

Results for Scheduling Benchmark Classes

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November 1, 2024

Table 1: Results for Taillard OpenShop (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
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

Table 1: Results for Taillard OpenShop (60 Instances)

Name	Nr Jobs	Nr Machines	Status	Time	Makespan	Bound	Gap Percent
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

Table 2: Results for Taillard JobShop (80 Instances)

Name	Nr Jobs	Nr Machines	Status	Time	Makespan	Bound	Gap Percent
tai100 20 0.json	100	20	Optimal	266.17	5464	5464.00	0.00
tai100 20 1.json	100	20	Optimal	31.20	5181	5181.00	0.00
tai100 20 2.json	100	20	Optimal	38.67	5568	5568.00	0.00
tai100 20 3.json	100	20	Optimal	177.17	5339	5339.00	0.00
tai100 20 4.json	100	20	Solution	300.04	5412	5392.00	0.37
tai100 20 5.json	100	20	Optimal	172.70	5342	5342.00	0.00
tai100 20 6.json	100	20	Optimal	298.02	5436	5436.00	0.00
tai100 20 7.json	100	20	Optimal	111.51	5394	5394.00	0.00
tai100 20 8.json	100	20	Optimal	86.84	5358	5358.00	0.00
tai100 20 9.json	100	20	Optimal	188.94	5183	5183.00	0.00
tai15 15 0.json	15	15	Optimal	12.44	1231	1231.00	0.00

Table 2: Results for Taillard JobShop (80 Instances)

Name	Nr Jobs	Nr Machines	Status	Time	Makespan	Bound	Gap Percent
tai15 15 1.json	15	15	Optimal	35.14	1244	1244.00	0.00
tai15 15 2.json	15	15	Optimal	17.26	1218	1218.00	0.00
tai15 15 3.json	15	15	Optimal	30.94	1175	1175.00	0.00
tai15 15 4.json	15	15	Optimal	134.85	1224	1224.00	0.00
tai15 15 5.json	15	15	Solution	300.02	1243	1183.00	4.83
tai15 15 6.json	15	15	Optimal	104.11	1227	1227.00	0.00
tai15 15 7.json	15	15	Optimal	102.79	1217	1217.00	0.00
tai15 15 8.json	15	15	Optimal	133.01	1274	1274.00	0.00
tai15 15 9.json	15	15	Optimal	32.78	1241	1241.00	0.00
tai20 15 0.json	20	15	Solution	300.02	1424	1274.00	10.53
tai20 15 1.json	20	15	Solution	300.01	1378	1328.00	3.63
tai20 15 2.json	20	15	Solution	300.02	1398	1243.00	11.09
tai20 15 3.json	20	15	Optimal	17.73	1345	1345.00	0.00
tai20 15 4.json	20	15	Solution	300.02	1374	1270.00	7.57
tai20 15 5.json	20	15	Solution	300.02	1389	1268.00	8.71
tai20 15 6.json	20	15	Optimal	76.19	1462	1462.00	0.00
tai20 15 7.json	20	15	Solution	300.02	1427	1358.00	4.84
tai20 15 8.json	20	15	Solution	300.02	1369	1258.00	8.11
tai20 15 9.json	20	15	Solution	300.02	1406	1289.00	8.32
tai20 20 0.json	20	20	Solution	300.02	1688	1514.00	10.31
tai20 20 1.json	20	20	Solution	300.02	1640	1454.00	11.34
tai20 20 2.json	20	20	Solution	300.02	1585	1456.00	8.14
tai20 20 3.json	20	20	Solution	300.01	1656	1583.00	4.41
tai20 20 4.json	20	20	Solution	300.02	1642	1474.00	10.23
tai20 20 5.json	20	20	Solution	300.02	1663	1490.00	10.40
tai20 20 6.json	20	20	Solution	300.02	1724	1605.00	6.90
tai20 20 7.json	20	20	Solution	300.02	1629	1564.00	3.99
tai20 20 8.json	20	20	Solution	300.02	1675	1466.00	12.48
tai20 20 9.json	20	20	Solution	300.01	1627	1424.00	12.48
tai30 15 0.json	30	15	Solution	300.03	1766	1764.00	0.11
tai30 15 1.json	30	15	Solution	300.03	1860	1774.00	4.62
tai30 15 2.json	30	15	Solution	300.03	1828	1778.00	2.74
tai30 15 3.json	30	15	Solution	300.03	1885	1828.00	3.02
tai30 15 4.json	30	15	Optimal	15.87	2007	2007.00	0.00
tai30 15 5.json	30	15	Solution	300.02	1852	1819.00	1.78
tai30 15 6.json	30	15	Solution	300.03	1804	1771.00	1.83
tai30 15 7.json	30	15	Solution	300.03	1701	1673.00	1.65
tai30 15 8.json	30	15	Solution	300.02	1821	1795.00	1.43
tai30 15 9.json	30	15	Solution	300.02	1706	1631.00	4.40
tai30 20 0.json	30	20	Solution	300.03	2071	1857.00	10.33
tai30 20 1.json	30	20	Solution	300.03	2006	1867.00	6.93
tai30 20 2.json	30	20	Solution	300.04	1912	1809.00	5.39
tai30 20 3.json	30	20	Solution	300.04	2086	1923.00	7.81
tai30 20 4.json	30	20	Solution	300.03	2014	1997.00	0.84
tai30 20 5.json	30	20	Solution	300.03	2070	1940.00	6.28

Table 2: Results for Taillard JobShop (80 Instances)

Name	Nr Jobs	Nr Machines	Status	Time	Makespan	Bound	Gap Percent
tai30 20 6.json	30	20	Solution	300.02	1942	1783.00	8.19
tai30 20 7.json	30	20	Solution	300.03	2027	1905.00	6.02
tai30 20 8.json	30	20	Solution	300.03	2026	1903.00	6.07
tai30 20 9.json	30	20	Solution	300.03	2006	1806.00	9.97
tai50 15 0.json	50	15	Optimal	90.61	2760	2760.00	0.00
tai50 15 1.json	50	15	Optimal	52.92	2756	2756.00	0.00
tai50 15 2.json	50	15	Optimal	16.80	2717	2717.00	0.00
tai50 15 3.json	50	15	Optimal	10.28	2839	2839.00	0.00
tai50 15 4.json	50	15	Optimal	35.27	2679	2679.00	0.00
tai50 15 5.json	50	15	Optimal	66.12	2781	2781.00	0.00
tai50 15 6.json	50	15	Optimal	15.50	2943	2943.00	0.00
tai50 15 7.json	50	15	Optimal	30.88	2885	2885.00	0.00
tai50 15 8.json	50	15	Optimal	35.67	2655	2655.00	0.00
tai50 15 9.json	50	15	Optimal	37.75	2723	2723.00	0.00
tai50 20 0.json	50	20	Optimal	165.80	2868	2868.00	0.00
tai50 20 1.json	50	20	Solution	300.11	2907	2869.00	1.31
tai50 20 2.json	50	20	Solution	300.10	2784	2755.00	1.04
tai50 20 3.json	50	20	Solution	300.10	2708	2702.00	0.22
tai50 20 4.json	50	20	Solution	300.11	2738	2725.00	0.47
tai50 20 5.json	50	20	Optimal	199.89	2845	2845.00	0.00
tai50 20 6.json	50	20	Solution	300.12	2826	2825.00	0.04
tai50 20 7.json	50	20	Optimal	144.63	2784	2784.00	0.00
tai50 20 8.json	50	20	Optimal	87.12	3071	3071.00	0.00
tai50 20 9.json	50	20	Solution	300.12	3036	2995.00	1.35

Table 3: Results for Taillard Flowshop (120 Instances)

Name	Nr Jobs	Nr Machines	Status	Time	Makespan	Bound	Gap Percent
tai100 10 0.json	100	10	Solution	600.16	5979	5759.00	3.68
tai100 10 1.json	100	10	Solution	600.06	5418	5345.00	1.35
tai100 10 2.json	100	10	Solution	600.06	5798	5646.00	2.62
tai100 10 3.json	100	10	Solution	600.03	6040	5737.00	5.02
tai100 10 4.json	100	10	Solution	600.02	5663	5431.00	4.10
tai100 10 5.json	100	10	Solution	600.05	5378	5274.00	1.93
tai100 10 6.json	100	10	Solution	600.04	5697	5553.00	2.53
tai100 10 7.json	100	10	Solution	600.03	5813	5575.00	4.09
tai100 10 8.json	100	10	Solution	600.04	5983	5838.00	2.42
tai100 10 9.json	100	10	Solution	600.02	5903	5835.00	1.15
tai100 20 0.json	100	20	Solution	600.07	6731	5914.00	12.14
tai100 20 1.json	100	20	Solution	600.05	6840	6115.00	10.60
tai100 20 2.json	100	20	Solution	600.06	6778	6139.00	9.43
tai100 20 3.json	100	20	Solution	600.06	6720	6117.00	8.97

Table 3: Results for Taillard Flowshop (120 Instances)

Name	Nr Jobs	Nr Machines	Status	Time	Makespan	Bound	Gap Percent
tai100 20 4.json	100	20	Solution	600.05	6853	6148.00	10.29
tai100 20 5.json	100	20	Solution	600.07	6989	6192.00	11.40
tai100 20 6.json	100	20	Solution	600.04	6772	6045.00	10.74
tai100 20 7.json	100	20	Solution	600.05	6940	6113.00	11.92
tai100 20 8.json	100	20	Solution	600.04	7092	6014.00	15.20
tai100 20 9.json	100	20	Solution	600.06	6871	6359.00	7.45
tai100 5 0.json	100	5	Optimal	73.90	5493	5493.00	0.00
tai100 5 1.json	100	5	Solution	600.13	5276	5232.00	0.83
tai100 5 2.json	100	5	Solution	600.11	5178	5170.00	0.15
tai100 5 3.json	100	5	Solution	600.12	4996	4993.00	0.06
tai100 5 4.json	100	5	Optimal	79.87	5247	5247.00	0.00
tai100 5 5.json	100	5	Optimal	231.03	5135	5135.00	0.00
tai100 5 6.json	100	5	Optimal	95.07	5232	5232.00	0.00
tai100 5 7.json	100	5	Optimal	293.37	5083	5083.00	0.00
tai100 5 8.json	100	5	Solution	600.12	5464	5438.00	0.48
tai100 5 9.json	100	5	Optimal	70.58	5318	5318.00	0.00
tai200 10 0.json	200	10	Solution	600.06	11136	10842.00	2.64
tai200 10 1.json	200	10	Solution	600.04	10981	10429.00	5.03
tai200 10 2.json	200	10	Solution	600.06	11276	10915.00	3.20
tai200 10 3.json	200	10	Solution	600.06	11217	10826.00	3.49
tai200 10 4.json	200	10	Solution	600.06	11139	10474.00	5.97
tai200 10 5.json	200	10	Solution	600.06	10828	10311.00	4.77
tai200 10 6.json	200	10	Solution	600.07	11202	10825.00	3.37
tai200 10 7.json	200	10	Solution	600.07	11287	10709.00	5.12
tai200 10 8.json	200	10	Solution	600.07	11004	10419.00	5.32
tai200 10 9.json	200	10	Solution	600.05	11178	10664.00	4.60
tai200 20 0.json	200	20	Solution	600.11	12439	11010.00	11.49
tai200 20 1.json	200	20	Solution	600.12	12878	10976.00	14.77
tai200 20 2.json	200	20	Solution	600.12	12506	11168.00	10.70
tai200 20 3.json	200	20	Solution	600.09	12618	11131.00	11.78
tai200 20 4.json	200	20	Solution	600.06	12649	11160.00	11.77
tai200 20 5.json	200	20	Solution	600.13	12740	11114.00	12.76
tai200 20 6.json	200	20	Solution	600.10	12985	11249.00	13.37
tai200 20 7.json	200	20	Solution	600.08	12724	11149.00	12.38
tai200 20 8.json	200	20	Solution	600.07	12693	11013.00	13.24
tai200 20 9.json	200	20	Solution	600.07	12869	11167.00	13.23
tai20 10 0.json	20	10	Solution	600.01	1575	1494.00	5.14
tai20 10 1.json	20	10	Solution	600.02	1648	1555.00	5.64
tai20 10 2.json	20	10	Solution	600.04	1477	1430.00	3.18
tai20 10 3.json	20	10	Optimal	170.76	1356	1356.00	0.00
tai20 10 4.json	20	10	Solution	600.04	1403	1353.00	3.56
tai20 10 5.json	20	10	Solution	600.03	1374	1352.00	1.60
tai20 10 6.json	20	10	Solution	600.03	1446	1388.00	4.01
tai20 10 7.json	20	10	Solution	600.02	1579	1407.00	10.89
tai20 10 8.json	20	10	Optimal	74.54	1586	1586.00	0.00

Table 3: Results for Taillard Flowshop (120 Instances)

Name	Nr Jobs	Nr Machines	Status	Time	Makespan	Bound	Gap Percent
tai20 10 9.json	20	10	Solution	600.02	1600	1473.00	7.94
tai20 20 0.json	20	20	Solution	600.04	2284	1970.00	13.75
tai20 20 1.json	20	20	Solution	600.05	2109	1784.00	15.41
tai20 20 2.json	20	20	Solution	600.05	2341	1924.00	17.81
tai20 20 3.json	20	20	Solution	600.04	2266	1892.00	16.50
tai20 20 4.json	20	20	Solution	600.04	2311	1994.00	13.72
tai20 20 5.json	20	20	Solution	600.03	2215	1899.00	14.27
tai20 20 6.json	20	20	Solution	600.03	2265	1952.00	13.82
tai20 20 7.json	20	20	Solution	600.04	2206	1931.00	12.47
tai20 20 8.json	20	20	Solution	600.03	2233	1900.00	14.91
tai20 20 9.json	20	20	Solution	600.03	2181	1939.00	11.10
tai20 5 0.json	20	5	Optimal	3.03	1278	1278.00	0.00
tai20 5 1.json	20	5	Optimal	2.20	1358	1358.00	0.00
tai20 5 2.json	20	5	Optimal	2.72	1073	1073.00	0.00
tai20 5 3.json	20	5	Optimal	3.28	1292	1292.00	0.00
tai20 5 4.json	20	5	Optimal	5.46	1231	1231.00	0.00
tai20 5 5.json	20	5	Optimal	2.45	1193	1193.00	0.00
tai20 5 6.json	20	5	Optimal	1.89	1234	1234.00	0.00
tai20 5 7.json	20	5	Optimal	3.99	1199	1199.00	0.00
tai20 5 8.json	20	5	Optimal	1.72	1210	1210.00	0.00
tai20 5 9.json	20	5	Optimal	1.76	1103	1103.00	0.00
tai500 20 0.json	500	20	Solution	600.23	28669	25931.00	9.55
tai500 20 1.json	500	20	Solution	600.18	29047	26390.00	9.15
tai500 20 2.json	500	20	Solution	600.22	28796	26330.00	8.56
tai500 20 3.json	500	20	Solution	600.18	28907	26456.00	8.48
tai500 20 4.json	500	20	Solution	600.21	28841	26205.00	9.14
tai500 20 5.json	500	20	Solution	600.19	28954	26436.00	8.70
tai500 20 6.json	500	20	Solution	600.17	28750	26329.00	8.42
tai500 20 7.json	500	20	Solution	600.17	28924	26451.00	8.55
tai500 20 8.json	500	20	Solution	600.19	28038	25929.00	7.52
tai500 20 9.json	500	20	Solution	600.22	28726	26355.00	8.25
tai50 10 0.json	50	10	Solution	600.07	3055	2962.00	3.04
tai50 10 1.json	50	10	Solution	600.10	2929	2829.00	3.41
tai50 10 2.json	50	10	Solution	600.11	2908	2825.00	2.85
tai50 10 3.json	50	10	Solution	600.06	3125	3038.00	2.78
tai50 10 4.json	50	10	Solution	600.06	3100	2923.00	5.71
tai50 10 5.json	50	10	Solution	600.11	3065	2966.00	3.23
tai50 10 6.json	50	10	Solution	600.06	3133	3063.00	2.23
tai50 10 7.json	50	10	Solution	600.11	3096	3000.00	3.10
tai50 10 8.json	50	10	Solution	600.09	2959	2832.00	4.29
tai50 10 9.json	50	10	Solution	600.08	3111	3046.00	2.09
tai50 20 0.json	50	20	Solution	600.17	4003	3562.00	11.02
tai50 20 1.json	50	20	Solution	600.20	4041	3533.00	12.57
tai50 20 2.json	50	20	Solution	600.18	3972	3412.00	14.10
tai50 20 3.json	50	20	Solution	600.16	3922	3383.00	13.74

Table 3: Results for Taillard Flowshop (120 Instances)

Name	Nr Jobs	Nr Machines	Status	Time	Makespan	Bound	Gap Percent
tai50 20 4.json	50	20	Solution	600.15	3830	3387.00	11.57
tai50 20 5.json	50	20	Solution	600.19	3861	3499.00	9.38
tai50 20 6.json	50	20	Solution	600.21	3930	3461.00	11.93
tai50 20 7.json	50	20	Solution	60.25	4056	3411.00	15.90
tai50 20 8.json	50	20	Solution	60.17	4115	3468.00	15.72
tai50 20 9.json	50	20	Solution	60.19	3986	3474.00	12.84
tai50 5 0.json	50	5	Optimal	17.70	2724	2724.00	0.00
tai50 5 1.json	50	5	Optimal	57.29	2834	2834.00	0.00
tai50 5 2.json	50	5	Optimal	47.53	2612	2612.00	0.00
tai50 5 3.json	50	5	Optimal	11.58	2751	2751.00	0.00
tai50 5 4.json	50	5	Optimal	23.50	2853	2853.00	0.00
tai50 5 5.json	50	5	Optimal	28.67	2825	2825.00	0.00
tai50 5 6.json	50	5	Optimal	42.14	2716	2716.00	0.00
tai50 5 7.json	50	5	Optimal	19.26	2683	2683.00	0.00
tai50 5 8.json	50	5	Optimal	56.32	2545	2545.00	0.00
tai50 5 9.json	50	5	Optimal	5.82	2776	2776.00	0.00