

Additional results

This supplementary material presents the additional results from the proposed algorithm. The stopping criterion considered for the algorithm HMSG was the average time consumed by the HSA. Table 1 reports the results. Columns “Objective function”, “RPD”, and “Run time” present the objective function value (“Best”, “Avg”, and “StdDev”), the Relative Percentage Deviation (RPD), and the run time (in seconds), of the algorithms, respectively.

Table 1.: Results of the algorithm HMSG considering the average time consumed by the HSA algorithm as the stopping criterion. The best RPD results are highlighted in bold.

Inst. ID	HSA					HMSG				
	Objective function Best	Avg	StdDev	RPD (%)	Run time (sec)	Objective function Best	Avg	StdDev	RPD (%)	Run time (sec)
01	1849	1944.9	59.7	5.2	1.1	1843	1865.1	16.8	1.2	1.1
02	2040	2076.4	36.6	1.8	19.9	2035	2035.6	1.7	0.0	20.0
03	2045	2168.8	100.5	6.1	89.0	2007	2027.6	13.7	1.0	89.9
04	2018	2193.5	109.4	8.7	230.6	1948	1968.0	9.1	1.0	231.8
05	1618	1690.0	66.0	4.4	265.6	1607	1611.1	2.6	0.3	267.2
06	598	617.3	15.3	3.2	15.0	597	601.1	2.7	0.7	15.4
07	1488	1632.8	85.1	9.7	157.2	1485	1499.5	6.0	1.0	158.6
08	1480	1613.7	71.4	9.0	207.2	1450	1461.0	2.8	0.8	208.7
09	241	255.8	7.8	6.1	1.4	241	241.0	0.0	0.0	1.5
10	1500	1599.4	49.6	6.6	291.8	1527	1527.0	0.0	1.8	293.8
11	131	136.3	3.3	4.1	0.3	128	128.5	1.4	0.4	0.3
12	1261	1358.1	35.8	7.7	13.9	1253	1313.8	20.1	4.8	14.2
13	2282	2393.2	52.0	4.9	47.5	2281	2300.7	11.2	0.9	47.9
14	1755	1847.3	77.5	5.3	549.9	1803	1873.5	43.7	6.8	555.5
15	1200	1269.4	51.5	5.8	71.3	1188	1217.9	15.4	2.5	72.4
16	1199	1306.0	107.4	8.9	1523.9	1199	1240.6	15.3	3.5	1535.0
17	2537	2604.3	65.2	2.7	1.1	2534	2538.0	5.4	0.2	1.1
18	1565	1732.3	87.3	10.7	2465.7	1629	1629.0	0.0	4.1	2468.2
19	1762	1810.9	41.1	2.8	17.0	1752	1772.7	6.7	1.2	17.2
20	1274	1350.8	45.0	6.0	18.2	1269	1298.6	15.1	2.3	18.3

As can be seen in Table 1, the HMSG outperformed the HSA in 95% of instances.