | 1 | 0 | Solution | 120.13 | 71 | 0.00 | 0.00 |
| instance n=100 132.alb | 1 | 0 | Solution | 120.13 | 77 | 0.00 | 0.00 |
| instance n=100 133.alb | 1 | 0 | Solution | 120.12 | 56 | 0.00 | 0.00 |
| instance n=100 134.alb | 1 | 0 | Solution | 120.12 | 56 | 0.00 | 0.00 |
| instance n=100 135.alb | 1 | 0 | Solution | 120.12 | 57 | 0.00 | 0.00 |
| instance n=100 136.alb | 1 | 0 | Solution | 120.13 | 76 | 0.00 | 0.00 |
| instance n=100 137.alb | 1 | 0 | Solution | 120.13 | 66 | 0.00 | 0.00 |
| instance n=100 138.alb | 1 | 0 | Solution | 120.13 | 76 | 0.00 | 0.00 |
| instance n=100 139.alb | 1 | 0 | Solution | 120.12 | 84 | 0.00 | 0.00 |
| instance n=100 14.alb | 1 | 0 | Solution | 120.12 | 66 | 0.00 | 0.00 |
| instance n=100 140.alb | 1 | 0 | Solution | 120.13 | 69 | 0.00 | 0.00 |
| instance n=100 141.alb | 1 | 0 | Solution | 120.13 | 53 | 0.00 | 0.00 |
| instance n=100 142.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 143.alb | 1 | 0 | Solution | 120.11 | 64 | 0.00 | 0.00 |
| instance n=100 144.alb | 1 | 0 | Solution | 120.12 | 76 | 0.00 | 0.00 |
| instance n=100 145.alb | 1 | 0 | Solution | 120.11 | 82 | 0.00 | 0.00 |
| instance n=100 146.alb | 1 | 0 | Solution | 120.12 | 53 | 0.00 | 0.00 |
| instance n=100 147.alb | 1 | 0 | Solution | 120.12 | 71 | 0.00 | 0.00 |
| instance n=100 148.alb | 1 | 0 | Solution | 120.13 | 80 | 0.00 | 0.00 |
| instance n=100 149.alb | 1 | 0 | Solution | 120.13 | 76 | 0.00 | 0.00 |
| instance n=100 15.alb | 1 | 0 | Solution | 120.13 | 63 | 0.00 | 0.00 |
| instance n=100 150.alb | 1 | 0 | Solution | 120.12 | 59 | 0.00 | 0.00 |
| instance n=100 151.alb | 1 | 0 | Solution | 120.13 | 36 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 152.alb | 1 | 0 | Solution | 120.13 | 75 | 0.00 | 0.00 |
| instance n=100 153.alb | 1 | 0 | Solution | 120.13 | 21 | 0.00 | 0.00 |
| instance n=100 154.alb | 1 | 0 | Solution | 120.12 | 76 | 0.00 | 0.00 |
| instance n=100 155.alb | 1 | 0 | Solution | 120.13 | 98 | 0.00 | 0.00 |
| instance n=100 156.alb | 1 | 0 | Solution | 120.12 | 69 | 0.00 | 0.00 |
| instance n=100 157.alb | 1 | 0 | Solution | 120.13 | 42 | 0.00 | 0.00 |
| instance n=100 158.alb | 1 | 0 | Solution | 120.13 | 86 | 0.00 | 0.00 |
| instance n=100 159.alb | 1 | 0 | Solution | 120.12 | 78 | 0.00 | 0.00 |
| instance n=100 16.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 160.alb | 1 | 0 | Solution | 120.11 | 89 | 0.00 | 0.00 |
| instance n=100 161.alb | 1 | 0 | Solution | 120.12 | 56 | 0.00 | 0.00 |
| instance n=100 162.alb | 1 | 0 | Solution | 120.14 | 32 | 0.00 | 0.00 |
| instance n=100 163.alb | 1 | 0 | Solution | 120.13 | 76 | 0.00 | 0.00 |
| instance n=100 164.alb | 1 | 0 | Solution | 120.12 | 53 | 0.00 | 0.00 |
| instance n=100 165.alb | 1 | 0 | Solution | 120.13 | 70 | 0.00 | 0.00 |
| instance n=100 166.alb | 1 | 0 | Solution | 120.13 | 32 | 0.00 | 0.00 |
| instance n=100 167.alb | 1 | 0 | Solution | 120.12 | 51 | 0.00 | 0.00 |
| instance n=100 168.alb | 1 | 0 | Solution | 120.11 | 75 | 0.00 | 0.00 |
| instance n=100 169.alb | 1 | 0 | Solution | 120.14 | 94 | 0.00 | 0.00 |
| instance n=100 17.alb | 1 | 0 | Solution | 120.13 | 68 | 0.00 | 0.00 |
| instance n=100 170.alb | 1 | 0 | Solution | 120.13 | 38 | 0.00 | 0.00 |
| instance n=100 171.alb | 1 | 0 | Solution | 120.13 | 25 | 0.00 | 0.00 |
| instance n=100 172.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 173.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 174.alb | 1 | 0 | Solution | 120.12 | 47 | 0.00 | 0.00 |
| instance n=100 175.alb | 1 | 0 | Solution | 120.13 | 71 | 0.00 | 0.00 |
| instance n=100 176.alb | 1 | 0 | Solution | 120.13 | 80 | 0.00 | 0.00 |
| instance n=100 177.alb | 1 | 0 | Solution | 120.12 | 95 | 0.00 | 0.00 |
| instance n=100 178.alb | 1 | 0 | Solution | 120.12 | 81 | 0.00 | 0.00 |
| instance n=100 179.alb | 1 | 0 | Solution | 120.11 | 74 | 0.00 | 0.00 |
| instance n=100 18.alb | 1 | 0 | Solution | 120.13 | 95 | 0.00 | 0.00 |
| instance n=100 180.alb | 1 | 0 | Solution | 120.13 | 91 | 0.00 | 0.00 |
| instance n=100 181.alb | 1 | 0 | Solution | 120.13 | 60 | 0.00 | 0.00 |
| instance n=100 182.alb | 1 | 0 | Solution | 120.12 | 47 | 0.00 | 0.00 |
| instance n=100 183.alb | 1 | 0 | Solution | 120.13 | 72 | 0.00 | 0.00 |
| instance n=100 184.alb | 1 | 0 | Solution | 120.11 | 96 | 0.00 | 0.00 |
| instance n=100 185.alb | 1 | 0 | Solution | 120.13 | 54 | 0.00 | 0.00 |
| instance n=100 186.alb | 1 | 0 | Solution | 120.14 | 64 | 0.00 | 0.00 |
| instance n=100 187.alb | 1 | 0 | Solution | 120.12 | 48 | 0.00 | 0.00 |
| instance n=100 188.alb | 1 | 0 | Solution | 120.13 | 69 | 0.00 | 0.00 |
| instance n=100 189.alb | 1 | 0 | Solution | 120.13 | 85 | 0.00 | 0.00 |
| instance n=100 19.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 190.alb | 1 | 0 | Solution | 120.13 | 89 | 0.00 | 0.00 |
| instance n=100 191.alb | 1 | 0 | Solution | 120.13 | 78 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 192.alb | 1 | 0 | Solution | 120.13 | 78 | 0.00 | 0.00 |
| instance n=100 193.alb | 1 | 0 | Solution | 120.13 | 98 | 0.00 | 0.00 |
| instance n=100 194.alb | 1 | 0 | Solution | 120.12 | 80 | 0.00 | 0.00 |
| instance n=100 195.alb | 1 | 0 | Solution | 120.12 | 85 | 0.00 | 0.00 |
| instance n=100 196.alb | 1 | 0 | Solution | 120.12 | 97 | 0.00 | 0.00 |
| instance n=100 197.alb | 1 | 0 | Solution | 120.16 | 24 | 0.00 | 0.00 |
| instance n=100 198.alb | 1 | 0 | Solution | 120.13 | 79 | 0.00 | 0.00 |
| instance n=100 199.alb | 1 | 0 | Solution | 120.14 | 19 | 0.00 | 0.00 |
| instance n=100 2.alb | 1 | 0 | Solution | 120.12 | 51 | 0.00 | 0.00 |
| instance n=100 20.alb | 1 | 0 | Solution | 120.12 | 76 | 0.00 | 0.00 |
| instance n=100 200.alb | 1 | 0 | Solution | 120.11 | 96 | 0.00 | 0.00 |
| instance n=100 201.alb | 1 | 0 | Solution | 120.12 | 84 | 0.00 | 0.00 |
| instance n=100 202.alb | 1 | 0 | Solution | 120.12 | 92 | 0.00 | 0.00 |
| instance n=100 203.alb | 1 | 0 | Solution | 120.13 | 64 | 0.00 | 0.00 |
| instance n=100 204.alb | 1 | 0 | Solution | 120.14 | 80 | 0.00 | 0.00 |
| instance n=100 205.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 206.alb | 1 | 0 | Solution | 120.11 | 57 | 0.00 | 0.00 |
| instance n=100 207.alb | 1 | 0 | Solution | 120.13 | 70 | 0.00 | 0.00 |
| instance n=100 208.alb | 1 | 0 | Solution | 120.13 | 87 | 0.00 | 0.00 |
| instance n=100 209.alb | 1 | 0 | Solution | 120.13 | 78 | 0.00 | 0.00 |
| instance n=100 21.alb | 1 | 0 | Solution | 120.12 | 79 | 0.00 | 0.00 |
| instance n=100 210.alb | 1 | 0 | Solution | 120.12 | 65 | 0.00 | 0.00 |
| instance n=100 211.alb | 1 | 0 | Solution | 120.11 | 81 | 0.00 | 0.00 |
| instance n=100 212.alb | 1 | 0 | Solution | 120.13 | 55 | 0.00 | 0.00 |
| instance n=100 213.alb | 1 | 0 | Solution | 120.13 | 96 | 0.00 | 0.00 |
| instance n=100 214.alb | 1 | 0 | Solution | 120.13 | 87 | 0.00 | 0.00 |
| instance n=100 215.alb | 1 | 0 | Solution | 120.12 | 76 | 0.00 | 0.00 |
| instance n=100 216.alb | 1 | 0 | Solution | 120.13 | 94 | 0.00 | 0.00 |
| instance n=100 217.alb | 1 | 0 | Solution | 120.12 | 84 | 0.00 | 0.00 |
| instance n=100 218.alb | 1 | 0 | Solution | 120.13 | 57 | 0.00 | 0.00 |
| instance n=100 219.alb | 1 | 0 | Solution | 120.13 | 88 | 0.00 | 0.00 |
| instance n=100 22.alb | 1 | 0 | Solution | 120.12 | 48 | 0.00 | 0.00 |
| instance n=100 220.alb | 1 | 0 | Solution | 120.14 | 87 | 0.00 | 0.00 |
| instance n=100 221.alb | 1 | 0 | Solution | 120.13 | 88 | 0.00 | 0.00 |
| instance n=100 222.alb | 1 | 0 | Solution | 120.12 | 66 | 0.00 | 0.00 |
| instance n=100 223.alb | 1 | 0 | Solution | 120.12 | 64 | 0.00 | 0.00 |
| instance n=100 224.alb | 1 | 0 | Solution | 120.13 | 63 | 0.00 | 0.00 |
| instance n=100 225.alb | 1 | 0 | Solution | 120.13 | 58 | 0.00 | 0.00 |
| instance n=100 226.alb | 1 | 0 | Solution | 120.14 | 68 | 0.00 | 0.00 |
| instance n=100 227.alb | 1 | 0 | Solution | 120.13 | 27 | 0.00 | 0.00 |
| instance n=100 228.alb | 1 | 0 | Solution | 120.12 | 22 | 0.00 | 0.00 |
| instance n=100 229.alb | 1 | 0 | Solution | 120.13 | 24 | 0.00 | 0.00 |
| instance n=100 23.alb | 1 | 0 | Solution | 120.13 | 98 | 0.00 | 0.00 |
| instance n=100 230.alb | 1 | 0 | Solution | 120.14 | 38 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 231.alb | 1 | 0 | Solution | 120.13 | 23 | 0.00 | 0.00 |
| instance n=100 232.alb | 1 | 0 | Solution | 120.13 | 35 | 0.00 | 0.00 |
| instance n=100 233.alb | 1 | 0 | Solution | 120.12 | 36 | 0.00 | 0.00 |
| instance n=100 234.alb | 1 | 0 | Solution | 120.12 | 23 | 0.00 | 0.00 |
| instance n=100 235.alb | 1 | 0 | Solution | 120.13 | 26 | 0.00 | 0.00 |
| instance n=100 236.alb | 1 | 0 | Solution | 120.13 | 23 | 0.00 | 0.00 |
| instance n=100 237.alb | 1 | 0 | Solution | 120.12 | 23 | 0.00 | 0.00 |
| instance n=100 238.alb | 1 | 0 | Solution | 120.13 | 49 | 0.00 | 0.00 |
| instance n=100 239.alb | 1 | 0 | Solution | 120.13 | 92 | 0.00 | 0.00 |
| instance n=100 24.alb | 1 | 0 | Solution | 120.12 | 69 | 0.00 | 0.00 |
| instance n=100 240.alb | 1 | 0 | Solution | 120.13 | 22 | 0.00 | 0.00 |
| instance n=100 241.alb | 1 | 0 | Solution | 120.13 | 67 | 0.00 | 0.00 |
| instance n=100 242.alb | 1 | 0 | Solution | 120.13 | 87 | 0.00 | 0.00 |
| instance n=100 243.alb | 1 | 0 | Solution | 120.13 | 28 | 0.00 | 0.00 |
| instance n=100 244.alb | 1 | 0 | Solution | 120.13 | 51 | 0.00 | 0.00 |
| instance n=100 245.alb | 1 | 0 | Solution | 120.12 | 24 | 0.00 | 0.00 |
| instance n=100 246.alb | 1 | 0 | Solution | 120.12 | 26 | 0.00 | 0.00 |
| instance n=100 247.alb | 1 | 0 | Solution | 120.14 | 24 | 0.00 | 0.00 |
| instance n=100 248.alb | 1 | 0 | Solution | 120.13 | 20 | 0.00 | 0.00 |
| instance n=100 249.alb | 1 | 0 | Solution | 120.13 | 69 | 0.00 | 0.00 |
| instance n=100 25.alb | 1 | 0 | Solution | 120.12 | 95 | 0.00 | 0.00 |
| instance n=100 250.alb | 1 | 0 | Solution | 120.12 | 24 | 0.00 | 0.00 |
| instance n=100 251.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 252.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 253.alb | 1 | 0 | Solution | 120.12 | 93 | 0.00 | 0.00 |
| instance n=100 254.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 255.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 256.alb | 1 | 0 | Solution | 120.12 | 15 | 0.00 | 0.00 |
| instance n=100 257.alb | 1 | 0 | Solution | 120.13 | 13 | 0.00 | 0.00 |
| instance n=100 258.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 259.alb | 1 | 0 | Solution | 120.14 | 35 | 0.00 | 0.00 |
| instance n=100 26.alb | 1 | 0 | Solution | 120.13 | 81 | 0.00 | 0.00 |
| instance n=100 260.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 261.alb | 1 | 0 | Solution | 120.12 | 49 | 0.00 | 0.00 |
| instance n=100 262.alb | 1 | 0 | Solution | 120.14 | 14 | 0.00 | 0.00 |
| instance n=100 263.alb | 1 | 0 | Solution | 120.12 | 14 | 0.00 | 0.00 |
| instance n=100 264.alb | 1 | 0 | Solution | 120.12 | 69 | 0.00 | 0.00 |
| instance n=100 265.alb | 1 | 0 | Solution | 120.13 | 96 | 0.00 | 0.00 |
| instance n=100 266.alb | 1 | 0 | Solution | 120.13 | 13 | 0.00 | 0.00 |
| instance n=100 267.alb | 1 | 0 | Solution | 120.12 | 13 | 0.00 | 0.00 |
| instance n=100 268.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 269.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 27.alb | 1 | 0 | Solution | 120.13 | 56 | 0.00 | 0.00 |
| instance n=100 270.alb | 1 | 0 | Solution | 120.13 | 13 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 271.alb | 1 | 0 | Solution | 120.13 | 95 | 0.00 | 0.00 |
| instance n=100 272.alb | 1 | 0 | Solution | 120.12 | 14 | 0.00 | 0.00 |
| instance n=100 273.alb | 1 | 0 | Solution | 120.13 | 13 | 0.00 | 0.00 |
| instance n=100 274.alb | 1 | 0 | Solution | 120.14 | 14 | 0.00 | 0.00 |
| instance n=100 275.alb | 1 | 0 | Solution | 120.14 | 13 | 0.00 | 0.00 |
| instance n=100 276.alb | 1 | 0 | Solution | 120.12 | 63 | 0.00 | 0.00 |
| instance n=100 277.alb | 1 | 0 | Solution | 120.13 | 78 | 0.00 | 0.00 |
| instance n=100 278.alb | 1 | 0 | Solution | 120.12 | 61 | 0.00 | 0.00 |
| instance n=100 279.alb | 1 | 0 | Solution | 120.12 | 58 | 0.00 | 0.00 |
| instance n=100 28.alb | 1 | 0 | Solution | 120.14 | 74 | 0.00 | 0.00 |
| instance n=100 280.alb | 1 | 0 | Solution | 120.13 | 68 | 0.00 | 0.00 |
| instance n=100 281.alb | 1 | 0 | Solution | 120.13 | 83 | 0.00 | 0.00 |
| instance n=100 282.alb | 1 | 0 | Solution | 120.12 | 90 | 0.00 | 0.00 |
| instance n=100 283.alb | 1 | 0 | Solution | 120.12 | 56 | 0.00 | 0.00 |
| instance n=100 284.alb | 1 | 0 | Solution | 120.13 | 59 | 0.00 | 0.00 |
| instance n=100 285.alb | 1 | 0 | Solution | 120.14 | 57 | 0.00 | 0.00 |
| instance n=100 286.alb | 1 | 0 | Solution | 120.13 | 84 | 0.00 | 0.00 |
| instance n=100 287.alb | 1 | 0 | Solution | 120.14 | 55 | 0.00 | 0.00 |
| instance n=100 288.alb | 1 | 0 | Solution | 120.13 | 58 | 0.00 | 0.00 |
| instance n=100 289.alb | 1 | 0 | Solution | 120.11 | 64 | 0.00 | 0.00 |
| instance n=100 29.alb | 1 | 0 | Solution | 120.12 | 83 | 0.00 | 0.00 |
| instance n=100 290.alb | 1 | 0 | Solution | 120.13 | 60 | 0.00 | 0.00 |
| instance n=100 291.alb | 1 | 0 | Solution | 120.13 | 54 | 0.00 | 0.00 |
| instance n=100 292.alb | 1 | 0 | Solution | 120.13 | 60 | 0.00 | 0.00 |
| instance n=100 293.alb | 1 | 0 | Solution | 120.13 | 84 | 0.00 | 0.00 |
| instance n=100 294.alb | 1 | 0 | Solution | 120.12 | 57 | 0.00 | 0.00 |
| instance n=100 295.alb | 1 | 0 | Solution | 120.12 | 62 | 0.00 | 0.00 |
| instance n=100 296.alb | 1 | 0 | Solution | 120.13 | 57 | 0.00 | 0.00 |
| instance n=100 297.alb | 1 | 0 | Solution | 120.12 | 79 | 0.00 | 0.00 |
| instance n=100 298.alb | 1 | 0 | Solution | 120.13 | 61 | 0.00 | 0.00 |
| instance n=100 299.alb | 1 | 0 | Solution | 120.12 | 69 | 0.00 | 0.00 |
| instance n=100 3.alb | 1 | 0 | Solution | 120.11 | 55 | 0.00 | 0.00 |
| instance n=100 30.alb | 1 | 0 | Solution | 120.13 | 73 | 0.00 | 0.00 |
| instance n=100 300.alb | 1 | 0 | Solution | 120.12 | 55 | 0.00 | 0.00 |
| instance n=100 301.alb | 1 | 0 | Solution | 120.13 | 31 | 0.00 | 0.00 |
| instance n=100 302.alb | 1 | 0 | Solution | 120.13 | 35 | 0.00 | 0.00 |
| instance n=100 303.alb | 1 | 0 | Solution | 120.11 | 65 | 0.00 | 0.00 |
| instance n=100 304.alb | 1 | 0 | Solution | 120.11 | 81 | 0.00 | 0.00 |
| instance n=100 305.alb | 1 | 0 | Solution | 120.12 | 82 | 0.00 | 0.00 |
| instance n=100 306.alb | 1 | 0 | Solution | 120.13 | 81 | 0.00 | 0.00 |
| instance n=100 307.alb | 1 | 0 | Solution | 120.12 | 44 | 0.00 | 0.00 |
| instance n=100 308.alb | 1 | 0 | Solution | 120.12 | 75 | 0.00 | 0.00 |
| instance n=100 309.alb | 1 | 0 | Solution | 120.13 | 80 | 0.00 | 0.00 |
| instance n=100 31.alb | 1 | 0 | Solution | 120.11 | 38 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 310.alb | 1 | 0 | Solution | 120.11 | 57 | 0.00 | 0.00 |
| instance n=100 311.alb | 1 | 0 | Solution | 120.13 | 94 | 0.00 | 0.00 |
| instance n=100 312.alb | 1 | 0 | Solution | 120.13 | 68 | 0.00 | 0.00 |
| instance n=100 313.alb | 1 | 0 | Solution | 120.13 | 88 | 0.00 | 0.00 |
| instance n=100 314.alb | 1 | 0 | Solution | 120.14 | 43 | 0.00 | 0.00 |
| instance n=100 315.alb | 1 | 0 | Solution | 120.12 | 51 | 0.00 | 0.00 |
| instance n=100 316.alb | 1 | 0 | Solution | 120.12 | 82 | 0.00 | 0.00 |
| instance n=100 317.alb | 1 | 0 | Solution | 120.13 | 97 | 0.00 | 0.00 |
| instance n=100 318.alb | 1 | 0 | Solution | 120.13 | 95 | 0.00 | 0.00 |
| instance n=100 319.alb | 1 | 0 | Solution | 120.12 | 85 | 0.00 | 0.00 |
| instance n=100 32.alb | 1 | 0 | Solution | 120.12 | 82 | 0.00 | 0.00 |
| instance n=100 320.alb | 1 | 0 | Solution | 120.12 | 95 | 0.00 | 0.00 |
| instance n=100 321.alb | 1 | 0 | Solution | 120.11 | 70 | 0.00 | 0.00 |
| instance n=100 322.alb | 1 | 0 | Solution | 120.12 | 59 | 0.00 | 0.00 |
| instance n=100 323.alb | 1 | 0 | Solution | 120.12 | 70 | 0.00 | 0.00 |
| instance n=100 324.alb | 1 | 0 | Solution | 120.12 | 66 | 0.00 | 0.00 |
| instance n=100 325.alb | 1 | 0 | Solution | 120.12 | 58 | 0.00 | 0.00 |
| instance n=100 326.alb | 1 | 0 | Solution | 120.13 | 92 | 0.00 | 0.00 |
| instance n=100 327.alb | 1 | 0 | Solution | 120.12 | 85 | 0.00 | 0.00 |
| instance n=100 328.alb | 1 | 0 | Solution | 120.12 | 82 | 0.00 | 0.00 |
| instance n=100 329.alb | 1 | 0 | Solution | 120.13 | 83 | 0.00 | 0.00 |
| instance n=100 33.alb | 1 | 0 | Solution | 120.12 | 50 | 0.00 | 0.00 |
| instance n=100 330.alb | 1 | 0 | Solution | 120.12 | 66 | 0.00 | 0.00 |
| instance n=100 331.alb | 1 | 0 | Solution | 120.13 | 86 | 0.00 | 0.00 |
| instance n=100 332.alb | 1 | 0 | Solution | 120.13 | 81 | 0.00 | 0.00 |
| instance n=100 333.alb | 1 | 0 | Solution | 120.16 | 86 | 0.00 | 0.00 |
| instance n=100 334.alb | 1 | 0 | Solution | 120.13 | 70 | 0.00 | 0.00 |
| instance n=100 335.alb | 1 | 0 | Solution | 120.13 | 71 | 0.00 | 0.00 |
| instance n=100 336.alb | 1 | 0 | Solution | 120.12 | 61 | 0.00 | 0.00 |
| instance n=100 337.alb | 1 | 0 | Solution | 120.12 | 85 | 0.00 | 0.00 |
| instance n=100 338.alb | 1 | 0 | Solution | 120.13 | 60 | 0.00 | 0.00 |
| instance n=100 339.alb | 1 | 0 | Solution | 120.11 | 88 | 0.00 | 0.00 |
| instance n=100 34.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 340.alb | 1 | 0 | Solution | 120.13 | 72 | 0.00 | 0.00 |
| instance n=100 341.alb | 1 | 0 | Solution | 120.14 | 75 | 0.00 | 0.00 |
| instance n=100 342.alb | 1 | 0 | Solution | 120.12 | 71 | 0.00 | 0.00 |
| instance n=100 343.alb | 1 | 0 | Solution | 120.13 | 81 | 0.00 | 0.00 |
| instance n=100 344.alb | 1 | 0 | Solution | 120.11 | 96 | 0.00 | 0.00 |
| instance n=100 345.alb | 1 | 0 | Solution | 120.12 | 14 | 0.00 | 0.00 |
| instance n=100 346.alb | 1 | 0 | Solution | 120.13 | 95 | 0.00 | 0.00 |
| instance n=100 347.alb | 1 | 0 | Solution | 120.13 | 73 | 0.00 | 0.00 |
| instance n=100 348.alb | 1 | 0 | Solution | 120.12 | 99 | 0.00 | 0.00 |
| instance n=100 349.alb | 1 | 0 | Solution | 120.10 | 79 | 0.00 | 0.00 |
| instance n=100 35.alb | 1 | 0 | Solution | 120.12 | 89 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 350.alb | 1 | 0 | Solution | 120.11 | 78 | 0.00 | 0.00 |
| instance n=100 351.alb | 1 | 0 | Solution | 120.13 | 89 | 0.00 | 0.00 |
| instance n=100 352.alb | 1 | 0 | Solution | 120.13 | 92 | 0.00 | 0.00 |
| instance n=100 353.alb | 1 | 0 | Solution | 120.13 | 83 | 0.00 | 0.00 |
| instance n=100 354.alb | 1 | 0 | Solution | 120.13 | 76 | 0.00 | 0.00 |
| instance n=100 355.alb | 1 | 0 | Solution | 120.13 | 88 | 0.00 | 0.00 |
| instance n=100 356.alb | 1 | 0 | Solution | 120.12 | 97 | 0.00 | 0.00 |
| instance n=100 357.alb | 1 | 0 | Solution | 120.13 | 98 | 0.00 | 0.00 |
| instance n=100 358.alb | 1 | 0 | Solution | 120.11 | 87 | 0.00 | 0.00 |
| instance n=100 359.alb | 1 | 0 | Solution | 120.12 | 94 | 0.00 | 0.00 |
| instance n=100 36.alb | 1 | 0 | Solution | 120.13 | 70 | 0.00 | 0.00 |
| instance n=100 360.alb | 1 | 0 | Solution | 120.13 | 81 | 0.00 | 0.00 |
| instance n=100 361.alb | 1 | 0 | Solution | 120.12 | 66 | 0.00 | 0.00 |
| instance n=100 362.alb | 1 | 0 | Solution | 120.13 | 75 | 0.00 | 0.00 |
| instance n=100 363.alb | 1 | 0 | Solution | 120.13 | 92 | 0.00 | 0.00 |
| instance n=100 364.alb | 1 | 0 | Solution | 120.13 | 86 | 0.00 | 0.00 |
| instance n=100 365.alb | 1 | 0 | Solution | 120.13 | 86 | 0.00 | 0.00 |
| instance n=100 366.alb | 1 | 0 | Solution | 120.13 | 95 | 0.00 | 0.00 |
| instance n=100 367.alb | 1 | 0 | Solution | 120.12 | 87 | 0.00 | 0.00 |
| instance n=100 368.alb | 1 | 0 | Solution | 120.15 | 99 | 0.00 | 0.00 |
| instance n=100 369.alb | 1 | 0 | Solution | 120.14 | 61 | 0.00 | 0.00 |
| instance n=100 37.alb | 1 | 0 | Solution | 120.13 | 95 | 0.00 | 0.00 |
| instance n=100 370.alb | 1 | 0 | Solution | 120.13 | 90 | 0.00 | 0.00 |
| instance n=100 371.alb | 1 | 0 | Solution | 120.13 | 81 | 0.00 | 0.00 |
| instance n=100 372.alb | 1 | 0 | Solution | 120.12 | 83 | 0.00 | 0.00 |
| instance n=100 373.alb | 1 | 0 | Solution | 120.13 | 67 | 0.00 | 0.00 |
| instance n=100 374.alb | 1 | 0 | Solution | 120.13 | 99 | 0.00 | 0.00 |
| instance n=100 375.alb | 1 | 0 | Solution | 120.13 | 92 | 0.00 | 0.00 |
| instance n=100 376.alb | 1 | 0 | Solution | 120.12 | 32 | 0.00 | 0.00 |
| instance n=100 377.alb | 1 | 0 | Solution | 120.13 | 28 | 0.00 | 0.00 |
| instance n=100 378.alb | 1 | 0 | Solution | 120.15 | 86 | 0.00 | 0.00 |
| instance n=100 379.alb | 1 | 0 | Solution | 120.11 | 90 | 0.00 | 0.00 |
| instance n=100 38.alb | 1 | 0 | Solution | 120.12 | 80 | 0.00 | 0.00 |
| instance n=100 380.alb | 1 | 0 | Solution | 120.13 | 46 | 0.00 | 0.00 |
| instance n=100 381.alb | 1 | 0 | Solution | 120.12 | 98 | 0.00 | 0.00 |
| instance n=100 382.alb | 1 | 0 | Solution | 120.16 | 43 | 0.00 | 0.00 |
| instance n=100 383.alb | 1 | 0 | Solution | 120.13 | 67 | 0.00 | 0.00 |
| instance n=100 384.alb | 1 | 0 | Solution | 120.12 | 96 | 0.00 | 0.00 |
| instance n=100 385.alb | 1 | 0 | Solution | 120.13 | 22 | 0.00 | 0.00 |
| instance n=100 386.alb | 1 | 0 | Solution | 120.14 | 72 | 0.00 | 0.00 |
| instance n=100 387.alb | 1 | 0 | Solution | 120.13 | 65 | 0.00 | 0.00 |
| instance n=100 388.alb | 1 | 0 | Solution | 120.13 | 40 | 0.00 | 0.00 |
| instance n=100 389.alb | 1 | 0 | Solution | 120.15 | 45 | 0.00 | 0.00 |
| instance n=100 39.alb | 1 | 0 | Solution | 120.11 | 94 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 390.alb | 1 | 0 | Solution | 120.13 | 63 | 0.00 | 0.00 |
| instance n=100 391.alb | 1 | 0 | Solution | 120.12 | 86 | 0.00 | 0.00 |
| instance n=100 392.alb | 1 | 0 | Solution | 120.13 | 77 | 0.00 | 0.00 |
| instance n=100 393.alb | 1 | 0 | Solution | 120.12 | 24 | 0.00 | 0.00 |
| instance n=100 394.alb | 1 | 0 | Solution | 120.14 | 22 | 0.00 | 0.00 |
| instance n=100 395.alb | 1 | 0 | Solution | 120.11 | 82 | 0.00 | 0.00 |
| instance n=100 396.alb | 1 | 0 | Solution | 120.13 | 61 | 0.00 | 0.00 |
| instance n=100 397.alb | 1 | 0 | Solution | 120.12 | 27 | 0.00 | 0.00 |
| instance n=100 398.alb | 1 | 0 | Solution | 120.13 | 78 | 0.00 | 0.00 |
| instance n=100 399.alb | 1 | 0 | Solution | 120.13 | 43 | 0.00 | 0.00 |
| instance n=100 4.alb | 1 | 0 | Solution | 120.13 | 57 | 0.00 | 0.00 |
| instance n=100 40.alb | 1 | 0 | Solution | 120.12 | 73 | 0.00 | 0.00 |
| instance n=100 400.alb | 1 | 0 | Solution | 120.13 | 24 | 0.00 | 0.00 |
| instance n=100 401.alb | 1 | 0 | Solution | 120.13 | 70 | 0.00 | 0.00 |
| instance n=100 402.alb | 1 | 0 | Solution | 120.13 | 87 | 0.00 | 0.00 |
| instance n=100 403.alb | 1 | 0 | Solution | 120.12 | 53 | 0.00 | 0.00 |
| instance n=100 404.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 405.alb | 1 | 0 | Solution | 120.12 | 87 | 0.00 | 0.00 |
| instance n=100 406.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 407.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 408.alb | 1 | 0 | Solution | 120.13 | 94 | 0.00 | 0.00 |
| instance n=100 409.alb | 1 | 0 | Solution | 120.13 | 26 | 0.00 | 0.00 |
| instance n=100 41.alb | 1 | 0 | Solution | 120.12 | 49 | 0.00 | 0.00 |
| instance n=100 410.alb | 1 | 0 | Solution | 120.11 | 14 | 0.00 | 0.00 |
| instance n=100 411.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 412.alb | 1 | 0 | Solution | 120.16 | 98 | 0.00 | 0.00 |
| instance n=100 413.alb | 1 | 0 | Solution | 120.12 | 14 | 0.00 | 0.00 |
| instance n=100 414.alb | 1 | 0 | Solution | 120.13 | 34 | 0.00 | 0.00 |
| instance n=100 415.alb | 1 | 0 | Solution | 120.13 | 13 | 0.00 | 0.00 |
| instance n=100 416.alb | 1 | 0 | Solution | 120.16 | 14 | 0.00 | 0.00 |
| instance n=100 417.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 418.alb | 1 | 0 | Solution | 120.13 | 16 | 0.00 | 0.00 |
| instance n=100 419.alb | 1 | 0 | Solution | 120.13 | 15 | 0.00 | 0.00 |
| instance n=100 42.alb | 1 | 0 | Solution | 120.12 | 87 | 0.00 | 0.00 |
| instance n=100 420.alb | 1 | 0 | Solution | 120.13 | 14 | 0.00 | 0.00 |
| instance n=100 421.alb | 1 | 0 | Solution | 120.11 | 87 | 0.00 | 0.00 |
| instance n=100 422.alb | 1 | 0 | Solution | 120.13 | 72 | 0.00 | 0.00 |
| instance n=100 423.alb | 1 | 0 | Solution | 120.13 | 91 | 0.00 | 0.00 |
| instance n=100 424.alb | 1 | 0 | Solution | 120.13 | 71 | 0.00 | 0.00 |
| instance n=100 425.alb | 1 | 0 | Solution | 120.14 | 57 | 0.00 | 0.00 |
| instance n=100 426.alb | 1 | 0 | Solution | 120.13 | 64 | 0.00 | 0.00 |
| instance n=100 427.alb | 1 | 0 | Solution | 120.13 | 59 | 0.00 | 0.00 |
| instance n=100 428.alb | 1 | 0 | Solution | 120.12 | 81 | 0.00 | 0.00 |
| instance n=100 429.alb | 1 | 0 | Solution | 120.14 | 61 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 43.alb | 1 | 0 | Solution | 120.12 | 95 | 0.00 | 0.00 |
| instance n=100 430.alb | 1 | 0 | Solution | 120.12 | 70 | 0.00 | 0.00 |
| instance n=100 431.alb | 1 | 0 | Solution | 120.13 | 84 | 0.00 | 0.00 |
| instance n=100 432.alb | 1 | 0 | Solution | 120.11 | 66 | 0.00 | 0.00 |
| instance n=100 433.alb | 1 | 0 | Solution | 120.13 | 54 | 0.00 | 0.00 |
| instance n=100 434.alb | 1 | 0 | Solution | 120.13 | 80 | 0.00 | 0.00 |
| instance n=100 435.alb | 1 | 0 | Solution | 120.13 | 58 | 0.00 | 0.00 |
| instance n=100 436.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 437.alb | 1 | 0 | Solution | 120.14 | 56 | 0.00 | 0.00 |
| instance n=100 438.alb | 1 | 0 | Solution | 120.12 | 72 | 0.00 | 0.00 |
| instance n=100 439.alb | 1 | 0 | Solution | 120.12 | 58 | 0.00 | 0.00 |
| instance n=100 44.alb | 1 | 0 | Solution | 120.12 | 83 | 0.00 | 0.00 |
| instance n=100 440.alb | 1 | 0 | Solution | 120.13 | 80 | 0.00 | 0.00 |
| instance n=100 441.alb | 1 | 0 | Solution | 120.13 | 61 | 0.00 | 0.00 |
| instance n=100 442.alb | 1 | 0 | Solution | 120.13 | 53 | 0.00 | 0.00 |
| instance n=100 443.alb | 1 | 0 | Solution | 120.13 | 56 | 0.00 | 0.00 |
| instance n=100 444.alb | 1 | 0 | Solution | 120.11 | 56 | 0.00 | 0.00 |
| instance n=100 445.alb | 1 | 0 | Solution | 120.13 | 56 | 0.00 | 0.00 |
| instance n=100 446.alb | 1 | 0 | Solution | 120.13 | 58 | 0.00 | 0.00 |
| instance n=100 447.alb | 1 | 0 | Solution | 120.12 | 63 | 0.00 | 0.00 |
| instance n=100 448.alb | 1 | 0 | Solution | 120.13 | 58 | 0.00 | 0.00 |
| instance n=100 449.alb | 1 | 0 | Solution | 120.12 | 56 | 0.00 | 0.00 |
| instance n=100 45.alb | 1 | 0 | Solution | 120.11 | 89 | 0.00 | 0.00 |
| instance n=100 450.alb | 1 | 0 | Solution | 120.11 | 56 | 0.00 | 0.00 |
| instance n=100 451.alb | 1 | 0 | Optimal | 14.71 | 26 | 0.00 | 0.00 |
| instance n=100 452.alb | 1 | 0 | Optimal | 15.47 | 22 | 0.00 | 0.00 |
| instance n=100 453.alb | 1 | 0 | Optimal | 5.62 | 24 | 0.00 | 0.00 |
| instance n=100 454.alb | 1 | 0 | Optimal | 6.32 | 23 | 0.00 | 0.00 |
| instance n=100 455.alb | 1 | 0 | Optimal | 5.70 | 23 | 0.00 | 0.00 |
| instance n=100 456.alb | 1 | 0 | Optimal | 11.83 | 26 | 0.00 | 0.00 |
| instance n=100 457.alb | 1 | 0 | Optimal | 2.99 | 23 | 0.00 | 0.00 |
| instance n=100 458.alb | 1 | 0 | Optimal | 3.47 | 24 | 0.00 | 0.00 |
| instance n=100 459.alb | 1 | 0 | Optimal | 12.84 | 23 | 0.00 | 0.00 |
| instance n=100 46.alb | 1 | 0 | Solution | 120.11 | 73 | 0.00 | 0.00 |
| instance n=100 460.alb | 1 | 0 | Optimal | 3.73 | 23 | 0.00 | 0.00 |
| instance n=100 461.alb | 1 | 0 | Optimal | 8.19 | 23 | 0.00 | 0.00 |
| instance n=100 462.alb | 1 | 0 | Optimal | 4.52 | 23 | 0.00 | 0.00 |
| instance n=100 463.alb | 1 | 0 | Optimal | 11.36 | 26 | 0.00 | 0.00 |
| instance n=100 464.alb | 1 | 0 | Optimal | 5.05 | 25 | 0.00 | 0.00 |
| instance n=100 465.alb | 1 | 0 | Optimal | 29.93 | 22 | 0.00 | 0.00 |
| instance n=100 466.alb | 1 | 0 | Optimal | 3.27 | 26 | 0.00 | 0.00 |
| instance n=100 467.alb | 1 | 0 | Optimal | 16.69 | 21 | 0.00 | 0.00 |
| instance n=100 468.alb | 1 | 0 | Optimal | 5.91 | 25 | 0.00 | 0.00 |
| instance n=100 469.alb | 1 | 0 | Optimal | 3.30 | 22 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 47.alb | 1 | 0 | Solution | 120.12 | 87 | 0.00 | 0.00 |
| instance n=100 470.alb | 1 | 0 | Optimal | 42.09 | 26 | 0.00 | 0.00 |
| instance n=100 471.alb | 1 | 0 | Optimal | 5.11 | 26 | 0.00 | 0.00 |
| instance n=100 472.alb | 1 | 0 | Optimal | 2.92 | 23 | 0.00 | 0.00 |
| instance n=100 473.alb | 1 | 0 | Optimal | 39.84 | 28 | 0.00 | 0.00 |
| instance n=100 474.alb | 1 | 0 | Optimal | 5.15 | 23 | 0.00 | 0.00 |
| instance n=100 475.alb | 1 | 0 | Optimal | 3.83 | 24 | 0.00 | 0.00 |
| instance n=100 476.alb | 1 | 0 | Optimal | 2.01 | 14 | 0.00 | 0.00 |
| instance n=100 477.alb | 1 | 0 | Optimal | 2.04 | 14 | 0.00 | 0.00 |
| instance n=100 478.alb | 1 | 0 | Optimal | 8.28 | 14 | 0.00 | 0.00 |
| instance n=100 479.alb | 1 | 0 | Optimal | 23.13 | 16 | 0.00 | 0.00 |
| instance n=100 48.alb | 1 | 0 | Solution | 120.13 | 73 | 0.00 | 0.00 |
| instance n=100 480.alb | 1 | 0 | Optimal | 14.67 | 15 | 0.00 | 0.00 |
| instance n=100 481.alb | 1 | 0 | Optimal | 5.84 | 15 | 0.00 | 0.00 |
| instance n=100 482.alb | 1 | 0 | Optimal | 3.86 | 15 | 0.00 | 0.00 |
| instance n=100 483.alb | 1 | 0 | Optimal | 2.40 | 14 | 0.00 | 0.00 |
| instance n=100 484.alb | 1 | 0 | Optimal | 2.22 | 14 | 0.00 | 0.00 |
| instance n=100 485.alb | 1 | 0 | Optimal | 38.95 | 16 | 0.00 | 0.00 |
| instance n=100 486.alb | 1 | 0 | Optimal | 4.10 | 15 | 0.00 | 0.00 |
| instance n=100 487.alb | 1 | 0 | Optimal | 3.00 | 15 | 0.00 | 0.00 |
| instance n=100 488.alb | 1 | 0 | Optimal | 9.25 | 16 | 0.00 | 0.00 |
| instance n=100 489.alb | 1 | 0 | Optimal | 3.87 | 13 | 0.00 | 0.00 |
| instance n=100 49.alb | 1 | 0 | Solution | 120.13 | 97 | 0.00 | 0.00 |
| instance n=100 490.alb | 1 | 0 | Optimal | 2.91 | 15 | 0.00 | 0.00 |
| instance n=100 491.alb | 1 | 0 | Optimal | 53.45 | 16 | 0.00 | 0.00 |
| instance n=100 492.alb | 1 | 0 | Optimal | 12.27 | 14 | 0.00 | 0.00 |
| instance n=100 493.alb | 1 | 0 | Optimal | 5.24 | 14 | 0.00 | 0.00 |
| instance n=100 494.alb | 1 | 0 | Optimal | 5.77 | 14 | 0.00 | 0.00 |
| instance n=100 495.alb | 1 | 0 | Optimal | 7.38 | 15 | 0.00 | 0.00 |
| instance n=100 496.alb | 1 | 0 | Optimal | 6.50 | 14 | 0.00 | 0.00 |
| instance n=100 497.alb | 1 | 0 | Optimal | 11.98 | 13 | 0.00 | 0.00 |
| instance n=100 498.alb | 1 | 0 | Optimal | 5.10 | 14 | 0.00 | 0.00 |
| instance n=100 499.alb | 1 | 0 | Optimal | 2.34 | 14 | 0.00 | 0.00 |
| instance n=100 5.alb | 1 | 0 | Solution | 120.12 | 92 | 0.00 | 0.00 |
| instance n=100 50.alb | 1 | 0 | Solution | 120.11 | 57 | 0.00 | 0.00 |
| instance n=100 500.alb | 1 | 0 | Optimal | 2.88 | 14 | 0.00 | 0.00 |
| instance n=100 501.alb | 1 | 0 | Optimal | 3.02 | 62 | 0.00 | 0.00 |
| instance n=100 502.alb | 1 | 0 | Optimal | 6.87 | 64 | 0.00 | 0.00 |
| instance n=100 503.alb | 1 | 0 | Optimal | 5.92 | 60 | 0.00 | 0.00 |
| instance n=100 504.alb | 1 | 0 | Optimal | 61.67 | 60 | 0.00 | 0.00 |
| instance n=100 505.alb | 1 | 0 | Optimal | 62.69 | 61 | 0.00 | 0.00 |
| instance n=100 506.alb | 1 | 0 | Optimal | 20.14 | 57 | 0.00 | 0.00 |
| instance n=100 507.alb | 1 | 0 | Optimal | 5.99 | 59 | 0.00 | 0.00 |
| instance n=100 508.alb | 1 | 0 | Optimal | 12.72 | 56 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 509.alb | 1 | 0 | Optimal | 10.10 | 57 | 0.00 | 0.00 |
| instance n=100 51.alb | 1 | 0 | Solution | 120.13 | 83 | 0.00 | 0.00 |
| instance n=100 510.alb | 1 | 0 | Optimal | 26.78 | 58 | 0.00 | 0.00 |
| instance n=100 511.alb | 1 | 0 | Optimal | 12.13 | 59 | 0.00 | 0.00 |
| instance n=100 512.alb | 1 | 0 | Optimal | 12.59 | 60 | 0.00 | 0.00 |
| instance n=100 513.alb | 1 | 0 | Optimal | 6.81 | 62 | 0.00 | 0.00 |
| instance n=100 514.alb | 1 | 0 | Optimal | 19.41 | 58 | 0.00 | 0.00 |
| instance n=100 515.alb | 1 | 0 | Optimal | 7.06 | 61 | 0.00 | 0.00 |
| instance n=100 516.alb | 1 | 0 | Optimal | 16.62 | 70 | 0.00 | 0.00 |
| instance n=100 517.alb | 1 | 0 | Optimal | 5.35 | 62 | 0.00 | 0.00 |
| instance n=100 518.alb | 1 | 0 | Optimal | 13.04 | 57 | 0.00 | 0.00 |
| instance n=100 519.alb | 1 | 0 | Optimal | 4.73 | 61 | 0.00 | 0.00 |
| instance n=100 52.alb | 1 | 0 | Solution | 120.12 | 85 | 0.00 | 0.00 |
| instance n=100 520.alb | 1 | 0 | Optimal | 5.08 | 60 | 0.00 | 0.00 |
| instance n=100 521.alb | 1 | 0 | Optimal | 5.66 | 70 | 0.00 | 0.00 |
| instance n=100 522.alb | 1 | 0 | Optimal | 90.00 | 59 | 0.00 | 0.00 |
| instance n=100 523.alb | 1 | 0 | Optimal | 12.87 | 55 | 0.00 | 0.00 |
| instance n=100 524.alb | 1 | 0 | Optimal | 17.22 | 59 | 0.00 | 0.00 |
| instance n=100 525.alb | 1 | 0 | Optimal | 10.31 | 62 | 0.00 | 0.00 |
| instance n=100 53.alb | 1 | 0 | Solution | 120.13 | 89 | 0.00 | 0.00 |
| instance n=100 54.alb | 1 | 0 | Solution | 120.13 | 95 | 0.00 | 0.00 |
| instance n=100 55.alb | 1 | 0 | Solution | 120.12 | 89 | 0.00 | 0.00 |
| instance n=100 56.alb | 1 | 0 | Solution | 120.11 | 75 | 0.00 | 0.00 |
| instance n=100 57.alb | 1 | 0 | Solution | 120.12 | 89 | 0.00 | 0.00 |
| instance n=100 58.alb | 1 | 0 | Solution | 120.14 | 92 | 0.00 | 0.00 |
| instance n=100 59.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 6.alb | 1 | 0 | Solution | 120.13 | 83 | 0.00 | 0.00 |
| instance n=100 60.alb | 1 | 0 | Solution | 120.12 | 76 | 0.00 | 0.00 |
| instance n=100 61.alb | 1 | 0 | Solution | 120.12 | 79 | 0.00 | 0.00 |
| instance n=100 62.alb | 1 | 0 | Solution | 120.11 | 57 | 0.00 | 0.00 |
| instance n=100 63.alb | 1 | 0 | Solution | 120.12 | 96 | 0.00 | 0.00 |
| instance n=100 64.alb | 1 | 0 | Solution | 120.11 | 88 | 0.00 | 0.00 |
| instance n=100 65.alb | 1 | 0 | Solution | 120.11 | 83 | 0.00 | 0.00 |
| instance n=100 66.alb | 1 | 0 | Solution | 120.13 | 98 | 0.00 | 0.00 |
| instance n=100 67.alb | 1 | 0 | Solution | 120.12 | 87 | 0.00 | 0.00 |
| instance n=100 68.alb | 1 | 0 | Solution | 120.11 | 86 | 0.00 | 0.00 |
| instance n=100 69.alb | 1 | 0 | Solution | 120.13 | 99 | 0.00 | 0.00 |
| instance n=100 7.alb | 1 | 0 | Solution | 120.13 | 53 | 0.00 | 0.00 |
| instance n=100 70.alb | 1 | 0 | Solution | 120.13 | 88 | 0.00 | 0.00 |
| instance n=100 71.alb | 1 | 0 | Solution | 120.13 | 91 | 0.00 | 0.00 |
| instance n=100 72.alb | 1 | 0 | Solution | 120.12 | 82 | 0.00 | 0.00 |
| instance n=100 73.alb | 1 | 0 | Solution | 120.12 | 89 | 0.00 | 0.00 |
| instance n=100 74.alb | 1 | 0 | Solution | 120.12 | 93 | 0.00 | 0.00 |
| instance n=100 75.alb | 1 | 0 | Solution | 120.13 | 87 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 76.alb | 1 | 0 | Solution | 120.13 | 86 | 0.00 | 0.00 |
| instance n=100 77.alb | 1 | 0 | Solution | 120.13 | 71 | 0.00 | 0.00 |
| instance n=100 78.alb | 1 | 0 | Solution | 120.13 | 43 | 0.00 | 0.00 |
| instance n=100 79.alb | 1 | 0 | Solution | 120.13 | 73 | 0.00 | 0.00 |
| instance n=100 8.alb | 1 | 0 | Solution | 120.11 | 69 | 0.00 | 0.00 |
| instance n=100 80.alb | 1 | 0 | Solution | 120.13 | 23 | 0.00 | 0.00 |
| instance n=100 81.alb | 1 | 0 | Solution | 120.14 | 54 | 0.00 | 0.00 |
| instance n=100 82.alb | 1 | 0 | Solution | 120.12 | 90 | 0.00 | 0.00 |
| instance n=100 83.alb | 1 | 0 | Solution | 120.12 | 90 | 0.00 | 0.00 |
| instance n=100 84.alb | 1 | 0 | Solution | 120.13 | 86 | 0.00 | 0.00 |
| instance n=100 85.alb | 1 | 0 | Solution | 120.12 | 25 | 0.00 | 0.00 |
| instance n=100 86.alb | 1 | 0 | Solution | 120.12 | 23 | 0.00 | 0.00 |
| instance n=100 87.alb | 1 | 0 | Solution | 120.13 | 74 | 0.00 | 0.00 |
| instance n=100 88.alb | 1 | 0 | Solution | 120.16 | 43 | 0.00 | 0.00 |
| instance n=100 89.alb | 1 | 0 | Solution | 120.14 | 45 | 0.00 | 0.00 |
| instance n=100 9.alb | 1 | 0 | Solution | 120.11 | 80 | 0.00 | 0.00 |
| instance n=100 90.alb | 1 | 0 | Solution | 120.12 | 75 | 0.00 | 0.00 |
| instance n=100 91.alb | 1 | 0 | Solution | 120.17 | 77 | 0.00 | 0.00 |
| instance n=100 92.alb | 1 | 0 | Solution | 120.13 | 24 | 0.00 | 0.00 |
| instance n=100 93.alb | 1 | 0 | Solution | 120.13 | 28 | 0.00 | 0.00 |
| instance n=100 94.alb | 1 | 0 | Solution | 120.12 | 91 | 0.00 | 0.00 |
| instance n=100 95.alb | 1 | 0 | Solution | 120.13 | 22 | 0.00 | 0.00 |
| instance n=100 96.alb | 1 | 0 | Solution | 120.12 | 22 | 0.00 | 0.00 |
| instance n=100 97.alb | 1 | 0 | Solution | 120.14 | 22 | 0.00 | 0.00 |
| instance n=100 98.alb | 1 | 0 | Solution | 120.13 | 63 | 0.00 | 0.00 |
| instance n=100 99.alb | 1 | 0 | Solution | 120.13 | 32 | 0.00 | 0.00 |
| instance n=20 1.alb | 1 | 0 | Optimal | 0.51 | 3 | 0.00 | 0.00 |
| instance n=20 10.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 100.alb | 1 | 0 | Optimal | 0.26 | 11 | 0.00 | 0.00 |
| instance n=20 101.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=20 102.alb | 1 | 0 | Optimal | 0.26 | 13 | 0.00 | 0.00 |
| instance n=20 103.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 104.alb | 1 | 0 | Optimal | 0.25 | 11 | 0.00 | 0.00 |
| instance n=20 105.alb | 1 | 0 | Optimal | 0.26 | 12 | 0.00 | 0.00 |
| instance n=20 106.alb | 1 | 0 | Optimal | 0.25 | 10 | 0.00 | 0.00 |
| instance n=20 107.alb | 1 | 0 | Optimal | 0.33 | 14 | 0.00 | 0.00 |
| instance n=20 108.alb | 1 | 0 | Optimal | 0.29 | 15 | 0.00 | 0.00 |
| instance n=20 109.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 11.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 110.alb | 1 | 0 | Optimal | 0.26 | 11 | 0.00 | 0.00 |
| instance n=20 111.alb | 1 | 0 | Optimal | 0.25 | 13 | 0.00 | 0.00 |
| instance n=20 112.alb | 1 | 0 | Optimal | 0.24 | 11 | 0.00 | 0.00 |
| instance n=20 113.alb | 1 | 0 | Optimal | 0.26 | 12 | 0.00 | 0.00 |
| instance n=20 114.alb | 1 | 0 | Optimal | 0.26 | 13 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 115.alb | 1 | 0 | Optimal | 0.24 | 11 | 0.00 | 0.00 |
| instance n=20 116.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 117.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 118.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 119.alb | 1 | 0 | Optimal | 0.22 | 6 | 0.00 | 0.00 |
| instance n=20 12.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 120.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 121.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 122.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 123.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 124.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 125.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 126.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 127.alb | 1 | 0 | Optimal | 0.25 | 4 | 0.00 | 0.00 |
| instance n=20 128.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 129.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 13.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 130.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |
| instance n=20 131.alb | 1 | 0 | Optimal | 0.23 | 7 | 0.00 | 0.00 |
| instance n=20 132.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 133.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 134.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 135.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 136.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 137.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 138.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 139.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 14.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 140.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 141.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 142.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 143.alb | 1 | 0 | Optimal | 0.22 | 3 | 0.00 | 0.00 |
| instance n=20 144.alb | 1 | 0 | Optimal | 0.25 | 4 | 0.00 | 0.00 |
| instance n=20 145.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 146.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 147.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 148.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 149.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 15.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 150.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 151.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 152.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 153.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 154.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 155.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 156.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 157.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 158.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 159.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 16.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 160.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 161.alb | 1 | 0 | Optimal | 0.22 | 3 | 0.00 | 0.00 |
| instance n=20 162.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 163.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 164.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 165.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 166.alb | 1 | 0 | Optimal | 0.37 | 12 | 0.00 | 0.00 |
| instance n=20 167.alb | 1 | 0 | Optimal | 0.59 | 11 | 0.00 | 0.00 |
| instance n=20 168.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=20 169.alb | 1 | 0 | Optimal | 0.31 | 11 | 0.00 | 0.00 |
| instance n=20 17.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=20 170.alb | 1 | 0 | Optimal | 0.32 | 11 | 0.00 | 0.00 |
| instance n=20 171.alb | 1 | 0 | Optimal | 1.97 | 13 | 0.00 | 0.00 |
| instance n=20 172.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=20 173.alb | 1 | 0 | Optimal | 0.33 | 11 | 0.00 | 0.00 |
| instance n=20 174.alb | 1 | 0 | Optimal | 0.33 | 12 | 0.00 | 0.00 |
| instance n=20 175.alb | 1 | 0 | Optimal | 0.26 | 10 | 0.00 | 0.00 |
| instance n=20 176.alb | 1 | 0 | Optimal | 0.34 | 11 | 0.00 | 0.00 |
| instance n=20 177.alb | 1 | 0 | Optimal | 0.49 | 10 | 0.00 | 0.00 |
| instance n=20 178.alb | 1 | 0 | Optimal | 0.31 | 11 | 0.00 | 0.00 |
| instance n=20 179.alb | 1 | 0 | Optimal | 0.31 | 11 | 0.00 | 0.00 |
| instance n=20 18.alb | 1 | 0 | Optimal | 0.26 | 11 | 0.00 | 0.00 |
| instance n=20 180.alb | 1 | 0 | Optimal | 0.45 | 13 | 0.00 | 0.00 |
| instance n=20 181.alb | 1 | 0 | Optimal | 0.25 | 11 | 0.00 | 0.00 |
| instance n=20 182.alb | 1 | 0 | Optimal | 0.85 | 11 | 0.00 | 0.00 |
| instance n=20 183.alb | 1 | 0 | Optimal | 0.64 | 13 | 0.00 | 0.00 |
| instance n=20 184.alb | 1 | 0 | Optimal | 0.33 | 12 | 0.00 | 0.00 |
| instance n=20 185.alb | 1 | 0 | Optimal | 0.45 | 15 | 0.00 | 0.00 |
| instance n=20 186.alb | 1 | 0 | Optimal | 0.56 | 14 | 0.00 | 0.00 |
| instance n=20 187.alb | 1 | 0 | Optimal | 0.23 | 10 | 0.00 | 0.00 |
| instance n=20 188.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=20 189.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 19.alb | 1 | 0 | Optimal | 0.50 | 14 | 0.00 | 0.00 |
| instance n=20 190.alb | 1 | 0 | Optimal | 0.84 | 15 | 0.00 | 0.00 |
| instance n=20 191.alb | 1 | 0 | Optimal | 0.23 | 4 | 0.00 | 0.00 |
| instance n=20 192.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 193.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 194.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 195.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 196.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 197.alb | 1 | 0 | Optimal | 0.22 | 4 | 0.00 | 0.00 |
| instance n=20 198.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 199.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 2.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 20.alb | 1 | 0 | Optimal | 0.37 | 11 | 0.00 | 0.00 |
| instance n=20 200.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 201.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=20 202.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 203.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 204.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 205.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 206.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 207.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 208.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 209.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 21.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=20 210.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 211.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 212.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 213.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 214.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 215.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 216.alb | 1 | 0 | Optimal | 0.22 | 3 | 0.00 | 0.00 |
| instance n=20 217.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 218.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 219.alb | 1 | 0 | Optimal | 0.22 | 3 | 0.00 | 0.00 |
| instance n=20 22.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=20 220.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 221.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 222.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 223.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 224.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 225.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 226.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 227.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 228.alb | 1 | 0 | Optimal | 0.24 | 2 | 0.00 | 0.00 |
| instance n=20 229.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 23.alb | 1 | 0 | Optimal | 0.68 | 13 | 0.00 | 0.00 |
| instance n=20 230.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 231.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 232.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 233.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 234.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 235.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 236.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 237.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 238.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 239.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 24.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=20 240.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 241.alb | 1 | 0 | Optimal | 0.23 | 13 | 0.00 | 0.00 |
| instance n=20 242.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 243.alb | 1 | 0 | Optimal | 0.26 | 10 | 0.00 | 0.00 |
| instance n=20 244.alb | 1 | 0 | Optimal | 0.24 | 11 | 0.00 | 0.00 |
| instance n=20 245.alb | 1 | 0 | Optimal | 0.23 | 13 | 0.00 | 0.00 |
| instance n=20 246.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 247.alb | 1 | 0 | Optimal | 0.24 | 11 | 0.00 | 0.00 |
| instance n=20 248.alb | 1 | 0 | Optimal | 0.25 | 11 | 0.00 | 0.00 |
| instance n=20 249.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 25.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=20 250.alb | 1 | 0 | Optimal | 0.25 | 10 | 0.00 | 0.00 |
| instance n=20 251.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 252.alb | 1 | 0 | Optimal | 0.24 | 11 | 0.00 | 0.00 |
| instance n=20 253.alb | 1 | 0 | Optimal | 0.25 | 13 | 0.00 | 0.00 |
| instance n=20 254.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 255.alb | 1 | 0 | Optimal | 0.26 | 13 | 0.00 | 0.00 |
| instance n=20 256.alb | 1 | 0 | Optimal | 0.25 | 14 | 0.00 | 0.00 |
| instance n=20 257.alb | 1 | 0 | Optimal | 0.24 | 10 | 0.00 | 0.00 |
| instance n=20 258.alb | 1 | 0 | Optimal | 0.24 | 13 | 0.00 | 0.00 |
| instance n=20 259.alb | 1 | 0 | Optimal | 0.25 | 13 | 0.00 | 0.00 |
| instance n=20 26.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=20 260.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 261.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 262.alb | 1 | 0 | Optimal | 0.24 | 11 | 0.00 | 0.00 |
| instance n=20 263.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 264.alb | 1 | 0 | Optimal | 0.26 | 12 | 0.00 | 0.00 |
| instance n=20 265.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 266.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 267.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 268.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 269.alb | 1 | 0 | Optimal | 0.25 | 7 | 0.00 | 0.00 |
| instance n=20 27.alb | 1 | 0 | Optimal | 0.40 | 13 | 0.00 | 0.00 |
| instance n=20 270.alb | 1 | 0 | Optimal | 0.24 | 7 | 0.00 | 0.00 |
| instance n=20 271.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |
| instance n=20 272.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 273.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 274.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |
| instance n=20 275.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 276.alb | 1 | 0 | Optimal | 0.23 | 4 | 0.00 | 0.00 |
| instance n=20 277.alb | 1 | 0 | Optimal | 0.25 | 4 | 0.00 | 0.00 |
| instance n=20 278.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 279.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 28.alb | 1 | 0 | Optimal | 0.45 | 12 | 0.00 | 0.00 |
| instance n=20 280.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 281.alb | 1 | 0 | Optimal | 0.25 | 4 | 0.00 | 0.00 |
| instance n=20 282.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 283.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 284.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 285.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 286.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 287.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 288.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 289.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 29.alb | 1 | 0 | Optimal | 0.95 | 10 | 0.00 | 0.00 |
| instance n=20 290.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 291.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 292.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 293.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 294.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 295.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 296.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 297.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 298.alb | 1 | 0 | Optimal | 0.22 | 3 | 0.00 | 0.00 |
| instance n=20 299.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 3.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 30.alb | 1 | 0 | Optimal | 0.57 | 16 | 0.00 | 0.00 |
| instance n=20 300.alb | 1 | 0 | Optimal | 0.25 | 4 | 0.00 | 0.00 |
| instance n=20 301.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 302.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 303.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 304.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 305.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 306.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 307.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 308.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 309.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 31.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 310.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 311.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 312.alb | 1 | 0 | Optimal | 0.23 | 4 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 313.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 314.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 315.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 316.alb | 1 | 0 | Optimal | 1.11 | 10 | 0.00 | 0.00 |
| instance n=20 317.alb | 1 | 0 | Optimal | 0.90 | 10 | 0.00 | 0.00 |
| instance n=20 318.alb | 1 | 0 | Optimal | 0.25 | 10 | 0.00 | 0.00 |
| instance n=20 319.alb | 1 | 0 | Optimal | 0.37 | 14 | 0.00 | 0.00 |
| instance n=20 32.alb | 1 | 0 | Optimal | 0.77 | 13 | 0.00 | 0.00 |
| instance n=20 320.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 321.alb | 1 | 0 | Optimal | 2.38 | 14 | 0.00 | 0.00 |
| instance n=20 322.alb | 1 | 0 | Optimal | 0.42 | 12 | 0.00 | 0.00 |
| instance n=20 323.alb | 1 | 0 | Optimal | 0.37 | 13 | 0.00 | 0.00 |
| instance n=20 324.alb | 1 | 0 | Optimal | 0.53 | 9 | 0.00 | 0.00 |
| instance n=20 325.alb | 1 | 0 | Optimal | 0.65 | 14 | 0.00 | 0.00 |
| instance n=20 326.alb | 1 | 0 | Optimal | 0.52 | 14 | 0.00 | 0.00 |
| instance n=20 327.alb | 1 | 0 | Optimal | 0.43 | 13 | 0.00 | 0.00 |
| instance n=20 328.alb | 1 | 0 | Optimal | 0.45 | 13 | 0.00 | 0.00 |
| instance n=20 329.alb | 1 | 0 | Optimal | 0.31 | 10 | 0.00 | 0.00 |
| instance n=20 33.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=20 330.alb | 1 | 0 | Optimal | 0.43 | 12 | 0.00 | 0.00 |
| instance n=20 331.alb | 1 | 0 | Optimal | 1.50 | 13 | 0.00 | 0.00 |
| instance n=20 332.alb | 1 | 0 | Optimal | 0.40 | 13 | 0.00 | 0.00 |
| instance n=20 333.alb | 1 | 0 | Optimal | 0.35 | 11 | 0.00 | 0.00 |
| instance n=20 334.alb | 1 | 0 | Optimal | 0.28 | 10 | 0.00 | 0.00 |
| instance n=20 335.alb | 1 | 0 | Optimal | 1.94 | 14 | 0.00 | 0.00 |
| instance n=20 336.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=20 337.alb | 1 | 0 | Optimal | 0.31 | 10 | 0.00 | 0.00 |
| instance n=20 338.alb | 1 | 0 | Optimal | 0.44 | 14 | 0.00 | 0.00 |
| instance n=20 339.alb | 1 | 0 | Optimal | 0.45 | 13 | 0.00 | 0.00 |
| instance n=20 34.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 340.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=20 341.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=20 342.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 343.alb | 1 | 0 | Optimal | 0.49 | 6 | 0.00 | 0.00 |
| instance n=20 344.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 345.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 346.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 347.alb | 1 | 0 | Optimal | 0.44 | 6 | 0.00 | 0.00 |
| instance n=20 348.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 349.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 35.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 350.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 351.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 352.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 353.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 354.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 355.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 356.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 357.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 358.alb | 1 | 0 | Optimal | 0.23 | 4 | 0.00 | 0.00 |
| instance n=20 359.alb | 1 | 0 | Optimal | 0.26 | 4 | 0.00 | 0.00 |
| instance n=20 36.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=20 360.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=20 361.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 362.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 363.alb | 1 | 0 | Optimal | 0.70 | 7 | 0.00 | 0.00 |
| instance n=20 364.alb | 1 | 0 | Optimal | 0.22 | 4 | 0.00 | 0.00 |
| instance n=20 365.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 366.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 367.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 368.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 369.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 37.alb | 1 | 0 | Optimal | 0.32 | 12 | 0.00 | 0.00 |
| instance n=20 370.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 371.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 372.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 373.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 374.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 375.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 376.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 377.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 378.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 379.alb | 1 | 0 | Optimal | 0.22 | 4 | 0.00 | 0.00 |
| instance n=20 38.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 380.alb | 1 | 0 | Optimal | 0.22 | 3 | 0.00 | 0.00 |
| instance n=20 381.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 382.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 383.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 384.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 385.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 386.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 387.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 388.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 389.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 39.alb | 1 | 0 | Optimal | 0.25 | 13 | 0.00 | 0.00 |
| instance n=20 390.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 391.alb | 1 | 0 | Optimal | 0.25 | 11 | 0.00 | 0.00 |
| instance n=20 392.alb | 1 | 0 | Optimal | 0.27 | 14 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 393.alb | 1 | 0 | Optimal | 0.24 | 11 | 0.00 | 0.00 |
| instance n=20 394.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 395.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 396.alb | 1 | 0 | Optimal | 0.25 | 13 | 0.00 | 0.00 |
| instance n=20 397.alb | 1 | 0 | Optimal | 0.25 | 10 | 0.00 | 0.00 |
| instance n=20 398.alb | 1 | 0 | Optimal | 0.23 | 11 | 0.00 | 0.00 |
| instance n=20 399.alb | 1 | 0 | Optimal | 0.26 | 13 | 0.00 | 0.00 |
| instance n=20 4.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 40.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=20 400.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 401.alb | 1 | 0 | Optimal | 0.26 | 12 | 0.00 | 0.00 |
| instance n=20 402.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 403.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 404.alb | 1 | 0 | Optimal | 0.26 | 10 | 0.00 | 0.00 |
| instance n=20 405.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 406.alb | 1 | 0 | Optimal | 0.25 | 14 | 0.00 | 0.00 |
| instance n=20 407.alb | 1 | 0 | Optimal | 0.25 | 10 | 0.00 | 0.00 |
| instance n=20 408.alb | 1 | 0 | Optimal | 0.25 | 14 | 0.00 | 0.00 |
| instance n=20 409.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 41.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 410.alb | 1 | 0 | Optimal | 0.25 | 11 | 0.00 | 0.00 |
| instance n=20 411.alb | 1 | 0 | Optimal | 0.26 | 15 | 0.00 | 0.00 |
| instance n=20 412.alb | 1 | 0 | Optimal | 0.25 | 11 | 0.00 | 0.00 |
| instance n=20 413.alb | 1 | 0 | Optimal | 0.24 | 10 | 0.00 | 0.00 |
| instance n=20 414.alb | 1 | 0 | Optimal | 0.26 | 12 | 0.00 | 0.00 |
| instance n=20 415.alb | 1 | 0 | Optimal | 0.25 | 10 | 0.00 | 0.00 |
| instance n=20 416.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 417.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 418.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 419.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 42.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 420.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 421.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 422.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 423.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 424.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 425.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 426.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 427.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |
| instance n=20 428.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 429.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 43.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 430.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 431.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 432.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 433.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 434.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 435.alb | 1 | 0 | Optimal | 0.24 | 7 | 0.00 | 0.00 |
| instance n=20 436.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 437.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 438.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 439.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 44.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 440.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 441.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 442.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 443.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 444.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 445.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 446.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 447.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 448.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 449.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 45.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 450.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 451.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 452.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 453.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 454.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 455.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 456.alb | 1 | 0 | Optimal | 0.23 | 4 | 0.00 | 0.00 |
| instance n=20 457.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 458.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 459.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 46.alb | 1 | 0 | Optimal | 0.25 | 4 | 0.00 | 0.00 |
| instance n=20 460.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 461.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 462.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 463.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 464.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 465.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 466.alb | 1 | 0 | Optimal | 0.24 | 13 | 0.00 | 0.00 |
| instance n=20 467.alb | 1 | 0 | Optimal | 0.24 | 14 | 0.00 | 0.00 |
| instance n=20 468.alb | 1 | 0 | Optimal | 0.25 | 13 | 0.00 | 0.00 |
| instance n=20 469.alb | 1 | 0 | Optimal | 0.23 | 14 | 0.00 | 0.00 |
| instance n=20 47.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 470.alb | 1 | 0 | Optimal | 0.23 | 12 | 0.00 | 0.00 |
| instance n=20 471.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 472.alb | 1 | 0 | Optimal | 0.23 | 13 | 0.00 | 0.00 |
| instance n=20 473.alb | 1 | 0 | Optimal | 0.24 | 10 | 0.00 | 0.00 |
| instance n=20 474.alb | 1 | 0 | Optimal | 0.25 | 14 | 0.00 | 0.00 |
| instance n=20 475.alb | 1 | 0 | Optimal | 0.23 | 11 | 0.00 | 0.00 |
| instance n=20 476.alb | 1 | 0 | Optimal | 0.23 | 11 | 0.00 | 0.00 |
| instance n=20 477.alb | 1 | 0 | Optimal | 0.23 | 11 | 0.00 | 0.00 |
| instance n=20 478.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 479.alb | 1 | 0 | Optimal | 0.23 | 13 | 0.00 | 0.00 |
| instance n=20 48.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 480.alb | 1 | 0 | Optimal | 0.24 | 13 | 0.00 | 0.00 |
| instance n=20 481.alb | 1 | 0 | Optimal | 0.24 | 13 | 0.00 | 0.00 |
| instance n=20 482.alb | 1 | 0 | Optimal | 0.23 | 13 | 0.00 | 0.00 |
| instance n=20 483.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 484.alb | 1 | 0 | Optimal | 0.25 | 13 | 0.00 | 0.00 |
| instance n=20 485.alb | 1 | 0 | Optimal | 0.24 | 15 | 0.00 | 0.00 |
| instance n=20 486.alb | 1 | 0 | Optimal | 0.23 | 11 | 0.00 | 0.00 |
| instance n=20 487.alb | 1 | 0 | Optimal | 0.24 | 12 | 0.00 | 0.00 |
| instance n=20 488.alb | 1 | 0 | Optimal | 0.25 | 15 | 0.00 | 0.00 |
| instance n=20 489.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 49.alb | 1 | 0 | Optimal | 0.23 | 4 | 0.00 | 0.00 |
| instance n=20 490.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 491.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 492.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 493.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 494.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |
| instance n=20 495.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |
| instance n=20 496.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 497.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |
| instance n=20 498.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 499.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 5.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 50.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 500.alb | 1 | 0 | Optimal | 0.23 | 8 | 0.00 | 0.00 |
| instance n=20 501.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 502.alb | 1 | 0 | Optimal | 0.26 | 4 | 0.00 | 0.00 |
| instance n=20 503.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |
| instance n=20 504.alb | 1 | 0 | Optimal | 0.24 | 6 | 0.00 | 0.00 |
| instance n=20 505.alb | 1 | 0 | Optimal | 0.23 | 6 | 0.00 | 0.00 |
| instance n=20 506.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 507.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 508.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 509.alb | 1 | 0 | Optimal | 0.25 | 4 | 0.00 | 0.00 |
| instance n=20 51.alb | 1 | 0 | Optimal | 0.22 | 4 | 0.00 | 0.00 |
| instance n=20 510.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 511.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 512.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 513.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 514.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 515.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=20 516.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 517.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 518.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 519.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 52.alb | 1 | 0 | Optimal | 0.23 | 4 | 0.00 | 0.00 |
| instance n=20 520.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 521.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 522.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 523.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 524.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 525.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 53.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 54.alb | 1 | 0 | Optimal | 0.23 | 5 | 0.00 | 0.00 |
| instance n=20 55.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 56.alb | 1 | 0 | Optimal | 0.24 | 4 | 0.00 | 0.00 |
| instance n=20 57.alb | 1 | 0 | Optimal | 0.23 | 4 | 0.00 | 0.00 |
| instance n=20 58.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 59.alb | 1 | 0 | Optimal | 0.26 | 4 | 0.00 | 0.00 |
| instance n=20 6.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 60.alb | 1 | 0 | Optimal | 0.58 | 6 | 0.00 | 0.00 |
| instance n=20 61.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=20 62.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 63.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 64.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 65.alb | 1 | 0 | Optimal | 0.24 | 5 | 0.00 | 0.00 |
| instance n=20 66.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 67.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 68.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 69.alb | 1 | 0 | Optimal | 0.24 | 2 | 0.00 | 0.00 |
| instance n=20 7.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 70.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 71.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 72.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 73.alb | 1 | 0 | Optimal | 0.24 | 2 | 0.00 | 0.00 |
| instance n=20 74.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 75.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 76.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 77.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 78.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=20 79.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 8.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 80.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 81.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 82.alb | 1 | 0 | Optimal | 0.25 | 4 | 0.00 | 0.00 |
| instance n=20 83.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 84.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 85.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 86.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 87.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 88.alb | 1 | 0 | Optimal | 0.23 | 3 | 0.00 | 0.00 |
| instance n=20 89.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 9.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 90.alb | 1 | 0 | Optimal | 0.24 | 3 | 0.00 | 0.00 |
| instance n=20 91.alb | 1 | 0 | Optimal | 0.24 | 11 | 0.00 | 0.00 |
| instance n=20 92.alb | 1 | 0 | Optimal | 0.23 | 11 | 0.00 | 0.00 |
| instance n=20 93.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 94.alb | 1 | 0 | Optimal | 0.25 | 10 | 0.00 | 0.00 |
| instance n=20 95.alb | 1 | 0 | Optimal | 0.25 | 12 | 0.00 | 0.00 |
| instance n=20 96.alb | 1 | 0 | Optimal | 0.25 | 10 | 0.00 | 0.00 |
| instance n=20 97.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=20 98.alb | 1 | 0 | Optimal | 0.26 | 13 | 0.00 | 0.00 |
| instance n=20 99.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 1.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 10.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 100.alb | 1 | 0 | Optimal | 1.34 | 7 | 0.00 | 0.00 |
| instance n=50 101.alb | 1 | 0 | Optimal | 15.64 | 30 | 0.00 | 0.00 |
| instance n=50 102.alb | 1 | 0 | Optimal | 14.72 | 32 | 0.00 | 0.00 |
| instance n=50 103.alb | 1 | 0 | Optimal | 29.99 | 29 | 0.00 | 0.00 |
| instance n=50 104.alb | 1 | 0 | Optimal | 1.86 | 27 | 0.00 | 0.00 |
| instance n=50 105.alb | 1 | 0 | Solution | 30.07 | 24 | 0.00 | 0.00 |
| instance n=50 106.alb | 1 | 0 | Optimal | 10.20 | 28 | 0.00 | 0.00 |
| instance n=50 107.alb | 1 | 0 | Optimal | 5.48 | 28 | 0.00 | 0.00 |
| instance n=50 108.alb | 1 | 0 | Optimal | 25.74 | 30 | 0.00 | 0.00 |
| instance n=50 109.alb | 1 | 0 | Optimal | 5.94 | 30 | 0.00 | 0.00 |
| instance n=50 11.alb | 1 | 0 | Solution | 30.07 | 7 | 0.00 | 0.00 |
| instance n=50 110.alb | 1 | 0 | Solution | 30.07 | 27 | 0.00 | 0.00 |
| instance n=50 111.alb | 1 | 0 | Optimal | 2.37 | 28 | 0.00 | 0.00 |
| instance n=50 112.alb | 1 | 0 | Optimal | 2.83 | 27 | 0.00 | 0.00 |
| instance n=50 113.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 114.alb | 1 | 0 | Optimal | 5.26 | 27 | 0.00 | 0.00 |
| instance n=50 115.alb | 1 | 0 | Solution | 30.07 | 29 | 0.00 | 0.00 |
| instance n=50 116.alb | 1 | 0 | Optimal | 14.07 | 32 | 0.00 | 0.00 |
| instance n=50 117.alb | 1 | 0 | Optimal | 9.98 | 27 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 118.alb | 1 | 0 | Optimal | 2.58 | 29 | 0.00 | 0.00 |
| instance n=50 119.alb | 1 | 0 | Optimal | 6.11 | 25 | 0.00 | 0.00 |
| instance n=50 12.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 120.alb | 1 | 0 | Optimal | 3.50 | 27 | 0.00 | 0.00 |
| instance n=50 121.alb | 1 | 0 | Optimal | 6.45 | 32 | 0.00 | 0.00 |
| instance n=50 122.alb | 1 | 0 | Optimal | 11.70 | 29 | 0.00 | 0.00 |
| instance n=50 123.alb | 1 | 0 | Optimal | 12.53 | 32 | 0.00 | 0.00 |
| instance n=50 124.alb | 1 | 0 | Optimal | 8.08 | 29 | 0.00 | 0.00 |
| instance n=50 125.alb | 1 | 0 | Solution | 30.05 | 33 | 0.00 | 0.00 |
| instance n=50 126.alb | 1 | 0 | Optimal | 10.18 | 12 | 0.00 | 0.00 |
| instance n=50 127.alb | 1 | 0 | Optimal | 3.28 | 14 | 0.00 | 0.00 |
| instance n=50 128.alb | 1 | 0 | Optimal | 4.33 | 12 | 0.00 | 0.00 |
| instance n=50 129.alb | 1 | 0 | Optimal | 11.79 | 13 | 0.00 | 0.00 |
| instance n=50 13.alb | 1 | 0 | Solution | 30.06 | 6 | 0.00 | 0.00 |
| instance n=50 130.alb | 1 | 0 | Optimal | 6.71 | 13 | 0.00 | 0.00 |
| instance n=50 131.alb | 1 | 0 | Optimal | 3.67 | 12 | 0.00 | 0.00 |
| instance n=50 132.alb | 1 | 0 | Optimal | 13.49 | 12 | 0.00 | 0.00 |
| instance n=50 133.alb | 1 | 0 | Optimal | 4.76 | 12 | 0.00 | 0.00 |
| instance n=50 134.alb | 1 | 0 | Optimal | 2.63 | 14 | 0.00 | 0.00 |
| instance n=50 135.alb | 1 | 0 | Optimal | 5.17 | 13 | 0.00 | 0.00 |
| instance n=50 136.alb | 1 | 0 | Optimal | 5.89 | 11 | 0.00 | 0.00 |
| instance n=50 137.alb | 1 | 0 | Optimal | 6.50 | 11 | 0.00 | 0.00 |
| instance n=50 138.alb | 1 | 0 | Optimal | 4.26 | 12 | 0.00 | 0.00 |
| instance n=50 139.alb | 1 | 0 | Optimal | 11.13 | 11 | 0.00 | 0.00 |
| instance n=50 14.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 140.alb | 1 | 0 | Optimal | 1.44 | 12 | 0.00 | 0.00 |
| instance n=50 141.alb | 1 | 0 | Optimal | 2.72 | 13 | 0.00 | 0.00 |
| instance n=50 142.alb | 1 | 0 | Optimal | 4.07 | 11 | 0.00 | 0.00 |
| instance n=50 143.alb | 1 | 0 | Optimal | 0.56 | 12 | 0.00 | 0.00 |
| instance n=50 144.alb | 1 | 0 | Optimal | 1.24 | 13 | 0.00 | 0.00 |
| instance n=50 145.alb | 1 | 0 | Optimal | 1.21 | 10 | 0.00 | 0.00 |
| instance n=50 146.alb | 1 | 0 | Optimal | 1.48 | 13 | 0.00 | 0.00 |
| instance n=50 147.alb | 1 | 0 | Optimal | 8.57 | 13 | 0.00 | 0.00 |
| instance n=50 148.alb | 1 | 0 | Optimal | 4.22 | 10 | 0.00 | 0.00 |
| instance n=50 149.alb | 1 | 0 | Optimal | 1.32 | 12 | 0.00 | 0.00 |
| instance n=50 15.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 150.alb | 1 | 0 | Optimal | 1.38 | 11 | 0.00 | 0.00 |
| instance n=50 151.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 152.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 153.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 154.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 155.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 156.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 157.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 158.alb | 1 | 0 | Solution | 30.06 | 46 | 0.00 | 0.00 |
| instance n=50 159.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 16.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 160.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 161.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 162.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 163.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 164.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 165.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 166.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 167.alb | 1 | 0 | Solution | 30.07 | 8 | 0.00 | 0.00 |
| instance n=50 168.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 169.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 17.alb | 1 | 0 | Solution | 30.07 | 7 | 0.00 | 0.00 |
| instance n=50 170.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 171.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 172.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 173.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 174.alb | 1 | 0 | Solution | 30.07 | 7 | 0.00 | 0.00 |
| instance n=50 175.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 176.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 177.alb | 1 | 0 | Solution | 30.07 | 28 | 0.00 | 0.00 |
| instance n=50 178.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 179.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 18.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 180.alb | 1 | 0 | Solution | 30.07 | 26 | 0.00 | 0.00 |
| instance n=50 181.alb | 1 | 0 | Solution | 30.06 | 31 | 0.00 | 0.00 |
| instance n=50 182.alb | 1 | 0 | Solution | 30.05 | 27 | 0.00 | 0.00 |
| instance n=50 183.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 184.alb | 1 | 0 | Solution | 30.05 | 40 | 0.00 | 0.00 |
| instance n=50 185.alb | 1 | 0 | Solution | 30.06 | 26 | 0.00 | 0.00 |
| instance n=50 186.alb | 1 | 0 | Solution | 30.07 | 27 | 0.00 | 0.00 |
| instance n=50 187.alb | 1 | 0 | Solution | 30.06 | 26 | 0.00 | 0.00 |
| instance n=50 188.alb | 1 | 0 | Solution | 30.06 | 25 | 0.00 | 0.00 |
| instance n=50 189.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 19.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 190.alb | 1 | 0 | Solution | 30.06 | 31 | 0.00 | 0.00 |
| instance n=50 191.alb | 1 | 0 | Solution | 30.06 | 30 | 0.00 | 0.00 |
| instance n=50 192.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 193.alb | 1 | 0 | Solution | 30.05 | 29 | 0.00 | 0.00 |
| instance n=50 194.alb | 1 | 0 | Solution | 30.06 | 39 | 0.00 | 0.00 |
| instance n=50 195.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 196.alb | 1 | 0 | Solution | 30.07 | 28 | 0.00 | 0.00 |
| instance n=50 197.alb | 1 | 0 | Solution | 30.07 | 29 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 198.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 199.alb | 1 | 0 | Solution | 30.06 | 29 | 0.00 | 0.00 |
| instance n=50 2.alb | 1 | 0 | Solution | 30.06 | 6 | 0.00 | 0.00 |
| instance n=50 20.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 200.alb | 1 | 0 | Solution | 30.07 | 37 | 0.00 | 0.00 |
| instance n=50 201.alb | 1 | 0 | Solution | 30.05 | 13 | 0.00 | 0.00 |
| instance n=50 202.alb | 1 | 0 | Solution | 30.06 | 9 | 0.00 | 0.00 |
| instance n=50 203.alb | 1 | 0 | Solution | 30.06 | 11 | 0.00 | 0.00 |
| instance n=50 204.alb | 1 | 0 | Solution | 30.06 | 11 | 0.00 | 0.00 |
| instance n=50 205.alb | 1 | 0 | Solution | 30.07 | 13 | 0.00 | 0.00 |
| instance n=50 206.alb | 1 | 0 | Solution | 30.06 | 12 | 0.00 | 0.00 |
| instance n=50 207.alb | 1 | 0 | Solution | 30.07 | 10 | 0.00 | 0.00 |
| instance n=50 208.alb | 1 | 0 | Solution | 30.05 | 50 | 0.00 | 0.00 |
| instance n=50 209.alb | 1 | 0 | Solution | 30.06 | 11 | 0.00 | 0.00 |
| instance n=50 21.alb | 1 | 0 | Solution | 30.07 | 6 | 0.00 | 0.00 |
| instance n=50 210.alb | 1 | 0 | Solution | 30.06 | 13 | 0.00 | 0.00 |
| instance n=50 211.alb | 1 | 0 | Solution | 30.06 | 12 | 0.00 | 0.00 |
| instance n=50 212.alb | 1 | 0 | Solution | 30.05 | 10 | 0.00 | 0.00 |
| instance n=50 213.alb | 1 | 0 | Solution | 30.06 | 13 | 0.00 | 0.00 |
| instance n=50 214.alb | 1 | 0 | Solution | 30.07 | 11 | 0.00 | 0.00 |
| instance n=50 215.alb | 1 | 0 | Solution | 30.06 | 11 | 0.00 | 0.00 |
| instance n=50 216.alb | 1 | 0 | Solution | 30.06 | 12 | 0.00 | 0.00 |
| instance n=50 217.alb | 1 | 0 | Solution | 30.07 | 13 | 0.00 | 0.00 |
| instance n=50 218.alb | 1 | 0 | Solution | 30.06 | 12 | 0.00 | 0.00 |
| instance n=50 219.alb | 1 | 0 | Solution | 30.06 | 11 | 0.00 | 0.00 |
| instance n=50 22.alb | 1 | 0 | Solution | 30.06 | 44 | 0.00 | 0.00 |
| instance n=50 220.alb | 1 | 0 | Solution | 30.07 | 11 | 0.00 | 0.00 |
| instance n=50 221.alb | 1 | 0 | Solution | 30.06 | 11 | 0.00 | 0.00 |
| instance n=50 222.alb | 1 | 0 | Solution | 30.06 | 14 | 0.00 | 0.00 |
| instance n=50 223.alb | 1 | 0 | Solution | 30.04 | 11 | 0.00 | 0.00 |
| instance n=50 224.alb | 1 | 0 | Solution | 30.07 | 11 | 0.00 | 0.00 |
| instance n=50 225.alb | 1 | 0 | Solution | 30.07 | 12 | 0.00 | 0.00 |
| instance n=50 226.alb | 1 | 0 | Optimal | 0.77 | 7 | 0.00 | 0.00 |
| instance n=50 227.alb | 1 | 0 | Optimal | 0.64 | 6 | 0.00 | 0.00 |
| instance n=50 228.alb | 1 | 0 | Optimal | 1.39 | 6 | 0.00 | 0.00 |
| instance n=50 229.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=50 23.alb | 1 | 0 | Solution | 30.07 | 7 | 0.00 | 0.00 |
| instance n=50 230.alb | 1 | 0 | Optimal | 0.92 | 7 | 0.00 | 0.00 |
| instance n=50 231.alb | 1 | 0 | Optimal | 0.54 | 7 | 0.00 | 0.00 |
| instance n=50 232.alb | 1 | 0 | Optimal | 0.62 | 7 | 0.00 | 0.00 |
| instance n=50 233.alb | 1 | 0 | Optimal | 0.38 | 6 | 0.00 | 0.00 |
| instance n=50 234.alb | 1 | 0 | Optimal | 1.46 | 8 | 0.00 | 0.00 |
| instance n=50 235.alb | 1 | 0 | Optimal | 0.88 | 7 | 0.00 | 0.00 |
| instance n=50 236.alb | 1 | 0 | Optimal | 1.04 | 7 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 237.alb | 1 | 0 | Optimal | 1.20 | 8 | 0.00 | 0.00 |
| instance n=50 238.alb | 1 | 0 | Optimal | 0.91 | 7 | 0.00 | 0.00 |
| instance n=50 239.alb | 1 | 0 | Optimal | 0.56 | 7 | 0.00 | 0.00 |
| instance n=50 24.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 240.alb | 1 | 0 | Optimal | 0.66 | 7 | 0.00 | 0.00 |
| instance n=50 241.alb | 1 | 0 | Optimal | 3.00 | 7 | 0.00 | 0.00 |
| instance n=50 242.alb | 1 | 0 | Optimal | 0.58 | 8 | 0.00 | 0.00 |
| instance n=50 243.alb | 1 | 0 | Optimal | 1.77 | 7 | 0.00 | 0.00 |
| instance n=50 244.alb | 1 | 0 | Optimal | 0.39 | 7 | 0.00 | 0.00 |
| instance n=50 245.alb | 1 | 0 | Optimal | 1.08 | 7 | 0.00 | 0.00 |
| instance n=50 246.alb | 1 | 0 | Optimal | 1.37 | 8 | 0.00 | 0.00 |
| instance n=50 247.alb | 1 | 0 | Optimal | 0.62 | 7 | 0.00 | 0.00 |
| instance n=50 248.alb | 1 | 0 | Optimal | 0.71 | 7 | 0.00 | 0.00 |
| instance n=50 249.alb | 1 | 0 | Optimal | 0.73 | 7 | 0.00 | 0.00 |
| instance n=50 25.alb | 1 | 0 | Solution | 30.07 | 6 | 0.00 | 0.00 |
| instance n=50 250.alb | 1 | 0 | Optimal | 0.82 | 7 | 0.00 | 0.00 |
| instance n=50 251.alb | 1 | 0 | Optimal | 4.64 | 27 | 0.00 | 0.00 |
| instance n=50 252.alb | 1 | 0 | Optimal | 4.19 | 32 | 0.00 | 0.00 |
| instance n=50 253.alb | 1 | 0 | Optimal | 7.88 | 28 | 0.00 | 0.00 |
| instance n=50 254.alb | 1 | 0 | Optimal | 11.32 | 30 | 0.00 | 0.00 |
| instance n=50 255.alb | 1 | 0 | Optimal | 4.35 | 29 | 0.00 | 0.00 |
| instance n=50 256.alb | 1 | 0 | Optimal | 25.77 | 30 | 0.00 | 0.00 |
| instance n=50 257.alb | 1 | 0 | Optimal | 7.59 | 33 | 0.00 | 0.00 |
| instance n=50 258.alb | 1 | 0 | Optimal | 6.89 | 28 | 0.00 | 0.00 |
| instance n=50 259.alb | 1 | 0 | Optimal | 4.14 | 31 | 0.00 | 0.00 |
| instance n=50 26.alb | 1 | 0 | Solution | 30.04 | 27 | 0.00 | 0.00 |
| instance n=50 260.alb | 1 | 0 | Optimal | 2.99 | 29 | 0.00 | 0.00 |
| instance n=50 261.alb | 1 | 0 | Optimal | 1.98 | 28 | 0.00 | 0.00 |
| instance n=50 262.alb | 1 | 0 | Optimal | 1.69 | 31 | 0.00 | 0.00 |
| instance n=50 263.alb | 1 | 0 | Optimal | 2.75 | 29 | 0.00 | 0.00 |
| instance n=50 264.alb | 1 | 0 | Optimal | 12.04 | 27 | 0.00 | 0.00 |
| instance n=50 265.alb | 1 | 0 | Optimal | 2.55 | 27 | 0.00 | 0.00 |
| instance n=50 266.alb | 1 | 0 | Optimal | 15.62 | 29 | 0.00 | 0.00 |
| instance n=50 267.alb | 1 | 0 | Optimal | 5.11 | 28 | 0.00 | 0.00 |
| instance n=50 268.alb | 1 | 0 | Optimal | 9.37 | 29 | 0.00 | 0.00 |
| instance n=50 269.alb | 1 | 0 | Optimal | 19.23 | 26 | 0.00 | 0.00 |
| instance n=50 27.alb | 1 | 0 | Solution | 30.06 | 30 | 0.00 | 0.00 |
| instance n=50 270.alb | 1 | 0 | Optimal | 9.09 | 28 | 0.00 | 0.00 |
| instance n=50 271.alb | 1 | 0 | Optimal | 4.22 | 31 | 0.00 | 0.00 |
| instance n=50 272.alb | 1 | 0 | Optimal | 1.99 | 27 | 0.00 | 0.00 |
| instance n=50 273.alb | 1 | 0 | Optimal | 16.36 | 27 | 0.00 | 0.00 |
| instance n=50 274.alb | 1 | 0 | Optimal | 2.11 | 29 | 0.00 | 0.00 |
| instance n=50 275.alb | 1 | 0 | Optimal | 5.10 | 27 | 0.00 | 0.00 |
| instance n=50 276.alb | 1 | 0 | Optimal | 0.67 | 12 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 277.alb | 1 | 0 | Optimal | 0.63 | 13 | 0.00 | 0.00 |
| instance n=50 278.alb | 1 | 0 | Optimal | 1.56 | 12 | 0.00 | 0.00 |
| instance n=50 279.alb | 1 | 0 | Optimal | 6.73 | 11 | 0.00 | 0.00 |
| instance n=50 28.alb | 1 | 0 | Solution | 30.05 | 28 | 0.00 | 0.00 |
| instance n=50 280.alb | 1 | 0 | Optimal | 0.80 | 13 | 0.00 | 0.00 |
| instance n=50 281.alb | 1 | 0 | Optimal | 0.63 | 11 | 0.00 | 0.00 |
| instance n=50 282.alb | 1 | 0 | Optimal | 5.70 | 12 | 0.00 | 0.00 |
| instance n=50 283.alb | 1 | 0 | Optimal | 1.74 | 12 | 0.00 | 0.00 |
| instance n=50 284.alb | 1 | 0 | Optimal | 1.73 | 11 | 0.00 | 0.00 |
| instance n=50 285.alb | 1 | 0 | Optimal | 0.93 | 13 | 0.00 | 0.00 |
| instance n=50 286.alb | 1 | 0 | Optimal | 1.43 | 11 | 0.00 | 0.00 |
| instance n=50 287.alb | 1 | 0 | Optimal | 2.51 | 12 | 0.00 | 0.00 |
| instance n=50 288.alb | 1 | 0 | Optimal | 0.98 | 10 | 0.00 | 0.00 |
| instance n=50 289.alb | 1 | 0 | Optimal | 1.34 | 11 | 0.00 | 0.00 |
| instance n=50 29.alb | 1 | 0 | Solution | 30.07 | 29 | 0.00 | 0.00 |
| instance n=50 290.alb | 1 | 0 | Optimal | 1.61 | 14 | 0.00 | 0.00 |
| instance n=50 291.alb | 1 | 0 | Optimal | 1.26 | 12 | 0.00 | 0.00 |
| instance n=50 292.alb | 1 | 0 | Optimal | 1.52 | 13 | 0.00 | 0.00 |
| instance n=50 293.alb | 1 | 0 | Optimal | 0.92 | 12 | 0.00 | 0.00 |
| instance n=50 294.alb | 1 | 0 | Optimal | 1.20 | 13 | 0.00 | 0.00 |
| instance n=50 295.alb | 1 | 0 | Optimal | 9.01 | 16 | 0.00 | 0.00 |
| instance n=50 296.alb | 1 | 0 | Solution | 30.06 | 13 | 0.00 | 0.00 |
| instance n=50 297.alb | 1 | 0 | Optimal | 4.57 | 13 | 0.00 | 0.00 |
| instance n=50 298.alb | 1 | 0 | Optimal | 1.05 | 11 | 0.00 | 0.00 |
| instance n=50 299.alb | 1 | 0 | Optimal | 1.79 | 12 | 0.00 | 0.00 |
| instance n=50 3.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 30.alb | 1 | 0 | Solution | 30.06 | 27 | 0.00 | 0.00 |
| instance n=50 300.alb | 1 | 0 | Optimal | 0.71 | 12 | 0.00 | 0.00 |
| instance n=50 301.alb | 1 | 0 | Solution | 30.05 | 6 | 0.00 | 0.00 |
| instance n=50 302.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 303.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 304.alb | 1 | 0 | Solution | 30.04 | 7 | 0.00 | 0.00 |
| instance n=50 305.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 306.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 307.alb | 1 | 0 | Solution | 30.07 | 7 | 0.00 | 0.00 |
| instance n=50 308.alb | 1 | 0 | Solution | 30.07 | 8 | 0.00 | 0.00 |
| instance n=50 309.alb | 1 | 0 | Solution | 30.06 | 29 | 0.00 | 0.00 |
| instance n=50 31.alb | 1 | 0 | Solution | 30.05 | 28 | 0.00 | 0.00 |
| instance n=50 310.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 311.alb | 1 | 0 | Solution | 30.04 | 8 | 0.00 | 0.00 |
| instance n=50 312.alb | 1 | 0 | Solution | 30.05 | 6 | 0.00 | 0.00 |
| instance n=50 313.alb | 1 | 0 | Solution | 30.05 | 8 | 0.00 | 0.00 |
| instance n=50 314.alb | 1 | 0 | Solution | 30.06 | 22 | 0.00 | 0.00 |
| instance n=50 315.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|-------|----------------|
| instance n=50 316.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 317.alb | 1 | 0 | Solution | 30.05 | 6 | 0.00 | 0.00 |
| instance n=50 318.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 319.alb | 1 | 0 | Solution | 30.05 | 7 | 0.00 | 0.00 |
| instance n=50 32.alb | 1 | 0 | Solution | 30.06 | 26 | 0.00 | 0.00 |
| instance n=50 320.alb | 1 | 0 | Solution | 30.06 | 8 | 0.00 | 0.00 |
| instance n=50 321.alb | 1 | 0 | Solution | 30.06 | 6 | 0.00 | 0.00 |
| instance n=50 322.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 323.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 324.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 325.alb | 1 | 0 | Solution | 30.06 | 7 | 0.00 | 0.00 |
| instance n=50 326.alb | 1 | 0 | Solution | 30.06 | 33 | 0.00 | 0.00 |
| instance n=50 327.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 328.alb | 1 | 0 | Solution | 30.06 | 32 | 0.00 | 0.00 |
| instance n=50 329.alb | 1 | 0 | Solution | 30.06 | 25 | 0.00 | 0.00 |
| instance n=50 33.alb | 1 | 0 | Solution | 30.07 | 25 | 0.00 | 0.00 |
| instance n=50 330.alb | 1 | 0 | Solution | 30.06 | 30 | 0.00 | 0.00 |
| instance n=50 331.alb | 1 | 0 | Solution | 30.06 | 40 | 0.00 | 0.00 |
| instance n=50 332.alb | 1 | 0 | Solution | 30.07 | 25 | 0.00 | 0.00 |
| instance n=50 333.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 334.alb | 1 | 0 | Solution | 30.05 | 29 | 0.00 | 0.00 |
| instance n=50 335.alb | 1 | 0 | Solution | 30.05 | 27 | 0.00 | 0.00 |
| instance n=50 336.alb | 1 | 0 | Solution | 30.06 | 26 | 0.00 | 0.00 |
| instance n=50 337.alb | 1 | 0 | Solution | 30.06 | 26 | 0.00 | 0.00 |
| instance n=50 338.alb | 1 | 0 | Solution | 30.06 | 36 | 0.00 | 0.00 |
| instance n=50 339.alb | 1 | 0 | Solution | 30.06 | 29 | 0.00 | 0.00 |
| instance n=50 34.alb | 1 | 0 | Solution | 30.06 | 30 | 0.00 | 0.00 |
| instance n=50 340.alb | 1 | 0 | Solution | 30.06 | 32 | 0.00 | 0.00 |
| instance n=50 341.alb | 1 | 0 | Solution | 30.06 | 27 | 0.00 | 0.00 |
| instance n=50 342.alb | 1 | 0 | Solution | 30.06 | 29 | 0.00 | 0.00 |
| instance n=50 343.alb | 1 | 0 | Solution | 30.06 | 28 | 0.00 | 0.00 |
| instance n=50 344.alb | 1 | 0 | Solution | 30.05 | 30 | 0.00 | 0.00 |
| instance n=50 345.alb | 1 | 0 | Solution | 30.05 | 29 | 0.00 | 0.00 |
| instance n=50 346.alb | 1 | 0 | Solution | 30.06 | 27 | 0.00 | 0.00 |
| instance n=50 347.alb | 1 | 0 | Solution | 30.06 | 31 | 0.00 | 0.00 |
| instance n=50 348.alb | 1 | 0 | Solution | 30.06 | 30 | 0.00 | 0.00 |
| instance n=50 349.alb | 1 | 0 | Solution | 30.06 | 29 | 0.00 | 0.00 |
| instance n=50 35.alb | 1 | 0 | Solution | 30.08 | 32 | 0.00 | 0.00 |
| instance n=50 350.alb | 1 | 0 | Solution | 30.07 | 32 | 0.00 | 0.00 |
| instance n=50 351.alb | 1 | 0 | Solution | 30.07 | 12 | 0.00 | 0.00 |
| instance n=50 352.alb | 1 | 0 | Solution | 30.06 | 10 | 0.00 | 0.00 |
| instance n=50 353.alb | 1 | 0 | Solution | 30.06 | 13 | 0.00 | 0.00 |
| instance n=50 354.alb | 1 | 0 | Solution | 30.06 | 14 | 0.00 | 0.00 |
| instance n=50 355.alb | 1 | 0 | Solution | 30.06 | 11 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 356.alb | 1 | 0 | Solution | 30.04 | 15 | 0.00 | 0.00 |
| instance n=50 357.alb | 1 | 0 | Solution | 30.07 | 12 | 0.00 | 0.00 |
| instance n=50 358.alb | 1 | 0 | Solution | 30.05 | 11 | 0.00 | 0.00 |
| instance n=50 359.alb | 1 | 0 | Solution | 30.10 | 10 | 0.00 | 0.00 |
| instance n=50 36.alb | 1 | 0 | Solution | 30.06 | 31 | 0.00 | 0.00 |
| instance n=50 360.alb | 1 | 0 | Solution | 30.06 | 12 | 0.00 | 0.00 |
| instance n=50 361.alb | 1 | 0 | Solution | 30.07 | 11 | 0.00 | 0.00 |
| instance n=50 362.alb | 1 | 0 | Solution | 120.07 | 10 | 0.00 | 0.00 |
| instance n=50 363.alb | 1 | 0 | Solution | 120.07 | 12 | 0.00 | 0.00 |
| instance n=50 364.alb | 1 | 0 | Solution | 120.07 | 13 | 0.00 | 0.00 |
| instance n=50 365.alb | 1 | 0 | Solution | 120.07 | 11 | 0.00 | 0.00 |
| instance n=50 366.alb | 1 | 0 | Solution | 120.06 | 13 | 0.00 | 0.00 |
| instance n=50 367.alb | 1 | 0 | Solution | 120.07 | 12 | 0.00 | 0.00 |
| instance n=50 368.alb | 1 | 0 | Solution | 120.07 | 12 | 0.00 | 0.00 |
| instance n=50 369.alb | 1 | 0 | Solution | 120.05 | 12 | 0.00 | 0.00 |
| instance n=50 37.alb | 1 | 0 | Solution | 120.05 | 32 | 0.00 | 0.00 |
| instance n=50 370.alb | 1 | 0 | Solution | 120.05 | 12 | 0.00 | 0.00 |
| instance n=50 371.alb | 1 | 0 | Solution | 120.06 | 12 | 0.00 | 0.00 |
| instance n=50 372.alb | 1 | 0 | Solution | 120.07 | 10 | 0.00 | 0.00 |
| instance n=50 373.alb | 1 | 0 | Solution | 120.07 | 12 | 0.00 | 0.00 |
| instance n=50 374.alb | 1 | 0 | Solution | 120.06 | 11 | 0.00 | 0.00 |
| instance n=50 375.alb | 1 | 0 | Solution | 120.07 | 13 | 0.00 | 0.00 |
| instance n=50 376.alb | 1 | 0 | Optimal | 1.22 | 7 | 0.00 | 0.00 |
| instance n=50 377.alb | 1 | 0 | Optimal | 2.61 | 7 | 0.00 | 0.00 |
| instance n=50 378.alb | 1 | 0 | Optimal | 1.84 | 8 | 0.00 | 0.00 |
| instance n=50 379.alb | 1 | 0 | Optimal | 1.96 | 7 | 0.00 | 0.00 |
| instance n=50 38.alb | 1 | 0 | Solution | 120.07 | 31 | 0.00 | 0.00 |
| instance n=50 380.alb | 1 | 0 | Optimal | 1.98 | 7 | 0.00 | 0.00 |
| instance n=50 381.alb | 1 | 0 | Optimal | 2.21 | 8 | 0.00 | 0.00 |
| instance n=50 382.alb | 1 | 0 | Optimal | 0.48 | 6 | 0.00 | 0.00 |
| instance n=50 383.alb | 1 | 0 | Optimal | 7.68 | 7 | 0.00 | 0.00 |
| instance n=50 384.alb | 1 | 0 | Optimal | 2.05 | 8 | 0.00 | 0.00 |
| instance n=50 385.alb | 1 | 0 | Optimal | 1.28 | 7 | 0.00 | 0.00 |
| instance n=50 386.alb | 1 | 0 | Optimal | 1.82 | 7 | 0.00 | 0.00 |
| instance n=50 387.alb | 1 | 0 | Optimal | 7.76 | 8 | 0.00 | 0.00 |
| instance n=50 388.alb | 1 | 0 | Optimal | 1.37 | 7 | 0.00 | 0.00 |
| instance n=50 389.alb | 1 | 0 | Optimal | 0.56 | 8 | 0.00 | 0.00 |
| instance n=50 39.alb | 1 | 0 | Solution | 120.07 | 29 | 0.00 | 0.00 |
| instance n=50 390.alb | 1 | 0 | Optimal | 1.86 | 7 | 0.00 | 0.00 |
| instance n=50 391.alb | 1 | 0 | Optimal | 0.49 | 7 | 0.00 | 0.00 |
| instance n=50 392.alb | 1 | 0 | Optimal | 5.86 | 8 | 0.00 | 0.00 |
| instance n=50 393.alb | 1 | 0 | Optimal | 1.16 | 7 | 0.00 | 0.00 |
| instance n=50 394.alb | 1 | 0 | Optimal | 5.73 | 8 | 0.00 | 0.00 |
| instance n=50 395.alb | 1 | 0 | Optimal | 3.19 | 7 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 396.alb | 1 | 0 | Optimal | 7.69 | 8 | 0.00 | 0.00 |
| instance n=50 397.alb | 1 | 0 | Optimal | 0.47 | 7 | 0.00 | 0.00 |
| instance n=50 398.alb | 1 | 0 | Optimal | 0.98 | 6 | 0.00 | 0.00 |
| instance n=50 399.alb | 1 | 0 | Optimal | 1.83 | 7 | 0.00 | 0.00 |
| instance n=50 4.alb | 1 | 0 | Solution | 120.07 | 7 | 0.00 | 0.00 |
| instance n=50 40.alb | 1 | 0 | Solution | 120.06 | 27 | 0.00 | 0.00 |
| instance n=50 400.alb | 1 | 0 | Optimal | 10.57 | 8 | 0.00 | 0.00 |
| instance n=50 401.alb | 1 | 0 | Solution | 120.07 | 28 | 0.00 | 0.00 |
| instance n=50 402.alb | 1 | 0 | Optimal | 9.44 | 27 | 0.00 | 0.00 |
| instance n=50 403.alb | 1 | 0 | Optimal | 9.93 | 34 | 0.00 | 0.00 |
| instance n=50 404.alb | 1 | 0 | Optimal | 3.16 | 31 | 0.00 | 0.00 |
| instance n=50 405.alb | 1 | 0 | Optimal | 3.56 | 27 | 0.00 | 0.00 |
| instance n=50 406.alb | 1 | 0 | Optimal | 14.55 | 32 | 0.00 | 0.00 |
| instance n=50 407.alb | 1 | 0 | Optimal | 6.85 | 29 | 0.00 | 0.00 |
| instance n=50 408.alb | 1 | 0 | Optimal | 79.30 | 26 | 0.00 | 0.00 |
| instance n=50 409.alb | 1 | 0 | Optimal | 15.82 | 33 | 0.00 | 0.00 |
| instance n=50 41.alb | 1 | 0 | Solution | 120.05 | 26 | 0.00 | 0.00 |
| instance n=50 410.alb | 1 | 0 | Optimal | 1.95 | 28 | 0.00 | 0.00 |
| instance n=50 411.alb | 1 | 0 | Optimal | 2.10 | 29 | 0.00 | 0.00 |
| instance n=50 412.alb | 1 | 0 | Optimal | 3.93 | 26 | 0.00 | 0.00 |
| instance n=50 413.alb | 1 | 0 | Optimal | 24.23 | 30 | 0.00 | 0.00 |
| instance n=50 414.alb | 1 | 0 | Optimal | 73.41 | 27 | 0.00 | 0.00 |
| instance n=50 415.alb | 1 | 0 | Optimal | 6.61 | 28 | 0.00 | 0.00 |
| instance n=50 416.alb | 1 | 0 | Optimal | 3.60 | 27 | 0.00 | 0.00 |
| instance n=50 417.alb | 1 | 0 | Optimal | 106.17 | 30 | 0.00 | 0.00 |
| instance n=50 418.alb | 1 | 0 | Optimal | 5.43 | 27 | 0.00 | 0.00 |
| instance n=50 419.alb | 1 | 0 | Optimal | 21.85 | 33 | 0.00 | 0.00 |
| instance n=50 42.alb | 1 | 0 | Solution | 120.05 | 24 | 0.00 | 0.00 |
| instance n=50 420.alb | 1 | 0 | Optimal | 36.05 | 28 | 0.00 | 0.00 |
| instance n=50 421.alb | 1 | 0 | Optimal | 4.65 | 34 | 0.00 | 0.00 |
| instance n=50 422.alb | 1 | 0 | Optimal | 17.60 | 29 | 0.00 | 0.00 |
| instance n=50 423.alb | 1 | 0 | Optimal | 5.98 | 29 | 0.00 | 0.00 |
| instance n=50 424.alb | 1 | 0 | Optimal | 2.65 | 27 | 0.00 | 0.00 |
| instance n=50 425.alb | 1 | 0 | Optimal | 47.23 | 34 | 0.00 | 0.00 |
| instance n=50 426.alb | 1 | 0 | Optimal | 2.18 | 11 | 0.00 | 0.00 |
| instance n=50 427.alb | 1 | 0 | Optimal | 1.90 | 12 | 0.00 | 0.00 |
| instance n=50 428.alb | 1 | 0 | Optimal | 6.82 | 13 | 0.00 | 0.00 |
| instance n=50 429.alb | 1 | 0 | Optimal | 2.93 | 11 | 0.00 | 0.00 |
| instance n=50 43.alb | 1 | 0 | Solution | 120.06 | 25 | 0.00 | 0.00 |
| instance n=50 430.alb | 1 | 0 | Optimal | 1.26 | 14 | 0.00 | 0.00 |
| instance n=50 431.alb | 1 | 0 | Optimal | 2.23 | 11 | 0.00 | 0.00 |
| instance n=50 432.alb | 1 | 0 | Optimal | 0.86 | 12 | 0.00 | 0.00 |
| instance n=50 433.alb | 1 | 0 | Optimal | 26.45 | 12 | 0.00 | 0.00 |
| instance n=50 434.alb | 1 | 0 | Optimal | 1.27 | 11 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 435.alb | 1 | 0 | Optimal | 1.39 | 11 | 0.00 | 0.00 |
| instance n=50 436.alb | 1 | 0 | Optimal | 33.69 | 11 | 0.00 | 0.00 |
| instance n=50 437.alb | 1 | 0 | Optimal | 3.81 | 12 | 0.00 | 0.00 |
| instance n=50 438.alb | 1 | 0 | Optimal | 4.85 | 10 | 0.00 | 0.00 |
| instance n=50 439.alb | 1 | 0 | Optimal | 2.17 | 12 | 0.00 | 0.00 |
| instance n=50 44.alb | 1 | 0 | Solution | 120.06 | 25 | 0.00 | 0.00 |
| instance n=50 440.alb | 1 | 0 | Optimal | 4.12 | 13 | 0.00 | 0.00 |
| instance n=50 441.alb | 1 | 0 | Optimal | 49.03 | 11 | 0.00 | 0.00 |
| instance n=50 442.alb | 1 | 0 | Optimal | 1.46 | 12 | 0.00 | 0.00 |
| instance n=50 443.alb | 1 | 0 | Optimal | 0.66 | 11 | 0.00 | 0.00 |
| instance n=50 444.alb | 1 | 0 | Optimal | 1.60 | 12 | 0.00 | 0.00 |
| instance n=50 445.alb | 1 | 0 | Optimal | 3.15 | 12 | 0.00 | 0.00 |
| instance n=50 446.alb | 1 | 0 | Optimal | 0.89 | 12 | 0.00 | 0.00 |
| instance n=50 447.alb | 1 | 0 | Optimal | 3.76 | 13 | 0.00 | 0.00 |
| instance n=50 448.alb | 1 | 0 | Optimal | 1.55 | 12 | 0.00 | 0.00 |
| instance n=50 449.alb | 1 | 0 | Optimal | 0.76 | 11 | 0.00 | 0.00 |
| instance n=50 45.alb | 1 | 0 | Solution | 120.07 | 25 | 0.00 | 0.00 |
| instance n=50 450.alb | 1 | 0 | Optimal | 1.12 | 11 | 0.00 | 0.00 |
| instance n=50 451.alb | 1 | 0 | Optimal | 0.36 | 8 | 0.00 | 0.00 |
| instance n=50 452.alb | 1 | 0 | Optimal | 0.37 | 8 | 0.00 | 0.00 |
| instance n=50 453.alb | 1 | 0 | Optimal | 0.35 | 7 | 0.00 | 0.00 |
| instance n=50 454.alb | 1 | 0 | Optimal | 0.36 | 8 | 0.00 | 0.00 |
| instance n=50 455.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=50 456.alb | 1 | 0 | Optimal | 0.35 | 8 | 0.00 | 0.00 |
| instance n=50 457.alb | 1 | 0 | Optimal | 0.36 | 8 | 0.00 | 0.00 |
| instance n=50 458.alb | 1 | 0 | Optimal | 0.35 | 7 | 0.00 | 0.00 |
| instance n=50 459.alb | 1 | 0 | Optimal | 0.34 | 7 | 0.00 | 0.00 |
| instance n=50 46.alb | 1 | 0 | Solution | 120.07 | 29 | 0.00 | 0.00 |
| instance n=50 460.alb | 1 | 0 | Optimal | 0.34 | 7 | 0.00 | 0.00 |
| instance n=50 461.alb | 1 | 0 | Optimal | 0.34 | 6 | 0.00 | 0.00 |
| instance n=50 462.alb | 1 | 0 | Optimal | 0.36 | 7 | 0.00 | 0.00 |
| instance n=50 463.alb | 1 | 0 | Optimal | 0.36 | 8 | 0.00 | 0.00 |
| instance n=50 464.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=50 465.alb | 1 | 0 | Optimal | 0.36 | 8 | 0.00 | 0.00 |
| instance n=50 466.alb | 1 | 0 | Optimal | 0.34 | 7 | 0.00 | 0.00 |
| instance n=50 467.alb | 1 | 0 | Optimal | 0.38 | 9 | 0.00 | 0.00 |
| instance n=50 468.alb | 1 | 0 | Optimal | 0.33 | 7 | 0.00 | 0.00 |
| instance n=50 469.alb | 1 | 0 | Optimal | 0.35 | 8 | 0.00 | 0.00 |
| instance n=50 47.alb | 1 | 0 | Solution | 120.06 | 45 | 0.00 | 0.00 |
| instance n=50 470.alb | 1 | 0 | Optimal | 0.36 | 8 | 0.00 | 0.00 |
| instance n=50 471.alb | 1 | 0 | Optimal | 0.34 | 7 | 0.00 | 0.00 |
| instance n=50 472.alb | 1 | 0 | Optimal | 0.38 | 8 | 0.00 | 0.00 |
| instance n=50 473.alb | 1 | 0 | Optimal | 0.35 | 7 | 0.00 | 0.00 |
| instance n=50 474.alb | 1 | 0 | Optimal | 0.35 | 7 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 475.alb | 1 | 0 | Optimal | 0.35 | 6 | 0.00 | 0.00 |
| instance n=50 476.alb | 1 | 0 | Optimal | 0.38 | 28 | 0.00 | 0.00 |
| instance n=50 477.alb | 1 | 0 | Optimal | 0.45 | 29 | 0.00 | 0.00 |
| instance n=50 478.alb | 1 | 0 | Optimal | 0.42 | 32 | 0.00 | 0.00 |
| instance n=50 479.alb | 1 | 0 | Optimal | 0.41 | 28 | 0.00 | 0.00 |
| instance n=50 48.alb | 1 | 0 | Solution | 120.06 | 27 | 0.00 | 0.00 |
| instance n=50 480.alb | 1 | 0 | Optimal | 0.34 | 34 | 0.00 | 0.00 |
| instance n=50 481.alb | 1 | 0 | Optimal | 0.36 | 28 | 0.00 | 0.00 |
| instance n=50 482.alb | 1 | 0 | Optimal | 0.38 | 27 | 0.00 | 0.00 |
| instance n=50 483.alb | 1 | 0 | Optimal | 0.41 | 30 | 0.00 | 0.00 |
| instance n=50 484.alb | 1 | 0 | Optimal | 0.34 | 32 | 0.00 | 0.00 |
| instance n=50 485.alb | 1 | 0 | Optimal | 0.37 | 31 | 0.00 | 0.00 |
| instance n=50 486.alb | 1 | 0 | Optimal | 0.36 | 32 | 0.00 | 0.00 |
| instance n=50 487.alb | 1 | 0 | Optimal | 0.49 | 31 | 0.00 | 0.00 |
| instance n=50 488.alb | 1 | 0 | Optimal | 0.46 | 31 | 0.00 | 0.00 |
| instance n=50 489.alb | 1 | 0 | Optimal | 0.38 | 35 | 0.00 | 0.00 |
| instance n=50 49.alb | 1 | 0 | Solution | 120.07 | 25 | 0.00 | 0.00 |
| instance n=50 490.alb | 1 | 0 | Optimal | 0.39 | 29 | 0.00 | 0.00 |
| instance n=50 491.alb | 1 | 0 | Optimal | 0.49 | 35 | 0.00 | 0.00 |
| instance n=50 492.alb | 1 | 0 | Optimal | 0.54 | 29 | 0.00 | 0.00 |
| instance n=50 493.alb | 1 | 0 | Optimal | 0.45 | 30 | 0.00 | 0.00 |
| instance n=50 494.alb | 1 | 0 | Optimal | 0.41 | 32 | 0.00 | 0.00 |
| instance n=50 495.alb | 1 | 0 | Optimal | 0.36 | 34 | 0.00 | 0.00 |
| instance n=50 496.alb | 1 | 0 | Optimal | 0.42 | 29 | 0.00 | 0.00 |
| instance n=50 497.alb | 1 | 0 | Optimal | 0.41 | 30 | 0.00 | 0.00 |
| instance n=50 498.alb | 1 | 0 | Optimal | 0.36 | 30 | 0.00 | 0.00 |
| instance n=50 499.alb | 1 | 0 | Optimal | 0.36 | 33 | 0.00 | 0.00 |
| instance n=50 5.alb | 1 | 0 | Solution | 120.05 | 7 | 0.00 | 0.00 |
| instance n=50 50.alb | 1 | 0 | Solution | 120.07 | 27 | 0.00 | 0.00 |
| instance n=50 500.alb | 1 | 0 | Optimal | 0.43 | 34 | 0.00 | 0.00 |
| instance n=50 501.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=50 502.alb | 1 | 0 | Optimal | 0.35 | 10 | 0.00 | 0.00 |
| instance n=50 503.alb | 1 | 0 | Optimal | 0.36 | 13 | 0.00 | 0.00 |
| instance n=50 504.alb | 1 | 0 | Optimal | 0.37 | 11 | 0.00 | 0.00 |
| instance n=50 505.alb | 1 | 0 | Optimal | 0.37 | 12 | 0.00 | 0.00 |
| instance n=50 506.alb | 1 | 0 | Optimal | 0.37 | 11 | 0.00 | 0.00 |
| instance n=50 507.alb | 1 | 0 | Optimal | 0.37 | 13 | 0.00 | 0.00 |
| instance n=50 508.alb | 1 | 0 | Optimal | 0.36 | 14 | 0.00 | 0.00 |
| instance n=50 509.alb | 1 | 0 | Optimal | 0.39 | 13 | 0.00 | 0.00 |
| instance n=50 51.alb | 1 | 0 | Solution | 120.07 | 12 | 0.00 | 0.00 |
| instance n=50 510.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=50 511.alb | 1 | 0 | Optimal | 0.36 | 13 | 0.00 | 0.00 |
| instance n=50 512.alb | 1 | 0 | Optimal | 0.39 | 13 | 0.00 | 0.00 |
| instance n=50 513.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 514.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=50 515.alb | 1 | 0 | Optimal | 0.37 | 11 | 0.00 | 0.00 |
| instance n=50 516.alb | 1 | 0 | Optimal | 0.37 | 13 | 0.00 | 0.00 |
| instance n=50 517.alb | 1 | 0 | Optimal | 0.41 | 14 | 0.00 | 0.00 |
| instance n=50 518.alb | 1 | 0 | Optimal | 0.36 | 11 | 0.00 | 0.00 |
| instance n=50 519.alb | 1 | 0 | Optimal | 0.39 | 12 | 0.00 | 0.00 |
| instance n=50 52.alb | 1 | 0 | Solution | 120.06 | 11 | 0.00 | 0.00 |
| instance n=50 520.alb | 1 | 0 | Optimal | 0.37 | 11 | 0.00 | 0.00 |
| instance n=50 521.alb | 1 | 0 | Optimal | 0.36 | 10 | 0.00 | 0.00 |
| instance n=50 522.alb | 1 | 0 | Optimal | 0.39 | 11 | 0.00 | 0.00 |
| instance n=50 523.alb | 1 | 0 | Optimal | 0.37 | 11 | 0.00 | 0.00 |
| instance n=50 524.alb | 1 | 0 | Optimal | 0.38 | 14 | 0.00 | 0.00 |
| instance n=50 525.alb | 1 | 0 | Optimal | 0.37 | 11 | 0.00 | 0.00 |
| instance n=50 53.alb | 1 | 0 | Solution | 120.07 | 13 | 0.00 | 0.00 |
| instance n=50 54.alb | 1 | 0 | Solution | 120.07 | 11 | 0.00 | 0.00 |
| instance n=50 55.alb | 1 | 0 | Solution | 120.06 | 13 | 0.00 | 0.00 |
| instance n=50 56.alb | 1 | 0 | Solution | 120.07 | 11 | 0.00 | 0.00 |
| instance n=50 57.alb | 1 | 0 | Solution | 120.06 | 13 | 0.00 | 0.00 |
| instance n=50 58.alb | 1 | 0 | Solution | 120.06 | 11 | 0.00 | 0.00 |
| instance n=50 59.alb | 1 | 0 | Solution | 120.06 | 11 | 0.00 | 0.00 |
| instance n=50 6.alb | 1 | 0 | Solution | 120.06 | 6 | 0.00 | 0.00 |
| instance n=50 60.alb | 1 | 0 | Solution | 120.07 | 12 | 0.00 | 0.00 |
| instance n=50 61.alb | 1 | 0 | Solution | 120.07 | 13 | 0.00 | 0.00 |
| instance n=50 62.alb | 1 | 0 | Solution | 120.07 | 13 | 0.00 | 0.00 |
| instance n=50 63.alb | 1 | 0 | Solution | 120.06 | 12 | 0.00 | 0.00 |
| instance n=50 64.alb | 1 | 0 | Solution | 120.07 | 13 | 0.00 | 0.00 |
| instance n=50 65.alb | 1 | 0 | Solution | 120.07 | 12 | 0.00 | 0.00 |
| instance n=50 66.alb | 1 | 0 | Solution | 120.06 | 12 | 0.00 | 0.00 |
| instance n=50 67.alb | 1 | 0 | Solution | 120.07 | 12 | 0.00 | 0.00 |
| instance n=50 68.alb | 1 | 0 | Solution | 120.06 | 12 | 0.00 | 0.00 |
| instance n=50 69.alb | 1 | 0 | Solution | 120.06 | 12 | 0.00 | 0.00 |
| instance n=50 7.alb | 1 | 0 | Solution | 120.06 | 7 | 0.00 | 0.00 |
| instance n=50 70.alb | 1 | 0 | Solution | 120.07 | 10 | 0.00 | 0.00 |
| instance n=50 71.alb | 1 | 0 | Solution | 120.07 | 13 | 0.00 | 0.00 |
| instance n=50 72.alb | 1 | 0 | Solution | 120.06 | 11 | 0.00 | 0.00 |
| instance n=50 73.alb | 1 | 0 | Solution | 120.06 | 11 | 0.00 | 0.00 |
| instance n=50 74.alb | 1 | 0 | Solution | 120.05 | 12 | 0.00 | 0.00 |
| instance n=50 75.alb | 1 | 0 | Solution | 120.05 | 11 | 0.00 | 0.00 |
| instance n=50 76.alb | 1 | 0 | Optimal | 24.90 | 7 | 0.00 | 0.00 |
| instance n=50 77.alb | 1 | 0 | Optimal | 1.47 | 7 | 0.00 | 0.00 |
| instance n=50 78.alb | 1 | 0 | Optimal | 24.48 | 7 | 0.00 | 0.00 |
| instance n=50 79.alb | 1 | 0 | Optimal | 2.48 | 8 | 0.00 | 0.00 |
| instance n=50 8.alb | 1 | 0 | Solution | 120.06 | 7 | 0.00 | 0.00 |
| instance n=50 80.alb | 1 | 0 | Optimal | 0.70 | 7 | 0.00 | 0.00 |

Table 6.4: Results for SALBP-1 Problems (Chuffed) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 81.alb | 1 | 0 | Optimal | 5.16 | 7 | 0.00 | 0.00 |
| instance n=50 82.alb | 1 | 0 | Optimal | 3.40 | 6 | 0.00 | 0.00 |
| instance n=50 83.alb | 1 | 0 | Optimal | 2.15 | 8 | 0.00 | 0.00 |
| instance n=50 84.alb | 1 | 0 | Optimal | 0.68 | 7 | 0.00 | 0.00 |
| instance n=50 85.alb | 1 | 0 | Optimal | 23.25 | 8 | 0.00 | 0.00 |
| instance n=50 86.alb | 1 | 0 | Optimal | 4.82 | 7 | 0.00 | 0.00 |
| instance n=50 87.alb | 1 | 0 | Optimal | 1.71 | 8 | 0.00 | 0.00 |
| instance n=50 88.alb | 1 | 0 | Solution | 120.06 | 8 | 0.00 | 0.00 |
| instance n=50 89.alb | 1 | 0 | Optimal | 1.02 | 7 | 0.00 | 0.00 |
| instance n=50 9.alb | 1 | 0 | Solution | 120.06 | 9 | 0.00 | 0.00 |
| instance n=50 90.alb | 1 | 0 | Optimal | 0.94 | 7 | 0.00 | 0.00 |
| instance n=50 91.alb | 1 | 0 | Optimal | 2.99 | 7 | 0.00 | 0.00 |
| instance n=50 92.alb | 1 | 0 | Optimal | 1.38 | 7 | 0.00 | 0.00 |
| instance n=50 93.alb | 1 | 0 | Optimal | 1.78 | 7 | 0.00 | 0.00 |
| instance n=50 94.alb | 1 | 0 | Optimal | 0.64 | 7 | 0.00 | 0.00 |
| instance n=50 95.alb | 1 | 0 | Optimal | 1.01 | 7 | 0.00 | 0.00 |
| instance n=50 96.alb | 1 | 0 | Optimal | 0.69 | 7 | 0.00 | 0.00 |
| instance n=50 97.alb | 1 | 0 | Optimal | 0.56 | 7 | 0.00 | 0.00 |
| instance n=50 98.alb | 1 | 0 | Optimal | 14.86 | 8 | 0.00 | 0.00 |
| instance n=50 99.alb | 1 | 0 | Optimal | 1.78 | 7 | 0.00 | 0.00 |

6.5 Results for MiniZinc/CPSat

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 1.alb | 1 | 0 | Unknown | 120258.00 | - | - | - |
| instance n=1000 10.alb | 1 | 0 | Unknown | 120230.00 | - | - | - |
| instance n=1000 100.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 101.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 102.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 103.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 104.alb | 1 | 0 | Unknown | 120258.00 | - | - | - |
| instance n=1000 105.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 106.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 107.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 108.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 109.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 11.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 110.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 111.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 112.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 113.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |
| instance n=1000 114.alb | 1 | 0 | Unknown | 120259.00 | - | - | - |
| instance n=1000 115.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 116.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 117.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 118.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 119.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 12.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 120.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 121.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 122.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 123.alb | 1 | 0 | Unknown | 120259.00 | - | - | - |
| instance n=1000 124.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 125.alb | 1 | 0 | Unknown | 120262.00 | - | - | - |
| instance n=1000 126.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 127.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 128.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |
| instance n=1000 129.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 13.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 130.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 131.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 132.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 133.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 134.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 135.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=1000 136.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 137.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 138.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 139.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 14.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 140.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 141.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 142.alb | 1 | 0 | Unknown | 120257.00 | - | - | - |
| instance n=1000 143.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 144.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 145.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 146.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 147.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 148.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 149.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 15.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 150.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 151.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 152.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 153.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 154.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 155.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 156.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 157.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 158.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 159.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 16.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |
| instance n=1000 160.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 161.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 162.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 163.alb | 1 | 0 | Unknown | 120234.00 | - | - | - |
| instance n=1000 164.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 165.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 166.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 167.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |
| instance n=1000 168.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 169.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 17.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 170.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 171.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 172.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 173.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 174.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 175.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 176.alb | 1 | 0 | Unknown | 120262.00 | - | - | - |
| instance n=1000 177.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 178.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 179.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 18.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 180.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 181.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 182.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 183.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 184.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 185.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 186.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 187.alb | 1 | 0 | Unknown | 120258.00 | - | - | - |
| instance n=1000 188.alb | 1 | 0 | Unknown | 120235.00 | - | - | - |
| instance n=1000 189.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 19.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 190.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 191.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 192.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 193.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 194.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 195.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 196.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=1000 197.alb | 1 | 0 | Unknown | 120235.00 | - | - | - |
| instance n=1000 198.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 199.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 2.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 20.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 200.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 201.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 202.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 203.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=1000 204.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 205.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 206.alb | 1 | 0 | Unknown | 120257.00 | - | - | - |
| instance n=1000 207.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 208.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 209.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 21.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 210.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 211.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 212.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 213.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 214.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 215.alb | 1 | 0 | Unknown | 120261.00 | - | - | - |
| instance n=1000 216.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 217.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 218.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 219.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 22.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 220.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 221.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 222.alb | 1 | 0 | Unknown | 120234.00 | - | - | - |
| instance n=1000 223.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 224.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 225.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 226.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 227.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 228.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=1000 229.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 23.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 230.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 231.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 232.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 233.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 234.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 235.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 236.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 237.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 238.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 239.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 24.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |
| instance n=1000 240.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 241.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 242.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 243.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 244.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 245.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 246.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 247.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 248.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=1000 249.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 25.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 250.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 251.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |
| instance n=1000 252.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 253.alb | 1 | 0 | Unknown | 120234.00 | - | - | - |
| instance n=1000 254.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 255.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 256.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 257.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 258.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 259.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 26.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 260.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 261.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 262.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 263.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 264.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 265.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 266.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 267.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 268.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 269.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 27.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 270.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 271.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 272.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 273.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 274.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 275.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 276.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 277.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 278.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 279.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 28.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 280.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 281.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 282.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 283.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 284.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 285.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 286.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 287.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 288.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 289.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 29.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 290.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 291.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 292.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 293.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=1000 294.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 295.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 296.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 297.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 298.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 299.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 3.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 30.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 300.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 301.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 302.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 303.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 304.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 305.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 306.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 307.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 308.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 309.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 31.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 310.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 311.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 312.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 313.alb | 1 | 0 | Unknown | 120234.00 | - | - | - |
| instance n=1000 314.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 315.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 316.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 317.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 318.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 319.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 32.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 320.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 321.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 322.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 323.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 324.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 325.alb | 1 | 0 | Unknown | 120235.00 | - | - | - |
| instance n=1000 326.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 327.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 328.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 329.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 33.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 330.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 331.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 332.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 333.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 334.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 335.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 336.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 337.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 338.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 339.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 34.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 340.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 341.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 342.alb | 1 | 0 | Unknown | 120234.00 | - | - | - |
| instance n=1000 343.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 344.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 345.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 346.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 347.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 348.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 349.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 35.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 350.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 351.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 352.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 353.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 354.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=1000 355.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 356.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 357.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 358.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 359.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 36.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 360.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 361.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 362.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 363.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 364.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 365.alb | 1 | 0 | Unknown | 120234.00 | - | - | - |
| instance n=1000 366.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 367.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 368.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 369.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 37.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 370.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 371.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 372.alb | 1 | 0 | Unknown | 120260.00 | - | - | - |
| instance n=1000 373.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 374.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 375.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 376.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 377.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 378.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 379.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 38.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 380.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 381.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 382.alb | 1 | 0 | Unknown | 120257.00 | - | - | - |
| instance n=1000 383.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 384.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 385.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 386.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 387.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 388.alb | 1 | 0 | Unknown | 120257.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 389.alb | 1 | 0 | Unknown | 120261.00 | - | - | - |
| instance n=1000 39.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 390.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 391.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 392.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 393.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 394.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 395.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 396.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 397.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 398.alb | 1 | 0 | Unknown | 120267.00 | - | - | - |
| instance n=1000 399.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 4.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 40.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 400.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 401.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 402.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 403.alb | 1 | 0 | Unknown | 120257.00 | - | - | - |
| instance n=1000 404.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 405.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 406.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 407.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 408.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=1000 409.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 41.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 410.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 411.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 412.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 413.alb | 1 | 0 | Unknown | 120271.00 | - | - | - |
| instance n=1000 414.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 415.alb | 1 | 0 | Unknown | 120263.00 | - | - | - |
| instance n=1000 416.alb | 1 | 0 | Unknown | 120261.00 | - | - | - |
| instance n=1000 417.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 418.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 419.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 42.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 420.alb | 1 | 0 | Unknown | 120230.00 | - | - | - |
| instance n=1000 421.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 422.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 423.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 424.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 425.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 426.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 427.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 428.alb | 1 | 0 | Unknown | 120275.00 | - | - | - |
| instance n=1000 429.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 43.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 430.alb | 1 | 0 | Unknown | 120263.00 | - | - | - |
| instance n=1000 431.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 432.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 433.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 434.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 435.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 436.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 437.alb | 1 | 0 | Unknown | 120258.00 | - | - | - |
| instance n=1000 438.alb | 1 | 0 | Unknown | 120262.00 | - | - | - |
| instance n=1000 439.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 44.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 440.alb | 1 | 0 | Unknown | 120257.00 | - | - | - |
| instance n=1000 441.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 442.alb | 1 | 0 | Unknown | 120263.00 | - | - | - |
| instance n=1000 443.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 444.alb | 1 | 0 | Unknown | 120259.00 | - | - | - |
| instance n=1000 445.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 446.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 447.alb | 1 | 0 | Unknown | 120236.00 | - | - | - |
| instance n=1000 448.alb | 1 | 0 | Unknown | 120235.00 | - | - | - |
| instance n=1000 449.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 45.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 450.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 451.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 452.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 453.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 454.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 455.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 456.alb | 1 | 0 | Unknown | 120235.00 | - | - | - |
| instance n=1000 457.alb | 1 | 0 | Unknown | 120257.00 | - | - | - |
| instance n=1000 458.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 459.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 46.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 460.alb | 1 | 0 | Unknown | 120260.00 | - | - | - |
| instance n=1000 461.alb | 1 | 0 | Unknown | 120263.00 | - | - | - |
| instance n=1000 462.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 463.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 464.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 465.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 466.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 467.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 468.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 469.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 47.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=1000 470.alb | 1 | 0 | Unknown | 120266.00 | - | - | - |
| instance n=1000 471.alb | 1 | 0 | Unknown | 120272.00 | - | - | - |
| instance n=1000 472.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 473.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 474.alb | 1 | 0 | Unknown | 120261.00 | - | - | - |
| instance n=1000 475.alb | 1 | 0 | Unknown | 120274.00 | - | - | - |
| instance n=1000 476.alb | 1 | 0 | Unknown | 120263.00 | - | - | - |
| instance n=1000 477.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 478.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=1000 479.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 48.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 480.alb | 1 | 0 | Unknown | 120260.00 | - | - | - |
| instance n=1000 481.alb | 1 | 0 | Unknown | 120263.00 | - | - | - |
| instance n=1000 482.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 483.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 484.alb | 1 | 0 | Unknown | 120264.00 | - | - | - |
| instance n=1000 485.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 486.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 487.alb | 1 | 0 | Unknown | 120263.00 | - | - | - |
| instance n=1000 488.alb | 1 | 0 | Unknown | 120258.00 | - | - | - |
| instance n=1000 489.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 49.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 490.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 491.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 492.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 493.alb | 1 | 0 | Unknown | 120258.00 | - | - | - |
| instance n=1000 494.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 495.alb | 1 | 0 | Unknown | 120258.00 | - | - | - |
| instance n=1000 496.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 497.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 498.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 499.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 5.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 50.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |
| instance n=1000 500.alb | 1 | 0 | Unknown | 120239.00 | - | - | - |
| instance n=1000 501.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 502.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 503.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 504.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 505.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 506.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 507.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 508.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 509.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 51.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 510.alb | 1 | 0 | Unknown | 120258.00 | - | - | - |
| instance n=1000 511.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 512.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 513.alb | 1 | 0 | Unknown | 120269.00 | - | - | - |
| instance n=1000 514.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 515.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 516.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 517.alb | 1 | 0 | Unknown | 120259.00 | - | - | - |
| instance n=1000 518.alb | 1 | 0 | Unknown | 120254.00 | - | - | - |
| instance n=1000 519.alb | 1 | 0 | Unknown | 120266.00 | - | - | - |
| instance n=1000 52.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 520.alb | 1 | 0 | Unknown | 120248.00 | - | - | - |
| instance n=1000 521.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 522.alb | 1 | 0 | Unknown | 120259.00 | - | - | - |
| instance n=1000 523.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 524.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 525.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 53.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 54.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 55.alb | 1 | 0 | Unknown | 120240.00 | - | - | - |
| instance n=1000 56.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 57.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 58.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 59.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 6.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=1000 60.alb | 1 | 0 | Unknown | 120247.00 | - | - | - |
| instance n=1000 61.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 62.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 63.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 64.alb | 1 | 0 | Unknown | 120257.00 | - | - | - |
| instance n=1000 65.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 66.alb | 1 | 0 | Unknown | 120230.00 | - | - | - |
| instance n=1000 67.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 68.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=1000 69.alb | 1 | 0 | Unknown | 120243.00 | - | - | - |
| instance n=1000 7.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 70.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 71.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 72.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=1000 73.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=1000 74.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 75.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=1000 76.alb | 1 | 0 | Unknown | 120242.00 | - | - | - |
| instance n=1000 77.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 78.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 79.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 8.alb | 1 | 0 | Unknown | 120237.00 | - | - | - |
| instance n=1000 80.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 81.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 82.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 83.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 84.alb | 1 | 0 | Unknown | 120253.00 | - | - | - |
| instance n=1000 85.alb | 1 | 0 | Unknown | 120260.00 | - | - | - |
| instance n=1000 86.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 87.alb | 1 | 0 | Unknown | 120234.00 | - | - | - |
| instance n=1000 88.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 89.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 9.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=1000 90.alb | 1 | 0 | Unknown | 120244.00 | - | - | - |
| instance n=1000 91.alb | 1 | 0 | Unknown | 120246.00 | - | - | - |
| instance n=1000 92.alb | 1 | 0 | Unknown | 120251.00 | - | - | - |
| instance n=1000 93.alb | 1 | 0 | Unknown | 120255.00 | - | - | - |
| instance n=1000 94.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=1000 95.alb | 1 | 0 | Unknown | 120256.00 | - | - | - |
| instance n=1000 96.alb | 1 | 0 | Unknown | 120260.00 | - | - | - |
| instance n=1000 97.alb | 1 | 0 | Unknown | 120252.00 | - | - | - |
| instance n=1000 98.alb | 1 | 0 | Unknown | 120241.00 | - | - | - |
| instance n=1000 99.alb | 1 | 0 | Unknown | 120249.00 | - | - | - |
| instance n=100 1.alb | 1 | 0 | Optimal | 5.41 | 23 | 0.00 | 0.00 |
| instance n=100 10.alb | 1 | 0 | Optimal | 0.30 | 22 | 0.00 | 0.00 |
| instance n=100 100.alb | 1 | 0 | Optimal | 4.13 | 25 | 0.00 | 0.00 |
| instance n=100 101.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 102.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 103.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 104.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 105.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=100 106.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 107.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 108.alb | 1 | 0 | Optimal | 9.42 | 14 | 0.00 | 0.00 |
| instance n=100 109.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 11.alb | 1 | 0 | Optimal | 0.37 | 24 | 0.00 | 0.00 |
| instance n=100 110.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=100 111.alb | 1 | 0 | Optimal | 0.46 | 16 | 0.00 | 0.00 |
| instance n=100 112.alb | 1 | 0 | Optimal | 17.65 | 13 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 113.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 114.alb | 1 | 0 | Optimal | 0.33 | 13 | 0.00 | 0.00 |
| instance n=100 115.alb | 1 | 0 | Optimal | 0.33 | 14 | 0.00 | 0.00 |
| instance n=100 116.alb | 1 | 0 | Optimal | 0.36 | 16 | 0.00 | 0.00 |
| instance n=100 117.alb | 1 | 0 | Optimal | 62.01 | 15 | 0.00 | 0.00 |
| instance n=100 118.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 119.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 12.alb | 1 | 0 | Optimal | 0.68 | 25 | 0.00 | 0.00 |
| instance n=100 120.alb | 1 | 0 | Optimal | 0.33 | 14 | 0.00 | 0.00 |
| instance n=100 121.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 122.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=100 123.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 124.alb | 1 | 0 | Optimal | 2.80 | 15 | 0.00 | 0.00 |
| instance n=100 125.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=100 126.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 127.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 128.alb | 1 | 0 | Unknown | 120227.00 | - | - | - |
| instance n=100 129.alb | 1 | 0 | Optimal | 1.27 | 54 | 0.00 | 0.00 |
| instance n=100 13.alb | 1 | 0 | Optimal | 0.41 | 24 | 0.00 | 0.00 |
| instance n=100 130.alb | 1 | 0 | Unknown | 120226.00 | - | - | - |
| instance n=100 131.alb | 1 | 0 | Unknown | 120227.00 | - | - | - |
| instance n=100 132.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 133.alb | 1 | 0 | Unknown | 120226.00 | - | - | - |
| instance n=100 134.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=100 135.alb | 1 | 0 | Unknown | 120225.00 | - | - | - |
| instance n=100 136.alb | 1 | 0 | Unknown | 120223.00 | - | - | - |
| instance n=100 137.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=100 138.alb | 1 | 0 | Optimal | 2.83 | 56 | 0.00 | 0.00 |
| instance n=100 139.alb | 1 | 0 | Optimal | 106.40 | 51 | 0.00 | 0.00 |
| instance n=100 14.alb | 1 | 0 | Optimal | 0.52 | 20 | 0.00 | 0.00 |
| instance n=100 140.alb | 1 | 0 | Unknown | 120221.00 | - | - | - |
| instance n=100 141.alb | 1 | 0 | Unknown | 120209.00 | - | - | - |
| instance n=100 142.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=100 143.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 144.alb | 1 | 0 | Unknown | 120221.00 | - | - | - |
| instance n=100 145.alb | 1 | 0 | Unknown | 120216.00 | - | - | - |
| instance n=100 146.alb | 1 | 0 | Optimal | 1.60 | 53 | 0.00 | 0.00 |
| instance n=100 147.alb | 1 | 0 | Unknown | 120228.00 | - | - | - |
| instance n=100 148.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 149.alb | 1 | 0 | Unknown | 120229.00 | - | - | - |
| instance n=100 15.alb | 1 | 0 | Optimal | 0.30 | 24 | 0.00 | 0.00 |
| instance n=100 150.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=100 151.alb | 1 | 0 | Unknown | 120211.00 | - | - | - |
| instance n=100 152.alb | 1 | 0 | Optimal | 0.44 | 22 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 153.alb | 1 | 0 | Optimal | 0.30 | 21 | 0.00 | 0.00 |
| instance n=100 154.alb | 1 | 0 | Optimal | 0.32 | 25 | 0.00 | 0.00 |
| instance n=100 155.alb | 1 | 0 | Optimal | 0.31 | 22 | 0.00 | 0.00 |
| instance n=100 156.alb | 1 | 0 | Optimal | 0.46 | 23 | 0.00 | 0.00 |
| instance n=100 157.alb | 1 | 0 | Optimal | 0.34 | 26 | 0.00 | 0.00 |
| instance n=100 158.alb | 1 | 0 | Optimal | 0.37 | 23 | 0.00 | 0.00 |
| instance n=100 159.alb | 1 | 0 | Optimal | 0.30 | 19 | 0.00 | 0.00 |
| instance n=100 16.alb | 1 | 0 | Optimal | 0.32 | 23 | 0.00 | 0.00 |
| instance n=100 160.alb | 1 | 0 | Optimal | 0.37 | 22 | 0.00 | 0.00 |
| instance n=100 161.alb | 1 | 0 | Unknown | 120227.00 | - | - | - |
| instance n=100 162.alb | 1 | 0 | Optimal | 86.86 | 22 | 0.00 | 0.00 |
| instance n=100 163.alb | 1 | 0 | Optimal | 0.33 | 25 | 0.00 | 0.00 |
| instance n=100 164.alb | 1 | 0 | Optimal | 0.38 | 23 | 0.00 | 0.00 |
| instance n=100 165.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 166.alb | 1 | 0 | Optimal | 1.13 | 24 | 0.00 | 0.00 |
| instance n=100 167.alb | 1 | 0 | Optimal | 0.32 | 22 | 0.00 | 0.00 |
| instance n=100 168.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 169.alb | 1 | 0 | Optimal | 0.41 | 21 | 0.00 | 0.00 |
| instance n=100 17.alb | 1 | 0 | Unknown | 120219.00 | - | - | - |
| instance n=100 170.alb | 1 | 0 | Optimal | 1.29 | 24 | 0.00 | 0.00 |
| instance n=100 171.alb | 1 | 0 | Unknown | 120219.00 | - | - | - |
| instance n=100 172.alb | 1 | 0 | Optimal | 0.32 | 24 | 0.00 | 0.00 |
| instance n=100 173.alb | 1 | 0 | Unknown | 120223.00 | - | - | - |
| instance n=100 174.alb | 1 | 0 | Optimal | 4.92 | 22 | 0.00 | 0.00 |
| instance n=100 175.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 176.alb | 1 | 0 | Optimal | 0.34 | 13 | 0.00 | 0.00 |
| instance n=100 177.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 178.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 179.alb | 1 | 0 | Optimal | 0.31 | 15 | 0.00 | 0.00 |
| instance n=100 18.alb | 1 | 0 | Unknown | 120223.00 | - | - | - |
| instance n=100 180.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 181.alb | 1 | 0 | Optimal | 0.34 | 13 | 0.00 | 0.00 |
| instance n=100 182.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 183.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=100 184.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 185.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 186.alb | 1 | 0 | Optimal | 0.37 | 14 | 0.00 | 0.00 |
| instance n=100 187.alb | 1 | 0 | Optimal | 24.27 | 13 | 0.00 | 0.00 |
| instance n=100 188.alb | 1 | 0 | Optimal | 0.30 | 16 | 0.00 | 0.00 |
| instance n=100 189.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 19.alb | 1 | 0 | Optimal | 0.35 | 23 | 0.00 | 0.00 |
| instance n=100 190.alb | 1 | 0 | Optimal | 0.37 | 13 | 0.00 | 0.00 |
| instance n=100 191.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 192.alb | 1 | 0 | Optimal | 1.69 | 13 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 193.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 194.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 195.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 196.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 197.alb | 1 | 0 | Optimal | 0.33 | 15 | 0.00 | 0.00 |
| instance n=100 198.alb | 1 | 0 | Optimal | 0.37 | 13 | 0.00 | 0.00 |
| instance n=100 199.alb | 1 | 0 | Optimal | 0.35 | 14 | 0.00 | 0.00 |
| instance n=100 2.alb | 1 | 0 | Optimal | 0.32 | 21 | 0.00 | 0.00 |
| instance n=100 20.alb | 1 | 0 | Optimal | 0.45 | 21 | 0.00 | 0.00 |
| instance n=100 200.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 201.alb | 1 | 0 | Unknown | 120214.00 | - | - | - |
| instance n=100 202.alb | 1 | 0 | Optimal | 1.22 | 61 | 0.00 | 0.00 |
| instance n=100 203.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 204.alb | 1 | 0 | Unknown | 120215.00 | - | - | - |
| instance n=100 205.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 206.alb | 1 | 0 | Unknown | 120229.00 | - | - | - |
| instance n=100 207.alb | 1 | 0 | Unknown | 120229.00 | - | - | - |
| instance n=100 208.alb | 1 | 0 | Unknown | 120212.00 | - | - | - |
| instance n=100 209.alb | 1 | 0 | Unknown | 120221.00 | - | - | - |
| instance n=100 21.alb | 1 | 0 | Optimal | 0.61 | 21 | 0.00 | 0.00 |
| instance n=100 210.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 211.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 212.alb | 1 | 0 | Unknown | 120216.00 | - | - | - |
| instance n=100 213.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 214.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=100 215.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 216.alb | 1 | 0 | Unknown | 120213.00 | - | - | - |
| instance n=100 217.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 218.alb | 1 | 0 | Unknown | 120226.00 | - | - | - |
| instance n=100 219.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 22.alb | 1 | 0 | Unknown | 120219.00 | - | - | - |
| instance n=100 220.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 221.alb | 1 | 0 | Unknown | 120223.00 | - | - | - |
| instance n=100 222.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=100 223.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=100 224.alb | 1 | 0 | Optimal | 98.26 | 55 | 0.00 | 0.00 |
| instance n=100 225.alb | 1 | 0 | Unknown | 120209.00 | - | - | - |
| instance n=100 226.alb | 1 | 0 | Unknown | 120223.00 | - | - | - |
| instance n=100 227.alb | 1 | 0 | Unknown | 120213.00 | - | - | - |
| instance n=100 228.alb | 1 | 0 | Optimal | 0.98 | 22 | 0.00 | 0.00 |
| instance n=100 229.alb | 1 | 0 | Optimal | 0.50 | 24 | 0.00 | 0.00 |
| instance n=100 23.alb | 1 | 0 | Optimal | 0.33 | 24 | 0.00 | 0.00 |
| instance n=100 230.alb | 1 | 0 | Optimal | 77.75 | 23 | 0.00 | 0.00 |
| instance n=100 231.alb | 1 | 0 | Optimal | 0.55 | 22 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 232.alb | 1 | 0 | Optimal | 0.56 | 22 | 0.00 | 0.00 |
| instance n=100 233.alb | 1 | 0 | Unknown | 120228.00 | - | - | - |
| instance n=100 234.alb | 1 | 0 | Optimal | 0.41 | 23 | 0.00 | 0.00 |
| instance n=100 235.alb | 1 | 0 | Optimal | 0.56 | 26 | 0.00 | 0.00 |
| instance n=100 236.alb | 1 | 0 | Unknown | 120214.00 | - | - | - |
| instance n=100 237.alb | 1 | 0 | Optimal | 0.53 | 23 | 0.00 | 0.00 |
| instance n=100 238.alb | 1 | 0 | Optimal | 1.58 | 23 | 0.00 | 0.00 |
| instance n=100 239.alb | 1 | 0 | Optimal | 0.34 | 21 | 0.00 | 0.00 |
| instance n=100 24.alb | 1 | 0 | Optimal | 0.32 | 24 | 0.00 | 0.00 |
| instance n=100 240.alb | 1 | 0 | Optimal | 2.13 | 22 | 0.00 | 0.00 |
| instance n=100 241.alb | 1 | 0 | Optimal | 1.36 | 22 | 0.00 | 0.00 |
| instance n=100 242.alb | 1 | 0 | Optimal | 1.44 | 23 | 0.00 | 0.00 |
| instance n=100 243.alb | 1 | 0 | Optimal | 30.26 | 23 | 0.00 | 0.00 |
| instance n=100 244.alb | 1 | 0 | Optimal | 0.45 | 21 | 0.00 | 0.00 |
| instance n=100 245.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 246.alb | 1 | 0 | Optimal | 1.32 | 26 | 0.00 | 0.00 |
| instance n=100 247.alb | 1 | 0 | Optimal | 1.73 | 22 | 0.00 | 0.00 |
| instance n=100 248.alb | 1 | 0 | Optimal | 35.01 | 19 | 0.00 | 0.00 |
| instance n=100 249.alb | 1 | 0 | Optimal | 0.65 | 21 | 0.00 | 0.00 |
| instance n=100 25.alb | 1 | 0 | Optimal | 0.72 | 22 | 0.00 | 0.00 |
| instance n=100 250.alb | 1 | 0 | Optimal | 0.47 | 24 | 0.00 | 0.00 |
| instance n=100 251.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 252.alb | 1 | 0 | Optimal | 0.33 | 14 | 0.00 | 0.00 |
| instance n=100 253.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 254.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 255.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 256.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 257.alb | 1 | 0 | Optimal | 1.59 | 12 | 0.00 | 0.00 |
| instance n=100 258.alb | 1 | 0 | Optimal | 4.73 | 14 | 0.00 | 0.00 |
| instance n=100 259.alb | 1 | 0 | Optimal | 0.38 | 15 | 0.00 | 0.00 |
| instance n=100 26.alb | 1 | 0 | Optimal | 1.21 | 14 | 0.00 | 0.00 |
| instance n=100 260.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 261.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 262.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 263.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 264.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 265.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 266.alb | 1 | 0 | Optimal | 0.62 | 13 | 0.00 | 0.00 |
| instance n=100 267.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=100 268.alb | 1 | 0 | Optimal | 0.31 | 15 | 0.00 | 0.00 |
| instance n=100 269.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 27.alb | 1 | 0 | Optimal | 0.53 | 13 | 0.00 | 0.00 |
| instance n=100 270.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=100 271.alb | 1 | 0 | Optimal | 7.97 | 13 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 272.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 273.alb | 1 | 0 | Optimal | 0.63 | 13 | 0.00 | 0.00 |
| instance n=100 274.alb | 1 | 0 | Optimal | 1.57 | 13 | 0.00 | 0.00 |
| instance n=100 275.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=100 276.alb | 1 | 0 | Unknown | 120227.00 | - | - | - |
| instance n=100 277.alb | 1 | 0 | Unknown | 120210.00 | - | - | - |
| instance n=100 278.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 279.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 28.alb | 1 | 0 | Optimal | 0.87 | 14 | 0.00 | 0.00 |
| instance n=100 280.alb | 1 | 0 | Unknown | 120228.00 | - | - | - |
| instance n=100 281.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 282.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 283.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 284.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 285.alb | 1 | 0 | Unknown | 120215.00 | - | - | - |
| instance n=100 286.alb | 1 | 0 | Unknown | 120228.00 | - | - | - |
| instance n=100 287.alb | 1 | 0 | Optimal | 3.46 | 54 | 0.00 | 0.00 |
| instance n=100 288.alb | 1 | 0 | Unknown | 120221.00 | - | - | - |
| instance n=100 289.alb | 1 | 0 | Optimal | 57.85 | 62 | 0.00 | 0.00 |
| instance n=100 29.alb | 1 | 0 | Optimal | 0.38 | 14 | 0.00 | 0.00 |
| instance n=100 290.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 291.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 292.alb | 1 | 0 | Unknown | 120211.00 | - | - | - |
| instance n=100 293.alb | 1 | 0 | Unknown | 120211.00 | - | - | - |
| instance n=100 294.alb | 1 | 0 | Unknown | 120211.00 | - | - | - |
| instance n=100 295.alb | 1 | 0 | Unknown | 120221.00 | - | - | - |
| instance n=100 296.alb | 1 | 0 | Unknown | 120223.00 | - | - | - |
| instance n=100 297.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 298.alb | 1 | 0 | Unknown | 120219.00 | - | - | - |
| instance n=100 299.alb | 1 | 0 | Optimal | 18.95 | 54 | 0.00 | 0.00 |
| instance n=100 3.alb | 1 | 0 | Optimal | 0.35 | 20 | 0.00 | 0.00 |
| instance n=100 30.alb | 1 | 0 | Optimal | 0.29 | 15 | 0.00 | 0.00 |
| instance n=100 300.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 301.alb | 1 | 0 | Optimal | 0.49 | 23 | 0.00 | 0.00 |
| instance n=100 302.alb | 1 | 0 | Optimal | 0.33 | 24 | 0.00 | 0.00 |
| instance n=100 303.alb | 1 | 0 | Optimal | 1.66 | 24 | 0.00 | 0.00 |
| instance n=100 304.alb | 1 | 0 | Optimal | 0.32 | 21 | 0.00 | 0.00 |
| instance n=100 305.alb | 1 | 0 | Optimal | 0.32 | 22 | 0.00 | 0.00 |
| instance n=100 306.alb | 1 | 0 | Optimal | 0.34 | 24 | 0.00 | 0.00 |
| instance n=100 307.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 308.alb | 1 | 0 | Optimal | 52.87 | 20 | 0.00 | 0.00 |
| instance n=100 309.alb | 1 | 0 | Unknown | 120219.00 | - | - | - |
| instance n=100 31.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 310.alb | 1 | 0 | Optimal | 0.45 | 23 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=100 311.alb | 1 | 0 | Optimal | 0.33 | 21 | 0.00 | 0.00 |
| instance n=100 312.alb | 1 | 0 | Optimal | 0.33 | 22 | 0.00 | 0.00 |
| instance n=100 313.alb | 1 | 0 | Optimal | 0.34 | 23 | 0.00 | 0.00 |
| instance n=100 314.alb | 1 | 0 | Optimal | 0.32 | 19 | 0.00 | 0.00 |
| instance n=100 315.alb | 1 | 0 | Optimal | 95.13 | 22 | 0.00 | 0.00 |
| instance n=100 316.alb | 1 | 0 | Optimal | 0.30 | 24 | 0.00 | 0.00 |
| instance n=100 317.alb | 1 | 0 | Optimal | 0.43 | 26 | 0.00 | 0.00 |
| instance n=100 318.alb | 1 | 0 | Optimal | 0.35 | 21 | 0.00 | 0.00 |
| instance n=100 319.alb | 1 | 0 | Optimal | 0.83 | 23 | 0.00 | 0.00 |
| instance n=100 32.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 320.alb | 1 | 0 | Optimal | 0.32 | 22 | 0.00 | 0.00 |
| instance n=100 321.alb | 1 | 0 | Optimal | 0.35 | 26 | 0.00 | 0.00 |
| instance n=100 322.alb | 1 | 0 | Optimal | 45.10 | 23 | 0.00 | 0.00 |
| instance n=100 323.alb | 1 | 0 | Optimal | 0.32 | 24 | 0.00 | 0.00 |
| instance n=100 324.alb | 1 | 0 | Optimal | 0.33 | 23 | 0.00 | 0.00 |
| instance n=100 325.alb | 1 | 0 | Optimal | 13.96 | 25 | 0.00 | 0.00 |
| instance n=100 326.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=100 327.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 328.alb | 1 | 0 | Optimal | 19.77 | 14 | 0.00 | 0.00 |
| instance n=100 329.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 33.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 330.alb | 1 | 0 | Optimal | 28.69 | 14 | 0.00 | 0.00 |
| instance n=100 331.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 332.alb | 1 | 0 | Optimal | 0.33 | 14 | 0.00 | 0.00 |
| instance n=100 333.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 334.alb | 1 | 0 | Optimal | 0.65 | 14 | 0.00 | 0.00 |
| instance n=100 335.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=100 336.alb | 1 | 0 | Optimal | 0.29 | 15 | 0.00 | 0.00 |
| instance n=100 337.alb | 1 | 0 | Optimal | 2.57 | 13 | 0.00 | 0.00 |
| instance n=100 338.alb | 1 | 0 | Optimal | 13.40 | 14 | 0.00 | 0.00 |
| instance n=100 339.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 34.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 340.alb | 1 | 0 | Optimal | 0.33 | 14 | 0.00 | 0.00 |
| instance n=100 341.alb | 1 | 0 | Optimal | 0.31 | 16 | 0.00 | 0.00 |
| instance n=100 342.alb | 1 | 0 | Optimal | 0.37 | 14 | 0.00 | 0.00 |
| instance n=100 343.alb | 1 | 0 | Optimal | 0.30 | 16 | 0.00 | 0.00 |
| instance n=100 344.alb | 1 | 0 | Optimal | 0.29 | 15 | 0.00 | 0.00 |
| instance n=100 345.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 346.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=100 347.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 348.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 349.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=100 35.alb | 1 | 0 | Optimal | 0.31 | 15 | 0.00 | 0.00 |
| instance n=100 350.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 351.alb | 1 | 0 | Unknown | 120228.00 | - | - | - |
| instance n=100 352.alb | 1 | 0 | Optimal | 0.38 | 63 | 0.00 | 0.00 |
| instance n=100 353.alb | 1 | 0 | Unknown | 120219.00 | - | - | - |
| instance n=100 354.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 355.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 356.alb | 1 | 0 | Optimal | 110.76 | 59 | 0.00 | 0.00 |
| instance n=100 357.alb | 1 | 0 | Optimal | 38.47 | 53 | 0.00 | 0.00 |
| instance n=100 358.alb | 1 | 0 | Unknown | 120227.00 | - | - | - |
| instance n=100 359.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=100 36.alb | 1 | 0 | Optimal | 104.95 | 14 | 0.00 | 0.00 |
| instance n=100 360.alb | 1 | 0 | Optimal | 1.76 | 54 | 0.00 | 0.00 |
| instance n=100 361.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 362.alb | 1 | 0 | Optimal | 2.65 | 57 | 0.00 | 0.00 |
| instance n=100 363.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 364.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 365.alb | 1 | 0 | Optimal | 7.95 | 52 | 0.00 | 0.00 |
| instance n=100 366.alb | 1 | 0 | Optimal | 2.47 | 61 | 0.00 | 0.00 |
| instance n=100 367.alb | 1 | 0 | Optimal | 17.94 | 55 | 0.00 | 0.00 |
| instance n=100 368.alb | 1 | 0 | Optimal | 3.66 | 58 | 0.00 | 0.00 |
| instance n=100 369.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 37.alb | 1 | 0 | Optimal | 0.28 | 14 | 0.00 | 0.00 |
| instance n=100 370.alb | 1 | 0 | Unknown | 120221.00 | - | - | - |
| instance n=100 371.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 372.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 373.alb | 1 | 0 | Unknown | 120215.00 | - | - | - |
| instance n=100 374.alb | 1 | 0 | Optimal | 107.71 | 51 | 0.00 | 0.00 |
| instance n=100 375.alb | 1 | 0 | Optimal | 29.09 | 57 | 0.00 | 0.00 |
| instance n=100 376.alb | 1 | 0 | Optimal | 0.34 | 23 | 0.00 | 0.00 |
| instance n=100 377.alb | 1 | 0 | Unknown | 120250.00 | - | - | - |
| instance n=100 378.alb | 1 | 0 | Optimal | 0.53 | 22 | 0.00 | 0.00 |
| instance n=100 379.alb | 1 | 0 | Optimal | 12.69 | 23 | 0.00 | 0.00 |
| instance n=100 38.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=100 380.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 381.alb | 1 | 0 | Optimal | 0.41 | 24 | 0.00 | 0.00 |
| instance n=100 382.alb | 1 | 0 | Optimal | 1.63 | 25 | 0.00 | 0.00 |
| instance n=100 383.alb | 1 | 0 | Optimal | 0.36 | 25 | 0.00 | 0.00 |
| instance n=100 384.alb | 1 | 0 | Optimal | 0.46 | 25 | 0.00 | 0.00 |
| instance n=100 385.alb | 1 | 0 | Optimal | 0.50 | 22 | 0.00 | 0.00 |
| instance n=100 386.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=100 387.alb | 1 | 0 | Optimal | 0.38 | 22 | 0.00 | 0.00 |
| instance n=100 388.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=100 389.alb | 1 | 0 | Optimal | 0.34 | 23 | 0.00 | 0.00 |
| instance n=100 39.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=100 390.alb | 1 | 0 | Optimal | 88.96 | 22 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 391.alb | 1 | 0 | Optimal | 0.33 | 20 | 0.00 | 0.00 |
| instance n=100 392.alb | 1 | 0 | Optimal | 0.36 | 22 | 0.00 | 0.00 |
| instance n=100 393.alb | 1 | 0 | Unknown | 120214.00 | - | - | - |
| instance n=100 394.alb | 1 | 0 | Optimal | 0.40 | 22 | 0.00 | 0.00 |
| instance n=100 395.alb | 1 | 0 | Optimal | 0.85 | 24 | 0.00 | 0.00 |
| instance n=100 396.alb | 1 | 0 | Optimal | 1.21 | 20 | 0.00 | 0.00 |
| instance n=100 397.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=100 398.alb | 1 | 0 | Optimal | 11.87 | 25 | 0.00 | 0.00 |
| instance n=100 399.alb | 1 | 0 | Optimal | 0.34 | 23 | 0.00 | 0.00 |
| instance n=100 4.alb | 1 | 0 | Optimal | 0.32 | 24 | 0.00 | 0.00 |
| instance n=100 40.alb | 1 | 0 | Optimal | 0.37 | 14 | 0.00 | 0.00 |
| instance n=100 400.alb | 1 | 0 | Optimal | 0.40 | 24 | 0.00 | 0.00 |
| instance n=100 401.alb | 1 | 0 | Optimal | 0.33 | 15 | 0.00 | 0.00 |
| instance n=100 402.alb | 1 | 0 | Optimal | 0.35 | 15 | 0.00 | 0.00 |
| instance n=100 403.alb | 1 | 0 | Optimal | 0.64 | 14 | 0.00 | 0.00 |
| instance n=100 404.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 405.alb | 1 | 0 | Optimal | 0.33 | 13 | 0.00 | 0.00 |
| instance n=100 406.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 407.alb | 1 | 0 | Optimal | 0.31 | 15 | 0.00 | 0.00 |
| instance n=100 408.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 409.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 41.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=100 410.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 411.alb | 1 | 0 | Optimal | 0.68 | 14 | 0.00 | 0.00 |
| instance n=100 412.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 413.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 414.alb | 1 | 0 | Optimal | 27.39 | 14 | 0.00 | 0.00 |
| instance n=100 415.alb | 1 | 0 | Optimal | 0.45 | 13 | 0.00 | 0.00 |
| instance n=100 416.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 417.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 418.alb | 1 | 0 | Optimal | 0.31 | 16 | 0.00 | 0.00 |
| instance n=100 419.alb | 1 | 0 | Optimal | 1.18 | 14 | 0.00 | 0.00 |
| instance n=100 42.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 420.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 421.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 422.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=100 423.alb | 1 | 0 | Optimal | 0.41 | 14 | 0.00 | 0.00 |
| instance n=100 424.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 425.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=100 426.alb | 1 | 0 | Unknown | 120216.00 | - | - | - |
| instance n=100 427.alb | 1 | 0 | Unknown | 120216.00 | - | - | - |
| instance n=100 428.alb | 1 | 0 | Optimal | 1.70 | 54 | 0.00 | 0.00 |
| instance n=100 429.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 43.alb | 1 | 0 | Optimal | 0.40 | 14 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 430.alb | 1 | 0 | Unknown | 120226.00 | - | - | - |
| instance n=100 431.alb | 1 | 0 | Unknown | 120215.00 | - | - | - |
| instance n=100 432.alb | 1 | 0 | Unknown | 120226.00 | - | - | - |
| instance n=100 433.alb | 1 | 0 | Optimal | 13.50 | 52 | 0.00 | 0.00 |
| instance n=100 434.alb | 1 | 0 | Unknown | 120230.00 | - | - | - |
| instance n=100 435.alb | 1 | 0 | Unknown | 120238.00 | - | - | - |
| instance n=100 436.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=100 437.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=100 438.alb | 1 | 0 | Unknown | 120212.00 | - | - | - |
| instance n=100 439.alb | 1 | 0 | Unknown | 120213.00 | - | - | - |
| instance n=100 44.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 440.alb | 1 | 0 | Unknown | 120216.00 | - | - | - |
| instance n=100 441.alb | 1 | 0 | Unknown | 120226.00 | - | - | - |
| instance n=100 442.alb | 1 | 0 | Unknown | 120215.00 | - | - | - |
| instance n=100 443.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 444.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 445.alb | 1 | 0 | Unknown | 120206.00 | - | - | - |
| instance n=100 446.alb | 1 | 0 | Unknown | 120245.00 | - | - | - |
| instance n=100 447.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 448.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 449.alb | 1 | 0 | Unknown | 120216.00 | - | - | - |
| instance n=100 45.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 450.alb | 1 | 0 | Unknown | 120235.00 | - | - | - |
| instance n=100 451.alb | 1 | 0 | Optimal | 0.41 | 26 | 0.00 | 0.00 |
| instance n=100 452.alb | 1 | 0 | Optimal | 0.36 | 22 | 0.00 | 0.00 |
| instance n=100 453.alb | 1 | 0 | Optimal | 0.41 | 24 | 0.00 | 0.00 |
| instance n=100 454.alb | 1 | 0 | Optimal | 0.34 | 23 | 0.00 | 0.00 |
| instance n=100 455.alb | 1 | 0 | Optimal | 0.67 | 23 | 0.00 | 0.00 |
| instance n=100 456.alb | 1 | 0 | Optimal | 0.34 | 26 | 0.00 | 0.00 |
| instance n=100 457.alb | 1 | 0 | Optimal | 0.47 | 23 | 0.00 | 0.00 |
| instance n=100 458.alb | 1 | 0 | Optimal | 0.37 | 24 | 0.00 | 0.00 |
| instance n=100 459.alb | 1 | 0 | Optimal | 0.38 | 23 | 0.00 | 0.00 |
| instance n=100 46.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=100 460.alb | 1 | 0 | Optimal | 0.35 | 23 | 0.00 | 0.00 |
| instance n=100 461.alb | 1 | 0 | Optimal | 0.91 | 23 | 0.00 | 0.00 |
| instance n=100 462.alb | 1 | 0 | Optimal | 0.36 | 23 | 0.00 | 0.00 |
| instance n=100 463.alb | 1 | 0 | Optimal | 0.55 | 26 | 0.00 | 0.00 |
| instance n=100 464.alb | 1 | 0 | Optimal | 0.51 | 25 | 0.00 | 0.00 |
| instance n=100 465.alb | 1 | 0 | Optimal | 0.49 | 22 | 0.00 | 0.00 |
| instance n=100 466.alb | 1 | 0 | Optimal | 0.41 | 26 | 0.00 | 0.00 |
| instance n=100 467.alb | 1 | 0 | Optimal | 1.38 | 21 | 0.00 | 0.00 |
| instance n=100 468.alb | 1 | 0 | Optimal | 0.67 | 25 | 0.00 | 0.00 |
| instance n=100 469.alb | 1 | 0 | Optimal | 0.36 | 22 | 0.00 | 0.00 |
| instance n=100 47.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=100 470.alb | 1 | 0 | Optimal | 1.67 | 26 | 0.00 | 0.00 |
| instance n=100 471.alb | 1 | 0 | Optimal | 0.77 | 26 | 0.00 | 0.00 |
| instance n=100 472.alb | 1 | 0 | Optimal | 0.39 | 23 | 0.00 | 0.00 |
| instance n=100 473.alb | 1 | 0 | Optimal | 0.56 | 28 | 0.00 | 0.00 |
| instance n=100 474.alb | 1 | 0 | Optimal | 0.45 | 23 | 0.00 | 0.00 |
| instance n=100 475.alb | 1 | 0 | Optimal | 1.77 | 24 | 0.00 | 0.00 |
| instance n=100 476.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 477.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 478.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 479.alb | 1 | 0 | Optimal | 0.36 | 16 | 0.00 | 0.00 |
| instance n=100 48.alb | 1 | 0 | Optimal | 0.43 | 15 | 0.00 | 0.00 |
| instance n=100 480.alb | 1 | 0 | Optimal | 0.34 | 15 | 0.00 | 0.00 |
| instance n=100 481.alb | 1 | 0 | Optimal | 0.34 | 15 | 0.00 | 0.00 |
| instance n=100 482.alb | 1 | 0 | Optimal | 0.42 | 15 | 0.00 | 0.00 |
| instance n=100 483.alb | 1 | 0 | Optimal | 0.34 | 14 | 0.00 | 0.00 |
| instance n=100 484.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 485.alb | 1 | 0 | Optimal | 0.48 | 16 | 0.00 | 0.00 |
| instance n=100 486.alb | 1 | 0 | Optimal | 0.34 | 15 | 0.00 | 0.00 |
| instance n=100 487.alb | 1 | 0 | Optimal | 0.38 | 15 | 0.00 | 0.00 |
| instance n=100 488.alb | 1 | 0 | Optimal | 0.36 | 16 | 0.00 | 0.00 |
| instance n=100 489.alb | 1 | 0 | Optimal | 0.38 | 13 | 0.00 | 0.00 |
| instance n=100 49.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 490.alb | 1 | 0 | Optimal | 0.33 | 15 | 0.00 | 0.00 |
| instance n=100 491.alb | 1 | 0 | Optimal | 0.40 | 16 | 0.00 | 0.00 |
| instance n=100 492.alb | 1 | 0 | Optimal | 0.52 | 14 | 0.00 | 0.00 |
| instance n=100 493.alb | 1 | 0 | Optimal | 0.39 | 14 | 0.00 | 0.00 |
| instance n=100 494.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 495.alb | 1 | 0 | Optimal | 0.42 | 15 | 0.00 | 0.00 |
| instance n=100 496.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=100 497.alb | 1 | 0 | Optimal | 0.34 | 13 | 0.00 | 0.00 |
| instance n=100 498.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 499.alb | 1 | 0 | Optimal | 0.35 | 14 | 0.00 | 0.00 |
| instance n=100 5.alb | 1 | 0 | Optimal | 0.31 | 22 | 0.00 | 0.00 |
| instance n=100 50.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=100 500.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=100 501.alb | 1 | 0 | Optimal | 2.12 | 62 | 0.00 | 0.00 |
| instance n=100 502.alb | 1 | 0 | Optimal | 0.64 | 64 | 0.00 | 0.00 |
| instance n=100 503.alb | 1 | 0 | Optimal | 1.98 | 60 | 0.00 | 0.00 |
| instance n=100 504.alb | 1 | 0 | Optimal | 6.94 | 60 | 0.00 | 0.00 |
| instance n=100 505.alb | 1 | 0 | Optimal | 0.71 | 61 | 0.00 | 0.00 |
| instance n=100 506.alb | 1 | 0 | Optimal | 0.70 | 57 | 0.00 | 0.00 |
| instance n=100 507.alb | 1 | 0 | Optimal | 3.61 | 59 | 0.00 | 0.00 |
| instance n=100 508.alb | 1 | 0 | Optimal | 3.31 | 56 | 0.00 | 0.00 |
| instance n=100 509.alb | 1 | 0 | Optimal | 0.84 | 57 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 51.alb | 1 | 0 | Unknown | 120214.00 | - | - | - |
| instance n=100 510.alb | 1 | 0 | Optimal | 4.72 | 58 | 0.00 | 0.00 |
| instance n=100 511.alb | 1 | 0 | Optimal | 3.74 | 59 | 0.00 | 0.00 |
| instance n=100 512.alb | 1 | 0 | Optimal | 0.43 | 60 | 0.00 | 0.00 |
| instance n=100 513.alb | 1 | 0 | Optimal | 8.99 | 62 | 0.00 | 0.00 |
| instance n=100 514.alb | 1 | 0 | Optimal | 4.69 | 58 | 0.00 | 0.00 |
| instance n=100 515.alb | 1 | 0 | Optimal | 4.20 | 61 | 0.00 | 0.00 |
| instance n=100 516.alb | 1 | 0 | Optimal | 0.36 | 70 | 0.00 | 0.00 |
| instance n=100 517.alb | 1 | 0 | Optimal | 2.77 | 62 | 0.00 | 0.00 |
| instance n=100 518.alb | 1 | 0 | Optimal | 1.98 | 57 | 0.00 | 0.00 |
| instance n=100 519.alb | 1 | 0 | Optimal | 1.02 | 61 | 0.00 | 0.00 |
| instance n=100 52.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=100 520.alb | 1 | 0 | Optimal | 7.01 | 60 | 0.00 | 0.00 |
| instance n=100 521.alb | 1 | 0 | Optimal | 1.21 | 70 | 0.00 | 0.00 |
| instance n=100 522.alb | 1 | 0 | Optimal | 12.09 | 59 | 0.00 | 0.00 |
| instance n=100 523.alb | 1 | 0 | Optimal | 5.20 | 55 | 0.00 | 0.00 |
| instance n=100 524.alb | 1 | 0 | Optimal | 3.20 | 59 | 0.00 | 0.00 |
| instance n=100 525.alb | 1 | 0 | Optimal | 3.09 | 62 | 0.00 | 0.00 |
| instance n=100 53.alb | 1 | 0 | Optimal | 12.17 | 52 | 0.00 | 0.00 |
| instance n=100 54.alb | 1 | 0 | Optimal | 42.47 | 51 | 0.00 | 0.00 |
| instance n=100 55.alb | 1 | 0 | Unknown | 120212.00 | - | - | - |
| instance n=100 56.alb | 1 | 0 | Unknown | 120216.00 | - | - | - |
| instance n=100 57.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 58.alb | 1 | 0 | Unknown | 120217.00 | - | - | - |
| instance n=100 59.alb | 1 | 0 | Optimal | 0.55 | 57 | 0.00 | 0.00 |
| instance n=100 6.alb | 1 | 0 | Optimal | 0.56 | 22 | 0.00 | 0.00 |
| instance n=100 60.alb | 1 | 0 | Unknown | 120226.00 | - | - | - |
| instance n=100 61.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 62.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=100 63.alb | 1 | 0 | Optimal | 0.67 | 61 | 0.00 | 0.00 |
| instance n=100 64.alb | 1 | 0 | Unknown | 120232.00 | - | - | - |
| instance n=100 65.alb | 1 | 0 | Optimal | 116.90 | 61 | 0.00 | 0.00 |
| instance n=100 66.alb | 1 | 0 | Unknown | 120209.00 | - | - | - |
| instance n=100 67.alb | 1 | 0 | Unknown | 120213.00 | - | - | - |
| instance n=100 68.alb | 1 | 0 | Optimal | 0.32 | 57 | 0.00 | 0.00 |
| instance n=100 69.alb | 1 | 0 | Optimal | 9.10 | 53 | 0.00 | 0.00 |
| instance n=100 7.alb | 1 | 0 | Optimal | 0.33 | 26 | 0.00 | 0.00 |
| instance n=100 70.alb | 1 | 0 | Unknown | 120219.00 | - | - | - |
| instance n=100 71.alb | 1 | 0 | Unknown | 120220.00 | - | - | - |
| instance n=100 72.alb | 1 | 0 | Unknown | 120227.00 | - | - | - |
| instance n=100 73.alb | 1 | 0 | Unknown | 120211.00 | - | - | - |
| instance n=100 74.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=100 75.alb | 1 | 0 | Optimal | 33.47 | 54 | 0.00 | 0.00 |
| instance n=100 76.alb | 1 | 0 | Optimal | 0.32 | 23 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=100 77.alb | 1 | 0 | Optimal | 0.32 | 20 | 0.00 | 0.00 |
| instance n=100 78.alb | 1 | 0 | Optimal | 1.70 | 21 | 0.00 | 0.00 |
| instance n=100 79.alb | 1 | 0 | Optimal | 0.33 | 21 | 0.00 | 0.00 |
| instance n=100 8.alb | 1 | 0 | Optimal | 0.33 | 24 | 0.00 | 0.00 |
| instance n=100 80.alb | 1 | 0 | Optimal | 44.53 | 22 | 0.00 | 0.00 |
| instance n=100 81.alb | 1 | 0 | Optimal | 0.75 | 20 | 0.00 | 0.00 |
| instance n=100 82.alb | 1 | 0 | Optimal | 0.48 | 21 | 0.00 | 0.00 |
| instance n=100 83.alb | 1 | 0 | Optimal | 0.33 | 22 | 0.00 | 0.00 |
| instance n=100 84.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=100 85.alb | 1 | 0 | Unknown | 120215.00 | - | - | - |
| instance n=100 86.alb | 1 | 0 | Optimal | 0.51 | 23 | 0.00 | 0.00 |
| instance n=100 87.alb | 1 | 0 | Optimal | 0.33 | 22 | 0.00 | 0.00 |
| instance n=100 88.alb | 1 | 0 | Unknown | 120229.00 | - | - | - |
| instance n=100 89.alb | 1 | 0 | Optimal | 0.32 | 24 | 0.00 | 0.00 |
| instance n=100 9.alb | 1 | 0 | Optimal | 5.76 | 23 | 0.00 | 0.00 |
| instance n=100 90.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=100 91.alb | 1 | 0 | Optimal | 0.42 | 25 | 0.00 | 0.00 |
| instance n=100 92.alb | 1 | 0 | Optimal | 0.35 | 24 | 0.00 | 0.00 |
| instance n=100 93.alb | 1 | 0 | Optimal | 5.90 | 27 | 0.00 | 0.00 |
| instance n=100 94.alb | 1 | 0 | Optimal | 14.45 | 22 | 0.00 | 0.00 |
| instance n=100 95.alb | 1 | 0 | Optimal | 0.39 | 21 | 0.00 | 0.00 |
| instance n=100 96.alb | 1 | 0 | Optimal | 1.38 | 21 | 0.00 | 0.00 |
| instance n=100 97.alb | 1 | 0 | Optimal | 0.45 | 22 | 0.00 | 0.00 |
| instance n=100 98.alb | 1 | 0 | Optimal | 0.33 | 22 | 0.00 | 0.00 |
| instance n=100 99.alb | 1 | 0 | Optimal | 0.34 | 22 | 0.00 | 0.00 |
| instance n=20 1.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 10.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 100.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=20 101.alb | 1 | 0 | Optimal | 0.40 | 13 | 0.00 | 0.00 |
| instance n=20 102.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=20 103.alb | 1 | 0 | Optimal | 0.33 | 12 | 0.00 | 0.00 |
| instance n=20 104.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=20 105.alb | 1 | 0 | Optimal | 0.26 | 12 | 0.00 | 0.00 |
| instance n=20 106.alb | 1 | 0 | Optimal | 0.29 | 10 | 0.00 | 0.00 |
| instance n=20 107.alb | 1 | 0 | Optimal | 0.28 | 14 | 0.00 | 0.00 |
| instance n=20 108.alb | 1 | 0 | Optimal | 0.28 | 15 | 0.00 | 0.00 |
| instance n=20 109.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=20 11.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 110.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 111.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 112.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=20 113.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 114.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 115.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 116.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 117.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 118.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 119.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 12.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 120.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 121.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 122.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 123.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 124.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 125.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 126.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 127.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 128.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 129.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 13.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 130.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=20 131.alb | 1 | 0 | Optimal | 0.32 | 7 | 0.00 | 0.00 |
| instance n=20 132.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 133.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 134.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 135.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 136.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 137.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 138.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 139.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 14.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 140.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 141.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 142.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 143.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 144.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 145.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 146.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 147.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 148.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 149.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 15.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 150.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 151.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 152.alb | 1 | 0 | Optimal | 0.44 | 3 | 0.00 | 0.00 |
| instance n=20 153.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 154.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 155.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 156.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 157.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 158.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 159.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 16.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 160.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 161.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 162.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 163.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 164.alb | 1 | 0 | Optimal | 0.46 | 4 | 0.00 | 0.00 |
| instance n=20 165.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 166.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 167.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 168.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=20 169.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 17.alb | 1 | 0 | Optimal | 0.32 | 10 | 0.00 | 0.00 |
| instance n=20 170.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=20 171.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 172.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 173.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 174.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 175.alb | 1 | 0 | Optimal | 0.30 | 10 | 0.00 | 0.00 |
| instance n=20 176.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 177.alb | 1 | 0 | Optimal | 0.58 | 10 | 0.00 | 0.00 |
| instance n=20 178.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=20 179.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=20 18.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 180.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 181.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=20 182.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=20 183.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 184.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 185.alb | 1 | 0 | Optimal | 0.27 | 15 | 0.00 | 0.00 |
| instance n=20 186.alb | 1 | 0 | Optimal | 0.82 | 14 | 0.00 | 0.00 |
| instance n=20 187.alb | 1 | 0 | Optimal | 0.33 | 10 | 0.00 | 0.00 |
| instance n=20 188.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 189.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 19.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=20 190.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=20 191.alb | 1 | 0 | Optimal | 0.28 | 4 | 0.00 | 0.00 |
| instance n=20 192.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 193.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 194.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 195.alb | 1 | 0 | Optimal | 0.31 | 6 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 196.alb | 1 | 0 | Optimal | 0.32 | 5 | 0.00 | 0.00 |
| instance n=20 197.alb | 1 | 0 | Optimal | 0.47 | 4 | 0.00 | 0.00 |
| instance n=20 198.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=20 199.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 2.alb | 1 | 0 | Optimal | 0.34 | 3 | 0.00 | 0.00 |
| instance n=20 20.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 200.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=20 201.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 202.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 203.alb | 1 | 0 | Optimal | 0.26 | 4 | 0.00 | 0.00 |
| instance n=20 204.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 205.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=20 206.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 207.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 208.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 209.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 21.alb | 1 | 0 | Optimal | 0.32 | 14 | 0.00 | 0.00 |
| instance n=20 210.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 211.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 212.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 213.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 214.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 215.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 216.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 217.alb | 1 | 0 | Optimal | 0.28 | 4 | 0.00 | 0.00 |
| instance n=20 218.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 219.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 22.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 220.alb | 1 | 0 | Optimal | 0.31 | 3 | 0.00 | 0.00 |
| instance n=20 221.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 222.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 223.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 224.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 225.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 226.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 227.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 228.alb | 1 | 0 | Optimal | 0.26 | 2 | 0.00 | 0.00 |
| instance n=20 229.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 23.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 230.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 231.alb | 1 | 0 | Optimal | 0.41 | 3 | 0.00 | 0.00 |
| instance n=20 232.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 233.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 234.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 235.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 236.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 237.alb | 1 | 0 | Optimal | 0.44 | 3 | 0.00 | 0.00 |
| instance n=20 238.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 239.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 24.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 240.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 241.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 242.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 243.alb | 1 | 0 | Optimal | 0.29 | 10 | 0.00 | 0.00 |
| instance n=20 244.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 245.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 246.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 247.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 248.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 249.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 25.alb | 1 | 0 | Optimal | 0.35 | 11 | 0.00 | 0.00 |
| instance n=20 250.alb | 1 | 0 | Optimal | 0.29 | 10 | 0.00 | 0.00 |
| instance n=20 251.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 252.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 253.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 254.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 255.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=20 256.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=20 257.alb | 1 | 0 | Optimal | 0.28 | 10 | 0.00 | 0.00 |
| instance n=20 258.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 259.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 26.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 260.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 261.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 262.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=20 263.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=20 264.alb | 1 | 0 | Optimal | 0.34 | 12 | 0.00 | 0.00 |
| instance n=20 265.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 266.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 267.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 268.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=20 269.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=20 27.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 270.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=20 271.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 272.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 273.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 274.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 275.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 276.alb | 1 | 0 | Optimal | 0.30 | 4 | 0.00 | 0.00 |
| instance n=20 277.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 278.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 279.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 28.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 280.alb | 1 | 0 | Optimal | 0.33 | 5 | 0.00 | 0.00 |
| instance n=20 281.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 282.alb | 1 | 0 | Optimal | 0.28 | 4 | 0.00 | 0.00 |
| instance n=20 283.alb | 1 | 0 | Optimal | 0.30 | 5 | 0.00 | 0.00 |
| instance n=20 284.alb | 1 | 0 | Optimal | 0.30 | 5 | 0.00 | 0.00 |
| instance n=20 285.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 286.alb | 1 | 0 | Optimal | 0.30 | 5 | 0.00 | 0.00 |
| instance n=20 287.alb | 1 | 0 | Optimal | 0.30 | 5 | 0.00 | 0.00 |
| instance n=20 288.alb | 1 | 0 | Optimal | 0.44 | 6 | 0.00 | 0.00 |
| instance n=20 289.alb | 1 | 0 | Optimal | 0.31 | 5 | 0.00 | 0.00 |
| instance n=20 29.alb | 1 | 0 | Optimal | 0.28 | 10 | 0.00 | 0.00 |
| instance n=20 290.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 291.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 292.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 293.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 294.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 295.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 296.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 297.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 298.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 299.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 3.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 30.alb | 1 | 0 | Optimal | 0.29 | 16 | 0.00 | 0.00 |
| instance n=20 300.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 301.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 302.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 303.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 304.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 305.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 306.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 307.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 308.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 309.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 31.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 310.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 311.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 312.alb | 1 | 0 | Optimal | 0.28 | 4 | 0.00 | 0.00 |
| instance n=20 313.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 314.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 315.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 316.alb | 1 | 0 | Optimal | 0.31 | 10 | 0.00 | 0.00 |
| instance n=20 317.alb | 1 | 0 | Optimal | 0.30 | 10 | 0.00 | 0.00 |
| instance n=20 318.alb | 1 | 0 | Optimal | 0.30 | 10 | 0.00 | 0.00 |
| instance n=20 319.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=20 32.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=20 320.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 321.alb | 1 | 0 | Optimal | 0.53 | 14 | 0.00 | 0.00 |
| instance n=20 322.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 323.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=20 324.alb | 1 | 0 | Optimal | 0.29 | 9 | 0.00 | 0.00 |
| instance n=20 325.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=20 326.alb | 1 | 0 | Optimal | 0.52 | 14 | 0.00 | 0.00 |
| instance n=20 327.alb | 1 | 0 | Optimal | 1.83 | 13 | 0.00 | 0.00 |
| instance n=20 328.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=20 329.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=20 33.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 330.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 331.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=20 332.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 333.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=20 334.alb | 1 | 0 | Optimal | 0.30 | 10 | 0.00 | 0.00 |
| instance n=20 335.alb | 1 | 0 | Optimal | 0.27 | 14 | 0.00 | 0.00 |
| instance n=20 336.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 337.alb | 1 | 0 | Optimal | 0.29 | 10 | 0.00 | 0.00 |
| instance n=20 338.alb | 1 | 0 | Optimal | 0.27 | 14 | 0.00 | 0.00 |
| instance n=20 339.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 34.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 340.alb | 1 | 0 | Optimal | 0.32 | 11 | 0.00 | 0.00 |
| instance n=20 341.alb | 1 | 0 | Optimal | 0.31 | 6 | 0.00 | 0.00 |
| instance n=20 342.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 343.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 344.alb | 1 | 0 | Optimal | 0.31 | 6 | 0.00 | 0.00 |
| instance n=20 345.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 346.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 347.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 348.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 349.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 35.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 350.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 351.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 352.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 353.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 354.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 355.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 356.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 357.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 358.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 359.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 36.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 360.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 361.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 362.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 363.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=20 364.alb | 1 | 0 | Optimal | 0.28 | 4 | 0.00 | 0.00 |
| instance n=20 365.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 366.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 367.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 368.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 369.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 37.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 370.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 371.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 372.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 373.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 374.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 375.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 376.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 377.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 378.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 379.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 38.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 380.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 381.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 382.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 383.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 384.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 385.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 386.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 387.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 388.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 389.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 39.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=20 390.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 391.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=20 392.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=20 393.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 394.alb | 1 | 0 | Optimal | 0.35 | 12 | 0.00 | 0.00 |
| instance n=20 395.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=20 396.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=20 397.alb | 1 | 0 | Optimal | 0.33 | 10 | 0.00 | 0.00 |
| instance n=20 398.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=20 399.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 4.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 40.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 400.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 401.alb | 1 | 0 | Optimal | 0.31 | 12 | 0.00 | 0.00 |
| instance n=20 402.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 403.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 404.alb | 1 | 0 | Optimal | 0.31 | 10 | 0.00 | 0.00 |
| instance n=20 405.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 406.alb | 1 | 0 | Optimal | 0.25 | 14 | 0.00 | 0.00 |
| instance n=20 407.alb | 1 | 0 | Optimal | 0.30 | 10 | 0.00 | 0.00 |
| instance n=20 408.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=20 409.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 41.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 410.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=20 411.alb | 1 | 0 | Optimal | 0.30 | 15 | 0.00 | 0.00 |
| instance n=20 412.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=20 413.alb | 1 | 0 | Optimal | 0.28 | 10 | 0.00 | 0.00 |
| instance n=20 414.alb | 1 | 0 | Optimal | 0.32 | 12 | 0.00 | 0.00 |
| instance n=20 415.alb | 1 | 0 | Optimal | 0.30 | 10 | 0.00 | 0.00 |
| instance n=20 416.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 417.alb | 1 | 0 | Optimal | 0.25 | 5 | 0.00 | 0.00 |
| instance n=20 418.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 419.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 42.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 420.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 421.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 422.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 423.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 424.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 425.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 426.alb | 1 | 0 | Optimal | 0.30 | 5 | 0.00 | 0.00 |
| instance n=20 427.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 428.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 429.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 43.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 430.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 431.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 432.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 433.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 434.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 435.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=20 436.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 437.alb | 1 | 0 | Optimal | 0.46 | 5 | 0.00 | 0.00 |
| instance n=20 438.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 439.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 44.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 440.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 441.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 442.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 443.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 444.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 445.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 446.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 447.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 448.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 449.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 45.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 450.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 451.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 452.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 453.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 454.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 455.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 456.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 457.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 458.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 459.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 46.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 460.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 461.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 462.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 463.alb | 1 | 0 | Optimal | 0.32 | 3 | 0.00 | 0.00 |
| instance n=20 464.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 465.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 466.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 467.alb | 1 | 0 | Optimal | 0.26 | 14 | 0.00 | 0.00 |
| instance n=20 468.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 469.alb | 1 | 0 | Optimal | 0.30 | 14 | 0.00 | 0.00 |
| instance n=20 47.alb | 1 | 0 | Optimal | 0.26 | 4 | 0.00 | 0.00 |
| instance n=20 470.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 471.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=20 472.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 473.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=20 474.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=20 475.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=20 476.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=20 477.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 478.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 479.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 48.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 480.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=20 481.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 482.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 483.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=20 484.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 485.alb | 1 | 0 | Optimal | 0.27 | 15 | 0.00 | 0.00 |
| instance n=20 486.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=20 487.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 488.alb | 1 | 0 | Optimal | 0.27 | 15 | 0.00 | 0.00 |
| instance n=20 489.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=20 49.alb | 1 | 0 | Optimal | 0.26 | 4 | 0.00 | 0.00 |
| instance n=20 490.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 491.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 492.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 493.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 494.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 495.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |
| instance n=20 496.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 497.alb | 1 | 0 | Optimal | 0.29 | 6 | 0.00 | 0.00 |
| instance n=20 498.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 499.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 5.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 50.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 500.alb | 1 | 0 | Optimal | 0.26 | 8 | 0.00 | 0.00 |
| instance n=20 501.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 502.alb | 1 | 0 | Optimal | 0.28 | 4 | 0.00 | 0.00 |
| instance n=20 503.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |
| instance n=20 504.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 505.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=20 506.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 507.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 508.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 509.alb | 1 | 0 | Optimal | 0.26 | 4 | 0.00 | 0.00 |
| instance n=20 51.alb | 1 | 0 | Optimal | 0.29 | 4 | 0.00 | 0.00 |
| instance n=20 510.alb | 1 | 0 | Optimal | 0.29 | 5 | 0.00 | 0.00 |
| instance n=20 511.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 512.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 513.alb | 1 | 0 | Optimal | 0.30 | 5 | 0.00 | 0.00 |
| instance n=20 514.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 515.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=20 516.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 517.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 518.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 519.alb | 1 | 0 | Optimal | 0.46 | 3 | 0.00 | 0.00 |
| instance n=20 52.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 520.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 521.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 522.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 523.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 524.alb | 1 | 0 | Optimal | 0.30 | 3 | 0.00 | 0.00 |
| instance n=20 525.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 53.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 54.alb | 1 | 0 | Optimal | 0.30 | 5 | 0.00 | 0.00 |
| instance n=20 55.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 56.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 57.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 58.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 59.alb | 1 | 0 | Optimal | 0.26 | 4 | 0.00 | 0.00 |
| instance n=20 6.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 60.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=20 61.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=20 62.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 63.alb | 1 | 0 | Optimal | 0.28 | 5 | 0.00 | 0.00 |
| instance n=20 64.alb | 1 | 0 | Optimal | 0.26 | 5 | 0.00 | 0.00 |
| instance n=20 65.alb | 1 | 0 | Optimal | 0.27 | 5 | 0.00 | 0.00 |
| instance n=20 66.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 67.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 68.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 69.alb | 1 | 0 | Optimal | 0.29 | 2 | 0.00 | 0.00 |
| instance n=20 7.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 70.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 71.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 72.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 73.alb | 1 | 0 | Optimal | 0.27 | 2 | 0.00 | 0.00 |
| instance n=20 74.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 75.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 76.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 77.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 78.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 79.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=20 8.alb | 1 | 0 | Optimal | 0.44 | 3 | 0.00 | 0.00 |
| instance n=20 80.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 81.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 82.alb | 1 | 0 | Optimal | 0.27 | 4 | 0.00 | 0.00 |
| instance n=20 83.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 84.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 85.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 86.alb | 1 | 0 | Optimal | 0.29 | 3 | 0.00 | 0.00 |
| instance n=20 87.alb | 1 | 0 | Optimal | 0.25 | 3 | 0.00 | 0.00 |
| instance n=20 88.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 89.alb | 1 | 0 | Optimal | 0.28 | 3 | 0.00 | 0.00 |
| instance n=20 9.alb | 1 | 0 | Optimal | 0.26 | 3 | 0.00 | 0.00 |
| instance n=20 90.alb | 1 | 0 | Optimal | 0.27 | 3 | 0.00 | 0.00 |
| instance n=20 91.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=20 92.alb | 1 | 0 | Optimal | 0.26 | 11 | 0.00 | 0.00 |
| instance n=20 93.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 94.alb | 1 | 0 | Optimal | 0.29 | 10 | 0.00 | 0.00 |
| instance n=20 95.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=20 96.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=20 97.alb | 1 | 0 | Optimal | 0.32 | 15 | 0.00 | 0.00 |
| instance n=20 98.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=20 99.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=50 1.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 10.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 100.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 101.alb | 1 | 0 | Optimal | 13.72 | 30 | 0.00 | 0.00 |
| instance n=50 102.alb | 1 | 0 | Optimal | 41.12 | 32 | 0.00 | 0.00 |
| instance n=50 103.alb | 1 | 0 | Optimal | 0.37 | 29 | 0.00 | 0.00 |
| instance n=50 104.alb | 1 | 0 | Optimal | 1.05 | 27 | 0.00 | 0.00 |
| instance n=50 105.alb | 1 | 0 | Optimal | 20.12 | 24 | 0.00 | 0.00 |
| instance n=50 106.alb | 1 | 0 | Optimal | 8.64 | 28 | 0.00 | 0.00 |
| instance n=50 107.alb | 1 | 0 | Optimal | 1.97 | 28 | 0.00 | 0.00 |
| instance n=50 108.alb | 1 | 0 | Optimal | 0.55 | 30 | 0.00 | 0.00 |
| instance n=50 109.alb | 1 | 0 | Optimal | 0.36 | 30 | 0.00 | 0.00 |
| instance n=50 11.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 110.alb | 1 | 0 | Optimal | 0.64 | 26 | 0.00 | 0.00 |
| instance n=50 111.alb | 1 | 0 | Optimal | 0.40 | 28 | 0.00 | 0.00 |
| instance n=50 112.alb | 1 | 0 | Optimal | 1.45 | 27 | 0.00 | 0.00 |
| instance n=50 113.alb | 1 | 0 | Optimal | 7.24 | 28 | 0.00 | 0.00 |
| instance n=50 114.alb | 1 | 0 | Optimal | 0.97 | 27 | 0.00 | 0.00 |
| instance n=50 115.alb | 1 | 0 | Unknown | 120230.00 | - | - | - |
| instance n=50 116.alb | 1 | 0 | Optimal | 0.63 | 32 | 0.00 | 0.00 |
| instance n=50 117.alb | 1 | 0 | Optimal | 13.43 | 27 | 0.00 | 0.00 |
| instance n=50 118.alb | 1 | 0 | Optimal | 0.37 | 29 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=50 119.alb | 1 | 0 | Optimal | 0.40 | 25 | 0.00 | 0.00 |
| instance n=50 12.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=50 120.alb | 1 | 0 | Optimal | 0.39 | 27 | 0.00 | 0.00 |
| instance n=50 121.alb | 1 | 0 | Optimal | 8.68 | 32 | 0.00 | 0.00 |
| instance n=50 122.alb | 1 | 0 | Optimal | 23.93 | 29 | 0.00 | 0.00 |
| instance n=50 123.alb | 1 | 0 | Optimal | 0.47 | 32 | 0.00 | 0.00 |
| instance n=50 124.alb | 1 | 0 | Optimal | 1.41 | 29 | 0.00 | 0.00 |
| instance n=50 125.alb | 1 | 0 | Optimal | 0.33 | 33 | 0.00 | 0.00 |
| instance n=50 126.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=50 127.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=50 128.alb | 1 | 0 | Optimal | 0.34 | 12 | 0.00 | 0.00 |
| instance n=50 129.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=50 13.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=50 130.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=50 131.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=50 132.alb | 1 | 0 | Optimal | 0.54 | 12 | 0.00 | 0.00 |
| instance n=50 133.alb | 1 | 0 | Optimal | 0.31 | 12 | 0.00 | 0.00 |
| instance n=50 134.alb | 1 | 0 | Optimal | 0.33 | 14 | 0.00 | 0.00 |
| instance n=50 135.alb | 1 | 0 | Optimal | 0.35 | 13 | 0.00 | 0.00 |
| instance n=50 136.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=50 137.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 138.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=50 139.alb | 1 | 0 | Optimal | 6.70 | 11 | 0.00 | 0.00 |
| instance n=50 14.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=50 140.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=50 141.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=50 142.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=50 143.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 144.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=50 145.alb | 1 | 0 | Optimal | 0.26 | 10 | 0.00 | 0.00 |
| instance n=50 146.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 147.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=50 148.alb | 1 | 0 | Optimal | 0.29 | 10 | 0.00 | 0.00 |
| instance n=50 149.alb | 1 | 0 | Optimal | 0.31 | 12 | 0.00 | 0.00 |
| instance n=50 15.alb | 1 | 0 | Optimal | 0.28 | 8 | 0.00 | 0.00 |
| instance n=50 150.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 151.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 152.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 153.alb | 1 | 0 | Optimal | 1.86 | 7 | 0.00 | 0.00 |
| instance n=50 154.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 155.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 156.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 157.alb | 1 | 0 | Optimal | 0.46 | 8 | 0.00 | 0.00 |
| instance n=50 158.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 159.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 16.alb | 1 | 0 | Optimal | 0.30 | 8 | 0.00 | 0.00 |
| instance n=50 160.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 161.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 162.alb | 1 | 0 | Optimal | 0.28 | 8 | 0.00 | 0.00 |
| instance n=50 163.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 164.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 165.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 166.alb | 1 | 0 | Optimal | 0.28 | 8 | 0.00 | 0.00 |
| instance n=50 167.alb | 1 | 0 | Optimal | 0.86 | 7 | 0.00 | 0.00 |
| instance n=50 168.alb | 1 | 0 | Optimal | 0.42 | 8 | 0.00 | 0.00 |
| instance n=50 169.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 17.alb | 1 | 0 | Optimal | 0.31 | 7 | 0.00 | 0.00 |
| instance n=50 170.alb | 1 | 0 | Optimal | 0.34 | 7 | 0.00 | 0.00 |
| instance n=50 171.alb | 1 | 0 | Optimal | 0.28 | 8 | 0.00 | 0.00 |
| instance n=50 172.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 173.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=50 174.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 175.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 176.alb | 1 | 0 | Optimal | 1.21 | 27 | 0.00 | 0.00 |
| instance n=50 177.alb | 1 | 0 | Unknown | 120230.00 | - | - | - |
| instance n=50 178.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=50 179.alb | 1 | 0 | Optimal | 19.92 | 26 | 0.00 | 0.00 |
| instance n=50 18.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=50 180.alb | 1 | 0 | Optimal | 1.18 | 26 | 0.00 | 0.00 |
| instance n=50 181.alb | 1 | 0 | Optimal | 7.20 | 29 | 0.00 | 0.00 |
| instance n=50 182.alb | 1 | 0 | Unknown | 120221.00 | - | - | - |
| instance n=50 183.alb | 1 | 0 | Optimal | 0.92 | 28 | 0.00 | 0.00 |
| instance n=50 184.alb | 1 | 0 | Optimal | 0.29 | 38 | 0.00 | 0.00 |
| instance n=50 185.alb | 1 | 0 | Optimal | 0.94 | 26 | 0.00 | 0.00 |
| instance n=50 186.alb | 1 | 0 | Optimal | 0.85 | 26 | 0.00 | 0.00 |
| instance n=50 187.alb | 1 | 0 | Unknown | 120229.00 | - | - | - |
| instance n=50 188.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=50 189.alb | 1 | 0 | Unknown | 120211.00 | - | - | - |
| instance n=50 19.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 190.alb | 1 | 0 | Optimal | 0.33 | 30 | 0.00 | 0.00 |
| instance n=50 191.alb | 1 | 0 | Optimal | 16.20 | 27 | 0.00 | 0.00 |
| instance n=50 192.alb | 1 | 0 | Optimal | 3.71 | 27 | 0.00 | 0.00 |
| instance n=50 193.alb | 1 | 0 | Optimal | 70.48 | 28 | 0.00 | 0.00 |
| instance n=50 194.alb | 1 | 0 | Optimal | 1.88 | 28 | 0.00 | 0.00 |
| instance n=50 195.alb | 1 | 0 | Optimal | 3.02 | 28 | 0.00 | 0.00 |
| instance n=50 196.alb | 1 | 0 | Optimal | 26.04 | 27 | 0.00 | 0.00 |
| instance n=50 197.alb | 1 | 0 | Optimal | 0.61 | 28 | 0.00 | 0.00 |
| instance n=50 198.alb | 1 | 0 | Optimal | 0.30 | 28 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 199.alb | 1 | 0 | Optimal | 0.36 | 29 | 0.00 | 0.00 |
| instance n=50 2.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |
| instance n=50 20.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 200.alb | 1 | 0 | Unknown | 120228.00 | - | - | - |
| instance n=50 201.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=50 202.alb | 1 | 0 | Optimal | 0.28 | 9 | 0.00 | 0.00 |
| instance n=50 203.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=50 204.alb | 1 | 0 | Optimal | 0.51 | 10 | 0.00 | 0.00 |
| instance n=50 205.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=50 206.alb | 1 | 0 | Optimal | 51.58 | 11 | 0.00 | 0.00 |
| instance n=50 207.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=50 208.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=50 209.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 21.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=50 210.alb | 1 | 0 | Optimal | 0.27 | 13 | 0.00 | 0.00 |
| instance n=50 211.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 212.alb | 1 | 0 | Optimal | 0.43 | 10 | 0.00 | 0.00 |
| instance n=50 213.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=50 214.alb | 1 | 0 | Optimal | 0.26 | 11 | 0.00 | 0.00 |
| instance n=50 215.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=50 216.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=50 217.alb | 1 | 0 | Optimal | 1.00 | 13 | 0.00 | 0.00 |
| instance n=50 218.alb | 1 | 0 | Optimal | 0.26 | 12 | 0.00 | 0.00 |
| instance n=50 219.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=50 22.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 220.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=50 221.alb | 1 | 0 | Optimal | 0.38 | 11 | 0.00 | 0.00 |
| instance n=50 222.alb | 1 | 0 | Optimal | 0.28 | 14 | 0.00 | 0.00 |
| instance n=50 223.alb | 1 | 0 | Optimal | 0.35 | 11 | 0.00 | 0.00 |
| instance n=50 224.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 225.alb | 1 | 0 | Optimal | 0.26 | 12 | 0.00 | 0.00 |
| instance n=50 226.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 227.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=50 228.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |
| instance n=50 229.alb | 1 | 0 | Optimal | 0.41 | 6 | 0.00 | 0.00 |
| instance n=50 23.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 230.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 231.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 232.alb | 1 | 0 | Optimal | 0.31 | 7 | 0.00 | 0.00 |
| instance n=50 233.alb | 1 | 0 | Optimal | 0.25 | 6 | 0.00 | 0.00 |
| instance n=50 234.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 235.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 236.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 237.alb | 1 | 0 | Optimal | 0.28 | 8 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=50 238.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 239.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 24.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 240.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 241.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 242.alb | 1 | 0 | Optimal | 0.25 | 8 | 0.00 | 0.00 |
| instance n=50 243.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 244.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 245.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 246.alb | 1 | 0 | Optimal | 0.44 | 8 | 0.00 | 0.00 |
| instance n=50 247.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 248.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 249.alb | 1 | 0 | Optimal | 0.32 | 7 | 0.00 | 0.00 |
| instance n=50 25.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |
| instance n=50 250.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 251.alb | 1 | 0 | Optimal | 2.71 | 27 | 0.00 | 0.00 |
| instance n=50 252.alb | 1 | 0 | Optimal | 4.31 | 32 | 0.00 | 0.00 |
| instance n=50 253.alb | 1 | 0 | Optimal | 3.78 | 28 | 0.00 | 0.00 |
| instance n=50 254.alb | 1 | 0 | Optimal | 0.32 | 30 | 0.00 | 0.00 |
| instance n=50 255.alb | 1 | 0 | Optimal | 0.80 | 29 | 0.00 | 0.00 |
| instance n=50 256.alb | 1 | 0 | Optimal | 0.40 | 30 | 0.00 | 0.00 |
| instance n=50 257.alb | 1 | 0 | Optimal | 4.81 | 33 | 0.00 | 0.00 |
| instance n=50 258.alb | 1 | 0 | Optimal | 5.00 | 28 | 0.00 | 0.00 |
| instance n=50 259.alb | 1 | 0 | Optimal | 3.91 | 31 | 0.00 | 0.00 |
| instance n=50 26.alb | 1 | 0 | Optimal | 0.39 | 27 | 0.00 | 0.00 |
| instance n=50 260.alb | 1 | 0 | Optimal | 0.62 | 29 | 0.00 | 0.00 |
| instance n=50 261.alb | 1 | 0 | Optimal | 2.08 | 28 | 0.00 | 0.00 |
| instance n=50 262.alb | 1 | 0 | Optimal | 0.94 | 31 | 0.00 | 0.00 |
| instance n=50 263.alb | 1 | 0 | Optimal | 1.27 | 29 | 0.00 | 0.00 |
| instance n=50 264.alb | 1 | 0 | Optimal | 2.65 | 27 | 0.00 | 0.00 |
| instance n=50 265.alb | 1 | 0 | Optimal | 0.91 | 27 | 0.00 | 0.00 |
| instance n=50 266.alb | 1 | 0 | Optimal | 5.48 | 29 | 0.00 | 0.00 |
| instance n=50 267.alb | 1 | 0 | Optimal | 3.86 | 28 | 0.00 | 0.00 |
| instance n=50 268.alb | 1 | 0 | Optimal | 5.26 | 29 | 0.00 | 0.00 |
| instance n=50 269.alb | 1 | 0 | Optimal | 1.13 | 26 | 0.00 | 0.00 |
| instance n=50 27.alb | 1 | 0 | Optimal | 0.37 | 30 | 0.00 | 0.00 |
| instance n=50 270.alb | 1 | 0 | Optimal | 0.38 | 28 | 0.00 | 0.00 |
| instance n=50 271.alb | 1 | 0 | Optimal | 3.38 | 31 | 0.00 | 0.00 |
| instance n=50 272.alb | 1 | 0 | Optimal | 2.06 | 27 | 0.00 | 0.00 |
| instance n=50 273.alb | 1 | 0 | Optimal | 5.74 | 27 | 0.00 | 0.00 |
| instance n=50 274.alb | 1 | 0 | Optimal | 0.33 | 29 | 0.00 | 0.00 |
| instance n=50 275.alb | 1 | 0 | Optimal | 2.43 | 27 | 0.00 | 0.00 |
| instance n=50 276.alb | 1 | 0 | Optimal | 0.32 | 12 | 0.00 | 0.00 |
| instance n=50 277.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 278.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=50 279.alb | 1 | 0 | Optimal | 0.33 | 11 | 0.00 | 0.00 |
| instance n=50 28.alb | 1 | 0 | Optimal | 1.70 | 28 | 0.00 | 0.00 |
| instance n=50 280.alb | 1 | 0 | Optimal | 0.32 | 13 | 0.00 | 0.00 |
| instance n=50 281.alb | 1 | 0 | Optimal | 0.31 | 11 | 0.00 | 0.00 |
| instance n=50 282.alb | 1 | 0 | Optimal | 3.82 | 12 | 0.00 | 0.00 |
| instance n=50 283.alb | 1 | 0 | Optimal | 0.34 | 12 | 0.00 | 0.00 |
| instance n=50 284.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 285.alb | 1 | 0 | Optimal | 0.31 | 13 | 0.00 | 0.00 |
| instance n=50 286.alb | 1 | 0 | Optimal | 0.34 | 11 | 0.00 | 0.00 |
| instance n=50 287.alb | 1 | 0 | Optimal | 0.47 | 12 | 0.00 | 0.00 |
| instance n=50 288.alb | 1 | 0 | Optimal | 0.36 | 10 | 0.00 | 0.00 |
| instance n=50 289.alb | 1 | 0 | Optimal | 0.38 | 11 | 0.00 | 0.00 |
| instance n=50 29.alb | 1 | 0 | Optimal | 0.28 | 29 | 0.00 | 0.00 |
| instance n=50 290.alb | 1 | 0 | Optimal | 0.31 | 14 | 0.00 | 0.00 |
| instance n=50 291.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 292.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 293.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=50 294.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=50 295.alb | 1 | 0 | Optimal | 0.30 | 16 | 0.00 | 0.00 |
| instance n=50 296.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=50 297.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 298.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 299.alb | 1 | 0 | Optimal | 1.22 | 12 | 0.00 | 0.00 |
| instance n=50 3.alb | 1 | 0 | Optimal | 0.25 | 8 | 0.00 | 0.00 |
| instance n=50 30.alb | 1 | 0 | Optimal | 21.20 | 26 | 0.00 | 0.00 |
| instance n=50 300.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 301.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=50 302.alb | 1 | 0 | Optimal | 0.39 | 7 | 0.00 | 0.00 |
| instance n=50 303.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 304.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 305.alb | 1 | 0 | Optimal | 0.26 | 8 | 0.00 | 0.00 |
| instance n=50 306.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 307.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 308.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 309.alb | 1 | 0 | Optimal | 0.31 | 7 | 0.00 | 0.00 |
| instance n=50 31.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=50 310.alb | 1 | 0 | Optimal | 0.28 | 8 | 0.00 | 0.00 |
| instance n=50 311.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 312.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=50 313.alb | 1 | 0 | Optimal | 0.28 | 8 | 0.00 | 0.00 |
| instance n=50 314.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 315.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 316.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 317.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |
| instance n=50 318.alb | 1 | 0 | Optimal | 0.25 | 8 | 0.00 | 0.00 |
| instance n=50 319.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 32.alb | 1 | 0 | Optimal | 0.90 | 25 | 0.00 | 0.00 |
| instance n=50 320.alb | 1 | 0 | Optimal | 0.25 | 8 | 0.00 | 0.00 |
| instance n=50 321.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=50 322.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 323.alb | 1 | 0 | Optimal | 0.25 | 7 | 0.00 | 0.00 |
| instance n=50 324.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 325.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 326.alb | 1 | 0 | Optimal | 0.35 | 33 | 0.00 | 0.00 |
| instance n=50 327.alb | 1 | 0 | Optimal | 0.29 | 28 | 0.00 | 0.00 |
| instance n=50 328.alb | 1 | 0 | Optimal | 0.29 | 32 | 0.00 | 0.00 |
| instance n=50 329.alb | 1 | 0 | Unknown | 120224.00 | - | - | - |
| instance n=50 33.alb | 1 | 0 | Unknown | 120223.00 | - | - | - |
| instance n=50 330.alb | 1 | 0 | Optimal | 0.27 | 29 | 0.00 | 0.00 |
| instance n=50 331.alb | 1 | 0 | Optimal | 0.83 | 29 | 0.00 | 0.00 |
| instance n=50 332.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=50 333.alb | 1 | 0 | Optimal | 0.51 | 28 | 0.00 | 0.00 |
| instance n=50 334.alb | 1 | 0 | Optimal | 0.28 | 29 | 0.00 | 0.00 |
| instance n=50 335.alb | 1 | 0 | Optimal | 0.40 | 27 | 0.00 | 0.00 |
| instance n=50 336.alb | 1 | 0 | Unknown | 120222.00 | - | - | - |
| instance n=50 337.alb | 1 | 0 | Optimal | 0.49 | 26 | 0.00 | 0.00 |
| instance n=50 338.alb | 1 | 0 | Optimal | 11.11 | 26 | 0.00 | 0.00 |
| instance n=50 339.alb | 1 | 0 | Optimal | 0.35 | 27 | 0.00 | 0.00 |
| instance n=50 34.alb | 1 | 0 | Optimal | 0.45 | 30 | 0.00 | 0.00 |
| instance n=50 340.alb | 1 | 0 | Unknown | 120230.00 | - | - | - |
| instance n=50 341.alb | 1 | 0 | Optimal | 0.33 | 27 | 0.00 | 0.00 |
| instance n=50 342.alb | 1 | 0 | Unknown | 120219.00 | - | - | - |
| instance n=50 343.alb | 1 | 0 | Optimal | 0.35 | 27 | 0.00 | 0.00 |
| instance n=50 344.alb | 1 | 0 | Optimal | 0.79 | 30 | 0.00 | 0.00 |
| instance n=50 345.alb | 1 | 0 | Optimal | 0.74 | 29 | 0.00 | 0.00 |
| instance n=50 346.alb | 1 | 0 | Optimal | 0.34 | 27 | 0.00 | 0.00 |
| instance n=50 347.alb | 1 | 0 | Optimal | 7.23 | 25 | 0.00 | 0.00 |
| instance n=50 348.alb | 1 | 0 | Optimal | 0.30 | 30 | 0.00 | 0.00 |
| instance n=50 349.alb | 1 | 0 | Optimal | 1.58 | 28 | 0.00 | 0.00 |
| instance n=50 35.alb | 1 | 0 | Optimal | 1.44 | 31 | 0.00 | 0.00 |
| instance n=50 350.alb | 1 | 0 | Unknown | 120233.00 | - | - | - |
| instance n=50 351.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 352.alb | 1 | 0 | Optimal | 1.33 | 10 | 0.00 | 0.00 |
| instance n=50 353.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=50 354.alb | 1 | 0 | Optimal | 27.87 | 13 | 0.00 | 0.00 |
| instance n=50 355.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 356.alb | 1 | 0 | Optimal | 0.27 | 15 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 357.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 358.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=50 359.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=50 36.alb | 1 | 0 | Optimal | 0.34 | 31 | 0.00 | 0.00 |
| instance n=50 360.alb | 1 | 0 | Optimal | 0.32 | 12 | 0.00 | 0.00 |
| instance n=50 361.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=50 362.alb | 1 | 0 | Optimal | 0.27 | 10 | 0.00 | 0.00 |
| instance n=50 363.alb | 1 | 0 | Unknown | 120230.00 | - | - | - |
| instance n=50 364.alb | 1 | 0 | Optimal | 0.30 | 13 | 0.00 | 0.00 |
| instance n=50 365.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 366.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 367.alb | 1 | 0 | Optimal | 0.31 | 12 | 0.00 | 0.00 |
| instance n=50 368.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=50 369.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 37.alb | 1 | 0 | Unknown | 120216.00 | - | - | - |
| instance n=50 370.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 371.alb | 1 | 0 | Optimal | 0.84 | 11 | 0.00 | 0.00 |
| instance n=50 372.alb | 1 | 0 | Optimal | 1.94 | 10 | 0.00 | 0.00 |
| instance n=50 373.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=50 374.alb | 1 | 0 | Optimal | 0.26 | 11 | 0.00 | 0.00 |
| instance n=50 375.alb | 1 | 0 | Optimal | 0.31 | 13 | 0.00 | 0.00 |
| instance n=50 376.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=50 377.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 378.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 379.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 38.alb | 1 | 0 | Optimal | 0.47 | 31 | 0.00 | 0.00 |
| instance n=50 380.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 381.alb | 1 | 0 | Optimal | 0.28 | 8 | 0.00 | 0.00 |
| instance n=50 382.alb | 1 | 0 | Optimal | 0.26 | 6 | 0.00 | 0.00 |
| instance n=50 383.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 384.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 385.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 386.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 387.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 388.alb | 1 | 0 | Optimal | 0.41 | 7 | 0.00 | 0.00 |
| instance n=50 389.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 39.alb | 1 | 0 | Unknown | 120223.00 | - | - | - |
| instance n=50 390.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=50 391.alb | 1 | 0 | Optimal | 0.43 | 7 | 0.00 | 0.00 |
| instance n=50 392.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 393.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 394.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 395.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=50 396.alb | 1 | 0 | Optimal | 0.26 | 8 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 397.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 398.alb | 1 | 0 | Optimal | 0.32 | 6 | 0.00 | 0.00 |
| instance n=50 399.alb | 1 | 0 | Optimal | 0.65 | 7 | 0.00 | 0.00 |
| instance n=50 4.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 40.alb | 1 | 0 | Optimal | 1.81 | 26 | 0.00 | 0.00 |
| instance n=50 400.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 401.alb | 1 | 0 | Optimal | 57.99 | 28 | 0.00 | 0.00 |
| instance n=50 402.alb | 1 | 0 | Optimal | 0.59 | 27 | 0.00 | 0.00 |
| instance n=50 403.alb | 1 | 0 | Optimal | 3.11 | 34 | 0.00 | 0.00 |
| instance n=50 404.alb | 1 | 0 | Optimal | 3.16 | 31 | 0.00 | 0.00 |
| instance n=50 405.alb | 1 | 0 | Optimal | 2.26 | 27 | 0.00 | 0.00 |
| instance n=50 406.alb | 1 | 0 | Optimal | 0.75 | 32 | 0.00 | 0.00 |
| instance n=50 407.alb | 1 | 0 | Optimal | 9.11 | 29 | 0.00 | 0.00 |
| instance n=50 408.alb | 1 | 0 | Optimal | 0.35 | 26 | 0.00 | 0.00 |
| instance n=50 409.alb | 1 | 0 | Optimal | 6.88 | 33 | 0.00 | 0.00 |
| instance n=50 41.alb | 1 | 0 | Optimal | 17.22 | 25 | 0.00 | 0.00 |
| instance n=50 410.alb | 1 | 0 | Optimal | 0.49 | 28 | 0.00 | 0.00 |
| instance n=50 411.alb | 1 | 0 | Optimal | 0.36 | 29 | 0.00 | 0.00 |
| instance n=50 412.alb | 1 | 0 | Optimal | 0.37 | 26 | 0.00 | 0.00 |
| instance n=50 413.alb | 1 | 0 | Optimal | 0.39 | 30 | 0.00 | 0.00 |
| instance n=50 414.alb | 1 | 0 | Optimal | 24.18 | 27 | 0.00 | 0.00 |
| instance n=50 415.alb | 1 | 0 | Optimal | 0.38 | 28 | 0.00 | 0.00 |
| instance n=50 416.alb | 1 | 0 | Optimal | 0.46 | 27 | 0.00 | 0.00 |
| instance n=50 417.alb | 1 | 0 | Optimal | 53.93 | 30 | 0.00 | 0.00 |
| instance n=50 418.alb | 1 | 0 | Optimal | 1.38 | 27 | 0.00 | 0.00 |
| instance n=50 419.alb | 1 | 0 | Optimal | 11.25 | 33 | 0.00 | 0.00 |
| instance n=50 42.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=50 420.alb | 1 | 0 | Optimal | 11.48 | 28 | 0.00 | 0.00 |
| instance n=50 421.alb | 1 | 0 | Optimal | 2.20 | 34 | 0.00 | 0.00 |
| instance n=50 422.alb | 1 | 0 | Optimal | 4.10 | 29 | 0.00 | 0.00 |
| instance n=50 423.alb | 1 | 0 | Optimal | 0.43 | 29 | 0.00 | 0.00 |
| instance n=50 424.alb | 1 | 0 | Optimal | 1.05 | 27 | 0.00 | 0.00 |
| instance n=50 425.alb | 1 | 0 | Optimal | 4.65 | 34 | 0.00 | 0.00 |
| instance n=50 426.alb | 1 | 0 | Optimal | 0.35 | 11 | 0.00 | 0.00 |
| instance n=50 427.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 428.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=50 429.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=50 43.alb | 1 | 0 | Optimal | 0.70 | 25 | 0.00 | 0.00 |
| instance n=50 430.alb | 1 | 0 | Optimal | 1.10 | 14 | 0.00 | 0.00 |
| instance n=50 431.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=50 432.alb | 1 | 0 | Optimal | 0.37 | 12 | 0.00 | 0.00 |
| instance n=50 433.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 434.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 435.alb | 1 | 0 | Optimal | 0.26 | 11 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 436.alb | 1 | 0 | Optimal | 0.31 | 11 | 0.00 | 0.00 |
| instance n=50 437.alb | 1 | 0 | Optimal | 5.39 | 12 | 0.00 | 0.00 |
| instance n=50 438.alb | 1 | 0 | Optimal | 1.71 | 10 | 0.00 | 0.00 |
| instance n=50 439.alb | 1 | 0 | Optimal | 1.25 | 12 | 0.00 | 0.00 |
| instance n=50 44.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=50 440.alb | 1 | 0 | Optimal | 1.33 | 13 | 0.00 | 0.00 |
| instance n=50 441.alb | 1 | 0 | Optimal | 0.32 | 11 | 0.00 | 0.00 |
| instance n=50 442.alb | 1 | 0 | Optimal | 0.31 | 12 | 0.00 | 0.00 |
| instance n=50 443.alb | 1 | 0 | Optimal | 0.32 | 11 | 0.00 | 0.00 |
| instance n=50 444.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 445.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=50 446.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |
| instance n=50 447.alb | 1 | 0 | Optimal | 0.31 | 13 | 0.00 | 0.00 |
| instance n=50 448.alb | 1 | 0 | Optimal | 0.87 | 12 | 0.00 | 0.00 |
| instance n=50 449.alb | 1 | 0 | Optimal | 0.32 | 11 | 0.00 | 0.00 |
| instance n=50 45.alb | 1 | 0 | Unknown | 120231.00 | - | - | - |
| instance n=50 450.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=50 451.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 452.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 453.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 454.alb | 1 | 0 | Optimal | 0.26 | 8 | 0.00 | 0.00 |
| instance n=50 455.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=50 456.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 457.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 458.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 459.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 46.alb | 1 | 0 | Optimal | 0.46 | 28 | 0.00 | 0.00 |
| instance n=50 460.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 461.alb | 1 | 0 | Optimal | 0.27 | 6 | 0.00 | 0.00 |
| instance n=50 462.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 463.alb | 1 | 0 | Optimal | 0.44 | 8 | 0.00 | 0.00 |
| instance n=50 464.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=50 465.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 466.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 467.alb | 1 | 0 | Optimal | 0.29 | 9 | 0.00 | 0.00 |
| instance n=50 468.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 469.alb | 1 | 0 | Optimal | 0.30 | 8 | 0.00 | 0.00 |
| instance n=50 47.alb | 1 | 0 | Optimal | 0.66 | 28 | 0.00 | 0.00 |
| instance n=50 470.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 471.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 472.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 473.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 474.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 475.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 476.alb | 1 | 0 | Optimal | 0.32 | 28 | 0.00 | 0.00 |
| instance n=50 477.alb | 1 | 0 | Optimal | 0.31 | 29 | 0.00 | 0.00 |
| instance n=50 478.alb | 1 | 0 | Optimal | 0.34 | 32 | 0.00 | 0.00 |
| instance n=50 479.alb | 1 | 0 | Optimal | 0.31 | 28 | 0.00 | 0.00 |
| instance n=50 48.alb | 1 | 0 | Optimal | 1.37 | 27 | 0.00 | 0.00 |
| instance n=50 480.alb | 1 | 0 | Optimal | 0.29 | 34 | 0.00 | 0.00 |
| instance n=50 481.alb | 1 | 0 | Optimal | 0.30 | 28 | 0.00 | 0.00 |
| instance n=50 482.alb | 1 | 0 | Optimal | 0.30 | 27 | 0.00 | 0.00 |
| instance n=50 483.alb | 1 | 0 | Optimal | 0.36 | 30 | 0.00 | 0.00 |
| instance n=50 484.alb | 1 | 0 | Optimal | 0.28 | 32 | 0.00 | 0.00 |
| instance n=50 485.alb | 1 | 0 | Optimal | 0.31 | 31 | 0.00 | 0.00 |
| instance n=50 486.alb | 1 | 0 | Optimal | 0.33 | 32 | 0.00 | 0.00 |
| instance n=50 487.alb | 1 | 0 | Optimal | 0.39 | 31 | 0.00 | 0.00 |
| instance n=50 488.alb | 1 | 0 | Optimal | 0.30 | 31 | 0.00 | 0.00 |
| instance n=50 489.alb | 1 | 0 | Optimal | 0.32 | 35 | 0.00 | 0.00 |
| instance n=50 49.alb | 1 | 0 | Optimal | 0.40 | 25 | 0.00 | 0.00 |
| instance n=50 490.alb | 1 | 0 | Optimal | 0.29 | 29 | 0.00 | 0.00 |
| instance n=50 491.alb | 1 | 0 | Optimal | 0.30 | 35 | 0.00 | 0.00 |
| instance n=50 492.alb | 1 | 0 | Optimal | 0.28 | 29 | 0.00 | 0.00 |
| instance n=50 493.alb | 1 | 0 | Optimal | 0.35 | 30 | 0.00 | 0.00 |
| instance n=50 494.alb | 1 | 0 | Optimal | 0.30 | 32 | 0.00 | 0.00 |
| instance n=50 495.alb | 1 | 0 | Optimal | 0.30 | 34 | 0.00 | 0.00 |
| instance n=50 496.alb | 1 | 0 | Optimal | 0.31 | 29 | 0.00 | 0.00 |
| instance n=50 497.alb | 1 | 0 | Optimal | 0.34 | 30 | 0.00 | 0.00 |
| instance n=50 498.alb | 1 | 0 | Optimal | 0.31 | 30 | 0.00 | 0.00 |
| instance n=50 499.alb | 1 | 0 | Optimal | 0.34 | 33 | 0.00 | 0.00 |
| instance n=50 5.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 50.alb | 1 | 0 | Unknown | 120227.00 | - | - | - |
| instance n=50 500.alb | 1 | 0 | Optimal | 0.33 | 34 | 0.00 | 0.00 |
| instance n=50 501.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 502.alb | 1 | 0 | Optimal | 0.28 | 10 | 0.00 | 0.00 |
| instance n=50 503.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 504.alb | 1 | 0 | Optimal | 0.26 | 11 | 0.00 | 0.00 |
| instance n=50 505.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 506.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 507.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 508.alb | 1 | 0 | Optimal | 0.28 | 14 | 0.00 | 0.00 |
| instance n=50 509.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 51.alb | 1 | 0 | Optimal | 0.28 | 12 | 0.00 | 0.00 |
| instance n=50 510.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=50 511.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 512.alb | 1 | 0 | Optimal | 0.31 | 13 | 0.00 | 0.00 |
| instance n=50 513.alb | 1 | 0 | Optimal | 0.31 | 12 | 0.00 | 0.00 |
| instance n=50 514.alb | 1 | 0 | Optimal | 0.30 | 12 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-----------|----------|-------|----------------|
| instance n=50 515.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=50 516.alb | 1 | 0 | Optimal | 0.29 | 13 | 0.00 | 0.00 |
| instance n=50 517.alb | 1 | 0 | Optimal | 0.29 | 14 | 0.00 | 0.00 |
| instance n=50 518.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 519.alb | 1 | 0 | Optimal | 0.31 | 12 | 0.00 | 0.00 |
| instance n=50 52.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 520.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 521.alb | 1 | 0 | Optimal | 0.28 | 10 | 0.00 | 0.00 |
| instance n=50 522.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 523.alb | 1 | 0 | Optimal | 0.27 | 11 | 0.00 | 0.00 |
| instance n=50 524.alb | 1 | 0 | Optimal | 0.27 | 14 | 0.00 | 0.00 |
| instance n=50 525.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 53.alb | 1 | 0 | Unknown | 120218.00 | - | - | - |
| instance n=50 54.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=50 55.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 56.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=50 57.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 58.alb | 1 | 0 | Optimal | 0.30 | 11 | 0.00 | 0.00 |
| instance n=50 59.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=50 6.alb | 1 | 0 | Optimal | 0.28 | 6 | 0.00 | 0.00 |
| instance n=50 60.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 61.alb | 1 | 0 | Optimal | 0.31 | 13 | 0.00 | 0.00 |
| instance n=50 62.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 63.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 64.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 65.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 66.alb | 1 | 0 | Optimal | 0.31 | 12 | 0.00 | 0.00 |
| instance n=50 67.alb | 1 | 0 | Optimal | 0.33 | 12 | 0.00 | 0.00 |
| instance n=50 68.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 69.alb | 1 | 0 | Optimal | 0.29 | 12 | 0.00 | 0.00 |
| instance n=50 7.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 70.alb | 1 | 0 | Optimal | 0.31 | 10 | 0.00 | 0.00 |
| instance n=50 71.alb | 1 | 0 | Optimal | 0.28 | 13 | 0.00 | 0.00 |
| instance n=50 72.alb | 1 | 0 | Optimal | 0.29 | 11 | 0.00 | 0.00 |
| instance n=50 73.alb | 1 | 0 | Optimal | 0.28 | 11 | 0.00 | 0.00 |
| instance n=50 74.alb | 1 | 0 | Optimal | 0.27 | 12 | 0.00 | 0.00 |
| instance n=50 75.alb | 1 | 0 | Optimal | 0.40 | 11 | 0.00 | 0.00 |
| instance n=50 76.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 77.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 78.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 79.alb | 1 | 0 | Optimal | 0.32 | 8 | 0.00 | 0.00 |
| instance n=50 8.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 80.alb | 1 | 0 | Optimal | 0.31 | 7 | 0.00 | 0.00 |
| instance n=50 81.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |

Table 6.5: Results for SALBP-1 Problems (MiniZinc/CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=50 82.alb | 1 | 0 | Optimal | 0.30 | 6 | 0.00 | 0.00 |
| instance n=50 83.alb | 1 | 0 | Optimal | 0.31 | 8 | 0.00 | 0.00 |
| instance n=50 84.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 85.alb | 1 | 0 | Optimal | 0.27 | 8 | 0.00 | 0.00 |
| instance n=50 86.alb | 1 | 0 | Optimal | 0.32 | 7 | 0.00 | 0.00 |
| instance n=50 87.alb | 1 | 0 | Optimal | 0.29 | 8 | 0.00 | 0.00 |
| instance n=50 88.alb | 1 | 0 | Optimal | 0.30 | 8 | 0.00 | 0.00 |
| instance n=50 89.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |
| instance n=50 9.alb | 1 | 0 | Optimal | 0.29 | 9 | 0.00 | 0.00 |
| instance n=50 90.alb | 1 | 0 | Optimal | 0.35 | 7 | 0.00 | 0.00 |
| instance n=50 91.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=50 92.alb | 1 | 0 | Optimal | 0.26 | 7 | 0.00 | 0.00 |
| instance n=50 93.alb | 1 | 0 | Optimal | 0.28 | 7 | 0.00 | 0.00 |
| instance n=50 94.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 95.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 96.alb | 1 | 0 | Optimal | 0.27 | 7 | 0.00 | 0.00 |
| instance n=50 97.alb | 1 | 0 | Optimal | 0.30 | 7 | 0.00 | 0.00 |
| instance n=50 98.alb | 1 | 0 | Optimal | 0.40 | 8 | 0.00 | 0.00 |
| instance n=50 99.alb | 1 | 0 | Optimal | 0.29 | 7 | 0.00 | 0.00 |

6.6 Alternative Model

6.6.1 CPO

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 1.alb | 1 | 1 | Solution | 120.20 | 136 | 135.00 | 0.74 |
| instance n=1000 10.alb | 1 | 1 | Solution | 120.07 | 140 | 140.00 | 0.00 |
| instance n=1000 100.alb | 1 | 1 | Solution | 120.05 | 138 | 137.00 | 0.72 |
| instance n=1000 101.alb | 1 | 1 | Solution | 120.13 | 552 | 505.00 | 8.51 |
| instance n=1000 102.alb | 1 | 1 | Solution | 120.25 | 549 | 503.00 | 8.38 |
| instance n=1000 103.alb | 1 | 1 | Solution | 120.11 | 556 | 503.00 | 9.53 |
| instance n=1000 104.alb | 1 | 1 | Solution | 120.24 | 544 | 504.00 | 7.35 |
| instance n=1000 105.alb | 1 | 1 | Solution | 120.13 | 536 | 499.00 | 6.90 |
| instance n=1000 106.alb | 1 | 1 | Solution | 120.13 | 545 | 499.00 | 8.44 |
| instance n=1000 107.alb | 1 | 1 | Solution | 120.05 | 531 | 496.00 | 6.59 |
| instance n=1000 108.alb | 1 | 1 | Solution | 120.08 | 538 | 498.00 | 7.43 |
| instance n=1000 109.alb | 1 | 1 | Solution | 120.05 | 541 | 500.00 | 7.58 |
| instance n=1000 11.alb | 1 | 1 | Solution | 120.06 | 135 | 134.00 | 0.74 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 110.alb | 1 | 1 | Solution | 120.12 | 548 | 501.00 | 8.58 |
| instance n=1000 111.alb | 1 | 1 | Solution | 120.08 | 536 | 500.00 | 6.72 |
| instance n=1000 112.alb | 1 | 1 | Solution | 120.15 | 542 | 499.00 | 7.93 |
| instance n=1000 113.alb | 1 | 1 | Solution | 120.13 | 533 | 495.00 | 7.13 |
| instance n=1000 114.alb | 1 | 1 | Solution | 120.12 | 539 | 502.00 | 6.86 |
| instance n=1000 115.alb | 1 | 1 | Solution | 120.08 | 533 | 498.00 | 6.57 |
| instance n=1000 116.alb | 1 | 1 | Solution | 120.07 | 536 | 496.00 | 7.46 |
| instance n=1000 117.alb | 1 | 1 | Solution | 120.05 | 542 | 500.00 | 7.75 |
| instance n=1000 118.alb | 1 | 1 | Solution | 120.04 | 556 | 509.00 | 8.45 |
| instance n=1000 119.alb | 1 | 1 | Solution | 120.15 | 525 | 496.00 | 5.52 |
| instance n=1000 12.alb | 1 | 1 | Solution | 120.04 | 134 | 134.00 | 0.00 |
| instance n=1000 120.alb | 1 | 1 | Solution | 120.03 | 541 | 502.00 | 7.21 |
| instance n=1000 121.alb | 1 | 1 | Solution | 120.10 | 533 | 496.00 | 6.94 |
| instance n=1000 122.alb | 1 | 1 | Solution | 120.10 | 524 | 493.00 | 5.92 |
| instance n=1000 123.alb | 1 | 1 | Solution | 120.05 | 545 | 504.00 | 7.52 |
| instance n=1000 124.alb | 1 | 1 | Solution | 120.04 | 533 | 498.00 | 6.57 |
| instance n=1000 125.alb | 1 | 1 | Solution | 120.04 | 537 | 499.00 | 7.08 |
| instance n=1000 126.alb | 1 | 1 | Solution | 120.08 | 231 | 228.00 | 1.30 |
| instance n=1000 127.alb | 1 | 1 | Solution | 120.08 | 222 | 221.00 | 0.45 |
| instance n=1000 128.alb | 1 | 1 | Solution | 120.08 | 224 | 222.00 | 0.89 |
| instance n=1000 129.alb | 1 | 1 | Solution | 120.08 | 224 | 223.00 | 0.45 |
| instance n=1000 13.alb | 1 | 1 | Solution | 120.06 | 132 | 131.00 | 0.76 |
| instance n=1000 130.alb | 1 | 1 | Solution | 120.08 | 223 | 221.00 | 0.90 |
| instance n=1000 131.alb | 1 | 1 | Solution | 120.09 | 222 | 220.00 | 0.90 |
| instance n=1000 132.alb | 1 | 1 | Solution | 120.06 | 216 | 214.00 | 0.93 |
| instance n=1000 133.alb | 1 | 1 | Solution | 120.11 | 228 | 226.00 | 0.88 |
| instance n=1000 134.alb | 1 | 1 | Solution | 120.10 | 217 | 215.00 | 0.92 |
| instance n=1000 135.alb | 1 | 1 | Solution | 120.07 | 227 | 225.00 | 0.88 |
| instance n=1000 136.alb | 1 | 1 | Solution | 120.08 | 230 | 228.00 | 0.87 |
| instance n=1000 137.alb | 1 | 1 | Solution | 120.11 | 215 | 213.00 | 0.93 |
| instance n=1000 138.alb | 1 | 1 | Solution | 120.10 | 223 | 221.00 | 0.90 |
| instance n=1000 139.alb | 1 | 1 | Solution | 120.08 | 226 | 224.00 | 0.88 |
| instance n=1000 14.alb | 1 | 1 | Solution | 120.05 | 137 | 136.00 | 0.73 |
| instance n=1000 140.alb | 1 | 1 | Solution | 120.09 | 228 | 226.00 | 0.88 |
| instance n=1000 141.alb | 1 | 1 | Solution | 120.09 | 217 | 215.00 | 0.92 |
| instance n=1000 142.alb | 1 | 1 | Solution | 120.04 | 222 | 220.00 | 0.90 |
| instance n=1000 143.alb | 1 | 1 | Solution | 120.04 | 215 | 213.00 | 0.93 |
| instance n=1000 144.alb | 1 | 1 | Solution | 120.07 | 219 | 217.00 | 0.91 |
| instance n=1000 145.alb | 1 | 1 | Solution | 120.08 | 222 | 220.00 | 0.90 |
| instance n=1000 146.alb | 1 | 1 | Solution | 120.08 | 221 | 219.00 | 0.90 |
| instance n=1000 147.alb | 1 | 1 | Solution | 120.05 | 232 | 229.00 | 1.29 |
| instance n=1000 148.alb | 1 | 1 | Solution | 120.09 | 221 | 219.00 | 0.90 |
| instance n=1000 149.alb | 1 | 1 | Solution | 120.08 | 239 | 237.00 | 0.84 |
| instance n=1000 15.alb | 1 | 1 | Solution | 120.04 | 136 | 136.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 150.alb | 1 | 1 | Solution | 120.06 | 224 | 222.00 | 0.89 |
| instance n=1000 151.alb | 1 | 1 | Solution | 120.04 | 139 | 138.00 | 0.72 |
| instance n=1000 152.alb | 1 | 1 | Solution | 120.06 | 137 | 136.00 | 0.73 |
| instance n=1000 153.alb | 1 | 1 | Solution | 120.05 | 138 | 137.00 | 0.72 |
| instance n=1000 154.alb | 1 | 1 | Solution | 120.06 | 140 | 140.00 | 0.00 |
| instance n=1000 155.alb | 1 | 1 | Solution | 120.08 | 140 | 139.00 | 0.71 |
| instance n=1000 156.alb | 1 | 1 | Solution | 120.08 | 142 | 141.00 | 0.70 |
| instance n=1000 157.alb | 1 | 1 | Solution | 120.09 | 141 | 140.00 | 0.71 |
| instance n=1000 158.alb | 1 | 1 | Solution | 120.03 | 136 | 136.00 | 0.00 |
| instance n=1000 159.alb | 1 | 1 | Solution | 120.06 | 139 | 138.00 | 0.72 |
| instance n=1000 16.alb | 1 | 1 | Solution | 120.06 | 137 | 137.00 | 0.00 |
| instance n=1000 160.alb | 1 | 1 | Solution | 120.07 | 139 | 138.00 | 0.72 |
| instance n=1000 161.alb | 1 | 1 | Solution | 120.06 | 133 | 133.00 | 0.00 |
| instance n=1000 162.alb | 1 | 1 | Solution | 120.06 | 136 | 136.00 | 0.00 |
| instance n=1000 163.alb | 1 | 1 | Solution | 120.04 | 140 | 139.00 | 0.71 |
| instance n=1000 164.alb | 1 | 1 | Solution | 120.03 | 142 | 141.00 | 0.70 |
| instance n=1000 165.alb | 1 | 1 | Solution | 120.06 | 136 | 135.00 | 0.74 |
| instance n=1000 166.alb | 1 | 1 | Solution | 120.03 | 140 | 139.00 | 0.71 |
| instance n=1000 167.alb | 1 | 1 | Solution | 120.04 | 140 | 139.00 | 0.71 |
| instance n=1000 168.alb | 1 | 1 | Solution | 120.06 | 139 | 138.00 | 0.72 |
| instance n=1000 169.alb | 1 | 1 | Solution | 120.02 | 135 | 134.00 | 0.74 |
| instance n=1000 17.alb | 1 | 1 | Solution | 120.06 | 135 | 135.00 | 0.00 |
| instance n=1000 170.alb | 1 | 1 | Solution | 120.07 | 135 | 134.00 | 0.74 |
| instance n=1000 171.alb | 1 | 1 | Solution | 120.08 | 138 | 137.00 | 0.72 |
| instance n=1000 172.alb | 1 | 1 | Solution | 120.04 | 136 | 135.00 | 0.74 |
| instance n=1000 173.alb | 1 | 1 | Solution | 120.06 | 136 | 135.00 | 0.74 |
| instance n=1000 174.alb | 1 | 1 | Solution | 120.07 | 137 | 136.00 | 0.73 |
| instance n=1000 175.alb | 1 | 1 | Solution | 120.06 | 139 | 138.00 | 0.72 |
| instance n=1000 176.alb | 1 | 1 | Solution | 120.11 | 538 | 500.00 | 7.06 |
| instance n=1000 177.alb | 1 | 1 | Solution | 120.04 | 532 | 499.00 | 6.20 |
| instance n=1000 178.alb | 1 | 1 | Solution | 120.10 | 553 | 506.00 | 8.50 |
| instance n=1000 179.alb | 1 | 1 | Solution | 120.06 | 544 | 505.00 | 7.17 |
| instance n=1000 18.alb | 1 | 1 | Solution | 120.05 | 134 | 134.00 | 0.00 |
| instance n=1000 180.alb | 1 | 1 | Solution | 120.05 | 554 | 503.00 | 9.21 |
| instance n=1000 181.alb | 1 | 1 | Solution | 120.02 | 549 | 505.00 | 8.01 |
| instance n=1000 182.alb | 1 | 1 | Solution | 120.10 | 543 | 502.00 | 7.55 |
| instance n=1000 183.alb | 1 | 1 | Solution | 120.08 | 539 | 500.00 | 7.24 |
| instance n=1000 184.alb | 1 | 1 | Solution | 120.07 | 546 | 502.00 | 8.06 |
| instance n=1000 185.alb | 1 | 1 | Solution | 120.08 | 545 | 503.00 | 7.71 |
| instance n=1000 186.alb | 1 | 1 | Solution | 120.12 | 536 | 500.00 | 6.72 |
| instance n=1000 187.alb | 1 | 1 | Solution | 120.07 | 553 | 505.00 | 8.68 |
| instance n=1000 188.alb | 1 | 1 | Solution | 120.05 | 538 | 498.00 | 7.43 |
| instance n=1000 189.alb | 1 | 1 | Solution | 120.05 | 533 | 498.00 | 6.57 |
| instance n=1000 19.alb | 1 | 1 | Solution | 120.07 | 137 | 137.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 190.alb | 1 | 1 | Solution | 120.12 | 543 | 501.00 | 7.73 |
| instance n=1000 191.alb | 1 | 1 | Solution | 120.11 | 542 | 501.00 | 7.56 |
| instance n=1000 192.alb | 1 | 1 | Solution | 120.10 | 539 | 501.00 | 7.05 |
| instance n=1000 193.alb | 1 | 1 | Solution | 120.10 | 542 | 503.00 | 7.20 |
| instance n=1000 194.alb | 1 | 1 | Solution | 120.09 | 540 | 502.00 | 7.04 |
| instance n=1000 195.alb | 1 | 1 | Solution | 120.13 | 553 | 502.00 | 9.22 |
| instance n=1000 196.alb | 1 | 1 | Solution | 120.09 | 545 | 500.00 | 8.26 |
| instance n=1000 197.alb | 1 | 1 | Solution | 120.06 | 523 | 496.00 | 5.16 |
| instance n=1000 198.alb | 1 | 1 | Solution | 120.11 | 548 | 503.00 | 8.21 |
| instance n=1000 199.alb | 1 | 1 | Solution | 120.04 | 527 | 495.00 | 6.07 |
| instance n=1000 2.alb | 1 | 1 | Solution | 120.04 | 138 | 137.00 | 0.72 |
| instance n=1000 20.alb | 1 | 1 | Solution | 120.01 | 138 | 138.00 | 0.00 |
| instance n=1000 200.alb | 1 | 1 | Solution | 120.04 | 529 | 498.00 | 5.86 |
| instance n=1000 201.alb | 1 | 1 | Solution | 120.01 | 231 | 229.00 | 0.87 |
| instance n=1000 202.alb | 1 | 1 | Solution | 120.04 | 228 | 225.00 | 1.32 |
| instance n=1000 203.alb | 1 | 1 | Solution | 120.02 | 232 | 229.00 | 1.29 |
| instance n=1000 204.alb | 1 | 1 | Solution | 120.06 | 231 | 228.00 | 1.30 |
| instance n=1000 205.alb | 1 | 1 | Solution | 120.04 | 231 | 229.00 | 0.87 |
| instance n=1000 206.alb | 1 | 1 | Solution | 120.06 | 231 | 229.00 | 0.87 |
| instance n=1000 207.alb | 1 | 1 | Solution | 120.08 | 232 | 230.00 | 0.86 |
| instance n=1000 208.alb | 1 | 1 | Solution | 120.04 | 232 | 229.00 | 1.29 |
| instance n=1000 209.alb | 1 | 1 | Solution | 120.01 | 230 | 228.00 | 0.87 |
| instance n=1000 21.alb | 1 | 1 | Solution | 120.04 | 138 | 138.00 | 0.00 |
| instance n=1000 210.alb | 1 | 1 | Solution | 120.07 | 226 | 224.00 | 0.88 |
| instance n=1000 211.alb | 1 | 1 | Solution | 120.07 | 221 | 219.00 | 0.90 |
| instance n=1000 212.alb | 1 | 1 | Solution | 120.05 | 219 | 217.00 | 0.91 |
| instance n=1000 213.alb | 1 | 1 | Solution | 120.07 | 236 | 233.00 | 1.27 |
| instance n=1000 214.alb | 1 | 1 | Solution | 120.03 | 227 | 225.00 | 0.88 |
| instance n=1000 215.alb | 1 | 1 | Solution | 120.08 | 225 | 223.00 | 0.89 |
| instance n=1000 216.alb | 1 | 1 | Solution | 120.07 | 222 | 221.00 | 0.45 |
| instance n=1000 217.alb | 1 | 1 | Solution | 120.08 | 227 | 225.00 | 0.88 |
| instance n=1000 218.alb | 1 | 1 | Solution | 120.05 | 221 | 219.00 | 0.90 |
| instance n=1000 219.alb | 1 | 1 | Solution | 120.02 | 234 | 232.00 | 0.85 |
| instance n=1000 22.alb | 1 | 1 | Solution | 120.08 | 138 | 137.00 | 0.72 |
| instance n=1000 220.alb | 1 | 1 | Solution | 120.06 | 227 | 225.00 | 0.88 |
| instance n=1000 221.alb | 1 | 1 | Solution | 120.05 | 233 | 231.00 | 0.86 |
| instance n=1000 222.alb | 1 | 1 | Solution | 120.09 | 224 | 221.00 | 1.34 |
| instance n=1000 223.alb | 1 | 1 | Solution | 120.10 | 223 | 221.00 | 0.90 |
| instance n=1000 224.alb | 1 | 1 | Solution | 120.08 | 229 | 226.00 | 1.31 |
| instance n=1000 225.alb | 1 | 1 | Solution | 120.04 | 231 | 229.00 | 0.87 |
| instance n=1000 226.alb | 1 | 1 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 227.alb | 1 | 1 | Solution | 120.07 | 139 | 138.00 | 0.72 |
| instance n=1000 228.alb | 1 | 1 | Solution | 120.09 | 134 | 133.00 | 0.75 |
| instance n=1000 229.alb | 1 | 1 | Solution | 120.09 | 135 | 134.00 | 0.74 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 23.alb | 1 | 1 | Solution | 120.03 | 136 | 136.00 | 0.00 |
| instance n=1000 230.alb | 1 | 1 | Solution | 120.06 | 132 | 131.00 | 0.76 |
| instance n=1000 231.alb | 1 | 1 | Solution | 120.11 | 139 | 138.00 | 0.72 |
| instance n=1000 232.alb | 1 | 1 | Solution | 120.09 | 134 | 133.00 | 0.75 |
| instance n=1000 233.alb | 1 | 1 | Solution | 120.07 | 136 | 135.00 | 0.74 |
| instance n=1000 234.alb | 1 | 1 | Solution | 120.03 | 138 | 137.00 | 0.72 |
| instance n=1000 235.alb | 1 | 1 | Solution | 120.08 | 134 | 133.00 | 0.75 |
| instance n=1000 236.alb | 1 | 1 | Solution | 120.13 | 137 | 136.00 | 0.73 |
| instance n=1000 237.alb | 1 | 1 | Solution | 120.10 | 139 | 138.00 | 0.72 |
| instance n=1000 238.alb | 1 | 1 | Solution | 120.05 | 139 | 138.00 | 0.72 |
| instance n=1000 239.alb | 1 | 1 | Solution | 120.06 | 136 | 135.00 | 0.74 |
| instance n=1000 24.alb | 1 | 1 | Solution | 120.07 | 140 | 140.00 | 0.00 |
| instance n=1000 240.alb | 1 | 1 | Solution | 120.02 | 136 | 135.00 | 0.74 |
| instance n=1000 241.alb | 1 | 1 | Solution | 120.03 | 139 | 138.00 | 0.72 |
| instance n=1000 242.alb | 1 | 1 | Solution | 120.05 | 136 | 135.00 | 0.74 |
| instance n=1000 243.alb | 1 | 1 | Solution | 120.08 | 138 | 137.00 | 0.72 |
| instance n=1000 244.alb | 1 | 1 | Solution | 120.08 | 138 | 137.00 | 0.72 |
| instance n=1000 245.alb | 1 | 1 | Solution | 120.10 | 136 | 135.00 | 0.74 |
| instance n=1000 246.alb | 1 | 1 | Solution | 120.04 | 136 | 135.00 | 0.74 |
| instance n=1000 247.alb | 1 | 1 | Solution | 120.05 | 139 | 138.00 | 0.72 |
| instance n=1000 248.alb | 1 | 1 | Solution | 120.05 | 140 | 138.00 | 1.43 |
| instance n=1000 249.alb | 1 | 1 | Solution | 120.09 | 139 | 138.00 | 0.72 |
| instance n=1000 25.alb | 1 | 1 | Solution | 120.04 | 136 | 136.00 | 0.00 |
| instance n=1000 250.alb | 1 | 1 | Solution | 120.10 | 141 | 140.00 | 0.71 |
| instance n=1000 251.alb | 1 | 1 | Solution | 120.07 | 558 | 502.00 | 10.04 |
| instance n=1000 252.alb | 1 | 1 | Solution | 120.05 | 560 | 501.00 | 10.54 |
| instance n=1000 253.alb | 1 | 1 | Solution | 120.04 | 555 | 502.00 | 9.55 |
| instance n=1000 254.alb | 1 | 1 | Solution | 120.12 | 550 | 501.00 | 8.91 |
| instance n=1000 255.alb | 1 | 1 | Solution | 120.11 | 547 | 498.00 | 8.96 |
| instance n=1000 256.alb | 1 | 1 | Solution | 120.14 | 542 | 495.00 | 8.67 |
| instance n=1000 257.alb | 1 | 1 | Solution | 120.04 | 559 | 502.00 | 10.20 |
| instance n=1000 258.alb | 1 | 1 | Solution | 120.13 | 556 | 497.00 | 10.61 |
| instance n=1000 259.alb | 1 | 1 | Solution | 120.18 | 545 | 496.00 | 8.99 |
| instance n=1000 26.alb | 1 | 1 | Solution | 120.10 | 541 | 502.00 | 7.21 |
| instance n=1000 260.alb | 1 | 1 | Solution | 120.09 | 547 | 495.00 | 9.51 |
| instance n=1000 261.alb | 1 | 1 | Solution | 120.10 | 553 | 501.00 | 9.40 |
| instance n=1000 262.alb | 1 | 1 | Solution | 120.14 | 534 | 495.00 | 7.30 |
| instance n=1000 263.alb | 1 | 1 | Solution | 120.07 | 553 | 499.00 | 9.76 |
| instance n=1000 264.alb | 1 | 1 | Solution | 120.12 | 546 | 499.00 | 8.61 |
| instance n=1000 265.alb | 1 | 1 | Solution | 120.07 | 570 | 506.00 | 11.23 |
| instance n=1000 266.alb | 1 | 1 | Solution | 120.12 | 554 | 500.00 | 9.75 |
| instance n=1000 267.alb | 1 | 1 | Solution | 120.17 | 560 | 506.00 | 9.64 |
| instance n=1000 268.alb | 1 | 1 | Solution | 120.05 | 544 | 497.00 | 8.64 |
| instance n=1000 269.alb | 1 | 1 | Solution | 120.17 | 549 | 500.00 | 8.93 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 27.alb | 1 | 1 | Solution | 120.12 | 542 | 502.00 | 7.38 |
| instance n=1000 270.alb | 1 | 1 | Solution | 120.05 | 578 | 508.00 | 12.11 |
| instance n=1000 271.alb | 1 | 1 | Solution | 120.10 | 543 | 497.00 | 8.47 |
| instance n=1000 272.alb | 1 | 1 | Solution | 120.05 | 558 | 502.00 | 10.04 |
| instance n=1000 273.alb | 1 | 1 | Solution | 120.10 | 552 | 500.00 | 9.42 |
| instance n=1000 274.alb | 1 | 1 | Solution | 120.08 | 554 | 496.00 | 10.47 |
| instance n=1000 275.alb | 1 | 1 | Solution | 120.06 | 563 | 504.00 | 10.48 |
| instance n=1000 276.alb | 1 | 1 | Solution | 120.11 | 220 | 217.00 | 1.36 |
| instance n=1000 277.alb | 1 | 1 | Solution | 120.11 | 228 | 225.00 | 1.32 |
| instance n=1000 278.alb | 1 | 1 | Solution | 120.11 | 224 | 220.00 | 1.79 |
| instance n=1000 279.alb | 1 | 1 | Solution | 120.04 | 218 | 215.00 | 1.38 |
| instance n=1000 28.alb | 1 | 1 | Solution | 120.13 | 526 | 497.00 | 5.51 |
| instance n=1000 280.alb | 1 | 1 | Solution | 120.13 | 229 | 226.00 | 1.31 |
| instance n=1000 281.alb | 1 | 1 | Solution | 120.15 | 223 | 219.00 | 1.79 |
| instance n=1000 282.alb | 1 | 1 | Solution | 120.14 | 217 | 214.00 | 1.38 |
| instance n=1000 283.alb | 1 | 1 | Solution | 120.05 | 227 | 224.00 | 1.32 |
| instance n=1000 284.alb | 1 | 1 | Solution | 120.16 | 220 | 217.00 | 1.36 |
| instance n=1000 285.alb | 1 | 1 | Solution | 120.09 | 225 | 221.00 | 1.78 |
| instance n=1000 286.alb | 1 | 1 | Solution | 120.17 | 225 | 221.00 | 1.78 |
| instance n=1000 287.alb | 1 | 1 | Solution | 120.06 | 227 | 224.00 | 1.32 |
| instance n=1000 288.alb | 1 | 1 | Solution | 120.14 | 222 | 219.00 | 1.35 |
| instance n=1000 289.alb | 1 | 1 | Solution | 120.06 | 224 | 220.00 | 1.79 |
| instance n=1000 29.alb | 1 | 1 | Solution | 120.10 | 530 | 498.00 | 6.04 |
| instance n=1000 290.alb | 1 | 1 | Solution | 120.04 | 225 | 222.00 | 1.33 |
| instance n=1000 291.alb | 1 | 1 | Solution | 120.05 | 228 | 225.00 | 1.32 |
| instance n=1000 292.alb | 1 | 1 | Solution | 120.04 | 229 | 226.00 | 1.31 |
| instance n=1000 293.alb | 1 | 1 | Solution | 120.15 | 228 | 225.00 | 1.32 |
| instance n=1000 294.alb | 1 | 1 | Solution | 120.11 | 233 | 230.00 | 1.29 |
| instance n=1000 295.alb | 1 | 1 | Solution | 120.12 | 230 | 227.00 | 1.30 |
| instance n=1000 296.alb | 1 | 1 | Solution | 120.16 | 210 | 208.00 | 0.95 |
| instance n=1000 297.alb | 1 | 1 | Solution | 120.17 | 219 | 217.00 | 0.91 |
| instance n=1000 298.alb | 1 | 1 | Solution | 120.09 | 218 | 214.00 | 1.83 |
| instance n=1000 299.alb | 1 | 1 | Solution | 120.09 | 229 | 226.00 | 1.31 |
| instance n=1000 3.alb | 1 | 1 | Solution | 120.05 | 137 | 136.00 | 0.73 |
| instance n=1000 30.alb | 1 | 1 | Solution | 120.06 | 546 | 506.00 | 7.33 |
| instance n=1000 300.alb | 1 | 1 | Solution | 120.12 | 232 | 228.00 | 1.72 |
| instance n=1000 301.alb | 1 | 1 | Solution | 120.10 | 137 | 137.00 | 0.00 |
| instance n=1000 302.alb | 1 | 1 | Solution | 120.06 | 139 | 139.00 | 0.00 |
| instance n=1000 303.alb | 1 | 1 | Solution | 120.09 | 139 | 138.00 | 0.72 |
| instance n=1000 304.alb | 1 | 1 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 305.alb | 1 | 1 | Solution | 120.13 | 140 | 140.00 | 0.00 |
| instance n=1000 306.alb | 1 | 1 | Solution | 120.07 | 135 | 135.00 | 0.00 |
| instance n=1000 307.alb | 1 | 1 | Solution | 120.03 | 136 | 136.00 | 0.00 |
| instance n=1000 308.alb | 1 | 1 | Solution | 120.05 | 138 | 137.00 | 0.72 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 309.alb | 1 | 1 | Solution | 120.14 | 135 | 135.00 | 0.00 |
| instance n=1000 31.alb | 1 | 1 | Solution | 120.07 | 539 | 506.00 | 6.12 |
| instance n=1000 310.alb | 1 | 1 | Solution | 120.07 | 142 | 141.00 | 0.70 |
| instance n=1000 311.alb | 1 | 1 | Solution | 120.06 | 140 | 139.00 | 0.71 |
| instance n=1000 312.alb | 1 | 1 | Solution | 120.11 | 135 | 135.00 | 0.00 |
| instance n=1000 313.alb | 1 | 1 | Solution | 120.07 | 138 | 138.00 | 0.00 |
| instance n=1000 314.alb | 1 | 1 | Solution | 120.14 | 142 | 142.00 | 0.00 |
| instance n=1000 315.alb | 1 | 1 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 316.alb | 1 | 1 | Solution | 120.07 | 138 | 137.00 | 0.72 |
| instance n=1000 317.alb | 1 | 1 | Solution | 120.12 | 137 | 136.00 | 0.73 |
| instance n=1000 318.alb | 1 | 1 | Solution | 120.08 | 138 | 138.00 | 0.00 |
| instance n=1000 319.alb | 1 | 1 | Solution | 120.13 | 141 | 140.00 | 0.71 |
| instance n=1000 32.alb | 1 | 1 | Solution | 120.10 | 527 | 502.00 | 4.74 |
| instance n=1000 320.alb | 1 | 1 | Solution | 120.09 | 141 | 141.00 | 0.00 |
| instance n=1000 321.alb | 1 | 1 | Solution | 120.08 | 140 | 140.00 | 0.00 |
| instance n=1000 322.alb | 1 | 1 | Solution | 120.09 | 139 | 139.00 | 0.00 |
| instance n=1000 323.alb | 1 | 1 | Solution | 120.09 | 138 | 138.00 | 0.00 |
| instance n=1000 324.alb | 1 | 1 | Solution | 120.10 | 141 | 140.00 | 0.71 |
| instance n=1000 325.alb | 1 | 1 | Solution | 120.05 | 139 | 138.00 | 0.72 |
| instance n=1000 326.alb | 1 | 1 | Solution | 120.04 | 529 | 496.00 | 6.24 |
| instance n=1000 327.alb | 1 | 1 | Solution | 120.05 | 535 | 503.00 | 5.98 |
| instance n=1000 328.alb | 1 | 1 | Solution | 120.05 | 526 | 500.00 | 4.94 |
| instance n=1000 329.alb | 1 | 1 | Solution | 120.09 | 533 | 502.00 | 5.82 |
| instance n=1000 33.alb | 1 | 1 | Solution | 120.16 | 528 | 501.00 | 5.11 |
| instance n=1000 330.alb | 1 | 1 | Solution | 120.17 | 525 | 498.00 | 5.14 |
| instance n=1000 331.alb | 1 | 1 | Solution | 120.16 | 527 | 498.00 | 5.50 |
| instance n=1000 332.alb | 1 | 1 | Solution | 120.04 | 522 | 495.00 | 5.17 |
| instance n=1000 333.alb | 1 | 1 | Solution | 120.12 | 541 | 499.00 | 7.76 |
| instance n=1000 334.alb | 1 | 1 | Solution | 120.18 | 521 | 498.00 | 4.41 |
| instance n=1000 335.alb | 1 | 1 | Solution | 120.22 | 531 | 496.00 | 6.59 |
| instance n=1000 336.alb | 1 | 1 | Solution | 120.08 | 523 | 497.00 | 4.97 |
| instance n=1000 337.alb | 1 | 1 | Solution | 120.17 | 537 | 501.00 | 6.70 |
| instance n=1000 338.alb | 1 | 1 | Solution | 120.06 | 535 | 502.00 | 6.17 |
| instance n=1000 339.alb | 1 | 1 | Solution | 120.04 | 539 | 500.00 | 7.24 |
| instance n=1000 34.alb | 1 | 1 | Solution | 120.04 | 555 | 507.00 | 8.65 |
| instance n=1000 340.alb | 1 | 1 | Solution | 120.05 | 551 | 505.00 | 8.35 |
| instance n=1000 341.alb | 1 | 1 | Solution | 120.16 | 539 | 503.00 | 6.68 |
| instance n=1000 342.alb | 1 | 1 | Solution | 120.16 | 534 | 500.00 | 6.37 |
| instance n=1000 343.alb | 1 | 1 | Solution | 120.11 | 538 | 500.00 | 7.06 |
| instance n=1000 344.alb | 1 | 1 | Solution | 120.06 | 531 | 500.00 | 5.84 |
| instance n=1000 345.alb | 1 | 1 | Solution | 120.17 | 535 | 502.00 | 6.17 |
| instance n=1000 346.alb | 1 | 1 | Solution | 120.15 | 530 | 501.00 | 5.47 |
| instance n=1000 347.alb | 1 | 1 | Solution | 120.05 | 533 | 498.00 | 6.57 |
| instance n=1000 348.alb | 1 | 1 | Solution | 120.09 | 556 | 506.00 | 8.99 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 349.alb | 1 | 1 | Solution | 120.10 | 539 | 503.00 | 6.68 |
| instance n=1000 35.alb | 1 | 1 | Solution | 120.15 | 528 | 501.00 | 5.11 |
| instance n=1000 350.alb | 1 | 1 | Solution | 120.11 | 524 | 496.00 | 5.34 |
| instance n=1000 351.alb | 1 | 1 | Solution | 120.15 | 229 | 227.00 | 0.87 |
| instance n=1000 352.alb | 1 | 1 | Solution | 120.14 | 229 | 227.00 | 0.87 |
| instance n=1000 353.alb | 1 | 1 | Solution | 120.12 | 219 | 217.00 | 0.91 |
| instance n=1000 354.alb | 1 | 1 | Solution | 120.14 | 224 | 222.00 | 0.89 |
| instance n=1000 355.alb | 1 | 1 | Solution | 120.05 | 222 | 220.00 | 0.90 |
| instance n=1000 356.alb | 1 | 1 | Solution | 120.10 | 228 | 226.00 | 0.88 |
| instance n=1000 357.alb | 1 | 1 | Solution | 120.12 | 215 | 213.00 | 0.93 |
| instance n=1000 358.alb | 1 | 1 | Solution | 120.07 | 221 | 219.00 | 0.90 |
| instance n=1000 359.alb | 1 | 1 | Solution | 120.14 | 224 | 222.00 | 0.89 |
| instance n=1000 36.alb | 1 | 1 | Solution | 120.08 | 524 | 497.00 | 5.15 |
| instance n=1000 360.alb | 1 | 1 | Solution | 120.17 | 231 | 229.00 | 0.87 |
| instance n=1000 361.alb | 1 | 1 | Solution | 120.08 | 217 | 215.00 | 0.92 |
| instance n=1000 362.alb | 1 | 1 | Solution | 120.10 | 224 | 223.00 | 0.45 |
| instance n=1000 363.alb | 1 | 1 | Solution | 120.05 | 217 | 215.00 | 0.92 |
| instance n=1000 364.alb | 1 | 1 | Solution | 120.06 | 223 | 221.00 | 0.90 |
| instance n=1000 365.alb | 1 | 1 | Solution | 120.12 | 229 | 227.00 | 0.87 |
| instance n=1000 366.alb | 1 | 1 | Solution | 120.11 | 230 | 228.00 | 0.87 |
| instance n=1000 367.alb | 1 | 1 | Solution | 120.05 | 229 | 227.00 | 0.87 |
| instance n=1000 368.alb | 1 | 1 | Solution | 120.14 | 228 | 226.00 | 0.88 |
| instance n=1000 369.alb | 1 | 1 | Solution | 120.12 | 222 | 220.00 | 0.90 |
| instance n=1000 37.alb | 1 | 1 | Solution | 120.07 | 550 | 506.00 | 8.00 |
| instance n=1000 370.alb | 1 | 1 | Solution | 120.09 | 225 | 223.00 | 0.89 |
| instance n=1000 371.alb | 1 | 1 | Solution | 120.16 | 221 | 220.00 | 0.45 |
| instance n=1000 372.alb | 1 | 1 | Solution | 120.14 | 232 | 230.00 | 0.86 |
| instance n=1000 373.alb | 1 | 1 | Solution | 120.09 | 220 | 219.00 | 0.45 |
| instance n=1000 374.alb | 1 | 1 | Solution | 120.12 | 220 | 219.00 | 0.45 |
| instance n=1000 375.alb | 1 | 1 | Solution | 120.06 | 229 | 227.00 | 0.87 |
| instance n=1000 376.alb | 1 | 1 | Solution | 120.06 | 133 | 132.00 | 0.75 |
| instance n=1000 377.alb | 1 | 1 | Solution | 120.05 | 137 | 137.00 | 0.00 |
| instance n=1000 378.alb | 1 | 1 | Solution | 120.03 | 135 | 134.00 | 0.74 |
| instance n=1000 379.alb | 1 | 1 | Solution | 120.09 | 138 | 137.00 | 0.72 |
| instance n=1000 38.alb | 1 | 1 | Solution | 120.24 | 545 | 504.00 | 7.52 |
| instance n=1000 380.alb | 1 | 1 | Solution | 120.09 | 135 | 134.00 | 0.74 |
| instance n=1000 381.alb | 1 | 1 | Solution | 120.05 | 138 | 138.00 | 0.00 |
| instance n=1000 382.alb | 1 | 1 | Solution | 120.22 | 132 | 131.00 | 0.76 |
| instance n=1000 383.alb | 1 | 1 | Solution | 120.12 | 139 | 138.00 | 0.72 |
| instance n=1000 384.alb | 1 | 1 | Solution | 120.15 | 140 | 139.00 | 0.71 |
| instance n=1000 385.alb | 1 | 1 | Solution | 120.11 | 136 | 135.00 | 0.74 |
| instance n=1000 386.alb | 1 | 1 | Solution | 120.11 | 140 | 139.00 | 0.71 |
| instance n=1000 387.alb | 1 | 1 | Solution | 120.05 | 138 | 137.00 | 0.72 |
| instance n=1000 388.alb | 1 | 1 | Solution | 120.06 | 137 | 137.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 389.alb | 1 | 1 | Solution | 120.06 | 137 | 136.00 | 0.73 |
| instance n=1000 39.alb | 1 | 1 | Solution | 120.20 | 545 | 507.00 | 6.97 |
| instance n=1000 390.alb | 1 | 1 | Solution | 120.15 | 137 | 136.00 | 0.73 |
| instance n=1000 391.alb | 1 | 1 | Solution | 120.10 | 136 | 135.00 | 0.74 |
| instance n=1000 392.alb | 1 | 1 | Solution | 120.20 | 137 | 136.00 | 0.73 |
| instance n=1000 393.alb | 1 | 1 | Solution | 120.07 | 137 | 136.00 | 0.73 |
| instance n=1000 394.alb | 1 | 1 | Solution | 120.05 | 140 | 138.00 | 1.43 |
| instance n=1000 395.alb | 1 | 1 | Solution | 120.12 | 140 | 139.00 | 0.71 |
| instance n=1000 396.alb | 1 | 1 | Solution | 120.05 | 137 | 136.00 | 0.73 |
| instance n=1000 397.alb | 1 | 1 | Solution | 120.09 | 141 | 140.00 | 0.71 |
| instance n=1000 398.alb | 1 | 1 | Solution | 120.10 | 135 | 134.00 | 0.74 |
| instance n=1000 399.alb | 1 | 1 | Solution | 120.10 | 140 | 139.00 | 0.71 |
| instance n=1000 4.alb | 1 | 1 | Solution | 120.10 | 139 | 138.00 | 0.72 |
| instance n=1000 40.alb | 1 | 1 | Solution | 120.12 | 519 | 496.00 | 4.43 |
| instance n=1000 400.alb | 1 | 1 | Solution | 120.08 | 141 | 140.00 | 0.71 |
| instance n=1000 401.alb | 1 | 1 | Solution | 120.24 | 539 | 497.00 | 7.79 |
| instance n=1000 402.alb | 1 | 1 | Solution | 120.03 | 552 | 500.00 | 9.42 |
| instance n=1000 403.alb | 1 | 1 | Solution | 120.15 | 549 | 500.00 | 8.93 |
| instance n=1000 404.alb | 1 | 1 | Solution | 120.13 | 543 | 500.00 | 7.92 |
| instance n=1000 405.alb | 1 | 1 | Solution | 120.25 | 559 | 501.00 | 10.38 |
| instance n=1000 406.alb | 1 | 1 | Solution | 120.11 | 533 | 495.00 | 7.13 |
| instance n=1000 407.alb | 1 | 1 | Solution | 120.06 | 548 | 498.00 | 9.12 |
| instance n=1000 408.alb | 1 | 1 | Solution | 120.16 | 552 | 501.00 | 9.24 |
| instance n=1000 409.alb | 1 | 1 | Solution | 120.25 | 548 | 504.00 | 8.03 |
| instance n=1000 41.alb | 1 | 1 | Solution | 120.04 | 527 | 500.00 | 5.12 |
| instance n=1000 410.alb | 1 | 1 | Solution | 120.11 | 569 | 505.00 | 11.25 |
| instance n=1000 411.alb | 1 | 1 | Solution | 120.19 | 546 | 498.00 | 8.79 |
| instance n=1000 412.alb | 1 | 1 | Solution | 120.11 | 550 | 499.00 | 9.27 |
| instance n=1000 413.alb | 1 | 1 | Solution | 120.07 | 549 | 503.00 | 8.38 |
| instance n=1000 414.alb | 1 | 1 | Solution | 120.08 | 547 | 501.00 | 8.41 |
| instance n=1000 415.alb | 1 | 1 | Solution | 120.08 | 545 | 501.00 | 8.07 |
| instance n=1000 416.alb | 1 | 1 | Solution | 120.23 | 550 | 502.00 | 8.73 |
| instance n=1000 417.alb | 1 | 1 | Solution | 120.08 | 580 | 512.00 | 11.72 |
| instance n=1000 418.alb | 1 | 1 | Solution | 120.08 | 549 | 501.00 | 8.74 |
| instance n=1000 419.alb | 1 | 1 | Solution | 120.22 | 574 | 510.00 | 11.15 |
| instance n=1000 42.alb | 1 | 1 | Solution | 120.06 | 518 | 497.00 | 4.05 |
| instance n=1000 420.alb | 1 | 1 | Solution | 120.25 | 553 | 501.00 | 9.40 |
| instance n=1000 421.alb | 1 | 1 | Solution | 120.11 | 545 | 499.00 | 8.44 |
| instance n=1000 422.alb | 1 | 1 | Solution | 120.07 | 543 | 495.00 | 8.84 |
| instance n=1000 423.alb | 1 | 1 | Solution | 120.14 | 559 | 500.00 | 10.55 |
| instance n=1000 424.alb | 1 | 1 | Solution | 120.09 | 535 | 495.00 | 7.48 |
| instance n=1000 425.alb | 1 | 1 | Solution | 120.08 | 559 | 504.00 | 9.84 |
| instance n=1000 426.alb | 1 | 1 | Solution | 120.22 | 227 | 224.00 | 1.32 |
| instance n=1000 427.alb | 1 | 1 | Solution | 120.04 | 232 | 229.00 | 1.29 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 428.alb | 1 | 1 | Solution | 120.12 | 226 | 224.00 | 0.88 |
| instance n=1000 429.alb | 1 | 1 | Solution | 120.15 | 238 | 235.00 | 1.26 |
| instance n=1000 43.alb | 1 | 1 | Solution | 120.23 | 524 | 496.00 | 5.34 |
| instance n=1000 430.alb | 1 | 1 | Solution | 120.12 | 222 | 220.00 | 0.90 |
| instance n=1000 431.alb | 1 | 1 | Solution | 120.20 | 232 | 230.00 | 0.86 |
| instance n=1000 432.alb | 1 | 1 | Solution | 120.15 | 230 | 227.00 | 1.30 |
| instance n=1000 433.alb | 1 | 1 | Solution | 120.08 | 232 | 229.00 | 1.29 |
| instance n=1000 434.alb | 1 | 1 | Solution | 120.08 | 214 | 212.00 | 0.93 |
| instance n=1000 435.alb | 1 | 1 | Solution | 120.25 | 229 | 227.00 | 0.87 |
| instance n=1000 436.alb | 1 | 1 | Solution | 120.05 | 230 | 226.00 | 1.74 |
| instance n=1000 437.alb | 1 | 1 | Solution | 120.32 | 224 | 222.00 | 0.89 |
| instance n=1000 438.alb | 1 | 1 | Solution | 120.05 | 223 | 221.00 | 0.90 |
| instance n=1000 439.alb | 1 | 1 | Solution | 120.07 | 227 | 225.00 | 0.88 |
| instance n=1000 44.alb | 1 | 1 | Solution | 120.11 | 543 | 502.00 | 7.55 |
| instance n=1000 440.alb | 1 | 1 | Solution | 120.15 | 228 | 225.00 | 1.32 |
| instance n=1000 441.alb | 1 | 1 | Solution | 120.07 | 224 | 221.00 | 1.34 |
| instance n=1000 442.alb | 1 | 1 | Solution | 120.08 | 233 | 230.00 | 1.29 |
| instance n=1000 443.alb | 1 | 1 | Solution | 120.18 | 220 | 217.00 | 1.36 |
| instance n=1000 444.alb | 1 | 1 | Solution | 120.10 | 225 | 222.00 | 1.33 |
| instance n=1000 445.alb | 1 | 1 | Solution | 120.15 | 233 | 229.00 | 1.72 |
| instance n=1000 446.alb | 1 | 1 | Solution | 120.09 | 230 | 228.00 | 0.87 |
| instance n=1000 447.alb | 1 | 1 | Solution | 120.19 | 224 | 221.00 | 1.34 |
| instance n=1000 448.alb | 1 | 1 | Solution | 120.08 | 224 | 222.00 | 0.89 |
| instance n=1000 449.alb | 1 | 1 | Solution | 120.05 | 236 | 232.00 | 1.69 |
| instance n=1000 45.alb | 1 | 1 | Solution | 120.05 | 509 | 492.00 | 3.34 |
| instance n=1000 450.alb | 1 | 1 | Solution | 120.09 | 222 | 220.00 | 0.90 |
| instance n=1000 451.alb | 1 | 1 | Solution | 120.12 | 138 | 136.00 | 1.45 |
| instance n=1000 452.alb | 1 | 1 | Solution | 120.04 | 133 | 132.00 | 0.75 |
| instance n=1000 453.alb | 1 | 1 | Solution | 120.11 | 140 | 138.00 | 1.43 |
| instance n=1000 454.alb | 1 | 1 | Solution | 120.10 | 141 | 139.00 | 1.42 |
| instance n=1000 455.alb | 1 | 1 | Solution | 120.06 | 138 | 136.00 | 1.45 |
| instance n=1000 456.alb | 1 | 1 | Solution | 120.10 | 137 | 135.00 | 1.46 |
| instance n=1000 457.alb | 1 | 1 | Solution | 120.09 | 139 | 137.00 | 1.44 |
| instance n=1000 458.alb | 1 | 1 | Solution | 120.09 | 136 | 135.00 | 0.74 |
| instance n=1000 459.alb | 1 | 1 | Solution | 120.11 | 139 | 137.00 | 1.44 |
| instance n=1000 46.alb | 1 | 1 | Solution | 120.10 | 526 | 498.00 | 5.32 |
| instance n=1000 460.alb | 1 | 1 | Solution | 120.08 | 139 | 138.00 | 0.72 |
| instance n=1000 461.alb | 1 | 1 | Solution | 120.12 | 138 | 137.00 | 0.72 |
| instance n=1000 462.alb | 1 | 1 | Solution | 120.11 | 138 | 136.00 | 1.45 |
| instance n=1000 463.alb | 1 | 1 | Solution | 120.10 | 138 | 136.00 | 1.45 |
| instance n=1000 464.alb | 1 | 1 | Solution | 120.06 | 140 | 138.00 | 1.43 |
| instance n=1000 465.alb | 1 | 1 | Solution | 120.11 | 140 | 138.00 | 1.43 |
| instance n=1000 466.alb | 1 | 1 | Solution | 120.06 | 135 | 133.00 | 1.48 |
| instance n=1000 467.alb | 1 | 1 | Solution | 120.10 | 139 | 138.00 | 0.72 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 468.alb | 1 | 1 | Solution | 120.06 | 138 | 137.00 | 0.72 |
| instance n=1000 469.alb | 1 | 1 | Solution | 120.09 | 139 | 137.00 | 1.44 |
| instance n=1000 47.alb | 1 | 1 | Solution | 120.16 | 526 | 499.00 | 5.13 |
| instance n=1000 470.alb | 1 | 1 | Solution | 120.05 | 136 | 135.00 | 0.74 |
| instance n=1000 471.alb | 1 | 1 | Solution | 120.10 | 137 | 135.00 | 1.46 |
| instance n=1000 472.alb | 1 | 1 | Solution | 120.08 | 142 | 140.00 | 1.41 |
| instance n=1000 473.alb | 1 | 1 | Solution | 120.07 | 137 | 135.00 | 1.46 |
| instance n=1000 474.alb | 1 | 1 | Solution | 120.06 | 138 | 136.00 | 1.45 |
| instance n=1000 475.alb | 1 | 1 | Solution | 120.11 | 138 | 136.00 | 1.45 |
| instance n=1000 476.alb | 1 | 1 | Solution | 120.05 | 575 | 503.00 | 12.52 |
| instance n=1000 477.alb | 1 | 1 | Solution | 120.12 | 582 | 507.00 | 12.89 |
| instance n=1000 478.alb | 1 | 1 | Unknown | 120.09 | - | - | - |
| instance n=1000 479.alb | 1 | 1 | Solution | 120.04 | 573 | 503.00 | 12.22 |
| instance n=1000 48.alb | 1 | 1 | Solution | 120.06 | 553 | 508.00 | 8.14 |
| instance n=1000 480.alb | 1 | 1 | Solution | 120.10 | 566 | 498.00 | 12.01 |
| instance n=1000 481.alb | 1 | 1 | Solution | 120.06 | 579 | 504.00 | 12.95 |
| instance n=1000 482.alb | 1 | 1 | Solution | 120.10 | 595 | 505.00 | 15.13 |
| instance n=1000 483.alb | 1 | 1 | Solution | 120.05 | 565 | 499.00 | 11.68 |
| instance n=1000 484.alb | 1 | 1 | Solution | 120.06 | 591 | 508.00 | 14.04 |
| instance n=1000 485.alb | 1 | 1 | Solution | 120.05 | 578 | 505.00 | 12.63 |
| instance n=1000 486.alb | 1 | 1 | Solution | 120.11 | 569 | 500.00 | 12.13 |
| instance n=1000 487.alb | 1 | 1 | Solution | 120.05 | 579 | 502.00 | 13.30 |
| instance n=1000 488.alb | 1 | 1 | Solution | 120.12 | 571 | 502.00 | 12.08 |
| instance n=1000 489.alb | 1 | 1 | Solution | 120.11 | 564 | 498.00 | 11.70 |
| instance n=1000 49.alb | 1 | 1 | Solution | 120.09 | 529 | 500.00 | 5.48 |
| instance n=1000 490.alb | 1 | 1 | Solution | 120.18 | 573 | 501.00 | 12.57 |
| instance n=1000 491.alb | 1 | 1 | Solution | 120.06 | 566 | 500.00 | 11.66 |
| instance n=1000 492.alb | 1 | 1 | Solution | 120.19 | 585 | 509.00 | 12.99 |
| instance n=1000 493.alb | 1 | 1 | Solution | 120.08 | 556 | 495.00 | 10.97 |
| instance n=1000 494.alb | 1 | 1 | Solution | 120.06 | 571 | 500.00 | 12.43 |
| instance n=1000 495.alb | 1 | 1 | Solution | 120.13 | 587 | 507.00 | 13.63 |
| instance n=1000 496.alb | 1 | 1 | Solution | 120.10 | 559 | 495.00 | 11.45 |
| instance n=1000 497.alb | 1 | 1 | Solution | 120.12 | 561 | 499.00 | 11.05 |
| instance n=1000 498.alb | 1 | 1 | Solution | 120.18 | 581 | 506.00 | 12.91 |
| instance n=1000 499.alb | 1 | 1 | Solution | 120.17 | 565 | 499.00 | 11.68 |
| instance n=1000 5.alb | 1 | 1 | Solution | 120.18 | 136 | 135.00 | 0.74 |
| instance n=1000 50.alb | 1 | 1 | Solution | 120.04 | 512 | 493.00 | 3.71 |
| instance n=1000 500.alb | 1 | 1 | Solution | 120.14 | 568 | 503.00 | 11.44 |
| instance n=1000 501.alb | 1 | 1 | Solution | 120.13 | 232 | 227.00 | 2.16 |
| instance n=1000 502.alb | 1 | 1 | Solution | 120.10 | 229 | 224.00 | 2.18 |
| instance n=1000 503.alb | 1 | 1 | Solution | 120.14 | 230 | 224.00 | 2.61 |
| instance n=1000 504.alb | 1 | 1 | Solution | 120.06 | 233 | 227.00 | 2.58 |
| instance n=1000 505.alb | 1 | 1 | Solution | 120.05 | 218 | 213.00 | 2.29 |
| instance n=1000 506.alb | 1 | 1 | Solution | 120.10 | 228 | 223.00 | 2.19 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 507.alb | 1 | 1 | Solution | 120.15 | 225 | 220.00 | 2.22 |
| instance n=1000 508.alb | 1 | 1 | Solution | 120.06 | 222 | 219.00 | 1.35 |
| instance n=1000 509.alb | 1 | 1 | Solution | 120.09 | 230 | 225.00 | 2.17 |
| instance n=1000 51.alb | 1 | 1 | Solution | 120.09 | 228 | 226.00 | 0.88 |
| instance n=1000 510.alb | 1 | 1 | Solution | 120.07 | 232 | 226.00 | 2.59 |
| instance n=1000 511.alb | 1 | 1 | Solution | 120.16 | 235 | 230.00 | 2.13 |
| instance n=1000 512.alb | 1 | 1 | Solution | 120.10 | 224 | 219.00 | 2.23 |
| instance n=1000 513.alb | 1 | 1 | Solution | 120.11 | 224 | 219.00 | 2.23 |
| instance n=1000 514.alb | 1 | 1 | Solution | 120.08 | 232 | 226.00 | 2.59 |
| instance n=1000 515.alb | 1 | 1 | Solution | 120.18 | 226 | 221.00 | 2.21 |
| instance n=1000 516.alb | 1 | 1 | Solution | 120.07 | 234 | 229.00 | 2.14 |
| instance n=1000 517.alb | 1 | 1 | Solution | 120.06 | 226 | 221.00 | 2.21 |
| instance n=1000 518.alb | 1 | 1 | Solution | 120.12 | 224 | 220.00 | 1.79 |
| instance n=1000 519.alb | 1 | 1 | Solution | 120.16 | 226 | 221.00 | 2.21 |
| instance n=1000 52.alb | 1 | 1 | Solution | 120.08 | 230 | 228.00 | 0.87 |
| instance n=1000 520.alb | 1 | 1 | Solution | 120.06 | 231 | 226.00 | 2.16 |
| instance n=1000 521.alb | 1 | 1 | Solution | 120.20 | 235 | 229.00 | 2.55 |
| instance n=1000 522.alb | 1 | 1 | Solution | 120.08 | 220 | 215.00 | 2.27 |
| instance n=1000 523.alb | 1 | 1 | Solution | 120.07 | 225 | 220.00 | 2.22 |
| instance n=1000 524.alb | 1 | 1 | Solution | 120.05 | 231 | 225.00 | 2.60 |
| instance n=1000 525.alb | 1 | 1 | Solution | 120.08 | 225 | 221.00 | 1.78 |
| instance n=1000 53.alb | 1 | 1 | Solution | 120.07 | 228 | 227.00 | 0.44 |
| instance n=1000 54.alb | 1 | 1 | Solution | 120.05 | 221 | 219.00 | 0.90 |
| instance n=1000 55.alb | 1 | 1 | Solution | 120.08 | 218 | 217.00 | 0.46 |
| instance n=1000 56.alb | 1 | 1 | Solution | 120.10 | 229 | 228.00 | 0.44 |
| instance n=1000 57.alb | 1 | 1 | Solution | 120.08 | 225 | 224.00 | 0.44 |
| instance n=1000 58.alb | 1 | 1 | Solution | 120.07 | 225 | 224.00 | 0.44 |
| instance n=1000 59.alb | 1 | 1 | Solution | 120.08 | 224 | 223.00 | 0.45 |
| instance n=1000 6.alb | 1 | 1 | Solution | 120.08 | 142 | 141.00 | 0.70 |
| instance n=1000 60.alb | 1 | 1 | Solution | 120.08 | 232 | 230.00 | 0.86 |
| instance n=1000 61.alb | 1 | 1 | Solution | 120.08 | 231 | 229.00 | 0.87 |
| instance n=1000 62.alb | 1 | 1 | Solution | 120.06 | 224 | 223.00 | 0.45 |
| instance n=1000 63.alb | 1 | 1 | Solution | 120.05 | 228 | 227.00 | 0.44 |
| instance n=1000 64.alb | 1 | 1 | Solution | 120.07 | 231 | 229.00 | 0.87 |
| instance n=1000 65.alb | 1 | 1 | Solution | 120.06 | 226 | 225.00 | 0.44 |
| instance n=1000 66.alb | 1 | 1 | Solution | 120.04 | 229 | 227.00 | 0.87 |
| instance n=1000 67.alb | 1 | 1 | Solution | 120.08 | 224 | 223.00 | 0.45 |
| instance n=1000 68.alb | 1 | 1 | Solution | 120.07 | 228 | 226.00 | 0.88 |
| instance n=1000 69.alb | 1 | 1 | Solution | 120.09 | 225 | 224.00 | 0.44 |
| instance n=1000 7.alb | 1 | 1 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 70.alb | 1 | 1 | Solution | 120.07 | 230 | 228.00 | 0.87 |
| instance n=1000 71.alb | 1 | 1 | Solution | 120.07 | 231 | 230.00 | 0.43 |
| instance n=1000 72.alb | 1 | 1 | Solution | 120.06 | 223 | 222.00 | 0.45 |
| instance n=1000 73.alb | 1 | 1 | Solution | 120.06 | 222 | 221.00 | 0.45 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 74.alb | 1 | 1 | Solution | 120.07 | 228 | 227.00 | 0.44 |
| instance n=1000 75.alb | 1 | 1 | Solution | 120.08 | 229 | 227.00 | 0.87 |
| instance n=1000 76.alb | 1 | 1 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 77.alb | 1 | 1 | Solution | 120.07 | 136 | 136.00 | 0.00 |
| instance n=1000 78.alb | 1 | 1 | Solution | 120.05 | 139 | 138.00 | 0.72 |
| instance n=1000 79.alb | 1 | 1 | Solution | 120.08 | 142 | 142.00 | 0.00 |
| instance n=1000 8.alb | 1 | 1 | Solution | 120.05 | 139 | 138.00 | 0.72 |
| instance n=1000 80.alb | 1 | 1 | Solution | 120.08 | 141 | 140.00 | 0.71 |
| instance n=1000 81.alb | 1 | 1 | Solution | 120.05 | 137 | 136.00 | 0.73 |
| instance n=1000 82.alb | 1 | 1 | Solution | 120.10 | 136 | 136.00 | 0.00 |
| instance n=1000 83.alb | 1 | 1 | Solution | 120.05 | 140 | 140.00 | 0.00 |
| instance n=1000 84.alb | 1 | 1 | Solution | 120.07 | 135 | 135.00 | 0.00 |
| instance n=1000 85.alb | 1 | 1 | Solution | 120.05 | 137 | 136.00 | 0.73 |
| instance n=1000 86.alb | 1 | 1 | Solution | 120.06 | 139 | 138.00 | 0.72 |
| instance n=1000 87.alb | 1 | 1 | Solution | 120.08 | 141 | 140.00 | 0.71 |
| instance n=1000 88.alb | 1 | 1 | Solution | 120.06 | 141 | 140.00 | 0.71 |
| instance n=1000 89.alb | 1 | 1 | Solution | 120.07 | 141 | 140.00 | 0.71 |
| instance n=1000 9.alb | 1 | 1 | Solution | 120.07 | 135 | 134.00 | 0.74 |
| instance n=1000 90.alb | 1 | 1 | Solution | 120.07 | 138 | 138.00 | 0.00 |
| instance n=1000 91.alb | 1 | 1 | Solution | 120.07 | 141 | 141.00 | 0.00 |
| instance n=1000 92.alb | 1 | 1 | Solution | 120.07 | 136 | 136.00 | 0.00 |
| instance n=1000 93.alb | 1 | 1 | Solution | 120.07 | 137 | 137.00 | 0.00 |
| instance n=1000 94.alb | 1 | 1 | Solution | 120.06 | 138 | 137.00 | 0.72 |
| instance n=1000 95.alb | 1 | 1 | Solution | 120.09 | 136 | 136.00 | 0.00 |
| instance n=1000 96.alb | 1 | 1 | Solution | 120.05 | 138 | 137.00 | 0.72 |
| instance n=1000 97.alb | 1 | 1 | Solution | 120.07 | 139 | 138.00 | 0.72 |
| instance n=1000 98.alb | 1 | 1 | Solution | 120.07 | 136 | 136.00 | 0.00 |
| instance n=1000 99.alb | 1 | 1 | Solution | 120.04 | 137 | 136.00 | 0.73 |
| instance n=100 1.alb | 1 | 1 | Solution | 120.12 | 23 | 23.00 | 0.00 |
| instance n=100 10.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 100.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 101.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 102.alb | 1 | 1 | Optimal | 4.76 | 14 | 14.00 | 0.00 |
| instance n=100 103.alb | 1 | 1 | Optimal | 8.81 | 14 | 14.00 | 0.00 |
| instance n=100 104.alb | 1 | 1 | Optimal | 77.15 | 14 | 14.00 | 0.00 |
| instance n=100 105.alb | 1 | 1 | Optimal | 28.61 | 13 | 13.00 | 0.00 |
| instance n=100 106.alb | 1 | 1 | Optimal | 1.74 | 14 | 14.00 | 0.00 |
| instance n=100 107.alb | 1 | 1 | Optimal | 26.66 | 14 | 14.00 | 0.00 |
| instance n=100 108.alb | 1 | 1 | Solution | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 109.alb | 1 | 1 | Optimal | 69.08 | 15 | 15.00 | 0.00 |
| instance n=100 11.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 110.alb | 1 | 1 | Optimal | 18.47 | 13 | 13.00 | 0.00 |
| instance n=100 111.alb | 1 | 1 | Solution | 120.02 | 16 | 16.00 | 0.00 |
| instance n=100 112.alb | 1 | 1 | Optimal | 21.63 | 13 | 13.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 113.alb | 1 | 1 | Optimal | 6.45 | 14 | 14.00 | 0.00 |
| instance n=100 114.alb | 1 | 1 | Optimal | 22.13 | 13 | 13.00 | 0.00 |
| instance n=100 115.alb | 1 | 1 | Optimal | 51.29 | 14 | 14.00 | 0.00 |
| instance n=100 116.alb | 1 | 1 | Optimal | 107.09 | 16 | 16.00 | 0.00 |
| instance n=100 117.alb | 1 | 1 | Optimal | 90.37 | 15 | 15.00 | 0.00 |
| instance n=100 118.alb | 1 | 1 | Optimal | 53.38 | 15 | 15.00 | 0.00 |
| instance n=100 119.alb | 1 | 1 | Optimal | 63.43 | 14 | 14.00 | 0.00 |
| instance n=100 12.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 120.alb | 1 | 1 | Optimal | 29.64 | 14 | 14.00 | 0.00 |
| instance n=100 121.alb | 1 | 1 | Optimal | 82.84 | 15 | 15.00 | 0.00 |
| instance n=100 122.alb | 1 | 1 | Optimal | 14.12 | 13 | 13.00 | 0.00 |
| instance n=100 123.alb | 1 | 1 | Optimal | 64.76 | 15 | 15.00 | 0.00 |
| instance n=100 124.alb | 1 | 1 | Optimal | 55.04 | 15 | 15.00 | 0.00 |
| instance n=100 125.alb | 1 | 1 | Optimal | 38.80 | 14 | 14.00 | 0.00 |
| instance n=100 126.alb | 1 | 1 | Solution | 120.01 | 51 | 49.00 | 3.92 |
| instance n=100 127.alb | 1 | 1 | Solution | 120.02 | 52 | 49.00 | 5.77 |
| instance n=100 128.alb | 1 | 1 | Solution | 120.02 | 57 | 52.00 | 8.77 |
| instance n=100 129.alb | 1 | 1 | Solution | 120.02 | 55 | 50.00 | 9.09 |
| instance n=100 13.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 130.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 131.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 132.alb | 1 | 1 | Solution | 120.02 | 57 | 52.00 | 8.77 |
| instance n=100 133.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 134.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 135.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 136.alb | 1 | 1 | Solution | 120.02 | 53 | 49.00 | 7.55 |
| instance n=100 137.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 138.alb | 1 | 1 | Solution | 120.01 | 57 | 52.00 | 8.77 |
| instance n=100 139.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 14.alb | 1 | 1 | Solution | 120.02 | 20 | 20.00 | 0.00 |
| instance n=100 140.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 141.alb | 1 | 1 | Solution | 120.01 | 50 | 49.00 | 2.00 |
| instance n=100 142.alb | 1 | 1 | Solution | 120.02 | 55 | 50.00 | 9.09 |
| instance n=100 143.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 144.alb | 1 | 1 | Solution | 120.01 | 49 | 47.00 | 4.08 |
| instance n=100 145.alb | 1 | 1 | Solution | 120.02 | 56 | 51.00 | 8.93 |
| instance n=100 146.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 147.alb | 1 | 1 | Solution | 120.02 | 59 | 52.00 | 11.86 |
| instance n=100 148.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 149.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 15.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 150.alb | 1 | 1 | Solution | 120.02 | 57 | 51.00 | 10.53 |
| instance n=100 151.alb | 1 | 1 | Solution | 120.02 | 22 | 21.00 | 4.55 |
| instance n=100 152.alb | 1 | 1 | Solution | 120.03 | 22 | 22.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 153.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 154.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 155.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 156.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 157.alb | 1 | 1 | Solution | 120.02 | 26 | 26.00 | 0.00 |
| instance n=100 158.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 159.alb | 1 | 1 | Solution | 120.02 | 19 | 19.00 | 0.00 |
| instance n=100 16.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 160.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 161.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 162.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 163.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 164.alb | 1 | 1 | Solution | 120.01 | 23 | 23.00 | 0.00 |
| instance n=100 165.alb | 1 | 1 | Solution | 120.02 | 25 | 24.00 | 4.00 |
| instance n=100 166.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 167.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 168.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 169.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 17.alb | 1 | 1 | Solution | 120.03 | 22 | 21.00 | 4.55 |
| instance n=100 170.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 171.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 172.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 173.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 174.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 175.alb | 1 | 1 | Solution | 120.02 | 27 | 26.00 | 3.70 |
| instance n=100 176.alb | 1 | 1 | Optimal | 31.45 | 13 | 13.00 | 0.00 |
| instance n=100 177.alb | 1 | 1 | Solution | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 178.alb | 1 | 1 | Solution | 120.01 | 15 | 15.00 | 0.00 |
| instance n=100 179.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 18.alb | 1 | 1 | Solution | 120.02 | 20 | 19.00 | 5.00 |
| instance n=100 180.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 181.alb | 1 | 1 | Optimal | 61.01 | 13 | 13.00 | 0.00 |
| instance n=100 182.alb | 1 | 1 | Optimal | 112.91 | 15 | 15.00 | 0.00 |
| instance n=100 183.alb | 1 | 1 | Solution | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 184.alb | 1 | 1 | Optimal | 48.71 | 14 | 14.00 | 0.00 |
| instance n=100 185.alb | 1 | 1 | Optimal | 11.55 | 15 | 15.00 | 0.00 |
| instance n=100 186.alb | 1 | 1 | Solution | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 187.alb | 1 | 1 | Optimal | 32.37 | 13 | 13.00 | 0.00 |
| instance n=100 188.alb | 1 | 1 | Solution | 120.02 | 16 | 16.00 | 0.00 |
| instance n=100 189.alb | 1 | 1 | Solution | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 19.alb | 1 | 1 | Solution | 120.03 | 23 | 23.00 | 0.00 |
| instance n=100 190.alb | 1 | 1 | Optimal | 69.51 | 13 | 13.00 | 0.00 |
| instance n=100 191.alb | 1 | 1 | Optimal | 100.25 | 14 | 14.00 | 0.00 |
| instance n=100 192.alb | 1 | 1 | Optimal | 77.04 | 13 | 13.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 193.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 194.alb | 1 | 1 | Solution | 120.01 | 15 | 15.00 | 0.00 |
| instance n=100 195.alb | 1 | 1 | Optimal | 71.97 | 15 | 15.00 | 0.00 |
| instance n=100 196.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 197.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 198.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=100 199.alb | 1 | 1 | Optimal | 72.67 | 14 | 14.00 | 0.00 |
| instance n=100 2.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 20.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 200.alb | 1 | 1 | Solution | 120.01 | 15 | 15.00 | 0.00 |
| instance n=100 201.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 202.alb | 1 | 1 | Solution | 120.02 | 61 | 52.00 | 14.75 |
| instance n=100 203.alb | 1 | 1 | Solution | 120.02 | 52 | 49.00 | 5.77 |
| instance n=100 204.alb | 1 | 1 | Solution | 120.03 | 50 | 48.00 | 4.00 |
| instance n=100 205.alb | 1 | 1 | Solution | 120.02 | 56 | 51.00 | 8.93 |
| instance n=100 206.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 207.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 208.alb | 1 | 1 | Solution | 120.02 | 56 | 51.00 | 8.93 |
| instance n=100 209.alb | 1 | 1 | Solution | 120.01 | 54 | 51.00 | 5.56 |
| instance n=100 21.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 210.alb | 1 | 1 | Solution | 120.02 | 52 | 49.00 | 5.77 |
| instance n=100 211.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 212.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 213.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 214.alb | 1 | 1 | Solution | 120.02 | 54 | 50.00 | 7.41 |
| instance n=100 215.alb | 1 | 1 | Solution | 120.02 | 49 | 47.00 | 4.08 |
| instance n=100 216.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 217.alb | 1 | 1 | Solution | 120.02 | 52 | 49.00 | 5.77 |
| instance n=100 218.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 219.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 22.alb | 1 | 1 | Solution | 120.03 | 24 | 24.00 | 0.00 |
| instance n=100 220.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 221.alb | 1 | 1 | Solution | 120.02 | 57 | 51.00 | 10.53 |
| instance n=100 222.alb | 1 | 1 | Solution | 120.03 | 53 | 50.00 | 5.66 |
| instance n=100 223.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 224.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 225.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 226.alb | 1 | 1 | Solution | 120.02 | 25 | 24.00 | 4.00 |
| instance n=100 227.alb | 1 | 1 | Solution | 120.02 | 27 | 26.00 | 3.70 |
| instance n=100 228.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 229.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 23.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 230.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 231.alb | 1 | 1 | Solution | 120.03 | 22 | 22.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 232.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 233.alb | 1 | 1 | Solution | 120.02 | 23 | 22.00 | 4.35 |
| instance n=100 234.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 235.alb | 1 | 1 | Solution | 120.01 | 26 | 26.00 | 0.00 |
| instance n=100 236.alb | 1 | 1 | Solution | 120.02 | 23 | 22.00 | 4.35 |
| instance n=100 237.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 238.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 239.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 24.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 240.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 241.alb | 1 | 1 | Solution | 120.01 | 22 | 22.00 | 0.00 |
| instance n=100 242.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 243.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 244.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 245.alb | 1 | 1 | Solution | 120.02 | 24 | 23.00 | 4.17 |
| instance n=100 246.alb | 1 | 1 | Solution | 120.02 | 26 | 26.00 | 0.00 |
| instance n=100 247.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 248.alb | 1 | 1 | Solution | 120.02 | 19 | 19.00 | 0.00 |
| instance n=100 249.alb | 1 | 1 | Solution | 120.01 | 21 | 21.00 | 0.00 |
| instance n=100 25.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 250.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 251.alb | 1 | 1 | Optimal | 78.03 | 15 | 15.00 | 0.00 |
| instance n=100 252.alb | 1 | 1 | Optimal | 36.22 | 14 | 14.00 | 0.00 |
| instance n=100 253.alb | 1 | 1 | Optimal | 45.76 | 14 | 14.00 | 0.00 |
| instance n=100 254.alb | 1 | 1 | Optimal | 87.69 | 14 | 14.00 | 0.00 |
| instance n=100 255.alb | 1 | 1 | Optimal | 0.52 | 14 | 14.00 | 0.00 |
| instance n=100 256.alb | 1 | 1 | Optimal | 19.10 | 15 | 15.00 | 0.00 |
| instance n=100 257.alb | 1 | 1 | Optimal | 11.64 | 12 | 12.00 | 0.00 |
| instance n=100 258.alb | 1 | 1 | Optimal | 97.17 | 14 | 14.00 | 0.00 |
| instance n=100 259.alb | 1 | 1 | Optimal | 73.31 | 15 | 15.00 | 0.00 |
| instance n=100 26.alb | 1 | 1 | Optimal | 61.17 | 14 | 14.00 | 0.00 |
| instance n=100 260.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 261.alb | 1 | 1 | Optimal | 4.94 | 14 | 14.00 | 0.00 |
| instance n=100 262.alb | 1 | 1 | Optimal | 23.72 | 14 | 14.00 | 0.00 |
| instance n=100 263.alb | 1 | 1 | Optimal | 9.24 | 14 | 14.00 | 0.00 |
| instance n=100 264.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 265.alb | 1 | 1 | Optimal | 7.88 | 14 | 14.00 | 0.00 |
| instance n=100 266.alb | 1 | 1 | Optimal | 85.09 | 13 | 13.00 | 0.00 |
| instance n=100 267.alb | 1 | 1 | Optimal | 85.29 | 13 | 13.00 | 0.00 |
| instance n=100 268.alb | 1 | 1 | Optimal | 10.41 | 15 | 15.00 | 0.00 |
| instance n=100 269.alb | 1 | 1 | Optimal | 51.02 | 15 | 15.00 | 0.00 |
| instance n=100 27.alb | 1 | 1 | Optimal | 41.61 | 13 | 13.00 | 0.00 |
| instance n=100 270.alb | 1 | 1 | Optimal | 27.54 | 13 | 13.00 | 0.00 |
| instance n=100 271.alb | 1 | 1 | Optimal | 26.61 | 13 | 13.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 272.alb | 1 | 1 | Optimal | 62.54 | 14 | 14.00 | 0.00 |
| instance n=100 273.alb | 1 | 1 | Optimal | 58.55 | 13 | 13.00 | 0.00 |
| instance n=100 274.alb | 1 | 1 | Optimal | 35.91 | 13 | 13.00 | 0.00 |
| instance n=100 275.alb | 1 | 1 | Optimal | 50.14 | 13 | 13.00 | 0.00 |
| instance n=100 276.alb | 1 | 1 | Solution | 120.02 | 60 | 51.00 | 15.00 |
| instance n=100 277.alb | 1 | 1 | Solution | 120.02 | 57 | 51.00 | 10.53 |
| instance n=100 278.alb | 1 | 1 | Solution | 120.02 | 57 | 51.00 | 10.53 |
| instance n=100 279.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 28.alb | 1 | 1 | Optimal | 80.31 | 14 | 14.00 | 0.00 |
| instance n=100 280.alb | 1 | 1 | Solution | 120.02 | 55 | 50.00 | 9.09 |
| instance n=100 281.alb | 1 | 1 | Solution | 120.02 | 62 | 53.00 | 14.52 |
| instance n=100 282.alb | 1 | 1 | Solution | 120.02 | 60 | 52.00 | 13.33 |
| instance n=100 283.alb | 1 | 1 | Solution | 120.02 | 55 | 50.00 | 9.09 |
| instance n=100 284.alb | 1 | 1 | Solution | 120.02 | 55 | 50.00 | 9.09 |
| instance n=100 285.alb | 1 | 1 | Solution | 120.02 | 54 | 50.00 | 7.41 |
| instance n=100 286.alb | 1 | 1 | Solution | 120.02 | 56 | 51.00 | 8.93 |
| instance n=100 287.alb | 1 | 1 | Solution | 120.02 | 54 | 50.00 | 7.41 |
| instance n=100 288.alb | 1 | 1 | Solution | 120.02 | 56 | 51.00 | 8.93 |
| instance n=100 289.alb | 1 | 1 | Solution | 120.02 | 62 | 51.00 | 17.74 |
| instance n=100 29.alb | 1 | 1 | Optimal | 54.51 | 14 | 14.00 | 0.00 |
| instance n=100 290.alb | 1 | 1 | Solution | 120.02 | 54 | 50.00 | 7.41 |
| instance n=100 291.alb | 1 | 1 | Solution | 120.03 | 53 | 49.00 | 7.55 |
| instance n=100 292.alb | 1 | 1 | Solution | 120.02 | 59 | 51.00 | 13.56 |
| instance n=100 293.alb | 1 | 1 | Solution | 120.02 | 52 | 49.00 | 5.77 |
| instance n=100 294.alb | 1 | 1 | Solution | 120.02 | 57 | 51.00 | 10.53 |
| instance n=100 295.alb | 1 | 1 | Solution | 120.02 | 57 | 51.00 | 10.53 |
| instance n=100 296.alb | 1 | 1 | Solution | 120.01 | 55 | 50.00 | 9.09 |
| instance n=100 297.alb | 1 | 1 | Solution | 120.01 | 59 | 51.00 | 13.56 |
| instance n=100 298.alb | 1 | 1 | Solution | 120.02 | 58 | 52.00 | 10.34 |
| instance n=100 299.alb | 1 | 1 | Solution | 120.02 | 54 | 50.00 | 7.41 |
| instance n=100 3.alb | 1 | 1 | Solution | 120.02 | 20 | 20.00 | 0.00 |
| instance n=100 30.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 300.alb | 1 | 1 | Solution | 120.03 | 54 | 49.00 | 9.26 |
| instance n=100 301.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 302.alb | 1 | 1 | Solution | 120.03 | 24 | 24.00 | 0.00 |
| instance n=100 303.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 304.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 305.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 306.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 307.alb | 1 | 1 | Solution | 120.03 | 24 | 23.00 | 4.17 |
| instance n=100 308.alb | 1 | 1 | Solution | 120.02 | 20 | 20.00 | 0.00 |
| instance n=100 309.alb | 1 | 1 | Solution | 120.02 | 22 | 21.00 | 4.55 |
| instance n=100 31.alb | 1 | 1 | Solution | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 310.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 311.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 312.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 313.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 314.alb | 1 | 1 | Solution | 120.02 | 19 | 19.00 | 0.00 |
| instance n=100 315.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 316.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 317.alb | 1 | 1 | Solution | 120.02 | 26 | 26.00 | 0.00 |
| instance n=100 318.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 319.alb | 1 | 1 | Solution | 120.03 | 23 | 23.00 | 0.00 |
| instance n=100 32.alb | 1 | 1 | Optimal | 45.28 | 14 | 14.00 | 0.00 |
| instance n=100 320.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 321.alb | 1 | 1 | Solution | 120.02 | 26 | 26.00 | 0.00 |
| instance n=100 322.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 323.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 324.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 325.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 326.alb | 1 | 1 | Optimal | 28.14 | 13 | 13.00 | 0.00 |
| instance n=100 327.alb | 1 | 1 | Optimal | 85.13 | 14 | 14.00 | 0.00 |
| instance n=100 328.alb | 1 | 1 | Optimal | 15.38 | 14 | 14.00 | 0.00 |
| instance n=100 329.alb | 1 | 1 | Optimal | 98.27 | 14 | 14.00 | 0.00 |
| instance n=100 33.alb | 1 | 1 | Solution | 120.01 | 15 | 15.00 | 0.00 |
| instance n=100 330.alb | 1 | 1 | Optimal | 53.13 | 14 | 14.00 | 0.00 |
| instance n=100 331.alb | 1 | 1 | Optimal | 71.96 | 14 | 14.00 | 0.00 |
| instance n=100 332.alb | 1 | 1 | Optimal | 43.83 | 14 | 14.00 | 0.00 |
| instance n=100 333.alb | 1 | 1 | Optimal | 51.59 | 15 | 15.00 | 0.00 |
| instance n=100 334.alb | 1 | 1 | Optimal | 39.37 | 14 | 14.00 | 0.00 |
| instance n=100 335.alb | 1 | 1 | Optimal | 9.22 | 13 | 13.00 | 0.00 |
| instance n=100 336.alb | 1 | 1 | Optimal | 72.34 | 15 | 15.00 | 0.00 |
| instance n=100 337.alb | 1 | 1 | Solution | 120.02 | 13 | 13.00 | 0.00 |
| instance n=100 338.alb | 1 | 1 | Optimal | 112.11 | 14 | 14.00 | 0.00 |
| instance n=100 339.alb | 1 | 1 | Optimal | 58.33 | 14 | 14.00 | 0.00 |
| instance n=100 34.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 340.alb | 1 | 1 | Optimal | 57.69 | 14 | 14.00 | 0.00 |
| instance n=100 341.alb | 1 | 1 | Solution | 120.02 | 16 | 16.00 | 0.00 |
| instance n=100 342.alb | 1 | 1 | Optimal | 83.24 | 14 | 14.00 | 0.00 |
| instance n=100 343.alb | 1 | 1 | Solution | 120.02 | 16 | 16.00 | 0.00 |
| instance n=100 344.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 345.alb | 1 | 1 | Optimal | 66.40 | 14 | 14.00 | 0.00 |
| instance n=100 346.alb | 1 | 1 | Optimal | 110.41 | 14 | 14.00 | 0.00 |
| instance n=100 347.alb | 1 | 1 | Optimal | 92.50 | 14 | 14.00 | 0.00 |
| instance n=100 348.alb | 1 | 1 | Optimal | 27.87 | 14 | 14.00 | 0.00 |
| instance n=100 349.alb | 1 | 1 | Optimal | 29.09 | 13 | 13.00 | 0.00 |
| instance n=100 35.alb | 1 | 1 | Optimal | 88.58 | 15 | 15.00 | 0.00 |
| instance n=100 350.alb | 1 | 1 | Optimal | 89.57 | 14 | 14.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 351.alb | 1 | 1 | Solution | 120.02 | 59 | 52.00 | 11.86 |
| instance n=100 352.alb | 1 | 1 | Solution | 120.02 | 63 | 52.00 | 17.46 |
| instance n=100 353.alb | 1 | 1 | Solution | 120.02 | 50 | 49.00 | 2.00 |
| instance n=100 354.alb | 1 | 1 | Solution | 120.02 | 52 | 49.00 | 5.77 |
| instance n=100 355.alb | 1 | 1 | Solution | 120.03 | 54 | 51.00 | 5.56 |
| instance n=100 356.alb | 1 | 1 | Solution | 120.02 | 59 | 53.00 | 10.17 |
| instance n=100 357.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 358.alb | 1 | 1 | Solution | 120.03 | 52 | 50.00 | 3.85 |
| instance n=100 359.alb | 1 | 1 | Solution | 120.03 | 53 | 50.00 | 5.66 |
| instance n=100 36.alb | 1 | 1 | Solution | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 360.alb | 1 | 1 | Solution | 120.02 | 54 | 51.00 | 5.56 |
| instance n=100 361.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 362.alb | 1 | 1 | Solution | 120.02 | 57 | 51.00 | 10.53 |
| instance n=100 363.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 364.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 365.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 366.alb | 1 | 1 | Solution | 120.02 | 61 | 53.00 | 13.11 |
| instance n=100 367.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 368.alb | 1 | 1 | Solution | 120.02 | 59 | 52.00 | 11.86 |
| instance n=100 369.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 37.alb | 1 | 1 | Optimal | 64.67 | 14 | 14.00 | 0.00 |
| instance n=100 370.alb | 1 | 1 | Solution | 120.02 | 56 | 52.00 | 7.14 |
| instance n=100 371.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 372.alb | 1 | 1 | Solution | 120.02 | 48 | 47.00 | 2.08 |
| instance n=100 373.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 374.alb | 1 | 1 | Solution | 120.02 | 51 | 50.00 | 1.96 |
| instance n=100 375.alb | 1 | 1 | Solution | 120.02 | 57 | 52.00 | 8.77 |
| instance n=100 376.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 377.alb | 1 | 1 | Solution | 120.02 | 20 | 20.00 | 0.00 |
| instance n=100 378.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 379.alb | 1 | 1 | Solution | 120.03 | 23 | 23.00 | 0.00 |
| instance n=100 38.alb | 1 | 1 | Solution | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 380.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 381.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 382.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 383.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 384.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 385.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 386.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 387.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 388.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 389.alb | 1 | 1 | Solution | 120.01 | 23 | 23.00 | 0.00 |
| instance n=100 39.alb | 1 | 1 | Optimal | 26.16 | 14 | 14.00 | 0.00 |
| instance n=100 390.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 391.alb | 1 | 1 | Solution | 120.02 | 20 | 20.00 | 0.00 |
| instance n=100 392.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 393.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 394.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 395.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 396.alb | 1 | 1 | Solution | 120.02 | 20 | 20.00 | 0.00 |
| instance n=100 397.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=100 398.alb | 1 | 1 | Solution | 120.02 | 25 | 24.00 | 4.00 |
| instance n=100 399.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 4.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 40.alb | 1 | 1 | Optimal | 68.59 | 14 | 14.00 | 0.00 |
| instance n=100 400.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 401.alb | 1 | 1 | Solution | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 402.alb | 1 | 1 | Optimal | 80.91 | 15 | 15.00 | 0.00 |
| instance n=100 403.alb | 1 | 1 | Solution | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 404.alb | 1 | 1 | Optimal | 9.37 | 15 | 15.00 | 0.00 |
| instance n=100 405.alb | 1 | 1 | Optimal | 36.55 | 13 | 13.00 | 0.00 |
| instance n=100 406.alb | 1 | 1 | Optimal | 24.64 | 14 | 14.00 | 0.00 |
| instance n=100 407.alb | 1 | 1 | Optimal | 105.38 | 15 | 15.00 | 0.00 |
| instance n=100 408.alb | 1 | 1 | Optimal | 13.98 | 14 | 14.00 | 0.00 |
| instance n=100 409.alb | 1 | 1 | Optimal | 53.47 | 15 | 15.00 | 0.00 |
| instance n=100 41.alb | 1 | 1 | Optimal | 33.89 | 13 | 13.00 | 0.00 |
| instance n=100 410.alb | 1 | 1 | Optimal | 67.35 | 14 | 14.00 | 0.00 |
| instance n=100 411.alb | 1 | 1 | Optimal | 53.70 | 14 | 14.00 | 0.00 |
| instance n=100 412.alb | 1 | 1 | Solution | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 413.alb | 1 | 1 | Optimal | 79.43 | 14 | 14.00 | 0.00 |
| instance n=100 414.alb | 1 | 1 | Optimal | 34.87 | 14 | 14.00 | 0.00 |
| instance n=100 415.alb | 1 | 1 | Optimal | 46.96 | 13 | 13.00 | 0.00 |
| instance n=100 416.alb | 1 | 1 | Optimal | 53.61 | 14 | 14.00 | 0.00 |
| instance n=100 417.alb | 1 | 1 | Optimal | 62.59 | 15 | 15.00 | 0.00 |
| instance n=100 418.alb | 1 | 1 | Optimal | 80.34 | 16 | 16.00 | 0.00 |
| instance n=100 419.alb | 1 | 1 | Optimal | 41.20 | 14 | 14.00 | 0.00 |
| instance n=100 42.alb | 1 | 1 | Optimal | 79.57 | 14 | 14.00 | 0.00 |
| instance n=100 420.alb | 1 | 1 | Optimal | 21.39 | 14 | 14.00 | 0.00 |
| instance n=100 421.alb | 1 | 1 | Optimal | 53.13 | 14 | 14.00 | 0.00 |
| instance n=100 422.alb | 1 | 1 | Optimal | 59.02 | 15 | 15.00 | 0.00 |
| instance n=100 423.alb | 1 | 1 | Optimal | 45.27 | 14 | 14.00 | 0.00 |
| instance n=100 424.alb | 1 | 1 | Optimal | 31.47 | 14 | 14.00 | 0.00 |
| instance n=100 425.alb | 1 | 1 | Optimal | 33.15 | 15 | 15.00 | 0.00 |
| instance n=100 426.alb | 1 | 1 | Solution | 120.03 | 60 | 53.00 | 11.67 |
| instance n=100 427.alb | 1 | 1 | Solution | 120.02 | 56 | 50.00 | 10.71 |
| instance n=100 428.alb | 1 | 1 | Solution | 120.02 | 54 | 51.00 | 5.56 |
| instance n=100 429.alb | 1 | 1 | Solution | 120.13 | 58 | 52.00 | 10.34 |
| instance n=100 43.alb | 1 | 1 | Optimal | 39.34 | 14 | 14.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 430.alb | 1 | 1 | Solution | 120.03 | 54 | 50.00 | 7.41 |
| instance n=100 431.alb | 1 | 1 | Solution | 120.02 | 54 | 50.00 | 7.41 |
| instance n=100 432.alb | 1 | 1 | Solution | 120.03 | 56 | 50.00 | 10.71 |
| instance n=100 433.alb | 1 | 1 | Solution | 120.03 | 52 | 49.00 | 5.77 |
| instance n=100 434.alb | 1 | 1 | Solution | 120.13 | 56 | 51.00 | 8.93 |
| instance n=100 435.alb | 1 | 1 | Solution | 120.03 | 56 | 50.00 | 10.71 |
| instance n=100 436.alb | 1 | 1 | Solution | 120.04 | 52 | 48.00 | 7.69 |
| instance n=100 437.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 438.alb | 1 | 1 | Solution | 120.03 | 55 | 51.00 | 7.27 |
| instance n=100 439.alb | 1 | 1 | Solution | 120.04 | 55 | 51.00 | 7.27 |
| instance n=100 44.alb | 1 | 1 | Optimal | 43.40 | 14 | 14.00 | 0.00 |
| instance n=100 440.alb | 1 | 1 | Solution | 120.03 | 53 | 49.00 | 7.55 |
| instance n=100 441.alb | 1 | 1 | Solution | 120.04 | 52 | 49.00 | 5.77 |
| instance n=100 442.alb | 1 | 1 | Solution | 120.04 | 52 | 48.00 | 7.69 |
| instance n=100 443.alb | 1 | 1 | Solution | 120.03 | 56 | 50.00 | 10.71 |
| instance n=100 444.alb | 1 | 1 | Solution | 120.03 | 53 | 50.00 | 5.66 |
| instance n=100 445.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 446.alb | 1 | 1 | Solution | 120.01 | 56 | 51.00 | 8.93 |
| instance n=100 447.alb | 1 | 1 | Solution | 120.02 | 54 | 50.00 | 7.41 |
| instance n=100 448.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 449.alb | 1 | 1 | Solution | 120.03 | 55 | 50.00 | 9.09 |
| instance n=100 45.alb | 1 | 1 | Optimal | 76.40 | 14 | 14.00 | 0.00 |
| instance n=100 450.alb | 1 | 1 | Solution | 120.03 | 54 | 50.00 | 7.41 |
| instance n=100 451.alb | 1 | 1 | Optimal | 5.18 | 26 | 26.00 | 0.00 |
| instance n=100 452.alb | 1 | 1 | Optimal | 13.35 | 22 | 22.00 | 0.00 |
| instance n=100 453.alb | 1 | 1 | Optimal | 6.11 | 24 | 24.00 | 0.00 |
| instance n=100 454.alb | 1 | 1 | Optimal | 5.62 | 23 | 23.00 | 0.00 |
| instance n=100 455.alb | 1 | 1 | Optimal | 6.14 | 23 | 23.00 | 0.00 |
| instance n=100 456.alb | 1 | 1 | Optimal | 8.80 | 26 | 26.00 | 0.00 |
| instance n=100 457.alb | 1 | 1 | Optimal | 2.88 | 23 | 23.00 | 0.00 |
| instance n=100 458.alb | 1 | 1 | Optimal | 4.74 | 24 | 24.00 | 0.00 |
| instance n=100 459.alb | 1 | 1 | Optimal | 11.04 | 23 | 23.00 | 0.00 |
| instance n=100 46.alb | 1 | 1 | Optimal | 108.02 | 14 | 14.00 | 0.00 |
| instance n=100 460.alb | 1 | 1 | Optimal | 4.08 | 23 | 23.00 | 0.00 |
| instance n=100 461.alb | 1 | 1 | Optimal | 8.17 | 23 | 23.00 | 0.00 |
| instance n=100 462.alb | 1 | 1 | Optimal | 7.10 | 23 | 23.00 | 0.00 |
| instance n=100 463.alb | 1 | 1 | Optimal | 7.23 | 26 | 26.00 | 0.00 |
| instance n=100 464.alb | 1 | 1 | Optimal | 6.02 | 25 | 25.00 | 0.00 |
| instance n=100 465.alb | 1 | 1 | Optimal | 6.46 | 22 | 22.00 | 0.00 |
| instance n=100 466.alb | 1 | 1 | Optimal | 6.55 | 26 | 26.00 | 0.00 |
| instance n=100 467.alb | 1 | 1 | Optimal | 12.28 | 21 | 21.00 | 0.00 |
| instance n=100 468.alb | 1 | 1 | Optimal | 6.74 | 25 | 25.00 | 0.00 |
| instance n=100 469.alb | 1 | 1 | Optimal | 6.88 | 22 | 22.00 | 0.00 |
| instance n=100 47.alb | 1 | 1 | Optimal | 22.13 | 14 | 14.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 470.alb | 1 | 1 | Optimal | 7.75 | 26 | 26.00 | 0.00 |
| instance n=100 471.alb | 1 | 1 | Optimal | 10.60 | 26 | 26.00 | 0.00 |
| instance n=100 472.alb | 1 | 1 | Optimal | 7.66 | 23 | 23.00 | 0.00 |
| instance n=100 473.alb | 1 | 1 | Optimal | 46.76 | 28 | 28.00 | 0.00 |
| instance n=100 474.alb | 1 | 1 | Optimal | 4.27 | 23 | 23.00 | 0.00 |
| instance n=100 475.alb | 1 | 1 | Optimal | 7.30 | 24 | 24.00 | 0.00 |
| instance n=100 476.alb | 1 | 1 | Optimal | 3.93 | 14 | 14.00 | 0.00 |
| instance n=100 477.alb | 1 | 1 | Optimal | 4.69 | 14 | 14.00 | 0.00 |
| instance n=100 478.alb | 1 | 1 | Optimal | 2.67 | 14 | 14.00 | 0.00 |
| instance n=100 479.alb | 1 | 1 | Optimal | 1.51 | 16 | 16.00 | 0.00 |
| instance n=100 48.alb | 1 | 1 | Solution | 120.03 | 15 | 15.00 | 0.00 |
| instance n=100 480.alb | 1 | 1 | Optimal | 1.38 | 15 | 15.00 | 0.00 |
| instance n=100 481.alb | 1 | 1 | Optimal | 4.43 | 15 | 15.00 | 0.00 |
| instance n=100 482.alb | 1 | 1 | Optimal | 1.06 | 15 | 15.00 | 0.00 |
| instance n=100 483.alb | 1 | 1 | Optimal | 2.35 | 14 | 14.00 | 0.00 |
| instance n=100 484.alb | 1 | 1 | Optimal | 4.86 | 14 | 14.00 | 0.00 |
| instance n=100 485.alb | 1 | 1 | Optimal | 0.91 | 16 | 16.00 | 0.00 |
| instance n=100 486.alb | 1 | 1 | Optimal | 3.86 | 15 | 15.00 | 0.00 |
| instance n=100 487.alb | 1 | 1 | Optimal | 1.36 | 15 | 15.00 | 0.00 |
| instance n=100 488.alb | 1 | 1 | Optimal | 2.37 | 16 | 16.00 | 0.00 |
| instance n=100 489.alb | 1 | 1 | Optimal | 2.25 | 13 | 13.00 | 0.00 |
| instance n=100 49.alb | 1 | 1 | Solution | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 490.alb | 1 | 1 | Optimal | 1.35 | 15 | 15.00 | 0.00 |
| instance n=100 491.alb | 1 | 1 | Optimal | 1.74 | 16 | 16.00 | 0.00 |
| instance n=100 492.alb | 1 | 1 | Optimal | 2.08 | 14 | 14.00 | 0.00 |
| instance n=100 493.alb | 1 | 1 | Optimal | 3.44 | 14 | 14.00 | 0.00 |
| instance n=100 494.alb | 1 | 1 | Optimal | 3.43 | 14 | 14.00 | 0.00 |
| instance n=100 495.alb | 1 | 1 | Optimal | 3.04 | 15 | 15.00 | 0.00 |
| instance n=100 496.alb | 1 | 1 | Optimal | 2.85 | 14 | 14.00 | 0.00 |
| instance n=100 497.alb | 1 | 1 | Optimal | 2.21 | 13 | 13.00 | 0.00 |
| instance n=100 498.alb | 1 | 1 | Optimal | 3.08 | 14 | 14.00 | 0.00 |
| instance n=100 499.alb | 1 | 1 | Optimal | 4.93 | 14 | 14.00 | 0.00 |
| instance n=100 5.alb | 1 | 1 | Solution | 120.12 | 22 | 22.00 | 0.00 |
| instance n=100 50.alb | 1 | 1 | Optimal | 40.19 | 14 | 14.00 | 0.00 |
| instance n=100 500.alb | 1 | 1 | Optimal | 4.52 | 14 | 14.00 | 0.00 |
| instance n=100 501.alb | 1 | 1 | Solution | 120.02 | 63 | 55.00 | 12.70 |
| instance n=100 502.alb | 1 | 1 | Solution | 120.02 | 64 | 55.00 | 14.06 |
| instance n=100 503.alb | 1 | 1 | Solution | 120.02 | 60 | 53.00 | 11.67 |
| instance n=100 504.alb | 1 | 1 | Solution | 120.01 | 60 | 54.00 | 10.00 |
| instance n=100 505.alb | 1 | 1 | Solution | 120.02 | 61 | 52.00 | 14.75 |
| instance n=100 506.alb | 1 | 1 | Solution | 120.01 | 58 | 53.00 | 8.62 |
| instance n=100 507.alb | 1 | 1 | Solution | 120.02 | 59 | 52.00 | 11.86 |
| instance n=100 508.alb | 1 | 1 | Solution | 120.02 | 56 | 53.00 | 5.36 |
| instance n=100 509.alb | 1 | 1 | Solution | 120.00 | 57 | 53.00 | 7.02 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|---------|----------|-------|----------------|
| instance n=100 51.alb | 1 | 1 | Solution | 120.03 | 50 | 48.00 | 4.00 |
| instance n=100 510.alb | 1 | 1 | Solution | 120.02 | 58 | 53.00 | 8.62 |
| instance n=100 511.alb | 1 | 1 | Solution | 120.02 | 59 | 54.00 | 8.47 |
| instance n=100 512.alb | 1 | 1 | Solution | 120.03 | 60 | 54.00 | 10.00 |
| instance n=100 513.alb | 1 | 1 | Solution | 120.03 | 62 | 52.00 | 16.13 |
| instance n=100 514.alb | 1 | 1 | Solution | 120.02 | 58 | 52.00 | 10.34 |
| instance n=100 515.alb | 1 | 1 | Solution | 120.03 | 61 | 53.00 | 13.11 |
| instance n=100 516.alb | 1 | 1 | Solution | 120.03 | 70 | 56.00 | 20.00 |
| instance n=100 517.alb | 1 | 1 | Solution | 120.02 | 62 | 54.00 | 12.90 |
| instance n=100 518.alb | 1 | 1 | Solution | 120.03 | 57 | 51.00 | 10.53 |
| instance n=100 519.alb | 1 | 1 | Solution | 120.01 | 61 | 54.00 | 11.48 |
| instance n=100 52.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 520.alb | 1 | 1 | Solution | 120.03 | 60 | 53.00 | 11.67 |
| instance n=100 521.alb | 1 | 1 | Solution | 120.02 | 70 | 57.00 | 18.57 |
| instance n=100 522.alb | 1 | 1 | Solution | 120.03 | 59 | 53.00 | 10.17 |
| instance n=100 523.alb | 1 | 1 | Solution | 120.03 | 55 | 51.00 | 7.27 |
| instance n=100 524.alb | 1 | 1 | Solution | 120.02 | 59 | 52.00 | 11.86 |
| instance n=100 525.alb | 1 | 1 | Solution | 120.04 | 62 | 52.00 | 16.13 |
| instance n=100 53.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 54.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 55.alb | 1 | 1 | Solution | 120.03 | 53 | 50.00 | 5.66 |
| instance n=100 56.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 57.alb | 1 | 1 | Solution | 120.03 | 54 | 51.00 | 5.56 |
| instance n=100 58.alb | 1 | 1 | Solution | 120.02 | 57 | 52.00 | 8.77 |
| instance n=100 59.alb | 1 | 1 | Solution | 120.03 | 57 | 51.00 | 10.53 |
| instance n=100 6.alb | 1 | 1 | Solution | 120.03 | 22 | 22.00 | 0.00 |
| instance n=100 60.alb | 1 | 1 | Solution | 120.02 | 53 | 51.00 | 3.77 |
| instance n=100 61.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 62.alb | 1 | 1 | Solution | 1254.58 | 52 | 49.00 | 5.77 |
| instance n=100 63.alb | 1 | 1 | Solution | 120.05 | 61 | 52.00 | 14.75 |
| instance n=100 64.alb | 1 | 1 | Solution | 120.01 | 56 | 51.00 | 8.93 |
| instance n=100 65.alb | 1 | 1 | Solution | 120.02 | 62 | 53.00 | 14.52 |
| instance n=100 66.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 67.alb | 1 | 1 | Solution | 120.02 | 55 | 51.00 | 7.27 |
| instance n=100 68.alb | 1 | 1 | Solution | 120.03 | 57 | 49.00 | 14.04 |
| instance n=100 69.alb | 1 | 1 | Solution | 120.03 | 53 | 51.00 | 3.77 |
| instance n=100 7.alb | 1 | 1 | Solution | 120.03 | 26 | 26.00 | 0.00 |
| instance n=100 70.alb | 1 | 1 | Solution | 120.02 | 52 | 50.00 | 3.85 |
| instance n=100 71.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 72.alb | 1 | 1 | Solution | 120.02 | 53 | 50.00 | 5.66 |
| instance n=100 73.alb | 1 | 1 | Solution | 120.03 | 55 | 52.00 | 5.45 |
| instance n=100 74.alb | 1 | 1 | Solution | 120.02 | 51 | 49.00 | 3.92 |
| instance n=100 75.alb | 1 | 1 | Solution | 120.03 | 54 | 51.00 | 5.56 |
| instance n=100 76.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 77.alb | 1 | 1 | Solution | 120.03 | 20 | 20.00 | 0.00 |
| instance n=100 78.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 79.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 8.alb | 1 | 1 | Solution | 120.03 | 24 | 24.00 | 0.00 |
| instance n=100 80.alb | 1 | 1 | Solution | 120.03 | 22 | 22.00 | 0.00 |
| instance n=100 81.alb | 1 | 1 | Solution | 120.02 | 20 | 20.00 | 0.00 |
| instance n=100 82.alb | 1 | 1 | Solution | 120.03 | 21 | 21.00 | 0.00 |
| instance n=100 83.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 84.alb | 1 | 1 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=100 85.alb | 1 | 1 | Solution | 120.02 | 25 | 24.00 | 4.00 |
| instance n=100 86.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 87.alb | 1 | 1 | Solution | 120.03 | 22 | 22.00 | 0.00 |
| instance n=100 88.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 89.alb | 1 | 1 | Solution | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 9.alb | 1 | 1 | Solution | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 90.alb | 1 | 1 | Solution | 120.02 | 21 | 20.00 | 4.76 |
| instance n=100 91.alb | 1 | 1 | Solution | 120.02 | 25 | 25.00 | 0.00 |
| instance n=100 92.alb | 1 | 1 | Solution | 120.03 | 24 | 24.00 | 0.00 |
| instance n=100 93.alb | 1 | 1 | Solution | 120.03 | 27 | 27.00 | 0.00 |
| instance n=100 94.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 95.alb | 1 | 1 | Solution | 120.02 | 21 | 21.00 | 0.00 |
| instance n=100 96.alb | 1 | 1 | Solution | 120.03 | 21 | 21.00 | 0.00 |
| instance n=100 97.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 98.alb | 1 | 1 | Solution | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 99.alb | 1 | 1 | Solution | 120.03 | 22 | 22.00 | 0.00 |
| instance n=20 1.alb | 1 | 1 | Optimal | 0.45 | 3 | 3.00 | 0.00 |
| instance n=20 10.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 100.alb | 1 | 1 | Optimal | 0.89 | 11 | 11.00 | 0.00 |
| instance n=20 101.alb | 1 | 1 | Optimal | 1.81 | 13 | 13.00 | 0.00 |
| instance n=20 102.alb | 1 | 1 | Optimal | 0.71 | 13 | 13.00 | 0.00 |
| instance n=20 103.alb | 1 | 1 | Optimal | 0.24 | 12 | 12.00 | 0.00 |
| instance n=20 104.alb | 1 | 1 | Optimal | 0.28 | 11 | 11.00 | 0.00 |
| instance n=20 105.alb | 1 | 1 | Optimal | 0.46 | 12 | 12.00 | 0.00 |
| instance n=20 106.alb | 1 | 1 | Optimal | 0.13 | 10 | 10.00 | 0.00 |
| instance n=20 107.alb | 1 | 1 | Optimal | 1.69 | 14 | 14.00 | 0.00 |
| instance n=20 108.alb | 1 | 1 | Optimal | 4.38 | 15 | 15.00 | 0.00 |
| instance n=20 109.alb | 1 | 1 | Optimal | 0.38 | 12 | 12.00 | 0.00 |
| instance n=20 11.alb | 1 | 1 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 110.alb | 1 | 1 | Optimal | 0.29 | 11 | 11.00 | 0.00 |
| instance n=20 111.alb | 1 | 1 | Optimal | 0.53 | 13 | 13.00 | 0.00 |
| instance n=20 112.alb | 1 | 1 | Optimal | 0.17 | 11 | 11.00 | 0.00 |
| instance n=20 113.alb | 1 | 1 | Optimal | 0.61 | 12 | 12.00 | 0.00 |
| instance n=20 114.alb | 1 | 1 | Optimal | 0.66 | 13 | 13.00 | 0.00 |
| instance n=20 115.alb | 1 | 1 | Optimal | 0.34 | 11 | 11.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 116.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 117.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 118.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 119.alb | 1 | 1 | Optimal | 0.12 | 6 | 6.00 | 0.00 |
| instance n=20 12.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 120.alb | 1 | 1 | Optimal | 0.15 | 6 | 6.00 | 0.00 |
| instance n=20 121.alb | 1 | 1 | Optimal | 0.27 | 5 | 5.00 | 0.00 |
| instance n=20 122.alb | 1 | 1 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 123.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 124.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 125.alb | 1 | 1 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 126.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 127.alb | 1 | 1 | Optimal | 0.13 | 4 | 4.00 | 0.00 |
| instance n=20 128.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 129.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 13.alb | 1 | 1 | Optimal | 0.64 | 3 | 3.00 | 0.00 |
| instance n=20 130.alb | 1 | 1 | Optimal | 0.22 | 6 | 6.00 | 0.00 |
| instance n=20 131.alb | 1 | 1 | Optimal | 0.13 | 7 | 7.00 | 0.00 |
| instance n=20 132.alb | 1 | 1 | Optimal | 0.16 | 4 | 4.00 | 0.00 |
| instance n=20 133.alb | 1 | 1 | Optimal | 0.16 | 5 | 5.00 | 0.00 |
| instance n=20 134.alb | 1 | 1 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 135.alb | 1 | 1 | Optimal | 0.03 | 6 | 6.00 | 0.00 |
| instance n=20 136.alb | 1 | 1 | Optimal | 0.13 | 6 | 6.00 | 0.00 |
| instance n=20 137.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 138.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 139.alb | 1 | 1 | Optimal | 0.16 | 5 | 5.00 | 0.00 |
| instance n=20 14.alb | 1 | 1 | Optimal | 0.47 | 3 | 3.00 | 0.00 |
| instance n=20 140.alb | 1 | 1 | Optimal | 0.12 | 5 | 5.00 | 0.00 |
| instance n=20 141.alb | 1 | 1 | Optimal | 0.40 | 3 | 3.00 | 0.00 |
| instance n=20 142.alb | 1 | 1 | Optimal | 0.39 | 3 | 3.00 | 0.00 |
| instance n=20 143.alb | 1 | 1 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 144.alb | 1 | 1 | Optimal | 0.27 | 4 | 4.00 | 0.00 |
| instance n=20 145.alb | 1 | 1 | Optimal | 0.43 | 3 | 3.00 | 0.00 |
| instance n=20 146.alb | 1 | 1 | Optimal | 0.43 | 3 | 3.00 | 0.00 |
| instance n=20 147.alb | 1 | 1 | Optimal | 0.39 | 3 | 3.00 | 0.00 |
| instance n=20 148.alb | 1 | 1 | Optimal | 0.52 | 3 | 3.00 | 0.00 |
| instance n=20 149.alb | 1 | 1 | Optimal | 0.47 | 3 | 3.00 | 0.00 |
| instance n=20 15.alb | 1 | 1 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 150.alb | 1 | 1 | Optimal | 0.50 | 3 | 3.00 | 0.00 |
| instance n=20 151.alb | 1 | 1 | Optimal | 0.44 | 3 | 3.00 | 0.00 |
| instance n=20 152.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 153.alb | 1 | 1 | Optimal | 0.41 | 3 | 3.00 | 0.00 |
| instance n=20 154.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 155.alb | 1 | 1 | Optimal | 0.50 | 3 | 3.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 156.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 157.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 158.alb | 1 | 1 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 159.alb | 1 | 1 | Optimal | 0.24 | 3 | 3.00 | 0.00 |
| instance n=20 16.alb | 1 | 1 | Optimal | 0.99 | 12 | 12.00 | 0.00 |
| instance n=20 160.alb | 1 | 1 | Optimal | 0.48 | 3 | 3.00 | 0.00 |
| instance n=20 161.alb | 1 | 1 | Optimal | 0.53 | 3 | 3.00 | 0.00 |
| instance n=20 162.alb | 1 | 1 | Optimal | 0.35 | 3 | 3.00 | 0.00 |
| instance n=20 163.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 164.alb | 1 | 1 | Optimal | 0.24 | 4 | 4.00 | 0.00 |
| instance n=20 165.alb | 1 | 1 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 166.alb | 1 | 1 | Optimal | 3.09 | 12 | 12.00 | 0.00 |
| instance n=20 167.alb | 1 | 1 | Optimal | 0.58 | 11 | 11.00 | 0.00 |
| instance n=20 168.alb | 1 | 1 | Optimal | 0.64 | 10 | 10.00 | 0.00 |
| instance n=20 169.alb | 1 | 1 | Optimal | 1.84 | 11 | 11.00 | 0.00 |
| instance n=20 17.alb | 1 | 1 | Optimal | 0.93 | 10 | 10.00 | 0.00 |
| instance n=20 170.alb | 1 | 1 | Optimal | 3.20 | 11 | 11.00 | 0.00 |
| instance n=20 171.alb | 1 | 1 | Optimal | 32.91 | 13 | 13.00 | 0.00 |
| instance n=20 172.alb | 1 | 1 | Optimal | 0.61 | 11 | 11.00 | 0.00 |
| instance n=20 173.alb | 1 | 1 | Optimal | 1.10 | 11 | 11.00 | 0.00 |
| instance n=20 174.alb | 1 | 1 | Optimal | 0.93 | 12 | 12.00 | 0.00 |
| instance n=20 175.alb | 1 | 1 | Optimal | 0.24 | 10 | 10.00 | 0.00 |
| instance n=20 176.alb | 1 | 1 | Optimal | 0.47 | 11 | 11.00 | 0.00 |
| instance n=20 177.alb | 1 | 1 | Optimal | 0.64 | 10 | 10.00 | 0.00 |
| instance n=20 178.alb | 1 | 1 | Optimal | 0.90 | 11 | 11.00 | 0.00 |
| instance n=20 179.alb | 1 | 1 | Optimal | 0.94 | 11 | 11.00 | 0.00 |
| instance n=20 18.alb | 1 | 1 | Optimal | 1.34 | 11 | 11.00 | 0.00 |
| instance n=20 180.alb | 1 | 1 | Optimal | 25.37 | 13 | 13.00 | 0.00 |
| instance n=20 181.alb | 1 | 1 | Optimal | 0.49 | 11 | 11.00 | 0.00 |
| instance n=20 182.alb | 1 | 1 | Optimal | 0.92 | 11 | 11.00 | 0.00 |
| instance n=20 183.alb | 1 | 1 | Optimal | 23.41 | 13 | 13.00 | 0.00 |
| instance n=20 184.alb | 1 | 1 | Optimal | 1.58 | 12 | 12.00 | 0.00 |
| instance n=20 185.alb | 1 | 1 | Optimal | 61.73 | 15 | 15.00 | 0.00 |
| instance n=20 186.alb | 1 | 1 | Optimal | 13.46 | 14 | 14.00 | 0.00 |
| instance n=20 187.alb | 1 | 1 | Optimal | 0.35 | 10 | 10.00 | 0.00 |
| instance n=20 188.alb | 1 | 1 | Optimal | 1.13 | 11 | 11.00 | 0.00 |
| instance n=20 189.alb | 1 | 1 | Optimal | 5.05 | 13 | 13.00 | 0.00 |
| instance n=20 19.alb | 1 | 1 | Optimal | 43.23 | 14 | 14.00 | 0.00 |
| instance n=20 190.alb | 1 | 1 | Solution | 120.01 | 15 | 12.00 | 20.00 |
| instance n=20 191.alb | 1 | 1 | Optimal | 0.52 | 4 | 4.00 | 0.00 |
| instance n=20 192.alb | 1 | 1 | Optimal | 0.17 | 5 | 5.00 | 0.00 |
| instance n=20 193.alb | 1 | 1 | Optimal | 0.35 | 5 | 5.00 | 0.00 |
| instance n=20 194.alb | 1 | 1 | Optimal | 0.22 | 6 | 6.00 | 0.00 |
| instance n=20 195.alb | 1 | 1 | Optimal | 0.02 | 6 | 6.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=20 196.alb | 1 | 1 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 197.alb | 1 | 1 | Optimal | 0.27 | 4 | 4.00 | 0.00 |
| instance n=20 198.alb | 1 | 1 | Optimal | 0.16 | 6 | 6.00 | 0.00 |
| instance n=20 199.alb | 1 | 1 | Optimal | 0.28 | 5 | 5.00 | 0.00 |
| instance n=20 2.alb | 1 | 1 | Optimal | 0.27 | 3 | 3.00 | 0.00 |
| instance n=20 20.alb | 1 | 1 | Optimal | 1.16 | 11 | 11.00 | 0.00 |
| instance n=20 200.alb | 1 | 1 | Optimal | 0.16 | 6 | 6.00 | 0.00 |
| instance n=20 201.alb | 1 | 1 | Optimal | 0.27 | 6 | 6.00 | 0.00 |
| instance n=20 202.alb | 1 | 1 | Optimal | 0.35 | 4 | 4.00 | 0.00 |
| instance n=20 203.alb | 1 | 1 | Optimal | 0.25 | 4 | 4.00 | 0.00 |
| instance n=20 204.alb | 1 | 1 | Optimal | 0.42 | 5 | 5.00 | 0.00 |
| instance n=20 205.alb | 1 | 1 | Optimal | 0.28 | 6 | 6.00 | 0.00 |
| instance n=20 206.alb | 1 | 1 | Optimal | 0.16 | 5 | 5.00 | 0.00 |
| instance n=20 207.alb | 1 | 1 | Optimal | 0.28 | 6 | 6.00 | 0.00 |
| instance n=20 208.alb | 1 | 1 | Optimal | 0.45 | 5 | 5.00 | 0.00 |
| instance n=20 209.alb | 1 | 1 | Optimal | 0.31 | 4 | 4.00 | 0.00 |
| instance n=20 21.alb | 1 | 1 | Optimal | 4.09 | 14 | 14.00 | 0.00 |
| instance n=20 210.alb | 1 | 1 | Optimal | 0.29 | 5 | 5.00 | 0.00 |
| instance n=20 211.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 212.alb | 1 | 1 | Optimal | 0.17 | 5 | 5.00 | 0.00 |
| instance n=20 213.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 214.alb | 1 | 1 | Optimal | 0.42 | 5 | 5.00 | 0.00 |
| instance n=20 215.alb | 1 | 1 | Optimal | 0.39 | 5 | 5.00 | 0.00 |
| instance n=20 216.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 217.alb | 1 | 1 | Optimal | 0.11 | 4 | 4.00 | 0.00 |
| instance n=20 218.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 219.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 22.alb | 1 | 1 | Optimal | 0.72 | 12 | 12.00 | 0.00 |
| instance n=20 220.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 221.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 222.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 223.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 224.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 225.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 226.alb | 1 | 1 | Optimal | 0.33 | 3 | 3.00 | 0.00 |
| instance n=20 227.alb | 1 | 1 | Optimal | 0.20 | 3 | 3.00 | 0.00 |
| instance n=20 228.alb | 1 | 1 | Optimal | 0.06 | 2 | 2.00 | 0.00 |
| instance n=20 229.alb | 1 | 1 | Optimal | 0.23 | 3 | 3.00 | 0.00 |
| instance n=20 23.alb | 1 | 1 | Optimal | 25.65 | 13 | 13.00 | 0.00 |
| instance n=20 230.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 231.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 232.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 233.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 234.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 235.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 236.alb | 1 | 1 | Optimal | 0.07 | 3 | 3.00 | 0.00 |
| instance n=20 237.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 238.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 239.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 24.alb | 1 | 1 | Optimal | 4.01 | 11 | 11.00 | 0.00 |
| instance n=20 240.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 241.alb | 1 | 1 | Optimal | 0.36 | 13 | 13.00 | 0.00 |
| instance n=20 242.alb | 1 | 1 | Optimal | 0.13 | 12 | 12.00 | 0.00 |
| instance n=20 243.alb | 1 | 1 | Optimal | 0.23 | 10 | 10.00 | 0.00 |
| instance n=20 244.alb | 1 | 1 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=20 245.alb | 1 | 1 | Optimal | 0.33 | 13 | 13.00 | 0.00 |
| instance n=20 246.alb | 1 | 1 | Optimal | 0.61 | 13 | 13.00 | 0.00 |
| instance n=20 247.alb | 1 | 1 | Optimal | 0.28 | 11 | 11.00 | 0.00 |
| instance n=20 248.alb | 1 | 1 | Optimal | 0.19 | 11 | 11.00 | 0.00 |
| instance n=20 249.alb | 1 | 1 | Optimal | 0.64 | 13 | 13.00 | 0.00 |
| instance n=20 25.alb | 1 | 1 | Optimal | 0.15 | 11 | 11.00 | 0.00 |
| instance n=20 250.alb | 1 | 1 | Optimal | 0.21 | 10 | 10.00 | 0.00 |
| instance n=20 251.alb | 1 | 1 | Optimal | 0.24 | 12 | 12.00 | 0.00 |
| instance n=20 252.alb | 1 | 1 | Optimal | 0.27 | 11 | 11.00 | 0.00 |
| instance n=20 253.alb | 1 | 1 | Optimal | 0.41 | 13 | 13.00 | 0.00 |
| instance n=20 254.alb | 1 | 1 | Optimal | 0.22 | 12 | 12.00 | 0.00 |
| instance n=20 255.alb | 1 | 1 | Optimal | 0.52 | 13 | 13.00 | 0.00 |
| instance n=20 256.alb | 1 | 1 | Optimal | 0.35 | 14 | 14.00 | 0.00 |
| instance n=20 257.alb | 1 | 1 | Optimal | 0.11 | 10 | 10.00 | 0.00 |
| instance n=20 258.alb | 1 | 1 | Optimal | 0.27 | 13 | 13.00 | 0.00 |
| instance n=20 259.alb | 1 | 1 | Optimal | 0.43 | 13 | 13.00 | 0.00 |
| instance n=20 26.alb | 1 | 1 | Optimal | 1.13 | 12 | 12.00 | 0.00 |
| instance n=20 260.alb | 1 | 1 | Optimal | 0.60 | 12 | 12.00 | 0.00 |
| instance n=20 261.alb | 1 | 1 | Optimal | 0.16 | 12 | 12.00 | 0.00 |
| instance n=20 262.alb | 1 | 1 | Optimal | 0.11 | 11 | 11.00 | 0.00 |
| instance n=20 263.alb | 1 | 1 | Optimal | 0.31 | 12 | 12.00 | 0.00 |
| instance n=20 264.alb | 1 | 1 | Optimal | 0.38 | 12 | 12.00 | 0.00 |
| instance n=20 265.alb | 1 | 1 | Optimal | 0.24 | 12 | 12.00 | 0.00 |
| instance n=20 266.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 267.alb | 1 | 1 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 268.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 269.alb | 1 | 1 | Optimal | 0.19 | 7 | 7.00 | 0.00 |
| instance n=20 27.alb | 1 | 1 | Optimal | 8.22 | 13 | 13.00 | 0.00 |
| instance n=20 270.alb | 1 | 1 | Optimal | 0.10 | 7 | 7.00 | 0.00 |
| instance n=20 271.alb | 1 | 1 | Optimal | 0.07 | 6 | 6.00 | 0.00 |
| instance n=20 272.alb | 1 | 1 | Optimal | 0.16 | 5 | 5.00 | 0.00 |
| instance n=20 273.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 274.alb | 1 | 1 | Optimal | 0.13 | 6 | 6.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|-------|----------|-------|----------------|
| instance n=20 275.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 276.alb | 1 | 1 | Optimal | 0.12 | 4 | 4.00 | 0.00 |
| instance n=20 277.alb | 1 | 1 | Optimal | 0.11 | 4 | 4.00 | 0.00 |
| instance n=20 278.alb | 1 | 1 | Optimal | 0.14 | 6 | 6.00 | 0.00 |
| instance n=20 279.alb | 1 | 1 | Optimal | 0.11 | 6 | 6.00 | 0.00 |
| instance n=20 28.alb | 1 | 1 | Optimal | 2.78 | 12 | 12.00 | 0.00 |
| instance n=20 280.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 281.alb | 1 | 1 | Optimal | 0.17 | 4 | 4.00 | 0.00 |
| instance n=20 282.alb | 1 | 1 | Optimal | 0.06 | 4 | 4.00 | 0.00 |
| instance n=20 283.alb | 1 | 1 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 284.alb | 1 | 1 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 285.alb | 1 | 1 | Optimal | 0.20 | 5 | 5.00 | 0.00 |
| instance n=20 286.alb | 1 | 1 | Optimal | 0.12 | 5 | 5.00 | 0.00 |
| instance n=20 287.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 288.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 289.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 29.alb | 1 | 1 | Optimal | 0.39 | 10 | 10.00 | 0.00 |
| instance n=20 290.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 291.alb | 1 | 1 | Optimal | 0.30 | 3 | 3.00 | 0.00 |
| instance n=20 292.alb | 1 | 1 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 293.alb | 1 | 1 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 294.alb | 1 | 1 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 295.alb | 1 | 1 | Optimal | 0.39 | 3 | 3.00 | 0.00 |
| instance n=20 296.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 297.alb | 1 | 1 | Optimal | 0.27 | 3 | 3.00 | 0.00 |
| instance n=20 298.alb | 1 | 1 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 299.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 3.alb | 1 | 1 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 30.alb | 1 | 1 | Optimal | 86.26 | 16 | 16.00 | 0.00 |
| instance n=20 300.alb | 1 | 1 | Optimal | 0.42 | 4 | 4.00 | 0.00 |
| instance n=20 301.alb | 1 | 1 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 302.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 303.alb | 1 | 1 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 304.alb | 1 | 1 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 305.alb | 1 | 1 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 306.alb | 1 | 1 | Optimal | 0.61 | 3 | 3.00 | 0.00 |
| instance n=20 307.alb | 1 | 1 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 308.alb | 1 | 1 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 309.alb | 1 | 1 | Optimal | 0.55 | 3 | 3.00 | 0.00 |
| instance n=20 31.alb | 1 | 1 | Optimal | 2.94 | 12 | 12.00 | 0.00 |
| instance n=20 310.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 311.alb | 1 | 1 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 312.alb | 1 | 1 | Optimal | 0.30 | 4 | 4.00 | 0.00 |
| instance n=20 313.alb | 1 | 1 | Optimal | 0.28 | 3 | 3.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 314.alb | 1 | 1 | Optimal | 0.49 | 3 | 3.00 | 0.00 |
| instance n=20 315.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 316.alb | 1 | 1 | Optimal | 6.82 | 10 | 10.00 | 0.00 |
| instance n=20 317.alb | 1 | 1 | Optimal | 2.08 | 10 | 10.00 | 0.00 |
| instance n=20 318.alb | 1 | 1 | Optimal | 0.35 | 10 | 10.00 | 0.00 |
| instance n=20 319.alb | 1 | 1 | Optimal | 6.90 | 14 | 14.00 | 0.00 |
| instance n=20 32.alb | 1 | 1 | Optimal | 17.57 | 13 | 13.00 | 0.00 |
| instance n=20 320.alb | 1 | 1 | Optimal | 1.18 | 12 | 12.00 | 0.00 |
| instance n=20 321.alb | 1 | 1 | Solution | 120.01 | 14 | 11.00 | 21.43 |
| instance n=20 322.alb | 1 | 1 | Optimal | 13.16 | 12 | 12.00 | 0.00 |
| instance n=20 323.alb | 1 | 1 | Optimal | 7.89 | 13 | 13.00 | 0.00 |
| instance n=20 324.alb | 1 | 1 | Optimal | 0.88 | 9 | 9.00 | 0.00 |
| instance n=20 325.alb | 1 | 1 | Optimal | 69.16 | 14 | 14.00 | 0.00 |
| instance n=20 326.alb | 1 | 1 | Optimal | 53.63 | 14 | 14.00 | 0.00 |
| instance n=20 327.alb | 1 | 1 | Optimal | 12.95 | 13 | 13.00 | 0.00 |
| instance n=20 328.alb | 1 | 1 | Optimal | 15.76 | 13 | 13.00 | 0.00 |
| instance n=20 329.alb | 1 | 1 | Optimal | 1.15 | 10 | 10.00 | 0.00 |
| instance n=20 33.alb | 1 | 1 | Optimal | 0.80 | 11 | 11.00 | 0.00 |
| instance n=20 330.alb | 1 | 1 | Optimal | 88.63 | 12 | 12.00 | 0.00 |
| instance n=20 331.alb | 1 | 1 | Solution | 120.00 | 13 | 12.00 | 7.69 |
| instance n=20 332.alb | 1 | 1 | Optimal | 11.42 | 13 | 13.00 | 0.00 |
| instance n=20 333.alb | 1 | 1 | Optimal | 1.63 | 11 | 11.00 | 0.00 |
| instance n=20 334.alb | 1 | 1 | Optimal | 0.74 | 10 | 10.00 | 0.00 |
| instance n=20 335.alb | 1 | 1 | Solution | 120.00 | 14 | 11.00 | 21.43 |
| instance n=20 336.alb | 1 | 1 | Optimal | 1.01 | 11 | 11.00 | 0.00 |
| instance n=20 337.alb | 1 | 1 | Optimal | 0.22 | 10 | 10.00 | 0.00 |
| instance n=20 338.alb | 1 | 1 | Optimal | 14.53 | 14 | 14.00 | 0.00 |
| instance n=20 339.alb | 1 | 1 | Optimal | 21.75 | 13 | 13.00 | 0.00 |
| instance n=20 34.alb | 1 | 1 | Optimal | 2.44 | 12 | 12.00 | 0.00 |
| instance n=20 340.alb | 1 | 1 | Optimal | 0.70 | 11 | 11.00 | 0.00 |
| instance n=20 341.alb | 1 | 1 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=20 342.alb | 1 | 1 | Optimal | 0.38 | 6 | 6.00 | 0.00 |
| instance n=20 343.alb | 1 | 1 | Optimal | 0.24 | 6 | 6.00 | 0.00 |
| instance n=20 344.alb | 1 | 1 | Optimal | 0.39 | 6 | 6.00 | 0.00 |
| instance n=20 345.alb | 1 | 1 | Optimal | 0.57 | 4 | 4.00 | 0.00 |
| instance n=20 346.alb | 1 | 1 | Optimal | 0.28 | 5 | 5.00 | 0.00 |
| instance n=20 347.alb | 1 | 1 | Optimal | 0.41 | 6 | 6.00 | 0.00 |
| instance n=20 348.alb | 1 | 1 | Optimal | 0.22 | 5 | 5.00 | 0.00 |
| instance n=20 349.alb | 1 | 1 | Optimal | 0.51 | 5 | 5.00 | 0.00 |
| instance n=20 35.alb | 1 | 1 | Optimal | 1.59 | 12 | 12.00 | 0.00 |
| instance n=20 350.alb | 1 | 1 | Optimal | 0.46 | 5 | 5.00 | 0.00 |
| instance n=20 351.alb | 1 | 1 | Optimal | 0.18 | 5 | 5.00 | 0.00 |
| instance n=20 352.alb | 1 | 1 | Optimal | 0.58 | 4 | 4.00 | 0.00 |
| instance n=20 353.alb | 1 | 1 | Optimal | 0.27 | 6 | 6.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 354.alb | 1 | 1 | Optimal | 0.31 | 6 | 6.00 | 0.00 |
| instance n=20 355.alb | 1 | 1 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 356.alb | 1 | 1 | Optimal | 0.32 | 5 | 5.00 | 0.00 |
| instance n=20 357.alb | 1 | 1 | Optimal | 0.72 | 5 | 5.00 | 0.00 |
| instance n=20 358.alb | 1 | 1 | Optimal | 0.27 | 4 | 4.00 | 0.00 |
| instance n=20 359.alb | 1 | 1 | Optimal | 0.32 | 4 | 4.00 | 0.00 |
| instance n=20 36.alb | 1 | 1 | Optimal | 1.81 | 13 | 13.00 | 0.00 |
| instance n=20 360.alb | 1 | 1 | Optimal | 0.38 | 6 | 6.00 | 0.00 |
| instance n=20 361.alb | 1 | 1 | Optimal | 0.44 | 5 | 5.00 | 0.00 |
| instance n=20 362.alb | 1 | 1 | Optimal | 0.32 | 5 | 5.00 | 0.00 |
| instance n=20 363.alb | 1 | 1 | Optimal | 0.41 | 7 | 7.00 | 0.00 |
| instance n=20 364.alb | 1 | 1 | Optimal | 0.31 | 4 | 4.00 | 0.00 |
| instance n=20 365.alb | 1 | 1 | Optimal | 0.44 | 5 | 5.00 | 0.00 |
| instance n=20 366.alb | 1 | 1 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 367.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 368.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 369.alb | 1 | 1 | Optimal | 0.25 | 3 | 3.00 | 0.00 |
| instance n=20 37.alb | 1 | 1 | Optimal | 3.26 | 12 | 12.00 | 0.00 |
| instance n=20 370.alb | 1 | 1 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 371.alb | 1 | 1 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 372.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 373.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 374.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 375.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 376.alb | 1 | 1 | Optimal | 0.17 | 3 | 3.00 | 0.00 |
| instance n=20 377.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 378.alb | 1 | 1 | Optimal | 0.02 | 3 | 3.00 | 0.00 |
| instance n=20 379.alb | 1 | 1 | Optimal | 0.06 | 4 | 4.00 | 0.00 |
| instance n=20 38.alb | 1 | 1 | Optimal | 0.53 | 12 | 12.00 | 0.00 |
| instance n=20 380.alb | 1 | 1 | Optimal | 0.19 | 3 | 3.00 | 0.00 |
| instance n=20 381.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 382.alb | 1 | 1 | Optimal | 0.17 | 4 | 4.00 | 0.00 |
| instance n=20 383.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 384.alb | 1 | 1 | Optimal | 0.21 | 3 | 3.00 | 0.00 |
| instance n=20 385.alb | 1 | 1 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 386.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 387.alb | 1 | 1 | Optimal | 0.26 | 3 | 3.00 | 0.00 |
| instance n=20 388.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 389.alb | 1 | 1 | Optimal | 0.13 | 3 | 3.00 | 0.00 |
| instance n=20 39.alb | 1 | 1 | Optimal | 5.75 | 13 | 13.00 | 0.00 |
| instance n=20 390.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 391.alb | 1 | 1 | Optimal | 0.27 | 11 | 11.00 | 0.00 |
| instance n=20 392.alb | 1 | 1 | Optimal | 0.39 | 14 | 14.00 | 0.00 |
| instance n=20 393.alb | 1 | 1 | Optimal | 0.24 | 11 | 11.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 394.alb | 1 | 1 | Optimal | 0.32 | 12 | 12.00 | 0.00 |
| instance n=20 395.alb | 1 | 1 | Optimal | 0.22 | 12 | 12.00 | 0.00 |
| instance n=20 396.alb | 1 | 1 | Optimal | 0.33 | 13 | 13.00 | 0.00 |
| instance n=20 397.alb | 1 | 1 | Optimal | 0.24 | 10 | 10.00 | 0.00 |
| instance n=20 398.alb | 1 | 1 | Optimal | 0.16 | 11 | 11.00 | 0.00 |
| instance n=20 399.alb | 1 | 1 | Optimal | 0.42 | 13 | 13.00 | 0.00 |
| instance n=20 4.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 40.alb | 1 | 1 | Optimal | 1.02 | 12 | 12.00 | 0.00 |
| instance n=20 400.alb | 1 | 1 | Optimal | 0.46 | 12 | 12.00 | 0.00 |
| instance n=20 401.alb | 1 | 1 | Optimal | 0.25 | 12 | 12.00 | 0.00 |
| instance n=20 402.alb | 1 | 1 | Optimal | 0.30 | 12 | 12.00 | 0.00 |
| instance n=20 403.alb | 1 | 1 | Optimal | 0.21 | 12 | 12.00 | 0.00 |
| instance n=20 404.alb | 1 | 1 | Optimal | 0.16 | 10 | 10.00 | 0.00 |
| instance n=20 405.alb | 1 | 1 | Optimal | 0.17 | 12 | 12.00 | 0.00 |
| instance n=20 406.alb | 1 | 1 | Optimal | 1.42 | 14 | 14.00 | 0.00 |
| instance n=20 407.alb | 1 | 1 | Optimal | 0.18 | 10 | 10.00 | 0.00 |
| instance n=20 408.alb | 1 | 1 | Optimal | 1.24 | 14 | 14.00 | 0.00 |
| instance n=20 409.alb | 1 | 1 | Optimal | 0.31 | 12 | 12.00 | 0.00 |
| instance n=20 41.alb | 1 | 1 | Optimal | 0.24 | 6 | 6.00 | 0.00 |
| instance n=20 410.alb | 1 | 1 | Optimal | 0.30 | 11 | 11.00 | 0.00 |
| instance n=20 411.alb | 1 | 1 | Optimal | 1.37 | 15 | 15.00 | 0.00 |
| instance n=20 412.alb | 1 | 1 | Optimal | 0.24 | 11 | 11.00 | 0.00 |
| instance n=20 413.alb | 1 | 1 | Optimal | 0.19 | 10 | 10.00 | 0.00 |
| instance n=20 414.alb | 1 | 1 | Optimal | 0.39 | 12 | 12.00 | 0.00 |
| instance n=20 415.alb | 1 | 1 | Optimal | 0.17 | 10 | 10.00 | 0.00 |
| instance n=20 416.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 417.alb | 1 | 1 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 418.alb | 1 | 1 | Optimal | 0.04 | 6 | 6.00 | 0.00 |
| instance n=20 419.alb | 1 | 1 | Optimal | 0.16 | 4 | 4.00 | 0.00 |
| instance n=20 42.alb | 1 | 1 | Optimal | 0.36 | 5 | 5.00 | 0.00 |
| instance n=20 420.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 421.alb | 1 | 1 | Optimal | 0.14 | 6 | 6.00 | 0.00 |
| instance n=20 422.alb | 1 | 1 | Optimal | 0.12 | 4 | 4.00 | 0.00 |
| instance n=20 423.alb | 1 | 1 | Optimal | 0.13 | 6 | 6.00 | 0.00 |
| instance n=20 424.alb | 1 | 1 | Optimal | 0.15 | 5 | 5.00 | 0.00 |
| instance n=20 425.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 426.alb | 1 | 1 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 427.alb | 1 | 1 | Optimal | 0.13 | 6 | 6.00 | 0.00 |
| instance n=20 428.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 429.alb | 1 | 1 | Optimal | 0.13 | 4 | 4.00 | 0.00 |
| instance n=20 43.alb | 1 | 1 | Optimal | 0.25 | 5 | 5.00 | 0.00 |
| instance n=20 430.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 431.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 432.alb | 1 | 1 | Optimal | 0.07 | 5 | 5.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 433.alb | 1 | 1 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 434.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 435.alb | 1 | 1 | Optimal | 0.18 | 7 | 7.00 | 0.00 |
| instance n=20 436.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 437.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 438.alb | 1 | 1 | Optimal | 0.13 | 6 | 6.00 | 0.00 |
| instance n=20 439.alb | 1 | 1 | Optimal | 0.14 | 5 | 5.00 | 0.00 |
| instance n=20 44.alb | 1 | 1 | Optimal | 0.36 | 5 | 5.00 | 0.00 |
| instance n=20 440.alb | 1 | 1 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 441.alb | 1 | 1 | Optimal | 0.03 | 3 | 3.00 | 0.00 |
| instance n=20 442.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 443.alb | 1 | 1 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 444.alb | 1 | 1 | Optimal | 0.07 | 3 | 3.00 | 0.00 |
| instance n=20 445.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 446.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 447.alb | 1 | 1 | Optimal | 0.07 | 3 | 3.00 | 0.00 |
| instance n=20 448.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 449.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 45.alb | 1 | 1 | Optimal | 0.17 | 6 | 6.00 | 0.00 |
| instance n=20 450.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 451.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 452.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 453.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 454.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 455.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 456.alb | 1 | 1 | Optimal | 0.06 | 4 | 4.00 | 0.00 |
| instance n=20 457.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 458.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 459.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 46.alb | 1 | 1 | Optimal | 0.30 | 4 | 4.00 | 0.00 |
| instance n=20 460.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 461.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 462.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 463.alb | 1 | 1 | Optimal | 0.07 | 3 | 3.00 | 0.00 |
| instance n=20 464.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 465.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 466.alb | 1 | 1 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=20 467.alb | 1 | 1 | Optimal | 0.13 | 14 | 14.00 | 0.00 |
| instance n=20 468.alb | 1 | 1 | Optimal | 0.13 | 13 | 13.00 | 0.00 |
| instance n=20 469.alb | 1 | 1 | Optimal | 0.12 | 14 | 14.00 | 0.00 |
| instance n=20 47.alb | 1 | 1 | Optimal | 0.24 | 4 | 4.00 | 0.00 |
| instance n=20 470.alb | 1 | 1 | Optimal | 0.14 | 12 | 12.00 | 0.00 |
| instance n=20 471.alb | 1 | 1 | Optimal | 0.06 | 12 | 12.00 | 0.00 |
| instance n=20 472.alb | 1 | 1 | Optimal | 0.13 | 13 | 13.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 473.alb | 1 | 1 | Optimal | 0.09 | 10 | 10.00 | 0.00 |
| instance n=20 474.alb | 1 | 1 | Optimal | 0.13 | 14 | 14.00 | 0.00 |
| instance n=20 475.alb | 1 | 1 | Optimal | 0.06 | 11 | 11.00 | 0.00 |
| instance n=20 476.alb | 1 | 1 | Optimal | 0.13 | 11 | 11.00 | 0.00 |
| instance n=20 477.alb | 1 | 1 | Optimal | 0.06 | 11 | 11.00 | 0.00 |
| instance n=20 478.alb | 1 | 1 | Optimal | 0.08 | 12 | 12.00 | 0.00 |
| instance n=20 479.alb | 1 | 1 | Optimal | 0.07 | 13 | 13.00 | 0.00 |
| instance n=20 48.alb | 1 | 1 | Optimal | 0.27 | 5 | 5.00 | 0.00 |
| instance n=20 480.alb | 1 | 1 | Optimal | 0.14 | 13 | 13.00 | 0.00 |
| instance n=20 481.alb | 1 | 1 | Optimal | 0.19 | 13 | 13.00 | 0.00 |
| instance n=20 482.alb | 1 | 1 | Optimal | 0.06 | 13 | 13.00 | 0.00 |
| instance n=20 483.alb | 1 | 1 | Optimal | 0.06 | 12 | 12.00 | 0.00 |
| instance n=20 484.alb | 1 | 1 | Optimal | 0.13 | 13 | 13.00 | 0.00 |
| instance n=20 485.alb | 1 | 1 | Optimal | 0.17 | 15 | 15.00 | 0.00 |
| instance n=20 486.alb | 1 | 1 | Optimal | 0.08 | 11 | 11.00 | 0.00 |
| instance n=20 487.alb | 1 | 1 | Optimal | 0.06 | 12 | 12.00 | 0.00 |
| instance n=20 488.alb | 1 | 1 | Optimal | 0.16 | 15 | 15.00 | 0.00 |
| instance n=20 489.alb | 1 | 1 | Optimal | 0.06 | 12 | 12.00 | 0.00 |
| instance n=20 49.alb | 1 | 1 | Optimal | 0.30 | 4 | 4.00 | 0.00 |
| instance n=20 490.alb | 1 | 1 | Optimal | 0.10 | 12 | 12.00 | 0.00 |
| instance n=20 491.alb | 1 | 1 | Optimal | 0.05 | 6 | 6.00 | 0.00 |
| instance n=20 492.alb | 1 | 1 | Optimal | 0.07 | 5 | 5.00 | 0.00 |
| instance n=20 493.alb | 1 | 1 | Optimal | 0.01 | 5 | 5.00 | 0.00 |
| instance n=20 494.alb | 1 | 1 | Optimal | 0.08 | 6 | 6.00 | 0.00 |
| instance n=20 495.alb | 1 | 1 | Optimal | 0.05 | 6 | 6.00 | 0.00 |
| instance n=20 496.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 497.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 498.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 499.alb | 1 | 1 | Optimal | 0.07 | 5 | 5.00 | 0.00 |
| instance n=20 5.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 50.alb | 1 | 1 | Optimal | 0.39 | 4 | 4.00 | 0.00 |
| instance n=20 500.alb | 1 | 1 | Optimal | 0.06 | 8 | 8.00 | 0.00 |
| instance n=20 501.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 502.alb | 1 | 1 | Optimal | 0.06 | 4 | 4.00 | 0.00 |
| instance n=20 503.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 504.alb | 1 | 1 | Optimal | 0.07 | 6 | 6.00 | 0.00 |
| instance n=20 505.alb | 1 | 1 | Optimal | 0.05 | 6 | 6.00 | 0.00 |
| instance n=20 506.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 507.alb | 1 | 1 | Optimal | 0.03 | 5 | 5.00 | 0.00 |
| instance n=20 508.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 509.alb | 1 | 1 | Optimal | 0.02 | 4 | 4.00 | 0.00 |
| instance n=20 51.alb | 1 | 1 | Optimal | 0.30 | 4 | 4.00 | 0.00 |
| instance n=20 510.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 511.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=20 512.alb | 1 | 1 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 513.alb | 1 | 1 | Optimal | 0.05 | 5 | 5.00 | 0.00 |
| instance n=20 514.alb | 1 | 1 | Optimal | 0.06 | 5 | 5.00 | 0.00 |
| instance n=20 515.alb | 1 | 1 | Optimal | 0.06 | 6 | 6.00 | 0.00 |
| instance n=20 516.alb | 1 | 1 | Optimal | 0.36 | 3 | 3.00 | 0.00 |
| instance n=20 517.alb | 1 | 1 | Optimal | 0.35 | 3 | 3.00 | 0.00 |
| instance n=20 518.alb | 1 | 1 | Optimal | 0.55 | 3 | 3.00 | 0.00 |
| instance n=20 519.alb | 1 | 1 | Optimal | 0.38 | 3 | 3.00 | 0.00 |
| instance n=20 52.alb | 1 | 1 | Optimal | 0.37 | 4 | 4.00 | 0.00 |
| instance n=20 520.alb | 1 | 1 | Optimal | 0.33 | 3 | 3.00 | 0.00 |
| instance n=20 521.alb | 1 | 1 | Optimal | 0.35 | 3 | 3.00 | 0.00 |
| instance n=20 522.alb | 1 | 1 | Optimal | 0.44 | 3 | 3.00 | 0.00 |
| instance n=20 523.alb | 1 | 1 | Optimal | 0.49 | 3 | 3.00 | 0.00 |
| instance n=20 524.alb | 1 | 1 | Optimal | 0.41 | 3 | 3.00 | 0.00 |
| instance n=20 525.alb | 1 | 1 | Optimal | 0.44 | 3 | 3.00 | 0.00 |
| instance n=20 53.alb | 1 | 1 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 54.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 55.alb | 1 | 1 | Optimal | 0.39 | 5 | 5.00 | 0.00 |
| instance n=20 56.alb | 1 | 1 | Optimal | 0.39 | 4 | 4.00 | 0.00 |
| instance n=20 57.alb | 1 | 1 | Optimal | 0.39 | 4 | 4.00 | 0.00 |
| instance n=20 58.alb | 1 | 1 | Optimal | 0.25 | 5 | 5.00 | 0.00 |
| instance n=20 59.alb | 1 | 1 | Optimal | 0.58 | 4 | 4.00 | 0.00 |
| instance n=20 6.alb | 1 | 1 | Optimal | 0.05 | 3 | 3.00 | 0.00 |
| instance n=20 60.alb | 1 | 1 | Optimal | 0.50 | 6 | 6.00 | 0.00 |
| instance n=20 61.alb | 1 | 1 | Optimal | 0.35 | 7 | 7.00 | 0.00 |
| instance n=20 62.alb | 1 | 1 | Optimal | 0.24 | 5 | 5.00 | 0.00 |
| instance n=20 63.alb | 1 | 1 | Optimal | 0.57 | 5 | 5.00 | 0.00 |
| instance n=20 64.alb | 1 | 1 | Optimal | 0.29 | 5 | 5.00 | 0.00 |
| instance n=20 65.alb | 1 | 1 | Optimal | 0.25 | 5 | 5.00 | 0.00 |
| instance n=20 66.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 67.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 68.alb | 1 | 1 | Optimal | 0.07 | 3 | 3.00 | 0.00 |
| instance n=20 69.alb | 1 | 1 | Optimal | 0.06 | 2 | 2.00 | 0.00 |
| instance n=20 7.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 70.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 71.alb | 1 | 1 | Optimal | 0.22 | 3 | 3.00 | 0.00 |
| instance n=20 72.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 73.alb | 1 | 1 | Optimal | 0.11 | 2 | 2.00 | 0.00 |
| instance n=20 74.alb | 1 | 1 | Optimal | 0.30 | 3 | 3.00 | 0.00 |
| instance n=20 75.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 76.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 77.alb | 1 | 1 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 78.alb | 1 | 1 | Optimal | 0.13 | 3 | 3.00 | 0.00 |
| instance n=20 79.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 8.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 80.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 81.alb | 1 | 1 | Optimal | 0.21 | 3 | 3.00 | 0.00 |
| instance n=20 82.alb | 1 | 1 | Optimal | 0.22 | 4 | 4.00 | 0.00 |
| instance n=20 83.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 84.alb | 1 | 1 | Optimal | 0.23 | 3 | 3.00 | 0.00 |
| instance n=20 85.alb | 1 | 1 | Optimal | 0.28 | 3 | 3.00 | 0.00 |
| instance n=20 86.alb | 1 | 1 | Optimal | 0.16 | 3 | 3.00 | 0.00 |
| instance n=20 87.alb | 1 | 1 | Optimal | 0.33 | 3 | 3.00 | 0.00 |
| instance n=20 88.alb | 1 | 1 | Optimal | 0.21 | 3 | 3.00 | 0.00 |
| instance n=20 89.alb | 1 | 1 | Optimal | 0.20 | 3 | 3.00 | 0.00 |
| instance n=20 9.alb | 1 | 1 | Optimal | 0.77 | 3 | 3.00 | 0.00 |
| instance n=20 90.alb | 1 | 1 | Optimal | 0.25 | 3 | 3.00 | 0.00 |
| instance n=20 91.alb | 1 | 1 | Optimal | 0.14 | 11 | 11.00 | 0.00 |
| instance n=20 92.alb | 1 | 1 | Optimal | 0.24 | 11 | 11.00 | 0.00 |
| instance n=20 93.alb | 1 | 1 | Optimal | 1.07 | 13 | 13.00 | 0.00 |
| instance n=20 94.alb | 1 | 1 | Optimal | 0.22 | 10 | 10.00 | 0.00 |
| instance n=20 95.alb | 1 | 1 | Optimal | 0.22 | 12 | 12.00 | 0.00 |
| instance n=20 96.alb | 1 | 1 | Optimal | 0.22 | 10 | 10.00 | 0.00 |
| instance n=20 97.alb | 1 | 1 | Optimal | 5.29 | 15 | 15.00 | 0.00 |
| instance n=20 98.alb | 1 | 1 | Optimal | 0.99 | 13 | 13.00 | 0.00 |
| instance n=20 99.alb | 1 | 1 | Optimal | 0.43 | 12 | 12.00 | 0.00 |
| instance n=50 1.alb | 1 | 1 | Optimal | 2.41 | 8 | 8.00 | 0.00 |
| instance n=50 10.alb | 1 | 1 | Optimal | 1.81 | 7 | 7.00 | 0.00 |
| instance n=50 100.alb | 1 | 1 | Optimal | 2.36 | 7 | 7.00 | 0.00 |
| instance n=50 101.alb | 1 | 1 | Solution | 120.02 | 30 | 26.00 | 13.33 |
| instance n=50 102.alb | 1 | 1 | Solution | 120.02 | 32 | 27.00 | 15.63 |
| instance n=50 103.alb | 1 | 1 | Solution | 120.02 | 29 | 25.00 | 13.79 |
| instance n=50 104.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 105.alb | 1 | 1 | Solution | 120.01 | 24 | 23.00 | 4.17 |
| instance n=50 106.alb | 1 | 1 | Solution | 120.02 | 28 | 26.00 | 7.14 |
| instance n=50 107.alb | 1 | 1 | Solution | 120.02 | 28 | 27.00 | 3.57 |
| instance n=50 108.alb | 1 | 1 | Solution | 120.02 | 30 | 26.00 | 13.33 |
| instance n=50 109.alb | 1 | 1 | Solution | 120.01 | 30 | 25.00 | 16.67 |
| instance n=50 11.alb | 1 | 1 | Optimal | 3.30 | 7 | 7.00 | 0.00 |
| instance n=50 110.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 111.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 112.alb | 1 | 1 | Solution | 120.02 | 27 | 25.00 | 7.41 |
| instance n=50 113.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 114.alb | 1 | 1 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=50 115.alb | 1 | 1 | Solution | 120.02 | 28 | 25.00 | 10.71 |
| instance n=50 116.alb | 1 | 1 | Solution | 120.01 | 32 | 26.00 | 18.75 |
| instance n=50 117.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 118.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 119.alb | 1 | 1 | Solution | 120.01 | 25 | 25.00 | 0.00 |
| instance n=50 12.alb | 1 | 1 | Optimal | 0.10 | 6 | 6.00 | 0.00 |
| instance n=50 120.alb | 1 | 1 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=50 121.alb | 1 | 1 | Solution | 120.02 | 32 | 27.00 | 15.63 |
| instance n=50 122.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 123.alb | 1 | 1 | Solution | 120.02 | 32 | 26.00 | 18.75 |
| instance n=50 124.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 125.alb | 1 | 1 | Solution | 120.01 | 33 | 27.00 | 18.18 |
| instance n=50 126.alb | 1 | 1 | Optimal | 1.24 | 12 | 12.00 | 0.00 |
| instance n=50 127.alb | 1 | 1 | Optimal | 12.49 | 14 | 14.00 | 0.00 |
| instance n=50 128.alb | 1 | 1 | Optimal | 13.27 | 12 | 12.00 | 0.00 |
| instance n=50 129.alb | 1 | 1 | Optimal | 3.23 | 13 | 13.00 | 0.00 |
| instance n=50 13.alb | 1 | 1 | Optimal | 0.69 | 6 | 6.00 | 0.00 |
| instance n=50 130.alb | 1 | 1 | Optimal | 7.38 | 13 | 13.00 | 0.00 |
| instance n=50 131.alb | 1 | 1 | Optimal | 24.71 | 12 | 12.00 | 0.00 |
| instance n=50 132.alb | 1 | 1 | Optimal | 19.58 | 12 | 12.00 | 0.00 |
| instance n=50 133.alb | 1 | 1 | Optimal | 5.01 | 12 | 12.00 | 0.00 |
| instance n=50 134.alb | 1 | 1 | Optimal | 26.48 | 14 | 14.00 | 0.00 |
| instance n=50 135.alb | 1 | 1 | Optimal | 8.21 | 13 | 13.00 | 0.00 |
| instance n=50 136.alb | 1 | 1 | Optimal | 6.46 | 11 | 11.00 | 0.00 |
| instance n=50 137.alb | 1 | 1 | Optimal | 8.85 | 11 | 11.00 | 0.00 |
| instance n=50 138.alb | 1 | 1 | Optimal | 21.31 | 12 | 12.00 | 0.00 |
| instance n=50 139.alb | 1 | 1 | Optimal | 32.22 | 11 | 11.00 | 0.00 |
| instance n=50 14.alb | 1 | 1 | Optimal | 4.93 | 7 | 7.00 | 0.00 |
| instance n=50 140.alb | 1 | 1 | Optimal | 3.80 | 12 | 12.00 | 0.00 |
| instance n=50 141.alb | 1 | 1 | Optimal | 7.59 | 13 | 13.00 | 0.00 |
| instance n=50 142.alb | 1 | 1 | Optimal | 13.14 | 11 | 11.00 | 0.00 |
| instance n=50 143.alb | 1 | 1 | Optimal | 5.27 | 12 | 12.00 | 0.00 |
| instance n=50 144.alb | 1 | 1 | Optimal | 1.27 | 13 | 13.00 | 0.00 |
| instance n=50 145.alb | 1 | 1 | Optimal | 4.29 | 10 | 10.00 | 0.00 |
| instance n=50 146.alb | 1 | 1 | Optimal | 4.94 | 13 | 13.00 | 0.00 |
| instance n=50 147.alb | 1 | 1 | Optimal | 1.14 | 13 | 13.00 | 0.00 |
| instance n=50 148.alb | 1 | 1 | Optimal | 2.88 | 10 | 10.00 | 0.00 |
| instance n=50 149.alb | 1 | 1 | Optimal | 3.41 | 12 | 12.00 | 0.00 |
| instance n=50 15.alb | 1 | 1 | Optimal | 6.67 | 8 | 8.00 | 0.00 |
| instance n=50 150.alb | 1 | 1 | Optimal | 1.78 | 11 | 11.00 | 0.00 |
| instance n=50 151.alb | 1 | 1 | Optimal | 1.74 | 7 | 7.00 | 0.00 |
| instance n=50 152.alb | 1 | 1 | Optimal | 3.61 | 7 | 7.00 | 0.00 |
| instance n=50 153.alb | 1 | 1 | Optimal | 0.95 | 7 | 7.00 | 0.00 |
| instance n=50 154.alb | 1 | 1 | Optimal | 4.31 | 8 | 8.00 | 0.00 |
| instance n=50 155.alb | 1 | 1 | Optimal | 2.69 | 7 | 7.00 | 0.00 |
| instance n=50 156.alb | 1 | 1 | Optimal | 3.08 | 7 | 7.00 | 0.00 |
| instance n=50 157.alb | 1 | 1 | Optimal | 1.61 | 8 | 8.00 | 0.00 |
| instance n=50 158.alb | 1 | 1 | Optimal | 1.13 | 7 | 7.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 159.alb | 1 | 1 | Optimal | 3.88 | 7 | 7.00 | 0.00 |
| instance n=50 16.alb | 1 | 1 | Optimal | 2.19 | 8 | 8.00 | 0.00 |
| instance n=50 160.alb | 1 | 1 | Optimal | 5.78 | 8 | 8.00 | 0.00 |
| instance n=50 161.alb | 1 | 1 | Optimal | 1.17 | 7 | 7.00 | 0.00 |
| instance n=50 162.alb | 1 | 1 | Optimal | 3.60 | 8 | 8.00 | 0.00 |
| instance n=50 163.alb | 1 | 1 | Optimal | 3.51 | 7 | 7.00 | 0.00 |
| instance n=50 164.alb | 1 | 1 | Optimal | 2.32 | 7 | 7.00 | 0.00 |
| instance n=50 165.alb | 1 | 1 | Optimal | 6.20 | 8 | 8.00 | 0.00 |
| instance n=50 166.alb | 1 | 1 | Optimal | 5.12 | 8 | 8.00 | 0.00 |
| instance n=50 167.alb | 1 | 1 | Optimal | 4.73 | 7 | 7.00 | 0.00 |
| instance n=50 168.alb | 1 | 1 | Optimal | 11.73 | 8 | 8.00 | 0.00 |
| instance n=50 169.alb | 1 | 1 | Optimal | 9.66 | 8 | 8.00 | 0.00 |
| instance n=50 17.alb | 1 | 1 | Optimal | 1.30 | 7 | 7.00 | 0.00 |
| instance n=50 170.alb | 1 | 1 | Optimal | 4.51 | 7 | 7.00 | 0.00 |
| instance n=50 171.alb | 1 | 1 | Optimal | 2.69 | 8 | 8.00 | 0.00 |
| instance n=50 172.alb | 1 | 1 | Optimal | 0.59 | 7 | 7.00 | 0.00 |
| instance n=50 173.alb | 1 | 1 | Optimal | 2.49 | 7 | 7.00 | 0.00 |
| instance n=50 174.alb | 1 | 1 | Optimal | 2.45 | 7 | 7.00 | 0.00 |
| instance n=50 175.alb | 1 | 1 | Optimal | 1.97 | 7 | 7.00 | 0.00 |
| instance n=50 176.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 177.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 178.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 179.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 18.alb | 1 | 1 | Optimal | 3.40 | 7 | 7.00 | 0.00 |
| instance n=50 180.alb | 1 | 1 | Solution | 120.02 | 26 | 25.00 | 3.85 |
| instance n=50 181.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 182.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 183.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 184.alb | 1 | 1 | Solution | 120.01 | 38 | 28.00 | 26.32 |
| instance n=50 185.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 186.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 187.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 188.alb | 1 | 1 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 189.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 19.alb | 1 | 1 | Optimal | 4.08 | 8 | 8.00 | 0.00 |
| instance n=50 190.alb | 1 | 1 | Solution | 120.01 | 30 | 26.00 | 13.33 |
| instance n=50 191.alb | 1 | 1 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=50 192.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 193.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 194.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 195.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 196.alb | 1 | 1 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=50 197.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 198.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 199.alb | 1 | 1 | Solution | 120.02 | 29 | 26.00 | 10.34 |
| instance n=50 2.alb | 1 | 1 | Optimal | 0.08 | 6 | 6.00 | 0.00 |
| instance n=50 20.alb | 1 | 1 | Optimal | 1.57 | 8 | 8.00 | 0.00 |
| instance n=50 200.alb | 1 | 1 | Solution | 120.00 | 25 | 24.00 | 4.00 |
| instance n=50 201.alb | 1 | 1 | Optimal | 54.74 | 13 | 13.00 | 0.00 |
| instance n=50 202.alb | 1 | 1 | Optimal | 24.05 | 9 | 9.00 | 0.00 |
| instance n=50 203.alb | 1 | 1 | Optimal | 23.16 | 11 | 11.00 | 0.00 |
| instance n=50 204.alb | 1 | 1 | Optimal | 18.76 | 10 | 10.00 | 0.00 |
| instance n=50 205.alb | 1 | 1 | Optimal | 48.36 | 13 | 13.00 | 0.00 |
| instance n=50 206.alb | 1 | 1 | Solution | 120.01 | 11 | 11.00 | 0.00 |
| instance n=50 207.alb | 1 | 1 | Optimal | 31.80 | 10 | 10.00 | 0.00 |
| instance n=50 208.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 209.alb | 1 | 1 | Optimal | 13.39 | 11 | 11.00 | 0.00 |
| instance n=50 21.alb | 1 | 1 | Optimal | 1.19 | 6 | 6.00 | 0.00 |
| instance n=50 210.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 211.alb | 1 | 1 | Optimal | 17.75 | 12 | 12.00 | 0.00 |
| instance n=50 212.alb | 1 | 1 | Optimal | 43.15 | 10 | 10.00 | 0.00 |
| instance n=50 213.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 214.alb | 1 | 1 | Optimal | 56.73 | 11 | 11.00 | 0.00 |
| instance n=50 215.alb | 1 | 1 | Optimal | 8.51 | 11 | 11.00 | 0.00 |
| instance n=50 216.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 217.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 218.alb | 1 | 1 | Optimal | 59.05 | 12 | 12.00 | 0.00 |
| instance n=50 219.alb | 1 | 1 | Optimal | 28.68 | 11 | 11.00 | 0.00 |
| instance n=50 22.alb | 1 | 1 | Optimal | 2.35 | 7 | 7.00 | 0.00 |
| instance n=50 220.alb | 1 | 1 | Optimal | 20.63 | 11 | 11.00 | 0.00 |
| instance n=50 221.alb | 1 | 1 | Optimal | 27.74 | 11 | 11.00 | 0.00 |
| instance n=50 222.alb | 1 | 1 | Optimal | 62.70 | 14 | 14.00 | 0.00 |
| instance n=50 223.alb | 1 | 1 | Optimal | 48.00 | 11 | 11.00 | 0.00 |
| instance n=50 224.alb | 1 | 1 | Optimal | 31.62 | 11 | 11.00 | 0.00 |
| instance n=50 225.alb | 1 | 1 | Optimal | 2.05 | 12 | 12.00 | 0.00 |
| instance n=50 226.alb | 1 | 1 | Optimal | 0.69 | 7 | 7.00 | 0.00 |
| instance n=50 227.alb | 1 | 1 | Optimal | 0.43 | 6 | 6.00 | 0.00 |
| instance n=50 228.alb | 1 | 1 | Optimal | 0.72 | 6 | 6.00 | 0.00 |
| instance n=50 229.alb | 1 | 1 | Optimal | 1.41 | 6 | 6.00 | 0.00 |
| instance n=50 23.alb | 1 | 1 | Optimal | 6.05 | 7 | 7.00 | 0.00 |
| instance n=50 230.alb | 1 | 1 | Optimal | 0.95 | 7 | 7.00 | 0.00 |
| instance n=50 231.alb | 1 | 1 | Optimal | 0.56 | 7 | 7.00 | 0.00 |
| instance n=50 232.alb | 1 | 1 | Optimal | 1.46 | 7 | 7.00 | 0.00 |
| instance n=50 233.alb | 1 | 1 | Optimal | 0.99 | 6 | 6.00 | 0.00 |
| instance n=50 234.alb | 1 | 1 | Optimal | 0.49 | 8 | 8.00 | 0.00 |
| instance n=50 235.alb | 1 | 1 | Optimal | 0.49 | 7 | 7.00 | 0.00 |
| instance n=50 236.alb | 1 | 1 | Optimal | 1.90 | 7 | 7.00 | 0.00 |
| instance n=50 237.alb | 1 | 1 | Optimal | 1.83 | 8 | 8.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 238.alb | 1 | 1 | Optimal | 0.64 | 7 | 7.00 | 0.00 |
| instance n=50 239.alb | 1 | 1 | Optimal | 2.17 | 7 | 7.00 | 0.00 |
| instance n=50 24.alb | 1 | 1 | Optimal | 2.18 | 7 | 7.00 | 0.00 |
| instance n=50 240.alb | 1 | 1 | Optimal | 1.93 | 7 | 7.00 | 0.00 |
| instance n=50 241.alb | 1 | 1 | Optimal | 1.46 | 7 | 7.00 | 0.00 |
| instance n=50 242.alb | 1 | 1 | Optimal | 1.10 | 8 | 8.00 | 0.00 |
| instance n=50 243.alb | 1 | 1 | Optimal | 1.09 | 7 | 7.00 | 0.00 |
| instance n=50 244.alb | 1 | 1 | Optimal | 0.76 | 7 | 7.00 | 0.00 |
| instance n=50 245.alb | 1 | 1 | Optimal | 1.98 | 7 | 7.00 | 0.00 |
| instance n=50 246.alb | 1 | 1 | Optimal | 1.70 | 8 | 8.00 | 0.00 |
| instance n=50 247.alb | 1 | 1 | Optimal | 0.83 | 7 | 7.00 | 0.00 |
| instance n=50 248.alb | 1 | 1 | Optimal | 1.82 | 7 | 7.00 | 0.00 |
| instance n=50 249.alb | 1 | 1 | Optimal | 2.12 | 7 | 7.00 | 0.00 |
| instance n=50 25.alb | 1 | 1 | Optimal | 1.07 | 6 | 6.00 | 0.00 |
| instance n=50 250.alb | 1 | 1 | Optimal | 1.10 | 7 | 7.00 | 0.00 |
| instance n=50 251.alb | 1 | 1 | Solution | 120.11 | 27 | 25.00 | 7.41 |
| instance n=50 252.alb | 1 | 1 | Solution | 120.01 | 32 | 27.00 | 15.63 |
| instance n=50 253.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 254.alb | 1 | 1 | Solution | 120.02 | 30 | 26.00 | 13.33 |
| instance n=50 255.alb | 1 | 1 | Solution | 120.01 | 29 | 25.00 | 13.79 |
| instance n=50 256.alb | 1 | 1 | Solution | 120.01 | 30 | 27.00 | 10.00 |
| instance n=50 257.alb | 1 | 1 | Solution | 120.01 | 33 | 27.00 | 18.18 |
| instance n=50 258.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 259.alb | 1 | 1 | Solution | 120.01 | 31 | 26.00 | 16.13 |
| instance n=50 26.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 260.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 261.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 262.alb | 1 | 1 | Solution | 120.01 | 31 | 26.00 | 16.13 |
| instance n=50 263.alb | 1 | 1 | Solution | 120.01 | 30 | 26.00 | 13.33 |
| instance n=50 264.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 265.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 266.alb | 1 | 1 | Optimal | 25.58 | 29 | 29.00 | 0.00 |
| instance n=50 267.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 268.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 269.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 27.alb | 1 | 1 | Solution | 120.01 | 30 | 27.00 | 10.00 |
| instance n=50 270.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 271.alb | 1 | 1 | Solution | 120.01 | 31 | 26.00 | 16.13 |
| instance n=50 272.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 273.alb | 1 | 1 | Optimal | 21.79 | 27 | 27.00 | 0.00 |
| instance n=50 274.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 275.alb | 1 | 1 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=50 276.alb | 1 | 1 | Optimal | 1.13 | 12 | 12.00 | 0.00 |
| instance n=50 277.alb | 1 | 1 | Optimal | 0.98 | 13 | 13.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 278.alb | 1 | 1 | Optimal | 2.34 | 12 | 12.00 | 0.00 |
| instance n=50 279.alb | 1 | 1 | Optimal | 4.97 | 11 | 11.00 | 0.00 |
| instance n=50 28.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 280.alb | 1 | 1 | Optimal | 6.12 | 13 | 13.00 | 0.00 |
| instance n=50 281.alb | 1 | 1 | Optimal | 1.49 | 11 | 11.00 | 0.00 |
| instance n=50 282.alb | 1 | 1 | Optimal | 1.27 | 12 | 12.00 | 0.00 |
| instance n=50 283.alb | 1 | 1 | Optimal | 2.01 | 12 | 12.00 | 0.00 |
| instance n=50 284.alb | 1 | 1 | Optimal | 1.10 | 11 | 11.00 | 0.00 |
| instance n=50 285.alb | 1 | 1 | Optimal | 1.07 | 13 | 13.00 | 0.00 |
| instance n=50 286.alb | 1 | 1 | Optimal | 1.53 | 11 | 11.00 | 0.00 |
| instance n=50 287.alb | 1 | 1 | Optimal | 5.08 | 12 | 12.00 | 0.00 |
| instance n=50 288.alb | 1 | 1 | Optimal | 1.16 | 10 | 10.00 | 0.00 |
| instance n=50 289.alb | 1 | 1 | Optimal | 5.95 | 11 | 11.00 | 0.00 |
| instance n=50 29.alb | 1 | 1 | Solution | 120.01 | 29 | 25.00 | 13.79 |
| instance n=50 290.alb | 1 | 1 | Optimal | 5.65 | 14 | 14.00 | 0.00 |
| instance n=50 291.alb | 1 | 1 | Optimal | 2.26 | 12 | 12.00 | 0.00 |
| instance n=50 292.alb | 1 | 1 | Optimal | 3.77 | 13 | 13.00 | 0.00 |
| instance n=50 293.alb | 1 | 1 | Optimal | 2.23 | 12 | 12.00 | 0.00 |
| instance n=50 294.alb | 1 | 1 | Optimal | 11.37 | 13 | 13.00 | 0.00 |
| instance n=50 295.alb | 1 | 1 | Optimal | 4.51 | 16 | 16.00 | 0.00 |
| instance n=50 296.alb | 1 | 1 | Optimal | 2.58 | 13 | 13.00 | 0.00 |
| instance n=50 297.alb | 1 | 1 | Optimal | 1.94 | 13 | 13.00 | 0.00 |
| instance n=50 298.alb | 1 | 1 | Optimal | 3.32 | 11 | 11.00 | 0.00 |
| instance n=50 299.alb | 1 | 1 | Optimal | 1.34 | 12 | 12.00 | 0.00 |
| instance n=50 3.alb | 1 | 1 | Optimal | 1.93 | 8 | 8.00 | 0.00 |
| instance n=50 30.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 300.alb | 1 | 1 | Optimal | 1.31 | 12 | 12.00 | 0.00 |
| instance n=50 301.alb | 1 | 1 | Optimal | 0.34 | 6 | 6.00 | 0.00 |
| instance n=50 302.alb | 1 | 1 | Optimal | 0.91 | 7 | 7.00 | 0.00 |
| instance n=50 303.alb | 1 | 1 | Optimal | 1.73 | 8 | 8.00 | 0.00 |
| instance n=50 304.alb | 1 | 1 | Optimal | 2.48 | 7 | 7.00 | 0.00 |
| instance n=50 305.alb | 1 | 1 | Optimal | 2.14 | 8 | 8.00 | 0.00 |
| instance n=50 306.alb | 1 | 1 | Optimal | 2.44 | 7 | 7.00 | 0.00 |
| instance n=50 307.alb | 1 | 1 | Optimal | 0.73 | 7 | 7.00 | 0.00 |
| instance n=50 308.alb | 1 | 1 | Optimal | 2.41 | 8 | 8.00 | 0.00 |
| instance n=50 309.alb | 1 | 1 | Optimal | 3.16 | 7 | 7.00 | 0.00 |
| instance n=50 31.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 310.alb | 1 | 1 | Optimal | 4.62 | 8 | 8.00 | 0.00 |
| instance n=50 311.alb | 1 | 1 | Optimal | 6.30 | 8 | 8.00 | 0.00 |
| instance n=50 312.alb | 1 | 1 | Optimal | 0.36 | 6 | 6.00 | 0.00 |
| instance n=50 313.alb | 1 | 1 | Optimal | 2.95 | 8 | 8.00 | 0.00 |
| instance n=50 314.alb | 1 | 1 | Optimal | 0.73 | 7 | 7.00 | 0.00 |
| instance n=50 315.alb | 1 | 1 | Optimal | 2.45 | 8 | 8.00 | 0.00 |
| instance n=50 316.alb | 1 | 1 | Optimal | 2.57 | 8 | 8.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 317.alb | 1 | 1 | Optimal | 1.09 | 6 | 6.00 | 0.00 |
| instance n=50 318.alb | 1 | 1 | Optimal | 5.75 | 8 | 8.00 | 0.00 |
| instance n=50 319.alb | 1 | 1 | Optimal | 2.87 | 7 | 7.00 | 0.00 |
| instance n=50 32.alb | 1 | 1 | Solution | 120.01 | 25 | 25.00 | 0.00 |
| instance n=50 320.alb | 1 | 1 | Optimal | 4.95 | 8 | 8.00 | 0.00 |
| instance n=50 321.alb | 1 | 1 | Optimal | 1.33 | 6 | 6.00 | 0.00 |
| instance n=50 322.alb | 1 | 1 | Optimal | 0.97 | 7 | 7.00 | 0.00 |
| instance n=50 323.alb | 1 | 1 | Optimal | 1.74 | 7 | 7.00 | 0.00 |
| instance n=50 324.alb | 1 | 1 | Optimal | 1.44 | 7 | 7.00 | 0.00 |
| instance n=50 325.alb | 1 | 1 | Optimal | 0.86 | 7 | 7.00 | 0.00 |
| instance n=50 326.alb | 1 | 1 | Solution | 120.01 | 33 | 27.00 | 18.18 |
| instance n=50 327.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 328.alb | 1 | 1 | Solution | 120.01 | 32 | 27.00 | 15.63 |
| instance n=50 329.alb | 1 | 1 | Solution | 120.01 | 24 | 24.00 | 0.00 |
| instance n=50 33.alb | 1 | 1 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 330.alb | 1 | 1 | Solution | 120.01 | 29 | 25.00 | 13.79 |
| instance n=50 331.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 332.alb | 1 | 1 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 333.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 334.alb | 1 | 1 | Solution | 120.01 | 29 | 25.00 | 13.79 |
| instance n=50 335.alb | 1 | 1 | Solution | 120.02 | 27 | 26.00 | 3.70 |
| instance n=50 336.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 337.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 338.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 339.alb | 1 | 1 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=50 34.alb | 1 | 1 | Solution | 120.01 | 30 | 26.00 | 13.33 |
| instance n=50 340.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 341.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 342.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 343.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 344.alb | 1 | 1 | Solution | 120.01 | 30 | 26.00 | 13.33 |
| instance n=50 345.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 346.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 347.alb | 1 | 1 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 348.alb | 1 | 1 | Solution | 120.01 | 30 | 25.00 | 16.67 |
| instance n=50 349.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 35.alb | 1 | 1 | Solution | 120.01 | 32 | 27.00 | 15.63 |
| instance n=50 350.alb | 1 | 1 | Solution | 120.01 | 24 | 23.00 | 4.17 |
| instance n=50 351.alb | 1 | 1 | Optimal | 103.80 | 12 | 12.00 | 0.00 |
| instance n=50 352.alb | 1 | 1 | Optimal | 25.37 | 10 | 10.00 | 0.00 |
| instance n=50 353.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 354.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 355.alb | 1 | 1 | Optimal | 11.73 | 11 | 11.00 | 0.00 |
| instance n=50 356.alb | 1 | 1 | Optimal | 96.73 | 15 | 15.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 357.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 358.alb | 1 | 1 | Optimal | 1.78 | 11 | 11.00 | 0.00 |
| instance n=50 359.alb | 1 | 1 | Optimal | 8.90 | 10 | 10.00 | 0.00 |
| instance n=50 36.alb | 1 | 1 | Solution | 120.01 | 31 | 26.00 | 16.13 |
| instance n=50 360.alb | 1 | 1 | Optimal | 81.66 | 12 | 12.00 | 0.00 |
| instance n=50 361.alb | 1 | 1 | Optimal | 29.94 | 11 | 11.00 | 0.00 |
| instance n=50 362.alb | 1 | 1 | Optimal | 36.11 | 10 | 10.00 | 0.00 |
| instance n=50 363.alb | 1 | 1 | Optimal | 10.94 | 11 | 11.00 | 0.00 |
| instance n=50 364.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 365.alb | 1 | 1 | Optimal | 8.09 | 11 | 11.00 | 0.00 |
| instance n=50 366.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 367.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 368.alb | 1 | 1 | Optimal | 63.88 | 12 | 12.00 | 0.00 |
| instance n=50 369.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 37.alb | 1 | 1 | Solution | 120.01 | 32 | 27.00 | 15.63 |
| instance n=50 370.alb | 1 | 1 | Optimal | 26.02 | 12 | 12.00 | 0.00 |
| instance n=50 371.alb | 1 | 1 | Optimal | 72.33 | 11 | 11.00 | 0.00 |
| instance n=50 372.alb | 1 | 1 | Optimal | 69.83 | 10 | 10.00 | 0.00 |
| instance n=50 373.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 374.alb | 1 | 1 | Optimal | 13.56 | 11 | 11.00 | 0.00 |
| instance n=50 375.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 376.alb | 1 | 1 | Optimal | 2.32 | 7 | 7.00 | 0.00 |
| instance n=50 377.alb | 1 | 1 | Optimal | 3.96 | 7 | 7.00 | 0.00 |
| instance n=50 378.alb | 1 | 1 | Optimal | 1.41 | 8 | 8.00 | 0.00 |
| instance n=50 379.alb | 1 | 1 | Optimal | 1.26 | 7 | 7.00 | 0.00 |
| instance n=50 38.alb | 1 | 1 | Solution | 120.01 | 31 | 27.00 | 12.90 |
| instance n=50 380.alb | 1 | 1 | Optimal | 2.90 | 7 | 7.00 | 0.00 |
| instance n=50 381.alb | 1 | 1 | Optimal | 1.60 | 8 | 8.00 | 0.00 |
| instance n=50 382.alb | 1 | 1 | Optimal | 1.70 | 6 | 6.00 | 0.00 |
| instance n=50 383.alb | 1 | 1 | Optimal | 1.73 | 7 | 7.00 | 0.00 |
| instance n=50 384.alb | 1 | 1 | Optimal | 2.31 | 8 | 8.00 | 0.00 |
| instance n=50 385.alb | 1 | 1 | Optimal | 3.04 | 7 | 7.00 | 0.00 |
| instance n=50 386.alb | 1 | 1 | Optimal | 2.36 | 7 | 7.00 | 0.00 |
| instance n=50 387.alb | 1 | 1 | Optimal | 2.46 | 8 | 8.00 | 0.00 |
| instance n=50 388.alb | 1 | 1 | Optimal | 1.89 | 7 | 7.00 | 0.00 |
| instance n=50 389.alb | 1 | 1 | Optimal | 1.10 | 8 | 8.00 | 0.00 |
| instance n=50 39.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 390.alb | 1 | 1 | Optimal | 3.18 | 7 | 7.00 | 0.00 |
| instance n=50 391.alb | 1 | 1 | Optimal | 3.67 | 7 | 7.00 | 0.00 |
| instance n=50 392.alb | 1 | 1 | Optimal | 1.90 | 8 | 8.00 | 0.00 |
| instance n=50 393.alb | 1 | 1 | Optimal | 2.30 | 7 | 7.00 | 0.00 |
| instance n=50 394.alb | 1 | 1 | Optimal | 2.32 | 8 | 8.00 | 0.00 |
| instance n=50 395.alb | 1 | 1 | Optimal | 3.09 | 7 | 7.00 | 0.00 |
| instance n=50 396.alb | 1 | 1 | Optimal | 1.89 | 8 | 8.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 397.alb | 1 | 1 | Optimal | 1.04 | 7 | 7.00 | 0.00 |
| instance n=50 398.alb | 1 | 1 | Optimal | 1.15 | 6 | 6.00 | 0.00 |
| instance n=50 399.alb | 1 | 1 | Optimal | 0.85 | 7 | 7.00 | 0.00 |
| instance n=50 4.alb | 1 | 1 | Optimal | 2.80 | 7 | 7.00 | 0.00 |
| instance n=50 40.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 400.alb | 1 | 1 | Optimal | 1.31 | 8 | 8.00 | 0.00 |
| instance n=50 401.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 402.alb | 1 | 1 | Solution | 120.02 | 27 | 25.00 | 7.41 |
| instance n=50 403.alb | 1 | 1 | Solution | 120.01 | 34 | 27.00 | 20.59 |
| instance n=50 404.alb | 1 | 1 | Solution | 120.01 | 31 | 26.00 | 16.13 |
| instance n=50 405.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 406.alb | 1 | 1 | Solution | 120.01 | 32 | 27.00 | 15.63 |
| instance n=50 407.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 408.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 409.alb | 1 | 1 | Solution | 120.01 | 33 | 26.00 | 21.21 |
| instance n=50 41.alb | 1 | 1 | Solution | 120.02 | 26 | 24.00 | 7.69 |
| instance n=50 410.alb | 1 | 1 | Solution | 120.02 | 28 | 26.00 | 7.14 |
| instance n=50 411.alb | 1 | 1 | Solution | 120.02 | 29 | 26.00 | 10.34 |
| instance n=50 412.alb | 1 | 1 | Solution | 120.01 | 26 | 25.00 | 3.85 |
| instance n=50 413.alb | 1 | 1 | Solution | 120.02 | 30 | 26.00 | 13.33 |
| instance n=50 414.alb | 1 | 1 | Solution | 120.02 | 27 | 25.00 | 7.41 |
| instance n=50 415.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 416.alb | 1 | 1 | Solution | 120.02 | 27 | 25.00 | 7.41 |
| instance n=50 417.alb | 1 | 1 | Solution | 120.02 | 30 | 27.00 | 10.00 |
| instance n=50 418.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 419.alb | 1 | 1 | Solution | 120.02 | 33 | 27.00 | 18.18 |
| instance n=50 42.alb | 1 | 1 | Solution | 120.01 | 24 | 23.00 | 4.17 |
| instance n=50 420.alb | 1 | 1 | Solution | 120.01 | 28 | 25.00 | 10.71 |
| instance n=50 421.alb | 1 | 1 | Solution | 120.02 | 34 | 27.00 | 20.59 |
| instance n=50 422.alb | 1 | 1 | Solution | 120.01 | 29 | 25.00 | 13.79 |
| instance n=50 423.alb | 1 | 1 | Solution | 120.01 | 29 | 26.00 | 10.34 |
| instance n=50 424.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 425.alb | 1 | 1 | Solution | 120.01 | 34 | 28.00 | 17.65 |
| instance n=50 426.alb | 1 | 1 | Optimal | 5.34 | 11 | 11.00 | 0.00 |
| instance n=50 427.alb | 1 | 1 | Optimal | 2.23 | 12 | 12.00 | 0.00 |
| instance n=50 428.alb | 1 | 1 | Optimal | 12.89 | 13 | 13.00 | 0.00 |
| instance n=50 429.alb | 1 | 1 | Optimal | 3.39 | 11 | 11.00 | 0.00 |
| instance n=50 43.alb | 1 | 1 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 430.alb | 1 | 1 | Optimal | 24.16 | 14 | 14.00 | 0.00 |
| instance n=50 431.alb | 1 | 1 | Optimal | 0.64 | 11 | 11.00 | 0.00 |
| instance n=50 432.alb | 1 | 1 | Optimal | 6.40 | 12 | 12.00 | 0.00 |
| instance n=50 433.alb | 1 | 1 | Optimal | 7.08 | 12 | 12.00 | 0.00 |
| instance n=50 434.alb | 1 | 1 | Optimal | 3.09 | 11 | 11.00 | 0.00 |
| instance n=50 435.alb | 1 | 1 | Optimal | 9.83 | 11 | 11.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 436.alb | 1 | 1 | Optimal | 3.12 | 11 | 11.00 | 0.00 |
| instance n=50 437.alb | 1 | 1 | Optimal | 10.49 | 12 | 12.00 | 0.00 |
| instance n=50 438.alb | 1 | 1 | Optimal | 7.92 | 10 | 10.00 | 0.00 |
| instance n=50 439.alb | 1 | 1 | Optimal | 8.94 | 12 | 12.00 | 0.00 |
| instance n=50 44.alb | 1 | 1 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 440.alb | 1 | 1 | Optimal | 2.79 | 13 | 13.00 | 0.00 |
| instance n=50 441.alb | 1 | 1 | Optimal | 1.94 | 11 | 11.00 | 0.00 |
| instance n=50 442.alb | 1 | 1 | Optimal | 4.21 | 12 | 12.00 | 0.00 |
| instance n=50 443.alb | 1 | 1 | Optimal | 7.56 | 11 | 11.00 | 0.00 |
| instance n=50 444.alb | 1 | 1 | Optimal | 7.65 | 12 | 12.00 | 0.00 |
| instance n=50 445.alb | 1 | 1 | Optimal | 7.35 | 12 | 12.00 | 0.00 |
| instance n=50 446.alb | 1 | 1 | Optimal | 5.38 | 12 | 12.00 | 0.00 |
| instance n=50 447.alb | 1 | 1 | Optimal | 19.23 | 13 | 13.00 | 0.00 |
| instance n=50 448.alb | 1 | 1 | Optimal | 10.60 | 12 | 12.00 | 0.00 |
| instance n=50 449.alb | 1 | 1 | Optimal | 6.58 | 11 | 11.00 | 0.00 |
| instance n=50 45.alb | 1 | 1 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 450.alb | 1 | 1 | Optimal | 7.07 | 11 | 11.00 | 0.00 |
| instance n=50 451.alb | 1 | 1 | Optimal | 0.14 | 8 | 8.00 | 0.00 |
| instance n=50 452.alb | 1 | 1 | Optimal | 0.23 | 8 | 8.00 | 0.00 |
| instance n=50 453.alb | 1 | 1 | Optimal | 0.25 | 7 | 7.00 | 0.00 |
| instance n=50 454.alb | 1 | 1 | Optimal | 0.21 | 8 | 8.00 | 0.00 |
| instance n=50 455.alb | 1 | 1 | Optimal | 0.16 | 6 | 6.00 | 0.00 |
| instance n=50 456.alb | 1 | 1 | Optimal | 0.26 | 8 | 8.00 | 0.00 |
| instance n=50 457.alb | 1 | 1 | Optimal | 0.18 | 8 | 8.00 | 0.00 |
| instance n=50 458.alb | 1 | 1 | Optimal | 0.11 | 7 | 7.00 | 0.00 |
| instance n=50 459.alb | 1 | 1 | Optimal | 0.21 | 7 | 7.00 | 0.00 |
| instance n=50 46.alb | 1 | 1 | Solution | 120.01 | 28 | 26.00 | 7.14 |
| instance n=50 460.alb | 1 | 1 | Optimal | 0.20 | 7 | 7.00 | 0.00 |
| instance n=50 461.alb | 1 | 1 | Optimal | 0.21 | 6 | 6.00 | 0.00 |
| instance n=50 462.alb | 1 | 1 | Optimal | 0.11 | 7 | 7.00 | 0.00 |
| instance n=50 463.alb | 1 | 1 | Optimal | 0.11 | 8 | 8.00 | 0.00 |
| instance n=50 464.alb | 1 | 1 | Optimal | 0.45 | 6 | 6.00 | 0.00 |
| instance n=50 465.alb | 1 | 1 | Optimal | 0.22 | 8 | 8.00 | 0.00 |
| instance n=50 466.alb | 1 | 1 | Optimal | 0.15 | 7 | 7.00 | 0.00 |
| instance n=50 467.alb | 1 | 1 | Optimal | 0.10 | 9 | 9.00 | 0.00 |
| instance n=50 468.alb | 1 | 1 | Optimal | 0.21 | 7 | 7.00 | 0.00 |
| instance n=50 469.alb | 1 | 1 | Optimal | 0.32 | 8 | 8.00 | 0.00 |
| instance n=50 47.alb | 1 | 1 | Solution | 120.02 | 28 | 26.00 | 7.14 |
| instance n=50 470.alb | 1 | 1 | Optimal | 0.14 | 8 | 8.00 | 0.00 |
| instance n=50 471.alb | 1 | 1 | Optimal | 0.13 | 7 | 7.00 | 0.00 |
| instance n=50 472.alb | 1 | 1 | Optimal | 0.10 | 8 | 8.00 | 0.00 |
| instance n=50 473.alb | 1 | 1 | Optimal | 0.31 | 7 | 7.00 | 0.00 |
| instance n=50 474.alb | 1 | 1 | Optimal | 0.11 | 7 | 7.00 | 0.00 |
| instance n=50 475.alb | 1 | 1 | Optimal | 0.10 | 6 | 6.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 476.alb | 1 | 1 | Optimal | 0.97 | 28 | 28.00 | 0.00 |
| instance n=50 477.alb | 1 | 1 | Optimal | 1.48 | 29 | 29.00 | 0.00 |
| instance n=50 478.alb | 1 | 1 | Optimal | 2.65 | 32 | 32.00 | 0.00 |
| instance n=50 479.alb | 1 | 1 | Optimal | 0.76 | 28 | 28.00 | 0.00 |
| instance n=50 48.alb | 1 | 1 | Solution | 120.01 | 27 | 26.00 | 3.70 |
| instance n=50 480.alb | 1 | 1 | Optimal | 1.18 | 34 | 34.00 | 0.00 |
| instance n=50 481.alb | 1 | 1 | Optimal | 0.56 | 28 | 28.00 | 0.00 |
| instance n=50 482.alb | 1 | 1 | Optimal | 0.69 | 27 | 27.00 | 0.00 |
| instance n=50 483.alb | 1 | 1 | Optimal | 2.07 | 30 | 30.00 | 0.00 |
| instance n=50 484.alb | 1 | 1 | Optimal | 1.07 | 32 | 32.00 | 0.00 |
| instance n=50 485.alb | 1 | 1 | Optimal | 1.15 | 31 | 31.00 | 0.00 |
| instance n=50 486.alb | 1 | 1 | Optimal | 1.08 | 32 | 32.00 | 0.00 |
| instance n=50 487.alb | 1 | 1 | Optimal | 1.15 | 31 | 31.00 | 0.00 |
| instance n=50 488.alb | 1 | 1 | Optimal | 2.81 | 31 | 31.00 | 0.00 |
| instance n=50 489.alb | 1 | 1 | Optimal | 4.65 | 35 | 35.00 | 0.00 |
| instance n=50 49.alb | 1 | 1 | Solution | 120.01 | 25 | 24.00 | 4.00 |
| instance n=50 490.alb | 1 | 1 | Optimal | 0.95 | 29 | 29.00 | 0.00 |
| instance n=50 491.alb | 1 | 1 | Optimal | 22.31 | 35 | 35.00 | 0.00 |
| instance n=50 492.alb | 1 | 1 | Optimal | 2.25 | 29 | 29.00 | 0.00 |
| instance n=50 493.alb | 1 | 1 | Optimal | 1.24 | 30 | 30.00 | 0.00 |
| instance n=50 494.alb | 1 | 1 | Optimal | 3.34 | 32 | 32.00 | 0.00 |
| instance n=50 495.alb | 1 | 1 | Optimal | 0.94 | 34 | 34.00 | 0.00 |
| instance n=50 496.alb | 1 | 1 | Optimal | 1.17 | 29 | 29.00 | 0.00 |
| instance n=50 497.alb | 1 | 1 | Optimal | 0.77 | 30 | 30.00 | 0.00 |
| instance n=50 498.alb | 1 | 1 | Optimal | 1.17 | 30 | 30.00 | 0.00 |
| instance n=50 499.alb | 1 | 1 | Optimal | 2.23 | 33 | 33.00 | 0.00 |
| instance n=50 5.alb | 1 | 1 | Optimal | 1.51 | 7 | 7.00 | 0.00 |
| instance n=50 50.alb | 1 | 1 | Solution | 120.01 | 27 | 25.00 | 7.41 |
| instance n=50 500.alb | 1 | 1 | Optimal | 2.44 | 34 | 34.00 | 0.00 |
| instance n=50 501.alb | 1 | 1 | Optimal | 0.34 | 12 | 12.00 | 0.00 |
| instance n=50 502.alb | 1 | 1 | Optimal | 0.10 | 10 | 10.00 | 0.00 |
| instance n=50 503.alb | 1 | 1 | Optimal | 0.26 | 13 | 13.00 | 0.00 |
| instance n=50 504.alb | 1 | 1 | Optimal | 0.26 | 11 | 11.00 | 0.00 |
| instance n=50 505.alb | 1 | 1 | Optimal | 0.31 | 12 | 12.00 | 0.00 |
| instance n=50 506.alb | 1 | 1 | Optimal | 0.37 | 11 | 11.00 | 0.00 |
| instance n=50 507.alb | 1 | 1 | Optimal | 0.18 | 13 | 13.00 | 0.00 |
| instance n=50 508.alb | 1 | 1 | Optimal | 0.22 | 14 | 14.00 | 0.00 |
| instance n=50 509.alb | 1 | 1 | Optimal | 0.22 | 13 | 13.00 | 0.00 |
| instance n=50 51.alb | 1 | 1 | Optimal | 13.69 | 12 | 12.00 | 0.00 |
| instance n=50 510.alb | 1 | 1 | Optimal | 0.10 | 11 | 11.00 | 0.00 |
| instance n=50 511.alb | 1 | 1 | Optimal | 0.15 | 13 | 13.00 | 0.00 |
| instance n=50 512.alb | 1 | 1 | Optimal | 0.31 | 13 | 13.00 | 0.00 |
| instance n=50 513.alb | 1 | 1 | Optimal | 0.32 | 12 | 12.00 | 0.00 |
| instance n=50 514.alb | 1 | 1 | Optimal | 0.20 | 12 | 12.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 515.alb | 1 | 1 | Optimal | 0.29 | 11 | 11.00 | 0.00 |
| instance n=50 516.alb | 1 | 1 | Optimal | 0.28 | 13 | 13.00 | 0.00 |
| instance n=50 517.alb | 1 | 1 | Optimal | 0.22 | 14 | 14.00 | 0.00 |
| instance n=50 518.alb | 1 | 1 | Optimal | 0.49 | 11 | 11.00 | 0.00 |
| instance n=50 519.alb | 1 | 1 | Optimal | 0.21 | 12 | 12.00 | 0.00 |
| instance n=50 52.alb | 1 | 1 | Optimal | 71.48 | 11 | 11.00 | 0.00 |
| instance n=50 520.alb | 1 | 1 | Optimal | 0.44 | 11 | 11.00 | 0.00 |
| instance n=50 521.alb | 1 | 1 | Optimal | 0.29 | 10 | 10.00 | 0.00 |
| instance n=50 522.alb | 1 | 1 | Optimal | 0.26 | 11 | 11.00 | 0.00 |
| instance n=50 523.alb | 1 | 1 | Optimal | 0.27 | 11 | 11.00 | 0.00 |
| instance n=50 524.alb | 1 | 1 | Optimal | 0.37 | 14 | 14.00 | 0.00 |
| instance n=50 525.alb | 1 | 1 | Optimal | 0.15 | 11 | 11.00 | 0.00 |
| instance n=50 53.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 54.alb | 1 | 1 | Optimal | 7.36 | 11 | 11.00 | 0.00 |
| instance n=50 55.alb | 1 | 1 | Optimal | 35.50 | 13 | 13.00 | 0.00 |
| instance n=50 56.alb | 1 | 1 | Optimal | 43.81 | 11 | 11.00 | 0.00 |
| instance n=50 57.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 58.alb | 1 | 1 | Solution | 120.01 | 11 | 11.00 | 0.00 |
| instance n=50 59.alb | 1 | 1 | Solution | 120.01 | 11 | 11.00 | 0.00 |
| instance n=50 6.alb | 1 | 1 | Optimal | 1.23 | 6 | 6.00 | 0.00 |
| instance n=50 60.alb | 1 | 1 | Optimal | 102.19 | 12 | 12.00 | 0.00 |
| instance n=50 61.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 62.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 63.alb | 1 | 1 | Optimal | 115.14 | 12 | 12.00 | 0.00 |
| instance n=50 64.alb | 1 | 1 | Optimal | 36.74 | 13 | 13.00 | 0.00 |
| instance n=50 65.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 66.alb | 1 | 1 | Optimal | 84.17 | 12 | 12.00 | 0.00 |
| instance n=50 67.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 68.alb | 1 | 1 | Optimal | 17.78 | 12 | 12.00 | 0.00 |
| instance n=50 69.alb | 1 | 1 | Optimal | 92.32 | 12 | 12.00 | 0.00 |
| instance n=50 7.alb | 1 | 1 | Optimal | 3.10 | 7 | 7.00 | 0.00 |
| instance n=50 70.alb | 1 | 1 | Optimal | 36.21 | 10 | 10.00 | 0.00 |
| instance n=50 71.alb | 1 | 1 | Solution | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 72.alb | 1 | 1 | Optimal | 56.59 | 11 | 11.00 | 0.00 |
| instance n=50 73.alb | 1 | 1 | Optimal | 100.54 | 11 | 11.00 | 0.00 |
| instance n=50 74.alb | 1 | 1 | Solution | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 75.alb | 1 | 1 | Optimal | 66.28 | 11 | 11.00 | 0.00 |
| instance n=50 76.alb | 1 | 1 | Optimal | 2.43 | 7 | 7.00 | 0.00 |
| instance n=50 77.alb | 1 | 1 | Optimal | 1.07 | 7 | 7.00 | 0.00 |
| instance n=50 78.alb | 1 | 1 | Optimal | 1.90 | 7 | 7.00 | 0.00 |
| instance n=50 79.alb | 1 | 1 | Optimal | 5.66 | 8 | 8.00 | 0.00 |
| instance n=50 8.alb | 1 | 1 | Optimal | 3.64 | 7 | 7.00 | 0.00 |
| instance n=50 80.alb | 1 | 1 | Optimal | 0.90 | 7 | 7.00 | 0.00 |
| instance n=50 81.alb | 1 | 1 | Optimal | 1.85 | 7 | 7.00 | 0.00 |

Table 6.6: Results for SALBP-1 Problems Alternative (CPO) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|---------|------|----------|-------|----------------|
| instance n=50 82.alb | 1 | 1 | Optimal | 1.05 | 6 | 6.00 | 0.00 |
| instance n=50 83.alb | 1 | 1 | Optimal | 8.47 | 8 | 8.00 | 0.00 |
| instance n=50 84.alb | 1 | 1 | Optimal | 0.89 | 7 | 7.00 | 0.00 |
| instance n=50 85.alb | 1 | 1 | Optimal | 2.09 | 8 | 8.00 | 0.00 |
| instance n=50 86.alb | 1 | 1 | Optimal | 2.04 | 7 | 7.00 | 0.00 |
| instance n=50 87.alb | 1 | 1 | Optimal | 5.79 | 8 | 8.00 | 0.00 |
| instance n=50 88.alb | 1 | 1 | Optimal | 0.48 | 8 | 8.00 | 0.00 |
| instance n=50 89.alb | 1 | 1 | Optimal | 1.47 | 7 | 7.00 | 0.00 |
| instance n=50 9.alb | 1 | 1 | Optimal | 3.14 | 9 | 9.00 | 0.00 |
| instance n=50 90.alb | 1 | 1 | Optimal | 1.41 | 7 | 7.00 | 0.00 |
| instance n=50 91.alb | 1 | 1 | Optimal | 1.86 | 7 | 7.00 | 0.00 |
| instance n=50 92.alb | 1 | 1 | Optimal | 4.71 | 7 | 7.00 | 0.00 |
| instance n=50 93.alb | 1 | 1 | Optimal | 1.48 | 7 | 7.00 | 0.00 |
| instance n=50 94.alb | 1 | 1 | Optimal | 3.18 | 7 | 7.00 | 0.00 |
| instance n=50 95.alb | 1 | 1 | Optimal | 1.29 | 7 | 7.00 | 0.00 |
| instance n=50 96.alb | 1 | 1 | Optimal | 1.03 | 7 | 7.00 | 0.00 |
| instance n=50 97.alb | 1 | 1 | Optimal | 1.40 | 7 | 7.00 | 0.00 |
| instance n=50 98.alb | 1 | 1 | Optimal | 3.38 | 8 | 8.00 | 0.00 |
| instance n=50 99.alb | 1 | 1 | Optimal | 2.28 | 7 | 7.00 | 0.00 |

6.6.2 CPSat

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat) (2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 1.alb | 1 | 1 | Solution | 120.17 | 136 | 135.00 | 0.74 |
| instance n=1000 10.alb | 1 | 1 | Solution | 120.81 | 141 | 140.00 | 0.71 |
| instance n=1000 100.alb | 1 | 1 | Solution | 120.04 | 138 | 137.00 | 0.72 |
| instance n=1000 101.alb | 1 | 1 | Solution | 120.63 | 554 | 504.00 | 9.03 |
| instance n=1000 102.alb | 1 | 1 | Solution | 120.07 | 557 | 503.00 | 9.69 |
| instance n=1000 103.alb | 1 | 1 | Solution | 120.45 | 560 | 503.00 | 10.18 |
| instance n=1000 104.alb | 1 | 1 | Solution | 120.12 | 549 | 504.00 | 8.20 |
| instance n=1000 105.alb | 1 | 1 | Solution | 120.46 | 549 | 498.00 | 9.29 |
| instance n=1000 106.alb | 1 | 1 | Solution | 120.63 | 554 | 499.00 | 9.93 |
| instance n=1000 107.alb | 1 | 1 | Solution | 120.55 | 540 | 496.00 | 8.15 |
| instance n=1000 108.alb | 1 | 1 | Solution | 120.06 | 546 | 497.00 | 8.97 |
| instance n=1000 109.alb | 1 | 1 | Solution | 120.12 | 546 | 499.00 | 8.61 |
| instance n=1000 11.alb | 1 | 1 | Solution | 120.86 | 135 | 134.00 | 0.74 |
| instance n=1000 110.alb | 1 | 1 | Solution | 120.05 | 560 | 500.00 | 10.71 |
| instance n=1000 111.alb | 1 | 1 | Solution | 120.35 | 546 | 500.00 | 8.42 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 112.alb | 1 | 1 | Solution | 120.10 | 548 | 498.00 | 9.12 |
| instance n=1000 113.alb | 1 | 1 | Solution | 120.16 | 543 | 494.00 | 9.02 |
| instance n=1000 114.alb | 1 | 1 | Solution | 120.71 | 548 | 501.00 | 8.58 |
| instance n=1000 115.alb | 1 | 1 | Solution | 120.39 | 543 | 498.00 | 8.29 |
| instance n=1000 116.alb | 1 | 1 | Solution | 120.05 | 541 | 496.00 | 8.32 |
| instance n=1000 117.alb | 1 | 1 | Solution | 120.70 | 551 | 500.00 | 9.26 |
| instance n=1000 118.alb | 1 | 1 | Solution | 120.07 | 563 | 508.00 | 9.77 |
| instance n=1000 119.alb | 1 | 1 | Solution | 120.13 | 527 | 495.00 | 6.07 |
| instance n=1000 12.alb | 1 | 1 | Solution | 120.51 | 135 | 134.00 | 0.74 |
| instance n=1000 120.alb | 1 | 1 | Solution | 120.31 | 546 | 502.00 | 8.06 |
| instance n=1000 121.alb | 1 | 1 | Solution | 120.73 | 543 | 495.00 | 8.84 |
| instance n=1000 122.alb | 1 | 1 | Solution | 120.04 | 536 | 493.00 | 8.02 |
| instance n=1000 123.alb | 1 | 1 | Solution | 120.09 | 558 | 503.00 | 9.86 |
| instance n=1000 124.alb | 1 | 1 | Solution | 120.79 | 541 | 498.00 | 7.95 |
| instance n=1000 125.alb | 1 | 1 | Solution | 120.40 | 543 | 498.00 | 8.29 |
| instance n=1000 126.alb | 1 | 1 | Solution | 120.75 | 231 | 228.00 | 1.30 |
| instance n=1000 127.alb | 1 | 1 | Solution | 120.34 | 223 | 220.00 | 1.35 |
| instance n=1000 128.alb | 1 | 1 | Solution | 120.04 | 225 | 222.00 | 1.33 |
| instance n=1000 129.alb | 1 | 1 | Solution | 120.62 | 225 | 222.00 | 1.33 |
| instance n=1000 13.alb | 1 | 1 | Solution | 120.05 | 132 | 131.00 | 0.76 |
| instance n=1000 130.alb | 1 | 1 | Solution | 120.15 | 224 | 221.00 | 1.34 |
| instance n=1000 131.alb | 1 | 1 | Solution | 120.75 | 223 | 219.00 | 1.79 |
| instance n=1000 132.alb | 1 | 1 | Solution | 120.05 | 218 | 214.00 | 1.83 |
| instance n=1000 133.alb | 1 | 1 | Solution | 120.64 | 229 | 226.00 | 1.31 |
| instance n=1000 134.alb | 1 | 1 | Solution | 120.78 | 218 | 215.00 | 1.38 |
| instance n=1000 135.alb | 1 | 1 | Solution | 120.81 | 228 | 225.00 | 1.32 |
| instance n=1000 136.alb | 1 | 1 | Solution | 120.07 | 231 | 228.00 | 1.30 |
| instance n=1000 137.alb | 1 | 1 | Solution | 120.06 | 215 | 213.00 | 0.93 |
| instance n=1000 138.alb | 1 | 1 | Solution | 120.02 | 224 | 221.00 | 1.34 |
| instance n=1000 139.alb | 1 | 1 | Solution | 120.78 | 227 | 224.00 | 1.32 |
| instance n=1000 14.alb | 1 | 1 | Solution | 120.82 | 138 | 136.00 | 1.45 |
| instance n=1000 140.alb | 1 | 1 | Solution | 120.05 | 228 | 226.00 | 0.88 |
| instance n=1000 141.alb | 1 | 1 | Solution | 120.08 | 218 | 215.00 | 1.38 |
| instance n=1000 142.alb | 1 | 1 | Solution | 120.33 | 223 | 220.00 | 1.35 |
| instance n=1000 143.alb | 1 | 1 | Solution | 120.29 | 216 | 213.00 | 1.39 |
| instance n=1000 144.alb | 1 | 1 | Solution | 120.10 | 220 | 217.00 | 1.36 |
| instance n=1000 145.alb | 1 | 1 | Solution | 120.50 | 222 | 220.00 | 0.90 |
| instance n=1000 146.alb | 1 | 1 | Solution | 120.05 | 222 | 219.00 | 1.35 |
| instance n=1000 147.alb | 1 | 1 | Solution | 120.05 | 233 | 229.00 | 1.72 |
| instance n=1000 148.alb | 1 | 1 | Solution | 120.81 | 222 | 219.00 | 1.35 |
| instance n=1000 149.alb | 1 | 1 | Solution | 120.04 | 239 | 236.00 | 1.26 |
| instance n=1000 15.alb | 1 | 1 | Solution | 120.78 | 137 | 136.00 | 0.73 |
| instance n=1000 150.alb | 1 | 1 | Solution | 120.03 | 224 | 222.00 | 0.89 |
| instance n=1000 151.alb | 1 | 1 | Solution | 120.99 | 139 | 138.00 | 0.72 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 152.alb | 1 | 1 | Solution | 120.45 | 138 | 136.00 | 1.45 |
| instance n=1000 153.alb | 1 | 1 | Solution | 120.06 | 139 | 137.00 | 1.44 |
| instance n=1000 154.alb | 1 | 1 | Solution | 120.42 | 141 | 140.00 | 0.71 |
| instance n=1000 155.alb | 1 | 1 | Solution | 120.05 | 141 | 139.00 | 1.42 |
| instance n=1000 156.alb | 1 | 1 | Solution | 121.27 | 142 | 141.00 | 0.70 |
| instance n=1000 157.alb | 1 | 1 | Solution | 120.98 | 141 | 140.00 | 0.71 |
| instance n=1000 158.alb | 1 | 1 | Solution | 120.08 | 137 | 136.00 | 0.73 |
| instance n=1000 159.alb | 1 | 1 | Solution | 120.04 | 139 | 138.00 | 0.72 |
| instance n=1000 16.alb | 1 | 1 | Solution | 120.62 | 138 | 137.00 | 0.72 |
| instance n=1000 160.alb | 1 | 1 | Solution | 121.06 | 140 | 138.00 | 1.43 |
| instance n=1000 161.alb | 1 | 1 | Solution | 120.07 | 134 | 132.00 | 1.49 |
| instance n=1000 162.alb | 1 | 1 | Solution | 121.09 | 137 | 136.00 | 0.73 |
| instance n=1000 163.alb | 1 | 1 | Solution | 120.07 | 140 | 139.00 | 0.71 |
| instance n=1000 164.alb | 1 | 1 | Solution | 120.71 | 143 | 141.00 | 1.40 |
| instance n=1000 165.alb | 1 | 1 | Solution | 120.30 | 137 | 135.00 | 1.46 |
| instance n=1000 166.alb | 1 | 1 | Solution | 120.05 | 141 | 139.00 | 1.42 |
| instance n=1000 167.alb | 1 | 1 | Solution | 120.79 | 141 | 139.00 | 1.42 |
| instance n=1000 168.alb | 1 | 1 | Solution | 121.03 | 140 | 138.00 | 1.43 |
| instance n=1000 169.alb | 1 | 1 | Solution | 121.03 | 135 | 134.00 | 0.74 |
| instance n=1000 17.alb | 1 | 1 | Solution | 120.04 | 136 | 134.00 | 1.47 |
| instance n=1000 170.alb | 1 | 1 | Solution | 120.06 | 136 | 134.00 | 1.47 |
| instance n=1000 171.alb | 1 | 1 | Solution | 120.06 | 138 | 137.00 | 0.72 |
| instance n=1000 172.alb | 1 | 1 | Solution | 120.40 | 136 | 135.00 | 0.74 |
| instance n=1000 173.alb | 1 | 1 | Solution | 120.06 | 136 | 135.00 | 0.74 |
| instance n=1000 174.alb | 1 | 1 | Solution | 120.05 | 137 | 136.00 | 0.73 |
| instance n=1000 175.alb | 1 | 1 | Solution | 120.08 | 140 | 138.00 | 1.43 |
| instance n=1000 176.alb | 1 | 1 | Solution | 120.08 | 561 | 500.00 | 10.87 |
| instance n=1000 177.alb | 1 | 1 | Solution | 120.24 | 546 | 499.00 | 8.61 |
| instance n=1000 178.alb | 1 | 1 | Solution | 120.71 | 562 | 505.00 | 10.14 |
| instance n=1000 179.alb | 1 | 1 | Solution | 120.06 | 561 | 505.00 | 9.98 |
| instance n=1000 18.alb | 1 | 1 | Solution | 120.75 | 135 | 134.00 | 0.74 |
| instance n=1000 180.alb | 1 | 1 | Solution | 120.37 | 563 | 502.00 | 10.83 |
| instance n=1000 181.alb | 1 | 1 | Solution | 120.87 | 566 | 505.00 | 10.78 |
| instance n=1000 182.alb | 1 | 1 | Solution | 120.11 | 561 | 502.00 | 10.52 |
| instance n=1000 183.alb | 1 | 1 | Solution | 120.46 | 551 | 499.00 | 9.44 |
| instance n=1000 184.alb | 1 | 1 | Solution | 120.07 | 560 | 501.00 | 10.54 |
| instance n=1000 185.alb | 1 | 1 | Solution | 120.05 | 555 | 502.00 | 9.55 |
| instance n=1000 186.alb | 1 | 1 | Solution | 120.07 | 552 | 500.00 | 9.42 |
| instance n=1000 187.alb | 1 | 1 | Solution | 120.07 | 565 | 505.00 | 10.62 |
| instance n=1000 188.alb | 1 | 1 | Solution | 120.79 | 552 | 498.00 | 9.78 |
| instance n=1000 189.alb | 1 | 1 | Solution | 120.20 | 551 | 498.00 | 9.62 |
| instance n=1000 19.alb | 1 | 1 | Solution | 120.06 | 138 | 137.00 | 0.72 |
| instance n=1000 190.alb | 1 | 1 | Solution | 120.07 | 552 | 501.00 | 9.24 |
| instance n=1000 191.alb | 1 | 1 | Solution | 120.77 | 553 | 501.00 | 9.40 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 192.alb | 1 | 1 | Solution | 120.08 | 558 | 501.00 | 10.22 |
| instance n=1000 193.alb | 1 | 1 | Solution | 120.08 | 565 | 503.00 | 10.97 |
| instance n=1000 194.alb | 1 | 1 | Solution | 120.55 | 556 | 501.00 | 9.89 |
| instance n=1000 195.alb | 1 | 1 | Solution | 120.06 | 564 | 501.00 | 11.17 |
| instance n=1000 196.alb | 1 | 1 | Solution | 120.92 | 559 | 499.00 | 10.73 |
| instance n=1000 197.alb | 1 | 1 | Solution | 120.08 | 542 | 495.00 | 8.67 |
| instance n=1000 198.alb | 1 | 1 | Solution | 120.70 | 567 | 503.00 | 11.29 |
| instance n=1000 199.alb | 1 | 1 | Solution | 120.62 | 541 | 495.00 | 8.50 |
| instance n=1000 2.alb | 1 | 1 | Solution | 120.49 | 138 | 137.00 | 0.72 |
| instance n=1000 20.alb | 1 | 1 | Solution | 120.43 | 139 | 138.00 | 0.72 |
| instance n=1000 200.alb | 1 | 1 | Solution | 120.06 | 546 | 497.00 | 8.97 |
| instance n=1000 201.alb | 1 | 1 | Solution | 120.04 | 232 | 228.00 | 1.72 |
| instance n=1000 202.alb | 1 | 1 | Solution | 120.03 | 229 | 225.00 | 1.75 |
| instance n=1000 203.alb | 1 | 1 | Solution | 120.20 | 233 | 229.00 | 1.72 |
| instance n=1000 204.alb | 1 | 1 | Solution | 120.50 | 232 | 228.00 | 1.72 |
| instance n=1000 205.alb | 1 | 1 | Solution | 120.04 | 233 | 229.00 | 1.72 |
| instance n=1000 206.alb | 1 | 1 | Solution | 121.04 | 233 | 228.00 | 2.15 |
| instance n=1000 207.alb | 1 | 1 | Solution | 120.05 | 233 | 229.00 | 1.72 |
| instance n=1000 208.alb | 1 | 1 | Solution | 120.07 | 233 | 229.00 | 1.72 |
| instance n=1000 209.alb | 1 | 1 | Solution | 120.05 | 232 | 227.00 | 2.16 |
| instance n=1000 21.alb | 1 | 1 | Solution | 120.11 | 139 | 138.00 | 0.72 |
| instance n=1000 210.alb | 1 | 1 | Solution | 120.06 | 227 | 224.00 | 1.32 |
| instance n=1000 211.alb | 1 | 1 | Solution | 121.04 | 223 | 219.00 | 1.79 |
| instance n=1000 212.alb | 1 | 1 | Solution | 120.36 | 220 | 217.00 | 1.36 |
| instance n=1000 213.alb | 1 | 1 | Solution | 121.05 | 238 | 233.00 | 2.10 |
| instance n=1000 214.alb | 1 | 1 | Solution | 120.28 | 228 | 225.00 | 1.32 |
| instance n=1000 215.alb | 1 | 1 | Solution | 120.87 | 227 | 223.00 | 1.76 |
| instance n=1000 216.alb | 1 | 1 | Solution | 120.11 | 224 | 220.00 | 1.79 |
| instance n=1000 217.alb | 1 | 1 | Solution | 120.96 | 229 | 225.00 | 1.75 |
| instance n=1000 218.alb | 1 | 1 | Solution | 120.90 | 222 | 218.00 | 1.80 |
| instance n=1000 219.alb | 1 | 1 | Solution | 120.77 | 235 | 232.00 | 1.28 |
| instance n=1000 22.alb | 1 | 1 | Solution | 120.07 | 138 | 137.00 | 0.72 |
| instance n=1000 220.alb | 1 | 1 | Solution | 120.08 | 228 | 224.00 | 1.75 |
| instance n=1000 221.alb | 1 | 1 | Solution | 120.84 | 235 | 231.00 | 1.70 |
| instance n=1000 222.alb | 1 | 1 | Solution | 120.77 | 225 | 221.00 | 1.78 |
| instance n=1000 223.alb | 1 | 1 | Solution | 120.20 | 225 | 221.00 | 1.78 |
| instance n=1000 224.alb | 1 | 1 | Solution | 120.25 | 230 | 226.00 | 1.74 |
| instance n=1000 225.alb | 1 | 1 | Solution | 120.07 | 233 | 229.00 | 1.72 |
| instance n=1000 226.alb | 1 | 1 | Solution | 120.11 | 138 | 136.00 | 1.45 |
| instance n=1000 227.alb | 1 | 1 | Solution | 120.04 | 140 | 137.00 | 2.14 |
| instance n=1000 228.alb | 1 | 1 | Solution | 120.03 | 135 | 133.00 | 1.48 |
| instance n=1000 229.alb | 1 | 1 | Solution | 120.05 | 136 | 134.00 | 1.47 |
| instance n=1000 23.alb | 1 | 1 | Solution | 120.88 | 137 | 136.00 | 0.73 |
| instance n=1000 230.alb | 1 | 1 | Solution | 120.38 | 133 | 131.00 | 1.50 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 231.alb | 1 | 1 | Solution | 120.96 | 140 | 138.00 | 1.43 |
| instance n=1000 232.alb | 1 | 1 | Solution | 120.02 | 135 | 133.00 | 1.48 |
| instance n=1000 233.alb | 1 | 1 | Solution | 120.29 | 137 | 135.00 | 1.46 |
| instance n=1000 234.alb | 1 | 1 | Solution | 120.17 | 139 | 137.00 | 1.44 |
| instance n=1000 235.alb | 1 | 1 | Solution | 120.05 | 135 | 133.00 | 1.48 |
| instance n=1000 236.alb | 1 | 1 | Solution | 120.06 | 138 | 136.00 | 1.45 |
| instance n=1000 237.alb | 1 | 1 | Solution | 120.05 | 140 | 138.00 | 1.43 |
| instance n=1000 238.alb | 1 | 1 | Solution | 120.96 | 140 | 138.00 | 1.43 |
| instance n=1000 239.alb | 1 | 1 | Solution | 120.03 | 136 | 135.00 | 0.74 |
| instance n=1000 24.alb | 1 | 1 | Solution | 120.50 | 141 | 140.00 | 0.71 |
| instance n=1000 240.alb | 1 | 1 | Solution | 120.77 | 137 | 135.00 | 1.46 |
| instance n=1000 241.alb | 1 | 1 | Solution | 120.04 | 140 | 138.00 | 1.43 |
| instance n=1000 242.alb | 1 | 1 | Solution | 120.00 | 137 | 135.00 | 1.46 |
| instance n=1000 243.alb | 1 | 1 | Solution | 120.05 | 139 | 137.00 | 1.44 |
| instance n=1000 244.alb | 1 | 1 | Solution | 120.24 | 138 | 137.00 | 0.72 |
| instance n=1000 245.alb | 1 | 1 | Solution | 120.35 | 137 | 135.00 | 1.46 |
| instance n=1000 246.alb | 1 | 1 | Solution | 120.06 | 137 | 135.00 | 1.46 |
| instance n=1000 247.alb | 1 | 1 | Solution | 120.03 | 140 | 138.00 | 1.43 |
| instance n=1000 248.alb | 1 | 1 | Solution | 120.03 | 141 | 138.00 | 2.13 |
| instance n=1000 249.alb | 1 | 1 | Solution | 120.05 | 140 | 138.00 | 1.43 |
| instance n=1000 25.alb | 1 | 1 | Solution | 120.04 | 137 | 135.00 | 1.46 |
| instance n=1000 250.alb | 1 | 1 | Solution | 120.12 | 142 | 140.00 | 1.41 |
| instance n=1000 251.alb | 1 | 1 | Solution | 120.81 | 591 | 502.00 | 15.06 |
| instance n=1000 252.alb | 1 | 1 | Solution | 120.81 | 577 | 501.00 | 13.17 |
| instance n=1000 253.alb | 1 | 1 | Solution | 120.39 | 575 | 501.00 | 12.87 |
| instance n=1000 254.alb | 1 | 1 | Solution | 120.32 | 568 | 500.00 | 11.97 |
| instance n=1000 255.alb | 1 | 1 | Solution | 120.58 | 564 | 497.00 | 11.88 |
| instance n=1000 256.alb | 1 | 1 | Solution | 120.69 | 565 | 495.00 | 12.39 |
| instance n=1000 257.alb | 1 | 1 | Solution | 120.07 | 580 | 501.00 | 13.62 |
| instance n=1000 258.alb | 1 | 1 | Solution | 120.44 | 569 | 496.00 | 12.83 |
| instance n=1000 259.alb | 1 | 1 | Solution | 120.04 | 562 | 496.00 | 11.74 |
| instance n=1000 26.alb | 1 | 1 | Solution | 120.08 | 551 | 501.00 | 9.07 |
| instance n=1000 260.alb | 1 | 1 | Solution | 120.09 | 566 | 494.00 | 12.72 |
| instance n=1000 261.alb | 1 | 1 | Solution | 120.57 | 569 | 500.00 | 12.13 |
| instance n=1000 262.alb | 1 | 1 | Solution | 120.04 | 556 | 494.00 | 11.15 |
| instance n=1000 263.alb | 1 | 1 | Solution | 120.90 | 568 | 499.00 | 12.15 |
| instance n=1000 264.alb | 1 | 1 | Solution | 120.02 | 574 | 499.00 | 13.07 |
| instance n=1000 265.alb | 1 | 1 | Solution | 120.84 | 594 | 506.00 | 14.81 |
| instance n=1000 266.alb | 1 | 1 | Solution | 120.32 | 564 | 499.00 | 11.52 |
| instance n=1000 267.alb | 1 | 1 | Solution | 120.07 | 585 | 506.00 | 13.50 |
| instance n=1000 268.alb | 1 | 1 | Solution | 120.14 | 562 | 497.00 | 11.57 |
| instance n=1000 269.alb | 1 | 1 | Solution | 120.81 | 571 | 499.00 | 12.61 |
| instance n=1000 27.alb | 1 | 1 | Solution | 120.63 | 548 | 502.00 | 8.39 |
| instance n=1000 270.alb | 1 | 1 | Solution | 120.80 | 601 | 508.00 | 15.47 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 271.alb | 1 | 1 | Solution | 120.06 | 562 | 497.00 | 11.57 |
| instance n=1000 272.alb | 1 | 1 | Solution | 120.07 | 575 | 501.00 | 12.87 |
| instance n=1000 273.alb | 1 | 1 | Solution | 120.03 | 575 | 500.00 | 13.04 |
| instance n=1000 274.alb | 1 | 1 | Solution | 120.49 | 574 | 496.00 | 13.59 |
| instance n=1000 275.alb | 1 | 1 | Solution | 120.16 | 574 | 503.00 | 12.37 |
| instance n=1000 276.alb | 1 | 1 | Solution | 120.10 | 222 | 217.00 | 2.25 |
| instance n=1000 277.alb | 1 | 1 | Solution | 120.03 | 230 | 225.00 | 2.17 |
| instance n=1000 278.alb | 1 | 1 | Solution | 120.74 | 226 | 220.00 | 2.65 |
| instance n=1000 279.alb | 1 | 1 | Solution | 120.02 | 219 | 215.00 | 1.83 |
| instance n=1000 28.alb | 1 | 1 | Solution | 120.08 | 533 | 496.00 | 6.94 |
| instance n=1000 280.alb | 1 | 1 | Solution | 120.88 | 231 | 225.00 | 2.60 |
| instance n=1000 281.alb | 1 | 1 | Solution | 120.01 | 225 | 219.00 | 2.67 |
| instance n=1000 282.alb | 1 | 1 | Solution | 120.98 | 219 | 214.00 | 2.28 |
| instance n=1000 283.alb | 1 | 1 | Solution | 120.02 | 230 | 224.00 | 2.61 |
| instance n=1000 284.alb | 1 | 1 | Solution | 120.96 | 222 | 217.00 | 2.25 |
| instance n=1000 285.alb | 1 | 1 | Solution | 120.05 | 227 | 221.00 | 2.64 |
| instance n=1000 286.alb | 1 | 1 | Solution | 120.02 | 226 | 221.00 | 2.21 |
| instance n=1000 287.alb | 1 | 1 | Solution | 120.93 | 229 | 224.00 | 2.18 |
| instance n=1000 288.alb | 1 | 1 | Solution | 120.02 | 224 | 219.00 | 2.23 |
| instance n=1000 289.alb | 1 | 1 | Solution | 120.01 | 225 | 220.00 | 2.22 |
| instance n=1000 29.alb | 1 | 1 | Solution | 120.62 | 538 | 498.00 | 7.43 |
| instance n=1000 290.alb | 1 | 1 | Solution | 120.23 | 228 | 222.00 | 2.63 |
| instance n=1000 291.alb | 1 | 1 | Solution | 120.33 | 230 | 225.00 | 2.17 |
| instance n=1000 292.alb | 1 | 1 | Solution | 120.12 | 231 | 225.00 | 2.60 |
| instance n=1000 293.alb | 1 | 1 | Solution | 120.99 | 230 | 225.00 | 2.17 |
| instance n=1000 294.alb | 1 | 1 | Solution | 120.18 | 236 | 230.00 | 2.54 |
| instance n=1000 295.alb | 1 | 1 | Solution | 120.64 | 232 | 227.00 | 2.16 |
| instance n=1000 296.alb | 1 | 1 | Solution | 120.02 | 212 | 207.00 | 2.36 |
| instance n=1000 297.alb | 1 | 1 | Solution | 120.01 | 221 | 217.00 | 1.81 |
| instance n=1000 298.alb | 1 | 1 | Solution | 120.70 | 219 | 214.00 | 2.28 |
| instance n=1000 299.alb | 1 | 1 | Solution | 120.03 | 232 | 226.00 | 2.59 |
| instance n=1000 3.alb | 1 | 1 | Solution | 120.87 | 137 | 136.00 | 0.73 |
| instance n=1000 30.alb | 1 | 1 | Solution | 120.76 | 558 | 505.00 | 9.50 |
| instance n=1000 300.alb | 1 | 1 | Solution | 120.38 | 233 | 228.00 | 2.15 |
| instance n=1000 301.alb | 1 | 1 | Solution | 121.05 | 138 | 137.00 | 0.72 |
| instance n=1000 302.alb | 1 | 1 | Solution | 120.98 | 140 | 139.00 | 0.71 |
| instance n=1000 303.alb | 1 | 1 | Solution | 120.06 | 139 | 138.00 | 0.72 |
| instance n=1000 304.alb | 1 | 1 | Solution | 120.10 | 137 | 136.00 | 0.73 |
| instance n=1000 305.alb | 1 | 1 | Solution | 120.06 | 141 | 139.00 | 1.42 |
| instance n=1000 306.alb | 1 | 1 | Solution | 121.00 | 136 | 135.00 | 0.74 |
| instance n=1000 307.alb | 1 | 1 | Solution | 120.28 | 137 | 135.00 | 1.46 |
| instance n=1000 308.alb | 1 | 1 | Solution | 120.20 | 138 | 137.00 | 0.72 |
| instance n=1000 309.alb | 1 | 1 | Solution | 120.78 | 136 | 134.00 | 1.47 |
| instance n=1000 31.alb | 1 | 1 | Solution | 120.47 | 547 | 505.00 | 7.68 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 310.alb | 1 | 1 | Solution | 120.15 | 143 | 141.00 | 1.40 |
| instance n=1000 311.alb | 1 | 1 | Solution | 120.21 | 140 | 139.00 | 0.71 |
| instance n=1000 312.alb | 1 | 1 | Solution | 120.06 | 136 | 135.00 | 0.74 |
| instance n=1000 313.alb | 1 | 1 | Solution | 121.08 | 139 | 138.00 | 0.72 |
| instance n=1000 314.alb | 1 | 1 | Solution | 120.80 | 143 | 141.00 | 1.40 |
| instance n=1000 315.alb | 1 | 1 | Solution | 120.28 | 138 | 136.00 | 1.45 |
| instance n=1000 316.alb | 1 | 1 | Solution | 120.13 | 138 | 137.00 | 0.72 |
| instance n=1000 317.alb | 1 | 1 | Solution | 120.33 | 137 | 136.00 | 0.73 |
| instance n=1000 318.alb | 1 | 1 | Solution | 120.61 | 139 | 138.00 | 0.72 |
| instance n=1000 319.alb | 1 | 1 | Solution | 120.06 | 141 | 140.00 | 0.71 |
| instance n=1000 32.alb | 1 | 1 | Solution | 120.08 | 535 | 502.00 | 6.17 |
| instance n=1000 320.alb | 1 | 1 | Solution | 120.07 | 142 | 141.00 | 0.70 |
| instance n=1000 321.alb | 1 | 1 | Solution | 120.14 | 141 | 140.00 | 0.71 |
| instance n=1000 322.alb | 1 | 1 | Solution | 120.08 | 140 | 138.00 | 1.43 |
| instance n=1000 323.alb | 1 | 1 | Solution | 120.98 | 139 | 138.00 | 0.72 |
| instance n=1000 324.alb | 1 | 1 | Solution | 120.77 | 141 | 140.00 | 0.71 |
| instance n=1000 325.alb | 1 | 1 | Solution | 120.86 | 139 | 138.00 | 0.72 |
| instance n=1000 326.alb | 1 | 1 | Solution | 120.38 | 538 | 496.00 | 7.81 |
| instance n=1000 327.alb | 1 | 1 | Solution | 120.87 | 548 | 502.00 | 8.39 |
| instance n=1000 328.alb | 1 | 1 | Solution | 120.21 | 534 | 499.00 | 6.55 |
| instance n=1000 329.alb | 1 | 1 | Solution | 120.08 | 547 | 502.00 | 8.23 |
| instance n=1000 33.alb | 1 | 1 | Solution | 120.06 | 544 | 500.00 | 8.09 |
| instance n=1000 330.alb | 1 | 1 | Solution | 120.71 | 535 | 497.00 | 7.10 |
| instance n=1000 331.alb | 1 | 1 | Solution | 120.07 | 539 | 498.00 | 7.61 |
| instance n=1000 332.alb | 1 | 1 | Solution | 120.07 | 530 | 495.00 | 6.60 |
| instance n=1000 333.alb | 1 | 1 | Solution | 120.07 | 550 | 498.00 | 9.45 |
| instance n=1000 334.alb | 1 | 1 | Solution | 120.22 | 533 | 498.00 | 6.57 |
| instance n=1000 335.alb | 1 | 1 | Solution | 120.08 | 541 | 495.00 | 8.50 |
| instance n=1000 336.alb | 1 | 1 | Solution | 120.07 | 531 | 497.00 | 6.40 |
| instance n=1000 337.alb | 1 | 1 | Solution | 120.37 | 549 | 501.00 | 8.74 |
| instance n=1000 338.alb | 1 | 1 | Solution | 120.05 | 544 | 502.00 | 7.72 |
| instance n=1000 339.alb | 1 | 1 | Solution | 120.07 | 550 | 500.00 | 9.09 |
| instance n=1000 34.alb | 1 | 1 | Solution | 120.06 | 561 | 506.00 | 9.80 |
| instance n=1000 340.alb | 1 | 1 | Solution | 120.06 | 556 | 504.00 | 9.35 |
| instance n=1000 341.alb | 1 | 1 | Solution | 121.12 | 550 | 502.00 | 8.73 |
| instance n=1000 342.alb | 1 | 1 | Solution | 120.78 | 547 | 499.00 | 8.78 |
| instance n=1000 343.alb | 1 | 1 | Solution | 120.08 | 548 | 499.00 | 8.94 |
| instance n=1000 344.alb | 1 | 1 | Solution | 120.05 | 542 | 500.00 | 7.75 |
| instance n=1000 345.alb | 1 | 1 | Solution | 120.81 | 546 | 502.00 | 8.06 |
| instance n=1000 346.alb | 1 | 1 | Solution | 120.07 | 543 | 500.00 | 7.92 |
| instance n=1000 347.alb | 1 | 1 | Solution | 120.06 | 543 | 498.00 | 8.29 |
| instance n=1000 348.alb | 1 | 1 | Solution | 120.06 | 563 | 505.00 | 10.30 |
| instance n=1000 349.alb | 1 | 1 | Solution | 120.06 | 551 | 502.00 | 8.89 |
| instance n=1000 35.alb | 1 | 1 | Solution | 120.06 | 537 | 500.00 | 6.89 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 350.alb | 1 | 1 | Solution | 120.20 | 527 | 495.00 | 6.07 |
| instance n=1000 351.alb | 1 | 1 | Solution | 120.05 | 230 | 227.00 | 1.30 |
| instance n=1000 352.alb | 1 | 1 | Solution | 120.05 | 229 | 227.00 | 0.87 |
| instance n=1000 353.alb | 1 | 1 | Solution | 120.16 | 220 | 217.00 | 1.36 |
| instance n=1000 354.alb | 1 | 1 | Solution | 120.93 | 225 | 222.00 | 1.33 |
| instance n=1000 355.alb | 1 | 1 | Solution | 120.05 | 223 | 220.00 | 1.35 |
| instance n=1000 356.alb | 1 | 1 | Solution | 120.33 | 229 | 226.00 | 1.31 |
| instance n=1000 357.alb | 1 | 1 | Solution | 120.06 | 216 | 213.00 | 1.39 |
| instance n=1000 358.alb | 1 | 1 | Solution | 120.87 | 221 | 219.00 | 0.90 |
| instance n=1000 359.alb | 1 | 1 | Solution | 120.29 | 225 | 222.00 | 1.33 |
| instance n=1000 36.alb | 1 | 1 | Solution | 120.07 | 529 | 496.00 | 6.24 |
| instance n=1000 360.alb | 1 | 1 | Solution | 120.06 | 232 | 229.00 | 1.29 |
| instance n=1000 361.alb | 1 | 1 | Solution | 121.03 | 218 | 215.00 | 1.38 |
| instance n=1000 362.alb | 1 | 1 | Solution | 121.04 | 225 | 223.00 | 0.89 |
| instance n=1000 363.alb | 1 | 1 | Solution | 120.07 | 217 | 215.00 | 0.92 |
| instance n=1000 364.alb | 1 | 1 | Solution | 120.84 | 224 | 221.00 | 1.34 |
| instance n=1000 365.alb | 1 | 1 | Solution | 120.06 | 230 | 227.00 | 1.30 |
| instance n=1000 366.alb | 1 | 1 | Solution | 120.06 | 230 | 228.00 | 0.87 |
| instance n=1000 367.alb | 1 | 1 | Solution | 120.93 | 230 | 227.00 | 1.30 |
| instance n=1000 368.alb | 1 | 1 | Solution | 120.93 | 229 | 226.00 | 1.31 |
| instance n=1000 369.alb | 1 | 1 | Solution | 120.05 | 223 | 220.00 | 1.35 |
| instance n=1000 37.alb | 1 | 1 | Solution | 120.49 | 557 | 505.00 | 9.34 |
| instance n=1000 370.alb | 1 | 1 | Solution | 120.24 | 226 | 223.00 | 1.33 |
| instance n=1000 371.alb | 1 | 1 | Solution | 120.17 | 222 | 219.00 | 1.35 |
| instance n=1000 372.alb | 1 | 1 | Solution | 120.85 | 233 | 230.00 | 1.29 |
| instance n=1000 373.alb | 1 | 1 | Solution | 120.05 | 221 | 218.00 | 1.36 |
| instance n=1000 374.alb | 1 | 1 | Solution | 120.43 | 221 | 218.00 | 1.36 |
| instance n=1000 375.alb | 1 | 1 | Solution | 120.89 | 229 | 226.00 | 1.31 |
| instance n=1000 376.alb | 1 | 1 | Solution | 120.04 | 133 | 132.00 | 0.75 |
| instance n=1000 377.alb | 1 | 1 | Solution | 120.04 | 138 | 137.00 | 0.72 |
| instance n=1000 378.alb | 1 | 1 | Solution | 120.06 | 136 | 134.00 | 1.47 |
| instance n=1000 379.alb | 1 | 1 | Solution | 120.07 | 139 | 137.00 | 1.44 |
| instance n=1000 38.alb | 1 | 1 | Solution | 120.05 | 552 | 504.00 | 8.70 |
| instance n=1000 380.alb | 1 | 1 | Solution | 120.05 | 136 | 134.00 | 1.47 |
| instance n=1000 381.alb | 1 | 1 | Solution | 120.08 | 139 | 137.00 | 1.44 |
| instance n=1000 382.alb | 1 | 1 | Solution | 120.09 | 132 | 131.00 | 0.76 |
| instance n=1000 383.alb | 1 | 1 | Solution | 120.05 | 140 | 138.00 | 1.43 |
| instance n=1000 384.alb | 1 | 1 | Solution | 120.05 | 141 | 139.00 | 1.42 |
| instance n=1000 385.alb | 1 | 1 | Solution | 120.36 | 137 | 135.00 | 1.46 |
| instance n=1000 386.alb | 1 | 1 | Solution | 120.18 | 140 | 139.00 | 0.71 |
| instance n=1000 387.alb | 1 | 1 | Solution | 120.56 | 139 | 137.00 | 1.44 |
| instance n=1000 388.alb | 1 | 1 | Solution | 120.07 | 138 | 136.00 | 1.45 |
| instance n=1000 389.alb | 1 | 1 | Solution | 120.03 | 137 | 136.00 | 0.73 |
| instance n=1000 39.alb | 1 | 1 | Solution | 120.74 | 550 | 506.00 | 8.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 390.alb | 1 | 1 | Solution | 120.86 | 137 | 136.00 | 0.73 |
| instance n=1000 391.alb | 1 | 1 | Solution | 120.06 | 137 | 135.00 | 1.46 |
| instance n=1000 392.alb | 1 | 1 | Solution | 120.03 | 137 | 136.00 | 0.73 |
| instance n=1000 393.alb | 1 | 1 | Solution | 120.05 | 138 | 136.00 | 1.45 |
| instance n=1000 394.alb | 1 | 1 | Solution | 120.04 | 140 | 138.00 | 1.43 |
| instance n=1000 395.alb | 1 | 1 | Solution | 120.50 | 141 | 139.00 | 1.42 |
| instance n=1000 396.alb | 1 | 1 | Solution | 120.05 | 138 | 136.00 | 1.45 |
| instance n=1000 397.alb | 1 | 1 | Solution | 120.86 | 141 | 140.00 | 0.71 |
| instance n=1000 398.alb | 1 | 1 | Solution | 120.50 | 136 | 134.00 | 1.47 |
| instance n=1000 399.alb | 1 | 1 | Solution | 120.64 | 140 | 139.00 | 0.71 |
| instance n=1000 4.alb | 1 | 1 | Solution | 120.06 | 139 | 138.00 | 0.72 |
| instance n=1000 40.alb | 1 | 1 | Solution | 120.73 | 522 | 495.00 | 5.17 |
| instance n=1000 400.alb | 1 | 1 | Solution | 120.03 | 142 | 140.00 | 1.41 |
| instance n=1000 401.alb | 1 | 1 | Solution | 120.16 | 557 | 497.00 | 10.77 |
| instance n=1000 402.alb | 1 | 1 | Solution | 120.36 | 568 | 500.00 | 11.97 |
| instance n=1000 403.alb | 1 | 1 | Solution | 120.07 | 562 | 500.00 | 11.03 |
| instance n=1000 404.alb | 1 | 1 | Solution | 120.07 | 558 | 499.00 | 10.57 |
| instance n=1000 405.alb | 1 | 1 | Solution | 120.36 | 569 | 501.00 | 11.95 |
| instance n=1000 406.alb | 1 | 1 | Solution | 120.07 | 547 | 494.00 | 9.69 |
| instance n=1000 407.alb | 1 | 1 | Solution | 120.05 | 563 | 497.00 | 11.72 |
| instance n=1000 408.alb | 1 | 1 | Solution | 120.13 | 572 | 501.00 | 12.41 |
| instance n=1000 409.alb | 1 | 1 | Solution | 120.07 | 563 | 503.00 | 10.66 |
| instance n=1000 41.alb | 1 | 1 | Solution | 120.49 | 536 | 499.00 | 6.90 |
| instance n=1000 410.alb | 1 | 1 | Solution | 120.52 | 582 | 505.00 | 13.23 |
| instance n=1000 411.alb | 1 | 1 | Solution | 120.69 | 559 | 498.00 | 10.91 |
| instance n=1000 412.alb | 1 | 1 | Solution | 120.13 | 564 | 499.00 | 11.52 |
| instance n=1000 413.alb | 1 | 1 | Solution | 120.03 | 562 | 503.00 | 10.50 |
| instance n=1000 414.alb | 1 | 1 | Solution | 120.04 | 560 | 501.00 | 10.54 |
| instance n=1000 415.alb | 1 | 1 | Solution | 120.31 | 562 | 500.00 | 11.03 |
| instance n=1000 416.alb | 1 | 1 | Solution | 120.53 | 561 | 502.00 | 10.52 |
| instance n=1000 417.alb | 1 | 1 | Solution | 120.06 | 596 | 511.00 | 14.26 |
| instance n=1000 418.alb | 1 | 1 | Solution | 120.62 | 558 | 500.00 | 10.39 |
| instance n=1000 419.alb | 1 | 1 | Solution | 120.36 | 590 | 510.00 | 13.56 |
| instance n=1000 42.alb | 1 | 1 | Solution | 120.75 | 525 | 496.00 | 5.52 |
| instance n=1000 420.alb | 1 | 1 | Solution | 120.07 | 559 | 501.00 | 10.38 |
| instance n=1000 421.alb | 1 | 1 | Solution | 120.27 | 556 | 498.00 | 10.43 |
| instance n=1000 422.alb | 1 | 1 | Solution | 120.05 | 553 | 494.00 | 10.67 |
| instance n=1000 423.alb | 1 | 1 | Solution | 120.73 | 567 | 499.00 | 11.99 |
| instance n=1000 424.alb | 1 | 1 | Solution | 120.04 | 550 | 495.00 | 10.00 |
| instance n=1000 425.alb | 1 | 1 | Solution | 120.76 | 572 | 504.00 | 11.89 |
| instance n=1000 426.alb | 1 | 1 | Solution | 120.73 | 228 | 224.00 | 1.75 |
| instance n=1000 427.alb | 1 | 1 | Solution | 120.88 | 234 | 229.00 | 2.14 |
| instance n=1000 428.alb | 1 | 1 | Solution | 120.06 | 227 | 223.00 | 1.76 |
| instance n=1000 429.alb | 1 | 1 | Solution | 120.05 | 239 | 234.00 | 2.09 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 43.alb | 1 | 1 | Solution | 120.07 | 526 | 495.00 | 5.89 |
| instance n=1000 430.alb | 1 | 1 | Solution | 120.05 | 224 | 220.00 | 1.79 |
| instance n=1000 431.alb | 1 | 1 | Solution | 120.59 | 234 | 229.00 | 2.14 |
| instance n=1000 432.alb | 1 | 1 | Solution | 120.03 | 231 | 227.00 | 1.73 |
| instance n=1000 433.alb | 1 | 1 | Solution | 120.28 | 234 | 229.00 | 2.14 |
| instance n=1000 434.alb | 1 | 1 | Solution | 120.22 | 215 | 211.00 | 1.86 |
| instance n=1000 435.alb | 1 | 1 | Solution | 120.67 | 230 | 227.00 | 1.30 |
| instance n=1000 436.alb | 1 | 1 | Solution | 120.87 | 231 | 226.00 | 2.16 |
| instance n=1000 437.alb | 1 | 1 | Solution | 120.03 | 225 | 221.00 | 1.78 |
| instance n=1000 438.alb | 1 | 1 | Solution | 120.07 | 225 | 221.00 | 1.78 |
| instance n=1000 439.alb | 1 | 1 | Solution | 120.04 | 229 | 225.00 | 1.75 |
| instance n=1000 44.alb | 1 | 1 | Solution | 120.05 | 547 | 501.00 | 8.41 |
| instance n=1000 440.alb | 1 | 1 | Solution | 120.06 | 229 | 225.00 | 1.75 |
| instance n=1000 441.alb | 1 | 1 | Solution | 120.92 | 225 | 221.00 | 1.78 |
| instance n=1000 442.alb | 1 | 1 | Solution | 120.20 | 234 | 230.00 | 1.71 |
| instance n=1000 443.alb | 1 | 1 | Solution | 120.22 | 220 | 217.00 | 1.36 |
| instance n=1000 444.alb | 1 | 1 | Solution | 120.02 | 226 | 222.00 | 1.77 |
| instance n=1000 445.alb | 1 | 1 | Solution | 120.07 | 234 | 229.00 | 2.14 |
| instance n=1000 446.alb | 1 | 1 | Solution | 120.03 | 231 | 228.00 | 1.30 |
| instance n=1000 447.alb | 1 | 1 | Solution | 120.91 | 225 | 221.00 | 1.78 |
| instance n=1000 448.alb | 1 | 1 | Solution | 120.04 | 225 | 222.00 | 1.33 |
| instance n=1000 449.alb | 1 | 1 | Solution | 120.69 | 237 | 232.00 | 2.11 |
| instance n=1000 45.alb | 1 | 1 | Solution | 120.06 | 517 | 491.00 | 5.03 |
| instance n=1000 450.alb | 1 | 1 | Solution | 120.06 | 224 | 220.00 | 1.79 |
| instance n=1000 451.alb | 1 | 1 | Solution | 120.09 | 139 | 136.00 | 2.16 |
| instance n=1000 452.alb | 1 | 1 | Solution | 120.47 | 134 | 132.00 | 1.49 |
| instance n=1000 453.alb | 1 | 1 | Solution | 120.07 | 141 | 138.00 | 2.13 |
| instance n=1000 454.alb | 1 | 1 | Solution | 120.51 | 142 | 139.00 | 2.11 |
| instance n=1000 455.alb | 1 | 1 | Solution | 120.14 | 139 | 136.00 | 2.16 |
| instance n=1000 456.alb | 1 | 1 | Solution | 120.04 | 137 | 135.00 | 1.46 |
| instance n=1000 457.alb | 1 | 1 | Solution | 120.04 | 140 | 137.00 | 2.14 |
| instance n=1000 458.alb | 1 | 1 | Solution | 120.19 | 137 | 135.00 | 1.46 |
| instance n=1000 459.alb | 1 | 1 | Solution | 120.14 | 139 | 137.00 | 1.44 |
| instance n=1000 46.alb | 1 | 1 | Solution | 120.05 | 532 | 497.00 | 6.58 |
| instance n=1000 460.alb | 1 | 1 | Solution | 120.10 | 140 | 138.00 | 1.43 |
| instance n=1000 461.alb | 1 | 1 | Solution | 120.47 | 139 | 137.00 | 1.44 |
| instance n=1000 462.alb | 1 | 1 | Solution | 120.19 | 138 | 136.00 | 1.45 |
| instance n=1000 463.alb | 1 | 1 | Solution | 120.32 | 138 | 136.00 | 1.45 |
| instance n=1000 464.alb | 1 | 1 | Solution | 120.04 | 141 | 138.00 | 2.13 |
| instance n=1000 465.alb | 1 | 1 | Solution | 120.05 | 141 | 138.00 | 2.13 |
| instance n=1000 466.alb | 1 | 1 | Solution | 120.63 | 135 | 133.00 | 1.48 |
| instance n=1000 467.alb | 1 | 1 | Solution | 120.81 | 140 | 138.00 | 1.43 |
| instance n=1000 468.alb | 1 | 1 | Solution | 120.21 | 139 | 136.00 | 2.16 |
| instance n=1000 469.alb | 1 | 1 | Solution | 120.17 | 140 | 137.00 | 2.14 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 47.alb | 1 | 1 | Solution | 120.06 | 533 | 498.00 | 6.57 |
| instance n=1000 470.alb | 1 | 1 | Solution | 120.04 | 137 | 135.00 | 1.46 |
| instance n=1000 471.alb | 1 | 1 | Solution | 120.08 | 138 | 135.00 | 2.17 |
| instance n=1000 472.alb | 1 | 1 | Solution | 120.05 | 143 | 140.00 | 2.10 |
| instance n=1000 473.alb | 1 | 1 | Solution | 120.02 | 138 | 135.00 | 2.17 |
| instance n=1000 474.alb | 1 | 1 | Solution | 120.05 | 139 | 136.00 | 2.16 |
| instance n=1000 475.alb | 1 | 1 | Solution | 120.40 | 139 | 136.00 | 2.16 |
| instance n=1000 476.alb | 1 | 1 | Solution | 120.03 | 591 | 503.00 | 14.89 |
| instance n=1000 477.alb | 1 | 1 | Solution | 120.05 | 593 | 506.00 | 14.67 |
| instance n=1000 478.alb | 1 | 1 | Solution | 120.71 | 607 | 509.00 | 16.14 |
| instance n=1000 479.alb | 1 | 1 | Solution | 120.11 | 592 | 502.00 | 15.20 |
| instance n=1000 48.alb | 1 | 1 | Solution | 120.61 | 563 | 507.00 | 9.95 |
| instance n=1000 480.alb | 1 | 1 | Solution | 120.04 | 580 | 497.00 | 14.31 |
| instance n=1000 481.alb | 1 | 1 | Solution | 120.07 | 587 | 503.00 | 14.31 |
| instance n=1000 482.alb | 1 | 1 | Solution | 120.61 | 614 | 505.00 | 17.75 |
| instance n=1000 483.alb | 1 | 1 | Solution | 120.65 | 579 | 499.00 | 13.82 |
| instance n=1000 484.alb | 1 | 1 | Solution | 120.09 | 602 | 508.00 | 15.61 |
| instance n=1000 485.alb | 1 | 1 | Solution | 120.06 | 592 | 505.00 | 14.70 |
| instance n=1000 486.alb | 1 | 1 | Solution | 120.10 | 583 | 499.00 | 14.41 |
| instance n=1000 487.alb | 1 | 1 | Solution | 120.70 | 595 | 502.00 | 15.63 |
| instance n=1000 488.alb | 1 | 1 | Solution | 120.39 | 592 | 501.00 | 15.37 |
| instance n=1000 489.alb | 1 | 1 | Solution | 120.14 | 577 | 498.00 | 13.69 |
| instance n=1000 49.alb | 1 | 1 | Solution | 120.73 | 539 | 499.00 | 7.42 |
| instance n=1000 490.alb | 1 | 1 | Solution | 120.78 | 592 | 500.00 | 15.54 |
| instance n=1000 491.alb | 1 | 1 | Solution | 120.86 | 584 | 499.00 | 14.55 |
| instance n=1000 492.alb | 1 | 1 | Solution | 120.32 | 600 | 509.00 | 15.17 |
| instance n=1000 493.alb | 1 | 1 | Solution | 120.89 | 570 | 494.00 | 13.33 |
| instance n=1000 494.alb | 1 | 1 | Solution | 120.81 | 584 | 500.00 | 14.38 |
| instance n=1000 495.alb | 1 | 1 | Solution | 120.06 | 608 | 506.00 | 16.78 |
| instance n=1000 496.alb | 1 | 1 | Solution | 120.07 | 572 | 495.00 | 13.46 |
| instance n=1000 497.alb | 1 | 1 | Solution | 120.82 | 578 | 499.00 | 13.67 |
| instance n=1000 498.alb | 1 | 1 | Solution | 120.35 | 593 | 505.00 | 14.84 |
| instance n=1000 499.alb | 1 | 1 | Solution | 120.39 | 583 | 498.00 | 14.58 |
| instance n=1000 5.alb | 1 | 1 | Solution | 120.93 | 136 | 135.00 | 0.74 |
| instance n=1000 50.alb | 1 | 1 | Solution | 120.73 | 519 | 492.00 | 5.20 |
| instance n=1000 500.alb | 1 | 1 | Solution | 120.08 | 583 | 503.00 | 13.72 |
| instance n=1000 501.alb | 1 | 1 | Solution | 120.23 | 234 | 227.00 | 2.99 |
| instance n=1000 502.alb | 1 | 1 | Solution | 120.43 | 231 | 224.00 | 3.03 |
| instance n=1000 503.alb | 1 | 1 | Solution | 120.03 | 231 | 224.00 | 3.03 |
| instance n=1000 504.alb | 1 | 1 | Solution | 120.04 | 234 | 227.00 | 2.99 |
| instance n=1000 505.alb | 1 | 1 | Solution | 120.03 | 220 | 213.00 | 3.18 |
| instance n=1000 506.alb | 1 | 1 | Solution | 120.09 | 229 | 222.00 | 3.06 |
| instance n=1000 507.alb | 1 | 1 | Solution | 120.07 | 227 | 220.00 | 3.08 |
| instance n=1000 508.alb | 1 | 1 | Solution | 120.05 | 224 | 218.00 | 2.68 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 509.alb | 1 | 1 | Solution | 120.05 | 231 | 225.00 | 2.60 |
| instance n=1000 51.alb | 1 | 1 | Solution | 120.15 | 229 | 226.00 | 1.31 |
| instance n=1000 510.alb | 1 | 1 | Solution | 120.06 | 234 | 226.00 | 3.42 |
| instance n=1000 511.alb | 1 | 1 | Solution | 120.37 | 238 | 230.00 | 3.36 |
| instance n=1000 512.alb | 1 | 1 | Solution | 120.01 | 225 | 219.00 | 2.67 |
| instance n=1000 513.alb | 1 | 1 | Solution | 120.43 | 226 | 219.00 | 3.10 |
| instance n=1000 514.alb | 1 | 1 | Solution | 120.32 | 234 | 226.00 | 3.42 |
| instance n=1000 515.alb | 1 | 1 | Solution | 120.57 | 227 | 221.00 | 2.64 |
| instance n=1000 516.alb | 1 | 1 | Solution | 120.44 | 237 | 229.00 | 3.38 |
| instance n=1000 517.alb | 1 | 1 | Solution | 120.05 | 228 | 221.00 | 3.07 |
| instance n=1000 518.alb | 1 | 1 | Solution | 120.28 | 226 | 219.00 | 3.10 |
| instance n=1000 519.alb | 1 | 1 | Solution | 120.06 | 227 | 221.00 | 2.64 |
| instance n=1000 52.alb | 1 | 1 | Solution | 120.60 | 230 | 228.00 | 0.87 |
| instance n=1000 520.alb | 1 | 1 | Solution | 120.05 | 232 | 225.00 | 3.02 |
| instance n=1000 521.alb | 1 | 1 | Solution | 120.06 | 236 | 229.00 | 2.97 |
| instance n=1000 522.alb | 1 | 1 | Solution | 120.04 | 221 | 215.00 | 2.71 |
| instance n=1000 523.alb | 1 | 1 | Solution | 120.04 | 227 | 220.00 | 3.08 |
| instance n=1000 524.alb | 1 | 1 | Solution | 120.03 | 232 | 225.00 | 3.02 |
| instance n=1000 525.alb | 1 | 1 | Solution | 120.03 | 227 | 221.00 | 2.64 |
| instance n=1000 53.alb | 1 | 1 | Solution | 120.05 | 229 | 227.00 | 0.87 |
| instance n=1000 54.alb | 1 | 1 | Solution | 120.06 | 222 | 219.00 | 1.35 |
| instance n=1000 55.alb | 1 | 1 | Solution | 120.05 | 219 | 217.00 | 0.91 |
| instance n=1000 56.alb | 1 | 1 | Solution | 120.04 | 230 | 227.00 | 1.30 |
| instance n=1000 57.alb | 1 | 1 | Solution | 120.85 | 226 | 223.00 | 1.33 |
| instance n=1000 58.alb | 1 | 1 | Solution | 120.13 | 226 | 223.00 | 1.33 |
| instance n=1000 59.alb | 1 | 1 | Solution | 120.06 | 225 | 223.00 | 0.89 |
| instance n=1000 6.alb | 1 | 1 | Solution | 120.43 | 142 | 141.00 | 0.70 |
| instance n=1000 60.alb | 1 | 1 | Solution | 120.31 | 232 | 230.00 | 0.86 |
| instance n=1000 61.alb | 1 | 1 | Solution | 120.85 | 232 | 229.00 | 1.29 |
| instance n=1000 62.alb | 1 | 1 | Solution | 120.79 | 225 | 223.00 | 0.89 |
| instance n=1000 63.alb | 1 | 1 | Solution | 120.60 | 229 | 226.00 | 1.31 |
| instance n=1000 64.alb | 1 | 1 | Solution | 120.04 | 232 | 229.00 | 1.29 |
| instance n=1000 65.alb | 1 | 1 | Solution | 120.06 | 227 | 224.00 | 1.32 |
| instance n=1000 66.alb | 1 | 1 | Solution | 120.06 | 229 | 227.00 | 0.87 |
| instance n=1000 67.alb | 1 | 1 | Solution | 120.10 | 225 | 223.00 | 0.89 |
| instance n=1000 68.alb | 1 | 1 | Solution | 120.04 | 229 | 226.00 | 1.31 |
| instance n=1000 69.alb | 1 | 1 | Solution | 120.05 | 226 | 223.00 | 1.33 |
| instance n=1000 7.alb | 1 | 1 | Solution | 121.07 | 137 | 136.00 | 0.73 |
| instance n=1000 70.alb | 1 | 1 | Solution | 120.06 | 230 | 228.00 | 0.87 |
| instance n=1000 71.alb | 1 | 1 | Solution | 120.04 | 232 | 230.00 | 0.86 |
| instance n=1000 72.alb | 1 | 1 | Solution | 120.05 | 224 | 222.00 | 0.89 |
| instance n=1000 73.alb | 1 | 1 | Solution | 120.05 | 223 | 221.00 | 0.90 |
| instance n=1000 74.alb | 1 | 1 | Solution | 120.87 | 229 | 227.00 | 0.87 |
| instance n=1000 75.alb | 1 | 1 | Solution | 120.07 | 229 | 227.00 | 0.87 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|--------|----------------|
| instance n=1000 76.alb | 1 | 1 | Solution | 120.72 | 137 | 136.00 | 0.73 |
| instance n=1000 77.alb | 1 | 1 | Solution | 120.03 | 137 | 136.00 | 0.73 |
| instance n=1000 78.alb | 1 | 1 | Solution | 120.67 | 140 | 138.00 | 1.43 |
| instance n=1000 79.alb | 1 | 1 | Solution | 120.12 | 143 | 142.00 | 0.70 |
| instance n=1000 8.alb | 1 | 1 | Solution | 120.24 | 139 | 138.00 | 0.72 |
| instance n=1000 80.alb | 1 | 1 | Solution | 120.19 | 141 | 140.00 | 0.71 |
| instance n=1000 81.alb | 1 | 1 | Solution | 120.54 | 137 | 136.00 | 0.73 |
| instance n=1000 82.alb | 1 | 1 | Solution | 120.50 | 137 | 136.00 | 0.73 |
| instance n=1000 83.alb | 1 | 1 | Solution | 120.12 | 141 | 139.00 | 1.42 |
| instance n=1000 84.alb | 1 | 1 | Solution | 120.04 | 136 | 135.00 | 0.74 |
| instance n=1000 85.alb | 1 | 1 | Solution | 120.73 | 137 | 136.00 | 0.73 |
| instance n=1000 86.alb | 1 | 1 | Solution | 120.07 | 139 | 138.00 | 0.72 |
| instance n=1000 87.alb | 1 | 1 | Solution | 120.42 | 141 | 140.00 | 0.71 |
| instance n=1000 88.alb | 1 | 1 | Solution | 120.03 | 141 | 140.00 | 0.71 |
| instance n=1000 89.alb | 1 | 1 | Solution | 120.03 | 141 | 140.00 | 0.71 |
| instance n=1000 9.alb | 1 | 1 | Solution | 120.04 | 135 | 134.00 | 0.74 |
| instance n=1000 90.alb | 1 | 1 | Solution | 120.06 | 139 | 138.00 | 0.72 |
| instance n=1000 91.alb | 1 | 1 | Solution | 120.05 | 142 | 141.00 | 0.70 |
| instance n=1000 92.alb | 1 | 1 | Solution | 120.03 | 137 | 136.00 | 0.73 |
| instance n=1000 93.alb | 1 | 1 | Solution | 120.02 | 138 | 137.00 | 0.72 |
| instance n=1000 94.alb | 1 | 1 | Solution | 120.74 | 139 | 137.00 | 1.44 |
| instance n=1000 95.alb | 1 | 1 | Solution | 120.19 | 137 | 136.00 | 0.73 |
| instance n=1000 96.alb | 1 | 1 | Solution | 120.03 | 138 | 137.00 | 0.72 |
| instance n=1000 97.alb | 1 | 1 | Solution | 120.03 | 139 | 138.00 | 0.72 |
| instance n=1000 98.alb | 1 | 1 | Solution | 120.43 | 137 | 136.00 | 0.73 |
| instance n=1000 99.alb | 1 | 1 | Solution | 120.06 | 137 | 136.00 | 0.73 |
| instance n=100 1.alb | 1 | 1 | Solution | 120.10 | 23 | 23.00 | 0.00 |
| instance n=100 10.alb | 1 | 1 | Solution | 120.06 | 22 | 22.00 | 0.00 |
| instance n=100 100.alb | 1 | 1 | Solution | 120.09 | 25 | 25.00 | 0.00 |
| instance n=100 101.alb | 1 | 1 | Solution | 120.08 | 15 | 15.00 | 0.00 |
| instance n=100 102.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=100 103.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 104.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 105.alb | 1 | 1 | Solution | 120.08 | 13 | 13.00 | 0.00 |
| instance n=100 106.alb | 1 | 1 | Optimal | 120.04 | 14 | 14.00 | 0.00 |
| instance n=100 107.alb | 1 | 1 | Solution | 120.07 | 14 | 14.00 | 0.00 |
| instance n=100 108.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 109.alb | 1 | 1 | Solution | 120.08 | 15 | 15.00 | 0.00 |
| instance n=100 11.alb | 1 | 1 | Solution | 120.15 | 24 | 24.00 | 0.00 |
| instance n=100 110.alb | 1 | 1 | Solution | 120.12 | 13 | 13.00 | 0.00 |
| instance n=100 111.alb | 1 | 1 | Solution | 120.08 | 16 | 16.00 | 0.00 |
| instance n=100 112.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=100 113.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 114.alb | 1 | 1 | Solution | 120.10 | 13 | 13.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 115.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 116.alb | 1 | 1 | Solution | 120.10 | 16 | 16.00 | 0.00 |
| instance n=100 117.alb | 1 | 1 | Solution | 120.09 | 16 | 15.00 | 6.25 |
| instance n=100 118.alb | 1 | 1 | Solution | 120.08 | 15 | 15.00 | 0.00 |
| instance n=100 119.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 12.alb | 1 | 1 | Solution | 120.10 | 25 | 25.00 | 0.00 |
| instance n=100 120.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 121.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |
| instance n=100 122.alb | 1 | 1 | Solution | 120.07 | 13 | 13.00 | 0.00 |
| instance n=100 123.alb | 1 | 1 | Solution | 120.13 | 15 | 15.00 | 0.00 |
| instance n=100 124.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |
| instance n=100 125.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 126.alb | 1 | 1 | Solution | 120.09 | 52 | 49.00 | 5.77 |
| instance n=100 127.alb | 1 | 1 | Solution | 120.07 | 53 | 49.00 | 7.55 |
| instance n=100 128.alb | 1 | 1 | Solution | 120.07 | 57 | 52.00 | 8.77 |
| instance n=100 129.alb | 1 | 1 | Solution | 120.08 | 56 | 50.00 | 10.71 |
| instance n=100 13.alb | 1 | 1 | Solution | 120.13 | 24 | 24.00 | 0.00 |
| instance n=100 130.alb | 1 | 1 | Solution | 120.06 | 55 | 51.00 | 7.27 |
| instance n=100 131.alb | 1 | 1 | Solution | 120.09 | 53 | 50.00 | 5.66 |
| instance n=100 132.alb | 1 | 1 | Solution | 120.07 | 59 | 52.00 | 11.86 |
| instance n=100 133.alb | 1 | 1 | Solution | 120.07 | 57 | 51.00 | 10.53 |
| instance n=100 134.alb | 1 | 1 | Solution | 120.06 | 55 | 51.00 | 7.27 |
| instance n=100 135.alb | 1 | 1 | Solution | 120.06 | 58 | 51.00 | 12.07 |
| instance n=100 136.alb | 1 | 1 | Solution | 120.06 | 54 | 49.00 | 9.26 |
| instance n=100 137.alb | 1 | 1 | Solution | 120.08 | 55 | 50.00 | 9.09 |
| instance n=100 138.alb | 1 | 1 | Solution | 120.08 | 59 | 52.00 | 11.86 |
| instance n=100 139.alb | 1 | 1 | Solution | 120.07 | 52 | 49.00 | 5.77 |
| instance n=100 14.alb | 1 | 1 | Solution | 120.12 | 20 | 20.00 | 0.00 |
| instance n=100 140.alb | 1 | 1 | Solution | 120.06 | 55 | 51.00 | 7.27 |
| instance n=100 141.alb | 1 | 1 | Solution | 120.06 | 51 | 49.00 | 3.92 |
| instance n=100 142.alb | 1 | 1 | Solution | 120.06 | 55 | 50.00 | 9.09 |
| instance n=100 143.alb | 1 | 1 | Solution | 120.09 | 54 | 50.00 | 7.41 |
| instance n=100 144.alb | 1 | 1 | Solution | 120.11 | 49 | 47.00 | 4.08 |
| instance n=100 145.alb | 1 | 1 | Solution | 120.06 | 58 | 51.00 | 12.07 |
| instance n=100 146.alb | 1 | 1 | Solution | 120.09 | 53 | 50.00 | 5.66 |
| instance n=100 147.alb | 1 | 1 | Solution | 120.05 | 61 | 52.00 | 14.75 |
| instance n=100 148.alb | 1 | 1 | Solution | 120.09 | 55 | 50.00 | 9.09 |
| instance n=100 149.alb | 1 | 1 | Solution | 120.08 | 56 | 51.00 | 8.93 |
| instance n=100 15.alb | 1 | 1 | Solution | 120.11 | 24 | 24.00 | 0.00 |
| instance n=100 150.alb | 1 | 1 | Solution | 120.08 | 57 | 51.00 | 10.53 |
| instance n=100 151.alb | 1 | 1 | Solution | 120.08 | 22 | 21.00 | 4.55 |
| instance n=100 152.alb | 1 | 1 | Solution | 120.08 | 22 | 22.00 | 0.00 |
| instance n=100 153.alb | 1 | 1 | Solution | 120.09 | 21 | 21.00 | 0.00 |
| instance n=100 154.alb | 1 | 1 | Solution | 120.09 | 25 | 25.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 155.alb | 1 | 1 | Solution | 120.10 | 22 | 22.00 | 0.00 |
| instance n=100 156.alb | 1 | 1 | Solution | 120.09 | 23 | 23.00 | 0.00 |
| instance n=100 157.alb | 1 | 1 | Solution | 120.08 | 26 | 26.00 | 0.00 |
| instance n=100 158.alb | 1 | 1 | Solution | 120.16 | 23 | 23.00 | 0.00 |
| instance n=100 159.alb | 1 | 1 | Solution | 120.16 | 19 | 19.00 | 0.00 |
| instance n=100 16.alb | 1 | 1 | Solution | 120.13 | 23 | 23.00 | 0.00 |
| instance n=100 160.alb | 1 | 1 | Solution | 120.13 | 22 | 22.00 | 0.00 |
| instance n=100 161.alb | 1 | 1 | Solution | 120.11 | 23 | 22.00 | 4.35 |
| instance n=100 162.alb | 1 | 1 | Solution | 120.08 | 22 | 22.00 | 0.00 |
| instance n=100 163.alb | 1 | 1 | Solution | 120.09 | 25 | 25.00 | 0.00 |
| instance n=100 164.alb | 1 | 1 | Solution | 120.08 | 23 | 23.00 | 0.00 |
| instance n=100 165.alb | 1 | 1 | Solution | 120.13 | 25 | 24.00 | 4.00 |
| instance n=100 166.alb | 1 | 1 | Solution | 120.09 | 24 | 24.00 | 0.00 |
| instance n=100 167.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=100 168.alb | 1 | 1 | Solution | 120.14 | 22 | 21.00 | 4.55 |
| instance n=100 169.alb | 1 | 1 | Solution | 120.11 | 21 | 21.00 | 0.00 |
| instance n=100 17.alb | 1 | 1 | Solution | 120.07 | 22 | 21.00 | 4.55 |
| instance n=100 170.alb | 1 | 1 | Solution | 120.08 | 25 | 24.00 | 4.00 |
| instance n=100 171.alb | 1 | 1 | Solution | 120.12 | 25 | 24.00 | 4.00 |
| instance n=100 172.alb | 1 | 1 | Solution | 120.12 | 24 | 24.00 | 0.00 |
| instance n=100 173.alb | 1 | 1 | Solution | 120.09 | 25 | 24.00 | 4.00 |
| instance n=100 174.alb | 1 | 1 | Solution | 120.11 | 22 | 22.00 | 0.00 |
| instance n=100 175.alb | 1 | 1 | Solution | 120.08 | 27 | 26.00 | 3.70 |
| instance n=100 176.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=100 177.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 178.alb | 1 | 1 | Solution | 120.15 | 15 | 15.00 | 0.00 |
| instance n=100 179.alb | 1 | 1 | Solution | 120.13 | 15 | 15.00 | 0.00 |
| instance n=100 18.alb | 1 | 1 | Solution | 120.10 | 20 | 19.00 | 5.00 |
| instance n=100 180.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |
| instance n=100 181.alb | 1 | 1 | Solution | 120.11 | 13 | 13.00 | 0.00 |
| instance n=100 182.alb | 1 | 1 | Solution | 120.09 | 15 | 15.00 | 0.00 |
| instance n=100 183.alb | 1 | 1 | Solution | 120.14 | 14 | 14.00 | 0.00 |
| instance n=100 184.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 185.alb | 1 | 1 | Solution | 120.09 | 15 | 15.00 | 0.00 |
| instance n=100 186.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 187.alb | 1 | 1 | Solution | 120.16 | 13 | 13.00 | 0.00 |
| instance n=100 188.alb | 1 | 1 | Solution | 120.14 | 16 | 16.00 | 0.00 |
| instance n=100 189.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 19.alb | 1 | 1 | Solution | 120.12 | 23 | 23.00 | 0.00 |
| instance n=100 190.alb | 1 | 1 | Solution | 120.10 | 13 | 13.00 | 0.00 |
| instance n=100 191.alb | 1 | 1 | Solution | 120.13 | 14 | 14.00 | 0.00 |
| instance n=100 192.alb | 1 | 1 | Solution | 120.12 | 13 | 13.00 | 0.00 |
| instance n=100 193.alb | 1 | 1 | Solution | 120.13 | 15 | 15.00 | 0.00 |
| instance n=100 194.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 195.alb | 1 | 1 | Solution | 120.11 | 15 | 15.00 | 0.00 |
| instance n=100 196.alb | 1 | 1 | Solution | 120.10 | 15 | 15.00 | 0.00 |
| instance n=100 197.alb | 1 | 1 | Solution | 120.14 | 15 | 15.00 | 0.00 |
| instance n=100 198.alb | 1 | 1 | Solution | 120.12 | 13 | 13.00 | 0.00 |
| instance n=100 199.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 2.alb | 1 | 1 | Solution | 120.08 | 21 | 21.00 | 0.00 |
| instance n=100 20.alb | 1 | 1 | Solution | 120.10 | 21 | 21.00 | 0.00 |
| instance n=100 200.alb | 1 | 1 | Solution | 120.09 | 15 | 15.00 | 0.00 |
| instance n=100 201.alb | 1 | 1 | Solution | 120.09 | 55 | 51.00 | 7.27 |
| instance n=100 202.alb | 1 | 1 | Solution | 120.12 | 62 | 52.00 | 16.13 |
| instance n=100 203.alb | 1 | 1 | Solution | 120.08 | 53 | 49.00 | 7.55 |
| instance n=100 204.alb | 1 | 1 | Solution | 120.12 | 52 | 48.00 | 7.69 |
| instance n=100 205.alb | 1 | 1 | Solution | 120.10 | 58 | 51.00 | 12.07 |
| instance n=100 206.alb | 1 | 1 | Solution | 120.15 | 52 | 49.00 | 5.77 |
| instance n=100 207.alb | 1 | 1 | Solution | 120.11 | 53 | 49.00 | 7.55 |
| instance n=100 208.alb | 1 | 1 | Solution | 120.08 | 59 | 51.00 | 13.56 |
| instance n=100 209.alb | 1 | 1 | Solution | 120.11 | 57 | 51.00 | 10.53 |
| instance n=100 21.alb | 1 | 1 | Solution | 120.14 | 21 | 21.00 | 0.00 |
| instance n=100 210.alb | 1 | 1 | Solution | 120.11 | 53 | 49.00 | 7.55 |
| instance n=100 211.alb | 1 | 1 | Solution | 120.11 | 52 | 49.00 | 5.77 |
| instance n=100 212.alb | 1 | 1 | Solution | 120.07 | 53 | 50.00 | 5.66 |
| instance n=100 213.alb | 1 | 1 | Solution | 120.11 | 54 | 50.00 | 7.41 |
| instance n=100 214.alb | 1 | 1 | Solution | 120.08 | 55 | 50.00 | 9.09 |
| instance n=100 215.alb | 1 | 1 | Solution | 120.12 | 50 | 47.00 | 6.00 |
| instance n=100 216.alb | 1 | 1 | Solution | 120.08 | 55 | 50.00 | 9.09 |
| instance n=100 217.alb | 1 | 1 | Solution | 120.14 | 54 | 49.00 | 9.26 |
| instance n=100 218.alb | 1 | 1 | Solution | 120.08 | 55 | 50.00 | 9.09 |
| instance n=100 219.alb | 1 | 1 | Solution | 120.11 | 52 | 49.00 | 5.77 |
| instance n=100 22.alb | 1 | 1 | Solution | 120.09 | 25 | 24.00 | 4.00 |
| instance n=100 220.alb | 1 | 1 | Solution | 120.16 | 54 | 50.00 | 7.41 |
| instance n=100 221.alb | 1 | 1 | Solution | 120.09 | 58 | 51.00 | 12.07 |
| instance n=100 222.alb | 1 | 1 | Solution | 120.11 | 55 | 50.00 | 9.09 |
| instance n=100 223.alb | 1 | 1 | Solution | 120.08 | 52 | 49.00 | 5.77 |
| instance n=100 224.alb | 1 | 1 | Solution | 120.07 | 57 | 51.00 | 10.53 |
| instance n=100 225.alb | 1 | 1 | Solution | 120.13 | 54 | 51.00 | 5.56 |
| instance n=100 226.alb | 1 | 1 | Solution | 120.06 | 25 | 24.00 | 4.00 |
| instance n=100 227.alb | 1 | 1 | Solution | 120.10 | 27 | 26.00 | 3.70 |
| instance n=100 228.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=100 229.alb | 1 | 1 | Solution | 120.09 | 24 | 24.00 | 0.00 |
| instance n=100 23.alb | 1 | 1 | Solution | 120.11 | 24 | 24.00 | 0.00 |
| instance n=100 230.alb | 1 | 1 | Solution | 120.08 | 24 | 23.00 | 4.17 |
| instance n=100 231.alb | 1 | 1 | Solution | 120.08 | 22 | 22.00 | 0.00 |
| instance n=100 232.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=100 233.alb | 1 | 1 | Solution | 120.14 | 23 | 22.00 | 4.35 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 234.alb | 1 | 1 | Solution | 120.10 | 23 | 23.00 | 0.00 |
| instance n=100 235.alb | 1 | 1 | Solution | 120.07 | 26 | 26.00 | 0.00 |
| instance n=100 236.alb | 1 | 1 | Solution | 120.08 | 23 | 22.00 | 4.35 |
| instance n=100 237.alb | 1 | 1 | Solution | 120.08 | 23 | 23.00 | 0.00 |
| instance n=100 238.alb | 1 | 1 | Solution | 120.10 | 23 | 23.00 | 0.00 |
| instance n=100 239.alb | 1 | 1 | Solution | 120.08 | 21 | 21.00 | 0.00 |
| instance n=100 24.alb | 1 | 1 | Solution | 120.08 | 24 | 24.00 | 0.00 |
| instance n=100 240.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=100 241.alb | 1 | 1 | Solution | 120.06 | 22 | 22.00 | 0.00 |
| instance n=100 242.alb | 1 | 1 | Solution | 120.10 | 23 | 23.00 | 0.00 |
| instance n=100 243.alb | 1 | 1 | Solution | 120.09 | 24 | 23.00 | 4.17 |
| instance n=100 244.alb | 1 | 1 | Solution | 120.08 | 21 | 21.00 | 0.00 |
| instance n=100 245.alb | 1 | 1 | Solution | 120.09 | 24 | 23.00 | 4.17 |
| instance n=100 246.alb | 1 | 1 | Solution | 120.09 | 26 | 26.00 | 0.00 |
| instance n=100 247.alb | 1 | 1 | Solution | 120.07 | 22 | 22.00 | 0.00 |
| instance n=100 248.alb | 1 | 1 | Solution | 120.08 | 19 | 19.00 | 0.00 |
| instance n=100 249.alb | 1 | 1 | Solution | 120.08 | 21 | 21.00 | 0.00 |
| instance n=100 25.alb | 1 | 1 | Solution | 120.12 | 22 | 22.00 | 0.00 |
| instance n=100 250.alb | 1 | 1 | Solution | 120.08 | 24 | 24.00 | 0.00 |
| instance n=100 251.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |
| instance n=100 252.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 253.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=100 254.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 255.alb | 1 | 1 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 256.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |
| instance n=100 257.alb | 1 | 1 | Solution | 120.11 | 12 | 12.00 | 0.00 |
| instance n=100 258.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 259.alb | 1 | 1 | Solution | 120.10 | 15 | 15.00 | 0.00 |
| instance n=100 26.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 260.alb | 1 | 1 | Solution | 120.10 | 15 | 15.00 | 0.00 |
| instance n=100 261.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 262.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 263.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 264.alb | 1 | 1 | Solution | 120.13 | 15 | 15.00 | 0.00 |
| instance n=100 265.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 266.alb | 1 | 1 | Solution | 120.13 | 13 | 13.00 | 0.00 |
| instance n=100 267.alb | 1 | 1 | Solution | 120.07 | 13 | 13.00 | 0.00 |
| instance n=100 268.alb | 1 | 1 | Solution | 120.11 | 15 | 15.00 | 0.00 |
| instance n=100 269.alb | 1 | 1 | Solution | 120.12 | 15 | 15.00 | 0.00 |
| instance n=100 27.alb | 1 | 1 | Solution | 120.10 | 13 | 13.00 | 0.00 |
| instance n=100 270.alb | 1 | 1 | Solution | 120.10 | 13 | 13.00 | 0.00 |
| instance n=100 271.alb | 1 | 1 | Solution | 120.12 | 14 | 13.00 | 7.14 |
| instance n=100 272.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 273.alb | 1 | 1 | Solution | 120.14 | 13 | 13.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 274.alb | 1 | 1 | Solution | 120.10 | 13 | 13.00 | 0.00 |
| instance n=100 275.alb | 1 | 1 | Solution | 120.10 | 13 | 13.00 | 0.00 |
| instance n=100 276.alb | 1 | 1 | Solution | 120.09 | 62 | 52.00 | 16.13 |
| instance n=100 277.alb | 1 | 1 | Solution | 120.14 | 60 | 51.00 | 15.00 |
| instance n=100 278.alb | 1 | 1 | Solution | 120.08 | 59 | 52.00 | 11.86 |
| instance n=100 279.alb | 1 | 1 | Solution | 120.09 | 56 | 51.00 | 8.93 |
| instance n=100 28.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 280.alb | 1 | 1 | Solution | 120.07 | 56 | 51.00 | 8.93 |
| instance n=100 281.alb | 1 | 1 | Solution | 120.06 | 64 | 53.00 | 17.19 |
| instance n=100 282.alb | 1 | 1 | Solution | 120.09 | 63 | 52.00 | 17.46 |
| instance n=100 283.alb | 1 | 1 | Solution | 120.07 | 57 | 50.00 | 12.28 |
| instance n=100 284.alb | 1 | 1 | Solution | 120.09 | 56 | 51.00 | 8.93 |
| instance n=100 285.alb | 1 | 1 | Solution | 120.07 | 57 | 50.00 | 12.28 |
| instance n=100 286.alb | 1 | 1 | Solution | 120.07 | 58 | 51.00 | 12.07 |
| instance n=100 287.alb | 1 | 1 | Solution | 120.09 | 56 | 50.00 | 10.71 |
| instance n=100 288.alb | 1 | 1 | Solution | 120.07 | 58 | 51.00 | 12.07 |
| instance n=100 289.alb | 1 | 1 | Solution | 120.10 | 64 | 52.00 | 18.75 |
| instance n=100 29.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 290.alb | 1 | 1 | Solution | 120.09 | 56 | 51.00 | 8.93 |
| instance n=100 291.alb | 1 | 1 | Solution | 120.09 | 54 | 49.00 | 9.26 |
| instance n=100 292.alb | 1 | 1 | Solution | 120.18 | 60 | 51.00 | 15.00 |
| instance n=100 293.alb | 1 | 1 | Solution | 120.08 | 55 | 50.00 | 9.09 |
| instance n=100 294.alb | 1 | 1 | Solution | 120.08 | 59 | 52.00 | 11.86 |
| instance n=100 295.alb | 1 | 1 | Solution | 120.07 | 58 | 51.00 | 12.07 |
| instance n=100 296.alb | 1 | 1 | Solution | 120.06 | 57 | 51.00 | 10.53 |
| instance n=100 297.alb | 1 | 1 | Solution | 120.08 | 60 | 51.00 | 15.00 |
| instance n=100 298.alb | 1 | 1 | Solution | 120.10 | 60 | 53.00 | 11.67 |
| instance n=100 299.alb | 1 | 1 | Solution | 120.06 | 56 | 50.00 | 10.71 |
| instance n=100 3.alb | 1 | 1 | Solution | 120.12 | 20 | 20.00 | 0.00 |
| instance n=100 30.alb | 1 | 1 | Solution | 120.11 | 15 | 15.00 | 0.00 |
| instance n=100 300.alb | 1 | 1 | Solution | 120.09 | 56 | 49.00 | 12.50 |
| instance n=100 301.alb | 1 | 1 | Solution | 120.20 | 23 | 23.00 | 0.00 |
| instance n=100 302.alb | 1 | 1 | Solution | 120.14 | 24 | 24.00 | 0.00 |
| instance n=100 303.alb | 1 | 1 | Solution | 120.12 | 24 | 24.00 | 0.00 |
| instance n=100 304.alb | 1 | 1 | Solution | 120.09 | 21 | 21.00 | 0.00 |
| instance n=100 305.alb | 1 | 1 | Solution | 120.15 | 22 | 22.00 | 0.00 |
| instance n=100 306.alb | 1 | 1 | Solution | 120.11 | 24 | 24.00 | 0.00 |
| instance n=100 307.alb | 1 | 1 | Solution | 120.11 | 24 | 23.00 | 4.17 |
| instance n=100 308.alb | 1 | 1 | Solution | 120.10 | 20 | 20.00 | 0.00 |
| instance n=100 309.alb | 1 | 1 | Solution | 120.10 | 22 | 21.00 | 4.55 |
| instance n=100 31.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 310.alb | 1 | 1 | Solution | 120.16 | 23 | 23.00 | 0.00 |
| instance n=100 311.alb | 1 | 1 | Solution | 120.11 | 21 | 21.00 | 0.00 |
| instance n=100 312.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 313.alb | 1 | 1 | Solution | 120.10 | 23 | 23.00 | 0.00 |
| instance n=100 314.alb | 1 | 1 | Solution | 120.12 | 19 | 19.00 | 0.00 |
| instance n=100 315.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=100 316.alb | 1 | 1 | Solution | 120.14 | 24 | 24.00 | 0.00 |
| instance n=100 317.alb | 1 | 1 | Solution | 120.10 | 26 | 26.00 | 0.00 |
| instance n=100 318.alb | 1 | 1 | Solution | 120.10 | 21 | 21.00 | 0.00 |
| instance n=100 319.alb | 1 | 1 | Solution | 120.18 | 23 | 23.00 | 0.00 |
| instance n=100 32.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 320.alb | 1 | 1 | Solution | 120.12 | 22 | 22.00 | 0.00 |
| instance n=100 321.alb | 1 | 1 | Solution | 120.13 | 26 | 26.00 | 0.00 |
| instance n=100 322.alb | 1 | 1 | Solution | 120.10 | 24 | 23.00 | 4.17 |
| instance n=100 323.alb | 1 | 1 | Solution | 120.15 | 24 | 24.00 | 0.00 |
| instance n=100 324.alb | 1 | 1 | Solution | 120.08 | 23 | 23.00 | 0.00 |
| instance n=100 325.alb | 1 | 1 | Solution | 120.08 | 26 | 25.00 | 3.85 |
| instance n=100 326.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=100 327.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 328.alb | 1 | 1 | Solution | 120.09 | 15 | 14.00 | 6.67 |
| instance n=100 329.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 33.alb | 1 | 1 | Solution | 120.08 | 15 | 15.00 | 0.00 |
| instance n=100 330.alb | 1 | 1 | Solution | 120.11 | 15 | 14.00 | 6.67 |
| instance n=100 331.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=100 332.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=100 333.alb | 1 | 1 | Solution | 120.10 | 15 | 15.00 | 0.00 |
| instance n=100 334.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 335.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=100 336.alb | 1 | 1 | Solution | 120.09 | 15 | 15.00 | 0.00 |
| instance n=100 337.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=100 338.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 339.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 34.alb | 1 | 1 | Solution | 120.13 | 15 | 15.00 | 0.00 |
| instance n=100 340.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=100 341.alb | 1 | 1 | Solution | 120.15 | 16 | 16.00 | 0.00 |
| instance n=100 342.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 343.alb | 1 | 1 | Solution | 120.11 | 16 | 16.00 | 0.00 |
| instance n=100 344.alb | 1 | 1 | Solution | 120.15 | 15 | 15.00 | 0.00 |
| instance n=100 345.alb | 1 | 1 | Solution | 120.17 | 14 | 14.00 | 0.00 |
| instance n=100 346.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 347.alb | 1 | 1 | Solution | 120.15 | 14 | 14.00 | 0.00 |
| instance n=100 348.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=100 349.alb | 1 | 1 | Solution | 120.10 | 13 | 13.00 | 0.00 |
| instance n=100 35.alb | 1 | 1 | Solution | 120.10 | 15 | 15.00 | 0.00 |
| instance n=100 350.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 351.alb | 1 | 1 | Solution | 120.10 | 60 | 52.00 | 13.33 |
| instance n=100 352.alb | 1 | 1 | Solution | 120.09 | 65 | 52.00 | 20.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 353.alb | 1 | 1 | Solution | 120.12 | 52 | 49.00 | 5.77 |
| instance n=100 354.alb | 1 | 1 | Solution | 120.08 | 52 | 49.00 | 5.77 |
| instance n=100 355.alb | 1 | 1 | Solution | 120.11 | 56 | 51.00 | 8.93 |
| instance n=100 356.alb | 1 | 1 | Solution | 120.11 | 60 | 53.00 | 11.67 |
| instance n=100 357.alb | 1 | 1 | Solution | 120.10 | 53 | 50.00 | 5.66 |
| instance n=100 358.alb | 1 | 1 | Solution | 120.11 | 53 | 50.00 | 5.66 |
| instance n=100 359.alb | 1 | 1 | Solution | 120.07 | 53 | 50.00 | 5.66 |
| instance n=100 36.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 360.alb | 1 | 1 | Solution | 120.10 | 55 | 51.00 | 7.27 |
| instance n=100 361.alb | 1 | 1 | Solution | 120.11 | 52 | 49.00 | 5.77 |
| instance n=100 362.alb | 1 | 1 | Solution | 120.13 | 58 | 51.00 | 12.07 |
| instance n=100 363.alb | 1 | 1 | Solution | 120.10 | 52 | 50.00 | 3.85 |
| instance n=100 364.alb | 1 | 1 | Solution | 120.09 | 53 | 50.00 | 5.66 |
| instance n=100 365.alb | 1 | 1 | Solution | 120.13 | 54 | 50.00 | 7.41 |
| instance n=100 366.alb | 1 | 1 | Solution | 120.12 | 62 | 53.00 | 14.52 |
| instance n=100 367.alb | 1 | 1 | Solution | 120.12 | 56 | 51.00 | 8.93 |
| instance n=100 368.alb | 1 | 1 | Solution | 120.11 | 60 | 52.00 | 13.33 |
| instance n=100 369.alb | 1 | 1 | Solution | 120.07 | 53 | 49.00 | 7.55 |
| instance n=100 37.alb | 1 | 1 | Solution | 120.13 | 14 | 14.00 | 0.00 |
| instance n=100 370.alb | 1 | 1 | Solution | 120.09 | 58 | 52.00 | 10.34 |
| instance n=100 371.alb | 1 | 1 | Solution | 120.07 | 54 | 50.00 | 7.41 |
| instance n=100 372.alb | 1 | 1 | Solution | 120.12 | 49 | 47.00 | 4.08 |
| instance n=100 373.alb | 1 | 1 | Solution | 120.10 | 52 | 49.00 | 5.77 |
| instance n=100 374.alb | 1 | 1 | Solution | 120.07 | 53 | 50.00 | 5.66 |
| instance n=100 375.alb | 1 | 1 | Solution | 120.11 | 60 | 52.00 | 13.33 |
| instance n=100 376.alb | 1 | 1 | Solution | 120.12 | 23 | 23.00 | 0.00 |
| instance n=100 377.alb | 1 | 1 | Solution | 120.08 | 21 | 20.00 | 4.76 |
| instance n=100 378.alb | 1 | 1 | Solution | 120.06 | 22 | 22.00 | 0.00 |
| instance n=100 379.alb | 1 | 1 | Solution | 120.08 | 23 | 23.00 | 0.00 |
| instance n=100 38.alb | 1 | 1 | Solution | 120.16 | 14 | 14.00 | 0.00 |
| instance n=100 380.alb | 1 | 1 | Solution | 120.09 | 23 | 22.00 | 4.35 |
| instance n=100 381.alb | 1 | 1 | Solution | 120.07 | 24 | 24.00 | 0.00 |
| instance n=100 382.alb | 1 | 1 | Solution | 120.09 | 25 | 25.00 | 0.00 |
| instance n=100 383.alb | 1 | 1 | Solution | 120.07 | 25 | 25.00 | 0.00 |
| instance n=100 384.alb | 1 | 1 | Solution | 120.08 | 25 | 25.00 | 0.00 |
| instance n=100 385.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=100 386.alb | 1 | 1 | Solution | 120.08 | 24 | 23.00 | 4.17 |
| instance n=100 387.alb | 1 | 1 | Solution | 120.07 | 22 | 22.00 | 0.00 |
| instance n=100 388.alb | 1 | 1 | Solution | 120.06 | 26 | 25.00 | 3.85 |
| instance n=100 389.alb | 1 | 1 | Solution | 120.09 | 23 | 23.00 | 0.00 |
| instance n=100 39.alb | 1 | 1 | Solution | 120.16 | 14 | 14.00 | 0.00 |
| instance n=100 390.alb | 1 | 1 | Solution | 120.09 | 23 | 22.00 | 4.35 |
| instance n=100 391.alb | 1 | 1 | Solution | 120.09 | 20 | 20.00 | 0.00 |
| instance n=100 392.alb | 1 | 1 | Solution | 120.07 | 22 | 22.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 393.alb | 1 | 1 | Solution | 120.09 | 23 | 23.00 | 0.00 |
| instance n=100 394.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=100 395.alb | 1 | 1 | Solution | 120.13 | 24 | 24.00 | 0.00 |
| instance n=100 396.alb | 1 | 1 | Solution | 120.08 | 20 | 20.00 | 0.00 |
| instance n=100 397.alb | 1 | 1 | Solution | 120.08 | 26 | 25.00 | 3.85 |
| instance n=100 398.alb | 1 | 1 | Solution | 120.09 | 25 | 24.00 | 4.00 |
| instance n=100 399.alb | 1 | 1 | Solution | 120.11 | 23 | 23.00 | 0.00 |
| instance n=100 4.alb | 1 | 1 | Solution | 120.14 | 24 | 24.00 | 0.00 |
| instance n=100 40.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 400.alb | 1 | 1 | Solution | 120.09 | 24 | 24.00 | 0.00 |
| instance n=100 401.alb | 1 | 1 | Solution | 120.09 | 15 | 15.00 | 0.00 |
| instance n=100 402.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |
| instance n=100 403.alb | 1 | 1 | Solution | 120.07 | 14 | 14.00 | 0.00 |
| instance n=100 404.alb | 1 | 1 | Solution | 120.08 | 15 | 15.00 | 0.00 |
| instance n=100 405.alb | 1 | 1 | Solution | 120.11 | 13 | 13.00 | 0.00 |
| instance n=100 406.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 407.alb | 1 | 1 | Solution | 120.10 | 15 | 15.00 | 0.00 |
| instance n=100 408.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 409.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |
| instance n=100 41.alb | 1 | 1 | Solution | 120.08 | 13 | 13.00 | 0.00 |
| instance n=100 410.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 411.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 412.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 413.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 414.alb | 1 | 1 | Solution | 120.07 | 15 | 14.00 | 6.67 |
| instance n=100 415.alb | 1 | 1 | Solution | 120.08 | 13 | 13.00 | 0.00 |
| instance n=100 416.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 417.alb | 1 | 1 | Solution | 120.08 | 15 | 15.00 | 0.00 |
| instance n=100 418.alb | 1 | 1 | Solution | 120.08 | 16 | 16.00 | 0.00 |
| instance n=100 419.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 42.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 420.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 421.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=100 422.alb | 1 | 1 | Solution | 120.08 | 15 | 15.00 | 0.00 |
| instance n=100 423.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 424.alb | 1 | 1 | Solution | 120.07 | 14 | 14.00 | 0.00 |
| instance n=100 425.alb | 1 | 1 | Solution | 120.08 | 15 | 15.00 | 0.00 |
| instance n=100 426.alb | 1 | 1 | Solution | 120.10 | 63 | 53.00 | 15.87 |
| instance n=100 427.alb | 1 | 1 | Solution | 120.10 | 58 | 50.00 | 13.79 |
| instance n=100 428.alb | 1 | 1 | Solution | 120.06 | 56 | 51.00 | 8.93 |
| instance n=100 429.alb | 1 | 1 | Solution | 120.37 | 59 | 52.00 | 11.86 |
| instance n=100 43.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 430.alb | 1 | 1 | Solution | 120.10 | 57 | 50.00 | 12.28 |
| instance n=100 431.alb | 1 | 1 | Solution | 120.11 | 54 | 50.00 | 7.41 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 432.alb | 1 | 1 | Solution | 120.07 | 57 | 51.00 | 10.53 |
| instance n=100 433.alb | 1 | 1 | Solution | 120.08 | 53 | 49.00 | 7.55 |
| instance n=100 434.alb | 1 | 1 | Solution | 120.07 | 58 | 51.00 | 12.07 |
| instance n=100 435.alb | 1 | 1 | Solution | 120.14 | 57 | 51.00 | 10.53 |
| instance n=100 436.alb | 1 | 1 | Solution | 120.06 | 52 | 49.00 | 5.77 |
| instance n=100 437.alb | 1 | 1 | Solution | 120.09 | 54 | 50.00 | 7.41 |
| instance n=100 438.alb | 1 | 1 | Solution | 120.05 | 57 | 51.00 | 10.53 |
| instance n=100 439.alb | 1 | 1 | Solution | 120.08 | 55 | 51.00 | 7.27 |
| instance n=100 44.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 440.alb | 1 | 1 | Solution | 120.06 | 54 | 49.00 | 9.26 |
| instance n=100 441.alb | 1 | 1 | Solution | 120.08 | 53 | 50.00 | 5.66 |
| instance n=100 442.alb | 1 | 1 | Solution | 120.07 | 54 | 48.00 | 11.11 |
| instance n=100 443.alb | 1 | 1 | Solution | 120.07 | 57 | 50.00 | 12.28 |
| instance n=100 444.alb | 1 | 1 | Solution | 120.08 | 55 | 50.00 | 9.09 |
| instance n=100 445.alb | 1 | 1 | Solution | 120.06 | 57 | 51.00 | 10.53 |
| instance n=100 446.alb | 1 | 1 | Solution | 120.09 | 57 | 52.00 | 8.77 |
| instance n=100 447.alb | 1 | 1 | Solution | 120.09 | 55 | 50.00 | 9.09 |
| instance n=100 448.alb | 1 | 1 | Solution | 120.06 | 57 | 51.00 | 10.53 |
| instance n=100 449.alb | 1 | 1 | Solution | 120.10 | 56 | 50.00 | 10.71 |
| instance n=100 45.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 450.alb | 1 | 1 | Solution | 120.07 | 55 | 51.00 | 7.27 |
| instance n=100 451.alb | 1 | 1 | Solution | 120.06 | 26 | 26.00 | 0.00 |
| instance n=100 452.alb | 1 | 1 | Solution | 120.07 | 22 | 22.00 | 0.00 |
| instance n=100 453.alb | 1 | 1 | Solution | 120.06 | 24 | 24.00 | 0.00 |
| instance n=100 454.alb | 1 | 1 | Optimal | 120.03 | 23 | 23.00 | 0.00 |
| instance n=100 455.alb | 1 | 1 | Optimal | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 456.alb | 1 | 1 | Optimal | 120.03 | 26 | 26.00 | 0.00 |
| instance n=100 457.alb | 1 | 1 | Optimal | 120.02 | 23 | 23.00 | 0.00 |
| instance n=100 458.alb | 1 | 1 | Optimal | 120.02 | 24 | 24.00 | 0.00 |
| instance n=100 459.alb | 1 | 1 | Solution | 120.06 | 23 | 23.00 | 0.00 |
| instance n=100 46.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=100 460.alb | 1 | 1 | Solution | 120.11 | 23 | 23.00 | 0.00 |
| instance n=100 461.alb | 1 | 1 | Solution | 120.09 | 23 | 23.00 | 0.00 |
| instance n=100 462.alb | 1 | 1 | Solution | 120.07 | 23 | 23.00 | 0.00 |
| instance n=100 463.alb | 1 | 1 | Solution | 120.06 | 26 | 26.00 | 0.00 |
| instance n=100 464.alb | 1 | 1 | Solution | 120.08 | 25 | 25.00 | 0.00 |
| instance n=100 465.alb | 1 | 1 | Optimal | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 466.alb | 1 | 1 | Solution | 120.07 | 26 | 26.00 | 0.00 |
| instance n=100 467.alb | 1 | 1 | Solution | 120.05 | 21 | 20.00 | 4.76 |
| instance n=100 468.alb | 1 | 1 | Solution | 120.07 | 25 | 25.00 | 0.00 |
| instance n=100 469.alb | 1 | 1 | Optimal | 120.02 | 22 | 22.00 | 0.00 |
| instance n=100 47.alb | 1 | 1 | Solution | 120.10 | 14 | 14.00 | 0.00 |
| instance n=100 470.alb | 1 | 1 | Solution | 120.09 | 26 | 26.00 | 0.00 |
| instance n=100 471.alb | 1 | 1 | Solution | 120.06 | 26 | 26.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 472.alb | 1 | 1 | Solution | 120.06 | 23 | 23.00 | 0.00 |
| instance n=100 473.alb | 1 | 1 | Solution | 120.06 | 28 | 28.00 | 0.00 |
| instance n=100 474.alb | 1 | 1 | Optimal | 120.03 | 23 | 23.00 | 0.00 |
| instance n=100 475.alb | 1 | 1 | Optimal | 120.03 | 24 | 24.00 | 0.00 |
| instance n=100 476.alb | 1 | 1 | Solution | 120.06 | 14 | 14.00 | 0.00 |
| instance n=100 477.alb | 1 | 1 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 478.alb | 1 | 1 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 479.alb | 1 | 1 | Optimal | 9.55 | 16 | 16.00 | 0.00 |
| instance n=100 48.alb | 1 | 1 | Solution | 120.11 | 15 | 15.00 | 0.00 |
| instance n=100 480.alb | 1 | 1 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 481.alb | 1 | 1 | Solution | 120.07 | 15 | 15.00 | 0.00 |
| instance n=100 482.alb | 1 | 1 | Optimal | 16.47 | 15 | 15.00 | 0.00 |
| instance n=100 483.alb | 1 | 1 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 484.alb | 1 | 1 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 485.alb | 1 | 1 | Optimal | 20.38 | 16 | 16.00 | 0.00 |
| instance n=100 486.alb | 1 | 1 | Optimal | 120.01 | 15 | 15.00 | 0.00 |
| instance n=100 487.alb | 1 | 1 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 488.alb | 1 | 1 | Optimal | 120.03 | 16 | 16.00 | 0.00 |
| instance n=100 489.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=100 49.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 490.alb | 1 | 1 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=100 491.alb | 1 | 1 | Optimal | 120.03 | 16 | 16.00 | 0.00 |
| instance n=100 492.alb | 1 | 1 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=100 493.alb | 1 | 1 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=100 494.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=100 495.alb | 1 | 1 | Optimal | 95.99 | 15 | 15.00 | 0.00 |
| instance n=100 496.alb | 1 | 1 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=100 497.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=100 498.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 499.alb | 1 | 1 | Solution | 120.09 | 14 | 14.00 | 0.00 |
| instance n=100 5.alb | 1 | 1 | Solution | 120.12 | 22 | 22.00 | 0.00 |
| instance n=100 50.alb | 1 | 1 | Solution | 120.07 | 14 | 14.00 | 0.00 |
| instance n=100 500.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=100 501.alb | 1 | 1 | Solution | 120.05 | 63 | 58.00 | 7.94 |
| instance n=100 502.alb | 1 | 1 | Solution | 120.06 | 67 | 56.00 | 16.42 |
| instance n=100 503.alb | 1 | 1 | Solution | 120.06 | 61 | 55.00 | 9.84 |
| instance n=100 504.alb | 1 | 1 | Solution | 120.05 | 60 | 56.00 | 6.67 |
| instance n=100 505.alb | 1 | 1 | Solution | 120.05 | 62 | 53.00 | 14.52 |
| instance n=100 506.alb | 1 | 1 | Solution | 120.04 | 59 | 53.00 | 10.17 |
| instance n=100 507.alb | 1 | 1 | Solution | 120.06 | 59 | 55.00 | 6.78 |
| instance n=100 508.alb | 1 | 1 | Solution | 120.06 | 56 | 55.00 | 1.79 |
| instance n=100 509.alb | 1 | 1 | Solution | 120.08 | 58 | 53.00 | 8.62 |
| instance n=100 51.alb | 1 | 1 | Solution | 120.09 | 51 | 48.00 | 5.88 |
| instance n=100 510.alb | 1 | 1 | Solution | 120.05 | 58 | 55.00 | 5.17 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 511.alb | 1 | 1 | Solution | 120.06 | 60 | 55.00 | 8.33 |
| instance n=100 512.alb | 1 | 1 | Solution | 120.04 | 60 | 55.00 | 8.33 |
| instance n=100 513.alb | 1 | 1 | Solution | 120.05 | 64 | 54.00 | 15.63 |
| instance n=100 514.alb | 1 | 1 | Solution | 120.07 | 58 | 55.00 | 5.17 |
| instance n=100 515.alb | 1 | 1 | Solution | 120.06 | 63 | 55.00 | 12.70 |
| instance n=100 516.alb | 1 | 1 | Solution | 120.05 | 70 | 57.00 | 18.57 |
| instance n=100 517.alb | 1 | 1 | Solution | 120.06 | 62 | 55.00 | 11.29 |
| instance n=100 518.alb | 1 | 1 | Solution | 120.06 | 57 | 53.00 | 7.02 |
| instance n=100 519.alb | 1 | 1 | Solution | 120.04 | 63 | 55.00 | 12.70 |
| instance n=100 52.alb | 1 | 1 | Solution | 120.08 | 53 | 50.00 | 5.66 |
| instance n=100 520.alb | 1 | 1 | Solution | 120.06 | 60 | 56.00 | 6.67 |
| instance n=100 521.alb | 1 | 1 | Solution | 120.06 | 70 | 58.00 | 17.14 |
| instance n=100 522.alb | 1 | 1 | Solution | 120.08 | 60 | 52.00 | 13.33 |
| instance n=100 523.alb | 1 | 1 | Solution | 120.08 | 56 | 52.00 | 7.14 |
| instance n=100 524.alb | 1 | 1 | Solution | 120.08 | 59 | 53.00 | 10.17 |
| instance n=100 525.alb | 1 | 1 | Solution | 120.06 | 62 | 53.00 | 14.52 |
| instance n=100 53.alb | 1 | 1 | Solution | 120.13 | 52 | 50.00 | 3.85 |
| instance n=100 54.alb | 1 | 1 | Solution | 120.07 | 51 | 49.00 | 3.92 |
| instance n=100 55.alb | 1 | 1 | Solution | 120.09 | 54 | 50.00 | 7.41 |
| instance n=100 56.alb | 1 | 1 | Solution | 120.11 | 53 | 50.00 | 5.66 |
| instance n=100 57.alb | 1 | 1 | Solution | 120.06 | 56 | 51.00 | 8.93 |
| instance n=100 58.alb | 1 | 1 | Solution | 120.09 | 58 | 52.00 | 10.34 |
| instance n=100 59.alb | 1 | 1 | Solution | 120.07 | 59 | 51.00 | 13.56 |
| instance n=100 6.alb | 1 | 1 | Solution | 120.08 | 22 | 22.00 | 0.00 |
| instance n=100 60.alb | 1 | 1 | Solution | 120.11 | 54 | 51.00 | 5.56 |
| instance n=100 61.alb | 1 | 1 | Solution | 120.07 | 56 | 51.00 | 8.93 |
| instance n=100 62.alb | 1 | 1 | Solution | 120.09 | 52 | 49.00 | 5.77 |
| instance n=100 63.alb | 1 | 1 | Solution | 120.07 | 62 | 52.00 | 16.13 |
| instance n=100 64.alb | 1 | 1 | Solution | 120.08 | 57 | 51.00 | 10.53 |
| instance n=100 65.alb | 1 | 1 | Solution | 120.07 | 62 | 53.00 | 14.52 |
| instance n=100 66.alb | 1 | 1 | Solution | 120.08 | 51 | 49.00 | 3.92 |
| instance n=100 67.alb | 1 | 1 | Solution | 120.09 | 56 | 51.00 | 8.93 |
| instance n=100 68.alb | 1 | 1 | Solution | 120.07 | 57 | 49.00 | 14.04 |
| instance n=100 69.alb | 1 | 1 | Solution | 120.07 | 54 | 51.00 | 5.56 |
| instance n=100 7.alb | 1 | 1 | Solution | 120.10 | 26 | 26.00 | 0.00 |
| instance n=100 70.alb | 1 | 1 | Solution | 120.07 | 56 | 50.00 | 10.71 |
| instance n=100 71.alb | 1 | 1 | Solution | 120.08 | 54 | 50.00 | 7.41 |
| instance n=100 72.alb | 1 | 1 | Solution | 120.08 | 55 | 50.00 | 9.09 |
| instance n=100 73.alb | 1 | 1 | Solution | 120.09 | 58 | 52.00 | 10.34 |
| instance n=100 74.alb | 1 | 1 | Solution | 120.08 | 52 | 49.00 | 5.77 |
| instance n=100 75.alb | 1 | 1 | Solution | 120.09 | 55 | 51.00 | 7.27 |
| instance n=100 76.alb | 1 | 1 | Solution | 120.09 | 23 | 23.00 | 0.00 |
| instance n=100 77.alb | 1 | 1 | Solution | 120.08 | 20 | 20.00 | 0.00 |
| instance n=100 78.alb | 1 | 1 | Solution | 120.09 | 22 | 21.00 | 4.55 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=100 79.alb | 1 | 1 | Solution | 120.07 | 21 | 21.00 | 0.00 |
| instance n=100 8.alb | 1 | 1 | Solution | 120.10 | 24 | 24.00 | 0.00 |
| instance n=100 80.alb | 1 | 1 | Solution | 120.08 | 23 | 22.00 | 4.35 |
| instance n=100 81.alb | 1 | 1 | Solution | 120.11 | 20 | 20.00 | 0.00 |
| instance n=100 82.alb | 1 | 1 | Solution | 120.08 | 21 | 21.00 | 0.00 |
| instance n=100 83.alb | 1 | 1 | Solution | 120.08 | 22 | 22.00 | 0.00 |
| instance n=100 84.alb | 1 | 1 | Solution | 120.09 | 27 | 26.00 | 3.70 |
| instance n=100 85.alb | 1 | 1 | Solution | 120.11 | 25 | 24.00 | 4.00 |
| instance n=100 86.alb | 1 | 1 | Solution | 120.11 | 23 | 23.00 | 0.00 |
| instance n=100 87.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=100 88.alb | 1 | 1 | Solution | 120.07 | 24 | 23.00 | 4.17 |
| instance n=100 89.alb | 1 | 1 | Solution | 120.08 | 24 | 24.00 | 0.00 |
| instance n=100 9.alb | 1 | 1 | Solution | 120.12 | 23 | 23.00 | 0.00 |
| instance n=100 90.alb | 1 | 1 | Solution | 120.09 | 21 | 20.00 | 4.76 |
| instance n=100 91.alb | 1 | 1 | Solution | 120.09 | 25 | 25.00 | 0.00 |
| instance n=100 92.alb | 1 | 1 | Solution | 120.07 | 24 | 24.00 | 0.00 |
| instance n=100 93.alb | 1 | 1 | Solution | 120.08 | 27 | 27.00 | 0.00 |
| instance n=100 94.alb | 1 | 1 | Solution | 120.07 | 23 | 22.00 | 4.35 |
| instance n=100 95.alb | 1 | 1 | Solution | 120.07 | 21 | 21.00 | 0.00 |
| instance n=100 96.alb | 1 | 1 | Solution | 120.09 | 21 | 21.00 | 0.00 |
| instance n=100 97.alb | 1 | 1 | Solution | 120.08 | 22 | 22.00 | 0.00 |
| instance n=100 98.alb | 1 | 1 | Solution | 120.08 | 22 | 22.00 | 0.00 |
| instance n=100 99.alb | 1 | 1 | Solution | 120.09 | 22 | 22.00 | 0.00 |
| instance n=20 1.alb | 1 | 1 | Optimal | 1.91 | 3 | 3.00 | 0.00 |
| instance n=20 10.alb | 1 | 1 | Optimal | 0.14 | 3 | 3.00 | 0.00 |
| instance n=20 100.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 101.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 102.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 103.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 104.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 105.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 106.alb | 1 | 1 | Optimal | 120.01 | 10 | 10.00 | 0.00 |
| instance n=20 107.alb | 1 | 1 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=20 108.alb | 1 | 1 | Optimal | 120.03 | 15 | 15.00 | 0.00 |
| instance n=20 109.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 11.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 110.alb | 1 | 1 | Optimal | 6.18 | 11 | 11.00 | 0.00 |
| instance n=20 111.alb | 1 | 1 | Optimal | 120.05 | 13 | 13.00 | 0.00 |
| instance n=20 112.alb | 1 | 1 | Optimal | 120.03 | 11 | 11.00 | 0.00 |
| instance n=20 113.alb | 1 | 1 | Optimal | 120.03 | 12 | 12.00 | 0.00 |
| instance n=20 114.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 115.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 116.alb | 1 | 1 | Optimal | 0.26 | 5 | 5.00 | 0.00 |
| instance n=20 117.alb | 1 | 1 | Optimal | 0.23 | 5 | 5.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 118.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 119.alb | 1 | 1 | Optimal | 0.55 | 6 | 6.00 | 0.00 |
| instance n=20 12.alb | 1 | 1 | Optimal | 31.96 | 3 | 3.00 | 0.00 |
| instance n=20 120.alb | 1 | 1 | Optimal | 0.69 | 6 | 6.00 | 0.00 |
| instance n=20 121.alb | 1 | 1 | Optimal | 2.07 | 5 | 5.00 | 0.00 |
| instance n=20 122.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=20 123.alb | 1 | 1 | Optimal | 0.95 | 5 | 5.00 | 0.00 |
| instance n=20 124.alb | 1 | 1 | Optimal | 0.30 | 5 | 5.00 | 0.00 |
| instance n=20 125.alb | 1 | 1 | Optimal | 0.12 | 5 | 5.00 | 0.00 |
| instance n=20 126.alb | 1 | 1 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 127.alb | 1 | 1 | Optimal | 120.02 | 4 | 4.00 | 0.00 |
| instance n=20 128.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 129.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 13.alb | 1 | 1 | Optimal | 1.41 | 3 | 3.00 | 0.00 |
| instance n=20 130.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=20 131.alb | 1 | 1 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=20 132.alb | 1 | 1 | Optimal | 120.01 | 4 | 4.00 | 0.00 |
| instance n=20 133.alb | 1 | 1 | Optimal | 1.59 | 5 | 5.00 | 0.00 |
| instance n=20 134.alb | 1 | 1 | Optimal | 4.47 | 6 | 6.00 | 0.00 |
| instance n=20 135.alb | 1 | 1 | Optimal | 0.08 | 6 | 6.00 | 0.00 |
| instance n=20 136.alb | 1 | 1 | Optimal | 0.21 | 6 | 6.00 | 0.00 |
| instance n=20 137.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 138.alb | 1 | 1 | Optimal | 0.51 | 5 | 5.00 | 0.00 |
| instance n=20 139.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 14.alb | 1 | 1 | Optimal | 120.02 | 3 | 3.00 | 0.00 |
| instance n=20 140.alb | 1 | 1 | Optimal | 20.51 | 5 | 5.00 | 0.00 |
| instance n=20 141.alb | 1 | 1 | Optimal | 0.93 | 3 | 3.00 | 0.00 |
| instance n=20 142.alb | 1 | 1 | Optimal | 120.02 | 3 | 3.00 | 0.00 |
| instance n=20 143.alb | 1 | 1 | Optimal | 0.21 | 3 | 3.00 | 0.00 |
| instance n=20 144.alb | 1 | 1 | Optimal | 1.51 | 4 | 4.00 | 0.00 |
| instance n=20 145.alb | 1 | 1 | Optimal | 3.05 | 3 | 3.00 | 0.00 |
| instance n=20 146.alb | 1 | 1 | Optimal | 3.81 | 3 | 3.00 | 0.00 |
| instance n=20 147.alb | 1 | 1 | Optimal | 119.68 | 3 | 3.00 | 0.00 |
| instance n=20 148.alb | 1 | 1 | Optimal | 2.40 | 3 | 3.00 | 0.00 |
| instance n=20 149.alb | 1 | 1 | Optimal | 2.23 | 3 | 3.00 | 0.00 |
| instance n=20 15.alb | 1 | 1 | Optimal | 0.06 | 3 | 3.00 | 0.00 |
| instance n=20 150.alb | 1 | 1 | Optimal | 120.02 | 3 | 3.00 | 0.00 |
| instance n=20 151.alb | 1 | 1 | Optimal | 1.91 | 3 | 3.00 | 0.00 |
| instance n=20 152.alb | 1 | 1 | Optimal | 0.23 | 3 | 3.00 | 0.00 |
| instance n=20 153.alb | 1 | 1 | Optimal | 27.90 | 3 | 3.00 | 0.00 |
| instance n=20 154.alb | 1 | 1 | Optimal | 0.28 | 3 | 3.00 | 0.00 |
| instance n=20 155.alb | 1 | 1 | Optimal | 1.32 | 3 | 3.00 | 0.00 |
| instance n=20 156.alb | 1 | 1 | Optimal | 0.47 | 3 | 3.00 | 0.00 |
| instance n=20 157.alb | 1 | 1 | Optimal | 0.51 | 3 | 3.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 158.alb | 1 | 1 | Optimal | 0.29 | 3 | 3.00 | 0.00 |
| instance n=20 159.alb | 1 | 1 | Optimal | 120.02 | 3 | 3.00 | 0.00 |
| instance n=20 16.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 160.alb | 1 | 1 | Optimal | 5.39 | 3 | 3.00 | 0.00 |
| instance n=20 161.alb | 1 | 1 | Optimal | 34.01 | 3 | 3.00 | 0.00 |
| instance n=20 162.alb | 1 | 1 | Optimal | 4.68 | 3 | 3.00 | 0.00 |
| instance n=20 163.alb | 1 | 1 | Optimal | 0.26 | 3 | 3.00 | 0.00 |
| instance n=20 164.alb | 1 | 1 | Optimal | 120.02 | 4 | 4.00 | 0.00 |
| instance n=20 165.alb | 1 | 1 | Optimal | 0.91 | 3 | 3.00 | 0.00 |
| instance n=20 166.alb | 1 | 1 | Optimal | 120.04 | 12 | 12.00 | 0.00 |
| instance n=20 167.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 168.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=20 169.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 17.alb | 1 | 1 | Optimal | 120.01 | 10 | 10.00 | 0.00 |
| instance n=20 170.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 171.alb | 1 | 1 | Solution | 120.12 | 13 | 12.00 | 7.69 |
| instance n=20 172.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 173.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 174.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 175.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=20 176.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 177.alb | 1 | 1 | Optimal | 120.04 | 10 | 10.00 | 0.00 |
| instance n=20 178.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 179.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 18.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 180.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=20 181.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 182.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 183.alb | 1 | 1 | Optimal | 120.05 | 13 | 13.00 | 0.00 |
| instance n=20 184.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 185.alb | 1 | 1 | Optimal | 120.02 | 15 | 15.00 | 0.00 |
| instance n=20 186.alb | 1 | 1 | Optimal | 120.05 | 14 | 14.00 | 0.00 |
| instance n=20 187.alb | 1 | 1 | Optimal | 120.01 | 10 | 10.00 | 0.00 |
| instance n=20 188.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 189.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 19.alb | 1 | 1 | Optimal | 120.03 | 14 | 14.00 | 0.00 |
| instance n=20 190.alb | 1 | 1 | Optimal | 120.04 | 15 | 15.00 | 0.00 |
| instance n=20 191.alb | 1 | 1 | Optimal | 1.39 | 4 | 4.00 | 0.00 |
| instance n=20 192.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 193.alb | 1 | 1 | Optimal | 1.62 | 5 | 5.00 | 0.00 |
| instance n=20 194.alb | 1 | 1 | Optimal | 0.41 | 6 | 6.00 | 0.00 |
| instance n=20 195.alb | 1 | 1 | Optimal | 1.54 | 6 | 6.00 | 0.00 |
| instance n=20 196.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 197.alb | 1 | 1 | Optimal | 9.39 | 4 | 4.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 198.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=20 199.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 2.alb | 1 | 1 | Optimal | 120.01 | 3 | 3.00 | 0.00 |
| instance n=20 20.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 200.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=20 201.alb | 1 | 1 | Optimal | 32.68 | 6 | 6.00 | 0.00 |
| instance n=20 202.alb | 1 | 1 | Optimal | 0.91 | 4 | 4.00 | 0.00 |
| instance n=20 203.alb | 1 | 1 | Optimal | 19.45 | 4 | 4.00 | 0.00 |
| instance n=20 204.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 205.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=20 206.alb | 1 | 1 | Optimal | 1.92 | 5 | 5.00 | 0.00 |
| instance n=20 207.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=20 208.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 209.alb | 1 | 1 | Optimal | 1.41 | 4 | 4.00 | 0.00 |
| instance n=20 21.alb | 1 | 1 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=20 210.alb | 1 | 1 | Optimal | 10.45 | 5 | 5.00 | 0.00 |
| instance n=20 211.alb | 1 | 1 | Optimal | 120.03 | 5 | 5.00 | 0.00 |
| instance n=20 212.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 213.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 214.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 215.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 216.alb | 1 | 1 | Optimal | 120.01 | 3 | 3.00 | 0.00 |
| instance n=20 217.alb | 1 | 1 | Optimal | 0.18 | 4 | 4.00 | 0.00 |
| instance n=20 218.alb | 1 | 1 | Optimal | 58.37 | 3 | 3.00 | 0.00 |
| instance n=20 219.alb | 1 | 1 | Optimal | 2.33 | 3 | 3.00 | 0.00 |
| instance n=20 22.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 220.alb | 1 | 1 | Optimal | 25.92 | 3 | 3.00 | 0.00 |
| instance n=20 221.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 222.alb | 1 | 1 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 223.alb | 1 | 1 | Optimal | 1.38 | 3 | 3.00 | 0.00 |
| instance n=20 224.alb | 1 | 1 | Optimal | 0.20 | 3 | 3.00 | 0.00 |
| instance n=20 225.alb | 1 | 1 | Optimal | 10.97 | 3 | 3.00 | 0.00 |
| instance n=20 226.alb | 1 | 1 | Optimal | 0.39 | 3 | 3.00 | 0.00 |
| instance n=20 227.alb | 1 | 1 | Optimal | 1.15 | 3 | 3.00 | 0.00 |
| instance n=20 228.alb | 1 | 1 | Optimal | 0.09 | 2 | 2.00 | 0.00 |
| instance n=20 229.alb | 1 | 1 | Optimal | 3.47 | 3 | 3.00 | 0.00 |
| instance n=20 23.alb | 1 | 1 | Solution | 120.11 | 13 | 12.00 | 7.69 |
| instance n=20 230.alb | 1 | 1 | Optimal | 1.14 | 3 | 3.00 | 0.00 |
| instance n=20 231.alb | 1 | 1 | Optimal | 6.88 | 3 | 3.00 | 0.00 |
| instance n=20 232.alb | 1 | 1 | Optimal | 0.33 | 3 | 3.00 | 0.00 |
| instance n=20 233.alb | 1 | 1 | Optimal | 0.94 | 3 | 3.00 | 0.00 |
| instance n=20 234.alb | 1 | 1 | Optimal | 0.35 | 3 | 3.00 | 0.00 |
| instance n=20 235.alb | 1 | 1 | Optimal | 7.22 | 3 | 3.00 | 0.00 |
| instance n=20 236.alb | 1 | 1 | Optimal | 4.35 | 3 | 3.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 237.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 238.alb | 1 | 1 | Optimal | 3.88 | 3 | 3.00 | 0.00 |
| instance n=20 239.alb | 1 | 1 | Optimal | 3.78 | 3 | 3.00 | 0.00 |
| instance n=20 24.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 240.alb | 1 | 1 | Optimal | 44.42 | 3 | 3.00 | 0.00 |
| instance n=20 241.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 242.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 243.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=20 244.alb | 1 | 1 | Optimal | 7.29 | 11 | 11.00 | 0.00 |
| instance n=20 245.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 246.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 247.alb | 1 | 1 | Optimal | 9.46 | 11 | 11.00 | 0.00 |
| instance n=20 248.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 249.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 25.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 250.alb | 1 | 1 | Optimal | 78.33 | 10 | 10.00 | 0.00 |
| instance n=20 251.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 252.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 253.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 254.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 255.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 256.alb | 1 | 1 | Optimal | 46.94 | 14 | 14.00 | 0.00 |
| instance n=20 257.alb | 1 | 1 | Optimal | 120.01 | 10 | 10.00 | 0.00 |
| instance n=20 258.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 259.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 26.alb | 1 | 1 | Optimal | 120.03 | 12 | 12.00 | 0.00 |
| instance n=20 260.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 261.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 262.alb | 1 | 1 | Optimal | 120.03 | 11 | 11.00 | 0.00 |
| instance n=20 263.alb | 1 | 1 | Optimal | 120.00 | 12 | 12.00 | 0.00 |
| instance n=20 264.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 265.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 266.alb | 1 | 1 | Optimal | 0.10 | 5 | 5.00 | 0.00 |
| instance n=20 267.alb | 1 | 1 | Optimal | 120.04 | 6 | 6.00 | 0.00 |
| instance n=20 268.alb | 1 | 1 | Optimal | 4.58 | 6 | 6.00 | 0.00 |
| instance n=20 269.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=20 27.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 270.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=20 271.alb | 1 | 1 | Optimal | 0.08 | 6 | 6.00 | 0.00 |
| instance n=20 272.alb | 1 | 1 | Optimal | 0.12 | 5 | 5.00 | 0.00 |
| instance n=20 273.alb | 1 | 1 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 274.alb | 1 | 1 | Optimal | 31.07 | 6 | 6.00 | 0.00 |
| instance n=20 275.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 276.alb | 1 | 1 | Optimal | 21.01 | 4 | 4.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 277.alb | 1 | 1 | Optimal | 4.06 | 4 | 4.00 | 0.00 |
| instance n=20 278.alb | 1 | 1 | Optimal | 0.12 | 6 | 6.00 | 0.00 |
| instance n=20 279.alb | 1 | 1 | Optimal | 0.12 | 6 | 6.00 | 0.00 |
| instance n=20 28.alb | 1 | 1 | Optimal | 120.05 | 12 | 12.00 | 0.00 |
| instance n=20 280.alb | 1 | 1 | Optimal | 0.13 | 5 | 5.00 | 0.00 |
| instance n=20 281.alb | 1 | 1 | Optimal | 0.36 | 4 | 4.00 | 0.00 |
| instance n=20 282.alb | 1 | 1 | Optimal | 0.22 | 4 | 4.00 | 0.00 |
| instance n=20 283.alb | 1 | 1 | Optimal | 32.89 | 5 | 5.00 | 0.00 |
| instance n=20 284.alb | 1 | 1 | Optimal | 120.03 | 5 | 5.00 | 0.00 |
| instance n=20 285.alb | 1 | 1 | Optimal | 0.15 | 5 | 5.00 | 0.00 |
| instance n=20 286.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 287.alb | 1 | 1 | Optimal | 1.63 | 5 | 5.00 | 0.00 |
| instance n=20 288.alb | 1 | 1 | Optimal | 25.70 | 6 | 6.00 | 0.00 |
| instance n=20 289.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 29.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=20 290.alb | 1 | 1 | Optimal | 4.78 | 5 | 5.00 | 0.00 |
| instance n=20 291.alb | 1 | 1 | Optimal | 3.56 | 3 | 3.00 | 0.00 |
| instance n=20 292.alb | 1 | 1 | Optimal | 1.10 | 3 | 3.00 | 0.00 |
| instance n=20 293.alb | 1 | 1 | Optimal | 0.56 | 3 | 3.00 | 0.00 |
| instance n=20 294.alb | 1 | 1 | Optimal | 0.07 | 3 | 3.00 | 0.00 |
| instance n=20 295.alb | 1 | 1 | Optimal | 56.19 | 3 | 3.00 | 0.00 |
| instance n=20 296.alb | 1 | 1 | Optimal | 2.41 | 3 | 3.00 | 0.00 |
| instance n=20 297.alb | 1 | 1 | Optimal | 0.96 | 3 | 3.00 | 0.00 |
| instance n=20 298.alb | 1 | 1 | Optimal | 0.24 | 3 | 3.00 | 0.00 |
| instance n=20 299.alb | 1 | 1 | Optimal | 8.47 | 3 | 3.00 | 0.00 |
| instance n=20 3.alb | 1 | 1 | Optimal | 0.67 | 3 | 3.00 | 0.00 |
| instance n=20 30.alb | 1 | 1 | Optimal | 120.04 | 16 | 16.00 | 0.00 |
| instance n=20 300.alb | 1 | 1 | Optimal | 120.02 | 4 | 4.00 | 0.00 |
| instance n=20 301.alb | 1 | 1 | Optimal | 0.38 | 3 | 3.00 | 0.00 |
| instance n=20 302.alb | 1 | 1 | Optimal | 0.84 | 3 | 3.00 | 0.00 |
| instance n=20 303.alb | 1 | 1 | Optimal | 0.34 | 3 | 3.00 | 0.00 |
| instance n=20 304.alb | 1 | 1 | Optimal | 0.71 | 3 | 3.00 | 0.00 |
| instance n=20 305.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 306.alb | 1 | 1 | Optimal | 22.24 | 3 | 3.00 | 0.00 |
| instance n=20 307.alb | 1 | 1 | Optimal | 0.13 | 3 | 3.00 | 0.00 |
| instance n=20 308.alb | 1 | 1 | Optimal | 0.24 | 3 | 3.00 | 0.00 |
| instance n=20 309.alb | 1 | 1 | Optimal | 120.01 | 3 | 3.00 | 0.00 |
| instance n=20 31.alb | 1 | 1 | Optimal | 120.03 | 12 | 12.00 | 0.00 |
| instance n=20 310.alb | 1 | 1 | Optimal | 0.37 | 3 | 3.00 | 0.00 |
| instance n=20 311.alb | 1 | 1 | Optimal | 0.15 | 3 | 3.00 | 0.00 |
| instance n=20 312.alb | 1 | 1 | Optimal | 120.01 | 4 | 4.00 | 0.00 |
| instance n=20 313.alb | 1 | 1 | Optimal | 110.04 | 3 | 3.00 | 0.00 |
| instance n=20 314.alb | 1 | 1 | Optimal | 1.22 | 3 | 3.00 | 0.00 |
| instance n=20 315.alb | 1 | 1 | Optimal | 4.14 | 3 | 3.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 316.alb | 1 | 1 | Solution | 120.09 | 10 | 10.00 | 0.00 |
| instance n=20 317.alb | 1 | 1 | Optimal | 120.01 | 10 | 10.00 | 0.00 |
| instance n=20 318.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=20 319.alb | 1 | 1 | Optimal | 120.04 | 14 | 14.00 | 0.00 |
| instance n=20 32.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 320.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 321.alb | 1 | 1 | Solution | 120.14 | 14 | 12.00 | 14.29 |
| instance n=20 322.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 323.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=20 324.alb | 1 | 1 | Optimal | 120.02 | 9 | 9.00 | 0.00 |
| instance n=20 325.alb | 1 | 1 | Optimal | 120.04 | 14 | 14.00 | 0.00 |
| instance n=20 326.alb | 1 | 1 | Optimal | 120.05 | 14 | 14.00 | 0.00 |
| instance n=20 327.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=20 328.alb | 1 | 1 | Optimal | 120.06 | 13 | 13.00 | 0.00 |
| instance n=20 329.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=20 33.alb | 1 | 1 | Optimal | 120.03 | 11 | 11.00 | 0.00 |
| instance n=20 330.alb | 1 | 1 | Solution | 120.07 | 12 | 11.00 | 8.33 |
| instance n=20 331.alb | 1 | 1 | Solution | 120.13 | 13 | 12.00 | 7.69 |
| instance n=20 332.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=20 333.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 334.alb | 1 | 1 | Optimal | 120.03 | 10 | 10.00 | 0.00 |
| instance n=20 335.alb | 1 | 1 | Solution | 120.14 | 14 | 11.00 | 21.43 |
| instance n=20 336.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 337.alb | 1 | 1 | Optimal | 120.01 | 10 | 10.00 | 0.00 |
| instance n=20 338.alb | 1 | 1 | Optimal | 120.05 | 14 | 14.00 | 0.00 |
| instance n=20 339.alb | 1 | 1 | Optimal | 120.04 | 13 | 13.00 | 0.00 |
| instance n=20 34.alb | 1 | 1 | Optimal | 120.05 | 12 | 12.00 | 0.00 |
| instance n=20 340.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 341.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=20 342.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=20 343.alb | 1 | 1 | Optimal | 8.30 | 6 | 6.00 | 0.00 |
| instance n=20 344.alb | 1 | 1 | Optimal | 120.04 | 6 | 6.00 | 0.00 |
| instance n=20 345.alb | 1 | 1 | Optimal | 120.02 | 4 | 4.00 | 0.00 |
| instance n=20 346.alb | 1 | 1 | Optimal | 5.47 | 5 | 5.00 | 0.00 |
| instance n=20 347.alb | 1 | 1 | Optimal | 120.03 | 6 | 6.00 | 0.00 |
| instance n=20 348.alb | 1 | 1 | Optimal | 7.83 | 5 | 5.00 | 0.00 |
| instance n=20 349.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 35.alb | 1 | 1 | Optimal | 120.03 | 12 | 12.00 | 0.00 |
| instance n=20 350.alb | 1 | 1 | Optimal | 5.09 | 5 | 5.00 | 0.00 |
| instance n=20 351.alb | 1 | 1 | Optimal | 94.07 | 5 | 5.00 | 0.00 |
| instance n=20 352.alb | 1 | 1 | Optimal | 4.16 | 4 | 4.00 | 0.00 |
| instance n=20 353.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=20 354.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=20 355.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 356.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 357.alb | 1 | 1 | Optimal | 120.03 | 5 | 5.00 | 0.00 |
| instance n=20 358.alb | 1 | 1 | Optimal | 32.87 | 4 | 4.00 | 0.00 |
| instance n=20 359.alb | 1 | 1 | Optimal | 12.26 | 4 | 4.00 | 0.00 |
| instance n=20 36.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=20 360.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=20 361.alb | 1 | 1 | Optimal | 120.03 | 5 | 5.00 | 0.00 |
| instance n=20 362.alb | 1 | 1 | Optimal | 92.36 | 5 | 5.00 | 0.00 |
| instance n=20 363.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=20 364.alb | 1 | 1 | Optimal | 120.02 | 4 | 4.00 | 0.00 |
| instance n=20 365.alb | 1 | 1 | Optimal | 9.54 | 5 | 5.00 | 0.00 |
| instance n=20 366.alb | 1 | 1 | Optimal | 4.12 | 3 | 3.00 | 0.00 |
| instance n=20 367.alb | 1 | 1 | Optimal | 17.02 | 3 | 3.00 | 0.00 |
| instance n=20 368.alb | 1 | 1 | Optimal | 5.91 | 3 | 3.00 | 0.00 |
| instance n=20 369.alb | 1 | 1 | Optimal | 40.49 | 3 | 3.00 | 0.00 |
| instance n=20 37.alb | 1 | 1 | Optimal | 71.02 | 12 | 12.00 | 0.00 |
| instance n=20 370.alb | 1 | 1 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 371.alb | 1 | 1 | Optimal | 17.31 | 3 | 3.00 | 0.00 |
| instance n=20 372.alb | 1 | 1 | Optimal | 0.42 | 3 | 3.00 | 0.00 |
| instance n=20 373.alb | 1 | 1 | Optimal | 0.18 | 3 | 3.00 | 0.00 |
| instance n=20 374.alb | 1 | 1 | Optimal | 0.83 | 3 | 3.00 | 0.00 |
| instance n=20 375.alb | 1 | 1 | Optimal | 0.31 | 3 | 3.00 | 0.00 |
| instance n=20 376.alb | 1 | 1 | Optimal | 57.11 | 3 | 3.00 | 0.00 |
| instance n=20 377.alb | 1 | 1 | Optimal | 0.32 | 3 | 3.00 | 0.00 |
| instance n=20 378.alb | 1 | 1 | Optimal | 0.08 | 3 | 3.00 | 0.00 |
| instance n=20 379.alb | 1 | 1 | Optimal | 94.05 | 4 | 4.00 | 0.00 |
| instance n=20 38.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 380.alb | 1 | 1 | Optimal | 4.89 | 3 | 3.00 | 0.00 |
| instance n=20 381.alb | 1 | 1 | Optimal | 42.10 | 3 | 3.00 | 0.00 |
| instance n=20 382.alb | 1 | 1 | Optimal | 2.97 | 4 | 4.00 | 0.00 |
| instance n=20 383.alb | 1 | 1 | Optimal | 115.52 | 3 | 3.00 | 0.00 |
| instance n=20 384.alb | 1 | 1 | Optimal | 13.87 | 3 | 3.00 | 0.00 |
| instance n=20 385.alb | 1 | 1 | Optimal | 120.01 | 3 | 3.00 | 0.00 |
| instance n=20 386.alb | 1 | 1 | Optimal | 28.24 | 3 | 3.00 | 0.00 |
| instance n=20 387.alb | 1 | 1 | Optimal | 36.80 | 3 | 3.00 | 0.00 |
| instance n=20 388.alb | 1 | 1 | Optimal | 5.49 | 3 | 3.00 | 0.00 |
| instance n=20 389.alb | 1 | 1 | Optimal | 7.08 | 3 | 3.00 | 0.00 |
| instance n=20 39.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 390.alb | 1 | 1 | Optimal | 36.25 | 3 | 3.00 | 0.00 |
| instance n=20 391.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 392.alb | 1 | 1 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=20 393.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 394.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 395.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 396.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 397.alb | 1 | 1 | Optimal | 25.52 | 10 | 10.00 | 0.00 |
| instance n=20 398.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 399.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 4.alb | 1 | 1 | Optimal | 0.43 | 3 | 3.00 | 0.00 |
| instance n=20 40.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 400.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 401.alb | 1 | 1 | Optimal | 117.19 | 12 | 12.00 | 0.00 |
| instance n=20 402.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 403.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 404.alb | 1 | 1 | Optimal | 120.03 | 10 | 10.00 | 0.00 |
| instance n=20 405.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 406.alb | 1 | 1 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=20 407.alb | 1 | 1 | Optimal | 38.11 | 10 | 10.00 | 0.00 |
| instance n=20 408.alb | 1 | 1 | Optimal | 120.05 | 14 | 14.00 | 0.00 |
| instance n=20 409.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 41.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=20 410.alb | 1 | 1 | Optimal | 9.99 | 11 | 11.00 | 0.00 |
| instance n=20 411.alb | 1 | 1 | Optimal | 120.01 | 15 | 15.00 | 0.00 |
| instance n=20 412.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 413.alb | 1 | 1 | Optimal | 120.01 | 10 | 10.00 | 0.00 |
| instance n=20 414.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=20 415.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=20 416.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=20 417.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 418.alb | 1 | 1 | Optimal | 0.25 | 6 | 6.00 | 0.00 |
| instance n=20 419.alb | 1 | 1 | Optimal | 120.02 | 4 | 4.00 | 0.00 |
| instance n=20 42.alb | 1 | 1 | Optimal | 1.10 | 5 | 5.00 | 0.00 |
| instance n=20 420.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 421.alb | 1 | 1 | Optimal | 40.27 | 6 | 6.00 | 0.00 |
| instance n=20 422.alb | 1 | 1 | Optimal | 77.13 | 4 | 4.00 | 0.00 |
| instance n=20 423.alb | 1 | 1 | Optimal | 69.45 | 6 | 6.00 | 0.00 |
| instance n=20 424.alb | 1 | 1 | Optimal | 13.22 | 5 | 5.00 | 0.00 |
| instance n=20 425.alb | 1 | 1 | Optimal | 58.65 | 6 | 6.00 | 0.00 |
| instance n=20 426.alb | 1 | 1 | Optimal | 0.78 | 5 | 5.00 | 0.00 |
| instance n=20 427.alb | 1 | 1 | Optimal | 6.14 | 6 | 6.00 | 0.00 |
| instance n=20 428.alb | 1 | 1 | Optimal | 0.12 | 5 | 5.00 | 0.00 |
| instance n=20 429.alb | 1 | 1 | Optimal | 3.32 | 4 | 4.00 | 0.00 |
| instance n=20 43.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 430.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 431.alb | 1 | 1 | Optimal | 0.21 | 6 | 6.00 | 0.00 |
| instance n=20 432.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 433.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 434.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 435.alb | 1 | 1 | Optimal | 0.43 | 7 | 7.00 | 0.00 |
| instance n=20 436.alb | 1 | 1 | Optimal | 1.18 | 5 | 5.00 | 0.00 |
| instance n=20 437.alb | 1 | 1 | Optimal | 0.45 | 5 | 5.00 | 0.00 |
| instance n=20 438.alb | 1 | 1 | Optimal | 120.00 | 6 | 6.00 | 0.00 |
| instance n=20 439.alb | 1 | 1 | Optimal | 23.79 | 5 | 5.00 | 0.00 |
| instance n=20 44.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 440.alb | 1 | 1 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 441.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 442.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 443.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 444.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 445.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 446.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 447.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 448.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 449.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 45.alb | 1 | 1 | Optimal | 2.06 | 6 | 6.00 | 0.00 |
| instance n=20 450.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 451.alb | 1 | 1 | Optimal | 0.44 | 3 | 3.00 | 0.00 |
| instance n=20 452.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 453.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 454.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 455.alb | 1 | 1 | Optimal | 0.10 | 3 | 3.00 | 0.00 |
| instance n=20 456.alb | 1 | 1 | Optimal | 0.10 | 4 | 4.00 | 0.00 |
| instance n=20 457.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 458.alb | 1 | 1 | Optimal | 0.09 | 3 | 3.00 | 0.00 |
| instance n=20 459.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 46.alb | 1 | 1 | Optimal | 15.74 | 4 | 4.00 | 0.00 |
| instance n=20 460.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 461.alb | 1 | 1 | Optimal | 0.13 | 3 | 3.00 | 0.00 |
| instance n=20 462.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 463.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 464.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 465.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 466.alb | 1 | 1 | Optimal | 0.10 | 13 | 13.00 | 0.00 |
| instance n=20 467.alb | 1 | 1 | Optimal | 120.01 | 14 | 14.00 | 0.00 |
| instance n=20 468.alb | 1 | 1 | Optimal | 5.28 | 13 | 13.00 | 0.00 |
| instance n=20 469.alb | 1 | 1 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=20 47.alb | 1 | 1 | Optimal | 120.01 | 4 | 4.00 | 0.00 |
| instance n=20 470.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 471.alb | 1 | 1 | Optimal | 14.71 | 12 | 12.00 | 0.00 |
| instance n=20 472.alb | 1 | 1 | Optimal | 73.35 | 13 | 13.00 | 0.00 |
| instance n=20 473.alb | 1 | 1 | Optimal | 0.11 | 10 | 10.00 | 0.00 |
| instance n=20 474.alb | 1 | 1 | Optimal | 120.01 | 14 | 14.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 475.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=20 476.alb | 1 | 1 | Optimal | 112.99 | 11 | 11.00 | 0.00 |
| instance n=20 477.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 478.alb | 1 | 1 | Optimal | 120.03 | 12 | 12.00 | 0.00 |
| instance n=20 479.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=20 48.alb | 1 | 1 | Optimal | 8.74 | 5 | 5.00 | 0.00 |
| instance n=20 480.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=20 481.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=20 482.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=20 483.alb | 1 | 1 | Optimal | 61.15 | 12 | 12.00 | 0.00 |
| instance n=20 484.alb | 1 | 1 | Optimal | 120.00 | 13 | 13.00 | 0.00 |
| instance n=20 485.alb | 1 | 1 | Optimal | 120.01 | 15 | 15.00 | 0.00 |
| instance n=20 486.alb | 1 | 1 | Optimal | 32.56 | 11 | 11.00 | 0.00 |
| instance n=20 487.alb | 1 | 1 | Optimal | 31.89 | 12 | 12.00 | 0.00 |
| instance n=20 488.alb | 1 | 1 | Optimal | 18.52 | 15 | 15.00 | 0.00 |
| instance n=20 489.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 49.alb | 1 | 1 | Optimal | 120.02 | 4 | 4.00 | 0.00 |
| instance n=20 490.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 491.alb | 1 | 1 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=20 492.alb | 1 | 1 | Optimal | 0.09 | 5 | 5.00 | 0.00 |
| instance n=20 493.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 494.alb | 1 | 1 | Optimal | 0.10 | 6 | 6.00 | 0.00 |
| instance n=20 495.alb | 1 | 1 | Optimal | 0.54 | 6 | 6.00 | 0.00 |
| instance n=20 496.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 497.alb | 1 | 1 | Optimal | 0.09 | 6 | 6.00 | 0.00 |
| instance n=20 498.alb | 1 | 1 | Optimal | 0.08 | 6 | 6.00 | 0.00 |
| instance n=20 499.alb | 1 | 1 | Optimal | 6.94 | 5 | 5.00 | 0.00 |
| instance n=20 5.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 50.alb | 1 | 1 | Optimal | 48.58 | 4 | 4.00 | 0.00 |
| instance n=20 500.alb | 1 | 1 | Optimal | 0.09 | 8 | 8.00 | 0.00 |
| instance n=20 501.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 502.alb | 1 | 1 | Optimal | 0.11 | 4 | 4.00 | 0.00 |
| instance n=20 503.alb | 1 | 1 | Optimal | 0.42 | 6 | 6.00 | 0.00 |
| instance n=20 504.alb | 1 | 1 | Optimal | 0.12 | 6 | 6.00 | 0.00 |
| instance n=20 505.alb | 1 | 1 | Optimal | 0.12 | 6 | 6.00 | 0.00 |
| instance n=20 506.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 507.alb | 1 | 1 | Optimal | 0.10 | 5 | 5.00 | 0.00 |
| instance n=20 508.alb | 1 | 1 | Optimal | 0.10 | 5 | 5.00 | 0.00 |
| instance n=20 509.alb | 1 | 1 | Optimal | 0.10 | 4 | 4.00 | 0.00 |
| instance n=20 51.alb | 1 | 1 | Optimal | 36.45 | 4 | 4.00 | 0.00 |
| instance n=20 510.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 511.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |
| instance n=20 512.alb | 1 | 1 | Optimal | 0.12 | 5 | 5.00 | 0.00 |
| instance n=20 513.alb | 1 | 1 | Optimal | 0.11 | 5 | 5.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|---------|--------|----------|-------|----------------|
| instance n=20 514.alb | 1 | 1 | Optimal | 0.08 | 5 | 5.00 | 0.00 |
| instance n=20 515.alb | 1 | 1 | Optimal | 0.10 | 6 | 6.00 | 0.00 |
| instance n=20 516.alb | 1 | 1 | Optimal | 1.19 | 3 | 3.00 | 0.00 |
| instance n=20 517.alb | 1 | 1 | Optimal | 26.06 | 3 | 3.00 | 0.00 |
| instance n=20 518.alb | 1 | 1 | Optimal | 120.02 | 3 | 3.00 | 0.00 |
| instance n=20 519.alb | 1 | 1 | Optimal | 22.43 | 3 | 3.00 | 0.00 |
| instance n=20 52.alb | 1 | 1 | Optimal | 2.87 | 4 | 4.00 | 0.00 |
| instance n=20 520.alb | 1 | 1 | Optimal | 120.02 | 3 | 3.00 | 0.00 |
| instance n=20 521.alb | 1 | 1 | Optimal | 120.01 | 3 | 3.00 | 0.00 |
| instance n=20 522.alb | 1 | 1 | Optimal | 2.26 | 3 | 3.00 | 0.00 |
| instance n=20 523.alb | 1 | 1 | Optimal | 5.29 | 3 | 3.00 | 0.00 |
| instance n=20 524.alb | 1 | 1 | Optimal | 9.36 | 3 | 3.00 | 0.00 |
| instance n=20 525.alb | 1 | 1 | Optimal | 16.07 | 3 | 3.00 | 0.00 |
| instance n=20 53.alb | 1 | 1 | Optimal | 120.03 | 5 | 5.00 | 0.00 |
| instance n=20 54.alb | 1 | 1 | Optimal | 11.40 | 5 | 5.00 | 0.00 |
| instance n=20 55.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 56.alb | 1 | 1 | Optimal | 36.24 | 4 | 4.00 | 0.00 |
| instance n=20 57.alb | 1 | 1 | Optimal | 120.01 | 4 | 4.00 | 0.00 |
| instance n=20 58.alb | 1 | 1 | Optimal | 0.87 | 5 | 5.00 | 0.00 |
| instance n=20 59.alb | 1 | 1 | Optimal | 7.25 | 4 | 4.00 | 0.00 |
| instance n=20 6.alb | 1 | 1 | Optimal | 2.91 | 3 | 3.00 | 0.00 |
| instance n=20 60.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=20 61.alb | 1 | 1 | Optimal | 89.14 | 7 | 7.00 | 0.00 |
| instance n=20 62.alb | 1 | 1 | Optimal | 0.65 | 5 | 5.00 | 0.00 |
| instance n=20 63.alb | 1 | 1 | Optimal | 120.01 | 5 | 5.00 | 0.00 |
| instance n=20 64.alb | 1 | 1 | Optimal | 7.46 | 5 | 5.00 | 0.00 |
| instance n=20 65.alb | 1 | 1 | Optimal | 120.02 | 5 | 5.00 | 0.00 |
| instance n=20 66.alb | 1 | 1 | Optimal | 0.71 | 3 | 3.00 | 0.00 |
| instance n=20 67.alb | 1 | 1 | Optimal | 1.71 | 3 | 3.00 | 0.00 |
| instance n=20 68.alb | 1 | 1 | Optimal | 0.61 | 3 | 3.00 | 0.00 |
| instance n=20 69.alb | 1 | 1 | Optimal | 0.09 | 2 | 2.00 | 0.00 |
| instance n=20 7.alb | 1 | 1 | Optimal | 64.78 | 3 | 3.00 | 0.00 |
| instance n=20 70.alb | 1 | 1 | Optimal | 46.29 | 3 | 3.00 | 0.00 |
| instance n=20 71.alb | 1 | 1 | Optimal | 0.37 | 3 | 3.00 | 0.00 |
| instance n=20 72.alb | 1 | 1 | Optimal | 20.08 | 3 | 3.00 | 0.00 |
| instance n=20 73.alb | 1 | 1 | Optimal | 0.38 | 2 | 2.00 | 0.00 |
| instance n=20 74.alb | 1 | 1 | Optimal | 120.02 | 3 | 3.00 | 0.00 |
| instance n=20 75.alb | 1 | 1 | Optimal | 0.33 | 3 | 3.00 | 0.00 |
| instance n=20 76.alb | 1 | 1 | Optimal | 8.92 | 3 | 3.00 | 0.00 |
| instance n=20 77.alb | 1 | 1 | Optimal | 5.63 | 3 | 3.00 | 0.00 |
| instance n=20 78.alb | 1 | 1 | Optimal | 0.23 | 3 | 3.00 | 0.00 |
| instance n=20 79.alb | 1 | 1 | Optimal | 3.38 | 3 | 3.00 | 0.00 |
| instance n=20 8.alb | 1 | 1 | Optimal | 2.47 | 3 | 3.00 | 0.00 |
| instance n=20 80.alb | 1 | 1 | Optimal | 3.60 | 3 | 3.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 81.alb | 1 | 1 | Optimal | 0.99 | 3 | 3.00 | 0.00 |
| instance n=20 82.alb | 1 | 1 | Optimal | 9.48 | 4 | 4.00 | 0.00 |
| instance n=20 83.alb | 1 | 1 | Optimal | 0.11 | 3 | 3.00 | 0.00 |
| instance n=20 84.alb | 1 | 1 | Optimal | 0.12 | 3 | 3.00 | 0.00 |
| instance n=20 85.alb | 1 | 1 | Optimal | 71.23 | 3 | 3.00 | 0.00 |
| instance n=20 86.alb | 1 | 1 | Optimal | 20.61 | 3 | 3.00 | 0.00 |
| instance n=20 87.alb | 1 | 1 | Optimal | 8.81 | 3 | 3.00 | 0.00 |
| instance n=20 88.alb | 1 | 1 | Optimal | 77.11 | 3 | 3.00 | 0.00 |
| instance n=20 89.alb | 1 | 1 | Optimal | 0.33 | 3 | 3.00 | 0.00 |
| instance n=20 9.alb | 1 | 1 | Optimal | 7.16 | 3 | 3.00 | 0.00 |
| instance n=20 90.alb | 1 | 1 | Optimal | 68.02 | 3 | 3.00 | 0.00 |
| instance n=20 91.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=20 92.alb | 1 | 1 | Optimal | 120.03 | 11 | 11.00 | 0.00 |
| instance n=20 93.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 94.alb | 1 | 1 | Optimal | 120.01 | 10 | 10.00 | 0.00 |
| instance n=20 95.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=20 96.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=20 97.alb | 1 | 1 | Optimal | 120.03 | 15 | 15.00 | 0.00 |
| instance n=20 98.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=20 99.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 1.alb | 1 | 1 | Solution | 120.11 | 8 | 8.00 | 0.00 |
| instance n=50 10.alb | 1 | 1 | Optimal | 10.34 | 7 | 7.00 | 0.00 |
| instance n=50 100.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 101.alb | 1 | 1 | Solution | 120.07 | 30 | 26.00 | 13.33 |
| instance n=50 102.alb | 1 | 1 | Solution | 120.08 | 32 | 27.00 | 15.63 |
| instance n=50 103.alb | 1 | 1 | Solution | 120.11 | 29 | 25.00 | 13.79 |
| instance n=50 104.alb | 1 | 1 | Solution | 120.17 | 27 | 25.00 | 7.41 |
| instance n=50 105.alb | 1 | 1 | Solution | 120.05 | 24 | 23.00 | 4.17 |
| instance n=50 106.alb | 1 | 1 | Solution | 120.07 | 28 | 26.00 | 7.14 |
| instance n=50 107.alb | 1 | 1 | Solution | 120.10 | 28 | 26.00 | 7.14 |
| instance n=50 108.alb | 1 | 1 | Solution | 120.11 | 30 | 26.00 | 13.33 |
| instance n=50 109.alb | 1 | 1 | Solution | 120.12 | 30 | 26.00 | 13.33 |
| instance n=50 11.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 110.alb | 1 | 1 | Solution | 120.08 | 26 | 25.00 | 3.85 |
| instance n=50 111.alb | 1 | 1 | Solution | 120.08 | 28 | 26.00 | 7.14 |
| instance n=50 112.alb | 1 | 1 | Solution | 120.53 | 27 | 25.00 | 7.41 |
| instance n=50 113.alb | 1 | 1 | Solution | 120.10 | 28 | 26.00 | 7.14 |
| instance n=50 114.alb | 1 | 1 | Solution | 120.08 | 28 | 25.00 | 10.71 |
| instance n=50 115.alb | 1 | 1 | Solution | 120.10 | 28 | 25.00 | 10.71 |
| instance n=50 116.alb | 1 | 1 | Solution | 120.10 | 32 | 27.00 | 15.63 |
| instance n=50 117.alb | 1 | 1 | Solution | 120.10 | 27 | 25.00 | 7.41 |
| instance n=50 118.alb | 1 | 1 | Solution | 120.08 | 29 | 27.00 | 6.90 |
| instance n=50 119.alb | 1 | 1 | Solution | 120.08 | 25 | 25.00 | 0.00 |
| instance n=50 12.alb | 1 | 1 | Optimal | 1.83 | 6 | 6.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 120.alb | 1 | 1 | Solution | 120.12 | 27 | 26.00 | 3.70 |
| instance n=50 121.alb | 1 | 1 | Solution | 120.07 | 32 | 27.00 | 15.63 |
| instance n=50 122.alb | 1 | 1 | Solution | 120.10 | 29 | 27.00 | 6.90 |
| instance n=50 123.alb | 1 | 1 | Solution | 120.07 | 32 | 26.00 | 18.75 |
| instance n=50 124.alb | 1 | 1 | Solution | 120.16 | 29 | 27.00 | 6.90 |
| instance n=50 125.alb | 1 | 1 | Solution | 120.08 | 33 | 26.00 | 21.21 |
| instance n=50 126.alb | 1 | 1 | Optimal | 9.41 | 12 | 12.00 | 0.00 |
| instance n=50 127.alb | 1 | 1 | Solution | 120.05 | 14 | 14.00 | 0.00 |
| instance n=50 128.alb | 1 | 1 | Solution | 120.09 | 12 | 12.00 | 0.00 |
| instance n=50 129.alb | 1 | 1 | Solution | 120.11 | 13 | 13.00 | 0.00 |
| instance n=50 13.alb | 1 | 1 | Optimal | 10.86 | 6 | 6.00 | 0.00 |
| instance n=50 130.alb | 1 | 1 | Solution | 120.12 | 13 | 13.00 | 0.00 |
| instance n=50 131.alb | 1 | 1 | Solution | 120.12 | 12 | 12.00 | 0.00 |
| instance n=50 132.alb | 1 | 1 | Solution | 120.08 | 12 | 12.00 | 0.00 |
| instance n=50 133.alb | 1 | 1 | Solution | 120.06 | 12 | 12.00 | 0.00 |
| instance n=50 134.alb | 1 | 1 | Solution | 120.12 | 14 | 14.00 | 0.00 |
| instance n=50 135.alb | 1 | 1 | Solution | 120.11 | 13 | 13.00 | 0.00 |
| instance n=50 136.alb | 1 | 1 | Solution | 120.12 | 11 | 11.00 | 0.00 |
| instance n=50 137.alb | 1 | 1 | Solution | 120.08 | 11 | 11.00 | 0.00 |
| instance n=50 138.alb | 1 | 1 | Solution | 120.10 | 12 | 12.00 | 0.00 |
| instance n=50 139.alb | 1 | 1 | Solution | 120.12 | 12 | 11.00 | 8.33 |
| instance n=50 14.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 140.alb | 1 | 1 | Solution | 120.10 | 12 | 12.00 | 0.00 |
| instance n=50 141.alb | 1 | 1 | Solution | 120.11 | 13 | 13.00 | 0.00 |
| instance n=50 142.alb | 1 | 1 | Solution | 120.13 | 11 | 11.00 | 0.00 |
| instance n=50 143.alb | 1 | 1 | Solution | 120.07 | 12 | 12.00 | 0.00 |
| instance n=50 144.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 145.alb | 1 | 1 | Solution | 120.09 | 10 | 10.00 | 0.00 |
| instance n=50 146.alb | 1 | 1 | Solution | 120.05 | 13 | 13.00 | 0.00 |
| instance n=50 147.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 148.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=50 149.alb | 1 | 1 | Solution | 120.09 | 12 | 12.00 | 0.00 |
| instance n=50 15.alb | 1 | 1 | Solution | 120.11 | 8 | 8.00 | 0.00 |
| instance n=50 150.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=50 151.alb | 1 | 1 | Solution | 120.19 | 7 | 7.00 | 0.00 |
| instance n=50 152.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 153.alb | 1 | 1 | Optimal | 8.90 | 7 | 7.00 | 0.00 |
| instance n=50 154.alb | 1 | 1 | Solution | 120.07 | 8 | 8.00 | 0.00 |
| instance n=50 155.alb | 1 | 1 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=50 156.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 157.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 158.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 159.alb | 1 | 1 | Optimal | 120.04 | 7 | 7.00 | 0.00 |
| instance n=50 16.alb | 1 | 1 | Solution | 120.09 | 8 | 8.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 160.alb | 1 | 1 | Solution | 120.10 | 8 | 8.00 | 0.00 |
| instance n=50 161.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 162.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 163.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 164.alb | 1 | 1 | Solution | 120.14 | 7 | 7.00 | 0.00 |
| instance n=50 165.alb | 1 | 1 | Solution | 120.10 | 8 | 8.00 | 0.00 |
| instance n=50 166.alb | 1 | 1 | Solution | 120.09 | 8 | 8.00 | 0.00 |
| instance n=50 167.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 168.alb | 1 | 1 | Solution | 120.09 | 8 | 8.00 | 0.00 |
| instance n=50 169.alb | 1 | 1 | Solution | 120.09 | 8 | 8.00 | 0.00 |
| instance n=50 17.alb | 1 | 1 | Optimal | 38.86 | 7 | 7.00 | 0.00 |
| instance n=50 170.alb | 1 | 1 | Solution | 120.15 | 7 | 7.00 | 0.00 |
| instance n=50 171.alb | 1 | 1 | Solution | 120.12 | 8 | 8.00 | 0.00 |
| instance n=50 172.alb | 1 | 1 | Solution | 120.10 | 7 | 7.00 | 0.00 |
| instance n=50 173.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 174.alb | 1 | 1 | Solution | 120.12 | 7 | 7.00 | 0.00 |
| instance n=50 175.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 176.alb | 1 | 1 | Solution | 120.08 | 27 | 25.00 | 7.41 |
| instance n=50 177.alb | 1 | 1 | Solution | 120.11 | 28 | 26.00 | 7.14 |
| instance n=50 178.alb | 1 | 1 | Solution | 120.23 | 28 | 26.00 | 7.14 |
| instance n=50 179.alb | 1 | 1 | Solution | 120.08 | 27 | 25.00 | 7.41 |
| instance n=50 18.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 180.alb | 1 | 1 | Solution | 120.08 | 26 | 25.00 | 3.85 |
| instance n=50 181.alb | 1 | 1 | Solution | 120.14 | 30 | 27.00 | 10.00 |
| instance n=50 182.alb | 1 | 1 | Solution | 120.10 | 27 | 25.00 | 7.41 |
| instance n=50 183.alb | 1 | 1 | Solution | 120.11 | 29 | 26.00 | 10.34 |
| instance n=50 184.alb | 1 | 1 | Solution | 120.12 | 38 | 28.00 | 26.32 |
| instance n=50 185.alb | 1 | 1 | Solution | 120.13 | 27 | 25.00 | 7.41 |
| instance n=50 186.alb | 1 | 1 | Solution | 120.12 | 27 | 25.00 | 7.41 |
| instance n=50 187.alb | 1 | 1 | Solution | 120.11 | 26 | 25.00 | 3.85 |
| instance n=50 188.alb | 1 | 1 | Solution | 120.12 | 25 | 24.00 | 4.00 |
| instance n=50 189.alb | 1 | 1 | Solution | 120.10 | 26 | 25.00 | 3.85 |
| instance n=50 19.alb | 1 | 1 | Optimal | 120.01 | 8 | 8.00 | 0.00 |
| instance n=50 190.alb | 1 | 1 | Solution | 120.07 | 30 | 26.00 | 13.33 |
| instance n=50 191.alb | 1 | 1 | Solution | 120.19 | 28 | 26.00 | 7.14 |
| instance n=50 192.alb | 1 | 1 | Solution | 120.08 | 27 | 26.00 | 3.70 |
| instance n=50 193.alb | 1 | 1 | Solution | 120.08 | 29 | 26.00 | 10.34 |
| instance n=50 194.alb | 1 | 1 | Solution | 120.07 | 28 | 26.00 | 7.14 |
| instance n=50 195.alb | 1 | 1 | Solution | 120.07 | 28 | 26.00 | 7.14 |
| instance n=50 196.alb | 1 | 1 | Solution | 120.09 | 29 | 26.00 | 10.34 |
| instance n=50 197.alb | 1 | 1 | Solution | 120.13 | 28 | 26.00 | 7.14 |
| instance n=50 198.alb | 1 | 1 | Solution | 120.15 | 28 | 25.00 | 10.71 |
| instance n=50 199.alb | 1 | 1 | Solution | 120.09 | 29 | 26.00 | 10.34 |
| instance n=50 2.alb | 1 | 1 | Optimal | 101.03 | 6 | 6.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 20.alb | 1 | 1 | Optimal | 81.19 | 8 | 8.00 | 0.00 |
| instance n=50 200.alb | 1 | 1 | Solution | 120.09 | 25 | 24.00 | 4.00 |
| instance n=50 201.alb | 1 | 1 | Solution | 120.07 | 13 | 13.00 | 0.00 |
| instance n=50 202.alb | 1 | 1 | Solution | 120.17 | 9 | 9.00 | 0.00 |
| instance n=50 203.alb | 1 | 1 | Solution | 120.06 | 11 | 11.00 | 0.00 |
| instance n=50 204.alb | 1 | 1 | Solution | 120.08 | 10 | 10.00 | 0.00 |
| instance n=50 205.alb | 1 | 1 | Solution | 120.14 | 13 | 13.00 | 0.00 |
| instance n=50 206.alb | 1 | 1 | Solution | 120.10 | 12 | 11.00 | 8.33 |
| instance n=50 207.alb | 1 | 1 | Solution | 120.10 | 10 | 10.00 | 0.00 |
| instance n=50 208.alb | 1 | 1 | Solution | 120.08 | 13 | 13.00 | 0.00 |
| instance n=50 209.alb | 1 | 1 | Solution | 120.08 | 11 | 11.00 | 0.00 |
| instance n=50 21.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=50 210.alb | 1 | 1 | Solution | 120.08 | 13 | 13.00 | 0.00 |
| instance n=50 211.alb | 1 | 1 | Optimal | 120.05 | 12 | 12.00 | 0.00 |
| instance n=50 212.alb | 1 | 1 | Solution | 120.08 | 10 | 10.00 | 0.00 |
| instance n=50 213.alb | 1 | 1 | Solution | 120.12 | 13 | 13.00 | 0.00 |
| instance n=50 214.alb | 1 | 1 | Solution | 120.11 | 11 | 11.00 | 0.00 |
| instance n=50 215.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 216.alb | 1 | 1 | Solution | 120.12 | 12 | 12.00 | 0.00 |
| instance n=50 217.alb | 1 | 1 | Solution | 120.06 | 13 | 13.00 | 0.00 |
| instance n=50 218.alb | 1 | 1 | Solution | 120.09 | 12 | 12.00 | 0.00 |
| instance n=50 219.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 22.alb | 1 | 1 | Optimal | 67.79 | 7 | 7.00 | 0.00 |
| instance n=50 220.alb | 1 | 1 | Solution | 120.15 | 11 | 11.00 | 0.00 |
| instance n=50 221.alb | 1 | 1 | Solution | 120.12 | 11 | 11.00 | 0.00 |
| instance n=50 222.alb | 1 | 1 | Solution | 120.08 | 14 | 14.00 | 0.00 |
| instance n=50 223.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 224.alb | 1 | 1 | Solution | 120.09 | 11 | 11.00 | 0.00 |
| instance n=50 225.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 226.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 227.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=50 228.alb | 1 | 1 | Optimal | 75.79 | 6 | 6.00 | 0.00 |
| instance n=50 229.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=50 23.alb | 1 | 1 | Optimal | 72.85 | 7 | 7.00 | 0.00 |
| instance n=50 230.alb | 1 | 1 | Optimal | 21.28 | 7 | 7.00 | 0.00 |
| instance n=50 231.alb | 1 | 1 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=50 232.alb | 1 | 1 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=50 233.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |
| instance n=50 234.alb | 1 | 1 | Optimal | 26.66 | 8 | 8.00 | 0.00 |
| instance n=50 235.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 236.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 237.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 238.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 239.alb | 1 | 1 | Solution | 120.11 | 7 | 7.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 24.alb | 1 | 1 | Optimal | 111.32 | 7 | 7.00 | 0.00 |
| instance n=50 240.alb | 1 | 1 | Solution | 120.11 | 7 | 7.00 | 0.00 |
| instance n=50 241.alb | 1 | 1 | Optimal | 70.33 | 7 | 7.00 | 0.00 |
| instance n=50 242.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 243.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 244.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 245.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 246.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 247.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 248.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 249.alb | 1 | 1 | Optimal | 84.06 | 7 | 7.00 | 0.00 |
| instance n=50 25.alb | 1 | 1 | Optimal | 3.39 | 6 | 6.00 | 0.00 |
| instance n=50 250.alb | 1 | 1 | Optimal | 25.19 | 7 | 7.00 | 0.00 |
| instance n=50 251.alb | 1 | 1 | Solution | 120.06 | 28 | 25.00 | 10.71 |
| instance n=50 252.alb | 1 | 1 | Solution | 120.05 | 32 | 27.00 | 15.63 |
| instance n=50 253.alb | 1 | 1 | Solution | 120.10 | 28 | 26.00 | 7.14 |
| instance n=50 254.alb | 1 | 1 | Solution | 120.34 | 30 | 26.00 | 13.33 |
| instance n=50 255.alb | 1 | 1 | Solution | 120.14 | 31 | 26.00 | 16.13 |
| instance n=50 256.alb | 1 | 1 | Solution | 120.11 | 30 | 27.00 | 10.00 |
| instance n=50 257.alb | 1 | 1 | Solution | 120.12 | 33 | 29.00 | 12.12 |
| instance n=50 258.alb | 1 | 1 | Solution | 120.07 | 28 | 26.00 | 7.14 |
| instance n=50 259.alb | 1 | 1 | Solution | 120.13 | 31 | 27.00 | 12.90 |
| instance n=50 26.alb | 1 | 1 | Solution | 120.09 | 27 | 25.00 | 7.41 |
| instance n=50 260.alb | 1 | 1 | Solution | 120.09 | 29 | 26.00 | 10.34 |
| instance n=50 261.alb | 1 | 1 | Solution | 120.13 | 28 | 25.00 | 10.71 |
| instance n=50 262.alb | 1 | 1 | Solution | 120.18 | 31 | 26.00 | 16.13 |
| instance n=50 263.alb | 1 | 1 | Solution | 120.13 | 30 | 26.00 | 13.33 |
| instance n=50 264.alb | 1 | 1 | Solution | 120.10 | 27 | 25.00 | 7.41 |
| instance n=50 265.alb | 1 | 1 | Solution | 120.08 | 27 | 25.00 | 7.41 |
| instance n=50 266.alb | 1 | 1 | Solution | 120.11 | 30 | 26.00 | 13.33 |
| instance n=50 267.alb | 1 | 1 | Solution | 120.07 | 29 | 26.00 | 10.34 |
| instance n=50 268.alb | 1 | 1 | Solution | 120.09 | 29 | 26.00 | 10.34 |
| instance n=50 269.alb | 1 | 1 | Solution | 120.09 | 26 | 26.00 | 0.00 |
| instance n=50 27.alb | 1 | 1 | Solution | 120.12 | 30 | 27.00 | 10.00 |
| instance n=50 270.alb | 1 | 1 | Solution | 120.14 | 28 | 26.00 | 7.14 |
| instance n=50 271.alb | 1 | 1 | Solution | 120.07 | 31 | 26.00 | 16.13 |
| instance n=50 272.alb | 1 | 1 | Solution | 120.06 | 27 | 25.00 | 7.41 |
| instance n=50 273.alb | 1 | 1 | Solution | 120.05 | 27 | 26.00 | 3.70 |
| instance n=50 274.alb | 1 | 1 | Solution | 120.12 | 29 | 26.00 | 10.34 |
| instance n=50 275.alb | 1 | 1 | Solution | 120.08 | 28 | 26.00 | 7.14 |
| instance n=50 276.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 277.alb | 1 | 1 | Optimal | 73.33 | 13 | 13.00 | 0.00 |
| instance n=50 278.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=50 279.alb | 1 | 1 | Solution | 120.17 | 11 | 11.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 28.alb | 1 | 1 | Solution | 120.11 | 28 | 26.00 | 7.14 |
| instance n=50 280.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=50 281.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=50 282.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=50 283.alb | 1 | 1 | Optimal | 120.03 | 12 | 12.00 | 0.00 |
| instance n=50 284.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=50 285.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=50 286.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |
| instance n=50 287.alb | 1 | 1 | Solution | 120.05 | 12 | 12.00 | 0.00 |
| instance n=50 288.alb | 1 | 1 | Optimal | 120.02 | 10 | 10.00 | 0.00 |
| instance n=50 289.alb | 1 | 1 | Solution | 120.06 | 11 | 11.00 | 0.00 |
| instance n=50 29.alb | 1 | 1 | Solution | 120.09 | 29 | 25.00 | 13.79 |
| instance n=50 290.alb | 1 | 1 | Solution | 120.11 | 14 | 14.00 | 0.00 |
| instance n=50 291.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=50 292.alb | 1 | 1 | Solution | 120.05 | 13 | 13.00 | 0.00 |
| instance n=50 293.alb | 1 | 1 | Solution | 120.10 | 12 | 12.00 | 0.00 |
| instance n=50 294.alb | 1 | 1 | Solution | 120.15 | 13 | 13.00 | 0.00 |
| instance n=50 295.alb | 1 | 1 | Solution | 120.08 | 16 | 16.00 | 0.00 |
| instance n=50 296.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=50 297.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=50 298.alb | 1 | 1 | Solution | 120.09 | 11 | 11.00 | 0.00 |
| instance n=50 299.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=50 3.alb | 1 | 1 | Solution | 120.07 | 8 | 8.00 | 0.00 |
| instance n=50 30.alb | 1 | 1 | Solution | 120.09 | 27 | 25.00 | 7.41 |
| instance n=50 300.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=50 301.alb | 1 | 1 | Optimal | 5.04 | 6 | 6.00 | 0.00 |
| instance n=50 302.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 303.alb | 1 | 1 | Solution | 120.07 | 8 | 8.00 | 0.00 |
| instance n=50 304.alb | 1 | 1 | Optimal | 11.44 | 7 | 7.00 | 0.00 |
| instance n=50 305.alb | 1 | 1 | Optimal | 120.03 | 8 | 8.00 | 0.00 |
| instance n=50 306.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 307.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 308.alb | 1 | 1 | Optimal | 109.45 | 8 | 8.00 | 0.00 |
| instance n=50 309.alb | 1 | 1 | Optimal | 30.04 | 7 | 7.00 | 0.00 |
| instance n=50 31.alb | 1 | 1 | Solution | 120.19 | 28 | 25.00 | 10.71 |
| instance n=50 310.alb | 1 | 1 | Solution | 120.07 | 8 | 8.00 | 0.00 |
| instance n=50 311.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 312.alb | 1 | 1 | Optimal | 4.04 | 6 | 6.00 | 0.00 |
| instance n=50 313.alb | 1 | 1 | Solution | 120.18 | 8 | 8.00 | 0.00 |
| instance n=50 314.alb | 1 | 1 | Optimal | 81.58 | 7 | 7.00 | 0.00 |
| instance n=50 315.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 316.alb | 1 | 1 | Solution | 120.11 | 8 | 8.00 | 0.00 |
| instance n=50 317.alb | 1 | 1 | Optimal | 9.18 | 6 | 6.00 | 0.00 |
| instance n=50 318.alb | 1 | 1 | Optimal | 81.19 | 8 | 8.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 319.alb | 1 | 1 | Optimal | 102.34 | 7 | 7.00 | 0.00 |
| instance n=50 32.alb | 1 | 1 | Solution | 120.07 | 25 | 25.00 | 0.00 |
| instance n=50 320.alb | 1 | 1 | Solution | 120.07 | 8 | 8.00 | 0.00 |
| instance n=50 321.alb | 1 | 1 | Optimal | 5.07 | 6 | 6.00 | 0.00 |
| instance n=50 322.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 323.alb | 1 | 1 | Optimal | 27.66 | 7 | 7.00 | 0.00 |
| instance n=50 324.alb | 1 | 1 | Optimal | 72.47 | 7 | 7.00 | 0.00 |
| instance n=50 325.alb | 1 | 1 | Optimal | 93.37 | 7 | 7.00 | 0.00 |
| instance n=50 326.alb | 1 | 1 | Solution | 120.10 | 33 | 27.00 | 18.18 |
| instance n=50 327.alb | 1 | 1 | Solution | 120.09 | 28 | 25.00 | 10.71 |
| instance n=50 328.alb | 1 | 1 | Solution | 120.08 | 32 | 27.00 | 15.63 |
| instance n=50 329.alb | 1 | 1 | Solution | 120.10 | 25 | 24.00 | 4.00 |
| instance n=50 33.alb | 1 | 1 | Solution | 120.08 | 25 | 24.00 | 4.00 |
| instance n=50 330.alb | 1 | 1 | Solution | 120.18 | 29 | 25.00 | 13.79 |
| instance n=50 331.alb | 1 | 1 | Solution | 120.10 | 29 | 26.00 | 10.34 |
| instance n=50 332.alb | 1 | 1 | Solution | 120.07 | 25 | 24.00 | 4.00 |
| instance n=50 333.alb | 1 | 1 | Solution | 120.12 | 28 | 26.00 | 7.14 |
| instance n=50 334.alb | 1 | 1 | Solution | 120.08 | 29 | 25.00 | 13.79 |
| instance n=50 335.alb | 1 | 1 | Solution | 120.08 | 27 | 26.00 | 3.70 |
| instance n=50 336.alb | 1 | 1 | Solution | 120.15 | 26 | 25.00 | 3.85 |
| instance n=50 337.alb | 1 | 1 | Solution | 120.14 | 26 | 25.00 | 3.85 |
| instance n=50 338.alb | 1 | 1 | Solution | 120.10 | 27 | 25.00 | 7.41 |
| instance n=50 339.alb | 1 | 1 | Solution | 120.11 | 27 | 26.00 | 3.70 |
| instance n=50 34.alb | 1 | 1 | Solution | 120.08 | 30 | 26.00 | 13.33 |
| instance n=50 340.alb | 1 | 1 | Solution | 120.13 | 28 | 26.00 | 7.14 |
| instance n=50 341.alb | 1 | 1 | Solution | 120.10 | 27 | 25.00 | 7.41 |
| instance n=50 342.alb | 1 | 1 | Solution | 120.13 | 28 | 26.00 | 7.14 |
| instance n=50 343.alb | 1 | 1 | Solution | 120.17 | 27 | 25.00 | 7.41 |
| instance n=50 344.alb | 1 | 1 | Solution | 120.12 | 30 | 26.00 | 13.33 |
| instance n=50 345.alb | 1 | 1 | Solution | 120.15 | 29 | 27.00 | 6.90 |
| instance n=50 346.alb | 1 | 1 | Solution | 120.11 | 27 | 25.00 | 7.41 |
| instance n=50 347.alb | 1 | 1 | Solution | 120.12 | 26 | 25.00 | 3.85 |
| instance n=50 348.alb | 1 | 1 | Solution | 120.13 | 30 | 25.00 | 16.67 |
| instance n=50 349.alb | 1 | 1 | Solution | 120.11 | 28 | 26.00 | 7.14 |
| instance n=50 35.alb | 1 | 1 | Solution | 120.10 | 32 | 27.00 | 15.63 |
| instance n=50 350.alb | 1 | 1 | Solution | 120.13 | 24 | 23.00 | 4.17 |
| instance n=50 351.alb | 1 | 1 | Solution | 120.16 | 12 | 12.00 | 0.00 |
| instance n=50 352.alb | 1 | 1 | Solution | 120.12 | 10 | 10.00 | 0.00 |
| instance n=50 353.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=50 354.alb | 1 | 1 | Solution | 120.07 | 14 | 13.00 | 7.14 |
| instance n=50 355.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 356.alb | 1 | 1 | Solution | 120.10 | 15 | 15.00 | 0.00 |
| instance n=50 357.alb | 1 | 1 | Solution | 120.11 | 12 | 12.00 | 0.00 |
| instance n=50 358.alb | 1 | 1 | Optimal | 120.01 | 11 | 11.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 359.alb | 1 | 1 | Solution | 120.12 | 10 | 10.00 | 0.00 |
| instance n=50 36.alb | 1 | 1 | Solution | 120.11 | 31 | 26.00 | 16.13 |
| instance n=50 360.alb | 1 | 1 | Solution | 120.13 | 12 | 12.00 | 0.00 |
| instance n=50 361.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 362.alb | 1 | 1 | Solution | 120.13 | 10 | 10.00 | 0.00 |
| instance n=50 363.alb | 1 | 1 | Solution | 120.07 | 12 | 11.00 | 8.33 |
| instance n=50 364.alb | 1 | 1 | Solution | 120.14 | 13 | 13.00 | 0.00 |
| instance n=50 365.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 366.alb | 1 | 1 | Solution | 120.07 | 13 | 13.00 | 0.00 |
| instance n=50 367.alb | 1 | 1 | Solution | 120.12 | 12 | 12.00 | 0.00 |
| instance n=50 368.alb | 1 | 1 | Solution | 120.13 | 12 | 12.00 | 0.00 |
| instance n=50 369.alb | 1 | 1 | Solution | 120.11 | 12 | 12.00 | 0.00 |
| instance n=50 37.alb | 1 | 1 | Solution | 120.07 | 32 | 27.00 | 15.63 |
| instance n=50 370.alb | 1 | 1 | Solution | 120.07 | 12 | 12.00 | 0.00 |
| instance n=50 371.alb | 1 | 1 | Solution | 120.09 | 11 | 11.00 | 0.00 |
| instance n=50 372.alb | 1 | 1 | Solution | 120.06 | 10 | 10.00 | 0.00 |
| instance n=50 373.alb | 1 | 1 | Solution | 120.10 | 12 | 12.00 | 0.00 |
| instance n=50 374.alb | 1 | 1 | Solution | 120.08 | 11 | 11.00 | 0.00 |
| instance n=50 375.alb | 1 | 1 | Solution | 120.18 | 13 | 13.00 | 0.00 |
| instance n=50 376.alb | 1 | 1 | Solution | 120.05 | 7 | 7.00 | 0.00 |
| instance n=50 377.alb | 1 | 1 | Solution | 120.08 | 7 | 7.00 | 0.00 |
| instance n=50 378.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 379.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 38.alb | 1 | 1 | Solution | 120.12 | 31 | 27.00 | 12.90 |
| instance n=50 380.alb | 1 | 1 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=50 381.alb | 1 | 1 | Optimal | 120.01 | 8 | 8.00 | 0.00 |
| instance n=50 382.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=50 383.alb | 1 | 1 | Optimal | 65.64 | 7 | 7.00 | 0.00 |
| instance n=50 384.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 385.alb | 1 | 1 | Solution | 120.09 | 7 | 7.00 | 0.00 |
| instance n=50 386.alb | 1 | 1 | Optimal | 79.31 | 7 | 7.00 | 0.00 |
| instance n=50 387.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 388.alb | 1 | 1 | Optimal | 53.22 | 7 | 7.00 | 0.00 |
| instance n=50 389.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 39.alb | 1 | 1 | Solution | 120.07 | 29 | 26.00 | 10.34 |
| instance n=50 390.alb | 1 | 1 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=50 391.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 392.alb | 1 | 1 | Optimal | 109.05 | 8 | 8.00 | 0.00 |
| instance n=50 393.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 394.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 395.alb | 1 | 1 | Solution | 120.07 | 7 | 7.00 | 0.00 |
| instance n=50 396.alb | 1 | 1 | Optimal | 117.39 | 8 | 8.00 | 0.00 |
| instance n=50 397.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 398.alb | 1 | 1 | Optimal | 120.01 | 6 | 6.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 399.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 4.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 40.alb | 1 | 1 | Solution | 120.11 | 26 | 25.00 | 3.85 |
| instance n=50 400.alb | 1 | 1 | Optimal | 120.01 | 8 | 8.00 | 0.00 |
| instance n=50 401.alb | 1 | 1 | Solution | 120.07 | 28 | 26.00 | 7.14 |
| instance n=50 402.alb | 1 | 1 | Solution | 120.10 | 27 | 26.00 | 3.70 |
| instance n=50 403.alb | 1 | 1 | Solution | 120.07 | 34 | 28.00 | 17.65 |
| instance n=50 404.alb | 1 | 1 | Solution | 120.16 | 31 | 27.00 | 12.90 |
| instance n=50 405.alb | 1 | 1 | Solution | 120.08 | 27 | 26.00 | 3.70 |
| instance n=50 406.alb | 1 | 1 | Solution | 120.16 | 33 | 29.00 | 12.12 |
| instance n=50 407.alb | 1 | 1 | Solution | 120.11 | 29 | 26.00 | 10.34 |
| instance n=50 408.alb | 1 | 1 | Solution | 120.09 | 26 | 25.00 | 3.85 |
| instance n=50 409.alb | 1 | 1 | Solution | 120.09 | 33 | 27.00 | 18.18 |
| instance n=50 41.alb | 1 | 1 | Solution | 120.10 | 26 | 25.00 | 3.85 |
| instance n=50 410.alb | 1 | 1 | Solution | 120.09 | 28 | 26.00 | 7.14 |
| instance n=50 411.alb | 1 | 1 | Solution | 120.08 | 29 | 27.00 | 6.90 |
| instance n=50 412.alb | 1 | 1 | Solution | 120.06 | 26 | 25.00 | 3.85 |
| instance n=50 413.alb | 1 | 1 | Solution | 120.09 | 30 | 27.00 | 10.00 |
| instance n=50 414.alb | 1 | 1 | Solution | 120.10 | 27 | 26.00 | 3.70 |
| instance n=50 415.alb | 1 | 1 | Solution | 120.06 | 29 | 26.00 | 10.34 |
| instance n=50 416.alb | 1 | 1 | Solution | 120.07 | 27 | 26.00 | 3.70 |
| instance n=50 417.alb | 1 | 1 | Solution | 120.09 | 30 | 27.00 | 10.00 |
| instance n=50 418.alb | 1 | 1 | Solution | 120.12 | 28 | 26.00 | 7.14 |
| instance n=50 419.alb | 1 | 1 | Solution | 120.08 | 33 | 27.00 | 18.18 |
| instance n=50 42.alb | 1 | 1 | Solution | 120.06 | 24 | 23.00 | 4.17 |
| instance n=50 420.alb | 1 | 1 | Solution | 120.09 | 28 | 26.00 | 7.14 |
| instance n=50 421.alb | 1 | 1 | Solution | 120.12 | 35 | 28.00 | 20.00 |
| instance n=50 422.alb | 1 | 1 | Solution | 120.11 | 29 | 26.00 | 10.34 |
| instance n=50 423.alb | 1 | 1 | Solution | 120.18 | 29 | 26.00 | 10.34 |
| instance n=50 424.alb | 1 | 1 | Solution | 120.07 | 27 | 26.00 | 3.70 |
| instance n=50 425.alb | 1 | 1 | Solution | 120.10 | 35 | 28.00 | 20.00 |
| instance n=50 426.alb | 1 | 1 | Solution | 120.05 | 11 | 11.00 | 0.00 |
| instance n=50 427.alb | 1 | 1 | Optimal | 120.01 | 12 | 12.00 | 0.00 |
| instance n=50 428.alb | 1 | 1 | Solution | 120.12 | 13 | 13.00 | 0.00 |
| instance n=50 429.alb | 1 | 1 | Solution | 120.06 | 11 | 11.00 | 0.00 |
| instance n=50 43.alb | 1 | 1 | Solution | 120.09 | 25 | 25.00 | 0.00 |
| instance n=50 430.alb | 1 | 1 | Solution | 120.15 | 14 | 14.00 | 0.00 |
| instance n=50 431.alb | 1 | 1 | Optimal | 4.06 | 11 | 11.00 | 0.00 |
| instance n=50 432.alb | 1 | 1 | Solution | 120.06 | 12 | 12.00 | 0.00 |
| instance n=50 433.alb | 1 | 1 | Solution | 120.12 | 12 | 12.00 | 0.00 |
| instance n=50 434.alb | 1 | 1 | Solution | 120.09 | 11 | 11.00 | 0.00 |
| instance n=50 435.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 436.alb | 1 | 1 | Solution | 120.06 | 11 | 11.00 | 0.00 |
| instance n=50 437.alb | 1 | 1 | Solution | 120.08 | 12 | 12.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 438.alb | 1 | 1 | Solution | 120.12 | 10 | 10.00 | 0.00 |
| instance n=50 439.alb | 1 | 1 | Solution | 120.13 | 12 | 12.00 | 0.00 |
| instance n=50 44.alb | 1 | 1 | Solution | 120.09 | 25 | 24.00 | 4.00 |
| instance n=50 440.alb | 1 | 1 | Optimal | 120.03 | 13 | 13.00 | 0.00 |
| instance n=50 441.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=50 442.alb | 1 | 1 | Solution | 120.05 | 12 | 12.00 | 0.00 |
| instance n=50 443.alb | 1 | 1 | Solution | 120.09 | 11 | 11.00 | 0.00 |
| instance n=50 444.alb | 1 | 1 | Solution | 120.05 | 12 | 12.00 | 0.00 |
| instance n=50 445.alb | 1 | 1 | Solution | 120.14 | 12 | 12.00 | 0.00 |
| instance n=50 446.alb | 1 | 1 | Solution | 120.17 | 12 | 12.00 | 0.00 |
| instance n=50 447.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=50 448.alb | 1 | 1 | Solution | 120.09 | 12 | 12.00 | 0.00 |
| instance n=50 449.alb | 1 | 1 | Solution | 120.06 | 11 | 11.00 | 0.00 |
| instance n=50 45.alb | 1 | 1 | Solution | 120.09 | 25 | 24.00 | 4.00 |
| instance n=50 450.alb | 1 | 1 | Solution | 120.12 | 11 | 11.00 | 0.00 |
| instance n=50 451.alb | 1 | 1 | Optimal | 0.15 | 8 | 8.00 | 0.00 |
| instance n=50 452.alb | 1 | 1 | Optimal | 120.01 | 8 | 8.00 | 0.00 |
| instance n=50 453.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 454.alb | 1 | 1 | Optimal | 0.39 | 8 | 8.00 | 0.00 |
| instance n=50 455.alb | 1 | 1 | Optimal | 23.92 | 6 | 6.00 | 0.00 |
| instance n=50 456.alb | 1 | 1 | Optimal | 1.65 | 8 | 8.00 | 0.00 |
| instance n=50 457.alb | 1 | 1 | Optimal | 2.20 | 8 | 8.00 | 0.00 |
| instance n=50 458.alb | 1 | 1 | Optimal | 6.29 | 7 | 7.00 | 0.00 |
| instance n=50 459.alb | 1 | 1 | Optimal | 0.39 | 7 | 7.00 | 0.00 |
| instance n=50 46.alb | 1 | 1 | Solution | 120.08 | 28 | 26.00 | 7.14 |
| instance n=50 460.alb | 1 | 1 | Optimal | 71.08 | 7 | 7.00 | 0.00 |
| instance n=50 461.alb | 1 | 1 | Optimal | 0.19 | 6 | 6.00 | 0.00 |
| instance n=50 462.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 463.alb | 1 | 1 | Optimal | 15.71 | 8 | 8.00 | 0.00 |
| instance n=50 464.alb | 1 | 1 | Optimal | 120.02 | 6 | 6.00 | 0.00 |
| instance n=50 465.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 466.alb | 1 | 1 | Optimal | 0.86 | 7 | 7.00 | 0.00 |
| instance n=50 467.alb | 1 | 1 | Optimal | 0.13 | 9 | 9.00 | 0.00 |
| instance n=50 468.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 469.alb | 1 | 1 | Optimal | 7.45 | 8 | 8.00 | 0.00 |
| instance n=50 47.alb | 1 | 1 | Solution | 120.10 | 28 | 26.00 | 7.14 |
| instance n=50 470.alb | 1 | 1 | Optimal | 120.01 | 8 | 8.00 | 0.00 |
| instance n=50 471.alb | 1 | 1 | Optimal | 0.43 | 7 | 7.00 | 0.00 |
| instance n=50 472.alb | 1 | 1 | Optimal | 0.32 | 8 | 8.00 | 0.00 |
| instance n=50 473.alb | 1 | 1 | Optimal | 31.09 | 7 | 7.00 | 0.00 |
| instance n=50 474.alb | 1 | 1 | Optimal | 0.15 | 7 | 7.00 | 0.00 |
| instance n=50 475.alb | 1 | 1 | Optimal | 0.37 | 6 | 6.00 | 0.00 |
| instance n=50 476.alb | 1 | 1 | Optimal | 120.01 | 28 | 28.00 | 0.00 |
| instance n=50 477.alb | 1 | 1 | Optimal | 120.03 | 29 | 29.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 478.alb | 1 | 1 | Optimal | 120.02 | 32 | 32.00 | 0.00 |
| instance n=50 479.alb | 1 | 1 | Optimal | 120.02 | 28 | 28.00 | 0.00 |
| instance n=50 48.alb | 1 | 1 | Solution | 120.06 | 28 | 26.00 | 7.14 |
| instance n=50 480.alb | 1 | 1 | Optimal | 85.29 | 34 | 34.00 | 0.00 |
| instance n=50 481.alb | 1 | 1 | Optimal | 120.01 | 28 | 28.00 | 0.00 |
| instance n=50 482.alb | 1 | 1 | Optimal | 120.01 | 27 | 27.00 | 0.00 |
| instance n=50 483.alb | 1 | 1 | Optimal | 120.02 | 30 | 30.00 | 0.00 |
| instance n=50 484.alb | 1 | 1 | Optimal | 120.04 | 32 | 32.00 | 0.00 |
| instance n=50 485.alb | 1 | 1 | Optimal | 120.02 | 31 | 31.00 | 0.00 |
| instance n=50 486.alb | 1 | 1 | Optimal | 120.02 | 32 | 32.00 | 0.00 |
| instance n=50 487.alb | 1 | 1 | Optimal | 120.01 | 31 | 31.00 | 0.00 |
| instance n=50 488.alb | 1 | 1 | Optimal | 120.04 | 31 | 31.00 | 0.00 |
| instance n=50 489.alb | 1 | 1 | Optimal | 120.02 | 35 | 35.00 | 0.00 |
| instance n=50 49.alb | 1 | 1 | Solution | 120.11 | 25 | 24.00 | 4.00 |
| instance n=50 490.alb | 1 | 1 | Optimal | 120.01 | 29 | 29.00 | 0.00 |
| instance n=50 491.alb | 1 | 1 | Optimal | 120.03 | 35 | 35.00 | 0.00 |
| instance n=50 492.alb | 1 | 1 | Solution | 120.12 | 29 | 27.00 | 6.90 |
| instance n=50 493.alb | 1 | 1 | Optimal | 120.02 | 30 | 30.00 | 0.00 |
| instance n=50 494.alb | 1 | 1 | Optimal | 120.01 | 32 | 32.00 | 0.00 |
| instance n=50 495.alb | 1 | 1 | Optimal | 33.41 | 34 | 34.00 | 0.00 |
| instance n=50 496.alb | 1 | 1 | Optimal | 120.02 | 29 | 29.00 | 0.00 |
| instance n=50 497.alb | 1 | 1 | Optimal | 120.01 | 30 | 30.00 | 0.00 |
| instance n=50 498.alb | 1 | 1 | Optimal | 120.02 | 30 | 30.00 | 0.00 |
| instance n=50 499.alb | 1 | 1 | Optimal | 120.02 | 33 | 33.00 | 0.00 |
| instance n=50 5.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 50.alb | 1 | 1 | Solution | 120.07 | 27 | 25.00 | 7.41 |
| instance n=50 500.alb | 1 | 1 | Optimal | 120.01 | 34 | 34.00 | 0.00 |
| instance n=50 501.alb | 1 | 1 | Optimal | 1.89 | 12 | 12.00 | 0.00 |
| instance n=50 502.alb | 1 | 1 | Optimal | 0.15 | 10 | 10.00 | 0.00 |
| instance n=50 503.alb | 1 | 1 | Optimal | 120.01 | 13 | 13.00 | 0.00 |
| instance n=50 504.alb | 1 | 1 | Optimal | 2.27 | 11 | 11.00 | 0.00 |
| instance n=50 505.alb | 1 | 1 | Optimal | 2.79 | 12 | 12.00 | 0.00 |
| instance n=50 506.alb | 1 | 1 | Optimal | 10.65 | 11 | 11.00 | 0.00 |
| instance n=50 507.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=50 508.alb | 1 | 1 | Optimal | 11.76 | 14 | 14.00 | 0.00 |
| instance n=50 509.alb | 1 | 1 | Optimal | 13.27 | 13 | 13.00 | 0.00 |
| instance n=50 51.alb | 1 | 1 | Solution | 120.11 | 12 | 12.00 | 0.00 |
| instance n=50 510.alb | 1 | 1 | Optimal | 120.00 | 11 | 11.00 | 0.00 |
| instance n=50 511.alb | 1 | 1 | Optimal | 40.91 | 13 | 13.00 | 0.00 |
| instance n=50 512.alb | 1 | 1 | Optimal | 120.02 | 13 | 13.00 | 0.00 |
| instance n=50 513.alb | 1 | 1 | Optimal | 27.94 | 12 | 12.00 | 0.00 |
| instance n=50 514.alb | 1 | 1 | Optimal | 0.14 | 12 | 12.00 | 0.00 |
| instance n=50 515.alb | 1 | 1 | Optimal | 78.31 | 11 | 11.00 | 0.00 |
| instance n=50 516.alb | 1 | 1 | Optimal | 6.07 | 13 | 13.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 517.alb | 1 | 1 | Optimal | 29.10 | 14 | 14.00 | 0.00 |
| instance n=50 518.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=50 519.alb | 1 | 1 | Optimal | 120.02 | 12 | 12.00 | 0.00 |
| instance n=50 52.alb | 1 | 1 | Solution | 120.12 | 11 | 11.00 | 0.00 |
| instance n=50 520.alb | 1 | 1 | Optimal | 8.61 | 11 | 11.00 | 0.00 |
| instance n=50 521.alb | 1 | 1 | Optimal | 0.70 | 10 | 10.00 | 0.00 |
| instance n=50 522.alb | 1 | 1 | Optimal | 0.41 | 11 | 11.00 | 0.00 |
| instance n=50 523.alb | 1 | 1 | Optimal | 5.66 | 11 | 11.00 | 0.00 |
| instance n=50 524.alb | 1 | 1 | Optimal | 120.02 | 14 | 14.00 | 0.00 |
| instance n=50 525.alb | 1 | 1 | Optimal | 120.02 | 11 | 11.00 | 0.00 |
| instance n=50 53.alb | 1 | 1 | Solution | 120.12 | 13 | 12.00 | 7.69 |
| instance n=50 54.alb | 1 | 1 | Solution | 120.09 | 11 | 11.00 | 0.00 |
| instance n=50 55.alb | 1 | 1 | Solution | 120.05 | 13 | 13.00 | 0.00 |
| instance n=50 56.alb | 1 | 1 | Solution | 120.06 | 11 | 11.00 | 0.00 |
| instance n=50 57.alb | 1 | 1 | Solution | 120.20 | 13 | 13.00 | 0.00 |
| instance n=50 58.alb | 1 | 1 | Solution | 120.09 | 11 | 11.00 | 0.00 |
| instance n=50 59.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 6.alb | 1 | 1 | Optimal | 15.26 | 6 | 6.00 | 0.00 |
| instance n=50 60.alb | 1 | 1 | Solution | 120.09 | 12 | 12.00 | 0.00 |
| instance n=50 61.alb | 1 | 1 | Solution | 120.16 | 13 | 13.00 | 0.00 |
| instance n=50 62.alb | 1 | 1 | Solution | 120.10 | 13 | 13.00 | 0.00 |
| instance n=50 63.alb | 1 | 1 | Solution | 120.05 | 12 | 12.00 | 0.00 |
| instance n=50 64.alb | 1 | 1 | Solution | 120.06 | 13 | 13.00 | 0.00 |
| instance n=50 65.alb | 1 | 1 | Solution | 120.08 | 12 | 12.00 | 0.00 |
| instance n=50 66.alb | 1 | 1 | Solution | 120.11 | 12 | 12.00 | 0.00 |
| instance n=50 67.alb | 1 | 1 | Solution | 120.10 | 12 | 12.00 | 0.00 |
| instance n=50 68.alb | 1 | 1 | Solution | 120.09 | 12 | 12.00 | 0.00 |
| instance n=50 69.alb | 1 | 1 | Solution | 120.07 | 12 | 12.00 | 0.00 |
| instance n=50 7.alb | 1 | 1 | Optimal | 22.99 | 7 | 7.00 | 0.00 |
| instance n=50 70.alb | 1 | 1 | Solution | 120.10 | 10 | 10.00 | 0.00 |
| instance n=50 71.alb | 1 | 1 | Solution | 120.09 | 13 | 13.00 | 0.00 |
| instance n=50 72.alb | 1 | 1 | Solution | 120.07 | 11 | 11.00 | 0.00 |
| instance n=50 73.alb | 1 | 1 | Solution | 120.10 | 11 | 11.00 | 0.00 |
| instance n=50 74.alb | 1 | 1 | Solution | 120.10 | 12 | 12.00 | 0.00 |
| instance n=50 75.alb | 1 | 1 | Solution | 120.12 | 11 | 11.00 | 0.00 |
| instance n=50 76.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 77.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 78.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 79.alb | 1 | 1 | Solution | 120.07 | 8 | 8.00 | 0.00 |
| instance n=50 8.alb | 1 | 1 | Optimal | 77.99 | 7 | 7.00 | 0.00 |
| instance n=50 80.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 81.alb | 1 | 1 | Optimal | 42.17 | 7 | 7.00 | 0.00 |
| instance n=50 82.alb | 1 | 1 | Optimal | 102.41 | 6 | 6.00 | 0.00 |
| instance n=50 83.alb | 1 | 1 | Solution | 120.20 | 8 | 8.00 | 0.00 |

Table 6.7: Results for SALBP-1 Problems Alternative (CPSat)
(2100 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=50 84.alb | 1 | 1 | Optimal | 33.33 | 7 | 7.00 | 0.00 |
| instance n=50 85.alb | 1 | 1 | Optimal | 120.02 | 8 | 8.00 | 0.00 |
| instance n=50 86.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 87.alb | 1 | 1 | Solution | 120.10 | 8 | 8.00 | 0.00 |
| instance n=50 88.alb | 1 | 1 | Optimal | 120.01 | 8 | 8.00 | 0.00 |
| instance n=50 89.alb | 1 | 1 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=50 9.alb | 1 | 1 | Optimal | 120.01 | 9 | 9.00 | 0.00 |
| instance n=50 90.alb | 1 | 1 | Solution | 120.08 | 7 | 7.00 | 0.00 |
| instance n=50 91.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 92.alb | 1 | 1 | Solution | 120.09 | 7 | 7.00 | 0.00 |
| instance n=50 93.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 94.alb | 1 | 1 | Optimal | 120.03 | 7 | 7.00 | 0.00 |
| instance n=50 95.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 96.alb | 1 | 1 | Optimal | 120.01 | 7 | 7.00 | 0.00 |
| instance n=50 97.alb | 1 | 1 | Optimal | 120.02 | 7 | 7.00 | 0.00 |
| instance n=50 98.alb | 1 | 1 | Solution | 120.11 | 8 | 8.00 | 0.00 |
| instance n=50 99.alb | 1 | 1 | Optimal | 120.04 | 7 | 7.00 | 0.00 |

6.6.3 Chuffed

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 1.alb | 1 | 1 | Solution | 120.25 | 11 | 0.00 | 100.00 |
| instance n=20 10.alb | 1 | 1 | Solution | 120.65 | 11 | 0.00 | 100.00 |
| instance n=20 100.alb | 1 | 1 | Optimal | 21.66 | 11 | 0.00 | 100.00 |
| instance n=20 101.alb | 1 | 1 | Optimal | 21.66 | 13 | 0.00 | 100.00 |
| instance n=20 102.alb | 1 | 1 | Optimal | 15.92 | 13 | 0.00 | 100.00 |
| instance n=20 103.alb | 1 | 1 | Optimal | 14.58 | 12 | 0.00 | 100.00 |
| instance n=20 104.alb | 1 | 1 | Optimal | 38.11 | 11 | 0.00 | 100.00 |
| instance n=20 105.alb | 1 | 1 | Optimal | 22.04 | 12 | 0.00 | 100.00 |
| instance n=20 106.alb | 1 | 1 | Optimal | 39.82 | 10 | 0.00 | 100.00 |
| instance n=20 107.alb | 1 | 1 | Optimal | 11.78 | 14 | 0.00 | 100.00 |
| instance n=20 108.alb | 1 | 1 | Optimal | 12.38 | 15 | 0.00 | 100.00 |
| instance n=20 109.alb | 1 | 1 | Optimal | 17.36 | 12 | 0.00 | 100.00 |
| instance n=20 11.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 110.alb | 1 | 1 | Optimal | 30.37 | 11 | 0.00 | 100.00 |
| instance n=20 111.alb | 1 | 1 | Optimal | 12.21 | 13 | 0.00 | 100.00 |
| instance n=20 112.alb | 1 | 1 | Optimal | 29.89 | 11 | 0.00 | 100.00 |
| instance n=20 113.alb | 1 | 1 | Optimal | 28.28 | 12 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 114.alb | 1 | 1 | Optimal | 17.37 | 13 | 0.00 | 100.00 |
| instance n=20 115.alb | 1 | 1 | Optimal | 61.28 | 11 | 0.00 | 100.00 |
| instance n=20 116.alb | 1 | 1 | Solution | 120.32 | 11 | 0.00 | 100.00 |
| instance n=20 117.alb | 1 | 1 | Solution | 120.42 | 10 | 0.00 | 100.00 |
| instance n=20 118.alb | 1 | 1 | Solution | 120.41 | 9 | 0.00 | 100.00 |
| instance n=20 119.alb | 1 | 1 | Solution | 121.01 | 9 | 0.00 | 100.00 |
| instance n=20 12.alb | 1 | 1 | Solution | 120.40 | 11 | 0.00 | 100.00 |
| instance n=20 120.alb | 1 | 1 | Solution | 120.99 | 9 | 0.00 | 100.00 |
| instance n=20 121.alb | 1 | 1 | Solution | 120.25 | 9 | 0.00 | 100.00 |
| instance n=20 122.alb | 1 | 1 | Solution | 120.37 | 10 | 0.00 | 100.00 |
| instance n=20 123.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 124.alb | 1 | 1 | Solution | 120.15 | 10 | 0.00 | 100.00 |
| instance n=20 125.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 126.alb | 1 | 1 | Solution | 120.11 | 8 | 0.00 | 100.00 |
| instance n=20 127.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 128.alb | 1 | 1 | Unknown | 121010.00 | - | - | - |
| instance n=20 129.alb | 1 | 1 | Solution | 121.01 | 10 | 0.00 | 100.00 |
| instance n=20 13.alb | 1 | 1 | Solution | 120.22 | 11 | 0.00 | 100.00 |
| instance n=20 130.alb | 1 | 1 | Solution | 120.62 | 7 | 0.00 | 100.00 |
| instance n=20 131.alb | 1 | 1 | Optimal | 43.43 | 7 | 0.00 | 100.00 |
| instance n=20 132.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 133.alb | 1 | 1 | Solution | 121.03 | 10 | 0.00 | 100.00 |
| instance n=20 134.alb | 1 | 1 | Solution | 120.24 | 7 | 0.00 | 100.00 |
| instance n=20 135.alb | 1 | 1 | Solution | 121.02 | 8 | 0.00 | 100.00 |
| instance n=20 136.alb | 1 | 1 | Solution | 120.91 | 9 | 0.00 | 100.00 |
| instance n=20 137.alb | 1 | 1 | Solution | 120.30 | 6 | 0.00 | 100.00 |
| instance n=20 138.alb | 1 | 1 | Solution | 120.63 | 9 | 0.00 | 100.00 |
| instance n=20 139.alb | 1 | 1 | Solution | 121.02 | 9 | 0.00 | 100.00 |
| instance n=20 14.alb | 1 | 1 | Solution | 120.76 | 11 | 0.00 | 100.00 |
| instance n=20 140.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 141.alb | 1 | 1 | Solution | 121.00 | 12 | 0.00 | 100.00 |
| instance n=20 142.alb | 1 | 1 | Solution | 120.64 | 12 | 0.00 | 100.00 |
| instance n=20 143.alb | 1 | 1 | Solution | 121.01 | 12 | 0.00 | 100.00 |
| instance n=20 144.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 145.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 146.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 147.alb | 1 | 1 | Solution | 120.96 | 12 | 0.00 | 100.00 |
| instance n=20 148.alb | 1 | 1 | Solution | 120.71 | 12 | 0.00 | 100.00 |
| instance n=20 149.alb | 1 | 1 | Solution | 120.82 | 12 | 0.00 | 100.00 |
| instance n=20 15.alb | 1 | 1 | Solution | 121.01 | 12 | 0.00 | 100.00 |
| instance n=20 150.alb | 1 | 1 | Solution | 121.00 | 12 | 0.00 | 100.00 |
| instance n=20 151.alb | 1 | 1 | Solution | 120.47 | 11 | 0.00 | 100.00 |
| instance n=20 152.alb | 1 | 1 | Solution | 121.01 | 12 | 0.00 | 100.00 |
| instance n=20 153.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 154.alb | 1 | 1 | Solution | 121.03 | 11 | 0.00 | 100.00 |
| instance n=20 155.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 156.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 157.alb | 1 | 1 | Solution | 120.75 | 11 | 0.00 | 100.00 |
| instance n=20 158.alb | 1 | 1 | Solution | 120.41 | 11 | 0.00 | 100.00 |
| instance n=20 159.alb | 1 | 1 | Unknown | 121005.00 | - | - | - |
| instance n=20 16.alb | 1 | 1 | Optimal | 38.84 | 12 | 0.00 | 100.00 |
| instance n=20 160.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 161.alb | 1 | 1 | Solution | 120.44 | 12 | 0.00 | 100.00 |
| instance n=20 162.alb | 1 | 1 | Solution | 120.38 | 12 | 0.00 | 100.00 |
| instance n=20 163.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 164.alb | 1 | 1 | Solution | 120.27 | 11 | 0.00 | 100.00 |
| instance n=20 165.alb | 1 | 1 | Solution | 120.89 | 11 | 0.00 | 100.00 |
| instance n=20 166.alb | 1 | 1 | Optimal | 49.10 | 12 | 0.00 | 100.00 |
| instance n=20 167.alb | 1 | 1 | Optimal | 45.68 | 11 | 0.00 | 100.00 |
| instance n=20 168.alb | 1 | 1 | Optimal | 35.69 | 10 | 0.00 | 100.00 |
| instance n=20 169.alb | 1 | 1 | Optimal | 65.22 | 11 | 0.00 | 100.00 |
| instance n=20 17.alb | 1 | 1 | Optimal | 58.20 | 10 | 0.00 | 100.00 |
| instance n=20 170.alb | 1 | 1 | Optimal | 53.43 | 11 | 0.00 | 100.00 |
| instance n=20 171.alb | 1 | 1 | Optimal | 43.65 | 13 | 0.00 | 100.00 |
| instance n=20 172.alb | 1 | 1 | Optimal | 36.96 | 11 | 0.00 | 100.00 |
| instance n=20 173.alb | 1 | 1 | Optimal | 47.24 | 11 | 0.00 | 100.00 |
| instance n=20 174.alb | 1 | 1 | Optimal | 21.46 | 12 | 0.00 | 100.00 |
| instance n=20 175.alb | 1 | 1 | Optimal | 55.40 | 10 | 0.00 | 100.00 |
| instance n=20 176.alb | 1 | 1 | Optimal | 41.01 | 11 | 0.00 | 100.00 |
| instance n=20 177.alb | 1 | 1 | Optimal | 58.07 | 10 | 0.00 | 100.00 |
| instance n=20 178.alb | 1 | 1 | Optimal | 34.50 | 11 | 0.00 | 100.00 |
| instance n=20 179.alb | 1 | 1 | Optimal | 38.36 | 11 | 0.00 | 100.00 |
| instance n=20 18.alb | 1 | 1 | Optimal | 50.98 | 11 | 0.00 | 100.00 |
| instance n=20 180.alb | 1 | 1 | Optimal | 30.12 | 13 | 0.00 | 100.00 |
| instance n=20 181.alb | 1 | 1 | Optimal | 32.20 | 11 | 0.00 | 100.00 |
| instance n=20 182.alb | 1 | 1 | Optimal | 50.42 | 11 | 0.00 | 100.00 |
| instance n=20 183.alb | 1 | 1 | Optimal | 41.37 | 13 | 0.00 | 100.00 |
| instance n=20 184.alb | 1 | 1 | Optimal | 20.30 | 12 | 0.00 | 100.00 |
| instance n=20 185.alb | 1 | 1 | Optimal | 25.95 | 15 | 0.00 | 100.00 |
| instance n=20 186.alb | 1 | 1 | Optimal | 45.42 | 14 | 0.00 | 100.00 |
| instance n=20 187.alb | 1 | 1 | Optimal | 59.83 | 10 | 0.00 | 100.00 |
| instance n=20 188.alb | 1 | 1 | Optimal | 47.31 | 11 | 0.00 | 100.00 |
| instance n=20 189.alb | 1 | 1 | Optimal | 29.07 | 13 | 0.00 | 100.00 |
| instance n=20 19.alb | 1 | 1 | Optimal | 42.87 | 14 | 0.00 | 100.00 |
| instance n=20 190.alb | 1 | 1 | Optimal | 41.32 | 15 | 0.00 | 100.00 |
| instance n=20 191.alb | 1 | 1 | Solution | 120.13 | 11 | 0.00 | 100.00 |
| instance n=20 192.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 193.alb | 1 | 1 | Solution | 121.03 | 10 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 194.alb | 1 | 1 | Solution | 120.16 | 11 | 0.00 | 100.00 |
| instance n=20 195.alb | 1 | 1 | Solution | 121.03 | 10 | 0.00 | 100.00 |
| instance n=20 196.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 197.alb | 1 | 1 | Solution | 120.35 | 11 | 0.00 | 100.00 |
| instance n=20 198.alb | 1 | 1 | Solution | 120.80 | 9 | 0.00 | 100.00 |
| instance n=20 199.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 2.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 20.alb | 1 | 1 | Optimal | 36.08 | 11 | 0.00 | 100.00 |
| instance n=20 200.alb | 1 | 1 | Solution | 120.11 | 10 | 0.00 | 100.00 |
| instance n=20 201.alb | 1 | 1 | Solution | 120.30 | 11 | 0.00 | 100.00 |
| instance n=20 202.alb | 1 | 1 | Solution | 120.19 | 11 | 0.00 | 100.00 |
| instance n=20 203.alb | 1 | 1 | Solution | 120.87 | 12 | 0.00 | 100.00 |
| instance n=20 204.alb | 1 | 1 | Solution | 120.99 | 11 | 0.00 | 100.00 |
| instance n=20 205.alb | 1 | 1 | Solution | 120.64 | 11 | 0.00 | 100.00 |
| instance n=20 206.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 207.alb | 1 | 1 | Solution | 120.13 | 10 | 0.00 | 100.00 |
| instance n=20 208.alb | 1 | 1 | Solution | 120.79 | 10 | 0.00 | 100.00 |
| instance n=20 209.alb | 1 | 1 | Solution | 120.67 | 12 | 0.00 | 100.00 |
| instance n=20 21.alb | 1 | 1 | Optimal | 26.36 | 14 | 0.00 | 100.00 |
| instance n=20 210.alb | 1 | 1 | Solution | 120.13 | 10 | 0.00 | 100.00 |
| instance n=20 211.alb | 1 | 1 | Solution | 121.03 | 11 | 0.00 | 100.00 |
| instance n=20 212.alb | 1 | 1 | Solution | 120.41 | 10 | 0.00 | 100.00 |
| instance n=20 213.alb | 1 | 1 | Solution | 120.17 | 10 | 0.00 | 100.00 |
| instance n=20 214.alb | 1 | 1 | Unknown | 121013.00 | - | - | - |
| instance n=20 215.alb | 1 | 1 | Solution | 120.42 | 11 | 0.00 | 100.00 |
| instance n=20 216.alb | 1 | 1 | Solution | 120.29 | 12 | 0.00 | 100.00 |
| instance n=20 217.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 218.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 219.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 22.alb | 1 | 1 | Optimal | 25.01 | 12 | 0.00 | 100.00 |
| instance n=20 220.alb | 1 | 1 | Solution | 120.62 | 12 | 0.00 | 100.00 |
| instance n=20 221.alb | 1 | 1 | Solution | 121.02 | 7 | 0.00 | 100.00 |
| instance n=20 222.alb | 1 | 1 | Solution | 120.12 | 10 | 0.00 | 100.00 |
| instance n=20 223.alb | 1 | 1 | Solution | 121.03 | 13 | 0.00 | 100.00 |
| instance n=20 224.alb | 1 | 1 | Solution | 120.78 | 13 | 0.00 | 100.00 |
| instance n=20 225.alb | 1 | 1 | Solution | 121.03 | 11 | 0.00 | 100.00 |
| instance n=20 226.alb | 1 | 1 | Solution | 120.98 | 12 | 0.00 | 100.00 |
| instance n=20 227.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 228.alb | 1 | 1 | Solution | 120.55 | 12 | 0.00 | 100.00 |
| instance n=20 229.alb | 1 | 1 | Solution | 120.64 | 12 | 0.00 | 100.00 |
| instance n=20 23.alb | 1 | 1 | Optimal | 30.80 | 13 | 0.00 | 100.00 |
| instance n=20 230.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 231.alb | 1 | 1 | Solution | 120.45 | 12 | 0.00 | 100.00 |
| instance n=20 232.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 233.alb | 1 | 1 | Unknown | 121018.00 | - | - | - |
| instance n=20 234.alb | 1 | 1 | Solution | 121.01 | 12 | 0.00 | 100.00 |
| instance n=20 235.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 236.alb | 1 | 1 | Solution | 120.62 | 10 | 0.00 | 100.00 |
| instance n=20 237.alb | 1 | 1 | Solution | 121.03 | 11 | 0.00 | 100.00 |
| instance n=20 238.alb | 1 | 1 | Solution | 120.83 | 12 | 0.00 | 100.00 |
| instance n=20 239.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 24.alb | 1 | 1 | Optimal | 54.31 | 11 | 0.00 | 100.00 |
| instance n=20 240.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 241.alb | 1 | 1 | Optimal | 3.18 | 13 | 0.00 | 100.00 |
| instance n=20 242.alb | 1 | 1 | Optimal | 2.56 | 12 | 0.00 | 100.00 |
| instance n=20 243.alb | 1 | 1 | Optimal | 60.79 | 10 | 0.00 | 100.00 |
| instance n=20 244.alb | 1 | 1 | Optimal | 13.85 | 11 | 0.00 | 100.00 |
| instance n=20 245.alb | 1 | 1 | Optimal | 5.30 | 13 | 0.00 | 100.00 |
| instance n=20 246.alb | 1 | 1 | Optimal | 9.48 | 13 | 0.00 | 100.00 |
| instance n=20 247.alb | 1 | 1 | Optimal | 23.60 | 11 | 0.00 | 100.00 |
| instance n=20 248.alb | 1 | 1 | Optimal | 24.54 | 11 | 0.00 | 100.00 |
| instance n=20 249.alb | 1 | 1 | Optimal | 14.82 | 13 | 0.00 | 100.00 |
| instance n=20 25.alb | 1 | 1 | Optimal | 18.24 | 11 | 0.00 | 100.00 |
| instance n=20 250.alb | 1 | 1 | Optimal | 17.17 | 10 | 0.00 | 100.00 |
| instance n=20 251.alb | 1 | 1 | Optimal | 12.73 | 12 | 0.00 | 100.00 |
| instance n=20 252.alb | 1 | 1 | Optimal | 13.03 | 11 | 0.00 | 100.00 |
| instance n=20 253.alb | 1 | 1 | Optimal | 5.76 | 13 | 0.00 | 100.00 |
| instance n=20 254.alb | 1 | 1 | Optimal | 8.94 | 12 | 0.00 | 100.00 |
| instance n=20 255.alb | 1 | 1 | Optimal | 4.55 | 13 | 0.00 | 100.00 |
| instance n=20 256.alb | 1 | 1 | Optimal | 2.12 | 14 | 0.00 | 100.00 |
| instance n=20 257.alb | 1 | 1 | Optimal | 17.03 | 10 | 0.00 | 100.00 |
| instance n=20 258.alb | 1 | 1 | Optimal | 6.09 | 13 | 0.00 | 100.00 |
| instance n=20 259.alb | 1 | 1 | Optimal | 7.03 | 13 | 0.00 | 100.00 |
| instance n=20 26.alb | 1 | 1 | Optimal | 20.62 | 12 | 0.00 | 100.00 |
| instance n=20 260.alb | 1 | 1 | Optimal | 3.26 | 12 | 0.00 | 100.00 |
| instance n=20 261.alb | 1 | 1 | Optimal | 3.69 | 12 | 0.00 | 100.00 |
| instance n=20 262.alb | 1 | 1 | Optimal | 20.54 | 11 | 0.00 | 100.00 |
| instance n=20 263.alb | 1 | 1 | Optimal | 17.28 | 12 | 0.00 | 100.00 |
| instance n=20 264.alb | 1 | 1 | Optimal | 16.47 | 12 | 0.00 | 100.00 |
| instance n=20 265.alb | 1 | 1 | Optimal | 12.84 | 12 | 0.00 | 100.00 |
| instance n=20 266.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 267.alb | 1 | 1 | Unknown | 121017.00 | - | - | - |
| instance n=20 268.alb | 1 | 1 | Solution | 120.15 | 9 | 0.00 | 100.00 |
| instance n=20 269.alb | 1 | 1 | Solution | 121.01 | 10 | 0.00 | 100.00 |
| instance n=20 27.alb | 1 | 1 | Optimal | 19.67 | 13 | 0.00 | 100.00 |
| instance n=20 270.alb | 1 | 1 | Solution | 120.26 | 8 | 0.00 | 100.00 |
| instance n=20 271.alb | 1 | 1 | Solution | 120.20 | 6 | 0.00 | 100.00 |
| instance n=20 272.alb | 1 | 1 | Solution | 120.15 | 5 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 273.alb | 1 | 1 | Solution | 121.01 | 10 | 0.00 | 100.00 |
| instance n=20 274.alb | 1 | 1 | Solution | 121.01 | 10 | 0.00 | 100.00 |
| instance n=20 275.alb | 1 | 1 | Solution | 121.02 | 9 | 0.00 | 100.00 |
| instance n=20 276.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 277.alb | 1 | 1 | Solution | 120.19 | 11 | 0.00 | 100.00 |
| instance n=20 278.alb | 1 | 1 | Solution | 120.50 | 10 | 0.00 | 100.00 |
| instance n=20 279.alb | 1 | 1 | Optimal | 85.57 | 6 | 0.00 | 100.00 |
| instance n=20 28.alb | 1 | 1 | Optimal | 37.77 | 12 | 0.00 | 100.00 |
| instance n=20 280.alb | 1 | 1 | Solution | 121.02 | 6 | 0.00 | 100.00 |
| instance n=20 281.alb | 1 | 1 | Solution | 121.03 | 11 | 0.00 | 100.00 |
| instance n=20 282.alb | 1 | 1 | Solution | 120.52 | 10 | 0.00 | 100.00 |
| instance n=20 283.alb | 1 | 1 | Solution | 120.18 | 10 | 0.00 | 100.00 |
| instance n=20 284.alb | 1 | 1 | Solution | 121.04 | 9 | 0.00 | 100.00 |
| instance n=20 285.alb | 1 | 1 | Solution | 120.10 | 10 | 0.00 | 100.00 |
| instance n=20 286.alb | 1 | 1 | Solution | 121.02 | 9 | 0.00 | 100.00 |
| instance n=20 287.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 288.alb | 1 | 1 | Solution | 120.88 | 8 | 0.00 | 100.00 |
| instance n=20 289.alb | 1 | 1 | Solution | 120.57 | 11 | 0.00 | 100.00 |
| instance n=20 29.alb | 1 | 1 | Optimal | 87.95 | 10 | 0.00 | 100.00 |
| instance n=20 290.alb | 1 | 1 | Solution | 120.92 | 8 | 0.00 | 100.00 |
| instance n=20 291.alb | 1 | 1 | Solution | 120.95 | 13 | 0.00 | 100.00 |
| instance n=20 292.alb | 1 | 1 | Solution | 121.01 | 12 | 0.00 | 100.00 |
| instance n=20 293.alb | 1 | 1 | Solution | 120.60 | 12 | 0.00 | 100.00 |
| instance n=20 294.alb | 1 | 1 | Solution | 120.12 | 11 | 0.00 | 100.00 |
| instance n=20 295.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 296.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 297.alb | 1 | 1 | Solution | 120.42 | 12 | 0.00 | 100.00 |
| instance n=20 298.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 299.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 3.alb | 1 | 1 | Solution | 120.51 | 12 | 0.00 | 100.00 |
| instance n=20 30.alb | 1 | 1 | Optimal | 13.60 | 16 | 0.00 | 100.00 |
| instance n=20 300.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 301.alb | 1 | 1 | Solution | 120.77 | 12 | 0.00 | 100.00 |
| instance n=20 302.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 303.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 304.alb | 1 | 1 | Solution | 121.03 | 11 | 0.00 | 100.00 |
| instance n=20 305.alb | 1 | 1 | Solution | 120.15 | 11 | 0.00 | 100.00 |
| instance n=20 306.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 307.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 308.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 309.alb | 1 | 1 | Solution | 120.34 | 12 | 0.00 | 100.00 |
| instance n=20 31.alb | 1 | 1 | Optimal | 28.62 | 12 | 0.00 | 100.00 |
| instance n=20 310.alb | 1 | 1 | Solution | 120.48 | 11 | 0.00 | 100.00 |
| instance n=20 311.alb | 1 | 1 | Unknown | 121028.00 | - | - | - |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 312.alb | 1 | 1 | Solution | 120.28 | 11 | 0.00 | 100.00 |
| instance n=20 313.alb | 1 | 1 | Solution | 120.90 | 13 | 0.00 | 100.00 |
| instance n=20 314.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 315.alb | 1 | 1 | Solution | 120.33 | 12 | 0.00 | 100.00 |
| instance n=20 316.alb | 1 | 1 | Optimal | 94.01 | 10 | 0.00 | 100.00 |
| instance n=20 317.alb | 1 | 1 | Solution | 120.11 | 10 | 0.00 | 100.00 |
| instance n=20 318.alb | 1 | 1 | Optimal | 52.94 | 10 | 0.00 | 100.00 |
| instance n=20 319.alb | 1 | 1 | Optimal | 19.77 | 14 | 0.00 | 100.00 |
| instance n=20 32.alb | 1 | 1 | Optimal | 27.33 | 13 | 0.00 | 100.00 |
| instance n=20 320.alb | 1 | 1 | Optimal | 47.45 | 12 | 0.00 | 100.00 |
| instance n=20 321.alb | 1 | 1 | Optimal | 77.41 | 14 | 0.00 | 100.00 |
| instance n=20 322.alb | 1 | 1 | Optimal | 63.66 | 12 | 0.00 | 100.00 |
| instance n=20 323.alb | 1 | 1 | Optimal | 53.70 | 13 | 0.00 | 100.00 |
| instance n=20 324.alb | 1 | 1 | Solution | 120.12 | 9 | 0.00 | 100.00 |
| instance n=20 325.alb | 1 | 1 | Optimal | 32.40 | 14 | 0.00 | 100.00 |
| instance n=20 326.alb | 1 | 1 | Optimal | 39.25 | 14 | 0.00 | 100.00 |
| instance n=20 327.alb | 1 | 1 | Optimal | 52.29 | 13 | 0.00 | 100.00 |
| instance n=20 328.alb | 1 | 1 | Optimal | 44.57 | 13 | 0.00 | 100.00 |
| instance n=20 329.alb | 1 | 1 | Optimal | 59.99 | 10 | 0.00 | 100.00 |
| instance n=20 33.alb | 1 | 1 | Optimal | 33.23 | 11 | 0.00 | 100.00 |
| instance n=20 330.alb | 1 | 1 | Optimal | 102.15 | 12 | 0.00 | 100.00 |
| instance n=20 331.alb | 1 | 1 | Optimal | 75.67 | 13 | 0.00 | 100.00 |
| instance n=20 332.alb | 1 | 1 | Optimal | 38.67 | 13 | 0.00 | 100.00 |
| instance n=20 333.alb | 1 | 1 | Optimal | 48.36 | 11 | 0.00 | 100.00 |
| instance n=20 334.alb | 1 | 1 | Optimal | 77.27 | 10 | 0.00 | 100.00 |
| instance n=20 335.alb | 1 | 1 | Optimal | 58.23 | 14 | 0.00 | 100.00 |
| instance n=20 336.alb | 1 | 1 | Optimal | 40.40 | 11 | 0.00 | 100.00 |
| instance n=20 337.alb | 1 | 1 | Optimal | 78.22 | 10 | 0.00 | 100.00 |
| instance n=20 338.alb | 1 | 1 | Optimal | 18.83 | 14 | 0.00 | 100.00 |
| instance n=20 339.alb | 1 | 1 | Optimal | 50.80 | 13 | 0.00 | 100.00 |
| instance n=20 34.alb | 1 | 1 | Optimal | 39.09 | 12 | 0.00 | 100.00 |
| instance n=20 340.alb | 1 | 1 | Optimal | 66.27 | 11 | 0.00 | 100.00 |
| instance n=20 341.alb | 1 | 1 | Solution | 120.93 | 11 | 0.00 | 100.00 |
| instance n=20 342.alb | 1 | 1 | Solution | 120.83 | 10 | 0.00 | 100.00 |
| instance n=20 343.alb | 1 | 1 | Solution | 121.01 | 10 | 0.00 | 100.00 |
| instance n=20 344.alb | 1 | 1 | Unknown | 121036.00 | - | - | - |
| instance n=20 345.alb | 1 | 1 | Solution | 120.64 | 12 | 0.00 | 100.00 |
| instance n=20 346.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 347.alb | 1 | 1 | Solution | 121.01 | 10 | 0.00 | 100.00 |
| instance n=20 348.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 349.alb | 1 | 1 | Solution | 121.00 | 10 | 0.00 | 100.00 |
| instance n=20 35.alb | 1 | 1 | Optimal | 22.81 | 12 | 0.00 | 100.00 |
| instance n=20 350.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 351.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 352.alb | 1 | 1 | Solution | 120.84 | 11 | 0.00 | 100.00 |
| instance n=20 353.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 354.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 355.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 356.alb | 1 | 1 | Solution | 120.95 | 11 | 0.00 | 100.00 |
| instance n=20 357.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 358.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 359.alb | 1 | 1 | Solution | 120.39 | 11 | 0.00 | 100.00 |
| instance n=20 36.alb | 1 | 1 | Optimal | 22.13 | 13 | 0.00 | 100.00 |
| instance n=20 360.alb | 1 | 1 | Solution | 121.03 | 10 | 0.00 | 100.00 |
| instance n=20 361.alb | 1 | 1 | Solution | 121.03 | 10 | 0.00 | 100.00 |
| instance n=20 362.alb | 1 | 1 | Solution | 120.49 | 11 | 0.00 | 100.00 |
| instance n=20 363.alb | 1 | 1 | Solution | 120.98 | 10 | 0.00 | 100.00 |
| instance n=20 364.alb | 1 | 1 | Solution | 120.91 | 12 | 0.00 | 100.00 |
| instance n=20 365.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 366.alb | 1 | 1 | Solution | 120.28 | 12 | 0.00 | 100.00 |
| instance n=20 367.alb | 1 | 1 | Solution | 120.36 | 13 | 0.00 | 100.00 |
| instance n=20 368.alb | 1 | 1 | Solution | 120.34 | 11 | 0.00 | 100.00 |
| instance n=20 369.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 37.alb | 1 | 1 | Optimal | 31.56 | 12 | 0.00 | 100.00 |
| instance n=20 370.alb | 1 | 1 | Solution | 120.21 | 12 | 0.00 | 100.00 |
| instance n=20 371.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 372.alb | 1 | 1 | Solution | 120.23 | 13 | 0.00 | 100.00 |
| instance n=20 373.alb | 1 | 1 | Solution | 120.76 | 12 | 0.00 | 100.00 |
| instance n=20 374.alb | 1 | 1 | Solution | 121.02 | 13 | 0.00 | 100.00 |
| instance n=20 375.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 376.alb | 1 | 1 | Solution | 120.28 | 12 | 0.00 | 100.00 |
| instance n=20 377.alb | 1 | 1 | Solution | 121.01 | 13 | 0.00 | 100.00 |
| instance n=20 378.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 379.alb | 1 | 1 | Solution | 120.45 | 12 | 0.00 | 100.00 |
| instance n=20 38.alb | 1 | 1 | Optimal | 33.63 | 12 | 0.00 | 100.00 |
| instance n=20 380.alb | 1 | 1 | Solution | 120.11 | 13 | 0.00 | 100.00 |
| instance n=20 381.alb | 1 | 1 | Solution | 120.12 | 13 | 0.00 | 100.00 |
| instance n=20 382.alb | 1 | 1 | Unknown | 121016.00 | - | - | - |
| instance n=20 383.alb | 1 | 1 | Solution | 121.02 | 13 | 0.00 | 100.00 |
| instance n=20 384.alb | 1 | 1 | Solution | 120.94 | 12 | 0.00 | 100.00 |
| instance n=20 385.alb | 1 | 1 | Solution | 120.77 | 12 | 0.00 | 100.00 |
| instance n=20 386.alb | 1 | 1 | Solution | 120.13 | 12 | 0.00 | 100.00 |
| instance n=20 387.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 388.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 389.alb | 1 | 1 | Solution | 120.68 | 12 | 0.00 | 100.00 |
| instance n=20 39.alb | 1 | 1 | Optimal | 24.09 | 13 | 0.00 | 100.00 |
| instance n=20 390.alb | 1 | 1 | Solution | 120.33 | 13 | 0.00 | 100.00 |
| instance n=20 391.alb | 1 | 1 | Optimal | 21.72 | 11 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 392.alb | 1 | 1 | Optimal | 8.29 | 14 | 0.00 | 100.00 |
| instance n=20 393.alb | 1 | 1 | Optimal | 16.75 | 11 | 0.00 | 100.00 |
| instance n=20 394.alb | 1 | 1 | Optimal | 20.11 | 12 | 0.00 | 100.00 |
| instance n=20 395.alb | 1 | 1 | Optimal | 16.98 | 12 | 0.00 | 100.00 |
| instance n=20 396.alb | 1 | 1 | Optimal | 19.57 | 13 | 0.00 | 100.00 |
| instance n=20 397.alb | 1 | 1 | Optimal | 31.90 | 10 | 0.00 | 100.00 |
| instance n=20 398.alb | 1 | 1 | Optimal | 31.70 | 11 | 0.00 | 100.00 |
| instance n=20 399.alb | 1 | 1 | Optimal | 6.39 | 13 | 0.00 | 100.00 |
| instance n=20 4.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 40.alb | 1 | 1 | Optimal | 33.51 | 12 | 0.00 | 100.00 |
| instance n=20 400.alb | 1 | 1 | Optimal | 26.79 | 12 | 0.00 | 100.00 |
| instance n=20 401.alb | 1 | 1 | Optimal | 13.15 | 12 | 0.00 | 100.00 |
| instance n=20 402.alb | 1 | 1 | Optimal | 24.82 | 12 | 0.00 | 100.00 |
| instance n=20 403.alb | 1 | 1 | Optimal | 14.34 | 12 | 0.00 | 100.00 |
| instance n=20 404.alb | 1 | 1 | Optimal | 56.92 | 10 | 0.00 | 100.00 |
| instance n=20 405.alb | 1 | 1 | Optimal | 22.83 | 12 | 0.00 | 100.00 |
| instance n=20 406.alb | 1 | 1 | Optimal | 12.78 | 14 | 0.00 | 100.00 |
| instance n=20 407.alb | 1 | 1 | Optimal | 47.83 | 10 | 0.00 | 100.00 |
| instance n=20 408.alb | 1 | 1 | Optimal | 9.96 | 14 | 0.00 | 100.00 |
| instance n=20 409.alb | 1 | 1 | Optimal | 20.44 | 12 | 0.00 | 100.00 |
| instance n=20 41.alb | 1 | 1 | Solution | 120.12 | 9 | 0.00 | 100.00 |
| instance n=20 410.alb | 1 | 1 | Optimal | 31.82 | 11 | 0.00 | 100.00 |
| instance n=20 411.alb | 1 | 1 | Optimal | 6.31 | 15 | 0.00 | 100.00 |
| instance n=20 412.alb | 1 | 1 | Optimal | 32.78 | 11 | 0.00 | 100.00 |
| instance n=20 413.alb | 1 | 1 | Optimal | 32.70 | 10 | 0.00 | 100.00 |
| instance n=20 414.alb | 1 | 1 | Optimal | 19.30 | 12 | 0.00 | 100.00 |
| instance n=20 415.alb | 1 | 1 | Optimal | 47.71 | 10 | 0.00 | 100.00 |
| instance n=20 416.alb | 1 | 1 | Solution | 120.88 | 11 | 0.00 | 100.00 |
| instance n=20 417.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 418.alb | 1 | 1 | Solution | 120.37 | 8 | 0.00 | 100.00 |
| instance n=20 419.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 42.alb | 1 | 1 | Solution | 120.57 | 11 | 0.00 | 100.00 |
| instance n=20 420.alb | 1 | 1 | Solution | 120.45 | 11 | 0.00 | 100.00 |
| instance n=20 421.alb | 1 | 1 | Solution | 120.14 | 11 | 0.00 | 100.00 |
| instance n=20 422.alb | 1 | 1 | Solution | 120.40 | 11 | 0.00 | 100.00 |
| instance n=20 423.alb | 1 | 1 | Solution | 121.01 | 10 | 0.00 | 100.00 |
| instance n=20 424.alb | 1 | 1 | Solution | 120.40 | 10 | 0.00 | 100.00 |
| instance n=20 425.alb | 1 | 1 | Solution | 120.11 | 7 | 0.00 | 100.00 |
| instance n=20 426.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 427.alb | 1 | 1 | Solution | 121.03 | 7 | 0.00 | 100.00 |
| instance n=20 428.alb | 1 | 1 | Solution | 120.26 | 9 | 0.00 | 100.00 |
| instance n=20 429.alb | 1 | 1 | Solution | 120.85 | 10 | 0.00 | 100.00 |
| instance n=20 43.alb | 1 | 1 | Solution | 120.25 | 10 | 0.00 | 100.00 |
| instance n=20 430.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 431.alb | 1 | 1 | Optimal | 112.69 | 6 | 0.00 | 100.00 |
| instance n=20 432.alb | 1 | 1 | Solution | 120.16 | 9 | 0.00 | 100.00 |
| instance n=20 433.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 434.alb | 1 | 1 | Solution | 120.80 | 11 | 0.00 | 100.00 |
| instance n=20 435.alb | 1 | 1 | Solution | 120.13 | 8 | 0.00 | 100.00 |
| instance n=20 436.alb | 1 | 1 | Solution | 120.48 | 10 | 0.00 | 100.00 |
| instance n=20 437.alb | 1 | 1 | Solution | 120.11 | 10 | 0.00 | 100.00 |
| instance n=20 438.alb | 1 | 1 | Solution | 120.92 | 10 | 0.00 | 100.00 |
| instance n=20 439.alb | 1 | 1 | Solution | 120.72 | 9 | 0.00 | 100.00 |
| instance n=20 44.alb | 1 | 1 | Solution | 120.27 | 9 | 0.00 | 100.00 |
| instance n=20 440.alb | 1 | 1 | Solution | 121.03 | 10 | 0.00 | 100.00 |
| instance n=20 441.alb | 1 | 1 | Solution | 120.29 | 10 | 0.00 | 100.00 |
| instance n=20 442.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 443.alb | 1 | 1 | Solution | 120.97 | 13 | 0.00 | 100.00 |
| instance n=20 444.alb | 1 | 1 | Solution | 120.19 | 9 | 0.00 | 100.00 |
| instance n=20 445.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 446.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 447.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 448.alb | 1 | 1 | Solution | 121.02 | 8 | 0.00 | 100.00 |
| instance n=20 449.alb | 1 | 1 | Unknown | 121021.00 | - | - | - |
| instance n=20 45.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 450.alb | 1 | 1 | Solution | 120.13 | 11 | 0.00 | 100.00 |
| instance n=20 451.alb | 1 | 1 | Solution | 120.82 | 11 | 0.00 | 100.00 |
| instance n=20 452.alb | 1 | 1 | Solution | 121.03 | 11 | 0.00 | 100.00 |
| instance n=20 453.alb | 1 | 1 | Solution | 120.28 | 9 | 0.00 | 100.00 |
| instance n=20 454.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 455.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 456.alb | 1 | 1 | Solution | 120.30 | 5 | 0.00 | 100.00 |
| instance n=20 457.alb | 1 | 1 | Solution | 121.03 | 10 | 0.00 | 100.00 |
| instance n=20 458.alb | 1 | 1 | Solution | 120.54 | 11 | 0.00 | 100.00 |
| instance n=20 459.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 46.alb | 1 | 1 | Unknown | 121016.00 | - | - | - |
| instance n=20 460.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 461.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 462.alb | 1 | 1 | Solution | 120.74 | 10 | 0.00 | 100.00 |
| instance n=20 463.alb | 1 | 1 | Solution | 120.11 | 10 | 0.00 | 100.00 |
| instance n=20 464.alb | 1 | 1 | Solution | 120.09 | 9 | 0.00 | 100.00 |
| instance n=20 465.alb | 1 | 1 | Unknown | 121013.00 | - | - | - |
| instance n=20 466.alb | 1 | 1 | Optimal | 13.01 | 13 | 0.00 | 100.00 |
| instance n=20 467.alb | 1 | 1 | Optimal | 7.02 | 14 | 0.00 | 100.00 |
| instance n=20 468.alb | 1 | 1 | Optimal | 8.82 | 13 | 0.00 | 100.00 |
| instance n=20 469.alb | 1 | 1 | Optimal | 1.08 | 14 | 0.00 | 100.00 |
| instance n=20 47.alb | 1 | 1 | Solution | 120.16 | 11 | 0.00 | 100.00 |
| instance n=20 470.alb | 1 | 1 | Optimal | 6.26 | 12 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 471.alb | 1 | 1 | Optimal | 10.25 | 12 | 0.00 | 100.00 |
| instance n=20 472.alb | 1 | 1 | Optimal | 6.44 | 13 | 0.00 | 100.00 |
| instance n=20 473.alb | 1 | 1 | Optimal | 18.78 | 10 | 0.00 | 100.00 |
| instance n=20 474.alb | 1 | 1 | Optimal | 8.35 | 14 | 0.00 | 100.00 |
| instance n=20 475.alb | 1 | 1 | Optimal | 7.56 | 11 | 0.00 | 100.00 |
| instance n=20 476.alb | 1 | 1 | Optimal | 13.65 | 11 | 0.00 | 100.00 |
| instance n=20 477.alb | 1 | 1 | Optimal | 10.72 | 11 | 0.00 | 100.00 |
| instance n=20 478.alb | 1 | 1 | Optimal | 13.64 | 12 | 0.00 | 100.00 |
| instance n=20 479.alb | 1 | 1 | Optimal | 4.30 | 13 | 0.00 | 100.00 |
| instance n=20 48.alb | 1 | 1 | Solution | 120.13 | 10 | 0.00 | 100.00 |
| instance n=20 480.alb | 1 | 1 | Optimal | 8.76 | 13 | 0.00 | 100.00 |
| instance n=20 481.alb | 1 | 1 | Optimal | 3.62 | 13 | 0.00 | 100.00 |
| instance n=20 482.alb | 1 | 1 | Optimal | 3.99 | 13 | 0.00 | 100.00 |
| instance n=20 483.alb | 1 | 1 | Optimal | 11.48 | 12 | 0.00 | 100.00 |
| instance n=20 484.alb | 1 | 1 | Optimal | 4.37 | 13 | 0.00 | 100.00 |
| instance n=20 485.alb | 1 | 1 | Optimal | 6.95 | 15 | 0.00 | 100.00 |
| instance n=20 486.alb | 1 | 1 | Optimal | 10.61 | 11 | 0.00 | 100.00 |
| instance n=20 487.alb | 1 | 1 | Optimal | 8.67 | 12 | 0.00 | 100.00 |
| instance n=20 488.alb | 1 | 1 | Optimal | 2.72 | 15 | 0.00 | 100.00 |
| instance n=20 489.alb | 1 | 1 | Optimal | 7.87 | 12 | 0.00 | 100.00 |
| instance n=20 49.alb | 1 | 1 | Solution | 120.26 | 11 | 0.00 | 100.00 |
| instance n=20 490.alb | 1 | 1 | Optimal | 6.38 | 12 | 0.00 | 100.00 |
| instance n=20 491.alb | 1 | 1 | Optimal | 76.12 | 6 | 0.00 | 100.00 |
| instance n=20 492.alb | 1 | 1 | Optimal | 47.61 | 5 | 0.00 | 100.00 |
| instance n=20 493.alb | 1 | 1 | Solution | 120.11 | 5 | 0.00 | 100.00 |
| instance n=20 494.alb | 1 | 1 | Solution | 120.17 | 7 | 0.00 | 100.00 |
| instance n=20 495.alb | 1 | 1 | Optimal | 110.95 | 6 | 0.00 | 100.00 |
| instance n=20 496.alb | 1 | 1 | Solution | 120.45 | 7 | 0.00 | 100.00 |
| instance n=20 497.alb | 1 | 1 | Optimal | 75.10 | 6 | 0.00 | 100.00 |
| instance n=20 498.alb | 1 | 1 | Optimal | 74.54 | 6 | 0.00 | 100.00 |
| instance n=20 499.alb | 1 | 1 | Optimal | 102.72 | 5 | 0.00 | 100.00 |
| instance n=20 5.alb | 1 | 1 | Solution | 121.00 | 12 | 0.00 | 100.00 |
| instance n=20 50.alb | 1 | 1 | Solution | 120.78 | 11 | 0.00 | 100.00 |
| instance n=20 500.alb | 1 | 1 | Optimal | 38.36 | 8 | 0.00 | 100.00 |
| instance n=20 501.alb | 1 | 1 | Optimal | 105.62 | 5 | 0.00 | 100.00 |
| instance n=20 502.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 503.alb | 1 | 1 | Solution | 121.02 | 7 | 0.00 | 100.00 |
| instance n=20 504.alb | 1 | 1 | Optimal | 102.12 | 6 | 0.00 | 100.00 |
| instance n=20 505.alb | 1 | 1 | Optimal | 90.43 | 6 | 0.00 | 100.00 |
| instance n=20 506.alb | 1 | 1 | Solution | 121.02 | 6 | 0.00 | 100.00 |
| instance n=20 507.alb | 1 | 1 | Optimal | 26.70 | 5 | 0.00 | 100.00 |
| instance n=20 508.alb | 1 | 1 | Solution | 120.28 | 6 | 0.00 | 100.00 |
| instance n=20 509.alb | 1 | 1 | Solution | 120.32 | 7 | 0.00 | 100.00 |
| instance n=20 51.alb | 1 | 1 | Solution | 120.42 | 10 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 510.alb | 1 | 1 | Solution | 120.27 | 6 | 0.00 | 100.00 |
| instance n=20 511.alb | 1 | 1 | Optimal | 37.11 | 5 | 0.00 | 100.00 |
| instance n=20 512.alb | 1 | 1 | Optimal | 113.16 | 5 | 0.00 | 100.00 |
| instance n=20 513.alb | 1 | 1 | Solution | 121.01 | 8 | 0.00 | 100.00 |
| instance n=20 514.alb | 1 | 1 | Solution | 120.92 | 5 | 0.00 | 100.00 |
| instance n=20 515.alb | 1 | 1 | Optimal | 72.34 | 6 | 0.00 | 100.00 |
| instance n=20 516.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 517.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 518.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 519.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 52.alb | 1 | 1 | Solution | 120.51 | 11 | 0.00 | 100.00 |
| instance n=20 520.alb | 1 | 1 | Solution | 121.01 | 12 | 0.00 | 100.00 |
| instance n=20 521.alb | 1 | 1 | Solution | 120.72 | 11 | 0.00 | 100.00 |
| instance n=20 522.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 523.alb | 1 | 1 | Solution | 120.29 | 11 | 0.00 | 100.00 |
| instance n=20 524.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 525.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 53.alb | 1 | 1 | Solution | 120.12 | 11 | 0.00 | 100.00 |
| instance n=20 54.alb | 1 | 1 | Solution | 120.37 | 10 | 0.00 | 100.00 |
| instance n=20 55.alb | 1 | 1 | Solution | 120.84 | 11 | 0.00 | 100.00 |
| instance n=20 56.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 57.alb | 1 | 1 | Solution | 121.03 | 11 | 0.00 | 100.00 |
| instance n=20 58.alb | 1 | 1 | Solution | 120.23 | 10 | 0.00 | 100.00 |
| instance n=20 59.alb | 1 | 1 | Solution | 120.75 | 10 | 0.00 | 100.00 |
| instance n=20 6.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 60.alb | 1 | 1 | Solution | 121.03 | 10 | 0.00 | 100.00 |
| instance n=20 61.alb | 1 | 1 | Solution | 121.02 | 9 | 0.00 | 100.00 |
| instance n=20 62.alb | 1 | 1 | Solution | 121.00 | 10 | 0.00 | 100.00 |
| instance n=20 63.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 64.alb | 1 | 1 | Solution | 120.31 | 10 | 0.00 | 100.00 |
| instance n=20 65.alb | 1 | 1 | Solution | 121.02 | 10 | 0.00 | 100.00 |
| instance n=20 66.alb | 1 | 1 | Solution | 120.17 | 12 | 0.00 | 100.00 |
| instance n=20 67.alb | 1 | 1 | Solution | 120.30 | 12 | 0.00 | 100.00 |
| instance n=20 68.alb | 1 | 1 | Solution | 120.67 | 11 | 0.00 | 100.00 |
| instance n=20 69.alb | 1 | 1 | Solution | 120.77 | 12 | 0.00 | 100.00 |
| instance n=20 7.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 70.alb | 1 | 1 | Solution | 121.02 | 11 | 0.00 | 100.00 |
| instance n=20 71.alb | 1 | 1 | Solution | 120.19 | 12 | 0.00 | 100.00 |
| instance n=20 72.alb | 1 | 1 | Solution | 120.64 | 12 | 0.00 | 100.00 |
| instance n=20 73.alb | 1 | 1 | Solution | 121.02 | 13 | 0.00 | 100.00 |
| instance n=20 74.alb | 1 | 1 | Solution | 120.21 | 12 | 0.00 | 100.00 |
| instance n=20 75.alb | 1 | 1 | Solution | 120.77 | 12 | 0.00 | 100.00 |
| instance n=20 76.alb | 1 | 1 | Solution | 120.45 | 11 | 0.00 | 100.00 |
| instance n=20 77.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |

Table 6.8: Results for SALBP-1 Problems Alternative (Chuffed)
(525 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 78.alb | 1 | 1 | Solution | 120.59 | 11 | 0.00 | 100.00 |
| instance n=20 79.alb | 1 | 1 | Solution | 120.27 | 11 | 0.00 | 100.00 |
| instance n=20 8.alb | 1 | 1 | Solution | 120.34 | 11 | 0.00 | 100.00 |
| instance n=20 80.alb | 1 | 1 | Solution | 120.49 | 12 | 0.00 | 100.00 |
| instance n=20 81.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 82.alb | 1 | 1 | Solution | 120.13 | 12 | 0.00 | 100.00 |
| instance n=20 83.alb | 1 | 1 | Solution | 120.94 | 11 | 0.00 | 100.00 |
| instance n=20 84.alb | 1 | 1 | Solution | 120.50 | 12 | 0.00 | 100.00 |
| instance n=20 85.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 86.alb | 1 | 1 | Solution | 120.11 | 11 | 0.00 | 100.00 |
| instance n=20 87.alb | 1 | 1 | Solution | 121.02 | 12 | 0.00 | 100.00 |
| instance n=20 88.alb | 1 | 1 | Solution | 121.00 | 12 | 0.00 | 100.00 |
| instance n=20 89.alb | 1 | 1 | Solution | 121.03 | 12 | 0.00 | 100.00 |
| instance n=20 9.alb | 1 | 1 | Solution | 121.01 | 11 | 0.00 | 100.00 |
| instance n=20 90.alb | 1 | 1 | Solution | 120.38 | 12 | 0.00 | 100.00 |
| instance n=20 91.alb | 1 | 1 | Optimal | 36.25 | 11 | 0.00 | 100.00 |
| instance n=20 92.alb | 1 | 1 | Optimal | 19.22 | 11 | 0.00 | 100.00 |
| instance n=20 93.alb | 1 | 1 | Optimal | 16.75 | 13 | 0.00 | 100.00 |
| instance n=20 94.alb | 1 | 1 | Optimal | 40.16 | 10 | 0.00 | 100.00 |
| instance n=20 95.alb | 1 | 1 | Optimal | 26.14 | 12 | 0.00 | 100.00 |
| instance n=20 96.alb | 1 | 1 | Optimal | 29.36 | 10 | 0.00 | 100.00 |
| instance n=20 97.alb | 1 | 1 | Optimal | 11.54 | 15 | 0.00 | 100.00 |
| instance n=20 98.alb | 1 | 1 | Optimal | 14.49 | 13 | 0.00 | 100.00 |
| instance n=20 99.alb | 1 | 1 | Optimal | 18.66 | 12 | 0.00 | 100.00 |

6.6.4 Cplex

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 1.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 10.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 100.alb | 1 | 1 | Solution | 120.04 | 11 | 0.00 | 100.00 |
| instance n=20 101.alb | 1 | 1 | Solution | 120.02 | 13 | 0.00 | 100.00 |
| instance n=20 102.alb | 1 | 1 | Optimal | 3.92 | 13 | 0.00 | 100.00 |
| instance n=20 103.alb | 1 | 1 | Optimal | 16.39 | 12 | 0.00 | 100.00 |
| instance n=20 104.alb | 1 | 1 | Optimal | 2.06 | 11 | 0.00 | 100.00 |
| instance n=20 105.alb | 1 | 1 | Optimal | 26.34 | 12 | 0.00 | 100.00 |
| instance n=20 106.alb | 1 | 1 | Optimal | 12.05 | 10 | 0.00 | 100.00 |
| instance n=20 107.alb | 1 | 1 | Solution | 120.03 | 14 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 108.alb | 1 | 1 | Solution | 120.04 | 15 | 0.00 | 100.00 |
| instance n=20 109.alb | 1 | 1 | Optimal | 4.47 | 12 | 0.00 | 100.00 |
| instance n=20 11.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 110.alb | 1 | 1 | Optimal | 2.03 | 11 | 0.00 | 100.00 |
| instance n=20 111.alb | 1 | 1 | Optimal | 4.45 | 13 | 0.00 | 100.00 |
| instance n=20 112.alb | 1 | 1 | Optimal | 3.47 | 11 | 0.00 | 100.00 |
| instance n=20 113.alb | 1 | 1 | Optimal | 8.33 | 12 | 0.00 | 100.00 |
| instance n=20 114.alb | 1 | 1 | Optimal | 46.44 | 13 | 0.00 | 100.00 |
| instance n=20 115.alb | 1 | 1 | Optimal | 7.57 | 11 | 0.00 | 100.00 |
| instance n=20 116.alb | 1 | 1 | Optimal | 53.33 | 5 | 0.00 | 100.00 |
| instance n=20 117.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 118.alb | 1 | 1 | Optimal | 5.14 | 5 | 0.00 | 100.00 |
| instance n=20 119.alb | 1 | 1 | Optimal | 1.42 | 6 | 0.00 | 100.00 |
| instance n=20 12.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 120.alb | 1 | 1 | Optimal | 7.69 | 6 | 0.00 | 100.00 |
| instance n=20 121.alb | 1 | 1 | Optimal | 88.61 | 5 | 0.00 | 100.00 |
| instance n=20 122.alb | 1 | 1 | Optimal | 3.49 | 6 | 0.00 | 100.00 |
| instance n=20 123.alb | 1 | 1 | Optimal | 7.72 | 5 | 0.00 | 100.00 |
| instance n=20 124.alb | 1 | 1 | Optimal | 6.09 | 5 | 0.00 | 100.00 |
| instance n=20 125.alb | 1 | 1 | Optimal | 14.03 | 5 | 0.00 | 100.00 |
| instance n=20 126.alb | 1 | 1 | Optimal | 1.45 | 5 | 0.00 | 100.00 |
| instance n=20 127.alb | 1 | 1 | Optimal | 27.99 | 4 | 0.00 | 100.00 |
| instance n=20 128.alb | 1 | 1 | Optimal | 73.10 | 5 | 0.00 | 100.00 |
| instance n=20 129.alb | 1 | 1 | Optimal | 2.89 | 5 | 0.00 | 100.00 |
| instance n=20 13.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 130.alb | 1 | 1 | Optimal | 2.83 | 6 | 0.00 | 100.00 |
| instance n=20 131.alb | 1 | 1 | Optimal | 1.28 | 7 | 0.00 | 100.00 |
| instance n=20 132.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 133.alb | 1 | 1 | Optimal | 21.50 | 5 | 0.00 | 100.00 |
| instance n=20 134.alb | 1 | 1 | Optimal | 13.06 | 6 | 0.00 | 100.00 |
| instance n=20 135.alb | 1 | 1 | Optimal | 5.24 | 6 | 0.00 | 100.00 |
| instance n=20 136.alb | 1 | 1 | Optimal | 2.00 | 6 | 0.00 | 100.00 |
| instance n=20 137.alb | 1 | 1 | Optimal | 1.59 | 5 | 0.00 | 100.00 |
| instance n=20 138.alb | 1 | 1 | Optimal | 6.42 | 5 | 0.00 | 100.00 |
| instance n=20 139.alb | 1 | 1 | Optimal | 9.35 | 5 | 0.00 | 100.00 |
| instance n=20 14.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 140.alb | 1 | 1 | Optimal | 80.24 | 5 | 0.00 | 100.00 |
| instance n=20 141.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 142.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 143.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 144.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 145.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 146.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 147.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 148.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 149.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 15.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 150.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 151.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 152.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 153.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 154.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 155.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 156.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 157.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 158.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 159.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 16.alb | 1 | 1 | Optimal | 45.22 | 12 | 0.00 | 100.00 |
| instance n=20 160.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 161.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 162.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 163.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 164.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 165.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 166.alb | 1 | 1 | Solution | 120.02 | 12 | 0.00 | 100.00 |
| instance n=20 167.alb | 1 | 1 | Solution | 120.03 | 11 | 0.00 | 100.00 |
| instance n=20 168.alb | 1 | 1 | Optimal | 49.28 | 10 | 0.00 | 100.00 |
| instance n=20 169.alb | 1 | 1 | Optimal | 117.94 | 11 | 0.00 | 100.00 |
| instance n=20 17.alb | 1 | 1 | Solution | 120.03 | 10 | 0.00 | 100.00 |
| instance n=20 170.alb | 1 | 1 | Solution | 120.05 | 11 | 0.00 | 100.00 |
| instance n=20 171.alb | 1 | 1 | Solution | 120.03 | 13 | 0.00 | 100.00 |
| instance n=20 172.alb | 1 | 1 | Optimal | 38.45 | 11 | 0.00 | 100.00 |
| instance n=20 173.alb | 1 | 1 | Solution | 120.05 | 11 | 0.00 | 100.00 |
| instance n=20 174.alb | 1 | 1 | Optimal | 90.54 | 12 | 0.00 | 100.00 |
| instance n=20 175.alb | 1 | 1 | Optimal | 14.02 | 10 | 0.00 | 100.00 |
| instance n=20 176.alb | 1 | 1 | Optimal | 45.53 | 11 | 0.00 | 100.00 |
| instance n=20 177.alb | 1 | 1 | Solution | 120.04 | 10 | 0.00 | 100.00 |
| instance n=20 178.alb | 1 | 1 | Optimal | 37.48 | 11 | 0.00 | 100.00 |
| instance n=20 179.alb | 1 | 1 | Solution | 120.03 | 11 | 0.00 | 100.00 |
| instance n=20 18.alb | 1 | 1 | Optimal | 74.25 | 11 | 0.00 | 100.00 |
| instance n=20 180.alb | 1 | 1 | Solution | 120.04 | 13 | 0.00 | 100.00 |
| instance n=20 181.alb | 1 | 1 | Optimal | 27.41 | 11 | 0.00 | 100.00 |
| instance n=20 182.alb | 1 | 1 | Solution | 120.03 | 11 | 0.00 | 100.00 |
| instance n=20 183.alb | 1 | 1 | Solution | 120.04 | 13 | 0.00 | 100.00 |
| instance n=20 184.alb | 1 | 1 | Solution | 120.04 | 12 | 0.00 | 100.00 |
| instance n=20 185.alb | 1 | 1 | Solution | 120.03 | 15 | 0.00 | 100.00 |
| instance n=20 186.alb | 1 | 1 | Solution | 120.04 | 14 | 0.00 | 100.00 |
| instance n=20 187.alb | 1 | 1 | Optimal | 5.15 | 10 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 188.alb | 1 | 1 | Optimal | 102.74 | 11 | 0.00 | 100.00 |
| instance n=20 189.alb | 1 | 1 | Solution | 120.03 | 13 | 0.00 | 100.00 |
| instance n=20 19.alb | 1 | 1 | Solution | 120.02 | 14 | 0.00 | 100.00 |
| instance n=20 190.alb | 1 | 1 | Solution | 120.05 | 15 | 0.00 | 100.00 |
| instance n=20 191.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 192.alb | 1 | 1 | Optimal | 66.43 | 5 | 0.00 | 100.00 |
| instance n=20 193.alb | 1 | 1 | Solution | 120.02 | 5 | 0.00 | 100.00 |
| instance n=20 194.alb | 1 | 1 | Optimal | 51.86 | 6 | 0.00 | 100.00 |
| instance n=20 195.alb | 1 | 1 | Solution | 120.04 | 6 | 0.00 | 100.00 |
| instance n=20 196.alb | 1 | 1 | Solution | 120.02 | 5 | 0.00 | 100.00 |
| instance n=20 197.alb | 1 | 1 | Optimal | 95.90 | 4 | 0.00 | 100.00 |
| instance n=20 198.alb | 1 | 1 | Optimal | 47.37 | 6 | 0.00 | 100.00 |
| instance n=20 199.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 2.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 20.alb | 1 | 1 | Solution | 120.03 | 11 | 0.00 | 100.00 |
| instance n=20 200.alb | 1 | 1 | Optimal | 51.89 | 6 | 0.00 | 100.00 |
| instance n=20 201.alb | 1 | 1 | Solution | 120.03 | 6 | 0.00 | 100.00 |
| instance n=20 202.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 203.alb | 1 | 1 | Solution | 120.04 | 4 | 0.00 | 100.00 |
| instance n=20 204.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 205.alb | 1 | 1 | Solution | 120.03 | 6 | 0.00 | 100.00 |
| instance n=20 206.alb | 1 | 1 | Optimal | 41.26 | 5 | 0.00 | 100.00 |
| instance n=20 207.alb | 1 | 1 | Optimal | 43.53 | 6 | 0.00 | 100.00 |
| instance n=20 208.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 209.alb | 1 | 1 | Solution | 120.04 | 4 | 0.00 | 100.00 |
| instance n=20 21.alb | 1 | 1 | Solution | 120.05 | 14 | 0.00 | 100.00 |
| instance n=20 210.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 211.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 212.alb | 1 | 1 | Optimal | 109.32 | 5 | 0.00 | 100.00 |
| instance n=20 213.alb | 1 | 1 | Optimal | 114.33 | 5 | 0.00 | 100.00 |
| instance n=20 214.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 215.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 216.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 217.alb | 1 | 1 | Optimal | 28.60 | 4 | 0.00 | 100.00 |
| instance n=20 218.alb | 1 | 1 | Optimal | 17.56 | 3 | 0.00 | 100.00 |
| instance n=20 219.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 22.alb | 1 | 1 | Solution | 120.04 | 12 | 0.00 | 100.00 |
| instance n=20 220.alb | 1 | 1 | Optimal | 84.78 | 3 | 0.00 | 100.00 |
| instance n=20 221.alb | 1 | 1 | Optimal | 19.28 | 3 | 0.00 | 100.00 |
| instance n=20 222.alb | 1 | 1 | Optimal | 32.96 | 3 | 0.00 | 100.00 |
| instance n=20 223.alb | 1 | 1 | Optimal | 30.98 | 3 | 0.00 | 100.00 |
| instance n=20 224.alb | 1 | 1 | Optimal | 47.45 | 3 | 0.00 | 100.00 |
| instance n=20 225.alb | 1 | 1 | Optimal | 57.04 | 3 | 0.00 | 100.00 |
| instance n=20 226.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 227.alb | 1 | 1 | Optimal | 60.25 | 3 | 0.00 | 100.00 |
| instance n=20 228.alb | 1 | 1 | Solution | 120.05 | 2 | 0.00 | 100.00 |
| instance n=20 229.alb | 1 | 1 | Optimal | 23.15 | 3 | 0.00 | 100.00 |
| instance n=20 23.alb | 1 | 1 | Solution | 120.03 | 13 | 0.00 | 100.00 |
| instance n=20 230.alb | 1 | 1 | Optimal | 57.49 | 3 | 0.00 | 100.00 |
| instance n=20 231.alb | 1 | 1 | Solution | 120.01 | 3 | 0.00 | 100.00 |
| instance n=20 232.alb | 1 | 1 | Optimal | 32.64 | 3 | 0.00 | 100.00 |
| instance n=20 233.alb | 1 | 1 | Optimal | 60.68 | 3 | 0.00 | 100.00 |
| instance n=20 234.alb | 1 | 1 | Optimal | 39.81 | 3 | 0.00 | 100.00 |
| instance n=20 235.alb | 1 | 1 | Optimal | 68.59 | 3 | 0.00 | 100.00 |
| instance n=20 236.alb | 1 | 1 | Optimal | 51.20 | 3 | 0.00 | 100.00 |
| instance n=20 237.alb | 1 | 1 | Optimal | 15.58 | 3 | 0.00 | 100.00 |
| instance n=20 238.alb | 1 | 1 | Optimal | 6.20 | 3 | 0.00 | 100.00 |
| instance n=20 239.alb | 1 | 1 | Optimal | 18.25 | 3 | 0.00 | 100.00 |
| instance n=20 24.alb | 1 | 1 | Solution | 120.03 | 11 | 0.00 | 100.00 |
| instance n=20 240.alb | 1 | 1 | Optimal | 36.93 | 3 | 0.00 | 100.00 |
| instance n=20 241.alb | 1 | 1 | Optimal | 3.13 | 13 | 0.00 | 100.00 |
| instance n=20 242.alb | 1 | 1 | Optimal | 0.92 | 12 | 0.00 | 100.00 |
| instance n=20 243.alb | 1 | 1 | Optimal | 21.28 | 10 | 0.00 | 100.00 |
| instance n=20 244.alb | 1 | 1 | Optimal | 2.05 | 11 | 0.00 | 100.00 |
| instance n=20 245.alb | 1 | 1 | Optimal | 2.98 | 13 | 0.00 | 100.00 |
| instance n=20 246.alb | 1 | 1 | Optimal | 11.53 | 13 | 0.00 | 100.00 |
| instance n=20 247.alb | 1 | 1 | Optimal | 16.26 | 11 | 0.00 | 100.00 |
| instance n=20 248.alb | 1 | 1 | Optimal | 2.76 | 11 | 0.00 | 100.00 |
| instance n=20 249.alb | 1 | 1 | Optimal | 9.09 | 13 | 0.00 | 100.00 |
| instance n=20 25.alb | 1 | 1 | Optimal | 36.53 | 11 | 0.00 | 100.00 |
| instance n=20 250.alb | 1 | 1 | Optimal | 9.09 | 10 | 0.00 | 100.00 |
| instance n=20 251.alb | 1 | 1 | Optimal | 2.09 | 12 | 0.00 | 100.00 |
| instance n=20 252.alb | 1 | 1 | Optimal | 2.53 | 11 | 0.00 | 100.00 |
| instance n=20 253.alb | 1 | 1 | Optimal | 6.97 | 13 | 0.00 | 100.00 |
| instance n=20 254.alb | 1 | 1 | Optimal | 2.12 | 12 | 0.00 | 100.00 |
| instance n=20 255.alb | 1 | 1 | Optimal | 8.86 | 13 | 0.00 | 100.00 |
| instance n=20 256.alb | 1 | 1 | Optimal | 2.45 | 14 | 0.00 | 100.00 |
| instance n=20 257.alb | 1 | 1 | Optimal | 52.13 | 10 | 0.00 | 100.00 |
| instance n=20 258.alb | 1 | 1 | Optimal | 2.07 | 13 | 0.00 | 100.00 |
| instance n=20 259.alb | 1 | 1 | Optimal | 4.31 | 13 | 0.00 | 100.00 |
| instance n=20 26.alb | 1 | 1 | Solution | 120.04 | 12 | 0.00 | 100.00 |
| instance n=20 260.alb | 1 | 1 | Optimal | 13.18 | 12 | 0.00 | 100.00 |
| instance n=20 261.alb | 1 | 1 | Optimal | 1.86 | 12 | 0.00 | 100.00 |
| instance n=20 262.alb | 1 | 1 | Optimal | 1.92 | 11 | 0.00 | 100.00 |
| instance n=20 263.alb | 1 | 1 | Optimal | 2.27 | 12 | 0.00 | 100.00 |
| instance n=20 264.alb | 1 | 1 | Optimal | 15.42 | 12 | 0.00 | 100.00 |
| instance n=20 265.alb | 1 | 1 | Optimal | 2.27 | 12 | 0.00 | 100.00 |
| instance n=20 266.alb | 1 | 1 | Optimal | 2.16 | 5 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 267.alb | 1 | 1 | Optimal | 0.92 | 6 | 0.00 | 100.00 |
| instance n=20 268.alb | 1 | 1 | Optimal | 1.87 | 6 | 0.00 | 100.00 |
| instance n=20 269.alb | 1 | 1 | Optimal | 10.02 | 7 | 0.00 | 100.00 |
| instance n=20 27.alb | 1 | 1 | Solution | 120.04 | 13 | 0.00 | 100.00 |
| instance n=20 270.alb | 1 | 1 | Optimal | 3.14 | 7 | 0.00 | 100.00 |
| instance n=20 271.alb | 1 | 1 | Optimal | 0.93 | 6 | 0.00 | 100.00 |
| instance n=20 272.alb | 1 | 1 | Optimal | 1.53 | 5 | 0.00 | 100.00 |
| instance n=20 273.alb | 1 | 1 | Optimal | 1.57 | 5 | 0.00 | 100.00 |
| instance n=20 274.alb | 1 | 1 | Optimal | 1.77 | 6 | 0.00 | 100.00 |
| instance n=20 275.alb | 1 | 1 | Optimal | 4.30 | 5 | 0.00 | 100.00 |
| instance n=20 276.alb | 1 | 1 | Optimal | 4.41 | 4 | 0.00 | 100.00 |
| instance n=20 277.alb | 1 | 1 | Optimal | 6.43 | 4 | 0.00 | 100.00 |
| instance n=20 278.alb | 1 | 1 | Optimal | 5.13 | 6 | 0.00 | 100.00 |
| instance n=20 279.alb | 1 | 1 | Optimal | 1.85 | 6 | 0.00 | 100.00 |
| instance n=20 28.alb | 1 | 1 | Solution | 120.04 | 12 | 0.00 | 100.00 |
| instance n=20 280.alb | 1 | 1 | Optimal | 3.01 | 5 | 0.00 | 100.00 |
| instance n=20 281.alb | 1 | 1 | Optimal | 11.62 | 4 | 0.00 | 100.00 |
| instance n=20 282.alb | 1 | 1 | Optimal | 6.61 | 4 | 0.00 | 100.00 |
| instance n=20 283.alb | 1 | 1 | Optimal | 4.19 | 5 | 0.00 | 100.00 |
| instance n=20 284.alb | 1 | 1 | Optimal | 2.48 | 5 | 0.00 | 100.00 |
| instance n=20 285.alb | 1 | 1 | Optimal | 5.32 | 5 | 0.00 | 100.00 |
| instance n=20 286.alb | 1 | 1 | Optimal | 1.91 | 5 | 0.00 | 100.00 |
| instance n=20 287.alb | 1 | 1 | Optimal | 4.14 | 5 | 0.00 | 100.00 |
| instance n=20 288.alb | 1 | 1 | Optimal | 2.47 | 6 | 0.00 | 100.00 |
| instance n=20 289.alb | 1 | 1 | Optimal | 4.50 | 5 | 0.00 | 100.00 |
| instance n=20 29.alb | 1 | 1 | Solution | 120.04 | 10 | 0.00 | 100.00 |
| instance n=20 290.alb | 1 | 1 | Optimal | 1.18 | 5 | 0.00 | 100.00 |
| instance n=20 291.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 292.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 293.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 294.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 295.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 296.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 297.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 298.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 299.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 3.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 30.alb | 1 | 1 | Solution | 120.03 | 16 | 0.00 | 100.00 |
| instance n=20 300.alb | 1 | 1 | Solution | 120.01 | 4 | 0.00 | 100.00 |
| instance n=20 301.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 302.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 303.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 304.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 305.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 306.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 307.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 308.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 309.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 31.alb | 1 | 1 | Solution | 120.04 | 12 | 0.00 | 100.00 |
| instance n=20 310.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 311.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 312.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 313.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 314.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 315.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 316.alb | 1 | 1 | Solution | 120.03 | 10 | 0.00 | 100.00 |
| instance n=20 317.alb | 1 | 1 | Solution | 120.04 | 10 | 0.00 | 100.00 |
| instance n=20 318.alb | 1 | 1 | Optimal | 109.73 | 10 | 0.00 | 100.00 |
| instance n=20 319.alb | 1 | 1 | Solution | 120.04 | 14 | 0.00 | 100.00 |
| instance n=20 32.alb | 1 | 1 | Solution | 120.04 | 13 | 0.00 | 100.00 |
| instance n=20 320.alb | 1 | 1 | Optimal | 112.73 | 12 | 0.00 | 100.00 |
| instance n=20 321.alb | 1 | 1 | Solution | 120.04 | 14 | 0.00 | 100.00 |
| instance n=20 322.alb | 1 | 1 | Solution | 120.03 | 12 | 0.00 | 100.00 |
| instance n=20 323.alb | 1 | 1 | Solution | 120.04 | 13 | 0.00 | 100.00 |
| instance n=20 324.alb | 1 | 1 | Solution | 120.04 | 9 | 0.00 | 100.00 |
| instance n=20 325.alb | 1 | 1 | Solution | 120.04 | 14 | 0.00 | 100.00 |
| instance n=20 326.alb | 1 | 1 | Solution | 120.03 | 14 | 0.00 | 100.00 |
| instance n=20 327.alb | 1 | 1 | Solution | 120.03 | 13 | 0.00 | 100.00 |
| instance n=20 328.alb | 1 | 1 | Solution | 120.03 | 13 | 0.00 | 100.00 |
| instance n=20 329.alb | 1 | 1 | Solution | 120.03 | 10 | 0.00 | 100.00 |
| instance n=20 33.alb | 1 | 1 | Optimal | 27.23 | 11 | 0.00 | 100.00 |
| instance n=20 330.alb | 1 | 1 | Solution | 120.04 | 12 | 0.00 | 100.00 |
| instance n=20 331.alb | 1 | 1 | Solution | 120.04 | 13 | 0.00 | 100.00 |
| instance n=20 332.alb | 1 | 1 | Solution | 120.04 | 13 | 0.00 | 100.00 |
| instance n=20 333.alb | 1 | 1 | Optimal | 41.21 | 11 | 0.00 | 100.00 |
| instance n=20 334.alb | 1 | 1 | Solution | 120.03 | 10 | 0.00 | 100.00 |
| instance n=20 335.alb | 1 | 1 | Solution | 120.04 | 14 | 0.00 | 100.00 |
| instance n=20 336.alb | 1 | 1 | Optimal | 32.17 | 11 | 0.00 | 100.00 |
| instance n=20 337.alb | 1 | 1 | Optimal | 81.96 | 10 | 0.00 | 100.00 |
| instance n=20 338.alb | 1 | 1 | Solution | 120.04 | 14 | 0.00 | 100.00 |
| instance n=20 339.alb | 1 | 1 | Solution | 120.03 | 13 | 0.00 | 100.00 |
| instance n=20 34.alb | 1 | 1 | Solution | 120.04 | 12 | 0.00 | 100.00 |
| instance n=20 340.alb | 1 | 1 | Optimal | 84.19 | 11 | 0.00 | 100.00 |
| instance n=20 341.alb | 1 | 1 | Solution | 120.03 | 6 | 0.00 | 100.00 |
| instance n=20 342.alb | 1 | 1 | Solution | 120.04 | 6 | 0.00 | 100.00 |
| instance n=20 343.alb | 1 | 1 | Solution | 120.03 | 6 | 0.00 | 100.00 |
| instance n=20 344.alb | 1 | 1 | Solution | 120.04 | 6 | 0.00 | 100.00 |
| instance n=20 345.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 346.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 347.alb | 1 | 1 | Solution | 120.03 | 6 | 0.00 | 100.00 |
| instance n=20 348.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 349.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 35.alb | 1 | 1 | Optimal | 69.47 | 12 | 0.00 | 100.00 |
| instance n=20 350.alb | 1 | 1 | Solution | 120.06 | 5 | 0.00 | 100.00 |
| instance n=20 351.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 352.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 353.alb | 1 | 1 | Optimal | 58.06 | 6 | 0.00 | 100.00 |
| instance n=20 354.alb | 1 | 1 | Solution | 120.04 | 6 | 0.00 | 100.00 |
| instance n=20 355.alb | 1 | 1 | Solution | 120.05 | 5 | 0.00 | 100.00 |
| instance n=20 356.alb | 1 | 1 | Solution | 120.02 | 5 | 0.00 | 100.00 |
| instance n=20 357.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 358.alb | 1 | 1 | Solution | 120.05 | 4 | 0.00 | 100.00 |
| instance n=20 359.alb | 1 | 1 | Solution | 120.02 | 4 | 0.00 | 100.00 |
| instance n=20 36.alb | 1 | 1 | Optimal | 61.68 | 13 | 0.00 | 100.00 |
| instance n=20 360.alb | 1 | 1 | Solution | 120.04 | 6 | 0.00 | 100.00 |
| instance n=20 361.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 362.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 363.alb | 1 | 1 | Solution | 120.03 | 7 | 0.00 | 100.00 |
| instance n=20 364.alb | 1 | 1 | Solution | 120.02 | 4 | 0.00 | 100.00 |
| instance n=20 365.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 366.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 367.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 368.alb | 1 | 1 | Optimal | 57.62 | 3 | 0.00 | 100.00 |
| instance n=20 369.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 37.alb | 1 | 1 | Solution | 120.04 | 12 | 0.00 | 100.00 |
| instance n=20 370.alb | 1 | 1 | Optimal | 92.47 | 3 | 0.00 | 100.00 |
| instance n=20 371.alb | 1 | 1 | Optimal | 109.61 | 3 | 0.00 | 100.00 |
| instance n=20 372.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 373.alb | 1 | 1 | Solution | 120.05 | 3 | 0.00 | 100.00 |
| instance n=20 374.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 375.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 376.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 377.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 378.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 379.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 38.alb | 1 | 1 | Optimal | 17.94 | 12 | 0.00 | 100.00 |
| instance n=20 380.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 381.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 382.alb | 1 | 1 | Optimal | 28.34 | 4 | 0.00 | 100.00 |
| instance n=20 383.alb | 1 | 1 | Optimal | 104.69 | 3 | 0.00 | 100.00 |
| instance n=20 384.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 385.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 386.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 387.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 388.alb | 1 | 1 | Optimal | 47.41 | 3 | 0.00 | 100.00 |
| instance n=20 389.alb | 1 | 1 | Optimal | 33.53 | 3 | 0.00 | 100.00 |
| instance n=20 39.alb | 1 | 1 | Solution | 120.04 | 13 | 0.00 | 100.00 |
| instance n=20 390.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 391.alb | 1 | 1 | Optimal | 1.66 | 11 | 0.00 | 100.00 |
| instance n=20 392.alb | 1 | 1 | Optimal | 15.49 | 14 | 0.00 | 100.00 |
| instance n=20 393.alb | 1 | 1 | Optimal | 2.20 | 11 | 0.00 | 100.00 |
| instance n=20 394.alb | 1 | 1 | Optimal | 5.89 | 12 | 0.00 | 100.00 |
| instance n=20 395.alb | 1 | 1 | Optimal | 3.13 | 12 | 0.00 | 100.00 |
| instance n=20 396.alb | 1 | 1 | Optimal | 7.57 | 13 | 0.00 | 100.00 |
| instance n=20 397.alb | 1 | 1 | Optimal | 11.91 | 10 | 0.00 | 100.00 |
| instance n=20 398.alb | 1 | 1 | Optimal | 1.72 | 11 | 0.00 | 100.00 |
| instance n=20 399.alb | 1 | 1 | Optimal | 2.61 | 13 | 0.00 | 100.00 |
| instance n=20 4.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 40.alb | 1 | 1 | Solution | 120.03 | 12 | 0.00 | 100.00 |
| instance n=20 400.alb | 1 | 1 | Optimal | 17.42 | 12 | 0.00 | 100.00 |
| instance n=20 401.alb | 1 | 1 | Optimal | 17.61 | 12 | 0.00 | 100.00 |
| instance n=20 402.alb | 1 | 1 | Optimal | 6.33 | 12 | 0.00 | 100.00 |
| instance n=20 403.alb | 1 | 1 | Optimal | 2.96 | 12 | 0.00 | 100.00 |
| instance n=20 404.alb | 1 | 1 | Optimal | 14.61 | 10 | 0.00 | 100.00 |
| instance n=20 405.alb | 1 | 1 | Optimal | 1.94 | 12 | 0.00 | 100.00 |
| instance n=20 406.alb | 1 | 1 | Optimal | 29.91 | 14 | 0.00 | 100.00 |
| instance n=20 407.alb | 1 | 1 | Optimal | 2.82 | 10 | 0.00 | 100.00 |
| instance n=20 408.alb | 1 | 1 | Optimal | 31.09 | 14 | 0.00 | 100.00 |
| instance n=20 409.alb | 1 | 1 | Optimal | 10.23 | 12 | 0.00 | 100.00 |
| instance n=20 41.alb | 1 | 1 | Solution | 120.02 | 6 | 0.00 | 100.00 |
| instance n=20 410.alb | 1 | 1 | Optimal | 7.26 | 11 | 0.00 | 100.00 |
| instance n=20 411.alb | 1 | 1 | Optimal | 40.12 | 15 | 0.00 | 100.00 |
| instance n=20 412.alb | 1 | 1 | Optimal | 2.40 | 11 | 0.00 | 100.00 |
| instance n=20 413.alb | 1 | 1 | Optimal | 1.97 | 10 | 0.00 | 100.00 |
| instance n=20 414.alb | 1 | 1 | Optimal | 33.57 | 12 | 0.00 | 100.00 |
| instance n=20 415.alb | 1 | 1 | Optimal | 14.81 | 10 | 0.00 | 100.00 |
| instance n=20 416.alb | 1 | 1 | Optimal | 2.76 | 6 | 0.00 | 100.00 |
| instance n=20 417.alb | 1 | 1 | Optimal | 13.70 | 5 | 0.00 | 100.00 |
| instance n=20 418.alb | 1 | 1 | Optimal | 1.25 | 6 | 0.00 | 100.00 |
| instance n=20 419.alb | 1 | 1 | Optimal | 51.83 | 4 | 0.00 | 100.00 |
| instance n=20 42.alb | 1 | 1 | Solution | 120.02 | 5 | 0.00 | 100.00 |
| instance n=20 420.alb | 1 | 1 | Optimal | 14.42 | 5 | 0.00 | 100.00 |
| instance n=20 421.alb | 1 | 1 | Optimal | 1.55 | 6 | 0.00 | 100.00 |
| instance n=20 422.alb | 1 | 1 | Optimal | 15.77 | 4 | 0.00 | 100.00 |
| instance n=20 423.alb | 1 | 1 | Optimal | 2.62 | 6 | 0.00 | 100.00 |
| instance n=20 424.alb | 1 | 1 | Optimal | 28.03 | 5 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 425.alb | 1 | 1 | Optimal | 1.38 | 6 | 0.00 | 100.00 |
| instance n=20 426.alb | 1 | 1 | Optimal | 1.25 | 5 | 0.00 | 100.00 |
| instance n=20 427.alb | 1 | 1 | Optimal | 9.16 | 6 | 0.00 | 100.00 |
| instance n=20 428.alb | 1 | 1 | Optimal | 5.19 | 5 | 0.00 | 100.00 |
| instance n=20 429.alb | 1 | 1 | Optimal | 10.86 | 4 | 0.00 | 100.00 |
| instance n=20 43.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 430.alb | 1 | 1 | Optimal | 4.60 | 5 | 0.00 | 100.00 |
| instance n=20 431.alb | 1 | 1 | Optimal | 2.63 | 6 | 0.00 | 100.00 |
| instance n=20 432.alb | 1 | 1 | Optimal | 1.77 | 5 | 0.00 | 100.00 |
| instance n=20 433.alb | 1 | 1 | Optimal | 2.90 | 5 | 0.00 | 100.00 |
| instance n=20 434.alb | 1 | 1 | Optimal | 3.19 | 5 | 0.00 | 100.00 |
| instance n=20 435.alb | 1 | 1 | Optimal | 1.10 | 7 | 0.00 | 100.00 |
| instance n=20 436.alb | 1 | 1 | Optimal | 6.05 | 5 | 0.00 | 100.00 |
| instance n=20 437.alb | 1 | 1 | Optimal | 3.26 | 5 | 0.00 | 100.00 |
| instance n=20 438.alb | 1 | 1 | Optimal | 2.33 | 6 | 0.00 | 100.00 |
| instance n=20 439.alb | 1 | 1 | Optimal | 1.46 | 5 | 0.00 | 100.00 |
| instance n=20 44.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 440.alb | 1 | 1 | Optimal | 4.30 | 5 | 0.00 | 100.00 |
| instance n=20 441.alb | 1 | 1 | Optimal | 0.83 | 3 | 0.00 | 100.00 |
| instance n=20 442.alb | 1 | 1 | Optimal | 1.08 | 3 | 0.00 | 100.00 |
| instance n=20 443.alb | 1 | 1 | Optimal | 0.81 | 3 | 0.00 | 100.00 |
| instance n=20 444.alb | 1 | 1 | Optimal | 1.35 | 3 | 0.00 | 100.00 |
| instance n=20 445.alb | 1 | 1 | Optimal | 0.80 | 3 | 0.00 | 100.00 |
| instance n=20 446.alb | 1 | 1 | Optimal | 0.91 | 3 | 0.00 | 100.00 |
| instance n=20 447.alb | 1 | 1 | Optimal | 0.86 | 3 | 0.00 | 100.00 |
| instance n=20 448.alb | 1 | 1 | Optimal | 0.89 | 3 | 0.00 | 100.00 |
| instance n=20 449.alb | 1 | 1 | Optimal | 1.01 | 3 | 0.00 | 100.00 |
| instance n=20 45.alb | 1 | 1 | Solution | 120.04 | 6 | 0.00 | 100.00 |
| instance n=20 450.alb | 1 | 1 | Optimal | 0.93 | 3 | 0.00 | 100.00 |
| instance n=20 451.alb | 1 | 1 | Optimal | 0.82 | 3 | 0.00 | 100.00 |
| instance n=20 452.alb | 1 | 1 | Optimal | 0.92 | 3 | 0.00 | 100.00 |
| instance n=20 453.alb | 1 | 1 | Optimal | 0.69 | 3 | 0.00 | 100.00 |
| instance n=20 454.alb | 1 | 1 | Optimal | 1.12 | 3 | 0.00 | 100.00 |
| instance n=20 455.alb | 1 | 1 | Optimal | 0.75 | 3 | 0.00 | 100.00 |
| instance n=20 456.alb | 1 | 1 | Optimal | 0.76 | 4 | 0.00 | 100.00 |
| instance n=20 457.alb | 1 | 1 | Optimal | 0.77 | 3 | 0.00 | 100.00 |
| instance n=20 458.alb | 1 | 1 | Optimal | 0.87 | 3 | 0.00 | 100.00 |
| instance n=20 459.alb | 1 | 1 | Optimal | 0.84 | 3 | 0.00 | 100.00 |
| instance n=20 46.alb | 1 | 1 | Solution | 120.02 | 4 | 0.00 | 100.00 |
| instance n=20 460.alb | 1 | 1 | Optimal | 0.83 | 3 | 0.00 | 100.00 |
| instance n=20 461.alb | 1 | 1 | Optimal | 0.67 | 3 | 0.00 | 100.00 |
| instance n=20 462.alb | 1 | 1 | Optimal | 0.72 | 3 | 0.00 | 100.00 |
| instance n=20 463.alb | 1 | 1 | Optimal | 1.25 | 3 | 0.00 | 100.00 |
| instance n=20 464.alb | 1 | 1 | Optimal | 1.23 | 3 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 465.alb | 1 | 1 | Optimal | 0.77 | 3 | 0.00 | 100.00 |
| instance n=20 466.alb | 1 | 1 | Optimal | 0.61 | 13 | 0.00 | 100.00 |
| instance n=20 467.alb | 1 | 1 | Optimal | 0.63 | 14 | 0.00 | 100.00 |
| instance n=20 468.alb | 1 | 1 | Optimal | 0.67 | 13 | 0.00 | 100.00 |
| instance n=20 469.alb | 1 | 1 | Optimal | 0.68 | 14 | 0.00 | 100.00 |
| instance n=20 47.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 470.alb | 1 | 1 | Optimal | 0.64 | 12 | 0.00 | 100.00 |
| instance n=20 471.alb | 1 | 1 | Optimal | 0.67 | 12 | 0.00 | 100.00 |
| instance n=20 472.alb | 1 | 1 | Optimal | 0.74 | 13 | 0.00 | 100.00 |
| instance n=20 473.alb | 1 | 1 | Optimal | 0.64 | 10 | 0.00 | 100.00 |
| instance n=20 474.alb | 1 | 1 | Optimal | 0.78 | 14 | 0.00 | 100.00 |
| instance n=20 475.alb | 1 | 1 | Optimal | 0.65 | 11 | 0.00 | 100.00 |
| instance n=20 476.alb | 1 | 1 | Optimal | 0.70 | 11 | 0.00 | 100.00 |
| instance n=20 477.alb | 1 | 1 | Optimal | 0.76 | 11 | 0.00 | 100.00 |
| instance n=20 478.alb | 1 | 1 | Optimal | 0.63 | 12 | 0.00 | 100.00 |
| instance n=20 479.alb | 1 | 1 | Optimal | 0.61 | 13 | 0.00 | 100.00 |
| instance n=20 48.alb | 1 | 1 | Solution | 120.02 | 5 | 0.00 | 100.00 |
| instance n=20 480.alb | 1 | 1 | Optimal | 0.65 | 13 | 0.00 | 100.00 |
| instance n=20 481.alb | 1 | 1 | Optimal | 0.72 | 13 | 0.00 | 100.00 |
| instance n=20 482.alb | 1 | 1 | Optimal | 0.57 | 13 | 0.00 | 100.00 |
| instance n=20 483.alb | 1 | 1 | Optimal | 0.67 | 12 | 0.00 | 100.00 |
| instance n=20 484.alb | 1 | 1 | Optimal | 0.70 | 13 | 0.00 | 100.00 |
| instance n=20 485.alb | 1 | 1 | Optimal | 1.45 | 15 | 0.00 | 100.00 |
| instance n=20 486.alb | 1 | 1 | Optimal | 0.74 | 11 | 0.00 | 100.00 |
| instance n=20 487.alb | 1 | 1 | Optimal | 0.72 | 12 | 0.00 | 100.00 |
| instance n=20 488.alb | 1 | 1 | Optimal | 0.75 | 15 | 0.00 | 100.00 |
| instance n=20 489.alb | 1 | 1 | Optimal | 0.64 | 12 | 0.00 | 100.00 |
| instance n=20 49.alb | 1 | 1 | Solution | 120.04 | 4 | 0.00 | 100.00 |
| instance n=20 490.alb | 1 | 1 | Optimal | 0.73 | 12 | 0.00 | 100.00 |
| instance n=20 491.alb | 1 | 1 | Optimal | 0.61 | 6 | 0.00 | 100.00 |
| instance n=20 492.alb | 1 | 1 | Optimal | 0.62 | 5 | 0.00 | 100.00 |
| instance n=20 493.alb | 1 | 1 | Optimal | 0.64 | 5 | 0.00 | 100.00 |
| instance n=20 494.alb | 1 | 1 | Optimal | 0.63 | 6 | 0.00 | 100.00 |
| instance n=20 495.alb | 1 | 1 | Optimal | 0.59 | 6 | 0.00 | 100.00 |
| instance n=20 496.alb | 1 | 1 | Optimal | 0.64 | 5 | 0.00 | 100.00 |
| instance n=20 497.alb | 1 | 1 | Optimal | 0.73 | 6 | 0.00 | 100.00 |
| instance n=20 498.alb | 1 | 1 | Optimal | 0.63 | 6 | 0.00 | 100.00 |
| instance n=20 499.alb | 1 | 1 | Optimal | 0.70 | 5 | 0.00 | 100.00 |
| instance n=20 5.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 50.alb | 1 | 1 | Solution | 120.04 | 4 | 0.00 | 100.00 |
| instance n=20 500.alb | 1 | 1 | Optimal | 0.62 | 8 | 0.00 | 100.00 |
| instance n=20 501.alb | 1 | 1 | Optimal | 0.78 | 5 | 0.00 | 100.00 |
| instance n=20 502.alb | 1 | 1 | Optimal | 0.85 | 4 | 0.00 | 100.00 |
| instance n=20 503.alb | 1 | 1 | Optimal | 0.76 | 6 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance n=20 504.alb | 1 | 1 | Optimal | 0.71 | 6 | 0.00 | 100.00 |
| instance n=20 505.alb | 1 | 1 | Optimal | 0.76 | 6 | 0.00 | 100.00 |
| instance n=20 506.alb | 1 | 1 | Optimal | 0.68 | 5 | 0.00 | 100.00 |
| instance n=20 507.alb | 1 | 1 | Optimal | 0.58 | 5 | 0.00 | 100.00 |
| instance n=20 508.alb | 1 | 1 | Optimal | 0.79 | 5 | 0.00 | 100.00 |
| instance n=20 509.alb | 1 | 1 | Optimal | 0.67 | 4 | 0.00 | 100.00 |
| instance n=20 51.alb | 1 | 1 | Solution | 120.02 | 4 | 0.00 | 100.00 |
| instance n=20 510.alb | 1 | 1 | Optimal | 0.62 | 5 | 0.00 | 100.00 |
| instance n=20 511.alb | 1 | 1 | Optimal | 0.73 | 5 | 0.00 | 100.00 |
| instance n=20 512.alb | 1 | 1 | Optimal | 0.68 | 5 | 0.00 | 100.00 |
| instance n=20 513.alb | 1 | 1 | Optimal | 0.76 | 5 | 0.00 | 100.00 |
| instance n=20 514.alb | 1 | 1 | Optimal | 0.62 | 5 | 0.00 | 100.00 |
| instance n=20 515.alb | 1 | 1 | Optimal | 0.63 | 6 | 0.00 | 100.00 |
| instance n=20 516.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 517.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 518.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 519.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 52.alb | 1 | 1 | Solution | 120.04 | 4 | 0.00 | 100.00 |
| instance n=20 520.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 521.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 522.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 523.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 524.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 525.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 53.alb | 1 | 1 | Optimal | 49.46 | 5 | 0.00 | 100.00 |
| instance n=20 54.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 55.alb | 1 | 1 | Solution | 120.04 | 5 | 0.00 | 100.00 |
| instance n=20 56.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 57.alb | 1 | 1 | Solution | 120.04 | 4 | 0.00 | 100.00 |
| instance n=20 58.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 59.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 6.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 60.alb | 1 | 1 | Solution | 120.04 | 6 | 0.00 | 100.00 |
| instance n=20 61.alb | 1 | 1 | Solution | 120.03 | 7 | 0.00 | 100.00 |
| instance n=20 62.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 63.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 64.alb | 1 | 1 | Solution | 120.02 | 5 | 0.00 | 100.00 |
| instance n=20 65.alb | 1 | 1 | Solution | 120.03 | 5 | 0.00 | 100.00 |
| instance n=20 66.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 67.alb | 1 | 1 | Optimal | 60.43 | 3 | 0.00 | 100.00 |
| instance n=20 68.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 69.alb | 1 | 1 | Solution | 120.03 | 2 | 0.00 | 100.00 |
| instance n=20 7.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 70.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=20 71.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 72.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 73.alb | 1 | 1 | Solution | 120.02 | 2 | 0.00 | 100.00 |
| instance n=20 74.alb | 1 | 1 | Optimal | 80.33 | 3 | 0.00 | 100.00 |
| instance n=20 75.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 76.alb | 1 | 1 | Optimal | 74.03 | 3 | 0.00 | 100.00 |
| instance n=20 77.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 78.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 79.alb | 1 | 1 | Optimal | 43.11 | 3 | 0.00 | 100.00 |
| instance n=20 8.alb | 1 | 1 | Solution | 120.02 | 3 | 0.00 | 100.00 |
| instance n=20 80.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 81.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 82.alb | 1 | 1 | Solution | 120.03 | 4 | 0.00 | 100.00 |
| instance n=20 83.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 84.alb | 1 | 1 | Solution | 120.05 | 3 | 0.00 | 100.00 |
| instance n=20 85.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 86.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 87.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 88.alb | 1 | 1 | Solution | 120.03 | 3 | 0.00 | 100.00 |
| instance n=20 89.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 9.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 90.alb | 1 | 1 | Solution | 120.04 | 3 | 0.00 | 100.00 |
| instance n=20 91.alb | 1 | 1 | Optimal | 4.17 | 11 | 0.00 | 100.00 |
| instance n=20 92.alb | 1 | 1 | Optimal | 1.93 | 11 | 0.00 | 100.00 |
| instance n=20 93.alb | 1 | 1 | Optimal | 96.86 | 13 | 0.00 | 100.00 |
| instance n=20 94.alb | 1 | 1 | Optimal | 3.23 | 10 | 0.00 | 100.00 |
| instance n=20 95.alb | 1 | 1 | Optimal | 3.09 | 12 | 0.00 | 100.00 |
| instance n=20 96.alb | 1 | 1 | Optimal | 3.42 | 10 | 0.00 | 100.00 |
| instance n=20 97.alb | 1 | 1 | Solution | 120.02 | 15 | 0.00 | 100.00 |
| instance n=20 98.alb | 1 | 1 | Optimal | 8.14 | 13 | 0.00 | 100.00 |
| instance n=20 99.alb | 1 | 1 | Optimal | 16.26 | 12 | 0.00 | 100.00 |
| instance n=50 1.alb | 1 | 1 | Solution | 120.13 | 8 | 0.00 | 100.00 |
| instance n=50 10.alb | 1 | 1 | Solution | 120.18 | 16 | 0.00 | 100.00 |
| instance n=50 100.alb | 1 | 1 | Unknown | 120764.00 | - | - | - |
| instance n=50 101.alb | 1 | 1 | Unknown | 120242.00 | - | - | - |
| instance n=50 102.alb | 1 | 1 | Unknown | 120208.00 | - | - | - |
| instance n=50 103.alb | 1 | 1 | Unknown | 120273.00 | - | - | - |
| instance n=50 104.alb | 1 | 1 | Unknown | 120315.00 | - | - | - |
| instance n=50 105.alb | 1 | 1 | Unknown | 120141.00 | - | - | - |
| instance n=50 106.alb | 1 | 1 | Unknown | 120180.00 | - | - | - |
| instance n=50 107.alb | 1 | 1 | Unknown | 120160.00 | - | - | - |
| instance n=50 108.alb | 1 | 1 | Unknown | 120172.00 | - | - | - |
| instance n=50 109.alb | 1 | 1 | Unknown | 120157.00 | - | - | - |
| instance n=50 11.alb | 1 | 1 | Solution | 120.19 | 8 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 110.alb | 1 | 1 | Unknown | 120168.00 | - | - | - |
| instance n=50 111.alb | 1 | 1 | Unknown | 120162.00 | - | - | - |
| instance n=50 112.alb | 1 | 1 | Unknown | 120168.00 | - | - | - |
| instance n=50 113.alb | 1 | 1 | Unknown | 120160.00 | - | - | - |
| instance n=50 114.alb | 1 | 1 | Unknown | 120180.00 | - | - | - |
| instance n=50 115.alb | 1 | 1 | Unknown | 120179.00 | - | - | - |
| instance n=50 116.alb | 1 | 1 | Unknown | 120210.00 | - | - | - |
| instance n=50 117.alb | 1 | 1 | Unknown | 120477.00 | - | - | - |
| instance n=50 118.alb | 1 | 1 | Unknown | 120185.00 | - | - | - |
| instance n=50 119.alb | 1 | 1 | Unknown | 120252.00 | - | - | - |
| instance n=50 12.alb | 1 | 1 | Solution | 120.20 | 22 | 0.00 | 100.00 |
| instance n=50 120.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 121.alb | 1 | 1 | Unknown | 120172.00 | - | - | - |
| instance n=50 122.alb | 1 | 1 | Solution | 120.19 | 50 | 0.00 | 100.00 |
| instance n=50 123.alb | 1 | 1 | Unknown | 120170.00 | - | - | - |
| instance n=50 124.alb | 1 | 1 | Unknown | 120260.00 | - | - | - |
| instance n=50 125.alb | 1 | 1 | Unknown | 120131.00 | - | - | - |
| instance n=50 126.alb | 1 | 1 | Unknown | 120158.00 | - | - | - |
| instance n=50 127.alb | 1 | 1 | Solution | 120.26 | 14 | 0.00 | 100.00 |
| instance n=50 128.alb | 1 | 1 | Solution | 120.16 | 13 | 0.00 | 100.00 |
| instance n=50 129.alb | 1 | 1 | Solution | 120.18 | 13 | 0.00 | 100.00 |
| instance n=50 13.alb | 1 | 1 | Solution | 120.18 | 12 | 0.00 | 100.00 |
| instance n=50 130.alb | 1 | 1 | Unknown | 120156.00 | - | - | - |
| instance n=50 131.alb | 1 | 1 | Solution | 120.33 | 12 | 0.00 | 100.00 |
| instance n=50 132.alb | 1 | 1 | Unknown | 120878.00 | - | - | - |
| instance n=50 133.alb | 1 | 1 | Solution | 120.17 | 13 | 0.00 | 100.00 |
| instance n=50 134.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 135.alb | 1 | 1 | Solution | 120.19 | 14 | 0.00 | 100.00 |
| instance n=50 136.alb | 1 | 1 | Unknown | 120153.00 | - | - | - |
| instance n=50 137.alb | 1 | 1 | Unknown | 120167.00 | - | - | - |
| instance n=50 138.alb | 1 | 1 | Solution | 120.14 | 12 | 0.00 | 100.00 |
| instance n=50 139.alb | 1 | 1 | Unknown | 120145.00 | - | - | - |
| instance n=50 14.alb | 1 | 1 | Solution | 120.16 | 8 | 0.00 | 100.00 |
| instance n=50 140.alb | 1 | 1 | Unknown | 120160.00 | - | - | - |
| instance n=50 141.alb | 1 | 1 | Solution | 120.20 | 14 | 0.00 | 100.00 |
| instance n=50 142.alb | 1 | 1 | Unknown | 120167.00 | - | - | - |
| instance n=50 143.alb | 1 | 1 | Solution | 120.42 | 12 | 0.00 | 100.00 |
| instance n=50 144.alb | 1 | 1 | Solution | 120.16 | 14 | 0.00 | 100.00 |
| instance n=50 145.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 146.alb | 1 | 1 | Unknown | 120161.00 | - | - | - |
| instance n=50 147.alb | 1 | 1 | Solution | 120.19 | 15 | 0.00 | 100.00 |
| instance n=50 148.alb | 1 | 1 | Solution | 120.14 | 10 | 0.00 | 100.00 |
| instance n=50 149.alb | 1 | 1 | Unknown | 120168.00 | - | - | - |
| instance n=50 15.alb | 1 | 1 | Unknown | 120645.00 | - | - | - |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 150.alb | 1 | 1 | Unknown | 120181.00 | - | - | - |
| instance n=50 151.alb | 1 | 1 | Unknown | 120187.00 | - | - | - |
| instance n=50 152.alb | 1 | 1 | Unknown | 120182.00 | - | - | - |
| instance n=50 153.alb | 1 | 1 | Unknown | 120157.00 | - | - | - |
| instance n=50 154.alb | 1 | 1 | Solution | 120.18 | 16 | 0.00 | 100.00 |
| instance n=50 155.alb | 1 | 1 | Solution | 121.02 | 8 | 0.00 | 100.00 |
| instance n=50 156.alb | 1 | 1 | Solution | 120.14 | 7 | 0.00 | 100.00 |
| instance n=50 157.alb | 1 | 1 | Unknown | 120239.00 | - | - | - |
| instance n=50 158.alb | 1 | 1 | Solution | 120.16 | 11 | 0.00 | 100.00 |
| instance n=50 159.alb | 1 | 1 | Solution | 120.17 | 8 | 0.00 | 100.00 |
| instance n=50 16.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 160.alb | 1 | 1 | Solution | 120.20 | 23 | 0.00 | 100.00 |
| instance n=50 161.alb | 1 | 1 | Solution | 120.17 | 32 | 0.00 | 100.00 |
| instance n=50 162.alb | 1 | 1 | Unknown | 120165.00 | - | - | - |
| instance n=50 163.alb | 1 | 1 | Unknown | 120161.00 | - | - | - |
| instance n=50 164.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 165.alb | 1 | 1 | Solution | 120.14 | 8 | 0.00 | 100.00 |
| instance n=50 166.alb | 1 | 1 | Solution | 120.19 | 11 | 0.00 | 100.00 |
| instance n=50 167.alb | 1 | 1 | Unknown | 120155.00 | - | - | - |
| instance n=50 168.alb | 1 | 1 | Unknown | 120156.00 | - | - | - |
| instance n=50 169.alb | 1 | 1 | Solution | 120.14 | 9 | 0.00 | 100.00 |
| instance n=50 17.alb | 1 | 1 | Solution | 120.15 | 7 | 0.00 | 100.00 |
| instance n=50 170.alb | 1 | 1 | Unknown | 120185.00 | - | - | - |
| instance n=50 171.alb | 1 | 1 | Unknown | 120156.00 | - | - | - |
| instance n=50 172.alb | 1 | 1 | Solution | 120.15 | 7 | 0.00 | 100.00 |
| instance n=50 173.alb | 1 | 1 | Unknown | 120165.00 | - | - | - |
| instance n=50 174.alb | 1 | 1 | Unknown | 120161.00 | - | - | - |
| instance n=50 175.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 176.alb | 1 | 1 | Solution | 120.24 | 30 | 0.00 | 100.00 |
| instance n=50 177.alb | 1 | 1 | Solution | 121.11 | 41 | 0.00 | 100.00 |
| instance n=50 178.alb | 1 | 1 | Solution | 120.21 | 29 | 0.00 | 100.00 |
| instance n=50 179.alb | 1 | 1 | Solution | 120.18 | 35 | 0.00 | 100.00 |
| instance n=50 18.alb | 1 | 1 | Unknown | 120172.00 | - | - | - |
| instance n=50 180.alb | 1 | 1 | Solution | 120.17 | 30 | 0.00 | 100.00 |
| instance n=50 181.alb | 1 | 1 | Solution | 120.20 | 33 | 0.00 | 100.00 |
| instance n=50 182.alb | 1 | 1 | Unknown | 120231.00 | - | - | - |
| instance n=50 183.alb | 1 | 1 | Solution | 120.18 | 34 | 0.00 | 100.00 |
| instance n=50 184.alb | 1 | 1 | Solution | 120.17 | 42 | 0.00 | 100.00 |
| instance n=50 185.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 186.alb | 1 | 1 | Unknown | 120176.00 | - | - | - |
| instance n=50 187.alb | 1 | 1 | Solution | 120.17 | 29 | 0.00 | 100.00 |
| instance n=50 188.alb | 1 | 1 | Unknown | 120154.00 | - | - | - |
| instance n=50 189.alb | 1 | 1 | Unknown | 120160.00 | - | - | - |
| instance n=50 19.alb | 1 | 1 | Unknown | 120177.00 | - | - | - |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 190.alb | 1 | 1 | Solution | 120.17 | 37 | 0.00 | 100.00 |
| instance n=50 191.alb | 1 | 1 | Solution | 120.53 | 32 | 0.00 | 100.00 |
| instance n=50 192.alb | 1 | 1 | Solution | 120.18 | 33 | 0.00 | 100.00 |
| instance n=50 193.alb | 1 | 1 | Unknown | 120182.00 | - | - | - |
| instance n=50 194.alb | 1 | 1 | Unknown | 120159.00 | - | - | - |
| instance n=50 195.alb | 1 | 1 | Solution | 120.30 | 30 | 0.00 | 100.00 |
| instance n=50 196.alb | 1 | 1 | Unknown | 120759.00 | - | - | - |
| instance n=50 197.alb | 1 | 1 | Solution | 120.16 | 32 | 0.00 | 100.00 |
| instance n=50 198.alb | 1 | 1 | Solution | 121.33 | 35 | 0.00 | 100.00 |
| instance n=50 199.alb | 1 | 1 | Solution | 120.16 | 32 | 0.00 | 100.00 |
| instance n=50 2.alb | 1 | 1 | Unknown | 120176.00 | - | - | - |
| instance n=50 20.alb | 1 | 1 | Unknown | 120180.00 | - | - | - |
| instance n=50 200.alb | 1 | 1 | Solution | 120.17 | 28 | 0.00 | 100.00 |
| instance n=50 201.alb | 1 | 1 | Unknown | 120178.00 | - | - | - |
| instance n=50 202.alb | 1 | 1 | Solution | 120.17 | 18 | 0.00 | 100.00 |
| instance n=50 203.alb | 1 | 1 | Unknown | 120243.00 | - | - | - |
| instance n=50 204.alb | 1 | 1 | Unknown | 120157.00 | - | - | - |
| instance n=50 205.alb | 1 | 1 | Unknown | 120155.00 | - | - | - |
| instance n=50 206.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 207.alb | 1 | 1 | Solution | 120.18 | 11 | 0.00 | 100.00 |
| instance n=50 208.alb | 1 | 1 | Unknown | 120143.00 | - | - | - |
| instance n=50 209.alb | 1 | 1 | Unknown | 120154.00 | - | - | - |
| instance n=50 21.alb | 1 | 1 | Unknown | 120173.00 | - | - | - |
| instance n=50 210.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 211.alb | 1 | 1 | Solution | 120.16 | 13 | 0.00 | 100.00 |
| instance n=50 212.alb | 1 | 1 | Solution | 120.16 | 11 | 0.00 | 100.00 |
| instance n=50 213.alb | 1 | 1 | Solution | 120.15 | 13 | 0.00 | 100.00 |
| instance n=50 214.alb | 1 | 1 | Unknown | 120162.00 | - | - | - |
| instance n=50 215.alb | 1 | 1 | Unknown | 120155.00 | - | - | - |
| instance n=50 216.alb | 1 | 1 | Unknown | 120177.00 | - | - | - |
| instance n=50 217.alb | 1 | 1 | Unknown | 120151.00 | - | - | - |
| instance n=50 218.alb | 1 | 1 | Solution | 120.17 | 13 | 0.00 | 100.00 |
| instance n=50 219.alb | 1 | 1 | Unknown | 120170.00 | - | - | - |
| instance n=50 22.alb | 1 | 1 | Unknown | 120173.00 | - | - | - |
| instance n=50 220.alb | 1 | 1 | Solution | 120.16 | 13 | 0.00 | 100.00 |
| instance n=50 221.alb | 1 | 1 | Unknown | 120202.00 | - | - | - |
| instance n=50 222.alb | 1 | 1 | Unknown | 120167.00 | - | - | - |
| instance n=50 223.alb | 1 | 1 | Unknown | 120164.00 | - | - | - |
| instance n=50 224.alb | 1 | 1 | Solution | 120.19 | 18 | 0.00 | 100.00 |
| instance n=50 225.alb | 1 | 1 | Unknown | 120507.00 | - | - | - |
| instance n=50 226.alb | 1 | 1 | Unknown | 120183.00 | - | - | - |
| instance n=50 227.alb | 1 | 1 | Unknown | 120150.00 | - | - | - |
| instance n=50 228.alb | 1 | 1 | Unknown | 120265.00 | - | - | - |
| instance n=50 229.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 23.alb | 1 | 1 | Unknown | 120194.00 | - | - | - |
| instance n=50 230.alb | 1 | 1 | Unknown | 120148.00 | - | - | - |
| instance n=50 231.alb | 1 | 1 | Solution | 120.12 | 9 | 0.00 | 100.00 |
| instance n=50 232.alb | 1 | 1 | Unknown | 120152.00 | - | - | - |
| instance n=50 233.alb | 1 | 1 | Unknown | 120164.00 | - | - | - |
| instance n=50 234.alb | 1 | 1 | Solution | 120.18 | 10 | 0.00 | 100.00 |
| instance n=50 235.alb | 1 | 1 | Unknown | 120165.00 | - | - | - |
| instance n=50 236.alb | 1 | 1 | Unknown | 120151.00 | - | - | - |
| instance n=50 237.alb | 1 | 1 | Unknown | 120172.00 | - | - | - |
| instance n=50 238.alb | 1 | 1 | Solution | 120.15 | 7 | 0.00 | 100.00 |
| instance n=50 239.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 24.alb | 1 | 1 | Solution | 120.16 | 7 | 0.00 | 100.00 |
| instance n=50 240.alb | 1 | 1 | Unknown | 120182.00 | - | - | - |
| instance n=50 241.alb | 1 | 1 | Unknown | 120265.00 | - | - | - |
| instance n=50 242.alb | 1 | 1 | Solution | 120.25 | 15 | 0.00 | 100.00 |
| instance n=50 243.alb | 1 | 1 | Unknown | 120180.00 | - | - | - |
| instance n=50 244.alb | 1 | 1 | Unknown | 120251.00 | - | - | - |
| instance n=50 245.alb | 1 | 1 | Unknown | 120876.00 | - | - | - |
| instance n=50 246.alb | 1 | 1 | Unknown | 120181.00 | - | - | - |
| instance n=50 247.alb | 1 | 1 | Unknown | 120170.00 | - | - | - |
| instance n=50 248.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 249.alb | 1 | 1 | Solution | 120.17 | 8 | 0.00 | 100.00 |
| instance n=50 25.alb | 1 | 1 | Unknown | 120174.00 | - | - | - |
| instance n=50 250.alb | 1 | 1 | Unknown | 120185.00 | - | - | - |
| instance n=50 251.alb | 1 | 1 | Unknown | 120158.00 | - | - | - |
| instance n=50 252.alb | 1 | 1 | Solution | 120.15 | 37 | 0.00 | 100.00 |
| instance n=50 253.alb | 1 | 1 | Unknown | 120151.00 | - | - | - |
| instance n=50 254.alb | 1 | 1 | Unknown | 120156.00 | - | - | - |
| instance n=50 255.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 256.alb | 1 | 1 | Solution | 120.16 | 50 | 0.00 | 100.00 |
| instance n=50 257.alb | 1 | 1 | Unknown | 120177.00 | - | - | - |
| instance n=50 258.alb | 1 | 1 | Unknown | 120154.00 | - | - | - |
| instance n=50 259.alb | 1 | 1 | Unknown | 120274.00 | - | - | - |
| instance n=50 26.alb | 1 | 1 | Solution | 120.19 | 37 | 0.00 | 100.00 |
| instance n=50 260.alb | 1 | 1 | Solution | 120.19 | 34 | 0.00 | 100.00 |
| instance n=50 261.alb | 1 | 1 | Solution | 120.16 | 28 | 0.00 | 100.00 |
| instance n=50 262.alb | 1 | 1 | Unknown | 120187.00 | - | - | - |
| instance n=50 263.alb | 1 | 1 | Unknown | 120159.00 | - | - | - |
| instance n=50 264.alb | 1 | 1 | Unknown | 120140.00 | - | - | - |
| instance n=50 265.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 266.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 267.alb | 1 | 1 | Unknown | 120196.00 | - | - | - |
| instance n=50 268.alb | 1 | 1 | Solution | 120.16 | 34 | 0.00 | 100.00 |
| instance n=50 269.alb | 1 | 1 | Unknown | 120159.00 | - | - | - |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 27.alb | 1 | 1 | Solution | 120.19 | 33 | 0.00 | 100.00 |
| instance n=50 270.alb | 1 | 1 | Unknown | 120152.00 | - | - | - |
| instance n=50 271.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 272.alb | 1 | 1 | Solution | 120.18 | 42 | 0.00 | 100.00 |
| instance n=50 273.alb | 1 | 1 | Solution | 121.44 | 31 | 0.00 | 100.00 |
| instance n=50 274.alb | 1 | 1 | Solution | 120.21 | 35 | 0.00 | 100.00 |
| instance n=50 275.alb | 1 | 1 | Solution | 120.15 | 30 | 0.00 | 100.00 |
| instance n=50 276.alb | 1 | 1 | Solution | 120.15 | 13 | 0.00 | 100.00 |
| instance n=50 277.alb | 1 | 1 | Solution | 120.18 | 18 | 0.00 | 100.00 |
| instance n=50 278.alb | 1 | 1 | Unknown | 120150.00 | - | - | - |
| instance n=50 279.alb | 1 | 1 | Solution | 120.18 | 11 | 0.00 | 100.00 |
| instance n=50 28.alb | 1 | 1 | Solution | 120.18 | 50 | 0.00 | 100.00 |
| instance n=50 280.alb | 1 | 1 | Solution | 120.27 | 14 | 0.00 | 100.00 |
| instance n=50 281.alb | 1 | 1 | Unknown | 120177.00 | - | - | - |
| instance n=50 282.alb | 1 | 1 | Unknown | 120185.00 | - | - | - |
| instance n=50 283.alb | 1 | 1 | Solution | 120.15 | 50 | 0.00 | 100.00 |
| instance n=50 284.alb | 1 | 1 | Unknown | 120403.00 | - | - | - |
| instance n=50 285.alb | 1 | 1 | Unknown | 120180.00 | - | - | - |
| instance n=50 286.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 287.alb | 1 | 1 | Unknown | 120160.00 | - | - | - |
| instance n=50 288.alb | 1 | 1 | Unknown | 120172.00 | - | - | - |
| instance n=50 289.alb | 1 | 1 | Unknown | 120240.00 | - | - | - |
| instance n=50 29.alb | 1 | 1 | Solution | 121.49 | 33 | 0.00 | 100.00 |
| instance n=50 290.alb | 1 | 1 | Unknown | 120150.00 | - | - | - |
| instance n=50 291.alb | 1 | 1 | Unknown | 120156.00 | - | - | - |
| instance n=50 292.alb | 1 | 1 | Solution | 120.17 | 13 | 0.00 | 100.00 |
| instance n=50 293.alb | 1 | 1 | Solution | 120.15 | 12 | 0.00 | 100.00 |
| instance n=50 294.alb | 1 | 1 | Unknown | 120226.00 | - | - | - |
| instance n=50 295.alb | 1 | 1 | Solution | 120.16 | 16 | 0.00 | 100.00 |
| instance n=50 296.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 297.alb | 1 | 1 | Solution | 120.15 | 14 | 0.00 | 100.00 |
| instance n=50 298.alb | 1 | 1 | Solution | 120.15 | 11 | 0.00 | 100.00 |
| instance n=50 299.alb | 1 | 1 | Unknown | 120150.00 | - | - | - |
| instance n=50 3.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 30.alb | 1 | 1 | Unknown | 120167.00 | - | - | - |
| instance n=50 300.alb | 1 | 1 | Unknown | 120267.00 | - | - | - |
| instance n=50 301.alb | 1 | 1 | Unknown | 120176.00 | - | - | - |
| instance n=50 302.alb | 1 | 1 | Unknown | 120180.00 | - | - | - |
| instance n=50 303.alb | 1 | 1 | Solution | 120.16 | 11 | 0.00 | 100.00 |
| instance n=50 304.alb | 1 | 1 | Solution | 120.17 | 10 | 0.00 | 100.00 |
| instance n=50 305.alb | 1 | 1 | Solution | 120.17 | 29 | 0.00 | 100.00 |
| instance n=50 306.alb | 1 | 1 | Unknown | 120151.00 | - | - | - |
| instance n=50 307.alb | 1 | 1 | Solution | 120.17 | 7 | 0.00 | 100.00 |
| instance n=50 308.alb | 1 | 1 | Solution | 120.18 | 10 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 309.alb | 1 | 1 | Solution | 120.15 | 19 | 0.00 | 100.00 |
| instance n=50 31.alb | 1 | 1 | Solution | 120.19 | 30 | 0.00 | 100.00 |
| instance n=50 310.alb | 1 | 1 | Solution | 120.18 | 11 | 0.00 | 100.00 |
| instance n=50 311.alb | 1 | 1 | Unknown | 120176.00 | - | - | - |
| instance n=50 312.alb | 1 | 1 | Solution | 120.14 | 7 | 0.00 | 100.00 |
| instance n=50 313.alb | 1 | 1 | Solution | 120.16 | 8 | 0.00 | 100.00 |
| instance n=50 314.alb | 1 | 1 | Solution | 121.54 | 50 | 0.00 | 100.00 |
| instance n=50 315.alb | 1 | 1 | Solution | 120.16 | 8 | 0.00 | 100.00 |
| instance n=50 316.alb | 1 | 1 | Solution | 120.21 | 10 | 0.00 | 100.00 |
| instance n=50 317.alb | 1 | 1 | Solution | 120.20 | 7 | 0.00 | 100.00 |
| instance n=50 318.alb | 1 | 1 | Unknown | 120299.00 | - | - | - |
| instance n=50 319.alb | 1 | 1 | Solution | 120.16 | 7 | 0.00 | 100.00 |
| instance n=50 32.alb | 1 | 1 | Unknown | 120207.00 | - | - | - |
| instance n=50 320.alb | 1 | 1 | Solution | 120.15 | 8 | 0.00 | 100.00 |
| instance n=50 321.alb | 1 | 1 | Solution | 120.15 | 6 | 0.00 | 100.00 |
| instance n=50 322.alb | 1 | 1 | Solution | 120.21 | 7 | 0.00 | 100.00 |
| instance n=50 323.alb | 1 | 1 | Solution | 120.29 | 13 | 0.00 | 100.00 |
| instance n=50 324.alb | 1 | 1 | Solution | 120.14 | 7 | 0.00 | 100.00 |
| instance n=50 325.alb | 1 | 1 | Unknown | 120155.00 | - | - | - |
| instance n=50 326.alb | 1 | 1 | Unknown | 120148.00 | - | - | - |
| instance n=50 327.alb | 1 | 1 | Solution | 120.16 | 31 | 0.00 | 100.00 |
| instance n=50 328.alb | 1 | 1 | Solution | 120.15 | 48 | 0.00 | 100.00 |
| instance n=50 329.alb | 1 | 1 | Unknown | 120152.00 | - | - | - |
| instance n=50 33.alb | 1 | 1 | Unknown | 120436.00 | - | - | - |
| instance n=50 330.alb | 1 | 1 | Unknown | 120264.00 | - | - | - |
| instance n=50 331.alb | 1 | 1 | Solution | 120.21 | 34 | 0.00 | 100.00 |
| instance n=50 332.alb | 1 | 1 | Solution | 120.19 | 28 | 0.00 | 100.00 |
| instance n=50 333.alb | 1 | 1 | Solution | 120.17 | 50 | 0.00 | 100.00 |
| instance n=50 334.alb | 1 | 1 | Solution | 120.20 | 32 | 0.00 | 100.00 |
| instance n=50 335.alb | 1 | 1 | Solution | 120.16 | 33 | 0.00 | 100.00 |
| instance n=50 336.alb | 1 | 1 | Solution | 120.21 | 31 | 0.00 | 100.00 |
| instance n=50 337.alb | 1 | 1 | Solution | 121.08 | 29 | 0.00 | 100.00 |
| instance n=50 338.alb | 1 | 1 | Solution | 120.16 | 29 | 0.00 | 100.00 |
| instance n=50 339.alb | 1 | 1 | Solution | 120.18 | 34 | 0.00 | 100.00 |
| instance n=50 34.alb | 1 | 1 | Solution | 120.19 | 31 | 0.00 | 100.00 |
| instance n=50 340.alb | 1 | 1 | Solution | 120.18 | 31 | 0.00 | 100.00 |
| instance n=50 341.alb | 1 | 1 | Unknown | 120302.00 | - | - | - |
| instance n=50 342.alb | 1 | 1 | Unknown | 120175.00 | - | - | - |
| instance n=50 343.alb | 1 | 1 | Solution | 120.30 | 29 | 0.00 | 100.00 |
| instance n=50 344.alb | 1 | 1 | Solution | 120.24 | 32 | 0.00 | 100.00 |
| instance n=50 345.alb | 1 | 1 | Solution | 120.18 | 33 | 0.00 | 100.00 |
| instance n=50 346.alb | 1 | 1 | Unknown | 120176.00 | - | - | - |
| instance n=50 347.alb | 1 | 1 | Solution | 120.16 | 30 | 0.00 | 100.00 |
| instance n=50 348.alb | 1 | 1 | Unknown | 120258.00 | - | - | - |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 349.alb | 1 | 1 | Solution | 120.16 | 32 | 0.00 | 100.00 |
| instance n=50 35.alb | 1 | 1 | Solution | 120.18 | 43 | 0.00 | 100.00 |
| instance n=50 350.alb | 1 | 1 | Solution | 120.17 | 27 | 0.00 | 100.00 |
| instance n=50 351.alb | 1 | 1 | Solution | 120.17 | 18 | 0.00 | 100.00 |
| instance n=50 352.alb | 1 | 1 | Solution | 120.18 | 11 | 0.00 | 100.00 |
| instance n=50 353.alb | 1 | 1 | Unknown | 120269.00 | - | - | - |
| instance n=50 354.alb | 1 | 1 | Solution | 120.20 | 15 | 0.00 | 100.00 |
| instance n=50 355.alb | 1 | 1 | Solution | 120.17 | 21 | 0.00 | 100.00 |
| instance n=50 356.alb | 1 | 1 | Solution | 120.19 | 15 | 0.00 | 100.00 |
| instance n=50 357.alb | 1 | 1 | Unknown | 120183.00 | - | - | - |
| instance n=50 358.alb | 1 | 1 | Solution | 120.16 | 13 | 0.00 | 100.00 |
| instance n=50 359.alb | 1 | 1 | Unknown | 120159.00 | - | - | - |
| instance n=50 36.alb | 1 | 1 | Solution | 120.19 | 33 | 0.00 | 100.00 |
| instance n=50 360.alb | 1 | 1 | Solution | 120.17 | 13 | 0.00 | 100.00 |
| instance n=50 361.alb | 1 | 1 | Unknown | 120175.00 | - | - | - |
| instance n=50 362.alb | 1 | 1 | Solution | 120.19 | 14 | 0.00 | 100.00 |
| instance n=50 363.alb | 1 | 1 | Solution | 120.19 | 14 | 0.00 | 100.00 |
| instance n=50 364.alb | 1 | 1 | Unknown | 120167.00 | - | - | - |
| instance n=50 365.alb | 1 | 1 | Solution | 120.16 | 13 | 0.00 | 100.00 |
| instance n=50 366.alb | 1 | 1 | Unknown | 120147.00 | - | - | - |
| instance n=50 367.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 368.alb | 1 | 1 | Unknown | 120146.00 | - | - | - |
| instance n=50 369.alb | 1 | 1 | Solution | 120.16 | 13 | 0.00 | 100.00 |
| instance n=50 37.alb | 1 | 1 | Unknown | 120623.00 | - | - | - |
| instance n=50 370.alb | 1 | 1 | Solution | 120.14 | 12 | 0.00 | 100.00 |
| instance n=50 371.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 372.alb | 1 | 1 | Solution | 120.17 | 18 | 0.00 | 100.00 |
| instance n=50 373.alb | 1 | 1 | Unknown | 120173.00 | - | - | - |
| instance n=50 374.alb | 1 | 1 | Solution | 120.20 | 11 | 0.00 | 100.00 |
| instance n=50 375.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 376.alb | 1 | 1 | Unknown | 120173.00 | - | - | - |
| instance n=50 377.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 378.alb | 1 | 1 | Unknown | 120191.00 | - | - | - |
| instance n=50 379.alb | 1 | 1 | Solution | 120.20 | 23 | 0.00 | 100.00 |
| instance n=50 38.alb | 1 | 1 | Solution | 120.19 | 39 | 0.00 | 100.00 |
| instance n=50 380.alb | 1 | 1 | Unknown | 120182.00 | - | - | - |
| instance n=50 381.alb | 1 | 1 | Unknown | 120711.00 | - | - | - |
| instance n=50 382.alb | 1 | 1 | Unknown | 120176.00 | - | - | - |
| instance n=50 383.alb | 1 | 1 | Unknown | 120180.00 | - | - | - |
| instance n=50 384.alb | 1 | 1 | Unknown | 120644.00 | - | - | - |
| instance n=50 385.alb | 1 | 1 | Unknown | 120253.00 | - | - | - |
| instance n=50 386.alb | 1 | 1 | Solution | 120.16 | 7 | 0.00 | 100.00 |
| instance n=50 387.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 388.alb | 1 | 1 | Unknown | 120178.00 | - | - | - |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 389.alb | 1 | 1 | Unknown | 120397.00 | - | - | - |
| instance n=50 39.alb | 1 | 1 | Unknown | 120161.00 | - | - | - |
| instance n=50 390.alb | 1 | 1 | Unknown | 120170.00 | - | - | - |
| instance n=50 391.alb | 1 | 1 | Solution | 120.16 | 9 | 0.00 | 100.00 |
| instance n=50 392.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 393.alb | 1 | 1 | Unknown | 120170.00 | - | - | - |
| instance n=50 394.alb | 1 | 1 | Unknown | 120150.00 | - | - | - |
| instance n=50 395.alb | 1 | 1 | Unknown | 120153.00 | - | - | - |
| instance n=50 396.alb | 1 | 1 | Unknown | 120168.00 | - | - | - |
| instance n=50 397.alb | 1 | 1 | Solution | 120.20 | 7 | 0.00 | 100.00 |
| instance n=50 398.alb | 1 | 1 | Unknown | 120159.00 | - | - | - |
| instance n=50 399.alb | 1 | 1 | Unknown | 120203.00 | - | - | - |
| instance n=50 4.alb | 1 | 1 | Unknown | 120329.00 | - | - | - |
| instance n=50 40.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 400.alb | 1 | 1 | Unknown | 120168.00 | - | - | - |
| instance n=50 401.alb | 1 | 1 | Unknown | 120323.00 | - | - | - |
| instance n=50 402.alb | 1 | 1 | Unknown | 120229.00 | - | - | - |
| instance n=50 403.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 404.alb | 1 | 1 | Unknown | 120160.00 | - | - | - |
| instance n=50 405.alb | 1 | 1 | Unknown | 120314.00 | - | - | - |
| instance n=50 406.alb | 1 | 1 | Solution | 120.16 | 35 | 0.00 | 100.00 |
| instance n=50 407.alb | 1 | 1 | Solution | 120.15 | 30 | 0.00 | 100.00 |
| instance n=50 408.alb | 1 | 1 | Unknown | 120230.00 | - | - | - |
| instance n=50 409.alb | 1 | 1 | Unknown | 120170.00 | - | - | - |
| instance n=50 41.alb | 1 | 1 | Solution | 120.20 | 31 | 0.00 | 100.00 |
| instance n=50 410.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 411.alb | 1 | 1 | Unknown | 120165.00 | - | - | - |
| instance n=50 412.alb | 1 | 1 | Unknown | 120221.00 | - | - | - |
| instance n=50 413.alb | 1 | 1 | Unknown | 120170.00 | - | - | - |
| instance n=50 414.alb | 1 | 1 | Unknown | 120165.00 | - | - | - |
| instance n=50 415.alb | 1 | 1 | Unknown | 120223.00 | - | - | - |
| instance n=50 416.alb | 1 | 1 | Unknown | 120287.00 | - | - | - |
| instance n=50 417.alb | 1 | 1 | Solution | 120.15 | 31 | 0.00 | 100.00 |
| instance n=50 418.alb | 1 | 1 | Unknown | 120306.00 | - | - | - |
| instance n=50 419.alb | 1 | 1 | Unknown | 120239.00 | - | - | - |
| instance n=50 42.alb | 1 | 1 | Solution | 120.19 | 26 | 0.00 | 100.00 |
| instance n=50 420.alb | 1 | 1 | Unknown | 120220.00 | - | - | - |
| instance n=50 421.alb | 1 | 1 | Unknown | 120329.00 | - | - | - |
| instance n=50 422.alb | 1 | 1 | Solution | 120.15 | 31 | 0.00 | 100.00 |
| instance n=50 423.alb | 1 | 1 | Unknown | 120158.00 | - | - | - |
| instance n=50 424.alb | 1 | 1 | Solution | 121.23 | 31 | 0.00 | 100.00 |
| instance n=50 425.alb | 1 | 1 | Solution | 120.17 | 37 | 0.00 | 100.00 |
| instance n=50 426.alb | 1 | 1 | Unknown | 120219.00 | - | - | - |
| instance n=50 427.alb | 1 | 1 | Solution | 120.17 | 12 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 428.alb | 1 | 1 | Unknown | 120185.00 | - | - | - |
| instance n=50 429.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 43.alb | 1 | 1 | Unknown | 120855.00 | - | - | - |
| instance n=50 430.alb | 1 | 1 | Unknown | 120698.00 | - | - | - |
| instance n=50 431.alb | 1 | 1 | Unknown | 120898.00 | - | - | - |
| instance n=50 432.alb | 1 | 1 | Solution | 120.18 | 13 | 0.00 | 100.00 |
| instance n=50 433.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 434.alb | 1 | 1 | Solution | 120.17 | 11 | 0.00 | 100.00 |
| instance n=50 435.alb | 1 | 1 | Unknown | 120153.00 | - | - | - |
| instance n=50 436.alb | 1 | 1 | Unknown | 120163.00 | - | - | - |
| instance n=50 437.alb | 1 | 1 | Unknown | 120143.00 | - | - | - |
| instance n=50 438.alb | 1 | 1 | Unknown | 120402.00 | - | - | - |
| instance n=50 439.alb | 1 | 1 | Unknown | 120162.00 | - | - | - |
| instance n=50 44.alb | 1 | 1 | Solution | 120.14 | 28 | 0.00 | 100.00 |
| instance n=50 440.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 441.alb | 1 | 1 | Solution | 120.15 | 11 | 0.00 | 100.00 |
| instance n=50 442.alb | 1 | 1 | Unknown | 120168.00 | - | - | - |
| instance n=50 443.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 444.alb | 1 | 1 | Unknown | 120189.00 | - | - | - |
| instance n=50 445.alb | 1 | 1 | Unknown | 120159.00 | - | - | - |
| instance n=50 446.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 447.alb | 1 | 1 | Solution | 120.17 | 16 | 0.00 | 100.00 |
| instance n=50 448.alb | 1 | 1 | Unknown | 120149.00 | - | - | - |
| instance n=50 449.alb | 1 | 1 | Unknown | 120170.00 | - | - | - |
| instance n=50 45.alb | 1 | 1 | Solution | 120.18 | 31 | 0.00 | 100.00 |
| instance n=50 450.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 451.alb | 1 | 1 | Solution | 120.12 | 8 | 0.00 | 100.00 |
| instance n=50 452.alb | 1 | 1 | Solution | 120.14 | 8 | 0.00 | 100.00 |
| instance n=50 453.alb | 1 | 1 | Solution | 120.17 | 7 | 0.00 | 100.00 |
| instance n=50 454.alb | 1 | 1 | Solution | 120.17 | 8 | 0.00 | 100.00 |
| instance n=50 455.alb | 1 | 1 | Solution | 120.15 | 6 | 0.00 | 100.00 |
| instance n=50 456.alb | 1 | 1 | Solution | 120.14 | 8 | 0.00 | 100.00 |
| instance n=50 457.alb | 1 | 1 | Solution | 120.14 | 8 | 0.00 | 100.00 |
| instance n=50 458.alb | 1 | 1 | Solution | 120.15 | 7 | 0.00 | 100.00 |
| instance n=50 459.alb | 1 | 1 | Solution | 120.14 | 7 | 0.00 | 100.00 |
| instance n=50 46.alb | 1 | 1 | Unknown | 120179.00 | - | - | - |
| instance n=50 460.alb | 1 | 1 | Solution | 120.98 | 7 | 0.00 | 100.00 |
| instance n=50 461.alb | 1 | 1 | Solution | 120.16 | 6 | 0.00 | 100.00 |
| instance n=50 462.alb | 1 | 1 | Solution | 120.81 | 7 | 0.00 | 100.00 |
| instance n=50 463.alb | 1 | 1 | Solution | 120.18 | 8 | 0.00 | 100.00 |
| instance n=50 464.alb | 1 | 1 | Solution | 120.15 | 6 | 0.00 | 100.00 |
| instance n=50 465.alb | 1 | 1 | Solution | 120.14 | 8 | 0.00 | 100.00 |
| instance n=50 466.alb | 1 | 1 | Solution | 120.18 | 7 | 0.00 | 100.00 |
| instance n=50 467.alb | 1 | 1 | Solution | 120.13 | 9 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 468.alb | 1 | 1 | Solution | 120.15 | 7 | 0.00 | 100.00 |
| instance n=50 469.alb | 1 | 1 | Solution | 120.82 | 8 | 0.00 | 100.00 |
| instance n=50 47.alb | 1 | 1 | Unknown | 120168.00 | - | - | - |
| instance n=50 470.alb | 1 | 1 | Solution | 120.13 | 8 | 0.00 | 100.00 |
| instance n=50 471.alb | 1 | 1 | Solution | 120.19 | 8 | 0.00 | 100.00 |
| instance n=50 472.alb | 1 | 1 | Solution | 120.15 | 8 | 0.00 | 100.00 |
| instance n=50 473.alb | 1 | 1 | Solution | 120.15 | 7 | 0.00 | 100.00 |
| instance n=50 474.alb | 1 | 1 | Solution | 120.13 | 7 | 0.00 | 100.00 |
| instance n=50 475.alb | 1 | 1 | Solution | 120.13 | 6 | 0.00 | 100.00 |
| instance n=50 476.alb | 1 | 1 | Solution | 120.17 | 28 | 0.00 | 100.00 |
| instance n=50 477.alb | 1 | 1 | Solution | 120.33 | 29 | 0.00 | 100.00 |
| instance n=50 478.alb | 1 | 1 | Solution | 120.15 | 32 | 0.00 | 100.00 |
| instance n=50 479.alb | 1 | 1 | Optimal | 93.04 | 28 | 0.00 | 100.00 |
| instance n=50 48.alb | 1 | 1 | Solution | 120.20 | 29 | 0.00 | 100.00 |
| instance n=50 480.alb | 1 | 1 | Solution | 120.33 | 34 | 0.00 | 100.00 |
| instance n=50 481.alb | 1 | 1 | Solution | 120.40 | 29 | 0.00 | 100.00 |
| instance n=50 482.alb | 1 | 1 | Solution | 120.17 | 27 | 0.00 | 100.00 |
| instance n=50 483.alb | 1 | 1 | Solution | 120.15 | 30 | 0.00 | 100.00 |
| instance n=50 484.alb | 1 | 1 | Optimal | 27.19 | 32 | 0.00 | 100.00 |
| instance n=50 485.alb | 1 | 1 | Solution | 120.17 | 31 | 0.00 | 100.00 |
| instance n=50 486.alb | 1 | 1 | Optimal | 40.84 | 32 | 0.00 | 100.00 |
| instance n=50 487.alb | 1 | 1 | Solution | 120.17 | 31 | 0.00 | 100.00 |
| instance n=50 488.alb | 1 | 1 | Solution | 120.16 | 31 | 0.00 | 100.00 |
| instance n=50 489.alb | 1 | 1 | Solution | 120.16 | 35 | 0.00 | 100.00 |
| instance n=50 49.alb | 1 | 1 | Unknown | 120143.00 | - | - | - |
| instance n=50 490.alb | 1 | 1 | Solution | 120.14 | 29 | 0.00 | 100.00 |
| instance n=50 491.alb | 1 | 1 | Solution | 120.15 | 35 | 0.00 | 100.00 |
| instance n=50 492.alb | 1 | 1 | Solution | 120.15 | 29 | 0.00 | 100.00 |
| instance n=50 493.alb | 1 | 1 | Solution | 120.17 | 30 | 0.00 | 100.00 |
| instance n=50 494.alb | 1 | 1 | Solution | 120.15 | 32 | 0.00 | 100.00 |
| instance n=50 495.alb | 1 | 1 | Solution | 120.15 | 34 | 0.00 | 100.00 |
| instance n=50 496.alb | 1 | 1 | Solution | 120.17 | 29 | 0.00 | 100.00 |
| instance n=50 497.alb | 1 | 1 | Solution | 120.15 | 30 | 0.00 | 100.00 |
| instance n=50 498.alb | 1 | 1 | Solution | 120.13 | 30 | 0.00 | 100.00 |
| instance n=50 499.alb | 1 | 1 | Solution | 120.17 | 34 | 0.00 | 100.00 |
| instance n=50 5.alb | 1 | 1 | Solution | 120.17 | 34 | 0.00 | 100.00 |
| instance n=50 50.alb | 1 | 1 | Solution | 120.19 | 46 | 0.00 | 100.00 |
| instance n=50 500.alb | 1 | 1 | Solution | 120.14 | 37 | 0.00 | 100.00 |
| instance n=50 501.alb | 1 | 1 | Solution | 120.14 | 12 | 0.00 | 100.00 |
| instance n=50 502.alb | 1 | 1 | Solution | 120.14 | 10 | 0.00 | 100.00 |
| instance n=50 503.alb | 1 | 1 | Optimal | 8.93 | 13 | 0.00 | 100.00 |
| instance n=50 504.alb | 1 | 1 | Solution | 120.15 | 11 | 0.00 | 100.00 |
| instance n=50 505.alb | 1 | 1 | Optimal | 8.29 | 12 | 0.00 | 100.00 |
| instance n=50 506.alb | 1 | 1 | Solution | 120.15 | 11 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 507.alb | 1 | 1 | Solution | 120.14 | 13 | 0.00 | 100.00 |
| instance n=50 508.alb | 1 | 1 | Solution | 120.14 | 14 | 0.00 | 100.00 |
| instance n=50 509.alb | 1 | 1 | Solution | 120.14 | 13 | 0.00 | 100.00 |
| instance n=50 51.alb | 1 | 1 | Solution | 120.17 | 12 | 0.00 | 100.00 |
| instance n=50 510.alb | 1 | 1 | Solution | 120.15 | 11 | 0.00 | 100.00 |
| instance n=50 511.alb | 1 | 1 | Solution | 120.13 | 13 | 0.00 | 100.00 |
| instance n=50 512.alb | 1 | 1 | Solution | 120.14 | 13 | 0.00 | 100.00 |
| instance n=50 513.alb | 1 | 1 | Solution | 120.12 | 12 | 0.00 | 100.00 |
| instance n=50 514.alb | 1 | 1 | Solution | 120.30 | 12 | 0.00 | 100.00 |
| instance n=50 515.alb | 1 | 1 | Solution | 120.15 | 11 | 0.00 | 100.00 |
| instance n=50 516.alb | 1 | 1 | Solution | 120.13 | 13 | 0.00 | 100.00 |
| instance n=50 517.alb | 1 | 1 | Optimal | 108.98 | 14 | 0.00 | 100.00 |
| instance n=50 518.alb | 1 | 1 | Solution | 120.15 | 11 | 0.00 | 100.00 |
| instance n=50 519.alb | 1 | 1 | Solution | 120.13 | 12 | 0.00 | 100.00 |
| instance n=50 52.alb | 1 | 1 | Unknown | 120187.00 | - | - | - |
| instance n=50 520.alb | 1 | 1 | Solution | 120.45 | 11 | 0.00 | 100.00 |
| instance n=50 521.alb | 1 | 1 | Solution | 120.16 | 10 | 0.00 | 100.00 |
| instance n=50 522.alb | 1 | 1 | Solution | 120.14 | 11 | 0.00 | 100.00 |
| instance n=50 523.alb | 1 | 1 | Solution | 120.16 | 11 | 0.00 | 100.00 |
| instance n=50 524.alb | 1 | 1 | Solution | 120.16 | 14 | 0.00 | 100.00 |
| instance n=50 525.alb | 1 | 1 | Solution | 120.16 | 11 | 0.00 | 100.00 |
| instance n=50 53.alb | 1 | 1 | Unknown | 120175.00 | - | - | - |
| instance n=50 54.alb | 1 | 1 | Unknown | 120192.00 | - | - | - |
| instance n=50 55.alb | 1 | 1 | Unknown | 120176.00 | - | - | - |
| instance n=50 56.alb | 1 | 1 | Solution | 120.20 | 12 | 0.00 | 100.00 |
| instance n=50 57.alb | 1 | 1 | Solution | 120.16 | 13 | 0.00 | 100.00 |
| instance n=50 58.alb | 1 | 1 | Unknown | 120182.00 | - | - | - |
| instance n=50 59.alb | 1 | 1 | Unknown | 120219.00 | - | - | - |
| instance n=50 6.alb | 1 | 1 | Solution | 120.16 | 11 | 0.00 | 100.00 |
| instance n=50 60.alb | 1 | 1 | Unknown | 120173.00 | - | - | - |
| instance n=50 61.alb | 1 | 1 | Unknown | 120188.00 | - | - | - |
| instance n=50 62.alb | 1 | 1 | Unknown | 120181.00 | - | - | - |
| instance n=50 63.alb | 1 | 1 | Unknown | 120165.00 | - | - | - |
| instance n=50 64.alb | 1 | 1 | Unknown | 120179.00 | - | - | - |
| instance n=50 65.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 66.alb | 1 | 1 | Solution | 120.16 | 14 | 0.00 | 100.00 |
| instance n=50 67.alb | 1 | 1 | Unknown | 120171.00 | - | - | - |
| instance n=50 68.alb | 1 | 1 | Unknown | 120178.00 | - | - | - |
| instance n=50 69.alb | 1 | 1 | Unknown | 120172.00 | - | - | - |
| instance n=50 7.alb | 1 | 1 | Unknown | 120208.00 | - | - | - |
| instance n=50 70.alb | 1 | 1 | Solution | 120.97 | 13 | 0.00 | 100.00 |
| instance n=50 71.alb | 1 | 1 | Unknown | 120153.00 | - | - | - |
| instance n=50 72.alb | 1 | 1 | Unknown | 120166.00 | - | - | - |
| instance n=50 73.alb | 1 | 1 | Solution | 120.16 | 13 | 0.00 | 100.00 |

Table 6.9: Results for SALBP-1 Problems Alternative (Cplex)
(1050 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-----------|----------|-------|----------------|
| instance n=50 74.alb | 1 | 1 | Solution | 120.18 | 12 | 0.00 | 100.00 |
| instance n=50 75.alb | 1 | 1 | Unknown | 120523.00 | - | - | - |
| instance n=50 76.alb | 1 | 1 | Unknown | 120820.00 | - | - | - |
| instance n=50 77.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 78.alb | 1 | 1 | Unknown | 120614.00 | - | - | - |
| instance n=50 79.alb | 1 | 1 | Unknown | 120159.00 | - | - | - |
| instance n=50 8.alb | 1 | 1 | Solution | 120.20 | 24 | 0.00 | 100.00 |
| instance n=50 80.alb | 1 | 1 | Unknown | 120168.00 | - | - | - |
| instance n=50 81.alb | 1 | 1 | Solution | 120.18 | 7 | 0.00 | 100.00 |
| instance n=50 82.alb | 1 | 1 | Solution | 120.93 | 7 | 0.00 | 100.00 |
| instance n=50 83.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 84.alb | 1 | 1 | Unknown | 120173.00 | - | - | - |
| instance n=50 85.alb | 1 | 1 | Unknown | 120167.00 | - | - | - |
| instance n=50 86.alb | 1 | 1 | Solution | 121.15 | 8 | 0.00 | 100.00 |
| instance n=50 87.alb | 1 | 1 | Unknown | 120182.00 | - | - | - |
| instance n=50 88.alb | 1 | 1 | Solution | 120.44 | 10 | 0.00 | 100.00 |
| instance n=50 89.alb | 1 | 1 | Unknown | 120174.00 | - | - | - |
| instance n=50 9.alb | 1 | 1 | Unknown | 120180.00 | - | - | - |
| instance n=50 90.alb | 1 | 1 | Unknown | 120699.00 | - | - | - |
| instance n=50 91.alb | 1 | 1 | Unknown | 120169.00 | - | - | - |
| instance n=50 92.alb | 1 | 1 | Unknown | 120181.00 | - | - | - |
| instance n=50 93.alb | 1 | 1 | Unknown | 120158.00 | - | - | - |
| instance n=50 94.alb | 1 | 1 | Unknown | 120177.00 | - | - | - |
| instance n=50 95.alb | 1 | 1 | Unknown | 120178.00 | - | - | - |
| instance n=50 96.alb | 1 | 1 | Unknown | 120172.00 | - | - | - |
| instance n=50 97.alb | 1 | 1 | Solution | 120.17 | 9 | 0.00 | 100.00 |
| instance n=50 98.alb | 1 | 1 | Unknown | 120161.00 | - | - | - |
| instance n=50 99.alb | 1 | 1 | Unknown | 120236.00 | - | - | - |

Chapter 7

Test Scheduling Problems

Due to the number of instances given, we only run problems for 30 seconds, some results are still missing. The original instance data was given in Prolog format, we generate a JSON equivalent, which is used as input to create the problems.

7.1 Results for CPOptimizer

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m10r10-1.pl.json | 100 | 10 | Solution | 30.24 | 10491 | 9055.00 | 13.69 |
| t100m10r10-10.pl.json | 100 | 10 | Solution | 30.05 | 9593 | 8369.00 | 12.76 |
| t100m10r10-11.pl.json | 100 | 10 | Solution | 30.06 | 5317 | 5100.00 | 4.08 |
| t100m10r10-12.pl.json | 100 | 10 | Solution | 30.07 | 6539 | 5613.00 | 14.16 |
| t100m10r10-13.pl.json | 100 | 10 | Solution | 30.05 | 6831 | 6786.00 | 0.66 |
| t100m10r10-14.pl.json | 100 | 10 | Solution | 30.04 | 5775 | 5257.00 | 8.97 |
| t100m10r10-15.pl.json | 100 | 10 | Solution | 30.04 | 6105 | 5012.00 | 17.90 |
| t100m10r10-16.pl.json | 100 | 10 | Solution | 30.08 | 12563 | 11589.00 | 7.75 |
| t100m10r10-17.pl.json | 100 | 10 | Solution | 30.09 | 8954 | 8114.00 | 9.38 |
| t100m10r10-18.pl.json | 100 | 10 | Solution | 30.04 | 10180 | 9304.00 | 8.61 |
| t100m10r10-19.pl.json | 100 | 10 | Solution | 30.09 | 9812 | 8514.00 | 13.23 |
| t100m10r10-2.pl.json | 100 | 10 | Solution | 30.07 | 11593 | 9807.00 | 15.41 |
| t100m10r10-20.pl.json | 100 | 10 | Solution | 30.15 | 12287 | 10686.00 | 13.03 |
| t100m10r10-3.pl.json | 100 | 10 | Solution | 30.06 | 6878 | 6379.00 | 7.26 |
| t100m10r10-4.pl.json | 100 | 10 | Solution | 30.11 | 11041 | 9111.00 | 17.48 |
| t100m10r10-5.pl.json | 100 | 10 | Solution | 30.09 | 12157 | 11823.00 | 2.75 |
| t100m10r10-6.pl.json | 100 | 10 | Solution | 30.06 | 11688 | 10914.00 | 6.62 |
| t100m10r10-7.pl.json | 100 | 10 | Solution | 30.05 | 6435 | 5732.00 | 10.92 |
| t100m10r10-8.pl.json | 100 | 10 | Solution | 30.10 | 11056 | 10010.00 | 9.46 |
| t100m10r10-9.pl.json | 100 | 10 | Solution | 30.11 | 9878 | 7991.00 | 19.10 |
| t100m10r3-1.pl.json | 100 | 10 | Optimal | 0.62 | 8711 | 8711.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m10r3-10.pl.json | 100 | 10 | Optimal | 0.43 | 8958 | 8958.00 | 0.00 |
| t100m10r3-11.pl.json | 100 | 10 | Optimal | 0.15 | 9560 | 9560.00 | 0.00 |
| t100m10r3-12.pl.json | 100 | 10 | Optimal | 0.38 | 7892 | 7892.00 | 0.00 |
| t100m10r3-13.pl.json | 100 | 10 | Optimal | 0.09 | 10078 | 10077.00 | 0.01 |
| t100m10r3-14.pl.json | 100 | 10 | Optimal | 0.36 | 8681 | 8681.00 | 0.00 |
| t100m10r3-15.pl.json | 100 | 10 | Optimal | 0.17 | 8810 | 8810.00 | 0.00 |
| t100m10r3-16.pl.json | 100 | 10 | Optimal | 0.47 | 11182 | 11182.00 | 0.00 |
| t100m10r3-17.pl.json | 100 | 10 | Optimal | 0.74 | 7534 | 7534.00 | 0.00 |
| t100m10r3-18.pl.json | 100 | 10 | Solution | 30.10 | 10376 | 9934.00 | 4.26 |
| t100m10r3-19.pl.json | 100 | 10 | Solution | 30.03 | 7706 | 6970.00 | 9.55 |
| t100m10r3-2.pl.json | 100 | 10 | Optimal | 0.29 | 7082 | 7082.00 | 0.00 |
| t100m10r3-20.pl.json | 100 | 10 | Optimal | 0.17 | 9025 | 9025.00 | 0.00 |
| t100m10r3-3.pl.json | 100 | 10 | Optimal | 0.42 | 10054 | 10053.00 | 0.01 |
| t100m10r3-4.pl.json | 100 | 10 | Optimal | 0.10 | 13122 | 13121.00 | 0.01 |
| t100m10r3-5.pl.json | 100 | 10 | Optimal | 1.50 | 7545 | 7545.00 | 0.00 |
| t100m10r3-6.pl.json | 100 | 10 | Optimal | 0.93 | 7840 | 7840.00 | 0.00 |
| t100m10r3-7.pl.json | 100 | 10 | Optimal | 0.16 | 11010 | 11009.00 | 0.01 |
| t100m10r3-8.pl.json | 100 | 10 | Optimal | 0.16 | 9112 | 9112.00 | 0.00 |
| t100m10r3-9.pl.json | 100 | 10 | Optimal | 0.34 | 8532 | 8532.00 | 0.00 |
| t100m10r5-1.pl.json | 100 | 10 | Solution | 30.04 | 7304 | 7300.00 | 0.05 |
| t100m10r5-10.pl.json | 100 | 10 | Optimal | 1.42 | 6972 | 6972.00 | 0.00 |
| t100m10r5-11.pl.json | 100 | 10 | Solution | 30.08 | 9091 | 8568.00 | 5.75 |
| t100m10r5-12.pl.json | 100 | 10 | Optimal | 0.66 | 6538 | 6538.00 | 0.00 |
| t100m10r5-13.pl.json | 100 | 10 | Optimal | 0.67 | 8972 | 8972.00 | 0.00 |
| t100m10r5-14.pl.json | 100 | 10 | Solution | 30.07 | 10478 | 10347.00 | 1.25 |
| t100m10r5-15.pl.json | 100 | 10 | Solution | 30.05 | 5762 | 5647.00 | 2.00 |
| t100m10r5-16.pl.json | 100 | 10 | Solution | 30.04 | 7019 | 6207.00 | 11.57 |
| t100m10r5-17.pl.json | 100 | 10 | Optimal | 0.23 | 6728 | 6728.00 | 0.00 |
| t100m10r5-18.pl.json | 100 | 10 | Solution | 30.12 | 8987 | 8811.00 | 1.96 |
| t100m10r5-19.pl.json | 100 | 10 | Optimal | 0.98 | 8885 | 8885.00 | 0.00 |
| t100m10r5-2.pl.json | 100 | 10 | Optimal | 2.05 | 9010 | 9010.00 | 0.00 |
| t100m10r5-20.pl.json | 100 | 10 | Optimal | 0.91 | 7022 | 7022.00 | 0.00 |
| t100m10r5-3.pl.json | 100 | 10 | Optimal | 0.99 | 8820 | 8820.00 | 0.00 |
| t100m10r5-4.pl.json | 100 | 10 | Optimal | 1.02 | 10753 | 10753.00 | 0.00 |
| t100m10r5-5.pl.json | 100 | 10 | Optimal | 2.03 | 6608 | 6608.00 | 0.00 |
| t100m10r5-6.pl.json | 100 | 10 | Solution | 30.06 | 9452 | 8456.00 | 10.54 |
| t100m10r5-7.pl.json | 100 | 10 | Solution | 30.05 | 8186 | 7664.00 | 6.38 |
| t100m10r5-8.pl.json | 100 | 10 | Solution | 30.12 | 11383 | 10079.00 | 11.46 |
| t100m10r5-9.pl.json | 100 | 10 | Solution | 30.05 | 11649 | 10683.00 | 8.29 |
| t100m20r10-1.pl.json | 100 | 20 | Solution | 30.19 | 12412 | 12180.00 | 1.87 |
| t100m20r10-10.pl.json | 100 | 20 | Solution | 30.05 | 12646 | 10953.00 | 13.39 |
| t100m20r10-11.pl.json | 100 | 20 | Solution | 30.09 | 8687 | 7289.00 | 16.09 |
| t100m20r10-12.pl.json | 100 | 20 | Solution | 30.20 | 7391 | 6774.00 | 8.35 |
| t100m20r10-13.pl.json | 100 | 20 | Solution | 30.08 | 9695 | 9229.00 | 4.81 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m20r10-14.pl.json | 100 | 20 | Solution | 30.16 | 10027 | 8652.00 | 13.71 |
| t100m20r10-15.pl.json | 100 | 20 | Solution | 30.04 | 6544 | 5362.00 | 18.06 |
| t100m20r10-16.pl.json | 100 | 20 | Solution | 30.10 | 9264 | 8343.00 | 9.94 |
| t100m20r10-17.pl.json | 100 | 20 | Solution | 30.15 | 8611 | 7381.00 | 14.28 |
| t100m20r10-18.pl.json | 100 | 20 | Optimal | 1.74 | 4843 | 4843.00 | 0.00 |
| t100m20r10-19.pl.json | 100 | 20 | Solution | 30.16 | 12320 | 11752.00 | 4.61 |
| t100m20r10-2.pl.json | 100 | 20 | Solution | 30.14 | 7740 | 6890.00 | 10.98 |
| t100m20r10-20.pl.json | 100 | 20 | Solution | 30.11 | 9873 | 8562.00 | 13.28 |
| t100m20r10-3.pl.json | 100 | 20 | Solution | 30.07 | 7133 | 6295.00 | 11.75 |
| t100m20r10-4.pl.json | 100 | 20 | Solution | 30.21 | 9510 | 9052.00 | 4.82 |
| t100m20r10-5.pl.json | 100 | 20 | Solution | 30.13 | 9230 | 8459.00 | 8.35 |
| t100m20r10-6.pl.json | 100 | 20 | Solution | 30.10 | 8781 | 7619.00 | 13.23 |
| t100m20r10-7.pl.json | 100 | 20 | Solution | 30.18 | 11313 | 9767.00 | 13.67 |
| t100m20r10-8.pl.json | 100 | 20 | Solution | 30.12 | 7096 | 7041.00 | 0.78 |
| t100m20r10-9.pl.json | 100 | 20 | Solution | 30.19 | 10835 | 10019.00 | 7.53 |
| t100m20r3-1.pl.json | 100 | 20 | Optimal | 0.59 | 6585 | 6585.00 | 0.00 |
| t100m20r3-10.pl.json | 100 | 20 | Optimal | 0.28 | 8535 | 8535.00 | 0.00 |
| t100m20r3-11.pl.json | 100 | 20 | Optimal | 0.60 | 9084 | 9084.00 | 0.00 |
| t100m20r3-12.pl.json | 100 | 20 | Optimal | 0.28 | 9066 | 9066.00 | 0.00 |
| t100m20r3-13.pl.json | 100 | 20 | Solution | 30.09 | 11412 | 9974.00 | 12.60 |
| t100m20r3-14.pl.json | 100 | 20 | Optimal | 0.54 | 8786 | 8786.00 | 0.00 |
| t100m20r3-15.pl.json | 100 | 20 | Optimal | 0.27 | 10205 | 10204.00 | 0.01 |
| t100m20r3-16.pl.json | 100 | 20 | Optimal | 0.28 | 8856 | 8856.00 | 0.00 |
| t100m20r3-17.pl.json | 100 | 20 | Optimal | 1.30 | 5451 | 5451.00 | 0.00 |
| t100m20r3-18.pl.json | 100 | 20 | Optimal | 0.51 | 8752 | 8752.00 | 0.00 |
| t100m20r3-19.pl.json | 100 | 20 | Solution | 30.13 | 8909 | 8860.00 | 0.55 |
| t100m20r3-2.pl.json | 100 | 20 | Optimal | 0.26 | 8498 | 8498.00 | 0.00 |
| t100m20r3-20.pl.json | 100 | 20 | Optimal | 0.87 | 7880 | 7880.00 | 0.00 |
| t100m20r3-3.pl.json | 100 | 20 | Solution | 30.21 | 12170 | 11987.00 | 1.50 |
| t100m20r3-4.pl.json | 100 | 20 | Optimal | 0.53 | 12258 | 12257.00 | 0.01 |
| t100m20r3-5.pl.json | 100 | 20 | Optimal | 0.25 | 11932 | 11931.00 | 0.01 |
| t100m20r3-6.pl.json | 100 | 20 | Optimal | 0.28 | 8531 | 8531.00 | 0.00 |
| t100m20r3-7.pl.json | 100 | 20 | Optimal | 0.28 | 6512 | 6512.00 | 0.00 |
| t100m20r3-8.pl.json | 100 | 20 | Optimal | 3.31 | 10690 | 10689.00 | 0.01 |
| t100m20r3-9.pl.json | 100 | 20 | Optimal | 0.30 | 8255 | 8255.00 | 0.00 |
| t100m20r5-1.pl.json | 100 | 20 | Optimal | 0.34 | 9098 | 9098.00 | 0.00 |
| t100m20r5-10.pl.json | 100 | 20 | Solution | 30.04 | 8340 | 7964.00 | 4.51 |
| t100m20r5-11.pl.json | 100 | 20 | Solution | 30.11 | 6828 | 5564.00 | 18.51 |
| t100m20r5-12.pl.json | 100 | 20 | Optimal | 3.25 | 8704 | 8704.00 | 0.00 |
| t100m20r5-13.pl.json | 100 | 20 | Optimal | 0.70 | 8880 | 8880.00 | 0.00 |
| t100m20r5-14.pl.json | 100 | 20 | Solution | 30.26 | 10590 | 9727.00 | 8.15 |
| t100m20r5-15.pl.json | 100 | 20 | Optimal | 0.59 | 8953 | 8953.00 | 0.00 |
| t100m20r5-16.pl.json | 100 | 20 | Solution | 30.15 | 7864 | 7594.00 | 3.43 |
| t100m20r5-17.pl.json | 100 | 20 | Solution | 30.15 | 5685 | 5524.00 | 2.83 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m20r5-18.pl.json | 100 | 20 | Optimal | 1.06 | 6617 | 6617.00 | 0.00 |
| t100m20r5-19.pl.json | 100 | 20 | Optimal | 0.42 | 9461 | 9461.00 | 0.00 |
| t100m20r5-2.pl.json | 100 | 20 | Optimal | 0.38 | 9566 | 9566.00 | 0.00 |
| t100m20r5-20.pl.json | 100 | 20 | Solution | 30.06 | 11569 | 10228.00 | 11.59 |
| t100m20r5-3.pl.json | 100 | 20 | Optimal | 1.74 | 9366 | 9366.00 | 0.00 |
| t100m20r5-4.pl.json | 100 | 20 | Solution | 30.07 | 14108 | 12456.00 | 11.71 |
| t100m20r5-5.pl.json | 100 | 20 | Optimal | 0.35 | 8585 | 8585.00 | 0.00 |
| t100m20r5-6.pl.json | 100 | 20 | Solution | 30.12 | 7528 | 6539.00 | 13.14 |
| t100m20r5-7.pl.json | 100 | 20 | Solution | 30.13 | 11254 | 10099.00 | 10.26 |
| t100m20r5-8.pl.json | 100 | 20 | Optimal | 2.49 | 5812 | 5812.00 | 0.00 |
| t100m20r5-9.pl.json | 100 | 20 | Solution | 30.16 | 6634 | 6496.00 | 2.08 |
| t100m50r10-1.pl.json | 100 | 50 | Solution | 30.17 | 7299 | 6941.00 | 4.90 |
| t100m50r10-10.pl.json | 100 | 50 | Solution | 30.23 | 5201 | 5108.00 | 1.79 |
| t100m50r10-11.pl.json | 100 | 50 | Solution | 30.09 | 4970 | 4782.00 | 3.78 |
| t100m50r10-12.pl.json | 100 | 50 | Solution | 30.06 | 9335 | 9122.00 | 2.28 |
| t100m50r10-13.pl.json | 100 | 50 | Solution | 30.26 | 9759 | 8828.00 | 9.54 |
| t100m50r10-14.pl.json | 100 | 50 | Solution | 30.10 | 10704 | 8290.00 | 22.55 |
| t100m50r10-15.pl.json | 100 | 50 | Solution | 30.08 | 8637 | 7804.00 | 9.64 |
| t100m50r10-16.pl.json | 100 | 50 | Solution | 30.14 | 14087 | 12381.00 | 12.11 |
| t100m50r10-17.pl.json | 100 | 50 | Solution | 30.18 | 9600 | 9151.00 | 4.68 |
| t100m50r10-18.pl.json | 100 | 50 | Solution | 30.34 | 7214 | 7120.00 | 1.30 |
| t100m50r10-19.pl.json | 100 | 50 | Solution | 30.18 | 8559 | 8059.00 | 5.84 |
| t100m50r10-2.pl.json | 100 | 50 | Solution | 30.25 | 7968 | 7568.00 | 5.02 |
| t100m50r10-20.pl.json | 100 | 50 | Solution | 30.09 | 8421 | 7939.00 | 5.72 |
| t100m50r10-3.pl.json | 100 | 50 | Optimal | 0.33 | 6937 | 6937.00 | 0.00 |
| t100m50r10-4.pl.json | 100 | 50 | Solution | 30.16 | 9952 | 8525.00 | 14.34 |
| t100m50r10-5.pl.json | 100 | 50 | Optimal | 1.35 | 9859 | 9859.00 | 0.00 |
| t100m50r10-6.pl.json | 100 | 50 | Solution | 30.31 | 7696 | 6837.00 | 11.16 |
| t100m50r10-7.pl.json | 100 | 50 | Optimal | 1.17 | 9542 | 9542.00 | 0.00 |
| t100m50r10-8.pl.json | 100 | 50 | Solution | 30.07 | 10719 | 9176.00 | 14.39 |
| t100m50r10-9.pl.json | 100 | 50 | Solution | 30.07 | 10411 | 9375.00 | 9.95 |
| t100m50r3-1.pl.json | 100 | 50 | Optimal | 0.46 | 9937 | 9937.00 | 0.00 |
| t100m50r3-10.pl.json | 100 | 50 | Solution | 30.06 | 8946 | 8877.00 | 0.77 |
| t100m50r3-11.pl.json | 100 | 50 | Optimal | 1.01 | 6141 | 6141.00 | 0.00 |
| t100m50r3-12.pl.json | 100 | 50 | Optimal | 0.87 | 6473 | 6473.00 | 0.00 |
| t100m50r3-13.pl.json | 100 | 50 | Optimal | 0.47 | 8653 | 8653.00 | 0.00 |
| t100m50r3-14.pl.json | 100 | 50 | Solution | 30.09 | 13018 | 12796.00 | 1.71 |
| t100m50r3-15.pl.json | 100 | 50 | Optimal | 3.29 | 9056 | 9056.00 | 0.00 |
| t100m50r3-16.pl.json | 100 | 50 | Optimal | 0.41 | 8680 | 8680.00 | 0.00 |
| t100m50r3-17.pl.json | 100 | 50 | Optimal | 0.55 | 8197 | 8197.00 | 0.00 |
| t100m50r3-18.pl.json | 100 | 50 | Optimal | 0.38 | 9318 | 9318.00 | 0.00 |
| t100m50r3-19.pl.json | 100 | 50 | Optimal | 0.35 | 12265 | 12264.00 | 0.01 |
| t100m50r3-2.pl.json | 100 | 50 | Optimal | 0.79 | 11030 | 11029.00 | 0.01 |
| t100m50r3-20.pl.json | 100 | 50 | Optimal | 0.38 | 7662 | 7662.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m50r3-3.pl.json | 100 | 50 | Optimal | 0.46 | 5348 | 5348.00 | 0.00 |
| t100m50r3-4.pl.json | 100 | 50 | Optimal | 2.02 | 7800 | 7800.00 | 0.00 |
| t100m50r3-5.pl.json | 100 | 50 | Optimal | 0.83 | 4207 | 4207.00 | 0.00 |
| t100m50r3-6.pl.json | 100 | 50 | Optimal | 6.31 | 10596 | 10596.00 | 0.00 |
| t100m50r3-7.pl.json | 100 | 50 | Optimal | 0.43 | 7826 | 7826.00 | 0.00 |
| t100m50r3-8.pl.json | 100 | 50 | Optimal | 0.81 | 7865 | 7865.00 | 0.00 |
| t100m50r3-9.pl.json | 100 | 50 | Optimal | 0.48 | 7891 | 7891.00 | 0.00 |
| t100m50r5-1.pl.json | 100 | 50 | Optimal | 0.78 | 7926 | 7926.00 | 0.00 |
| t100m50r5-10.pl.json | 100 | 50 | Solution | 30.23 | 7299 | 6521.00 | 10.66 |
| t100m50r5-11.pl.json | 100 | 50 | Optimal | 1.56 | 9417 | 9417.00 | 0.00 |
| t100m50r5-12.pl.json | 100 | 50 | Optimal | 3.81 | 8824 | 8824.00 | 0.00 |
| t100m50r5-13.pl.json | 100 | 50 | Solution | 30.05 | 10473 | 9115.00 | 12.97 |
| t100m50r5-14.pl.json | 100 | 50 | Solution | 30.33 | 7503 | 7134.00 | 4.92 |
| t100m50r5-15.pl.json | 100 | 50 | Solution | 30.06 | 10141 | 9853.00 | 2.84 |
| t100m50r5-16.pl.json | 100 | 50 | Optimal | 0.47 | 6481 | 6481.00 | 0.00 |
| t100m50r5-17.pl.json | 100 | 50 | Optimal | 0.50 | 6129 | 6129.00 | 0.00 |
| t100m50r5-18.pl.json | 100 | 50 | Solution | 30.06 | 9100 | 8337.00 | 8.38 |
| t100m50r5-19.pl.json | 100 | 50 | Solution | 30.20 | 6762 | 6356.00 | 6.00 |
| t100m50r5-2.pl.json | 100 | 50 | Optimal | 1.00 | 6651 | 6651.00 | 0.00 |
| t100m50r5-20.pl.json | 100 | 50 | Solution | 30.05 | 6894 | 6667.00 | 3.29 |
| t100m50r5-3.pl.json | 100 | 50 | Solution | 30.19 | 7944 | 7857.00 | 1.10 |
| t100m50r5-4.pl.json | 100 | 50 | Optimal | 1.39 | 8296 | 8296.00 | 0.00 |
| t100m50r5-5.pl.json | 100 | 50 | Optimal | 1.26 | 9977 | 9977.00 | 0.00 |
| t100m50r5-6.pl.json | 100 | 50 | Optimal | 0.91 | 8240 | 8240.00 | 0.00 |
| t100m50r5-7.pl.json | 100 | 50 | Optimal | 1.34 | 10904 | 10903.00 | 0.01 |
| t100m50r5-8.pl.json | 100 | 50 | Optimal | 0.90 | 8293 | 8293.00 | 0.00 |
| t100m50r5-9.pl.json | 100 | 50 | Solution | 30.06 | 7879 | 7622.00 | 3.26 |
| t20m10r10-1.pl.json | 20 | 10 | Optimal | 0.07 | 1337 | 1337.00 | 0.00 |
| t20m10r10-10.pl.json | 20 | 10 | Optimal | 0.05 | 3882 | 3882.00 | 0.00 |
| t20m10r10-11.pl.json | 20 | 10 | Optimal | 0.06 | 2002 | 2002.00 | 0.00 |
| t20m10r10-12.pl.json | 20 | 10 | Optimal | 0.31 | 1257 | 1257.00 | 0.00 |
| t20m10r10-13.pl.json | 20 | 10 | Optimal | 0.06 | 2110 | 2110.00 | 0.00 |
| t20m10r10-14.pl.json | 20 | 10 | Optimal | 2.43 | 2546 | 2546.00 | 0.00 |
| t20m10r10-15.pl.json | 20 | 10 | Optimal | 0.05 | 3344 | 3344.00 | 0.00 |
| t20m10r10-16.pl.json | 20 | 10 | Optimal | 3.87 | 1643 | 1643.00 | 0.00 |
| t20m10r10-17.pl.json | 20 | 10 | Optimal | 0.43 | 1069 | 1069.00 | 0.00 |
| t20m10r10-18.pl.json | 20 | 10 | Optimal | 0.04 | 3041 | 3041.00 | 0.00 |
| t20m10r10-19.pl.json | 20 | 10 | Optimal | 0.04 | 2422 | 2422.00 | 0.00 |
| t20m10r10-2.pl.json | 20 | 10 | Optimal | 0.05 | 1819 | 1819.00 | 0.00 |
| t20m10r10-20.pl.json | 20 | 10 | Optimal | 0.05 | 1595 | 1595.00 | 0.00 |
| t20m10r10-3.pl.json | 20 | 10 | Solution | 30.02 | 843 | 771.00 | 8.54 |
| t20m10r10-4.pl.json | 20 | 10 | Optimal | 0.04 | 1396 | 1396.00 | 0.00 |
| t20m10r10-5.pl.json | 20 | 10 | Optimal | 0.05 | 1710 | 1710.00 | 0.00 |
| t20m10r10-6.pl.json | 20 | 10 | Optimal | 0.03 | 2434 | 2434.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t20m10r10-7.pl.json | 20 | 10 | Optimal | 0.41 | 2696 | 2696.00 | 0.00 |
| t20m10r10-8.pl.json | 20 | 10 | Optimal | 0.03 | 1329 | 1329.00 | 0.00 |
| t20m10r10-9.pl.json | 20 | 10 | Optimal | 4.48 | 2933 | 2933.00 | 0.00 |
| t20m10r3-1.pl.json | 20 | 10 | Optimal | 0.05 | 1876 | 1876.00 | 0.00 |
| t20m10r3-10.pl.json | 20 | 10 | Optimal | 0.05 | 1652 | 1652.00 | 0.00 |
| t20m10r3-11.pl.json | 20 | 10 | Optimal | 0.04 | 1640 | 1640.00 | 0.00 |
| t20m10r3-12.pl.json | 20 | 10 | Optimal | 0.03 | 1758 | 1758.00 | 0.00 |
| t20m10r3-13.pl.json | 20 | 10 | Optimal | 0.03 | 3099 | 3099.00 | 0.00 |
| t20m10r3-14.pl.json | 20 | 10 | Solution | 30.01 | 3891 | 3520.00 | 9.53 |
| t20m10r3-15.pl.json | 20 | 10 | Optimal | 0.05 | 1433 | 1433.00 | 0.00 |
| t20m10r3-16.pl.json | 20 | 10 | Optimal | 0.04 | 1564 | 1564.00 | 0.00 |
| t20m10r3-17.pl.json | 20 | 10 | Optimal | 0.04 | 2321 | 2321.00 | 0.00 |
| t20m10r3-18.pl.json | 20 | 10 | Solution | 30.01 | 821 | 746.00 | 9.14 |
| t20m10r3-19.pl.json | 20 | 10 | Optimal | 0.09 | 1236 | 1236.00 | 0.00 |
| t20m10r3-2.pl.json | 20 | 10 | Optimal | 0.05 | 3258 | 3258.00 | 0.00 |
| t20m10r3-20.pl.json | 20 | 10 | Optimal | 0.04 | 2168 | 2168.00 | 0.00 |
| t20m10r3-3.pl.json | 20 | 10 | Optimal | 0.03 | 2255 | 2255.00 | 0.00 |
| t20m10r3-4.pl.json | 20 | 10 | Optimal | 0.03 | 2707 | 2707.00 | 0.00 |
| t20m10r3-5.pl.json | 20 | 10 | Optimal | 0.05 | 2381 | 2381.00 | 0.00 |
| t20m10r3-6.pl.json | 20 | 10 | Optimal | 0.03 | 3043 | 3043.00 | 0.00 |
| t20m10r3-7.pl.json | 20 | 10 | Optimal | 0.05 | 1738 | 1738.00 | 0.00 |
| t20m10r3-8.pl.json | 20 | 10 | Optimal | 2.74 | 1278 | 1278.00 | 0.00 |
| t20m10r3-9.pl.json | 20 | 10 | Optimal | 0.04 | 2874 | 2874.00 | 0.00 |
| t20m10r5-1.pl.json | 20 | 10 | Optimal | 0.04 | 2586 | 2586.00 | 0.00 |
| t20m10r5-10.pl.json | 20 | 10 | Optimal | 0.05 | 2260 | 2260.00 | 0.00 |
| t20m10r5-11.pl.json | 20 | 10 | Optimal | 0.03 | 3487 | 3487.00 | 0.00 |
| t20m10r5-12.pl.json | 20 | 10 | Optimal | 0.03 | 1559 | 1559.00 | 0.00 |
| t20m10r5-13.pl.json | 20 | 10 | Optimal | 0.22 | 1457 | 1457.00 | 0.00 |
| t20m10r5-14.pl.json | 20 | 10 | Optimal | 0.06 | 1141 | 1141.00 | 0.00 |
| t20m10r5-15.pl.json | 20 | 10 | Optimal | 0.18 | 821 | 821.00 | 0.00 |
| t20m10r5-16.pl.json | 20 | 10 | Optimal | 0.03 | 2910 | 2910.00 | 0.00 |
| t20m10r5-17.pl.json | 20 | 10 | Optimal | 0.05 | 2337 | 2337.00 | 0.00 |
| t20m10r5-18.pl.json | 20 | 10 | Optimal | 3.96 | 2920 | 2920.00 | 0.00 |
| t20m10r5-19.pl.json | 20 | 10 | Optimal | 0.03 | 1952 | 1952.00 | 0.00 |
| t20m10r5-2.pl.json | 20 | 10 | Optimal | 0.03 | 1639 | 1639.00 | 0.00 |
| t20m10r5-20.pl.json | 20 | 10 | Optimal | 0.03 | 2660 | 2660.00 | 0.00 |
| t20m10r5-3.pl.json | 20 | 10 | Optimal | 0.05 | 1406 | 1406.00 | 0.00 |
| t20m10r5-4.pl.json | 20 | 10 | Optimal | 0.05 | 2658 | 2658.00 | 0.00 |
| t20m10r5-5.pl.json | 20 | 10 | Optimal | 0.08 | 794 | 794.00 | 0.00 |
| t20m10r5-6.pl.json | 20 | 10 | Optimal | 0.03 | 2398 | 2398.00 | 0.00 |
| t20m10r5-7.pl.json | 20 | 10 | Optimal | 0.04 | 1430 | 1430.00 | 0.00 |
| t20m10r5-8.pl.json | 20 | 10 | Optimal | 0.06 | 976 | 976.00 | 0.00 |
| t20m10r5-9.pl.json | 20 | 10 | Optimal | 0.04 | 2953 | 2953.00 | 0.00 |
| t30m10r10-1.pl.json | 30 | 10 | Optimal | 6.81 | 3344 | 3344.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t30m10r10-10.pl.json | 30 | 10 | Solution | 30.03 | 4692 | 4146.00 | 11.64 |
| t30m10r10-11.pl.json | 30 | 10 | Optimal | 0.06 | 2905 | 2905.00 | 0.00 |
| t30m10r10-12.pl.json | 30 | 10 | Optimal | 0.06 | 3672 | 3672.00 | 0.00 |
| t30m10r10-13.pl.json | 30 | 10 | Optimal | 0.36 | 2778 | 2778.00 | 0.00 |
| t30m10r10-14.pl.json | 30 | 10 | Optimal | 2.31 | 2741 | 2741.00 | 0.00 |
| t30m10r10-15.pl.json | 30 | 10 | Optimal | 0.05 | 2388 | 2388.00 | 0.00 |
| t30m10r10-16.pl.json | 30 | 10 | Solution | 30.03 | 4225 | 3900.00 | 7.69 |
| t30m10r10-17.pl.json | 30 | 10 | Optimal | 0.08 | 1504 | 1504.00 | 0.00 |
| t30m10r10-18.pl.json | 30 | 10 | Solution | 30.03 | 3287 | 2730.00 | 16.95 |
| t30m10r10-19.pl.json | 30 | 10 | Optimal | 0.05 | 3874 | 3874.00 | 0.00 |
| t30m10r10-2.pl.json | 30 | 10 | Optimal | 0.03 | 3169 | 3169.00 | 0.00 |
| t30m10r10-20.pl.json | 30 | 10 | Optimal | 0.05 | 2691 | 2691.00 | 0.00 |
| t30m10r10-3.pl.json | 30 | 10 | Solution | 30.01 | 3360 | 2851.00 | 15.15 |
| t30m10r10-4.pl.json | 30 | 10 | Optimal | 0.06 | 3452 | 3452.00 | 0.00 |
| t30m10r10-5.pl.json | 30 | 10 | Optimal | 0.05 | 2785 | 2785.00 | 0.00 |
| t30m10r10-6.pl.json | 30 | 10 | Solution | 30.03 | 1013 | 775.00 | 23.49 |
| t30m10r10-7.pl.json | 30 | 10 | Optimal | 27.69 | 3755 | 3755.00 | 0.00 |
| t30m10r10-8.pl.json | 30 | 10 | Solution | 30.02 | 4613 | 4160.00 | 9.82 |
| t30m10r10-9.pl.json | 30 | 10 | Optimal | 0.03 | 2770 | 2770.00 | 0.00 |
| t30m10r3-1.pl.json | 30 | 10 | Optimal | 0.05 | 2901 | 2901.00 | 0.00 |
| t30m10r3-10.pl.json | 30 | 10 | Optimal | 0.04 | 4829 | 4829.00 | 0.00 |
| t30m10r3-11.pl.json | 30 | 10 | Optimal | 0.04 | 2584 | 2584.00 | 0.00 |
| t30m10r3-12.pl.json | 30 | 10 | Optimal | 0.03 | 2130 | 2130.00 | 0.00 |
| t30m10r3-13.pl.json | 30 | 10 | Optimal | 0.03 | 4253 | 4253.00 | 0.00 |
| t30m10r3-14.pl.json | 30 | 10 | Optimal | 0.17 | 1393 | 1393.00 | 0.00 |
| t30m10r3-15.pl.json | 30 | 10 | Optimal | 0.03 | 4149 | 4149.00 | 0.00 |
| t30m10r3-16.pl.json | 30 | 10 | Optimal | 0.05 | 2027 | 2027.00 | 0.00 |
| t30m10r3-17.pl.json | 30 | 10 | Optimal | 0.05 | 2975 | 2975.00 | 0.00 |
| t30m10r3-18.pl.json | 30 | 10 | Optimal | 0.05 | 5477 | 5477.00 | 0.00 |
| t30m10r3-19.pl.json | 30 | 10 | Solution | 30.01 | 1289 | 1042.00 | 19.16 |
| t30m10r3-2.pl.json | 30 | 10 | Optimal | 0.14 | 2523 | 2523.00 | 0.00 |
| t30m10r3-20.pl.json | 30 | 10 | Optimal | 0.05 | 4754 | 4754.00 | 0.00 |
| t30m10r3-3.pl.json | 30 | 10 | Optimal | 0.04 | 2793 | 2793.00 | 0.00 |
| t30m10r3-4.pl.json | 30 | 10 | Optimal | 0.69 | 2809 | 2809.00 | 0.00 |
| t30m10r3-5.pl.json | 30 | 10 | Optimal | 0.04 | 3758 | 3758.00 | 0.00 |
| t30m10r3-6.pl.json | 30 | 10 | Optimal | 0.05 | 2870 | 2870.00 | 0.00 |
| t30m10r3-7.pl.json | 30 | 10 | Optimal | 0.05 | 2122 | 2122.00 | 0.00 |
| t30m10r3-8.pl.json | 30 | 10 | Optimal | 0.03 | 2862 | 2862.00 | 0.00 |
| t30m10r3-9.pl.json | 30 | 10 | Optimal | 0.08 | 2754 | 2754.00 | 0.00 |
| t30m10r5-1.pl.json | 30 | 10 | Optimal | 0.04 | 1998 | 1998.00 | 0.00 |
| t30m10r5-10.pl.json | 30 | 10 | Optimal | 0.04 | 3743 | 3743.00 | 0.00 |
| t30m10r5-11.pl.json | 30 | 10 | Optimal | 0.05 | 2138 | 2138.00 | 0.00 |
| t30m10r5-12.pl.json | 30 | 10 | Optimal | 0.05 | 2251 | 2251.00 | 0.00 |
| t30m10r5-13.pl.json | 30 | 10 | Optimal | 0.05 | 2632 | 2632.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t30m10r5-14.pl.json | 30 | 10 | Optimal | 0.06 | 2201 | 2201.00 | 0.00 |
| t30m10r5-15.pl.json | 30 | 10 | Optimal | 0.09 | 2339 | 2339.00 | 0.00 |
| t30m10r5-16.pl.json | 30 | 10 | Optimal | 0.05 | 4293 | 4293.00 | 0.00 |
| t30m10r5-17.pl.json | 30 | 10 | Optimal | 0.11 | 1314 | 1314.00 | 0.00 |
| t30m10r5-18.pl.json | 30 | 10 | Optimal | 0.07 | 2169 | 2169.00 | 0.00 |
| t30m10r5-19.pl.json | 30 | 10 | Solution | 30.01 | 1346 | 1279.00 | 4.98 |
| t30m10r5-2.pl.json | 30 | 10 | Optimal | 0.05 | 2399 | 2399.00 | 0.00 |
| t30m10r5-20.pl.json | 30 | 10 | Optimal | 0.05 | 1486 | 1486.00 | 0.00 |
| t30m10r5-3.pl.json | 30 | 10 | Optimal | 0.05 | 2494 | 2494.00 | 0.00 |
| t30m10r5-4.pl.json | 30 | 10 | Optimal | 0.03 | 3405 | 3405.00 | 0.00 |
| t30m10r5-5.pl.json | 30 | 10 | Solution | 30.02 | 5243 | 4550.00 | 13.22 |
| t30m10r5-6.pl.json | 30 | 10 | Optimal | 0.05 | 2382 | 2382.00 | 0.00 |
| t30m10r5-7.pl.json | 30 | 10 | Optimal | 0.06 | 2018 | 2018.00 | 0.00 |
| t30m10r5-8.pl.json | 30 | 10 | Optimal | 0.04 | 3089 | 3089.00 | 0.00 |
| t30m10r5-9.pl.json | 30 | 10 | Optimal | 0.05 | 3704 | 3704.00 | 0.00 |
| t30m20r10-1.pl.json | 30 | 20 | Solution | 30.03 | 3702 | 2850.00 | 23.01 |
| t30m20r10-10.pl.json | 30 | 20 | Optimal | 4.79 | 2508 | 2508.00 | 0.00 |
| t30m20r10-11.pl.json | 30 | 20 | Solution | 30.02 | 3648 | 3482.00 | 4.55 |
| t30m20r10-12.pl.json | 30 | 20 | Optimal | 0.09 | 4214 | 4214.00 | 0.00 |
| t30m20r10-13.pl.json | 30 | 20 | Optimal | 15.77 | 3980 | 3980.00 | 0.00 |
| t30m20r10-14.pl.json | 30 | 20 | Optimal | 13.92 | 3141 | 3141.00 | 0.00 |
| t30m20r10-15.pl.json | 30 | 20 | Solution | 30.02 | 4322 | 3457.00 | 20.01 |
| t30m20r10-16.pl.json | 30 | 20 | Optimal | 0.11 | 4002 | 4002.00 | 0.00 |
| t30m20r10-17.pl.json | 30 | 20 | Solution | 30.02 | 4161 | 3363.00 | 19.18 |
| t30m20r10-18.pl.json | 30 | 20 | Optimal | 6.32 | 1992 | 1992.00 | 0.00 |
| t30m20r10-19.pl.json | 30 | 20 | Solution | 30.04 | 2789 | 2250.00 | 19.33 |
| t30m20r10-2.pl.json | 30 | 20 | Solution | 30.02 | 3982 | 3447.00 | 13.44 |
| t30m20r10-20.pl.json | 30 | 20 | Optimal | 5.60 | 2314 | 2314.00 | 0.00 |
| t30m20r10-3.pl.json | 30 | 20 | Optimal | 0.09 | 2158 | 2158.00 | 0.00 |
| t30m20r10-4.pl.json | 30 | 20 | Solution | 30.03 | 4040 | 3217.00 | 20.37 |
| t30m20r10-5.pl.json | 30 | 20 | Optimal | 0.09 | 1237 | 1237.00 | 0.00 |
| t30m20r10-6.pl.json | 30 | 20 | Solution | 30.04 | 3770 | 3600.00 | 4.51 |
| t30m20r10-7.pl.json | 30 | 20 | Optimal | 0.08 | 2266 | 2266.00 | 0.00 |
| t30m20r10-8.pl.json | 30 | 20 | Optimal | 2.08 | 1855 | 1855.00 | 0.00 |
| t30m20r10-9.pl.json | 30 | 20 | Optimal | 3.60 | 2028 | 2028.00 | 0.00 |
| t30m20r3-1.pl.json | 30 | 20 | Optimal | 0.08 | 2200 | 2200.00 | 0.00 |
| t30m20r3-10.pl.json | 30 | 20 | Optimal | 0.07 | 3291 | 3291.00 | 0.00 |
| t30m20r3-11.pl.json | 30 | 20 | Optimal | 0.08 | 4473 | 4473.00 | 0.00 |
| t30m20r3-12.pl.json | 30 | 20 | Solution | 30.02 | 5060 | 4931.00 | 2.55 |
| t30m20r3-13.pl.json | 30 | 20 | Optimal | 0.07 | 3536 | 3536.00 | 0.00 |
| t30m20r3-14.pl.json | 30 | 20 | Optimal | 0.08 | 3432 | 3432.00 | 0.00 |
| t30m20r3-15.pl.json | 30 | 20 | Optimal | 0.08 | 3463 | 3463.00 | 0.00 |
| t30m20r3-16.pl.json | 30 | 20 | Optimal | 0.07 | 3893 | 3893.00 | 0.00 |
| t30m20r3-17.pl.json | 30 | 20 | Optimal | 0.07 | 1892 | 1892.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t30m20r3-18.pl.json | 30 | 20 | Optimal | 0.08 | 2653 | 2653.00 | 0.00 |
| t30m20r3-19.pl.json | 30 | 20 | Optimal | 0.08 | 3141 | 3141.00 | 0.00 |
| t30m20r3-2.pl.json | 30 | 20 | Optimal | 0.08 | 1251 | 1251.00 | 0.00 |
| t30m20r3-20.pl.json | 30 | 20 | Optimal | 5.77 | 2745 | 2745.00 | 0.00 |
| t30m20r3-3.pl.json | 30 | 20 | Optimal | 0.08 | 3434 | 3434.00 | 0.00 |
| t30m20r3-4.pl.json | 30 | 20 | Optimal | 0.10 | 2394 | 2394.00 | 0.00 |
| t30m20r3-5.pl.json | 30 | 20 | Optimal | 0.06 | 3776 | 3776.00 | 0.00 |
| t30m20r3-6.pl.json | 30 | 20 | Optimal | 0.08 | 2250 | 2250.00 | 0.00 |
| t30m20r3-7.pl.json | 30 | 20 | Optimal | 0.12 | 1693 | 1693.00 | 0.00 |
| t30m20r3-8.pl.json | 30 | 20 | Optimal | 0.08 | 4997 | 4997.00 | 0.00 |
| t30m20r3-9.pl.json | 30 | 20 | Optimal | 0.08 | 4898 | 4898.00 | 0.00 |
| t30m20r5-1.pl.json | 30 | 20 | Solution | 30.02 | 3195 | 2787.00 | 12.77 |
| t30m20r5-10.pl.json | 30 | 20 | Optimal | 5.14 | 2133 | 2133.00 | 0.00 |
| t30m20r5-11.pl.json | 30 | 20 | Optimal | 0.08 | 3974 | 3974.00 | 0.00 |
| t30m20r5-12.pl.json | 30 | 20 | Optimal | 0.08 | 2197 | 2197.00 | 0.00 |
| t30m20r5-13.pl.json | 30 | 20 | Optimal | 0.09 | 2296 | 2296.00 | 0.00 |
| t30m20r5-14.pl.json | 30 | 20 | Optimal | 0.07 | 3861 | 3861.00 | 0.00 |
| t30m20r5-15.pl.json | 30 | 20 | Optimal | 0.08 | 2353 | 2353.00 | 0.00 |
| t30m20r5-16.pl.json | 30 | 20 | Optimal | 4.27 | 2751 | 2751.00 | 0.00 |
| t30m20r5-17.pl.json | 30 | 20 | Optimal | 0.08 | 3555 | 3555.00 | 0.00 |
| t30m20r5-18.pl.json | 30 | 20 | Optimal | 0.06 | 2384 | 2384.00 | 0.00 |
| t30m20r5-19.pl.json | 30 | 20 | Optimal | 0.11 | 2080 | 2080.00 | 0.00 |
| t30m20r5-2.pl.json | 30 | 20 | Optimal | 0.10 | 1715 | 1715.00 | 0.00 |
| t30m20r5-20.pl.json | 30 | 20 | Optimal | 0.10 | 4176 | 4176.00 | 0.00 |
| t30m20r5-3.pl.json | 30 | 20 | Solution | 30.05 | 4528 | 4037.00 | 10.84 |
| t30m20r5-4.pl.json | 30 | 20 | Optimal | 0.09 | 3083 | 3083.00 | 0.00 |
| t30m20r5-5.pl.json | 30 | 20 | Optimal | 0.08 | 1969 | 1969.00 | 0.00 |
| t30m20r5-6.pl.json | 30 | 20 | Optimal | 0.08 | 4250 | 4250.00 | 0.00 |
| t30m20r5-7.pl.json | 30 | 20 | Optimal | 0.08 | 3036 | 3036.00 | 0.00 |
| t30m20r5-8.pl.json | 30 | 20 | Optimal | 1.55 | 2834 | 2834.00 | 0.00 |
| t30m20r5-9.pl.json | 30 | 20 | Optimal | 0.10 | 2343 | 2343.00 | 0.00 |
| t40m10r10-1.pl.json | 40 | 10 | Optimal | 0.11 | 2514 | 2514.00 | 0.00 |
| t40m10r10-10.pl.json | 40 | 10 | Optimal | 0.08 | 3557 | 3557.00 | 0.00 |
| t40m10r10-11.pl.json | 40 | 10 | Solution | 30.03 | 4556 | 4262.00 | 6.45 |
| t40m10r10-12.pl.json | 40 | 10 | Solution | 30.01 | 5225 | 4355.00 | 16.65 |
| t40m10r10-13.pl.json | 40 | 10 | Optimal | 16.47 | 2789 | 2789.00 | 0.00 |
| t40m10r10-14.pl.json | 40 | 10 | Optimal | 0.47 | 1648 | 1648.00 | 0.00 |
| t40m10r10-15.pl.json | 40 | 10 | Optimal | 2.03 | 1844 | 1844.00 | 0.00 |
| t40m10r10-16.pl.json | 40 | 10 | Solution | 30.02 | 3749 | 3380.00 | 9.84 |
| t40m10r10-17.pl.json | 40 | 10 | Optimal | 0.14 | 2363 | 2363.00 | 0.00 |
| t40m10r10-18.pl.json | 40 | 10 | Optimal | 0.06 | 4973 | 4973.00 | 0.00 |
| t40m10r10-19.pl.json | 40 | 10 | Optimal | 0.06 | 3181 | 3181.00 | 0.00 |
| t40m10r10-2.pl.json | 40 | 10 | Optimal | 0.20 | 2350 | 2350.00 | 0.00 |
| t40m10r10-20.pl.json | 40 | 10 | Solution | 30.04 | 2730 | 2470.00 | 9.52 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t40m10r10-3.pl.json | 40 | 10 | Optimal | 0.06 | 3717 | 3717.00 | 0.00 |
| t40m10r10-4.pl.json | 40 | 10 | Optimal | 0.08 | 3414 | 3414.00 | 0.00 |
| t40m10r10-5.pl.json | 40 | 10 | Optimal | 5.68 | 2852 | 2852.00 | 0.00 |
| t40m10r10-6.pl.json | 40 | 10 | Solution | 30.02 | 3262 | 2910.00 | 10.79 |
| t40m10r10-7.pl.json | 40 | 10 | Optimal | 0.08 | 4572 | 4572.00 | 0.00 |
| t40m10r10-8.pl.json | 40 | 10 | Solution | 30.03 | 3776 | 3385.00 | 10.35 |
| t40m10r10-9.pl.json | 40 | 10 | Optimal | 0.11 | 2524 | 2524.00 | 0.00 |
| t40m10r3-1.pl.json | 40 | 10 | Optimal | 0.09 | 4832 | 4832.00 | 0.00 |
| t40m10r3-10.pl.json | 40 | 10 | Optimal | 0.15 | 2442 | 2442.00 | 0.00 |
| t40m10r3-11.pl.json | 40 | 10 | Optimal | 0.06 | 3218 | 3218.00 | 0.00 |
| t40m10r3-12.pl.json | 40 | 10 | Optimal | 0.06 | 3863 | 3863.00 | 0.00 |
| t40m10r3-13.pl.json | 40 | 10 | Optimal | 0.07 | 3564 | 3564.00 | 0.00 |
| t40m10r3-14.pl.json | 40 | 10 | Optimal | 0.08 | 4913 | 4913.00 | 0.00 |
| t40m10r3-15.pl.json | 40 | 10 | Optimal | 0.26 | 3785 | 3785.00 | 0.00 |
| t40m10r3-16.pl.json | 40 | 10 | Optimal | 0.11 | 2840 | 2840.00 | 0.00 |
| t40m10r3-17.pl.json | 40 | 10 | Optimal | 0.06 | 5506 | 5506.00 | 0.00 |
| t40m10r3-18.pl.json | 40 | 10 | Optimal | 0.08 | 3848 | 3848.00 | 0.00 |
| t40m10r3-19.pl.json | 40 | 10 | Optimal | 0.11 | 2259 | 2259.00 | 0.00 |
| t40m10r3-2.pl.json | 40 | 10 | Solution | 30.04 | 1727 | 1589.00 | 7.99 |
| t40m10r3-20.pl.json | 40 | 10 | Optimal | 0.09 | 4157 | 4157.00 | 0.00 |
| t40m10r3-3.pl.json | 40 | 10 | Optimal | 0.08 | 4903 | 4903.00 | 0.00 |
| t40m10r3-4.pl.json | 40 | 10 | Solution | 30.03 | 1635 | 1341.00 | 17.98 |
| t40m10r3-5.pl.json | 40 | 10 | Optimal | 0.16 | 1984 | 1984.00 | 0.00 |
| t40m10r3-6.pl.json | 40 | 10 | Optimal | 0.06 | 5005 | 5005.00 | 0.00 |
| t40m10r3-7.pl.json | 40 | 10 | Solution | 30.03 | 5545 | 5188.00 | 6.44 |
| t40m10r3-8.pl.json | 40 | 10 | Optimal | 0.08 | 3658 | 3658.00 | 0.00 |
| t40m10r3-9.pl.json | 40 | 10 | Optimal | 0.19 | 3830 | 3830.00 | 0.00 |
| t40m10r5-1.pl.json | 40 | 10 | Optimal | 0.08 | 4857 | 4857.00 | 0.00 |
| t40m10r5-10.pl.json | 40 | 10 | Optimal | 0.08 | 3989 | 3989.00 | 0.00 |
| t40m10r5-11.pl.json | 40 | 10 | Optimal | 0.08 | 5238 | 5238.00 | 0.00 |
| t40m10r5-12.pl.json | 40 | 10 | Optimal | 0.08 | 4584 | 4584.00 | 0.00 |
| t40m10r5-13.pl.json | 40 | 10 | Optimal | 0.09 | 2307 | 2307.00 | 0.00 |
| t40m10r5-14.pl.json | 40 | 10 | Optimal | 0.30 | 1826 | 1826.00 | 0.00 |
| t40m10r5-15.pl.json | 40 | 10 | Optimal | 0.11 | 1926 | 1926.00 | 0.00 |
| t40m10r5-16.pl.json | 40 | 10 | Optimal | 0.11 | 5216 | 5216.00 | 0.00 |
| t40m10r5-17.pl.json | 40 | 10 | Optimal | 0.08 | 7162 | 7162.00 | 0.00 |
| t40m10r5-18.pl.json | 40 | 10 | Optimal | 0.11 | 4892 | 4892.00 | 0.00 |
| t40m10r5-19.pl.json | 40 | 10 | Optimal | 0.08 | 4027 | 4027.00 | 0.00 |
| t40m10r5-2.pl.json | 40 | 10 | Optimal | 8.38 | 4099 | 4099.00 | 0.00 |
| t40m10r5-20.pl.json | 40 | 10 | Solution | 30.02 | 4899 | 4755.00 | 2.94 |
| t40m10r5-3.pl.json | 40 | 10 | Optimal | 0.08 | 3113 | 3113.00 | 0.00 |
| t40m10r5-4.pl.json | 40 | 10 | Optimal | 0.10 | 6626 | 6626.00 | 0.00 |
| t40m10r5-5.pl.json | 40 | 10 | Optimal | 0.08 | 3828 | 3828.00 | 0.00 |
| t40m10r5-6.pl.json | 40 | 10 | Optimal | 0.09 | 4213 | 4213.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t40m10r5-7.pl.json | 40 | 10 | Optimal | 0.28 | 4303 | 4303.00 | 0.00 |
| t40m10r5-8.pl.json | 40 | 10 | Solution | 30.03 | 3559 | 3189.00 | 10.40 |
| t40m10r5-9.pl.json | 40 | 10 | Optimal | 0.41 | 1953 | 1953.00 | 0.00 |
| t40m20r10-1.pl.json | 40 | 20 | Solution | 30.09 | 4518 | 3972.00 | 12.08 |
| t40m20r10-10.pl.json | 40 | 20 | Optimal | 12.43 | 3862 | 3862.00 | 0.00 |
| t40m20r10-11.pl.json | 40 | 20 | Optimal | 0.14 | 1952 | 1952.00 | 0.00 |
| t40m20r10-12.pl.json | 40 | 20 | Optimal | 0.14 | 4129 | 4129.00 | 0.00 |
| t40m20r10-13.pl.json | 40 | 20 | Optimal | 0.28 | 2927 | 2927.00 | 0.00 |
| t40m20r10-14.pl.json | 40 | 20 | Solution | 30.05 | 2701 | 2381.00 | 11.85 |
| t40m20r10-15.pl.json | 40 | 20 | Optimal | 11.77 | 3168 | 3168.00 | 0.00 |
| t40m20r10-16.pl.json | 40 | 20 | Optimal | 0.14 | 2812 | 2812.00 | 0.00 |
| t40m20r10-17.pl.json | 40 | 20 | Solution | 30.07 | 4288 | 3718.00 | 13.29 |
| t40m20r10-18.pl.json | 40 | 20 | Solution | 30.05 | 3611 | 3194.00 | 11.55 |
| t40m20r10-19.pl.json | 40 | 20 | Optimal | 12.23 | 2891 | 2891.00 | 0.00 |
| t40m20r10-2.pl.json | 40 | 20 | Optimal | 8.74 | 3284 | 3284.00 | 0.00 |
| t40m20r10-20.pl.json | 40 | 20 | Solution | 30.04 | 5506 | 4945.00 | 10.19 |
| t40m20r10-3.pl.json | 40 | 20 | Solution | 30.08 | 5981 | 5478.00 | 8.41 |
| t40m20r10-4.pl.json | 40 | 20 | Optimal | 0.14 | 3409 | 3409.00 | 0.00 |
| t40m20r10-5.pl.json | 40 | 20 | Solution | 30.06 | 5113 | 4278.00 | 16.33 |
| t40m20r10-6.pl.json | 40 | 20 | Solution | 30.03 | 2376 | 2333.00 | 1.81 |
| t40m20r10-7.pl.json | 40 | 20 | Solution | 30.06 | 4799 | 4243.00 | 11.59 |
| t40m20r10-8.pl.json | 40 | 20 | Solution | 30.02 | 3924 | 3327.00 | 15.21 |
| t40m20r10-9.pl.json | 40 | 20 | Optimal | 3.86 | 2043 | 2043.00 | 0.00 |
| t40m20r3-1.pl.json | 40 | 20 | Optimal | 0.16 | 3524 | 3524.00 | 0.00 |
| t40m20r3-10.pl.json | 40 | 20 | Optimal | 0.19 | 3110 | 3110.00 | 0.00 |
| t40m20r3-11.pl.json | 40 | 20 | Optimal | 0.15 | 3695 | 3695.00 | 0.00 |
| t40m20r3-12.pl.json | 40 | 20 | Optimal | 0.24 | 4828 | 4828.00 | 0.00 |
| t40m20r3-13.pl.json | 40 | 20 | Optimal | 0.25 | 4010 | 4010.00 | 0.00 |
| t40m20r3-14.pl.json | 40 | 20 | Optimal | 0.14 | 2752 | 2752.00 | 0.00 |
| t40m20r3-15.pl.json | 40 | 20 | Optimal | 0.16 | 3312 | 3312.00 | 0.00 |
| t40m20r3-16.pl.json | 40 | 20 | Optimal | 0.16 | 4304 | 4304.00 | 0.00 |
| t40m20r3-17.pl.json | 40 | 20 | Optimal | 0.17 | 3991 | 3991.00 | 0.00 |
| t40m20r3-18.pl.json | 40 | 20 | Optimal | 0.17 | 5733 | 5733.00 | 0.00 |
| t40m20r3-19.pl.json | 40 | 20 | Optimal | 0.17 | 3581 | 3581.00 | 0.00 |
| t40m20r3-2.pl.json | 40 | 20 | Optimal | 0.17 | 4869 | 4869.00 | 0.00 |
| t40m20r3-20.pl.json | 40 | 20 | Optimal | 0.17 | 3514 | 3514.00 | 0.00 |
| t40m20r3-3.pl.json | 40 | 20 | Optimal | 0.24 | 2503 | 2503.00 | 0.00 |
| t40m20r3-4.pl.json | 40 | 20 | Optimal | 0.13 | 4323 | 4323.00 | 0.00 |
| t40m20r3-5.pl.json | 40 | 20 | Optimal | 0.17 | 3626 | 3626.00 | 0.00 |
| t40m20r3-6.pl.json | 40 | 20 | Optimal | 0.17 | 2488 | 2488.00 | 0.00 |
| t40m20r3-7.pl.json | 40 | 20 | Optimal | 0.17 | 3470 | 3470.00 | 0.00 |
| t40m20r3-8.pl.json | 40 | 20 | Optimal | 0.24 | 6730 | 6730.00 | 0.00 |
| t40m20r3-9.pl.json | 40 | 20 | Optimal | 0.20 | 4656 | 4656.00 | 0.00 |
| t40m20r5-1.pl.json | 40 | 20 | Optimal | 0.28 | 1318 | 1318.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t40m20r5-10.pl.json | 40 | 20 | Optimal | 0.25 | 2216 | 2216.00 | 0.00 |
| t40m20r5-11.pl.json | 40 | 20 | Optimal | 0.25 | 3538 | 3538.00 | 0.00 |
| t40m20r5-12.pl.json | 40 | 20 | Optimal | 0.23 | 5346 | 5346.00 | 0.00 |
| t40m20r5-13.pl.json | 40 | 20 | Solution | 30.03 | 4589 | 4393.00 | 4.27 |
| t40m20r5-14.pl.json | 40 | 20 | Optimal | 0.17 | 2243 | 2243.00 | 0.00 |
| t40m20r5-15.pl.json | 40 | 20 | Solution | 30.08 | 3869 | 3590.00 | 7.21 |
| t40m20r5-16.pl.json | 40 | 20 | Optimal | 0.17 | 4319 | 4319.00 | 0.00 |
| t40m20r5-17.pl.json | 40 | 20 | Optimal | 0.18 | 4866 | 4866.00 | 0.00 |
| t40m20r5-18.pl.json | 40 | 20 | Optimal | 0.39 | 5802 | 5802.00 | 0.00 |
| t40m20r5-19.pl.json | 40 | 20 | Solution | 30.06 | 4197 | 4072.00 | 2.98 |
| t40m20r5-2.pl.json | 40 | 20 | Optimal | 0.16 | 2634 | 2634.00 | 0.00 |
| t40m20r5-20.pl.json | 40 | 20 | Solution | 30.03 | 6482 | 6232.00 | 3.86 |
| t40m20r5-3.pl.json | 40 | 20 | Optimal | 0.19 | 4391 | 4391.00 | 0.00 |
| t40m20r5-4.pl.json | 40 | 20 | Optimal | 9.64 | 4610 | 4610.00 | 0.00 |
| t40m20r5-5.pl.json | 40 | 20 | Optimal | 0.17 | 3105 | 3105.00 | 0.00 |
| t40m20r5-6.pl.json | 40 | 20 | Optimal | 0.16 | 4760 | 4760.00 | 0.00 |
| t40m20r5-7.pl.json | 40 | 20 | Optimal | 0.31 | 1218 | 1218.00 | 0.00 |
| t40m20r5-8.pl.json | 40 | 20 | Solution | 30.05 | 2601 | 2190.00 | 15.80 |
| t40m20r5-9.pl.json | 40 | 20 | Optimal | 0.19 | 3141 | 3141.00 | 0.00 |
| t500m100r10-1.pl.json | 500 | 100 | Solution | 30.96 | 50084 | 799.00 | 98.40 |
| t500m100r10-10.pl.json | 500 | 100 | Solution | 30.54 | 43793 | 795.00 | 98.18 |
| t500m100r10-11.pl.json | 500 | 100 | Solution | 30.92 | 36367 | 801.00 | 97.80 |
| t500m100r10-12.pl.json | 500 | 100 | Solution | 30.64 | 52619 | 801.00 | 98.48 |
| t500m100r10-13.pl.json | 500 | 100 | Solution | 30.63 | 45030 | 801.00 | 98.22 |
| t500m100r10-14.pl.json | 500 | 100 | Solution | 30.54 | 40089 | 800.00 | 98.00 |
| t500m100r10-15.pl.json | 500 | 100 | Solution | 30.45 | 41425 | 801.00 | 98.07 |
| t500m100r10-16.pl.json | 500 | 100 | Solution | 30.65 | 40463 | 801.00 | 98.02 |
| t500m100r10-17.pl.json | 500 | 100 | Solution | 30.43 | 33209 | 798.00 | 97.60 |
| t500m100r10-18.pl.json | 500 | 100 | Solution | 30.44 | 41028 | 801.00 | 98.05 |
| t500m100r10-19.pl.json | 500 | 100 | Solution | 30.94 | 49137 | 801.00 | 98.37 |
| t500m100r10-2.pl.json | 500 | 100 | Solution | 30.54 | 42142 | 796.00 | 98.11 |
| t500m100r10-20.pl.json | 500 | 100 | Solution | 30.35 | 38167 | 801.00 | 97.90 |
| t500m100r10-3.pl.json | 500 | 100 | Solution | 30.39 | 37653 | 801.00 | 97.87 |
| t500m100r10-4.pl.json | 500 | 100 | Solution | 30.67 | 39921 | 798.00 | 98.00 |
| t500m100r10-5.pl.json | 500 | 100 | Solution | 30.47 | 35252 | 800.00 | 97.73 |
| t500m100r10-6.pl.json | 500 | 100 | Solution | 30.65 | 41172 | 801.00 | 98.05 |
| t500m100r10-7.pl.json | 500 | 100 | Solution | 30.97 | 41044 | 800.00 | 98.05 |
| t500m100r10-8.pl.json | 500 | 100 | Solution | 30.52 | 46351 | 800.00 | 98.27 |
| t500m100r10-9.pl.json | 500 | 100 | Solution | 30.51 | 40539 | 800.00 | 98.03 |
| t500m100r3-1.pl.json | 500 | 100 | Solution | 30.55 | 39303 | 801.00 | 97.96 |
| t500m100r3-10.pl.json | 500 | 100 | Solution | 30.65 | 42052 | 801.00 | 98.10 |
| t500m100r3-11.pl.json | 500 | 100 | Solution | 30.62 | 38084 | 794.00 | 97.92 |
| t500m100r3-12.pl.json | 500 | 100 | Solution | 30.70 | 38483 | 800.00 | 97.92 |
| t500m100r3-13.pl.json | 500 | 100 | Solution | 30.57 | 35447 | 801.00 | 97.74 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m100r3-14.pl.json | 500 | 100 | Solution | 30.42 | 40571 | 798.00 | 98.03 |
| t500m100r3-15.pl.json | 500 | 100 | Solution | 30.45 | 38987 | 801.00 | 97.95 |
| t500m100r3-16.pl.json | 500 | 100 | Solution | 30.59 | 41984 | 798.00 | 98.10 |
| t500m100r3-17.pl.json | 500 | 100 | Solution | 30.48 | 54523 | 801.00 | 98.53 |
| t500m100r3-18.pl.json | 500 | 100 | Solution | 30.89 | 39919 | 801.00 | 97.99 |
| t500m100r3-19.pl.json | 500 | 100 | Optimal | 10.63 | 41896 | 41892.00 | 0.01 |
| t500m100r3-2.pl.json | 500 | 100 | Optimal | 10.86 | 41211 | 41207.00 | 0.01 |
| t500m100r3-20.pl.json | 500 | 100 | Solution | 30.78 | 38551 | 800.00 | 97.92 |
| t500m100r3-3.pl.json | 500 | 100 | Solution | 30.79 | 35516 | 798.00 | 97.75 |
| t500m100r3-4.pl.json | 500 | 100 | Solution | 30.36 | 32084 | 798.00 | 97.51 |
| t500m100r3-5.pl.json | 500 | 100 | Solution | 30.66 | 38761 | 801.00 | 97.93 |
| t500m100r3-6.pl.json | 500 | 100 | Solution | 30.52 | 46048 | 800.00 | 98.26 |
| t500m100r3-7.pl.json | 500 | 100 | Solution | 30.45 | 37680 | 800.00 | 97.88 |
| t500m100r3-8.pl.json | 500 | 100 | Solution | 30.69 | 40838 | 799.00 | 98.04 |
| t500m100r3-9.pl.json | 500 | 100 | Solution | 30.85 | 44803 | 801.00 | 98.21 |
| t500m100r5-1.pl.json | 500 | 100 | Solution | 30.49 | 36936 | 797.00 | 97.84 |
| t500m100r5-10.pl.json | 500 | 100 | Solution | 31.15 | 30332 | 800.00 | 97.36 |
| t500m100r5-11.pl.json | 500 | 100 | Solution | 30.80 | 37660 | 801.00 | 97.87 |
| t500m100r5-12.pl.json | 500 | 100 | Solution | 30.42 | 39090 | 799.00 | 97.96 |
| t500m100r5-13.pl.json | 500 | 100 | Solution | 30.39 | 44171 | 801.00 | 98.19 |
| t500m100r5-14.pl.json | 500 | 100 | Solution | 30.45 | 39568 | 800.00 | 97.98 |
| t500m100r5-15.pl.json | 500 | 100 | Solution | 30.57 | 38257 | 800.00 | 97.91 |
| t500m100r5-16.pl.json | 500 | 100 | Solution | 30.61 | 35151 | 798.00 | 97.73 |
| t500m100r5-17.pl.json | 500 | 100 | Solution | 30.72 | 39749 | 797.00 | 97.99 |
| t500m100r5-18.pl.json | 500 | 100 | Solution | 30.54 | 45868 | 801.00 | 98.25 |
| t500m100r5-19.pl.json | 500 | 100 | Solution | 30.40 | 46018 | 801.00 | 98.26 |
| t500m100r5-2.pl.json | 500 | 100 | Solution | 30.58 | 43708 | 800.00 | 98.17 |
| t500m100r5-20.pl.json | 500 | 100 | Solution | 30.82 | 39466 | 800.00 | 97.97 |
| t500m100r5-3.pl.json | 500 | 100 | Solution | 30.77 | 42468 | 801.00 | 98.11 |
| t500m100r5-4.pl.json | 500 | 100 | Solution | 30.57 | 33936 | 801.00 | 97.64 |
| t500m100r5-5.pl.json | 500 | 100 | Solution | 30.69 | 38103 | 795.00 | 97.91 |
| t500m100r5-6.pl.json | 500 | 100 | Solution | 30.62 | 45271 | 801.00 | 98.23 |
| t500m100r5-7.pl.json | 500 | 100 | Solution | 30.68 | 43542 | 800.00 | 98.16 |
| t500m100r5-8.pl.json | 500 | 100 | Solution | 30.74 | 38116 | 796.00 | 97.91 |
| t500m100r5-9.pl.json | 500 | 100 | Solution | 30.43 | 39282 | 801.00 | 97.96 |
| t500m10r10-1.pl.json | 500 | 10 | Solution | 30.06 | 48213 | 42756.00 | 11.32 |
| t500m10r10-10.pl.json | 500 | 10 | Solution | 30.08 | 35490 | 30745.00 | 13.37 |
| t500m10r10-11.pl.json | 500 | 10 | Solution | 30.10 | 47651 | 42832.00 | 10.11 |
| t500m10r10-12.pl.json | 500 | 10 | Solution | 30.09 | 43253 | 35908.00 | 16.98 |
| t500m10r10-13.pl.json | 500 | 10 | Solution | 30.28 | 45925 | 798.00 | 98.26 |
| t500m10r10-14.pl.json | 500 | 10 | Solution | 30.12 | 41016 | 799.00 | 98.05 |
| t500m10r10-15.pl.json | 500 | 10 | Solution | 30.28 | 38848 | 801.00 | 97.94 |
| t500m10r10-16.pl.json | 500 | 10 | Solution | 31.63 | 40674 | 801.00 | 98.03 |
| t500m10r10-17.pl.json | 500 | 10 | Solution | 30.09 | 38549 | 798.00 | 97.93 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m10r10-18.pl.json | 500 | 10 | Solution | 30.26 | 39836 | 801.00 | 97.99 |
| t500m10r10-19.pl.json | 500 | 10 | Solution | 30.49 | 49367 | 797.00 | 98.39 |
| t500m10r10-2.pl.json | 500 | 10 | Solution | 31.15 | 38579 | 798.00 | 97.93 |
| t500m10r10-20.pl.json | 500 | 10 | Solution | 30.87 | 42088 | 801.00 | 98.10 |
| t500m10r10-3.pl.json | 500 | 10 | Solution | 30.31 | 38070 | 801.00 | 97.90 |
| t500m10r10-4.pl.json | 500 | 10 | Solution | 30.26 | 46184 | 799.00 | 98.27 |
| t500m10r10-5.pl.json | 500 | 10 | Solution | 31.06 | 47452 | 799.00 | 98.32 |
| t500m10r10-6.pl.json | 500 | 10 | Solution | 30.17 | 35899 | 799.00 | 97.77 |
| t500m10r10-7.pl.json | 500 | 10 | Solution | 30.64 | 39279 | 33091.00 | 15.75 |
| t500m10r10-8.pl.json | 500 | 10 | Solution | 30.32 | 45094 | 801.00 | 98.22 |
| t500m10r10-9.pl.json | 500 | 10 | Solution | 31.96 | 37640 | 801.00 | 97.87 |
| t500m10r3-1.pl.json | 500 | 10 | Solution | 30.16 | 38726 | 801.00 | 97.93 |
| t500m10r3-10.pl.json | 500 | 10 | Solution | 30.98 | 47861 | 801.00 | 98.33 |
| t500m10r3-11.pl.json | 500 | 10 | Solution | 31.01 | 38763 | 801.00 | 97.93 |
| t500m10r3-12.pl.json | 500 | 10 | Solution | 31.17 | 41550 | 800.00 | 98.07 |
| t500m10r3-13.pl.json | 500 | 10 | Solution | 30.56 | 38451 | 36639.00 | 4.71 |
| t500m10r3-14.pl.json | 500 | 10 | Solution | 30.16 | 39832 | 799.00 | 97.99 |
| t500m10r3-15.pl.json | 500 | 10 | Solution | 31.31 | 40922 | 801.00 | 98.04 |
| t500m10r3-16.pl.json | 500 | 10 | Solution | 31.25 | 34687 | 798.00 | 97.70 |
| t500m10r3-17.pl.json | 500 | 10 | Solution | 30.28 | 48591 | 801.00 | 98.35 |
| t500m10r3-18.pl.json | 500 | 10 | Solution | 32.24 | 38349 | 801.00 | 97.91 |
| t500m10r3-19.pl.json | 500 | 10 | Optimal | 13.39 | 49332 | 49328.00 | 0.01 |
| t500m10r3-2.pl.json | 500 | 10 | Solution | 30.14 | 41108 | 801.00 | 98.05 |
| t500m10r3-20.pl.json | 500 | 10 | Solution | 30.29 | 47503 | 801.00 | 98.31 |
| t500m10r3-3.pl.json | 500 | 10 | Solution | 30.21 | 38241 | 37399.00 | 2.20 |
| t500m10r3-4.pl.json | 500 | 10 | Solution | 30.20 | 48648 | 801.00 | 98.35 |
| t500m10r3-5.pl.json | 500 | 10 | Solution | 30.17 | 39474 | 800.00 | 97.97 |
| t500m10r3-6.pl.json | 500 | 10 | Solution | 30.56 | 41357 | 801.00 | 98.06 |
| t500m10r3-7.pl.json | 500 | 10 | Solution | 30.46 | 37420 | 800.00 | 97.86 |
| t500m10r3-8.pl.json | 500 | 10 | Solution | 30.28 | 43484 | 801.00 | 98.16 |
| t500m10r3-9.pl.json | 500 | 10 | Solution | 31.26 | 41905 | 799.00 | 98.09 |
| t500m10r5-1.pl.json | 500 | 10 | Solution | 30.33 | 41726 | 801.00 | 98.08 |
| t500m10r5-10.pl.json | 500 | 10 | Solution | 30.55 | 41224 | 801.00 | 98.06 |
| t500m10r5-11.pl.json | 500 | 10 | Solution | 31.07 | 45156 | 801.00 | 98.23 |
| t500m10r5-12.pl.json | 500 | 10 | Solution | 31.19 | 36993 | 801.00 | 97.83 |
| t500m10r5-13.pl.json | 500 | 10 | Solution | 30.81 | 43453 | 801.00 | 98.16 |
| t500m10r5-14.pl.json | 500 | 10 | Solution | 30.28 | 40022 | 799.00 | 98.00 |
| t500m10r5-15.pl.json | 500 | 10 | Solution | 30.21 | 39552 | 801.00 | 97.97 |
| t500m10r5-16.pl.json | 500 | 10 | Solution | 30.28 | 38482 | 801.00 | 97.92 |
| t500m10r5-17.pl.json | 500 | 10 | Solution | 30.13 | 42266 | 798.00 | 98.11 |
| t500m10r5-18.pl.json | 500 | 10 | Solution | 31.18 | 42898 | 798.00 | 98.14 |
| t500m10r5-19.pl.json | 500 | 10 | Solution | 30.21 | 41858 | 801.00 | 98.09 |
| t500m10r5-2.pl.json | 500 | 10 | Solution | 30.47 | 38818 | 800.00 | 97.94 |
| t500m10r5-20.pl.json | 500 | 10 | Solution | 30.13 | 47214 | 799.00 | 98.31 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m10r5-3.pl.json | 500 | 10 | Solution | 30.66 | 42610 | 800.00 | 98.12 |
| t500m10r5-4.pl.json | 500 | 10 | Solution | 30.98 | 38232 | 796.00 | 97.92 |
| t500m10r5-5.pl.json | 500 | 10 | Solution | 32.41 | 35577 | 799.00 | 97.75 |
| t500m10r5-6.pl.json | 500 | 10 | Solution | 30.50 | 42661 | 801.00 | 98.12 |
| t500m10r5-7.pl.json | 500 | 10 | Solution | 31.06 | 39272 | 801.00 | 97.96 |
| t500m10r5-8.pl.json | 500 | 10 | Solution | 30.20 | 45732 | 800.00 | 98.25 |
| t500m10r5-9.pl.json | 500 | 10 | Solution | 30.10 | 40110 | 800.00 | 98.01 |
| t500m20r10-1.pl.json | 500 | 20 | Solution | 30.46 | 41844 | 801.00 | 98.09 |
| t500m20r10-10.pl.json | 500 | 20 | Solution | 30.25 | 38682 | 798.00 | 97.94 |
| t500m20r10-11.pl.json | 500 | 20 | Solution | 30.30 | 38851 | 799.00 | 97.94 |
| t500m20r10-12.pl.json | 500 | 20 | Solution | 30.60 | 40997 | 801.00 | 98.05 |
| t500m20r10-13.pl.json | 500 | 20 | Solution | 30.80 | 42326 | 800.00 | 98.11 |
| t500m20r10-14.pl.json | 500 | 20 | Solution | 30.37 | 40102 | 798.00 | 98.01 |
| t500m20r10-15.pl.json | 500 | 20 | Solution | 30.37 | 37261 | 801.00 | 97.85 |
| t500m20r10-16.pl.json | 500 | 20 | Solution | 30.31 | 45059 | 799.00 | 98.23 |
| t500m20r10-17.pl.json | 500 | 20 | Solution | 30.47 | 40322 | 801.00 | 98.01 |
| t500m20r10-18.pl.json | 500 | 20 | Solution | 30.42 | 41699 | 801.00 | 98.08 |
| t500m20r10-19.pl.json | 500 | 20 | Solution | 30.41 | 42802 | 800.00 | 98.13 |
| t500m20r10-2.pl.json | 500 | 20 | Solution | 30.44 | 46938 | 801.00 | 98.29 |
| t500m20r10-20.pl.json | 500 | 20 | Solution | 30.63 | 41229 | 801.00 | 98.06 |
| t500m20r10-3.pl.json | 500 | 20 | Solution | 31.61 | 42399 | 797.00 | 98.12 |
| t500m20r10-4.pl.json | 500 | 20 | Solution | 30.25 | 35833 | 801.00 | 97.76 |
| t500m20r10-5.pl.json | 500 | 20 | Solution | 31.95 | 47409 | 799.00 | 98.31 |
| t500m20r10-6.pl.json | 500 | 20 | Solution | 30.28 | 38270 | 800.00 | 97.91 |
| t500m20r10-7.pl.json | 500 | 20 | Solution | 30.43 | 33671 | 800.00 | 97.62 |
| t500m20r10-8.pl.json | 500 | 20 | Solution | 30.29 | 42768 | 801.00 | 98.13 |
| t500m20r10-9.pl.json | 500 | 20 | Solution | 31.70 | 42752 | 800.00 | 98.13 |
| t500m20r3-1.pl.json | 500 | 20 | Solution | 30.60 | 37589 | 800.00 | 97.87 |
| t500m20r3-10.pl.json | 500 | 20 | Solution | 30.36 | 43028 | 799.00 | 98.14 |
| t500m20r3-11.pl.json | 500 | 20 | Solution | 30.25 | 38845 | 798.00 | 97.95 |
| t500m20r3-12.pl.json | 500 | 20 | Optimal | 20.86 | 40309 | 40305.00 | 0.01 |
| t500m20r3-13.pl.json | 500 | 20 | Solution | 30.28 | 33674 | 801.00 | 97.62 |
| t500m20r3-14.pl.json | 500 | 20 | Solution | 31.31 | 35053 | 801.00 | 97.71 |
| t500m20r3-15.pl.json | 500 | 20 | Solution | 30.48 | 37738 | 798.00 | 97.89 |
| t500m20r3-16.pl.json | 500 | 20 | Optimal | 10.02 | 42848 | 42844.00 | 0.01 |
| t500m20r3-17.pl.json | 500 | 20 | Solution | 30.45 | 39712 | 801.00 | 97.98 |
| t500m20r3-18.pl.json | 500 | 20 | Optimal | 26.11 | 43126 | 43122.00 | 0.01 |
| t500m20r3-19.pl.json | 500 | 20 | Solution | 30.60 | 38470 | 801.00 | 97.92 |
| t500m20r3-2.pl.json | 500 | 20 | Solution | 31.20 | 42503 | 801.00 | 98.12 |
| t500m20r3-20.pl.json | 500 | 20 | Solution | 30.56 | 45671 | 796.00 | 98.26 |
| t500m20r3-3.pl.json | 500 | 20 | Solution | 31.44 | 31953 | 801.00 | 97.49 |
| t500m20r3-4.pl.json | 500 | 20 | Optimal | 19.30 | 43640 | 43636.00 | 0.01 |
| t500m20r3-5.pl.json | 500 | 20 | Solution | 31.71 | 48450 | 801.00 | 98.35 |
| t500m20r3-6.pl.json | 500 | 20 | Solution | 30.21 | 35374 | 799.00 | 97.74 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|--------|----------------|
| t500m20r3-7.pl.json | 500 | 20 | Solution | 31.64 | 45964 | 796.00 | 98.27 |
| t500m20r3-8.pl.json | 500 | 20 | Solution | 31.19 | 44328 | 800.00 | 98.20 |
| t500m20r3-9.pl.json | 500 | 20 | Solution | 30.76 | 41079 | 801.00 | 98.05 |
| t500m20r5-1.pl.json | 500 | 20 | Solution | 30.82 | 36856 | 801.00 | 97.83 |
| t500m20r5-10.pl.json | 500 | 20 | Solution | 34.35 | 45187 | 801.00 | 98.23 |
| t500m20r5-11.pl.json | 500 | 20 | Solution | 30.26 | 37707 | 801.00 | 97.88 |
| t500m20r5-12.pl.json | 500 | 20 | Solution | 30.38 | 37405 | 800.00 | 97.86 |
| t500m20r5-13.pl.json | 500 | 20 | Solution | 31.71 | 42913 | 799.00 | 98.14 |
| t500m20r5-14.pl.json | 500 | 20 | Solution | 30.23 | 47228 | 801.00 | 98.30 |
| t500m20r5-15.pl.json | 500 | 20 | Solution | 30.47 | 40611 | 801.00 | 98.03 |
| t500m20r5-16.pl.json | 500 | 20 | Solution | 30.25 | 38970 | 796.00 | 97.96 |
| t500m20r5-17.pl.json | 500 | 20 | Solution | 31.62 | 42158 | 799.00 | 98.10 |
| t500m20r5-18.pl.json | 500 | 20 | Solution | 30.57 | 43669 | 800.00 | 98.17 |
| t500m20r5-19.pl.json | 500 | 20 | Solution | 32.15 | 41883 | 800.00 | 98.09 |
| t500m20r5-2.pl.json | 500 | 20 | Solution | 30.51 | 42467 | 800.00 | 98.12 |
| t500m20r5-20.pl.json | 500 | 20 | Solution | 31.79 | 37677 | 801.00 | 97.87 |
| t500m20r5-3.pl.json | 500 | 20 | Solution | 31.76 | 41645 | 801.00 | 98.08 |
| t500m20r5-4.pl.json | 500 | 20 | Solution | 30.15 | 43010 | 801.00 | 98.14 |
| t500m20r5-5.pl.json | 500 | 20 | Solution | 31.17 | 43158 | 801.00 | 98.14 |
| t500m20r5-6.pl.json | 500 | 20 | Solution | 32.51 | 42199 | 801.00 | 98.10 |
| t500m20r5-7.pl.json | 500 | 20 | Solution | 32.83 | 39535 | 801.00 | 97.97 |
| t500m20r5-8.pl.json | 500 | 20 | Solution | 30.30 | 44676 | 801.00 | 98.21 |
| t500m20r5-9.pl.json | 500 | 20 | Solution | 31.25 | 41543 | 801.00 | 98.07 |
| t500m50r10-1.pl.json | 500 | 50 | Solution | 30.78 | 44568 | 800.00 | 98.20 |
| t500m50r10-10.pl.json | 500 | 50 | Solution | 30.55 | 41613 | 800.00 | 98.08 |
| t500m50r10-11.pl.json | 500 | 50 | Solution | 30.90 | 46894 | 800.00 | 98.29 |
| t500m50r10-12.pl.json | 500 | 50 | Solution | 30.37 | 37026 | 800.00 | 97.84 |
| t500m50r10-13.pl.json | 500 | 50 | Solution | 30.38 | 34634 | 799.00 | 97.69 |
| t500m50r10-14.pl.json | 500 | 50 | Solution | 30.43 | 45916 | 801.00 | 98.26 |
| t500m50r10-15.pl.json | 500 | 50 | Solution | 31.36 | 39306 | 801.00 | 97.96 |
| t500m50r10-16.pl.json | 500 | 50 | Solution | 30.25 | 36757 | 801.00 | 97.82 |
| t500m50r10-17.pl.json | 500 | 50 | Solution | 31.08 | 33180 | 800.00 | 97.59 |
| t500m50r10-18.pl.json | 500 | 50 | Solution | 30.64 | 47233 | 800.00 | 98.31 |
| t500m50r10-19.pl.json | 500 | 50 | Solution | 30.48 | 42433 | 801.00 | 98.11 |
| t500m50r10-2.pl.json | 500 | 50 | Solution | 30.60 | 43789 | 795.00 | 98.18 |
| t500m50r10-20.pl.json | 500 | 50 | Solution | 30.76 | 40950 | 799.00 | 98.05 |
| t500m50r10-3.pl.json | 500 | 50 | Solution | 31.76 | 42014 | 801.00 | 98.09 |
| t500m50r10-4.pl.json | 500 | 50 | Solution | 30.63 | 42966 | 801.00 | 98.14 |
| t500m50r10-5.pl.json | 500 | 50 | Solution | 32.16 | 37220 | 801.00 | 97.85 |
| t500m50r10-6.pl.json | 500 | 50 | Solution | 30.47 | 33806 | 799.00 | 97.64 |
| t500m50r10-7.pl.json | 500 | 50 | Solution | 30.57 | 35308 | 801.00 | 97.73 |
| t500m50r10-8.pl.json | 500 | 50 | Solution | 30.57 | 45479 | 801.00 | 98.24 |
| t500m50r10-9.pl.json | 500 | 50 | Solution | 31.13 | 39057 | 801.00 | 97.95 |
| t500m50r3-1.pl.json | 500 | 50 | Solution | 30.75 | 43686 | 799.00 | 98.17 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m50r3-10.pl.json | 500 | 50 | Solution | 30.38 | 43311 | 801.00 | 98.15 |
| t500m50r3-11.pl.json | 500 | 50 | Solution | 30.52 | 40856 | 801.00 | 98.04 |
| t500m50r3-12.pl.json | 500 | 50 | Solution | 31.12 | 38574 | 800.00 | 97.93 |
| t500m50r3-13.pl.json | 500 | 50 | Solution | 30.39 | 40371 | 801.00 | 98.02 |
| t500m50r3-14.pl.json | 500 | 50 | Solution | 30.71 | 33849 | 801.00 | 97.63 |
| t500m50r3-15.pl.json | 500 | 50 | Solution | 30.55 | 39980 | 801.00 | 98.00 |
| t500m50r3-16.pl.json | 500 | 50 | Solution | 31.08 | 43812 | 800.00 | 98.17 |
| t500m50r3-17.pl.json | 500 | 50 | Solution | 30.64 | 37519 | 800.00 | 97.87 |
| t500m50r3-18.pl.json | 500 | 50 | Solution | 30.30 | 42694 | 800.00 | 98.13 |
| t500m50r3-19.pl.json | 500 | 50 | Solution | 30.27 | 35437 | 801.00 | 97.74 |
| t500m50r3-2.pl.json | 500 | 50 | Solution | 31.61 | 39303 | 801.00 | 97.96 |
| t500m50r3-20.pl.json | 500 | 50 | Solution | 30.62 | 42019 | 801.00 | 98.09 |
| t500m50r3-3.pl.json | 500 | 50 | Solution | 30.84 | 45798 | 799.00 | 98.26 |
| t500m50r3-4.pl.json | 500 | 50 | Solution | 30.67 | 43883 | 795.00 | 98.19 |
| t500m50r3-5.pl.json | 500 | 50 | Solution | 30.72 | 45514 | 801.00 | 98.24 |
| t500m50r3-6.pl.json | 500 | 50 | Solution | 31.17 | 39292 | 801.00 | 97.96 |
| t500m50r3-7.pl.json | 500 | 50 | Solution | 31.28 | 42541 | 801.00 | 98.12 |
| t500m50r3-8.pl.json | 500 | 50 | Optimal | 14.11 | 46948 | 46944.00 | 0.01 |
| t500m50r3-9.pl.json | 500 | 50 | Solution | 30.93 | 46088 | 798.00 | 98.27 |
| t500m50r5-1.pl.json | 500 | 50 | Solution | 30.33 | 43603 | 798.00 | 98.17 |
| t500m50r5-10.pl.json | 500 | 50 | Solution | 31.41 | 43308 | 799.00 | 98.16 |
| t500m50r5-11.pl.json | 500 | 50 | Solution | 31.16 | 45756 | 799.00 | 98.25 |
| t500m50r5-12.pl.json | 500 | 50 | Solution | 30.53 | 42655 | 798.00 | 98.13 |
| t500m50r5-13.pl.json | 500 | 50 | Solution | 30.57 | 39240 | 801.00 | 97.96 |
| t500m50r5-14.pl.json | 500 | 50 | Solution | 30.66 | 41327 | 800.00 | 98.06 |
| t500m50r5-15.pl.json | 500 | 50 | Solution | 30.36 | 46276 | 801.00 | 98.27 |
| t500m50r5-16.pl.json | 500 | 50 | Solution | 31.01 | 43409 | 801.00 | 98.15 |
| t500m50r5-17.pl.json | 500 | 50 | Solution | 30.82 | 37044 | 799.00 | 97.84 |
| t500m50r5-18.pl.json | 500 | 50 | Solution | 31.01 | 36830 | 800.00 | 97.83 |
| t500m50r5-19.pl.json | 500 | 50 | Solution | 30.65 | 39841 | 798.00 | 98.00 |
| t500m50r5-2.pl.json | 500 | 50 | Solution | 31.27 | 42587 | 801.00 | 98.12 |
| t500m50r5-20.pl.json | 500 | 50 | Solution | 31.02 | 43943 | 801.00 | 98.18 |
| t500m50r5-3.pl.json | 500 | 50 | Solution | 30.34 | 38800 | 800.00 | 97.94 |
| t500m50r5-4.pl.json | 500 | 50 | Solution | 30.81 | 34378 | 801.00 | 97.67 |
| t500m50r5-5.pl.json | 500 | 50 | Solution | 30.55 | 35109 | 801.00 | 97.72 |
| t500m50r5-6.pl.json | 500 | 50 | Solution | 30.66 | 45567 | 801.00 | 98.24 |
| t500m50r5-7.pl.json | 500 | 50 | Solution | 30.55 | 45340 | 797.00 | 98.24 |
| t500m50r5-8.pl.json | 500 | 50 | Solution | 30.41 | 34311 | 800.00 | 97.67 |
| t500m50r5-9.pl.json | 500 | 50 | Solution | 31.20 | 32817 | 797.00 | 97.57 |
| t50m10r10-1.pl.json | 50 | 10 | Solution | 30.11 | 6499 | 5840.00 | 10.14 |
| t50m10r10-10.pl.json | 50 | 10 | Solution | 30.27 | 3396 | 3172.00 | 6.60 |
| t50m10r10-11.pl.json | 50 | 10 | Solution | 30.40 | 3398 | 3141.00 | 7.56 |
| t50m10r10-12.pl.json | 50 | 10 | Solution | 30.54 | 7550 | 6544.00 | 13.32 |
| t50m10r10-13.pl.json | 50 | 10 | Solution | 30.55 | 5484 | 5191.00 | 5.34 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t50m10r10-14.pl.json | 50 | 10 | Solution | 30.27 | 4666 | 3431.00 | 26.47 |
| t50m10r10-15.pl.json | 50 | 10 | Solution | 30.91 | 6640 | 5903.00 | 11.10 |
| t50m10r10-16.pl.json | 50 | 10 | Solution | 30.38 | 4914 | 4515.00 | 8.12 |
| t50m10r10-17.pl.json | 50 | 10 | Optimal | 8.07 | 2252 | 2252.00 | 0.00 |
| t50m10r10-18.pl.json | 50 | 10 | Solution | 30.74 | 4034 | 3841.00 | 4.78 |
| t50m10r10-19.pl.json | 50 | 10 | Solution | 30.42 | 4873 | 4532.00 | 7.00 |
| t50m10r10-2.pl.json | 50 | 10 | Solution | 30.36 | 4148 | 3646.00 | 12.10 |
| t50m10r10-20.pl.json | 50 | 10 | Optimal | 6.15 | 3158 | 3158.00 | 0.00 |
| t50m10r10-3.pl.json | 50 | 10 | Solution | 30.40 | 4334 | 4190.00 | 3.32 |
| t50m10r10-4.pl.json | 50 | 10 | Solution | 30.42 | 4259 | 3715.00 | 12.77 |
| t50m10r10-5.pl.json | 50 | 10 | Solution | 30.75 | 2211 | 2199.00 | 0.54 |
| t50m10r10-6.pl.json | 50 | 10 | Solution | 30.32 | 5752 | 5457.00 | 5.13 |
| t50m10r10-7.pl.json | 50 | 10 | Solution | 30.47 | 3239 | 3125.00 | 3.52 |
| t50m10r10-8.pl.json | 50 | 10 | Optimal | 10.44 | 2624 | 2624.00 | 0.00 |
| t50m10r10-9.pl.json | 50 | 10 | Solution | 30.28 | 5109 | 5015.00 | 1.84 |
| t50m10r3-1.pl.json | 50 | 10 | Optimal | 1.52 | 7067 | 7067.00 | 0.00 |
| t50m10r3-10.pl.json | 50 | 10 | Optimal | 1.64 | 4504 | 4504.00 | 0.00 |
| t50m10r3-11.pl.json | 50 | 10 | Solution | 30.38 | 3856 | 3811.00 | 1.17 |
| t50m10r3-12.pl.json | 50 | 10 | Optimal | 2.46 | 3063 | 3063.00 | 0.00 |
| t50m10r3-13.pl.json | 50 | 10 | Optimal | 1.56 | 5368 | 5368.00 | 0.00 |
| t50m10r3-14.pl.json | 50 | 10 | Optimal | 1.56 | 5759 | 5759.00 | 0.00 |
| t50m10r3-15.pl.json | 50 | 10 | Optimal | 4.99 | 6360 | 6360.00 | 0.00 |
| t50m10r3-16.pl.json | 50 | 10 | Optimal | 1.98 | 7616 | 7616.00 | 0.00 |
| t50m10r3-17.pl.json | 50 | 10 | Solution | 30.18 | 5429 | 5233.00 | 3.61 |
| t50m10r3-18.pl.json | 50 | 10 | Optimal | 1.79 | 5186 | 5186.00 | 0.00 |
| t50m10r3-19.pl.json | 50 | 10 | Optimal | 2.82 | 4197 | 4197.00 | 0.00 |
| t50m10r3-2.pl.json | 50 | 10 | Optimal | 1.73 | 5680 | 5680.00 | 0.00 |
| t50m10r3-20.pl.json | 50 | 10 | Optimal | 2.67 | 7792 | 7792.00 | 0.00 |
| t50m10r3-3.pl.json | 50 | 10 | Optimal | 5.77 | 3752 | 3752.00 | 0.00 |
| t50m10r3-4.pl.json | 50 | 10 | Optimal | 3.35 | 4942 | 4942.00 | 0.00 |
| t50m10r3-5.pl.json | 50 | 10 | Optimal | 1.80 | 6159 | 6159.00 | 0.00 |
| t50m10r3-6.pl.json | 50 | 10 | Optimal | 4.39 | 3804 | 3804.00 | 0.00 |
| t50m10r3-7.pl.json | 50 | 10 | Optimal | 2.96 | 6186 | 6186.00 | 0.00 |
| t50m10r3-8.pl.json | 50 | 10 | Optimal | 2.17 | 5142 | 5142.00 | 0.00 |
| t50m10r3-9.pl.json | 50 | 10 | Solution | 30.43 | 7279 | 7191.00 | 1.21 |
| t50m10r5-1.pl.json | 50 | 10 | Optimal | 1.94 | 5397 | 5397.00 | 0.00 |
| t50m10r5-10.pl.json | 50 | 10 | Optimal | 1.81 | 4926 | 4926.00 | 0.00 |
| t50m10r5-11.pl.json | 50 | 10 | Optimal | 3.35 | 3620 | 3620.00 | 0.00 |
| t50m10r5-12.pl.json | 50 | 10 | Optimal | 5.13 | 5183 | 5183.00 | 0.00 |
| t50m10r5-13.pl.json | 50 | 10 | Solution | 30.36 | 5716 | 5394.00 | 5.63 |
| t50m10r5-14.pl.json | 50 | 10 | Optimal | 3.28 | 2828 | 2828.00 | 0.00 |
| t50m10r5-15.pl.json | 50 | 10 | Solution | 30.43 | 6385 | 6283.00 | 1.60 |
| t50m10r5-16.pl.json | 50 | 10 | Solution | 30.23 | 4548 | 3970.00 | 12.71 |
| t50m10r5-17.pl.json | 50 | 10 | Optimal | 2.89 | 5129 | 5129.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t50m10r5-18.pl.json | 50 | 10 | Solution | 30.55 | 5831 | 5303.00 | 9.06 |
| t50m10r5-19.pl.json | 50 | 10 | Solution | 30.37 | 5552 | 5213.00 | 6.11 |
| t50m10r5-2.pl.json | 50 | 10 | Optimal | 1.70 | 5153 | 5153.00 | 0.00 |
| t50m10r5-20.pl.json | 50 | 10 | Solution | 30.32 | 3900 | 3686.00 | 5.49 |
| t50m10r5-3.pl.json | 50 | 10 | Solution | 30.25 | 4708 | 4667.00 | 0.87 |
| t50m10r5-4.pl.json | 50 | 10 | Solution | 30.36 | 5551 | 4986.00 | 10.18 |
| t50m10r5-5.pl.json | 50 | 10 | Optimal | 3.36 | 7451 | 7451.00 | 0.00 |
| t50m10r5-6.pl.json | 50 | 10 | Optimal | 2.76 | 3781 | 3781.00 | 0.00 |
| t50m10r5-7.pl.json | 50 | 10 | Solution | 30.10 | 3323 | 3164.00 | 4.78 |
| t50m10r5-8.pl.json | 50 | 10 | Solution | 30.32 | 5559 | 4986.00 | 10.31 |
| t50m10r5-9.pl.json | 50 | 10 | Solution | 30.21 | 6385 | 6082.00 | 4.75 |
| t50m20r10-1.pl.json | 50 | 20 | Solution | 30.30 | 5211 | 4457.00 | 14.47 |
| t50m20r10-10.pl.json | 50 | 20 | Optimal | 3.71 | 7934 | 7934.00 | 0.00 |
| t50m20r10-11.pl.json | 50 | 20 | Solution | 30.84 | 5509 | 5264.00 | 4.45 |
| t50m20r10-12.pl.json | 50 | 20 | Solution | 30.38 | 5023 | 4256.00 | 15.27 |
| t50m20r10-13.pl.json | 50 | 20 | Optimal | 3.51 | 4143 | 4143.00 | 0.00 |
| t50m20r10-14.pl.json | 50 | 20 | Optimal | 3.25 | 6048 | 6048.00 | 0.00 |
| t50m20r10-15.pl.json | 50 | 20 | Solution | 30.15 | 5992 | 5301.00 | 11.53 |
| t50m20r10-16.pl.json | 50 | 20 | Optimal | 5.39 | 5032 | 5032.00 | 0.00 |
| t50m20r10-17.pl.json | 50 | 20 | Optimal | 3.01 | 4488 | 4488.00 | 0.00 |
| t50m20r10-18.pl.json | 50 | 20 | Solution | 30.20 | 4848 | 4599.00 | 5.14 |
| t50m20r10-19.pl.json | 50 | 20 | Solution | 30.38 | 5430 | 4555.00 | 16.11 |
| t50m20r10-2.pl.json | 50 | 20 | Solution | 30.80 | 6192 | 5348.00 | 13.63 |
| t50m20r10-20.pl.json | 50 | 20 | Solution | 30.20 | 6271 | 5680.00 | 9.42 |
| t50m20r10-3.pl.json | 50 | 20 | Solution | 30.90 | 6582 | 6278.00 | 4.62 |
| t50m20r10-4.pl.json | 50 | 20 | Solution | 31.22 | 5686 | 5160.00 | 9.25 |
| t50m20r10-5.pl.json | 50 | 20 | Optimal | 4.66 | 3301 | 3301.00 | 0.00 |
| t50m20r10-6.pl.json | 50 | 20 | Solution | 30.44 | 4425 | 795.00 | 82.03 |
| t50m20r10-7.pl.json | 50 | 20 | Optimal | 5.62 | 3519 | 3519.00 | 0.00 |
| t50m20r10-8.pl.json | 50 | 20 | Solution | 30.31 | 4630 | 4569.00 | 1.32 |
| t50m20r10-9.pl.json | 50 | 20 | Solution | 30.25 | 5869 | 5303.00 | 9.64 |
| t50m20r3-1.pl.json | 50 | 20 | Optimal | 2.72 | 3869 | 3869.00 | 0.00 |
| t50m20r3-10.pl.json | 50 | 20 | Optimal | 2.86 | 3982 | 3982.00 | 0.00 |
| t50m20r3-11.pl.json | 50 | 20 | Optimal | 2.65 | 4144 | 4144.00 | 0.00 |
| t50m20r3-12.pl.json | 50 | 20 | Optimal | 3.17 | 2791 | 2791.00 | 0.00 |
| t50m20r3-13.pl.json | 50 | 20 | Optimal | 6.37 | 6449 | 6449.00 | 0.00 |
| t50m20r3-14.pl.json | 50 | 20 | Optimal | 2.91 | 4933 | 4933.00 | 0.00 |
| t50m20r3-15.pl.json | 50 | 20 | Solution | 30.45 | 2436 | 2218.00 | 8.95 |
| t50m20r3-16.pl.json | 50 | 20 | Optimal | 2.72 | 5872 | 5872.00 | 0.00 |
| t50m20r3-17.pl.json | 50 | 20 | Optimal | 6.52 | 6880 | 6880.00 | 0.00 |
| t50m20r3-18.pl.json | 50 | 20 | Optimal | 3.21 | 2811 | 2811.00 | 0.00 |
| t50m20r3-19.pl.json | 50 | 20 | Optimal | 3.25 | 3465 | 3465.00 | 0.00 |
| t50m20r3-2.pl.json | 50 | 20 | Optimal | 3.02 | 5570 | 5570.00 | 0.00 |
| t50m20r3-20.pl.json | 50 | 20 | Optimal | 2.42 | 6364 | 6364.00 | 0.00 |

Table 7.1: Results for Test Scheduling Problems (CPO) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t50m20r3-3.pl.json | 50 | 20 | Optimal | 2.73 | 3081 | 3081.00 | 0.00 |
| t50m20r3-4.pl.json | 50 | 20 | Optimal | 2.54 | 3505 | 3505.00 | 0.00 |
| t50m20r3-5.pl.json | 50 | 20 | Optimal | 2.82 | 2228 | 2228.00 | 0.00 |
| t50m20r3-6.pl.json | 50 | 20 | Optimal | 4.73 | 5713 | 5713.00 | 0.00 |
| t50m20r3-7.pl.json | 50 | 20 | Optimal | 3.34 | 3173 | 3173.00 | 0.00 |
| t50m20r3-8.pl.json | 50 | 20 | Solution | 30.22 | 3908 | 3772.00 | 3.48 |
| t50m20r3-9.pl.json | 50 | 20 | Optimal | 3.23 | 4661 | 4661.00 | 0.00 |
| t50m20r5-1.pl.json | 50 | 20 | Solution | 30.23 | 6273 | 5304.00 | 15.45 |
| t50m20r5-10.pl.json | 50 | 20 | Optimal | 3.06 | 2328 | 2328.00 | 0.00 |
| t50m20r5-11.pl.json | 50 | 20 | Optimal | 3.05 | 6403 | 6403.00 | 0.00 |
| t50m20r5-12.pl.json | 50 | 20 | Optimal | 2.81 | 4281 | 4281.00 | 0.00 |
| t50m20r5-13.pl.json | 50 | 20 | Optimal | 3.17 | 5754 | 5754.00 | 0.00 |
| t50m20r5-14.pl.json | 50 | 20 | Solution | 30.47 | 6639 | 5359.00 | 19.28 |
| t50m20r5-15.pl.json | 50 | 20 | Optimal | 2.69 | 3472 | 3472.00 | 0.00 |
| t50m20r5-16.pl.json | 50 | 20 | Solution | 30.29 | 5934 | 5042.00 | 15.03 |
| t50m20r5-17.pl.json | 50 | 20 | Optimal | 2.73 | 4745 | 4745.00 | 0.00 |
| t50m20r5-18.pl.json | 50 | 20 | Optimal | 6.48 | 3147 | 3147.00 | 0.00 |
| t50m20r5-19.pl.json | 50 | 20 | Optimal | 9.46 | 5960 | 5960.00 | 0.00 |
| t50m20r5-2.pl.json | 50 | 20 | Solution | 30.38 | 5547 | 5417.00 | 2.34 |
| t50m20r5-20.pl.json | 50 | 20 | Optimal | 2.75 | 3913 | 3913.00 | 0.00 |
| t50m20r5-3.pl.json | 50 | 20 | Solution | 30.27 | 5598 | 4754.00 | 15.08 |
| t50m20r5-4.pl.json | 50 | 20 | Solution | 30.39 | 5367 | 4465.00 | 16.81 |
| t50m20r5-5.pl.json | 50 | 20 | Optimal | 7.45 | 3648 | 3648.00 | 0.00 |
| t50m20r5-6.pl.json | 50 | 20 | Optimal | 2.76 | 5449 | 5449.00 | 0.00 |
| t50m20r5-7.pl.json | 50 | 20 | Solution | 30.13 | 4127 | 3794.00 | 8.07 |
| t50m20r5-8.pl.json | 50 | 20 | Solution | 30.32 | 5003 | 4535.00 | 9.35 |
| t50m20r5-9.pl.json | 50 | 20 | Optimal | 3.06 | 4022 | 4022.00 | 0.00 |

7.2 Results for CPSat

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t100m10r10-1.pl.json | 100 | 10 | Solution | 30.04 | 10491 | 9055.00 | 13.69 |
| t100m10r10-10.pl.json | 100 | 10 | Solution | 30.04 | 9599 | 8369.00 | 12.81 |
| t100m10r10-11.pl.json | 100 | 10 | Solution | 30.04 | 5336 | 5100.00 | 4.42 |
| t100m10r10-12.pl.json | 100 | 10 | Solution | 30.04 | 6564 | 5613.00 | 14.49 |
| t100m10r10-13.pl.json | 100 | 10 | Solution | 30.05 | 6831 | 6786.00 | 0.66 |
| t100m10r10-14.pl.json | 100 | 10 | Solution | 30.03 | 5775 | 5257.00 | 8.97 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m10r10-15.pl.json | 100 | 10 | Solution | 30.02 | 6105 | 5012.00 | 17.90 |
| t100m10r10-16.pl.json | 100 | 10 | Solution | 30.04 | 12563 | 11589.00 | 7.75 |
| t100m10r10-17.pl.json | 100 | 10 | Solution | 30.05 | 8954 | 8114.00 | 9.38 |
| t100m10r10-18.pl.json | 100 | 10 | Solution | 30.05 | 10180 | 9304.00 | 8.61 |
| t100m10r10-19.pl.json | 100 | 10 | Solution | 30.03 | 9812 | 8514.00 | 13.23 |
| t100m10r10-2.pl.json | 100 | 10 | Solution | 30.02 | 11593 | 9807.00 | 15.41 |
| t100m10r10-20.pl.json | 100 | 10 | Solution | 30.04 | 12342 | 10686.00 | 13.42 |
| t100m10r10-3.pl.json | 100 | 10 | Solution | 30.03 | 6884 | 6379.00 | 7.34 |
| t100m10r10-4.pl.json | 100 | 10 | Solution | 30.03 | 11041 | 9111.00 | 17.48 |
| t100m10r10-5.pl.json | 100 | 10 | Solution | 30.04 | 12241 | 11823.00 | 3.41 |
| t100m10r10-6.pl.json | 100 | 10 | Solution | 30.04 | 11906 | 10914.00 | 8.33 |
| t100m10r10-7.pl.json | 100 | 10 | Solution | 30.05 | 6435 | 5732.00 | 10.92 |
| t100m10r10-8.pl.json | 100 | 10 | Solution | 30.03 | 11070 | 10010.00 | 9.58 |
| t100m10r10-9.pl.json | 100 | 10 | Solution | 30.03 | 9878 | 7991.00 | 19.10 |
| t100m10r3-1.pl.json | 100 | 10 | Optimal | 12.19 | 8711 | 8711.00 | 0.00 |
| t100m10r3-10.pl.json | 100 | 10 | Optimal | 15.43 | 8958 | 8958.00 | 0.00 |
| t100m10r3-11.pl.json | 100 | 10 | Optimal | 3.27 | 9560 | 9560.00 | 0.00 |
| t100m10r3-12.pl.json | 100 | 10 | Optimal | 2.92 | 7892 | 7892.00 | 0.00 |
| t100m10r3-13.pl.json | 100 | 10 | Optimal | 19.27 | 10078 | 10078.00 | 0.00 |
| t100m10r3-14.pl.json | 100 | 10 | Optimal | 18.02 | 8681 | 8681.00 | 0.00 |
| t100m10r3-15.pl.json | 100 | 10 | Optimal | 2.13 | 8810 | 8810.00 | 0.00 |
| t100m10r3-16.pl.json | 100 | 10 | Optimal | 10.48 | 11182 | 11182.00 | 0.00 |
| t100m10r3-17.pl.json | 100 | 10 | Optimal | 10.25 | 7534 | 7534.00 | 0.00 |
| t100m10r3-18.pl.json | 100 | 10 | Solution | 30.05 | 10376 | 9934.00 | 4.26 |
| t100m10r3-19.pl.json | 100 | 10 | Solution | 30.04 | 7706 | 6970.00 | 9.55 |
| t100m10r3-2.pl.json | 100 | 10 | Optimal | 1.65 | 7082 | 7082.00 | 0.00 |
| t100m10r3-20.pl.json | 100 | 10 | Optimal | 0.47 | 9025 | 9025.00 | 0.00 |
| t100m10r3-3.pl.json | 100 | 10 | Optimal | 3.03 | 10054 | 10054.00 | 0.00 |
| t100m10r3-4.pl.json | 100 | 10 | Optimal | 1.74 | 13122 | 13122.00 | 0.00 |
| t100m10r3-5.pl.json | 100 | 10 | Optimal | 13.52 | 7545 | 7545.00 | 0.00 |
| t100m10r3-6.pl.json | 100 | 10 | Optimal | 14.51 | 7840 | 7840.00 | 0.00 |
| t100m10r3-7.pl.json | 100 | 10 | Optimal | 3.63 | 11010 | 11010.00 | 0.00 |
| t100m10r3-8.pl.json | 100 | 10 | Optimal | 5.99 | 9112 | 9112.00 | 0.00 |
| t100m10r3-9.pl.json | 100 | 10 | Optimal | 11.16 | 8532 | 8532.00 | 0.00 |
| t100m10r5-1.pl.json | 100 | 10 | Solution | 30.04 | 7304 | 7300.00 | 0.05 |
| t100m10r5-10.pl.json | 100 | 10 | Optimal | 12.84 | 6972 | 6972.00 | 0.00 |
| t100m10r5-11.pl.json | 100 | 10 | Solution | 30.04 | 9098 | 8568.00 | 5.83 |
| t100m10r5-12.pl.json | 100 | 10 | Optimal | 5.79 | 6538 | 6538.00 | 0.00 |
| t100m10r5-13.pl.json | 100 | 10 | Optimal | 18.18 | 8972 | 8972.00 | 0.00 |
| t100m10r5-14.pl.json | 100 | 10 | Solution | 30.03 | 10539 | 10347.00 | 1.82 |
| t100m10r5-15.pl.json | 100 | 10 | Solution | 30.03 | 5762 | 5647.00 | 2.00 |
| t100m10r5-16.pl.json | 100 | 10 | Solution | 30.04 | 7019 | 6207.00 | 11.57 |
| t100m10r5-17.pl.json | 100 | 10 | Optimal | 4.08 | 6728 | 6728.00 | 0.00 |
| t100m10r5-18.pl.json | 100 | 10 | Solution | 30.04 | 9019 | 8811.00 | 2.31 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m10r5-19.pl.json | 100 | 10 | Optimal | 13.99 | 8885 | 8885.00 | 0.00 |
| t100m10r5-2.pl.json | 100 | 10 | Optimal | 8.51 | 9010 | 9010.00 | 0.00 |
| t100m10r5-20.pl.json | 100 | 10 | Optimal | 12.69 | 7022 | 7022.00 | 0.00 |
| t100m10r5-3.pl.json | 100 | 10 | Solution | 30.04 | 8857 | 8820.00 | 0.42 |
| t100m10r5-4.pl.json | 100 | 10 | Optimal | 22.41 | 10753 | 10753.00 | 0.00 |
| t100m10r5-5.pl.json | 100 | 10 | Optimal | 11.65 | 6608 | 6608.00 | 0.00 |
| t100m10r5-6.pl.json | 100 | 10 | Solution | 30.04 | 9452 | 8456.00 | 10.54 |
| t100m10r5-7.pl.json | 100 | 10 | Solution | 30.04 | 8186 | 7664.00 | 6.38 |
| t100m10r5-8.pl.json | 100 | 10 | Solution | 30.03 | 11383 | 10079.00 | 11.46 |
| t100m10r5-9.pl.json | 100 | 10 | Solution | 30.03 | 11649 | 10683.00 | 8.29 |
| t100m20r10-1.pl.json | 100 | 20 | Solution | 30.06 | 12643 | 12180.00 | 3.66 |
| t100m20r10-10.pl.json | 100 | 20 | Solution | 30.05 | 12653 | 10953.00 | 13.44 |
| t100m20r10-11.pl.json | 100 | 20 | Solution | 30.06 | 8724 | 7289.00 | 16.45 |
| t100m20r10-12.pl.json | 100 | 20 | Solution | 30.05 | 7404 | 6774.00 | 8.51 |
| t100m20r10-13.pl.json | 100 | 20 | Solution | 30.05 | 9695 | 9229.00 | 4.81 |
| t100m20r10-14.pl.json | 100 | 20 | Solution | 30.05 | 10027 | 8652.00 | 13.71 |
| t100m20r10-15.pl.json | 100 | 20 | Solution | 30.05 | 6544 | 5362.00 | 18.06 |
| t100m20r10-16.pl.json | 100 | 20 | Solution | 30.05 | 9264 | 8343.00 | 9.94 |
| t100m20r10-17.pl.json | 100 | 20 | Solution | 30.07 | 8691 | 7381.00 | 15.07 |
| t100m20r10-18.pl.json | 100 | 20 | Optimal | 15.69 | 4843 | 4843.00 | 0.00 |
| t100m20r10-19.pl.json | 100 | 20 | Solution | 30.05 | 12320 | 11752.00 | 4.61 |
| t100m20r10-2.pl.json | 100 | 20 | Solution | 30.05 | 7760 | 6890.00 | 11.21 |
| t100m20r10-20.pl.json | 100 | 20 | Solution | 30.03 | 10030 | 8562.00 | 14.64 |
| t100m20r10-3.pl.json | 100 | 20 | Solution | 30.06 | 7133 | 6295.00 | 11.75 |
| t100m20r10-4.pl.json | 100 | 20 | Solution | 30.06 | 9671 | 9052.00 | 6.40 |
| t100m20r10-5.pl.json | 100 | 20 | Solution | 30.04 | 9230 | 8459.00 | 8.35 |
| t100m20r10-6.pl.json | 100 | 20 | Solution | 30.06 | 8781 | 7619.00 | 13.23 |
| t100m20r10-7.pl.json | 100 | 20 | Solution | 30.05 | 11318 | 9767.00 | 13.70 |
| t100m20r10-8.pl.json | 100 | 20 | Solution | 30.06 | 7852 | 7041.00 | 10.33 |
| t100m20r10-9.pl.json | 100 | 20 | Solution | 30.05 | 10856 | 10019.00 | 7.71 |
| t100m20r3-1.pl.json | 100 | 20 | Optimal | 9.73 | 6585 | 6585.00 | 0.00 |
| t100m20r3-10.pl.json | 100 | 20 | Optimal | 4.77 | 8535 | 8535.00 | 0.00 |
| t100m20r3-11.pl.json | 100 | 20 | Optimal | 13.99 | 9084 | 9084.00 | 0.00 |
| t100m20r3-12.pl.json | 100 | 20 | Optimal | 2.36 | 9066 | 9066.00 | 0.00 |
| t100m20r3-13.pl.json | 100 | 20 | Solution | 30.07 | 11429 | 9974.00 | 12.73 |
| t100m20r3-14.pl.json | 100 | 20 | Optimal | 8.11 | 8786 | 8786.00 | 0.00 |
| t100m20r3-15.pl.json | 100 | 20 | Optimal | 12.26 | 10205 | 10205.00 | 0.00 |
| t100m20r3-16.pl.json | 100 | 20 | Optimal | 10.67 | 8856 | 8856.00 | 0.00 |
| t100m20r3-17.pl.json | 100 | 20 | Optimal | 10.75 | 5451 | 5451.00 | 0.00 |
| t100m20r3-18.pl.json | 100 | 20 | Optimal | 11.28 | 8752 | 8752.00 | 0.00 |
| t100m20r3-19.pl.json | 100 | 20 | Solution | 30.04 | 8909 | 8860.00 | 0.55 |
| t100m20r3-2.pl.json | 100 | 20 | Optimal | 13.78 | 8498 | 8498.00 | 0.00 |
| t100m20r3-20.pl.json | 100 | 20 | Optimal | 3.73 | 7880 | 7880.00 | 0.00 |
| t100m20r3-3.pl.json | 100 | 20 | Solution | 30.04 | 12192 | 11987.00 | 1.68 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m20r3-4.pl.json | 100 | 20 | Optimal | 18.10 | 12258 | 12258.00 | 0.00 |
| t100m20r3-5.pl.json | 100 | 20 | Optimal | 7.98 | 11932 | 11932.00 | 0.00 |
| t100m20r3-6.pl.json | 100 | 20 | Optimal | 10.86 | 8531 | 8531.00 | 0.00 |
| t100m20r3-7.pl.json | 100 | 20 | Optimal | 7.63 | 6512 | 6512.00 | 0.00 |
| t100m20r3-8.pl.json | 100 | 20 | Optimal | 18.30 | 10690 | 10690.00 | 0.00 |
| t100m20r3-9.pl.json | 100 | 20 | Optimal | 2.31 | 8255 | 8255.00 | 0.00 |
| t100m20r5-1.pl.json | 100 | 20 | Optimal | 12.04 | 9098 | 9098.00 | 0.00 |
| t100m20r5-10.pl.json | 100 | 20 | Solution | 30.05 | 8340 | 7964.00 | 4.51 |
| t100m20r5-11.pl.json | 100 | 20 | Solution | 30.05 | 6828 | 5564.00 | 18.51 |
| t100m20r5-12.pl.json | 100 | 20 | Solution | 30.04 | 8722 | 8704.00 | 0.21 |
| t100m20r5-13.pl.json | 100 | 20 | Optimal | 16.31 | 8880 | 8880.00 | 0.00 |
| t100m20r5-14.pl.json | 100 | 20 | Solution | 30.06 | 10621 | 9727.00 | 8.42 |
| t100m20r5-15.pl.json | 100 | 20 | Optimal | 18.85 | 8953 | 8953.00 | 0.00 |
| t100m20r5-16.pl.json | 100 | 20 | Solution | 30.05 | 8020 | 7594.00 | 5.31 |
| t100m20r5-17.pl.json | 100 | 20 | Solution | 30.05 | 5685 | 5524.00 | 2.83 |
| t100m20r5-18.pl.json | 100 | 20 | Solution | 30.03 | 6637 | 6617.00 | 0.30 |
| t100m20r5-19.pl.json | 100 | 20 | Optimal | 22.81 | 9461 | 9461.00 | 0.00 |
| t100m20r5-2.pl.json | 100 | 20 | Optimal | 13.63 | 9566 | 9566.00 | 0.00 |
| t100m20r5-20.pl.json | 100 | 20 | Solution | 30.03 | 11569 | 10228.00 | 11.59 |
| t100m20r5-3.pl.json | 100 | 20 | Solution | 30.06 | 9470 | 9366.00 | 1.10 |
| t100m20r5-4.pl.json | 100 | 20 | Solution | 30.04 | 14465 | 12456.00 | 13.89 |
| t100m20r5-5.pl.json | 100 | 20 | Optimal | 12.10 | 8585 | 8585.00 | 0.00 |
| t100m20r5-6.pl.json | 100 | 20 | Solution | 30.05 | 7528 | 6539.00 | 13.14 |
| t100m20r5-7.pl.json | 100 | 20 | Solution | 30.05 | 11413 | 10099.00 | 11.51 |
| t100m20r5-8.pl.json | 100 | 20 | Optimal | 17.27 | 5812 | 5812.00 | 0.00 |
| t100m20r5-9.pl.json | 100 | 20 | Solution | 30.06 | 6657 | 6496.00 | 2.42 |
| t100m50r10-1.pl.json | 100 | 50 | Solution | 30.10 | 7299 | 6941.00 | 4.90 |
| t100m50r10-10.pl.json | 100 | 50 | Solution | 30.08 | 5201 | 5108.00 | 1.79 |
| t100m50r10-11.pl.json | 100 | 50 | Solution | 30.11 | 4970 | 4782.00 | 3.78 |
| t100m50r10-12.pl.json | 100 | 50 | Solution | 30.12 | 9335 | 9122.00 | 2.28 |
| t100m50r10-13.pl.json | 100 | 50 | Solution | 30.11 | 9759 | 8828.00 | 9.54 |
| t100m50r10-14.pl.json | 100 | 50 | Solution | 30.08 | 10724 | 8290.00 | 22.70 |
| t100m50r10-15.pl.json | 100 | 50 | Solution | 30.08 | 8640 | 7804.00 | 9.68 |
| t100m50r10-16.pl.json | 100 | 50 | Solution | 30.12 | 14211 | 12381.00 | 12.88 |
| t100m50r10-17.pl.json | 100 | 50 | Solution | 30.10 | 9826 | 9151.00 | 6.87 |
| t100m50r10-18.pl.json | 100 | 50 | Solution | 30.09 | 7384 | 7120.00 | 3.58 |
| t100m50r10-19.pl.json | 100 | 50 | Solution | 30.07 | 8559 | 8059.00 | 5.84 |
| t100m50r10-2.pl.json | 100 | 50 | Solution | 30.12 | 7968 | 7568.00 | 5.02 |
| t100m50r10-20.pl.json | 100 | 50 | Solution | 30.11 | 8421 | 7939.00 | 5.72 |
| t100m50r10-3.pl.json | 100 | 50 | Optimal | 2.98 | 6937 | 6937.00 | 0.00 |
| t100m50r10-4.pl.json | 100 | 50 | Solution | 30.10 | 10208 | 8525.00 | 16.49 |
| t100m50r10-5.pl.json | 100 | 50 | Optimal | 18.08 | 9859 | 9859.00 | 0.00 |
| t100m50r10-6.pl.json | 100 | 50 | Solution | 30.09 | 7715 | 6837.00 | 11.38 |
| t100m50r10-7.pl.json | 100 | 50 | Solution | 30.10 | 9691 | 9542.00 | 1.54 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t100m50r10-8.pl.json | 100 | 50 | Solution | 30.13 | 10719 | 9176.00 | 14.39 |
| t100m50r10-9.pl.json | 100 | 50 | Solution | 30.08 | 10453 | 9375.00 | 10.31 |
| t100m50r3-1.pl.json | 100 | 50 | Optimal | 10.47 | 9937 | 9937.00 | 0.00 |
| t100m50r3-10.pl.json | 100 | 50 | Solution | 30.12 | 8957 | 8877.00 | 0.89 |
| t100m50r3-11.pl.json | 100 | 50 | Optimal | 16.48 | 6141 | 6141.00 | 0.00 |
| t100m50r3-12.pl.json | 100 | 50 | Optimal | 3.37 | 6473 | 6473.00 | 0.00 |
| t100m50r3-13.pl.json | 100 | 50 | Optimal | 7.08 | 8653 | 8653.00 | 0.00 |
| t100m50r3-14.pl.json | 100 | 50 | Solution | 30.07 | 13039 | 12796.00 | 1.86 |
| t100m50r3-15.pl.json | 100 | 50 | Solution | 30.13 | 9271 | 9056.00 | 2.32 |
| t100m50r3-16.pl.json | 100 | 50 | Optimal | 15.74 | 8680 | 8680.00 | 0.00 |
| t100m50r3-17.pl.json | 100 | 50 | Optimal | 5.79 | 8197 | 8197.00 | 0.00 |
| t100m50r3-18.pl.json | 100 | 50 | Optimal | 6.21 | 9318 | 9318.00 | 0.00 |
| t100m50r3-19.pl.json | 100 | 50 | Optimal | 4.24 | 12265 | 12265.00 | 0.00 |
| t100m50r3-2.pl.json | 100 | 50 | Optimal | 25.96 | 11030 | 11030.00 | 0.00 |
| t100m50r3-20.pl.json | 100 | 50 | Optimal | 2.53 | 7662 | 7662.00 | 0.00 |
| t100m50r3-3.pl.json | 100 | 50 | Optimal | 2.34 | 5348 | 5348.00 | 0.00 |
| t100m50r3-4.pl.json | 100 | 50 | Optimal | 14.63 | 7800 | 7800.00 | 0.00 |
| t100m50r3-5.pl.json | 100 | 50 | Optimal | 13.56 | 4207 | 4207.00 | 0.00 |
| t100m50r3-6.pl.json | 100 | 50 | Solution | 30.08 | 10674 | 10596.00 | 0.73 |
| t100m50r3-7.pl.json | 100 | 50 | Optimal | 3.88 | 7826 | 7826.00 | 0.00 |
| t100m50r3-8.pl.json | 100 | 50 | Optimal | 14.67 | 7865 | 7865.00 | 0.00 |
| t100m50r3-9.pl.json | 100 | 50 | Optimal | 3.79 | 7891 | 7891.00 | 0.00 |
| t100m50r5-1.pl.json | 100 | 50 | Solution | 30.07 | 8016 | 7926.00 | 1.12 |
| t100m50r5-10.pl.json | 100 | 50 | Solution | 30.08 | 7299 | 6521.00 | 10.66 |
| t100m50r5-11.pl.json | 100 | 50 | Optimal | 18.72 | 9417 | 9417.00 | 0.00 |
| t100m50r5-12.pl.json | 100 | 50 | Optimal | 4.77 | 8824 | 8824.00 | 0.00 |
| t100m50r5-13.pl.json | 100 | 50 | Solution | 30.12 | 10473 | 9115.00 | 12.97 |
| t100m50r5-14.pl.json | 100 | 50 | Solution | 30.08 | 7503 | 7134.00 | 4.92 |
| t100m50r5-15.pl.json | 100 | 50 | Solution | 30.10 | 10141 | 9853.00 | 2.84 |
| t100m50r5-16.pl.json | 100 | 50 | Optimal | 9.40 | 6481 | 6481.00 | 0.00 |
| t100m50r5-17.pl.json | 100 | 50 | Optimal | 5.97 | 6129 | 6129.00 | 0.00 |
| t100m50r5-18.pl.json | 100 | 50 | Solution | 30.08 | 9100 | 8337.00 | 8.38 |
| t100m50r5-19.pl.json | 100 | 50 | Solution | 30.09 | 6762 | 6356.00 | 6.00 |
| t100m50r5-2.pl.json | 100 | 50 | Optimal | 4.94 | 6651 | 6651.00 | 0.00 |
| t100m50r5-20.pl.json | 100 | 50 | Solution | 30.08 | 6894 | 6667.00 | 3.29 |
| t100m50r5-3.pl.json | 100 | 50 | Solution | 30.11 | 7944 | 7857.00 | 1.10 |
| t100m50r5-4.pl.json | 100 | 50 | Optimal | 18.31 | 8296 | 8296.00 | 0.00 |
| t100m50r5-5.pl.json | 100 | 50 | Optimal | 9.79 | 9977 | 9977.00 | 0.00 |
| t100m50r5-6.pl.json | 100 | 50 | Optimal | 5.27 | 8240 | 8240.00 | 0.00 |
| t100m50r5-7.pl.json | 100 | 50 | Solution | 30.11 | 10917 | 10904.00 | 0.12 |
| t100m50r5-8.pl.json | 100 | 50 | Optimal | 17.90 | 8293 | 8293.00 | 0.00 |
| t100m50r5-9.pl.json | 100 | 50 | Solution | 30.12 | 7879 | 7622.00 | 3.26 |
| t20m10r10-1.pl.json | 20 | 10 | Optimal | 0.06 | 1337 | 1337.00 | 0.00 |
| t20m10r10-10.pl.json | 20 | 10 | Optimal | 0.05 | 3882 | 3882.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t20m10r10-11.pl.json | 20 | 10 | Optimal | 0.08 | 2002 | 2002.00 | 0.00 |
| t20m10r10-12.pl.json | 20 | 10 | Optimal | 0.05 | 1257 | 1257.00 | 0.00 |
| t20m10r10-13.pl.json | 20 | 10 | Optimal | 0.08 | 2110 | 2110.00 | 0.00 |
| t20m10r10-14.pl.json | 20 | 10 | Optimal | 0.04 | 2546 | 2546.00 | 0.00 |
| t20m10r10-15.pl.json | 20 | 10 | Optimal | 0.05 | 3344 | 3344.00 | 0.00 |
| t20m10r10-16.pl.json | 20 | 10 | Optimal | 0.68 | 1643 | 1643.00 | 0.00 |
| t20m10r10-17.pl.json | 20 | 10 | Optimal | 0.06 | 1069 | 1069.00 | 0.00 |
| t20m10r10-18.pl.json | 20 | 10 | Optimal | 0.06 | 3041 | 3041.00 | 0.00 |
| t20m10r10-19.pl.json | 20 | 10 | Optimal | 0.05 | 2422 | 2422.00 | 0.00 |
| t20m10r10-2.pl.json | 20 | 10 | Optimal | 0.07 | 1819 | 1819.00 | 0.00 |
| t20m10r10-20.pl.json | 20 | 10 | Optimal | 0.05 | 1595 | 1595.00 | 0.00 |
| t20m10r10-3.pl.json | 20 | 10 | Solution | 30.02 | 843 | 771.00 | 8.54 |
| t20m10r10-4.pl.json | 20 | 10 | Optimal | 0.07 | 1396 | 1396.00 | 0.00 |
| t20m10r10-5.pl.json | 20 | 10 | Optimal | 0.07 | 1710 | 1710.00 | 0.00 |
| t20m10r10-6.pl.json | 20 | 10 | Optimal | 0.06 | 2434 | 2434.00 | 0.00 |
| t20m10r10-7.pl.json | 20 | 10 | Optimal | 0.12 | 2696 | 2696.00 | 0.00 |
| t20m10r10-8.pl.json | 20 | 10 | Optimal | 0.05 | 1329 | 1329.00 | 0.00 |
| t20m10r10-9.pl.json | 20 | 10 | Optimal | 0.93 | 2933 | 2933.00 | 0.00 |
| t20m10r3-1.pl.json | 20 | 10 | Optimal | 0.05 | 1876 | 1876.00 | 0.00 |
| t20m10r3-10.pl.json | 20 | 10 | Optimal | 0.06 | 1652 | 1652.00 | 0.00 |
| t20m10r3-11.pl.json | 20 | 10 | Optimal | 0.04 | 1640 | 1640.00 | 0.00 |
| t20m10r3-12.pl.json | 20 | 10 | Optimal | 0.07 | 1758 | 1758.00 | 0.00 |
| t20m10r3-13.pl.json | 20 | 10 | Optimal | 0.06 | 3099 | 3099.00 | 0.00 |
| t20m10r3-14.pl.json | 20 | 10 | Optimal | 1.76 | 3891 | 3891.00 | 0.00 |
| t20m10r3-15.pl.json | 20 | 10 | Optimal | 0.07 | 1433 | 1433.00 | 0.00 |
| t20m10r3-16.pl.json | 20 | 10 | Optimal | 0.06 | 1564 | 1564.00 | 0.00 |
| t20m10r3-17.pl.json | 20 | 10 | Optimal | 0.06 | 2321 | 2321.00 | 0.00 |
| t20m10r3-18.pl.json | 20 | 10 | Solution | 30.05 | 821 | 746.00 | 9.14 |
| t20m10r3-19.pl.json | 20 | 10 | Optimal | 0.07 | 1236 | 1236.00 | 0.00 |
| t20m10r3-2.pl.json | 20 | 10 | Optimal | 0.06 | 3258 | 3258.00 | 0.00 |
| t20m10r3-20.pl.json | 20 | 10 | Optimal | 0.04 | 2168 | 2168.00 | 0.00 |
| t20m10r3-3.pl.json | 20 | 10 | Optimal | 0.04 | 2255 | 2255.00 | 0.00 |
| t20m10r3-4.pl.json | 20 | 10 | Optimal | 0.09 | 2707 | 2707.00 | 0.00 |
| t20m10r3-5.pl.json | 20 | 10 | Optimal | 0.06 | 2381 | 2381.00 | 0.00 |
| t20m10r3-6.pl.json | 20 | 10 | Optimal | 0.07 | 3043 | 3043.00 | 0.00 |
| t20m10r3-7.pl.json | 20 | 10 | Optimal | 0.05 | 1738 | 1738.00 | 0.00 |
| t20m10r3-8.pl.json | 20 | 10 | Optimal | 0.18 | 1278 | 1278.00 | 0.00 |
| t20m10r3-9.pl.json | 20 | 10 | Optimal | 0.05 | 2874 | 2874.00 | 0.00 |
| t20m10r5-1.pl.json | 20 | 10 | Optimal | 0.06 | 2586 | 2586.00 | 0.00 |
| t20m10r5-10.pl.json | 20 | 10 | Optimal | 0.07 | 2260 | 2260.00 | 0.00 |
| t20m10r5-11.pl.json | 20 | 10 | Optimal | 0.05 | 3487 | 3487.00 | 0.00 |
| t20m10r5-12.pl.json | 20 | 10 | Optimal | 0.05 | 1559 | 1559.00 | 0.00 |
| t20m10r5-13.pl.json | 20 | 10 | Optimal | 0.06 | 1457 | 1457.00 | 0.00 |
| t20m10r5-14.pl.json | 20 | 10 | Optimal | 0.08 | 1141 | 1141.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t20m10r5-15.pl.json | 20 | 10 | Optimal | 0.14 | 821 | 821.00 | 0.00 |
| t20m10r5-16.pl.json | 20 | 10 | Optimal | 0.06 | 2910 | 2910.00 | 0.00 |
| t20m10r5-17.pl.json | 20 | 10 | Optimal | 0.07 | 2337 | 2337.00 | 0.00 |
| t20m10r5-18.pl.json | 20 | 10 | Optimal | 0.80 | 2920 | 2920.00 | 0.00 |
| t20m10r5-19.pl.json | 20 | 10 | Optimal | 0.04 | 1952 | 1952.00 | 0.00 |
| t20m10r5-2.pl.json | 20 | 10 | Optimal | 0.06 | 1639 | 1639.00 | 0.00 |
| t20m10r5-20.pl.json | 20 | 10 | Optimal | 0.04 | 2660 | 2660.00 | 0.00 |
| t20m10r5-3.pl.json | 20 | 10 | Optimal | 0.06 | 1406 | 1406.00 | 0.00 |
| t20m10r5-4.pl.json | 20 | 10 | Optimal | 0.07 | 2658 | 2658.00 | 0.00 |
| t20m10r5-5.pl.json | 20 | 10 | Optimal | 0.09 | 794 | 794.00 | 0.00 |
| t20m10r5-6.pl.json | 20 | 10 | Optimal | 0.06 | 2398 | 2398.00 | 0.00 |
| t20m10r5-7.pl.json | 20 | 10 | Optimal | 0.04 | 1430 | 1430.00 | 0.00 |
| t20m10r5-8.pl.json | 20 | 10 | Optimal | 0.09 | 976 | 976.00 | 0.00 |
| t20m10r5-9.pl.json | 20 | 10 | Optimal | 0.06 | 2953 | 2953.00 | 0.00 |
| t30m10r10-1.pl.json | 30 | 10 | Optimal | 3.50 | 3344 | 3344.00 | 0.00 |
| t30m10r10-10.pl.json | 30 | 10 | Solution | 30.03 | 4692 | 4146.00 | 11.64 |
| t30m10r10-11.pl.json | 30 | 10 | Optimal | 0.12 | 2905 | 2905.00 | 0.00 |
| t30m10r10-12.pl.json | 30 | 10 | Optimal | 0.11 | 3672 | 3672.00 | 0.00 |
| t30m10r10-13.pl.json | 30 | 10 | Optimal | 0.15 | 2778 | 2778.00 | 0.00 |
| t30m10r10-14.pl.json | 30 | 10 | Optimal | 1.59 | 2741 | 2741.00 | 0.00 |
| t30m10r10-15.pl.json | 30 | 10 | Optimal | 0.12 | 2388 | 2388.00 | 0.00 |
| t30m10r10-16.pl.json | 30 | 10 | Optimal | 3.04 | 4225 | 4225.00 | 0.00 |
| t30m10r10-17.pl.json | 30 | 10 | Optimal | 0.11 | 1504 | 1504.00 | 0.00 |
| t30m10r10-18.pl.json | 30 | 10 | Optimal | 7.37 | 3287 | 3287.00 | 0.00 |
| t30m10r10-19.pl.json | 30 | 10 | Optimal | 0.11 | 3874 | 3874.00 | 0.00 |
| t30m10r10-2.pl.json | 30 | 10 | Optimal | 0.09 | 3169 | 3169.00 | 0.00 |
| t30m10r10-20.pl.json | 30 | 10 | Optimal | 0.07 | 2691 | 2691.00 | 0.00 |
| t30m10r10-3.pl.json | 30 | 10 | Solution | 30.02 | 3360 | 2851.00 | 15.15 |
| t30m10r10-4.pl.json | 30 | 10 | Optimal | 0.08 | 3452 | 3452.00 | 0.00 |
| t30m10r10-5.pl.json | 30 | 10 | Optimal | 0.08 | 2785 | 2785.00 | 0.00 |
| t30m10r10-6.pl.json | 30 | 10 | Solution | 30.09 | 1011 | 775.00 | 23.34 |
| t30m10r10-7.pl.json | 30 | 10 | Optimal | 4.10 | 3755 | 3755.00 | 0.00 |
| t30m10r10-8.pl.json | 30 | 10 | Optimal | 11.44 | 4613 | 4613.00 | 0.00 |
| t30m10r10-9.pl.json | 30 | 10 | Optimal | 0.08 | 2770 | 2770.00 | 0.00 |
| t30m10r3-1.pl.json | 30 | 10 | Optimal | 0.17 | 2901 | 2901.00 | 0.00 |
| t30m10r3-10.pl.json | 30 | 10 | Optimal | 0.10 | 4829 | 4829.00 | 0.00 |
| t30m10r3-11.pl.json | 30 | 10 | Optimal | 0.09 | 2584 | 2584.00 | 0.00 |
| t30m10r3-12.pl.json | 30 | 10 | Optimal | 0.08 | 2130 | 2130.00 | 0.00 |
| t30m10r3-13.pl.json | 30 | 10 | Optimal | 0.07 | 4253 | 4253.00 | 0.00 |
| t30m10r3-14.pl.json | 30 | 10 | Optimal | 0.16 | 1393 | 1393.00 | 0.00 |
| t30m10r3-15.pl.json | 30 | 10 | Optimal | 0.11 | 4149 | 4149.00 | 0.00 |
| t30m10r3-16.pl.json | 30 | 10 | Optimal | 0.23 | 2027 | 2027.00 | 0.00 |
| t30m10r3-17.pl.json | 30 | 10 | Optimal | 0.11 | 2975 | 2975.00 | 0.00 |
| t30m10r3-18.pl.json | 30 | 10 | Optimal | 0.13 | 5477 | 5477.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t30m10r3-19.pl.json | 30 | 10 | Solution | 30.02 | 1288 | 1042.00 | 19.10 |
| t30m10r3-2.pl.json | 30 | 10 | Optimal | 0.15 | 2523 | 2523.00 | 0.00 |
| t30m10r3-20.pl.json | 30 | 10 | Optimal | 0.09 | 4754 | 4754.00 | 0.00 |
| t30m10r3-3.pl.json | 30 | 10 | Optimal | 0.07 | 2793 | 2793.00 | 0.00 |
| t30m10r3-4.pl.json | 30 | 10 | Optimal | 0.97 | 2809 | 2809.00 | 0.00 |
| t30m10r3-5.pl.json | 30 | 10 | Optimal | 0.14 | 3758 | 3758.00 | 0.00 |
| t30m10r3-6.pl.json | 30 | 10 | Optimal | 0.06 | 2870 | 2870.00 | 0.00 |
| t30m10r3-7.pl.json | 30 | 10 | Optimal | 0.13 | 2122 | 2122.00 | 0.00 |
| t30m10r3-8.pl.json | 30 | 10 | Optimal | 0.13 | 2862 | 2862.00 | 0.00 |
| t30m10r3-9.pl.json | 30 | 10 | Optimal | 0.09 | 2754 | 2754.00 | 0.00 |
| t30m10r5-1.pl.json | 30 | 10 | Optimal | 0.09 | 1998 | 1998.00 | 0.00 |
| t30m10r5-10.pl.json | 30 | 10 | Optimal | 0.12 | 3743 | 3743.00 | 0.00 |
| t30m10r5-11.pl.json | 30 | 10 | Optimal | 0.12 | 2138 | 2138.00 | 0.00 |
| t30m10r5-12.pl.json | 30 | 10 | Optimal | 0.08 | 2251 | 2251.00 | 0.00 |
| t30m10r5-13.pl.json | 30 | 10 | Optimal | 0.10 | 2632 | 2632.00 | 0.00 |
| t30m10r5-14.pl.json | 30 | 10 | Optimal | 0.11 | 2201 | 2201.00 | 0.00 |
| t30m10r5-15.pl.json | 30 | 10 | Optimal | 0.10 | 2339 | 2339.00 | 0.00 |
| t30m10r5-16.pl.json | 30 | 10 | Optimal | 0.17 | 4293 | 4293.00 | 0.00 |
| t30m10r5-17.pl.json | 30 | 10 | Optimal | 0.15 | 1314 | 1314.00 | 0.00 |
| t30m10r5-18.pl.json | 30 | 10 | Optimal | 0.09 | 2169 | 2169.00 | 0.00 |
| t30m10r5-19.pl.json | 30 | 10 | Solution | 30.14 | 1346 | 1279.00 | 4.98 |
| t30m10r5-2.pl.json | 30 | 10 | Optimal | 0.05 | 2399 | 2399.00 | 0.00 |
| t30m10r5-20.pl.json | 30 | 10 | Optimal | 0.18 | 1486 | 1486.00 | 0.00 |
| t30m10r5-3.pl.json | 30 | 10 | Optimal | 0.08 | 2494 | 2494.00 | 0.00 |
| t30m10r5-4.pl.json | 30 | 10 | Optimal | 0.11 | 3405 | 3405.00 | 0.00 |
| t30m10r5-5.pl.json | 30 | 10 | Optimal | 3.99 | 5243 | 5243.00 | 0.00 |
| t30m10r5-6.pl.json | 30 | 10 | Optimal | 0.09 | 2382 | 2382.00 | 0.00 |
| t30m10r5-7.pl.json | 30 | 10 | Optimal | 0.10 | 2018 | 2018.00 | 0.00 |
| t30m10r5-8.pl.json | 30 | 10 | Optimal | 0.13 | 3089 | 3089.00 | 0.00 |
| t30m10r5-9.pl.json | 30 | 10 | Optimal | 0.12 | 3704 | 3704.00 | 0.00 |
| t30m20r10-1.pl.json | 30 | 20 | Solution | 30.01 | 3702 | 2850.00 | 23.01 |
| t30m20r10-10.pl.json | 30 | 20 | Optimal | 0.11 | 2508 | 2508.00 | 0.00 |
| t30m20r10-11.pl.json | 30 | 20 | Optimal | 1.75 | 3648 | 3648.00 | 0.00 |
| t30m20r10-12.pl.json | 30 | 20 | Optimal | 0.36 | 4214 | 4214.00 | 0.00 |
| t30m20r10-13.pl.json | 30 | 20 | Optimal | 6.20 | 3980 | 3980.00 | 0.00 |
| t30m20r10-14.pl.json | 30 | 20 | Optimal | 0.17 | 3141 | 3141.00 | 0.00 |
| t30m20r10-15.pl.json | 30 | 20 | Solution | 30.03 | 4322 | 3457.00 | 20.01 |
| t30m20r10-16.pl.json | 30 | 20 | Optimal | 0.22 | 4002 | 4002.00 | 0.00 |
| t30m20r10-17.pl.json | 30 | 20 | Optimal | 19.13 | 4161 | 4161.00 | 0.00 |
| t30m20r10-18.pl.json | 30 | 20 | Optimal | 3.59 | 1992 | 1992.00 | 0.00 |
| t30m20r10-19.pl.json | 30 | 20 | Optimal | 0.17 | 2789 | 2789.00 | 0.00 |
| t30m20r10-2.pl.json | 30 | 20 | Optimal | 20.44 | 3982 | 3982.00 | 0.00 |
| t30m20r10-20.pl.json | 30 | 20 | Optimal | 0.18 | 2314 | 2314.00 | 0.00 |
| t30m20r10-3.pl.json | 30 | 20 | Optimal | 0.15 | 2158 | 2158.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------------|------------|----------------|---------|-------|----------|---------|----------------|
| t30m20r10-4.pl.json | 30 | 20 | Optimal | 6.52 | 4040 | 4040.00 | 0.00 |
| t30m20r10-5.pl.json | 30 | 20 | Optimal | 0.14 | 1237 | 1237.00 | 0.00 |
| t30m20r10-6.pl.json | 30 | 20 | Optimal | 3.53 | 3770 | 3770.00 | 0.00 |
| t30m20r10-7.pl.json | 30 | 20 | Optimal | 0.18 | 2266 | 2266.00 | 0.00 |
| t30m20r10-8.pl.json | 30 | 20 | Optimal | 0.45 | 1855 | 1855.00 | 0.00 |
| t30m20r10-9.pl.json | 30 | 20 | Optimal | 0.80 | 2028 | 2028.00 | 0.00 |
| t30m20r3-1.pl.json | 30 | 20 | Optimal | 0.17 | 2200 | 2200.00 | 0.00 |
| t30m20r3-10.pl.json | 30 | 20 | Optimal | 0.13 | 3291 | 3291.00 | 0.00 |
| t30m20r3-11.pl.json | 30 | 20 | Optimal | 0.22 | 4473 | 4473.00 | 0.00 |
| t30m20r3-12.pl.json | 30 | 20 | Optimal | 3.75 | 5060 | 5060.00 | 0.00 |
| t30m20r3-13.pl.json | 30 | 20 | Optimal | 0.14 | 3536 | 3536.00 | 0.00 |
| t30m20r3-14.pl.json | 30 | 20 | Optimal | 0.15 | 3432 | 3432.00 | 0.00 |
| t30m20r3-15.pl.json | 30 | 20 | Optimal | 0.14 | 3463 | 3463.00 | 0.00 |
| t30m20r3-16.pl.json | 30 | 20 | Optimal | 0.16 | 3893 | 3893.00 | 0.00 |
| t30m20r3-17.pl.json | 30 | 20 | Optimal | 0.19 | 1892 | 1892.00 | 0.00 |
| t30m20r3-18.pl.json | 30 | 20 | Optimal | 0.16 | 2653 | 2653.00 | 0.00 |
| t30m20r3-19.pl.json | 30 | 20 | Optimal | 0.18 | 3141 | 3141.00 | 0.00 |
| t30m20r3-2.pl.json | 30 | 20 | Optimal | 0.15 | 1251 | 1251.00 | 0.00 |
| t30m20r3-20.pl.json | 30 | 20 | Optimal | 2.08 | 2745 | 2745.00 | 0.00 |
| t30m20r3-3.pl.json | 30 | 20 | Optimal | 0.18 | 3434 | 3434.00 | 0.00 |
| t30m20r3-4.pl.json | 30 | 20 | Optimal | 0.19 | 2394 | 2394.00 | 0.00 |
| t30m20r3-5.pl.json | 30 | 20 | Optimal | 0.12 | 3776 | 3776.00 | 0.00 |
| t30m20r3-6.pl.json | 30 | 20 | Optimal | 0.20 | 2250 | 2250.00 | 0.00 |
| t30m20r3-7.pl.json | 30 | 20 | Optimal | 0.21 | 1693 | 1693.00 | 0.00 |
| t30m20r3-8.pl.json | 30 | 20 | Optimal | 0.12 | 4997 | 4997.00 | 0.00 |
| t30m20r3-9.pl.json | 30 | 20 | Optimal | 0.16 | 4898 | 4898.00 | 0.00 |
| t30m20r5-1.pl.json | 30 | 20 | Optimal | 2.62 | 3195 | 3195.00 | 0.00 |
| t30m20r5-10.pl.json | 30 | 20 | Optimal | 0.72 | 2133 | 2133.00 | 0.00 |
| t30m20r5-11.pl.json | 30 | 20 | Optimal | 0.17 | 3974 | 3974.00 | 0.00 |
| t30m20r5-12.pl.json | 30 | 20 | Optimal | 0.16 | 2197 | 2197.00 | 0.00 |
| t30m20r5-13.pl.json | 30 | 20 | Optimal | 0.15 | 2296 | 2296.00 | 0.00 |
| t30m20r5-14.pl.json | 30 | 20 | Optimal | 0.21 | 3861 | 3861.00 | 0.00 |
| t30m20r5-15.pl.json | 30 | 20 | Optimal | 0.16 | 2353 | 2353.00 | 0.00 |
| t30m20r5-16.pl.json | 30 | 20 | Optimal | 1.80 | 2751 | 2751.00 | 0.00 |
| t30m20r5-17.pl.json | 30 | 20 | Optimal | 0.22 | 3555 | 3555.00 | 0.00 |
| t30m20r5-18.pl.json | 30 | 20 | Optimal | 0.14 | 2384 | 2384.00 | 0.00 |
| t30m20r5-19.pl.json | 30 | 20 | Optimal | 0.17 | 2080 | 2080.00 | 0.00 |
| t30m20r5-2.pl.json | 30 | 20 | Optimal | 0.11 | 1715 | 1715.00 | 0.00 |
| t30m20r5-20.pl.json | 30 | 20 | Optimal | 0.15 | 4176 | 4176.00 | 0.00 |
| t30m20r5-3.pl.json | 30 | 20 | Optimal | 15.15 | 4528 | 4528.00 | 0.00 |
| t30m20r5-4.pl.json | 30 | 20 | Optimal | 0.20 | 3083 | 3083.00 | 0.00 |
| t30m20r5-5.pl.json | 30 | 20 | Optimal | 0.12 | 1969 | 1969.00 | 0.00 |
| t30m20r5-6.pl.json | 30 | 20 | Optimal | 0.15 | 4250 | 4250.00 | 0.00 |
| t30m20r5-7.pl.json | 30 | 20 | Optimal | 0.19 | 3036 | 3036.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t30m20r5-8.pl.json | 30 | 20 | Optimal | 2.07 | 2834 | 2834.00 | 0.00 |
| t30m20r5-9.pl.json | 30 | 20 | Optimal | 0.16 | 2343 | 2343.00 | 0.00 |
| t40m10r10-1.pl.json | 40 | 10 | Optimal | 0.18 | 2514 | 2514.00 | 0.00 |
| t40m10r10-10.pl.json | 40 | 10 | Optimal | 0.18 | 3557 | 3557.00 | 0.00 |
| t40m10r10-11.pl.json | 40 | 10 | Solution | 30.03 | 4556 | 4262.00 | 6.45 |
| t40m10r10-12.pl.json | 40 | 10 | Solution | 30.04 | 5225 | 4355.00 | 16.65 |
| t40m10r10-13.pl.json | 40 | 10 | Optimal | 5.66 | 2789 | 2789.00 | 0.00 |
| t40m10r10-14.pl.json | 40 | 10 | Optimal | 0.34 | 1648 | 1648.00 | 0.00 |
| t40m10r10-15.pl.json | 40 | 10 | Optimal | 1.53 | 1844 | 1844.00 | 0.00 |
| t40m10r10-16.pl.json | 40 | 10 | Optimal | 9.44 | 3749 | 3749.00 | 0.00 |
| t40m10r10-17.pl.json | 40 | 10 | Optimal | 0.15 | 2363 | 2363.00 | 0.00 |
| t40m10r10-18.pl.json | 40 | 10 | Optimal | 0.23 | 4973 | 4973.00 | 0.00 |
| t40m10r10-19.pl.json | 40 | 10 | Optimal | 0.26 | 3181 | 3181.00 | 0.00 |
| t40m10r10-2.pl.json | 40 | 10 | Optimal | 0.24 | 2350 | 2350.00 | 0.00 |
| t40m10r10-20.pl.json | 40 | 10 | Optimal | 11.15 | 2730 | 2730.00 | 0.00 |
| t40m10r10-3.pl.json | 40 | 10 | Optimal | 0.17 | 3717 | 3717.00 | 0.00 |
| t40m10r10-4.pl.json | 40 | 10 | Optimal | 0.17 | 3414 | 3414.00 | 0.00 |
| t40m10r10-5.pl.json | 40 | 10 | Optimal | 2.53 | 2852 | 2852.00 | 0.00 |
| t40m10r10-6.pl.json | 40 | 10 | Optimal | 8.05 | 3262 | 3262.00 | 0.00 |
| t40m10r10-7.pl.json | 40 | 10 | Optimal | 0.15 | 4572 | 4572.00 | 0.00 |
| t40m10r10-8.pl.json | 40 | 10 | Optimal | 6.04 | 3776 | 3776.00 | 0.00 |
| t40m10r10-9.pl.json | 40 | 10 | Optimal | 0.34 | 2524 | 2524.00 | 0.00 |
| t40m10r3-1.pl.json | 40 | 10 | Optimal | 0.17 | 4832 | 4832.00 | 0.00 |
| t40m10r3-10.pl.json | 40 | 10 | Optimal | 0.12 | 2442 | 2442.00 | 0.00 |
| t40m10r3-11.pl.json | 40 | 10 | Optimal | 0.52 | 3218 | 3218.00 | 0.00 |
| t40m10r3-12.pl.json | 40 | 10 | Optimal | 0.11 | 3863 | 3863.00 | 0.00 |
| t40m10r3-13.pl.json | 40 | 10 | Optimal | 0.41 | 3564 | 3564.00 | 0.00 |
| t40m10r3-14.pl.json | 40 | 10 | Optimal | 0.15 | 4913 | 4913.00 | 0.00 |
| t40m10r3-15.pl.json | 40 | 10 | Optimal | 0.21 | 3785 | 3785.00 | 0.00 |
| t40m10r3-16.pl.json | 40 | 10 | Optimal | 0.37 | 2840 | 2840.00 | 0.00 |
| t40m10r3-17.pl.json | 40 | 10 | Optimal | 0.20 | 5506 | 5506.00 | 0.00 |
| t40m10r3-18.pl.json | 40 | 10 | Optimal | 0.38 | 3848 | 3848.00 | 0.00 |
| t40m10r3-19.pl.json | 40 | 10 | Optimal | 0.27 | 2259 | 2259.00 | 0.00 |
| t40m10r3-2.pl.json | 40 | 10 | Solution | 30.18 | 1729 | 1589.00 | 8.10 |
| t40m10r3-20.pl.json | 40 | 10 | Optimal | 0.26 | 4157 | 4157.00 | 0.00 |
| t40m10r3-3.pl.json | 40 | 10 | Optimal | 0.33 | 4903 | 4903.00 | 0.00 |
| t40m10r3-4.pl.json | 40 | 10 | Solution | 30.02 | 1633 | 1341.00 | 17.88 |
| t40m10r3-5.pl.json | 40 | 10 | Optimal | 0.34 | 1984 | 1984.00 | 0.00 |
| t40m10r3-6.pl.json | 40 | 10 | Optimal | 0.35 | 5005 | 5005.00 | 0.00 |
| t40m10r3-7.pl.json | 40 | 10 | Solution | 30.02 | 5545 | 5188.00 | 6.44 |
| t40m10r3-8.pl.json | 40 | 10 | Optimal | 0.24 | 3658 | 3658.00 | 0.00 |
| t40m10r3-9.pl.json | 40 | 10 | Optimal | 0.36 | 3830 | 3830.00 | 0.00 |
| t40m10r5-1.pl.json | 40 | 10 | Optimal | 0.20 | 4857 | 4857.00 | 0.00 |
| t40m10r5-10.pl.json | 40 | 10 | Optimal | 0.20 | 3989 | 3989.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t40m10r5-11.pl.json | 40 | 10 | Optimal | 0.33 | 5238 | 5238.00 | 0.00 |
| t40m10r5-12.pl.json | 40 | 10 | Optimal | 0.42 | 4584 | 4584.00 | 0.00 |
| t40m10r5-13.pl.json | 40 | 10 | Optimal | 0.40 | 2307 | 2307.00 | 0.00 |
| t40m10r5-14.pl.json | 40 | 10 | Optimal | 0.21 | 1826 | 1826.00 | 0.00 |
| t40m10r5-15.pl.json | 40 | 10 | Optimal | 0.17 | 1926 | 1926.00 | 0.00 |
| t40m10r5-16.pl.json | 40 | 10 | Optimal | 0.26 | 5216 | 5216.00 | 0.00 |
| t40m10r5-17.pl.json | 40 | 10 | Optimal | 0.14 | 7162 | 7162.00 | 0.00 |
| t40m10r5-18.pl.json | 40 | 10 | Optimal | 0.24 | 4892 | 4892.00 | 0.00 |
| t40m10r5-19.pl.json | 40 | 10 | Optimal | 0.18 | 4027 | 4027.00 | 0.00 |
| t40m10r5-2.pl.json | 40 | 10 | Optimal | 3.51 | 4099 | 4099.00 | 0.00 |
| t40m10r5-20.pl.json | 40 | 10 | Optimal | 10.41 | 4899 | 4899.00 | 0.00 |
| t40m10r5-3.pl.json | 40 | 10 | Optimal | 0.64 | 3113 | 3113.00 | 0.00 |
| t40m10r5-4.pl.json | 40 | 10 | Optimal | 0.21 | 6626 | 6626.00 | 0.00 |
| t40m10r5-5.pl.json | 40 | 10 | Optimal | 0.25 | 3828 | 3828.00 | 0.00 |
| t40m10r5-6.pl.json | 40 | 10 | Optimal | 0.33 | 4213 | 4213.00 | 0.00 |
| t40m10r5-7.pl.json | 40 | 10 | Optimal | 0.21 | 4303 | 4303.00 | 0.00 |
| t40m10r5-8.pl.json | 40 | 10 | Solution | 30.02 | 3559 | 3189.00 | 10.40 |
| t40m10r5-9.pl.json | 40 | 10 | Optimal | 0.30 | 1953 | 1953.00 | 0.00 |
| t40m20r10-1.pl.json | 40 | 20 | Solution | 30.05 | 4518 | 3972.00 | 12.08 |
| t40m20r10-10.pl.json | 40 | 20 | Optimal | 4.24 | 3862 | 3862.00 | 0.00 |
| t40m20r10-11.pl.json | 40 | 20 | Optimal | 0.21 | 1952 | 1952.00 | 0.00 |
| t40m20r10-12.pl.json | 40 | 20 | Optimal | 0.71 | 4129 | 4129.00 | 0.00 |
| t40m20r10-13.pl.json | 40 | 20 | Optimal | 0.23 | 2927 | 2927.00 | 0.00 |
| t40m20r10-14.pl.json | 40 | 20 | Optimal | 6.14 | 2701 | 2701.00 | 0.00 |
| t40m20r10-15.pl.json | 40 | 20 | Optimal | 6.72 | 3168 | 3168.00 | 0.00 |
| t40m20r10-16.pl.json | 40 | 20 | Optimal | 0.15 | 2812 | 2812.00 | 0.00 |
| t40m20r10-17.pl.json | 40 | 20 | Optimal | 8.83 | 4288 | 4288.00 | 0.00 |
| t40m20r10-18.pl.json | 40 | 20 | Optimal | 8.25 | 3611 | 3611.00 | 0.00 |
| t40m20r10-19.pl.json | 40 | 20 | Optimal | 1.71 | 2891 | 2891.00 | 0.00 |
| t40m20r10-2.pl.json | 40 | 20 | Optimal | 0.16 | 3284 | 3284.00 | 0.00 |
| t40m20r10-20.pl.json | 40 | 20 | Optimal | 23.67 | 5506 | 5506.00 | 0.00 |
| t40m20r10-3.pl.json | 40 | 20 | Solution | 30.03 | 5981 | 5478.00 | 8.41 |
| t40m20r10-4.pl.json | 40 | 20 | Optimal | 0.16 | 3409 | 3409.00 | 0.00 |
| t40m20r10-5.pl.json | 40 | 20 | Solution | 30.04 | 5113 | 4278.00 | 16.33 |
| t40m20r10-6.pl.json | 40 | 20 | Optimal | 21.04 | 2376 | 2376.00 | 0.00 |
| t40m20r10-7.pl.json | 40 | 20 | Optimal | 18.53 | 4799 | 4799.00 | 0.00 |
| t40m20r10-8.pl.json | 40 | 20 | Optimal | 6.17 | 3924 | 3924.00 | 0.00 |
| t40m20r10-9.pl.json | 40 | 20 | Optimal | 4.28 | 2043 | 2043.00 | 0.00 |
| t40m20r3-1.pl.json | 40 | 20 | Optimal | 0.26 | 3524 | 3524.00 | 0.00 |
| t40m20r3-10.pl.json | 40 | 20 | Optimal | 0.60 | 3110 | 3110.00 | 0.00 |
| t40m20r3-11.pl.json | 40 | 20 | Optimal | 0.22 | 3695 | 3695.00 | 0.00 |
| t40m20r3-12.pl.json | 40 | 20 | Optimal | 0.31 | 4828 | 4828.00 | 0.00 |
| t40m20r3-13.pl.json | 40 | 20 | Optimal | 0.35 | 4010 | 4010.00 | 0.00 |
| t40m20r3-14.pl.json | 40 | 20 | Optimal | 0.14 | 2752 | 2752.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t40m20r3-15.pl.json | 40 | 20 | Optimal | 0.22 | 3312 | 3312.00 | 0.00 |
| t40m20r3-16.pl.json | 40 | 20 | Optimal | 0.41 | 4304 | 4304.00 | 0.00 |
| t40m20r3-17.pl.json | 40 | 20 | Optimal | 0.29 | 3991 | 3991.00 | 0.00 |
| t40m20r3-18.pl.json | 40 | 20 | Optimal | 0.27 | 5733 | 5733.00 | 0.00 |
| t40m20r3-19.pl.json | 40 | 20 | Optimal | 0.24 | 3581 | 3581.00 | 0.00 |
| t40m20r3-2.pl.json | 40 | 20 | Optimal | 0.30 | 4869 | 4869.00 | 0.00 |
| t40m20r3-20.pl.json | 40 | 20 | Optimal | 0.34 | 3514 | 3514.00 | 0.00 |
| t40m20r3-3.pl.json | 40 | 20 | Optimal | 0.27 | 2503 | 2503.00 | 0.00 |
| t40m20r3-4.pl.json | 40 | 20 | Optimal | 0.21 | 4323 | 4323.00 | 0.00 |
| t40m20r3-5.pl.json | 40 | 20 | Optimal | 0.29 | 3626 | 3626.00 | 0.00 |
| t40m20r3-6.pl.json | 40 | 20 | Optimal | 0.22 | 2488 | 2488.00 | 0.00 |
| t40m20r3-7.pl.json | 40 | 20 | Optimal | 0.16 | 3470 | 3470.00 | 0.00 |
| t40m20r3-8.pl.json | 40 | 20 | Optimal | 0.84 | 6730 | 6730.00 | 0.00 |
| t40m20r3-9.pl.json | 40 | 20 | Optimal | 0.23 | 4656 | 4656.00 | 0.00 |
| t40m20r5-1.pl.json | 40 | 20 | Optimal | 0.20 | 1318 | 1318.00 | 0.00 |
| t40m20r5-10.pl.json | 40 | 20 | Optimal | 0.27 | 2216 | 2216.00 | 0.00 |
| t40m20r5-11.pl.json | 40 | 20 | Optimal | 0.23 | 3538 | 3538.00 | 0.00 |
| t40m20r5-12.pl.json | 40 | 20 | Optimal | 0.33 | 5346 | 5346.00 | 0.00 |
| t40m20r5-13.pl.json | 40 | 20 | Optimal | 21.99 | 4589 | 4589.00 | 0.00 |
| t40m20r5-14.pl.json | 40 | 20 | Optimal | 0.21 | 2243 | 2243.00 | 0.00 |
| t40m20r5-15.pl.json | 40 | 20 | Optimal | 8.96 | 3869 | 3869.00 | 0.00 |
| t40m20r5-16.pl.json | 40 | 20 | Optimal | 0.28 | 4319 | 4319.00 | 0.00 |
| t40m20r5-17.pl.json | 40 | 20 | Optimal | 0.21 | 4866 | 4866.00 | 0.00 |
| t40m20r5-18.pl.json | 40 | 20 | Optimal | 0.66 | 5802 | 5802.00 | 0.00 |
| t40m20r5-19.pl.json | 40 | 20 | Optimal | 10.46 | 4197 | 4197.00 | 0.00 |
| t40m20r5-2.pl.json | 40 | 20 | Optimal | 0.17 | 2634 | 2634.00 | 0.00 |
| t40m20r5-20.pl.json | 40 | 20 | Solution | 30.05 | 6482 | 6232.00 | 3.86 |
| t40m20r5-3.pl.json | 40 | 20 | Optimal | 0.38 | 4391 | 4391.00 | 0.00 |
| t40m20r5-4.pl.json | 40 | 20 | Optimal | 5.34 | 4610 | 4610.00 | 0.00 |
| t40m20r5-5.pl.json | 40 | 20 | Optimal | 0.17 | 3105 | 3105.00 | 0.00 |
| t40m20r5-6.pl.json | 40 | 20 | Optimal | 0.21 | 4760 | 4760.00 | 0.00 |
| t40m20r5-7.pl.json | 40 | 20 | Optimal | 0.22 | 1218 | 1218.00 | 0.00 |
| t40m20r5-8.pl.json | 40 | 20 | Optimal | 0.20 | 2601 | 2601.00 | 0.00 |
| t40m20r5-9.pl.json | 40 | 20 | Optimal | 0.17 | 3141 | 3141.00 | 0.00 |
| t500m100r10-1.pl.json | 500 | 100 | Solution | 34.47 | 99985 | 44508.00 | 55.49 |
| t500m100r10-10.pl.json | 500 | 100 | Solution | 36.70 | 99989 | 35930.00 | 64.07 |
| t500m100r10-11.pl.json | 500 | 100 | Solution | 37.37 | 99998 | 31878.00 | 68.12 |
| t500m100r10-12.pl.json | 500 | 100 | Solution | 41.73 | 99997 | 44533.00 | 55.47 |
| t500m100r10-13.pl.json | 500 | 100 | Solution | 40.49 | 99999 | 37955.00 | 62.04 |
| t500m100r10-14.pl.json | 500 | 100 | Solution | 36.97 | 99990 | 34723.00 | 65.27 |
| t500m100r10-15.pl.json | 500 | 100 | Solution | 40.76 | 100000 | 35403.00 | 64.60 |
| t500m100r10-16.pl.json | 500 | 100 | Solution | 39.01 | 99999 | 33693.00 | 66.31 |
| t500m100r10-17.pl.json | 500 | 100 | Solution | 42.46 | 99997 | 28688.00 | 71.31 |
| t500m100r10-18.pl.json | 500 | 100 | Solution | 42.66 | 100000 | 37334.00 | 62.67 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|------------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m100r10-19.pl.json | 500 | 100 | Solution | 43.40 | 100000 | 40128.00 | 59.87 |
| t500m100r10-2.pl.json | 500 | 100 | Solution | 43.11 | 100000 | 37597.00 | 62.40 |
| t500m100r10-20.pl.json | 500 | 100 | Solution | 42.96 | 100000 | 30194.00 | 69.81 |
| t500m100r10-3.pl.json | 500 | 100 | Solution | 43.67 | 99999 | 31662.00 | 68.34 |
| t500m100r10-4.pl.json | 500 | 100 | Solution | 43.11 | 99993 | 35350.00 | 64.65 |
| t500m100r10-5.pl.json | 500 | 100 | Solution | 44.75 | 99996 | 30335.00 | 69.66 |
| t500m100r10-6.pl.json | 500 | 100 | Solution | 41.60 | 99986 | 35654.00 | 64.34 |
| t500m100r10-7.pl.json | 500 | 100 | Solution | 89.79 | 99991 | 35760.00 | 64.24 |
| t500m100r10-8.pl.json | 500 | 100 | Solution | 81.73 | 99990 | 37775.00 | 62.22 |
| t500m100r10-9.pl.json | 500 | 100 | Solution | 43.73 | 100000 | 34951.00 | 65.05 |
| t500m100r3-1.pl.json | 500 | 100 | Solution | 42.91 | 99985 | 37887.00 | 62.11 |
| t500m100r3-10.pl.json | 500 | 100 | Solution | 43.92 | 99993 | 41592.00 | 58.41 |
| t500m100r3-11.pl.json | 500 | 100 | Solution | 46.47 | 99996 | 36331.00 | 63.67 |
| t500m100r3-12.pl.json | 500 | 100 | Solution | 45.82 | 100000 | 36704.00 | 63.30 |
| t500m100r3-13.pl.json | 500 | 100 | Solution | 42.12 | 99995 | 35381.00 | 64.62 |
| t500m100r3-14.pl.json | 500 | 100 | Solution | 88.74 | 99982 | 40411.00 | 59.58 |
| t500m100r3-15.pl.json | 500 | 100 | Solution | 44.26 | 99992 | 38658.00 | 61.34 |
| t500m100r3-16.pl.json | 500 | 100 | Solution | 93.53 | 99986 | 39443.00 | 60.55 |
| t500m100r3-17.pl.json | 500 | 100 | Solution | 42.16 | 99994 | 54487.00 | 45.51 |
| t500m100r3-18.pl.json | 500 | 100 | Solution | 91.03 | 100000 | 38068.00 | 61.93 |
| t500m100r3-19.pl.json | 500 | 100 | Solution | 48.15 | 100000 | 41896.00 | 58.10 |
| t500m100r3-2.pl.json | 500 | 100 | Solution | 48.01 | 99993 | 41211.00 | 58.79 |
| t500m100r3-20.pl.json | 500 | 100 | Solution | 42.84 | 100000 | 37671.00 | 62.33 |
| t500m100r3-3.pl.json | 500 | 100 | Solution | 88.52 | 99990 | 35084.00 | 64.91 |
| t500m100r3-4.pl.json | 500 | 100 | Solution | 47.32 | 99997 | 32016.00 | 67.98 |
| t500m100r3-5.pl.json | 500 | 100 | Solution | 47.73 | 100000 | 38298.00 | 61.70 |
| t500m100r3-6.pl.json | 500 | 100 | Solution | 44.73 | 99979 | 46003.00 | 53.99 |
| t500m100r3-7.pl.json | 500 | 100 | Solution | 47.33 | 99998 | 37262.00 | 62.74 |
| t500m100r3-8.pl.json | 500 | 100 | Solution | 46.35 | 99996 | 40827.00 | 59.17 |
| t500m100r3-9.pl.json | 500 | 100 | Solution | 44.71 | 99998 | 44625.00 | 55.37 |
| t500m100r5-1.pl.json | 500 | 100 | Solution | 34.78 | 99995 | 34446.00 | 65.55 |
| t500m100r5-10.pl.json | 500 | 100 | Solution | 37.04 | 100000 | 27639.00 | 72.36 |
| t500m100r5-11.pl.json | 500 | 100 | Solution | 35.72 | 100000 | 35280.00 | 64.72 |
| t500m100r5-12.pl.json | 500 | 100 | Solution | 31.74 | 99993 | 37187.00 | 62.81 |
| t500m100r5-13.pl.json | 500 | 100 | Solution | 39.48 | 99998 | 43728.00 | 56.27 |
| t500m100r5-14.pl.json | 500 | 100 | Solution | 37.64 | 100000 | 38862.00 | 61.14 |
| t500m100r5-15.pl.json | 500 | 100 | Solution | 37.56 | 99991 | 36096.00 | 63.90 |
| t500m100r5-16.pl.json | 500 | 100 | Solution | 41.37 | 100000 | 34669.00 | 65.33 |
| t500m100r5-17.pl.json | 500 | 100 | Solution | 41.38 | 99999 | 37944.00 | 62.06 |
| t500m100r5-18.pl.json | 500 | 100 | Solution | 41.58 | 99996 | 42744.00 | 57.25 |
| t500m100r5-19.pl.json | 500 | 100 | Solution | 42.75 | 99997 | 44310.00 | 55.69 |
| t500m100r5-2.pl.json | 500 | 100 | Solution | 41.26 | 99999 | 40905.00 | 59.09 |
| t500m100r5-20.pl.json | 500 | 100 | Solution | 41.73 | 99999 | 38404.00 | 61.60 |
| t500m100r5-3.pl.json | 500 | 100 | Solution | 43.39 | 99997 | 38651.00 | 61.35 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m100r5-4.pl.json | 500 | 100 | Solution | 43.76 | 99991 | 30938.00 | 69.06 |
| t500m100r5-5.pl.json | 500 | 100 | Solution | 38.67 | 100000 | 37915.00 | 62.09 |
| t500m100r5-6.pl.json | 500 | 100 | Solution | 44.47 | 99984 | 40363.00 | 59.63 |
| t500m100r5-7.pl.json | 500 | 100 | Solution | 43.93 | 99992 | 40749.00 | 59.25 |
| t500m100r5-8.pl.json | 500 | 100 | Solution | 46.34 | 100000 | 37050.00 | 62.95 |
| t500m100r5-9.pl.json | 500 | 100 | Solution | 44.35 | 99992 | 39160.00 | 60.84 |
| t500m10r10-1.pl.json | 500 | 10 | Solution | 30.11 | 95746 | 42756.00 | 55.34 |
| t500m10r10-10.pl.json | 500 | 10 | Solution | 30.08 | 95000 | 30745.00 | 67.64 |
| t500m10r10-11.pl.json | 500 | 10 | Solution | 30.06 | 94588 | 42832.00 | 54.72 |
| t500m10r10-12.pl.json | 500 | 10 | Solution | 30.09 | 93713 | 35908.00 | 61.68 |
| t500m10r10-13.pl.json | 500 | 10 | Solution | 30.07 | 95952 | 38554.00 | 59.82 |
| t500m10r10-14.pl.json | 500 | 10 | Solution | 30.06 | 94768 | 34152.00 | 63.96 |
| t500m10r10-15.pl.json | 500 | 10 | Solution | 30.07 | 96018 | 32118.00 | 66.55 |
| t500m10r10-16.pl.json | 500 | 10 | Solution | 30.07 | 94780 | 32243.00 | 65.98 |
| t500m10r10-17.pl.json | 500 | 10 | Solution | 30.07 | 96565 | 32882.00 | 65.95 |
| t500m10r10-18.pl.json | 500 | 10 | Solution | 30.08 | 94982 | 33101.00 | 65.15 |
| t500m10r10-19.pl.json | 500 | 10 | Solution | 30.07 | 95235 | 40550.00 | 57.42 |
| t500m10r10-2.pl.json | 500 | 10 | Solution | 30.06 | 93974 | 34094.00 | 63.72 |
| t500m10r10-20.pl.json | 500 | 10 | Solution | 30.09 | 94572 | 36034.00 | 61.90 |
| t500m10r10-3.pl.json | 500 | 10 | Solution | 30.06 | 95991 | 34790.00 | 63.76 |
| t500m10r10-4.pl.json | 500 | 10 | Solution | 30.05 | 94949 | 40391.00 | 57.46 |
| t500m10r10-5.pl.json | 500 | 10 | Solution | 30.09 | 96784 | 40910.00 | 57.73 |
| t500m10r10-6.pl.json | 500 | 10 | Solution | 30.07 | 94288 | 31591.00 | 66.50 |
| t500m10r10-7.pl.json | 500 | 10 | Solution | 30.06 | 96950 | 33091.00 | 65.87 |
| t500m10r10-8.pl.json | 500 | 10 | Solution | 30.05 | 95149 | 37700.00 | 60.38 |
| t500m10r10-9.pl.json | 500 | 10 | Solution | 30.07 | 93849 | 31331.00 | 66.62 |
| t500m10r3-1.pl.json | 500 | 10 | Solution | 30.06 | 92705 | 38470.00 | 58.50 |
| t500m10r3-10.pl.json | 500 | 10 | Solution | 30.06 | 96160 | 46481.00 | 51.66 |
| t500m10r3-11.pl.json | 500 | 10 | Solution | 30.10 | 95135 | 37621.00 | 60.46 |
| t500m10r3-12.pl.json | 500 | 10 | Solution | 30.06 | 93775 | 41276.00 | 55.98 |
| t500m10r3-13.pl.json | 500 | 10 | Solution | 30.06 | 96699 | 36639.00 | 62.11 |
| t500m10r3-14.pl.json | 500 | 10 | Solution | 30.09 | 95937 | 39052.00 | 59.29 |
| t500m10r3-15.pl.json | 500 | 10 | Solution | 30.08 | 96302 | 40506.00 | 57.94 |
| t500m10r3-16.pl.json | 500 | 10 | Solution | 30.08 | 94188 | 32654.00 | 65.33 |
| t500m10r3-17.pl.json | 500 | 10 | Solution | 30.09 | 94889 | 48574.00 | 48.81 |
| t500m10r3-18.pl.json | 500 | 10 | Solution | 30.07 | 94265 | 37386.00 | 60.34 |
| t500m10r3-19.pl.json | 500 | 10 | Solution | 30.06 | 95914 | 49330.00 | 48.57 |
| t500m10r3-2.pl.json | 500 | 10 | Solution | 30.16 | 97153 | 40595.00 | 58.22 |
| t500m10r3-20.pl.json | 500 | 10 | Solution | 30.07 | 92943 | 46331.00 | 50.15 |
| t500m10r3-3.pl.json | 500 | 10 | Solution | 30.08 | 94467 | 37399.00 | 60.41 |
| t500m10r3-4.pl.json | 500 | 10 | Solution | 30.05 | 97560 | 48637.00 | 50.15 |
| t500m10r3-5.pl.json | 500 | 10 | Solution | 30.07 | 94536 | 38945.00 | 58.80 |
| t500m10r3-6.pl.json | 500 | 10 | Solution | 30.06 | 96686 | 39113.00 | 59.55 |
| t500m10r3-7.pl.json | 500 | 10 | Solution | 30.09 | 96742 | 36212.00 | 62.57 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m10r3-8.pl.json | 500 | 10 | Solution | 30.14 | 94423 | 42992.00 | 54.47 |
| t500m10r3-9.pl.json | 500 | 10 | Solution | 30.06 | 94916 | 41201.00 | 56.59 |
| t500m10r5-1.pl.json | 500 | 10 | Solution | 30.07 | 95693 | 38422.00 | 59.85 |
| t500m10r5-10.pl.json | 500 | 10 | Solution | 30.10 | 96968 | 40616.00 | 58.11 |
| t500m10r5-11.pl.json | 500 | 10 | Solution | 30.05 | 96445 | 43447.00 | 54.95 |
| t500m10r5-12.pl.json | 500 | 10 | Solution | 30.06 | 96045 | 35447.00 | 63.09 |
| t500m10r5-13.pl.json | 500 | 10 | Solution | 30.08 | 95556 | 41212.00 | 56.87 |
| t500m10r5-14.pl.json | 500 | 10 | Solution | 30.05 | 95732 | 37546.00 | 60.78 |
| t500m10r5-15.pl.json | 500 | 10 | Solution | 30.08 | 77582 | 36409.00 | 53.07 |
| t500m10r5-16.pl.json | 500 | 10 | Solution | 30.09 | 94243 | 37966.00 | 59.71 |
| t500m10r5-17.pl.json | 500 | 10 | Solution | 30.08 | 95414 | 41333.00 | 56.68 |
| t500m10r5-18.pl.json | 500 | 10 | Solution | 30.07 | 95623 | 40205.00 | 57.95 |
| t500m10r5-19.pl.json | 500 | 10 | Solution | 30.06 | 94847 | 38862.00 | 59.03 |
| t500m10r5-2.pl.json | 500 | 10 | Solution | 30.08 | 95895 | 36135.00 | 62.32 |
| t500m10r5-20.pl.json | 500 | 10 | Solution | 30.08 | 94987 | 42789.00 | 54.95 |
| t500m10r5-3.pl.json | 500 | 10 | Solution | 30.08 | 94696 | 41375.00 | 56.31 |
| t500m10r5-4.pl.json | 500 | 10 | Solution | 30.08 | 95774 | 34710.00 | 63.76 |
| t500m10r5-5.pl.json | 500 | 10 | Solution | 30.06 | 95351 | 33781.00 | 64.57 |
| t500m10r5-6.pl.json | 500 | 10 | Solution | 30.06 | 94254 | 41208.00 | 56.28 |
| t500m10r5-7.pl.json | 500 | 10 | Solution | 30.08 | 71786 | 37543.00 | 47.70 |
| t500m10r5-8.pl.json | 500 | 10 | Solution | 30.06 | 94893 | 40616.00 | 57.20 |
| t500m10r5-9.pl.json | 500 | 10 | Solution | 30.06 | 93998 | 37557.00 | 60.04 |
| t500m20r10-1.pl.json | 500 | 20 | Solution | 30.14 | 97697 | 35120.00 | 64.05 |
| t500m20r10-10.pl.json | 500 | 20 | Solution | 30.11 | 97516 | 34269.00 | 64.86 |
| t500m20r10-11.pl.json | 500 | 20 | Solution | 30.13 | 97580 | 33469.00 | 65.70 |
| t500m20r10-12.pl.json | 500 | 20 | Solution | 30.13 | 95009 | 36943.00 | 61.12 |
| t500m20r10-13.pl.json | 500 | 20 | Solution | 30.11 | 98196 | 36175.00 | 63.16 |
| t500m20r10-14.pl.json | 500 | 20 | Solution | 30.19 | 94915 | 34601.00 | 63.55 |
| t500m20r10-15.pl.json | 500 | 20 | Solution | 30.11 | 96944 | 32963.00 | 66.00 |
| t500m20r10-16.pl.json | 500 | 20 | Solution | 30.25 | 95596 | 37875.00 | 60.38 |
| t500m20r10-17.pl.json | 500 | 20 | Solution | 30.10 | 96973 | 34515.00 | 64.41 |
| t500m20r10-18.pl.json | 500 | 20 | Solution | 30.14 | 97844 | 35137.00 | 64.09 |
| t500m20r10-19.pl.json | 500 | 20 | Solution | 30.14 | 96900 | 37146.00 | 61.67 |
| t500m20r10-2.pl.json | 500 | 20 | Solution | 30.12 | 95672 | 39857.00 | 58.34 |
| t500m20r10-20.pl.json | 500 | 20 | Solution | 30.14 | 96470 | 35785.00 | 62.91 |
| t500m20r10-3.pl.json | 500 | 20 | Solution | 30.15 | 95282 | 35332.00 | 62.92 |
| t500m20r10-4.pl.json | 500 | 20 | Solution | 30.13 | 96463 | 30197.00 | 68.70 |
| t500m20r10-5.pl.json | 500 | 20 | Solution | 30.16 | 97742 | 39933.00 | 59.14 |
| t500m20r10-6.pl.json | 500 | 20 | Solution | 30.25 | 96682 | 33282.00 | 65.58 |
| t500m20r10-7.pl.json | 500 | 20 | Solution | 30.10 | 95513 | 30485.00 | 68.08 |
| t500m20r10-8.pl.json | 500 | 20 | Solution | 30.11 | 97048 | 37688.00 | 61.17 |
| t500m20r10-9.pl.json | 500 | 20 | Solution | 30.17 | 95122 | 40863.00 | 57.04 |
| t500m20r3-1.pl.json | 500 | 20 | Solution | 30.11 | 96331 | 36188.00 | 62.43 |
| t500m20r3-10.pl.json | 500 | 20 | Solution | 30.13 | 95729 | 42859.00 | 55.23 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m20r3-11.pl.json | 500 | 20 | Solution | 30.11 | 95560 | 38401.00 | 59.81 |
| t500m20r3-12.pl.json | 500 | 20 | Solution | 30.12 | 95608 | 40309.00 | 57.84 |
| t500m20r3-13.pl.json | 500 | 20 | Solution | 30.11 | 97160 | 33374.00 | 65.65 |
| t500m20r3-14.pl.json | 500 | 20 | Solution | 30.10 | 47664 | 34978.00 | 26.62 |
| t500m20r3-15.pl.json | 500 | 20 | Solution | 30.25 | 94244 | 37664.00 | 60.04 |
| t500m20r3-16.pl.json | 500 | 20 | Solution | 30.13 | 95521 | 42848.00 | 55.14 |
| t500m20r3-17.pl.json | 500 | 20 | Solution | 30.15 | 97072 | 39524.00 | 59.28 |
| t500m20r3-18.pl.json | 500 | 20 | Solution | 30.11 | 95122 | 43126.00 | 54.66 |
| t500m20r3-19.pl.json | 500 | 20 | Solution | 30.11 | 44926 | 37033.00 | 17.57 |
| t500m20r3-2.pl.json | 500 | 20 | Solution | 30.12 | 96028 | 42127.00 | 56.13 |
| t500m20r3-20.pl.json | 500 | 20 | Solution | 30.10 | 94804 | 45628.00 | 51.87 |
| t500m20r3-3.pl.json | 500 | 20 | Solution | 30.25 | 97763 | 31170.00 | 68.12 |
| t500m20r3-4.pl.json | 500 | 20 | Solution | 30.11 | 94497 | 43640.00 | 53.82 |
| t500m20r3-5.pl.json | 500 | 20 | Solution | 30.15 | 96748 | 48397.00 | 49.98 |
| t500m20r3-6.pl.json | 500 | 20 | Solution | 30.11 | 96780 | 35195.00 | 63.63 |
| t500m20r3-7.pl.json | 500 | 20 | Solution | 30.12 | 96251 | 45611.00 | 52.61 |
| t500m20r3-8.pl.json | 500 | 20 | Solution | 30.25 | 97074 | 44320.00 | 54.34 |
| t500m20r3-9.pl.json | 500 | 20 | Solution | 30.11 | 95614 | 41018.00 | 57.10 |
| t500m20r5-1.pl.json | 500 | 20 | Solution | 30.25 | 97130 | 35280.00 | 63.68 |
| t500m20r5-10.pl.json | 500 | 20 | Solution | 30.11 | 96985 | 42735.00 | 55.94 |
| t500m20r5-11.pl.json | 500 | 20 | Solution | 30.13 | 94840 | 33780.00 | 64.38 |
| t500m20r5-12.pl.json | 500 | 20 | Solution | 30.11 | 94597 | 37117.00 | 60.76 |
| t500m20r5-13.pl.json | 500 | 20 | Solution | 30.13 | 97220 | 39429.00 | 59.44 |
| t500m20r5-14.pl.json | 500 | 20 | Solution | 30.11 | 96568 | 45311.00 | 53.08 |
| t500m20r5-15.pl.json | 500 | 20 | Solution | 30.12 | 95130 | 38015.00 | 60.04 |
| t500m20r5-16.pl.json | 500 | 20 | Solution | 30.15 | 94779 | 36087.00 | 61.93 |
| t500m20r5-17.pl.json | 500 | 20 | Solution | 30.11 | 98195 | 41447.00 | 57.79 |
| t500m20r5-18.pl.json | 500 | 20 | Solution | 30.13 | 94881 | 40783.00 | 57.02 |
| t500m20r5-19.pl.json | 500 | 20 | Solution | 30.11 | 95921 | 40972.00 | 57.29 |
| t500m20r5-2.pl.json | 500 | 20 | Solution | 30.12 | 95081 | 39591.00 | 58.36 |
| t500m20r5-20.pl.json | 500 | 20 | Solution | 30.14 | 95319 | 37542.00 | 60.61 |
| t500m20r5-3.pl.json | 500 | 20 | Solution | 30.14 | 95802 | 39647.00 | 58.62 |
| t500m20r5-4.pl.json | 500 | 20 | Solution | 30.23 | 96496 | 40300.00 | 58.24 |
| t500m20r5-5.pl.json | 500 | 20 | Solution | 30.16 | 96540 | 41014.00 | 57.52 |
| t500m20r5-6.pl.json | 500 | 20 | Solution | 30.13 | 94656 | 41439.00 | 56.22 |
| t500m20r5-7.pl.json | 500 | 20 | Solution | 30.14 | 96949 | 37547.00 | 61.27 |
| t500m20r5-8.pl.json | 500 | 20 | Solution | 30.11 | 95312 | 41282.00 | 56.69 |
| t500m20r5-9.pl.json | 500 | 20 | Solution | 30.20 | 95186 | 39384.00 | 58.62 |
| t500m50r10-1.pl.json | 500 | 50 | Solution | 30.26 | 98574 | 39376.00 | 60.05 |
| t500m50r10-10.pl.json | 500 | 50 | Solution | 30.53 | 97898 | 34844.00 | 64.41 |
| t500m50r10-11.pl.json | 500 | 50 | Solution | 30.31 | 97432 | 39722.00 | 59.23 |
| t500m50r10-12.pl.json | 500 | 50 | Solution | 30.27 | 97544 | 32276.00 | 66.91 |
| t500m50r10-13.pl.json | 500 | 50 | Solution | 30.33 | 98339 | 29550.00 | 69.95 |
| t500m50r10-14.pl.json | 500 | 50 | Solution | 34.32 | 97956 | 37824.00 | 61.39 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m50r10-15.pl.json | 500 | 50 | Solution | 30.30 | 97960 | 33997.00 | 65.30 |
| t500m50r10-16.pl.json | 500 | 50 | Solution | 30.55 | 99118 | 31567.00 | 68.15 |
| t500m50r10-17.pl.json | 500 | 50 | Solution | 30.30 | 99163 | 28277.00 | 71.48 |
| t500m50r10-18.pl.json | 500 | 50 | Solution | 30.41 | 98458 | 39127.00 | 60.26 |
| t500m50r10-19.pl.json | 500 | 50 | Solution | 30.30 | 96340 | 38100.00 | 60.45 |
| t500m50r10-2.pl.json | 500 | 50 | Solution | 34.68 | 97717 | 37318.00 | 61.81 |
| t500m50r10-20.pl.json | 500 | 50 | Solution | 30.49 | 97088 | 32654.00 | 66.37 |
| t500m50r10-3.pl.json | 500 | 50 | Solution | 30.25 | 97120 | 36737.00 | 62.17 |
| t500m50r10-4.pl.json | 500 | 50 | Solution | 30.35 | 98732 | 36302.00 | 63.23 |
| t500m50r10-5.pl.json | 500 | 50 | Solution | 34.52 | 98061 | 31982.00 | 67.39 |
| t500m50r10-6.pl.json | 500 | 50 | Solution | 30.34 | 96562 | 28608.00 | 70.37 |
| t500m50r10-7.pl.json | 500 | 50 | Solution | 30.55 | 96332 | 30074.00 | 68.78 |
| t500m50r10-8.pl.json | 500 | 50 | Solution | 30.28 | 97888 | 39978.00 | 59.16 |
| t500m50r10-9.pl.json | 500 | 50 | Solution | 30.33 | 96470 | 35216.00 | 63.50 |
| t500m50r3-1.pl.json | 500 | 50 | Solution | 30.29 | 96953 | 43548.00 | 55.08 |
| t500m50r3-10.pl.json | 500 | 50 | Solution | 34.27 | 96965 | 43200.00 | 55.45 |
| t500m50r3-11.pl.json | 500 | 50 | Solution | 30.47 | 97740 | 40426.00 | 58.64 |
| t500m50r3-12.pl.json | 500 | 50 | Solution | 30.28 | 97264 | 36948.00 | 62.01 |
| t500m50r3-13.pl.json | 500 | 50 | Solution | 30.30 | 97299 | 38482.00 | 60.45 |
| t500m50r3-14.pl.json | 500 | 50 | Solution | 30.26 | 95702 | 33747.00 | 64.74 |
| t500m50r3-15.pl.json | 500 | 50 | Solution | 30.44 | 95916 | 39597.00 | 58.72 |
| t500m50r3-16.pl.json | 500 | 50 | Solution | 34.46 | 97474 | 42361.00 | 56.54 |
| t500m50r3-17.pl.json | 500 | 50 | Solution | 30.47 | 98815 | 36939.00 | 62.62 |
| t500m50r3-18.pl.json | 500 | 50 | Solution | 30.33 | 97270 | 42601.00 | 56.20 |
| t500m50r3-19.pl.json | 500 | 50 | Solution | 30.27 | 97126 | 34933.00 | 64.03 |
| t500m50r3-2.pl.json | 500 | 50 | Solution | 34.38 | 97040 | 39261.00 | 59.54 |
| t500m50r3-20.pl.json | 500 | 50 | Solution | 30.32 | 97582 | 41275.00 | 57.70 |
| t500m50r3-3.pl.json | 500 | 50 | Solution | 34.67 | 98223 | 45600.00 | 53.58 |
| t500m50r3-4.pl.json | 500 | 50 | Solution | 30.50 | 97899 | 43554.00 | 55.51 |
| t500m50r3-5.pl.json | 500 | 50 | Solution | 30.33 | 98115 | 44963.00 | 54.17 |
| t500m50r3-6.pl.json | 500 | 50 | Solution | 30.31 | 97331 | 38374.00 | 60.57 |
| t500m50r3-7.pl.json | 500 | 50 | Solution | 30.30 | 96331 | 41410.00 | 57.01 |
| t500m50r3-8.pl.json | 500 | 50 | Solution | 30.35 | 97725 | 46945.00 | 51.96 |
| t500m50r3-9.pl.json | 500 | 50 | Solution | 30.28 | 97526 | 45689.00 | 53.15 |
| t500m50r5-1.pl.json | 500 | 50 | Solution | 30.27 | 97780 | 43579.00 | 55.43 |
| t500m50r5-10.pl.json | 500 | 50 | Solution | 30.31 | 97631 | 41522.00 | 57.47 |
| t500m50r5-11.pl.json | 500 | 50 | Solution | 34.24 | 97571 | 40447.00 | 58.55 |
| t500m50r5-12.pl.json | 500 | 50 | Solution | 30.34 | 97678 | 41246.00 | 57.77 |
| t500m50r5-13.pl.json | 500 | 50 | Solution | 30.28 | 97497 | 37668.00 | 61.36 |
| t500m50r5-14.pl.json | 500 | 50 | Solution | 30.29 | 99505 | 37897.00 | 61.91 |
| t500m50r5-15.pl.json | 500 | 50 | Solution | 30.45 | 97382 | 44019.00 | 54.80 |
| t500m50r5-16.pl.json | 500 | 50 | Solution | 30.28 | 97763 | 41798.00 | 57.25 |
| t500m50r5-17.pl.json | 500 | 50 | Solution | 30.32 | 96938 | 36155.00 | 62.70 |
| t500m50r5-18.pl.json | 500 | 50 | Solution | 30.26 | 97819 | 33100.00 | 66.16 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|----------|----------------|
| t500m50r5-19.pl.json | 500 | 50 | Solution | 34.56 | 97278 | 36464.00 | 62.52 |
| t500m50r5-2.pl.json | 500 | 50 | Solution | 30.29 | 96060 | 40840.00 | 57.48 |
| t500m50r5-20.pl.json | 500 | 50 | Solution | 34.18 | 98245 | 41452.00 | 57.81 |
| t500m50r5-3.pl.json | 500 | 50 | Solution | 30.49 | 99069 | 37737.00 | 61.91 |
| t500m50r5-4.pl.json | 500 | 50 | Solution | 30.26 | 98094 | 33092.00 | 66.27 |
| t500m50r5-5.pl.json | 500 | 50 | Solution | 30.35 | 97837 | 33529.00 | 65.73 |
| t500m50r5-6.pl.json | 500 | 50 | Solution | 30.28 | 97882 | 39918.00 | 59.22 |
| t500m50r5-7.pl.json | 500 | 50 | Solution | 30.30 | 97935 | 41726.00 | 57.39 |
| t500m50r5-8.pl.json | 500 | 50 | Solution | 30.28 | 96977 | 34249.00 | 64.68 |
| t500m50r5-9.pl.json | 500 | 50 | Solution | 30.27 | 96065 | 30499.00 | 68.25 |
| t50m10r10-1.pl.json | 50 | 10 | Solution | 30.04 | 6499 | 5840.00 | 10.14 |
| t50m10r10-10.pl.json | 50 | 10 | Optimal | 6.15 | 3396 | 3396.00 | 0.00 |
| t50m10r10-11.pl.json | 50 | 10 | Optimal | 7.37 | 3398 | 3398.00 | 0.00 |
| t50m10r10-12.pl.json | 50 | 10 | Solution | 30.04 | 7550 | 6544.00 | 13.32 |
| t50m10r10-13.pl.json | 50 | 10 | Optimal | 16.73 | 5484 | 5484.00 | 0.00 |
| t50m10r10-14.pl.json | 50 | 10 | Solution | 30.03 | 4666 | 3431.00 | 26.47 |
| t50m10r10-15.pl.json | 50 | 10 | Solution | 30.03 | 6640 | 5903.00 | 11.10 |
| t50m10r10-16.pl.json | 50 | 10 | Optimal | 21.47 | 4914 | 4914.00 | 0.00 |
| t50m10r10-17.pl.json | 50 | 10 | Optimal | 0.60 | 2252 | 2252.00 | 0.00 |
| t50m10r10-18.pl.json | 50 | 10 | Solution | 30.04 | 4034 | 3841.00 | 4.78 |
| t50m10r10-19.pl.json | 50 | 10 | Solution | 30.04 | 4873 | 4532.00 | 7.00 |
| t50m10r10-2.pl.json | 50 | 10 | Solution | 30.02 | 4148 | 3646.00 | 12.10 |
| t50m10r10-20.pl.json | 50 | 10 | Optimal | 0.38 | 3158 | 3158.00 | 0.00 |
| t50m10r10-3.pl.json | 50 | 10 | Solution | 30.04 | 4334 | 4190.00 | 3.32 |
| t50m10r10-4.pl.json | 50 | 10 | Solution | 30.01 | 4259 | 3715.00 | 12.77 |
| t50m10r10-5.pl.json | 50 | 10 | Optimal | 5.78 | 2211 | 2211.00 | 0.00 |
| t50m10r10-6.pl.json | 50 | 10 | Solution | 30.04 | 5752 | 5457.00 | 5.13 |
| t50m10r10-7.pl.json | 50 | 10 | Optimal | 10.99 | 3239 | 3239.00 | 0.00 |
| t50m10r10-8.pl.json | 50 | 10 | Optimal | 0.80 | 2624 | 2624.00 | 0.00 |
| t50m10r10-9.pl.json | 50 | 10 | Solution | 30.02 | 5109 | 5015.00 | 1.84 |
| t50m10r3-1.pl.json | 50 | 10 | Optimal | 0.54 | 7067 | 7067.00 | 0.00 |
| t50m10r3-10.pl.json | 50 | 10 | Optimal | 0.35 | 4504 | 4504.00 | 0.00 |
| t50m10r3-11.pl.json | 50 | 10 | Solution | 30.03 | 3856 | 3811.00 | 1.17 |
| t50m10r3-12.pl.json | 50 | 10 | Optimal | 0.35 | 3063 | 3063.00 | 0.00 |
| t50m10r3-13.pl.json | 50 | 10 | Optimal | 0.22 | 5368 | 5368.00 | 0.00 |
| t50m10r3-14.pl.json | 50 | 10 | Optimal | 0.22 | 5759 | 5759.00 | 0.00 |
| t50m10r3-15.pl.json | 50 | 10 | Optimal | 1.89 | 6360 | 6360.00 | 0.00 |
| t50m10r3-16.pl.json | 50 | 10 | Optimal | 0.54 | 7616 | 7616.00 | 0.00 |
| t50m10r3-17.pl.json | 50 | 10 | Solution | 30.03 | 5429 | 5233.00 | 3.61 |
| t50m10r3-18.pl.json | 50 | 10 | Optimal | 0.94 | 5186 | 5186.00 | 0.00 |
| t50m10r3-19.pl.json | 50 | 10 | Optimal | 0.48 | 4197 | 4197.00 | 0.00 |
| t50m10r3-2.pl.json | 50 | 10 | Optimal | 0.43 | 5680 | 5680.00 | 0.00 |
| t50m10r3-20.pl.json | 50 | 10 | Optimal | 0.44 | 7792 | 7792.00 | 0.00 |
| t50m10r3-3.pl.json | 50 | 10 | Optimal | 0.79 | 3752 | 3752.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t50m10r3-4.pl.json | 50 | 10 | Optimal | 0.66 | 4942 | 4942.00 | 0.00 |
| t50m10r3-5.pl.json | 50 | 10 | Optimal | 0.44 | 6159 | 6159.00 | 0.00 |
| t50m10r3-6.pl.json | 50 | 10 | Optimal | 0.52 | 3804 | 3804.00 | 0.00 |
| t50m10r3-7.pl.json | 50 | 10 | Optimal | 0.16 | 6186 | 6186.00 | 0.00 |
| t50m10r3-8.pl.json | 50 | 10 | Optimal | 0.71 | 5142 | 5142.00 | 0.00 |
| t50m10r3-9.pl.json | 50 | 10 | Solution | 30.02 | 7279 | 7191.00 | 1.21 |
| t50m10r5-1.pl.json | 50 | 10 | Optimal | 0.68 | 5397 | 5397.00 | 0.00 |
| t50m10r5-10.pl.json | 50 | 10 | Optimal | 0.26 | 4926 | 4926.00 | 0.00 |
| t50m10r5-11.pl.json | 50 | 10 | Optimal | 0.54 | 3620 | 3620.00 | 0.00 |
| t50m10r5-12.pl.json | 50 | 10 | Optimal | 0.26 | 5183 | 5183.00 | 0.00 |
| t50m10r5-13.pl.json | 50 | 10 | Solution | 30.03 | 5716 | 5394.00 | 5.63 |
| t50m10r5-14.pl.json | 50 | 10 | Optimal | 0.60 | 2828 | 2828.00 | 0.00 |
| t50m10r5-15.pl.json | 50 | 10 | Solution | 30.01 | 6385 | 6283.00 | 1.60 |
| t50m10r5-16.pl.json | 50 | 10 | Solution | 30.04 | 4548 | 3970.00 | 12.71 |
| t50m10r5-17.pl.json | 50 | 10 | Optimal | 0.33 | 5129 | 5129.00 | 0.00 |
| t50m10r5-18.pl.json | 50 | 10 | Solution | 30.02 | 5831 | 5303.00 | 9.06 |
| t50m10r5-19.pl.json | 50 | 10 | Solution | 30.04 | 5552 | 5213.00 | 6.11 |
| t50m10r5-2.pl.json | 50 | 10 | Optimal | 0.33 | 5153 | 5153.00 | 0.00 |
| t50m10r5-20.pl.json | 50 | 10 | Optimal | 9.30 | 3900 | 3900.00 | 0.00 |
| t50m10r5-3.pl.json | 50 | 10 | Solution | 30.03 | 4708 | 4667.00 | 0.87 |
| t50m10r5-4.pl.json | 50 | 10 | Solution | 30.02 | 5551 | 4986.00 | 10.18 |
| t50m10r5-5.pl.json | 50 | 10 | Optimal | 0.31 | 7451 | 7451.00 | 0.00 |
| t50m10r5-6.pl.json | 50 | 10 | Optimal | 0.53 | 3781 | 3781.00 | 0.00 |
| t50m10r5-7.pl.json | 50 | 10 | Optimal | 17.68 | 3323 | 3323.00 | 0.00 |
| t50m10r5-8.pl.json | 50 | 10 | Solution | 30.02 | 5559 | 4986.00 | 10.31 |
| t50m10r5-9.pl.json | 50 | 10 | Solution | 30.02 | 6385 | 6082.00 | 4.75 |
| t50m20r10-1.pl.json | 50 | 20 | Solution | 30.04 | 5211 | 4457.00 | 14.47 |
| t50m20r10-10.pl.json | 50 | 20 | Optimal | 0.59 | 7934 | 7934.00 | 0.00 |
| t50m20r10-11.pl.json | 50 | 20 | Optimal | 21.37 | 5509 | 5509.00 | 0.00 |
| t50m20r10-12.pl.json | 50 | 20 | Solution | 30.04 | 5023 | 4256.00 | 15.27 |
| t50m20r10-13.pl.json | 50 | 20 | Optimal | 0.36 | 4143 | 4143.00 | 0.00 |
| t50m20r10-14.pl.json | 50 | 20 | Optimal | 0.43 | 6048 | 6048.00 | 0.00 |
| t50m20r10-15.pl.json | 50 | 20 | Solution | 30.03 | 5992 | 5301.00 | 11.53 |
| t50m20r10-16.pl.json | 50 | 20 | Optimal | 0.66 | 5032 | 5032.00 | 0.00 |
| t50m20r10-17.pl.json | 50 | 20 | Optimal | 0.40 | 4488 | 4488.00 | 0.00 |
| t50m20r10-18.pl.json | 50 | 20 | Solution | 30.02 | 4848 | 4599.00 | 5.14 |
| t50m20r10-19.pl.json | 50 | 20 | Solution | 30.03 | 5430 | 4555.00 | 16.11 |
| t50m20r10-2.pl.json | 50 | 20 | Solution | 30.03 | 6192 | 5348.00 | 13.63 |
| t50m20r10-20.pl.json | 50 | 20 | Solution | 30.03 | 6271 | 5680.00 | 9.42 |
| t50m20r10-3.pl.json | 50 | 20 | Solution | 30.03 | 6582 | 6278.00 | 4.62 |
| t50m20r10-4.pl.json | 50 | 20 | Solution | 30.03 | 5686 | 5160.00 | 9.25 |
| t50m20r10-5.pl.json | 50 | 20 | Optimal | 0.37 | 3301 | 3301.00 | 0.00 |
| t50m20r10-6.pl.json | 50 | 20 | Optimal | 20.69 | 4425 | 4425.00 | 0.00 |
| t50m20r10-7.pl.json | 50 | 20 | Optimal | 1.52 | 3519 | 3519.00 | 0.00 |

Table 7.2: Results for Test Scheduling Problems (CPSat) (840 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------------|------------|----------------|----------|-------|----------|---------|----------------|
| t50m20r10-8.pl.json | 50 | 20 | Solution | 30.02 | 4630 | 4569.00 | 1.32 |
| t50m20r10-9.pl.json | 50 | 20 | Solution | 30.05 | 5869 | 5303.00 | 9.64 |
| t50m20r3-1.pl.json | 50 | 20 | Optimal | 0.26 | 3869 | 3869.00 | 0.00 |
| t50m20r3-10.pl.json | 50 | 20 | Optimal | 0.33 | 3982 | 3982.00 | 0.00 |
| t50m20r3-11.pl.json | 50 | 20 | Optimal | 0.38 | 4144 | 4144.00 | 0.00 |
| t50m20r3-12.pl.json | 50 | 20 | Optimal | 0.39 | 2791 | 2791.00 | 0.00 |
| t50m20r3-13.pl.json | 50 | 20 | Optimal | 1.02 | 6449 | 6449.00 | 0.00 |
| t50m20r3-14.pl.json | 50 | 20 | Optimal | 0.36 | 4933 | 4933.00 | 0.00 |
| t50m20r3-15.pl.json | 50 | 20 | Optimal | 22.87 | 2436 | 2436.00 | 0.00 |
| t50m20r3-16.pl.json | 50 | 20 | Optimal | 0.19 | 5872 | 5872.00 | 0.00 |
| t50m20r3-17.pl.json | 50 | 20 | Optimal | 0.54 | 6880 | 6880.00 | 0.00 |
| t50m20r3-18.pl.json | 50 | 20 | Optimal | 0.32 | 2811 | 2811.00 | 0.00 |
| t50m20r3-19.pl.json | 50 | 20 | Optimal | 0.44 | 3465 | 3465.00 | 0.00 |
| t50m20r3-2.pl.json | 50 | 20 | Optimal | 0.38 | 5570 | 5570.00 | 0.00 |
| t50m20r3-20.pl.json | 50 | 20 | Optimal | 0.44 | 6364 | 6364.00 | 0.00 |
| t50m20r3-3.pl.json | 50 | 20 | Optimal | 0.51 | 3081 | 3081.00 | 0.00 |
| t50m20r3-4.pl.json | 50 | 20 | Optimal | 0.43 | 3505 | 3505.00 | 0.00 |
| t50m20r3-5.pl.json | 50 | 20 | Optimal | 0.44 | 2228 | 2228.00 | 0.00 |
| t50m20r3-6.pl.json | 50 | 20 | Optimal | 0.82 | 5713 | 5713.00 | 0.00 |
| t50m20r3-7.pl.json | 50 | 20 | Optimal | 0.74 | 3173 | 3173.00 | 0.00 |
| t50m20r3-8.pl.json | 50 | 20 | Optimal | 14.05 | 3908 | 3908.00 | 0.00 |
| t50m20r3-9.pl.json | 50 | 20 | Optimal | 0.44 | 4661 | 4661.00 | 0.00 |
| t50m20r5-1.pl.json | 50 | 20 | Solution | 30.04 | 6273 | 5304.00 | 15.45 |
| t50m20r5-10.pl.json | 50 | 20 | Optimal | 0.55 | 2328 | 2328.00 | 0.00 |
| t50m20r5-11.pl.json | 50 | 20 | Optimal | 1.81 | 6403 | 6403.00 | 0.00 |
| t50m20r5-12.pl.json | 50 | 20 | Optimal | 1.21 | 4281 | 4281.00 | 0.00 |
| t50m20r5-13.pl.json | 50 | 20 | Optimal | 0.58 | 5754 | 5754.00 | 0.00 |
| t50m20r5-14.pl.json | 50 | 20 | Solution | 30.03 | 6639 | 5359.00 | 19.28 |
| t50m20r5-15.pl.json | 50 | 20 | Optimal | 0.41 | 3472 | 3472.00 | 0.00 |
| t50m20r5-16.pl.json | 50 | 20 | Solution | 30.04 | 5934 | 5042.00 | 15.03 |
| t50m20r5-17.pl.json | 50 | 20 | Optimal | 0.28 | 4745 | 4745.00 | 0.00 |
| t50m20r5-18.pl.json | 50 | 20 | Optimal | 0.31 | 3147 | 3147.00 | 0.00 |
| t50m20r5-19.pl.json | 50 | 20 | Optimal | 0.65 | 5960 | 5960.00 | 0.00 |
| t50m20r5-2.pl.json | 50 | 20 | Solution | 30.03 | 5547 | 5417.00 | 2.34 |
| t50m20r5-20.pl.json | 50 | 20 | Optimal | 0.30 | 3913 | 3913.00 | 0.00 |
| t50m20r5-3.pl.json | 50 | 20 | Solution | 30.04 | 5598 | 4754.00 | 15.08 |
| t50m20r5-4.pl.json | 50 | 20 | Solution | 30.03 | 5367 | 4465.00 | 16.81 |
| t50m20r5-5.pl.json | 50 | 20 | Optimal | 1.74 | 3648 | 3648.00 | 0.00 |
| t50m20r5-6.pl.json | 50 | 20 | Optimal | 0.38 | 5449 | 5449.00 | 0.00 |
| t50m20r5-7.pl.json | 50 | 20 | Solution | 30.04 | 4127 | 3794.00 | 8.07 |
| t50m20r5-8.pl.json | 50 | 20 | Solution | 30.05 | 5003 | 4535.00 | 9.35 |
| t50m20r5-9.pl.json | 50 | 20 | Optimal | 0.40 | 4022 | 4022.00 | 0.00 |

Chapter 8

J&J Hybrid Flexible Flowshop with Transportation Times

8.1 Without Transportation Times

8.1.1 Results for CPOptimizer

Table 8.1: Results for Factory Design (CPO) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance100 1.txt | 100 | 80 | Solution | 300.32 | 98 | 56.00 | 42.86 |
| instance100 10.txt | 100 | 80 | Solution | 300.23 | 97 | 63.00 | 35.05 |
| instance100 11.txt | 100 | 80 | Solution | 300.37 | 97 | 69.00 | 28.87 |
| instance100 12.txt | 100 | 80 | Solution | 300.26 | 98 | 60.00 | 38.78 |
| instance100 13.txt | 100 | 80 | Solution | 300.26 | 102 | 58.00 | 43.14 |
| instance100 14.txt | 100 | 80 | Solution | 300.17 | 106 | 59.00 | 44.34 |
| instance100 15.txt | 100 | 80 | Solution | 300.21 | 97 | 59.00 | 39.18 |
| instance100 16.txt | 100 | 80 | Solution | 300.24 | 98 | 58.00 | 40.82 |
| instance100 17.txt | 100 | 80 | Solution | 300.21 | 94 | 70.00 | 25.53 |
| instance100 18.txt | 100 | 80 | Solution | 300.22 | 100 | 60.00 | 40.00 |
| instance100 19.txt | 100 | 80 | Solution | 300.16 | 96 | 59.00 | 38.54 |
| instance100 2.txt | 100 | 80 | Solution | 300.20 | 97 | 58.00 | 40.21 |
| instance100 20.txt | 100 | 80 | Solution | 300.21 | 98 | 56.00 | 42.86 |
| instance100 21.txt | 100 | 80 | Solution | 300.22 | 99 | 67.00 | 32.32 |
| instance100 22.txt | 100 | 80 | Solution | 300.26 | 94 | 57.00 | 39.36 |
| instance100 23.txt | 100 | 80 | Solution | 300.23 | 97 | 59.00 | 39.18 |
| instance100 24.txt | 100 | 80 | Solution | 300.21 | 104 | 69.00 | 33.65 |
| instance100 25.txt | 100 | 80 | Solution | 300.21 | 100 | 59.00 | 41.00 |
| instance100 3.txt | 100 | 80 | Solution | 300.23 | 92 | 53.00 | 42.39 |
| instance100 4.txt | 100 | 80 | Solution | 300.24 | 94 | 61.00 | 35.11 |

Table 8.1: Results for Factory Design (CPO) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance100 5.txt | 100 | 80 | Solution | 300.22 | 102 | 58.00 | 43.14 |
| instance100 6.txt | 100 | 80 | Solution | 300.23 | 110 | 64.00 | 41.82 |
| instance100 7.txt | 100 | 80 | Solution | 300.24 | 101 | 64.00 | 36.63 |
| instance100 8.txt | 100 | 80 | Solution | 300.20 | 101 | 55.00 | 45.54 |
| instance100 9.txt | 100 | 80 | Solution | 300.19 | 100 | 65.00 | 35.00 |
| instance200 1.txt | 200 | 80 | Solution | 300.33 | 168 | 62.00 | 63.10 |
| instance200 10.txt | 200 | 80 | Solution | 300.23 | 157 | 63.00 | 59.87 |
| instance200 11.txt | 200 | 80 | Solution | 300.26 | 156 | 64.00 | 58.97 |
| instance200 12.txt | 200 | 80 | Solution | 300.17 | 164 | 65.00 | 60.37 |
| instance200 13.txt | 200 | 80 | Solution | 300.17 | 158 | 61.00 | 61.39 |
| instance200 14.txt | 200 | 80 | Solution | 300.27 | 182 | 65.00 | 64.29 |
| instance200 15.txt | 200 | 80 | Solution | 300.18 | 157 | 59.00 | 62.42 |
| instance200 16.txt | 200 | 80 | Solution | 300.29 | 151 | 67.00 | 55.63 |
| instance200 17.txt | 200 | 80 | Solution | 300.21 | 151 | 62.00 | 58.94 |
| instance200 18.txt | 200 | 80 | Solution | 300.29 | 171 | 64.00 | 62.57 |
| instance200 19.txt | 200 | 80 | Solution | 300.20 | 160 | 58.00 | 63.75 |
| instance200 2.txt | 200 | 80 | Solution | 300.22 | 162 | 63.00 | 61.11 |
| instance200 20.txt | 200 | 80 | Solution | 300.19 | 161 | 68.00 | 57.76 |
| instance200 21.txt | 200 | 80 | Solution | 300.22 | 163 | 67.00 | 58.90 |
| instance200 22.txt | 200 | 80 | Solution | 300.24 | 155 | 57.00 | 63.23 |
| instance200 23.txt | 200 | 80 | Solution | 300.24 | 146 | 62.00 | 57.53 |
| instance200 24.txt | 200 | 80 | Solution | 300.25 | 173 | 69.00 | 60.12 |
| instance200 25.txt | 200 | 80 | Solution | 300.28 | 167 | 65.00 | 61.08 |
| instance200 3.txt | 200 | 80 | Solution | 300.20 | 153 | 64.00 | 58.17 |
| instance200 4.txt | 200 | 80 | Solution | 300.21 | 161 | 68.00 | 57.76 |
| instance200 5.txt | 200 | 80 | Solution | 300.19 | 164 | 61.00 | 62.80 |
| instance200 6.txt | 200 | 80 | Solution | 300.20 | 164 | 66.00 | 59.76 |
| instance200 7.txt | 200 | 80 | Solution | 300.21 | 161 | 64.00 | 60.25 |
| instance200 8.txt | 200 | 80 | Solution | 300.23 | 164 | 58.00 | 64.63 |
| instance200 9.txt | 200 | 80 | Solution | 300.22 | 166 | 65.00 | 60.84 |
| instance20 1.txt | 20 | 80 | Optimal | 0.60 | 55 | 55.00 | 0.00 |
| instance20 10.txt | 20 | 80 | Optimal | 0.46 | 53 | 53.00 | 0.00 |
| instance20 11.txt | 20 | 80 | Optimal | 0.45 | 61 | 61.00 | 0.00 |
| instance20 12.txt | 20 | 80 | Optimal | 0.48 | 56 | 56.00 | 0.00 |
| instance20 13.txt | 20 | 80 | Optimal | 0.45 | 61 | 61.00 | 0.00 |
| instance20 14.txt | 20 | 80 | Solution | 300.06 | 54 | 53.00 | 1.85 |
| instance20 15.txt | 20 | 80 | Solution | 300.04 | 49 | 45.00 | 8.16 |
| instance20 16.txt | 20 | 80 | Optimal | 0.42 | 52 | 52.00 | 0.00 |
| instance20 17.txt | 20 | 80 | Optimal | 0.41 | 53 | 53.00 | 0.00 |
| instance20 18.txt | 20 | 80 | Optimal | 0.38 | 56 | 56.00 | 0.00 |
| instance20 19.txt | 20 | 80 | Optimal | 0.44 | 56 | 56.00 | 0.00 |
| instance20 2.txt | 20 | 80 | Optimal | 0.57 | 53 | 53.00 | 0.00 |
| instance20 20.txt | 20 | 80 | Optimal | 0.43 | 55 | 55.00 | 0.00 |
| instance20 21.txt | 20 | 80 | Optimal | 0.46 | 58 | 58.00 | 0.00 |
| instance20 22.txt | 20 | 80 | Optimal | 10.34 | 56 | 56.00 | 0.00 |

Table 8.1: Results for Factory Design (CPO) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance20 23.txt | 20 | 80 | Optimal | 0.46 | 47 | 47.00 | 0.00 |
| instance20 24.txt | 20 | 80 | Optimal | 0.47 | 59 | 59.00 | 0.00 |
| instance20 25.txt | 20 | 80 | Optimal | 0.49 | 59 | 59.00 | 0.00 |
| instance20 3.txt | 20 | 80 | Optimal | 0.53 | 51 | 51.00 | 0.00 |
| instance20 4.txt | 20 | 80 | Solution | 300.03 | 50 | 49.00 | 2.00 |
| instance20 5.txt | 20 | 80 | Solution | 300.09 | 56 | 55.00 | 1.79 |
| instance20 6.txt | 20 | 80 | Solution | 300.06 | 56 | 52.00 | 7.14 |
| instance20 7.txt | 20 | 80 | Optimal | 0.53 | 61 | 61.00 | 0.00 |
| instance20 8.txt | 20 | 80 | Solution | 300.07 | 52 | 51.00 | 1.92 |
| instance20 9.txt | 20 | 80 | Optimal | 0.53 | 65 | 65.00 | 0.00 |
| instance25 1.txt | 25 | 80 | Optimal | 2.44 | 55 | 55.00 | 0.00 |
| instance25 10.txt | 25 | 80 | Optimal | 7.90 | 53 | 53.00 | 0.00 |
| instance25 11.txt | 25 | 80 | Solution | 300.16 | 50 | 48.00 | 4.00 |
| instance25 12.txt | 25 | 80 | Optimal | 2.54 | 56 | 56.00 | 0.00 |
| instance25 13.txt | 25 | 80 | Optimal | 2.38 | 61 | 61.00 | 0.00 |
| instance25 14.txt | 25 | 80 | Solution | 300.21 | 57 | 53.00 | 7.02 |
| instance25 15.txt | 25 | 80 | Optimal | 2.87 | 54 | 54.00 | 0.00 |
| instance25 16.txt | 25 | 80 | Solution | 300.25 | 52 | 50.00 | 3.85 |
| instance25 17.txt | 25 | 80 | Optimal | 2.45 | 55 | 55.00 | 0.00 |
| instance25 18.txt | 25 | 80 | Optimal | 3.63 | 54 | 54.00 | 0.00 |
| instance25 19.txt | 25 | 80 | Optimal | 2.47 | 54 | 54.00 | 0.00 |
| instance25 2.txt | 25 | 80 | Optimal | 2.52 | 57 | 57.00 | 0.00 |
| instance25 20.txt | 25 | 80 | Optimal | 7.99 | 56 | 56.00 | 0.00 |
| instance25 21.txt | 25 | 80 | Optimal | 2.53 | 62 | 62.00 | 0.00 |
| instance25 22.txt | 25 | 80 | Optimal | 5.65 | 56 | 56.00 | 0.00 |
| instance25 23.txt | 25 | 80 | Optimal | 2.56 | 54 | 54.00 | 0.00 |
| instance25 24.txt | 25 | 80 | Optimal | 2.36 | 59 | 59.00 | 0.00 |
| instance25 25.txt | 25 | 80 | Optimal | 5.20 | 59 | 59.00 | 0.00 |
| instance25 3.txt | 25 | 80 | Optimal | 6.11 | 52 | 52.00 | 0.00 |
| instance25 4.txt | 25 | 80 | Solution | 300.21 | 53 | 49.00 | 7.55 |
| instance25 5.txt | 25 | 80 | Solution | 300.16 | 57 | 52.00 | 8.77 |
| instance25 6.txt | 25 | 80 | Optimal | 4.18 | 64 | 64.00 | 0.00 |
| instance25 7.txt | 25 | 80 | Optimal | 2.42 | 64 | 64.00 | 0.00 |
| instance25 8.txt | 25 | 80 | Optimal | 2.56 | 55 | 55.00 | 0.00 |
| instance25 9.txt | 25 | 80 | Optimal | 2.45 | 65 | 65.00 | 0.00 |
| instance300 1.txt | 300 | 80 | Solution | 300.33 | 235 | 61.00 | 74.04 |
| instance300 10.txt | 300 | 80 | Solution | 300.37 | 220 | 63.00 | 71.36 |
| instance300 11.txt | 300 | 80 | Solution | 300.30 | 216 | 69.00 | 68.06 |
| instance300 12.txt | 300 | 80 | Solution | 300.32 | 223 | 63.00 | 71.75 |
| instance300 13.txt | 300 | 80 | Solution | 300.26 | 229 | 65.00 | 71.62 |
| instance300 14.txt | 300 | 80 | Solution | 300.29 | 243 | 65.00 | 73.25 |
| instance300 15.txt | 300 | 80 | Solution | 300.40 | 215 | 60.00 | 72.09 |
| instance300 16.txt | 300 | 80 | Solution | 300.35 | 210 | 62.00 | 70.48 |
| instance300 17.txt | 300 | 80 | Solution | 300.39 | 223 | 62.00 | 72.20 |
| instance300 18.txt | 300 | 80 | Solution | 300.37 | 241 | 62.00 | 74.27 |

Table 8.1: Results for Factory Design (CPO) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance300 19.txt | 300 | 80 | Solution | 300.32 | 232 | 65.00 | 71.98 |
| instance300 2.txt | 300 | 80 | Solution | 300.35 | 220 | 59.00 | 73.18 |
| instance300 20.txt | 300 | 80 | Solution | 300.31 | 225 | 64.00 | 71.56 |
| instance300 21.txt | 300 | 80 | Solution | 300.35 | 228 | 65.00 | 71.49 |
| instance300 22.txt | 300 | 80 | Solution | 300.31 | 220 | 58.00 | 73.64 |
| instance300 23.txt | 300 | 80 | Solution | 300.29 | 203 | 63.00 | 68.97 |
| instance300 24.txt | 300 | 80 | Solution | 300.25 | 233 | 69.00 | 70.39 |
| instance300 25.txt | 300 | 80 | Solution | 300.37 | 235 | 65.00 | 72.34 |
| instance300 3.txt | 300 | 80 | Solution | 300.27 | 233 | 67.00 | 71.24 |
| instance300 4.txt | 300 | 80 | Solution | 300.29 | 228 | 68.00 | 70.18 |
| instance300 5.txt | 300 | 80 | Solution | 300.36 | 231 | 63.00 | 72.73 |
| instance300 6.txt | 300 | 80 | Solution | 300.45 | 235 | 66.00 | 71.91 |
| instance300 7.txt | 300 | 80 | Solution | 300.34 | 222 | 64.00 | 71.17 |
| instance300 8.txt | 300 | 80 | Solution | 300.28 | 235 | 63.00 | 73.19 |
| instance300 9.txt | 300 | 80 | Solution | 300.36 | 236 | 65.00 | 72.46 |
| instance30 1.txt | 30 | 80 | Optimal | 23.19 | 56 | 56.00 | 0.00 |
| instance30 10.txt | 30 | 80 | Optimal | 9.12 | 63 | 63.00 | 0.00 |
| instance30 11.txt | 30 | 80 | Solution | 300.45 | 52 | 51.00 | 1.92 |
| instance30 12.txt | 30 | 80 | Optimal | 4.35 | 56 | 56.00 | 0.00 |
| instance30 13.txt | 30 | 80 | Optimal | 4.59 | 61 | 61.00 | 0.00 |
| instance30 14.txt | 30 | 80 | Solution | 300.38 | 60 | 59.00 | 1.67 |
| instance30 15.txt | 30 | 80 | Solution | 300.42 | 55 | 54.00 | 1.82 |
| instance30 16.txt | 30 | 80 | Optimal | 6.94 | 55 | 55.00 | 0.00 |
| instance30 17.txt | 30 | 80 | Optimal | 4.55 | 55 | 55.00 | 0.00 |
| instance30 18.txt | 30 | 80 | Optimal | 3.89 | 61 | 61.00 | 0.00 |
| instance30 19.txt | 30 | 80 | Optimal | 4.48 | 56 | 56.00 | 0.00 |
| instance30 2.txt | 30 | 80 | Optimal | 44.83 | 56 | 56.00 | 0.00 |
| instance30 20.txt | 30 | 80 | Solution | 300.96 | 57 | 53.00 | 7.02 |
| instance30 21.txt | 30 | 80 | Optimal | 4.30 | 62 | 62.00 | 0.00 |
| instance30 22.txt | 30 | 80 | Solution | 300.17 | 58 | 56.00 | 3.45 |
| instance30 23.txt | 30 | 80 | Optimal | 7.11 | 54 | 54.00 | 0.00 |
| instance30 24.txt | 30 | 80 | Optimal | 66.57 | 61 | 61.00 | 0.00 |
| instance30 25.txt | 30 | 80 | Solution | 300.55 | 60 | 59.00 | 1.67 |
| instance30 3.txt | 30 | 80 | Solution | 300.20 | 54 | 52.00 | 3.70 |
| instance30 4.txt | 30 | 80 | Solution | 300.32 | 56 | 49.00 | 12.50 |
| instance30 5.txt | 30 | 80 | Solution | 300.18 | 62 | 55.00 | 11.29 |
| instance30 6.txt | 30 | 80 | Optimal | 72.28 | 64 | 64.00 | 0.00 |
| instance30 7.txt | 30 | 80 | Optimal | 4.74 | 61 | 61.00 | 0.00 |
| instance30 8.txt | 30 | 80 | Solution | 300.24 | 57 | 54.00 | 5.26 |
| instance30 9.txt | 30 | 80 | Optimal | 5.81 | 65 | 65.00 | 0.00 |
| instance400 1.txt | 400 | 80 | Solution | 300.47 | 288 | 59.00 | 79.51 |
| instance400 10.txt | 400 | 80 | Solution | 300.39 | 286 | 64.00 | 77.62 |
| instance400 11.txt | 400 | 80 | Solution | 300.48 | 269 | 62.00 | 76.95 |
| instance400 12.txt | 400 | 80 | Solution | 300.44 | 290 | 65.00 | 77.59 |
| instance400 13.txt | 400 | 80 | Solution | 300.55 | 280 | 61.00 | 78.21 |

Table 8.1: Results for Factory Design (CPO) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance400 14.txt | 400 | 80 | Solution | 300.55 | 315 | 60.00 | 80.95 |
| instance400 15.txt | 400 | 80 | Solution | 300.41 | 287 | 62.00 | 78.40 |
| instance400 16.txt | 400 | 80 | Solution | 300.38 | 270 | 62.00 | 77.04 |
| instance400 17.txt | 400 | 80 | Solution | 300.36 | 279 | 70.00 | 74.91 |
| instance400 18.txt | 400 | 80 | Solution | 300.32 | 304 | 64.00 | 78.95 |
| instance400 19.txt | 400 | 80 | Solution | 300.37 | 300 | 65.00 | 78.33 |
| instance400 2.txt | 400 | 80 | Solution | 300.39 | 289 | 64.00 | 77.85 |
| instance400 20.txt | 400 | 80 | Solution | 300.38 | 289 | 66.00 | 77.16 |
| instance400 21.txt | 400 | 80 | Solution | 300.47 | 292 | 67.00 | 77.05 |
| instance400 22.txt | 400 | 80 | Solution | 300.47 | 272 | 59.00 | 78.31 |
| instance400 23.txt | 400 | 80 | Solution | 300.35 | 269 | 66.00 | 75.46 |
| instance400 24.txt | 400 | 80 | Solution | 300.34 | 303 | 65.00 | 78.55 |
| instance400 25.txt | 400 | 80 | Solution | 300.40 | 294 | 65.00 | 77.89 |
| instance400 3.txt | 400 | 80 | Solution | 300.45 | 283 | 66.00 | 76.68 |
| instance400 4.txt | 400 | 80 | Solution | 300.35 | 296 | 68.00 | 77.03 |
| instance400 5.txt | 400 | 80 | Solution | 300.44 | 292 | 58.00 | 80.14 |
| instance400 6.txt | 400 | 80 | Solution | 300.49 | 297 | 66.00 | 77.78 |
| instance400 7.txt | 400 | 80 | Solution | 300.55 | 289 | 64.00 | 77.85 |
| instance400 8.txt | 400 | 80 | Solution | 300.34 | 299 | 64.00 | 78.60 |
| instance400 9.txt | 400 | 80 | Solution | 300.41 | 291 | 65.00 | 77.66 |
| instance40 1.txt | 40 | 80 | Solution | 300.09 | 61 | 56.00 | 8.20 |
| instance40 10.txt | 40 | 80 | Solution | 300.11 | 62 | 53.00 | 14.52 |
| instance40 11.txt | 40 | 80 | Solution | 300.34 | 59 | 54.00 | 8.47 |
| instance40 12.txt | 40 | 80 | Solution | 300.19 | 58 | 54.00 | 6.90 |
| instance40 13.txt | 40 | 80 | Solution | 300.23 | 62 | 57.00 | 8.06 |
| instance40 14.txt | 40 | 80 | Solution | 300.23 | 64 | 59.00 | 7.81 |
| instance40 15.txt | 40 | 80 | Solution | 300.19 | 60 | 48.00 | 20.00 |
| instance40 16.txt | 40 | 80 | Solution | 300.36 | 59 | 58.00 | 1.69 |
| instance40 17.txt | 40 | 80 | Solution | 300.32 | 57 | 55.00 | 3.51 |
| instance40 18.txt | 40 | 80 | Solution | 300.17 | 62 | 56.00 | 9.68 |
| instance40 19.txt | 40 | 80 | Optimal | 2.62 | 62 | 62.00 | 0.00 |
| instance40 2.txt | 40 | 80 | Solution | 300.15 | 64 | 58.00 | 9.38 |
| instance40 20.txt | 40 | 80 | Solution | 300.15 | 63 | 55.00 | 12.70 |
| instance40 21.txt | 40 | 80 | Optimal | 4.47 | 65 | 65.00 | 0.00 |
| instance40 22.txt | 40 | 80 | Solution | 300.41 | 58 | 56.00 | 3.45 |
| instance40 23.txt | 40 | 80 | Optimal | 44.64 | 56 | 56.00 | 0.00 |
| instance40 24.txt | 40 | 80 | Solution | 300.30 | 67 | 61.00 | 8.96 |
| instance40 25.txt | 40 | 80 | Solution | 300.08 | 67 | 65.00 | 2.99 |
| instance40 3.txt | 40 | 80 | Solution | 300.06 | 54 | 53.00 | 1.85 |
| instance40 4.txt | 40 | 80 | Solution | 300.30 | 60 | 51.00 | 15.00 |
| instance40 5.txt | 40 | 80 | Solution | 300.16 | 63 | 58.00 | 7.94 |
| instance40 6.txt | 40 | 80 | Solution | 300.15 | 66 | 64.00 | 3.03 |
| instance40 7.txt | 40 | 80 | Optimal | 18.16 | 61 | 61.00 | 0.00 |
| instance40 8.txt | 40 | 80 | Solution | 300.32 | 60 | 55.00 | 8.33 |
| instance40 9.txt | 40 | 80 | Optimal | 5.42 | 65 | 65.00 | 0.00 |

Table 8.1: Results for Factory Design (CPO) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance50 1.txt | 50 | 80 | Solution | 300.17 | 65 | 56.00 | 13.85 |
| instance50 10.txt | 50 | 80 | Solution | 300.32 | 65 | 53.00 | 18.46 |
| instance50 11.txt | 50 | 80 | Solution | 300.35 | 66 | 61.00 | 7.58 |
| instance50 12.txt | 50 | 80 | Solution | 300.24 | 63 | 57.00 | 9.52 |
| instance50 13.txt | 50 | 80 | Solution | 300.16 | 67 | 58.00 | 13.43 |
| instance50 14.txt | 50 | 80 | Solution | 300.13 | 70 | 59.00 | 15.71 |
| instance50 15.txt | 50 | 80 | Solution | 300.14 | 66 | 55.00 | 16.67 |
| instance50 16.txt | 50 | 80 | Solution | 300.35 | 64 | 56.00 | 12.50 |
| instance50 17.txt | 50 | 80 | Solution | 300.12 | 61 | 55.00 | 9.84 |
| instance50 18.txt | 50 | 80 | Solution | 300.27 | 70 | 64.00 | 8.57 |
| instance50 19.txt | 50 | 80 | Solution | 300.24 | 62 | 54.00 | 12.90 |
| instance50 2.txt | 50 | 80 | Solution | 300.12 | 68 | 58.00 | 14.71 |
| instance50 20.txt | 50 | 80 | Solution | 300.27 | 68 | 54.00 | 20.59 |
| instance50 21.txt | 50 | 80 | Optimal | 177.71 | 67 | 67.00 | 0.00 |
| instance50 22.txt | 50 | 80 | Solution | 300.32 | 65 | 56.00 | 13.85 |
| instance50 23.txt | 50 | 80 | Solution | 300.10 | 63 | 54.00 | 14.29 |
| instance50 24.txt | 50 | 80 | Solution | 300.13 | 72 | 65.00 | 9.72 |
| instance50 25.txt | 50 | 80 | Solution | 300.54 | 71 | 59.00 | 16.90 |
| instance50 3.txt | 50 | 80 | Solution | 300.09 | 62 | 58.00 | 6.45 |
| instance50 4.txt | 50 | 80 | Solution | 300.13 | 66 | 54.00 | 18.18 |
| instance50 5.txt | 50 | 80 | Solution | 300.21 | 69 | 58.00 | 15.94 |
| instance50 6.txt | 50 | 80 | Solution | 300.46 | 71 | 64.00 | 9.86 |
| instance50 7.txt | 50 | 80 | Solution | 300.20 | 68 | 64.00 | 5.88 |
| instance50 8.txt | 50 | 80 | Solution | 300.13 | 65 | 54.00 | 16.92 |
| instance50 9.txt | 50 | 80 | Solution | 300.11 | 71 | 65.00 | 8.45 |

8.1.2 Results for CPSat

Table 8.2: Results for Factory Design (CPSat) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance100 1.txt | 100 | 80 | Solution | 300.37 | 112 | 56.00 | 50.00 |
| instance100 10.txt | 100 | 80 | Solution | 300.46 | 120 | 63.00 | 47.50 |
| instance100 11.txt | 100 | 80 | Solution | 300.43 | 124 | 69.00 | 44.35 |
| instance100 12.txt | 100 | 80 | Solution | 300.52 | 120 | 60.00 | 50.00 |
| instance100 13.txt | 100 | 80 | Solution | 300.45 | 116 | 58.00 | 50.00 |
| instance100 14.txt | 100 | 80 | Solution | 300.44 | 121 | 59.00 | 51.24 |
| instance100 15.txt | 100 | 80 | Solution | 300.43 | 113 | 59.00 | 47.79 |
| instance100 16.txt | 100 | 80 | Solution | 300.46 | 111 | 58.00 | 47.75 |
| instance100 17.txt | 100 | 80 | Solution | 300.45 | 116 | 70.00 | 39.66 |
| instance100 18.txt | 100 | 80 | Solution | 300.45 | 119 | 60.00 | 49.58 |
| instance100 19.txt | 100 | 80 | Solution | 300.45 | 109 | 59.00 | 45.87 |

Table 8.2: Results for Factory Design (CPSat) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance100 2.txt | 100 | 80 | Solution | 300.44 | 121 | 58.00 | 52.07 |
| instance100 20.txt | 100 | 80 | Solution | 300.45 | 132 | 56.00 | 57.58 |
| instance100 21.txt | 100 | 80 | Solution | 300.45 | 116 | 67.00 | 42.24 |
| instance100 22.txt | 100 | 80 | Solution | 300.45 | 118 | 57.00 | 51.69 |
| instance100 23.txt | 100 | 80 | Solution | 300.45 | 114 | 59.00 | 48.25 |
| instance100 24.txt | 100 | 80 | Solution | 300.48 | 121 | 69.00 | 42.98 |
| instance100 25.txt | 100 | 80 | Solution | 300.49 | 125 | 59.00 | 52.80 |
| instance100 3.txt | 100 | 80 | Solution | 300.45 | 115 | 53.00 | 53.91 |
| instance100 4.txt | 100 | 80 | Solution | 300.45 | 113 | 61.00 | 46.02 |
| instance100 5.txt | 100 | 80 | Solution | 300.48 | 118 | 58.00 | 50.85 |
| instance100 6.txt | 100 | 80 | Solution | 300.47 | 129 | 64.00 | 50.39 |
| instance100 7.txt | 100 | 80 | Solution | 300.50 | 122 | 64.00 | 47.54 |
| instance100 8.txt | 100 | 80 | Solution | 300.45 | 117 | 55.00 | 52.99 |
| instance100 9.txt | 100 | 80 | Solution | 300.48 | 135 | 65.00 | 51.85 |
| instance200 1.txt | 200 | 80 | Solution | 301.17 | 528 | 62.00 | 88.26 |
| instance200 10.txt | 200 | 80 | Solution | 301.34 | 265 | 63.00 | 76.23 |
| instance200 11.txt | 200 | 80 | Solution | 301.34 | 284 | 64.00 | 77.46 |
| instance200 12.txt | 200 | 80 | Solution | 301.40 | 458 | 65.00 | 85.81 |
| instance200 13.txt | 200 | 80 | Solution | 301.32 | 330 | 61.00 | 81.52 |
| instance200 14.txt | 200 | 80 | Solution | 301.33 | 217 | 65.00 | 70.05 |
| instance200 15.txt | 200 | 80 | Solution | 301.31 | 195 | 59.00 | 69.74 |
| instance200 16.txt | 200 | 80 | Solution | 301.32 | 218 | 67.00 | 69.27 |
| instance200 17.txt | 200 | 80 | Solution | 301.33 | 195 | 62.00 | 68.21 |
| instance200 18.txt | 200 | 80 | Solution | 301.27 | 240 | 64.00 | 73.33 |
| instance200 19.txt | 200 | 80 | Solution | 301.35 | 192 | 58.00 | 69.79 |
| instance200 2.txt | 200 | 80 | Solution | 301.41 | 205 | 63.00 | 69.27 |
| instance200 20.txt | 200 | 80 | Solution | 301.41 | 325 | 68.00 | 79.08 |
| instance200 21.txt | 200 | 80 | Solution | 301.45 | 413 | 67.00 | 83.78 |
| instance200 22.txt | 200 | 80 | Solution | 301.45 | 426 | 57.00 | 86.62 |
| instance200 23.txt | 200 | 80 | Solution | 301.48 | 187 | 62.00 | 66.84 |
| instance200 24.txt | 200 | 80 | Solution | 301.40 | 327 | 69.00 | 78.90 |
| instance200 25.txt | 200 | 80 | Solution | 301.46 | 269 | 65.00 | 75.84 |
| instance200 3.txt | 200 | 80 | Solution | 301.52 | 483 | 64.00 | 86.75 |
| instance200 4.txt | 200 | 80 | Solution | 301.58 | 435 | 68.00 | 84.37 |
| instance200 5.txt | 200 | 80 | Solution | 301.45 | 263 | 61.00 | 76.81 |
| instance200 6.txt | 200 | 80 | Solution | 301.48 | 470 | 66.00 | 85.96 |
| instance200 7.txt | 200 | 80 | Solution | 301.51 | 258 | 64.00 | 75.19 |
| instance200 8.txt | 200 | 80 | Solution | 301.46 | 213 | 58.00 | 72.77 |
| instance200 9.txt | 200 | 80 | Solution | 301.46 | 214 | 65.00 | 69.63 |
| instance20 1.txt | 20 | 80 | Optimal | 2.47 | 55 | 55.00 | 0.00 |
| instance20 10.txt | 20 | 80 | Optimal | 2.61 | 53 | 53.00 | 0.00 |
| instance20 11.txt | 20 | 80 | Optimal | 1.74 | 61 | 61.00 | 0.00 |
| instance20 12.txt | 20 | 80 | Optimal | 2.48 | 56 | 56.00 | 0.00 |
| instance20 13.txt | 20 | 80 | Optimal | 1.47 | 61 | 61.00 | 0.00 |
| instance20 14.txt | 20 | 80 | Optimal | 52.64 | 54 | 54.00 | 0.00 |

Table 8.2: Results for Factory Design (CPSat) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance20 15.txt | 20 | 80 | Optimal | 10.57 | 49 | 49.00 | 0.00 |
| instance20 16.txt | 20 | 80 | Optimal | 2.97 | 52 | 52.00 | 0.00 |
| instance20 17.txt | 20 | 80 | Optimal | 4.02 | 53 | 53.00 | 0.00 |
| instance20 18.txt | 20 | 80 | Optimal | 1.89 | 56 | 56.00 | 0.00 |
| instance20 19.txt | 20 | 80 | Optimal | 2.43 | 56 | 56.00 | 0.00 |
| instance20 2.txt | 20 | 80 | Optimal | 4.55 | 53 | 53.00 | 0.00 |
| instance20 20.txt | 20 | 80 | Optimal | 4.03 | 55 | 55.00 | 0.00 |
| instance20 21.txt | 20 | 80 | Optimal | 2.20 | 58 | 58.00 | 0.00 |
| instance20 22.txt | 20 | 80 | Optimal | 56.65 | 56 | 56.00 | 0.00 |
| instance20 23.txt | 20 | 80 | Optimal | 4.08 | 47 | 47.00 | 0.00 |
| instance20 24.txt | 20 | 80 | Optimal | 2.76 | 59 | 59.00 | 0.00 |
| instance20 25.txt | 20 | 80 | Optimal | 3.67 | 59 | 59.00 | 0.00 |
| instance20 3.txt | 20 | 80 | Optimal | 2.44 | 51 | 51.00 | 0.00 |
| instance20 4.txt | 20 | 80 | Solution | 300.15 | 50 | 49.00 | 2.00 |
| instance20 5.txt | 20 | 80 | Optimal | 18.43 | 56 | 56.00 | 0.00 |
| instance20 6.txt | 20 | 80 | Optimal | 42.43 | 56 | 56.00 | 0.00 |
| instance20 7.txt | 20 | 80 | Optimal | 3.56 | 61 | 61.00 | 0.00 |
| instance20 8.txt | 20 | 80 | Optimal | 27.78 | 52 | 52.00 | 0.00 |
| instance20 9.txt | 20 | 80 | Optimal | 3.64 | 65 | 65.00 | 0.00 |
| instance25 1.txt | 25 | 80 | Optimal | 5.30 | 55 | 55.00 | 0.00 |
| instance25 10.txt | 25 | 80 | Optimal | 24.74 | 53 | 53.00 | 0.00 |
| instance25 11.txt | 25 | 80 | Solution | 300.19 | 51 | 48.00 | 5.88 |
| instance25 12.txt | 25 | 80 | Optimal | 3.97 | 56 | 56.00 | 0.00 |
| instance25 13.txt | 25 | 80 | Optimal | 3.15 | 61 | 61.00 | 0.00 |
| instance25 14.txt | 25 | 80 | Optimal | 63.01 | 57 | 57.00 | 0.00 |
| instance25 15.txt | 25 | 80 | Optimal | 4.26 | 54 | 54.00 | 0.00 |
| instance25 16.txt | 25 | 80 | Optimal | 26.97 | 52 | 52.00 | 0.00 |
| instance25 17.txt | 25 | 80 | Optimal | 4.45 | 55 | 55.00 | 0.00 |
| instance25 18.txt | 25 | 80 | Optimal | 6.77 | 54 | 54.00 | 0.00 |
| instance25 19.txt | 25 | 80 | Optimal | 4.64 | 54 | 54.00 | 0.00 |
| instance25 2.txt | 25 | 80 | Optimal | 4.21 | 57 | 57.00 | 0.00 |
| instance25 20.txt | 25 | 80 | Optimal | 32.34 | 56 | 56.00 | 0.00 |
| instance25 21.txt | 25 | 80 | Optimal | 3.50 | 62 | 62.00 | 0.00 |
| instance25 22.txt | 25 | 80 | Optimal | 26.08 | 56 | 56.00 | 0.00 |
| instance25 23.txt | 25 | 80 | Optimal | 3.14 | 54 | 54.00 | 0.00 |
| instance25 24.txt | 25 | 80 | Optimal | 12.90 | 59 | 59.00 | 0.00 |
| instance25 25.txt | 25 | 80 | Optimal | 8.21 | 59 | 59.00 | 0.00 |
| instance25 3.txt | 25 | 80 | Optimal | 6.47 | 52 | 52.00 | 0.00 |
| instance25 4.txt | 25 | 80 | Solution | 300.17 | 53 | 49.00 | 7.55 |
| instance25 5.txt | 25 | 80 | Solution | 300.16 | 57 | 52.00 | 8.77 |
| instance25 6.txt | 25 | 80 | Optimal | 3.00 | 64 | 64.00 | 0.00 |
| instance25 7.txt | 25 | 80 | Optimal | 4.96 | 64 | 64.00 | 0.00 |
| instance25 8.txt | 25 | 80 | Optimal | 3.30 | 55 | 55.00 | 0.00 |
| instance25 9.txt | 25 | 80 | Optimal | 5.98 | 65 | 65.00 | 0.00 |
| instance300 1.txt | 300 | 80 | Solution | 303.33 | 549 | 61.00 | 88.89 |

Table 8.2: Results for Factory Design (CPSat) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance300 10.txt | 300 | 80 | Solution | 303.66 | 302 | 63.00 | 79.14 |
| instance300 11.txt | 300 | 80 | Solution | 303.60 | 646 | 69.00 | 89.32 |
| instance300 12.txt | 300 | 80 | Solution | 303.65 | 935 | 63.00 | 93.26 |
| instance300 13.txt | 300 | 80 | Solution | 303.78 | 1078 | 65.00 | 93.97 |
| instance300 14.txt | 300 | 80 | Solution | 303.90 | 635 | 65.00 | 89.76 |
| instance300 15.txt | 300 | 80 | Solution | 304.23 | 560 | 60.00 | 89.29 |
| instance300 16.txt | 300 | 80 | Solution | 304.09 | 613 | 62.00 | 89.89 |
| instance300 17.txt | 300 | 80 | Solution | 304.08 | 284 | 62.00 | 78.17 |
| instance300 18.txt | 300 | 80 | Solution | 303.75 | 676 | 62.00 | 90.83 |
| instance300 19.txt | 300 | 80 | Solution | 303.98 | 1185 | 65.00 | 94.51 |
| instance300 20.txt | 300 | 80 | Solution | 304.10 | 305 | 64.00 | 79.02 |
| instance300 21.txt | 300 | 80 | Solution | 304.00 | 594 | 65.00 | 89.06 |
| instance300 22.txt | 300 | 80 | Solution | 304.21 | 620 | 58.00 | 90.65 |
| instance300 23.txt | 300 | 80 | Solution | 304.29 | 270 | 63.00 | 76.67 |
| instance300 24.txt | 300 | 80 | Solution | 304.65 | 1127 | 69.00 | 93.88 |
| instance300 25.txt | 300 | 80 | Solution | 304.36 | 1253 | 65.00 | 94.81 |
| instance300 3.txt | 300 | 80 | Solution | 304.31 | 316 | 67.00 | 78.80 |
| instance300 4.txt | 300 | 80 | Solution | 304.28 | 306 | 68.00 | 77.78 |
| instance300 5.txt | 300 | 80 | Solution | 304.65 | 295 | 63.00 | 78.64 |
| instance300 6.txt | 300 | 80 | Solution | 304.51 | 313 | 66.00 | 78.91 |
| instance300 7.txt | 300 | 80 | Solution | 304.69 | 644 | 64.00 | 90.06 |
| instance300 8.txt | 300 | 80 | Solution | 304.61 | 303 | 63.00 | 79.21 |
| instance300 9.txt | 300 | 80 | Solution | 304.87 | 539 | 65.00 | 87.94 |
| instance30 1.txt | 30 | 80 | Optimal | 42.15 | 56 | 56.00 | 0.00 |
| instance30 10.txt | 30 | 80 | Optimal | 15.04 | 63 | 63.00 | 0.00 |
| instance30 11.txt | 30 | 80 | Solution | 300.20 | 52 | 51.00 | 1.92 |
| instance30 12.txt | 30 | 80 | Optimal | 14.46 | 56 | 56.00 | 0.00 |
| instance30 13.txt | 30 | 80 | Optimal | 19.35 | 61 | 61.00 | 0.00 |
| instance30 14.txt | 30 | 80 | Solution | 300.25 | 61 | 59.00 | 3.28 |
| instance30 15.txt | 30 | 80 | Optimal | 82.53 | 54 | 54.00 | 0.00 |
| instance30 16.txt | 30 | 80 | Optimal | 15.53 | 55 | 55.00 | 0.00 |
| instance30 17.txt | 30 | 80 | Optimal | 10.57 | 55 | 55.00 | 0.00 |
| instance30 18.txt | 30 | 80 | Optimal | 10.27 | 61 | 61.00 | 0.00 |
| instance30 19.txt | 30 | 80 | Optimal | 27.64 | 56 | 56.00 | 0.00 |
| instance30 2.txt | 30 | 80 | Optimal | 183.78 | 56 | 56.00 | 0.00 |
| instance30 20.txt | 30 | 80 | Solution | 300.23 | 59 | 53.00 | 10.17 |
| instance30 21.txt | 30 | 80 | Optimal | 3.38 | 62 | 62.00 | 0.00 |
| instance30 22.txt | 30 | 80 | Solution | 300.23 | 58 | 56.00 | 3.45 |
| instance30 23.txt | 30 | 80 | Optimal | 46.44 | 54 | 54.00 | 0.00 |
| instance30 24.txt | 30 | 80 | Optimal | 138.38 | 61 | 61.00 | 0.00 |
| instance30 25.txt | 30 | 80 | Solution | 300.26 | 60 | 59.00 | 1.67 |
| instance30 3.txt | 30 | 80 | Solution | 300.21 | 56 | 52.00 | 7.14 |
| instance30 4.txt | 30 | 80 | Solution | 300.21 | 56 | 49.00 | 12.50 |
| instance30 5.txt | 30 | 80 | Solution | 300.22 | 62 | 55.00 | 11.29 |
| instance30 6.txt | 30 | 80 | Optimal | 128.19 | 64 | 64.00 | 0.00 |

Table 8.2: Results for Factory Design (CPSat) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance30 7.txt | 30 | 80 | Optimal | 13.72 | 61 | 61.00 | 0.00 |
| instance30 8.txt | 30 | 80 | Solution | 300.20 | 58 | 54.00 | 6.90 |
| instance30 9.txt | 30 | 80 | Optimal | 34.69 | 65 | 65.00 | 0.00 |
| instance400 1.txt | 400 | 80 | Solution | 309.66 | 373 | 59.00 | 84.18 |
| instance400 10.txt | 400 | 80 | Solution | 310.09 | 876 | 64.00 | 92.69 |
| instance400 11.txt | 400 | 80 | Solution | 310.09 | 1307 | 62.00 | 95.26 |
| instance400 12.txt | 400 | 80 | Solution | 310.27 | 390 | 65.00 | 83.33 |
| instance400 13.txt | 400 | 80 | Solution | 310.12 | 373 | 61.00 | 83.65 |
| instance400 14.txt | 400 | 80 | Solution | 310.27 | 386 | 60.00 | 84.46 |
| instance400 15.txt | 400 | 80 | Solution | 310.95 | 952 | 62.00 | 93.49 |
| instance400 16.txt | 400 | 80 | Solution | 311.32 | 386 | 62.00 | 83.94 |
| instance400 17.txt | 400 | 80 | Solution | 313.04 | 655 | 70.00 | 89.31 |
| instance400 18.txt | 400 | 80 | Solution | 310.47 | 855 | 64.00 | 92.51 |
| instance400 19.txt | 400 | 80 | Solution | 314.45 | 560 | 65.00 | 88.39 |
| instance400 2.txt | 400 | 80 | Solution | 311.52 | 1102 | 64.00 | 94.19 |
| instance400 20.txt | 400 | 80 | Solution | 314.70 | 388 | 66.00 | 82.99 |
| instance400 21.txt | 400 | 80 | Solution | 313.19 | 837 | 67.00 | 92.00 |
| instance400 22.txt | 400 | 80 | Solution | 312.34 | 992 | 59.00 | 94.05 |
| instance400 23.txt | 400 | 80 | Solution | 313.05 | 347 | 66.00 | 80.98 |
| instance400 24.txt | 400 | 80 | Solution | 313.85 | 541 | 65.00 | 87.99 |
| instance400 25.txt | 400 | 80 | Solution | 312.67 | 945 | 65.00 | 93.12 |
| instance400 3.txt | 400 | 80 | Solution | 312.60 | 922 | 66.00 | 92.84 |
| instance400 4.txt | 400 | 80 | Solution | 313.19 | 934 | 68.00 | 92.72 |
| instance400 5.txt | 400 | 80 | Solution | 314.76 | 1034 | 58.00 | 94.39 |
| instance400 6.txt | 400 | 80 | Solution | 311.64 | 884 | 66.00 | 92.53 |
| instance400 7.txt | 400 | 80 | Solution | 312.73 | 911 | 64.00 | 92.97 |
| instance400 8.txt | 400 | 80 | Solution | 313.55 | 386 | 64.00 | 83.42 |
| instance400 9.txt | 400 | 80 | Solution | 313.53 | 457 | 65.00 | 85.78 |
| instance40 1.txt | 40 | 80 | Solution | 300.41 | 62 | 56.00 | 9.68 |
| instance40 10.txt | 40 | 80 | Solution | 300.35 | 65 | 53.00 | 18.46 |
| instance40 11.txt | 40 | 80 | Solution | 300.36 | 63 | 54.00 | 14.29 |
| instance40 12.txt | 40 | 80 | Solution | 300.34 | 60 | 54.00 | 10.00 |
| instance40 13.txt | 40 | 80 | Solution | 300.29 | 65 | 57.00 | 12.31 |
| instance40 14.txt | 40 | 80 | Solution | 300.32 | 69 | 59.00 | 14.49 |
| instance40 15.txt | 40 | 80 | Solution | 300.28 | 62 | 48.00 | 22.58 |
| instance40 16.txt | 40 | 80 | Solution | 300.31 | 62 | 58.00 | 6.45 |
| instance40 17.txt | 40 | 80 | Solution | 300.29 | 58 | 55.00 | 5.17 |
| instance40 18.txt | 40 | 80 | Solution | 300.39 | 64 | 56.00 | 12.50 |
| instance40 19.txt | 40 | 80 | Optimal | 66.89 | 62 | 62.00 | 0.00 |
| instance40 2.txt | 40 | 80 | Solution | 300.31 | 67 | 58.00 | 13.43 |
| instance40 20.txt | 40 | 80 | Solution | 300.33 | 67 | 55.00 | 17.91 |
| instance40 21.txt | 40 | 80 | Solution | 300.30 | 67 | 65.00 | 2.99 |
| instance40 22.txt | 40 | 80 | Solution | 300.32 | 62 | 56.00 | 9.68 |
| instance40 23.txt | 40 | 80 | Solution | 300.36 | 59 | 56.00 | 5.08 |
| instance40 24.txt | 40 | 80 | Solution | 300.37 | 69 | 61.00 | 11.59 |

Table 8.2: Results for Factory Design (CPSat) (225 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------------|------------|----------------|----------|--------|----------|-------|----------------|
| instance40 25.txt | 40 | 80 | Solution | 300.36 | 73 | 65.00 | 10.96 |
| instance40 3.txt | 40 | 80 | Solution | 300.29 | 57 | 53.00 | 7.02 |
| instance40 4.txt | 40 | 80 | Solution | 300.33 | 63 | 51.00 | 19.05 |
| instance40 5.txt | 40 | 80 | Solution | 300.35 | 65 | 58.00 | 10.77 |
| instance40 6.txt | 40 | 80 | Solution | 300.38 | 70 | 64.00 | 8.57 |
| instance40 7.txt | 40 | 80 | Solution | 300.32 | 63 | 61.00 | 3.17 |
| instance40 8.txt | 40 | 80 | Solution | 300.34 | 64 | 55.00 | 14.06 |
| instance40 9.txt | 40 | 80 | Solution | 300.36 | 66 | 65.00 | 1.52 |
| instance50 1.txt | 50 | 80 | Solution | 300.37 | 71 | 56.00 | 21.13 |
| instance50 10.txt | 50 | 80 | Solution | 300.41 | 70 | 53.00 | 24.29 |
| instance50 11.txt | 50 | 80 | Solution | 300.35 | 71 | 61.00 | 14.08 |
| instance50 12.txt | 50 | 80 | Solution | 300.36 | 68 | 57.00 | 16.18 |
| instance50 13.txt | 50 | 80 | Solution | 300.46 | 73 | 58.00 | 20.55 |
| instance50 14.txt | 50 | 80 | Solution | 300.42 | 76 | 59.00 | 22.37 |
| instance50 15.txt | 50 | 80 | Solution | 300.34 | 69 | 55.00 | 20.29 |
| instance50 16.txt | 50 | 80 | Solution | 300.36 | 69 | 56.00 | 18.84 |
| instance50 17.txt | 50 | 80 | Solution | 300.38 | 65 | 55.00 | 15.38 |
| instance50 18.txt | 50 | 80 | Solution | 300.39 | 76 | 64.00 | 15.79 |
| instance50 19.txt | 50 | 80 | Solution | 300.35 | 66 | 54.00 | 18.18 |
| instance50 2.txt | 50 | 80 | Solution | 300.39 | 73 | 58.00 | 20.55 |
| instance50 20.txt | 50 | 80 | Solution | 300.34 | 72 | 54.00 | 25.00 |
| instance50 21.txt | 50 | 80 | Solution | 300.38 | 70 | 67.00 | 4.29 |
| instance50 22.txt | 50 | 80 | Solution | 300.37 | 69 | 56.00 | 18.84 |
| instance50 23.txt | 50 | 80 | Solution | 300.38 | 69 | 54.00 | 21.74 |
| instance50 24.txt | 50 | 80 | Solution | 300.35 | 76 | 65.00 | 14.47 |
| instance50 25.txt | 50 | 80 | Solution | 300.37 | 77 | 59.00 | 23.38 |
| instance50 3.txt | 50 | 80 | Solution | 300.34 | 67 | 58.00 | 13.43 |
| instance50 4.txt | 50 | 80 | Solution | 300.42 | 72 | 54.00 | 25.00 |
| instance50 5.txt | 50 | 80 | Solution | 300.38 | 77 | 58.00 | 24.68 |
| instance50 6.txt | 50 | 80 | Solution | 300.33 | 76 | 64.00 | 15.79 |
| instance50 7.txt | 50 | 80 | Solution | 300.37 | 74 | 64.00 | 13.51 |
| instance50 8.txt | 50 | 80 | Solution | 300.38 | 72 | 54.00 | 25.00 |
| instance50 9.txt | 50 | 80 | Solution | 300.45 | 78 | 65.00 | 16.67 |

Chapter 9

RCPSP SingleMode

The detailed result tables for the individual RCPSP instances show that many instances are solved with either solver in less than a second, but that there are a few families of problems which are more difficult to solve. For problem type J30, the sets 13, 29, and 45 are such examples, they are still solved to optimality, but the time required is larger. For bigger problem instances, the solvers are not able to find and prove the optimal solutions for such families, for example sets 9, 13, 25, 29, 41, 45 for j60. It would be interesting to understand this better, and see which generator settings make these instance families more difficult to solve.

9.1 Size J30

9.1.1 CPO

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3010 1.json | 1 | 0 | Optimal | 0.12 | 42 | 42.00 | 0.00 |
| j3010 10.json | 1 | 0 | Optimal | 0.11 | 41 | 41.00 | 0.00 |
| j3010 2.json | 1 | 0 | Optimal | 0.20 | 56 | 56.00 | 0.00 |
| j3010 3.json | 1 | 0 | Optimal | 0.09 | 62 | 62.00 | 0.00 |
| j3010 4.json | 1 | 0 | Optimal | 0.10 | 58 | 58.00 | 0.00 |
| j3010 5.json | 1 | 0 | Optimal | 0.03 | 41 | 41.00 | 0.00 |
| j3010 6.json | 1 | 0 | Optimal | 0.10 | 44 | 44.00 | 0.00 |
| j3010 7.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3010 8.json | 1 | 0 | Optimal | 0.10 | 54 | 54.00 | 0.00 |
| j3010 9.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j3011 1.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3011 10.json | 1 | 0 | Optimal | 0.02 | 38 | 38.00 | 0.00 |
| j3011 2.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j3011 3.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j3011 4.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|-------|----------|--------|----------------|
| j3011 5.json | 1 | 0 | Optimal | 0.11 | 49 | 49.00 | 0.00 |
| j3011 6.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3011 7.json | 1 | 0 | Optimal | 0.02 | 36 | 36.00 | 0.00 |
| j3011 8.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j3011 9.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j3012 1.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3012 10.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3012 2.json | 1 | 0 | Optimal | 0.02 | 46 | 46.00 | 0.00 |
| j3012 3.json | 1 | 0 | Optimal | 0.02 | 37 | 37.00 | 0.00 |
| j3012 4.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3012 5.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3012 6.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3012 7.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3012 8.json | 1 | 0 | Optimal | 0.02 | 35 | 35.00 | 0.00 |
| j3012 9.json | 1 | 0 | Optimal | 0.03 | 52 | 52.00 | 0.00 |
| j3013 1.json | 1 | 0 | Optimal | 7.46 | 58 | 58.00 | 0.00 |
| j3013 10.json | 1 | 0 | Optimal | 1.82 | 64 | 64.00 | 0.00 |
| j3013 2.json | 1 | 0 | Optimal | 29.16 | 62 | 62.00 | 0.00 |
| j3013 3.json | 1 | 0 | Optimal | 5.16 | 76 | 76.00 | 0.00 |
| j3013 4.json | 1 | 0 | Optimal | 2.17 | 72 | 72.00 | 0.00 |
| j3013 5.json | 1 | 0 | Optimal | 11.34 | 67 | 67.00 | 0.00 |
| j3013 6.json | 1 | 0 | Optimal | 17.89 | 64 | 64.00 | 0.00 |
| j3013 7.json | 1 | 0 | Optimal | 4.13 | 77 | 77.00 | 0.00 |
| j3013 8.json | 1 | 0 | Optimal | 11.54 | 106 | 106.00 | 0.00 |
| j3013 9.json | 1 | 0 | Optimal | 1.04 | 71 | 69.00 | 2.82 |
| j3014 1.json | 1 | 0 | Optimal | 0.18 | 50 | 50.00 | 0.00 |
| j3014 10.json | 1 | 0 | Optimal | 0.04 | 61 | 61.00 | 0.00 |
| j3014 2.json | 1 | 0 | Optimal | 0.65 | 53 | 53.00 | 0.00 |
| j3014 3.json | 1 | 0 | Optimal | 0.08 | 58 | 58.00 | 0.00 |
| j3014 4.json | 1 | 0 | Optimal | 0.46 | 50 | 50.00 | 0.00 |
| j3014 5.json | 1 | 0 | Optimal | 0.03 | 52 | 52.00 | 0.00 |
| j3014 6.json | 1 | 0 | Optimal | 0.02 | 35 | 35.00 | 0.00 |
| j3014 7.json | 1 | 0 | Optimal | 0.47 | 50 | 50.00 | 0.00 |
| j3014 8.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3014 9.json | 1 | 0 | Optimal | 0.27 | 46 | 46.00 | 0.00 |
| j3015 1.json | 1 | 0 | Optimal | 0.02 | 46 | 46.00 | 0.00 |
| j3015 10.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j3015 2.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3015 3.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3015 4.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3015 5.json | 1 | 0 | Optimal | 0.32 | 58 | 58.00 | 0.00 |
| j3015 6.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j3015 7.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3015 8.json | 1 | 0 | Optimal | 0.02 | 50 | 50.00 | 0.00 |
| j3015 9.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3016 1.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3016 10.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3016 2.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3016 3.json | 1 | 0 | Optimal | 0.02 | 36 | 36.00 | 0.00 |
| j3016 4.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3016 5.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3016 6.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3016 7.json | 1 | 0 | Optimal | 0.02 | 34 | 34.00 | 0.00 |
| j3016 8.json | 1 | 0 | Optimal | 0.03 | 44 | 44.00 | 0.00 |
| j3016 9.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3017 1.json | 1 | 0 | Optimal | 0.08 | 64 | 64.00 | 0.00 |
| j3017 10.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j3017 2.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j3017 3.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3017 4.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3017 5.json | 1 | 0 | Optimal | 0.08 | 47 | 47.00 | 0.00 |
| j3017 6.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3017 7.json | 1 | 0 | Optimal | 0.07 | 57 | 57.00 | 0.00 |
| j3017 8.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3017 9.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3018 1.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3018 10.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j3018 2.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3018 3.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j3018 4.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j3018 5.json | 1 | 0 | Optimal | 0.02 | 52 | 52.00 | 0.00 |
| j3018 6.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j3018 7.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3018 8.json | 1 | 0 | Optimal | 0.02 | 52 | 52.00 | 0.00 |
| j3018 9.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3019 1.json | 1 | 0 | Optimal | 0.02 | 40 | 40.00 | 0.00 |
| j3019 10.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3019 2.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3019 3.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j3019 4.json | 1 | 0 | Optimal | 0.02 | 39 | 39.00 | 0.00 |
| j3019 5.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3019 6.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3019 7.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3019 8.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3019 9.json | 1 | 0 | Optimal | 0.02 | 38 | 38.00 | 0.00 |
| j301 1.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j301 10.json | 1 | 0 | Optimal | 0.02 | 45 | 45.00 | 0.00 |
| j301 2.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j301 3.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j301 4.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j301 5.json | 1 | 0 | Optimal | 0.09 | 39 | 39.00 | 0.00 |
| j301 6.json | 1 | 0 | Optimal | 0.07 | 48 | 48.00 | 0.00 |
| j301 7.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j301 8.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j301 9.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j3020 1.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3020 10.json | 1 | 0 | Optimal | 0.02 | 37 | 37.00 | 0.00 |
| j3020 2.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j3020 3.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3020 4.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j3020 5.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3020 6.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3020 7.json | 1 | 0 | Optimal | 0.02 | 42 | 42.00 | 0.00 |
| j3020 8.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3020 9.json | 1 | 0 | Optimal | 0.02 | 41 | 41.00 | 0.00 |
| j3021 1.json | 1 | 0 | Optimal | 0.14 | 84 | 84.00 | 0.00 |
| j3021 10.json | 1 | 0 | Optimal | 0.08 | 69 | 69.00 | 0.00 |
| j3021 2.json | 1 | 0 | Optimal | 0.15 | 59 | 59.00 | 0.00 |
| j3021 3.json | 1 | 0 | Optimal | 0.16 | 76 | 76.00 | 0.00 |
| j3021 4.json | 1 | 0 | Optimal | 0.14 | 70 | 70.00 | 0.00 |
| j3021 5.json | 1 | 0 | Optimal | 0.08 | 55 | 55.00 | 0.00 |
| j3021 6.json | 1 | 0 | Optimal | 0.18 | 76 | 76.00 | 0.00 |
| j3021 7.json | 1 | 0 | Optimal | 0.15 | 65 | 65.00 | 0.00 |
| j3021 8.json | 1 | 0 | Optimal | 0.15 | 62 | 62.00 | 0.00 |
| j3021 9.json | 1 | 0 | Optimal | 0.29 | 69 | 69.00 | 0.00 |
| j3022 1.json | 1 | 0 | Optimal | 0.03 | 42 | 42.00 | 0.00 |
| j3022 10.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3022 2.json | 1 | 0 | Optimal | 0.02 | 45 | 45.00 | 0.00 |
| j3022 3.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3022 4.json | 1 | 0 | Optimal | 0.02 | 42 | 42.00 | 0.00 |
| j3022 5.json | 1 | 0 | Optimal | 0.02 | 52 | 52.00 | 0.00 |
| j3022 6.json | 1 | 0 | Optimal | 0.04 | 52 | 52.00 | 0.00 |
| j3022 7.json | 1 | 0 | Optimal | 0.10 | 60 | 60.00 | 0.00 |
| j3022 8.json | 1 | 0 | Optimal | 0.09 | 55 | 55.00 | 0.00 |
| j3022 9.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j3023 1.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3023 10.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3023 2.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3023 3.json | 1 | 0 | Optimal | 0.02 | 46 | 46.00 | 0.00 |
| j3023 4.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j3023 5.json | 1 | 0 | Optimal | 0.02 | 52 | 52.00 | 0.00 |
| j3023 6.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3023 7.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3023 8.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3023 9.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3024 1.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3024 10.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3024 2.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3024 3.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j3024 4.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3024 5.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3024 6.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j3024 7.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3024 8.json | 1 | 0 | Optimal | 0.02 | 38 | 38.00 | 0.00 |
| j3024 9.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j3025 1.json | 1 | 0 | Optimal | 1.03 | 93 | 93.00 | 0.00 |
| j3025 10.json | 1 | 0 | Optimal | 0.31 | 58 | 58.00 | 0.00 |
| j3025 2.json | 1 | 0 | Optimal | 0.91 | 75 | 75.00 | 0.00 |
| j3025 3.json | 1 | 0 | Optimal | 1.49 | 76 | 76.00 | 0.00 |
| j3025 4.json | 1 | 0 | Optimal | 1.08 | 81 | 81.00 | 0.00 |
| j3025 5.json | 1 | 0 | Optimal | 1.03 | 72 | 72.00 | 0.00 |
| j3025 6.json | 1 | 0 | Optimal | 0.75 | 58 | 58.00 | 0.00 |
| j3025 7.json | 1 | 0 | Optimal | 0.77 | 95 | 95.00 | 0.00 |
| j3025 8.json | 1 | 0 | Optimal | 0.67 | 69 | 69.00 | 0.00 |
| j3025 9.json | 1 | 0 | Optimal | 0.68 | 84 | 84.00 | 0.00 |
| j3026 1.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3026 10.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3026 2.json | 1 | 0 | Optimal | 0.02 | 40 | 40.00 | 0.00 |
| j3026 3.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3026 4.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j3026 5.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j3026 6.json | 1 | 0 | Optimal | 0.09 | 53 | 53.00 | 0.00 |
| j3026 7.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j3026 8.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j3026 9.json | 1 | 0 | Optimal | 0.10 | 43 | 43.00 | 0.00 |
| j3027 1.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j3027 10.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j3027 2.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3027 3.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3027 4.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j3027 5.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3027 6.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3027 7.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3027 8.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j3027 9.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3028 1.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j3028 10.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3028 2.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3028 3.json | 1 | 0 | Optimal | 0.02 | 40 | 40.00 | 0.00 |
| j3028 4.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|-------|----------|--------|----------------|
| j3028 5.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j3028 6.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3028 7.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3028 8.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3028 9.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j3029 1.json | 1 | 0 | Optimal | 0.79 | 85 | 85.00 | 0.00 |
| j3029 10.json | 1 | 0 | Optimal | 0.47 | 76 | 76.00 | 0.00 |
| j3029 2.json | 1 | 0 | Optimal | 1.36 | 90 | 90.00 | 0.00 |
| j3029 3.json | 1 | 0 | Optimal | 56.03 | 78 | 78.00 | 0.00 |
| j3029 4.json | 1 | 0 | Optimal | 7.43 | 103 | 103.00 | 0.00 |
| j3029 5.json | 1 | 0 | Optimal | 1.36 | 98 | 98.00 | 0.00 |
| j3029 6.json | 1 | 0 | Optimal | 25.83 | 92 | 92.00 | 0.00 |
| j3029 7.json | 1 | 0 | Optimal | 1.99 | 73 | 73.00 | 0.00 |
| j3029 8.json | 1 | 0 | Optimal | 17.32 | 80 | 80.00 | 0.00 |
| j3029 9.json | 1 | 0 | Optimal | 4.06 | 97 | 97.00 | 0.00 |
| j302 1.json | 1 | 0 | Optimal | 0.02 | 38 | 38.00 | 0.00 |
| j302 10.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j302 2.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j302 3.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j302 4.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j302 5.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j302 6.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j302 7.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j302 8.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j302 9.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3030 1.json | 1 | 0 | Optimal | 0.27 | 47 | 47.00 | 0.00 |
| j3030 10.json | 1 | 0 | Optimal | 0.45 | 53 | 53.00 | 0.00 |
| j3030 2.json | 1 | 0 | Optimal | 0.49 | 68 | 68.00 | 0.00 |
| j3030 3.json | 1 | 0 | Optimal | 0.28 | 55 | 55.00 | 0.00 |
| j3030 4.json | 1 | 0 | Optimal | 0.09 | 53 | 53.00 | 0.00 |
| j3030 5.json | 1 | 0 | Optimal | 0.18 | 54 | 54.00 | 0.00 |
| j3030 6.json | 1 | 0 | Optimal | 0.54 | 62 | 62.00 | 0.00 |
| j3030 7.json | 1 | 0 | Optimal | 0.09 | 68 | 68.00 | 0.00 |
| j3030 8.json | 1 | 0 | Optimal | 0.10 | 46 | 46.00 | 0.00 |
| j3030 9.json | 1 | 0 | Optimal | 0.10 | 46 | 46.00 | 0.00 |
| j3031 1.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j3031 10.json | 1 | 0 | Optimal | 0.20 | 55 | 55.00 | 0.00 |
| j3031 2.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3031 3.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3031 4.json | 1 | 0 | Optimal | 0.02 | 50 | 50.00 | 0.00 |
| j3031 5.json | 1 | 0 | Optimal | 0.12 | 52 | 52.00 | 0.00 |
| j3031 6.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3031 7.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3031 8.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3031 9.json | 1 | 0 | Optimal | 0.10 | 50 | 50.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3032 1.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3032 10.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3032 2.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3032 3.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3032 4.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j3032 5.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3032 6.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3032 7.json | 1 | 0 | Optimal | 0.02 | 35 | 35.00 | 0.00 |
| j3032 8.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3032 9.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j3033 1.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j3033 10.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3033 2.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3033 3.json | 1 | 0 | Optimal | 0.04 | 55 | 55.00 | 0.00 |
| j3033 4.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j3033 5.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3033 6.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3033 7.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3033 8.json | 1 | 0 | Optimal | 0.10 | 61 | 61.00 | 0.00 |
| j3033 9.json | 1 | 0 | Optimal | 0.09 | 65 | 65.00 | 0.00 |
| j3034 1.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j3034 10.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3034 2.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3034 3.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j3034 4.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j3034 5.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3034 6.json | 1 | 0 | Optimal | 0.02 | 52 | 52.00 | 0.00 |
| j3034 7.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3034 8.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3034 9.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3035 1.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3035 10.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3035 2.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3035 3.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3035 4.json | 1 | 0 | Optimal | 0.02 | 50 | 50.00 | 0.00 |
| j3035 5.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3035 6.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3035 7.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3035 8.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3035 9.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3036 1.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j3036 10.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3036 2.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3036 3.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3036 4.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3036 5.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j3036 6.json | 1 | 0 | Optimal | 0.02 | 46 | 46.00 | 0.00 |
| j3036 7.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j3036 8.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3036 9.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3037 1.json | 1 | 0 | Optimal | 0.23 | 79 | 79.00 | 0.00 |
| j3037 10.json | 1 | 0 | Optimal | 0.16 | 81 | 81.00 | 0.00 |
| j3037 2.json | 1 | 0 | Optimal | 0.08 | 69 | 69.00 | 0.00 |
| j3037 3.json | 1 | 0 | Optimal | 0.22 | 81 | 81.00 | 0.00 |
| j3037 4.json | 1 | 0 | Optimal | 0.24 | 83 | 83.00 | 0.00 |
| j3037 5.json | 1 | 0 | Optimal | 0.08 | 80 | 80.00 | 0.00 |
| j3037 6.json | 1 | 0 | Optimal | 0.08 | 73 | 73.00 | 0.00 |
| j3037 7.json | 1 | 0 | Optimal | 0.39 | 92 | 92.00 | 0.00 |
| j3037 8.json | 1 | 0 | Optimal | 0.15 | 72 | 72.00 | 0.00 |
| j3037 9.json | 1 | 0 | Optimal | 0.15 | 57 | 57.00 | 0.00 |
| j3038 1.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3038 10.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3038 2.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3038 3.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3038 4.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3038 5.json | 1 | 0 | Optimal | 0.10 | 71 | 71.00 | 0.00 |
| j3038 6.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3038 7.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j3038 8.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j3038 9.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3039 1.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3039 10.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3039 2.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3039 3.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3039 4.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3039 5.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3039 6.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j3039 7.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j3039 8.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j3039 9.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j303 1.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j303 10.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j303 2.json | 1 | 0 | Optimal | 0.02 | 40 | 40.00 | 0.00 |
| j303 3.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j303 4.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j303 5.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j303 6.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j303 7.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j303 8.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j303 9.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|--------|----------------|
| j3040 1.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3040 10.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3040 2.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j3040 3.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3040 4.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3040 5.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j3040 6.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3040 7.json | 1 | 0 | Optimal | 0.02 | 46 | 46.00 | 0.00 |
| j3040 8.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3040 9.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j3041 1.json | 1 | 0 | Optimal | 0.23 | 86 | 86.00 | 0.00 |
| j3041 10.json | 1 | 0 | Optimal | 2.52 | 99 | 99.00 | 0.00 |
| j3041 2.json | 1 | 0 | Optimal | 1.14 | 89 | 89.00 | 0.00 |
| j3041 3.json | 1 | 0 | Optimal | 0.42 | 85 | 85.00 | 0.00 |
| j3041 4.json | 1 | 0 | Optimal | 0.64 | 78 | 78.00 | 0.00 |
| j3041 5.json | 1 | 0 | Optimal | 0.40 | 99 | 99.00 | 0.00 |
| j3041 6.json | 1 | 0 | Optimal | 2.30 | 103 | 103.00 | 0.00 |
| j3041 7.json | 1 | 0 | Optimal | 0.78 | 92 | 92.00 | 0.00 |
| j3041 8.json | 1 | 0 | Optimal | 1.22 | 88 | 88.00 | 0.00 |
| j3041 9.json | 1 | 0 | Optimal | 0.29 | 92 | 92.00 | 0.00 |
| j3042 1.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3042 10.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j3042 2.json | 1 | 0 | Optimal | 0.10 | 50 | 50.00 | 0.00 |
| j3042 3.json | 1 | 0 | Optimal | 0.08 | 60 | 60.00 | 0.00 |
| j3042 4.json | 1 | 0 | Optimal | 0.15 | 49 | 49.00 | 0.00 |
| j3042 5.json | 1 | 0 | Optimal | 0.02 | 52 | 52.00 | 0.00 |
| j3042 6.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j3042 7.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j3042 8.json | 1 | 0 | Optimal | 0.09 | 82 | 82.00 | 0.00 |
| j3042 9.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3043 1.json | 1 | 0 | Optimal | 0.09 | 55 | 55.00 | 0.00 |
| j3043 10.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j3043 2.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j3043 3.json | 1 | 0 | Optimal | 0.07 | 57 | 57.00 | 0.00 |
| j3043 4.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j3043 5.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j3043 6.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3043 7.json | 1 | 0 | Optimal | 0.02 | 52 | 52.00 | 0.00 |
| j3043 8.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j3043 9.json | 1 | 0 | Optimal | 0.12 | 57 | 57.00 | 0.00 |
| j3044 1.json | 1 | 0 | Optimal | 0.02 | 50 | 50.00 | 0.00 |
| j3044 10.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3044 2.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3044 3.json | 1 | 0 | Optimal | 0.03 | 51 | 51.00 | 0.00 |
| j3044 4.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|-------|----------|--------|----------------|
| j3044 5.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3044 6.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j3044 7.json | 1 | 0 | Optimal | 0.02 | 42 | 42.00 | 0.00 |
| j3044 8.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3044 9.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j3045 1.json | 1 | 0 | Optimal | 1.63 | 82 | 82.00 | 0.00 |
| j3045 10.json | 1 | 0 | Optimal | 1.73 | 90 | 90.00 | 0.00 |
| j3045 2.json | 1 | 0 | Optimal | 66.04 | 125 | 125.00 | 0.00 |
| j3045 3.json | 1 | 0 | Optimal | 0.67 | 92 | 92.00 | 0.00 |
| j3045 4.json | 1 | 0 | Optimal | 0.75 | 84 | 84.00 | 0.00 |
| j3045 5.json | 1 | 0 | Optimal | 0.82 | 86 | 86.00 | 0.00 |
| j3045 6.json | 1 | 0 | Optimal | 44.91 | 129 | 129.00 | 0.00 |
| j3045 7.json | 1 | 0 | Optimal | 1.12 | 101 | 101.00 | 0.00 |
| j3045 8.json | 1 | 0 | Optimal | 1.39 | 94 | 94.00 | 0.00 |
| j3045 9.json | 1 | 0 | Optimal | 0.61 | 82 | 82.00 | 0.00 |
| j3046 1.json | 1 | 0 | Optimal | 0.10 | 59 | 59.00 | 0.00 |
| j3046 10.json | 1 | 0 | Optimal | 0.46 | 55 | 55.00 | 0.00 |
| j3046 2.json | 1 | 0 | Optimal | 0.18 | 67 | 67.00 | 0.00 |
| j3046 3.json | 1 | 0 | Optimal | 0.18 | 65 | 65.00 | 0.00 |
| j3046 4.json | 1 | 0 | Optimal | 0.03 | 64 | 64.00 | 0.00 |
| j3046 5.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3046 6.json | 1 | 0 | Optimal | 0.40 | 59 | 59.00 | 0.00 |
| j3046 7.json | 1 | 0 | Optimal | 0.49 | 59 | 59.00 | 0.00 |
| j3046 8.json | 1 | 0 | Optimal | 0.09 | 58 | 58.00 | 0.00 |
| j3046 9.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3047 1.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3047 10.json | 1 | 0 | Optimal | 0.10 | 60 | 60.00 | 0.00 |
| j3047 2.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3047 3.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3047 4.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3047 5.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3047 6.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3047 7.json | 1 | 0 | Optimal | 0.04 | 66 | 66.00 | 0.00 |
| j3047 8.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3047 9.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j3048 1.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3048 10.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3048 2.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j3048 3.json | 1 | 0 | Optimal | 0.02 | 50 | 50.00 | 0.00 |
| j3048 4.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3048 5.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3048 6.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3048 7.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3048 8.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3048 9.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------|------------|----------------|---------|------|----------|-------|----------------|
| j304 1.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j304 10.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j304 2.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j304 3.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j304 4.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j304 5.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j304 6.json | 1 | 0 | Optimal | 0.02 | 45 | 45.00 | 0.00 |
| j304 7.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j304 8.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j304 9.json | 1 | 0 | Optimal | 0.02 | 38 | 38.00 | 0.00 |
| j305 1.json | 1 | 0 | Optimal | 0.10 | 53 | 53.00 | 0.00 |
| j305 10.json | 1 | 0 | Optimal | 0.18 | 70 | 70.00 | 0.00 |
| j305 2.json | 1 | 0 | Optimal | 0.23 | 82 | 82.00 | 0.00 |
| j305 3.json | 1 | 0 | Optimal | 0.22 | 76 | 76.00 | 0.00 |
| j305 4.json | 1 | 0 | Optimal | 0.25 | 63 | 63.00 | 0.00 |
| j305 5.json | 1 | 0 | Optimal | 0.22 | 76 | 76.00 | 0.00 |
| j305 6.json | 1 | 0 | Optimal | 0.14 | 64 | 64.00 | 0.00 |
| j305 7.json | 1 | 0 | Optimal | 0.23 | 76 | 76.00 | 0.00 |
| j305 8.json | 1 | 0 | Optimal | 0.23 | 67 | 67.00 | 0.00 |
| j305 9.json | 1 | 0 | Optimal | 0.08 | 49 | 49.00 | 0.00 |
| j306 1.json | 1 | 0 | Optimal | 0.09 | 59 | 59.00 | 0.00 |
| j306 10.json | 1 | 0 | Optimal | 0.09 | 61 | 61.00 | 0.00 |
| j306 2.json | 1 | 0 | Optimal | 0.03 | 51 | 51.00 | 0.00 |
| j306 3.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j306 4.json | 1 | 0 | Optimal | 0.11 | 42 | 42.00 | 0.00 |
| j306 5.json | 1 | 0 | Optimal | 0.09 | 67 | 67.00 | 0.00 |
| j306 6.json | 1 | 0 | Optimal | 0.02 | 37 | 37.00 | 0.00 |
| j306 7.json | 1 | 0 | Optimal | 0.02 | 46 | 46.00 | 0.00 |
| j306 8.json | 1 | 0 | Optimal | 0.02 | 39 | 39.00 | 0.00 |
| j306 9.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j307 1.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j307 10.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j307 2.json | 1 | 0 | Optimal | 0.02 | 42 | 42.00 | 0.00 |
| j307 3.json | 1 | 0 | Optimal | 0.02 | 42 | 42.00 | 0.00 |
| j307 4.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j307 5.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j307 6.json | 1 | 0 | Optimal | 0.02 | 35 | 35.00 | 0.00 |
| j307 7.json | 1 | 0 | Optimal | 0.02 | 50 | 50.00 | 0.00 |
| j307 8.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j307 9.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j308 1.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j308 10.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j308 2.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j308 3.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j308 4.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |

Table 9.1: Results for RCPSP J30 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------|------------|----------------|---------|-------|----------|-------|----------------|
| j308 5.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j308 6.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j308 7.json | 1 | 0 | Optimal | 0.02 | 41 | 41.00 | 0.00 |
| j308 8.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j308 9.json | 1 | 0 | Optimal | 0.02 | 39 | 39.00 | 0.00 |
| j309 1.json | 1 | 0 | Optimal | 0.92 | 83 | 83.00 | 0.00 |
| j309 10.json | 1 | 0 | Optimal | 1.21 | 88 | 88.00 | 0.00 |
| j309 2.json | 1 | 0 | Optimal | 14.64 | 92 | 92.00 | 0.00 |
| j309 3.json | 1 | 0 | Optimal | 0.40 | 68 | 68.00 | 0.00 |
| j309 4.json | 1 | 0 | Optimal | 0.38 | 71 | 71.00 | 0.00 |
| j309 5.json | 1 | 0 | Optimal | 0.23 | 70 | 70.00 | 0.00 |
| j309 6.json | 1 | 0 | Optimal | 0.48 | 59 | 59.00 | 0.00 |
| j309 7.json | 1 | 0 | Optimal | 0.75 | 63 | 63.00 | 0.00 |
| j309 8.json | 1 | 0 | Optimal | 0.53 | 91 | 91.00 | 0.00 |
| j309 9.json | 1 | 0 | Optimal | 0.85 | 63 | 63.00 | 0.00 |

9.1.2 CPSat

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3010 1.json | 1 | 0 | Optimal | 0.10 | 42 | 42.00 | 0.00 |
| j3010 10.json | 1 | 0 | Optimal | 0.09 | 41 | 41.00 | 0.00 |
| j3010 2.json | 1 | 0 | Optimal | 0.06 | 56 | 56.00 | 0.00 |
| j3010 3.json | 1 | 0 | Optimal | 0.05 | 62 | 62.00 | 0.00 |
| j3010 4.json | 1 | 0 | Optimal | 0.05 | 58 | 58.00 | 0.00 |
| j3010 5.json | 1 | 0 | Optimal | 0.08 | 41 | 41.00 | 0.00 |
| j3010 6.json | 1 | 0 | Optimal | 0.04 | 44 | 44.00 | 0.00 |
| j3010 7.json | 1 | 0 | Optimal | 0.04 | 49 | 49.00 | 0.00 |
| j3010 8.json | 1 | 0 | Optimal | 0.05 | 54 | 54.00 | 0.00 |
| j3010 9.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3011 1.json | 1 | 0 | Optimal | 0.09 | 54 | 54.00 | 0.00 |
| j3011 10.json | 1 | 0 | Optimal | 0.02 | 38 | 38.00 | 0.00 |
| j3011 2.json | 1 | 0 | Optimal | 0.04 | 56 | 56.00 | 0.00 |
| j3011 3.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j3011 4.json | 1 | 0 | Optimal | 0.04 | 63 | 63.00 | 0.00 |
| j3011 5.json | 1 | 0 | Optimal | 0.04 | 49 | 49.00 | 0.00 |
| j3011 6.json | 1 | 0 | Optimal | 0.04 | 44 | 44.00 | 0.00 |
| j3011 7.json | 1 | 0 | Optimal | 0.03 | 36 | 36.00 | 0.00 |
| j3011 8.json | 1 | 0 | Optimal | 0.10 | 62 | 62.00 | 0.00 |
| j3011 9.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j3012 1.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|-------|----------|--------|----------------|
| j3012 10.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3012 2.json | 1 | 0 | Optimal | 0.02 | 46 | 46.00 | 0.00 |
| j3012 3.json | 1 | 0 | Optimal | 0.02 | 37 | 37.00 | 0.00 |
| j3012 4.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3012 5.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3012 6.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j3012 7.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3012 8.json | 1 | 0 | Optimal | 0.02 | 35 | 35.00 | 0.00 |
| j3012 9.json | 1 | 0 | Optimal | 0.02 | 52 | 52.00 | 0.00 |
| j3013 1.json | 1 | 0 | Optimal | 19.42 | 58 | 58.00 | 0.00 |
| j3013 10.json | 1 | 0 | Optimal | 0.37 | 64 | 64.00 | 0.00 |
| j3013 2.json | 1 | 0 | Optimal | 80.41 | 62 | 62.00 | 0.00 |
| j3013 3.json | 1 | 0 | Optimal | 6.63 | 76 | 76.00 | 0.00 |
| j3013 4.json | 1 | 0 | Optimal | 0.84 | 72 | 72.00 | 0.00 |
| j3013 5.json | 1 | 0 | Optimal | 47.35 | 67 | 67.00 | 0.00 |
| j3013 6.json | 1 | 0 | Optimal | 38.61 | 64 | 64.00 | 0.00 |
| j3013 7.json | 1 | 0 | Optimal | 6.63 | 77 | 77.00 | 0.00 |
| j3013 8.json | 1 | 0 | Optimal | 5.03 | 106 | 106.00 | 0.00 |
| j3013 9.json | 1 | 0 | Optimal | 0.47 | 71 | 71.00 | 0.00 |
| j3014 1.json | 1 | 0 | Optimal | 0.11 | 50 | 50.00 | 0.00 |
| j3014 10.json | 1 | 0 | Optimal | 0.06 | 61 | 61.00 | 0.00 |
| j3014 2.json | 1 | 0 | Optimal | 0.25 | 53 | 53.00 | 0.00 |
| j3014 3.json | 1 | 0 | Optimal | 0.05 | 58 | 58.00 | 0.00 |
| j3014 4.json | 1 | 0 | Optimal | 0.10 | 50 | 50.00 | 0.00 |
| j3014 5.json | 1 | 0 | Optimal | 0.06 | 52 | 52.00 | 0.00 |
| j3014 6.json | 1 | 0 | Optimal | 0.07 | 35 | 35.00 | 0.00 |
| j3014 7.json | 1 | 0 | Optimal | 0.15 | 50 | 50.00 | 0.00 |
| j3014 8.json | 1 | 0 | Optimal | 0.04 | 54 | 54.00 | 0.00 |
| j3014 9.json | 1 | 0 | Optimal | 0.08 | 46 | 46.00 | 0.00 |
| j3015 1.json | 1 | 0 | Optimal | 0.05 | 46 | 46.00 | 0.00 |
| j3015 10.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j3015 2.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j3015 3.json | 1 | 0 | Optimal | 0.03 | 48 | 48.00 | 0.00 |
| j3015 4.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3015 5.json | 1 | 0 | Optimal | 0.12 | 58 | 58.00 | 0.00 |
| j3015 6.json | 1 | 0 | Optimal | 0.04 | 67 | 67.00 | 0.00 |
| j3015 7.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j3015 8.json | 1 | 0 | Optimal | 0.03 | 50 | 50.00 | 0.00 |
| j3015 9.json | 1 | 0 | Optimal | 0.03 | 54 | 54.00 | 0.00 |
| j3016 1.json | 1 | 0 | Optimal | 0.03 | 51 | 51.00 | 0.00 |
| j3016 10.json | 1 | 0 | Optimal | 0.03 | 51 | 51.00 | 0.00 |
| j3016 2.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3016 3.json | 1 | 0 | Optimal | 0.02 | 36 | 36.00 | 0.00 |
| j3016 4.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3016 5.json | 1 | 0 | Optimal | 0.03 | 51 | 51.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3016 6.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3016 7.json | 1 | 0 | Optimal | 0.03 | 34 | 34.00 | 0.00 |
| j3016 8.json | 1 | 0 | Optimal | 0.03 | 44 | 44.00 | 0.00 |
| j3016 9.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3017 1.json | 1 | 0 | Optimal | 0.03 | 64 | 64.00 | 0.00 |
| j3017 10.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j3017 2.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j3017 3.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3017 4.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j3017 5.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j3017 6.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3017 7.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3017 8.json | 1 | 0 | Optimal | 0.04 | 61 | 61.00 | 0.00 |
| j3017 9.json | 1 | 0 | Optimal | 0.03 | 48 | 48.00 | 0.00 |
| j3018 1.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j3018 10.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3018 2.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3018 3.json | 1 | 0 | Optimal | 0.03 | 56 | 56.00 | 0.00 |
| j3018 4.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j3018 5.json | 1 | 0 | Optimal | 0.03 | 52 | 52.00 | 0.00 |
| j3018 6.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j3018 7.json | 1 | 0 | Optimal | 0.03 | 48 | 48.00 | 0.00 |
| j3018 8.json | 1 | 0 | Optimal | 0.03 | 52 | 52.00 | 0.00 |
| j3018 9.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j3019 1.json | 1 | 0 | Optimal | 0.02 | 40 | 40.00 | 0.00 |
| j3019 10.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j3019 2.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3019 3.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j3019 4.json | 1 | 0 | Optimal | 0.03 | 39 | 39.00 | 0.00 |
| j3019 5.json | 1 | 0 | Optimal | 0.02 | 48 | 48.00 | 0.00 |
| j3019 6.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3019 7.json | 1 | 0 | Optimal | 0.03 | 57 | 57.00 | 0.00 |
| j3019 8.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3019 9.json | 1 | 0 | Optimal | 0.02 | 38 | 38.00 | 0.00 |
| j301 1.json | 1 | 0 | Optimal | 0.11 | 43 | 43.00 | 0.00 |
| j301 10.json | 1 | 0 | Optimal | 0.03 | 45 | 45.00 | 0.00 |
| j301 2.json | 1 | 0 | Optimal | 0.02 | 47 | 47.00 | 0.00 |
| j301 3.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j301 4.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j301 5.json | 1 | 0 | Optimal | 0.03 | 39 | 39.00 | 0.00 |
| j301 6.json | 1 | 0 | Optimal | 0.03 | 48 | 48.00 | 0.00 |
| j301 7.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j301 8.json | 1 | 0 | Optimal | 0.04 | 53 | 53.00 | 0.00 |
| j301 9.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j3020 1.json | 1 | 0 | Optimal | 0.01 | 57 | 57.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3020 10.json | 1 | 0 | Optimal | 0.01 | 37 | 37.00 | 0.00 |
| j3020 2.json | 1 | 0 | Optimal | 0.01 | 70 | 70.00 | 0.00 |
| j3020 3.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j3020 4.json | 1 | 0 | Optimal | 0.01 | 43 | 43.00 | 0.00 |
| j3020 5.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3020 6.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j3020 7.json | 1 | 0 | Optimal | 0.01 | 42 | 42.00 | 0.00 |
| j3020 8.json | 1 | 0 | Optimal | 0.01 | 51 | 51.00 | 0.00 |
| j3020 9.json | 1 | 0 | Optimal | 0.01 | 41 | 41.00 | 0.00 |
| j3021 1.json | 1 | 0 | Optimal | 0.06 | 84 | 84.00 | 0.00 |
| j3021 10.json | 1 | 0 | Optimal | 0.07 | 69 | 69.00 | 0.00 |
| j3021 2.json | 1 | 0 | Optimal | 0.14 | 59 | 59.00 | 0.00 |
| j3021 3.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j3021 4.json | 1 | 0 | Optimal | 0.17 | 70 | 70.00 | 0.00 |
| j3021 5.json | 1 | 0 | Optimal | 0.05 | 55 | 55.00 | 0.00 |
| j3021 6.json | 1 | 0 | Optimal | 0.07 | 76 | 76.00 | 0.00 |
| j3021 7.json | 1 | 0 | Optimal | 0.07 | 65 | 65.00 | 0.00 |
| j3021 8.json | 1 | 0 | Optimal | 0.14 | 62 | 62.00 | 0.00 |
| j3021 9.json | 1 | 0 | Optimal | 0.17 | 69 | 69.00 | 0.00 |
| j3022 1.json | 1 | 0 | Optimal | 0.04 | 42 | 42.00 | 0.00 |
| j3022 10.json | 1 | 0 | Optimal | 0.04 | 55 | 55.00 | 0.00 |
| j3022 2.json | 1 | 0 | Optimal | 0.03 | 45 | 45.00 | 0.00 |
| j3022 3.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3022 4.json | 1 | 0 | Optimal | 0.03 | 42 | 42.00 | 0.00 |
| j3022 5.json | 1 | 0 | Optimal | 0.04 | 52 | 52.00 | 0.00 |
| j3022 6.json | 1 | 0 | Optimal | 0.04 | 52 | 52.00 | 0.00 |
| j3022 7.json | 1 | 0 | Optimal | 0.04 | 60 | 60.00 | 0.00 |
| j3022 8.json | 1 | 0 | Optimal | 0.04 | 55 | 55.00 | 0.00 |
| j3022 9.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j3023 1.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3023 10.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j3023 2.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3023 3.json | 1 | 0 | Optimal | 0.03 | 46 | 46.00 | 0.00 |
| j3023 4.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j3023 5.json | 1 | 0 | Optimal | 0.03 | 52 | 52.00 | 0.00 |
| j3023 6.json | 1 | 0 | Optimal | 0.03 | 48 | 48.00 | 0.00 |
| j3023 7.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3023 8.json | 1 | 0 | Optimal | 0.04 | 48 | 48.00 | 0.00 |
| j3023 9.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3024 1.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3024 10.json | 1 | 0 | Optimal | 0.01 | 53 | 53.00 | 0.00 |
| j3024 2.json | 1 | 0 | Optimal | 0.01 | 58 | 58.00 | 0.00 |
| j3024 3.json | 1 | 0 | Optimal | 0.01 | 69 | 69.00 | 0.00 |
| j3024 4.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3024 5.json | 1 | 0 | Optimal | 0.01 | 51 | 51.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3024 6.json | 1 | 0 | Optimal | 0.01 | 56 | 56.00 | 0.00 |
| j3024 7.json | 1 | 0 | Optimal | 0.03 | 44 | 44.00 | 0.00 |
| j3024 8.json | 1 | 0 | Optimal | 0.02 | 38 | 38.00 | 0.00 |
| j3024 9.json | 1 | 0 | Optimal | 0.03 | 43 | 43.00 | 0.00 |
| j3025 1.json | 1 | 0 | Optimal | 0.82 | 93 | 93.00 | 0.00 |
| j3025 10.json | 1 | 0 | Optimal | 0.08 | 58 | 58.00 | 0.00 |
| j3025 2.json | 1 | 0 | Optimal | 0.37 | 75 | 75.00 | 0.00 |
| j3025 3.json | 1 | 0 | Optimal | 0.62 | 76 | 76.00 | 0.00 |
| j3025 4.json | 1 | 0 | Optimal | 1.25 | 81 | 81.00 | 0.00 |
| j3025 5.json | 1 | 0 | Optimal | 0.76 | 72 | 72.00 | 0.00 |
| j3025 6.json | 1 | 0 | Optimal | 0.33 | 58 | 58.00 | 0.00 |
| j3025 7.json | 1 | 0 | Optimal | 0.32 | 95 | 95.00 | 0.00 |
| j3025 8.json | 1 | 0 | Optimal | 0.40 | 69 | 69.00 | 0.00 |
| j3025 9.json | 1 | 0 | Optimal | 0.21 | 84 | 84.00 | 0.00 |
| j3026 1.json | 1 | 0 | Optimal | 0.06 | 59 | 59.00 | 0.00 |
| j3026 10.json | 1 | 0 | Optimal | 0.04 | 49 | 49.00 | 0.00 |
| j3026 2.json | 1 | 0 | Optimal | 0.03 | 40 | 40.00 | 0.00 |
| j3026 3.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3026 4.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j3026 5.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j3026 6.json | 1 | 0 | Optimal | 0.04 | 53 | 53.00 | 0.00 |
| j3026 7.json | 1 | 0 | Optimal | 0.06 | 56 | 56.00 | 0.00 |
| j3026 8.json | 1 | 0 | Optimal | 0.04 | 66 | 66.00 | 0.00 |
| j3026 9.json | 1 | 0 | Optimal | 0.04 | 43 | 43.00 | 0.00 |
| j3027 1.json | 1 | 0 | Optimal | 0.03 | 43 | 43.00 | 0.00 |
| j3027 10.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j3027 2.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3027 3.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3027 4.json | 1 | 0 | Optimal | 0.03 | 64 | 64.00 | 0.00 |
| j3027 5.json | 1 | 0 | Optimal | 0.04 | 49 | 49.00 | 0.00 |
| j3027 6.json | 1 | 0 | Optimal | 0.05 | 59 | 59.00 | 0.00 |
| j3027 7.json | 1 | 0 | Optimal | 0.04 | 49 | 49.00 | 0.00 |
| j3027 8.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j3027 9.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3028 1.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j3028 10.json | 1 | 0 | Optimal | 0.01 | 59 | 59.00 | 0.00 |
| j3028 2.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3028 3.json | 1 | 0 | Optimal | 0.02 | 40 | 40.00 | 0.00 |
| j3028 4.json | 1 | 0 | Optimal | 0.02 | 49 | 49.00 | 0.00 |
| j3028 5.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j3028 6.json | 1 | 0 | Optimal | 0.01 | 55 | 55.00 | 0.00 |
| j3028 7.json | 1 | 0 | Optimal | 0.01 | 48 | 48.00 | 0.00 |
| j3028 8.json | 1 | 0 | Optimal | 0.01 | 53 | 53.00 | 0.00 |
| j3028 9.json | 1 | 0 | Optimal | 0.01 | 62 | 62.00 | 0.00 |
| j3029 1.json | 1 | 0 | Optimal | 0.18 | 85 | 85.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|-------|----------|--------|----------------|
| j3029 10.json | 1 | 0 | Optimal | 0.12 | 76 | 76.00 | 0.00 |
| j3029 2.json | 1 | 0 | Optimal | 0.67 | 90 | 90.00 | 0.00 |
| j3029 3.json | 1 | 0 | Optimal | 13.50 | 78 | 78.00 | 0.00 |
| j3029 4.json | 1 | 0 | Optimal | 5.92 | 103 | 103.00 | 0.00 |
| j3029 5.json | 1 | 0 | Optimal | 0.80 | 98 | 98.00 | 0.00 |
| j3029 6.json | 1 | 0 | Optimal | 18.71 | 92 | 92.00 | 0.00 |
| j3029 7.json | 1 | 0 | Optimal | 0.78 | 73 | 73.00 | 0.00 |
| j3029 8.json | 1 | 0 | Optimal | 19.68 | 80 | 80.00 | 0.00 |
| j3029 9.json | 1 | 0 | Optimal | 4.50 | 97 | 97.00 | 0.00 |
| j302 1.json | 1 | 0 | Optimal | 0.03 | 38 | 38.00 | 0.00 |
| j302 10.json | 1 | 0 | Optimal | 0.02 | 43 | 43.00 | 0.00 |
| j302 2.json | 1 | 0 | Optimal | 0.03 | 51 | 51.00 | 0.00 |
| j302 3.json | 1 | 0 | Optimal | 0.03 | 43 | 43.00 | 0.00 |
| j302 4.json | 1 | 0 | Optimal | 0.03 | 43 | 43.00 | 0.00 |
| j302 5.json | 1 | 0 | Optimal | 0.02 | 51 | 51.00 | 0.00 |
| j302 6.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j302 7.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j302 8.json | 1 | 0 | Optimal | 0.01 | 54 | 54.00 | 0.00 |
| j302 9.json | 1 | 0 | Optimal | 0.03 | 54 | 54.00 | 0.00 |
| j3030 1.json | 1 | 0 | Optimal | 0.07 | 47 | 47.00 | 0.00 |
| j3030 10.json | 1 | 0 | Optimal | 0.12 | 53 | 53.00 | 0.00 |
| j3030 2.json | 1 | 0 | Optimal | 0.12 | 68 | 68.00 | 0.00 |
| j3030 3.json | 1 | 0 | Optimal | 0.05 | 55 | 55.00 | 0.00 |
| j3030 4.json | 1 | 0 | Optimal | 0.06 | 53 | 53.00 | 0.00 |
| j3030 5.json | 1 | 0 | Optimal | 0.09 | 54 | 54.00 | 0.00 |
| j3030 6.json | 1 | 0 | Optimal | 0.11 | 62 | 62.00 | 0.00 |
| j3030 7.json | 1 | 0 | Optimal | 0.08 | 68 | 68.00 | 0.00 |
| j3030 8.json | 1 | 0 | Optimal | 0.06 | 46 | 46.00 | 0.00 |
| j3030 9.json | 1 | 0 | Optimal | 0.04 | 46 | 46.00 | 0.00 |
| j3031 1.json | 1 | 0 | Optimal | 0.03 | 43 | 43.00 | 0.00 |
| j3031 10.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3031 2.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3031 3.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3031 4.json | 1 | 0 | Optimal | 0.03 | 50 | 50.00 | 0.00 |
| j3031 5.json | 1 | 0 | Optimal | 0.04 | 52 | 52.00 | 0.00 |
| j3031 6.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j3031 7.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j3031 8.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3031 9.json | 1 | 0 | Optimal | 0.04 | 50 | 50.00 | 0.00 |
| j3032 1.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j3032 10.json | 1 | 0 | Optimal | 0.01 | 51 | 51.00 | 0.00 |
| j3032 2.json | 1 | 0 | Optimal | 0.01 | 60 | 60.00 | 0.00 |
| j3032 3.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j3032 4.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j3032 5.json | 1 | 0 | Optimal | 0.03 | 54 | 54.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3032 6.json | 1 | 0 | Optimal | 0.03 | 44 | 44.00 | 0.00 |
| j3032 7.json | 1 | 0 | Optimal | 0.03 | 35 | 35.00 | 0.00 |
| j3032 8.json | 1 | 0 | Optimal | 0.01 | 54 | 54.00 | 0.00 |
| j3032 9.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j3033 1.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j3033 10.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j3033 2.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3033 3.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3033 4.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j3033 5.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j3033 6.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j3033 7.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3033 8.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j3033 9.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j3034 1.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j3034 10.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j3034 2.json | 1 | 0 | Optimal | 0.01 | 44 | 44.00 | 0.00 |
| j3034 3.json | 1 | 0 | Optimal | 0.01 | 69 | 69.00 | 0.00 |
| j3034 4.json | 1 | 0 | Optimal | 0.01 | 67 | 67.00 | 0.00 |
| j3034 5.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3034 6.json | 1 | 0 | Optimal | 0.03 | 52 | 52.00 | 0.00 |
| j3034 7.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3034 8.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3034 9.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3035 1.json | 1 | 0 | Optimal | 0.03 | 57 | 57.00 | 0.00 |
| j3035 10.json | 1 | 0 | Optimal | 0.01 | 59 | 59.00 | 0.00 |
| j3035 2.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j3035 3.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3035 4.json | 1 | 0 | Optimal | 0.03 | 50 | 50.00 | 0.00 |
| j3035 5.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3035 6.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3035 7.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j3035 8.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j3035 9.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j3036 1.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j3036 10.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j3036 2.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j3036 3.json | 1 | 0 | Optimal | 0.01 | 61 | 61.00 | 0.00 |
| j3036 4.json | 1 | 0 | Optimal | 0.01 | 59 | 59.00 | 0.00 |
| j3036 5.json | 1 | 0 | Optimal | 0.01 | 64 | 64.00 | 0.00 |
| j3036 6.json | 1 | 0 | Optimal | 0.01 | 46 | 46.00 | 0.00 |
| j3036 7.json | 1 | 0 | Optimal | 0.03 | 56 | 56.00 | 0.00 |
| j3036 8.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3036 9.json | 1 | 0 | Optimal | 0.01 | 59 | 59.00 | 0.00 |
| j3037 1.json | 1 | 0 | Optimal | 0.17 | 79 | 79.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j3037 10.json | 1 | 0 | Optimal | 0.04 | 81 | 81.00 | 0.00 |
| j3037 2.json | 1 | 0 | Optimal | 0.12 | 69 | 69.00 | 0.00 |
| j3037 3.json | 1 | 0 | Optimal | 0.12 | 81 | 81.00 | 0.00 |
| j3037 4.json | 1 | 0 | Optimal | 0.07 | 83 | 83.00 | 0.00 |
| j3037 5.json | 1 | 0 | Optimal | 0.06 | 80 | 80.00 | 0.00 |
| j3037 6.json | 1 | 0 | Optimal | 0.06 | 73 | 73.00 | 0.00 |
| j3037 7.json | 1 | 0 | Optimal | 0.20 | 92 | 92.00 | 0.00 |
| j3037 8.json | 1 | 0 | Optimal | 0.06 | 72 | 72.00 | 0.00 |
| j3037 9.json | 1 | 0 | Optimal | 0.04 | 57 | 57.00 | 0.00 |
| j3038 1.json | 1 | 0 | Optimal | 0.03 | 48 | 48.00 | 0.00 |
| j3038 10.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3038 2.json | 1 | 0 | Optimal | 0.03 | 54 | 54.00 | 0.00 |
| j3038 3.json | 1 | 0 | Optimal | 0.04 | 59 | 59.00 | 0.00 |
| j3038 4.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j3038 5.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j3038 6.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3038 7.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j3038 8.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j3038 9.json | 1 | 0 | Optimal | 0.04 | 63 | 63.00 | 0.00 |
| j3039 1.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3039 10.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3039 2.json | 1 | 0 | Optimal | 0.03 | 54 | 54.00 | 0.00 |
| j3039 3.json | 1 | 0 | Optimal | 0.03 | 54 | 54.00 | 0.00 |
| j3039 4.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j3039 5.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3039 6.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j3039 7.json | 1 | 0 | Optimal | 0.03 | 56 | 56.00 | 0.00 |
| j3039 8.json | 1 | 0 | Optimal | 0.03 | 67 | 67.00 | 0.00 |
| j3039 9.json | 1 | 0 | Optimal | 0.03 | 64 | 64.00 | 0.00 |
| j303 1.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j303 10.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j303 2.json | 1 | 0 | Optimal | 0.03 | 40 | 40.00 | 0.00 |
| j303 3.json | 1 | 0 | Optimal | 0.01 | 57 | 57.00 | 0.00 |
| j303 4.json | 1 | 0 | Optimal | 0.01 | 98 | 98.00 | 0.00 |
| j303 5.json | 1 | 0 | Optimal | 0.01 | 53 | 53.00 | 0.00 |
| j303 6.json | 1 | 0 | Optimal | 0.01 | 54 | 54.00 | 0.00 |
| j303 7.json | 1 | 0 | Optimal | 0.01 | 48 | 48.00 | 0.00 |
| j303 8.json | 1 | 0 | Optimal | 0.01 | 54 | 54.00 | 0.00 |
| j303 9.json | 1 | 0 | Optimal | 0.01 | 65 | 65.00 | 0.00 |
| j3040 1.json | 1 | 0 | Optimal | 0.03 | 51 | 51.00 | 0.00 |
| j3040 10.json | 1 | 0 | Optimal | 0.01 | 51 | 51.00 | 0.00 |
| j3040 2.json | 1 | 0 | Optimal | 0.01 | 56 | 56.00 | 0.00 |
| j3040 3.json | 1 | 0 | Optimal | 0.01 | 57 | 57.00 | 0.00 |
| j3040 4.json | 1 | 0 | Optimal | 0.03 | 57 | 57.00 | 0.00 |
| j3040 5.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|--------|----------------|
| j3040 6.json | 1 | 0 | Optimal | 0.01 | 60 | 60.00 | 0.00 |
| j3040 7.json | 1 | 0 | Optimal | 0.03 | 46 | 46.00 | 0.00 |
| j3040 8.json | 1 | 0 | Optimal | 0.03 | 57 | 57.00 | 0.00 |
| j3040 9.json | 1 | 0 | Optimal | 0.03 | 64 | 64.00 | 0.00 |
| j3041 1.json | 1 | 0 | Optimal | 0.17 | 86 | 86.00 | 0.00 |
| j3041 10.json | 1 | 0 | Optimal | 2.73 | 99 | 99.00 | 0.00 |
| j3041 2.json | 1 | 0 | Optimal | 0.28 | 89 | 89.00 | 0.00 |
| j3041 3.json | 1 | 0 | Optimal | 0.16 | 85 | 85.00 | 0.00 |
| j3041 4.json | 1 | 0 | Optimal | 0.12 | 78 | 78.00 | 0.00 |
| j3041 5.json | 1 | 0 | Optimal | 0.20 | 99 | 99.00 | 0.00 |
| j3041 6.json | 1 | 0 | Optimal | 0.68 | 103 | 103.00 | 0.00 |
| j3041 7.json | 1 | 0 | Optimal | 0.26 | 92 | 92.00 | 0.00 |
| j3041 8.json | 1 | 0 | Optimal | 0.53 | 88 | 88.00 | 0.00 |
| j3041 9.json | 1 | 0 | Optimal | 0.23 | 92 | 92.00 | 0.00 |
| j3042 1.json | 1 | 0 | Optimal | 0.04 | 58 | 58.00 | 0.00 |
| j3042 10.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j3042 2.json | 1 | 0 | Optimal | 0.04 | 50 | 50.00 | 0.00 |
| j3042 3.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3042 4.json | 1 | 0 | Optimal | 0.06 | 49 | 49.00 | 0.00 |
| j3042 5.json | 1 | 0 | Optimal | 0.03 | 52 | 52.00 | 0.00 |
| j3042 6.json | 1 | 0 | Optimal | 0.04 | 66 | 66.00 | 0.00 |
| j3042 7.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j3042 8.json | 1 | 0 | Optimal | 0.06 | 82 | 82.00 | 0.00 |
| j3042 9.json | 1 | 0 | Optimal | 0.06 | 60 | 60.00 | 0.00 |
| j3043 1.json | 1 | 0 | Optimal | 0.04 | 55 | 55.00 | 0.00 |
| j3043 10.json | 1 | 0 | Optimal | 0.04 | 60 | 60.00 | 0.00 |
| j3043 2.json | 1 | 0 | Optimal | 0.03 | 43 | 43.00 | 0.00 |
| j3043 3.json | 1 | 0 | Optimal | 0.03 | 57 | 57.00 | 0.00 |
| j3043 4.json | 1 | 0 | Optimal | 0.03 | 67 | 67.00 | 0.00 |
| j3043 5.json | 1 | 0 | Optimal | 0.04 | 64 | 64.00 | 0.00 |
| j3043 6.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3043 7.json | 1 | 0 | Optimal | 0.03 | 52 | 52.00 | 0.00 |
| j3043 8.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j3043 9.json | 1 | 0 | Optimal | 0.03 | 57 | 57.00 | 0.00 |
| j3044 1.json | 1 | 0 | Optimal | 0.03 | 50 | 50.00 | 0.00 |
| j3044 10.json | 1 | 0 | Optimal | 0.01 | 63 | 63.00 | 0.00 |
| j3044 2.json | 1 | 0 | Optimal | 0.01 | 54 | 54.00 | 0.00 |
| j3044 3.json | 1 | 0 | Optimal | 0.01 | 51 | 51.00 | 0.00 |
| j3044 4.json | 1 | 0 | Optimal | 0.03 | 57 | 57.00 | 0.00 |
| j3044 5.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3044 6.json | 1 | 0 | Optimal | 0.03 | 56 | 56.00 | 0.00 |
| j3044 7.json | 1 | 0 | Optimal | 0.03 | 42 | 42.00 | 0.00 |
| j3044 8.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j3044 9.json | 1 | 0 | Optimal | 0.01 | 64 | 64.00 | 0.00 |
| j3045 1.json | 1 | 0 | Optimal | 0.91 | 82 | 82.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|--------|----------------|
| j3045 10.json | 1 | 0 | Optimal | 0.76 | 90 | 90.00 | 0.00 |
| j3045 2.json | 1 | 0 | Optimal | 7.18 | 125 | 125.00 | 0.00 |
| j3045 3.json | 1 | 0 | Optimal | 0.14 | 92 | 92.00 | 0.00 |
| j3045 4.json | 1 | 0 | Optimal | 0.24 | 84 | 84.00 | 0.00 |
| j3045 5.json | 1 | 0 | Optimal | 0.26 | 86 | 86.00 | 0.00 |
| j3045 6.json | 1 | 0 | Optimal | 7.20 | 129 | 129.00 | 0.00 |
| j3045 7.json | 1 | 0 | Optimal | 0.19 | 101 | 101.00 | 0.00 |
| j3045 8.json | 1 | 0 | Optimal | 0.37 | 94 | 94.00 | 0.00 |
| j3045 9.json | 1 | 0 | Optimal | 0.20 | 82 | 82.00 | 0.00 |
| j3046 1.json | 1 | 0 | Optimal | 0.05 | 59 | 59.00 | 0.00 |
| j3046 10.json | 1 | 0 | Optimal | 0.11 | 55 | 55.00 | 0.00 |
| j3046 2.json | 1 | 0 | Optimal | 0.07 | 67 | 67.00 | 0.00 |
| j3046 3.json | 1 | 0 | Optimal | 0.06 | 65 | 65.00 | 0.00 |
| j3046 4.json | 1 | 0 | Optimal | 0.04 | 64 | 64.00 | 0.00 |
| j3046 5.json | 1 | 0 | Optimal | 0.04 | 57 | 57.00 | 0.00 |
| j3046 6.json | 1 | 0 | Optimal | 0.06 | 59 | 59.00 | 0.00 |
| j3046 7.json | 1 | 0 | Optimal | 0.15 | 59 | 59.00 | 0.00 |
| j3046 8.json | 1 | 0 | Optimal | 0.04 | 58 | 58.00 | 0.00 |
| j3046 9.json | 1 | 0 | Optimal | 0.06 | 49 | 49.00 | 0.00 |
| j3047 1.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3047 10.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j3047 2.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j3047 3.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j3047 4.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j3047 5.json | 1 | 0 | Optimal | 0.03 | 47 | 47.00 | 0.00 |
| j3047 6.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j3047 7.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j3047 8.json | 1 | 0 | Optimal | 0.03 | 48 | 48.00 | 0.00 |
| j3047 9.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j3048 1.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j3048 10.json | 1 | 0 | Optimal | 0.03 | 54 | 54.00 | 0.00 |
| j3048 2.json | 1 | 0 | Optimal | 0.01 | 54 | 54.00 | 0.00 |
| j3048 3.json | 1 | 0 | Optimal | 0.02 | 50 | 50.00 | 0.00 |
| j3048 4.json | 1 | 0 | Optimal | 0.01 | 57 | 57.00 | 0.00 |
| j3048 5.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j3048 6.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j3048 7.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j3048 8.json | 1 | 0 | Optimal | 0.03 | 44 | 44.00 | 0.00 |
| j3048 9.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j304 1.json | 1 | 0 | Optimal | 0.01 | 49 | 49.00 | 0.00 |
| j304 10.json | 1 | 0 | Optimal | 0.01 | 48 | 48.00 | 0.00 |
| j304 2.json | 1 | 0 | Optimal | 0.01 | 60 | 60.00 | 0.00 |
| j304 3.json | 1 | 0 | Optimal | 0.01 | 47 | 47.00 | 0.00 |
| j304 4.json | 1 | 0 | Optimal | 0.01 | 57 | 57.00 | 0.00 |
| j304 5.json | 1 | 0 | Optimal | 0.01 | 59 | 59.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------|------------|----------------|---------|------|----------|-------|----------------|
| j304 6.json | 1 | 0 | Optimal | 0.01 | 45 | 45.00 | 0.00 |
| j304 7.json | 1 | 0 | Optimal | 0.01 | 56 | 56.00 | 0.00 |
| j304 8.json | 1 | 0 | Optimal | 0.01 | 55 | 55.00 | 0.00 |
| j304 9.json | 1 | 0 | Optimal | 0.01 | 38 | 38.00 | 0.00 |
| j305 1.json | 1 | 0 | Optimal | 0.04 | 53 | 53.00 | 0.00 |
| j305 10.json | 1 | 0 | Optimal | 0.06 | 70 | 70.00 | 0.00 |
| j305 2.json | 1 | 0 | Optimal | 0.13 | 82 | 82.00 | 0.00 |
| j305 3.json | 1 | 0 | Optimal | 0.31 | 76 | 76.00 | 0.00 |
| j305 4.json | 1 | 0 | Optimal | 0.08 | 63 | 63.00 | 0.00 |
| j305 5.json | 1 | 0 | Optimal | 0.12 | 76 | 76.00 | 0.00 |
| j305 6.json | 1 | 0 | Optimal | 0.04 | 64 | 64.00 | 0.00 |
| j305 7.json | 1 | 0 | Optimal | 0.16 | 76 | 76.00 | 0.00 |
| j305 8.json | 1 | 0 | Optimal | 0.12 | 67 | 67.00 | 0.00 |
| j305 9.json | 1 | 0 | Optimal | 0.06 | 49 | 49.00 | 0.00 |
| j306 1.json | 1 | 0 | Optimal | 0.04 | 59 | 59.00 | 0.00 |
| j306 10.json | 1 | 0 | Optimal | 0.05 | 61 | 61.00 | 0.00 |
| j306 2.json | 1 | 0 | Optimal | 0.04 | 51 | 51.00 | 0.00 |
| j306 3.json | 1 | 0 | Optimal | 0.04 | 48 | 48.00 | 0.00 |
| j306 4.json | 1 | 0 | Optimal | 0.04 | 42 | 42.00 | 0.00 |
| j306 5.json | 1 | 0 | Optimal | 0.03 | 67 | 67.00 | 0.00 |
| j306 6.json | 1 | 0 | Optimal | 0.03 | 37 | 37.00 | 0.00 |
| j306 7.json | 1 | 0 | Optimal | 0.04 | 46 | 46.00 | 0.00 |
| j306 8.json | 1 | 0 | Optimal | 0.04 | 39 | 39.00 | 0.00 |
| j306 9.json | 1 | 0 | Optimal | 0.03 | 51 | 51.00 | 0.00 |
| j307 1.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j307 10.json | 1 | 0 | Optimal | 0.03 | 49 | 49.00 | 0.00 |
| j307 2.json | 1 | 0 | Optimal | 0.03 | 42 | 42.00 | 0.00 |
| j307 3.json | 1 | 0 | Optimal | 0.03 | 42 | 42.00 | 0.00 |
| j307 4.json | 1 | 0 | Optimal | 0.03 | 44 | 44.00 | 0.00 |
| j307 5.json | 1 | 0 | Optimal | 0.03 | 44 | 44.00 | 0.00 |
| j307 6.json | 1 | 0 | Optimal | 0.03 | 35 | 35.00 | 0.00 |
| j307 7.json | 1 | 0 | Optimal | 0.03 | 50 | 50.00 | 0.00 |
| j307 8.json | 1 | 0 | Optimal | 0.03 | 44 | 44.00 | 0.00 |
| j307 9.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j308 1.json | 1 | 0 | Optimal | 0.01 | 44 | 44.00 | 0.00 |
| j308 10.json | 1 | 0 | Optimal | 0.01 | 67 | 67.00 | 0.00 |
| j308 2.json | 1 | 0 | Optimal | 0.01 | 51 | 51.00 | 0.00 |
| j308 3.json | 1 | 0 | Optimal | 0.01 | 53 | 53.00 | 0.00 |
| j308 4.json | 1 | 0 | Optimal | 0.01 | 48 | 48.00 | 0.00 |
| j308 5.json | 1 | 0 | Optimal | 0.01 | 58 | 58.00 | 0.00 |
| j308 6.json | 1 | 0 | Optimal | 0.01 | 47 | 47.00 | 0.00 |
| j308 7.json | 1 | 0 | Optimal | 0.01 | 41 | 41.00 | 0.00 |
| j308 8.json | 1 | 0 | Optimal | 0.01 | 51 | 51.00 | 0.00 |
| j308 9.json | 1 | 0 | Optimal | 0.01 | 39 | 39.00 | 0.00 |
| j309 1.json | 1 | 0 | Optimal | 0.61 | 83 | 83.00 | 0.00 |

Table 9.2: Results for RCPSP J30 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------|------------|----------------|---------|------|----------|-------|----------------|
| j309 10.json | 1 | 0 | Optimal | 0.64 | 88 | 88.00 | 0.00 |
| j309 2.json | 1 | 0 | Optimal | 7.05 | 92 | 92.00 | 0.00 |
| j309 3.json | 1 | 0 | Optimal | 0.15 | 68 | 68.00 | 0.00 |
| j309 4.json | 1 | 0 | Optimal | 0.30 | 71 | 71.00 | 0.00 |
| j309 5.json | 1 | 0 | Optimal | 0.09 | 70 | 70.00 | 0.00 |
| j309 6.json | 1 | 0 | Optimal | 0.17 | 59 | 59.00 | 0.00 |
| j309 7.json | 1 | 0 | Optimal | 0.31 | 63 | 63.00 | 0.00 |
| j309 8.json | 1 | 0 | Optimal | 0.34 | 91 | 91.00 | 0.00 |
| j309 9.json | 1 | 0 | Optimal | 0.72 | 63 | 63.00 | 0.00 |

9.2 Size J60

9.2.1 CPO

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j6010 1.json | 1 | 0 | Optimal | 0.12 | 85 | 85.00 | 0.00 |
| j6010 10.json | 1 | 0 | Optimal | 0.03 | 73 | 73.00 | 0.00 |
| j6010 2.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j6010 3.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j6010 4.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j6010 5.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j6010 6.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j6010 7.json | 1 | 0 | Optimal | 0.04 | 69 | 69.00 | 0.00 |
| j6010 8.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j6010 9.json | 1 | 0 | Optimal | 0.05 | 73 | 73.00 | 0.00 |
| j6011 1.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6011 10.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j6011 2.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j6011 3.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6011 4.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6011 5.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6011 6.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6011 7.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6011 8.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6011 9.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j6012 1.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j6012 10.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j6012 2.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j6012 3.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6012 4.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6012 5.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j6012 6.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j6012 7.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6012 8.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j6012 9.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j6013 1.json | 1 | 0 | Solution | 600.01 | 114 | 105.00 | 7.89 |
| j6013 10.json | 1 | 0 | Solution | 600.01 | 117 | 114.00 | 2.56 |
| j6013 2.json | 1 | 0 | Solution | 600.01 | 108 | 103.00 | 4.63 |
| j6013 3.json | 1 | 0 | Solution | 600.01 | 88 | 84.00 | 4.55 |
| j6013 4.json | 1 | 0 | Solution | 600.01 | 105 | 98.00 | 6.67 |
| j6013 5.json | 1 | 0 | Solution | 600.01 | 98 | 93.00 | 5.10 |
| j6013 6.json | 1 | 0 | Solution | 600.01 | 95 | 91.00 | 4.21 |
| j6013 7.json | 1 | 0 | Solution | 600.01 | 89 | 83.00 | 6.74 |
| j6013 8.json | 1 | 0 | Solution | 600.01 | 123 | 112.00 | 8.94 |
| j6013 9.json | 1 | 0 | Solution | 600.01 | 103 | 97.00 | 5.83 |
| j6014 1.json | 1 | 0 | Optimal | 33.24 | 61 | 61.00 | 0.00 |
| j6014 10.json | 1 | 0 | Optimal | 56.92 | 72 | 72.00 | 0.00 |
| j6014 2.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j6014 3.json | 1 | 0 | Optimal | 351.54 | 61 | 61.00 | 0.00 |
| j6014 4.json | 1 | 0 | Optimal | 0.18 | 65 | 65.00 | 0.00 |
| j6014 5.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j6014 6.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j6014 7.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6014 8.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j6014 9.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j6015 1.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j6015 10.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j6015 2.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j6015 3.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j6015 4.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j6015 5.json | 1 | 0 | Optimal | 0.03 | 70 | 70.00 | 0.00 |
| j6015 6.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6015 7.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6015 8.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j6015 9.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j6016 1.json | 1 | 0 | Optimal | 0.03 | 64 | 64.00 | 0.00 |
| j6016 10.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6016 2.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6016 3.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j6016 4.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j6016 5.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j6016 6.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6016 7.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j6016 8.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j6016 9.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j6017 1.json | 1 | 0 | Optimal | 0.07 | 86 | 86.00 | 0.00 |
| j6017 10.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6017 2.json | 1 | 0 | Optimal | 0.07 | 69 | 69.00 | 0.00 |
| j6017 3.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j6017 4.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6017 5.json | 1 | 0 | Optimal | 0.06 | 59 | 59.00 | 0.00 |
| j6017 6.json | 1 | 0 | Optimal | 0.06 | 69 | 69.00 | 0.00 |
| j6017 7.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6017 8.json | 1 | 0 | Optimal | 0.19 | 85 | 85.00 | 0.00 |
| j6017 9.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6018 1.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6018 10.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j6018 2.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6018 3.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6018 4.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6018 5.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j6018 6.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j6018 7.json | 1 | 0 | Optimal | 0.03 | 93 | 93.00 | 0.00 |
| j6018 8.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6018 9.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6019 1.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j6019 10.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6019 2.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6019 3.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6019 4.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j6019 5.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j6019 6.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6019 7.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j6019 8.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j6019 9.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j601 1.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j601 10.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j601 2.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j601 3.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j601 4.json | 1 | 0 | Optimal | 0.08 | 91 | 91.00 | 0.00 |
| j601 5.json | 1 | 0 | Optimal | 0.04 | 73 | 73.00 | 0.00 |
| j601 6.json | 1 | 0 | Optimal | 0.36 | 66 | 66.00 | 0.00 |
| j601 7.json | 1 | 0 | Optimal | 0.21 | 72 | 72.00 | 0.00 |
| j601 8.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j601 9.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j6020 1.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j6020 10.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6020 2.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6020 3.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6020 4.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|--------|----------------|
| j6020 5.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6020 6.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j6020 7.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6020 8.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6020 9.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6021 1.json | 1 | 0 | Optimal | 1.13 | 103 | 103.00 | 0.00 |
| j6021 10.json | 1 | 0 | Optimal | 0.85 | 80 | 80.00 | 0.00 |
| j6021 2.json | 1 | 0 | Optimal | 0.60 | 108 | 108.00 | 0.00 |
| j6021 3.json | 1 | 0 | Optimal | 0.51 | 87 | 87.00 | 0.00 |
| j6021 4.json | 1 | 0 | Optimal | 2.82 | 95 | 95.00 | 0.00 |
| j6021 5.json | 1 | 0 | Optimal | 3.61 | 89 | 89.00 | 0.00 |
| j6021 6.json | 1 | 0 | Optimal | 1.18 | 84 | 84.00 | 0.00 |
| j6021 7.json | 1 | 0 | Optimal | 1.55 | 103 | 103.00 | 0.00 |
| j6021 8.json | 1 | 0 | Optimal | 1.57 | 110 | 110.00 | 0.00 |
| j6021 9.json | 1 | 0 | Optimal | 9.88 | 89 | 89.00 | 0.00 |
| j6022 1.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6022 10.json | 1 | 0 | Optimal | 0.03 | 70 | 70.00 | 0.00 |
| j6022 2.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6022 3.json | 1 | 0 | Optimal | 0.03 | 70 | 70.00 | 0.00 |
| j6022 4.json | 1 | 0 | Optimal | 0.43 | 73 | 73.00 | 0.00 |
| j6022 5.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6022 6.json | 1 | 0 | Optimal | 0.07 | 79 | 79.00 | 0.00 |
| j6022 7.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6022 8.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j6022 9.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6023 1.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6023 10.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6023 2.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6023 3.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6023 4.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6023 5.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6023 6.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6023 7.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j6023 8.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6023 9.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6024 1.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6024 10.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j6024 2.json | 1 | 0 | Optimal | 0.02 | 55 | 55.00 | 0.00 |
| j6024 3.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j6024 4.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6024 5.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6024 6.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6024 7.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6024 8.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j6024 9.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6025 1.json | 1 | 0 | Solution | 600.01 | 114 | 102.00 | 10.53 |
| j6025 10.json | 1 | 0 | Solution | 600.01 | 108 | 102.00 | 5.56 |
| j6025 2.json | 1 | 0 | Solution | 600.01 | 99 | 91.00 | 8.08 |
| j6025 3.json | 1 | 0 | Optimal | 105.03 | 113 | 113.00 | 0.00 |
| j6025 4.json | 1 | 0 | Solution | 600.01 | 108 | 103.00 | 4.63 |
| j6025 5.json | 1 | 0 | Solution | 600.01 | 98 | 86.00 | 12.24 |
| j6025 6.json | 1 | 0 | Solution | 600.01 | 112 | 99.00 | 11.61 |
| j6025 7.json | 1 | 0 | Solution | 600.01 | 91 | 86.00 | 5.49 |
| j6025 8.json | 1 | 0 | Solution | 600.01 | 99 | 92.00 | 7.07 |
| j6025 9.json | 1 | 0 | Optimal | 103.66 | 99 | 99.00 | 0.00 |
| j6026 1.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j6026 10.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j6026 2.json | 1 | 0 | Optimal | 0.19 | 66 | 66.00 | 0.00 |
| j6026 3.json | 1 | 0 | Optimal | 2.41 | 76 | 76.00 | 0.00 |
| j6026 4.json | 1 | 0 | Optimal | 0.95 | 67 | 67.00 | 0.00 |
| j6026 5.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j6026 6.json | 1 | 0 | Optimal | 0.52 | 74 | 74.00 | 0.00 |
| j6026 7.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j6026 8.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j6026 9.json | 1 | 0 | Optimal | 1.30 | 65 | 65.00 | 0.00 |
| j6027 1.json | 1 | 0 | Optimal | 0.03 | 96 | 96.00 | 0.00 |
| j6027 10.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j6027 2.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6027 3.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j6027 4.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j6027 5.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6027 6.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6027 7.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6027 8.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j6027 9.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6028 1.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j6028 10.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j6028 2.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6028 3.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6028 4.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j6028 5.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6028 6.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j6028 7.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6028 8.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j6028 9.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6029 1.json | 1 | 0 | Solution | 600.01 | 104 | 95.00 | 8.65 |
| j6029 10.json | 1 | 0 | Solution | 600.01 | 120 | 112.00 | 6.67 |
| j6029 2.json | 1 | 0 | Solution | 600.01 | 133 | 116.00 | 12.78 |
| j6029 3.json | 1 | 0 | Solution | 600.01 | 122 | 114.00 | 6.56 |
| j6029 4.json | 1 | 0 | Solution | 600.01 | 137 | 124.00 | 9.49 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6029 5.json | 1 | 0 | Solution | 600.02 | 110 | 101.00 | 8.18 |
| j6029 6.json | 1 | 0 | Solution | 600.01 | 156 | 145.00 | 7.05 |
| j6029 7.json | 1 | 0 | Solution | 600.01 | 125 | 115.00 | 8.00 |
| j6029 8.json | 1 | 0 | Solution | 600.01 | 103 | 97.00 | 5.83 |
| j6029 9.json | 1 | 0 | Solution | 600.01 | 113 | 97.00 | 14.16 |
| j602 1.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j602 10.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j602 2.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j602 3.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j602 4.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j602 5.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j602 6.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j602 7.json | 1 | 0 | Optimal | 0.02 | 53 | 53.00 | 0.00 |
| j602 8.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j602 9.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6030 1.json | 1 | 0 | Optimal | 0.04 | 70 | 70.00 | 0.00 |
| j6030 10.json | 1 | 0 | Optimal | 67.18 | 86 | 86.00 | 0.00 |
| j6030 2.json | 1 | 0 | Solution | 600.01 | 70 | 69.00 | 1.43 |
| j6030 3.json | 1 | 0 | Optimal | 0.31 | 82 | 82.00 | 0.00 |
| j6030 4.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6030 5.json | 1 | 0 | Optimal | 103.34 | 76 | 76.00 | 0.00 |
| j6030 6.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6030 7.json | 1 | 0 | Optimal | 46.96 | 86 | 86.00 | 0.00 |
| j6030 8.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j6030 9.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j6031 1.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6031 10.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j6031 2.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6031 3.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6031 4.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j6031 5.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j6031 6.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6031 7.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6031 8.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6031 9.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j6032 1.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6032 10.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j6032 2.json | 1 | 0 | Optimal | 0.03 | 114 | 114.00 | 0.00 |
| j6032 3.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j6032 4.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j6032 5.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6032 6.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j6032 7.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6032 8.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6032 9.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|--------|----------------|
| j6033 1.json | 1 | 0 | Optimal | 0.07 | 105 | 105.00 | 0.00 |
| j6033 10.json | 1 | 0 | Optimal | 0.05 | 84 | 84.00 | 0.00 |
| j6033 2.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j6033 3.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j6033 4.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6033 5.json | 1 | 0 | Optimal | 0.08 | 108 | 108.00 | 0.00 |
| j6033 6.json | 1 | 0 | Optimal | 0.22 | 75 | 75.00 | 0.00 |
| j6033 7.json | 1 | 0 | Optimal | 0.14 | 78 | 78.00 | 0.00 |
| j6033 8.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j6033 9.json | 1 | 0 | Optimal | 0.04 | 108 | 108.00 | 0.00 |
| j6034 1.json | 1 | 0 | Optimal | 0.04 | 72 | 72.00 | 0.00 |
| j6034 10.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j6034 2.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6034 3.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j6034 4.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6034 5.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j6034 6.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j6034 7.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j6034 8.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j6034 9.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6035 1.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j6035 10.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6035 2.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6035 3.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j6035 4.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6035 5.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6035 6.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j6035 7.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j6035 8.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6035 9.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6036 1.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j6036 10.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6036 2.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6036 3.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j6036 4.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j6036 5.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j6036 6.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6036 7.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6036 8.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6036 9.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j6037 1.json | 1 | 0 | Optimal | 2.54 | 97 | 97.00 | 0.00 |
| j6037 10.json | 1 | 0 | Optimal | 0.52 | 96 | 96.00 | 0.00 |
| j6037 2.json | 1 | 0 | Optimal | 3.65 | 95 | 95.00 | 0.00 |
| j6037 3.json | 1 | 0 | Optimal | 1.87 | 139 | 139.00 | 0.00 |
| j6037 4.json | 1 | 0 | Optimal | 0.64 | 101 | 101.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|-------|----------|--------|----------------|
| j6037 5.json | 1 | 0 | Optimal | 0.94 | 98 | 98.00 | 0.00 |
| j6037 6.json | 1 | 0 | Optimal | 21.45 | 102 | 102.00 | 0.00 |
| j6037 7.json | 1 | 0 | Optimal | 5.92 | 110 | 110.00 | 0.00 |
| j6037 8.json | 1 | 0 | Optimal | 0.76 | 93 | 93.00 | 0.00 |
| j6037 9.json | 1 | 0 | Optimal | 1.49 | 96 | 96.00 | 0.00 |
| j6038 1.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j6038 10.json | 1 | 0 | Optimal | 0.19 | 66 | 66.00 | 0.00 |
| j6038 2.json | 1 | 0 | Optimal | 1.51 | 76 | 76.00 | 0.00 |
| j6038 3.json | 1 | 0 | Optimal | 0.04 | 77 | 77.00 | 0.00 |
| j6038 4.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j6038 5.json | 1 | 0 | Optimal | 0.02 | 103 | 103.00 | 0.00 |
| j6038 6.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j6038 7.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6038 8.json | 1 | 0 | Optimal | 0.06 | 71 | 71.00 | 0.00 |
| j6038 9.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6039 1.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j6039 10.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j6039 2.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j6039 3.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j6039 4.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j6039 5.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j6039 6.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j6039 7.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6039 8.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6039 9.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j603 1.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j603 10.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j603 2.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j603 3.json | 1 | 0 | Optimal | 0.02 | 105 | 105.00 | 0.00 |
| j603 4.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j603 5.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j603 6.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j603 7.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j603 8.json | 1 | 0 | Optimal | 0.09 | 55 | 55.00 | 0.00 |
| j603 9.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j6040 1.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j6040 10.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j6040 2.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6040 3.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6040 4.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j6040 5.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6040 6.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6040 7.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6040 8.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j6040 9.json | 1 | 0 | Optimal | 0.02 | 90 | 90.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6041 1.json | 1 | 0 | Optimal | 40.76 | 122 | 122.00 | 0.00 |
| j6041 10.json | 1 | 0 | Solution | 600.01 | 111 | 108.00 | 2.70 |
| j6041 2.json | 1 | 0 | Optimal | 31.96 | 113 | 113.00 | 0.00 |
| j6041 3.json | 1 | 0 | Solution | 600.01 | 99 | 89.00 | 10.10 |
| j6041 4.json | 1 | 0 | Optimal | 8.26 | 133 | 133.00 | 0.00 |
| j6041 5.json | 1 | 0 | Solution | 600.01 | 117 | 101.00 | 13.68 |
| j6041 6.json | 1 | 0 | Optimal | 65.80 | 134 | 134.00 | 0.00 |
| j6041 7.json | 1 | 0 | Optimal | 18.86 | 132 | 132.00 | 0.00 |
| j6041 8.json | 1 | 0 | Optimal | 21.69 | 135 | 135.00 | 0.00 |
| j6041 9.json | 1 | 0 | Optimal | 35.00 | 131 | 131.00 | 0.00 |
| j6042 1.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6042 10.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j6042 2.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6042 3.json | 1 | 0 | Optimal | 4.44 | 78 | 78.00 | 0.00 |
| j6042 4.json | 1 | 0 | Optimal | 0.56 | 103 | 103.00 | 0.00 |
| j6042 5.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j6042 6.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j6042 7.json | 1 | 0 | Optimal | 2.18 | 59 | 59.00 | 0.00 |
| j6042 8.json | 1 | 0 | Optimal | 0.78 | 82 | 82.00 | 0.00 |
| j6042 9.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j6043 1.json | 1 | 0 | Optimal | 0.02 | 108 | 108.00 | 0.00 |
| j6043 10.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6043 2.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j6043 3.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6043 4.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6043 5.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6043 6.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j6043 7.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j6043 8.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6043 9.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6044 1.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j6044 10.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6044 2.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6044 3.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j6044 4.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6044 5.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j6044 6.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6044 7.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6044 8.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6044 9.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6045 1.json | 1 | 0 | Solution | 600.01 | 96 | 89.00 | 7.29 |
| j6045 10.json | 1 | 0 | Solution | 600.01 | 115 | 104.00 | 9.57 |
| j6045 2.json | 1 | 0 | Solution | 600.01 | 144 | 122.00 | 15.28 |
| j6045 3.json | 1 | 0 | Solution | 600.01 | 144 | 130.00 | 9.72 |
| j6045 4.json | 1 | 0 | Solution | 600.01 | 109 | 100.00 | 8.26 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6045 5.json | 1 | 0 | Solution | 600.01 | 106 | 100.00 | 5.66 |
| j6045 6.json | 1 | 0 | Solution | 600.01 | 145 | 129.00 | 11.03 |
| j6045 7.json | 1 | 0 | Solution | 600.01 | 122 | 110.00 | 9.84 |
| j6045 8.json | 1 | 0 | Solution | 600.01 | 130 | 112.00 | 13.85 |
| j6045 9.json | 1 | 0 | Solution | 600.02 | 124 | 111.00 | 10.48 |
| j6046 1.json | 1 | 0 | Optimal | 0.90 | 79 | 78.00 | 1.27 |
| j6046 10.json | 1 | 0 | Optimal | 135.10 | 88 | 88.00 | 0.00 |
| j6046 2.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6046 3.json | 1 | 0 | Optimal | 1.54 | 79 | 79.00 | 0.00 |
| j6046 4.json | 1 | 0 | Optimal | 32.94 | 74 | 74.00 | 0.00 |
| j6046 5.json | 1 | 0 | Optimal | 17.77 | 91 | 91.00 | 0.00 |
| j6046 6.json | 1 | 0 | Optimal | 8.76 | 90 | 90.00 | 0.00 |
| j6046 7.json | 1 | 0 | Optimal | 67.16 | 78 | 78.00 | 0.00 |
| j6046 8.json | 1 | 0 | Optimal | 1.25 | 75 | 75.00 | 0.00 |
| j6046 9.json | 1 | 0 | Optimal | 314.39 | 69 | 69.00 | 0.00 |
| j6047 1.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6047 10.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j6047 2.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6047 3.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6047 4.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6047 5.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j6047 6.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6047 7.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6047 8.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j6047 9.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6048 1.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6048 10.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6048 2.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j6048 3.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j6048 4.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j6048 5.json | 1 | 0 | Optimal | 0.02 | 101 | 101.00 | 0.00 |
| j6048 6.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6048 7.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j6048 8.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j6048 9.json | 1 | 0 | Optimal | 0.03 | 82 | 82.00 | 0.00 |
| j604 1.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j604 10.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j604 2.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j604 3.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j604 4.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j604 5.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j604 6.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j604 7.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j604 8.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j604 9.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------|------------|----------------|----------|--------|----------|--------|----------------|
| j605 1.json | 1 | 0 | Optimal | 5.94 | 76 | 76.00 | 0.00 |
| j605 10.json | 1 | 0 | Optimal | 25.80 | 81 | 81.00 | 0.00 |
| j605 2.json | 1 | 0 | Optimal | 4.69 | 106 | 106.00 | 0.00 |
| j605 3.json | 1 | 0 | Optimal | 2.77 | 80 | 80.00 | 0.00 |
| j605 4.json | 1 | 0 | Optimal | 5.12 | 72 | 72.00 | 0.00 |
| j605 5.json | 1 | 0 | Optimal | 2.27 | 108 | 108.00 | 0.00 |
| j605 6.json | 1 | 0 | Optimal | 0.92 | 74 | 74.00 | 0.00 |
| j605 7.json | 1 | 0 | Optimal | 11.15 | 75 | 75.00 | 0.00 |
| j605 8.json | 1 | 0 | Optimal | 0.64 | 78 | 76.00 | 2.56 |
| j605 9.json | 1 | 0 | Optimal | 0.44 | 83 | 83.00 | 0.00 |
| j606 1.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j606 10.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j606 2.json | 1 | 0 | Optimal | 0.03 | 67 | 67.00 | 0.00 |
| j606 3.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j606 4.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j606 5.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j606 6.json | 1 | 0 | Optimal | 0.31 | 55 | 55.00 | 0.00 |
| j606 7.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j606 8.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j606 9.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j607 1.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j607 10.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j607 2.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j607 3.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j607 4.json | 1 | 0 | Optimal | 0.02 | 63 | 63.00 | 0.00 |
| j607 5.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j607 6.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j607 7.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j607 8.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j607 9.json | 1 | 0 | Optimal | 0.02 | 44 | 44.00 | 0.00 |
| j608 1.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j608 10.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j608 2.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j608 3.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j608 4.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j608 5.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j608 6.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j608 7.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j608 8.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j608 9.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j609 1.json | 1 | 0 | Solution | 600.01 | 87 | 85.00 | 2.30 |
| j609 10.json | 1 | 0 | Solution | 600.02 | 95 | 90.00 | 5.26 |
| j609 2.json | 1 | 0 | Optimal | 173.20 | 82 | 82.00 | 0.00 |
| j609 3.json | 1 | 0 | Solution | 600.01 | 101 | 93.00 | 7.92 |
| j609 4.json | 1 | 0 | Optimal | 19.41 | 87 | 87.00 | 0.00 |

Table 9.3: Results for RCPSP J60 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|-------------|------------|----------------|----------|--------|----------|--------|----------------|
| j609 5.json | 1 | 0 | Solution | 600.01 | 87 | 81.00 | 6.90 |
| j609 6.json | 1 | 0 | Solution | 600.01 | 112 | 104.00 | 7.14 |
| j609 7.json | 1 | 0 | Solution | 600.01 | 111 | 104.00 | 6.31 |
| j609 8.json | 1 | 0 | Solution | 600.03 | 96 | 90.00 | 6.25 |
| j609 9.json | 1 | 0 | Solution | 600.06 | 99 | 98.00 | 1.01 |

9.2.2 CPSat

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6010 1.json | 1 | 0 | Optimal | 0.10 | 85 | 85.00 | 0.00 |
| j6010 10.json | 1 | 0 | Optimal | 0.03 | 73 | 73.00 | 0.00 |
| j6010 2.json | 1 | 0 | Optimal | 0.05 | 62 | 62.00 | 0.00 |
| j6010 3.json | 1 | 0 | Optimal | 0.04 | 72 | 72.00 | 0.00 |
| j6010 4.json | 1 | 0 | Optimal | 0.07 | 80 | 80.00 | 0.00 |
| j6010 5.json | 1 | 0 | Optimal | 0.07 | 79 | 79.00 | 0.00 |
| j6010 6.json | 1 | 0 | Optimal | 0.07 | 67 | 67.00 | 0.00 |
| j6010 7.json | 1 | 0 | Optimal | 0.06 | 69 | 69.00 | 0.00 |
| j6010 8.json | 1 | 0 | Optimal | 0.07 | 65 | 65.00 | 0.00 |
| j6010 9.json | 1 | 0 | Optimal | 0.10 | 73 | 73.00 | 0.00 |
| j6011 1.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j6011 10.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j6011 2.json | 1 | 0 | Optimal | 0.04 | 61 | 61.00 | 0.00 |
| j6011 3.json | 1 | 0 | Optimal | 0.05 | 76 | 76.00 | 0.00 |
| j6011 4.json | 1 | 0 | Optimal | 0.07 | 69 | 69.00 | 0.00 |
| j6011 5.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j6011 6.json | 1 | 0 | Optimal | 0.03 | 70 | 70.00 | 0.00 |
| j6011 7.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6011 8.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6011 9.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j6012 1.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j6012 10.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j6012 2.json | 1 | 0 | Optimal | 0.02 | 58 | 58.00 | 0.00 |
| j6012 3.json | 1 | 0 | Optimal | 0.04 | 75 | 75.00 | 0.00 |
| j6012 4.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6012 5.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j6012 6.json | 1 | 0 | Optimal | 0.02 | 54 | 54.00 | 0.00 |
| j6012 7.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j6012 8.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j6012 9.json | 1 | 0 | Optimal | 0.02 | 59 | 59.00 | 0.00 |
| j6013 1.json | 1 | 0 | Solution | 600.98 | 113 | 104.00 | 7.96 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6013 10.json | 1 | 0 | Solution | 600.25 | 120 | 112.00 | 6.67 |
| j6013 2.json | 1 | 0 | Solution | 600.19 | 107 | 102.00 | 4.67 |
| j6013 3.json | 1 | 0 | Solution | 600.14 | 91 | 83.00 | 8.79 |
| j6013 4.json | 1 | 0 | Solution | 600.21 | 105 | 97.00 | 7.62 |
| j6013 5.json | 1 | 0 | Solution | 600.17 | 99 | 91.00 | 8.08 |
| j6013 6.json | 1 | 0 | Solution | 601.31 | 96 | 91.00 | 5.21 |
| j6013 7.json | 1 | 0 | Solution | 600.15 | 89 | 81.00 | 8.99 |
| j6013 8.json | 1 | 0 | Solution | 600.18 | 122 | 114.00 | 6.56 |
| j6013 9.json | 1 | 0 | Solution | 600.34 | 103 | 95.00 | 7.77 |
| j6014 1.json | 1 | 0 | Optimal | 595.18 | 61 | 61.00 | 0.00 |
| j6014 10.json | 1 | 0 | Optimal | 600.02 | 72 | 72.00 | 0.00 |
| j6014 2.json | 1 | 0 | Optimal | 0.07 | 65 | 65.00 | 0.00 |
| j6014 3.json | 1 | 0 | Optimal | 600.01 | 61 | 61.00 | 0.00 |
| j6014 4.json | 1 | 0 | Optimal | 19.55 | 65 | 65.00 | 0.00 |
| j6014 5.json | 1 | 0 | Optimal | 0.04 | 59 | 59.00 | 0.00 |
| j6014 6.json | 1 | 0 | Optimal | 0.06 | 65 | 65.00 | 0.00 |
| j6014 7.json | 1 | 0 | Optimal | 0.06 | 69 | 69.00 | 0.00 |
| j6014 8.json | 1 | 0 | Optimal | 0.04 | 88 | 88.00 | 0.00 |
| j6014 9.json | 1 | 0 | Optimal | 0.04 | 61 | 61.00 | 0.00 |
| j6015 1.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j6015 10.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j6015 2.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j6015 3.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j6015 4.json | 1 | 0 | Optimal | 0.05 | 75 | 75.00 | 0.00 |
| j6015 5.json | 1 | 0 | Optimal | 0.03 | 70 | 70.00 | 0.00 |
| j6015 6.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6015 7.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6015 8.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j6015 9.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6016 1.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6016 10.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j6016 2.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j6016 3.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j6016 4.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j6016 5.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6016 6.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6016 7.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j6016 8.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j6016 9.json | 1 | 0 | Optimal | 0.03 | 54 | 54.00 | 0.00 |
| j6017 1.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j6017 10.json | 1 | 0 | Optimal | 0.04 | 72 | 72.00 | 0.00 |
| j6017 2.json | 1 | 0 | Optimal | 0.06 | 69 | 69.00 | 0.00 |
| j6017 3.json | 1 | 0 | Optimal | 0.07 | 89 | 89.00 | 0.00 |
| j6017 4.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j6017 5.json | 1 | 0 | Optimal | 0.06 | 59 | 59.00 | 0.00 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|--------|----------------|
| j6017 6.json | 1 | 0 | Optimal | 0.06 | 69 | 69.00 | 0.00 |
| j6017 7.json | 1 | 0 | Optimal | 0.06 | 83 | 83.00 | 0.00 |
| j6017 8.json | 1 | 0 | Optimal | 0.09 | 85 | 85.00 | 0.00 |
| j6017 9.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j6018 1.json | 1 | 0 | Optimal | 0.05 | 81 | 81.00 | 0.00 |
| j6018 10.json | 1 | 0 | Optimal | 0.04 | 97 | 97.00 | 0.00 |
| j6018 2.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6018 3.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6018 4.json | 1 | 0 | Optimal | 0.06 | 71 | 71.00 | 0.00 |
| j6018 5.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j6018 6.json | 1 | 0 | Optimal | 0.04 | 61 | 61.00 | 0.00 |
| j6018 7.json | 1 | 0 | Optimal | 0.03 | 93 | 93.00 | 0.00 |
| j6018 8.json | 1 | 0 | Optimal | 0.04 | 78 | 78.00 | 0.00 |
| j6018 9.json | 1 | 0 | Optimal | 0.04 | 69 | 69.00 | 0.00 |
| j6019 1.json | 1 | 0 | Optimal | 0.04 | 62 | 62.00 | 0.00 |
| j6019 10.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j6019 2.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6019 3.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j6019 4.json | 1 | 0 | Optimal | 0.03 | 67 | 67.00 | 0.00 |
| j6019 5.json | 1 | 0 | Optimal | 0.03 | 73 | 73.00 | 0.00 |
| j6019 6.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6019 7.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j6019 8.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j6019 9.json | 1 | 0 | Optimal | 0.06 | 69 | 69.00 | 0.00 |
| j601 1.json | 1 | 0 | Optimal | 0.06 | 77 | 77.00 | 0.00 |
| j601 10.json | 1 | 0 | Optimal | 0.04 | 80 | 80.00 | 0.00 |
| j601 2.json | 1 | 0 | Optimal | 0.04 | 68 | 68.00 | 0.00 |
| j601 3.json | 1 | 0 | Optimal | 0.07 | 68 | 68.00 | 0.00 |
| j601 4.json | 1 | 0 | Optimal | 0.04 | 91 | 91.00 | 0.00 |
| j601 5.json | 1 | 0 | Optimal | 0.12 | 73 | 73.00 | 0.00 |
| j601 6.json | 1 | 0 | Optimal | 0.11 | 66 | 66.00 | 0.00 |
| j601 7.json | 1 | 0 | Optimal | 0.11 | 72 | 72.00 | 0.00 |
| j601 8.json | 1 | 0 | Optimal | 0.07 | 75 | 75.00 | 0.00 |
| j601 9.json | 1 | 0 | Optimal | 0.11 | 85 | 85.00 | 0.00 |
| j6020 1.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j6020 10.json | 1 | 0 | Optimal | 0.03 | 70 | 70.00 | 0.00 |
| j6020 2.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j6020 3.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6020 4.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j6020 5.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j6020 6.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j6020 7.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j6020 8.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j6020 9.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j6021 1.json | 1 | 0 | Optimal | 1.09 | 103 | 103.00 | 0.00 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6021 10.json | 1 | 0 | Optimal | 0.47 | 80 | 80.00 | 0.00 |
| j6021 2.json | 1 | 0 | Optimal | 0.32 | 108 | 108.00 | 0.00 |
| j6021 3.json | 1 | 0 | Optimal | 0.82 | 87 | 87.00 | 0.00 |
| j6021 4.json | 1 | 0 | Optimal | 2.42 | 95 | 95.00 | 0.00 |
| j6021 5.json | 1 | 0 | Optimal | 2.05 | 89 | 89.00 | 0.00 |
| j6021 6.json | 1 | 0 | Optimal | 1.23 | 84 | 84.00 | 0.00 |
| j6021 7.json | 1 | 0 | Optimal | 0.58 | 103 | 103.00 | 0.00 |
| j6021 8.json | 1 | 0 | Optimal | 1.48 | 110 | 110.00 | 0.00 |
| j6021 9.json | 1 | 0 | Optimal | 31.08 | 89 | 89.00 | 0.00 |
| j6022 1.json | 1 | 0 | Optimal | 0.05 | 64 | 64.00 | 0.00 |
| j6022 10.json | 1 | 0 | Optimal | 0.06 | 70 | 70.00 | 0.00 |
| j6022 2.json | 1 | 0 | Optimal | 0.09 | 83 | 83.00 | 0.00 |
| j6022 3.json | 1 | 0 | Optimal | 0.10 | 70 | 70.00 | 0.00 |
| j6022 4.json | 1 | 0 | Optimal | 0.10 | 73 | 73.00 | 0.00 |
| j6022 5.json | 1 | 0 | Optimal | 0.06 | 76 | 76.00 | 0.00 |
| j6022 6.json | 1 | 0 | Optimal | 0.04 | 79 | 79.00 | 0.00 |
| j6022 7.json | 1 | 0 | Optimal | 0.06 | 69 | 69.00 | 0.00 |
| j6022 8.json | 1 | 0 | Optimal | 0.06 | 59 | 59.00 | 0.00 |
| j6022 9.json | 1 | 0 | Optimal | 0.06 | 65 | 65.00 | 0.00 |
| j6023 1.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j6023 10.json | 1 | 0 | Optimal | 0.05 | 68 | 68.00 | 0.00 |
| j6023 2.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6023 3.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j6023 4.json | 1 | 0 | Optimal | 0.04 | 83 | 83.00 | 0.00 |
| j6023 5.json | 1 | 0 | Optimal | 0.04 | 72 | 72.00 | 0.00 |
| j6023 6.json | 1 | 0 | Optimal | 0.04 | 81 | 81.00 | 0.00 |
| j6023 7.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j6023 8.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6023 9.json | 1 | 0 | Optimal | 0.04 | 64 | 64.00 | 0.00 |
| j6024 1.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6024 10.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6024 2.json | 1 | 0 | Optimal | 0.03 | 55 | 55.00 | 0.00 |
| j6024 3.json | 1 | 0 | Optimal | 0.03 | 67 | 67.00 | 0.00 |
| j6024 4.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6024 5.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j6024 6.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6024 7.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j6024 8.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6024 9.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j6025 1.json | 1 | 0 | Optimal | 600.03 | 114 | 114.00 | 0.00 |
| j6025 10.json | 1 | 0 | Optimal | 586.36 | 108 | 108.00 | 0.00 |
| j6025 2.json | 1 | 0 | Solution | 601.75 | 99 | 91.00 | 8.08 |
| j6025 3.json | 1 | 0 | Optimal | 67.98 | 113 | 113.00 | 0.00 |
| j6025 4.json | 1 | 0 | Solution | 600.30 | 108 | 100.00 | 7.41 |
| j6025 5.json | 1 | 0 | Optimal | 600.02 | 98 | 98.00 | 0.00 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6025 6.json | 1 | 0 | Solution | 600.18 | 113 | 102.00 | 9.73 |
| j6025 7.json | 1 | 0 | Solution | 601.43 | 90 | 84.00 | 6.67 |
| j6025 8.json | 1 | 0 | Solution | 601.73 | 99 | 92.00 | 7.07 |
| j6025 9.json | 1 | 0 | Optimal | 160.54 | 99 | 99.00 | 0.00 |
| j6026 1.json | 1 | 0 | Optimal | 0.08 | 80 | 80.00 | 0.00 |
| j6026 10.json | 1 | 0 | Optimal | 0.06 | 85 | 85.00 | 0.00 |
| j6026 2.json | 1 | 0 | Optimal | 0.10 | 66 | 66.00 | 0.00 |
| j6026 3.json | 1 | 0 | Optimal | 0.34 | 76 | 76.00 | 0.00 |
| j6026 4.json | 1 | 0 | Optimal | 1.99 | 67 | 67.00 | 0.00 |
| j6026 5.json | 1 | 0 | Optimal | 0.07 | 61 | 61.00 | 0.00 |
| j6026 6.json | 1 | 0 | Optimal | 0.09 | 74 | 74.00 | 0.00 |
| j6026 7.json | 1 | 0 | Optimal | 0.07 | 72 | 72.00 | 0.00 |
| j6026 8.json | 1 | 0 | Optimal | 0.07 | 89 | 89.00 | 0.00 |
| j6026 9.json | 1 | 0 | Optimal | 0.29 | 65 | 65.00 | 0.00 |
| j6027 1.json | 1 | 0 | Optimal | 0.03 | 96 | 96.00 | 0.00 |
| j6027 10.json | 1 | 0 | Optimal | 0.03 | 57 | 57.00 | 0.00 |
| j6027 2.json | 1 | 0 | Optimal | 0.04 | 74 | 74.00 | 0.00 |
| j6027 3.json | 1 | 0 | Optimal | 0.07 | 76 | 76.00 | 0.00 |
| j6027 4.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j6027 5.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j6027 6.json | 1 | 0 | Optimal | 0.04 | 64 | 64.00 | 0.00 |
| j6027 7.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6027 8.json | 1 | 0 | Optimal | 0.04 | 88 | 88.00 | 0.00 |
| j6027 9.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j6028 1.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j6028 10.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6028 2.json | 1 | 0 | Optimal | 0.03 | 64 | 64.00 | 0.00 |
| j6028 3.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6028 4.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j6028 5.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6028 6.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j6028 7.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j6028 8.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j6028 9.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6029 1.json | 1 | 0 | Solution | 601.51 | 106 | 96.00 | 9.43 |
| j6029 10.json | 1 | 0 | Solution | 600.22 | 121 | 110.00 | 9.09 |
| j6029 2.json | 1 | 0 | Solution | 600.18 | 135 | 116.00 | 14.07 |
| j6029 3.json | 1 | 0 | Solution | 600.48 | 122 | 113.00 | 7.38 |
| j6029 4.json | 1 | 0 | Solution | 601.36 | 137 | 120.00 | 12.41 |
| j6029 5.json | 1 | 0 | Solution | 600.19 | 111 | 100.00 | 9.91 |
| j6029 6.json | 1 | 0 | Solution | 601.84 | 156 | 143.00 | 8.33 |
| j6029 7.json | 1 | 0 | Solution | 601.58 | 124 | 113.00 | 8.87 |
| j6029 8.json | 1 | 0 | Solution | 600.20 | 104 | 95.00 | 8.65 |
| j6029 9.json | 1 | 0 | Solution | 600.18 | 113 | 100.00 | 11.50 |
| j602 1.json | 1 | 0 | Optimal | 0.04 | 65 | 65.00 | 0.00 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j602 10.json | 1 | 0 | Optimal | 0.04 | 69 | 69.00 | 0.00 |
| j602 2.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |
| j602 3.json | 1 | 0 | Optimal | 0.04 | 78 | 78.00 | 0.00 |
| j602 4.json | 1 | 0 | Optimal | 0.06 | 78 | 78.00 | 0.00 |
| j602 5.json | 1 | 0 | Optimal | 0.04 | 54 | 54.00 | 0.00 |
| j602 6.json | 1 | 0 | Optimal | 0.04 | 64 | 64.00 | 0.00 |
| j602 7.json | 1 | 0 | Optimal | 0.03 | 53 | 53.00 | 0.00 |
| j602 8.json | 1 | 0 | Optimal | 0.06 | 66 | 66.00 | 0.00 |
| j602 9.json | 1 | 0 | Optimal | 0.04 | 65 | 65.00 | 0.00 |
| j6030 1.json | 1 | 0 | Optimal | 0.07 | 70 | 70.00 | 0.00 |
| j6030 10.json | 1 | 0 | Optimal | 600.01 | 86 | 86.00 | 0.00 |
| j6030 2.json | 1 | 0 | Solution | 600.28 | 70 | 68.00 | 2.86 |
| j6030 3.json | 1 | 0 | Optimal | 0.08 | 82 | 82.00 | 0.00 |
| j6030 4.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6030 5.json | 1 | 0 | Optimal | 600.02 | 76 | 76.00 | 0.00 |
| j6030 6.json | 1 | 0 | Optimal | 0.07 | 68 | 68.00 | 0.00 |
| j6030 7.json | 1 | 0 | Optimal | 600.03 | 86 | 86.00 | 0.00 |
| j6030 8.json | 1 | 0 | Optimal | 0.05 | 63 | 63.00 | 0.00 |
| j6030 9.json | 1 | 0 | Optimal | 0.09 | 98 | 98.00 | 0.00 |
| j6031 1.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j6031 10.json | 1 | 0 | Optimal | 0.03 | 56 | 56.00 | 0.00 |
| j6031 2.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6031 3.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6031 4.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6031 5.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j6031 6.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j6031 7.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j6031 8.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j6031 9.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j6032 1.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6032 10.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j6032 2.json | 1 | 0 | Optimal | 0.02 | 114 | 114.00 | 0.00 |
| j6032 3.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j6032 4.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j6032 5.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j6032 6.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j6032 7.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6032 8.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j6032 9.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6033 1.json | 1 | 0 | Optimal | 0.06 | 105 | 105.00 | 0.00 |
| j6033 10.json | 1 | 0 | Optimal | 0.07 | 84 | 84.00 | 0.00 |
| j6033 2.json | 1 | 0 | Optimal | 0.04 | 100 | 100.00 | 0.00 |
| j6033 3.json | 1 | 0 | Optimal | 0.04 | 79 | 79.00 | 0.00 |
| j6033 4.json | 1 | 0 | Optimal | 0.07 | 81 | 81.00 | 0.00 |
| j6033 5.json | 1 | 0 | Optimal | 0.04 | 108 | 108.00 | 0.00 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|-------|----------|--------|----------------|
| j6033 6.json | 1 | 0 | Optimal | 0.07 | 75 | 75.00 | 0.00 |
| j6033 7.json | 1 | 0 | Optimal | 0.12 | 78 | 78.00 | 0.00 |
| j6033 8.json | 1 | 0 | Optimal | 0.11 | 79 | 79.00 | 0.00 |
| j6033 9.json | 1 | 0 | Optimal | 0.06 | 108 | 108.00 | 0.00 |
| j6034 1.json | 1 | 0 | Optimal | 0.04 | 72 | 72.00 | 0.00 |
| j6034 10.json | 1 | 0 | Optimal | 0.04 | 92 | 92.00 | 0.00 |
| j6034 2.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j6034 3.json | 1 | 0 | Optimal | 0.06 | 61 | 61.00 | 0.00 |
| j6034 4.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j6034 5.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j6034 6.json | 1 | 0 | Optimal | 0.04 | 81 | 81.00 | 0.00 |
| j6034 7.json | 1 | 0 | Optimal | 0.04 | 85 | 85.00 | 0.00 |
| j6034 8.json | 1 | 0 | Optimal | 0.04 | 63 | 63.00 | 0.00 |
| j6034 9.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j6035 1.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j6035 10.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j6035 2.json | 1 | 0 | Optimal | 0.04 | 77 | 77.00 | 0.00 |
| j6035 3.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j6035 4.json | 1 | 0 | Optimal | 0.04 | 72 | 72.00 | 0.00 |
| j6035 5.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j6035 6.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j6035 7.json | 1 | 0 | Optimal | 0.03 | 73 | 73.00 | 0.00 |
| j6035 8.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j6035 9.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j6036 1.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j6036 10.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j6036 2.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j6036 3.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6036 4.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j6036 5.json | 1 | 0 | Optimal | 0.02 | 57 | 57.00 | 0.00 |
| j6036 6.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j6036 7.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j6036 8.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j6036 9.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j6037 1.json | 1 | 0 | Optimal | 1.70 | 97 | 97.00 | 0.00 |
| j6037 10.json | 1 | 0 | Optimal | 0.28 | 96 | 96.00 | 0.00 |
| j6037 2.json | 1 | 0 | Optimal | 37.52 | 95 | 95.00 | 0.00 |
| j6037 3.json | 1 | 0 | Optimal | 1.52 | 139 | 139.00 | 0.00 |
| j6037 4.json | 1 | 0 | Optimal | 0.34 | 101 | 101.00 | 0.00 |
| j6037 5.json | 1 | 0 | Optimal | 1.40 | 98 | 98.00 | 0.00 |
| j6037 6.json | 1 | 0 | Optimal | 18.04 | 102 | 102.00 | 0.00 |
| j6037 7.json | 1 | 0 | Optimal | 5.39 | 110 | 110.00 | 0.00 |
| j6037 8.json | 1 | 0 | Optimal | 0.23 | 93 | 93.00 | 0.00 |
| j6037 9.json | 1 | 0 | Optimal | 0.60 | 96 | 96.00 | 0.00 |
| j6038 1.json | 1 | 0 | Optimal | 0.06 | 73 | 73.00 | 0.00 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6038 10.json | 1 | 0 | Optimal | 0.06 | 66 | 66.00 | 0.00 |
| j6038 2.json | 1 | 0 | Optimal | 0.98 | 76 | 76.00 | 0.00 |
| j6038 3.json | 1 | 0 | Optimal | 0.06 | 77 | 77.00 | 0.00 |
| j6038 4.json | 1 | 0 | Optimal | 0.09 | 58 | 58.00 | 0.00 |
| j6038 5.json | 1 | 0 | Optimal | 0.06 | 103 | 103.00 | 0.00 |
| j6038 6.json | 1 | 0 | Optimal | 0.06 | 86 | 86.00 | 0.00 |
| j6038 7.json | 1 | 0 | Optimal | 0.06 | 74 | 74.00 | 0.00 |
| j6038 8.json | 1 | 0 | Optimal | 0.09 | 71 | 71.00 | 0.00 |
| j6038 9.json | 1 | 0 | Optimal | 0.09 | 66 | 66.00 | 0.00 |
| j6039 1.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j6039 10.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j6039 2.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j6039 3.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j6039 4.json | 1 | 0 | Optimal | 0.04 | 92 | 92.00 | 0.00 |
| j6039 5.json | 1 | 0 | Optimal | 0.03 | 73 | 73.00 | 0.00 |
| j6039 6.json | 1 | 0 | Optimal | 0.04 | 84 | 84.00 | 0.00 |
| j6039 7.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j6039 8.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j6039 9.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j603 1.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j603 10.json | 1 | 0 | Optimal | 0.04 | 69 | 69.00 | 0.00 |
| j603 2.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j603 3.json | 1 | 0 | Optimal | 0.03 | 105 | 105.00 | 0.00 |
| j603 4.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j603 5.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j603 6.json | 1 | 0 | Optimal | 0.05 | 57 | 57.00 | 0.00 |
| j603 7.json | 1 | 0 | Optimal | 0.03 | 59 | 59.00 | 0.00 |
| j603 8.json | 1 | 0 | Optimal | 0.04 | 55 | 55.00 | 0.00 |
| j603 9.json | 1 | 0 | Optimal | 0.03 | 67 | 67.00 | 0.00 |
| j6040 1.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j6040 10.json | 1 | 0 | Optimal | 0.03 | 73 | 73.00 | 0.00 |
| j6040 2.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6040 3.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6040 4.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j6040 5.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j6040 6.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6040 7.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j6040 8.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j6040 9.json | 1 | 0 | Optimal | 0.02 | 90 | 90.00 | 0.00 |
| j6041 1.json | 1 | 0 | Optimal | 29.14 | 122 | 122.00 | 0.00 |
| j6041 10.json | 1 | 0 | Solution | 600.16 | 111 | 105.00 | 5.41 |
| j6041 2.json | 1 | 0 | Optimal | 93.30 | 113 | 113.00 | 0.00 |
| j6041 3.json | 1 | 0 | Solution | 600.16 | 98 | 87.00 | 11.22 |
| j6041 4.json | 1 | 0 | Optimal | 5.70 | 133 | 133.00 | 0.00 |
| j6041 5.json | 1 | 0 | Solution | 600.16 | 117 | 105.00 | 10.26 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|--------|----------|--------|----------------|
| j6041 6.json | 1 | 0 | Optimal | 34.86 | 134 | 134.00 | 0.00 |
| j6041 7.json | 1 | 0 | Optimal | 28.37 | 132 | 132.00 | 0.00 |
| j6041 8.json | 1 | 0 | Optimal | 26.60 | 135 | 135.00 | 0.00 |
| j6041 9.json | 1 | 0 | Optimal | 50.88 | 131 | 131.00 | 0.00 |
| j6042 1.json | 1 | 0 | Optimal | 0.05 | 83 | 83.00 | 0.00 |
| j6042 10.json | 1 | 0 | Optimal | 0.09 | 87 | 87.00 | 0.00 |
| j6042 2.json | 1 | 0 | Optimal | 0.07 | 68 | 68.00 | 0.00 |
| j6042 3.json | 1 | 0 | Optimal | 3.54 | 78 | 78.00 | 0.00 |
| j6042 4.json | 1 | 0 | Optimal | 0.11 | 103 | 103.00 | 0.00 |
| j6042 5.json | 1 | 0 | Optimal | 0.06 | 73 | 73.00 | 0.00 |
| j6042 6.json | 1 | 0 | Optimal | 0.10 | 82 | 82.00 | 0.00 |
| j6042 7.json | 1 | 0 | Optimal | 0.41 | 59 | 59.00 | 0.00 |
| j6042 8.json | 1 | 0 | Optimal | 0.14 | 82 | 82.00 | 0.00 |
| j6042 9.json | 1 | 0 | Optimal | 0.07 | 71 | 71.00 | 0.00 |
| j6043 1.json | 1 | 0 | Optimal | 0.08 | 108 | 108.00 | 0.00 |
| j6043 10.json | 1 | 0 | Optimal | 0.04 | 78 | 78.00 | 0.00 |
| j6043 2.json | 1 | 0 | Optimal | 0.08 | 85 | 85.00 | 0.00 |
| j6043 3.json | 1 | 0 | Optimal | 0.04 | 74 | 74.00 | 0.00 |
| j6043 4.json | 1 | 0 | Optimal | 0.04 | 75 | 75.00 | 0.00 |
| j6043 5.json | 1 | 0 | Optimal | 0.05 | 64 | 64.00 | 0.00 |
| j6043 6.json | 1 | 0 | Optimal | 0.04 | 84 | 84.00 | 0.00 |
| j6043 7.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j6043 8.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j6043 9.json | 1 | 0 | Optimal | 0.03 | 70 | 70.00 | 0.00 |
| j6044 1.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j6044 10.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6044 2.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j6044 3.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j6044 4.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j6044 5.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j6044 6.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j6044 7.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j6044 8.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j6044 9.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j6045 1.json | 1 | 0 | Solution | 600.17 | 97 | 87.00 | 10.31 |
| j6045 10.json | 1 | 0 | Solution | 600.23 | 114 | 99.00 | 13.16 |
| j6045 2.json | 1 | 0 | Solution | 601.26 | 145 | 126.00 | 13.10 |
| j6045 3.json | 1 | 0 | Solution | 600.33 | 147 | 129.00 | 12.24 |
| j6045 4.json | 1 | 0 | Solution | 600.19 | 108 | 97.00 | 10.19 |
| j6045 5.json | 1 | 0 | Solution | 601.71 | 108 | 98.00 | 9.26 |
| j6045 6.json | 1 | 0 | Solution | 601.08 | 147 | 125.00 | 14.97 |
| j6045 7.json | 1 | 0 | Solution | 600.28 | 122 | 109.00 | 10.66 |
| j6045 8.json | 1 | 0 | Solution | 600.26 | 129 | 114.00 | 11.63 |
| j6045 9.json | 1 | 0 | Solution | 600.27 | 124 | 108.00 | 12.90 |
| j6046 1.json | 1 | 0 | Optimal | 0.10 | 79 | 79.00 | 0.00 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|--------|----------|--------|----------------|
| j6046 10.json | 1 | 0 | Optimal | 142.88 | 88 | 88.00 | 0.00 |
| j6046 2.json | 1 | 0 | Optimal | 0.04 | 78 | 78.00 | 0.00 |
| j6046 3.json | 1 | 0 | Optimal | 0.78 | 79 | 79.00 | 0.00 |
| j6046 4.json | 1 | 0 | Optimal | 11.37 | 74 | 74.00 | 0.00 |
| j6046 5.json | 1 | 0 | Optimal | 8.15 | 91 | 91.00 | 0.00 |
| j6046 6.json | 1 | 0 | Optimal | 14.21 | 90 | 90.00 | 0.00 |
| j6046 7.json | 1 | 0 | Optimal | 119.87 | 78 | 78.00 | 0.00 |
| j6046 8.json | 1 | 0 | Optimal | 0.64 | 75 | 75.00 | 0.00 |
| j6046 9.json | 1 | 0 | Optimal | 600.02 | 69 | 69.00 | 0.00 |
| j6047 1.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j6047 10.json | 1 | 0 | Optimal | 0.04 | 66 | 66.00 | 0.00 |
| j6047 2.json | 1 | 0 | Optimal | 0.04 | 66 | 66.00 | 0.00 |
| j6047 3.json | 1 | 0 | Optimal | 0.05 | 69 | 69.00 | 0.00 |
| j6047 4.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j6047 5.json | 1 | 0 | Optimal | 0.06 | 87 | 87.00 | 0.00 |
| j6047 6.json | 1 | 0 | Optimal | 0.06 | 76 | 76.00 | 0.00 |
| j6047 7.json | 1 | 0 | Optimal | 0.04 | 68 | 68.00 | 0.00 |
| j6047 8.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j6047 9.json | 1 | 0 | Optimal | 0.05 | 76 | 76.00 | 0.00 |
| j6048 1.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j6048 10.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j6048 2.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j6048 3.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j6048 4.json | 1 | 0 | Optimal | 0.03 | 62 | 62.00 | 0.00 |
| j6048 5.json | 1 | 0 | Optimal | 0.03 | 101 | 101.00 | 0.00 |
| j6048 6.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j6048 7.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j6048 8.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j6048 9.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j604 1.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j604 10.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j604 2.json | 1 | 0 | Optimal | 0.03 | 60 | 60.00 | 0.00 |
| j604 3.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j604 4.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j604 5.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j604 6.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j604 7.json | 1 | 0 | Optimal | 0.03 | 67 | 67.00 | 0.00 |
| j604 8.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j604 9.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j605 1.json | 1 | 0 | Optimal | 46.92 | 76 | 76.00 | 0.00 |
| j605 10.json | 1 | 0 | Optimal | 600.03 | 81 | 81.00 | 0.00 |
| j605 2.json | 1 | 0 | Optimal | 18.55 | 106 | 106.00 | 0.00 |
| j605 3.json | 1 | 0 | Optimal | 4.17 | 80 | 80.00 | 0.00 |
| j605 4.json | 1 | 0 | Optimal | 49.00 | 72 | 72.00 | 0.00 |
| j605 5.json | 1 | 0 | Optimal | 2.75 | 108 | 108.00 | 0.00 |

Table 9.4: Results for RCPSP J60 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------|------------|----------------|----------|--------|----------|--------|----------------|
| j605 6.json | 1 | 0 | Optimal | 0.33 | 74 | 74.00 | 0.00 |
| j605 7.json | 1 | 0 | Optimal | 22.18 | 75 | 75.00 | 0.00 |
| j605 8.json | 1 | 0 | Optimal | 0.38 | 78 | 78.00 | 0.00 |
| j605 9.json | 1 | 0 | Optimal | 0.18 | 83 | 83.00 | 0.00 |
| j606 1.json | 1 | 0 | Optimal | 0.09 | 60 | 60.00 | 0.00 |
| j606 10.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j606 2.json | 1 | 0 | Optimal | 0.06 | 67 | 67.00 | 0.00 |
| j606 3.json | 1 | 0 | Optimal | 0.09 | 72 | 72.00 | 0.00 |
| j606 4.json | 1 | 0 | Optimal | 0.04 | 67 | 67.00 | 0.00 |
| j606 5.json | 1 | 0 | Optimal | 0.06 | 78 | 78.00 | 0.00 |
| j606 6.json | 1 | 0 | Optimal | 0.10 | 55 | 55.00 | 0.00 |
| j606 7.json | 1 | 0 | Optimal | 0.07 | 61 | 61.00 | 0.00 |
| j606 8.json | 1 | 0 | Optimal | 0.06 | 72 | 72.00 | 0.00 |
| j606 9.json | 1 | 0 | Optimal | 0.03 | 64 | 64.00 | 0.00 |
| j607 1.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j607 10.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |
| j607 2.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j607 3.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j607 4.json | 1 | 0 | Optimal | 0.04 | 63 | 63.00 | 0.00 |
| j607 5.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j607 6.json | 1 | 0 | Optimal | 0.04 | 65 | 65.00 | 0.00 |
| j607 7.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j607 8.json | 1 | 0 | Optimal | 0.04 | 66 | 66.00 | 0.00 |
| j607 9.json | 1 | 0 | Optimal | 0.04 | 44 | 44.00 | 0.00 |
| j608 1.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j608 10.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j608 2.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j608 3.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j608 4.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j608 5.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j608 6.json | 1 | 0 | Optimal | 0.02 | 56 | 56.00 | 0.00 |
| j608 7.json | 1 | 0 | Optimal | 0.02 | 62 | 62.00 | 0.00 |
| j608 8.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j608 9.json | 1 | 0 | Optimal | 0.03 | 58 | 58.00 | 0.00 |
| j609 1.json | 1 | 0 | Solution | 600.21 | 87 | 84.00 | 3.45 |
| j609 10.json | 1 | 0 | Solution | 600.23 | 95 | 86.00 | 9.47 |
| j609 2.json | 1 | 0 | Optimal | 130.11 | 82 | 82.00 | 0.00 |
| j609 3.json | 1 | 0 | Optimal | 600.03 | 100 | 100.00 | 0.00 |
| j609 4.json | 1 | 0 | Optimal | 554.99 | 87 | 87.00 | 0.00 |
| j609 5.json | 1 | 0 | Solution | 600.19 | 86 | 80.00 | 6.98 |
| j609 6.json | 1 | 0 | Solution | 600.17 | 112 | 100.00 | 10.71 |
| j609 7.json | 1 | 0 | Solution | 600.26 | 111 | 103.00 | 7.21 |
| j609 8.json | 1 | 0 | Solution | 600.19 | 96 | 90.00 | 6.25 |
| j609 9.json | 1 | 0 | Optimal | 600.09 | 99 | 99.00 | 0.00 |

9.3 Size J90

9.3.1 CPO

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9010 1.json | 1 | 0 | Optimal | 0.13 | 77 | 77.00 | 0.00 |
| j9010 10.json | 1 | 0 | Optimal | 0.07 | 75 | 75.00 | 0.00 |
| j9010 2.json | 1 | 0 | Optimal | 0.04 | 95 | 95.00 | 0.00 |
| j9010 3.json | 1 | 0 | Optimal | 0.03 | 112 | 112.00 | 0.00 |
| j9010 4.json | 1 | 0 | Optimal | 0.03 | 94 | 94.00 | 0.00 |
| j9010 5.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j9010 6.json | 1 | 0 | Optimal | 0.04 | 92 | 92.00 | 0.00 |
| j9010 7.json | 1 | 0 | Optimal | 0.04 | 83 | 83.00 | 0.00 |
| j9010 8.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j9010 9.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j9011 1.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9011 10.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j9011 2.json | 1 | 0 | Optimal | 0.04 | 99 | 99.00 | 0.00 |
| j9011 3.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j9011 4.json | 1 | 0 | Optimal | 0.02 | 64 | 64.00 | 0.00 |
| j9011 5.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j9011 6.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j9011 7.json | 1 | 0 | Optimal | 0.04 | 95 | 95.00 | 0.00 |
| j9011 8.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |
| j9011 9.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j9012 1.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j9012 10.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9012 2.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j9012 3.json | 1 | 0 | Optimal | 0.03 | 93 | 93.00 | 0.00 |
| j9012 4.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j9012 5.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j9012 6.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j9012 7.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j9012 8.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j9012 9.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j9013 1.json | 1 | 0 | Solution | 30.01 | 143 | 128.00 | 10.49 |
| j9013 10.json | 1 | 0 | Solution | 30.02 | 123 | 113.00 | 8.13 |
| j9013 2.json | 1 | 0 | Solution | 30.02 | 132 | 119.00 | 9.85 |
| j9013 3.json | 1 | 0 | Solution | 30.02 | 110 | 104.00 | 5.45 |
| j9013 4.json | 1 | 0 | Solution | 30.02 | 115 | 109.00 | 5.22 |
| j9013 5.json | 1 | 0 | Solution | 30.01 | 117 | 108.00 | 7.69 |
| j9013 6.json | 1 | 0 | Solution | 30.01 | 127 | 117.00 | 7.87 |
| j9013 7.json | 1 | 0 | Solution | 30.02 | 127 | 116.00 | 8.66 |
| j9013 8.json | 1 | 0 | Solution | 30.01 | 120 | 113.00 | 5.83 |
| j9013 9.json | 1 | 0 | Solution | 30.02 | 127 | 117.00 | 7.87 |
| j9014 1.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|--------|----------------|
| j9014 10.json | 1 | 0 | Optimal | 0.04 | 85 | 85.00 | 0.00 |
| j9014 2.json | 1 | 0 | Optimal | 0.04 | 79 | 79.00 | 0.00 |
| j9014 3.json | 1 | 0 | Optimal | 0.03 | 94 | 94.00 | 0.00 |
| j9014 4.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j9014 5.json | 1 | 0 | Optimal | 0.04 | 84 | 84.00 | 0.00 |
| j9014 6.json | 1 | 0 | Optimal | 3.56 | 76 | 76.00 | 0.00 |
| j9014 7.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9014 8.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j9014 9.json | 1 | 0 | Optimal | 0.03 | 112 | 112.00 | 0.00 |
| j9015 1.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j9015 10.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j9015 2.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j9015 3.json | 1 | 0 | Optimal | 0.03 | 82 | 82.00 | 0.00 |
| j9015 4.json | 1 | 0 | Optimal | 0.04 | 92 | 92.00 | 0.00 |
| j9015 5.json | 1 | 0 | Optimal | 0.04 | 93 | 93.00 | 0.00 |
| j9015 6.json | 1 | 0 | Optimal | 0.03 | 61 | 61.00 | 0.00 |
| j9015 7.json | 1 | 0 | Optimal | 0.03 | 82 | 82.00 | 0.00 |
| j9015 8.json | 1 | 0 | Optimal | 0.03 | 82 | 82.00 | 0.00 |
| j9015 9.json | 1 | 0 | Optimal | 0.04 | 83 | 83.00 | 0.00 |
| j9016 1.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j9016 10.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j9016 2.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j9016 3.json | 1 | 0 | Optimal | 0.03 | 73 | 73.00 | 0.00 |
| j9016 4.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j9016 5.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j9016 6.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j9016 7.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j9016 8.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j9016 9.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j9017 1.json | 1 | 0 | Optimal | 0.28 | 92 | 92.00 | 0.00 |
| j9017 10.json | 1 | 0 | Optimal | 0.47 | 89 | 89.00 | 0.00 |
| j9017 2.json | 1 | 0 | Optimal | 0.54 | 100 | 100.00 | 0.00 |
| j9017 3.json | 1 | 0 | Optimal | 0.06 | 89 | 89.00 | 0.00 |
| j9017 4.json | 1 | 0 | Optimal | 0.04 | 94 | 94.00 | 0.00 |
| j9017 5.json | 1 | 0 | Optimal | 0.02 | 113 | 113.00 | 0.00 |
| j9017 6.json | 1 | 0 | Optimal | 0.05 | 94 | 94.00 | 0.00 |
| j9017 7.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j9017 8.json | 1 | 0 | Optimal | 0.43 | 113 | 113.00 | 0.00 |
| j9017 9.json | 1 | 0 | Optimal | 0.32 | 96 | 96.00 | 0.00 |
| j9018 1.json | 1 | 0 | Optimal | 0.02 | 101 | 101.00 | 0.00 |
| j9018 10.json | 1 | 0 | Optimal | 0.02 | 94 | 94.00 | 0.00 |
| j9018 2.json | 1 | 0 | Optimal | 0.02 | 94 | 94.00 | 0.00 |
| j9018 3.json | 1 | 0 | Optimal | 0.01 | 83 | 83.00 | 0.00 |
| j9018 4.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j9018 5.json | 1 | 0 | Optimal | 0.02 | 90 | 90.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9018 6.json | 1 | 0 | Optimal | 0.01 | 83 | 83.00 | 0.00 |
| j9018 7.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j9018 8.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j9018 9.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j9019 1.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j9019 10.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j9019 2.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j9019 3.json | 1 | 0 | Optimal | 0.01 | 89 | 89.00 | 0.00 |
| j9019 4.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j9019 5.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j9019 6.json | 1 | 0 | Optimal | 0.02 | 136 | 136.00 | 0.00 |
| j9019 7.json | 1 | 0 | Optimal | 0.02 | 66 | 66.00 | 0.00 |
| j9019 8.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j9019 9.json | 1 | 0 | Optimal | 0.03 | 121 | 121.00 | 0.00 |
| j901 1.json | 1 | 0 | Optimal | 0.46 | 73 | 73.00 | 0.00 |
| j901 10.json | 1 | 0 | Optimal | 0.35 | 90 | 90.00 | 0.00 |
| j901 2.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j901 3.json | 1 | 0 | Optimal | 0.58 | 66 | 66.00 | 0.00 |
| j901 4.json | 1 | 0 | Optimal | 0.77 | 86 | 86.00 | 0.00 |
| j901 5.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j901 6.json | 1 | 0 | Optimal | 0.31 | 74 | 74.00 | 0.00 |
| j901 7.json | 1 | 0 | Optimal | 0.09 | 91 | 91.00 | 0.00 |
| j901 8.json | 1 | 0 | Optimal | 0.21 | 95 | 95.00 | 0.00 |
| j901 9.json | 1 | 0 | Optimal | 0.16 | 72 | 72.00 | 0.00 |
| j9020 1.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j9020 10.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j9020 2.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j9020 3.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9020 4.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9020 5.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j9020 6.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j9020 7.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j9020 8.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j9020 9.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j9021 1.json | 1 | 0 | Solution | 30.03 | 114 | 102.00 | 10.53 |
| j9021 10.json | 1 | 0 | Solution | 30.02 | 109 | 105.00 | 3.67 |
| j9021 2.json | 1 | 0 | Solution | 30.00 | 117 | 111.00 | 5.13 |
| j9021 3.json | 1 | 0 | Solution | 30.01 | 125 | 119.00 | 4.80 |
| j9021 4.json | 1 | 0 | Optimal | 8.19 | 106 | 106.00 | 0.00 |
| j9021 5.json | 1 | 0 | Solution | 30.01 | 112 | 104.00 | 7.14 |
| j9021 6.json | 1 | 0 | Solution | 30.02 | 108 | 104.00 | 3.70 |
| j9021 7.json | 1 | 0 | Solution | 30.00 | 112 | 100.00 | 10.71 |
| j9021 8.json | 1 | 0 | Solution | 30.02 | 112 | 101.00 | 9.82 |
| j9021 9.json | 1 | 0 | Solution | 30.00 | 122 | 110.00 | 9.84 |
| j9022 1.json | 1 | 0 | Optimal | 0.03 | 108 | 108.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9022 10.json | 1 | 0 | Optimal | 0.18 | 75 | 75.00 | 0.00 |
| j9022 2.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j9022 3.json | 1 | 0 | Optimal | 0.17 | 83 | 83.00 | 0.00 |
| j9022 4.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j9022 5.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j9022 6.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j9022 7.json | 1 | 0 | Optimal | 0.03 | 90 | 90.00 | 0.00 |
| j9022 8.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j9022 9.json | 1 | 0 | Optimal | 0.03 | 101 | 101.00 | 0.00 |
| j9023 1.json | 1 | 0 | Optimal | 0.03 | 90 | 90.00 | 0.00 |
| j9023 10.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j9023 2.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j9023 3.json | 1 | 0 | Optimal | 0.03 | 116 | 116.00 | 0.00 |
| j9023 4.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j9023 5.json | 1 | 0 | Optimal | 0.02 | 95 | 95.00 | 0.00 |
| j9023 6.json | 1 | 0 | Optimal | 0.04 | 87 | 87.00 | 0.00 |
| j9023 7.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j9023 8.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j9023 9.json | 1 | 0 | Optimal | 0.03 | 126 | 126.00 | 0.00 |
| j9024 1.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j9024 10.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j9024 2.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j9024 3.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j9024 4.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j9024 5.json | 1 | 0 | Optimal | 0.04 | 85 | 85.00 | 0.00 |
| j9024 6.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j9024 7.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j9024 8.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j9024 9.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j9025 1.json | 1 | 0 | Solution | 30.01 | 131 | 116.00 | 11.45 |
| j9025 10.json | 1 | 0 | Solution | 30.01 | 135 | 119.00 | 11.85 |
| j9025 2.json | 1 | 0 | Solution | 30.01 | 134 | 122.00 | 8.96 |
| j9025 3.json | 1 | 0 | Solution | 30.01 | 128 | 111.00 | 13.28 |
| j9025 4.json | 1 | 0 | Solution | 30.01 | 140 | 128.00 | 8.57 |
| j9025 5.json | 1 | 0 | Solution | 30.01 | 119 | 109.00 | 8.40 |
| j9025 6.json | 1 | 0 | Solution | 30.01 | 124 | 113.00 | 8.87 |
| j9025 7.json | 1 | 0 | Solution | 30.01 | 133 | 122.00 | 8.27 |
| j9025 8.json | 1 | 0 | Solution | 30.01 | 143 | 130.00 | 9.09 |
| j9025 9.json | 1 | 0 | Solution | 30.01 | 109 | 97.00 | 11.01 |
| j9026 1.json | 1 | 0 | Optimal | 0.02 | 90 | 90.00 | 0.00 |
| j9026 10.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j9026 2.json | 1 | 0 | Optimal | 0.50 | 85 | 85.00 | 0.00 |
| j9026 3.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j9026 4.json | 1 | 0 | Solution | 30.01 | 98 | 96.00 | 2.04 |
| j9026 5.json | 1 | 0 | Solution | 30.01 | 86 | 84.00 | 2.33 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9026 6.json | 1 | 0 | Optimal | 0.03 | 108 | 108.00 | 0.00 |
| j9026 7.json | 1 | 0 | Optimal | 1.82 | 82 | 82.00 | 0.00 |
| j9026 8.json | 1 | 0 | Solution | 30.02 | 83 | 82.00 | 1.20 |
| j9026 9.json | 1 | 0 | Optimal | 0.05 | 87 | 87.00 | 0.00 |
| j9027 1.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j9027 10.json | 1 | 0 | Optimal | 0.04 | 97 | 97.00 | 0.00 |
| j9027 2.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j9027 3.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j9027 4.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j9027 5.json | 1 | 0 | Optimal | 0.03 | 99 | 99.00 | 0.00 |
| j9027 6.json | 1 | 0 | Optimal | 0.04 | 87 | 87.00 | 0.00 |
| j9027 7.json | 1 | 0 | Optimal | 0.01 | 73 | 73.00 | 0.00 |
| j9027 8.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j9027 9.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j9028 1.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j9028 10.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j9028 2.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j9028 3.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j9028 4.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j9028 5.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j9028 6.json | 1 | 0 | Optimal | 0.02 | 102 | 102.00 | 0.00 |
| j9028 7.json | 1 | 0 | Optimal | 0.04 | 97 | 97.00 | 0.00 |
| j9028 8.json | 1 | 0 | Optimal | 0.03 | 110 | 110.00 | 0.00 |
| j9028 9.json | 1 | 0 | Optimal | 0.02 | 120 | 120.00 | 0.00 |
| j9029 1.json | 1 | 0 | Solution | 30.00 | 138 | 125.00 | 9.42 |
| j9029 10.json | 1 | 0 | Solution | 30.02 | 128 | 118.00 | 7.81 |
| j9029 2.json | 1 | 0 | Solution | 30.01 | 132 | 121.00 | 8.33 |
| j9029 3.json | 1 | 0 | Solution | 30.02 | 147 | 135.00 | 8.16 |
| j9029 4.json | 1 | 0 | Solution | 30.01 | 153 | 138.00 | 9.80 |
| j9029 5.json | 1 | 0 | Solution | 30.01 | 125 | 115.00 | 8.00 |
| j9029 6.json | 1 | 0 | Solution | 30.01 | 127 | 116.00 | 8.66 |
| j9029 7.json | 1 | 0 | Solution | 30.01 | 176 | 156.00 | 11.36 |
| j9029 8.json | 1 | 0 | Solution | 30.01 | 160 | 146.00 | 8.75 |
| j9029 9.json | 1 | 0 | Solution | 30.01 | 132 | 119.00 | 9.85 |
| j902 1.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j902 10.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j902 2.json | 1 | 0 | Optimal | 0.02 | 114 | 114.00 | 0.00 |
| j902 3.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j902 4.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j902 5.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j902 6.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j902 7.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j902 8.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j902 9.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j9030 1.json | 1 | 0 | Optimal | 0.03 | 102 | 102.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9030 10.json | 1 | 0 | Optimal | 0.03 | 90 | 90.00 | 0.00 |
| j9030 2.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j9030 3.json | 1 | 0 | Optimal | 0.05 | 102 | 102.00 | 0.00 |
| j9030 4.json | 1 | 0 | Optimal | 0.04 | 104 | 104.00 | 0.00 |
| j9030 5.json | 1 | 0 | Solution | 30.02 | 84 | 83.00 | 1.19 |
| j9030 6.json | 1 | 0 | Optimal | 0.03 | 90 | 90.00 | 0.00 |
| j9030 7.json | 1 | 0 | Solution | 30.01 | 85 | 84.00 | 1.18 |
| j9030 8.json | 1 | 0 | Optimal | 0.03 | 82 | 82.00 | 0.00 |
| j9030 9.json | 1 | 0 | Solution | 30.01 | 95 | 91.00 | 4.21 |
| j9031 1.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j9031 10.json | 1 | 0 | Optimal | 0.03 | 99 | 99.00 | 0.00 |
| j9031 2.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j9031 3.json | 1 | 0 | Optimal | 0.03 | 106 | 106.00 | 0.00 |
| j9031 4.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j9031 5.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j9031 6.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j9031 7.json | 1 | 0 | Optimal | 0.03 | 97 | 97.00 | 0.00 |
| j9031 8.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j9031 9.json | 1 | 0 | Optimal | 0.03 | 72 | 72.00 | 0.00 |
| j9032 1.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j9032 10.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j9032 2.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j9032 3.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j9032 4.json | 1 | 0 | Optimal | 0.03 | 104 | 104.00 | 0.00 |
| j9032 5.json | 1 | 0 | Optimal | 0.03 | 93 | 93.00 | 0.00 |
| j9032 6.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9032 7.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j9032 8.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j9032 9.json | 1 | 0 | Optimal | 0.03 | 95 | 95.00 | 0.00 |
| j9033 1.json | 1 | 0 | Optimal | 0.30 | 99 | 99.00 | 0.00 |
| j9033 10.json | 1 | 0 | Optimal | 0.08 | 114 | 114.00 | 0.00 |
| j9033 2.json | 1 | 0 | Optimal | 0.05 | 112 | 112.00 | 0.00 |
| j9033 3.json | 1 | 0 | Optimal | 0.02 | 108 | 108.00 | 0.00 |
| j9033 4.json | 1 | 0 | Optimal | 0.08 | 92 | 92.00 | 0.00 |
| j9033 5.json | 1 | 0 | Optimal | 0.18 | 109 | 109.00 | 0.00 |
| j9033 6.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j9033 7.json | 1 | 0 | Optimal | 0.10 | 109 | 109.00 | 0.00 |
| j9033 8.json | 1 | 0 | Optimal | 0.17 | 110 | 110.00 | 0.00 |
| j9033 9.json | 1 | 0 | Optimal | 0.56 | 95 | 95.00 | 0.00 |
| j9034 1.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j9034 10.json | 1 | 0 | Optimal | 0.02 | 101 | 101.00 | 0.00 |
| j9034 2.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j9034 3.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j9034 4.json | 1 | 0 | Optimal | 0.12 | 81 | 81.00 | 0.00 |
| j9034 5.json | 1 | 0 | Optimal | 0.07 | 83 | 83.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9034 6.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j9034 7.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j9034 8.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j9034 9.json | 1 | 0 | Optimal | 0.02 | 109 | 109.00 | 0.00 |
| j9035 1.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j9035 10.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j9035 2.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j9035 3.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j9035 4.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j9035 5.json | 1 | 0 | Optimal | 0.02 | 103 | 103.00 | 0.00 |
| j9035 6.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j9035 7.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j9035 8.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j9035 9.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j9036 1.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j9036 10.json | 1 | 0 | Optimal | 0.02 | 109 | 109.00 | 0.00 |
| j9036 2.json | 1 | 0 | Optimal | 0.02 | 114 | 114.00 | 0.00 |
| j9036 3.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j9036 4.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j9036 5.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j9036 6.json | 1 | 0 | Optimal | 0.02 | 99 | 99.00 | 0.00 |
| j9036 7.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j9036 8.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j9036 9.json | 1 | 0 | Optimal | 0.02 | 102 | 102.00 | 0.00 |
| j9037 1.json | 1 | 0 | Solution | 30.01 | 112 | 101.00 | 9.82 |
| j9037 10.json | 1 | 0 | Solution | 30.02 | 123 | 108.00 | 12.20 |
| j9037 2.json | 1 | 0 | Solution | 30.01 | 115 | 106.00 | 7.83 |
| j9037 3.json | 1 | 0 | Optimal | 5.87 | 132 | 132.00 | 0.00 |
| j9037 4.json | 1 | 0 | Optimal | 20.92 | 123 | 123.00 | 0.00 |
| j9037 5.json | 1 | 0 | Solution | 30.01 | 127 | 114.00 | 10.24 |
| j9037 6.json | 1 | 0 | Solution | 30.01 | 133 | 120.00 | 9.77 |
| j9037 7.json | 1 | 0 | Optimal | 9.09 | 123 | 123.00 | 0.00 |
| j9037 8.json | 1 | 0 | Solution | 30.01 | 120 | 106.00 | 11.67 |
| j9037 9.json | 1 | 0 | Optimal | 7.51 | 123 | 123.00 | 0.00 |
| j9038 1.json | 1 | 0 | Optimal | 0.40 | 85 | 85.00 | 0.00 |
| j9038 10.json | 1 | 0 | Optimal | 0.02 | 108 | 108.00 | 0.00 |
| j9038 2.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j9038 3.json | 1 | 0 | Optimal | 0.47 | 89 | 89.00 | 0.00 |
| j9038 4.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j9038 5.json | 1 | 0 | Optimal | 0.42 | 86 | 86.00 | 0.00 |
| j9038 6.json | 1 | 0 | Optimal | 0.07 | 88 | 88.00 | 0.00 |
| j9038 7.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j9038 8.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j9038 9.json | 1 | 0 | Optimal | 0.03 | 95 | 95.00 | 0.00 |
| j9039 1.json | 1 | 0 | Optimal | 0.02 | 106 | 106.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9039 10.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j9039 2.json | 1 | 0 | Optimal | 0.02 | 119 | 119.00 | 0.00 |
| j9039 3.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j9039 4.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j9039 5.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |
| j9039 6.json | 1 | 0 | Optimal | 0.02 | 102 | 102.00 | 0.00 |
| j9039 7.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j9039 8.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j9039 9.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j903 1.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j903 10.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j903 2.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j903 3.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j903 4.json | 1 | 0 | Optimal | 0.02 | 104 | 104.00 | 0.00 |
| j903 5.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j903 6.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j903 7.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j903 8.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j903 9.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j9040 1.json | 1 | 0 | Optimal | 0.02 | 95 | 95.00 | 0.00 |
| j9040 10.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j9040 2.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j9040 3.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j9040 4.json | 1 | 0 | Optimal | 0.02 | 106 | 106.00 | 0.00 |
| j9040 5.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j9040 6.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9040 7.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j9040 8.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j9040 9.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j9041 1.json | 1 | 0 | Solution | 30.01 | 147 | 128.00 | 12.93 |
| j9041 10.json | 1 | 0 | Solution | 30.01 | 154 | 143.00 | 7.14 |
| j9041 2.json | 1 | 0 | Solution | 30.01 | 170 | 153.00 | 10.00 |
| j9041 3.json | 1 | 0 | Solution | 30.01 | 164 | 145.00 | 11.59 |
| j9041 4.json | 1 | 0 | Solution | 30.01 | 158 | 140.00 | 11.39 |
| j9041 5.json | 1 | 0 | Solution | 30.01 | 129 | 115.00 | 10.85 |
| j9041 6.json | 1 | 0 | Solution | 30.01 | 137 | 127.00 | 7.30 |
| j9041 7.json | 1 | 0 | Solution | 30.01 | 158 | 142.00 | 10.13 |
| j9041 8.json | 1 | 0 | Solution | 30.01 | 168 | 147.00 | 12.50 |
| j9041 9.json | 1 | 0 | Solution | 30.01 | 125 | 110.00 | 12.00 |
| j9042 1.json | 1 | 0 | Optimal | 0.03 | 106 | 106.00 | 0.00 |
| j9042 10.json | 1 | 0 | Solution | 30.01 | 91 | 89.00 | 2.20 |
| j9042 2.json | 1 | 0 | Solution | 30.01 | 103 | 101.00 | 1.94 |
| j9042 3.json | 1 | 0 | Optimal | 0.12 | 94 | 94.00 | 0.00 |
| j9042 4.json | 1 | 0 | Optimal | 0.03 | 102 | 102.00 | 0.00 |
| j9042 5.json | 1 | 0 | Optimal | 0.03 | 105 | 105.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9042 6.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j9042 7.json | 1 | 0 | Solution | 30.00 | 87 | 86.00 | 1.15 |
| j9042 8.json | 1 | 0 | Optimal | 0.02 | 105 | 105.00 | 0.00 |
| j9042 9.json | 1 | 0 | Optimal | 2.78 | 83 | 83.00 | 0.00 |
| j9043 1.json | 1 | 0 | Optimal | 0.02 | 99 | 99.00 | 0.00 |
| j9043 10.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j9043 2.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j9043 3.json | 1 | 0 | Optimal | 0.01 | 102 | 102.00 | 0.00 |
| j9043 4.json | 1 | 0 | Optimal | 0.03 | 94 | 94.00 | 0.00 |
| j9043 5.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j9043 6.json | 1 | 0 | Optimal | 0.01 | 114 | 114.00 | 0.00 |
| j9043 7.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j9043 8.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j9043 9.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j9044 1.json | 1 | 0 | Optimal | 0.03 | 100 | 100.00 | 0.00 |
| j9044 10.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9044 2.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j9044 3.json | 1 | 0 | Optimal | 0.03 | 110 | 110.00 | 0.00 |
| j9044 4.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j9044 5.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j9044 6.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j9044 7.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j9044 8.json | 1 | 0 | Optimal | 0.03 | 99 | 99.00 | 0.00 |
| j9044 9.json | 1 | 0 | Optimal | 0.03 | 96 | 96.00 | 0.00 |
| j9045 1.json | 1 | 0 | Solution | 30.02 | 151 | 142.00 | 5.96 |
| j9045 10.json | 1 | 0 | Solution | 30.01 | 170 | 156.00 | 8.24 |
| j9045 2.json | 1 | 0 | Solution | 30.01 | 150 | 138.00 | 8.00 |
| j9045 3.json | 1 | 0 | Solution | 30.01 | 160 | 142.00 | 11.25 |
| j9045 4.json | 1 | 0 | Solution | 30.00 | 139 | 125.00 | 10.07 |
| j9045 5.json | 1 | 0 | Solution | 30.00 | 180 | 163.00 | 9.44 |
| j9045 6.json | 1 | 0 | Solution | 30.01 | 178 | 157.00 | 11.80 |
| j9045 7.json | 1 | 0 | Solution | 30.02 | 140 | 127.00 | 9.29 |
| j9045 8.json | 1 | 0 | Solution | 30.01 | 163 | 147.00 | 9.82 |
| j9045 9.json | 1 | 0 | Solution | 30.02 | 161 | 141.00 | 12.42 |
| j9046 1.json | 1 | 0 | Optimal | 4.15 | 104 | 104.00 | 0.00 |
| j9046 10.json | 1 | 0 | Optimal | 0.02 | 114 | 114.00 | 0.00 |
| j9046 2.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j9046 3.json | 1 | 0 | Optimal | 2.76 | 113 | 113.00 | 0.00 |
| j9046 4.json | 1 | 0 | Solution | 30.02 | 93 | 92.00 | 1.08 |
| j9046 5.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j9046 6.json | 1 | 0 | Optimal | 0.05 | 83 | 83.00 | 0.00 |
| j9046 7.json | 1 | 0 | Optimal | 0.05 | 89 | 89.00 | 0.00 |
| j9046 8.json | 1 | 0 | Solution | 30.01 | 97 | 93.00 | 4.12 |
| j9046 9.json | 1 | 0 | Solution | 30.02 | 90 | 86.00 | 4.44 |
| j9047 1.json | 1 | 0 | Optimal | 0.03 | 82 | 82.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9047 10.json | 1 | 0 | Optimal | 0.03 | 65 | 65.00 | 0.00 |
| j9047 2.json | 1 | 0 | Optimal | 0.03 | 90 | 90.00 | 0.00 |
| j9047 3.json | 1 | 0 | Optimal | 0.02 | 102 | 102.00 | 0.00 |
| j9047 4.json | 1 | 0 | Optimal | 0.03 | 93 | 93.00 | 0.00 |
| j9047 5.json | 1 | 0 | Optimal | 0.03 | 93 | 93.00 | 0.00 |
| j9047 6.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j9047 7.json | 1 | 0 | Optimal | 0.03 | 94 | 94.00 | 0.00 |
| j9047 8.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j9047 9.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9048 1.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j9048 10.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j9048 2.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j9048 3.json | 1 | 0 | Optimal | 0.01 | 86 | 86.00 | 0.00 |
| j9048 4.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j9048 5.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j9048 6.json | 1 | 0 | Optimal | 0.03 | 114 | 114.00 | 0.00 |
| j9048 7.json | 1 | 0 | Optimal | 0.03 | 103 | 103.00 | 0.00 |
| j9048 8.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j9048 9.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j904 1.json | 1 | 0 | Optimal | 0.03 | 93 | 93.00 | 0.00 |
| j904 10.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j904 2.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j904 3.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j904 4.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j904 5.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j904 6.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j904 7.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j904 8.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j904 9.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j905 1.json | 1 | 0 | Optimal | 7.71 | 78 | 78.00 | 0.00 |
| j905 10.json | 1 | 0 | Solution | 30.01 | 97 | 94.00 | 3.09 |
| j905 2.json | 1 | 0 | Optimal | 12.63 | 93 | 93.00 | 0.00 |
| j905 3.json | 1 | 0 | Solution | 30.01 | 89 | 84.00 | 5.62 |
| j905 4.json | 1 | 0 | Solution | 30.01 | 103 | 98.00 | 4.85 |
| j905 5.json | 1 | 0 | Solution | 30.02 | 113 | 109.00 | 3.54 |
| j905 6.json | 1 | 0 | Solution | 30.02 | 88 | 85.00 | 3.41 |
| j905 7.json | 1 | 0 | Solution | 30.01 | 110 | 106.00 | 3.64 |
| j905 8.json | 1 | 0 | Solution | 30.01 | 104 | 95.00 | 8.65 |
| j905 9.json | 1 | 0 | Solution | 30.01 | 119 | 109.00 | 8.40 |
| j906 1.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j906 10.json | 1 | 0 | Optimal | 0.02 | 94 | 94.00 | 0.00 |
| j906 2.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j906 3.json | 1 | 0 | Optimal | 0.59 | 77 | 77.00 | 0.00 |
| j906 4.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j906 5.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |

Table 9.5: Results for RCPSP J90 (CPO) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------|------------|----------------|----------|-------|----------|--------|----------------|
| j906 6.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j906 7.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j906 8.json | 1 | 0 | Optimal | 1.79 | 68 | 68.00 | 0.00 |
| j906 9.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j907 1.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j907 10.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j907 2.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j907 3.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j907 4.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j907 5.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j907 6.json | 1 | 0 | Optimal | 0.03 | 90 | 90.00 | 0.00 |
| j907 7.json | 1 | 0 | Optimal | 0.03 | 90 | 90.00 | 0.00 |
| j907 8.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j907 9.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j908 1.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j908 10.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j908 2.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j908 3.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j908 4.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j908 5.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j908 6.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j908 7.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j908 8.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j908 9.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j909 1.json | 1 | 0 | Solution | 30.01 | 108 | 99.00 | 8.33 |
| j909 10.json | 1 | 0 | Solution | 30.01 | 115 | 104.00 | 9.57 |
| j909 2.json | 1 | 0 | Solution | 30.01 | 133 | 120.00 | 9.77 |
| j909 3.json | 1 | 0 | Solution | 30.01 | 106 | 98.00 | 7.55 |
| j909 4.json | 1 | 0 | Solution | 30.01 | 131 | 119.00 | 9.16 |
| j909 5.json | 1 | 0 | Solution | 30.00 | 143 | 123.00 | 13.99 |
| j909 6.json | 1 | 0 | Solution | 30.01 | 122 | 112.00 | 8.20 |
| j909 7.json | 1 | 0 | Solution | 30.01 | 110 | 103.00 | 6.36 |
| j909 8.json | 1 | 0 | Solution | 30.02 | 119 | 110.00 | 7.56 |
| j909 9.json | 1 | 0 | Solution | 30.01 | 119 | 106.00 | 10.92 |

9.3.2 CPSat

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|-------|----------------|
| j9010 1.json | 1 | 0 | Optimal | 0.06 | 77 | 77.00 | 0.00 |
| j9010 10.json | 1 | 0 | Optimal | 0.05 | 75 | 75.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9010 2.json | 1 | 0 | Optimal | 0.08 | 95 | 95.00 | 0.00 |
| j9010 3.json | 1 | 0 | Optimal | 0.07 | 112 | 112.00 | 0.00 |
| j9010 4.json | 1 | 0 | Optimal | 0.05 | 94 | 94.00 | 0.00 |
| j9010 5.json | 1 | 0 | Optimal | 0.05 | 78 | 78.00 | 0.00 |
| j9010 6.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j9010 7.json | 1 | 0 | Optimal | 0.05 | 83 | 83.00 | 0.00 |
| j9010 8.json | 1 | 0 | Optimal | 0.09 | 81 | 81.00 | 0.00 |
| j9010 9.json | 1 | 0 | Optimal | 0.04 | 88 | 88.00 | 0.00 |
| j9011 1.json | 1 | 0 | Optimal | 0.06 | 86 | 86.00 | 0.00 |
| j9011 10.json | 1 | 0 | Optimal | 0.09 | 81 | 81.00 | 0.00 |
| j9011 2.json | 1 | 0 | Optimal | 0.07 | 99 | 99.00 | 0.00 |
| j9011 3.json | 1 | 0 | Optimal | 0.05 | 69 | 69.00 | 0.00 |
| j9011 4.json | 1 | 0 | Optimal | 0.05 | 64 | 64.00 | 0.00 |
| j9011 5.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j9011 6.json | 1 | 0 | Optimal | 0.04 | 78 | 78.00 | 0.00 |
| j9011 7.json | 1 | 0 | Optimal | 0.02 | 95 | 95.00 | 0.00 |
| j9011 8.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |
| j9011 9.json | 1 | 0 | Optimal | 0.04 | 81 | 81.00 | 0.00 |
| j9012 1.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j9012 10.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j9012 2.json | 1 | 0 | Optimal | 0.02 | 71 | 71.00 | 0.00 |
| j9012 3.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j9012 4.json | 1 | 0 | Optimal | 0.02 | 73 | 73.00 | 0.00 |
| j9012 5.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j9012 6.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j9012 7.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j9012 8.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j9012 9.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j9013 1.json | 1 | 0 | Solution | 30.02 | 144 | 127.00 | 11.81 |
| j9013 10.json | 1 | 0 | Solution | 30.04 | 127 | 112.00 | 11.81 |
| j9013 2.json | 1 | 0 | Solution | 30.02 | 134 | 116.00 | 13.43 |
| j9013 3.json | 1 | 0 | Solution | 30.03 | 112 | 104.00 | 7.14 |
| j9013 4.json | 1 | 0 | Solution | 30.03 | 118 | 108.00 | 8.47 |
| j9013 5.json | 1 | 0 | Solution | 30.02 | 119 | 108.00 | 9.24 |
| j9013 6.json | 1 | 0 | Solution | 30.03 | 131 | 116.00 | 11.45 |
| j9013 7.json | 1 | 0 | Solution | 30.02 | 131 | 114.00 | 12.98 |
| j9013 8.json | 1 | 0 | Solution | 30.03 | 124 | 112.00 | 9.68 |
| j9013 9.json | 1 | 0 | Solution | 30.01 | 128 | 115.00 | 10.16 |
| j9014 1.json | 1 | 0 | Optimal | 0.07 | 89 | 89.00 | 0.00 |
| j9014 10.json | 1 | 0 | Optimal | 0.08 | 85 | 85.00 | 0.00 |
| j9014 2.json | 1 | 0 | Optimal | 0.04 | 79 | 79.00 | 0.00 |
| j9014 3.json | 1 | 0 | Optimal | 0.06 | 94 | 94.00 | 0.00 |
| j9014 4.json | 1 | 0 | Optimal | 0.07 | 88 | 88.00 | 0.00 |
| j9014 5.json | 1 | 0 | Optimal | 0.07 | 84 | 84.00 | 0.00 |
| j9014 6.json | 1 | 0 | Optimal | 30.01 | 76 | 76.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|---------|------|----------|--------|----------------|
| j9014 7.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j9014 8.json | 1 | 0 | Optimal | 0.05 | 80 | 80.00 | 0.00 |
| j9014 9.json | 1 | 0 | Optimal | 0.06 | 112 | 112.00 | 0.00 |
| j9015 1.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j9015 10.json | 1 | 0 | Optimal | 0.06 | 78 | 78.00 | 0.00 |
| j9015 2.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j9015 3.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |
| j9015 4.json | 1 | 0 | Optimal | 0.04 | 92 | 92.00 | 0.00 |
| j9015 5.json | 1 | 0 | Optimal | 0.07 | 93 | 93.00 | 0.00 |
| j9015 6.json | 1 | 0 | Optimal | 0.02 | 61 | 61.00 | 0.00 |
| j9015 7.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |
| j9015 8.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |
| j9015 9.json | 1 | 0 | Optimal | 0.04 | 83 | 83.00 | 0.00 |
| j9016 1.json | 1 | 0 | Optimal | 0.04 | 85 | 85.00 | 0.00 |
| j9016 10.json | 1 | 0 | Optimal | 0.03 | 71 | 71.00 | 0.00 |
| j9016 2.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j9016 3.json | 1 | 0 | Optimal | 0.04 | 73 | 73.00 | 0.00 |
| j9016 4.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j9016 5.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j9016 6.json | 1 | 0 | Optimal | 0.03 | 74 | 74.00 | 0.00 |
| j9016 7.json | 1 | 0 | Optimal | 0.02 | 65 | 65.00 | 0.00 |
| j9016 8.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j9016 9.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j9017 1.json | 1 | 0 | Optimal | 0.13 | 92 | 92.00 | 0.00 |
| j9017 10.json | 1 | 0 | Optimal | 0.18 | 89 | 89.00 | 0.00 |
| j9017 2.json | 1 | 0 | Optimal | 0.31 | 100 | 100.00 | 0.00 |
| j9017 3.json | 1 | 0 | Optimal | 0.13 | 89 | 89.00 | 0.00 |
| j9017 4.json | 1 | 0 | Optimal | 0.11 | 94 | 94.00 | 0.00 |
| j9017 5.json | 1 | 0 | Optimal | 0.12 | 113 | 113.00 | 0.00 |
| j9017 6.json | 1 | 0 | Optimal | 0.12 | 94 | 94.00 | 0.00 |
| j9017 7.json | 1 | 0 | Optimal | 0.12 | 80 | 80.00 | 0.00 |
| j9017 8.json | 1 | 0 | Optimal | 0.12 | 113 | 113.00 | 0.00 |
| j9017 9.json | 1 | 0 | Optimal | 0.14 | 96 | 96.00 | 0.00 |
| j9018 1.json | 1 | 0 | Optimal | 0.06 | 101 | 101.00 | 0.00 |
| j9018 10.json | 1 | 0 | Optimal | 0.07 | 94 | 94.00 | 0.00 |
| j9018 2.json | 1 | 0 | Optimal | 0.04 | 94 | 94.00 | 0.00 |
| j9018 3.json | 1 | 0 | Optimal | 0.07 | 83 | 83.00 | 0.00 |
| j9018 4.json | 1 | 0 | Optimal | 0.06 | 98 | 98.00 | 0.00 |
| j9018 5.json | 1 | 0 | Optimal | 0.04 | 90 | 90.00 | 0.00 |
| j9018 6.json | 1 | 0 | Optimal | 0.09 | 83 | 83.00 | 0.00 |
| j9018 7.json | 1 | 0 | Optimal | 0.07 | 73 | 73.00 | 0.00 |
| j9018 8.json | 1 | 0 | Optimal | 0.05 | 92 | 92.00 | 0.00 |
| j9018 9.json | 1 | 0 | Optimal | 0.05 | 79 | 79.00 | 0.00 |
| j9019 1.json | 1 | 0 | Optimal | 0.04 | 98 | 98.00 | 0.00 |
| j9019 10.json | 1 | 0 | Optimal | 0.03 | 85 | 85.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9019 2.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j9019 3.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j9019 4.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j9019 5.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j9019 6.json | 1 | 0 | Optimal | 0.04 | 136 | 136.00 | 0.00 |
| j9019 7.json | 1 | 0 | Optimal | 0.06 | 66 | 66.00 | 0.00 |
| j9019 8.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j9019 9.json | 1 | 0 | Optimal | 0.02 | 121 | 121.00 | 0.00 |
| j901 1.json | 1 | 0 | Optimal | 0.12 | 73 | 73.00 | 0.00 |
| j901 10.json | 1 | 0 | Optimal | 0.09 | 90 | 90.00 | 0.00 |
| j901 2.json | 1 | 0 | Optimal | 0.13 | 92 | 92.00 | 0.00 |
| j901 3.json | 1 | 0 | Optimal | 0.21 | 66 | 66.00 | 0.00 |
| j901 4.json | 1 | 0 | Optimal | 1.51 | 86 | 86.00 | 0.00 |
| j901 5.json | 1 | 0 | Optimal | 0.11 | 87 | 87.00 | 0.00 |
| j901 6.json | 1 | 0 | Optimal | 0.14 | 74 | 74.00 | 0.00 |
| j901 7.json | 1 | 0 | Optimal | 0.08 | 91 | 91.00 | 0.00 |
| j901 8.json | 1 | 0 | Optimal | 0.14 | 95 | 95.00 | 0.00 |
| j901 9.json | 1 | 0 | Optimal | 0.25 | 72 | 72.00 | 0.00 |
| j9020 1.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j9020 10.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j9020 2.json | 1 | 0 | Optimal | 0.02 | 76 | 76.00 | 0.00 |
| j9020 3.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j9020 4.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j9020 5.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j9020 6.json | 1 | 0 | Optimal | 0.02 | 83 | 83.00 | 0.00 |
| j9020 7.json | 1 | 0 | Optimal | 0.03 | 82 | 82.00 | 0.00 |
| j9020 8.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j9020 9.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j9021 1.json | 1 | 0 | Solution | 30.03 | 111 | 100.00 | 9.91 |
| j9021 10.json | 1 | 0 | Solution | 30.03 | 109 | 102.00 | 6.42 |
| j9021 2.json | 1 | 0 | Solution | 30.02 | 116 | 108.00 | 6.90 |
| j9021 3.json | 1 | 0 | Solution | 30.03 | 124 | 117.00 | 5.65 |
| j9021 4.json | 1 | 0 | Optimal | 30.01 | 106 | 106.00 | 0.00 |
| j9021 5.json | 1 | 0 | Solution | 30.03 | 112 | 101.00 | 9.82 |
| j9021 6.json | 1 | 0 | Solution | 30.03 | 106 | 103.00 | 2.83 |
| j9021 7.json | 1 | 0 | Solution | 30.06 | 110 | 101.00 | 8.18 |
| j9021 8.json | 1 | 0 | Solution | 30.05 | 112 | 101.00 | 9.82 |
| j9021 9.json | 1 | 0 | Solution | 30.04 | 121 | 113.00 | 6.61 |
| j9022 1.json | 1 | 0 | Optimal | 0.05 | 108 | 108.00 | 0.00 |
| j9022 10.json | 1 | 0 | Optimal | 0.12 | 75 | 75.00 | 0.00 |
| j9022 2.json | 1 | 0 | Optimal | 0.09 | 85 | 85.00 | 0.00 |
| j9022 3.json | 1 | 0 | Optimal | 0.12 | 83 | 83.00 | 0.00 |
| j9022 4.json | 1 | 0 | Optimal | 0.04 | 96 | 96.00 | 0.00 |
| j9022 5.json | 1 | 0 | Optimal | 0.05 | 96 | 96.00 | 0.00 |
| j9022 6.json | 1 | 0 | Optimal | 0.07 | 71 | 71.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9022 7.json | 1 | 0 | Optimal | 0.07 | 90 | 90.00 | 0.00 |
| j9022 8.json | 1 | 0 | Optimal | 0.04 | 97 | 97.00 | 0.00 |
| j9022 9.json | 1 | 0 | Optimal | 0.15 | 101 | 101.00 | 0.00 |
| j9023 1.json | 1 | 0 | Optimal | 0.07 | 90 | 90.00 | 0.00 |
| j9023 10.json | 1 | 0 | Optimal | 0.04 | 87 | 87.00 | 0.00 |
| j9023 2.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j9023 3.json | 1 | 0 | Optimal | 0.04 | 116 | 116.00 | 0.00 |
| j9023 4.json | 1 | 0 | Optimal | 0.06 | 85 | 85.00 | 0.00 |
| j9023 5.json | 1 | 0 | Optimal | 0.02 | 95 | 95.00 | 0.00 |
| j9023 6.json | 1 | 0 | Optimal | 0.06 | 87 | 87.00 | 0.00 |
| j9023 7.json | 1 | 0 | Optimal | 0.04 | 77 | 77.00 | 0.00 |
| j9023 8.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j9023 9.json | 1 | 0 | Optimal | 0.04 | 126 | 126.00 | 0.00 |
| j9024 1.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j9024 10.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j9024 2.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j9024 3.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j9024 4.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j9024 5.json | 1 | 0 | Optimal | 0.02 | 85 | 85.00 | 0.00 |
| j9024 6.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j9024 7.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j9024 8.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j9024 9.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j9025 1.json | 1 | 0 | Solution | 30.02 | 128 | 115.00 | 10.16 |
| j9025 10.json | 1 | 0 | Solution | 30.07 | 132 | 118.00 | 10.61 |
| j9025 2.json | 1 | 0 | Solution | 30.03 | 135 | 120.00 | 11.11 |
| j9025 3.json | 1 | 0 | Solution | 30.03 | 125 | 111.00 | 11.20 |
| j9025 4.json | 1 | 0 | Solution | 30.04 | 143 | 128.00 | 10.49 |
| j9025 5.json | 1 | 0 | Solution | 30.04 | 120 | 109.00 | 9.17 |
| j9025 6.json | 1 | 0 | Solution | 30.02 | 126 | 112.00 | 11.11 |
| j9025 7.json | 1 | 0 | Solution | 30.07 | 136 | 121.00 | 11.03 |
| j9025 8.json | 1 | 0 | Solution | 30.03 | 142 | 130.00 | 8.45 |
| j9025 9.json | 1 | 0 | Solution | 30.02 | 109 | 96.00 | 11.93 |
| j9026 1.json | 1 | 0 | Optimal | 0.05 | 90 | 90.00 | 0.00 |
| j9026 10.json | 1 | 0 | Optimal | 0.08 | 92 | 92.00 | 0.00 |
| j9026 2.json | 1 | 0 | Optimal | 30.01 | 85 | 85.00 | 0.00 |
| j9026 3.json | 1 | 0 | Optimal | 0.07 | 80 | 80.00 | 0.00 |
| j9026 4.json | 1 | 0 | Solution | 30.03 | 97 | 96.00 | 1.03 |
| j9026 5.json | 1 | 0 | Solution | 30.03 | 86 | 83.00 | 3.49 |
| j9026 6.json | 1 | 0 | Optimal | 0.08 | 108 | 108.00 | 0.00 |
| j9026 7.json | 1 | 0 | Optimal | 0.80 | 82 | 82.00 | 0.00 |
| j9026 8.json | 1 | 0 | Optimal | 30.01 | 82 | 82.00 | 0.00 |
| j9026 9.json | 1 | 0 | Optimal | 0.09 | 87 | 87.00 | 0.00 |
| j9027 1.json | 1 | 0 | Optimal | 0.05 | 96 | 96.00 | 0.00 |
| j9027 10.json | 1 | 0 | Optimal | 0.05 | 97 | 97.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9027 2.json | 1 | 0 | Optimal | 0.05 | 81 | 81.00 | 0.00 |
| j9027 3.json | 1 | 0 | Optimal | 0.04 | 91 | 91.00 | 0.00 |
| j9027 4.json | 1 | 0 | Optimal | 0.06 | 79 | 79.00 | 0.00 |
| j9027 5.json | 1 | 0 | Optimal | 0.04 | 99 | 99.00 | 0.00 |
| j9027 6.json | 1 | 0 | Optimal | 0.06 | 87 | 87.00 | 0.00 |
| j9027 7.json | 1 | 0 | Optimal | 0.04 | 73 | 73.00 | 0.00 |
| j9027 8.json | 1 | 0 | Optimal | 0.05 | 72 | 72.00 | 0.00 |
| j9027 9.json | 1 | 0 | Optimal | 0.05 | 84 | 84.00 | 0.00 |
| j9028 1.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j9028 10.json | 1 | 0 | Optimal | 0.03 | 68 | 68.00 | 0.00 |
| j9028 2.json | 1 | 0 | Optimal | 0.03 | 76 | 76.00 | 0.00 |
| j9028 3.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9028 4.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j9028 5.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j9028 6.json | 1 | 0 | Optimal | 0.03 | 102 | 102.00 | 0.00 |
| j9028 7.json | 1 | 0 | Optimal | 0.03 | 97 | 97.00 | 0.00 |
| j9028 8.json | 1 | 0 | Optimal | 0.03 | 110 | 110.00 | 0.00 |
| j9028 9.json | 1 | 0 | Optimal | 0.03 | 120 | 120.00 | 0.00 |
| j9029 1.json | 1 | 0 | Solution | 30.02 | 139 | 123.00 | 11.51 |
| j9029 10.json | 1 | 0 | Solution | 30.02 | 129 | 117.00 | 9.30 |
| j9029 2.json | 1 | 0 | Solution | 30.03 | 130 | 120.00 | 7.69 |
| j9029 3.json | 1 | 0 | Solution | 30.05 | 148 | 135.00 | 8.78 |
| j9029 4.json | 1 | 0 | Solution | 30.04 | 156 | 136.00 | 12.82 |
| j9029 5.json | 1 | 0 | Solution | 30.03 | 127 | 114.00 | 10.24 |
| j9029 6.json | 1 | 0 | Solution | 30.03 | 131 | 116.00 | 11.45 |
| j9029 7.json | 1 | 0 | Solution | 30.03 | 177 | 158.00 | 10.73 |
| j9029 8.json | 1 | 0 | Solution | 30.03 | 162 | 145.00 | 10.49 |
| j9029 9.json | 1 | 0 | Solution | 30.03 | 134 | 118.00 | 11.94 |
| j902 1.json | 1 | 0 | Optimal | 0.05 | 96 | 96.00 | 0.00 |
| j902 10.json | 1 | 0 | Optimal | 0.09 | 80 | 80.00 | 0.00 |
| j902 2.json | 1 | 0 | Optimal | 0.07 | 114 | 114.00 | 0.00 |
| j902 3.json | 1 | 0 | Optimal | 0.05 | 75 | 75.00 | 0.00 |
| j902 4.json | 1 | 0 | Optimal | 0.03 | 70 | 70.00 | 0.00 |
| j902 5.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j902 6.json | 1 | 0 | Optimal | 0.11 | 67 | 67.00 | 0.00 |
| j902 7.json | 1 | 0 | Optimal | 0.06 | 92 | 92.00 | 0.00 |
| j902 8.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |
| j902 9.json | 1 | 0 | Optimal | 0.06 | 79 | 79.00 | 0.00 |
| j9030 1.json | 1 | 0 | Optimal | 0.07 | 102 | 102.00 | 0.00 |
| j9030 10.json | 1 | 0 | Optimal | 0.09 | 90 | 90.00 | 0.00 |
| j9030 2.json | 1 | 0 | Optimal | 0.05 | 76 | 76.00 | 0.00 |
| j9030 3.json | 1 | 0 | Optimal | 0.09 | 102 | 102.00 | 0.00 |
| j9030 4.json | 1 | 0 | Optimal | 0.08 | 104 | 104.00 | 0.00 |
| j9030 5.json | 1 | 0 | Solution | 30.02 | 85 | 83.00 | 2.35 |
| j9030 6.json | 1 | 0 | Optimal | 0.06 | 90 | 90.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9030 7.json | 1 | 0 | Solution | 30.03 | 85 | 84.00 | 1.18 |
| j9030 8.json | 1 | 0 | Optimal | 0.08 | 82 | 82.00 | 0.00 |
| j9030 9.json | 1 | 0 | Solution | 30.02 | 96 | 90.00 | 6.25 |
| j9031 1.json | 1 | 0 | Optimal | 0.05 | 79 | 79.00 | 0.00 |
| j9031 10.json | 1 | 0 | Optimal | 0.06 | 99 | 99.00 | 0.00 |
| j9031 2.json | 1 | 0 | Optimal | 0.04 | 69 | 69.00 | 0.00 |
| j9031 3.json | 1 | 0 | Optimal | 0.07 | 106 | 106.00 | 0.00 |
| j9031 4.json | 1 | 0 | Optimal | 0.05 | 79 | 79.00 | 0.00 |
| j9031 5.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j9031 6.json | 1 | 0 | Optimal | 0.05 | 80 | 80.00 | 0.00 |
| j9031 7.json | 1 | 0 | Optimal | 0.03 | 97 | 97.00 | 0.00 |
| j9031 8.json | 1 | 0 | Optimal | 0.04 | 83 | 83.00 | 0.00 |
| j9031 9.json | 1 | 0 | Optimal | 0.04 | 72 | 72.00 | 0.00 |
| j9032 1.json | 1 | 0 | Optimal | 0.04 | 78 | 78.00 | 0.00 |
| j9032 10.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j9032 2.json | 1 | 0 | Optimal | 0.04 | 78 | 78.00 | 0.00 |
| j9032 3.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j9032 4.json | 1 | 0 | Optimal | 0.04 | 104 | 104.00 | 0.00 |
| j9032 5.json | 1 | 0 | Optimal | 0.04 | 93 | 93.00 | 0.00 |
| j9032 6.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j9032 7.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j9032 8.json | 1 | 0 | Optimal | 0.04 | 79 | 79.00 | 0.00 |
| j9032 9.json | 1 | 0 | Optimal | 0.03 | 95 | 95.00 | 0.00 |
| j9033 1.json | 1 | 0 | Optimal | 0.16 | 99 | 99.00 | 0.00 |
| j9033 10.json | 1 | 0 | Optimal | 0.11 | 114 | 114.00 | 0.00 |
| j9033 2.json | 1 | 0 | Optimal | 0.12 | 112 | 112.00 | 0.00 |
| j9033 3.json | 1 | 0 | Optimal | 0.09 | 108 | 108.00 | 0.00 |
| j9033 4.json | 1 | 0 | Optimal | 0.12 | 92 | 92.00 | 0.00 |
| j9033 5.json | 1 | 0 | Optimal | 0.12 | 109 | 109.00 | 0.00 |
| j9033 6.json | 1 | 0 | Optimal | 0.12 | 88 | 88.00 | 0.00 |
| j9033 7.json | 1 | 0 | Optimal | 0.10 | 109 | 109.00 | 0.00 |
| j9033 8.json | 1 | 0 | Optimal | 0.13 | 110 | 110.00 | 0.00 |
| j9033 9.json | 1 | 0 | Optimal | 0.12 | 95 | 95.00 | 0.00 |
| j9034 1.json | 1 | 0 | Optimal | 0.07 | 83 | 83.00 | 0.00 |
| j9034 10.json | 1 | 0 | Optimal | 0.04 | 101 | 101.00 | 0.00 |
| j9034 2.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j9034 3.json | 1 | 0 | Optimal | 0.05 | 82 | 82.00 | 0.00 |
| j9034 4.json | 1 | 0 | Optimal | 0.05 | 81 | 81.00 | 0.00 |
| j9034 5.json | 1 | 0 | Optimal | 0.07 | 83 | 83.00 | 0.00 |
| j9034 6.json | 1 | 0 | Optimal | 0.05 | 89 | 89.00 | 0.00 |
| j9034 7.json | 1 | 0 | Optimal | 0.06 | 92 | 92.00 | 0.00 |
| j9034 8.json | 1 | 0 | Optimal | 0.07 | 81 | 81.00 | 0.00 |
| j9034 9.json | 1 | 0 | Optimal | 0.05 | 109 | 109.00 | 0.00 |
| j9035 1.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j9035 10.json | 1 | 0 | Optimal | 0.04 | 82 | 82.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9035 2.json | 1 | 0 | Optimal | 0.04 | 92 | 92.00 | 0.00 |
| j9035 3.json | 1 | 0 | Optimal | 0.05 | 96 | 96.00 | 0.00 |
| j9035 4.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j9035 5.json | 1 | 0 | Optimal | 0.04 | 103 | 103.00 | 0.00 |
| j9035 6.json | 1 | 0 | Optimal | 0.07 | 72 | 72.00 | 0.00 |
| j9035 7.json | 1 | 0 | Optimal | 0.04 | 78 | 78.00 | 0.00 |
| j9035 8.json | 1 | 0 | Optimal | 0.04 | 85 | 85.00 | 0.00 |
| j9035 9.json | 1 | 0 | Optimal | 0.04 | 76 | 76.00 | 0.00 |
| j9036 1.json | 1 | 0 | Optimal | 0.03 | 97 | 97.00 | 0.00 |
| j9036 10.json | 1 | 0 | Optimal | 0.02 | 109 | 109.00 | 0.00 |
| j9036 2.json | 1 | 0 | Optimal | 0.03 | 114 | 114.00 | 0.00 |
| j9036 3.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j9036 4.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j9036 5.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j9036 6.json | 1 | 0 | Optimal | 0.04 | 99 | 99.00 | 0.00 |
| j9036 7.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j9036 8.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j9036 9.json | 1 | 0 | Optimal | 0.03 | 102 | 102.00 | 0.00 |
| j9037 1.json | 1 | 0 | Optimal | 30.01 | 110 | 110.00 | 0.00 |
| j9037 10.json | 1 | 0 | Solution | 30.05 | 124 | 112.00 | 9.68 |
| j9037 2.json | 1 | 0 | Solution | 30.05 | 116 | 105.00 | 9.48 |
| j9037 3.json | 1 | 0 | Optimal | 8.76 | 132 | 132.00 | 0.00 |
| j9037 4.json | 1 | 0 | Optimal | 30.01 | 123 | 123.00 | 0.00 |
| j9037 5.json | 1 | 0 | Solution | 30.04 | 126 | 114.00 | 9.52 |
| j9037 6.json | 1 | 0 | Solution | 30.03 | 132 | 120.00 | 9.09 |
| j9037 7.json | 1 | 0 | Optimal | 30.02 | 123 | 123.00 | 0.00 |
| j9037 8.json | 1 | 0 | Solution | 30.03 | 119 | 105.00 | 11.76 |
| j9037 9.json | 1 | 0 | Optimal | 30.02 | 123 | 123.00 | 0.00 |
| j9038 1.json | 1 | 0 | Optimal | 0.11 | 85 | 85.00 | 0.00 |
| j9038 10.json | 1 | 0 | Optimal | 0.09 | 108 | 108.00 | 0.00 |
| j9038 2.json | 1 | 0 | Optimal | 0.10 | 78 | 78.00 | 0.00 |
| j9038 3.json | 1 | 0 | Optimal | 0.42 | 89 | 89.00 | 0.00 |
| j9038 4.json | 1 | 0 | Optimal | 0.10 | 89 | 89.00 | 0.00 |
| j9038 5.json | 1 | 0 | Optimal | 0.40 | 86 | 86.00 | 0.00 |
| j9038 6.json | 1 | 0 | Optimal | 0.09 | 88 | 88.00 | 0.00 |
| j9038 7.json | 1 | 0 | Optimal | 0.09 | 85 | 85.00 | 0.00 |
| j9038 8.json | 1 | 0 | Optimal | 0.09 | 91 | 91.00 | 0.00 |
| j9038 9.json | 1 | 0 | Optimal | 0.17 | 95 | 95.00 | 0.00 |
| j9039 1.json | 1 | 0 | Optimal | 0.08 | 106 | 106.00 | 0.00 |
| j9039 10.json | 1 | 0 | Optimal | 0.04 | 100 | 100.00 | 0.00 |
| j9039 2.json | 1 | 0 | Optimal | 0.03 | 119 | 119.00 | 0.00 |
| j9039 3.json | 1 | 0 | Optimal | 0.04 | 83 | 83.00 | 0.00 |
| j9039 4.json | 1 | 0 | Optimal | 0.04 | 81 | 81.00 | 0.00 |
| j9039 5.json | 1 | 0 | Optimal | 0.04 | 85 | 85.00 | 0.00 |
| j9039 6.json | 1 | 0 | Optimal | 0.08 | 102 | 102.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9039 7.json | 1 | 0 | Optimal | 0.04 | 85 | 85.00 | 0.00 |
| j9039 8.json | 1 | 0 | Optimal | 0.05 | 81 | 81.00 | 0.00 |
| j9039 9.json | 1 | 0 | Optimal | 0.09 | 79 | 79.00 | 0.00 |
| j903 1.json | 1 | 0 | Optimal | 0.04 | 81 | 81.00 | 0.00 |
| j903 10.json | 1 | 0 | Optimal | 0.04 | 65 | 65.00 | 0.00 |
| j903 2.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j903 3.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j903 4.json | 1 | 0 | Optimal | 0.04 | 104 | 104.00 | 0.00 |
| j903 5.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j903 6.json | 1 | 0 | Optimal | 0.04 | 68 | 68.00 | 0.00 |
| j903 7.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j903 8.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j903 9.json | 1 | 0 | Optimal | 0.06 | 61 | 61.00 | 0.00 |
| j9040 1.json | 1 | 0 | Optimal | 0.02 | 95 | 95.00 | 0.00 |
| j9040 10.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j9040 2.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j9040 3.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j9040 4.json | 1 | 0 | Optimal | 0.04 | 106 | 106.00 | 0.00 |
| j9040 5.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j9040 6.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j9040 7.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j9040 8.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j9040 9.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j9041 1.json | 1 | 0 | Solution | 30.02 | 147 | 128.00 | 12.93 |
| j9041 10.json | 1 | 0 | Solution | 30.02 | 153 | 143.00 | 6.54 |
| j9041 2.json | 1 | 0 | Solution | 30.03 | 173 | 152.00 | 12.14 |
| j9041 3.json | 1 | 0 | Solution | 30.02 | 171 | 145.00 | 15.20 |
| j9041 4.json | 1 | 0 | Solution | 30.02 | 161 | 140.00 | 13.04 |
| j9041 5.json | 1 | 0 | Solution | 30.02 | 131 | 114.00 | 12.98 |
| j9041 6.json | 1 | 0 | Solution | 30.03 | 137 | 119.00 | 13.14 |
| j9041 7.json | 1 | 0 | Solution | 30.03 | 162 | 140.00 | 13.58 |
| j9041 8.json | 1 | 0 | Solution | 30.07 | 170 | 144.00 | 15.29 |
| j9041 9.json | 1 | 0 | Solution | 30.03 | 123 | 109.00 | 11.38 |
| j9042 1.json | 1 | 0 | Optimal | 0.15 | 106 | 106.00 | 0.00 |
| j9042 10.json | 1 | 0 | Solution | 30.03 | 91 | 88.00 | 3.30 |
| j9042 2.json | 1 | 0 | Optimal | 30.01 | 102 | 102.00 | 0.00 |
| j9042 3.json | 1 | 0 | Optimal | 0.08 | 94 | 94.00 | 0.00 |
| j9042 4.json | 1 | 0 | Optimal | 0.07 | 102 | 102.00 | 0.00 |
| j9042 5.json | 1 | 0 | Optimal | 0.09 | 105 | 105.00 | 0.00 |
| j9042 6.json | 1 | 0 | Optimal | 0.07 | 89 | 89.00 | 0.00 |
| j9042 7.json | 1 | 0 | Solution | 30.04 | 87 | 85.00 | 2.30 |
| j9042 8.json | 1 | 0 | Optimal | 0.09 | 105 | 105.00 | 0.00 |
| j9042 9.json | 1 | 0 | Optimal | 10.18 | 83 | 83.00 | 0.00 |
| j9043 1.json | 1 | 0 | Optimal | 0.07 | 99 | 99.00 | 0.00 |
| j9043 10.json | 1 | 0 | Optimal | 0.07 | 92 | 92.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9043 2.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j9043 3.json | 1 | 0 | Optimal | 0.06 | 102 | 102.00 | 0.00 |
| j9043 4.json | 1 | 0 | Optimal | 0.02 | 94 | 94.00 | 0.00 |
| j9043 5.json | 1 | 0 | Optimal | 0.04 | 98 | 98.00 | 0.00 |
| j9043 6.json | 1 | 0 | Optimal | 0.04 | 114 | 114.00 | 0.00 |
| j9043 7.json | 1 | 0 | Optimal | 0.07 | 88 | 88.00 | 0.00 |
| j9043 8.json | 1 | 0 | Optimal | 0.05 | 100 | 100.00 | 0.00 |
| j9043 9.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j9044 1.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j9044 10.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j9044 2.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j9044 3.json | 1 | 0 | Optimal | 0.02 | 110 | 110.00 | 0.00 |
| j9044 4.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j9044 5.json | 1 | 0 | Optimal | 0.03 | 84 | 84.00 | 0.00 |
| j9044 6.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j9044 7.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j9044 8.json | 1 | 0 | Optimal | 0.02 | 99 | 99.00 | 0.00 |
| j9044 9.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j9045 1.json | 1 | 0 | Solution | 30.03 | 152 | 142.00 | 6.58 |
| j9045 10.json | 1 | 0 | Solution | 30.02 | 177 | 155.00 | 12.43 |
| j9045 2.json | 1 | 0 | Solution | 30.03 | 153 | 136.00 | 11.11 |
| j9045 3.json | 1 | 0 | Solution | 30.09 | 161 | 139.00 | 13.66 |
| j9045 4.json | 1 | 0 | Solution | 30.03 | 140 | 123.00 | 12.14 |
| j9045 5.json | 1 | 0 | Solution | 30.03 | 186 | 162.00 | 12.90 |
| j9045 6.json | 1 | 0 | Solution | 30.03 | 186 | 160.00 | 13.98 |
| j9045 7.json | 1 | 0 | Solution | 30.03 | 146 | 127.00 | 13.01 |
| j9045 8.json | 1 | 0 | Solution | 30.03 | 167 | 147.00 | 11.98 |
| j9045 9.json | 1 | 0 | Solution | 30.03 | 163 | 141.00 | 13.50 |
| j9046 1.json | 1 | 0 | Optimal | 30.01 | 104 | 104.00 | 0.00 |
| j9046 10.json | 1 | 0 | Optimal | 0.09 | 114 | 114.00 | 0.00 |
| j9046 2.json | 1 | 0 | Optimal | 0.12 | 98 | 98.00 | 0.00 |
| j9046 3.json | 1 | 0 | Optimal | 0.16 | 113 | 113.00 | 0.00 |
| j9046 4.json | 1 | 0 | Solution | 30.01 | 94 | 90.00 | 4.26 |
| j9046 5.json | 1 | 0 | Optimal | 0.08 | 91 | 91.00 | 0.00 |
| j9046 6.json | 1 | 0 | Optimal | 0.09 | 83 | 83.00 | 0.00 |
| j9046 7.json | 1 | 0 | Optimal | 0.21 | 89 | 89.00 | 0.00 |
| j9046 8.json | 1 | 0 | Solution | 30.03 | 98 | 93.00 | 5.10 |
| j9046 9.json | 1 | 0 | Solution | 30.02 | 90 | 85.00 | 5.56 |
| j9047 1.json | 1 | 0 | Optimal | 0.05 | 82 | 82.00 | 0.00 |
| j9047 10.json | 1 | 0 | Optimal | 0.05 | 65 | 65.00 | 0.00 |
| j9047 2.json | 1 | 0 | Optimal | 0.05 | 90 | 90.00 | 0.00 |
| j9047 3.json | 1 | 0 | Optimal | 0.07 | 102 | 102.00 | 0.00 |
| j9047 4.json | 1 | 0 | Optimal | 0.07 | 93 | 93.00 | 0.00 |
| j9047 5.json | 1 | 0 | Optimal | 0.03 | 93 | 93.00 | 0.00 |
| j9047 6.json | 1 | 0 | Optimal | 0.04 | 98 | 98.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j9047 7.json | 1 | 0 | Optimal | 0.04 | 94 | 94.00 | 0.00 |
| j9047 8.json | 1 | 0 | Optimal | 0.04 | 98 | 98.00 | 0.00 |
| j9047 9.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j9048 1.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j9048 10.json | 1 | 0 | Optimal | 0.04 | 93 | 93.00 | 0.00 |
| j9048 2.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j9048 3.json | 1 | 0 | Optimal | 0.04 | 86 | 86.00 | 0.00 |
| j9048 4.json | 1 | 0 | Optimal | 0.04 | 91 | 91.00 | 0.00 |
| j9048 5.json | 1 | 0 | Optimal | 0.04 | 75 | 75.00 | 0.00 |
| j9048 6.json | 1 | 0 | Optimal | 0.03 | 114 | 114.00 | 0.00 |
| j9048 7.json | 1 | 0 | Optimal | 0.03 | 103 | 103.00 | 0.00 |
| j9048 8.json | 1 | 0 | Optimal | 0.04 | 74 | 74.00 | 0.00 |
| j9048 9.json | 1 | 0 | Optimal | 0.04 | 89 | 89.00 | 0.00 |
| j904 1.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j904 10.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j904 2.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j904 3.json | 1 | 0 | Optimal | 0.02 | 67 | 67.00 | 0.00 |
| j904 4.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j904 5.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j904 6.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j904 7.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j904 8.json | 1 | 0 | Optimal | 0.03 | 69 | 69.00 | 0.00 |
| j904 9.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j905 1.json | 1 | 0 | Optimal | 30.01 | 78 | 78.00 | 0.00 |
| j905 10.json | 1 | 0 | Solution | 30.04 | 98 | 94.00 | 4.08 |
| j905 2.json | 1 | 0 | Optimal | 30.00 | 93 | 93.00 | 0.00 |
| j905 3.json | 1 | 0 | Solution | 30.04 | 91 | 83.00 | 8.79 |
| j905 4.json | 1 | 0 | Solution | 30.02 | 103 | 98.00 | 4.85 |
| j905 5.json | 1 | 0 | Solution | 30.02 | 113 | 108.00 | 4.42 |
| j905 6.json | 1 | 0 | Solution | 30.03 | 87 | 83.00 | 4.60 |
| j905 7.json | 1 | 0 | Solution | 30.03 | 109 | 106.00 | 2.75 |
| j905 8.json | 1 | 0 | Solution | 30.02 | 105 | 96.00 | 8.57 |
| j905 9.json | 1 | 0 | Solution | 30.02 | 116 | 107.00 | 7.76 |
| j906 1.json | 1 | 0 | Optimal | 0.06 | 82 | 82.00 | 0.00 |
| j906 10.json | 1 | 0 | Optimal | 0.09 | 94 | 94.00 | 0.00 |
| j906 2.json | 1 | 0 | Optimal | 0.06 | 86 | 86.00 | 0.00 |
| j906 3.json | 1 | 0 | Optimal | 0.18 | 77 | 77.00 | 0.00 |
| j906 4.json | 1 | 0 | Optimal | 0.05 | 80 | 80.00 | 0.00 |
| j906 5.json | 1 | 0 | Optimal | 0.08 | 71 | 71.00 | 0.00 |
| j906 6.json | 1 | 0 | Optimal | 0.04 | 98 | 98.00 | 0.00 |
| j906 7.json | 1 | 0 | Optimal | 0.04 | 71 | 71.00 | 0.00 |
| j906 8.json | 1 | 0 | Optimal | 18.15 | 68 | 68.00 | 0.00 |
| j906 9.json | 1 | 0 | Optimal | 0.04 | 68 | 68.00 | 0.00 |
| j907 1.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j907 10.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |

Table 9.6: Results for RCPSP J90 (CPSat) (480 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|--------------|------------|----------------|----------|-------|----------|--------|----------------|
| j907 2.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j907 3.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j907 4.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j907 5.json | 1 | 0 | Optimal | 0.04 | 79 | 79.00 | 0.00 |
| j907 6.json | 1 | 0 | Optimal | 0.04 | 90 | 90.00 | 0.00 |
| j907 7.json | 1 | 0 | Optimal | 0.02 | 90 | 90.00 | 0.00 |
| j907 8.json | 1 | 0 | Optimal | 0.02 | 60 | 60.00 | 0.00 |
| j907 9.json | 1 | 0 | Optimal | 0.06 | 83 | 83.00 | 0.00 |
| j908 1.json | 1 | 0 | Optimal | 0.02 | 96 | 96.00 | 0.00 |
| j908 10.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j908 2.json | 1 | 0 | Optimal | 0.02 | 78 | 78.00 | 0.00 |
| j908 3.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j908 4.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j908 5.json | 1 | 0 | Optimal | 0.03 | 63 | 63.00 | 0.00 |
| j908 6.json | 1 | 0 | Optimal | 0.02 | 70 | 70.00 | 0.00 |
| j908 7.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j908 8.json | 1 | 0 | Optimal | 0.02 | 68 | 68.00 | 0.00 |
| j908 9.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j909 1.json | 1 | 0 | Solution | 30.02 | 108 | 98.00 | 9.26 |
| j909 10.json | 1 | 0 | Solution | 30.02 | 115 | 104.00 | 9.57 |
| j909 2.json | 1 | 0 | Solution | 30.04 | 132 | 120.00 | 9.09 |
| j909 3.json | 1 | 0 | Solution | 30.02 | 106 | 97.00 | 8.49 |
| j909 4.json | 1 | 0 | Solution | 30.02 | 132 | 118.00 | 10.61 |
| j909 5.json | 1 | 0 | Solution | 30.06 | 145 | 125.00 | 13.79 |
| j909 6.json | 1 | 0 | Solution | 30.03 | 121 | 111.00 | 8.26 |
| j909 7.json | 1 | 0 | Solution | 30.02 | 113 | 102.00 | 9.73 |
| j909 8.json | 1 | 0 | Solution | 30.07 | 121 | 109.00 | 9.92 |
| j909 9.json | 1 | 0 | Solution | 30.04 | 122 | 105.00 | 13.93 |

9.4 Size J120

9.4.1 CPO

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|---------|------|----------|--------|----------------|
| j12010 1.json | 1 | 0 | Optimal | 0.12 | 111 | 111.00 | 0.00 |
| j12010 10.json | 1 | 0 | Optimal | 0.03 | 66 | 66.00 | 0.00 |
| j12010 2.json | 1 | 0 | Optimal | 0.04 | 91 | 91.00 | 0.00 |
| j12010 3.json | 1 | 0 | Optimal | 0.05 | 99 | 99.00 | 0.00 |
| j12010 4.json | 1 | 0 | Optimal | 0.03 | 95 | 95.00 | 0.00 |
| j12010 5.json | 1 | 0 | Optimal | 0.03 | 97 | 97.00 | 0.00 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12010 6.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j12010 7.json | 1 | 0 | Optimal | 0.06 | 79 | 79.00 | 0.00 |
| j12010 8.json | 1 | 0 | Optimal | 0.03 | 114 | 114.00 | 0.00 |
| j12010 9.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j12011 1.json | 1 | 0 | Solution | 60.02 | 180 | 155.00 | 13.89 |
| j12011 10.json | 1 | 0 | Solution | 60.03 | 188 | 163.00 | 13.30 |
| j12011 2.json | 1 | 0 | Solution | 60.02 | 164 | 144.00 | 12.20 |
| j12011 3.json | 1 | 0 | Solution | 60.03 | 212 | 186.00 | 12.26 |
| j12011 4.json | 1 | 0 | Solution | 60.03 | 207 | 175.00 | 15.46 |
| j12011 5.json | 1 | 0 | Solution | 60.03 | 222 | 191.00 | 13.96 |
| j12011 6.json | 1 | 0 | Solution | 60.02 | 223 | 188.00 | 15.70 |
| j12011 7.json | 1 | 0 | Solution | 60.03 | 170 | 147.00 | 13.53 |
| j12011 8.json | 1 | 0 | Solution | 60.02 | 167 | 151.00 | 9.58 |
| j12011 9.json | 1 | 0 | Solution | 60.05 | 181 | 167.00 | 7.73 |
| j12012 1.json | 1 | 0 | Solution | 60.02 | 143 | 127.00 | 11.19 |
| j12012 10.json | 1 | 0 | Solution | 60.02 | 146 | 142.00 | 2.74 |
| j12012 2.json | 1 | 0 | Solution | 60.01 | 119 | 111.00 | 6.72 |
| j12012 3.json | 1 | 0 | Solution | 60.02 | 140 | 132.00 | 5.71 |
| j12012 4.json | 1 | 0 | Solution | 60.02 | 128 | 122.00 | 4.69 |
| j12012 5.json | 1 | 0 | Solution | 60.01 | 168 | 153.00 | 8.93 |
| j12012 6.json | 1 | 0 | Solution | 60.02 | 126 | 116.00 | 7.94 |
| j12012 7.json | 1 | 0 | Solution | 60.03 | 123 | 116.00 | 5.69 |
| j12012 8.json | 1 | 0 | Solution | 60.02 | 123 | 113.00 | 8.13 |
| j12012 9.json | 1 | 0 | Solution | 60.02 | 109 | 101.00 | 7.34 |
| j12013 1.json | 1 | 0 | Solution | 60.03 | 130 | 123.00 | 5.38 |
| j12013 10.json | 1 | 0 | Solution | 60.02 | 95 | 89.00 | 6.32 |
| j12013 2.json | 1 | 0 | Solution | 60.02 | 89 | 88.00 | 1.12 |
| j12013 3.json | 1 | 0 | Solution | 60.02 | 121 | 115.00 | 4.96 |
| j12013 4.json | 1 | 0 | Solution | 60.01 | 115 | 108.00 | 6.09 |
| j12013 5.json | 1 | 0 | Solution | 60.02 | 93 | 90.00 | 3.23 |
| j12013 6.json | 1 | 0 | Solution | 60.03 | 101 | 95.00 | 5.94 |
| j12013 7.json | 1 | 0 | Solution | 60.01 | 112 | 107.00 | 4.46 |
| j12013 8.json | 1 | 0 | Solution | 60.01 | 97 | 91.00 | 6.19 |
| j12013 9.json | 1 | 0 | Solution | 60.01 | 86 | 83.00 | 3.49 |
| j12014 1.json | 1 | 0 | Solution | 60.02 | 87 | 84.00 | 3.45 |
| j12014 10.json | 1 | 0 | Solution | 60.02 | 83 | 80.00 | 3.61 |
| j12014 2.json | 1 | 0 | Solution | 60.02 | 94 | 90.00 | 4.26 |
| j12014 3.json | 1 | 0 | Optimal | 1.53 | 88 | 88.00 | 0.00 |
| j12014 4.json | 1 | 0 | Solution | 60.02 | 90 | 85.00 | 5.56 |
| j12014 5.json | 1 | 0 | Solution | 60.01 | 99 | 93.00 | 6.06 |
| j12014 6.json | 1 | 0 | Optimal | 0.62 | 91 | 91.00 | 0.00 |
| j12014 7.json | 1 | 0 | Solution | 60.03 | 91 | 90.00 | 1.10 |
| j12014 8.json | 1 | 0 | Solution | 60.02 | 114 | 110.00 | 3.51 |
| j12014 9.json | 1 | 0 | Optimal | 0.05 | 101 | 101.00 | 0.00 |
| j12015 1.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12015 10.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j12015 2.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j12015 3.json | 1 | 0 | Optimal | 0.04 | 87 | 87.00 | 0.00 |
| j12015 4.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j12015 5.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j12015 6.json | 1 | 0 | Optimal | 0.03 | 97 | 97.00 | 0.00 |
| j12015 7.json | 1 | 0 | Optimal | 0.03 | 75 | 75.00 | 0.00 |
| j12015 8.json | 1 | 0 | Optimal | 0.02 | 126 | 126.00 | 0.00 |
| j12015 9.json | 1 | 0 | Optimal | 0.04 | 109 | 109.00 | 0.00 |
| j12016 1.json | 1 | 0 | Solution | 60.03 | 204 | 179.00 | 12.25 |
| j12016 10.json | 1 | 0 | Solution | 60.01 | 224 | 201.00 | 10.27 |
| j12016 2.json | 1 | 0 | Solution | 60.02 | 243 | 221.00 | 9.05 |
| j12016 3.json | 1 | 0 | Solution | 60.02 | 245 | 219.00 | 10.61 |
| j12016 4.json | 1 | 0 | Solution | 60.01 | 207 | 189.00 | 8.70 |
| j12016 5.json | 1 | 0 | Solution | 60.01 | 207 | 182.00 | 12.08 |
| j12016 6.json | 1 | 0 | Solution | 60.03 | 213 | 194.00 | 8.92 |
| j12016 7.json | 1 | 0 | Solution | 60.02 | 191 | 174.00 | 8.90 |
| j12016 8.json | 1 | 0 | Solution | 60.02 | 200 | 180.00 | 10.00 |
| j12016 9.json | 1 | 0 | Solution | 60.02 | 214 | 188.00 | 12.15 |
| j12017 1.json | 1 | 0 | Solution | 60.01 | 145 | 135.00 | 6.90 |
| j12017 10.json | 1 | 0 | Solution | 60.02 | 139 | 131.00 | 5.76 |
| j12017 2.json | 1 | 0 | Solution | 60.02 | 128 | 121.00 | 5.47 |
| j12017 3.json | 1 | 0 | Solution | 60.02 | 111 | 106.00 | 4.50 |
| j12017 4.json | 1 | 0 | Solution | 60.02 | 123 | 118.00 | 4.07 |
| j12017 5.json | 1 | 0 | Solution | 60.01 | 133 | 123.00 | 7.52 |
| j12017 6.json | 1 | 0 | Solution | 60.02 | 140 | 133.00 | 5.00 |
| j12017 7.json | 1 | 0 | Solution | 60.00 | 150 | 141.00 | 6.00 |
| j12017 8.json | 1 | 0 | Solution | 60.02 | 131 | 126.00 | 3.82 |
| j12017 9.json | 1 | 0 | Solution | 60.01 | 138 | 129.00 | 6.52 |
| j12018 1.json | 1 | 0 | Solution | 60.01 | 142 | 137.00 | 3.52 |
| j12018 10.json | 1 | 0 | Solution | 60.01 | 100 | 97.00 | 3.00 |
| j12018 2.json | 1 | 0 | Solution | 60.00 | 119 | 111.00 | 6.72 |
| j12018 3.json | 1 | 0 | Solution | 60.01 | 103 | 100.00 | 2.91 |
| j12018 4.json | 1 | 0 | Solution | 60.01 | 103 | 98.00 | 4.85 |
| j12018 5.json | 1 | 0 | Solution | 60.01 | 121 | 117.00 | 3.31 |
| j12018 6.json | 1 | 0 | Solution | 60.01 | 137 | 131.00 | 4.38 |
| j12018 7.json | 1 | 0 | Solution | 60.02 | 120 | 112.00 | 6.67 |
| j12018 8.json | 1 | 0 | Solution | 60.00 | 107 | 102.00 | 4.67 |
| j12018 9.json | 1 | 0 | Solution | 60.02 | 94 | 89.00 | 5.32 |
| j12019 1.json | 1 | 0 | Optimal | 0.08 | 88 | 88.00 | 0.00 |
| j12019 10.json | 1 | 0 | Optimal | 0.03 | 88 | 88.00 | 0.00 |
| j12019 2.json | 1 | 0 | Solution | 60.02 | 84 | 81.00 | 3.57 |
| j12019 3.json | 1 | 0 | Solution | 60.02 | 86 | 83.00 | 3.49 |
| j12019 4.json | 1 | 0 | Solution | 60.02 | 110 | 103.00 | 6.36 |
| j12019 5.json | 1 | 0 | Solution | 60.02 | 106 | 101.00 | 4.72 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12019 6.json | 1 | 0 | Solution | 60.00 | 91 | 89.00 | 2.20 |
| j12019 7.json | 1 | 0 | Optimal | 0.05 | 93 | 93.00 | 0.00 |
| j12019 8.json | 1 | 0 | Solution | 60.01 | 94 | 93.00 | 1.06 |
| j12019 9.json | 1 | 0 | Solution | 60.02 | 90 | 88.00 | 2.22 |
| j1201 1.json | 1 | 0 | Optimal | 22.53 | 105 | 105.00 | 0.00 |
| j1201 10.json | 1 | 0 | Optimal | 2.36 | 108 | 108.00 | 0.00 |
| j1201 2.json | 1 | 0 | Optimal | 2.20 | 109 | 109.00 | 0.00 |
| j1201 3.json | 1 | 0 | Solution | 60.02 | 126 | 115.00 | 8.73 |
| j1201 4.json | 1 | 0 | Optimal | 1.90 | 97 | 97.00 | 0.00 |
| j1201 5.json | 1 | 0 | Optimal | 3.17 | 112 | 112.00 | 0.00 |
| j1201 6.json | 1 | 0 | Optimal | 0.86 | 84 | 84.00 | 0.00 |
| j1201 7.json | 1 | 0 | Optimal | 0.97 | 117 | 117.00 | 0.00 |
| j1201 8.json | 1 | 0 | Optimal | 5.19 | 109 | 109.00 | 0.00 |
| j1201 9.json | 1 | 0 | Optimal | 0.86 | 112 | 112.00 | 0.00 |
| j12020 1.json | 1 | 0 | Optimal | 0.17 | 89 | 89.00 | 0.00 |
| j12020 10.json | 1 | 0 | Optimal | 0.03 | 81 | 81.00 | 0.00 |
| j12020 2.json | 1 | 0 | Optimal | 0.03 | 99 | 99.00 | 0.00 |
| j12020 3.json | 1 | 0 | Solution | 60.00 | 79 | 75.00 | 5.06 |
| j12020 4.json | 1 | 0 | Optimal | 0.02 | 89 | 89.00 | 0.00 |
| j12020 5.json | 1 | 0 | Optimal | 0.02 | 69 | 69.00 | 0.00 |
| j12020 6.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j12020 7.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j12020 8.json | 1 | 0 | Optimal | 10.16 | 107 | 107.00 | 0.00 |
| j12020 9.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j12021 1.json | 1 | 0 | Optimal | 8.08 | 114 | 114.00 | 0.00 |
| j12021 10.json | 1 | 0 | Optimal | 4.05 | 102 | 102.00 | 0.00 |
| j12021 2.json | 1 | 0 | Optimal | 15.64 | 117 | 117.00 | 0.00 |
| j12021 3.json | 1 | 0 | Optimal | 2.07 | 143 | 143.00 | 0.00 |
| j12021 4.json | 1 | 0 | Optimal | 6.50 | 135 | 135.00 | 0.00 |
| j12021 5.json | 1 | 0 | Optimal | 1.65 | 110 | 110.00 | 0.00 |
| j12021 6.json | 1 | 0 | Optimal | 2.84 | 109 | 109.00 | 0.00 |
| j12021 7.json | 1 | 0 | Optimal | 15.91 | 111 | 111.00 | 0.00 |
| j12021 8.json | 1 | 0 | Optimal | 0.56 | 127 | 127.00 | 0.00 |
| j12021 9.json | 1 | 0 | Optimal | 0.80 | 102 | 102.00 | 0.00 |
| j12022 1.json | 1 | 0 | Optimal | 0.91 | 101 | 101.00 | 0.00 |
| j12022 10.json | 1 | 0 | Optimal | 0.33 | 79 | 79.00 | 0.00 |
| j12022 2.json | 1 | 0 | Optimal | 0.03 | 107 | 107.00 | 0.00 |
| j12022 3.json | 1 | 0 | Optimal | 19.99 | 96 | 96.00 | 0.00 |
| j12022 4.json | 1 | 0 | Optimal | 0.50 | 90 | 90.00 | 0.00 |
| j12022 5.json | 1 | 0 | Optimal | 0.39 | 93 | 93.00 | 0.00 |
| j12022 6.json | 1 | 0 | Optimal | 0.53 | 103 | 103.00 | 0.00 |
| j12022 7.json | 1 | 0 | Optimal | 0.03 | 133 | 133.00 | 0.00 |
| j12022 8.json | 1 | 0 | Optimal | 3.32 | 103 | 103.00 | 0.00 |
| j12022 9.json | 1 | 0 | Optimal | 0.61 | 109 | 109.00 | 0.00 |
| j12023 1.json | 1 | 0 | Optimal | 0.03 | 107 | 107.00 | 0.00 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12023 10.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j12023 2.json | 1 | 0 | Optimal | 0.02 | 116 | 116.00 | 0.00 |
| j12023 3.json | 1 | 0 | Optimal | 0.02 | 99 | 99.00 | 0.00 |
| j12023 4.json | 1 | 0 | Optimal | 0.02 | 106 | 106.00 | 0.00 |
| j12023 5.json | 1 | 0 | Optimal | 0.06 | 99 | 99.00 | 0.00 |
| j12023 6.json | 1 | 0 | Optimal | 0.03 | 106 | 106.00 | 0.00 |
| j12023 7.json | 1 | 0 | Optimal | 0.02 | 104 | 104.00 | 0.00 |
| j12023 8.json | 1 | 0 | Optimal | 0.02 | 101 | 101.00 | 0.00 |
| j12023 9.json | 1 | 0 | Optimal | 0.03 | 107 | 107.00 | 0.00 |
| j12024 1.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j12024 10.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j12024 2.json | 1 | 0 | Optimal | 0.05 | 91 | 91.00 | 0.00 |
| j12024 3.json | 1 | 0 | Optimal | 0.03 | 89 | 89.00 | 0.00 |
| j12024 4.json | 1 | 0 | Optimal | 0.03 | 101 | 101.00 | 0.00 |
| j12024 5.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j12024 6.json | 1 | 0 | Optimal | 0.02 | 95 | 95.00 | 0.00 |
| j12024 7.json | 1 | 0 | Optimal | 0.03 | 112 | 112.00 | 0.00 |
| j12024 8.json | 1 | 0 | Optimal | 0.02 | 104 | 104.00 | 0.00 |
| j12024 9.json | 1 | 0 | Optimal | 0.38 | 82 | 82.00 | 0.00 |
| j12025 1.json | 1 | 0 | Optimal | 0.02 | 82 | 82.00 | 0.00 |
| j12025 10.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j12025 2.json | 1 | 0 | Optimal | 0.02 | 108 | 108.00 | 0.00 |
| j12025 3.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j12025 4.json | 1 | 0 | Optimal | 0.02 | 117 | 117.00 | 0.00 |
| j12025 5.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j12025 6.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j12025 7.json | 1 | 0 | Optimal | 0.08 | 92 | 92.00 | 0.00 |
| j12025 8.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j12025 9.json | 1 | 0 | Optimal | 0.02 | 94 | 94.00 | 0.00 |
| j12026 1.json | 1 | 0 | Solution | 60.02 | 177 | 148.00 | 16.38 |
| j12026 10.json | 1 | 0 | Solution | 60.01 | 191 | 157.00 | 17.80 |
| j12026 2.json | 1 | 0 | Solution | 60.01 | 176 | 147.00 | 16.48 |
| j12026 3.json | 1 | 0 | Solution | 60.00 | 173 | 154.00 | 10.98 |
| j12026 4.json | 1 | 0 | Solution | 60.02 | 176 | 152.00 | 13.64 |
| j12026 5.json | 1 | 0 | Solution | 60.01 | 164 | 138.00 | 15.85 |
| j12026 6.json | 1 | 0 | Solution | 60.00 | 191 | 170.00 | 10.99 |
| j12026 7.json | 1 | 0 | Solution | 60.02 | 163 | 143.00 | 12.27 |
| j12026 8.json | 1 | 0 | Solution | 60.01 | 178 | 155.00 | 12.92 |
| j12026 9.json | 1 | 0 | Solution | 60.01 | 181 | 157.00 | 13.26 |
| j12027 1.json | 1 | 0 | Solution | 60.02 | 111 | 107.00 | 3.60 |
| j12027 10.json | 1 | 0 | Solution | 60.01 | 118 | 109.00 | 7.63 |
| j12027 2.json | 1 | 0 | Solution | 60.01 | 119 | 107.00 | 10.08 |
| j12027 3.json | 1 | 0 | Solution | 60.01 | 146 | 140.00 | 4.11 |
| j12027 4.json | 1 | 0 | Solution | 60.02 | 108 | 105.00 | 2.78 |
| j12027 5.json | 1 | 0 | Solution | 60.02 | 114 | 103.00 | 9.65 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12027 6.json | 1 | 0 | Solution | 60.00 | 149 | 131.00 | 12.08 |
| j12027 7.json | 1 | 0 | Solution | 60.01 | 127 | 118.00 | 7.09 |
| j12027 8.json | 1 | 0 | Solution | 60.00 | 142 | 135.00 | 4.93 |
| j12027 9.json | 1 | 0 | Solution | 60.02 | 131 | 120.00 | 8.40 |
| j12028 1.json | 1 | 0 | Solution | 60.02 | 108 | 105.00 | 2.78 |
| j12028 10.json | 1 | 0 | Solution | 60.00 | 117 | 114.00 | 2.56 |
| j12028 2.json | 1 | 0 | Optimal | 5.74 | 110 | 110.00 | 0.00 |
| j12028 3.json | 1 | 0 | Optimal | 0.02 | 101 | 101.00 | 0.00 |
| j12028 4.json | 1 | 0 | Optimal | 25.01 | 112 | 112.00 | 0.00 |
| j12028 5.json | 1 | 0 | Optimal | 0.02 | 102 | 102.00 | 0.00 |
| j12028 6.json | 1 | 0 | Optimal | 1.77 | 103 | 103.00 | 0.00 |
| j12028 7.json | 1 | 0 | Solution | 60.00 | 111 | 107.00 | 3.60 |
| j12028 8.json | 1 | 0 | Solution | 60.00 | 100 | 98.00 | 2.00 |
| j12028 9.json | 1 | 0 | Solution | 60.02 | 98 | 97.00 | 1.02 |
| j12029 1.json | 1 | 0 | Optimal | 0.03 | 104 | 104.00 | 0.00 |
| j12029 10.json | 1 | 0 | Optimal | 0.03 | 96 | 96.00 | 0.00 |
| j12029 2.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j12029 3.json | 1 | 0 | Solution | 60.02 | 99 | 95.00 | 4.04 |
| j12029 4.json | 1 | 0 | Optimal | 3.90 | 80 | 80.00 | 0.00 |
| j12029 5.json | 1 | 0 | Optimal | 0.30 | 102 | 102.00 | 0.00 |
| j12029 6.json | 1 | 0 | Solution | 60.01 | 91 | 88.00 | 3.30 |
| j12029 7.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j12029 8.json | 1 | 0 | Optimal | 1.56 | 80 | 80.00 | 0.00 |
| j12029 9.json | 1 | 0 | Optimal | 0.03 | 97 | 97.00 | 0.00 |
| j1202 1.json | 1 | 0 | Optimal | 0.85 | 87 | 87.00 | 0.00 |
| j1202 10.json | 1 | 0 | Optimal | 0.55 | 96 | 96.00 | 0.00 |
| j1202 2.json | 1 | 0 | Optimal | 1.13 | 75 | 75.00 | 0.00 |
| j1202 3.json | 1 | 0 | Optimal | 1.63 | 92 | 92.00 | 0.00 |
| j1202 4.json | 1 | 0 | Optimal | 0.47 | 95 | 95.00 | 0.00 |
| j1202 5.json | 1 | 0 | Optimal | 0.60 | 103 | 103.00 | 0.00 |
| j1202 6.json | 1 | 0 | Optimal | 0.37 | 92 | 92.00 | 0.00 |
| j1202 7.json | 1 | 0 | Optimal | 0.20 | 90 | 90.00 | 0.00 |
| j1202 8.json | 1 | 0 | Optimal | 0.41 | 83 | 83.00 | 0.00 |
| j1202 9.json | 1 | 0 | Optimal | 1.27 | 94 | 94.00 | 0.00 |
| j12030 1.json | 1 | 0 | Optimal | 0.03 | 102 | 102.00 | 0.00 |
| j12030 10.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j12030 2.json | 1 | 0 | Optimal | 0.03 | 112 | 112.00 | 0.00 |
| j12030 3.json | 1 | 0 | Optimal | 0.02 | 108 | 108.00 | 0.00 |
| j12030 4.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j12030 5.json | 1 | 0 | Optimal | 2.12 | 83 | 83.00 | 0.00 |
| j12030 6.json | 1 | 0 | Optimal | 0.03 | 79 | 79.00 | 0.00 |
| j12030 7.json | 1 | 0 | Optimal | 0.63 | 93 | 93.00 | 0.00 |
| j12030 8.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j12030 9.json | 1 | 0 | Optimal | 0.02 | 93 | 93.00 | 0.00 |
| j12031 1.json | 1 | 0 | Solution | 60.02 | 206 | 178.00 | 13.59 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12031 10.json | 1 | 0 | Solution | 60.03 | 234 | 201.00 | 14.10 |
| j12031 2.json | 1 | 0 | Solution | 60.02 | 200 | 174.00 | 13.00 |
| j12031 3.json | 1 | 0 | Solution | 60.02 | 181 | 158.00 | 12.71 |
| j12031 4.json | 1 | 0 | Solution | 60.01 | 234 | 188.00 | 19.66 |
| j12031 5.json | 1 | 0 | Solution | 60.02 | 211 | 184.00 | 12.80 |
| j12031 6.json | 1 | 0 | Solution | 60.02 | 201 | 182.00 | 9.45 |
| j12031 7.json | 1 | 0 | Solution | 60.02 | 214 | 189.00 | 11.68 |
| j12031 8.json | 1 | 0 | Solution | 60.00 | 199 | 172.00 | 13.57 |
| j12031 9.json | 1 | 0 | Solution | 60.02 | 198 | 173.00 | 12.63 |
| j12032 1.json | 1 | 0 | Solution | 60.01 | 150 | 141.00 | 6.00 |
| j12032 10.json | 1 | 0 | Solution | 60.02 | 133 | 125.00 | 6.02 |
| j12032 2.json | 1 | 0 | Solution | 60.01 | 135 | 123.00 | 8.89 |
| j12032 3.json | 1 | 0 | Solution | 60.01 | 150 | 134.00 | 10.67 |
| j12032 4.json | 1 | 0 | Solution | 60.02 | 139 | 127.00 | 8.63 |
| j12032 5.json | 1 | 0 | Solution | 60.00 | 142 | 133.00 | 6.34 |
| j12032 6.json | 1 | 0 | Solution | 60.01 | 132 | 122.00 | 7.58 |
| j12032 7.json | 1 | 0 | Solution | 60.01 | 125 | 118.00 | 5.60 |
| j12032 8.json | 1 | 0 | Solution | 60.01 | 139 | 132.00 | 5.04 |
| j12032 9.json | 1 | 0 | Solution | 60.00 | 130 | 125.00 | 3.85 |
| j12033 1.json | 1 | 0 | Solution | 60.00 | 109 | 105.00 | 3.67 |
| j12033 10.json | 1 | 0 | Solution | 60.02 | 109 | 102.00 | 6.42 |
| j12033 2.json | 1 | 0 | Solution | 60.02 | 116 | 107.00 | 7.76 |
| j12033 3.json | 1 | 0 | Solution | 60.03 | 110 | 102.00 | 7.27 |
| j12033 4.json | 1 | 0 | Solution | 60.02 | 114 | 106.00 | 7.02 |
| j12033 5.json | 1 | 0 | Solution | 60.02 | 144 | 133.00 | 7.64 |
| j12033 6.json | 1 | 0 | Solution | 60.01 | 117 | 115.00 | 1.71 |
| j12033 7.json | 1 | 0 | Solution | 60.01 | 125 | 121.00 | 3.20 |
| j12033 8.json | 1 | 0 | Solution | 60.02 | 114 | 107.00 | 6.14 |
| j12033 9.json | 1 | 0 | Solution | 60.01 | 117 | 109.00 | 6.84 |
| j12034 1.json | 1 | 0 | Solution | 60.02 | 79 | 76.00 | 3.80 |
| j12034 10.json | 1 | 0 | Optimal | 0.05 | 101 | 101.00 | 0.00 |
| j12034 2.json | 1 | 0 | Solution | 60.00 | 107 | 103.00 | 3.74 |
| j12034 3.json | 1 | 0 | Solution | 60.01 | 103 | 100.00 | 2.91 |
| j12034 4.json | 1 | 0 | Optimal | 3.83 | 95 | 95.00 | 0.00 |
| j12034 5.json | 1 | 0 | Solution | 60.01 | 104 | 101.00 | 2.88 |
| j12034 6.json | 1 | 0 | Optimal | 0.05 | 100 | 100.00 | 0.00 |
| j12034 7.json | 1 | 0 | Optimal | 2.62 | 105 | 105.00 | 0.00 |
| j12034 8.json | 1 | 0 | Solution | 60.01 | 91 | 86.00 | 5.49 |
| j12034 9.json | 1 | 0 | Solution | 60.01 | 96 | 91.00 | 5.21 |
| j12035 1.json | 1 | 0 | Optimal | 0.03 | 87 | 87.00 | 0.00 |
| j12035 10.json | 1 | 0 | Optimal | 0.03 | 86 | 86.00 | 0.00 |
| j12035 2.json | 1 | 0 | Solution | 60.02 | 112 | 111.00 | 0.89 |
| j12035 3.json | 1 | 0 | Optimal | 1.08 | 77 | 77.00 | 0.00 |
| j12035 4.json | 1 | 0 | Optimal | 0.05 | 101 | 101.00 | 0.00 |
| j12035 5.json | 1 | 0 | Solution | 60.00 | 93 | 92.00 | 1.08 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12035 6.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j12035 7.json | 1 | 0 | Optimal | 0.02 | 99 | 99.00 | 0.00 |
| j12035 8.json | 1 | 0 | Optimal | 0.03 | 101 | 101.00 | 0.00 |
| j12035 9.json | 1 | 0 | Optimal | 0.79 | 91 | 91.00 | 0.00 |
| j12036 1.json | 1 | 0 | Solution | 60.01 | 218 | 199.00 | 8.72 |
| j12036 10.json | 1 | 0 | Solution | 60.00 | 224 | 197.00 | 12.05 |
| j12036 2.json | 1 | 0 | Solution | 60.02 | 231 | 201.00 | 12.99 |
| j12036 3.json | 1 | 0 | Solution | 60.01 | 237 | 217.00 | 8.44 |
| j12036 4.json | 1 | 0 | Solution | 60.01 | 250 | 215.00 | 14.00 |
| j12036 5.json | 1 | 0 | Solution | 60.02 | 240 | 210.00 | 12.50 |
| j12036 6.json | 1 | 0 | Solution | 60.01 | 236 | 204.00 | 13.56 |
| j12036 7.json | 1 | 0 | Solution | 60.01 | 215 | 195.00 | 9.30 |
| j12036 8.json | 1 | 0 | Solution | 60.00 | 182 | 152.00 | 16.48 |
| j12036 9.json | 1 | 0 | Solution | 60.01 | 228 | 198.00 | 13.16 |
| j12037 1.json | 1 | 0 | Solution | 60.01 | 149 | 138.00 | 7.38 |
| j12037 10.json | 1 | 0 | Solution | 60.02 | 136 | 127.00 | 6.62 |
| j12037 2.json | 1 | 0 | Solution | 60.01 | 149 | 141.00 | 5.37 |
| j12037 3.json | 1 | 0 | Solution | 60.02 | 143 | 135.00 | 5.59 |
| j12037 4.json | 1 | 0 | Solution | 60.03 | 166 | 156.00 | 6.02 |
| j12037 5.json | 1 | 0 | Solution | 60.02 | 212 | 194.00 | 8.49 |
| j12037 6.json | 1 | 0 | Solution | 60.03 | 169 | 154.00 | 8.88 |
| j12037 7.json | 1 | 0 | Solution | 60.02 | 166 | 150.00 | 9.64 |
| j12037 8.json | 1 | 0 | Solution | 60.01 | 184 | 166.00 | 9.78 |
| j12037 9.json | 1 | 0 | Solution | 60.00 | 149 | 138.00 | 7.38 |
| j12038 1.json | 1 | 0 | Solution | 60.02 | 111 | 105.00 | 5.41 |
| j12038 10.json | 1 | 0 | Solution | 60.02 | 143 | 137.00 | 4.20 |
| j12038 2.json | 1 | 0 | Solution | 60.02 | 129 | 119.00 | 7.75 |
| j12038 3.json | 1 | 0 | Solution | 60.02 | 158 | 153.00 | 3.16 |
| j12038 4.json | 1 | 0 | Solution | 60.01 | 143 | 138.00 | 3.50 |
| j12038 5.json | 1 | 0 | Solution | 60.00 | 116 | 110.00 | 5.17 |
| j12038 6.json | 1 | 0 | Solution | 60.02 | 125 | 118.00 | 5.60 |
| j12038 7.json | 1 | 0 | Solution | 60.02 | 107 | 102.00 | 4.67 |
| j12038 8.json | 1 | 0 | Solution | 60.02 | 128 | 121.00 | 5.47 |
| j12038 9.json | 1 | 0 | Solution | 60.01 | 135 | 134.00 | 0.74 |
| j12039 1.json | 1 | 0 | Optimal | 27.11 | 95 | 95.00 | 0.00 |
| j12039 10.json | 1 | 0 | Solution | 60.00 | 112 | 105.00 | 6.25 |
| j12039 2.json | 1 | 0 | Solution | 60.02 | 111 | 105.00 | 5.41 |
| j12039 3.json | 1 | 0 | Solution | 60.02 | 114 | 109.00 | 4.39 |
| j12039 4.json | 1 | 0 | Solution | 60.01 | 100 | 97.00 | 3.00 |
| j12039 5.json | 1 | 0 | Optimal | 0.05 | 106 | 106.00 | 0.00 |
| j12039 6.json | 1 | 0 | Optimal | 0.05 | 95 | 95.00 | 0.00 |
| j12039 7.json | 1 | 0 | Solution | 60.01 | 106 | 101.00 | 4.72 |
| j12039 8.json | 1 | 0 | Solution | 60.00 | 98 | 93.00 | 5.10 |
| j12039 9.json | 1 | 0 | Solution | 60.01 | 94 | 89.00 | 5.32 |
| j1203 1.json | 1 | 0 | Optimal | 0.96 | 80 | 80.00 | 0.00 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j1203 10.json | 1 | 0 | Optimal | 0.02 | 103 | 103.00 | 0.00 |
| j1203 2.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j1203 3.json | 1 | 0 | Optimal | 0.03 | 100 | 100.00 | 0.00 |
| j1203 4.json | 1 | 0 | Optimal | 0.11 | 71 | 71.00 | 0.00 |
| j1203 5.json | 1 | 0 | Optimal | 0.05 | 84 | 84.00 | 0.00 |
| j1203 6.json | 1 | 0 | Optimal | 0.03 | 102 | 102.00 | 0.00 |
| j1203 7.json | 1 | 0 | Optimal | 0.05 | 93 | 93.00 | 0.00 |
| j1203 8.json | 1 | 0 | Optimal | 0.03 | 77 | 77.00 | 0.00 |
| j1203 9.json | 1 | 0 | Optimal | 0.02 | 86 | 86.00 | 0.00 |
| j12040 1.json | 1 | 0 | Solution | 60.02 | 82 | 80.00 | 2.44 |
| j12040 10.json | 1 | 0 | Optimal | 0.04 | 96 | 96.00 | 0.00 |
| j12040 2.json | 1 | 0 | Optimal | 4.82 | 90 | 90.00 | 0.00 |
| j12040 3.json | 1 | 0 | Optimal | 1.41 | 87 | 87.00 | 0.00 |
| j12040 4.json | 1 | 0 | Optimal | 0.02 | 112 | 112.00 | 0.00 |
| j12040 5.json | 1 | 0 | Optimal | 0.03 | 101 | 101.00 | 0.00 |
| j12040 6.json | 1 | 0 | Optimal | 0.02 | 90 | 90.00 | 0.00 |
| j12040 7.json | 1 | 0 | Optimal | 0.02 | 91 | 91.00 | 0.00 |
| j12040 8.json | 1 | 0 | Optimal | 0.03 | 97 | 97.00 | 0.00 |
| j12040 9.json | 1 | 0 | Optimal | 0.05 | 117 | 117.00 | 0.00 |
| j12041 1.json | 1 | 0 | Optimal | 0.58 | 127 | 127.00 | 0.00 |
| j12041 10.json | 1 | 0 | Optimal | 0.85 | 136 | 136.00 | 0.00 |
| j12041 2.json | 1 | 0 | Optimal | 19.30 | 141 | 141.00 | 0.00 |
| j12041 3.json | 1 | 0 | Optimal | 1.80 | 141 | 141.00 | 0.00 |
| j12041 4.json | 1 | 0 | Optimal | 2.32 | 116 | 116.00 | 0.00 |
| j12041 5.json | 1 | 0 | Optimal | 0.87 | 138 | 138.00 | 0.00 |
| j12041 6.json | 1 | 0 | Optimal | 1.18 | 113 | 113.00 | 0.00 |
| j12041 7.json | 1 | 0 | Optimal | 7.03 | 109 | 109.00 | 0.00 |
| j12041 8.json | 1 | 0 | Optimal | 3.97 | 138 | 138.00 | 0.00 |
| j12041 9.json | 1 | 0 | Optimal | 5.53 | 121 | 121.00 | 0.00 |
| j12042 1.json | 1 | 0 | Solution | 60.01 | 109 | 104.00 | 4.59 |
| j12042 10.json | 1 | 0 | Optimal | 0.89 | 118 | 118.00 | 0.00 |
| j12042 2.json | 1 | 0 | Optimal | 0.02 | 126 | 126.00 | 0.00 |
| j12042 3.json | 1 | 0 | Optimal | 0.41 | 106 | 106.00 | 0.00 |
| j12042 4.json | 1 | 0 | Optimal | 0.43 | 104 | 104.00 | 0.00 |
| j12042 5.json | 1 | 0 | Optimal | 4.11 | 120 | 120.00 | 0.00 |
| j12042 6.json | 1 | 0 | Optimal | 2.77 | 119 | 119.00 | 0.00 |
| j12042 7.json | 1 | 0 | Optimal | 0.03 | 123 | 123.00 | 0.00 |
| j12042 8.json | 1 | 0 | Optimal | 5.00 | 113 | 113.00 | 0.00 |
| j12042 9.json | 1 | 0 | Optimal | 0.41 | 104 | 104.00 | 0.00 |
| j12043 1.json | 1 | 0 | Optimal | 0.02 | 105 | 105.00 | 0.00 |
| j12043 10.json | 1 | 0 | Optimal | 0.02 | 113 | 113.00 | 0.00 |
| j12043 2.json | 1 | 0 | Optimal | 0.02 | 120 | 120.00 | 0.00 |
| j12043 3.json | 1 | 0 | Optimal | 0.06 | 95 | 95.00 | 0.00 |
| j12043 4.json | 1 | 0 | Optimal | 0.49 | 105 | 105.00 | 0.00 |
| j12043 5.json | 1 | 0 | Optimal | 0.11 | 105 | 105.00 | 0.00 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12043 6.json | 1 | 0 | Optimal | 0.86 | 98 | 98.00 | 0.00 |
| j12043 7.json | 1 | 0 | Optimal | 0.06 | 122 | 122.00 | 0.00 |
| j12043 8.json | 1 | 0 | Optimal | 0.03 | 115 | 115.00 | 0.00 |
| j12043 9.json | 1 | 0 | Optimal | 0.03 | 105 | 105.00 | 0.00 |
| j12044 1.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j12044 10.json | 1 | 0 | Optimal | 0.02 | 98 | 98.00 | 0.00 |
| j12044 2.json | 1 | 0 | Optimal | 0.13 | 112 | 112.00 | 0.00 |
| j12044 3.json | 1 | 0 | Optimal | 0.03 | 107 | 107.00 | 0.00 |
| j12044 4.json | 1 | 0 | Optimal | 0.03 | 95 | 95.00 | 0.00 |
| j12044 5.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j12044 6.json | 1 | 0 | Optimal | 0.02 | 106 | 106.00 | 0.00 |
| j12044 7.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j12044 8.json | 1 | 0 | Optimal | 0.14 | 108 | 108.00 | 0.00 |
| j12044 9.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j12045 1.json | 1 | 0 | Optimal | 0.02 | 108 | 108.00 | 0.00 |
| j12045 10.json | 1 | 0 | Optimal | 0.02 | 99 | 99.00 | 0.00 |
| j12045 2.json | 1 | 0 | Optimal | 0.03 | 91 | 91.00 | 0.00 |
| j12045 3.json | 1 | 0 | Optimal | 0.03 | 98 | 98.00 | 0.00 |
| j12045 4.json | 1 | 0 | Optimal | 0.03 | 103 | 103.00 | 0.00 |
| j12045 5.json | 1 | 0 | Optimal | 0.04 | 116 | 116.00 | 0.00 |
| j12045 6.json | 1 | 0 | Optimal | 0.02 | 125 | 125.00 | 0.00 |
| j12045 7.json | 1 | 0 | Optimal | 0.02 | 103 | 103.00 | 0.00 |
| j12045 8.json | 1 | 0 | Optimal | 0.02 | 103 | 103.00 | 0.00 |
| j12045 9.json | 1 | 0 | Optimal | 0.02 | 114 | 114.00 | 0.00 |
| j12046 1.json | 1 | 0 | Solution | 60.02 | 197 | 158.00 | 19.80 |
| j12046 10.json | 1 | 0 | Solution | 60.01 | 195 | 168.00 | 13.85 |
| j12046 2.json | 1 | 0 | Solution | 60.02 | 204 | 174.00 | 14.71 |
| j12046 3.json | 1 | 0 | Solution | 60.01 | 181 | 150.00 | 17.13 |
| j12046 4.json | 1 | 0 | Solution | 60.01 | 173 | 154.00 | 10.98 |
| j12046 5.json | 1 | 0 | Solution | 60.02 | 158 | 137.00 | 13.29 |
| j12046 6.json | 1 | 0 | Solution | 60.01 | 181 | 157.00 | 13.26 |
| j12046 7.json | 1 | 0 | Solution | 60.02 | 172 | 149.00 | 13.37 |
| j12046 8.json | 1 | 0 | Solution | 60.01 | 180 | 156.00 | 13.33 |
| j12046 9.json | 1 | 0 | Solution | 60.02 | 168 | 146.00 | 13.10 |
| j12047 1.json | 1 | 0 | Solution | 60.01 | 146 | 120.00 | 17.81 |
| j12047 10.json | 1 | 0 | Solution | 60.02 | 134 | 130.00 | 2.99 |
| j12047 2.json | 1 | 0 | Solution | 60.00 | 134 | 122.00 | 8.96 |
| j12047 3.json | 1 | 0 | Solution | 60.01 | 127 | 120.00 | 5.51 |
| j12047 4.json | 1 | 0 | Solution | 60.01 | 135 | 120.00 | 11.11 |
| j12047 5.json | 1 | 0 | Solution | 60.01 | 131 | 120.00 | 8.40 |
| j12047 6.json | 1 | 0 | Solution | 60.02 | 139 | 129.00 | 7.19 |
| j12047 7.json | 1 | 0 | Solution | 60.02 | 121 | 113.00 | 6.61 |
| j12047 8.json | 1 | 0 | Solution | 60.01 | 136 | 120.00 | 11.76 |
| j12047 9.json | 1 | 0 | Solution | 60.00 | 146 | 136.00 | 6.85 |
| j12048 1.json | 1 | 0 | Optimal | 53.72 | 100 | 100.00 | 0.00 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12048 10.json | 1 | 0 | Solution | 60.02 | 112 | 110.00 | 1.79 |
| j12048 2.json | 1 | 0 | Solution | 60.01 | 114 | 111.00 | 2.63 |
| j12048 3.json | 1 | 0 | Solution | 60.01 | 113 | 108.00 | 4.42 |
| j12048 4.json | 1 | 0 | Solution | 60.01 | 128 | 123.00 | 3.91 |
| j12048 5.json | 1 | 0 | Solution | 60.01 | 112 | 109.00 | 2.68 |
| j12048 6.json | 1 | 0 | Solution | 60.01 | 106 | 101.00 | 4.72 |
| j12048 7.json | 1 | 0 | Solution | 60.04 | 108 | 104.00 | 3.70 |
| j12048 8.json | 1 | 0 | Solution | 60.01 | 116 | 112.00 | 3.45 |
| j12048 9.json | 1 | 0 | Optimal | 12.52 | 113 | 113.00 | 0.00 |
| j12049 1.json | 1 | 0 | Optimal | 0.04 | 96 | 96.00 | 0.00 |
| j12049 10.json | 1 | 0 | Solution | 60.02 | 97 | 96.00 | 1.03 |
| j12049 2.json | 1 | 0 | Solution | 60.01 | 109 | 105.00 | 3.67 |
| j12049 3.json | 1 | 0 | Solution | 60.01 | 96 | 95.00 | 1.04 |
| j12049 4.json | 1 | 0 | Solution | 60.01 | 97 | 95.00 | 2.06 |
| j12049 5.json | 1 | 0 | Optimal | 11.35 | 89 | 89.00 | 0.00 |
| j12049 6.json | 1 | 0 | Optimal | 0.03 | 128 | 128.00 | 0.00 |
| j12049 7.json | 1 | 0 | Optimal | 5.93 | 99 | 99.00 | 0.00 |
| j12049 8.json | 1 | 0 | Optimal | 4.76 | 113 | 113.00 | 0.00 |
| j12049 9.json | 1 | 0 | Optimal | 1.70 | 97 | 97.00 | 0.00 |
| j1204 1.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j1204 10.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |
| j1204 2.json | 1 | 0 | Optimal | 0.02 | 107 | 107.00 | 0.00 |
| j1204 3.json | 1 | 0 | Optimal | 0.03 | 95 | 95.00 | 0.00 |
| j1204 4.json | 1 | 0 | Optimal | 0.02 | 75 | 75.00 | 0.00 |
| j1204 5.json | 1 | 0 | Optimal | 0.02 | 74 | 74.00 | 0.00 |
| j1204 6.json | 1 | 0 | Optimal | 0.03 | 90 | 90.00 | 0.00 |
| j1204 7.json | 1 | 0 | Optimal | 0.02 | 81 | 81.00 | 0.00 |
| j1204 8.json | 1 | 0 | Optimal | 0.02 | 90 | 90.00 | 0.00 |
| j1204 9.json | 1 | 0 | Optimal | 0.02 | 79 | 79.00 | 0.00 |
| j12050 1.json | 1 | 0 | Optimal | 0.03 | 116 | 116.00 | 0.00 |
| j12050 10.json | 1 | 0 | Optimal | 0.07 | 103 | 103.00 | 0.00 |
| j12050 2.json | 1 | 0 | Optimal | 4.06 | 112 | 112.00 | 0.00 |
| j12050 3.json | 1 | 0 | Optimal | 0.03 | 111 | 111.00 | 0.00 |
| j12050 4.json | 1 | 0 | Solution | 60.02 | 100 | 99.00 | 1.00 |
| j12050 5.json | 1 | 0 | Optimal | 0.16 | 100 | 100.00 | 0.00 |
| j12050 6.json | 1 | 0 | Optimal | 0.02 | 102 | 102.00 | 0.00 |
| j12050 7.json | 1 | 0 | Optimal | 0.03 | 137 | 137.00 | 0.00 |
| j12050 8.json | 1 | 0 | Optimal | 0.03 | 112 | 112.00 | 0.00 |
| j12050 9.json | 1 | 0 | Optimal | 0.03 | 101 | 101.00 | 0.00 |
| j12051 1.json | 1 | 0 | Solution | 60.02 | 215 | 178.00 | 17.21 |
| j12051 10.json | 1 | 0 | Solution | 60.01 | 239 | 192.00 | 19.67 |
| j12051 2.json | 1 | 0 | Solution | 60.01 | 227 | 191.00 | 15.86 |
| j12051 3.json | 1 | 0 | Solution | 60.01 | 233 | 190.00 | 18.45 |
| j12051 4.json | 1 | 0 | Solution | 60.01 | 219 | 195.00 | 10.96 |
| j12051 5.json | 1 | 0 | Solution | 60.02 | 234 | 194.00 | 17.09 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12051 6.json | 1 | 0 | Solution | 60.02 | 221 | 188.00 | 14.93 |
| j12051 7.json | 1 | 0 | Solution | 60.01 | 218 | 180.00 | 17.43 |
| j12051 8.json | 1 | 0 | Solution | 60.01 | 215 | 182.00 | 15.35 |
| j12051 9.json | 1 | 0 | Solution | 60.01 | 222 | 187.00 | 15.77 |
| j12052 1.json | 1 | 0 | Solution | 60.01 | 182 | 154.00 | 15.38 |
| j12052 10.json | 1 | 0 | Solution | 60.01 | 148 | 133.00 | 10.14 |
| j12052 2.json | 1 | 0 | Solution | 60.02 | 188 | 167.00 | 11.17 |
| j12052 3.json | 1 | 0 | Solution | 60.01 | 139 | 124.00 | 10.79 |
| j12052 4.json | 1 | 0 | Solution | 60.01 | 176 | 157.00 | 10.80 |
| j12052 5.json | 1 | 0 | Solution | 60.01 | 173 | 157.00 | 9.25 |
| j12052 6.json | 1 | 0 | Solution | 60.01 | 207 | 182.00 | 12.08 |
| j12052 7.json | 1 | 0 | Solution | 60.01 | 153 | 142.00 | 7.19 |
| j12052 8.json | 1 | 0 | Solution | 60.01 | 164 | 147.00 | 10.37 |
| j12052 9.json | 1 | 0 | Solution | 60.02 | 153 | 142.00 | 7.19 |
| j12053 1.json | 1 | 0 | Solution | 60.01 | 146 | 137.00 | 6.16 |
| j12053 10.json | 1 | 0 | Solution | 60.01 | 135 | 124.00 | 8.15 |
| j12053 2.json | 1 | 0 | Solution | 60.01 | 118 | 109.00 | 7.63 |
| j12053 3.json | 1 | 0 | Solution | 60.01 | 113 | 106.00 | 6.19 |
| j12053 4.json | 1 | 0 | Solution | 60.01 | 147 | 137.00 | 6.80 |
| j12053 5.json | 1 | 0 | Solution | 60.01 | 115 | 109.00 | 5.22 |
| j12053 6.json | 1 | 0 | Solution | 60.01 | 107 | 101.00 | 5.61 |
| j12053 7.json | 1 | 0 | Solution | 60.01 | 121 | 116.00 | 4.13 |
| j12053 8.json | 1 | 0 | Solution | 60.01 | 143 | 135.00 | 5.59 |
| j12053 9.json | 1 | 0 | Solution | 60.01 | 168 | 150.00 | 10.71 |
| j12054 1.json | 1 | 0 | Solution | 60.01 | 106 | 101.00 | 4.72 |
| j12054 10.json | 1 | 0 | Solution | 60.01 | 109 | 105.00 | 3.67 |
| j12054 2.json | 1 | 0 | Optimal | 0.03 | 134 | 134.00 | 0.00 |
| j12054 3.json | 1 | 0 | Optimal | 0.68 | 111 | 111.00 | 0.00 |
| j12054 4.json | 1 | 0 | Solution | 60.01 | 121 | 119.00 | 1.65 |
| j12054 5.json | 1 | 0 | Solution | 60.01 | 111 | 107.00 | 3.60 |
| j12054 6.json | 1 | 0 | Solution | 60.01 | 110 | 103.00 | 6.36 |
| j12054 7.json | 1 | 0 | Solution | 60.01 | 112 | 106.00 | 5.36 |
| j12054 8.json | 1 | 0 | Solution | 60.01 | 103 | 99.00 | 3.88 |
| j12054 9.json | 1 | 0 | Solution | 60.02 | 108 | 104.00 | 3.70 |
| j12055 1.json | 1 | 0 | Solution | 60.03 | 102 | 99.00 | 2.94 |
| j12055 10.json | 1 | 0 | Optimal | 0.02 | 100 | 100.00 | 0.00 |
| j12055 2.json | 1 | 0 | Optimal | 0.03 | 83 | 83.00 | 0.00 |
| j12055 3.json | 1 | 0 | Optimal | 0.03 | 126 | 126.00 | 0.00 |
| j12055 4.json | 1 | 0 | Optimal | 0.27 | 90 | 90.00 | 0.00 |
| j12055 5.json | 1 | 0 | Optimal | 0.03 | 106 | 106.00 | 0.00 |
| j12055 6.json | 1 | 0 | Solution | 60.01 | 101 | 98.00 | 2.97 |
| j12055 7.json | 1 | 0 | Optimal | 0.03 | 105 | 105.00 | 0.00 |
| j12055 8.json | 1 | 0 | Optimal | 1.26 | 101 | 101.00 | 0.00 |
| j12055 9.json | 1 | 0 | Optimal | 0.05 | 94 | 94.00 | 0.00 |
| j12056 1.json | 1 | 0 | Solution | 60.00 | 245 | 215.00 | 12.24 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12056 10.json | 1 | 0 | Solution | 60.02 | 268 | 227.00 | 15.30 |
| j12056 2.json | 1 | 0 | Solution | 60.03 | 214 | 183.00 | 14.49 |
| j12056 3.json | 1 | 0 | Solution | 60.01 | 249 | 216.00 | 13.25 |
| j12056 4.json | 1 | 0 | Solution | 60.00 | 234 | 201.00 | 14.10 |
| j12056 5.json | 1 | 0 | Solution | 60.02 | 289 | 246.00 | 14.88 |
| j12056 6.json | 1 | 0 | Solution | 60.01 | 223 | 194.00 | 13.00 |
| j12056 7.json | 1 | 0 | Solution | 60.01 | 294 | 242.00 | 17.69 |
| j12056 8.json | 1 | 0 | Solution | 60.01 | 298 | 250.00 | 16.11 |
| j12056 9.json | 1 | 0 | Solution | 60.02 | 297 | 254.00 | 14.48 |
| j12057 1.json | 1 | 0 | Solution | 60.01 | 189 | 173.00 | 8.47 |
| j12057 10.json | 1 | 0 | Solution | 60.01 | 172 | 156.00 | 9.30 |
| j12057 2.json | 1 | 0 | Solution | 60.01 | 166 | 151.00 | 9.04 |
| j12057 3.json | 1 | 0 | Solution | 60.01 | 189 | 175.00 | 7.41 |
| j12057 4.json | 1 | 0 | Solution | 60.01 | 208 | 186.00 | 10.58 |
| j12057 5.json | 1 | 0 | Solution | 60.02 | 184 | 169.00 | 8.15 |
| j12057 6.json | 1 | 0 | Solution | 60.01 | 193 | 173.00 | 10.36 |
| j12057 7.json | 1 | 0 | Solution | 60.01 | 170 | 155.00 | 8.82 |
| j12057 8.json | 1 | 0 | Solution | 60.02 | 167 | 155.00 | 7.19 |
| j12057 9.json | 1 | 0 | Solution | 60.01 | 171 | 155.00 | 9.36 |
| j12058 1.json | 1 | 0 | Solution | 60.01 | 144 | 132.00 | 8.33 |
| j12058 10.json | 1 | 0 | Solution | 60.02 | 137 | 125.00 | 8.76 |
| j12058 2.json | 1 | 0 | Solution | 60.01 | 128 | 122.00 | 4.69 |
| j12058 3.json | 1 | 0 | Solution | 60.01 | 123 | 116.00 | 5.69 |
| j12058 4.json | 1 | 0 | Solution | 60.02 | 150 | 139.00 | 7.33 |
| j12058 5.json | 1 | 0 | Solution | 60.02 | 122 | 116.00 | 4.92 |
| j12058 6.json | 1 | 0 | Solution | 60.02 | 144 | 135.00 | 6.25 |
| j12058 7.json | 1 | 0 | Solution | 60.02 | 150 | 143.00 | 4.67 |
| j12058 8.json | 1 | 0 | Solution | 60.02 | 136 | 125.00 | 8.09 |
| j12058 9.json | 1 | 0 | Solution | 60.02 | 133 | 126.00 | 5.26 |
| j12059 1.json | 1 | 0 | Solution | 60.01 | 115 | 112.00 | 2.61 |
| j12059 10.json | 1 | 0 | Solution | 60.02 | 135 | 126.00 | 6.67 |
| j12059 2.json | 1 | 0 | Solution | 60.02 | 108 | 103.00 | 4.63 |
| j12059 3.json | 1 | 0 | Solution | 60.02 | 109 | 108.00 | 0.92 |
| j12059 4.json | 1 | 0 | Solution | 60.02 | 110 | 107.00 | 2.73 |
| j12059 5.json | 1 | 0 | Solution | 60.02 | 107 | 104.00 | 2.80 |
| j12059 6.json | 1 | 0 | Solution | 60.02 | 118 | 111.00 | 5.93 |
| j12059 7.json | 1 | 0 | Solution | 60.02 | 115 | 109.00 | 5.22 |
| j12059 8.json | 1 | 0 | Solution | 60.02 | 112 | 106.00 | 5.36 |
| j12059 9.json | 1 | 0 | Solution | 60.02 | 119 | 117.00 | 1.68 |
| j1205 1.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j1205 10.json | 1 | 0 | Optimal | 0.02 | 92 | 92.00 | 0.00 |
| j1205 2.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j1205 3.json | 1 | 0 | Optimal | 0.02 | 72 | 72.00 | 0.00 |
| j1205 4.json | 1 | 0 | Optimal | 0.02 | 97 | 97.00 | 0.00 |
| j1205 5.json | 1 | 0 | Optimal | 0.02 | 77 | 77.00 | 0.00 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j1205 6.json | 1 | 0 | Optimal | 0.02 | 88 | 88.00 | 0.00 |
| j1205 7.json | 1 | 0 | Optimal | 0.02 | 84 | 84.00 | 0.00 |
| j1205 8.json | 1 | 0 | Optimal | 0.03 | 78 | 78.00 | 0.00 |
| j1205 9.json | 1 | 0 | Optimal | 0.03 | 106 | 106.00 | 0.00 |
| j12060 1.json | 1 | 0 | Optimal | 0.03 | 101 | 101.00 | 0.00 |
| j12060 10.json | 1 | 0 | Solution | 60.02 | 90 | 88.00 | 2.22 |
| j12060 2.json | 1 | 0 | Solution | 60.01 | 84 | 81.00 | 3.57 |
| j12060 3.json | 1 | 0 | Solution | 60.01 | 90 | 88.00 | 2.22 |
| j12060 4.json | 1 | 0 | Solution | 60.02 | 104 | 101.00 | 2.88 |
| j12060 5.json | 1 | 0 | Solution | 60.02 | 106 | 103.00 | 2.83 |
| j12060 6.json | 1 | 0 | Optimal | 0.05 | 110 | 110.00 | 0.00 |
| j12060 7.json | 1 | 0 | Solution | 60.01 | 95 | 90.00 | 5.26 |
| j12060 8.json | 1 | 0 | Optimal | 36.75 | 101 | 101.00 | 0.00 |
| j12060 9.json | 1 | 0 | Optimal | 0.02 | 101 | 101.00 | 0.00 |
| j1206 1.json | 1 | 0 | Solution | 60.01 | 150 | 132.00 | 12.00 |
| j1206 10.json | 1 | 0 | Solution | 60.02 | 178 | 157.00 | 11.80 |
| j1206 2.json | 1 | 0 | Solution | 60.01 | 140 | 126.00 | 10.00 |
| j1206 3.json | 1 | 0 | Solution | 60.01 | 137 | 126.00 | 8.03 |
| j1206 4.json | 1 | 0 | Solution | 60.01 | 157 | 143.00 | 8.92 |
| j1206 5.json | 1 | 0 | Solution | 60.01 | 129 | 116.00 | 10.08 |
| j1206 6.json | 1 | 0 | Solution | 60.01 | 158 | 138.00 | 12.66 |
| j1206 7.json | 1 | 0 | Solution | 60.01 | 172 | 152.00 | 11.63 |
| j1206 8.json | 1 | 0 | Solution | 60.02 | 150 | 137.00 | 8.67 |
| j1206 9.json | 1 | 0 | Solution | 60.02 | 164 | 144.00 | 12.20 |
| j1207 1.json | 1 | 0 | Solution | 60.01 | 104 | 98.00 | 5.77 |
| j1207 10.json | 1 | 0 | Solution | 60.01 | 121 | 111.00 | 8.26 |
| j1207 2.json | 1 | 0 | Solution | 60.01 | 116 | 112.00 | 3.45 |
| j1207 3.json | 1 | 0 | Solution | 60.02 | 102 | 97.00 | 4.90 |
| j1207 4.json | 1 | 0 | Solution | 60.01 | 115 | 106.00 | 7.83 |
| j1207 5.json | 1 | 0 | Solution | 60.01 | 135 | 126.00 | 6.67 |
| j1207 6.json | 1 | 0 | Solution | 60.01 | 129 | 114.00 | 11.63 |
| j1207 7.json | 1 | 0 | Solution | 60.01 | 120 | 114.00 | 5.00 |
| j1207 8.json | 1 | 0 | Solution | 60.01 | 99 | 93.00 | 6.06 |
| j1207 9.json | 1 | 0 | Solution | 60.02 | 91 | 86.00 | 5.49 |
| j1208 1.json | 1 | 0 | Optimal | 0.56 | 95 | 95.00 | 0.00 |
| j1208 10.json | 1 | 0 | Solution | 60.01 | 94 | 92.00 | 2.13 |
| j1208 2.json | 1 | 0 | Solution | 60.01 | 105 | 100.00 | 4.76 |
| j1208 3.json | 1 | 0 | Solution | 60.02 | 96 | 94.00 | 2.08 |
| j1208 4.json | 1 | 0 | Solution | 60.01 | 95 | 90.00 | 5.26 |
| j1208 5.json | 1 | 0 | Solution | 60.01 | 105 | 100.00 | 4.76 |
| j1208 6.json | 1 | 0 | Solution | 60.01 | 85 | 84.00 | 1.18 |
| j1208 7.json | 1 | 0 | Solution | 60.02 | 88 | 87.00 | 1.14 |
| j1208 8.json | 1 | 0 | Solution | 60.01 | 88 | 87.00 | 1.14 |
| j1208 9.json | 1 | 0 | Solution | 60.02 | 95 | 90.00 | 5.26 |
| j1209 1.json | 1 | 0 | Optimal | 0.04 | 88 | 88.00 | 0.00 |

Table 9.7: Results for RCPSP J120 (CPO) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j1209 10.json | 1 | 0 | Optimal | 0.05 | 84 | 84.00 | 0.00 |
| j1209 2.json | 1 | 0 | Optimal | 0.03 | 94 | 94.00 | 0.00 |
| j1209 3.json | 1 | 0 | Optimal | 0.02 | 87 | 87.00 | 0.00 |
| j1209 4.json | 1 | 0 | Solution | 60.01 | 87 | 84.00 | 3.45 |
| j1209 5.json | 1 | 0 | Optimal | 0.03 | 114 | 114.00 | 0.00 |
| j1209 6.json | 1 | 0 | Optimal | 2.12 | 98 | 98.00 | 0.00 |
| j1209 7.json | 1 | 0 | Optimal | 0.02 | 80 | 80.00 | 0.00 |
| j1209 8.json | 1 | 0 | Optimal | 0.03 | 80 | 80.00 | 0.00 |
| j1209 9.json | 1 | 0 | Optimal | 0.10 | 87 | 87.00 | 0.00 |

9.4.2 CPSat

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12010 1.json | 1 | 0 | Optimal | 0.11 | 111 | 111.00 | 0.00 |
| j12010 10.json | 1 | 0 | Optimal | 0.06 | 66 | 66.00 | 0.00 |
| j12010 2.json | 1 | 0 | Optimal | 0.07 | 91 | 91.00 | 0.00 |
| j12010 3.json | 1 | 0 | Optimal | 0.10 | 99 | 99.00 | 0.00 |
| j12010 4.json | 1 | 0 | Optimal | 0.14 | 95 | 95.00 | 0.00 |
| j12010 5.json | 1 | 0 | Optimal | 0.10 | 97 | 97.00 | 0.00 |
| j12010 6.json | 1 | 0 | Optimal | 0.03 | 92 | 92.00 | 0.00 |
| j12010 7.json | 1 | 0 | Optimal | 0.36 | 79 | 79.00 | 0.00 |
| j12010 8.json | 1 | 0 | Optimal | 0.17 | 114 | 114.00 | 0.00 |
| j12010 9.json | 1 | 0 | Optimal | 0.04 | 77 | 77.00 | 0.00 |
| j12011 1.json | 1 | 0 | Solution | 60.03 | 183 | 155.00 | 15.30 |
| j12011 10.json | 1 | 0 | Solution | 60.03 | 194 | 163.00 | 15.98 |
| j12011 2.json | 1 | 0 | Solution | 60.05 | 166 | 145.00 | 12.65 |
| j12011 3.json | 1 | 0 | Solution | 60.04 | 219 | 187.00 | 14.61 |
| j12011 4.json | 1 | 0 | Solution | 60.03 | 210 | 176.00 | 16.19 |
| j12011 5.json | 1 | 0 | Solution | 60.03 | 224 | 192.00 | 14.29 |
| j12011 6.json | 1 | 0 | Solution | 60.07 | 223 | 187.00 | 16.14 |
| j12011 7.json | 1 | 0 | Solution | 60.04 | 172 | 148.00 | 13.95 |
| j12011 8.json | 1 | 0 | Solution | 60.04 | 173 | 152.00 | 12.14 |
| j12011 9.json | 1 | 0 | Solution | 60.05 | 184 | 168.00 | 8.70 |
| j12012 1.json | 1 | 0 | Solution | 60.05 | 146 | 125.00 | 14.38 |
| j12012 10.json | 1 | 0 | Solution | 60.04 | 148 | 142.00 | 4.05 |
| j12012 2.json | 1 | 0 | Solution | 60.02 | 124 | 111.00 | 10.48 |
| j12012 3.json | 1 | 0 | Solution | 60.03 | 142 | 132.00 | 7.04 |
| j12012 4.json | 1 | 0 | Solution | 60.03 | 129 | 121.00 | 6.20 |
| j12012 5.json | 1 | 0 | Solution | 60.07 | 169 | 154.00 | 8.88 |
| j12012 6.json | 1 | 0 | Solution | 60.06 | 129 | 115.00 | 10.85 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12012 7.json | 1 | 0 | Solution | 60.03 | 124 | 116.00 | 6.45 |
| j12012 8.json | 1 | 0 | Solution | 60.03 | 125 | 113.00 | 9.60 |
| j12012 9.json | 1 | 0 | Solution | 60.01 | 109 | 101.00 | 7.34 |
| j12013 1.json | 1 | 0 | Solution | 60.03 | 131 | 122.00 | 6.87 |
| j12013 10.json | 1 | 0 | Solution | 60.03 | 97 | 88.00 | 9.28 |
| j12013 2.json | 1 | 0 | Solution | 60.04 | 90 | 88.00 | 2.22 |
| j12013 3.json | 1 | 0 | Solution | 60.02 | 120 | 115.00 | 4.17 |
| j12013 4.json | 1 | 0 | Solution | 60.01 | 116 | 108.00 | 6.90 |
| j12013 5.json | 1 | 0 | Solution | 60.03 | 94 | 90.00 | 4.26 |
| j12013 6.json | 1 | 0 | Solution | 60.02 | 102 | 95.00 | 6.86 |
| j12013 7.json | 1 | 0 | Solution | 60.03 | 112 | 107.00 | 4.46 |
| j12013 8.json | 1 | 0 | Solution | 60.02 | 96 | 91.00 | 5.21 |
| j12013 9.json | 1 | 0 | Solution | 60.03 | 87 | 82.00 | 5.75 |
| j12014 1.json | 1 | 0 | Solution | 60.03 | 87 | 84.00 | 3.45 |
| j12014 10.json | 1 | 0 | Solution | 60.03 | 83 | 80.00 | 3.61 |
| j12014 2.json | 1 | 0 | Solution | 60.02 | 95 | 90.00 | 5.26 |
| j12014 3.json | 1 | 0 | Optimal | 28.27 | 88 | 88.00 | 0.00 |
| j12014 4.json | 1 | 0 | Solution | 60.02 | 89 | 85.00 | 4.49 |
| j12014 5.json | 1 | 0 | Solution | 60.03 | 99 | 93.00 | 6.06 |
| j12014 6.json | 1 | 0 | Optimal | 60.01 | 91 | 91.00 | 0.00 |
| j12014 7.json | 1 | 0 | Solution | 60.03 | 92 | 89.00 | 3.26 |
| j12014 8.json | 1 | 0 | Solution | 60.03 | 113 | 109.00 | 3.54 |
| j12014 9.json | 1 | 0 | Optimal | 0.15 | 101 | 101.00 | 0.00 |
| j12015 1.json | 1 | 0 | Optimal | 0.10 | 81 | 81.00 | 0.00 |
| j12015 10.json | 1 | 0 | Optimal | 0.10 | 91 | 91.00 | 0.00 |
| j12015 2.json | 1 | 0 | Optimal | 0.04 | 75 | 75.00 | 0.00 |
| j12015 3.json | 1 | 0 | Optimal | 0.10 | 87 | 87.00 | 0.00 |
| j12015 4.json | 1 | 0 | Optimal | 0.10 | 82 | 82.00 | 0.00 |
| j12015 5.json | 1 | 0 | Optimal | 0.09 | 87 | 87.00 | 0.00 |
| j12015 6.json | 1 | 0 | Optimal | 0.08 | 97 | 97.00 | 0.00 |
| j12015 7.json | 1 | 0 | Optimal | 0.05 | 75 | 75.00 | 0.00 |
| j12015 8.json | 1 | 0 | Optimal | 0.07 | 126 | 126.00 | 0.00 |
| j12015 9.json | 1 | 0 | Optimal | 0.06 | 109 | 109.00 | 0.00 |
| j12016 1.json | 1 | 0 | Solution | 60.05 | 212 | 178.00 | 16.04 |
| j12016 10.json | 1 | 0 | Solution | 60.04 | 228 | 201.00 | 11.84 |
| j12016 2.json | 1 | 0 | Solution | 60.04 | 253 | 220.00 | 13.04 |
| j12016 3.json | 1 | 0 | Solution | 60.02 | 252 | 219.00 | 13.10 |
| j12016 4.json | 1 | 0 | Solution | 60.05 | 213 | 188.00 | 11.74 |
| j12016 5.json | 1 | 0 | Solution | 60.05 | 213 | 181.00 | 15.02 |
| j12016 6.json | 1 | 0 | Solution | 60.05 | 217 | 193.00 | 11.06 |
| j12016 7.json | 1 | 0 | Solution | 60.03 | 199 | 172.00 | 13.57 |
| j12016 8.json | 1 | 0 | Solution | 60.05 | 206 | 181.00 | 12.14 |
| j12016 9.json | 1 | 0 | Solution | 60.09 | 223 | 187.00 | 16.14 |
| j12017 1.json | 1 | 0 | Solution | 60.02 | 147 | 133.00 | 9.52 |
| j12017 10.json | 1 | 0 | Solution | 60.03 | 141 | 121.00 | 14.18 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12017 2.json | 1 | 0 | Solution | 60.02 | 130 | 110.00 | 15.38 |
| j12017 3.json | 1 | 0 | Solution | 60.03 | 113 | 98.00 | 13.27 |
| j12017 4.json | 1 | 0 | Solution | 60.03 | 124 | 108.00 | 12.90 |
| j12017 5.json | 1 | 0 | Solution | 60.02 | 136 | 122.00 | 10.29 |
| j12017 6.json | 1 | 0 | Solution | 60.02 | 143 | 131.00 | 8.39 |
| j12017 7.json | 1 | 0 | Solution | 60.02 | 153 | 140.00 | 8.50 |
| j12017 8.json | 1 | 0 | Solution | 60.03 | 132 | 124.00 | 6.06 |
| j12017 9.json | 1 | 0 | Solution | 60.03 | 142 | 127.00 | 10.56 |
| j12018 1.json | 1 | 0 | Solution | 60.03 | 142 | 115.00 | 19.01 |
| j12018 10.json | 1 | 0 | Solution | 60.04 | 100 | 90.00 | 10.00 |
| j12018 2.json | 1 | 0 | Solution | 60.02 | 121 | 111.00 | 8.26 |
| j12018 3.json | 1 | 0 | Solution | 60.02 | 103 | 90.00 | 12.62 |
| j12018 4.json | 1 | 0 | Solution | 60.02 | 104 | 96.00 | 7.69 |
| j12018 5.json | 1 | 0 | Solution | 60.02 | 123 | 106.00 | 13.82 |
| j12018 6.json | 1 | 0 | Solution | 60.03 | 139 | 124.00 | 10.79 |
| j12018 7.json | 1 | 0 | Solution | 60.02 | 122 | 111.00 | 9.02 |
| j12018 8.json | 1 | 0 | Solution | 60.04 | 108 | 95.00 | 12.04 |
| j12018 9.json | 1 | 0 | Solution | 60.03 | 95 | 83.00 | 12.63 |
| j12019 1.json | 1 | 0 | Optimal | 0.10 | 88 | 88.00 | 0.00 |
| j12019 10.json | 1 | 0 | Optimal | 0.06 | 88 | 88.00 | 0.00 |
| j12019 2.json | 1 | 0 | Solution | 60.02 | 84 | 81.00 | 3.57 |
| j12019 3.json | 1 | 0 | Solution | 60.03 | 88 | 82.00 | 6.82 |
| j12019 4.json | 1 | 0 | Solution | 60.02 | 109 | 97.00 | 11.01 |
| j12019 5.json | 1 | 0 | Solution | 60.03 | 108 | 99.00 | 8.33 |
| j12019 6.json | 1 | 0 | Solution | 60.02 | 92 | 80.00 | 13.04 |
| j12019 7.json | 1 | 0 | Optimal | 0.09 | 93 | 93.00 | 0.00 |
| j12019 8.json | 1 | 0 | Solution | 60.03 | 95 | 93.00 | 2.11 |
| j12019 9.json | 1 | 0 | Solution | 60.02 | 90 | 75.00 | 16.67 |
| j1201 1.json | 1 | 0 | Solution | 60.02 | 105 | 104.00 | 0.95 |
| j1201 10.json | 1 | 0 | Optimal | 15.90 | 108 | 108.00 | 0.00 |
| j1201 2.json | 1 | 0 | Optimal | 1.55 | 109 | 109.00 | 0.00 |
| j1201 3.json | 1 | 0 | Solution | 60.06 | 126 | 118.00 | 6.35 |
| j1201 4.json | 1 | 0 | Optimal | 0.79 | 97 | 97.00 | 0.00 |
| j1201 5.json | 1 | 0 | Optimal | 0.74 | 112 | 112.00 | 0.00 |
| j1201 6.json | 1 | 0 | Optimal | 0.71 | 84 | 84.00 | 0.00 |
| j1201 7.json | 1 | 0 | Optimal | 4.35 | 117 | 117.00 | 0.00 |
| j1201 8.json | 1 | 0 | Optimal | 60.02 | 109 | 109.00 | 0.00 |
| j1201 9.json | 1 | 0 | Optimal | 0.33 | 112 | 112.00 | 0.00 |
| j12020 1.json | 1 | 0 | Optimal | 60.02 | 89 | 89.00 | 0.00 |
| j12020 10.json | 1 | 0 | Optimal | 0.09 | 81 | 81.00 | 0.00 |
| j12020 2.json | 1 | 0 | Optimal | 0.08 | 99 | 99.00 | 0.00 |
| j12020 3.json | 1 | 0 | Solution | 60.02 | 78 | 74.00 | 5.13 |
| j12020 4.json | 1 | 0 | Optimal | 0.08 | 89 | 89.00 | 0.00 |
| j12020 5.json | 1 | 0 | Optimal | 0.08 | 69 | 69.00 | 0.00 |
| j12020 6.json | 1 | 0 | Optimal | 0.07 | 80 | 80.00 | 0.00 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|---------|-------|----------|--------|----------------|
| j12020 7.json | 1 | 0 | Optimal | 0.07 | 81 | 81.00 | 0.00 |
| j12020 8.json | 1 | 0 | Optimal | 60.01 | 107 | 107.00 | 0.00 |
| j12020 9.json | 1 | 0 | Optimal | 0.07 | 80 | 80.00 | 0.00 |
| j12021 1.json | 1 | 0 | Optimal | 60.01 | 114 | 114.00 | 0.00 |
| j12021 10.json | 1 | 0 | Optimal | 13.02 | 102 | 102.00 | 0.00 |
| j12021 2.json | 1 | 0 | Optimal | 37.55 | 117 | 117.00 | 0.00 |
| j12021 3.json | 1 | 0 | Optimal | 1.65 | 143 | 143.00 | 0.00 |
| j12021 4.json | 1 | 0 | Optimal | 11.74 | 135 | 135.00 | 0.00 |
| j12021 5.json | 1 | 0 | Optimal | 5.01 | 110 | 110.00 | 0.00 |
| j12021 6.json | 1 | 0 | Optimal | 1.60 | 109 | 109.00 | 0.00 |
| j12021 7.json | 1 | 0 | Optimal | 5.83 | 111 | 111.00 | 0.00 |
| j12021 8.json | 1 | 0 | Optimal | 0.23 | 127 | 127.00 | 0.00 |
| j12021 9.json | 1 | 0 | Optimal | 0.41 | 102 | 102.00 | 0.00 |
| j12022 1.json | 1 | 0 | Optimal | 1.52 | 101 | 101.00 | 0.00 |
| j12022 10.json | 1 | 0 | Optimal | 0.17 | 79 | 79.00 | 0.00 |
| j12022 2.json | 1 | 0 | Optimal | 0.18 | 107 | 107.00 | 0.00 |
| j12022 3.json | 1 | 0 | Optimal | 60.01 | 96 | 96.00 | 0.00 |
| j12022 4.json | 1 | 0 | Optimal | 0.19 | 90 | 90.00 | 0.00 |
| j12022 5.json | 1 | 0 | Optimal | 0.18 | 93 | 93.00 | 0.00 |
| j12022 6.json | 1 | 0 | Optimal | 0.21 | 103 | 103.00 | 0.00 |
| j12022 7.json | 1 | 0 | Optimal | 0.09 | 133 | 133.00 | 0.00 |
| j12022 8.json | 1 | 0 | Optimal | 3.11 | 103 | 103.00 | 0.00 |
| j12022 9.json | 1 | 0 | Optimal | 0.21 | 109 | 109.00 | 0.00 |
| j12023 1.json | 1 | 0 | Optimal | 0.09 | 107 | 107.00 | 0.00 |
| j12023 10.json | 1 | 0 | Optimal | 0.14 | 100 | 100.00 | 0.00 |
| j12023 2.json | 1 | 0 | Optimal | 0.08 | 116 | 116.00 | 0.00 |
| j12023 3.json | 1 | 0 | Optimal | 0.10 | 99 | 99.00 | 0.00 |
| j12023 4.json | 1 | 0 | Optimal | 0.15 | 106 | 106.00 | 0.00 |
| j12023 5.json | 1 | 0 | Optimal | 0.09 | 99 | 99.00 | 0.00 |
| j12023 6.json | 1 | 0 | Optimal | 0.12 | 106 | 106.00 | 0.00 |
| j12023 7.json | 1 | 0 | Optimal | 0.14 | 104 | 104.00 | 0.00 |
| j12023 8.json | 1 | 0 | Optimal | 0.15 | 101 | 101.00 | 0.00 |
| j12023 9.json | 1 | 0 | Optimal | 0.13 | 107 | 107.00 | 0.00 |
| j12024 1.json | 1 | 0 | Optimal | 0.06 | 93 | 93.00 | 0.00 |
| j12024 10.json | 1 | 0 | Optimal | 0.14 | 91 | 91.00 | 0.00 |
| j12024 2.json | 1 | 0 | Optimal | 0.12 | 91 | 91.00 | 0.00 |
| j12024 3.json | 1 | 0 | Optimal | 0.10 | 89 | 89.00 | 0.00 |
| j12024 4.json | 1 | 0 | Optimal | 0.12 | 101 | 101.00 | 0.00 |
| j12024 5.json | 1 | 0 | Optimal | 0.10 | 86 | 86.00 | 0.00 |
| j12024 6.json | 1 | 0 | Optimal | 0.09 | 95 | 95.00 | 0.00 |
| j12024 7.json | 1 | 0 | Optimal | 0.12 | 112 | 112.00 | 0.00 |
| j12024 8.json | 1 | 0 | Optimal | 0.13 | 104 | 104.00 | 0.00 |
| j12024 9.json | 1 | 0 | Optimal | 0.12 | 82 | 82.00 | 0.00 |
| j12025 1.json | 1 | 0 | Optimal | 0.12 | 82 | 82.00 | 0.00 |
| j12025 10.json | 1 | 0 | Optimal | 0.05 | 92 | 92.00 | 0.00 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12025 2.json | 1 | 0 | Optimal | 0.10 | 108 | 108.00 | 0.00 |
| j12025 3.json | 1 | 0 | Optimal | 0.06 | 100 | 100.00 | 0.00 |
| j12025 4.json | 1 | 0 | Optimal | 0.05 | 117 | 117.00 | 0.00 |
| j12025 5.json | 1 | 0 | Optimal | 0.05 | 100 | 100.00 | 0.00 |
| j12025 6.json | 1 | 0 | Optimal | 0.07 | 92 | 92.00 | 0.00 |
| j12025 7.json | 1 | 0 | Optimal | 0.12 | 92 | 92.00 | 0.00 |
| j12025 8.json | 1 | 0 | Optimal | 0.10 | 80 | 80.00 | 0.00 |
| j12025 9.json | 1 | 0 | Optimal | 0.05 | 94 | 94.00 | 0.00 |
| j12026 1.json | 1 | 0 | Solution | 60.03 | 173 | 150.00 | 13.29 |
| j12026 10.json | 1 | 0 | Solution | 60.02 | 186 | 160.00 | 13.98 |
| j12026 2.json | 1 | 0 | Solution | 60.06 | 172 | 150.00 | 12.79 |
| j12026 3.json | 1 | 0 | Solution | 60.04 | 172 | 154.00 | 10.47 |
| j12026 4.json | 1 | 0 | Solution | 60.07 | 177 | 151.00 | 14.69 |
| j12026 5.json | 1 | 0 | Solution | 60.05 | 159 | 136.00 | 14.47 |
| j12026 6.json | 1 | 0 | Solution | 60.03 | 190 | 170.00 | 10.53 |
| j12026 7.json | 1 | 0 | Solution | 60.03 | 161 | 143.00 | 11.18 |
| j12026 8.json | 1 | 0 | Solution | 60.06 | 178 | 159.00 | 10.67 |
| j12026 9.json | 1 | 0 | Solution | 60.03 | 178 | 160.00 | 10.11 |
| j12027 1.json | 1 | 0 | Solution | 60.03 | 110 | 105.00 | 4.55 |
| j12027 10.json | 1 | 0 | Solution | 60.02 | 117 | 108.00 | 7.69 |
| j12027 2.json | 1 | 0 | Solution | 60.05 | 116 | 108.00 | 6.90 |
| j12027 3.json | 1 | 0 | Solution | 60.07 | 149 | 141.00 | 5.37 |
| j12027 4.json | 1 | 0 | Solution | 60.09 | 110 | 104.00 | 5.45 |
| j12027 5.json | 1 | 0 | Solution | 60.03 | 114 | 102.00 | 10.53 |
| j12027 6.json | 1 | 0 | Solution | 60.05 | 150 | 132.00 | 12.00 |
| j12027 7.json | 1 | 0 | Solution | 60.08 | 126 | 115.00 | 8.73 |
| j12027 8.json | 1 | 0 | Solution | 60.07 | 144 | 135.00 | 6.25 |
| j12027 9.json | 1 | 0 | Solution | 60.05 | 128 | 120.00 | 6.25 |
| j12028 1.json | 1 | 0 | Solution | 60.04 | 110 | 105.00 | 4.55 |
| j12028 10.json | 1 | 0 | Solution | 60.03 | 117 | 111.00 | 5.13 |
| j12028 2.json | 1 | 0 | Optimal | 60.02 | 110 | 110.00 | 0.00 |
| j12028 3.json | 1 | 0 | Optimal | 0.20 | 101 | 101.00 | 0.00 |
| j12028 4.json | 1 | 0 | Optimal | 60.02 | 112 | 112.00 | 0.00 |
| j12028 5.json | 1 | 0 | Optimal | 0.21 | 102 | 102.00 | 0.00 |
| j12028 6.json | 1 | 0 | Optimal | 3.89 | 103 | 103.00 | 0.00 |
| j12028 7.json | 1 | 0 | Solution | 60.02 | 109 | 103.00 | 5.50 |
| j12028 8.json | 1 | 0 | Solution | 60.05 | 100 | 97.00 | 3.00 |
| j12028 9.json | 1 | 0 | Solution | 60.03 | 98 | 96.00 | 2.04 |
| j12029 1.json | 1 | 0 | Optimal | 0.12 | 104 | 104.00 | 0.00 |
| j12029 10.json | 1 | 0 | Optimal | 0.14 | 96 | 96.00 | 0.00 |
| j12029 2.json | 1 | 0 | Optimal | 0.12 | 91 | 91.00 | 0.00 |
| j12029 3.json | 1 | 0 | Solution | 60.05 | 98 | 94.00 | 4.08 |
| j12029 4.json | 1 | 0 | Optimal | 0.88 | 80 | 80.00 | 0.00 |
| j12029 5.json | 1 | 0 | Optimal | 0.58 | 102 | 102.00 | 0.00 |
| j12029 6.json | 1 | 0 | Solution | 60.03 | 92 | 88.00 | 4.35 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12029 7.json | 1 | 0 | Optimal | 0.11 | 97 | 97.00 | 0.00 |
| j12029 8.json | 1 | 0 | Optimal | 0.63 | 80 | 80.00 | 0.00 |
| j12029 9.json | 1 | 0 | Optimal | 0.11 | 97 | 97.00 | 0.00 |
| j1202 1.json | 1 | 0 | Optimal | 7.10 | 87 | 87.00 | 0.00 |
| j1202 10.json | 1 | 0 | Optimal | 0.38 | 96 | 96.00 | 0.00 |
| j1202 2.json | 1 | 0 | Optimal | 1.81 | 75 | 75.00 | 0.00 |
| j1202 3.json | 1 | 0 | Optimal | 5.29 | 92 | 92.00 | 0.00 |
| j1202 4.json | 1 | 0 | Optimal | 0.19 | 95 | 95.00 | 0.00 |
| j1202 5.json | 1 | 0 | Optimal | 0.39 | 103 | 103.00 | 0.00 |
| j1202 6.json | 1 | 0 | Optimal | 0.29 | 92 | 92.00 | 0.00 |
| j1202 7.json | 1 | 0 | Optimal | 0.17 | 90 | 90.00 | 0.00 |
| j1202 8.json | 1 | 0 | Optimal | 0.19 | 83 | 83.00 | 0.00 |
| j1202 9.json | 1 | 0 | Optimal | 6.64 | 94 | 94.00 | 0.00 |
| j12030 1.json | 1 | 0 | Optimal | 0.08 | 102 | 102.00 | 0.00 |
| j12030 10.json | 1 | 0 | Optimal | 0.08 | 86 | 86.00 | 0.00 |
| j12030 2.json | 1 | 0 | Optimal | 0.09 | 112 | 112.00 | 0.00 |
| j12030 3.json | 1 | 0 | Optimal | 0.08 | 108 | 108.00 | 0.00 |
| j12030 4.json | 1 | 0 | Optimal | 0.09 | 83 | 83.00 | 0.00 |
| j12030 5.json | 1 | 0 | Optimal | 53.55 | 83 | 83.00 | 0.00 |
| j12030 6.json | 1 | 0 | Optimal | 0.05 | 79 | 79.00 | 0.00 |
| j12030 7.json | 1 | 0 | Optimal | 0.57 | 93 | 93.00 | 0.00 |
| j12030 8.json | 1 | 0 | Optimal | 0.07 | 79 | 79.00 | 0.00 |
| j12030 9.json | 1 | 0 | Optimal | 0.10 | 93 | 93.00 | 0.00 |
| j12031 1.json | 1 | 0 | Solution | 60.06 | 205 | 179.00 | 12.68 |
| j12031 10.json | 1 | 0 | Solution | 60.03 | 241 | 199.00 | 17.43 |
| j12031 2.json | 1 | 0 | Solution | 60.04 | 202 | 174.00 | 13.86 |
| j12031 3.json | 1 | 0 | Solution | 60.04 | 183 | 158.00 | 13.66 |
| j12031 4.json | 1 | 0 | Solution | 60.03 | 235 | 186.00 | 20.85 |
| j12031 5.json | 1 | 0 | Solution | 60.03 | 213 | 185.00 | 13.15 |
| j12031 6.json | 1 | 0 | Solution | 60.04 | 204 | 181.00 | 11.27 |
| j12031 7.json | 1 | 0 | Solution | 60.02 | 218 | 190.00 | 12.84 |
| j12031 8.json | 1 | 0 | Solution | 60.03 | 203 | 173.00 | 14.78 |
| j12031 9.json | 1 | 0 | Solution | 60.07 | 206 | 175.00 | 15.05 |
| j12032 1.json | 1 | 0 | Solution | 60.03 | 150 | 143.00 | 4.67 |
| j12032 10.json | 1 | 0 | Solution | 60.03 | 137 | 125.00 | 8.76 |
| j12032 2.json | 1 | 0 | Solution | 60.03 | 139 | 122.00 | 12.23 |
| j12032 3.json | 1 | 0 | Solution | 60.04 | 152 | 133.00 | 12.50 |
| j12032 4.json | 1 | 0 | Solution | 60.04 | 141 | 126.00 | 10.64 |
| j12032 5.json | 1 | 0 | Solution | 60.04 | 144 | 132.00 | 8.33 |
| j12032 6.json | 1 | 0 | Solution | 60.02 | 134 | 121.00 | 9.70 |
| j12032 7.json | 1 | 0 | Solution | 60.03 | 127 | 118.00 | 7.09 |
| j12032 8.json | 1 | 0 | Solution | 60.04 | 141 | 131.00 | 7.09 |
| j12032 9.json | 1 | 0 | Solution | 60.03 | 132 | 124.00 | 6.06 |
| j12033 1.json | 1 | 0 | Solution | 60.03 | 110 | 104.00 | 5.45 |
| j12033 10.json | 1 | 0 | Solution | 60.03 | 111 | 102.00 | 8.11 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12033 2.json | 1 | 0 | Solution | 60.03 | 117 | 105.00 | 10.26 |
| j12033 3.json | 1 | 0 | Solution | 60.03 | 111 | 101.00 | 9.01 |
| j12033 4.json | 1 | 0 | Solution | 60.03 | 117 | 105.00 | 10.26 |
| j12033 5.json | 1 | 0 | Solution | 60.03 | 148 | 132.00 | 10.81 |
| j12033 6.json | 1 | 0 | Solution | 60.05 | 118 | 115.00 | 2.54 |
| j12033 7.json | 1 | 0 | Solution | 60.02 | 126 | 121.00 | 3.97 |
| j12033 8.json | 1 | 0 | Solution | 60.02 | 114 | 106.00 | 7.02 |
| j12033 9.json | 1 | 0 | Solution | 60.03 | 120 | 108.00 | 10.00 |
| j12034 1.json | 1 | 0 | Solution | 60.01 | 79 | 75.00 | 5.06 |
| j12034 10.json | 1 | 0 | Optimal | 0.18 | 101 | 101.00 | 0.00 |
| j12034 2.json | 1 | 0 | Solution | 60.02 | 107 | 102.00 | 4.67 |
| j12034 3.json | 1 | 0 | Solution | 60.02 | 103 | 98.00 | 4.85 |
| j12034 4.json | 1 | 0 | Optimal | 8.06 | 95 | 95.00 | 0.00 |
| j12034 5.json | 1 | 0 | Solution | 60.03 | 105 | 101.00 | 3.81 |
| j12034 6.json | 1 | 0 | Optimal | 0.29 | 100 | 100.00 | 0.00 |
| j12034 7.json | 1 | 0 | Optimal | 14.52 | 105 | 105.00 | 0.00 |
| j12034 8.json | 1 | 0 | Solution | 60.02 | 90 | 85.00 | 5.56 |
| j12034 9.json | 1 | 0 | Solution | 60.03 | 97 | 90.00 | 7.22 |
| j12035 1.json | 1 | 0 | Optimal | 0.09 | 87 | 87.00 | 0.00 |
| j12035 10.json | 1 | 0 | Optimal | 0.10 | 86 | 86.00 | 0.00 |
| j12035 2.json | 1 | 0 | Solution | 60.03 | 112 | 111.00 | 0.89 |
| j12035 3.json | 1 | 0 | Optimal | 60.01 | 77 | 77.00 | 0.00 |
| j12035 4.json | 1 | 0 | Optimal | 0.12 | 101 | 101.00 | 0.00 |
| j12035 5.json | 1 | 0 | Optimal | 60.01 | 92 | 92.00 | 0.00 |
| j12035 6.json | 1 | 0 | Optimal | 0.07 | 86 | 86.00 | 0.00 |
| j12035 7.json | 1 | 0 | Optimal | 0.08 | 99 | 99.00 | 0.00 |
| j12035 8.json | 1 | 0 | Optimal | 0.11 | 101 | 101.00 | 0.00 |
| j12035 9.json | 1 | 0 | Optimal | 29.79 | 91 | 91.00 | 0.00 |
| j12036 1.json | 1 | 0 | Solution | 60.04 | 222 | 186.00 | 16.22 |
| j12036 10.json | 1 | 0 | Solution | 60.03 | 231 | 191.00 | 17.32 |
| j12036 2.json | 1 | 0 | Solution | 60.11 | 238 | 201.00 | 15.55 |
| j12036 3.json | 1 | 0 | Solution | 60.04 | 243 | 216.00 | 11.11 |
| j12036 4.json | 1 | 0 | Solution | 60.04 | 257 | 215.00 | 16.34 |
| j12036 5.json | 1 | 0 | Solution | 60.09 | 247 | 208.00 | 15.79 |
| j12036 6.json | 1 | 0 | Solution | 60.04 | 244 | 201.00 | 17.62 |
| j12036 7.json | 1 | 0 | Solution | 60.04 | 220 | 193.00 | 12.27 |
| j12036 8.json | 1 | 0 | Solution | 60.03 | 185 | 151.00 | 18.38 |
| j12036 9.json | 1 | 0 | Solution | 60.13 | 233 | 200.00 | 14.16 |
| j12037 1.json | 1 | 0 | Solution | 60.02 | 151 | 137.00 | 9.27 |
| j12037 10.json | 1 | 0 | Solution | 60.03 | 138 | 126.00 | 8.70 |
| j12037 2.json | 1 | 0 | Solution | 60.03 | 152 | 132.00 | 13.16 |
| j12037 3.json | 1 | 0 | Solution | 60.03 | 146 | 125.00 | 14.38 |
| j12037 4.json | 1 | 0 | Solution | 60.05 | 170 | 147.00 | 13.53 |
| j12037 5.json | 1 | 0 | Solution | 60.03 | 217 | 191.00 | 11.98 |
| j12037 6.json | 1 | 0 | Solution | 60.04 | 172 | 140.00 | 18.60 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12037 7.json | 1 | 0 | Solution | 60.03 | 168 | 148.00 | 11.90 |
| j12037 8.json | 1 | 0 | Solution | 60.03 | 189 | 165.00 | 12.70 |
| j12037 9.json | 1 | 0 | Solution | 60.04 | 151 | 126.00 | 16.56 |
| j12038 1.json | 1 | 0 | Solution | 60.03 | 111 | 104.00 | 6.31 |
| j12038 10.json | 1 | 0 | Solution | 60.02 | 145 | 114.00 | 21.38 |
| j12038 2.json | 1 | 0 | Solution | 60.03 | 131 | 117.00 | 10.69 |
| j12038 3.json | 1 | 0 | Solution | 60.03 | 161 | 147.00 | 8.70 |
| j12038 4.json | 1 | 0 | Solution | 60.03 | 145 | 122.00 | 15.86 |
| j12038 5.json | 1 | 0 | Solution | 60.03 | 117 | 101.00 | 13.68 |
| j12038 6.json | 1 | 0 | Solution | 60.02 | 127 | 109.00 | 14.17 |
| j12038 7.json | 1 | 0 | Solution | 60.03 | 108 | 97.00 | 10.19 |
| j12038 8.json | 1 | 0 | Solution | 60.03 | 129 | 108.00 | 16.28 |
| j12038 9.json | 1 | 0 | Solution | 60.03 | 138 | 134.00 | 2.90 |
| j12039 1.json | 1 | 0 | Optimal | 60.01 | 95 | 95.00 | 0.00 |
| j12039 10.json | 1 | 0 | Solution | 60.02 | 113 | 99.00 | 12.39 |
| j12039 2.json | 1 | 0 | Solution | 60.03 | 112 | 104.00 | 7.14 |
| j12039 3.json | 1 | 0 | Solution | 60.02 | 114 | 103.00 | 9.65 |
| j12039 4.json | 1 | 0 | Solution | 60.02 | 101 | 89.00 | 11.88 |
| j12039 5.json | 1 | 0 | Optimal | 0.12 | 106 | 106.00 | 0.00 |
| j12039 6.json | 1 | 0 | Optimal | 0.23 | 95 | 95.00 | 0.00 |
| j12039 7.json | 1 | 0 | Solution | 60.01 | 108 | 94.00 | 12.96 |
| j12039 8.json | 1 | 0 | Solution | 60.04 | 100 | 93.00 | 7.00 |
| j12039 9.json | 1 | 0 | Solution | 60.03 | 95 | 87.00 | 8.42 |
| j1203 1.json | 1 | 0 | Optimal | 0.25 | 80 | 80.00 | 0.00 |
| j1203 10.json | 1 | 0 | Optimal | 0.13 | 103 | 103.00 | 0.00 |
| j1203 2.json | 1 | 0 | Optimal | 0.11 | 88 | 88.00 | 0.00 |
| j1203 3.json | 1 | 0 | Optimal | 0.11 | 100 | 100.00 | 0.00 |
| j1203 4.json | 1 | 0 | Optimal | 0.12 | 71 | 71.00 | 0.00 |
| j1203 5.json | 1 | 0 | Optimal | 0.12 | 84 | 84.00 | 0.00 |
| j1203 6.json | 1 | 0 | Optimal | 0.12 | 102 | 102.00 | 0.00 |
| j1203 7.json | 1 | 0 | Optimal | 0.09 | 93 | 93.00 | 0.00 |
| j1203 8.json | 1 | 0 | Optimal | 0.17 | 77 | 77.00 | 0.00 |
| j1203 9.json | 1 | 0 | Optimal | 0.12 | 86 | 86.00 | 0.00 |
| j12040 1.json | 1 | 0 | Solution | 60.03 | 82 | 78.00 | 4.88 |
| j12040 10.json | 1 | 0 | Optimal | 0.10 | 96 | 96.00 | 0.00 |
| j12040 2.json | 1 | 0 | Optimal | 0.53 | 90 | 90.00 | 0.00 |
| j12040 3.json | 1 | 0 | Optimal | 60.01 | 87 | 87.00 | 0.00 |
| j12040 4.json | 1 | 0 | Optimal | 0.07 | 112 | 112.00 | 0.00 |
| j12040 5.json | 1 | 0 | Optimal | 0.08 | 101 | 101.00 | 0.00 |
| j12040 6.json | 1 | 0 | Optimal | 0.06 | 90 | 90.00 | 0.00 |
| j12040 7.json | 1 | 0 | Optimal | 0.07 | 91 | 91.00 | 0.00 |
| j12040 8.json | 1 | 0 | Optimal | 0.09 | 97 | 97.00 | 0.00 |
| j12040 9.json | 1 | 0 | Optimal | 0.16 | 117 | 117.00 | 0.00 |
| j12041 1.json | 1 | 0 | Optimal | 0.34 | 127 | 127.00 | 0.00 |
| j12041 10.json | 1 | 0 | Optimal | 0.86 | 136 | 136.00 | 0.00 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12041 2.json | 1 | 0 | Optimal | 26.27 | 141 | 141.00 | 0.00 |
| j12041 3.json | 1 | 0 | Optimal | 3.91 | 141 | 141.00 | 0.00 |
| j12041 4.json | 1 | 0 | Optimal | 1.15 | 116 | 116.00 | 0.00 |
| j12041 5.json | 1 | 0 | Optimal | 0.32 | 138 | 138.00 | 0.00 |
| j12041 6.json | 1 | 0 | Optimal | 1.61 | 113 | 113.00 | 0.00 |
| j12041 7.json | 1 | 0 | Optimal | 4.27 | 109 | 109.00 | 0.00 |
| j12041 8.json | 1 | 0 | Optimal | 2.72 | 138 | 138.00 | 0.00 |
| j12041 9.json | 1 | 0 | Optimal | 60.01 | 121 | 121.00 | 0.00 |
| j12042 1.json | 1 | 0 | Solution | 60.15 | 108 | 105.00 | 2.78 |
| j12042 10.json | 1 | 0 | Optimal | 1.19 | 118 | 118.00 | 0.00 |
| j12042 2.json | 1 | 0 | Optimal | 0.07 | 126 | 126.00 | 0.00 |
| j12042 3.json | 1 | 0 | Optimal | 0.23 | 106 | 106.00 | 0.00 |
| j12042 4.json | 1 | 0 | Optimal | 0.18 | 104 | 104.00 | 0.00 |
| j12042 5.json | 1 | 0 | Optimal | 22.61 | 120 | 120.00 | 0.00 |
| j12042 6.json | 1 | 0 | Optimal | 13.42 | 119 | 119.00 | 0.00 |
| j12042 7.json | 1 | 0 | Optimal | 0.18 | 123 | 123.00 | 0.00 |
| j12042 8.json | 1 | 0 | Optimal | 60.00 | 113 | 113.00 | 0.00 |
| j12042 9.json | 1 | 0 | Optimal | 0.17 | 104 | 104.00 | 0.00 |
| j12043 1.json | 1 | 0 | Optimal | 0.13 | 105 | 105.00 | 0.00 |
| j12043 10.json | 1 | 0 | Optimal | 0.15 | 113 | 113.00 | 0.00 |
| j12043 2.json | 1 | 0 | Optimal | 0.13 | 120 | 120.00 | 0.00 |
| j12043 3.json | 1 | 0 | Optimal | 0.15 | 95 | 95.00 | 0.00 |
| j12043 4.json | 1 | 0 | Optimal | 0.17 | 105 | 105.00 | 0.00 |
| j12043 5.json | 1 | 0 | Optimal | 0.15 | 105 | 105.00 | 0.00 |
| j12043 6.json | 1 | 0 | Optimal | 0.92 | 98 | 98.00 | 0.00 |
| j12043 7.json | 1 | 0 | Optimal | 0.16 | 122 | 122.00 | 0.00 |
| j12043 8.json | 1 | 0 | Optimal | 0.12 | 115 | 115.00 | 0.00 |
| j12043 9.json | 1 | 0 | Optimal | 0.14 | 105 | 105.00 | 0.00 |
| j12044 1.json | 1 | 0 | Optimal | 0.11 | 100 | 100.00 | 0.00 |
| j12044 10.json | 1 | 0 | Optimal | 0.12 | 98 | 98.00 | 0.00 |
| j12044 2.json | 1 | 0 | Optimal | 0.12 | 112 | 112.00 | 0.00 |
| j12044 3.json | 1 | 0 | Optimal | 0.09 | 107 | 107.00 | 0.00 |
| j12044 4.json | 1 | 0 | Optimal | 0.07 | 95 | 95.00 | 0.00 |
| j12044 5.json | 1 | 0 | Optimal | 0.12 | 98 | 98.00 | 0.00 |
| j12044 6.json | 1 | 0 | Optimal | 0.13 | 106 | 106.00 | 0.00 |
| j12044 7.json | 1 | 0 | Optimal | 0.12 | 98 | 98.00 | 0.00 |
| j12044 8.json | 1 | 0 | Optimal | 0.09 | 108 | 108.00 | 0.00 |
| j12044 9.json | 1 | 0 | Optimal | 0.11 | 91 | 91.00 | 0.00 |
| j12045 1.json | 1 | 0 | Optimal | 0.10 | 108 | 108.00 | 0.00 |
| j12045 10.json | 1 | 0 | Optimal | 0.12 | 99 | 99.00 | 0.00 |
| j12045 2.json | 1 | 0 | Optimal | 0.09 | 91 | 91.00 | 0.00 |
| j12045 3.json | 1 | 0 | Optimal | 0.09 | 98 | 98.00 | 0.00 |
| j12045 4.json | 1 | 0 | Optimal | 0.10 | 103 | 103.00 | 0.00 |
| j12045 5.json | 1 | 0 | Optimal | 0.10 | 116 | 116.00 | 0.00 |
| j12045 6.json | 1 | 0 | Optimal | 0.04 | 125 | 125.00 | 0.00 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12045 7.json | 1 | 0 | Optimal | 0.09 | 103 | 103.00 | 0.00 |
| j12045 8.json | 1 | 0 | Optimal | 0.13 | 103 | 103.00 | 0.00 |
| j12045 9.json | 1 | 0 | Optimal | 0.06 | 114 | 114.00 | 0.00 |
| j12046 1.json | 1 | 0 | Solution | 60.15 | 193 | 159.00 | 17.62 |
| j12046 10.json | 1 | 0 | Solution | 60.05 | 191 | 173.00 | 9.42 |
| j12046 2.json | 1 | 0 | Solution | 60.03 | 199 | 174.00 | 12.56 |
| j12046 3.json | 1 | 0 | Solution | 60.07 | 183 | 153.00 | 16.39 |
| j12046 4.json | 1 | 0 | Solution | 60.05 | 173 | 162.00 | 6.36 |
| j12046 5.json | 1 | 0 | Solution | 60.04 | 154 | 135.00 | 12.34 |
| j12046 6.json | 1 | 0 | Solution | 60.07 | 181 | 159.00 | 12.15 |
| j12046 7.json | 1 | 0 | Solution | 60.08 | 173 | 155.00 | 10.40 |
| j12046 8.json | 1 | 0 | Solution | 60.03 | 181 | 157.00 | 13.26 |
| j12046 9.json | 1 | 0 | Solution | 60.04 | 170 | 147.00 | 13.53 |
| j12047 1.json | 1 | 0 | Solution | 60.06 | 140 | 121.00 | 13.57 |
| j12047 10.json | 1 | 0 | Solution | 60.02 | 135 | 127.00 | 5.93 |
| j12047 2.json | 1 | 0 | Solution | 60.09 | 133 | 120.00 | 9.77 |
| j12047 3.json | 1 | 0 | Solution | 60.02 | 127 | 118.00 | 7.09 |
| j12047 4.json | 1 | 0 | Solution | 60.05 | 137 | 117.00 | 14.60 |
| j12047 5.json | 1 | 0 | Solution | 60.03 | 129 | 119.00 | 7.75 |
| j12047 6.json | 1 | 0 | Solution | 60.03 | 142 | 127.00 | 10.56 |
| j12047 7.json | 1 | 0 | Solution | 60.04 | 122 | 112.00 | 8.20 |
| j12047 8.json | 1 | 0 | Solution | 60.04 | 138 | 122.00 | 11.59 |
| j12047 9.json | 1 | 0 | Solution | 60.05 | 146 | 136.00 | 6.85 |
| j12048 1.json | 1 | 0 | Optimal | 60.02 | 100 | 100.00 | 0.00 |
| j12048 10.json | 1 | 0 | Solution | 60.06 | 111 | 106.00 | 4.50 |
| j12048 2.json | 1 | 0 | Solution | 60.04 | 114 | 111.00 | 2.63 |
| j12048 3.json | 1 | 0 | Solution | 60.05 | 114 | 106.00 | 7.02 |
| j12048 4.json | 1 | 0 | Solution | 60.03 | 129 | 121.00 | 6.20 |
| j12048 5.json | 1 | 0 | Solution | 60.03 | 111 | 104.00 | 6.31 |
| j12048 6.json | 1 | 0 | Solution | 60.03 | 106 | 99.00 | 6.60 |
| j12048 7.json | 1 | 0 | Solution | 60.05 | 107 | 102.00 | 4.67 |
| j12048 8.json | 1 | 0 | Solution | 60.03 | 116 | 109.00 | 6.03 |
| j12048 9.json | 1 | 0 | Optimal | 60.02 | 113 | 113.00 | 0.00 |
| j12049 1.json | 1 | 0 | Optimal | 0.11 | 96 | 96.00 | 0.00 |
| j12049 10.json | 1 | 0 | Solution | 60.09 | 97 | 95.00 | 2.06 |
| j12049 2.json | 1 | 0 | Solution | 60.03 | 109 | 104.00 | 4.59 |
| j12049 3.json | 1 | 0 | Optimal | 60.02 | 96 | 96.00 | 0.00 |
| j12049 4.json | 1 | 0 | Solution | 60.03 | 97 | 94.00 | 3.09 |
| j12049 5.json | 1 | 0 | Optimal | 60.01 | 89 | 89.00 | 0.00 |
| j12049 6.json | 1 | 0 | Optimal | 0.16 | 128 | 128.00 | 0.00 |
| j12049 7.json | 1 | 0 | Optimal | 3.41 | 99 | 99.00 | 0.00 |
| j12049 8.json | 1 | 0 | Optimal | 49.19 | 113 | 113.00 | 0.00 |
| j12049 9.json | 1 | 0 | Optimal | 7.50 | 97 | 97.00 | 0.00 |
| j1204 1.json | 1 | 0 | Optimal | 0.11 | 74 | 74.00 | 0.00 |
| j1204 10.json | 1 | 0 | Optimal | 0.08 | 77 | 77.00 | 0.00 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j1204 2.json | 1 | 0 | Optimal | 0.09 | 107 | 107.00 | 0.00 |
| j1204 3.json | 1 | 0 | Optimal | 0.09 | 95 | 95.00 | 0.00 |
| j1204 4.json | 1 | 0 | Optimal | 0.10 | 75 | 75.00 | 0.00 |
| j1204 5.json | 1 | 0 | Optimal | 0.09 | 74 | 74.00 | 0.00 |
| j1204 6.json | 1 | 0 | Optimal | 0.11 | 90 | 90.00 | 0.00 |
| j1204 7.json | 1 | 0 | Optimal | 0.10 | 81 | 81.00 | 0.00 |
| j1204 8.json | 1 | 0 | Optimal | 0.05 | 90 | 90.00 | 0.00 |
| j1204 9.json | 1 | 0 | Optimal | 0.07 | 79 | 79.00 | 0.00 |
| j12050 1.json | 1 | 0 | Optimal | 0.07 | 116 | 116.00 | 0.00 |
| j12050 10.json | 1 | 0 | Optimal | 0.15 | 103 | 103.00 | 0.00 |
| j12050 2.json | 1 | 0 | Optimal | 8.68 | 112 | 112.00 | 0.00 |
| j12050 3.json | 1 | 0 | Optimal | 0.11 | 111 | 111.00 | 0.00 |
| j12050 4.json | 1 | 0 | Solution | 60.04 | 100 | 98.00 | 2.00 |
| j12050 5.json | 1 | 0 | Optimal | 0.12 | 100 | 100.00 | 0.00 |
| j12050 6.json | 1 | 0 | Optimal | 0.09 | 102 | 102.00 | 0.00 |
| j12050 7.json | 1 | 0 | Optimal | 0.09 | 137 | 137.00 | 0.00 |
| j12050 8.json | 1 | 0 | Optimal | 0.11 | 112 | 112.00 | 0.00 |
| j12050 9.json | 1 | 0 | Optimal | 0.09 | 101 | 101.00 | 0.00 |
| j12051 1.json | 1 | 0 | Solution | 60.05 | 221 | 180.00 | 18.55 |
| j12051 10.json | 1 | 0 | Solution | 60.05 | 238 | 193.00 | 18.91 |
| j12051 2.json | 1 | 0 | Solution | 60.03 | 233 | 192.00 | 17.60 |
| j12051 3.json | 1 | 0 | Solution | 60.07 | 235 | 189.00 | 19.57 |
| j12051 4.json | 1 | 0 | Solution | 60.04 | 222 | 196.00 | 11.71 |
| j12051 5.json | 1 | 0 | Solution | 60.02 | 244 | 193.00 | 20.90 |
| j12051 6.json | 1 | 0 | Solution | 60.07 | 225 | 190.00 | 15.56 |
| j12051 7.json | 1 | 0 | Solution | 60.03 | 220 | 179.00 | 18.64 |
| j12051 8.json | 1 | 0 | Solution | 60.05 | 216 | 184.00 | 14.81 |
| j12051 9.json | 1 | 0 | Solution | 60.03 | 228 | 188.00 | 17.54 |
| j12052 1.json | 1 | 0 | Solution | 60.04 | 183 | 157.00 | 14.21 |
| j12052 10.json | 1 | 0 | Solution | 60.03 | 150 | 129.00 | 14.00 |
| j12052 2.json | 1 | 0 | Solution | 60.04 | 192 | 167.00 | 13.02 |
| j12052 3.json | 1 | 0 | Solution | 60.05 | 141 | 124.00 | 12.06 |
| j12052 4.json | 1 | 0 | Solution | 60.04 | 178 | 155.00 | 12.92 |
| j12052 5.json | 1 | 0 | Solution | 60.04 | 174 | 157.00 | 9.77 |
| j12052 6.json | 1 | 0 | Solution | 60.04 | 208 | 181.00 | 12.98 |
| j12052 7.json | 1 | 0 | Solution | 60.09 | 155 | 139.00 | 10.32 |
| j12052 8.json | 1 | 0 | Solution | 60.02 | 166 | 147.00 | 11.45 |
| j12052 9.json | 1 | 0 | Solution | 60.09 | 154 | 141.00 | 8.44 |
| j12053 1.json | 1 | 0 | Solution | 60.04 | 149 | 137.00 | 8.05 |
| j12053 10.json | 1 | 0 | Solution | 60.03 | 136 | 123.00 | 9.56 |
| j12053 2.json | 1 | 0 | Solution | 60.05 | 119 | 108.00 | 9.24 |
| j12053 3.json | 1 | 0 | Solution | 60.02 | 114 | 105.00 | 7.89 |
| j12053 4.json | 1 | 0 | Solution | 60.03 | 148 | 136.00 | 8.11 |
| j12053 5.json | 1 | 0 | Solution | 60.04 | 115 | 108.00 | 6.09 |
| j12053 6.json | 1 | 0 | Solution | 60.09 | 109 | 100.00 | 8.26 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12053 7.json | 1 | 0 | Solution | 60.02 | 121 | 116.00 | 4.13 |
| j12053 8.json | 1 | 0 | Solution | 60.05 | 142 | 134.00 | 5.63 |
| j12053 9.json | 1 | 0 | Solution | 60.03 | 168 | 149.00 | 11.31 |
| j12054 1.json | 1 | 0 | Solution | 60.09 | 106 | 101.00 | 4.72 |
| j12054 10.json | 1 | 0 | Solution | 60.06 | 108 | 104.00 | 3.70 |
| j12054 2.json | 1 | 0 | Optimal | 0.13 | 134 | 134.00 | 0.00 |
| j12054 3.json | 1 | 0 | Optimal | 1.35 | 111 | 111.00 | 0.00 |
| j12054 4.json | 1 | 0 | Solution | 60.06 | 120 | 119.00 | 0.83 |
| j12054 5.json | 1 | 0 | Solution | 60.05 | 111 | 106.00 | 4.50 |
| j12054 6.json | 1 | 0 | Solution | 60.05 | 111 | 103.00 | 7.21 |
| j12054 7.json | 1 | 0 | Solution | 60.04 | 112 | 103.00 | 8.04 |
| j12054 8.json | 1 | 0 | Solution | 60.03 | 104 | 99.00 | 4.81 |
| j12054 9.json | 1 | 0 | Solution | 60.04 | 108 | 104.00 | 3.70 |
| j12055 1.json | 1 | 0 | Solution | 60.03 | 101 | 99.00 | 1.98 |
| j12055 10.json | 1 | 0 | Optimal | 0.15 | 100 | 100.00 | 0.00 |
| j12055 2.json | 1 | 0 | Optimal | 0.08 | 83 | 83.00 | 0.00 |
| j12055 3.json | 1 | 0 | Optimal | 0.10 | 126 | 126.00 | 0.00 |
| j12055 4.json | 1 | 0 | Optimal | 0.14 | 90 | 90.00 | 0.00 |
| j12055 5.json | 1 | 0 | Optimal | 0.09 | 106 | 106.00 | 0.00 |
| j12055 6.json | 1 | 0 | Solution | 60.04 | 102 | 98.00 | 3.92 |
| j12055 7.json | 1 | 0 | Optimal | 0.09 | 105 | 105.00 | 0.00 |
| j12055 8.json | 1 | 0 | Optimal | 7.76 | 101 | 101.00 | 0.00 |
| j12055 9.json | 1 | 0 | Optimal | 0.10 | 94 | 94.00 | 0.00 |
| j12056 1.json | 1 | 0 | Solution | 60.04 | 255 | 214.00 | 16.08 |
| j12056 10.json | 1 | 0 | Solution | 60.05 | 275 | 228.00 | 17.09 |
| j12056 2.json | 1 | 0 | Solution | 60.15 | 221 | 183.00 | 17.19 |
| j12056 3.json | 1 | 0 | Solution | 60.04 | 257 | 214.00 | 16.73 |
| j12056 4.json | 1 | 0 | Solution | 60.05 | 240 | 199.00 | 17.08 |
| j12056 5.json | 1 | 0 | Solution | 60.04 | 298 | 242.00 | 18.79 |
| j12056 6.json | 1 | 0 | Solution | 60.03 | 230 | 194.00 | 15.65 |
| j12056 7.json | 1 | 0 | Solution | 60.03 | 299 | 242.00 | 19.06 |
| j12056 8.json | 1 | 0 | Solution | 60.05 | 304 | 244.00 | 19.74 |
| j12056 9.json | 1 | 0 | Solution | 60.03 | 306 | 254.00 | 16.99 |
| j12057 1.json | 1 | 0 | Solution | 60.07 | 198 | 169.00 | 14.65 |
| j12057 10.json | 1 | 0 | Solution | 60.04 | 173 | 153.00 | 11.56 |
| j12057 2.json | 1 | 0 | Solution | 60.04 | 169 | 147.00 | 13.02 |
| j12057 3.json | 1 | 0 | Solution | 60.04 | 192 | 173.00 | 9.90 |
| j12057 4.json | 1 | 0 | Solution | 60.03 | 208 | 183.00 | 12.02 |
| j12057 5.json | 1 | 0 | Solution | 60.03 | 190 | 167.00 | 12.11 |
| j12057 6.json | 1 | 0 | Solution | 60.04 | 200 | 171.00 | 14.50 |
| j12057 7.json | 1 | 0 | Solution | 60.04 | 174 | 153.00 | 12.07 |
| j12057 8.json | 1 | 0 | Solution | 60.03 | 172 | 149.00 | 13.37 |
| j12057 9.json | 1 | 0 | Solution | 60.05 | 176 | 154.00 | 12.50 |
| j12058 1.json | 1 | 0 | Solution | 60.03 | 146 | 130.00 | 10.96 |
| j12058 10.json | 1 | 0 | Solution | 60.08 | 138 | 123.00 | 10.87 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|----------------|------------|----------------|----------|-------|----------|--------|----------------|
| j12058 2.json | 1 | 0 | Solution | 60.03 | 130 | 113.00 | 13.08 |
| j12058 3.json | 1 | 0 | Solution | 60.04 | 125 | 113.00 | 9.60 |
| j12058 4.json | 1 | 0 | Solution | 60.03 | 152 | 128.00 | 15.79 |
| j12058 5.json | 1 | 0 | Solution | 60.04 | 123 | 107.00 | 13.01 |
| j12058 6.json | 1 | 0 | Solution | 60.03 | 146 | 127.00 | 13.01 |
| j12058 7.json | 1 | 0 | Solution | 60.04 | 155 | 132.00 | 14.84 |
| j12058 8.json | 1 | 0 | Solution | 60.04 | 138 | 124.00 | 10.14 |
| j12058 9.json | 1 | 0 | Solution | 60.04 | 135 | 117.00 | 13.33 |
| j12059 1.json | 1 | 0 | Solution | 60.03 | 116 | 110.00 | 5.17 |
| j12059 10.json | 1 | 0 | Solution | 60.04 | 136 | 124.00 | 8.82 |
| j12059 2.json | 1 | 0 | Solution | 60.03 | 108 | 93.00 | 13.89 |
| j12059 3.json | 1 | 0 | Optimal | 60.02 | 108 | 108.00 | 0.00 |
| j12059 4.json | 1 | 0 | Solution | 60.01 | 112 | 107.00 | 4.46 |
| j12059 5.json | 1 | 0 | Solution | 60.03 | 108 | 100.00 | 7.41 |
| j12059 6.json | 1 | 0 | Solution | 60.03 | 117 | 107.00 | 8.55 |
| j12059 7.json | 1 | 0 | Solution | 60.03 | 115 | 108.00 | 6.09 |
| j12059 8.json | 1 | 0 | Solution | 60.01 | 113 | 100.00 | 11.50 |
| j12059 9.json | 1 | 0 | Solution | 60.07 | 120 | 115.00 | 4.17 |
| j1205 1.json | 1 | 0 | Optimal | 0.04 | 92 | 92.00 | 0.00 |
| j1205 10.json | 1 | 0 | Optimal | 0.06 | 92 | 92.00 | 0.00 |
| j1205 2.json | 1 | 0 | Optimal | 0.07 | 80 | 80.00 | 0.00 |
| j1205 3.json | 1 | 0 | Optimal | 0.09 | 72 | 72.00 | 0.00 |
| j1205 4.json | 1 | 0 | Optimal | 0.06 | 97 | 97.00 | 0.00 |
| j1205 5.json | 1 | 0 | Optimal | 0.05 | 77 | 77.00 | 0.00 |
| j1205 6.json | 1 | 0 | Optimal | 0.11 | 88 | 88.00 | 0.00 |
| j1205 7.json | 1 | 0 | Optimal | 0.06 | 84 | 84.00 | 0.00 |
| j1205 8.json | 1 | 0 | Optimal | 0.11 | 78 | 78.00 | 0.00 |
| j1205 9.json | 1 | 0 | Optimal | 0.12 | 106 | 106.00 | 0.00 |
| j12060 1.json | 1 | 0 | Optimal | 0.09 | 101 | 101.00 | 0.00 |
| j12060 10.json | 1 | 0 | Solution | 60.03 | 90 | 85.00 | 5.56 |
| j12060 2.json | 1 | 0 | Solution | 60.03 | 84 | 81.00 | 3.57 |
| j12060 3.json | 1 | 0 | Solution | 60.02 | 91 | 81.00 | 10.99 |
| j12060 4.json | 1 | 0 | Solution | 60.02 | 105 | 101.00 | 3.81 |
| j12060 5.json | 1 | 0 | Solution | 60.02 | 106 | 96.00 | 9.43 |
| j12060 6.json | 1 | 0 | Optimal | 0.08 | 110 | 110.00 | 0.00 |
| j12060 7.json | 1 | 0 | Solution | 60.04 | 97 | 88.00 | 9.28 |
| j12060 8.json | 1 | 0 | Solution | 60.04 | 102 | 101.00 | 0.98 |
| j12060 9.json | 1 | 0 | Optimal | 0.08 | 101 | 101.00 | 0.00 |
| j1206 1.json | 1 | 0 | Solution | 60.03 | 152 | 133.00 | 12.50 |
| j1206 10.json | 1 | 0 | Solution | 60.04 | 178 | 156.00 | 12.36 |
| j1206 2.json | 1 | 0 | Solution | 60.05 | 141 | 125.00 | 11.35 |
| j1206 3.json | 1 | 0 | Solution | 60.05 | 135 | 125.00 | 7.41 |
| j1206 4.json | 1 | 0 | Solution | 60.14 | 156 | 144.00 | 7.69 |
| j1206 5.json | 1 | 0 | Solution | 60.04 | 129 | 116.00 | 10.08 |
| j1206 6.json | 1 | 0 | Solution | 60.04 | 158 | 140.00 | 11.39 |

Table 9.8: Results for RCPSP J120 (CPSat) (600 Instances)

| Name | Nr Jobs | Nr Machines | Status | Time | Makespan | Bound | Gap Percent |
|---------------|------------|----------------|----------|-------|----------|--------|----------------|
| j1206 7.json | 1 | 0 | Solution | 60.03 | 172 | 151.00 | 12.21 |
| j1206 8.json | 1 | 0 | Solution | 60.05 | 150 | 140.00 | 6.67 |
| j1206 9.json | 1 | 0 | Solution | 60.04 | 164 | 146.00 | 10.98 |
| j1207 1.json | 1 | 0 | Solution | 60.03 | 105 | 98.00 | 6.67 |
| j1207 10.json | 1 | 0 | Solution | 60.02 | 122 | 111.00 | 9.02 |
| j1207 2.json | 1 | 0 | Solution | 60.03 | 114 | 106.00 | 7.02 |
| j1207 3.json | 1 | 0 | Solution | 60.04 | 100 | 94.00 | 6.00 |
| j1207 4.json | 1 | 0 | Solution | 60.04 | 116 | 105.00 | 9.48 |
| j1207 5.json | 1 | 0 | Solution | 60.06 | 137 | 125.00 | 8.76 |
| j1207 6.json | 1 | 0 | Solution | 60.03 | 126 | 115.00 | 8.73 |
| j1207 7.json | 1 | 0 | Solution | 60.06 | 120 | 113.00 | 5.83 |
| j1207 8.json | 1 | 0 | Solution | 60.03 | 100 | 92.00 | 8.00 |
| j1207 9.json | 1 | 0 | Solution | 60.04 | 92 | 86.00 | 6.52 |
| j1208 1.json | 1 | 0 | Optimal | 0.72 | 95 | 95.00 | 0.00 |
| j1208 10.json | 1 | 0 | Solution | 60.02 | 94 | 91.00 | 3.19 |
| j1208 2.json | 1 | 0 | Solution | 60.04 | 104 | 97.00 | 6.73 |
| j1208 3.json | 1 | 0 | Solution | 60.05 | 95 | 93.00 | 2.11 |
| j1208 4.json | 1 | 0 | Solution | 60.01 | 95 | 89.00 | 6.32 |
| j1208 5.json | 1 | 0 | Solution | 60.05 | 107 | 99.00 | 7.48 |
| j1208 6.json | 1 | 0 | Solution | 60.03 | 85 | 83.00 | 2.35 |
| j1208 7.json | 1 | 0 | Solution | 60.02 | 88 | 87.00 | 1.14 |
| j1208 8.json | 1 | 0 | Solution | 60.03 | 89 | 87.00 | 2.25 |
| j1208 9.json | 1 | 0 | Solution | 60.02 | 96 | 88.00 | 8.33 |
| j1209 1.json | 1 | 0 | Optimal | 0.12 | 88 | 88.00 | 0.00 |
| j1209 10.json | 1 | 0 | Optimal | 0.13 | 84 | 84.00 | 0.00 |
| j1209 2.json | 1 | 0 | Optimal | 0.10 | 94 | 94.00 | 0.00 |
| j1209 3.json | 1 | 0 | Optimal | 0.18 | 87 | 87.00 | 0.00 |
| j1209 4.json | 1 | 0 | Solution | 60.02 | 87 | 84.00 | 3.45 |
| j1209 5.json | 1 | 0 | Optimal | 0.07 | 114 | 114.00 | 0.00 |
| j1209 6.json | 1 | 0 | Optimal | 60.01 | 98 | 98.00 | 0.00 |
| j1209 7.json | 1 | 0 | Optimal | 0.09 | 80 | 80.00 | 0.00 |
| j1209 8.json | 1 | 0 | Optimal | 0.07 | 80 | 80.00 | 0.00 |
| j1209 9.json | 1 | 0 | Optimal | 0.27 | 87 | 87.00 | 0.00 |

Chapter 10

Result Comparison for SALBP

Table 10.1: SALBP Results Summary Size 20 (525 Instances)

| Type | base | Laborie | CPO | CPSat | Cplex | Chuffed | MCPSat | CPOA | CPSatA | ChuffedA | CplexA |
|-----------------------|------|---------|-----|-------|-------|---------|--------|------|--------|----------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - | - | - | - | - | - |
| SharedProvenOptimal | 521 | - | 522 | 525 | 525 | 525 | 525 | 521 | 518 | 190 | 283 |
| UniqueUnprovenOptimal | - | - | - | - | - | - | - | - | - | - | - |
| SharedUnprovenOptimal | 4 | - | 3 | - | - | - | - | 4 | 7 | 6 | 242 |
| Optimal | 525 | - | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 196 | 525 |
| UniqueBest | - | - | - | - | - | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - | - | - | - | - | - |
| Best | - | - | - | - | - | - | - | - | - | - | - |
| BestOrOptimal | 525 | - | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 196 | 525 |
| Gap1 | - | - | - | - | - | - | - | - | - | 14 | - |
| Gap2 | - | - | - | - | - | - | - | - | - | 5 | - |
| Gap3 | - | - | - | - | - | - | - | - | - | 12 | - |
| Gap4Plus | - | - | - | - | - | - | - | - | - | 287 | - |
| NonBest | - | - | - | - | - | - | - | - | - | 318 | - |
| Solved | 525 | - | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 514 | 525 |
| Unknown | - | - | - | - | - | - | - | - | - | 11 | - |
| Infeasible | - | - | - | - | - | - | - | - | - | - | - |
| NotPresent | - | 525 | - | - | - | - | - | - | - | - | - |
| N/A | - | 525 | - | - | - | - | - | - | - | 11 | - |
| Total | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 |

Table 10.2: SALBP Results Summary Size 20 (525 Instances)

| Type | base | Laborie | CPO | CPSat | Cplex | Chuffed | MCPSat | CPOA | CPSatA | ChuffedA | CplexA |
|-----------------------|--------|---------|--------|--------|--------|---------|--------|--------|--------|----------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - | - | - | - | - | - |
| SharedProvenOptimal | 99.24 | - | 99.43 | 100.00 | 100.00 | 100.00 | 100.00 | 99.24 | 98.67 | 36.19 | 53.90 |
| UniqueUnprovenOptimal | - | - | - | - | - | - | - | - | - | - | - |
| SharedUnprovenOptimal | 0.76 | - | 0.57 | - | - | - | - | 0.76 | 1.33 | 1.14 | 46.10 |
| Optimal | 100.00 | - | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 37.33 | 100.00 |
| UniqueBest | - | - | - | - | - | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - | - | - | - | - | - |
| Best | - | - | - | - | - | - | - | - | - | - | - |
| BestOrOptimal | 100.00 | - | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 37.33 | 100.00 |
| Gap1 | - | - | - | - | - | - | - | - | - | 2.67 | - |
| Gap2 | - | - | - | - | - | - | - | - | - | 0.95 | - |
| Gap3 | - | - | - | - | - | - | - | - | - | 2.29 | - |
| Gap4Plus | - | - | - | - | - | - | - | - | - | 54.67 | - |
| NonBest | - | - | - | - | - | - | - | - | - | 60.57 | - |
| Solved | 100.00 | - | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 97.90 | 100.00 |
| Unknown | - | - | - | - | - | - | - | - | - | 2.10 | - |
| Infeasible | - | - | - | - | - | - | - | - | - | - | - |
| NotPresent | - | 100.00 | - | - | - | - | - | - | - | - | - |
| N/A | - | 100.00 | - | - | - | - | - | - | - | 2.10 | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 10.3: SALBP Results Summary Size 50 (525 Instances)

| Type | base | Laborie | CPO | CPSat | Cplex | Chuffed | MCPSat | CPOA | CPSatA | ChuffedA | CplexA |
|-----------------------|------|---------|-----|-------|-------|---------|--------|------|--------|----------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - | - | - | - | - | - |
| SharedProvenOptimal | 426 | - | 382 | 501 | 61 | 292 | 501 | 352 | 218 | - | 6 |
| UniqueUnprovenOptimal | - | - | - | - | - | - | - | 1 | - | - | - |
| SharedUnprovenOptimal | 44 | - | 113 | 3 | 232 | 171 | - | 152 | 258 | - | 105 |
| Optimal | 470 | - | 495 | 504 | 293 | 463 | 501 | 505 | 476 | - | 111 |
| UniqueBest | - | - | - | - | - | - | - | - | - | - | - |
| SharedBest | 12 | - | 16 | 16 | - | 12 | - | 16 | 16 | - | - |
| Best | 12 | - | 16 | 16 | - | 12 | - | 16 | 16 | - | - |
| BestOrOptimal | 482 | - | 511 | 520 | 293 | 475 | 501 | 521 | 492 | - | 111 |
| Gap1 | 39 | - | 14 | 5 | 97 | 31 | - | 4 | 31 | - | 34 |
| Gap2 | 4 | - | - | - | 39 | 5 | - | - | 2 | - | 22 |
| Gap3 | - | - | - | - | 34 | 1 | - | - | - | - | 24 |
| Gap4Plus | - | - | - | - | 62 | 13 | - | - | - | - | 61 |
| NonBest | 43 | - | 14 | 5 | 232 | 50 | - | 4 | 33 | - | 141 |
| Solved | 525 | - | 525 | 525 | 525 | 525 | 501 | 525 | 525 | - | 252 |
| Unknown | - | - | - | - | - | - | 24 | - | - | - | 273 |
| Infeasible | - | - | - | - | - | - | - | - | - | - | - |
| NotPresent | - | 525 | - | - | - | - | - | - | - | 525 | - |
| N/A | - | 525 | - | - | - | - | 24 | - | - | 525 | 273 |
| Total | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 |

Table 10.4: SALBP Results Summary Size 50 (525 Instances)

| Type | base | Laborie | CPO | CPSat | Cplex | Chuffed | MCPSat | CPOA | CPSatA | ChuffedA | CplexA |
|-----------------------|--------|---------|--------|--------|--------|---------|--------|--------|--------|----------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - | - | - | - | - | - |
| SharedProvenOptimal | 81.14 | - | 72.76 | 95.43 | 11.62 | 55.62 | 95.43 | 67.05 | 41.52 | - | 1.14 |
| UniqueUnprovenOptimal | - | - | - | - | - | - | - | 0.19 | - | - | - |
| SharedUnprovenOptimal | 8.38 | - | 21.52 | 0.57 | 44.19 | 32.57 | - | 28.95 | 49.14 | - | 20.00 |
| Optimal | 89.52 | - | 94.29 | 96.00 | 55.81 | 88.19 | 95.43 | 96.19 | 90.67 | - | 21.14 |
| UniqueBest | - | - | - | - | - | - | - | - | - | - | - |
| SharedBest | 2.29 | - | 3.05 | 3.05 | - | 2.29 | - | 3.05 | 3.05 | - | - |
| Best | 2.29 | - | 3.05 | 3.05 | - | 2.29 | - | 3.05 | 3.05 | - | - |
| BestOrOptimal | 91.81 | - | 97.33 | 99.05 | 55.81 | 90.48 | 95.43 | 99.24 | 93.71 | - | 21.14 |
| Gap1 | 7.43 | - | 2.67 | 0.95 | 18.48 | 5.90 | - | 0.76 | 5.90 | - | 6.48 |
| Gap2 | 0.76 | - | - | - | 7.43 | 0.95 | - | - | 0.38 | - | 4.19 |
| Gap3 | - | - | - | - | 6.48 | 0.19 | - | - | - | - | 4.57 |
| Gap4Plus | - | - | - | - | 11.81 | 2.48 | - | - | - | - | 11.62 |
| NonBest | 8.19 | - | 2.67 | 0.95 | 44.19 | 9.52 | - | 0.76 | 6.29 | - | 26.86 |
| Solved | 100.00 | - | 100.00 | 100.00 | 100.00 | 100.00 | 95.43 | 100.00 | 100.00 | - | 48.00 |
| Unknown | - | - | - | - | - | - | 4.57 | - | - | - | 52.00 |
| Infeasible | - | - | - | - | - | - | - | - | - | - | - |
| NotPresent | - | 100.00 | - | - | - | - | - | - | - | 100.00 | - |
| N/A | - | 100.00 | - | - | - | - | 4.57 | - | - | 100.00 | 52.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 10.5: SALBP Results Summary Size 100 (525 Instances)

| Type | base | Laborie | CPO | CPSat | Cplex | Chuffed | MCPSat | CPOA | CPSatA | ChuffedA | CplexA |
|-----------------------|------|---------|-----|-------|-------|---------|--------|------|--------|----------|--------|
| UniqueProvenOptimal | 11 | - | 1 | 1 | - | - | - | - | - | - | - |
| SharedProvenOptimal | 344 | - | 318 | 373 | - | 75 | 378 | 166 | 30 | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - | - | 10 | - | - | - |
| SharedUnprovenOptimal | 7 | 25 | 37 | 1 | 11 | 52 | - | 220 | 298 | - | - |
| Optimal | 362 | 25 | 356 | 375 | 11 | 127 | 378 | 396 | 328 | - | - |
| UniqueBest | 1 | 2 | - | 8 | - | - | - | 8 | - | - | - |
| SharedBest | 8 | 51 | 50 | 82 | - | 2 | - | 87 | 16 | - | - |
| Best | 9 | 53 | 50 | 90 | - | 2 | - | 95 | 16 | - | - |
| BestOrOptimal | 371 | 78 | 406 | 465 | 11 | 129 | 378 | 491 | 344 | - | - |
| Gap1 | 59 | 37 | 117 | 59 | 25 | 33 | - | 33 | 103 | - | - |
| Gap2 | 50 | - | 2 | 1 | 19 | 11 | - | 1 | 58 | - | - |
| Gap3 | 30 | - | - | - | 7 | 13 | - | - | 18 | - | - |
| Gap4Plus | 15 | - | - | - | 250 | 339 | - | - | 2 | - | - |
| NonBest | 154 | 37 | 119 | 60 | 301 | 396 | - | 34 | 181 | - | - |
| Solved | 525 | 115 | 525 | 525 | 312 | 525 | 378 | 525 | 525 | - | - |
| Unknown | - | - | - | - | 213 | - | 147 | - | - | - | - |
| Infeasible | - | - | - | - | - | - | - | - | - | - | - |
| NotPresent | - | 410 | - | - | - | - | - | - | - | 525 | 525 |
| N/A | - | 410 | - | - | 213 | - | 147 | - | - | 525 | 525 |
| Total | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 |

Table 10.6: SALBP Results Summary Size 100 (525 Instances)

| Type | base | Laborie | CPO | CPSat | Cplex | Chuffed | MCPSat | CPOA | CPSatA | ChuffedA | CplexA |
|-----------------------|--------|---------|--------|--------|--------|---------|--------|--------|--------|----------|--------|
| UniqueProvenOptimal | 2.10 | - | 0.19 | 0.19 | - | - | - | - | - | - | - |
| SharedProvenOptimal | 65.52 | - | 60.57 | 71.05 | - | 14.29 | 72.00 | 31.62 | 5.71 | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - | - | 1.90 | - | - | - |
| SharedUnprovenOptimal | 1.33 | 4.76 | 7.05 | 0.19 | 2.10 | 9.90 | - | 41.90 | 56.76 | - | - |
| Optimal | 68.95 | 4.76 | 67.81 | 71.43 | 2.10 | 24.19 | 72.00 | 75.43 | 62.48 | - | - |
| UniqueBest | 0.19 | 0.38 | - | 1.52 | - | - | - | 1.52 | - | - | - |
| SharedBest | 1.52 | 9.71 | 9.52 | 15.62 | - | 0.38 | - | 16.57 | 3.05 | - | - |
| Best | 1.71 | 10.10 | 9.52 | 17.14 | - | 0.38 | - | 18.10 | 3.05 | - | - |
| BestOrOptimal | 70.67 | 14.86 | 77.33 | 88.57 | 2.10 | 24.57 | 72.00 | 93.52 | 65.52 | - | - |
| Gap1 | 11.24 | 7.05 | 22.29 | 11.24 | 4.76 | 6.29 | - | 6.29 | 19.62 | - | - |
| Gap2 | 9.52 | - | 0.38 | 0.19 | 3.62 | 2.10 | - | 0.19 | 11.05 | - | - |
| Gap3 | 5.71 | - | - | - | 1.33 | 2.48 | - | - | 3.43 | - | - |
| Gap4Plus | 2.86 | - | - | - | 47.62 | 64.57 | - | - | 0.38 | - | - |
| NonBest | 29.33 | 7.05 | 22.67 | 11.43 | 57.33 | 75.43 | - | 6.48 | 34.48 | - | - |
| Solved | 100.00 | 21.90 | 100.00 | 100.00 | 59.43 | 100.00 | 72.00 | 100.00 | 100.00 | - | - |
| Unknown | - | - | - | - | 40.57 | - | 28.00 | - | - | - | - |
| Infeasible | - | - | - | - | - | - | - | - | - | - | - |
| NotPresent | - | 78.10 | - | - | - | - | - | - | - | 100.00 | 100.00 |
| N/A | - | 78.10 | - | - | 40.57 | - | 28.00 | - | - | 100.00 | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 10.7: SALBP Results Summary Size 1000 (525 Instances)

| Type | base | Laborie | CPO | CPSat | Cplex | Chuffed | MCPSat | CPOA | CPSatA | ChuffedA | CplexA |
|-----------------------|------|---------|-----|-------|-------|---------|--------|------|--------|----------|--------|
| UniqueProvenOptimal | 142 | - | - | - | - | - | - | - | - | - | - |
| SharedProvenOptimal | 44 | - | - | - | - | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - | - | 44 | - | - | - |
| Optimal | 186 | - | - | - | - | - | - | 44 | - | - | - |
| UniqueBest | 86 | 82 | 1 | 1 | - | - | - | 52 | - | - | - |
| SharedBest | 61 | 55 | 3 | 5 | - | - | - | 116 | 9 | - | - |
| Best | 147 | 137 | 4 | 6 | - | - | - | 168 | 9 | - | - |
| BestOrOptimal | 333 | 137 | 4 | 6 | - | - | - | 212 | 9 | - | - |
| Gap1 | 59 | 18 | 83 | 98 | - | - | - | 181 | 172 | - | - |
| Gap2 | 30 | 16 | 165 | 182 | - | - | - | 45 | 128 | - | - |
| Gap3 | 14 | 3 | 80 | 49 | - | - | - | 21 | 34 | - | - |
| Gap4Plus | 89 | 6 | 193 | 190 | - | 112 | - | 65 | 182 | - | - |
| NonBest | 192 | 43 | 521 | 519 | - | 112 | - | 312 | 516 | - | - |
| Solved | 525 | 180 | 525 | 525 | - | 112 | - | 524 | 525 | - | - |
| Unknown | - | - | - | - | - | 413 | 525 | 1 | - | - | - |
| Infeasible | - | - | - | - | - | - | - | - | - | - | - |
| NotPresent | - | 345 | - | - | 525 | - | - | - | - | 525 | 525 |
| N/A | - | 345 | - | - | 525 | 413 | 525 | 1 | - | 525 | 525 |
| Total | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 | 525 |

Table 10.8: SALBP Results Summary Size 1000 (525 Instances)

| Type | base | Laborie | CPO | CPSat | Cplex | Chuffed | MCPSat | CPOA | CPSatA | ChuffedA | CplexA |
|-----------------------|--------|---------|--------|--------|--------|---------|--------|--------|--------|----------|--------|
| UniqueProvenOptimal | 27.05 | - | - | - | - | - | - | - | - | - | - |
| SharedProvenOptimal | 8.38 | - | - | - | - | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - | - | 8.38 | - | - | - |
| Optimal | 35.43 | - | - | - | - | - | - | 8.38 | - | - | - |
| UniqueBest | 16.38 | 15.62 | 0.19 | 0.19 | - | - | - | 9.90 | - | - | - |
| SharedBest | 11.62 | 10.48 | 0.57 | 0.95 | - | - | - | 22.10 | 1.71 | - | - |
| Best | 28.00 | 26.10 | 0.76 | 1.14 | - | - | - | 32.00 | 1.71 | - | - |
| BestOrOptimal | 63.43 | 26.10 | 0.76 | 1.14 | - | - | - | 40.38 | 1.71 | - | - |
| Gap1 | 11.24 | 3.43 | 15.81 | 18.67 | - | - | - | 34.48 | 32.76 | - | - |
| Gap2 | 5.71 | 3.05 | 31.43 | 34.67 | - | - | - | 8.57 | 24.38 | - | - |
| Gap3 | 2.67 | 0.57 | 15.24 | 9.33 | - | - | - | 4.00 | 6.48 | - | - |
| Gap4Plus | 16.95 | 1.14 | 36.76 | 36.19 | - | 21.33 | - | 12.38 | 34.67 | - | - |
| NonBest | 36.57 | 8.19 | 99.24 | 98.86 | - | 21.33 | - | 59.43 | 98.29 | - | - |
| Solved | 100.00 | 34.29 | 100.00 | 100.00 | - | 21.33 | - | 99.81 | 100.00 | - | - |
| Unknown | - | - | - | - | - | 78.67 | 100.00 | 0.19 | - | - | - |
| Infeasible | - | - | - | - | - | - | - | - | - | - | - |
| NotPresent | - | 65.71 | - | - | 100.00 | - | - | - | - | 100.00 | 100.00 |
| N/A | - | 65.71 | - | - | 100.00 | 78.67 | 100.00 | 0.19 | - | 100.00 | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

10.1 SALBP Results Size 20

Table 10.9: Result Comparison for SALBP Size 20 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | MiniZinc Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|----------------|
| 20 1 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 2 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 3 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 4 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 5 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 6 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 7 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 8 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 9 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 10 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 11 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 12 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 13 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 14 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 15 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 16 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 17 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 18 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 19 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 20 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 21 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 22 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 23 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 24 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 25 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 26 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 27 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 28 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 29 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 30 | 16 | 16 | 16 | - | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| 20 31 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 32 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 33 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 34 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 35 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 36 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 37 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 38 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 39 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 40 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 41 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 9 | 6 |
| 20 42 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 43 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 44 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 45 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 46 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | ??? | 4 |
| 20 47 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 48 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 49 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 50 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 51 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 10 | 4 |
| 20 52 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 53 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 54 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 55 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 56 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 57 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 58 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 59 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 10 | 4 |
| 20 60 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 61 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 9 | 7 |
| 20 62 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 63 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 64 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 65 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 66 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 67 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 68 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 69 | 2 | 2 | 2 | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 12 | 2 |
| 20 70 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 71 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 72 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 73 | 2 | 2 | 2 | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 13 | 2 |
| 20 74 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 75 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 76 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 77 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 78 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 79 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 80 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 81 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 82 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 4 |
| 20 83 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 84 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 85 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 86 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 87 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 88 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |

Table 10.9: Result Comparison for SALBP Size 20 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | MiniZinc Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|----------------|
| 20 89 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 90 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 91 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 92 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 93 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 94 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 95 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 96 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 97 | 15 | 13 | 15 | - | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 20 98 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 99 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 100 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 101 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 102 | 13 | 11 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 103 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 104 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 105 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 106 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 107 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 108 | 15 | 15 | 15 | - | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 20 109 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 110 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 111 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 112 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 113 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 114 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 115 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 116 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 117 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 118 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 119 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 9 | 6 |
| 20 120 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 9 | 6 |
| 20 121 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 122 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 123 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 124 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 125 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 126 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 8 | 5 |
| 20 127 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 10 | 4 |
| 20 128 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | ??? | 5 |
| 20 129 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 130 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 6 |
| 20 131 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 20 132 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 10 | 4 |
| 20 133 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 134 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 6 |
| 20 135 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 8 | 6 |
| 20 136 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 9 | 6 |
| 20 137 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 5 |
| 20 138 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 139 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 140 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 141 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 142 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 143 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 144 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 145 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 146 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 147 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 148 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 149 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 150 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 151 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 152 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 153 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 154 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 155 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 156 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 157 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 158 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 159 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | ??? | 3 |
| 20 160 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 161 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 162 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 163 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 164 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 165 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 166 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 167 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 168 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 169 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 170 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 171 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 172 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 173 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 174 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 175 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 176 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 177 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 178 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 179 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 180 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 181 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 182 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |

Table 10.9: Result Comparison for SALBP Size 20 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | MiniZinc Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|----------------|
| 20 183 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 184 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 185 | 15 | 15 | 15 | - | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 20 186 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 187 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 188 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 189 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 190 | 15 | 15 | 15 | - | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 20 191 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 192 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 193 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 194 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 11 | 6 |
| 20 195 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 196 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 197 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 198 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 9 | 6 |
| 20 199 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 200 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 201 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 11 | 6 |
| 20 202 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 203 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 4 |
| 20 204 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 205 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 11 | 6 |
| 20 206 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 207 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 208 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 209 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 4 |
| 20 210 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 211 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 212 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 213 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 214 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | ??? | 5 |
| 20 215 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 216 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 217 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 218 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 219 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 220 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 221 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 7 | 3 |
| 20 222 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 3 |
| 20 223 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 224 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 225 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 226 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 227 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 228 | 2 | 2 | 2 | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 12 | 2 |
| 20 229 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 230 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 231 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 232 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 233 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | ??? | 3 |
| 20 234 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 235 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 236 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 3 |
| 20 237 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 238 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 239 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 240 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 241 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 242 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 243 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 244 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 245 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 246 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 247 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 248 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 249 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 250 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 251 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 252 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 253 | 13 | 11 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 254 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 255 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 256 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 257 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 258 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 259 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 260 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 261 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 262 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 263 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 264 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 265 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 266 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 267 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | ??? | 6 |
| 20 268 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 9 | 6 |
| 20 269 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 10 | 7 |
| 20 270 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 7 |
| 20 271 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 272 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 273 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 274 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 275 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 276 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |

Table 10.9: Result Comparison for SALBP Size 20 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | MiniZinc Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|----------------|
| 20 277 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 278 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 279 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 280 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 5 |
| 20 281 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 282 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 10 | 4 |
| 20 283 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 284 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 285 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 286 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 287 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 288 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 8 | 6 |
| 20 289 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 290 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 8 | 5 |
| 20 291 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 292 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 293 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 294 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 295 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 296 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 297 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 298 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 299 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 300 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 4 |
| 20 301 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 302 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 303 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 304 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 305 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 306 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 307 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 308 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 309 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 310 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 311 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | ??? | 3 |
| 20 312 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 313 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 314 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 315 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 316 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 317 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 318 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 319 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 320 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 321 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 322 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 323 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 324 | 9 | 9 | 9 | - | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| 20 325 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 326 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 327 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 328 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 329 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 330 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 331 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 332 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 333 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 334 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 335 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 336 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 337 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 338 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 339 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 340 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 341 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 11 | 6 |
| 20 342 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 343 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 344 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | ??? | 6 |
| 20 345 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 4 |
| 20 346 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 347 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 348 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 349 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 350 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 351 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 352 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 353 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 354 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 11 | 6 |
| 20 355 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 356 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 357 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 12 | 5 |
| 20 358 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 359 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 360 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 361 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 362 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 363 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 10 | 7 |
| 20 364 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 4 |
| 20 365 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 366 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 367 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 368 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 369 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 370 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |

Table 10.9: Result Comparison for SALBP Size 20 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | MiniZinc Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|----------------|
| 20 371 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 372 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 373 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 374 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 375 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 376 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 377 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 378 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 379 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 | 4 |
| 20 380 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 381 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 382 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | ??? | 4 |
| 20 383 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 384 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 385 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 386 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 387 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 388 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 389 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 390 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 391 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 392 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 393 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 394 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 395 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 396 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 397 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 398 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 399 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 400 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 401 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 402 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 403 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 404 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 405 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 406 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 407 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 408 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 409 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 410 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 411 | 15 | 15 | 15 | - | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 20 412 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 413 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 414 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 415 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 416 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 11 | 6 |
| 20 417 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 418 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 8 | 6 |
| 20 419 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 420 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 421 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 11 | 6 |
| 20 422 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 11 | 4 |
| 20 423 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 424 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 425 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 6 |
| 20 426 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 427 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 6 |
| 20 428 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 429 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 10 | 4 |
| 20 430 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 431 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 432 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 433 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 434 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 11 | 5 |
| 20 435 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 8 | 7 |
| 20 436 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 437 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 438 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 10 | 6 |
| 20 439 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 9 | 5 |
| 20 440 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 10 | 5 |
| 20 441 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 3 |
| 20 442 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 443 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 13 | 3 |
| 20 444 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 9 | 3 |
| 20 445 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 3 |
| 20 446 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 447 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 3 |
| 20 448 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 8 | 3 |
| 20 449 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | ??? | 3 |
| 20 450 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 451 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 452 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 453 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 9 | 3 |
| 20 454 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 455 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 456 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 |
| 20 457 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 3 |
| 20 458 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 459 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 460 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 12 | 3 |
| 20 461 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 11 | 3 |
| 20 462 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 3 |
| 20 463 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 10 | 3 |
| 20 464 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 9 | 3 |

Table 10.9: Result Comparison for SALBP Size 20 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | MiniZinc Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|----------------|
| 20 465 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | ??? | 3 |
| 20 466 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 467 | 14 | 12 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 468 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 469 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 470 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 471 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 472 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 473 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 474 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 20 475 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 476 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 477 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 478 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 479 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 480 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 481 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 482 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 483 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 484 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 20 485 | 15 | 15 | 15 | - | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 20 486 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 20 487 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 488 | 15 | 15 | 15 | - | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 20 489 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 490 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 20 491 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 492 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 493 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 494 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 495 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 496 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 497 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 498 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 499 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 500 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 20 501 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 502 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 20 503 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 504 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 505 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 506 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 507 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 508 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 509 | 4 | 4 | 4 | - | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 20 510 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 511 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 512 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 513 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 514 | 5 | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 20 515 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 20 516 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 517 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 518 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 519 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 520 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 521 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 522 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 523 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 524 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 20 525 | 3 | 3 | 3 | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

10.2 SALBP Results Size 50

Table 10.10: Result Comparison for SALBP Size 50 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | MiniZinc Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|----------------|
| 50 1 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 2 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 3 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 4 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 5 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 34 |
| 50 6 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 11 |
| 50 7 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 8 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 24 |
| 50 9 | 9 | 9 | 9 | - | 9 | 9 | 9 | 9 | 9 | 9 | 9 | - | ??? |
| 50 10 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 16 |
| 50 11 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 8 |
| 50 12 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 22 |
| 50 13 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 12 |
| 50 14 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 8 |
| 50 15 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 16 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 17 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |

Table 10.10: Result Comparison for SALBP Size 50 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|-------|
| 50 18 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 19 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 20 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 21 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 22 | 7 | 7 | 7 | - | 7 | 7 | 7 | 44 | 7 | 7 | 7 | - | ??? |
| 50 23 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 24 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 25 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 26 | 27 | 27 | 27 | - | 27 | 27 | 30 | 27 | 27 | 27 | 27 | - | 37 |
| 50 27 | 30 | 30 | 30 | - | 30 | 30 | 35 | 30 | 30 | 30 | 30 | - | 33 |
| 50 28 | 28 | 28 | 29 | - | 28 | 28 | 34 | 28 | 28 | 28 | 28 | - | 50 |
| 50 29 | 29 | 29 | 29 | - | 29 | 29 | 32 | 29 | 29 | 29 | 29 | - | 33 |
| 50 30 | 26 | 26 | 28 | - | 27 | 26 | 30 | 27 | 26 | 26 | 27 | - | ??? |
| 50 31 | 27 | 27 | 28 | - | 28 | 28 | 31 | 28 | ??? | 28 | 28 | - | 30 |
| 50 32 | 25 | 25 | 26 | - | 25 | 25 | 31 | 26 | 25 | 25 | 25 | - | ??? |
| 50 33 | 24 | 24 | 25 | - | 25 | 25 | 28 | 25 | ??? | 25 | 25 | - | ??? |
| 50 34 | 30 | 30 | 30 | - | 30 | 30 | 32 | 30 | 30 | 30 | 30 | - | 31 |
| 50 35 | 31 | 31 | 31 | - | 32 | 31 | 33 | 32 | 31 | 32 | 32 | - | 43 |
| 50 36 | 31 | 31 | 31 | - | 31 | 31 | 35 | 31 | 31 | 31 | 31 | - | 33 |
| 50 37 | 32 | 32 | 32 | - | 32 | 32 | 36 | 32 | ??? | 32 | 32 | - | ??? |
| 50 38 | 31 | 31 | 31 | - | 31 | 31 | 35 | 31 | 31 | 31 | 31 | - | 39 |
| 50 39 | 29 | 29 | 29 | - | 29 | 29 | 35 | 29 | ??? | 29 | 29 | - | ??? |
| 50 40 | 26 | 26 | 26 | - | 26 | 26 | 32 | 27 | 26 | 26 | 26 | - | ??? |
| 50 41 | 25 | 25 | 26 | - | 26 | 25 | 32 | 26 | 25 | 26 | 26 | - | 31 |
| 50 42 | 23 | 23 | 24 | - | 24 | 24 | 31 | 24 | ??? | 24 | 24 | - | 26 |
| 50 43 | 25 | 25 | 26 | - | 25 | 25 | 31 | 25 | 25 | 25 | 25 | - | ??? |
| 50 44 | 24 | 24 | 25 | - | 25 | 25 | 31 | 25 | ??? | 25 | 25 | - | 28 |
| 50 45 | 24 | 24 | 25 | - | 25 | 25 | 28 | 25 | ??? | 25 | 25 | - | 31 |
| 50 46 | 28 | 28 | 29 | - | 28 | 28 | 33 | 29 | 28 | 28 | 28 | - | ??? |
| 50 47 | 28 | 28 | 28 | - | 28 | 28 | 33 | 45 | 28 | 28 | 28 | - | ??? |
| 50 48 | 27 | 27 | 28 | - | 27 | 27 | 32 | 27 | 27 | 27 | 28 | - | 29 |
| 50 49 | 25 | 24 | 25 | - | 25 | 25 | 31 | 25 | 25 | 25 | 25 | - | ??? |
| 50 50 | 26 | 26 | 27 | - | 27 | 27 | 32 | 27 | ??? | 27 | 27 | - | 46 |
| 50 51 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 52 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 53 | 12 | 12 | 12 | - | 13 | 13 | 13 | 13 | ??? | 12 | 13 | - | ??? |
| 50 54 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 55 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | ??? |
| 50 56 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | 12 |
| 50 57 | 13 | 13 | 13 | - | 13 | 13 | 15 | 13 | 13 | 13 | 13 | - | 13 |
| 50 58 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 59 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 60 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 61 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 62 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | ??? |
| 50 63 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 64 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 65 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 66 | 12 | 12 | 12 | - | 12 | 12 | 14 | 12 | 12 | 12 | 12 | - | 14 |
| 50 67 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 68 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 69 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 70 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | - | 13 |
| 50 71 | 13 | 13 | 13 | - | 13 | 13 | 15 | 13 | 13 | 13 | 13 | - | ??? |
| 50 72 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 73 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | 13 |
| 50 74 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 75 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 76 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 77 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 78 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 79 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 80 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 81 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 82 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 7 |
| 50 83 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 84 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 85 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 86 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 8 |
| 50 87 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 88 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 10 |
| 50 89 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 90 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 91 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 92 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 93 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 94 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 95 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 96 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 97 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 9 |
| 50 98 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 99 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 100 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 101 | 30 | 29 | 30 | - | 30 | 30 | 33 | 30 | 30 | 30 | 30 | - | ??? |
| 50 102 | 32 | 30 | 32 | - | 32 | 32 | 34 | 32 | 32 | 32 | 32 | - | ??? |
| 50 103 | 29 | 29 | 29 | - | 29 | 29 | 30 | 29 | 29 | 29 | 29 | - | ??? |
| 50 104 | 27 | 25 | 28 | - | 27 | 27 | 29 | 27 | 27 | 27 | 27 | - | ??? |
| 50 105 | 24 | 23 | 25 | - | 24 | 24 | 27 | 24 | 24 | 24 | 24 | - | ??? |
| 50 106 | 28 | 27 | 28 | - | 28 | 28 | 29 | 28 | 28 | 28 | 28 | - | ??? |
| 50 107 | 28 | 28 | 28 | - | 28 | 28 | 31 | 28 | 28 | 28 | 28 | - | ??? |
| 50 108 | 30 | 30 | 30 | - | 30 | 30 | 33 | 30 | 30 | 30 | 30 | - | ??? |
| 50 109 | 30 | 30 | 30 | - | 30 | 30 | 31 | 30 | 30 | 30 | 30 | - | ??? |
| 50 110 | 26 | 26 | 27 | - | 26 | 26 | 28 | 27 | 26 | 26 | 26 | - | ??? |
| 50 111 | 28 | 28 | 29 | - | 28 | 28 | 29 | 28 | 28 | 28 | 28 | - | ??? |

Table 10.10: Result Comparison for SALBP Size 50 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | Direct CPSat | Cplex | Direct MiniZinc Chuffed | Direct MiniZinc CPSat | Alternative CPO | Alternative CPSat | Alternative MiniZinc Chuffed | Alternative MiniZinc Cplex |
|----------|---------|-----------|-----------|-------------|------------|--------------|-------|-------------------------|-----------------------|-----------------|-------------------|------------------------------|----------------------------|
| 50 112 | 27 | 27 | 27 | - | 27 | 27 | 29 | 27 | 27 | 27 | 27 | - | ??? |
| 50 113 | 28 | 28 | 28 | - | 28 | 28 | 31 | 28 | 28 | 28 | 28 | - | ??? |
| 50 114 | 27 | 27 | 27 | - | 27 | 27 | 30 | 27 | 27 | 27 | 28 | - | ??? |
| 50 115 | 28 | 26 | 28 | - | 28 | 28 | 31 | 29 | ??? | 28 | 28 | - | ??? |
| 50 116 | 32 | 31 | 33 | - | 32 | 32 | 34 | 32 | 32 | 32 | 32 | - | ??? |
| 50 117 | 27 | 26 | 27 | - | 27 | 27 | 27 | 27 | 27 | 27 | 27 | - | ??? |
| 50 118 | 29 | 29 | 29 | - | 29 | 29 | 32 | 29 | 29 | 29 | 29 | - | ??? |
| 50 119 | 25 | 25 | 25 | - | 25 | 25 | 27 | 25 | 25 | 25 | 25 | - | ??? |
| 50 120 | 27 | 27 | 27 | - | 27 | 27 | 29 | 27 | 27 | 27 | 27 | - | ??? |
| 50 121 | 32 | 31 | 32 | - | 32 | 32 | 32 | 32 | 32 | 32 | 32 | - | ??? |
| 50 122 | 29 | 28 | 30 | - | 29 | 29 | 32 | 29 | 29 | 29 | 29 | - | 50 |
| 50 123 | 32 | 32 | 32 | - | 32 | 32 | 33 | 32 | 32 | 32 | 32 | - | ??? |
| 50 124 | 29 | 29 | 30 | - | 29 | 29 | 31 | 29 | 29 | 29 | 29 | - | ??? |
| 50 125 | 33 | 32 | 33 | - | 33 | 33 | 34 | 33 | 33 | 33 | 33 | - | ??? |
| 50 126 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 127 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | - | 14 |
| 50 128 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | 13 |
| 50 129 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 13 |
| 50 130 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 131 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 132 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 133 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 13 |
| 50 134 | 14 | 14 | 14 | - | 14 | 14 | 15 | 14 | 14 | 14 | 14 | - | ??? |
| 50 135 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | 14 |
| 50 136 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 137 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 138 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 139 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 12 | - | ??? |
| 50 140 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 141 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 14 |
| 50 142 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 143 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 144 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 14 |
| 50 145 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | - | ??? |
| 50 146 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 147 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 15 |
| 50 148 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | - | 10 |
| 50 149 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 150 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 151 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 152 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 153 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 154 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 16 |
| 50 155 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 8 |
| 50 156 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 157 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 158 | 7 | 7 | 7 | - | 7 | 7 | 7 | 46 | 7 | 7 | 7 | - | 11 |
| 50 159 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 8 |
| 50 160 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 23 |
| 50 161 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 32 |
| 50 162 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 163 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 164 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 165 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 166 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 11 |
| 50 167 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 168 | 8 | 8 | 8 | - | 8 | 8 | 9 | 8 | 8 | 8 | 8 | - | ??? |
| 50 169 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 9 |
| 50 170 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 171 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 172 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 173 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 174 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 175 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 176 | 27 | 27 | 27 | - | 27 | 27 | 33 | 28 | 27 | 27 | 27 | - | 30 |
| 50 177 | 27 | 27 | 28 | - | 28 | 28 | 33 | 28 | ??? | 28 | 28 | - | 41 |
| 50 178 | 27 | 27 | 28 | - | 28 | 28 | 32 | 28 | ??? | 28 | 28 | - | 29 |
| 50 179 | 26 | 26 | 26 | - | 27 | 26 | 32 | 28 | 26 | 26 | 27 | - | 35 |
| 50 180 | 26 | 26 | 26 | - | 26 | 26 | 30 | 26 | 26 | 26 | 26 | - | 30 |
| 50 181 | 29 | 29 | 29 | - | 29 | 29 | 33 | 31 | 29 | 29 | 30 | - | 33 |
| 50 182 | 26 | 26 | 27 | - | 27 | 26 | 30 | 27 | ??? | 26 | 27 | - | ??? |
| 50 183 | 28 | 28 | 28 | - | 29 | 28 | 33 | 28 | 28 | 29 | 29 | - | 34 |
| 50 184 | 38 | 38 | 38 | - | 38 | 38 | 39 | 40 | 38 | 38 | 38 | - | 42 |
| 50 185 | 26 | 26 | 26 | - | 27 | 26 | 32 | 26 | 26 | 26 | 27 | - | ??? |
| 50 186 | 26 | 26 | 26 | - | 26 | 26 | 32 | 27 | 26 | 26 | 27 | - | ??? |
| 50 187 | 25 | 25 | 27 | - | 26 | 26 | 31 | 26 | ??? | 26 | 26 | - | 29 |
| 50 188 | 24 | 24 | 25 | - | 25 | 25 | 27 | 25 | ??? | 25 | 25 | - | ??? |
| 50 189 | 26 | 26 | 26 | - | 26 | 26 | 31 | 28 | ??? | 26 | 26 | - | ??? |
| 50 190 | 30 | 30 | 30 | - | 30 | 30 | 34 | 31 | 30 | 30 | 30 | - | 37 |
| 50 191 | 27 | 27 | 28 | - | 28 | 28 | 33 | 30 | 27 | 27 | 28 | - | 32 |
| 50 192 | 27 | 27 | 28 | - | 27 | 27 | 31 | 28 | 27 | 27 | 27 | - | 33 |
| 50 193 | 28 | 28 | 28 | - | 28 | 28 | 35 | 29 | 28 | 28 | 29 | - | ??? |
| 50 194 | 28 | 28 | 29 | - | 28 | 28 | 32 | 39 | 28 | 28 | 28 | - | ??? |
| 50 195 | 28 | 28 | 28 | - | 28 | 28 | 33 | 28 | 28 | 28 | 28 | - | 30 |
| 50 196 | 27 | 27 | 27 | - | 27 | 27 | 33 | 28 | 27 | 27 | 29 | - | ??? |
| 50 197 | 28 | 28 | 29 | - | 28 | 28 | 32 | 29 | 28 | 28 | 28 | - | 32 |
| 50 198 | 28 | 28 | 28 | - | 28 | 28 | 32 | 28 | 28 | 28 | 28 | - | 35 |
| 50 199 | 29 | 29 | 29 | - | 29 | 29 | 34 | 29 | 29 | 29 | 29 | - | 32 |
| 50 200 | 24 | 24 | 26 | - | 25 | 25 | 30 | 37 | ??? | 25 | 25 | - | 28 |
| 50 201 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 202 | 9 | 9 | 9 | - | 9 | 9 | 10 | 9 | 9 | 9 | 9 | - | 18 |
| 50 203 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 204 | 10 | 10 | 10 | - | 10 | 10 | 11 | 11 | 10 | 10 | 10 | - | ??? |
| 50 205 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |

Table 10.10: Result Comparison for SALBP Size 50 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | Direct CPSat | Cplex | Direct MiniZinc Chuffed | Direct MiniZinc CPSat | Alternative CPO | Alternative CPSat | Alternative MiniZinc Chuffed | Alternative MiniZinc Cplex |
|----------|---------|-----------|-----------|-------------|------------|--------------|-------|-------------------------|-----------------------|-----------------|-------------------|------------------------------|----------------------------|
| 50 206 | 11 | 11 | 11 | - | 11 | 11 | 13 | 12 | 11 | 11 | 12 | - | ??? |
| 50 207 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | - | 11 |
| 50 208 | 13 | 13 | 13 | - | 13 | 13 | 14 | 50 | 13 | 13 | 13 | - | ??? |
| 50 209 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 210 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | ??? |
| 50 211 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 13 |
| 50 212 | 10 | 10 | 10 | - | 10 | 10 | 11 | 10 | 10 | 10 | 10 | - | 11 |
| 50 213 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | 13 |
| 50 214 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 215 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 216 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 217 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | ??? |
| 50 218 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | 13 |
| 50 219 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 220 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | 13 |
| 50 221 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 222 | 14 | 14 | 14 | - | 14 | 14 | 16 | 14 | 14 | 14 | 14 | - | ??? |
| 50 223 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 224 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 18 |
| 50 225 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 226 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 227 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 228 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 229 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 230 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 231 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 9 |
| 50 232 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 233 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 234 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 10 |
| 50 235 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 236 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 237 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 238 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 239 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 240 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 241 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 242 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 15 |
| 50 243 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 244 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 245 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 246 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 247 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 248 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 249 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 8 |
| 50 250 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 251 | 27 | 26 | 28 | - | 27 | 27 | 29 | 27 | 27 | 27 | 28 | - | ??? |
| 50 252 | 32 | 31 | 33 | - | 32 | 32 | 35 | 32 | 32 | 32 | 32 | - | 37 |
| 50 253 | 28 | 27 | 29 | - | 28 | 28 | 31 | 28 | 28 | 28 | 28 | - | ??? |
| 50 254 | 30 | 30 | 30 | - | 30 | 30 | 33 | 30 | 30 | 30 | 30 | - | ??? |
| 50 255 | 29 | 27 | 31 | - | 29 | 29 | 32 | 29 | 29 | 29 | 31 | - | ??? |
| 50 256 | 30 | 30 | 30 | - | 30 | 30 | 32 | 30 | 30 | 30 | 30 | - | 50 |
| 50 257 | 33 | 31 | 33 | - | 33 | 33 | 35 | 33 | 33 | 33 | 33 | - | ??? |
| 50 258 | 28 | 26 | 28 | - | 28 | 28 | 30 | 28 | 28 | 28 | 28 | - | ??? |
| 50 259 | 31 | 29 | 31 | - | 31 | 31 | 32 | 31 | 31 | 31 | 31 | - | ??? |
| 50 260 | 29 | 28 | 29 | - | 29 | 29 | 30 | 29 | 29 | 29 | 29 | - | 34 |
| 50 261 | 28 | 25 | 28 | - | 28 | 28 | 30 | 28 | 28 | 28 | 28 | - | 28 |
| 50 262 | 31 | 30 | 31 | - | 31 | 31 | 31 | 31 | 31 | 31 | 31 | - | ??? |
| 50 263 | 29 | 28 | 31 | - | 29 | 29 | 31 | 29 | 29 | 30 | 30 | - | ??? |
| 50 264 | 27 | 27 | 27 | - | 27 | 27 | 31 | 27 | 27 | 27 | 27 | - | ??? |
| 50 265 | 27 | 27 | 27 | - | 27 | 27 | 30 | 27 | 27 | 27 | 27 | - | ??? |
| 50 266 | 29 | 29 | 29 | - | 29 | 29 | 31 | 29 | 29 | 29 | 30 | - | ??? |
| 50 267 | 28 | 27 | 29 | - | 28 | 28 | 30 | 28 | 28 | 28 | 29 | - | ??? |
| 50 268 | 29 | 28 | 29 | - | 29 | 29 | 31 | 29 | 29 | 29 | 29 | - | 34 |
| 50 269 | 26 | 26 | 26 | - | 26 | 26 | 29 | 26 | 26 | 26 | 26 | - | ??? |
| 50 270 | 28 | 28 | 28 | - | 28 | 28 | 29 | 28 | 28 | 28 | 28 | - | ??? |
| 50 271 | 31 | 28 | 31 | - | 31 | 31 | 33 | 31 | 31 | 31 | 31 | - | ??? |
| 50 272 | 27 | 27 | 27 | - | 27 | 27 | 30 | 27 | 27 | 27 | 27 | - | 42 |
| 50 273 | 27 | 25 | 28 | - | 27 | 27 | 30 | 27 | 27 | 27 | 27 | - | 31 |
| 50 274 | 29 | 29 | 30 | - | 29 | 29 | 32 | 29 | 29 | 29 | 29 | - | 35 |
| 50 275 | 27 | 27 | 27 | - | 27 | 27 | 29 | 27 | 27 | 27 | 28 | - | 30 |
| 50 276 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | 13 |
| 50 277 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 18 |
| 50 278 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 279 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 280 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 14 |
| 50 281 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 282 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 283 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | 50 |
| 50 284 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 285 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | ??? |
| 50 286 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 287 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 288 | 10 | 10 | 10 | - | 10 | 10 | 11 | 10 | 10 | 10 | 10 | - | ??? |
| 50 289 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 290 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | - | ??? |
| 50 291 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 292 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 13 |
| 50 293 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 294 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 295 | 16 | 16 | 16 | - | 16 | 16 | 17 | 16 | 16 | 16 | 16 | - | 16 |
| 50 296 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 297 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 14 |
| 50 298 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 299 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |

Table 10.10: Result Comparison for SALBP Size 50 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | Direct CPSat | Direct Cplex | MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | Alternative CPSat | Alternative Chuffed | MiniZinc Cplex |
|----------|---------|-----------|-----------|-------------|------------|--------------|--------------|------------------|----------------|-----------------|-------------------|---------------------|----------------|
| 50 300 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 301 | 6 | 6 | 6 | - | 6 | 6 | 7 | 6 | 6 | 6 | 6 | - | ??? |
| 50 302 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 303 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 11 |
| 50 304 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 10 |
| 50 305 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 29 |
| 50 306 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 307 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 308 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 10 |
| 50 309 | 7 | 7 | 7 | - | 7 | 7 | 8 | 29 | 7 | 7 | 7 | - | 19 |
| 50 310 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 11 |
| 50 311 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 312 | 6 | 6 | 6 | - | 6 | 6 | 7 | 6 | 6 | 6 | 6 | - | 7 |
| 50 313 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 314 | 7 | 7 | 7 | - | 7 | 7 | 7 | 22 | 7 | 7 | 7 | - | 50 |
| 50 315 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 316 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 10 |
| 50 317 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 7 |
| 50 318 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 319 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 320 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 321 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 6 |
| 50 322 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 323 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 13 |
| 50 324 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 325 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 326 | 33 | 33 | 33 | - | 33 | 33 | 36 | 33 | 33 | 33 | 33 | - | ??? |
| 50 327 | 28 | 28 | 28 | - | 28 | 28 | 31 | 28 | 28 | 28 | 28 | - | 31 |
| 50 328 | 32 | 32 | 32 | - | 32 | 32 | 34 | 32 | 32 | 32 | 32 | - | 48 |
| 50 329 | 24 | 24 | 25 | - | 25 | 25 | 30 | 25 | ??? | 24 | 25 | - | ??? |
| 50 330 | 29 | 29 | 29 | - | 29 | 29 | 33 | 30 | 29 | 29 | 29 | - | ??? |
| 50 331 | 29 | 29 | 29 | - | 29 | 29 | 36 | 40 | 29 | 29 | 29 | - | 34 |
| 50 332 | 24 | 24 | 25 | - | 25 | 25 | 30 | 25 | ??? | 25 | 25 | - | 28 |
| 50 333 | 28 | 28 | 28 | - | 28 | 28 | 32 | 28 | 28 | 28 | 28 | - | 50 |
| 50 334 | 29 | 29 | 29 | - | 29 | 29 | 32 | 29 | 29 | 29 | 29 | - | 32 |
| 50 335 | 27 | 27 | 27 | - | 27 | 27 | 33 | 27 | 27 | 27 | 27 | - | 33 |
| 50 336 | 25 | 25 | 26 | - | 26 | 26 | 31 | 26 | ??? | 26 | 26 | - | 31 |
| 50 337 | 26 | 26 | 26 | - | 26 | 26 | 31 | 26 | 26 | 26 | 26 | - | 29 |
| 50 338 | 26 | 26 | 27 | - | 27 | 26 | 34 | 36 | 26 | 26 | 27 | - | 29 |
| 50 339 | 27 | 27 | 28 | - | 27 | 27 | 32 | 29 | 27 | 27 | 27 | - | 34 |
| 50 340 | 27 | 27 | 29 | - | 28 | 28 | 33 | 32 | ??? | 28 | 28 | - | 31 |
| 50 341 | 27 | 27 | 27 | - | 27 | 27 | 33 | 27 | 27 | 27 | 27 | - | ??? |
| 50 342 | 27 | 27 | 28 | - | 28 | 28 | 33 | 29 | ??? | 28 | 28 | - | ??? |
| 50 343 | 27 | 26 | 27 | - | 27 | 27 | 31 | 28 | 27 | 27 | 27 | - | 29 |
| 50 344 | 30 | 30 | 30 | - | 30 | 30 | 33 | 30 | 30 | 30 | 30 | - | 32 |
| 50 345 | 29 | 29 | 30 | - | 29 | 29 | 35 | 29 | 29 | 29 | 29 | - | 33 |
| 50 346 | 27 | 27 | 27 | - | 27 | 27 | 30 | 27 | 27 | 27 | 27 | - | ??? |
| 50 347 | 25 | 25 | 26 | - | 26 | 25 | 33 | 31 | 25 | 25 | 26 | - | 30 |
| 50 348 | 30 | 30 | 30 | - | 30 | 30 | 33 | 30 | 30 | 30 | 30 | - | ??? |
| 50 349 | 28 | 28 | 29 | - | 28 | 28 | 33 | 29 | 28 | 28 | 28 | - | 32 |
| 50 350 | 23 | 23 | 25 | - | 24 | 24 | 28 | 32 | ??? | 24 | 24 | - | 27 |
| 50 351 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 18 |
| 50 352 | 10 | 10 | 10 | - | 10 | 10 | 11 | 10 | 10 | 10 | 10 | - | 11 |
| 50 353 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | ??? |
| 50 354 | 13 | 13 | 13 | - | 14 | 14 | 14 | 14 | 13 | 13 | 14 | - | 15 |
| 50 355 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 21 |
| 50 356 | 15 | 15 | 15 | - | 15 | 15 | 16 | 15 | 15 | 15 | 15 | - | 15 |
| 50 357 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 358 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 13 |
| 50 359 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | - | ??? |
| 50 360 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | 13 |
| 50 361 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 362 | 10 | 10 | 10 | - | 10 | 10 | 11 | 10 | 10 | 10 | 10 | - | 14 |
| 50 363 | 11 | 11 | 11 | - | 12 | 12 | 12 | 12 | ??? | 11 | 12 | - | 14 |
| 50 364 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 365 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 13 |
| 50 366 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | ??? |
| 50 367 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 368 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 369 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | 13 |
| 50 370 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 371 | 11 | 11 | 11 | - | 11 | 11 | 12 | 12 | 11 | 11 | 11 | - | ??? |
| 50 372 | 10 | 10 | 10 | - | 10 | 10 | 11 | 10 | 10 | 10 | 10 | - | 18 |
| 50 373 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 374 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 375 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | ??? |
| 50 376 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 377 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 378 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 379 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 23 |
| 50 380 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 381 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 382 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 383 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 384 | 8 | 8 | 8 | - | 8 | 8 | 9 | 8 | 8 | 8 | 8 | - | ??? |
| 50 385 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 386 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 387 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 388 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 389 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 390 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 391 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 9 |
| 50 392 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 393 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |

Table 10.10: Result Comparison for SALBP Size 50 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | MiniZinc Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|----------------|-----------------|-------|------------------------------|----------------|
| 50 394 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 395 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | ??? |
| 50 396 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 397 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 398 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | ??? |
| 50 399 | 7 | 7 | 7 | - | 7 | 7 | 8 | 7 | 7 | 7 | 7 | - | ??? |
| 50 400 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | ??? |
| 50 401 | 28 | 28 | 28 | - | 28 | 28 | 31 | 28 | 28 | 28 | 28 | - | ??? |
| 50 402 | 27 | 27 | 27 | - | 27 | 27 | 30 | 27 | 27 | 27 | 27 | - | ??? |
| 50 403 | 34 | 33 | 34 | - | 34 | 34 | 36 | 34 | 34 | 34 | 34 | - | ??? |
| 50 404 | 31 | 29 | 32 | - | 31 | 31 | 32 | 31 | 31 | 31 | 31 | - | ??? |
| 50 405 | 27 | 27 | 27 | - | 27 | 27 | 29 | 27 | 27 | 27 | 27 | - | ??? |
| 50 406 | 32 | 32 | 34 | - | 32 | 32 | 36 | 32 | 32 | 32 | 33 | - | 35 |
| 50 407 | 29 | 27 | 30 | - | 29 | 29 | 30 | 29 | 29 | 29 | 29 | - | 30 |
| 50 408 | 26 | 26 | 26 | - | 26 | 26 | 28 | 26 | 26 | 26 | 26 | - | ??? |
| 50 409 | 33 | 30 | 33 | - | 33 | 33 | 34 | 33 | 33 | 33 | 33 | - | ??? |
| 50 410 | 28 | 28 | 28 | - | 28 | 28 | 30 | 28 | 28 | 28 | 28 | - | ??? |
| 50 411 | 29 | 29 | 29 | - | 29 | 29 | 32 | 29 | 29 | 29 | 29 | - | ??? |
| 50 412 | 26 | 26 | 26 | - | 26 | 26 | 29 | 26 | 26 | 26 | 26 | - | ??? |
| 50 413 | 30 | 28 | 30 | - | 30 | 30 | 32 | 30 | 30 | 30 | 30 | - | ??? |
| 50 414 | 27 | 27 | 27 | - | 27 | 27 | 28 | 27 | 27 | 27 | 27 | - | ??? |
| 50 415 | 28 | 26 | 29 | - | 28 | 28 | 32 | 28 | 28 | 28 | 29 | - | ??? |
| 50 416 | 27 | 27 | 27 | - | 27 | 27 | 29 | 27 | 27 | 27 | 27 | - | ??? |
| 50 417 | 30 | 30 | 30 | - | 30 | 30 | 32 | 30 | 30 | 30 | 30 | - | 31 |
| 50 418 | 27 | 26 | 28 | - | 27 | 27 | 29 | 27 | 27 | 27 | 28 | - | ??? |
| 50 419 | 33 | 32 | 33 | - | 33 | 33 | 34 | 33 | 33 | 33 | 33 | - | ??? |
| 50 420 | 28 | 27 | 28 | - | 28 | 28 | 30 | 28 | 28 | 28 | 28 | - | ??? |
| 50 421 | 34 | 34 | 34 | - | 34 | 34 | 35 | 34 | 34 | 34 | 35 | - | ??? |
| 50 422 | 29 | 26 | 29 | - | 29 | 29 | 31 | 29 | 29 | 29 | 29 | - | 31 |
| 50 423 | 29 | 27 | 29 | - | 29 | 29 | 31 | 29 | 29 | 29 | 29 | - | ??? |
| 50 424 | 27 | 27 | 27 | - | 27 | 27 | 30 | 27 | 27 | 27 | 27 | - | 31 |
| 50 425 | 34 | 34 | 34 | - | 34 | 34 | 35 | 34 | 34 | 34 | 35 | - | 37 |
| 50 426 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 427 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 428 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 429 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 430 | 14 | 14 | 14 | - | 14 | 14 | 15 | 14 | 14 | 14 | 14 | - | ??? |
| 50 431 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 432 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | 13 |
| 50 433 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 434 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 435 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 436 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 437 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 438 | 10 | 10 | 10 | - | 10 | 10 | 11 | 10 | 10 | 10 | 10 | - | ??? |
| 50 439 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 440 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | ??? |
| 50 441 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 442 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 443 | 11 | 11 | 11 | - | 11 | 11 | 12 | 11 | 11 | 11 | 11 | - | ??? |
| 50 444 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 445 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | ??? |
| 50 446 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 447 | 13 | 13 | 13 | - | 13 | 13 | 14 | 13 | 13 | 13 | 13 | - | 16 |
| 50 448 | 12 | 12 | 12 | - | 12 | 12 | 13 | 12 | 12 | 12 | 12 | - | ??? |
| 50 449 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 450 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | ??? |
| 50 451 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 452 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 453 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 454 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 455 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 6 |
| 50 456 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 457 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 458 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 459 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 460 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 461 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 6 |
| 50 462 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 463 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 464 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 6 |
| 50 465 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 466 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 467 | 9 | 9 | 9 | - | 9 | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 |
| 50 468 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 469 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 470 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 471 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 8 |
| 50 472 | 8 | 8 | 8 | - | 8 | 8 | 8 | 8 | 8 | 8 | 8 | - | 8 |
| 50 473 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 474 | 7 | 7 | 7 | - | 7 | 7 | 7 | 7 | 7 | 7 | 7 | - | 7 |
| 50 475 | 6 | 6 | 6 | - | 6 | 6 | 6 | 6 | 6 | 6 | 6 | - | 6 |
| 50 476 | 28 | 26 | 28 | - | 28 | 28 | 28 | 28 | 28 | 28 | 28 | - | 28 |
| 50 477 | 29 | 27 | 29 | - | 29 | 29 | 29 | 29 | 29 | 29 | 29 | - | 29 |
| 50 478 | 32 | 29 | 32 | - | 32 | 32 | 32 | 32 | 32 | 32 | 32 | - | 32 |
| 50 479 | 28 | 28 | 28 | - | 28 | 28 | 28 | 28 | 28 | 28 | 28 | - | 28 |
| 50 480 | 34 | 34 | 34 | - | 34 | 34 | 34 | 34 | 34 | 34 | 34 | - | 34 |
| 50 481 | 28 | 26 | 28 | - | 28 | 28 | 28 | 28 | 28 | 28 | 28 | - | 29 |
| 50 482 | 27 | 26 | 27 | - | 27 | 27 | 27 | 27 | 27 | 27 | 27 | - | 27 |
| 50 483 | 30 | 28 | 30 | - | 30 | 30 | 30 | 30 | 30 | 30 | 30 | - | 30 |
| 50 484 | 32 | 30 | 32 | - | 32 | 32 | 32 | 32 | 32 | 32 | 32 | - | 32 |
| 50 485 | 31 | 29 | 31 | - | 31 | 31 | 31 | 31 | 31 | 31 | 31 | - | 31 |
| 50 486 | 32 | 30 | 32 | - | 32 | 32 | 32 | 32 | 32 | 32 | 32 | - | 32 |
| 50 487 | 31 | 30 | 31 | - | 31 | 31 | 31 | 31 | 31 | 31 | 31 | - | 31 |

Table 10.10: Result Comparison for SALBP Size 50 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|-------|-----------------|-------|------------------------------|-------|
| 50 488 | 31 | 28 | 31 | - | 31 | 31 | 31 | 31 | 31 | 31 | 31 | - | 31 |
| 50 489 | 35 | 33 | 35 | - | 35 | 35 | 35 | 35 | 35 | 35 | 35 | - | 35 |
| 50 490 | 29 | 29 | 29 | - | 29 | 29 | 29 | 29 | 29 | 29 | 29 | - | 29 |
| 50 491 | 35 | 33 | 35 | - | 35 | 35 | 35 | 35 | 35 | 35 | 35 | - | 35 |
| 50 492 | 29 | 28 | 30 | - | 29 | 29 | 29 | 29 | 29 | 29 | 29 | - | 29 |
| 50 493 | 30 | 27 | 30 | - | 30 | 30 | 30 | 30 | 30 | 30 | 30 | - | 30 |
| 50 494 | 32 | 30 | 32 | - | 32 | 32 | 32 | 32 | 32 | 32 | 32 | - | 32 |
| 50 495 | 34 | 34 | 34 | - | 34 | 34 | 34 | 34 | 34 | 34 | 34 | - | 34 |
| 50 496 | 29 | 27 | 29 | - | 29 | 29 | 29 | 29 | 29 | 29 | 29 | - | 29 |
| 50 497 | 30 | 28 | 30 | - | 30 | 30 | 30 | 30 | 30 | 30 | 30 | - | 30 |
| 50 498 | 30 | 28 | 30 | - | 30 | 30 | 30 | 30 | 30 | 30 | 30 | - | 30 |
| 50 499 | 33 | 31 | 33 | - | 33 | 33 | 33 | 33 | 33 | 33 | 33 | - | 33 |
| 50 500 | 34 | 30 | 34 | - | 34 | 34 | 34 | 34 | 34 | 34 | 34 | - | 34 |
| 50 501 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 502 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | - | 10 |
| 50 503 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 13 |
| 50 504 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 505 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 506 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 507 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 13 |
| 50 508 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | - | 14 |
| 50 509 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 13 |
| 50 510 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 511 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 13 |
| 50 512 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 13 |
| 50 513 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 514 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 515 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 516 | 13 | 13 | 13 | - | 13 | 13 | 13 | 13 | 13 | 13 | 13 | - | 13 |
| 50 517 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | - | 14 |
| 50 518 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 519 | 12 | 12 | 12 | - | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - | 12 |
| 50 520 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 521 | 10 | 10 | 10 | - | 10 | 10 | 10 | 10 | 10 | 10 | 10 | - | 10 |
| 50 522 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 523 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |
| 50 524 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | - | 14 |
| 50 525 | 11 | 11 | 11 | - | 11 | 11 | 11 | 11 | 11 | 11 | 11 | - | 11 |

10.3 SALBP Results Size 100

Table 10.11: Result Comparison for SALBP Size 100 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|----|-------------|------------|-------|-------|-------------------------|-------|-----------------|-------|------------------------------|-------|
| 100 1 | 23 | 23 | 23 | - | 23 | 23 | 24 | 78 | 23 | 23 | 23 | - | - |
| 100 2 | 21 | 21 | 21 | - | 21 | 21 | ??? | 51 | 21 | 21 | 21 | - | - |
| 100 3 | 20 | 20 | 20 | - | 20 | 20 | 62 | 55 | 20 | 20 | 20 | - | - |
| 100 4 | 24 | 24 | 24 | - | 24 | 24 | ??? | 57 | 24 | 24 | 24 | - | - |
| 100 5 | 22 | 22 | 22 | - | 22 | 22 | 24 | 92 | 22 | 22 | 22 | - | - |
| 100 6 | 22 | 22 | 22 | - | 22 | 22 | ??? | 83 | 22 | 22 | 22 | - | - |
| 100 7 | 26 | 26 | 26 | - | 26 | 26 | ??? | 53 | 26 | 26 | 26 | - | - |
| 100 8 | 24 | 24 | 24 | - | 24 | 24 | ??? | 69 | 24 | 24 | 24 | - | - |
| 100 9 | 23 | 23 | 23 | - | 23 | 23 | 25 | 80 | 23 | 23 | 23 | - | - |
| 100 10 | 22 | 22 | 22 | - | 22 | 22 | ??? | 56 | 22 | 22 | 22 | - | - |
| 100 11 | 24 | 24 | 24 | - | 24 | 24 | 53 | 88 | 24 | 24 | 24 | - | - |
| 100 12 | 25 | 25 | 25 | - | 25 | 25 | 27 | 79 | 25 | 25 | 25 | - | - |
| 100 13 | 24 | 24 | 24 | - | 24 | 24 | 25 | 84 | 24 | 24 | 24 | - | - |
| 100 14 | 20 | 20 | 20 | - | 20 | 20 | ??? | 66 | 20 | 20 | 20 | - | - |
| 100 15 | 24 | 24 | 24 | - | 24 | 24 | 93 | 63 | 24 | 24 | 24 | - | - |
| 100 16 | 23 | 23 | 23 | - | 23 | 23 | 43 | 91 | 23 | 23 | 23 | - | - |
| 100 17 | 21 | 21 | 21 | - | 22 | 22 | ??? | 68 | ??? | 22 | 22 | - | - |
| 100 18 | 19 | 19 | 19 | - | 20 | 20 | ??? | 95 | ??? | 20 | 20 | - | - |
| 100 19 | 23 | 23 | 23 | - | 23 | 23 | ??? | 91 | 23 | 23 | 23 | - | - |
| 100 20 | 21 | 21 | 21 | - | 21 | 21 | ??? | 76 | 21 | 21 | 21 | - | - |
| 100 21 | 21 | 21 | 21 | - | 21 | 21 | 22 | 79 | 21 | 21 | 21 | - | - |
| 100 22 | 24 | 24 | 24 | - | 25 | 25 | ??? | 48 | ??? | 24 | 25 | - | - |
| 100 23 | 24 | 24 | 24 | - | 24 | 24 | ??? | 98 | 24 | 24 | 24 | - | - |
| 100 24 | 24 | 24 | 24 | - | 24 | 24 | 42 | 69 | 24 | 24 | 24 | - | - |
| 100 25 | 22 | 22 | 22 | - | 22 | 22 | 25 | 95 | 22 | 22 | 22 | - | - |
| 100 26 | 14 | 14 | 14 | - | 14 | 14 | ??? | 81 | 14 | 14 | 14 | - | - |
| 100 27 | 13 | 13 | 13 | - | 13 | 13 | 35 | 56 | 13 | 13 | 13 | - | - |
| 100 28 | 14 | 14 | 14 | - | 14 | 14 | 15 | 74 | 14 | 14 | 14 | - | - |
| 100 29 | 14 | 14 | 14 | - | 14 | 14 | 16 | 83 | 14 | 14 | 14 | - | - |
| 100 30 | 15 | 15 | 15 | - | 15 | 15 | 71 | 73 | 15 | 15 | 15 | - | - |
| 100 31 | 14 | 14 | 14 | - | 14 | 14 | ??? | 38 | 14 | 14 | 14 | - | - |
| 100 32 | 14 | 14 | 14 | - | 14 | 14 | 100 | 82 | 14 | 14 | 14 | - | - |
| 100 33 | 15 | 15 | 15 | - | 15 | 15 | 93 | 50 | 15 | 15 | 15 | - | - |
| 100 34 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | 15 | 15 | 15 | - | - |
| 100 35 | 15 | 15 | 15 | - | 15 | 15 | 16 | 89 | 15 | 15 | 15 | - | - |
| 100 36 | 14 | 14 | 14 | - | 14 | 14 | ??? | 70 | 14 | 14 | 14 | - | - |
| 100 37 | 14 | 14 | 14 | - | 14 | 14 | ??? | 95 | 14 | 14 | 14 | - | - |
| 100 38 | 14 | 14 | 14 | - | 14 | 14 | 16 | 80 | 14 | 14 | 14 | - | - |
| 100 39 | 14 | 14 | 14 | - | 14 | 14 | 30 | 94 | 14 | 14 | 14 | - | - |
| 100 40 | 14 | 14 | 14 | - | 14 | 14 | 57 | 73 | 14 | 14 | 14 | - | - |

Table 10.11: Result Comparison for SALBP Size 100 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | Direct CPSat | Direct Cplex | MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | Alternative CPSat | Alternative MiniZinc Chuffed | Alternative MiniZinc Cplex |
|----------|---------|-----------|-----------|-------------|------------|--------------|--------------|------------------|----------------|-----------------|-------------------|------------------------------|----------------------------|
| 100 41 | 13 | 13 | 13 | - | 13 | 13 | ??? | 49 | 13 | 13 | 13 | - | - |
| 100 42 | 14 | 14 | 14 | - | 14 | 14 | ??? | 87 | 14 | 14 | 14 | - | - |
| 100 43 | 14 | 14 | 14 | - | 14 | 14 | 15 | 95 | 14 | 14 | 14 | - | - |
| 100 44 | 14 | 14 | 14 | - | 14 | 14 | 37 | 83 | 14 | 14 | 14 | - | - |
| 100 45 | 14 | 14 | 14 | - | 14 | 14 | 95 | 89 | 14 | 14 | 14 | - | - |
| 100 46 | 14 | 14 | 14 | - | 14 | 14 | 14 | 73 | 14 | 14 | 14 | - | - |
| 100 47 | 14 | 14 | 14 | - | 14 | 14 | ??? | 87 | 14 | 14 | 14 | - | - |
| 100 48 | 15 | 15 | 15 | - | 15 | 15 | 16 | 73 | 15 | 15 | 15 | - | - |
| 100 49 | 14 | 14 | 14 | - | 14 | 14 | 15 | 97 | 14 | 14 | 14 | - | - |
| 100 50 | 14 | 14 | 14 | - | 14 | 14 | 14 | 57 | 14 | 14 | 14 | - | - |
| 100 51 | 49 | 48 | 51 | 50 | 51 | 50 | ??? | 83 | ??? | 50 | 51 | - | - |
| 100 52 | 52 | 52 | 54 | 52 | 53 | 53 | 71 | 85 | ??? | 52 | 53 | - | - |
| 100 53 | 52 | 52 | 53 | 52 | 52 | 52 | 88 | 89 | 52 | 52 | 52 | - | - |
| 100 54 | 51 | 51 | 52 | 51 | 51 | 51 | ??? | 95 | 51 | 51 | 51 | - | - |
| 100 55 | 52 | 52 | 54 | 53 | 53 | 53 | ??? | 89 | ??? | 53 | 54 | - | - |
| 100 56 | 51 | 51 | 53 | 52 | 52 | 52 | 68 | 75 | ??? | 52 | 53 | - | - |
| 100 57 | 53 | 53 | 58 | 54 | 55 | 54 | 100 | 89 | ??? | 54 | 56 | - | - |
| 100 58 | 56 | 56 | 58 | 57 | 57 | 57 | 86 | 92 | ??? | 57 | 58 | - | - |
| 100 59 | 57 | 57 | 57 | - | 57 | 57 | 84 | 91 | 57 | 57 | 59 | - | - |
| 100 60 | 53 | 53 | 57 | 54 | 54 | 54 | ??? | 76 | ??? | 53 | 54 | - | - |
| 100 61 | 54 | 54 | 54 | - | 54 | 55 | 76 | 79 | ??? | 55 | 56 | - | - |
| 100 62 | 50 | 50 | 53 | 51 | 52 | 52 | 100 | 57 | ??? | 52 | 52 | - | - |
| 100 63 | 61 | 61 | 61 | - | 61 | 61 | ??? | 96 | 61 | 61 | 62 | - | - |
| 100 64 | 55 | 55 | 56 | - | 57 | 56 | 71 | 88 | ??? | 56 | 57 | - | - |
| 100 65 | 61 | 61 | 61 | - | 62 | 62 | 66 | 83 | 61 | 62 | 62 | - | - |
| 100 66 | 50 | 50 | 52 | 51 | 52 | 51 | 78 | 98 | ??? | 51 | 51 | - | - |
| 100 67 | 54 | 54 | 56 | 55 | 55 | 55 | ??? | 87 | ??? | 55 | 56 | - | - |
| 100 68 | 57 | 57 | 57 | - | 57 | 57 | 99 | 86 | 57 | 57 | 57 | - | - |
| 100 69 | 53 | 53 | 55 | 53 | 53 | 53 | 81 | 99 | 53 | 53 | 54 | - | - |
| 100 70 | 51 | 51 | 56 | 53 | 53 | 53 | ??? | 88 | ??? | 52 | 56 | - | - |
| 100 71 | 52 | 52 | 53 | - | 53 | 53 | 95 | 91 | ??? | 53 | 54 | - | - |
| 100 72 | 52 | 52 | 56 | 54 | 54 | 53 | 77 | 82 | ??? | 53 | 55 | - | - |
| 100 73 | 55 | 55 | 58 | 56 | 56 | 56 | 71 | 89 | ??? | 55 | 58 | - | - |
| 100 74 | 50 | 50 | 52 | 51 | 52 | 51 | ??? | 93 | ??? | 51 | 52 | - | - |
| 100 75 | 54 | 54 | 55 | - | 55 | 54 | 85 | 87 | 54 | 54 | 55 | - | - |
| 100 76 | 23 | 23 | 23 | - | 23 | 23 | ??? | 86 | 23 | 23 | 23 | - | - |
| 100 77 | 20 | 20 | 20 | - | 20 | 20 | ??? | 71 | 20 | 20 | 20 | - | - |
| 100 78 | 21 | 21 | 21 | - | 21 | 21 | 65 | 43 | 21 | 21 | 22 | - | - |
| 100 79 | 21 | 21 | 21 | - | 21 | 21 | ??? | 73 | 21 | 21 | 21 | - | - |
| 100 80 | 22 | 22 | 22 | - | 22 | 22 | 99 | 23 | 22 | 22 | 23 | - | - |
| 100 81 | 20 | 20 | 20 | - | 20 | 20 | ??? | 54 | 20 | 20 | 20 | - | - |
| 100 82 | 21 | 21 | 21 | - | 21 | 21 | ??? | 90 | 21 | 21 | 21 | - | - |
| 100 83 | 22 | 22 | 22 | - | 22 | 22 | ??? | 90 | 22 | 22 | 22 | - | - |
| 100 84 | 26 | 26 | 27 | - | 27 | 27 | 45 | 86 | ??? | 27 | 27 | - | - |
| 100 85 | 24 | 24 | 24 | - | 25 | 25 | ??? | 25 | ??? | 25 | 25 | - | - |
| 100 86 | 23 | 23 | 23 | - | 23 | 23 | ??? | 23 | 23 | 23 | 23 | - | - |
| 100 87 | 22 | 22 | 22 | - | 22 | 22 | ??? | 74 | 22 | 22 | 22 | - | - |
| 100 88 | 23 | 23 | 23 | - | 24 | 24 | ??? | 43 | ??? | 23 | 24 | - | - |
| 100 89 | 24 | 24 | 24 | - | 24 | 24 | 73 | 45 | 24 | 24 | 24 | - | - |
| 100 90 | 20 | 20 | 20 | - | 21 | 21 | ??? | 75 | ??? | 21 | 21 | - | - |
| 100 91 | 25 | 25 | 25 | - | 25 | 25 | ??? | 77 | 25 | 25 | 25 | - | - |
| 100 92 | 24 | 24 | 24 | - | 24 | 24 | ??? | 24 | 24 | 24 | 24 | - | - |
| 100 93 | 27 | 27 | 28 | 27 | 27 | 27 | ??? | 28 | 27 | 27 | 27 | - | - |
| 100 94 | 22 | 22 | 22 | - | 22 | 22 | 57 | 91 | 22 | 22 | 23 | - | - |
| 100 95 | 21 | 21 | 21 | - | 21 | 21 | ??? | 22 | 21 | 21 | 21 | - | - |
| 100 96 | 21 | 21 | 21 | - | 21 | 21 | 100 | 22 | 21 | 21 | 21 | - | - |
| 100 97 | 22 | 22 | 22 | - | 22 | 22 | ??? | 22 | 22 | 22 | 22 | - | - |
| 100 98 | 22 | 22 | 22 | - | 22 | 22 | ??? | 63 | 22 | 22 | 22 | - | - |
| 100 99 | 22 | 22 | 22 | - | 22 | 22 | ??? | 32 | 22 | 22 | 22 | - | - |
| 100 100 | 25 | 25 | 25 | - | 25 | 25 | ??? | 65 | 25 | 25 | 25 | - | - |
| 100 101 | 15 | 15 | 15 | - | 15 | 15 | ??? | 70 | 15 | 15 | 15 | - | - |
| 100 102 | 14 | 14 | 14 | - | 14 | 14 | ??? | 15 | 14 | 14 | 14 | - | - |
| 100 103 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 104 | 14 | 14 | 14 | - | 14 | 14 | ??? | 83 | 14 | 14 | 14 | - | - |
| 100 105 | 13 | 13 | 13 | - | 13 | 13 | ??? | 13 | 13 | 13 | 13 | - | - |
| 100 106 | 14 | 14 | 14 | - | 14 | 14 | 41 | 14 | 14 | 14 | 14 | - | - |
| 100 107 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 108 | 14 | 14 | 14 | - | 14 | 14 | ??? | 15 | 14 | 14 | 14 | - | - |
| 100 109 | 15 | 15 | 15 | - | 15 | 15 | ??? | 92 | 15 | 15 | 15 | - | - |
| 100 110 | 13 | 13 | 13 | - | 13 | 13 | 45 | 84 | 13 | 13 | 13 | - | - |
| 100 111 | 16 | 16 | 16 | - | 16 | 16 | ??? | 98 | 16 | 16 | 16 | - | - |
| 100 112 | 13 | 13 | 13 | - | 13 | 13 | ??? | 14 | 13 | 13 | 13 | - | - |
| 100 113 | 14 | 14 | 14 | - | 14 | 14 | 34 | 49 | 14 | 14 | 14 | - | - |
| 100 114 | 13 | 13 | 13 | - | 13 | 13 | ??? | 14 | 13 | 13 | 13 | - | - |
| 100 115 | 14 | 14 | 14 | - | 14 | 14 | 20 | 17 | 14 | 14 | 14 | - | - |
| 100 116 | 16 | 16 | 16 | - | 16 | 16 | ??? | 71 | 16 | 16 | 16 | - | - |
| 100 117 | 15 | 15 | 15 | - | 15 | 15 | ??? | 78 | 15 | 15 | 16 | - | - |
| 100 118 | 15 | 15 | 15 | - | 15 | 15 | 43 | 15 | 15 | 15 | 15 | - | - |
| 100 119 | 14 | 14 | 14 | - | 14 | 14 | ??? | 90 | 14 | 14 | 14 | - | - |
| 100 120 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 121 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | 15 | 15 | 15 | - | - |
| 100 122 | 13 | 13 | 13 | - | 13 | 13 | 41 | 19 | 13 | 13 | 13 | - | - |
| 100 123 | 15 | 15 | 15 | - | 15 | 15 | ??? | 71 | 15 | 15 | 15 | - | - |
| 100 124 | 15 | 15 | 15 | - | 15 | 15 | ??? | 16 | 15 | 15 | 15 | - | - |
| 100 125 | 14 | 14 | 14 | - | 14 | 14 | 48 | 14 | 14 | 14 | 14 | - | - |
| 100 126 | 50 | 49 | 54 | 51 | 51 | 51 | 77 | 63 | ??? | 51 | 52 | - | - |
| 100 127 | 50 | 50 | 54 | 53 | 53 | 52 | 78 | 53 | ??? | 52 | 53 | - | - |
| 100 128 | 56 | 56 | 59 | 57 | 57 | 57 | 70 | 83 | ??? | 57 | 57 | - | - |
| 100 129 | 54 | 53 | 56 | 55 | 55 | 54 | 67 | 55 | 54 | 55 | 56 | - | - |
| 100 130 | 52 | 52 | 56 | 55 | 55 | 55 | 79 | 56 | ??? | 55 | 55 | - | - |
| 100 131 | 51 | 50 | 54 | 53 | 53 | 53 | 69 | 71 | ??? | 52 | 53 | - | - |
| 100 132 | 56 | 56 | 59 | 58 | 57 | 58 | 70 | 77 | ??? | 57 | 59 | - | - |
| 100 133 | 53 | 53 | 56 | - | 55 | 55 | 86 | 56 | ??? | 55 | 57 | - | - |
| 100 134 | 52 | 52 | 58 | 55 | 54 | 54 | 72 | 56 | ??? | 55 | 55 | - | - |

Table 10.11: Result Comparison for SALBP Size 100 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | Direct CPSat | Direct Cplex | MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | Alternative CPSat | Alternative MiniZinc Chuffed | Alternative MiniZinc Cplex |
|----------|---------|-----------|-----------|-------------|------------|--------------|--------------|------------------|----------------|-----------------|-------------------|------------------------------|----------------------------|
| 100 135 | 53 | 53 | 58 | 55 | 56 | 55 | 71 | 57 | ??? | 55 | 58 | - | - |
| 100 136 | 50 | 49 | 54 | 53 | 52 | 52 | 72 | 76 | ??? | 53 | 54 | - | - |
| 100 137 | 51 | 50 | 57 | 54 | 54 | 54 | 75 | 66 | ??? | 53 | 55 | - | - |
| 100 138 | 56 | 56 | 57 | 56 | 56 | 56 | 70 | 76 | 56 | 57 | 59 | - | - |
| 100 139 | 51 | 50 | 52 | - | 52 | 51 | 70 | 84 | 51 | 51 | 52 | - | - |
| 100 140 | 54 | 54 | 57 | 55 | 55 | 55 | 65 | 69 | ??? | 55 | 55 | - | - |
| 100 141 | 49 | 49 | 51 | - | 51 | 51 | 70 | 53 | ??? | 50 | 51 | - | - |
| 100 142 | 52 | 52 | 57 | 55 | 55 | 55 | 68 | 91 | ??? | 55 | 55 | - | - |
| 100 143 | 51 | 51 | 52 | - | 53 | 53 | 84 | 64 | ??? | 53 | 54 | - | - |
| 100 144 | 47 | 47 | 49 | 48 | 49 | 49 | 59 | 76 | ??? | 49 | 49 | - | - |
| 100 145 | 53 | 53 | 58 | 57 | 56 | 56 | ??? | 82 | ??? | 56 | 58 | - | - |
| 100 146 | 53 | 53 | 53 | - | 53 | 53 | 63 | 53 | 53 | 53 | 53 | - | - |
| 100 147 | 58 | 58 | 62 | 59 | 59 | 59 | 73 | 71 | ??? | 59 | 61 | - | - |
| 100 148 | 50 | 50 | 54 | 53 | 53 | 52 | 65 | 80 | ??? | 53 | 55 | - | - |
| 100 149 | 54 | 54 | 57 | 55 | 55 | 55 | 69 | 76 | ??? | 55 | 56 | - | - |
| 100 150 | 54 | 54 | 58 | 57 | 58 | 57 | 72 | 59 | ??? | 57 | 57 | - | - |
| 100 151 | 21 | 21 | 21 | - | 22 | 22 | ??? | 36 | ??? | 22 | 22 | - | - |
| 100 152 | 22 | 22 | 22 | - | 22 | 22 | ??? | 75 | 22 | 22 | 22 | - | - |
| 100 153 | 21 | 21 | 21 | - | 21 | 21 | ??? | 21 | 21 | 21 | 21 | - | - |
| 100 154 | 25 | 25 | 25 | - | 25 | 25 | ??? | 76 | 25 | 25 | 25 | - | - |
| 100 155 | 22 | 22 | 22 | - | 22 | 22 | ??? | 98 | 22 | 22 | 22 | - | - |
| 100 156 | 23 | 23 | 23 | - | 23 | 23 | 97 | 69 | 23 | 23 | 23 | - | - |
| 100 157 | 26 | 26 | 26 | - | 26 | 26 | 60 | 42 | 26 | 26 | 26 | - | - |
| 100 158 | 23 | 23 | 23 | - | 23 | 23 | ??? | 86 | 23 | 23 | 23 | - | - |
| 100 159 | 19 | 19 | 19 | - | 19 | 19 | ??? | 78 | 19 | 19 | 19 | - | - |
| 100 160 | 22 | 22 | 22 | - | 22 | 22 | ??? | 89 | 22 | 22 | 22 | - | - |
| 100 161 | 22 | 22 | 22 | - | 22 | 23 | ??? | 56 | ??? | 22 | 23 | - | - |
| 100 162 | 22 | 22 | 22 | - | 23 | 22 | ??? | 32 | 22 | 22 | 22 | - | - |
| 100 163 | 25 | 25 | 25 | - | 25 | 25 | ??? | 76 | 25 | 25 | 25 | - | - |
| 100 164 | 23 | 23 | 23 | - | 23 | 23 | 53 | 53 | 23 | 23 | 23 | - | - |
| 100 165 | 24 | 24 | 24 | - | 25 | 25 | ??? | 70 | ??? | 25 | 25 | - | - |
| 100 166 | 24 | 24 | 24 | - | 24 | 24 | ??? | 32 | 24 | 24 | 24 | - | - |
| 100 167 | 22 | 22 | 22 | - | 22 | 22 | ??? | 51 | 22 | 22 | 22 | - | - |
| 100 168 | 21 | 21 | 21 | - | 22 | 21 | ??? | 75 | ??? | 21 | 22 | - | - |
| 100 169 | 21 | 21 | 21 | - | 21 | 21 | ??? | 94 | 21 | 21 | 21 | - | - |
| 100 170 | 24 | 24 | 24 | - | 24 | 24 | 52 | 38 | 24 | 24 | 25 | - | - |
| 100 171 | 24 | 24 | 24 | - | 25 | 25 | 25 | 25 | ??? | 24 | 25 | - | - |
| 100 172 | 24 | 24 | 24 | - | 24 | 24 | ??? | 91 | 24 | 24 | 24 | - | - |
| 100 173 | 24 | 24 | 25 | - | 25 | 25 | 26 | 91 | ??? | 24 | 25 | - | - |
| 100 174 | 22 | 22 | 22 | - | 22 | 22 | ??? | 47 | 22 | 22 | 22 | - | - |
| 100 175 | 26 | 26 | 27 | - | 27 | 27 | 100 | 71 | ??? | 27 | 27 | - | - |
| 100 176 | 13 | 13 | 13 | - | 13 | 13 | 14 | 80 | 13 | 13 | 13 | - | - |
| 100 177 | 14 | 14 | 14 | - | 14 | 14 | 19 | 95 | 14 | 14 | 14 | - | - |
| 100 178 | 15 | 15 | 15 | - | 15 | 15 | ??? | 81 | 15 | 15 | 15 | - | - |
| 100 179 | 15 | 15 | 15 | - | 15 | 15 | 16 | 74 | 15 | 15 | 15 | - | - |
| 100 180 | 15 | 15 | 15 | - | 15 | 15 | 15 | 91 | 15 | 15 | 15 | - | - |
| 100 181 | 13 | 13 | 13 | - | 13 | 13 | 14 | 60 | 13 | 13 | 13 | - | - |
| 100 182 | 15 | 15 | 15 | - | 15 | 15 | 15 | 47 | 15 | 15 | 15 | - | - |
| 100 183 | 14 | 14 | 14 | - | 14 | 14 | 31 | 72 | 14 | 14 | 14 | - | - |
| 100 184 | 14 | 14 | 14 | - | 14 | 14 | ??? | 96 | 14 | 14 | 14 | - | - |
| 100 185 | 15 | 15 | 15 | - | 15 | 15 | ??? | 54 | 15 | 15 | 15 | - | - |
| 100 186 | 14 | 14 | 14 | - | 14 | 14 | 15 | 64 | 14 | 14 | 14 | - | - |
| 100 187 | 13 | 13 | 13 | - | 13 | 13 | 14 | 48 | 13 | 13 | 13 | - | - |
| 100 188 | 16 | 16 | 16 | - | 16 | 16 | ??? | 69 | 16 | 16 | 16 | - | - |
| 100 189 | 14 | 14 | 14 | - | 14 | 14 | ??? | 85 | 14 | 14 | 14 | - | - |
| 100 190 | 13 | 13 | 13 | - | 13 | 13 | 14 | 89 | 13 | 13 | 13 | - | - |
| 100 191 | 14 | 14 | 14 | - | 14 | 14 | 14 | 78 | 14 | 14 | 14 | - | - |
| 100 192 | 13 | 13 | 13 | - | 13 | 13 | 14 | 78 | 13 | 13 | 13 | - | - |
| 100 193 | 15 | 15 | 15 | - | 15 | 15 | 62 | 98 | 15 | 15 | 15 | - | - |
| 100 194 | 15 | 15 | 15 | - | 15 | 15 | ??? | 80 | 15 | 15 | 15 | - | - |
| 100 195 | 15 | 15 | 15 | - | 15 | 15 | 36 | 85 | 15 | 15 | 15 | - | - |
| 100 196 | 15 | 15 | 15 | - | 15 | 15 | 15 | 97 | 15 | 15 | 15 | - | - |
| 100 197 | 15 | 15 | 15 | - | 15 | 15 | 100 | 24 | 15 | 15 | 15 | - | - |
| 100 198 | 13 | 13 | 13 | - | 13 | 13 | 37 | 79 | 13 | 13 | 13 | - | - |
| 100 199 | 14 | 14 | 14 | - | 14 | 14 | 20 | 19 | 14 | 14 | 14 | - | - |
| 100 200 | 15 | 15 | 15 | - | 15 | 15 | ??? | 96 | 15 | 15 | 15 | - | - |
| 100 201 | 52 | 52 | 54 | 53 | 53 | 53 | 72 | 84 | ??? | 52 | 55 | - | - |
| 100 202 | 61 | 61 | 62 | 61 | 61 | 61 | 100 | 92 | 61 | 61 | 62 | - | - |
| 100 203 | 52 | 52 | 53 | 52 | 53 | 52 | ??? | 64 | ??? | 52 | 53 | - | - |
| 100 204 | 49 | 49 | 51 | - | 51 | 51 | ??? | 80 | ??? | 50 | 52 | - | - |
| 100 205 | 56 | 56 | 58 | 57 | 57 | 57 | 75 | 91 | ??? | 56 | 58 | - | - |
| 100 206 | 50 | 50 | 54 | 51 | 52 | 52 | ??? | 57 | ??? | 51 | 52 | - | - |
| 100 207 | 50 | 50 | 52 | 51 | 52 | 51 | ??? | 70 | ??? | 51 | 53 | - | - |
| 100 208 | 56 | 56 | 60 | 56 | 57 | 57 | ??? | 87 | ??? | 56 | 59 | - | - |
| 100 209 | 54 | 54 | 56 | - | 55 | 55 | 73 | 78 | ??? | 54 | 57 | - | - |
| 100 210 | 51 | 51 | 53 | 52 | 53 | 52 | 65 | 65 | ??? | 52 | 53 | - | - |
| 100 211 | 51 | 51 | 53 | 51 | 52 | 51 | 79 | 81 | ??? | 51 | 52 | - | - |
| 100 212 | 51 | 51 | 53 | 52 | 53 | 52 | 69 | 55 | ??? | 52 | 53 | - | - |
| 100 213 | 51 | 51 | 54 | 53 | 53 | 52 | 74 | 96 | ??? | 52 | 54 | - | - |
| 100 214 | 53 | 53 | 56 | 54 | 55 | 55 | 71 | 87 | ??? | 54 | 55 | - | - |
| 100 215 | 48 | 47 | 49 | - | 49 | 50 | ??? | 76 | ??? | 49 | 50 | - | - |
| 100 216 | 51 | 51 | 53 | - | 53 | 52 | ??? | 94 | ??? | 53 | 55 | - | - |
| 100 217 | 51 | 51 | 53 | 52 | 52 | 52 | 70 | 84 | ??? | 52 | 54 | - | - |
| 100 218 | 52 | 52 | 56 | 53 | 54 | 53 | 65 | 57 | ??? | 53 | 55 | - | - |
| 100 219 | 51 | 51 | 53 | 52 | 52 | 52 | 77 | 88 | ??? | 51 | 52 | - | - |
| 100 220 | 52 | 52 | 54 | - | 54 | 53 | 88 | 87 | ??? | 53 | 54 | - | - |
| 100 221 | 56 | 56 | 57 | - | 57 | 57 | 97 | 88 | ??? | 57 | 58 | - | - |
| 100 222 | 51 | 51 | 55 | 53 | 53 | 53 | 82 | 66 | ??? | 53 | 55 | - | - |
| 100 223 | 50 | 50 | 53 | 51 | 51 | 51 | ??? | 64 | ??? | 51 | 52 | - | - |
| 100 224 | 55 | 55 | 56 | - | 56 | 55 | ??? | 63 | 55 | 55 | 57 | - | - |
| 100 225 | 52 | 51 | 55 | 53 | 53 | 53 | 74 | 58 | ??? | 53 | 54 | - | - |
| 100 226 | 24 | 24 | 24 | - | 25 | 25 | ??? | 68 | ??? | 25 | 25 | - | - |
| 100 227 | 26 | 26 | 27 | - | 26 | 27 | ??? | 27 | ??? | 27 | 27 | - | - |
| 100 228 | 22 | 22 | 22 | - | 22 | 22 | ??? | 22 | 22 | 22 | 22 | - | - |

Table 10.11: Result Comparison for SALBP Size 100 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | Direct CPSat | Direct Cplex | MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | Alternative CPSat | Alternative MiniZinc Chuffed | Alternative MiniZinc Cplex |
|----------|---------|-----------|-----------|-------------|------------|--------------|--------------|------------------|----------------|-----------------|-------------------|------------------------------|----------------------------|
| 100 229 | 24 | 24 | 24 | - | 24 | 24 | ??? | 24 | 24 | 24 | 24 | - | - |
| 100 230 | 23 | 23 | 23 | - | 23 | 23 | ??? | 38 | 23 | 23 | 24 | - | - |
| 100 231 | 22 | 22 | 22 | - | 22 | 22 | ??? | 23 | 22 | 22 | 22 | - | - |
| 100 232 | 22 | 22 | 22 | - | 22 | 22 | 99 | 35 | 22 | 22 | 22 | - | - |
| 100 233 | 22 | 22 | 22 | - | 23 | 23 | ??? | 36 | ??? | 23 | 23 | - | - |
| 100 234 | 23 | 23 | 23 | - | 23 | 23 | ??? | 23 | 23 | 23 | 23 | - | - |
| 100 235 | 26 | 26 | 26 | - | 26 | 26 | 54 | 26 | 26 | 26 | 26 | - | - |
| 100 236 | 22 | 22 | 22 | - | 23 | 23 | 25 | 23 | ??? | 23 | 23 | - | - |
| 100 237 | 23 | 23 | 23 | - | 23 | 23 | ??? | 23 | 23 | 23 | 23 | - | - |
| 100 238 | 23 | 23 | 23 | - | 23 | 23 | ??? | 49 | 23 | 23 | 23 | - | - |
| 100 239 | 21 | 21 | 21 | - | 21 | 21 | 36 | 92 | 21 | 21 | 21 | - | - |
| 100 240 | 22 | 22 | 22 | - | 22 | 22 | ??? | 22 | 22 | 22 | 22 | - | - |
| 100 241 | 22 | 22 | 22 | - | 22 | 22 | ??? | 67 | 22 | 22 | 22 | - | - |
| 100 242 | 23 | 23 | 23 | - | 23 | 23 | ??? | 87 | 23 | 23 | 23 | - | - |
| 100 243 | 23 | 23 | 23 | - | 23 | 24 | ??? | 28 | 23 | 23 | 24 | - | - |
| 100 244 | 21 | 21 | 21 | - | 21 | 21 | ??? | 51 | 21 | 21 | 21 | - | - |
| 100 245 | 23 | 23 | 24 | - | 24 | 24 | ??? | 24 | ??? | 24 | 24 | - | - |
| 100 246 | 26 | 26 | 26 | - | 26 | 26 | 89 | 26 | 26 | 26 | 26 | - | - |
| 100 247 | 22 | 22 | 22 | - | 22 | 22 | ??? | 24 | 22 | 22 | 22 | - | - |
| 100 248 | 19 | 19 | 19 | - | 19 | 19 | 36 | 20 | 19 | 19 | 19 | - | - |
| 100 249 | 21 | 21 | 21 | - | 21 | 21 | ??? | 69 | 21 | 21 | 21 | - | - |
| 100 250 | 24 | 24 | 24 | - | 24 | 24 | ??? | 24 | 24 | 24 | 24 | - | - |
| 100 251 | 15 | 15 | 15 | - | 15 | 15 | 25 | 15 | 15 | 15 | 15 | - | - |
| 100 252 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 253 | 14 | 14 | 14 | - | 14 | 14 | 26 | 93 | 14 | 14 | 14 | - | - |
| 100 254 | 14 | 14 | 14 | - | 14 | 14 | 42 | 14 | 14 | 14 | 14 | - | - |
| 100 255 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | - | - |
| 100 256 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | 15 | 15 | 15 | - | - |
| 100 257 | 12 | 12 | 12 | - | 12 | 12 | 100 | 13 | 12 | 12 | 12 | - | - |
| 100 258 | 14 | 14 | 14 | - | 14 | 14 | ??? | 15 | 14 | 14 | 14 | - | - |
| 100 259 | 15 | 15 | 15 | - | 15 | 15 | ??? | 35 | 15 | 15 | 15 | - | - |
| 100 260 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | 15 | 15 | 15 | - | - |
| 100 261 | 14 | 14 | 14 | - | 14 | 14 | 99 | 49 | 14 | 14 | 14 | - | - |
| 100 262 | 14 | 14 | 14 | - | 14 | 14 | 100 | 14 | 14 | 14 | 14 | - | - |
| 100 263 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 264 | 15 | 15 | 15 | - | 15 | 15 | 41 | 69 | 15 | 15 | 15 | - | - |
| 100 265 | 14 | 14 | 14 | - | 14 | 14 | 100 | 96 | 14 | 14 | 14 | - | - |
| 100 266 | 13 | 13 | 13 | - | 13 | 13 | 32 | 13 | 13 | 13 | 13 | - | - |
| 100 267 | 13 | 13 | 13 | - | 13 | 13 | 25 | 13 | 13 | 13 | 13 | - | - |
| 100 268 | 15 | 15 | 15 | - | 15 | 15 | 15 | 15 | 15 | 15 | 15 | - | - |
| 100 269 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | 15 | 15 | 15 | - | - |
| 100 270 | 13 | 13 | 13 | - | 13 | 13 | 99 | 13 | 13 | 13 | 13 | - | - |
| 100 271 | 13 | 13 | 13 | - | 13 | 13 | 39 | 95 | 13 | 13 | 14 | - | - |
| 100 272 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 273 | 13 | 13 | 13 | - | 13 | 13 | ??? | 13 | 13 | 13 | 13 | - | - |
| 100 274 | 13 | 13 | 13 | - | 13 | 13 | ??? | 14 | 13 | 13 | 13 | - | - |
| 100 275 | 13 | 13 | 13 | - | 13 | 13 | 100 | 13 | 13 | 13 | 13 | - | - |
| 100 276 | 58 | 58 | 63 | 61 | 60 | 60 | 69 | 63 | ??? | 60 | 62 | - | - |
| 100 277 | 54 | 53 | 61 | - | 57 | 57 | 70 | 78 | ??? | 57 | 60 | - | - |
| 100 278 | 55 | 55 | 60 | - | 58 | 57 | 67 | 61 | ??? | 57 | 59 | - | - |
| 100 279 | 52 | 52 | 58 | 54 | 54 | 53 | 73 | 58 | ??? | 53 | 56 | - | - |
| 100 280 | 52 | 51 | 57 | 55 | 56 | 55 | 67 | 68 | ??? | 55 | 56 | - | - |
| 100 281 | 60 | 59 | 64 | 62 | 62 | 62 | 85 | 83 | ??? | 62 | 64 | - | - |
| 100 282 | 57 | 57 | 63 | - | 60 | 60 | 71 | 90 | ??? | 60 | 63 | - | - |
| 100 283 | 53 | 53 | 57 | 55 | 55 | 55 | 65 | 56 | ??? | 55 | 57 | - | - |
| 100 284 | 54 | 54 | 56 | 55 | 55 | 55 | 72 | 59 | ??? | 55 | 56 | - | - |
| 100 285 | 52 | 52 | 57 | 55 | 55 | 55 | 69 | 57 | ??? | 54 | 57 | - | - |
| 100 286 | 55 | 55 | 60 | 57 | 57 | 56 | 77 | 84 | ??? | 56 | 58 | - | - |
| 100 287 | 54 | 53 | 56 | 55 | 54 | 54 | 78 | 55 | 54 | 54 | 56 | - | - |
| 100 288 | 53 | 53 | 59 | - | 56 | 56 | 67 | 58 | ??? | 56 | 58 | - | - |
| 100 289 | 62 | 61 | 65 | 62 | 62 | 62 | 73 | 64 | 62 | 62 | 64 | - | - |
| 100 290 | 52 | 52 | 59 | 54 | 55 | 54 | 67 | 60 | ??? | 54 | 56 | - | - |
| 100 291 | 49 | 49 | 53 | - | 53 | 52 | 72 | 54 | ??? | 53 | 54 | - | - |
| 100 292 | 55 | 55 | 58 | - | 58 | 57 | 72 | 60 | ??? | 59 | 60 | - | - |
| 100 293 | 50 | 50 | 56 | 53 | 53 | 52 | 63 | 84 | ??? | 52 | 55 | - | - |
| 100 294 | 54 | 54 | 58 | - | 58 | 57 | 73 | 57 | ??? | 57 | 59 | - | - |
| 100 295 | 55 | 55 | 60 | 57 | 57 | 56 | 73 | 62 | ??? | 57 | 58 | - | - |
| 100 296 | 53 | 53 | 58 | 55 | 55 | 55 | 69 | 57 | ??? | 55 | 57 | - | - |
| 100 297 | 58 | 54 | 61 | - | 59 | 58 | 68 | 79 | ??? | 59 | 60 | - | - |
| 100 298 | 57 | 57 | 59 | - | 59 | 58 | 68 | 61 | ??? | 58 | 60 | - | - |
| 100 299 | 54 | 54 | 56 | 55 | 55 | 55 | 66 | 69 | 54 | 54 | 56 | - | - |
| 100 300 | 51 | 51 | 57 | 55 | 54 | 54 | 97 | 55 | ??? | 54 | 56 | - | - |
| 100 301 | 23 | 23 | 23 | - | 23 | 23 | 25 | 31 | 23 | 23 | 23 | - | - |
| 100 302 | 24 | 24 | 24 | - | 24 | 24 | 68 | 35 | 24 | 24 | 24 | - | - |
| 100 303 | 24 | 24 | 24 | - | 24 | 24 | 56 | 65 | 24 | 24 | 24 | - | - |
| 100 304 | 21 | 21 | 21 | - | 21 | 21 | 54 | 81 | 21 | 21 | 21 | - | - |
| 100 305 | 22 | 22 | 22 | - | 22 | 22 | ??? | 82 | 22 | 22 | 22 | - | - |
| 100 306 | 24 | 24 | 24 | - | 24 | 24 | ??? | 81 | 24 | 24 | 24 | - | - |
| 100 307 | 23 | 23 | 23 | - | 24 | 24 | ??? | 44 | ??? | 24 | 24 | - | - |
| 100 308 | 20 | 20 | 20 | - | 21 | 20 | 22 | 75 | 20 | 20 | 20 | - | - |
| 100 309 | 21 | 21 | 21 | - | 22 | 22 | ??? | 80 | ??? | 22 | 22 | - | - |
| 100 310 | 23 | 23 | 23 | - | 23 | 23 | ??? | 57 | 23 | 23 | 23 | - | - |
| 100 311 | 21 | 21 | 21 | - | 21 | 21 | ??? | 94 | 21 | 21 | 21 | - | - |
| 100 312 | 22 | 22 | 22 | - | 22 | 22 | 44 | 68 | 22 | 22 | 22 | - | - |
| 100 313 | 23 | 23 | 23 | - | 23 | 23 | ??? | 88 | 23 | 23 | 23 | - | - |
| 100 314 | 19 | 19 | 19 | - | 19 | 19 | 100 | 43 | 19 | 19 | 19 | - | - |
| 100 315 | 22 | 22 | 22 | - | 23 | 22 | ??? | 51 | 22 | 22 | 22 | - | - |
| 100 316 | 24 | 24 | 24 | - | 24 | 24 | ??? | 82 | 24 | 24 | 24 | - | - |
| 100 317 | 26 | 26 | 26 | - | 26 | 26 | ??? | 97 | 26 | 26 | 26 | - | - |
| 100 318 | 21 | 21 | 21 | - | 21 | 21 | ??? | 95 | 21 | 21 | 21 | - | - |
| 100 319 | 23 | 23 | 23 | - | 23 | 23 | ??? | 85 | 23 | 23 | 23 | - | - |
| 100 320 | 22 | 22 | 22 | - | 22 | 22 | ??? | 95 | 22 | 22 | 22 | - | - |
| 100 321 | 26 | 26 | 26 | - | 26 | 26 | 53 | 70 | 26 | 26 | 26 | - | - |
| 100 322 | 23 | 23 | 23 | - | 24 | 24 | 46 | 59 | 23 | 23 | 24 | - | - |

Table 10.11: Result Comparison for SALBP Size 100 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | Direct CPSat | Direct MiniZinc Cplex | Direct MiniZinc Chuffed | Direct MiniZinc CPSat | Alternative CPO | Alternative CPSat | Alternative MiniZinc Chuffed | Alternative MiniZinc Cplex |
|----------|---------|-----------|-----------|-------------|------------|--------------|-----------------------|-------------------------|-----------------------|-----------------|-------------------|------------------------------|----------------------------|
| 100 323 | 24 | 24 | 24 | - | 24 | 24 | 26 | 70 | 24 | 24 | 24 | - | - |
| 100 324 | 23 | 23 | 23 | - | 23 | 23 | ??? | 66 | 23 | 23 | 23 | - | - |
| 100 325 | 25 | 25 | 25 | - | 26 | 25 | ??? | 58 | 25 | 25 | 26 | - | - |
| 100 326 | 13 | 13 | 13 | - | 13 | 13 | 14 | 92 | 13 | 13 | 13 | - | - |
| 100 327 | 14 | 14 | 14 | - | 14 | 14 | 15 | 85 | 14 | 14 | 14 | - | - |
| 100 328 | 14 | 14 | 14 | - | 14 | 15 | 100 | 82 | 14 | 14 | 15 | - | - |
| 100 329 | 14 | 14 | 14 | - | 14 | 14 | 65 | 83 | 14 | 14 | 14 | - | - |
| 100 330 | 14 | 14 | 14 | - | 14 | 14 | ??? | 66 | 14 | 14 | 15 | - | - |
| 100 331 | 14 | 14 | 14 | - | 14 | 14 | 92 | 86 | 14 | 14 | 14 | - | - |
| 100 332 | 14 | 14 | 14 | - | 14 | 14 | 14 | 81 | 14 | 14 | 14 | - | - |
| 100 333 | 15 | 15 | 15 | - | 15 | 15 | 49 | 86 | 15 | 15 | 15 | - | - |
| 100 334 | 14 | 14 | 14 | - | 14 | 14 | ??? | 70 | 14 | 14 | 14 | - | - |
| 100 335 | 13 | 13 | 13 | - | 13 | 13 | 14 | 71 | 13 | 13 | 13 | - | - |
| 100 336 | 15 | 15 | 15 | - | 15 | 15 | 55 | 61 | 15 | 15 | 15 | - | - |
| 100 337 | 13 | 13 | 13 | - | 13 | 13 | 14 | 85 | 13 | 13 | 13 | - | - |
| 100 338 | 14 | 14 | 14 | - | 15 | 14 | 16 | 60 | 14 | 14 | 14 | - | - |
| 100 339 | 14 | 14 | 14 | - | 14 | 14 | 16 | 88 | 14 | 14 | 14 | - | - |
| 100 340 | 14 | 14 | 14 | - | 14 | 14 | 15 | 72 | 14 | 14 | 14 | - | - |
| 100 341 | 16 | 16 | 16 | - | 16 | 16 | ??? | 75 | 16 | 16 | 16 | - | - |
| 100 342 | 14 | 14 | 14 | - | 14 | 14 | 100 | 71 | 14 | 14 | 14 | - | - |
| 100 343 | 16 | 16 | 16 | - | 16 | 16 | ??? | 81 | 16 | 16 | 16 | - | - |
| 100 344 | 15 | 15 | 15 | - | 15 | 15 | 100 | 96 | 15 | 15 | 15 | - | - |
| 100 345 | 14 | 14 | 14 | - | 14 | 14 | 98 | 14 | 14 | 14 | 14 | - | - |
| 100 346 | 14 | 14 | 14 | - | 14 | 14 | 99 | 95 | 14 | 14 | 14 | - | - |
| 100 347 | 14 | 14 | 14 | - | 14 | 14 | 15 | 73 | 14 | 14 | 14 | - | - |
| 100 348 | 14 | 14 | 14 | - | 14 | 14 | ??? | 99 | 14 | 14 | 14 | - | - |
| 100 349 | 13 | 13 | 13 | - | 13 | 13 | 14 | 79 | 13 | 13 | 13 | - | - |
| 100 350 | 14 | 14 | 14 | - | 14 | 14 | 36 | 78 | 14 | 14 | 14 | - | - |
| 100 351 | 58 | 58 | 60 | 59 | 59 | 59 | 98 | 89 | ??? | 59 | 60 | - | - |
| 100 352 | 63 | 63 | 63 | - | 63 | 63 | 82 | 92 | 63 | 63 | 65 | - | - |
| 100 353 | 50 | 50 | 54 | 51 | 51 | 52 | ??? | 83 | ??? | 50 | 52 | - | - |
| 100 354 | 51 | 51 | 54 | 52 | 53 | 52 | 67 | 76 | ??? | 52 | 52 | - | - |
| 100 355 | 53 | 53 | 55 | - | 55 | 55 | 68 | 88 | ??? | 54 | 56 | - | - |
| 100 356 | 59 | 59 | 61 | 59 | 61 | 60 | ??? | 97 | 59 | 59 | 60 | - | - |
| 100 357 | 53 | 53 | 53 | - | 54 | 53 | 79 | 98 | 53 | 53 | 53 | - | - |
| 100 358 | 51 | 51 | 54 | 52 | 53 | 52 | 100 | 87 | ??? | 52 | 53 | - | - |
| 100 359 | 52 | 52 | 54 | 53 | 54 | 53 | 99 | 94 | ??? | 53 | 53 | - | - |
| 100 360 | 54 | 54 | 57 | 55 | 55 | 54 | ??? | 81 | 54 | 54 | 55 | - | - |
| 100 361 | 50 | 50 | 52 | - | 52 | 52 | ??? | 66 | ??? | 51 | 52 | - | - |
| 100 362 | 57 | 57 | 57 | - | 57 | 57 | 98 | 75 | 57 | 57 | 58 | - | - |
| 100 363 | 51 | 51 | 53 | - | 53 | 53 | 65 | 92 | ??? | 52 | 52 | - | - |
| 100 364 | 51 | 51 | 53 | 52 | 53 | 52 | 79 | 86 | ??? | 52 | 53 | - | - |
| 100 365 | 52 | 52 | 54 | 53 | 53 | 53 | 76 | 86 | 52 | 52 | 54 | - | - |
| 100 366 | 61 | 61 | 61 | - | 61 | 61 | 88 | 95 | 61 | 61 | 62 | - | - |
| 100 367 | 55 | 55 | 57 | 55 | 56 | 55 | 82 | 87 | 55 | 55 | 56 | - | - |
| 100 368 | 58 | 58 | 59 | - | 59 | 58 | 100 | 99 | 58 | 59 | 60 | - | - |
| 100 369 | 50 | 49 | 52 | 51 | 51 | 51 | ??? | 61 | ??? | 51 | 53 | - | - |
| 100 370 | 56 | 56 | 57 | - | 57 | 57 | 91 | 90 | ??? | 56 | 58 | - | - |
| 100 371 | 51 | 51 | 54 | 53 | 53 | 53 | 100 | 81 | ??? | 53 | 54 | - | - |
| 100 372 | 48 | 47 | 49 | - | 49 | 49 | ??? | 83 | ??? | 48 | 49 | - | - |
| 100 373 | 50 | 49 | 52 | 51 | 51 | 51 | ??? | 67 | ??? | 51 | 52 | - | - |
| 100 374 | 51 | 51 | 53 | 51 | 53 | 52 | ??? | 99 | 51 | 51 | 53 | - | - |
| 100 375 | 57 | 57 | 57 | - | 58 | 57 | 81 | 92 | 57 | 57 | 60 | - | - |
| 100 376 | 23 | 23 | 23 | - | 23 | 23 | ??? | 32 | 23 | 23 | 23 | - | - |
| 100 377 | 20 | 20 | 20 | - | 21 | 21 | ??? | 28 | ??? | 20 | 21 | - | - |
| 100 378 | 22 | 22 | 22 | - | 22 | 22 | ??? | 86 | 22 | 22 | 22 | - | - |
| 100 379 | 23 | 23 | 23 | - | 23 | 23 | ??? | 90 | 23 | 23 | 23 | - | - |
| 100 380 | 22 | 22 | 22 | - | 23 | 23 | ??? | 46 | ??? | 22 | 23 | - | - |
| 100 381 | 24 | 24 | 24 | - | 24 | 24 | ??? | 98 | 24 | 24 | 24 | - | - |
| 100 382 | 25 | 25 | 25 | - | 25 | 25 | 61 | 43 | 25 | 25 | 25 | - | - |
| 100 383 | 25 | 25 | 25 | - | 25 | 25 | 54 | 67 | 25 | 25 | 25 | - | - |
| 100 384 | 25 | 25 | 25 | - | 25 | 25 | ??? | 96 | 25 | 25 | 25 | - | - |
| 100 385 | 22 | 22 | 22 | - | 22 | 22 | ??? | 22 | 22 | 22 | 22 | - | - |
| 100 386 | 23 | 23 | 23 | - | 23 | 24 | ??? | 72 | ??? | 23 | 24 | - | - |
| 100 387 | 22 | 22 | 22 | - | 22 | 22 | ??? | 65 | 22 | 22 | 22 | - | - |
| 100 388 | 25 | 25 | 25 | - | 26 | 25 | ??? | 40 | ??? | 25 | 26 | - | - |
| 100 389 | 23 | 23 | 23 | - | 23 | 23 | ??? | 45 | 23 | 23 | 23 | - | - |
| 100 390 | 22 | 22 | 22 | - | 23 | 22 | 67 | 63 | 22 | 22 | 23 | - | - |
| 100 391 | 20 | 20 | 20 | - | 20 | 20 | ??? | 86 | 20 | 20 | 20 | - | - |
| 100 392 | 22 | 22 | 22 | - | 22 | 22 | 47 | 77 | 22 | 22 | 22 | - | - |
| 100 393 | 23 | 23 | 23 | - | 24 | 24 | ??? | 24 | ??? | 23 | 23 | - | - |
| 100 394 | 22 | 22 | 22 | - | 22 | 22 | ??? | 22 | 22 | 22 | 22 | - | - |
| 100 395 | 24 | 24 | 24 | - | 24 | 24 | ??? | 82 | 24 | 24 | 24 | - | - |
| 100 396 | 20 | 20 | 20 | - | 20 | 20 | ??? | 61 | 20 | 20 | 20 | - | - |
| 100 397 | 25 | 25 | 26 | - | 26 | 26 | 57 | 27 | ??? | 26 | 26 | - | - |
| 100 398 | 25 | 25 | 25 | - | 25 | 25 | ??? | 78 | 25 | 25 | 25 | - | - |
| 100 399 | 23 | 23 | 23 | - | 23 | 23 | ??? | 43 | 23 | 23 | 23 | - | - |
| 100 400 | 24 | 24 | 24 | - | 24 | 24 | 31 | 24 | 24 | 24 | 24 | - | - |
| 100 401 | 15 | 15 | 15 | - | 15 | 15 | ??? | 70 | 15 | 15 | 15 | - | - |
| 100 402 | 15 | 15 | 15 | - | 15 | 15 | ??? | 87 | 15 | 15 | 15 | - | - |
| 100 403 | 14 | 14 | 14 | - | 14 | 14 | 99 | 53 | 14 | 14 | 14 | - | - |
| 100 404 | 15 | 15 | 15 | - | 15 | 15 | 56 | 15 | 15 | 15 | 15 | - | - |
| 100 405 | 13 | 13 | 13 | - | 13 | 13 | 14 | 87 | 13 | 13 | 13 | - | - |
| 100 406 | 14 | 14 | 14 | - | 14 | 14 | 14 | 14 | 14 | 14 | 14 | - | - |
| 100 407 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | 15 | 15 | 15 | - | - |
| 100 408 | 14 | 14 | 14 | - | 14 | 14 | 90 | 94 | 14 | 14 | 14 | - | - |
| 100 409 | 15 | 15 | 15 | - | 15 | 15 | ??? | 26 | 15 | 15 | 15 | - | - |
| 100 410 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 411 | 14 | 14 | 14 | - | 14 | 14 | ??? | 15 | 14 | 14 | 14 | - | - |
| 100 412 | 14 | 14 | 14 | - | 14 | 14 | ??? | 98 | 14 | 14 | 14 | - | - |
| 100 413 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 414 | 14 | 14 | 14 | - | 14 | 14 | 47 | 34 | 14 | 14 | 15 | - | - |
| 100 415 | 13 | 13 | 13 | - | 13 | 13 | 99 | 13 | 13 | 13 | 13 | - | - |
| 100 416 | 14 | 14 | 14 | - | 14 | 14 | 52 | 14 | 14 | 14 | 14 | - | - |

Table 10.11: Result Comparison for SALBP Size 100 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | Direct CPSat | Direct Cplex | MiniZinc Chuffed | MiniZinc CPSat | Alternative CPO | Alternative CPSat | Alternative MiniZinc Chuffed | Alternative MiniZinc Cplex |
|----------|---------|-----------|-----------|-------------|------------|--------------|--------------|------------------|----------------|-----------------|-------------------|------------------------------|----------------------------|
| 100 417 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | 15 | 15 | 15 | - | - |
| 100 418 | 16 | 16 | 16 | - | 16 | 16 | ??? | 16 | 16 | 16 | 16 | - | - |
| 100 419 | 14 | 14 | 14 | - | 14 | 14 | ??? | 15 | 14 | 14 | 14 | - | - |
| 100 420 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 421 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | 14 | 14 | 14 | - | - |
| 100 422 | 15 | 15 | 15 | - | 15 | 15 | ??? | 39 | 72 | 15 | 15 | - | - |
| 100 423 | 14 | 14 | 14 | - | 14 | 14 | ??? | 42 | 91 | 14 | 14 | - | - |
| 100 424 | 14 | 14 | 14 | - | 14 | 14 | ??? | 57 | 71 | 14 | 14 | - | - |
| 100 425 | 15 | 15 | 15 | - | 15 | 15 | ??? | 98 | 57 | 15 | 15 | - | - |
| 100 426 | 58 | 58 | 63 | 61 | 60 | 60 | 74 | 64 | ??? | 60 | 63 | - | - |
| 100 427 | 54 | 54 | 57 | 56 | 56 | 55 | 78 | 59 | ??? | 56 | 58 | - | - |
| 100 428 | 54 | 54 | 57 | 54 | 55 | 55 | 69 | 81 | ??? | 54 | 56 | - | - |
| 100 429 | 57 | 57 | 61 | - | 59 | 58 | 73 | 61 | ??? | 58 | 59 | - | - |
| 100 430 | 52 | 52 | 54 | - | 54 | 53 | 68 | 70 | ??? | 54 | 57 | - | - |
| 100 431 | 52 | 52 | 55 | 54 | 54 | 54 | 68 | 84 | ??? | 54 | 54 | - | - |
| 100 432 | 54 | 54 | 59 | 56 | 56 | 56 | 74 | 66 | ??? | 56 | 57 | - | - |
| 100 433 | 52 | 51 | 54 | 52 | 53 | 52 | 65 | 54 | ??? | 52 | 53 | - | - |
| 100 434 | 55 | 55 | 59 | - | 57 | 56 | 70 | 80 | ??? | 56 | 58 | - | - |
| 100 435 | 52 | 52 | 58 | 56 | 56 | 56 | 69 | 58 | ??? | 56 | 57 | - | - |
| 100 436 | 49 | 49 | 55 | 52 | 52 | 52 | 66 | 91 | ??? | 52 | 52 | - | - |
| 100 437 | 51 | 51 | 56 | 53 | 53 | 53 | 66 | 56 | ??? | 53 | 54 | - | - |
| 100 438 | 52 | 52 | 57 | 55 | 55 | 55 | 66 | 72 | ??? | 55 | 57 | - | - |
| 100 439 | 54 | 54 | 58 | 55 | 56 | 55 | 79 | 58 | ??? | 55 | 55 | - | - |
| 100 440 | 51 | 51 | 55 | 54 | 53 | 53 | 63 | 80 | ??? | 53 | 54 | - | - |
| 100 441 | 51 | 51 | 54 | 53 | 53 | 52 | 66 | 61 | ??? | 52 | 53 | - | - |
| 100 442 | 49 | 48 | 56 | - | 53 | 52 | 68 | 53 | ??? | 52 | 54 | - | - |
| 100 443 | 53 | 53 | 58 | 56 | 56 | 55 | 66 | 56 | ??? | 56 | 57 | - | - |
| 100 444 | 51 | 51 | 56 | 53 | 54 | 54 | 99 | 56 | ??? | 53 | 55 | - | - |
| 100 445 | 54 | 54 | 57 | 56 | 55 | 55 | 65 | 56 | ??? | 55 | 57 | - | - |
| 100 446 | 54 | 54 | 57 | 56 | 57 | 57 | 73 | 58 | ??? | 56 | 57 | - | - |
| 100 447 | 52 | 52 | 55 | 54 | 54 | 54 | 64 | 63 | ??? | 54 | 55 | - | - |
| 100 448 | 54 | 54 | 60 | 56 | 56 | 55 | 84 | 58 | ??? | 55 | 57 | - | - |
| 100 449 | 52 | 52 | 57 | - | 56 | 55 | 71 | 56 | ??? | 55 | 56 | - | - |
| 100 450 | 53 | 53 | 53 | - | 54 | 53 | 68 | 56 | ??? | 54 | 55 | - | - |
| 100 451 | 26 | 26 | 26 | - | 26 | 26 | 30 | 26 | ??? | 26 | 26 | - | - |
| 100 452 | 22 | 22 | 22 | - | 22 | 22 | 24 | 22 | ??? | 22 | 22 | - | - |
| 100 453 | 24 | 24 | 24 | - | 24 | 24 | ??? | 24 | ??? | 24 | 24 | - | - |
| 100 454 | 23 | 23 | 23 | - | 23 | 23 | ??? | 23 | ??? | 23 | 23 | - | - |
| 100 455 | 23 | 23 | 23 | - | 23 | 23 | ??? | 23 | ??? | 23 | 23 | - | - |
| 100 456 | 26 | 26 | 26 | - | 26 | 26 | 29 | 26 | ??? | 26 | 26 | - | - |
| 100 457 | 23 | 23 | 23 | - | 23 | 23 | ??? | 23 | ??? | 23 | 23 | - | - |
| 100 458 | 24 | 24 | 24 | - | 24 | 24 | ??? | 24 | ??? | 24 | 24 | - | - |
| 100 459 | 23 | 23 | 23 | - | 23 | 23 | ??? | 23 | ??? | 23 | 23 | - | - |
| 100 460 | 23 | 23 | 23 | - | 23 | 23 | 26 | 23 | ??? | 23 | 23 | - | - |
| 100 461 | 23 | 23 | 23 | - | 23 | 23 | 31 | 23 | ??? | 23 | 23 | - | - |
| 100 462 | 23 | 23 | 23 | - | 23 | 23 | ??? | 23 | ??? | 23 | 23 | - | - |
| 100 463 | 26 | 26 | 26 | - | 26 | 26 | 28 | 26 | ??? | 26 | 26 | - | - |
| 100 464 | 25 | 25 | 25 | - | 25 | 25 | 31 | 25 | ??? | 25 | 25 | - | - |
| 100 465 | 22 | 22 | 22 | - | 22 | 22 | 30 | 22 | ??? | 22 | 22 | - | - |
| 100 466 | 26 | 26 | 26 | - | 26 | 26 | 39 | 26 | ??? | 26 | 26 | - | - |
| 100 467 | 21 | 21 | 21 | - | 21 | 21 | ??? | 21 | ??? | 21 | 21 | - | - |
| 100 468 | 25 | 25 | 25 | - | 25 | 25 | 32 | 25 | ??? | 25 | 25 | - | - |
| 100 469 | 22 | 22 | 22 | - | 22 | 22 | 24 | 22 | ??? | 22 | 22 | - | - |
| 100 470 | 26 | 26 | 26 | - | 26 | 26 | ??? | 26 | ??? | 26 | 26 | - | - |
| 100 471 | 26 | 26 | 26 | - | 26 | 26 | 88 | 26 | ??? | 26 | 26 | - | - |
| 100 472 | 23 | 23 | 23 | - | 23 | 23 | 32 | 23 | ??? | 23 | 23 | - | - |
| 100 473 | 28 | 28 | 28 | - | 28 | 28 | ??? | 28 | ??? | 28 | 28 | - | - |
| 100 474 | 23 | 23 | 23 | - | 23 | 23 | 25 | 23 | ??? | 23 | 23 | - | - |
| 100 475 | 24 | 24 | 24 | - | 24 | 24 | ??? | 24 | ??? | 24 | 24 | - | - |
| 100 476 | 14 | 14 | 14 | - | 14 | 14 | 15 | 14 | ??? | 14 | 14 | - | - |
| 100 477 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | ??? | 14 | 14 | - | - |
| 100 478 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | ??? | 14 | 14 | - | - |
| 100 479 | 16 | 16 | 16 | - | 16 | 16 | ??? | 16 | ??? | 16 | 16 | - | - |
| 100 480 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | ??? | 15 | 15 | - | - |
| 100 481 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | ??? | 15 | 15 | - | - |
| 100 482 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | ??? | 15 | 15 | - | - |
| 100 483 | 14 | 14 | 14 | - | 14 | 14 | 26 | 14 | ??? | 14 | 14 | - | - |
| 100 484 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | ??? | 14 | 14 | - | - |
| 100 485 | 16 | 16 | 16 | - | 16 | 16 | 20 | 16 | ??? | 16 | 16 | - | - |
| 100 486 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | ??? | 15 | 15 | - | - |
| 100 487 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | ??? | 15 | 15 | - | - |
| 100 488 | 16 | 16 | 16 | - | 16 | 16 | ??? | 16 | ??? | 16 | 16 | - | - |
| 100 489 | 13 | 13 | 13 | - | 13 | 13 | 33 | 13 | ??? | 13 | 13 | - | - |
| 100 490 | 15 | 15 | 15 | - | 15 | 15 | ??? | 15 | ??? | 15 | 15 | - | - |
| 100 491 | 16 | 16 | 16 | - | 16 | 16 | 28 | 16 | ??? | 16 | 16 | - | - |
| 100 492 | 14 | 14 | 14 | - | 14 | 14 | 95 | 14 | ??? | 14 | 14 | - | - |
| 100 493 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | ??? | 14 | 14 | - | - |
| 100 494 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | ??? | 14 | 14 | - | - |
| 100 495 | 15 | 15 | 15 | - | 15 | 15 | 18 | 15 | ??? | 15 | 15 | - | - |
| 100 496 | 14 | 14 | 14 | - | 14 | 14 | 24 | 14 | ??? | 14 | 14 | - | - |
| 100 497 | 13 | 13 | 13 | - | 13 | 13 | 64 | 13 | ??? | 13 | 13 | - | - |
| 100 498 | 14 | 14 | 14 | - | 14 | 14 | ??? | 14 | ??? | 14 | 14 | - | - |
| 100 499 | 14 | 14 | 14 | - | 14 | 14 | 25 | 14 | ??? | 14 | 14 | - | - |
| 100 500 | 14 | 14 | 14 | - | 14 | 14 | 17 | 14 | ??? | 14 | 14 | - | - |
| 100 501 | 62 | 58 | 63 | 62 | 63 | 62 | 67 | 62 | ??? | 62 | 63 | - | - |
| 100 502 | 64 | 60 | 67 | - | 64 | 64 | 69 | 64 | ??? | 64 | 67 | - | - |
| 100 503 | 60 | 55 | 62 | 60 | 60 | 60 | 65 | 60 | ??? | 60 | 61 | - | - |
| 100 504 | 60 | 55 | 62 | - | 60 | 60 | 64 | 60 | ??? | 60 | 60 | - | - |
| 100 505 | 61 | 55 | 62 | - | 61 | 61 | 63 | 61 | ??? | 61 | 62 | - | - |
| 100 506 | 57 | 54 | 58 | - | 58 | 57 | 64 | 57 | ??? | 57 | 59 | - | - |
| 100 507 | 59 | 55 | 60 | - | 59 | 59 | 62 | 59 | ??? | 59 | 59 | - | - |
| 100 508 | 56 | 53 | 56 | - | 56 | 56 | 61 | 56 | ??? | 56 | 56 | - | - |
| 100 509 | 57 | 53 | 60 | 58 | 57 | 57 | 63 | 57 | ??? | 57 | 58 | - | - |
| 100 510 | 58 | 54 | 60 | - | 58 | 58 | 63 | 58 | ??? | 58 | 58 | - | - |

Table 10.11: Result Comparison for SALBP Size 100 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|-----------|-------------|------------|-------|-------|-------------------------|-------|-----------------|-------|------------------------------|-------|
| 100 511 | 59 | 56 | 59 | - | 60 | 59 | 61 | 59 | 59 | 59 | 60 | - | - |
| 100 512 | 60 | 57 | 61 | 60 | 60 | 60 | 66 | 60 | 60 | 60 | 60 | - | - |
| 100 513 | 62 | 55 | 63 | 62 | 62 | 62 | 64 | 62 | 62 | 62 | 64 | - | - |
| 100 514 | 58 | 54 | 60 | - | 58 | 58 | 66 | 58 | 58 | 58 | 58 | - | - |
| 100 515 | 61 | 56 | 63 | 61 | 61 | 61 | 65 | 61 | 61 | 61 | 63 | - | - |
| 100 516 | 70 | 67 | 70 | - | 70 | 70 | 78 | 70 | 70 | 70 | 70 | - | - |
| 100 517 | 62 | 57 | 62 | - | 62 | 62 | 64 | 62 | 62 | 62 | 62 | - | - |
| 100 518 | 57 | 51 | 58 | 57 | 57 | 57 | 67 | 57 | 57 | 57 | 57 | - | - |
| 100 519 | 61 | 57 | 63 | 61 | 61 | 61 | 69 | 61 | 61 | 61 | 63 | - | - |
| 100 520 | 60 | 54 | 62 | 60 | 60 | 60 | 64 | 60 | 60 | 60 | 60 | - | - |
| 100 521 | 70 | 65 | 70 | - | 70 | 70 | 75 | 70 | 70 | 70 | 70 | - | - |
| 100 522 | 59 | 54 | 60 | - | 59 | 59 | 65 | 59 | 59 | 59 | 60 | - | - |
| 100 523 | 55 | 52 | 58 | 55 | 55 | 55 | 61 | 55 | 55 | 55 | 56 | - | - |
| 100 524 | 59 | 53 | 59 | - | 59 | 59 | 68 | 59 | 59 | 59 | 59 | - | - |
| 100 525 | 62 | 55 | 62 | - | 62 | 62 | 66 | 62 | 62 | 62 | 62 | - | - |

10.4 SALBP Results Size 1000

Table 10.12: Result Comparison for SALBP Size 1000 (525 Instances)

| Instance | Best LB | SALOME LB | SALOME UB | Laborie CPO | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|-----------|-------------|------------|-------|-------|-------------------------|-------|-----------------|-------|------------------------------|-------|
| 1000 1 | 135 | 135 | 135 | - | 136 | 136 | - | 1000 | ??? | 136 | 136 | - | - |
| 1000 2 | 137 | 137 | 137 | - | 138 | 138 | - | 999 | ??? | 138 | 138 | - | - |
| 1000 3 | 136 | 136 | 136 | - | 138 | 138 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 4 | 138 | 138 | 138 | - | 139 | 139 | - | 1000 | ??? | 139 | 139 | - | - |
| 1000 5 | 135 | 135 | 135 | - | 136 | 136 | - | 999 | ??? | 136 | 136 | - | - |
| 1000 6 | 141 | 141 | 141 | - | 143 | 143 | - | ??? | ??? | 142 | 142 | - | - |
| 1000 7 | 136 | 136 | 136 | - | 138 | 138 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 8 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 139 | 139 | - | - |
| 1000 9 | 134 | 134 | 134 | - | 136 | 136 | - | ??? | ??? | 135 | 135 | - | - |
| 1000 10 | 140 | 140 | 140 | - | 141 | 141 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 11 | 134 | 134 | 134 | - | 135 | 135 | - | ??? | ??? | 135 | 135 | - | - |
| 1000 12 | 134 | 134 | 134 | - | 135 | 135 | - | 1000 | ??? | 134 | 135 | - | - |
| 1000 13 | 131 | 131 | 131 | - | 132 | 132 | - | 1000 | ??? | 132 | 132 | - | - |
| 1000 14 | 136 | 136 | 136 | - | 138 | 138 | - | 1000 | ??? | 137 | 138 | - | - |
| 1000 15 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 16 | 137 | 137 | 137 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 17 | 135 | 135 | 135 | - | 136 | 136 | - | ??? | ??? | 135 | 136 | - | - |
| 1000 18 | 134 | 134 | 134 | - | 135 | 135 | - | ??? | ??? | 134 | 135 | - | - |
| 1000 19 | 137 | 137 | 137 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 20 | 138 | 138 | 138 | - | 139 | 139 | - | 1000 | ??? | 138 | 139 | - | - |
| 1000 21 | 138 | 138 | 138 | - | 139 | 139 | - | 1000 | ??? | 138 | 139 | - | - |
| 1000 22 | 137 | 137 | 137 | - | 139 | 139 | - | ??? | ??? | 138 | 138 | - | - |
| 1000 23 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 24 | 140 | 140 | 140 | - | 141 | 141 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 25 | 136 | 136 | 136 | - | 137 | 137 | - | 1000 | ??? | 136 | 137 | - | - |
| 1000 26 | 515 | 515 | 532 | - | 555 | 554 | - | ??? | ??? | 541 | 551 | - | - |
| 1000 27 | 516 | 516 | 536 | - | 551 | 554 | - | ??? | ??? | 542 | 548 | - | - |
| 1000 28 | 510 | 510 | 523 | - | 538 | 541 | - | ??? | ??? | 526 | 533 | - | - |
| 1000 29 | 507 | 507 | 524 | - | 542 | 544 | - | ??? | ??? | 530 | 538 | - | - |
| 1000 30 | 528 | 528 | 548 | 547 | 559 | 570 | - | ??? | ??? | 546 | 558 | - | - |
| 1000 31 | 520 | 520 | 536 | - | 555 | 556 | - | ??? | ??? | 539 | 547 | - | - |
| 1000 32 | 507 | 507 | 527 | - | 542 | 554 | - | ??? | ??? | 527 | 535 | - | - |
| 1000 33 | 509 | 509 | 531 | 530 | 548 | 551 | - | ??? | ??? | 528 | 544 | - | - |
| 1000 34 | 534 | 534 | 551 | - | 563 | 575 | - | ??? | ??? | 555 | 561 | - | - |
| 1000 35 | 506 | 506 | 529 | 527 | 544 | 544 | - | ??? | ??? | 528 | 537 | - | - |
| 1000 36 | 502 | 502 | 527 | 522 | 538 | 547 | - | ??? | ??? | 524 | 529 | - | - |
| 1000 37 | 529 | 529 | 547 | - | 559 | 566 | - | ??? | ??? | 550 | 557 | - | - |
| 1000 38 | 519 | 519 | 546 | 542 | 557 | 564 | - | ??? | ??? | 545 | 552 | - | - |
| 1000 39 | 520 | 520 | 539 | - | 560 | 565 | - | ??? | ??? | 545 | 550 | - | - |
| 1000 40 | 504 | 504 | 520 | - | 531 | 529 | - | ??? | ??? | 519 | 522 | - | - |
| 1000 41 | 505 | 505 | 525 | - | 543 | 555 | - | 1000 | ??? | 527 | 536 | - | - |
| 1000 42 | 499 | 499 | 524 | 517 | 533 | 534 | - | ??? | ??? | 518 | 525 | - | - |
| 1000 43 | 504 | 504 | 533 | 524 | 534 | 541 | - | ??? | ??? | 524 | 526 | - | - |
| 1000 44 | 508 | 508 | 525 | - | 550 | 554 | - | 1000 | ??? | 543 | 547 | - | - |
| 1000 45 | 493 | 493 | 512 | 511 | 524 | 534 | - | ??? | ??? | 509 | 517 | - | - |
| 1000 46 | 499 | 499 | 521 | - | 538 | 545 | - | ??? | ??? | 526 | 532 | - | - |
| 1000 47 | 507 | 507 | 528 | 526 | 542 | 547 | - | ??? | ??? | 526 | 533 | - | - |
| 1000 48 | 530 | 530 | 549 | - | 565 | 573 | - | ??? | ??? | 553 | 563 | - | - |
| 1000 49 | 507 | 507 | 525 | - | 544 | 546 | - | ??? | ??? | 529 | 539 | - | - |
| 1000 50 | 493 | 493 | 513 | - | 526 | 535 | - | ??? | ??? | 512 | 519 | - | - |
| 1000 51 | 226 | 226 | 228 | - | 229 | 230 | - | ??? | ??? | 228 | 229 | - | - |
| 1000 52 | 228 | 228 | 229 | - | 231 | 232 | - | 999 | ??? | 230 | 230 | - | - |
| 1000 53 | 227 | 227 | 229 | - | 230 | 231 | - | ??? | ??? | 228 | 229 | - | - |
| 1000 54 | 219 | 219 | 221 | - | 223 | 223 | - | ??? | ??? | 221 | 222 | - | - |
| 1000 55 | 217 | 217 | 218 | - | 220 | 221 | - | ??? | ??? | 218 | 219 | - | - |
| 1000 56 | 228 | 228 | 229 | - | 232 | 231 | - | ??? | ??? | 229 | 230 | - | - |
| 1000 57 | 224 | 224 | 226 | 225 | 227 | 227 | - | ??? | ??? | 225 | 226 | - | - |
| 1000 58 | 224 | 224 | 225 | - | 227 | 227 | - | ??? | ??? | 225 | 226 | - | - |
| 1000 59 | 223 | 223 | 224 | - | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 60 | 230 | 230 | 232 | - | 233 | 234 | - | ??? | ??? | 232 | 232 | - | - |
| 1000 61 | 229 | 229 | 231 | - | 233 | 233 | - | ??? | ??? | 231 | 232 | - | - |
| 1000 62 | 223 | 223 | 225 | - | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 63 | 227 | 227 | 229 | 228 | 230 | 230 | - | ??? | ??? | 228 | 229 | - | - |

Table 10.12: Result Comparison for SALBP Size 1000 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Direct MiniZinc Cplex | Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|-----|-------------|------------|-------|-----------------------|---------|-------|-----------------|-------|------------------------------|-------|
| 1000 64 | 229 | 229 | 229 | - | 233 | 233 | - | ??? | ??? | 231 | 232 | - | - |
| 1000 65 | 225 | 225 | 226 | - | 227 | 228 | - | ??? | ??? | 226 | 227 | - | - |
| 1000 66 | 227 | 227 | 227 | - | 230 | 230 | - | ??? | ??? | 229 | 229 | - | - |
| 1000 67 | 223 | 223 | 224 | - | 226 | 227 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 68 | 226 | 226 | 228 | - | 230 | 231 | - | ??? | ??? | 228 | 229 | - | - |
| 1000 69 | 224 | 224 | 224 | - | 227 | 227 | - | ??? | ??? | 225 | 226 | - | - |
| 1000 70 | 228 | 228 | 230 | 229 | 231 | 232 | - | 1000 | ??? | 230 | 230 | - | - |
| 1000 71 | 230 | 230 | 232 | 231 | 233 | 233 | - | ??? | ??? | 231 | 232 | - | - |
| 1000 72 | 222 | 222 | 223 | - | 225 | 226 | - | ??? | ??? | 223 | 224 | - | - |
| 1000 73 | 221 | 221 | 223 | 222 | 224 | 225 | - | ??? | ??? | 222 | 223 | - | - |
| 1000 74 | 227 | 227 | 229 | - | 231 | 231 | - | ??? | ??? | 228 | 229 | - | - |
| 1000 75 | 227 | 227 | 229 | - | 230 | 231 | - | ??? | ??? | 229 | 229 | - | - |
| 1000 76 | 136 | 136 | 136 | - | 137 | 138 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 77 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 78 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 79 | 142 | 142 | 142 | - | 143 | 143 | - | 1000 | ??? | 142 | 143 | - | - |
| 1000 80 | 140 | 140 | 140 | - | 141 | 141 | - | ??? | ??? | 141 | 141 | - | - |
| 1000 81 | 136 | 136 | 136 | - | 138 | 137 | - | 1000 | ??? | 137 | 137 | - | - |
| 1000 82 | 136 | 136 | 136 | - | 137 | 137 | - | 1000 | ??? | 136 | 137 | - | - |
| 1000 83 | 140 | 140 | 140 | - | 141 | 141 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 84 | 135 | 135 | 135 | - | 136 | 136 | - | ??? | ??? | 135 | 136 | - | - |
| 1000 85 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 86 | 138 | 138 | 138 | - | 139 | 139 | - | ??? | ??? | 139 | 139 | - | - |
| 1000 87 | 140 | 140 | 140 | - | 142 | 142 | - | ??? | ??? | 141 | 141 | - | - |
| 1000 88 | 140 | 140 | 140 | - | 142 | 142 | - | ??? | ??? | 141 | 141 | - | - |
| 1000 89 | 140 | 140 | 140 | - | 141 | 141 | - | 1000 | ??? | 141 | 141 | - | - |
| 1000 90 | 138 | 138 | 138 | - | 139 | 139 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 91 | 141 | 141 | 141 | - | 142 | 142 | - | ??? | ??? | 141 | 142 | - | - |
| 1000 92 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 93 | 137 | 137 | 137 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 94 | 137 | 137 | 137 | - | 139 | 139 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 95 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 96 | 137 | 137 | 137 | - | 139 | 139 | - | ??? | ??? | 138 | 138 | - | - |
| 1000 97 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 139 | 139 | - | - |
| 1000 98 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 99 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 100 | 137 | 137 | 137 | - | 139 | 139 | - | 1000 | ??? | 138 | 138 | - | - |
| 1000 101 | 515 | 515 | 550 | 545 | 558 | 554 | - | ??? | ??? | 552 | 554 | - | - |
| 1000 102 | 522 | 522 | 551 | 548 | 556 | 556 | - | ??? | ??? | 549 | 557 | - | - |
| 1000 103 | 522 | 522 | 556 | 555 | 562 | 560 | - | ??? | ??? | 556 | 560 | - | - |
| 1000 104 | 515 | 515 | 555 | 539 | 553 | 550 | - | ??? | ??? | 544 | 549 | - | - |
| 1000 105 | 510 | 510 | 541 | 540 | 548 | 545 | - | ??? | ??? | 536 | 549 | - | - |
| 1000 106 | 526 | 526 | 557 | 546 | 556 | 552 | - | ??? | ??? | 545 | 554 | - | - |
| 1000 107 | 501 | 501 | 539 | 533 | 540 | 540 | - | ??? | ??? | 531 | 540 | - | - |
| 1000 108 | 508 | 508 | 553 | 540 | 545 | 543 | - | ??? | ??? | 538 | 546 | - | - |
| 1000 109 | 513 | 513 | 556 | 543 | 549 | 546 | - | ??? | ??? | 541 | 546 | - | - |
| 1000 110 | 516 | 516 | 555 | 547 | 555 | 557 | - | ??? | ??? | 548 | 560 | - | - |
| 1000 111 | 509 | 509 | 541 | 537 | 546 | 544 | - | ??? | ??? | 536 | 546 | - | - |
| 1000 112 | 509 | 509 | 550 | 543 | 548 | 549 | - | ??? | ??? | 542 | 548 | - | - |
| 1000 113 | 496 | 496 | 549 | 535 | 540 | 537 | - | ??? | ??? | 533 | 543 | - | - |
| 1000 114 | 512 | 512 | 553 | 540 | 550 | 548 | - | ??? | ??? | 539 | 548 | - | - |
| 1000 115 | 503 | 503 | 550 | 534 | 539 | 541 | - | ??? | ??? | 533 | 543 | - | - |
| 1000 116 | 499 | 499 | 542 | 534 | 545 | 543 | - | ??? | ??? | 536 | 541 | - | - |
| 1000 117 | 512 | 512 | 550 | 544 | 552 | 548 | - | ??? | ??? | 542 | 551 | - | - |
| 1000 118 | 524 | 524 | 570 | 556 | 563 | 564 | - | ??? | ??? | 556 | 563 | - | - |
| 1000 119 | 501 | 501 | 538 | 525 | 529 | 534 | - | ??? | ??? | 525 | 527 | - | - |
| 1000 120 | 518 | 518 | 561 | 543 | 549 | 549 | - | ??? | ??? | 541 | 546 | - | - |
| 1000 121 | 496 | 496 | 536 | 532 | 541 | 543 | - | ??? | ??? | 533 | 543 | - | - |
| 1000 122 | 493 | 493 | 528 | 523 | 535 | 533 | - | ??? | ??? | 524 | 536 | - | - |
| 1000 123 | 513 | 513 | 548 | 545 | 555 | 556 | - | ??? | ??? | 545 | 558 | - | - |
| 1000 124 | 504 | 504 | 541 | 536 | 543 | 543 | - | ??? | ??? | 533 | 541 | - | - |
| 1000 125 | 507 | 507 | 546 | 535 | 545 | 545 | - | ??? | ??? | 537 | 543 | - | - |
| 1000 126 | 228 | 228 | 231 | 230 | 232 | 232 | - | 1000 | ??? | 231 | 231 | - | - |
| 1000 127 | 221 | 221 | 223 | - | 224 | 224 | - | ??? | ??? | 222 | 223 | - | - |
| 1000 128 | 222 | 222 | 225 | 224 | 225 | 225 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 129 | 223 | 223 | 223 | - | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 130 | 221 | 221 | 223 | - | 225 | 225 | - | ??? | ??? | 223 | 224 | - | - |
| 1000 131 | 220 | 220 | 220 | - | 223 | 224 | - | ??? | ??? | 222 | 223 | - | - |
| 1000 132 | 214 | 214 | 217 | 216 | 218 | 218 | - | ??? | ??? | 216 | 218 | - | - |
| 1000 133 | 226 | 226 | 227 | - | 229 | 229 | - | 1000 | ??? | 228 | 229 | - | - |
| 1000 134 | 215 | 215 | 215 | - | 219 | 219 | - | ??? | ??? | 217 | 218 | - | - |
| 1000 135 | 225 | 225 | 228 | 227 | 229 | 229 | - | ??? | ??? | 227 | 228 | - | - |
| 1000 136 | 228 | 228 | 230 | - | 232 | 232 | - | 1000 | ??? | 230 | 231 | - | - |
| 1000 137 | 213 | 213 | 215 | - | 216 | 216 | - | ??? | ??? | 215 | 215 | - | - |
| 1000 138 | 221 | 221 | 224 | 223 | 225 | 225 | - | ??? | ??? | 223 | 224 | - | - |
| 1000 139 | 224 | 224 | 227 | 226 | 227 | 228 | - | ??? | ??? | 226 | 227 | - | - |
| 1000 140 | 226 | 226 | 228 | - | 230 | 230 | - | ??? | ??? | 228 | 228 | - | - |
| 1000 141 | 215 | 215 | 219 | 217 | 218 | 219 | - | ??? | ??? | 217 | 218 | - | - |
| 1000 142 | 220 | 220 | 223 | 222 | 223 | 224 | - | ??? | ??? | 222 | 223 | - | - |
| 1000 143 | 213 | 213 | 216 | 215 | 216 | 217 | - | 999 | ??? | 215 | 216 | - | - |
| 1000 144 | 217 | 217 | 220 | 219 | 221 | 220 | - | ??? | ??? | 219 | 220 | - | - |
| 1000 145 | 220 | 220 | 223 | 222 | 223 | 223 | - | ??? | ??? | 222 | 222 | - | - |
| 1000 146 | 219 | 219 | 222 | - | 223 | 223 | - | ??? | ??? | 221 | 222 | - | - |
| 1000 147 | 229 | 229 | 232 | - | 234 | 233 | - | ??? | ??? | 232 | 233 | - | - |
| 1000 148 | 219 | 219 | 219 | - | 223 | 223 | - | ??? | ??? | 221 | 222 | - | - |
| 1000 149 | 237 | 237 | 240 | 239 | 241 | 241 | - | ??? | ??? | 239 | 239 | - | - |
| 1000 150 | 222 | 222 | 225 | 224 | 225 | 225 | - | ??? | ??? | 224 | 224 | - | - |
| 1000 151 | 138 | 138 | 138 | - | 140 | 140 | - | 1000 | ??? | 139 | 139 | - | - |
| 1000 152 | 136 | 136 | 136 | - | 138 | 138 | - | 992 | ??? | 137 | 138 | - | - |
| 1000 153 | 137 | 137 | 137 | - | 139 | 139 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 154 | 140 | 140 | 140 | - | 142 | 142 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 155 | 139 | 139 | 139 | - | 141 | 141 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 156 | 141 | 141 | 141 | - | 143 | 143 | - | 1000 | ??? | 142 | 142 | - | - |
| 1000 157 | 140 | 140 | 140 | - | 141 | 142 | - | 999 | ??? | 141 | 141 | - | - |

Table 10.12: Result Comparison for SALBP Size 1000 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Direct MiniZinc Cplex | Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|-----|-------------|------------|-------|-----------------------|---------|-------|-----------------|-------|------------------------------|-------|
| 1000 158 | 136 | 136 | 136 | - | 137 | 137 | - | 999 | ??? | 136 | 137 | - | - |
| 1000 159 | 138 | 138 | 138 | - | 140 | 139 | - | ??? | ??? | 139 | 139 | - | - |
| 1000 160 | 138 | 138 | 138 | - | 140 | 140 | - | 1000 | ??? | 139 | 140 | - | - |
| 1000 161 | 133 | 133 | 133 | - | 134 | 134 | - | 1000 | ??? | 133 | 134 | - | - |
| 1000 162 | 136 | 136 | 136 | - | 137 | 137 | - | 1000 | ??? | 136 | 137 | - | - |
| 1000 163 | 139 | 139 | 139 | - | 141 | 141 | - | 1000 | ??? | 140 | 140 | - | - |
| 1000 164 | 141 | 141 | 141 | - | 143 | 143 | - | ??? | ??? | 142 | 143 | - | - |
| 1000 165 | 135 | 135 | 135 | - | 137 | 137 | - | 999 | ??? | 136 | 137 | - | - |
| 1000 166 | 139 | 139 | 139 | - | 141 | 141 | - | 1000 | ??? | 140 | 141 | - | - |
| 1000 167 | 139 | 139 | 139 | - | 141 | 140 | - | 1000 | ??? | 140 | 141 | - | - |
| 1000 168 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 169 | 134 | 134 | 134 | - | 136 | 136 | - | ??? | ??? | 135 | 135 | - | - |
| 1000 170 | 134 | 134 | 134 | - | 136 | 136 | - | 1000 | ??? | 135 | 136 | - | - |
| 1000 171 | 137 | 137 | 137 | - | 139 | 138 | - | 1000 | ??? | 138 | 138 | - | - |
| 1000 172 | 135 | 135 | 135 | - | 136 | 136 | - | ??? | ??? | 136 | 136 | - | - |
| 1000 173 | 135 | 135 | 135 | - | 137 | 136 | - | 1000 | ??? | 136 | 136 | - | - |
| 1000 174 | 136 | 136 | 136 | - | 138 | 137 | - | 1000 | ??? | 137 | 137 | - | - |
| 1000 175 | 138 | 138 | 138 | - | 140 | 140 | - | 1000 | ??? | 139 | 140 | - | - |
| 1000 176 | 507 | 507 | 529 | - | 557 | 562 | - | 1000 | ??? | 538 | 561 | - | - |
| 1000 177 | 505 | 505 | 528 | - | 552 | 563 | - | ??? | ??? | 532 | 546 | - | - |
| 1000 178 | 521 | 521 | 547 | 545 | 566 | 567 | - | ??? | ??? | 553 | 562 | - | - |
| 1000 179 | 516 | 516 | 546 | - | 564 | 571 | - | ??? | ??? | 544 | 561 | - | - |
| 1000 180 | 522 | 522 | 544 | - | 559 | 567 | - | ??? | ??? | 554 | 563 | - | - |
| 1000 181 | 515 | 515 | 553 | 547 | 561 | 567 | - | ??? | ??? | 549 | 566 | - | - |
| 1000 182 | 513 | 513 | 538 | - | 557 | 565 | - | ??? | ??? | 543 | 561 | - | - |
| 1000 183 | 510 | 510 | 534 | - | 552 | 554 | - | 999 | ??? | 539 | 551 | - | - |
| 1000 184 | 510 | 510 | 540 | - | 559 | 561 | - | ??? | ??? | 546 | 560 | - | - |
| 1000 185 | 512 | 512 | 540 | - | 560 | 557 | - | ??? | ??? | 545 | 555 | - | - |
| 1000 186 | 505 | 505 | 533 | - | 552 | 562 | - | ??? | ??? | 536 | 552 | - | - |
| 1000 187 | 520 | 520 | 556 | 551 | 565 | 565 | - | ??? | ??? | 553 | 565 | - | - |
| 1000 188 | 504 | 504 | 527 | - | 552 | 555 | - | ??? | ??? | 538 | 552 | - | - |
| 1000 189 | 501 | 501 | 534 | - | 552 | 555 | - | ??? | ??? | 533 | 551 | - | - |
| 1000 190 | 512 | 512 | 535 | - | 556 | 563 | - | ??? | ??? | 543 | 552 | - | - |
| 1000 191 | 510 | 510 | 541 | 538 | 553 | 560 | - | 1000 | ??? | 542 | 553 | - | - |
| 1000 192 | 507 | 507 | 530 | - | 556 | 563 | - | 1000 | ??? | 539 | 558 | - | - |
| 1000 193 | 511 | 511 | 535 | - | 559 | 568 | - | ??? | ??? | 542 | 565 | - | - |
| 1000 194 | 508 | 508 | 532 | - | 560 | 568 | - | 1000 | ??? | 540 | 556 | - | - |
| 1000 195 | 517 | 517 | 538 | - | 562 | 568 | - | 1000 | ??? | 553 | 564 | - | - |
| 1000 196 | 515 | 515 | 537 | - | 559 | 560 | - | 1000 | ??? | 545 | 559 | - | - |
| 1000 197 | 499 | 499 | 524 | - | 546 | 546 | - | ??? | ??? | 523 | 542 | - | - |
| 1000 198 | 515 | 515 | 544 | - | 562 | 567 | - | ??? | ??? | 548 | 567 | - | - |
| 1000 199 | 497 | 497 | 525 | 520 | 541 | 547 | - | ??? | ??? | 527 | 541 | - | - |
| 1000 200 | 500 | 500 | 537 | 529 | 550 | 556 | - | ??? | ??? | 529 | 546 | - | - |
| 1000 201 | 229 | 229 | 231 | - | 233 | 233 | - | 1000 | ??? | 231 | 232 | - | - |
| 1000 202 | 225 | 225 | 225 | - | 230 | 230 | - | 1000 | ??? | 228 | 229 | - | - |
| 1000 203 | 229 | 229 | 232 | 231 | 234 | 234 | - | 1000 | ??? | 232 | 233 | - | - |
| 1000 204 | 228 | 228 | 230 | - | 233 | 232 | - | 1000 | ??? | 231 | 232 | - | - |
| 1000 205 | 229 | 229 | 231 | - | 234 | 234 | - | 1000 | ??? | 231 | 233 | - | - |
| 1000 206 | 229 | 229 | 230 | - | 233 | 233 | - | 1000 | ??? | 231 | 233 | - | - |
| 1000 207 | 230 | 230 | 230 | - | 234 | 235 | - | ??? | ??? | 232 | 233 | - | - |
| 1000 208 | 229 | 229 | 231 | - | 234 | 234 | - | ??? | ??? | 232 | 233 | - | - |
| 1000 209 | 228 | 228 | 228 | - | 233 | 232 | - | ??? | ??? | 230 | 232 | - | - |
| 1000 210 | 224 | 224 | 224 | - | 229 | 229 | - | 1000 | ??? | 226 | 227 | - | - |
| 1000 211 | 219 | 219 | 221 | - | 223 | 224 | - | ??? | ??? | 221 | 223 | - | - |
| 1000 212 | 217 | 217 | 219 | - | 221 | 221 | - | ??? | ??? | 219 | 220 | - | - |
| 1000 213 | 233 | 233 | 236 | - | 238 | 238 | - | ??? | ??? | 236 | 238 | - | - |
| 1000 214 | 225 | 225 | 226 | - | 230 | 230 | - | ??? | ??? | 227 | 228 | - | - |
| 1000 215 | 223 | 223 | 224 | - | 227 | 227 | - | ??? | ??? | 225 | 227 | - | - |
| 1000 216 | 221 | 221 | 222 | - | 225 | 225 | - | 999 | ??? | 222 | 224 | - | - |
| 1000 217 | 225 | 225 | 227 | - | 229 | 229 | - | 1000 | ??? | 227 | 229 | - | - |
| 1000 218 | 219 | 219 | 221 | - | 223 | 223 | - | ??? | ??? | 221 | 222 | - | - |
| 1000 219 | 232 | 232 | 233 | - | 236 | 237 | - | 1000 | ??? | 234 | 235 | - | - |
| 1000 220 | 225 | 225 | 227 | - | 229 | 229 | - | 999 | ??? | 227 | 228 | - | - |
| 1000 221 | 231 | 231 | 233 | - | 236 | 236 | - | 1000 | ??? | 233 | 235 | - | - |
| 1000 222 | 221 | 221 | 222 | - | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 223 | 221 | 221 | 222 | - | 226 | 226 | - | ??? | ??? | 223 | 225 | - | - |
| 1000 224 | 226 | 226 | 227 | - | 231 | 231 | - | ??? | ??? | 229 | 230 | - | - |
| 1000 225 | 229 | 229 | 231 | - | 234 | 234 | - | ??? | ??? | 231 | 233 | - | - |
| 1000 226 | 136 | 136 | 136 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 227 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 228 | 133 | 133 | 133 | - | 135 | 135 | - | ??? | ??? | 134 | 135 | - | - |
| 1000 229 | 134 | 134 | 134 | - | 136 | 136 | - | ??? | ??? | 135 | 136 | - | - |
| 1000 230 | 131 | 131 | 131 | - | 134 | 133 | - | ??? | ??? | 132 | 133 | - | - |
| 1000 231 | 138 | 138 | 138 | - | 141 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 232 | 133 | 133 | 133 | - | 135 | 135 | - | ??? | ??? | 134 | 135 | - | - |
| 1000 233 | 135 | 135 | 135 | - | 138 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 234 | 137 | 137 | 137 | - | 139 | 139 | - | 1000 | ??? | 138 | 139 | - | - |
| 1000 235 | 133 | 133 | 133 | - | 134 | 134 | - | ??? | ??? | 134 | 135 | - | - |
| 1000 236 | 136 | 136 | 136 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 237 | 138 | 138 | 138 | - | 141 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 238 | 138 | 138 | 138 | - | 140 | 139 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 239 | 135 | 135 | 135 | - | 137 | 136 | - | ??? | ??? | 136 | 136 | - | - |
| 1000 240 | 135 | 135 | 135 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 241 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 242 | 135 | 135 | 135 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 243 | 137 | 137 | 137 | - | 139 | 139 | - | 1000 | ??? | 138 | 139 | - | - |
| 1000 244 | 137 | 137 | 137 | - | 139 | 138 | - | ??? | ??? | 138 | 138 | - | - |
| 1000 245 | 135 | 135 | 135 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 246 | 135 | 135 | 135 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 247 | 138 | 138 | 138 | - | 141 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 248 | 138 | 138 | 138 | - | 141 | 141 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 249 | 138 | 138 | 138 | - | 141 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 250 | 140 | 140 | 140 | - | 142 | 142 | - | ??? | ??? | 141 | 142 | - | - |
| 1000 251 | 516 | 516 | 557 | - | 568 | 577 | - | ??? | ??? | 558 | 591 | - | - |

Table 10.12: Result Comparison for SALBP Size 1000 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Direct MiniZinc Cplex | Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|-----|-------------|------------|-------|-----------------------|---------|-------|-----------------|-------|------------------------------|-------|
| 1000 252 | 512 | 512 | 558 | 556 | 567 | 569 | - | ??? | ??? | 560 | 577 | - | - |
| 1000 253 | 511 | 511 | 557 | 554 | 560 | 577 | - | ??? | ??? | 555 | 575 | - | - |
| 1000 254 | 511 | 511 | 555 | 552 | 563 | 568 | - | ??? | ??? | 550 | 568 | - | - |
| 1000 255 | 504 | 504 | 546 | - | 551 | 556 | - | ??? | ??? | 547 | 564 | - | - |
| 1000 256 | 496 | 496 | 546 | 542 | 558 | 561 | - | ??? | ??? | 542 | 565 | - | - |
| 1000 257 | 517 | 517 | 558 | 556 | 566 | 571 | - | ??? | ??? | 559 | 580 | - | - |
| 1000 258 | 502 | 502 | 549 | 545 | 557 | 562 | - | ??? | ??? | 556 | 569 | - | - |
| 1000 259 | 498 | 498 | 544 | 542 | 557 | 561 | - | ??? | ??? | 545 | 562 | - | - |
| 1000 260 | 495 | 495 | 542 | 538 | 556 | 556 | - | ??? | ??? | 547 | 566 | - | - |
| 1000 261 | 509 | 509 | 548 | - | 564 | 566 | - | ??? | ??? | 553 | 569 | - | - |
| 1000 262 | 501 | 501 | 538 | 532 | 544 | 554 | - | ??? | ??? | 534 | 556 | - | - |
| 1000 263 | 514 | 514 | 545 | - | 561 | 564 | - | ??? | ??? | 553 | 568 | - | - |
| 1000 264 | 500 | 500 | 551 | 544 | 557 | 560 | - | ??? | ??? | 546 | 574 | - | - |
| 1000 265 | 527 | 527 | 568 | 567 | 579 | 580 | - | ??? | ??? | 570 | 594 | - | - |
| 1000 266 | 507 | 507 | 543 | - | 562 | 560 | - | ??? | ??? | 554 | 564 | - | - |
| 1000 267 | 519 | 519 | 566 | 559 | 571 | 584 | - | ??? | ??? | 560 | 585 | - | - |
| 1000 268 | 504 | 504 | 537 | - | 554 | 558 | - | ??? | ??? | 544 | 562 | - | - |
| 1000 269 | 503 | 503 | 553 | 547 | 558 | 564 | - | ??? | ??? | 549 | 571 | - | - |
| 1000 270 | 532 | 532 | 570 | - | 581 | 590 | - | ??? | ??? | 578 | 601 | - | - |
| 1000 271 | 501 | 501 | 545 | 536 | 553 | 555 | - | ??? | ??? | 543 | 562 | - | - |
| 1000 272 | 516 | 516 | 554 | - | 567 | 577 | - | ??? | ??? | 558 | 575 | - | - |
| 1000 273 | 512 | 512 | 550 | - | 563 | 566 | - | ??? | ??? | 552 | 575 | - | - |
| 1000 274 | 507 | 507 | 551 | - | 559 | 566 | - | ??? | ??? | 554 | 574 | - | - |
| 1000 275 | 516 | 516 | 563 | 560 | 565 | 571 | - | ??? | ??? | 563 | 574 | - | - |
| 1000 276 | 217 | 217 | 220 | - | 223 | 222 | - | ??? | ??? | 220 | 222 | - | - |
| 1000 277 | 225 | 225 | 227 | - | 230 | 230 | - | ??? | ??? | 228 | 230 | - | - |
| 1000 278 | 220 | 220 | 220 | - | 226 | 225 | - | ??? | ??? | 224 | 226 | - | - |
| 1000 279 | 215 | 215 | 218 | - | 220 | 220 | - | ??? | ??? | 218 | 219 | - | - |
| 1000 280 | 226 | 226 | 229 | - | 231 | 230 | - | ??? | ??? | 229 | 231 | - | - |
| 1000 281 | 219 | 219 | 223 | 222 | 225 | 224 | - | ??? | ??? | 223 | 225 | - | - |
| 1000 282 | 214 | 214 | 215 | - | 220 | 219 | - | ??? | ??? | 217 | 219 | - | - |
| 1000 283 | 224 | 224 | 224 | - | 230 | 229 | - | ??? | ??? | 227 | 230 | - | - |
| 1000 284 | 217 | 217 | 220 | - | 222 | 222 | - | ??? | ??? | 220 | 222 | - | - |
| 1000 285 | 221 | 221 | 225 | - | 227 | 225 | - | ??? | ??? | 225 | 227 | - | - |
| 1000 286 | 221 | 221 | 224 | - | 227 | 226 | - | ??? | ??? | 225 | 226 | - | - |
| 1000 287 | 224 | 224 | 227 | - | 230 | 229 | - | ??? | ??? | 227 | 229 | - | - |
| 1000 288 | 219 | 219 | 222 | - | 225 | 224 | - | ??? | ??? | 222 | 224 | - | - |
| 1000 289 | 220 | 220 | 223 | - | 225 | 225 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 290 | 222 | 222 | 224 | - | 228 | 227 | - | ??? | ??? | 225 | 228 | - | - |
| 1000 291 | 225 | 225 | 227 | - | 231 | 230 | - | ??? | ??? | 228 | 230 | - | - |
| 1000 292 | 226 | 226 | 228 | - | 232 | 231 | - | ??? | ??? | 229 | 231 | - | - |
| 1000 293 | 225 | 225 | 225 | - | 231 | 231 | - | ??? | ??? | 228 | 230 | - | - |
| 1000 294 | 230 | 230 | 234 | 233 | 236 | 235 | - | ??? | ??? | 233 | 236 | - | - |
| 1000 295 | 227 | 227 | 228 | - | 233 | 233 | - | ??? | ??? | 230 | 232 | - | - |
| 1000 296 | 208 | 208 | 211 | 210 | 213 | 212 | - | ??? | ??? | 210 | 212 | - | - |
| 1000 297 | 217 | 217 | 218 | - | 222 | 221 | - | ??? | ??? | 219 | 221 | - | - |
| 1000 298 | 214 | 214 | 217 | - | 219 | 219 | - | ??? | ??? | 218 | 219 | - | - |
| 1000 299 | 226 | 226 | 230 | - | 232 | 231 | - | ??? | ??? | 229 | 232 | - | - |
| 1000 300 | 228 | 228 | 232 | 231 | 234 | 234 | - | ??? | ??? | 232 | 233 | - | - |
| 1000 301 | 137 | 137 | 137 | - | 138 | 138 | - | 999 | ??? | 137 | 138 | - | - |
| 1000 302 | 139 | 139 | 139 | - | 140 | 140 | - | 999 | ??? | 139 | 140 | - | - |
| 1000 303 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 139 | 139 | - | - |
| 1000 304 | 136 | 136 | 136 | - | 138 | 138 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 305 | 140 | 140 | 140 | - | 141 | 141 | - | 1000 | ??? | 140 | 141 | - | - |
| 1000 306 | 135 | 135 | 135 | - | 136 | 136 | - | ??? | ??? | 135 | 136 | - | - |
| 1000 307 | 136 | 136 | 136 | - | 137 | 137 | - | 1000 | ??? | 136 | 137 | - | - |
| 1000 308 | 137 | 137 | 137 | - | 138 | 139 | - | 998 | ??? | 138 | 138 | - | - |
| 1000 309 | 135 | 135 | 135 | - | 136 | 136 | - | ??? | ??? | 135 | 136 | - | - |
| 1000 310 | 141 | 141 | 141 | - | 143 | 143 | - | 999 | ??? | 142 | 143 | - | - |
| 1000 311 | 139 | 139 | 139 | - | 141 | 140 | - | 1000 | ??? | 140 | 140 | - | - |
| 1000 312 | 135 | 135 | 135 | - | 136 | 136 | - | 1000 | ??? | 135 | 136 | - | - |
| 1000 313 | 138 | 138 | 138 | - | 139 | 139 | - | 999 | ??? | 138 | 139 | - | - |
| 1000 314 | 142 | 142 | 142 | - | 143 | 143 | - | 999 | ??? | 142 | 143 | - | - |
| 1000 315 | 136 | 136 | 136 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 316 | 137 | 137 | 137 | - | 139 | 138 | - | 1000 | ??? | 138 | 138 | - | - |
| 1000 317 | 136 | 136 | 136 | - | 137 | 137 | - | 999 | ??? | 137 | 137 | - | - |
| 1000 318 | 138 | 138 | 138 | - | 139 | 139 | - | 1000 | ??? | 138 | 139 | - | - |
| 1000 319 | 140 | 140 | 140 | - | 142 | 142 | - | ??? | ??? | 141 | 141 | - | - |
| 1000 320 | 141 | 141 | 141 | - | 142 | 143 | - | ??? | ??? | 141 | 142 | - | - |
| 1000 321 | 140 | 140 | 140 | - | 141 | 141 | - | 1000 | ??? | 140 | 141 | - | - |
| 1000 322 | 139 | 139 | 139 | - | 140 | 140 | - | 1000 | ??? | 139 | 140 | - | - |
| 1000 323 | 138 | 138 | 138 | - | 140 | 139 | - | 999 | ??? | 138 | 139 | - | - |
| 1000 324 | 140 | 140 | 140 | - | 141 | 141 | - | 1000 | ??? | 141 | 141 | - | - |
| 1000 325 | 138 | 138 | 138 | - | 140 | 139 | - | 989 | ??? | 139 | 139 | - | - |
| 1000 326 | 504 | 504 | 523 | - | 541 | 551 | - | ??? | ??? | 529 | 538 | - | - |
| 1000 327 | 509 | 509 | 536 | 534 | 552 | 564 | - | ??? | ??? | 535 | 548 | - | - |
| 1000 328 | 506 | 506 | 532 | 525 | 545 | 553 | - | 1000 | ??? | 526 | 534 | - | - |
| 1000 329 | 509 | 509 | 535 | - | 554 | 565 | - | 1000 | ??? | 533 | 547 | - | - |
| 1000 330 | 509 | 509 | 522 | - | 538 | 545 | - | ??? | ??? | 525 | 535 | - | - |
| 1000 331 | 502 | 502 | 531 | 527 | 547 | 550 | - | ??? | ??? | 527 | 539 | - | - |
| 1000 332 | 497 | 497 | 524 | 518 | 535 | 543 | - | 1000 | ??? | 522 | 530 | - | - |
| 1000 333 | 515 | 515 | 539 | - | 553 | 555 | - | ??? | ??? | 541 | 550 | - | - |
| 1000 334 | 501 | 501 | 520 | - | 540 | 544 | - | 1000 | ??? | 521 | 533 | - | - |
| 1000 335 | 511 | 511 | 526 | - | 544 | 548 | - | ??? | ??? | 531 | 541 | - | - |
| 1000 336 | 502 | 502 | 528 | 518 | 534 | 544 | - | 1000 | ??? | 523 | 531 | - | - |
| 1000 337 | 515 | 515 | 535 | - | 551 | 554 | - | 998 | ??? | 537 | 549 | - | - |
| 1000 338 | 512 | 512 | 540 | 534 | 553 | 554 | - | ??? | ??? | 535 | 544 | - | - |
| 1000 339 | 526 | 526 | 542 | 541 | 555 | 557 | - | 1000 | ??? | 539 | 550 | - | - |
| 1000 340 | 531 | 531 | 545 | - | 563 | 567 | - | 1000 | ??? | 551 | 556 | - | - |
| 1000 341 | 513 | 513 | 539 | 537 | 552 | 555 | - | 999 | ??? | 539 | 550 | - | - |
| 1000 342 | 506 | 506 | 530 | - | 549 | 552 | - | ??? | ??? | 534 | 547 | - | - |
| 1000 343 | 510 | 510 | 540 | 539 | 554 | 552 | - | 1000 | ??? | 538 | 548 | - | - |
| 1000 344 | 510 | 510 | 531 | 530 | 545 | 552 | - | 1000 | ??? | 531 | 542 | - | - |
| 1000 345 | 510 | 510 | 538 | 537 | 552 | 560 | - | 1000 | ??? | 535 | 546 | - | - |

Table 10.12: Result Comparison for SALBP Size 1000 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Direct MiniZinc Cplex | Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|-----|-------------|------------|-------|-----------------------|---------|-------|-----------------|-------|------------------------------|-------|
| 1000 346 | 505 | 505 | 528 | 525 | 551 | 550 | - | 1000 | ??? | 530 | 543 | - | - |
| 1000 347 | 505 | 505 | 531 | 530 | 547 | 549 | - | 1000 | ??? | 533 | 543 | - | - |
| 1000 348 | 539 | 539 | 553 | 552 | 566 | 570 | - | ??? | ??? | 556 | 563 | - | - |
| 1000 349 | 512 | 512 | 535 | - | 558 | 559 | - | ??? | ??? | 539 | 551 | - | - |
| 1000 350 | 498 | 498 | 526 | 518 | 534 | 539 | - | 1000 | ??? | 524 | 527 | - | - |
| 1000 351 | 227 | 227 | 229 | - | 231 | 232 | - | ??? | ??? | 229 | 230 | - | - |
| 1000 352 | 227 | 227 | 229 | - | 231 | 231 | - | ??? | ??? | 229 | 229 | - | - |
| 1000 353 | 217 | 217 | 218 | - | 221 | 220 | - | ??? | ??? | 219 | 220 | - | - |
| 1000 354 | 222 | 222 | 224 | - | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 355 | 220 | 220 | 222 | - | 224 | 224 | - | ??? | ??? | 222 | 223 | - | - |
| 1000 356 | 226 | 226 | 227 | - | 230 | 230 | - | ??? | ??? | 228 | 229 | - | - |
| 1000 357 | 213 | 213 | 214 | - | 217 | 216 | - | 999 | ??? | 215 | 216 | - | - |
| 1000 358 | 219 | 219 | 220 | - | 223 | 223 | - | 999 | ??? | 221 | 221 | - | - |
| 1000 359 | 222 | 222 | 224 | - | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 360 | 229 | 229 | 230 | - | 233 | 233 | - | ??? | ??? | 231 | 232 | - | - |
| 1000 361 | 215 | 215 | 215 | - | 219 | 219 | - | ??? | ??? | 217 | 218 | - | - |
| 1000 362 | 223 | 223 | 224 | - | 226 | 227 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 363 | 215 | 215 | 217 | - | 218 | 219 | - | ??? | ??? | 217 | 217 | - | - |
| 1000 364 | 221 | 221 | 222 | - | 225 | 224 | - | ??? | ??? | 223 | 224 | - | - |
| 1000 365 | 227 | 227 | 229 | - | 231 | 231 | - | 999 | ??? | 229 | 230 | - | - |
| 1000 366 | 228 | 228 | 230 | 229 | 232 | 231 | - | ??? | ??? | 230 | 230 | - | - |
| 1000 367 | 227 | 227 | 228 | - | 231 | 231 | - | ??? | ??? | 229 | 230 | - | - |
| 1000 368 | 226 | 226 | 228 | - | 230 | 230 | - | 1000 | ??? | 228 | 229 | - | - |
| 1000 369 | 220 | 220 | 221 | - | 224 | 224 | - | ??? | ??? | 222 | 223 | - | - |
| 1000 370 | 223 | 223 | 224 | - | 227 | 227 | - | 1000 | ??? | 225 | 226 | - | - |
| 1000 371 | 220 | 220 | 221 | - | 223 | 223 | - | 999 | ??? | 221 | 222 | - | - |
| 1000 372 | 230 | 230 | 232 | - | 234 | 234 | - | ??? | ??? | 232 | 233 | - | - |
| 1000 373 | 219 | 219 | 220 | - | 223 | 222 | - | 1000 | ??? | 220 | 221 | - | - |
| 1000 374 | 219 | 219 | 220 | - | 222 | 222 | - | ??? | ??? | 220 | 221 | - | - |
| 1000 375 | 227 | 227 | 229 | 228 | 231 | 230 | - | 1000 | ??? | 229 | 229 | - | - |
| 1000 376 | 132 | 132 | 132 | - | 134 | 134 | - | ??? | ??? | 133 | 133 | - | - |
| 1000 377 | 137 | 137 | 137 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 378 | 134 | 134 | 134 | - | 136 | 135 | - | ??? | ??? | 135 | 136 | - | - |
| 1000 379 | 137 | 137 | 137 | - | 139 | 139 | - | 962 | ??? | 138 | 139 | - | - |
| 1000 380 | 134 | 134 | 134 | - | 136 | 136 | - | ??? | ??? | 135 | 136 | - | - |
| 1000 381 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 382 | 131 | 131 | 131 | - | 133 | 132 | - | ??? | ??? | 132 | 132 | - | - |
| 1000 383 | 138 | 138 | 138 | - | 141 | 140 | - | 1000 | ??? | 139 | 140 | - | - |
| 1000 384 | 139 | 139 | 139 | - | 141 | 141 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 385 | 135 | 135 | 135 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 386 | 139 | 139 | 139 | - | 141 | 141 | - | ??? | ??? | 140 | 140 | - | - |
| 1000 387 | 137 | 137 | 137 | - | 139 | 139 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 388 | 137 | 137 | 137 | - | 138 | 138 | - | 1000 | ??? | 137 | 138 | - | - |
| 1000 389 | 136 | 136 | 136 | - | 138 | 137 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 390 | 136 | 136 | 136 | - | 138 | 137 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 391 | 135 | 135 | 135 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 392 | 136 | 136 | 136 | - | 137 | 137 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 393 | 136 | 136 | 136 | - | 138 | 137 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 394 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 140 | 140 | - | - |
| 1000 395 | 139 | 139 | 139 | - | 141 | 141 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 396 | 136 | 136 | 136 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 397 | 140 | 140 | 140 | - | 142 | 142 | - | ??? | ??? | 141 | 141 | - | - |
| 1000 398 | 134 | 134 | 134 | - | 136 | 136 | - | ??? | ??? | 135 | 136 | - | - |
| 1000 399 | 139 | 139 | 139 | - | 140 | 141 | - | ??? | ??? | 140 | 140 | - | - |
| 1000 400 | 140 | 140 | 140 | - | 142 | 142 | - | ??? | ??? | 141 | 142 | - | - |
| 1000 401 | 500 | 500 | 547 | 541 | 554 | 553 | - | ??? | ??? | 539 | 557 | - | - |
| 1000 402 | 518 | 518 | 565 | 552 | 559 | 556 | - | ??? | ??? | 552 | 568 | - | - |
| 1000 403 | 511 | 511 | 557 | 545 | 555 | 557 | - | ??? | ??? | 549 | 562 | - | - |
| 1000 404 | 505 | 505 | 550 | 539 | 555 | 554 | - | ??? | ??? | 543 | 558 | - | - |
| 1000 405 | 514 | 514 | 557 | 551 | 564 | 562 | - | ??? | ??? | 559 | 569 | - | - |
| 1000 406 | 497 | 497 | 542 | 534 | 547 | 547 | - | ??? | ??? | 533 | 547 | - | - |
| 1000 407 | 500 | 500 | 548 | 544 | 559 | 555 | - | ??? | ??? | 548 | 563 | - | - |
| 1000 408 | 520 | 520 | 567 | 554 | 564 | 563 | - | ??? | ??? | 552 | 572 | - | - |
| 1000 409 | 512 | 512 | 559 | 547 | 565 | 566 | - | ??? | ??? | 548 | 563 | - | - |
| 1000 410 | 523 | 523 | 561 | - | 575 | 575 | - | ??? | ??? | 569 | 582 | - | - |
| 1000 411 | 504 | 504 | 541 | - | 559 | 558 | - | ??? | ??? | 546 | 559 | - | - |
| 1000 412 | 509 | 509 | 547 | 545 | 558 | 558 | - | ??? | ??? | 550 | 564 | - | - |
| 1000 413 | 515 | 515 | 547 | 546 | 564 | 558 | - | ??? | ??? | 549 | 562 | - | - |
| 1000 414 | 505 | 505 | 557 | 546 | 558 | 562 | - | ??? | ??? | 547 | 560 | - | - |
| 1000 415 | 509 | 509 | 553 | 546 | 559 | 561 | - | ??? | ??? | 545 | 562 | - | - |
| 1000 416 | 520 | 520 | 561 | 554 | 564 | 562 | - | ??? | ??? | 550 | 561 | - | - |
| 1000 417 | 550 | 550 | 585 | 579 | 585 | 594 | - | ??? | ??? | 580 | 596 | - | - |
| 1000 418 | 507 | 507 | 548 | 545 | 558 | 552 | - | ??? | ??? | 549 | 558 | - | - |
| 1000 419 | 537 | 537 | 574 | 568 | 579 | 577 | - | ??? | ??? | 574 | 590 | - | - |
| 1000 420 | 512 | 512 | 551 | 548 | 561 | 556 | - | ??? | ??? | 553 | 559 | - | - |
| 1000 421 | 506 | 506 | 546 | 541 | 556 | 556 | - | ??? | ??? | 545 | 556 | - | - |
| 1000 422 | 499 | 499 | 546 | 540 | 552 | 552 | - | ??? | ??? | 543 | 553 | - | - |
| 1000 423 | 515 | 515 | 557 | 551 | 562 | 561 | - | ??? | ??? | 559 | 567 | - | - |
| 1000 424 | 496 | 496 | 545 | 534 | 550 | 548 | - | ??? | ??? | 535 | 550 | - | - |
| 1000 425 | 527 | 527 | 563 | 559 | 565 | 567 | - | 1000 | ??? | 559 | 572 | - | - |
| 1000 426 | 224 | 224 | 227 | 226 | 229 | 229 | - | 1000 | ??? | 227 | 228 | - | - |
| 1000 427 | 229 | 229 | 232 | - | 235 | 234 | - | ??? | ??? | 232 | 234 | - | - |
| 1000 428 | 224 | 224 | 227 | 226 | 228 | 228 | - | ??? | ??? | 226 | 227 | - | - |
| 1000 429 | 235 | 235 | 237 | - | 240 | 239 | - | ??? | ??? | 238 | 239 | - | - |
| 1000 430 | 220 | 220 | 223 | 222 | 224 | 224 | - | ??? | ??? | 222 | 224 | - | - |
| 1000 431 | 230 | 230 | 232 | - | 234 | 234 | - | ??? | ??? | 232 | 234 | - | - |
| 1000 432 | 227 | 227 | 230 | - | 232 | 232 | - | ??? | ??? | 230 | 231 | - | - |
| 1000 433 | 229 | 229 | 233 | 232 | 234 | 234 | - | ??? | ??? | 232 | 234 | - | - |
| 1000 434 | 212 | 212 | 214 | - | 215 | 215 | - | ??? | ??? | 214 | 215 | - | - |
| 1000 435 | 227 | 227 | 230 | 229 | 232 | 231 | - | ??? | ??? | 229 | 230 | - | - |
| 1000 436 | 226 | 226 | 230 | 229 | 231 | 231 | - | ??? | ??? | 230 | 231 | - | - |
| 1000 437 | 222 | 222 | 225 | 224 | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 438 | 221 | 221 | 224 | - | 226 | 225 | - | ??? | ??? | 223 | 225 | - | - |
| 1000 439 | 225 | 225 | 228 | 227 | 229 | 230 | - | ??? | ??? | 227 | 229 | - | - |

Table 10.12: Result Comparison for SALBP Size 1000 (525 Instances)

| Instance | Best LB | SALOME LB | UB | Laborie CPO | Direct CPO | CPSat | Direct Cplex | MiniZinc Chuffed | CPSat | Alternative CPO | CPSat | Alternative MiniZinc Chuffed | Cplex |
|----------|---------|-----------|-----|-------------|------------|-------|--------------|------------------|-------|-----------------|-------|------------------------------|-------|
| 1000 440 | 225 | 225 | 225 | - | 230 | 230 | - | ??? | ??? | 228 | 229 | - | - |
| 1000 441 | 221 | 221 | 225 | 224 | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 442 | 230 | 230 | 234 | 233 | 235 | 235 | - | 991 | ??? | 233 | 234 | - | - |
| 1000 443 | 217 | 217 | 220 | 219 | 222 | 221 | - | ??? | ??? | 220 | 220 | - | - |
| 1000 444 | 222 | 222 | 225 | 224 | 227 | 227 | - | 1000 | ??? | 225 | 226 | - | - |
| 1000 445 | 229 | 229 | 233 | - | 235 | 235 | - | ??? | ??? | 233 | 234 | - | - |
| 1000 446 | 228 | 228 | 231 | 230 | 232 | 232 | - | ??? | ??? | 230 | 231 | - | - |
| 1000 447 | 221 | 221 | 225 | 224 | 227 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 448 | 222 | 222 | 222 | - | 226 | 226 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 449 | 232 | 232 | 236 | 235 | 238 | 238 | - | ??? | ??? | 236 | 237 | - | - |
| 1000 450 | 220 | 220 | 220 | - | 225 | 224 | - | ??? | ??? | 222 | 224 | - | - |
| 1000 451 | 136 | 136 | 136 | - | 140 | 139 | - | 1000 | ??? | 138 | 139 | - | - |
| 1000 452 | 132 | 132 | 133 | - | 134 | 134 | - | ??? | ??? | 133 | 134 | - | - |
| 1000 453 | 138 | 138 | 138 | - | 141 | 140 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 454 | 139 | 139 | 140 | - | 142 | 142 | - | ??? | ??? | 141 | 142 | - | - |
| 1000 455 | 136 | 136 | 136 | - | 139 | 139 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 456 | 135 | 135 | 135 | - | 138 | 137 | - | ??? | ??? | 137 | 137 | - | - |
| 1000 457 | 137 | 137 | 137 | - | 140 | 139 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 458 | 135 | 135 | 135 | - | 137 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 459 | 137 | 137 | 137 | - | 140 | 140 | - | ??? | ??? | 139 | 139 | - | - |
| 1000 460 | 138 | 138 | 138 | - | 141 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 461 | 137 | 137 | 137 | - | 140 | 139 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 462 | 136 | 136 | 136 | - | 139 | 138 | - | ??? | ??? | 138 | 138 | - | - |
| 1000 463 | 136 | 136 | 136 | - | 138 | 138 | - | ??? | ??? | 138 | 138 | - | - |
| 1000 464 | 138 | 138 | 139 | - | 141 | 141 | - | ??? | ??? | 140 | 141 | - | - |
| 1000 465 | 138 | 138 | 138 | - | 141 | 141 | - | 1000 | ??? | 140 | 141 | - | - |
| 1000 466 | 133 | 133 | 133 | - | 137 | 136 | - | ??? | ??? | 135 | 135 | - | - |
| 1000 467 | 138 | 138 | 138 | - | 140 | 140 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 468 | 137 | 137 | 138 | - | 139 | 139 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 469 | 137 | 137 | 137 | - | 140 | 139 | - | ??? | ??? | 139 | 140 | - | - |
| 1000 470 | 135 | 135 | 135 | - | 138 | 137 | - | ??? | ??? | 136 | 137 | - | - |
| 1000 471 | 135 | 135 | 135 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 472 | 140 | 140 | 140 | - | 142 | 142 | - | ??? | ??? | 142 | 143 | - | - |
| 1000 473 | 135 | 135 | 135 | - | 138 | 138 | - | ??? | ??? | 137 | 138 | - | - |
| 1000 474 | 136 | 136 | 137 | - | 139 | 139 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 475 | 136 | 136 | 136 | - | 139 | 138 | - | ??? | ??? | 138 | 139 | - | - |
| 1000 476 | 519 | 519 | 585 | 573 | 574 | 575 | - | ??? | ??? | 575 | 591 | - | - |
| 1000 477 | 526 | 526 | 597 | 581 | 586 | 585 | - | ??? | ??? | 582 | 593 | - | - |
| 1000 478 | 545 | 545 | 607 | 598 | 596 | 594 | - | ??? | ??? | ??? | 607 | - | - |
| 1000 479 | 513 | 513 | 588 | 578 | 579 | 577 | - | ??? | ??? | 573 | 592 | - | - |
| 1000 480 | 508 | 508 | 582 | 566 | 566 | 566 | - | ??? | ??? | 566 | 580 | - | - |
| 1000 481 | 519 | 519 | 594 | 579 | 581 | 580 | - | ??? | ??? | 579 | 587 | - | - |
| 1000 482 | 541 | 541 | 604 | 592 | 596 | 603 | - | ??? | ??? | 595 | 614 | - | - |
| 1000 483 | 506 | 506 | 588 | 566 | 569 | 571 | - | ??? | ??? | 565 | 579 | - | - |
| 1000 484 | 535 | 535 | 598 | 588 | 589 | 588 | - | ??? | ??? | 591 | 602 | - | - |
| 1000 485 | 521 | 521 | 594 | 579 | 586 | 584 | - | ??? | ??? | 578 | 592 | - | - |
| 1000 486 | 510 | 510 | 582 | 570 | 571 | 575 | - | ??? | ??? | 569 | 583 | - | - |
| 1000 487 | 524 | 524 | 597 | 583 | 584 | 582 | - | ??? | ??? | 579 | 595 | - | - |
| 1000 488 | 511 | 511 | 581 | 567 | 572 | 575 | - | ??? | ??? | 571 | 592 | - | - |
| 1000 489 | 502 | 502 | 578 | 563 | 568 | 568 | - | ??? | ??? | 564 | 577 | - | - |
| 1000 490 | 514 | 514 | 594 | 573 | 573 | 576 | - | ??? | ??? | 573 | 592 | - | - |
| 1000 491 | 507 | 507 | 585 | 570 | 575 | 571 | - | ??? | ??? | 566 | 584 | - | - |
| 1000 492 | 527 | 527 | 606 | 582 | 585 | 592 | - | ??? | ??? | 585 | 600 | - | - |
| 1000 493 | 498 | 498 | 571 | 558 | 561 | 564 | - | ??? | ??? | 556 | 570 | - | - |
| 1000 494 | 515 | 514 | 583 | 567 | 571 | 579 | - | ??? | ??? | 571 | 584 | - | - |
| 1000 495 | 530 | 530 | 606 | 590 | 587 | 595 | - | ??? | ??? | 587 | 608 | - | - |
| 1000 496 | 505 | 505 | 569 | 556 | 553 | 563 | - | ??? | ??? | 559 | 572 | - | - |
| 1000 497 | 504 | 504 | 580 | 563 | 566 | 569 | - | ??? | ??? | 561 | 578 | - | - |
| 1000 498 | 523 | 523 | 593 | 582 | 588 | 585 | - | ??? | ??? | 581 | 593 | - | - |
| 1000 499 | 505 | 505 | 579 | 563 | 566 | 567 | - | ??? | ??? | 565 | 583 | - | - |
| 1000 500 | 512 | 512 | 591 | 570 | 571 | 584 | - | ??? | ??? | 568 | 583 | - | - |
| 1000 501 | 227 | 227 | 234 | 232 | 234 | 233 | - | ??? | ??? | 232 | 234 | - | - |
| 1000 502 | 224 | 224 | 230 | 228 | 232 | 229 | - | ??? | ??? | 229 | 231 | - | - |
| 1000 503 | 225 | 224 | 231 | 229 | 233 | 232 | - | ??? | ??? | 230 | 231 | - | - |
| 1000 504 | 227 | 227 | 234 | 233 | 236 | 233 | - | ??? | ??? | 233 | 234 | - | - |
| 1000 505 | 213 | 213 | 218 | - | 219 | 219 | - | ??? | ??? | 218 | 220 | - | - |
| 1000 506 | 223 | 223 | 230 | 228 | 230 | 229 | - | ??? | ??? | 228 | 229 | - | - |
| 1000 507 | 220 | 220 | 227 | 226 | 228 | 226 | - | ??? | ??? | 225 | 227 | - | - |
| 1000 508 | 219 | 219 | 225 | 223 | 226 | 224 | - | ??? | ??? | 222 | 224 | - | - |
| 1000 509 | 225 | 225 | 232 | 230 | 232 | 231 | - | ??? | ??? | 230 | 231 | - | - |
| 1000 510 | 226 | 226 | 234 | 232 | 235 | 233 | - | ??? | ??? | 232 | 234 | - | - |
| 1000 511 | 230 | 230 | 237 | 235 | 237 | 237 | - | ??? | ??? | 235 | 238 | - | - |
| 1000 512 | 219 | 219 | 227 | 224 | 226 | 224 | - | ??? | ??? | 224 | 225 | - | - |
| 1000 513 | 219 | 219 | 226 | 224 | 227 | 226 | - | ??? | ??? | 224 | 226 | - | - |
| 1000 514 | 226 | 226 | 232 | - | 233 | 233 | - | ??? | ??? | 232 | 234 | - | - |
| 1000 515 | 221 | 221 | 227 | 225 | 228 | 228 | - | ??? | ??? | 226 | 227 | - | - |
| 1000 516 | 229 | 229 | 236 | 235 | 237 | 235 | - | ??? | ??? | 234 | 237 | - | - |
| 1000 517 | 221 | 221 | 228 | 226 | 229 | 227 | - | ??? | ??? | 226 | 228 | - | - |
| 1000 518 | 220 | 220 | 226 | 224 | 226 | 226 | - | ??? | ??? | 224 | 226 | - | - |
| 1000 519 | 221 | 221 | 226 | - | 229 | 228 | - | ??? | ??? | 226 | 227 | - | - |
| 1000 520 | 226 | 226 | 231 | - | 234 | 232 | - | ??? | ??? | 231 | 232 | - | - |
| 1000 521 | 229 | 229 | 236 | 234 | 236 | 236 | - | ??? | ??? | 235 | 236 | - | - |
| 1000 522 | 215 | 215 | 221 | 220 | 221 | 221 | - | ??? | ??? | 220 | 221 | - | - |
| 1000 523 | 220 | 220 | 226 | 225 | 228 | 226 | - | ??? | ??? | 225 | 227 | - | - |
| 1000 524 | 226 | 225 | 233 | 231 | 232 | 233 | - | ??? | ??? | 231 | 232 | - | - |
| 1000 525 | 221 | 221 | 227 | 226 | 229 | 227 | - | 1000 | ??? | 225 | 227 | - | - |

Chapter 11

Result Comparison for Taillard FSS

Table 11.1: Taillard FSS Results Summary Size 100 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 10 | 10 | - | - | 10 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 1 | - | - | - | - | - |
| Optimal | 1 | 10 | 10 | - | - | 10 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 1 | 10 | 10 | - | - | 10 |
| Gap1 | 2 | - | - | - | - | - |
| Gap2 | 1 | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 6 | - | - | 10 | 10 | - |
| NonBest | 9 | - | - | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 10 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 11.2: Taillard FSS Results Summary Size 100 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 100.00 | 100.00 | - | - | 100.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 10.00 | - | - | - | - | - |
| Optimal | 10.00 | 100.00 | 100.00 | - | - | 100.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 10.00 | 100.00 | 100.00 | - | - | 100.00 |
| Gap1 | 20.00 | - | - | - | - | - |
| Gap2 | 10.00 | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 60.00 | - | - | 100.00 | 100.00 | - |
| NonBest | 90.00 | - | - | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 11.3: Taillard FSS Results Summary Size 200 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 2 | 1 | - | - | 2 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | 2 | 1 | - | - | 2 |
| UniqueBest | - | 5 | 3 | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | 5 | 3 | - | - | - |
| BestOrOptimal | - | 7 | 4 | - | - | 2 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 10 | 3 | 6 | 10 | 10 | - |
| NonBest | 10 | 3 | 6 | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 2 |
| Unknown | - | - | - | - | - | 8 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | 8 |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 11.4: Taillard FSS Results Summary Size 200 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 20.00 | 10.00 | - | - | 20.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | 20.00 | 10.00 | - | - | 20.00 |
| UniqueBest | - | 50.00 | 30.00 | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | 50.00 | 30.00 | - | - | - |
| BestOrOptimal | - | 70.00 | 40.00 | - | - | 20.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 100.00 | 30.00 | 60.00 | 100.00 | 100.00 | - |
| NonBest | 100.00 | 30.00 | 60.00 | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 20.00 |
| Unknown | - | - | - | - | - | 80.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 80.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 11.5: Taillard FSS Results Summary Size 250 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 10 | 9 | - | - | 10 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 4 | - | - | - | - | - |
| Optimal | 4 | 10 | 9 | - | - | 10 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 4 | 10 | 9 | - | - | 10 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 6 | - | 1 | 10 | 10 | - |
| NonBest | 6 | - | 1 | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 10 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 11.6: Taillard FSS Results Summary Size 250 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 100.00 | 90.00 | - | - | 100.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 40.00 | - | - | - | - | - |
| Optimal | 40.00 | 100.00 | 90.00 | - | - | 100.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 40.00 | 100.00 | 90.00 | - | - | 100.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 60.00 | - | 10.00 | 100.00 | 100.00 | - |
| NonBest | 60.00 | - | 10.00 | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 11.7: Taillard FSS Results Summary Size 400 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 5 | 2 | 3 | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 5 | 2 | 3 | - | - | - |
| BestOrOptimal | 5 | 2 | 3 | - | - | - |
| Gap1 | 1 | - | - | - | - | - |
| Gap2 | 1 | - | - | - | - | - |
| Gap3 | - | 1 | - | - | - | - |
| Gap4Plus | 3 | 7 | 7 | 10 | 10 | - |
| NonBest | 5 | 8 | 7 | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | - |
| Unknown | - | - | - | - | - | 10 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 10 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 11.8: Taillard FSS Results Summary Size 400 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 50.00 | 20.00 | 30.00 | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 50.00 | 20.00 | 30.00 | - | - | - |
| BestOrOptimal | 50.00 | 20.00 | 30.00 | - | - | - |
| Gap1 | 10.00 | - | - | - | - | - |
| Gap2 | 10.00 | - | - | - | - | - |
| Gap3 | - | 10.00 | - | - | - | - |
| Gap4Plus | 30.00 | 70.00 | 70.00 | 100.00 | 100.00 | - |
| NonBest | 50.00 | 80.00 | 70.00 | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | - |
| Unknown | - | - | - | - | - | 100.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 11.9: Taillard FSS Results Summary Size 500 (20 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | 6 | - | - | - | - |
| SharedProvenOptimal | - | 2 | 2 | - | - | 2 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 2 | - | - | - | - | - |
| Optimal | 2 | 8 | 2 | - | - | 2 |
| UniqueBest | 11 | 1 | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 11 | 1 | - | - | - | - |
| BestOrOptimal | 13 | 9 | 2 | - | - | 2 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | 1 | - | - | - | - | - |
| Gap3 | 1 | - | - | - | - | - |
| Gap4Plus | 5 | 11 | 18 | 20 | 20 | - |
| NonBest | 7 | 11 | 18 | 20 | 20 | - |
| Solved | 20 | 20 | 20 | 20 | 20 | 2 |
| Unknown | - | - | - | - | - | 18 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 18 |
| Total | 20 | 20 | 20 | 20 | 20 | 20 |

Table 11.10: Taillard FSS Results Summary Size 500 (20 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | 30.00 | - | - | - | - |
| SharedProvenOptimal | - | 10.00 | 10.00 | - | - | 10.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 10.00 | - | - | - | - | - |
| Optimal | 10.00 | 40.00 | 10.00 | - | - | 10.00 |
| UniqueBest | 55.00 | 5.00 | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 55.00 | 5.00 | - | - | - | - |
| BestOrOptimal | 65.00 | 45.00 | 10.00 | - | - | 10.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | 5.00 | - | - | - | - | - |
| Gap3 | 5.00 | - | - | - | - | - |
| Gap4Plus | 25.00 | 55.00 | 90.00 | 100.00 | 100.00 | - |
| NonBest | 35.00 | 55.00 | 90.00 | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 10.00 |
| Unknown | - | - | - | - | - | 90.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 90.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 11.11: Taillard FSS Results Summary Size 1000 (20 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 20 | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 20 | - | - | - | - | - |
| BestOrOptimal | 20 | - | - | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | 20 | 20 | 20 | 20 | - |
| NonBest | - | 20 | 20 | 20 | 20 | - |
| Solved | 20 | 20 | 20 | 20 | 20 | - |
| Unknown | - | - | - | - | - | 13 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | 7 |
| N/A | - | - | - | - | - | 20 |
| Total | 20 | 20 | 20 | 20 | 20 | 20 |

Table 11.12: Taillard FSS Results Summary Size 1000 (20 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 100.00 | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 100.00 | - | - | - | - | - |
| BestOrOptimal | 100.00 | - | - | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | 100.00 | 100.00 | 100.00 | 100.00 | - |
| NonBest | - | 100.00 | 100.00 | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | - |
| Unknown | - | - | - | - | - | 65.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | 35.00 |
| N/A | - | - | - | - | - | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 11.13: Taillard FSS Results Summary Size 2000 (20 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 20 | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 20 | - | - | - | - | - |
| BestOrOptimal | 20 | - | - | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | 20 | 20 | 8 | 20 | - |
| NonBest | - | 20 | 20 | 8 | 20 | - |
| Solved | 20 | 20 | 20 | 8 | 20 | - |
| Unknown | - | - | - | 12 | - | 20 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 12 | - | 20 |
| Total | 20 | 20 | 20 | 20 | 20 | 20 |

Table 11.14: Taillard FSS Results Summary Size 2000 (20 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 100.00 | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 100.00 | - | - | - | - | - |
| BestOrOptimal | 100.00 | - | - | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | 100.00 | 100.00 | 40.00 | 100.00 | - |
| NonBest | - | 100.00 | 100.00 | 40.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 40.00 | 100.00 | - |
| Unknown | - | - | - | 60.00 | - | 100.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 60.00 | - | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 11.15: Taillard FSS Results Summary Size 4000 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 10 | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 10 | - | - | - | - | - |
| BestOrOptimal | 10 | - | - | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | 10 | 10 | - | 10 | - |
| NonBest | - | 10 | 10 | - | 10 | - |
| Solved | 10 | 10 | 10 | - | 10 | - |
| Unknown | - | - | - | 10 | - | 10 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 10 | - | 10 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 11.16: Taillard FSS Results Summary Size 4000 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 100.00 | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 100.00 | - | - | - | - | - |
| BestOrOptimal | 100.00 | - | - | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | 100.00 | 100.00 | - | 100.00 | - |
| NonBest | - | 100.00 | 100.00 | - | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | - | 100.00 | - |
| Unknown | - | - | - | 100.00 | - | 100.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 100.00 | - | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 11.17: Taillard FSS Results Summary Size 10000 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 10 | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 10 | - | - | - | - | - |
| BestOrOptimal | 10 | - | - | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | 10 | 10 | - | - | - |
| NonBest | - | 10 | 10 | - | - | - |
| Solved | 10 | 10 | 10 | - | - | - |
| Unknown | - | - | - | - | 10 | 10 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | 10 | - | - |
| N/A | - | - | - | 10 | 10 | 10 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 11.18: Taillard FSS Results Summary Size 10000 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 100.00 | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 100.00 | - | - | - | - | - |
| BestOrOptimal | 100.00 | - | - | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | 100.00 | 100.00 | - | - | - |
| NonBest | - | 100.00 | 100.00 | - | - | - |
| Solved | 100.00 | 100.00 | 100.00 | - | - | - |
| Unknown | - | - | - | - | 100.00 | 100.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | 100.00 | - | - |
| N/A | - | - | - | 100.00 | 100.00 | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

11.1 Taillard FSS Results Size 100

Table 11.19: Result Comparison for Taillard FSS Size 100 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|----------------|------------|----------|------|-------------|-------------|-------|-----------------|-------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai20 5 0.json | 1278 | 1232 | 1278 | 1278 | 1278 | 1297 | 1393 | 1278 |
| tai20 5 1.json | 1358 | 1290 | 1359 | 1358 | 1358 | 1420 | 1529 | 1358 |
| tai20 5 2.json | 1073 | 1073 | 1081 | 1073 | 1073 | 1103 | 1298 | 1073 |
| tai20 5 3.json | 1292 | 1268 | 1293 | 1292 | 1292 | 1450 | 1506 | 1292 |
| tai20 5 4.json | 1231 | 1198 | 1236 | 1231 | 1231 | 1276 | 1405 | 1231 |
| tai20 5 5.json | 1193 | 1180 | 1195 | 1193 | 1193 | 1248 | 1402 | 1193 |
| tai20 5 6.json | 1234 | 1226 | 1239 | 1234 | 1234 | 1259 | 1351 | 1234 |
| tai20 5 7.json | 1199 | 1170 | 1206 | 1199 | 1199 | 1260 | 1424 | 1199 |
| tai20 5 8.json | 1210 | 1206 | 1230 | 1210 | 1210 | 1271 | 1415 | 1210 |
| tai20 5 9.json | 1103 | 1082 | 1108 | 1103 | 1103 | 1244 | 1300 | 1103 |

11.2 Taillard FSS Results Size 200

Table 11.20: Result Comparison for Taillard FSS Size 200 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-----------------|------------|----------|------|-------------|-------------|-------|-----------------|-------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai20 10 0.json | 1547 | 1448 | 1582 | 1559 | 1579 | 1830 | 1975 | ??? |
| tai20 10 1.json | 1587 | 1479 | 1659 | 1655 | 1686 | 1938 | 2045 | ??? |
| tai20 10 2.json | 1438 | 1407 | 1496 | 1490 | 1481 | 1594 | 1807 | ??? |
| tai20 10 3.json | 1356 | 1308 | 1378 | 1356 | 1400 | 1601 | 1662 | 1356 |
| tai20 10 4.json | 1360 | 1325 | 1419 | 1402 | 1411 | 1676 | 1799 | ??? |
| tai20 10 5.json | 1356 | 1290 | 1397 | 1378 | 1374 | 1652 | 1591 | ??? |
| tai20 10 6.json | 1398 | 1388 | 1484 | 1450 | 1446 | 1603 | 1958 | ??? |
| tai20 10 7.json | 1448 | 1363 | 1538 | 1530 | 1548 | 1819 | 1977 | ??? |
| tai20 10 8.json | 1586 | 1472 | 1593 | 1586 | 1586 | 1774 | 1854 | 1586 |
| tai20 10 9.json | 1529 | 1356 | 1591 | 1579 | 1590 | 1722 | 1974 | ??? |

11.3 Taillard FSS Results Size 250

Table 11.21: Result Comparison for Taillard FSS Size 250 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|----------------|------------|----------|------|-------------|-------------|-------|-----------------|-------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai50 5 0.json | 2724 | 2712 | 2724 | 2724 | 2724 | 3703 | 3191 | 2724 |
| tai50 5 1.json | 2834 | 2808 | 2834 | 2834 | 2834 | 3822 | 3049 | 2834 |
| tai50 5 2.json | 2612 | 2596 | 2621 | 2612 | 2612 | 3357 | 3154 | 2612 |
| tai50 5 3.json | 2751 | 2740 | 2751 | 2751 | 2751 | 3573 | 3304 | 2751 |
| tai50 5 4.json | 2853 | 2837 | 2863 | 2853 | 2853 | 3808 | 3409 | 2853 |
| tai50 5 5.json | 2825 | 2793 | 2829 | 2825 | 2825 | 3549 | 3308 | 2825 |
| tai50 5 6.json | 2716 | 2689 | 2725 | 2716 | 2716 | 3289 | 3097 | 2716 |
| tai50 5 7.json | 2683 | 2667 | 2683 | 2683 | 2683 | 3704 | 3420 | 2683 |
| tai50 5 8.json | 2545 | 2527 | 2552 | 2545 | 2549 | 3599 | 2910 | 2545 |
| tai50 5 9.json | 2776 | 2776 | 2782 | 2776 | 2776 | 3859 | 3391 | 2776 |

11.4 Taillard FSS Results Size 400

Table 11.22: Result Comparison for Taillard FSS Size 400 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-----------------|------------|----------|------|--------|-------|-------|-----------------|-------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai20 20 0.json | 2047 | 1911 | 2297 | 2309 | 2265 | 2592 | 2780 | ??? |
| tai20 20 1.json | 1844 | 1711 | 2100 | 2110 | 2125 | 2771 | 2602 | ??? |
| tai20 20 2.json | 1993 | 1844 | 2326 | 2330 | 2349 | 2946 | 2802 | ??? |
| tai20 20 3.json | 1957 | 1810 | 2223 | 2222 | 2281 | 2657 | 2782 | ??? |
| tai20 20 4.json | 2058 | 1899 | 2291 | 2267 | 2376 | 2780 | 2794 | ??? |
| tai20 20 5.json | 1974 | 1875 | 2226 | 2209 | 2176 | 2775 | 2689 | ??? |
| tai20 20 6.json | 2001 | 1875 | 2273 | 2287 | 2320 | 2654 | 2701 | ??? |
| tai20 20 7.json | 1982 | 1880 | 2200 | 2208 | 2247 | 2822 | 2739 | ??? |
| tai20 20 8.json | 1960 | 1840 | 2237 | 2240 | 2267 | 2747 | 2744 | ??? |
| tai20 20 9.json | 1971 | 1900 | 2178 | 2195 | 2176 | 3084 | 2655 | ??? |

11.5 Taillard FSS Results Size 500

Table 11.23: Result Comparison for Taillard FSS Size 500 (20 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|------------------|---------|----------|-------------|-------------|-------------|-------|-----------------|-------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tail00 5 0.json | 5493 | 5437 | 5493 | 5493 | 5493 | 7467 | 6207 | 5493 |
| tail50 10 0.json | 2976 | 2907 | 3025 | 3126 | 3162 | 5056 | 3738 | ??? |
| tail00 5 1.json | 5257 | 5208 | 5268 | 5257 | 5294 | 7427 | 5996 | ??? |
| tail50 10 1.json | 2829 | 2821 | 2892 | 2929 | 3048 | 4511 | 3503 | ??? |
| tail00 5 2.json | 5173 | 5130 | 5175 | 5173 | 5216 | 9159 | 5817 | ??? |
| tail50 10 2.json | 2830 | 2801 | 2864 | 2959 | 2962 | 4690 | 3829 | ??? |
| tail00 5 3.json | 4993 | 4963 | 5014 | 4997 | 5001 | 7711 | 5653 | ??? |
| tail50 10 3.json | 3059 | 2968 | 3064 | 3108 | 3166 | 4585 | 3981 | ??? |
| tail00 5 4.json | 5247 | 5195 | 5250 | 5247 | 5279 | 6494 | 6063 | ??? |
| tail50 10 4.json | 2933 | 2908 | 2986 | 3041 | 3093 | 4798 | 3973 | ??? |
| tail00 5 5.json | 5135 | 5063 | 5135 | 5135 | 5135 | 6895 | 5785 | 5135 |
| tail50 10 5.json | 2986 | 2941 | 3006 | 3045 | 3155 | 5262 | 3738 | ??? |
| tail00 5 6.json | 5232 | 5198 | 5246 | 5232 | 5281 | 8930 | 6023 | ??? |
| tail50 10 6.json | 3093 | 3062 | 3107 | 3142 | 3201 | 5122 | 4038 | ??? |
| tail00 5 7.json | 5083 | 5038 | 5106 | 5083 | 5137 | 8591 | 5736 | ??? |
| tail50 10 7.json | 3003 | 2959 | 3039 | 3067 | 3184 | 4647 | 3881 | ??? |
| tail00 5 8.json | 5442 | 5385 | 5454 | 5459 | 5481 | 10484 | 6077 | ??? |
| tail50 10 8.json | 2864 | 2795 | 2902 | 2950 | 3004 | 5168 | 3814 | ??? |
| tail00 5 9.json | 5318 | 5272 | 5328 | 5318 | 5346 | 7031 | 5894 | ??? |
| tail50 10 9.json | 3046 | 3046 | 3091 | 3150 | 3192 | 4844 | 3926 | ??? |

11.6 Taillard FSS Results Size 1000

Table 11.24: Result Comparison for Taillard FSS Size 1000 (20 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|------------------|---------|----------|-------------|--------|-------|-------|-----------------|-------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tail00 10 0.json | 5759 | 5759 | 5770 | 5813 | 6170 | 13926 | 6838 | ??? |
| tail50 20 0.json | 3591 | 3480 | 3875 | 3977 | 4301 | 6396 | 4874 | ??? |
| tail00 10 1.json | 5345 | 5345 | 5349 | 5438 | 5813 | 13833 | 6494 | ??? |
| tail50 20 1.json | 3554 | 3424 | 3715 | 4021 | 4085 | 8176 | 4631 | ??? |
| tail00 10 2.json | 5646 | 5623 | 5677 | 5800 | 6133 | 14051 | 6632 | ??? |
| tail50 20 2.json | 3431 | 3351 | 3668 | 3855 | 4227 | 8126 | 4636 | - |
| tail00 10 3.json | 5737 | 5732 | 5791 | 5942 | 6464 | 14455 | 7049 | ??? |
| tail50 20 3.json | 3419 | 3336 | 3752 | 3898 | 4203 | 8269 | 4887 | - |
| tail00 10 4.json | 5431 | 5431 | 5468 | 5586 | 6143 | 13433 | 6515 | ??? |
| tail50 20 4.json | 3415 | 3313 | 3635 | 3885 | 4100 | 8144 | 4455 | - |
| tail00 10 5.json | 5274 | 5246 | 5303 | 5425 | 5844 | 13887 | 6317 | ??? |
| tail50 20 5.json | 3516 | 3460 | 3698 | 3889 | 4109 | 7754 | 4589 | - |
| tail00 10 6.json | 5553 | 5523 | 5599 | 5712 | 5949 | 13754 | 6543 | ??? |
| tail50 20 6.json | 3494 | 3427 | 3716 | 3887 | 4079 | 7220 | 4660 | - |
| tail00 10 7.json | 5575 | 5556 | 5623 | 5835 | 6180 | 13909 | 6759 | ??? |
| tail50 20 7.json | 3456 | 3383 | 3709 | 3951 | 4129 | 10418 | 5023 | - |
| tail00 10 8.json | 5844 | 5779 | 5875 | 5960 | 6341 | 14723 | 6938 | ??? |
| tail50 20 8.json | 3489 | 3457 | 3765 | 4015 | 4143 | 7177 | 4811 | - |
| tail00 10 9.json | 5835 | 5830 | 5845 | 5964 | 6317 | 14483 | 6911 | ??? |
| tail50 20 9.json | 3520 | 3438 | 3777 | 3896 | 4300 | 10276 | 4848 | ??? |

11.7 Taillard FSS Results Size 2000

Table 11.25: Result Comparison for Taillard FSS Size 2000 (20 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-------------------|---------|----------|--------------|--------|-------|-------|-----------------|-------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tail00 20 0.json | 5914 | 5851 | 6286 | 6926 | 7389 | 49943 | 7844 | ??? |
| tail200 10 0.json | 10842 | 10816 | 10868 | 11159 | 11993 | ??? | 11959 | ??? |
| tail00 20 1.json | 6115 | 6099 | 6241 | 6750 | 7196 | 50000 | 7687 | ??? |
| tail200 10 1.json | 10429 | 10422 | 10494 | 11022 | 12255 | ??? | 12350 | ??? |
| tail00 20 2.json | 6139 | 6099 | 6329 | 6911 | 7408 | 50000 | 7913 | ??? |
| tail200 10 2.json | 10915 | 10886 | 10922 | 11183 | 11987 | ??? | 12369 | ??? |
| tail00 20 3.json | 6117 | 6072 | 6306 | 6719 | 7050 | ??? | 7775 | ??? |
| tail200 10 3.json | 10826 | 10794 | 10889 | 11094 | 11934 | ??? | 12324 | ??? |
| tail00 20 4.json | 6148 | 6009 | 6377 | 6926 | 7220 | 50000 | 7807 | ??? |
| tail200 10 4.json | 10474 | 10437 | 10524 | 11222 | 11982 | ??? | 12521 | ??? |
| tail00 20 5.json | 6192 | 6144 | 6437 | 6947 | 7646 | 50000 | 7846 | ??? |
| tail200 10 5.json | 10311 | 10255 | 10331 | 10741 | 11666 | ??? | 12196 | ??? |
| tail00 20 6.json | 6045 | 5991 | 6346 | 6765 | 7164 | ??? | 7989 | ??? |
| tail200 10 6.json | 10825 | 10761 | 10857 | 11278 | 12236 | ??? | 12541 | ??? |
| tail00 20 7.json | 6113 | 6084 | 6481 | 7236 | 7691 | 50000 | 8202 | ??? |
| tail200 10 7.json | 10709 | 10663 | 10731 | 11223 | 12186 | ??? | 12515 | ??? |
| tail00 20 8.json | 6014 | 5979 | 6358 | 7082 | 7445 | 49971 | 7877 | ??? |

Table 11.25: Result Comparison for Taillard FSS Size 2000 (20 Instances)

| Instance | | Best LB | Taillard | | Direct | | Direct MiniZinc | | |
|----------|-----------|------------|----------|-------|--------|-------|-----------------|---------|-----|
| | | | LB | UB | CPO | CPSat | Cplex | Chuffed | |
| tai200 | 10 8.json | 10419 | 10348 | 10438 | 10720 | 11818 | ??? | 12294 | ??? |
| tai100 | 20 9.json | 6359 | 6298 | 6465 | 6841 | 7429 | 50000 | 7934 | ??? |
| tai200 | 10 9.json | 10664 | 10616 | 10676 | 11206 | 11764 | ??? | 12378 | ??? |

11.8 Taillard FSS Results Size 4000

Table 11.26: Result Comparison for Taillard FSS Size 4000 (10 Instances)

| Instance | | Best LB | Taillard | | Direct | | Direct MiniZinc | | |
|----------|-----------|------------|----------|-------|--------|-------|-----------------|---------|-----|
| | | | LB | UB | CPO | CPSat | Cplex | Chuffed | |
| tai200 | 20 0.json | 11010 | 10979 | 11294 | 12474 | 13270 | ??? | 13870 | ??? |
| tai200 | 20 1.json | 10976 | 10947 | 11420 | 12872 | 13276 | ??? | 13614 | ??? |
| tai200 | 20 2.json | 11168 | 11150 | 11446 | 12486 | 13303 | ??? | 13308 | ??? |
| tai200 | 20 3.json | 11131 | 11127 | 11347 | 12786 | 13647 | ??? | 13695 | ??? |
| tai200 | 20 4.json | 11160 | 11132 | 11311 | 12460 | 13271 | ??? | 13835 | ??? |
| tai200 | 20 5.json | 11114 | 11085 | 11282 | 12811 | 13608 | ??? | 13409 | ??? |
| tai200 | 20 6.json | 11249 | 11194 | 11456 | 12961 | 13515 | ??? | 13933 | ??? |
| tai200 | 20 7.json | 11149 | 11126 | 11415 | 12812 | 13193 | ??? | 13773 | ??? |
| tai200 | 20 8.json | 11013 | 10965 | 11343 | 12543 | 13298 | ??? | 13726 | ??? |
| tai200 | 20 9.json | 11167 | 11122 | 11422 | 12815 | 13355 | ??? | 13455 | ??? |

11.9 Taillard FSS Results Size 10000

Table 11.27: Result Comparison for Taillard FSS Size 10000 (10 Instances)

| Instance | | Best LB | Taillard | | Direct | | Direct MiniZinc | | |
|----------|-----------|------------|----------|-------|--------|-------|-----------------|---------|-----|
| | | | LB | UB | CPO | CPSat | Cplex | Chuffed | |
| tai500 | 20 0.json | 25931 | 25922 | 26189 | 28702 | 30220 | - | ??? | ??? |
| tai500 | 20 1.json | 26390 | 26353 | 26629 | 29015 | 30765 | - | ??? | ??? |
| tai500 | 20 2.json | 26330 | 26320 | 26458 | 28835 | 30517 | - | ??? | ??? |
| tai500 | 20 3.json | 26456 | 26424 | 26549 | 28890 | 30572 | - | ??? | ??? |
| tai500 | 20 4.json | 26205 | 26181 | 26404 | 28809 | 30483 | - | ??? | ??? |
| tai500 | 20 5.json | 26436 | 26401 | 26581 | 29034 | 30843 | - | ??? | ??? |
| tai500 | 20 6.json | 26329 | 26300 | 26461 | 28713 | 30714 | - | ??? | ??? |
| tai500 | 20 7.json | 26451 | 26429 | 26615 | 28882 | 30625 | - | ??? | ??? |
| tai500 | 20 8.json | 25929 | 25891 | 26083 | 28099 | 30367 | - | ??? | ??? |
| tai500 | 20 9.json | 26355 | 26315 | 26527 | 28721 | 30643 | - | ??? | ??? |

Chapter 12

Result Comparison for Taillard JSS

Table 12.1: Taillard JSS Results Summary Size 225 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 9 | 9 | - | - | 3 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 2 | - | - | - | - | - |
| Optimal | 2 | 9 | 9 | - | - | 3 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | 1 | 1 | - | - | - |
| Best | - | 1 | 1 | - | - | - |
| BestOrOptimal | 2 | 10 | 10 | - | - | 3 |
| Gap1 | 1 | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | 1 | - | - | - | - | - |
| Gap4Plus | 6 | - | - | 10 | 10 | - |
| NonBest | 8 | - | - | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 3 |
| Unknown | - | - | - | - | - | 7 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 7 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 12.2: Taillard JSS Results Summary Size 225 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 90.00 | 90.00 | - | - | 30.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 20.00 | - | - | - | - | - |
| Optimal | 20.00 | 90.00 | 90.00 | - | - | 30.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | 10.00 | 10.00 | - | - | - |
| Best | - | 10.00 | 10.00 | - | - | - |
| BestOrOptimal | 20.00 | 100.00 | 100.00 | - | - | 30.00 |
| Gap1 | 10.00 | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | 10.00 | - | - | - | - | - |
| Gap4Plus | 60.00 | - | - | 100.00 | 100.00 | - |
| NonBest | 80.00 | - | - | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 30.00 |
| Unknown | - | - | - | - | - | 70.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 70.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 12.3: Taillard JSS Results Summary Size 300 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 2 | 2 | - | - | 1 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 1 | - | - | - | - | - |
| Optimal | 1 | 2 | 2 | - | - | 1 |
| UniqueBest | 1 | 1 | 6 | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 1 | 1 | 6 | - | - | - |
| BestOrOptimal | 2 | 3 | 8 | - | - | 1 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 8 | 7 | 2 | 10 | 10 | - |
| NonBest | 8 | 7 | 2 | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 1 |
| Unknown | - | - | - | - | - | 9 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | 9 |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 12.4: Taillard JSS Results Summary Size 300 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 20.00 | 20.00 | - | - | 10.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 10.00 | - | - | - | - | - |
| Optimal | 10.00 | 20.00 | 20.00 | - | - | 10.00 |
| UniqueBest | 10.00 | 10.00 | 60.00 | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 10.00 | 10.00 | 60.00 | - | - | - |
| BestOrOptimal | 20.00 | 30.00 | 80.00 | - | - | 10.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 80.00 | 70.00 | 20.00 | 100.00 | 100.00 | - |
| NonBest | 80.00 | 70.00 | 20.00 | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 10.00 |
| Unknown | - | - | - | - | - | 90.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 90.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 12.5: Taillard JSS Results Summary Size 400 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 4 | 2 | 2 | - | - | - |
| SharedBest | 1 | 1 | 2 | - | - | - |
| Best | 5 | 3 | 4 | - | - | - |
| BestOrOptimal | 5 | 3 | 4 | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | 1 | 1 | - | - | - |
| Gap4Plus | 5 | 6 | 5 | 10 | 10 | - |
| NonBest | 5 | 7 | 6 | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | - |
| Unknown | - | - | - | - | - | 10 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 10 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 12.6: Taillard JSS Results Summary Size 400 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 40.00 | 20.00 | 20.00 | - | - | - |
| SharedBest | 10.00 | 10.00 | 20.00 | - | - | - |
| Best | 50.00 | 30.00 | 40.00 | - | - | - |
| BestOrOptimal | 50.00 | 30.00 | 40.00 | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | 10.00 | 10.00 | - | - | - |
| Gap4Plus | 50.00 | 60.00 | 50.00 | 100.00 | 100.00 | - |
| NonBest | 50.00 | 70.00 | 60.00 | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | - |
| Unknown | - | - | - | - | - | 100.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 12.7: Taillard JSS Results Summary Size 450 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | 1 | - | - | - |
| SharedProvenOptimal | - | 1 | 1 | - | - | 1 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 1 | - | - | - | - | - |
| Optimal | 1 | 1 | 2 | - | - | 1 |
| UniqueBest | 3 | 5 | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 3 | 5 | - | - | - | - |
| BestOrOptimal | 4 | 6 | 2 | - | - | 1 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | 1 | - | - | - |
| Gap4Plus | 6 | 4 | 7 | 10 | 10 | - |
| NonBest | 6 | 4 | 8 | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 1 |
| Unknown | - | - | - | - | - | 9 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 9 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 12.8: Taillard JSS Results Summary Size 450 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | 10.00 | - | - | - |
| SharedProvenOptimal | - | 10.00 | 10.00 | - | - | 10.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 10.00 | - | - | - | - | - |
| Optimal | 10.00 | 10.00 | 20.00 | - | - | 10.00 |
| UniqueBest | 30.00 | 50.00 | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 30.00 | 50.00 | - | - | - | - |
| BestOrOptimal | 40.00 | 60.00 | 20.00 | - | - | 10.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | 10.00 | - | - | - |
| Gap4Plus | 60.00 | 40.00 | 70.00 | 100.00 | 100.00 | - |
| NonBest | 60.00 | 40.00 | 80.00 | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 10.00 |
| Unknown | - | - | - | - | - | 90.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | 90.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 12.9: Taillard JSS Results Summary Size 600 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 5 | 4 | 1 | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 5 | 4 | 1 | - | - | - |
| BestOrOptimal | 5 | 4 | 1 | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | 1 | - | - | - | - | - |
| Gap4Plus | 4 | 6 | 9 | 2 | 10 | - |
| NonBest | 5 | 6 | 9 | 2 | 10 | - |
| Solved | 10 | 10 | 10 | 2 | 10 | - |
| Unknown | - | - | - | 8 | - | 10 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 8 | - | 10 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 12.10: Taillard JSS Results Summary Size 600 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | - | - | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | - | - | - | - | - |
| UniqueBest | 50.00 | 40.00 | 10.00 | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | 50.00 | 40.00 | 10.00 | - | - | - |
| BestOrOptimal | 50.00 | 40.00 | 10.00 | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | 10.00 | - | - | - | - | - |
| Gap4Plus | 40.00 | 60.00 | 90.00 | 20.00 | 100.00 | - |
| NonBest | 50.00 | 60.00 | 90.00 | 20.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 20.00 | 100.00 | - |
| Unknown | - | - | - | 80.00 | - | 100.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 80.00 | - | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 12.11: Taillard JSS Results Summary Size 750 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | 9 | 10 | 10 | - | - | 1 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 1 | - | - | - | - | - |
| Optimal | 10 | 10 | 10 | - | - | 1 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 10 | 10 | 10 | - | - | 1 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | - | - | - | 10 | - |
| NonBest | - | - | - | - | 10 | - |
| Solved | 10 | 10 | 10 | - | 10 | 1 |
| Unknown | - | - | - | 10 | - | 9 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 10 | - | 9 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 12.12: Taillard JSS Results Summary Size 750 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | 90.00 | 100.00 | 100.00 | - | - | 10.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 10.00 | - | - | - | - | - |
| Optimal | 100.00 | 100.00 | 100.00 | - | - | 10.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 100.00 | 100.00 | 100.00 | - | - | 10.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | - | - | - | 100.00 | - |
| NonBest | - | - | - | - | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | - | 100.00 | 10.00 |
| Unknown | - | - | - | 100.00 | - | 90.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 100.00 | - | 90.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 12.13: Taillard JSS Results Summary Size 1000 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | 1 | - | - | - | - | - |
| SharedProvenOptimal | 5 | 7 | 1 | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 2 | - | - | - | - | - |
| Optimal | 8 | 7 | 1 | - | - | - |
| UniqueBest | - | 2 | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | 2 | - | - | - | - |
| BestOrOptimal | 8 | 9 | 1 | - | - | - |
| Gap1 | 1 | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 1 | 1 | 9 | - | 10 | - |
| NonBest | 2 | 1 | 9 | - | 10 | - |
| Solved | 10 | 10 | 10 | - | 10 | - |
| Unknown | - | - | - | 10 | - | 10 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 10 | - | 10 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 12.14: Taillard JSS Results Summary Size 1000 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | 10.00 | - | - | - | - | - |
| SharedProvenOptimal | 50.00 | 70.00 | 10.00 | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 20.00 | - | - | - | - | - |
| Optimal | 80.00 | 70.00 | 10.00 | - | - | - |
| UniqueBest | - | 20.00 | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | 20.00 | - | - | - | - |
| BestOrOptimal | 80.00 | 90.00 | 10.00 | - | - | - |
| Gap1 | 10.00 | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 10.00 | 10.00 | 90.00 | - | 100.00 | - |
| NonBest | 20.00 | 10.00 | 90.00 | - | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | - | 100.00 | - |
| Unknown | - | - | - | 100.00 | - | 100.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 100.00 | - | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 12.15: Taillard JSS Results Summary Size 2000 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | 9 | 10 | 1 | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 1 | - | - | - | - | - |
| Optimal | 10 | 10 | 1 | - | - | - |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 10 | 10 | 1 | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | - | 9 | - | - | - |
| NonBest | - | - | 9 | - | - | - |
| Solved | 10 | 10 | 10 | - | - | - |
| Unknown | - | - | - | - | 10 | 10 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | 10 | - | - |
| N/A | - | - | - | 10 | 10 | 10 |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 12.16: Taillard JSS Results Summary Size 2000 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | 90.00 | 100.00 | 10.00 | - | - | - |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 10.00 | - | - | - | - | - |
| Optimal | 100.00 | 100.00 | 10.00 | - | - | - |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 100.00 | 100.00 | 10.00 | - | - | - |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | - | 90.00 | - | - | - |
| NonBest | - | - | 90.00 | - | - | - |
| Solved | 100.00 | 100.00 | 100.00 | - | - | - |
| Unknown | - | - | - | - | 100.00 | 100.00 |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | 100.00 | - | - |
| N/A | - | - | - | 100.00 | 100.00 | 100.00 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

12.1 Taillard JSS Results Size 225

Table 12.17: Result Comparison for Taillard JSS Size 225 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-----------------|---------|----------|------|-------------|-------------|-------|-----------------|-------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai15 15 0.json | 1231 | 1005 | 1231 | 1231 | 1231 | 1291 | 9418 | 1231 |
| tai15 15 1.json | 1244 | 953 | 1244 | 1244 | 1244 | 1308 | 8797 | ??? |
| tai15 15 2.json | 1218 | 1036 | 1222 | 1218 | 1218 | 1280 | 9156 | 1218 |
| tai15 15 3.json | 1175 | 973 | 1181 | 1175 | 1175 | 1265 | 8304 | ??? |
| tai15 15 4.json | 1224 | 940 | 1233 | 1224 | 1224 | 1310 | 9176 | ??? |
| tai15 15 5.json | 1202 | 1134 | 1243 | 1238 | 1238 | 1314 | 8914 | ??? |
| tai15 15 6.json | 1227 | 1103 | 1228 | 1227 | 1227 | 1292 | 8194 | ??? |
| tai15 15 7.json | 1217 | 980 | 1220 | 1217 | 1217 | 1275 | 8770 | ??? |
| tai15 15 8.json | 1274 | 1020 | 1282 | 1274 | 1274 | 1381 | 9923 | ??? |
| tai15 15 9.json | 1241 | 940 | 1259 | 1241 | 1241 | 1339 | 8035 | 1241 |

12.2 Taillard JSS Results Size 300

Table 12.18: Result Comparison for Taillard JSS Size 300 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-----------------|---------|----------|-------------|-------------|-------------|-------|-----------------|-------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai20 15 0.json | 1310 | 1254 | 1376 | 1393 | 1368 | 1760 | 10811 | ??? |
| tai20 15 1.json | 1351 | 1267 | 1377 | 1373 | 1379 | 1622 | 12768 | ??? |
| tai20 15 2.json | 1277 | 1243 | 1367 | 1360 | 1356 | 1698 | 11324 | ??? |
| tai20 15 3.json | 1345 | 1329 | 1345 | 1345 | 1345 | 1512 | 11721 | 1345 |
| tai20 15 4.json | 1301 | 1163 | 1366 | 1373 | 1355 | 1693 | 11651 | ??? |
| tai20 15 5.json | 1302 | 1211 | 1371 | 1378 | 1360 | 1688 | 12945 | ??? |
| tai20 15 6.json | 1462 | 1306 | 1480 | 1462 | 1462 | 1755 | 11955 | ??? |
| tai20 15 7.json | 1359 | 1315 | 1413 | 1425 | 1417 | 1721 | 12108 | ??? |
| tai20 15 8.json | 1297 | 1202 | 1352 | 1366 | 1336 | 1578 | 11810 | ??? |
| tai20 15 9.json | 1315 | 1213 | 1362 | 1360 | 1355 | 1655 | 12143 | ??? |

12.3 Taillard JSS Results Size 400

Table 12.19: Result Comparison for Taillard JSS Size 400 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-----------------|---------|----------|-------------|-------------|-------------|-------|-----------------|-------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai20 20 0.json | 1572 | 1217 | 1663 | 1687 | 1666 | 2049 | 16156 | ??? |
| tai20 20 1.json | 1524 | 1314 | 1626 | 1651 | 1630 | 1953 | 16929 | ??? |
| tai20 20 2.json | 1491 | 1248 | 1574 | 1561 | 1565 | 1821 | 16304 | ??? |
| tai20 20 3.json | 1611 | 1284 | 1660 | 1650 | 1647 | 1862 | 16037 | ??? |
| tai20 20 4.json | 1524 | 1256 | 1598 | 1619 | 1598 | 1915 | 15175 | ??? |
| tai20 20 5.json | 1557 | 1245 | 1657 | 1676 | 1663 | 1987 | 17266 | ??? |
| tai20 20 6.json | 1621 | 1403 | 1704 | 1694 | 1700 | 2056 | 17621 | ??? |
| tai20 20 7.json | 1585 | 1387 | 1626 | 1614 | 1614 | 1908 | 15773 | ??? |
| tai20 20 8.json | 1529 | 1352 | 1629 | 1642 | 1640 | 1937 | 17547 | ??? |
| tai20 20 9.json | 1478 | 1277 | 1614 | 1640 | 1600 | 1919 | 16171 | ??? |

12.4 Taillard JSS Results Size 450

Table 12.20: Result Comparison for Taillard JSS Size 450 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-----------------|---------|----------|-------------|-------------|-------------|-------|-----------------|-------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai30 15 0.json | 1764 | 1764 | 1770 | 1766 | 1778 | 2407 | 17886 | ??? |
| tai30 15 1.json | 1774 | 1774 | 1841 | 1845 | 1851 | 2659 | 18875 | ??? |
| tai30 15 2.json | 1783 | 1733 | 1832 | 1842 | 1842 | 2610 | 18545 | ??? |
| tai30 15 3.json | 1828 | 1828 | 1851 | 1846 | 1866 | 2493 | 17846 | ??? |
| tai30 15 4.json | 2007 | 1754 | 2007 | 2007 | 2007 | 2682 | 17984 | 2007 |
| tai30 15 5.json | 1819 | 1777 | 1844 | 1825 | 1828 | 2349 | 18289 | ??? |
| tai30 15 6.json | 1771 | 1771 | 1815 | 1791 | 1815 | 2465 | 18281 | ??? |
| tai30 15 7.json | 1673 | 1673 | 1700 | 1690 | 1704 | 2315 | 17162 | ??? |
| tai30 15 8.json | 1795 | 1764 | 1811 | 1821 | 1795 | 2493 | 15933 | ??? |
| tai30 15 9.json | 1642 | 1608 | 1720 | 1740 | 1737 | 2508 | 17342 | ??? |

12.5 Taillard JSS Results Size 600

Table 12.21: Result Comparison for Taillard JSS Size 600 (10 Instances)

| Instance | Best LB | Taillard LB | UB | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | CPSat |
|-----------------|---------|-------------|------|------------|-------|-------|-------------------------|-------|
| tai30 20 0.json | 1889 | 1850 | 2064 | 2061 | 2127 | ??? | 25752 | ??? |
| tai30 20 1.json | 1873 | 1761 | 1983 | 2001 | 2019 | 3450 | 25464 | ??? |
| tai30 20 2.json | 1809 | 1710 | 1896 | 1889 | 1926 | ??? | 23352 | ??? |
| tai30 20 3.json | 1936 | 1820 | 2031 | 2027 | 2051 | ??? | 22755 | ??? |
| tai30 20 4.json | 1997 | 1785 | 2032 | 2037 | 2100 | ??? | 25207 | ??? |
| tai30 20 5.json | 1943 | 1940 | 2057 | 2095 | 2053 | ??? | 25193 | ??? |
| tai30 20 6.json | 1797 | 1751 | 1947 | 1959 | 1979 | ??? | 23771 | ??? |
| tai30 20 7.json | 1912 | 1770 | 2001 | 1991 | 2001 | 3544 | 23737 | ??? |
| tai30 20 8.json | 1926 | 1758 | 2013 | 2027 | 2050 | ??? | 24001 | ??? |
| tai30 20 9.json | 1819 | 1678 | 1973 | 2009 | 1991 | ??? | 25025 | ??? |

12.6 Taillard JSS Results Size 750

Table 12.22: Result Comparison for Taillard JSS Size 750 (10 Instances)

| Instance | Best LB | Taillard LB | UB | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | CPSat |
|-----------------|---------|-------------|------|------------|-------|-------|-------------------------|-------|
| tai50 15 0.json | 2760 | 2760 | 2760 | 2760 | 2760 | ??? | 30383 | ??? |
| tai50 15 1.json | 2756 | 2756 | 2756 | 2756 | 2756 | ??? | 30234 | ??? |
| tai50 15 2.json | 2717 | 2717 | 2717 | 2717 | 2717 | ??? | 27935 | ??? |
| tai50 15 3.json | 2839 | 2813 | 2839 | 2839 | 2839 | ??? | 27740 | 2839 |
| tai50 15 4.json | 2679 | 2679 | 2679 | 2679 | 2679 | ??? | 28759 | ??? |
| tai50 15 5.json | 2781 | 2781 | 2781 | 2781 | 2781 | ??? | 30548 | ??? |
| tai50 15 6.json | 2943 | 2943 | 2943 | 2943 | 2943 | ??? | 30818 | ??? |
| tai50 15 7.json | 2885 | 2885 | 2885 | 2885 | 2885 | ??? | 31225 | ??? |
| tai50 15 8.json | 2655 | 2655 | 2655 | 2655 | 2655 | ??? | 29536 | ??? |
| tai50 15 9.json | 2723 | 2723 | 2723 | 2723 | 2723 | ??? | 30233 | ??? |

12.7 Taillard JSS Results Size 1000

Table 12.23: Result Comparison for Taillard JSS Size 1000 (10 Instances)

| Instance | Best LB | Taillard LB | UB | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | CPSat |
|-----------------|---------|-------------|------|------------|-------|-------|-------------------------|-------|
| tai50 20 0.json | 2868 | 2868 | 2868 | 2868 | 2881 | ??? | 40459 | ??? |
| tai50 20 1.json | 2869 | 2848 | 2902 | 2901 | 2981 | ??? | 43188 | ??? |
| tai50 20 2.json | 2755 | 2755 | 2755 | 2755 | 2797 | ??? | 41135 | ??? |
| tai50 20 3.json | 2702 | 2697 | 2702 | 2702 | 2738 | ??? | 40216 | ??? |
| tai50 20 4.json | 2725 | 2725 | 2725 | 2725 | 2805 | ??? | 40058 | ??? |
| tai50 20 5.json | 2845 | 2845 | 2845 | 2881 | 2895 | ??? | 40644 | ??? |
| tai50 20 6.json | 2825 | 2812 | 2841 | 2826 | 2872 | ??? | 40272 | ??? |
| tai50 20 7.json | 2784 | 2764 | 2784 | 2784 | 2829 | ??? | 39736 | ??? |
| tai50 20 8.json | 3071 | 3071 | 3071 | 3071 | 3071 | ??? | 41170 | ??? |
| tai50 20 9.json | 2995 | 2995 | 2995 | 2995 | 3046 | ??? | 41424 | ??? |

12.8 Taillard JSS Results Size 2000

Table 12.24: Result Comparison for Taillard JSS Size 2000 (10 Instances)

| Instance | Best LB | Taillard LB | UB | Direct CPO | CPSat | Cplex | Direct MiniZinc Chuffed | CPSat |
|------------------|---------|-------------|------|------------|-------|-------|-------------------------|-------|
| tai100 20 0.json | 5464 | 5464 | 5464 | 5464 | 5616 | - | ??? | ??? |
| tai100 20 1.json | 5181 | 5181 | 5181 | 5181 | 5282 | - | ??? | ??? |
| tai100 20 2.json | 5568 | 5552 | 5568 | 5568 | 5568 | - | ??? | ??? |
| tai100 20 3.json | 5339 | 5339 | 5339 | 5339 | 5356 | - | ??? | ??? |
| tai100 20 4.json | 5392 | 5392 | 5392 | 5392 | 5656 | - | ??? | ??? |
| tai100 20 5.json | 5342 | 5342 | 5342 | 5342 | 5411 | - | ??? | ??? |
| tai100 20 6.json | 5436 | 5436 | 5436 | 5436 | 5473 | - | ??? | ??? |
| tai100 20 7.json | 5394 | 5394 | 5394 | 5394 | 5431 | - | ??? | ??? |
| tai100 20 8.json | 5358 | 5358 | 5358 | 5358 | 5409 | - | ??? | ??? |
| tai100 20 9.json | 5183 | 5183 | 5183 | 5183 | 5288 | - | ??? | ??? |

Chapter 13

Result Comparison for Taillard OSS

Table 13.1: Taillard OSS Results Summary Size 16 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 10 | 10 | 10 | 10 | 10 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 10 | - | - | - | - | - |
| Optimal | 10 | 10 | 10 | 10 | 10 | 10 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 10 | 10 | 10 | 10 | 10 | 10 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | - | - | - | - | - |
| NonBest | - | - | - | - | - | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 10 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 13.2: Taillard OSS Results Summary Size 16 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 100.00 | - | - | - | - | - |
| Optimal | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | - | - | - | - | - | - |
| NonBest | - | - | - | - | - | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 13.3: Taillard OSS Results Summary Size 25 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 10 | 10 | 10 | 10 | 10 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 7 | - | - | - | - | - |
| Optimal | 7 | 10 | 10 | 10 | 10 | 10 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 7 | 10 | 10 | 10 | 10 | 10 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | 1 | - | - | - | - | - |
| Gap3 | 1 | - | - | - | - | - |
| Gap4Plus | 1 | - | - | - | - | - |
| NonBest | 3 | - | - | - | - | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 10 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 13.4: Taillard OSS Results Summary Size 25 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | 70.00 | - | - | - | - | - |
| Optimal | 70.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | 70.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | 10.00 | - | - | - | - | - |
| Gap3 | 10.00 | - | - | - | - | - |
| Gap4Plus | 10.00 | - | - | - | - | - |
| NonBest | 30.00 | - | - | - | - | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 13.5: Taillard OSS Results Summary Size 49 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 10 | 10 | 4 | 10 | 10 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | 6 | - | - |
| Optimal | - | 10 | 10 | 10 | 10 | 10 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | - | 10 | 10 | 10 | 10 | 10 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | 3 | - | - | - | - | - |
| Gap3 | 2 | - | - | - | - | - |
| Gap4Plus | 5 | - | - | - | - | - |
| NonBest | 10 | - | - | - | - | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 10 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 13.6: Taillard OSS Results Summary Size 49 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 100.00 | 100.00 | 40.00 | 100.00 | 100.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | 60.00 | - | - |
| Optimal | - | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | - | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | 30.00 | - | - | - | - | - |
| Gap3 | 20.00 | - | - | - | - | - |
| Gap4Plus | 50.00 | - | - | - | - | - |
| NonBest | 100.00 | - | - | - | - | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 13.7: Taillard OSS Results Summary Size 100 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 10 | 10 | - | - | 10 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | 2 | - | - |
| Optimal | - | 10 | 10 | 2 | - | 10 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | - | 10 | 10 | 2 | - | 10 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 10 | - | - | 8 | 10 | - |
| NonBest | 10 | - | - | 8 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 10 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 13.8: Taillard OSS Results Summary Size 100 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 100.00 | 100.00 | - | - | 100.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | 20.00 | - | - |
| Optimal | - | 100.00 | 100.00 | 20.00 | - | 100.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | - | 100.00 | 100.00 | 20.00 | - | 100.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 100.00 | - | - | 80.00 | 100.00 | - |
| NonBest | 100.00 | - | - | 80.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 13.9: Taillard OSS Results Summary Size 225 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 10 | 10 | - | - | 10 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | 10 | 10 | - | - | 10 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | - | 10 | 10 | - | - | 10 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 10 | - | - | 10 | 10 | - |
| NonBest | 10 | - | - | 10 | 10 | - |
| Solved | 10 | 10 | 10 | 10 | 10 | 10 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 13.10: Taillard OSS Results Summary Size 225 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 100.00 | 100.00 | - | - | 100.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | 100.00 | 100.00 | - | - | 100.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | - | 100.00 | 100.00 | - | - | 100.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 100.00 | - | - | 100.00 | 100.00 | - |
| NonBest | 100.00 | - | - | 100.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Unknown | - | - | - | - | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | - | - | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Table 13.11: Taillard OSS Results Summary Size 400 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|------|-----|-------|-------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 10 | 10 | - | - | 10 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | 10 | 10 | - | - | 10 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | - | 10 | 10 | - | - | 10 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 10 | - | - | 7 | 10 | - |
| NonBest | 10 | - | - | 7 | 10 | - |
| Solved | 10 | 10 | 10 | 7 | 10 | 10 |
| Unknown | - | - | - | 3 | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 3 | - | - |
| Total | 10 | 10 | 10 | 10 | 10 | 10 |

Table 13.12: Taillard OSS Results Summary Size 400 (10 Instances)

| Type | base | CPO | CPSat | Cplex | Chuffed | MCPSat |
|-----------------------|--------|--------|--------|--------|---------|--------|
| UniqueProvenOptimal | - | - | - | - | - | - |
| SharedProvenOptimal | - | 100.00 | 100.00 | - | - | 100.00 |
| UniqueUnprovenOptimal | - | - | - | - | - | - |
| SharedUnprovenOptimal | - | - | - | - | - | - |
| Optimal | - | 100.00 | 100.00 | - | - | 100.00 |
| UniqueBest | - | - | - | - | - | - |
| SharedBest | - | - | - | - | - | - |
| Best | - | - | - | - | - | - |
| BestOrOptimal | - | 100.00 | 100.00 | - | - | 100.00 |
| Gap1 | - | - | - | - | - | - |
| Gap2 | - | - | - | - | - | - |
| Gap3 | - | - | - | - | - | - |
| Gap4Plus | 100.00 | - | - | 70.00 | 100.00 | - |
| NonBest | 100.00 | - | - | 70.00 | 100.00 | - |
| Solved | 100.00 | 100.00 | 100.00 | 70.00 | 100.00 | 100.00 |
| Unknown | - | - | - | 30.00 | - | - |
| Infeasible | - | - | - | - | - | - |
| NotPresent | - | - | - | - | - | - |
| N/A | - | - | - | 30.00 | - | - |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

13.1 Taillard OSS Results Size 16

Table 13.13: Result Comparison for Taillard OSS Size 16 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Direct MiniZinc | | |
|---------------|---------|----------|-----|------------|------------|-----------------|------------|------------|
| | | LB | UB | CPO | CPSat | Cplex | Chuffed | CPSat |
| tai4 4 0.json | 193 | 186 | 193 | 193 | 193 | 193 | 193 | 193 |
| tai4 4 1.json | 236 | 229 | 236 | 236 | 236 | 236 | 236 | 236 |
| tai4 4 2.json | 271 | 262 | 271 | 271 | 271 | 271 | 271 | 271 |
| tai4 4 3.json | 250 | 245 | 250 | 250 | 250 | 250 | 250 | 250 |
| tai4 4 4.json | 295 | 287 | 295 | 295 | 295 | 295 | 295 | 295 |
| tai4 4 5.json | 189 | 185 | 189 | 189 | 189 | 189 | 189 | 189 |
| tai4 4 6.json | 201 | 197 | 201 | 201 | 201 | 201 | 201 | 201 |
| tai4 4 7.json | 217 | 212 | 217 | 217 | 217 | 217 | 217 | 217 |
| tai4 4 8.json | 261 | 258 | 261 | 261 | 261 | 261 | 261 | 261 |
| tai4 4 9.json | 217 | 213 | 217 | 217 | 217 | 217 | 217 | 217 |

13.2 Taillard OSS Results Size 25

Table 13.14: Result Comparison for Taillard OSS Size 25 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Direct MiniZinc | | |
|---------------|---------|----------|-----|------------|------------|-----------------|------------|------------|
| | | LB | UB | CPO | CPSat | Cplex | Chuffed | CPSat |
| tai5 5 0.json | 300 | 295 | 300 | 300 | 300 | 300 | 300 | 300 |
| tai5 5 1.json | 262 | 255 | 262 | 262 | 262 | 262 | 262 | 262 |
| tai5 5 2.json | 323 | 321 | 328 | 323 | 323 | 323 | 323 | 323 |
| tai5 5 3.json | 310 | 306 | 310 | 310 | 310 | 310 | 310 | 310 |
| tai5 5 4.json | 326 | 321 | 329 | 326 | 326 | 326 | 326 | 326 |
| tai5 5 5.json | 312 | 307 | 312 | 312 | 312 | 312 | 312 | 312 |
| tai5 5 6.json | 303 | 298 | 305 | 303 | 303 | 303 | 303 | 303 |
| tai5 5 7.json | 300 | 292 | 300 | 300 | 300 | 300 | 300 | 300 |
| tai5 5 8.json | 353 | 349 | 353 | 353 | 353 | 353 | 353 | 353 |
| tai5 5 9.json | 326 | 321 | 326 | 326 | 326 | 326 | 326 | 326 |

13.3 Taillard OSS Results Size 49

Table 13.15: Result Comparison for Taillard OSS Size 49 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Direct MiniZinc | | |
|---------------|---------|----------|-----|------------|------------|-----------------|------------|------------|
| | | LB | UB | CPO | CPSat | Cplex | Chuffed | CPSat |
| tai7 7 0.json | 435 | 435 | 438 | 435 | 435 | 435 | 435 | 435 |
| tai7 7 1.json | 443 | 443 | 449 | 443 | 443 | 443 | 443 | 443 |
| tai7 7 2.json | 468 | 468 | 479 | 468 | 468 | 468 | 468 | 468 |
| tai7 7 3.json | 463 | 463 | 467 | 463 | 463 | 463 | 463 | 463 |
| tai7 7 4.json | 416 | 416 | 419 | 416 | 416 | 416 | 416 | 416 |
| tai7 7 5.json | 451 | 451 | 460 | 451 | 451 | 451 | 451 | 451 |
| tai7 7 6.json | 422 | 422 | 435 | 422 | 422 | 422 | 422 | 422 |
| tai7 7 7.json | 424 | 424 | 426 | 424 | 424 | 424 | 424 | 424 |
| tai7 7 8.json | 458 | 458 | 460 | 458 | 458 | 458 | 458 | 458 |
| tai7 7 9.json | 398 | 398 | 400 | 398 | 398 | 398 | 398 | 398 |

13.4 Taillard OSS Results Size 100

Table 13.16: Result Comparison for Taillard OSS Size 100 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Direct MiniZinc | | |
|-----------------|---------|----------|-----|------------|------------|-----------------|---------|------------|
| | | LB | UB | CPO | CPSat | Cplex | Chuffed | CPSat |
| tai10 10 0.json | 637 | 637 | 652 | 637 | 637 | 686 | 3333 | 637 |
| tai10 10 1.json | 588 | 588 | 596 | 588 | 588 | 588 | 3044 | 588 |
| tai10 10 2.json | 598 | 598 | 617 | 598 | 598 | 609 | 3375 | 598 |
| tai10 10 3.json | 577 | 577 | 581 | 577 | 577 | 581 | 2922 | 577 |
| tai10 10 4.json | 640 | 640 | 657 | 640 | 640 | 680 | 3155 | 640 |
| tai10 10 5.json | 538 | 538 | 545 | 538 | 538 | 555 | 2777 | 538 |
| tai10 10 6.json | 616 | 616 | 623 | 616 | 616 | 620 | 3085 | 616 |
| tai10 10 7.json | 595 | 595 | 606 | 595 | 595 | 599 | 2814 | 595 |
| tai10 10 8.json | 595 | 595 | 606 | 595 | 595 | 595 | 2275 | 595 |
| tai10 10 9.json | 596 | 596 | 604 | 596 | 596 | 602 | 2539 | 596 |

13.5 Taillard OSS Results Size 225

Table 13.17: Result Comparison for Taillard OSS Size 225 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-----------------|------------|----------|-----|------------|------------|-------|-----------------|------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai15 15 0.json | 937 | 937 | 956 | 937 | 937 | 1401 | 8625 | 937 |
| tai15 15 1.json | 918 | 918 | 957 | 918 | 918 | 1419 | 8960 | 918 |
| tai15 15 2.json | 871 | 871 | 899 | 871 | 871 | 1224 | 8472 | 871 |
| tai15 15 3.json | 934 | 934 | 946 | 934 | 934 | 1189 | 9134 | 934 |
| tai15 15 4.json | 946 | 946 | 992 | 946 | 946 | 1290 | 8257 | 946 |
| tai15 15 5.json | 933 | 933 | 959 | 933 | 933 | 1226 | 8782 | 933 |
| tai15 15 6.json | 891 | 891 | 931 | 891 | 891 | 1261 | 8325 | 891 |
| tai15 15 7.json | 893 | 893 | 916 | 893 | 893 | 1223 | 9288 | 893 |
| tai15 15 8.json | 899 | 899 | 951 | 899 | 899 | 1296 | 8785 | 899 |
| tai15 15 9.json | 902 | 902 | 935 | 902 | 902 | 1263 | 9097 | 902 |

13.6 Taillard OSS Results Size 400

Table 13.18: Result Comparison for Taillard OSS Size 400 (10 Instances)

| Instance | Best LB | Taillard | | Direct | | Cplex | Direct MiniZinc | |
|-----------------|------------|----------|------|-------------|-------------|-------|-----------------|-------------|
| | | LB | UB | CPO | CPSat | | Chuffed | CPSat |
| tai20 20 0.json | 1155 | 1155 | 1215 | 1155 | 1155 | 4464 | 14845 | 1155 |
| tai20 20 1.json | 1241 | 1241 | 1332 | 1241 | 1241 | 5450 | 16520 | 1241 |
| tai20 20 2.json | 1257 | 1257 | 1294 | 1257 | 1257 | 5121 | 16782 | 1257 |
| tai20 20 3.json | 1248 | 1248 | 1310 | 1248 | 1248 | ??? | 15893 | 1248 |
| tai20 20 4.json | 1256 | 1256 | 1301 | 1256 | 1256 | ??? | 15745 | 1256 |
| tai20 20 5.json | 1204 | 1204 | 1252 | 1204 | 1204 | 3377 | 16048 | 1204 |
| tai20 20 6.json | 1294 | 1294 | 1352 | 1294 | 1294 | 5160 | 16680 | 1294 |
| tai20 20 7.json | 1169 | 1169 | 1269 | 1169 | 1169 | ??? | 16067 | 1169 |
| tai20 20 8.json | 1289 | 1289 | 1322 | 1289 | 1289 | 4701 | 16624 | 1289 |
| tai20 20 9.json | 1241 | 1241 | 1284 | 1241 | 1241 | 3399 | 16896 | 1241 |