|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Problem size | J | I | B | F | Time | | |
| NSGA-II | Hybrid | MOEA/D |
| Small | 8 | 2 | 1 | 1 | 6.4396 |  |  |
|  | 3 | 2 | 1 | 6.3983 |  |  |
| 10 | 3 | 1 | 1 | 6.7213 |  |  |
|  | 3 | 2 | 1 | 6.8484 |  |  |
|  | 4 | 2 | 2 | 6.6140 |  |  |
| 12 | 3 | 1 | 1 | 6.7359 |  |  |
|  | 3 | 2 | 1 | 6.3839 |  |  |
|  | 4 | 2 | 2 | 6.4692 |  |  |
| Medium | 15 | 4 | 2 | 1 | 6.6534 |  |  |
|  | 6 | 3 | 2 | 7.0574 |  |  |
| 20 | 4 | 2 | 1 | 7.1017 |  |  |
|  | 6 | 3 | 2 | 6.9953 |  |  |
| 25 | 4 | 2 | 1 | 8.1506 |  |  |
|  | 6 | 3 | 2 | 8.0938 |  |  |
| 30 | 4 | 2 | 1 | 8.8394 |  |  |
|  | 6 | 3 | 2 | 9.5120 |  |  |
| Large | 40 | 8 | 3 | 2 | 9.9198 |  |  |
|  | 10 | 4 | 3 | 10.0053 |  |  |
| 50 | 10 | 3 | 2 | 11.5119 |  |  |
|  | 12 | 4 | 3 | 13.8102 |  |  |
| 60 | 12 | 3 | 2 | 14.1081 |  |  |
|  | 15 | 4 | 3 | 14.8974 |  |  |
| 80 | 15 | 3 | 2 | 23.5373 |  |  |
|  | 20 | 4 | 3 | 23.4585 |  |  |

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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 |  |  |  | 1.20710 |  |  |  | 42.6465 |  |  |  |
|  | 3 | 2 | 1 | 6 |  |  |  | 1.17950 |  |  |  | 20.3940 |  |  |  |
| 10 | 3 | 1 | 1 | 5 |  |  |  | 0.88722 |  |  |  | 27.3542 |  |  |  |
|  | 3 | 2 | 1 | 3 |  |  |  | 1.22150 |  |  |  | 18.9451 |  |  |  |
|  | 4 | 2 | 2 | 8 |  |  |  | 1.10740 |  |  |  | 39.4873 |  |  |  |
| 12 | 3 | 1 | 1 | 13 |  |  |  | 0.89456 |  |  |  | 95.5925 |  |  |  |
|  | 3 | 2 | 1 | 24 |  |  |  | 0.95882 |  |  |  | 67.1600 |  |  |  |
|  | 4 | 2 | 2 | 2 |  |  |  | 1.20710 |  |  |  | 15.3080 |  |  |  |
| Medium | 15 | 4 | 2 | 1 | 5 |  |  |  | 1.21780 |  |  |  | 30.2292 |  |  |  |
|  | 6 | 3 | 2 | 13 |  |  |  | 0.79831 |  |  |  | 55.5388 |  |  |  |
| 20 | 4 | 2 | 1 | 34 |  |  |  | 0.75994 |  |  |  | 221.3999 |  |  |  |
|  | 6 | 3 | 2 | 35 |  |  |  | 0.85848 |  |  |  | 62.9232 |  |  |  |
| 25 | 4 | 2 | 1 | 20 |  |  |  | 0.89604 |  |  |  | 193.1032 |  |  |  |
|  | 6 | 3 | 2 | 29 |  |  |  | 0.95488 |  |  |  | 313.9602 |  |  |  |
| 30 | 4 | 2 | 1 | 28 |  |  |  | 0.95112 |  |  |  | 118.2066 |  |  |  |
|  | 6 | 3 | 2 | 9 |  |  |  | 0.77857 |  |  |  | 82.2560 |  |  |  |
| Large | 40 | 8 | 3 | 2 | 29 |  |  |  | 0.98687 |  |  |  | 252.2011 |  |  |  |
|  | 10 | 4 | 3 | 15 |  |  |  | 0.72445 |  |  |  | 185.2255 |  |  |  |
| 50 | 10 | 3 | 2 | 26 |  |  |  | 0.53111 |  |  |  | 231.3724 |  |  |  |
|  | 12 | 4 | 3 | 41 |  |  |  | 0.79443 |  |  |  | 235.3222 |  |  |  |
| 60 | 12 | 3 | 2 | 35 |  |  |  | 0.83815 |  |  |  | 192.6229 |  |  |  |
|  | 15 | 4 | 3 | 34 |  |  |  | 0.81653 |  |  |  | 214.6931 |  |  |  |
| 80 | 15 | 3 | 2 | 32 |  |  |  | 0.71412 |  |  |  | 394.5263 |  |  |  |
|  | 20 | 4 | 3 | 24 |  |  |  | 0.87323 |  |  |  | 205.8851 |  |  |  |

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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 |  |  |  | 0.56637 |  |  |  |  |  |  |
|  | 3 | 2 | 1 | 0.12356 |  |  |  | 0.49501 |  |  |  |  |  |  |
| 10 | 3 | 1 | 1 | 0.35343 |  |  |  | 0.27704 |  |  |  |  |  |  |
|  | 3 | 2 | 1 | 0.20859 |  |  |  | 0.24505 |  |  |  |  |  |  |
|  | 4 | 2 | 2 | 0.26967 |  |  |  | 0.49601 |  |  |  |  |  |  |
| 12 | 3 | 1 | 1 | 0.22202 |  |  |  | 0.68729 |  |  |  |  |  |  |
|  | 3 | 2 | 1 | 0.15245 |  |  |  | 0.56075 |  |  |  |  |  |  |
|  | 4 | 2 | 2 | 0.29289 |  |  |  | 0.20697 |  |  |  |  |  |  |
| Medium | 15 | 4 | 2 | 1 | 0.14247 |  |  |  | 0.36883 |  |  |  |  |  |  |
|  | 6 | 3 | 2 | 0.31702 |  |  |  | 0.47497 |  |  |  |  |  |  |
| 20 | 4 | 2 | 1 | 0.18988 |  |  |  | 1.05580 |  |  |  |  |  |  |
|  | 6 | 3 | 2 | 0.14899 |  |  |  | 0.41743 |  |  |  |  |  |  |
| 25 | 4 | 2 | 1 | 0.23996 |  |  |  | 0.36538 |  |  |  |  |  |  |
|  | 6 | 3 | 2 | 0.17610 |  |  |  | 1.03690 |  |  |  |  |  |  |
| 30 | 4 | 2 | 1 | 0.11092 |  |  |  | 0.18442 |  |  |  |  |  |  |
|  | 6 | 3 | 2 | 0.32840 |  |  |  | 0.15896 |  |  |  |  |  |  |
| Large | 40 | 8 | 3 | 2 | 0.26570 |  |  |  | 0.63128 |  |  |  |  |  |  |
|  | 10 | 4 | 3 | 0.38901 |  |  |  | 0.24026 |  |  |  |  |  |  |
| 50 | 10 | 3 | 2 | 0.35776 |  |  |  | 0.20539 |  |  |  |  |  |  |
|  | 12 | 4 | 3 | 0.17918 |  |  |  | 0.30148 |  |  |  |  |  |  |
| 60 | 12 | 3 | 2 | 0.18163 |  |  |  | 0.21860 |  |  |  |  |  |  |
|  | 15 | 4 | 3 | 0.20906 |  |  |  | 0.28342 |  |  |  |  |  |  |
| 80 | 15 | 3 | 2 | 0.20691 |  |  |  | 0.23598 |  |  |  |  |  |  |
|  | 20 | 4 | 3 | 0.22982 |  |  |  | 0.14572 |  |  |  |  |  |  |

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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 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |