|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Problem size | J | I | B | F | Time | | |
| NSGA-II | Hybrid | MOEA/D |
| Small | 8 | 2 | 1 | 1 | 8.9960 | 3.8855 | 18.2036 |
|  | 3 | 2 | 1 | 8.5663 | 5.2327 | 18.8123 |
| 10 | 3 | 1 | 1 | 9.0384 |  |  |
|  | 3 | 2 | 1 | 9.2231 |  |  |
|  | 4 | 2 | 2 | 8.8460 |  |  |
| 12 | 3 | 1 | 1 | 11.8532 |  |  |
|  | 3 | 2 | 1 | 9.0413 |  |  |
|  | 4 | 2 | 2 | 9.5053 |  |  |
| Medium | 15 | 4 | 2 | 1 | 9.2931 |  |  |
|  | 6 | 3 | 2 | 10.1669 |  |  |
| 20 | 4 | 2 | 1 | 9.9874 |  |  |
|  | 6 | 3 | 2 | 9.8164 |  |  |
| 25 | 4 | 2 | 1 | 11.691 |  |  |
|  | 6 | 3 | 2 | 12.3118 |  |  |
| 30 | 4 | 2 | 1 | 13.3388 |  |  |
|  | 6 | 3 | 2 | 14.3206 |  |  |
| Large | 40 | 8 | 3 | 2 | 15.4601 |  |  |
|  | 10 | 4 | 3 | 15.2108 |  |  |
| 50 | 10 | 3 | 2 | 18.4186 |  |  |
|  | 12 | 4 | 3 | 22.9051 |  |  |
| 60 | 12 | 3 | 2 | 23.5460 |  |  |
|  | 15 | 4 | 3 | 23.9478 |  |  |
| 80 | 15 | 3 | 2 | 39.8054 |  |  |
|  | 20 | 4 | 3 | 41.8129 |  |  |

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| Problem size | J | I | B | F | NPS | | |  | MID | | |  | DM | | |  |
| NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D |
| Small | 8 | 2 | 1 | 1 | 2 | 5 | 2 |  | 1.20710 | 1.21380 | 1.20710 |  | 42.6465 | 31.9731 | 50.3063 |  |
|  | 3 | 2 | 1 | 6 | 5 | 7 |  | 1.17950 | 1.11020 | 1.18570 |  | 20.3940 | 23.4970 | 30.2898 |  |
| 10 | 3 | 1 | 1 | 4 |  |  |  | 0.88682 |  |  |  | 27.3542 |  |  |  |
|  | 3 | 2 | 1 | 3 |  |  |  | 1.22150 |  |  |  | 18.9451 |  |  |  |
|  | 4 | 2 | 2 | 8 |  |  |  | 1.10740 |  |  |  | 39.4873 |  |  |  |
| 12 | 3 | 1 | 1 | 15 |  |  |  | 0.88324 |  |  |  | 95.5925 |  |  |  |
|  | 3 | 2 | 1 | 24 |  |  |  | 0.95852 |  |  |  | 67.1600 |  |  |  |
|  | 4 | 2 | 2 | 2 |  |  |  | 1.20710 |  |  |  | 15.3080 |  |  |  |
| Medium | 15 | 4 | 2 | 1 | 7 |  |  |  | 1.16410 |  |  |  | 31.5048 |  |  |  |
|  | 6 | 3 | 2 | 16 |  |  |  | 0.75406 |  |  |  | 64.1825 |  |  |  |
| 20 | 4 | 2 | 1 | 38 |  |  |  | 0.78272 |  |  |  | 179.2889 |  |  |  |
|  | 6 | 3 | 2 | 24 |  |  |  | 0.91930 |  |  |  | 57.7783 |  |  |  |
| 25 | 4 | 2 | 1 | 22 |  |  |  | 0.78465 |  |  |  | 200.8967 |  |  |  |
|  | 6 | 3 | 2 | 24 |  |  |  | 0.82290 |  |  |  | 253.0182 |  |  |  |
| 30 | 4 | 2 | 1 | 26 |  |  |  | 0.94265 |  |  |  | 113.2199 |  |  |  |
|  | 6 | 3 | 2 | 12 |  |  |  | 0.76425 |  |  |  | 83.311 |  |  |  |
| Large | 40 | 8 | 3 | 2 | 21 |  |  |  | 0.94214 |  |  |  | 289.0038 |  |  |  |
|  | 10 | 4 | 3 | 19 |  |  |  | 0.69079 |  |  |  | 94.9914 |  |  |  |
| 50 | 10 | 3 | 2 | 31 |  |  |  | 0.66007 |  |  |  | 224.8189 |  |  |  |
|  | 12 | 4 | 3 | 33 |  |  |  | 0.84256 |  |  |  | 283.9943 |  |  |  |
| 60 | 12 | 3 | 2 | 20 |  |  |  | 0.82077 |  |  |  | 131.3297 |  |  |  |
|  | 15 | 4 | 3 | 36 |  |  |  | 0.94207 |  |  |  | 133.5321 |  |  |  |
| 80 | 15 | 3 | 2 | 30 |  |  |  | 0.96335 |  |  |  | 190.8398 |  |  |  |
|  | 20 | 4 | 3 | 29 |  |  |  | 1.00870 |  |  |  | 165.4372 |  |  |  |

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| Problem size | J | I | B | F | SNS | | |  | RAS | | |  | QM | | |
| NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D |
| Small | 8 | 2 | 1 | 1 | 0.29289 | 0.12491 | 0.29289 |  | 0.56637 | 0.30796 | 0.60158 |  | 1.0 | 0.0 | 0.0 |
|  | 3 | 2 | 1 | 0.12356 | 0.30530 | 0.14940 |  | 0.49501 | 0.36343 | 0.65509 |  | 1.0 | 0.0 | 0.0 |
| 10 | 3 | 1 | 1 | 0.40810 |  |  |  | 0.30073 |  |  |  |  |  |  |
|  | 3 | 2 | 1 | 0.20859 |  |  |  | 0.24505 |  |  |  |  |  |  |
|  | 4 | 2 | 2 | 0.26967 |  |  |  | 0.49601 |  |  |  |  |  |  |
| 12 | 3 | 1 | 1 | 0.20777 |  |  |  | 0.68171 |  |  |  |  |  |  |
|  | 3 | 2 | 1 | 0.14969 |  |  |  | 0.56075 |  |  |  |  |  |  |
|  | 4 | 2 | 2 | 0.29289 |  |  |  | 0.20697 |  |  |  |  |  |  |
| Medium | 15 | 4 | 2 | 1 | 0.12572 |  |  |  | 0.33081 |  |  |  |  |  |  |
|  | 6 | 3 | 2 | 0.22551 |  |  |  | 0.48332 |  |  |  |  |  |  |
| 20 | 4 | 2 | 1 | 0.16033 |  |  |  | 0.95204 |  |  |  |  |  |  |
|  | 6 | 3 | 2 | 0.16909 |  |  |  | 0.41440 |  |  |  |  |  |  |
| 25 | 4 | 2 | 1 | 0.21101 |  |  |  | 0.33017 |  |  |  |  |  |  |
|  | 6 | 3 | 2 | 0.20253 |  |  |  | 0.74425 |  |  |  |  |  |  |
| 30 | 4 | 2 | 1 | 0.18349 |  |  |  | 0.15902 |  |  |  |  |  |  |
|  | 6 | 3 | 2 | 0.35851 |  |  |  | 0.19559 |  |  |  |  |  |  |
| Large | 40 | 8 | 3 | 2 | 0.25402 |  |  |  | 0.76292 |  |  |  |  |  |  |
|  | 10 | 4 | 3 | 0.24877 |  |  |  | 0.12472 |  |  |  |  |  |  |
| 50 | 10 | 3 | 2 | 0.28318 |  |  |  | 0.26406 |  |  |  |  |  |  |
|  | 12 | 4 | 3 | 0.22614 |  |  |  | 0.32088 |  |  |  |  |  |  |
| 60 | 12 | 3 | 2 | 0.22663 |  |  |  | 0.13465 |  |  |  |  |  |  |
|  | 15 | 4 | 3 | 0.15962 |  |  |  | 0.15462 |  |  |  |  |  |  |
| 80 | 15 | 3 | 2 | 0.19515 |  |  |  | 0.10371 |  |  |  |  |  |  |
|  | 20 | 4 | 3 | 0.12039 |  |  |  | 0.11825 |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Problem size | J | I | B | F | NPS | | |  | MID | | |  | DM | | |  | SNS | | |  | RAS | | |  | QM | | |  | Time | | |
| NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D | NSGA-II | Hybrid | MOEA/D |
| Small | 8 | 2 | 1 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 3 | 2 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | 3 | 1 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 3 | 2 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 4 | 2 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | 3 | 1 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 3 | 2 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 4 | 2 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Medium | 15 | 4 | 2 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 6 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | 4 | 2 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 6 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25 | 4 | 2 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 6 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 | 4 | 2 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 6 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Large | 40 | 8 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 10 | 4 | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50 | 10 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 12 | 4 | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 | 12 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 15 | 4 | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 80 | 15 | 3 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 20 | 4 | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |