Electronic Companion of:
A Unified Solution Framework for Multi-Attribute Vehicle Routing Problems

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NOTE: This document complements the main paper "Vidal, T., Crainic, T. G., Gendreau, M., & Prins, C. (2012). A Unified Solution Framework for Multi-Attribute Vehicle Routing Problems. Submitted to EJOR." with detailed experimental results.

Tables 3 to 34 present the detailed results of UHGS and other state-of-the-art methods for a variety of vehicle routing variants and benchmarks. The first group of columns displays the instance identifier, number of customers n, vehicle fleet limit m when applicable, and also the number of customer clusters c in the GVRP case, the number of vehicle types w in fleet size and mix settings, and the number of periods t and depots d in the MDPVRP case. The next group of columns presents the results of actual state-of-the-art methods for each problem, as well as the results of UHGS. When available, both average and best results on several runs (number of runs specified in the headings of the Table) are provided.

We indicate in boldface the best average result among algorithms for each instance as well as the previous Best Known Solution (BKS) in the last column. New best known solutions are underlined. Finally, average measures over sets of instances are presented in the last lines: the computation time for each method, the average percentage of error (Gap) relative to the previous BKS, and the processor used. Some specific details for each problem and benchmark are listed in the following.

VRP with Backhauls (VRPB). "Double" precision values have been used for distance computations. Comparison is made with methods that rely on the same assumption. A fleet size value m is specified in the instances. As in the previous works, we consider a fixed fleet size without allowing less or more than m vehicles. To that extent, the distance matrix has been modified by setting $d_{00} = +\infty$. Other variants of the VRPB, such as the vehicle routing with mixed backhauls, the VRPB with time windows or with multiple depots, can be addressed by UHGS. For the sake of conciseness, results on these variants are not reported in this paper.

Cumulative VRP (CCVRP). Following the guidelines of Ngueveu et al. (2010), the duration constraint is not considered and the fleet size limit is fixed to the minimum feasible value. In the original paper of NPW10, only the best solution on the benchmark instances of Christofides et al. (1979) were reported. This algorithm was then provided to Ribeiro and Laporte (2012) who ran more extensive experiments on all instances. We rely on these latter values for our experimental comparison.

VRP with Simultaneous Deliveries and Pickups (VRPSDP). "Double" precision values have been used for distances and demands. We only compare to recent methods that rely on the same convention.

VRP with Mixed Deliveries and Pickups (VRPMDP). This problem is also sometimes called Mixed VRP with Backhauls (MVRPB). "Double" precision values have been used for distance computations. Comparison is made with methods that rely on the same assumption.

Load Dependent VRP (LDVRP). As in previous work, maximum trip duration constraints are taken into account (sum of driving length plus service time) and the fleet size is unconstrained.

Generalized VRP (GVRP). Distances were rounded to the closest integer to compare with the recent works of Bektas et al. (2011) and Moccia et al. (2012) using the same assumptions.

Open VRP (OVRP). The hierarchical objective of fleet minimization and then distance is used. As almost all recent methods succeeded in reaching the same best known fleet size for each problem, this fleet size "$\mathrm{m}_{\mathrm{BKS}}$" is presented in a single column. The same convention as Repoussis et al. (2010) is used: the route duration from the benchmark instances of Christofides et al. (1979) is multiplied by a factor of 0.9, whereas for the benchmark instances of Golden et al. (1998) the duration constraint is not considered.

Vehicle Fleet Mix Problem with Time Windows (VFMPTW). The benchmark instances of Liu and Shen (1999) are considered with three different fleet cost settings (type A,B,C instances). As in the former paper and several following works, we addressed the minimization of fixed fleet cost plus the *trip duration*, i.e., the time elapsed between departure from the depot and return minus the service time (Tables 24-26). Is should be noted that the departure time is not constrained to be time 0, and several best known solutions require a delayed departure from the depot. Additional experiments have also been conducted to address the more standard objective of fixed fleet cost plus total distance (Tables 27-29).

VRP with Soft Time Windows (VRPSTW). A classification and notation for soft time windows settings is introduced in Fu et al. (2007). Type 1 and type 2 soft time windows have been addressed in this paper. Several criteria have been considered by previous authors to assess on the quality of solutions, these criteria include the fleet size, the number of customers serviced outside of their time windows, the amount of lateness and earliness, and the route distance. To optimize on these objectives, we implemented a general formulation of service costs $c_i(t_i)$ to customer as a function of the service date t_i, given in Equation (1). In these equations, γ represents a fixed penalty for servicing a customer outside of its time window, and α and β are respectively the penalties for one unit of tardiness or earliness.

$$c_i(t_i) = \begin{cases} \gamma + \beta(e_i - t_i) & \text{if } t_i < e_i \\ 0 & \text{if } e_i \leq t_i \leq l_i \\ \gamma + \alpha(t_i - l_i) & \text{if } l_i < t_i \end{cases} \quad (1)$$

Two settings of type 1 soft time windows have been addressed. To address the hierarchical objective of minimizing first the fleet size, then the number of customers serviced outside of their time windows, then lateness, and finally distance, the parameters values have been to $\beta = +\infty$, $\gamma = 100000$ and $\alpha = 100$ and the fleet size has been minimized by iteratively reducing the fleet limit (Table 30). Another objective, involving the minimization of distance plus lateness with $\alpha = 1$ has been also addressed (Table 31). In this case, the other parameters have been set to $\beta = +\infty$ and $\gamma = 0$.

Furthermore, two settings of type 2 soft time windows have been addressed. The hierarchical objective has been addressed by setting $\beta = 100$, $\gamma = 100000$ and $\alpha = 100$ (Table 32). We also provide results for the objective seeking to minimize the sum of distance, earliness and lateness by setting $\beta = 1$, $\gamma = 0$ and $\alpha = 1$ (Table 33).

VRP with Backhauls and Time Windows (VRPBTW). "Double" precision values have been used for distance computations. Comparison is made with methods that rely on the same assumption. The objective is to minimize first the fleet size, and the the distance.

Comparison is made with methods that rely on the same assumption. A fleet size value m is specified in the instances. As in the previous works, we consider a fixed fleet size without allowing less or more than m vehicles. To that extent, the distance matrix has been modified by setting $d_{00} = +\infty$. Other variants of the VRPB, such as the vehicle routing with mixed backhauls, the VRPB with time windows or with multiple depots, can be addressed by UHGS. For the sake of conciseness, results on these variants are not reported in this paper.

Time-Dependent VRP with Time Windows (TDVRPTW). The same setting as Kritzinger et al. (2012) is considered, involving the minimization of the total time dependent travel time. The same convention as the authors is used, and thus all routes are constrained to start at time 0, waiting time being allowed only at a customer location upon an early arrival. We consider the same fleet size limits as in Kritzinger et al. (2012). The benchmark instances of Solomon (1987) are used, along with the three travel time scenarios of Ichoua et al. (2003). The results are reported in Tables (21-23). The planning horizon is divided into three parts of 20%, 60% and 20%, respectively, as in Ichoua et al. (2003). The arc category matrix of Balseiro et al. (2011) is used. Some problem instances may be infeasible, and thus the computation of overall gaps to BKS was based on the subset of instances for which a feasible solution has been found by all methods.

Multi-Depot Periodic VRP with Time Windows (MDPVRPTW). The set of MDPVRP instances from Vidal et al. (2012), originally issued from the combination of multi-depot and periodic instances of Cordeau et al. (1997, 2001), has been completed with the time windows values from Cordeau et al. (2001). Experiments have been conducted to set the fleet size value close to the minimum fleet size. The corresponding values of m are reported, along with the results, in Table 34.

Table 1: List of benchmark instances and methods

Benchmark instances:					
B11	Bektas et al. (2011)	G84	Golden (1984)	LS99	Liu and Shen (1999)
CGL97	Cordeau et al. (1997)	G09	Goel (2009)	MG06	Montané and Galvão (2006)
CL01	Cordeau and Laporte (2001)	GDDS95	Gélinas et al. (1995)	S87	Solomon (1987)
CMT79	Christofides et al. (1979)	GH99	Gehring and Homberger (1999)	SN99	Salhi and Nagy (1999)
F94	Fisher (1994)	GJ89	Goetschalckx and J.-B. (1989)		
FTV94	Fischetti et al. (1994)	GWKC98	Golden et al. (1998)		

State-of-the-art algorithms:					
ART13	Anagnostopoulou et al. (2013)	JCL13	Jin et al. (2012)	RL12	Ribeiro and Laporte (2012)
B10	Belhaiza (2010)	KTDHS12	Kritzinger et al. (2012)	RT10	Repoussis and Tarantilis (2010)
BDHMG08	Bräysy et al. (2008)	MB07	Mester and Bräysy (2007)	RTBI10	Repoussis et al. (2010)
BER11	Bektas et al. (2011)	MCL12	Moccia et al. (2012)	RTI09	Repoussis et al. (2009)
BLR11	Balseiro et al. (2011)	NB09	Nagata and Bräysy (2009)	SDBOF10	Subramanian et al. (2010)
BPDRT09	Bräysy et al. (2009)	NBD10	Nagata et al. (2010)	SPUO12	Subramanian et al. (2012)
CM12	Cordeau and M. (2012)	NPW10	Ngueveu et al. (2010)	SUO13	Subramanian et al. (2013)
F10	Figliozzi (2010)	P09	Prins (2009)	TAR13	Tarantilis et al. (2013)
FEL07	Fu et al. (2007)	PBDH08	Polacek et al. (2008)	XZKX12	Xiao et al. (2012)
GA09	Gajpal and Abad (2009)	PDDR10	Prescott-Gagnon et al. (2010)	ZTK10	Zachariadis et al. (2010)
GG11	Groër et al. (2011)	PR07	Pisinger and Ropke (2007)	ZK10	Zachariadis and Kiranoudis (2010)
HDH09	Hemmelmayr et al. (2009)	PR08	Pirkwieser and Raidl (2008)	ZK11	Zachariadis and Kiranoudis (2011)
ISW09	Imran et al. (2009)	RP06	Ropke and Pisinger (2006)	ZK12	Zachariadis and Kiranoudis (2012)

Table 2: Results on the AVRP, instances of Fischetti et al. (1994)

Inst	**n**	**m**	**SUO13**		**UHGS**			**BKS**
			Avg 10	Best 10	Avg 10	Best 10	T(min)	
A034-02f	33	2	**1406.00**	**1406.00**	**1406.00**	**1406.00**	0.19	1406.00
A034-04f	33	4	**1773.00**	**1773.00**	**1773.00**	**1773.00**	0.15	1773.00
A034-08f	33	8	**2672.00**	**2672.00**	**2672.00**	**2672.00**	0.11	2672.00
A036-03f	35	3	**1644.00**	**1644.00**	**1644.00**	**1644.00**	0.15	1644.00
A036-05f	35	5	**2110.00**	**2110.00**	**2110.00**	**2110.00**	0.16	2110.00
A036-10f	35	10	**3338.00**	**3338.00**	**3338.00**	**3338.00**	0.12	3338.00
A039-03f	38	3	**1654.00**	**1654.00**	**1654.00**	**1654.00**	0.17	1654.00
A039-06f	38	6	**2289.00**	**2289.00**	**2289.00**	**2289.00**	0.15	2289.00
A039-12f	38	12	**3705.00**	**3705.00**	**3705.00**	**3705.00**	0.13	3705.00
A045-03f	44	3	**1740.00**	**1740.00**	**1740.00**	**1740.00**	0.21	1740.00
A045-06f	44	6	**2303.00**	**2303.00**	**2303.00**	**2303.00**	0.23	2303.00
A045-11f	44	11	**3544.00**	**3544.00**	**3544.00**	**3544.00**	0.24	3544.00
A048-03f	47	3	**1891.00**	**1891.00**	**1891.00**	**1891.00**	0.27	1891.00
A048-05f	47	5	**2283.00**	**2283.00**	**2283.00**	**2283.00**	0.30	2283.00
A048-10f	47	10	**3325.00**	**3325.00**	**3325.00**	**3325.00**	0.26	3325.00
A056-03f	55	3	**1739.00**	**1739.00**	**1739.00**	**1739.00**	0.42	1739.00
A056-05f	55	5	**2165.00**	**2165.00**	**2165.00**	**2165.00**	0.34	2165.00
A056-10f	55	10	**3263.00**	**3263.00**	**3263.00**	**3263.00**	0.32	3263.00
A065-03f	64	3	**1974.00**	**1974.00**	**1974.00**	**1974.00**	0.42	1974.00
A065-06f	64	6	2571.70	**2567.00**	2567.40	**2567.00**	0.70	2567.00
A065-12f	64	12	3904.90	**3902.00**	**3902.00**	**3902.00**	0.47	3902.00
A071-03f	70	3	**2054.00**	**2054.00**	**2054.00**	**2054.00**	0.48	2054.00
A071-05f	70	5	2457.90	**2457.00**	**2457.00**	**2457.00**	0.57	2457.00
A071-10f	70	10	3492.90	**3486.00**	3488.40	**3486.00**	0.64	3486.00
Time			2.24 min		0.30 min			
Gap			+0.02%	+0.00%	+0.00%	+0.00%		
CPU			Xeon 2.93G		Opt 2.2G			

Table 3: Results on the VRPB, instances of Goetschalckx and Jacobs-Blecha (1989)

Inst	**n**	**m**	**GA09**		**ZK11**		**UHGS**			**BKS**
			Avg 8	Best X	Avg 10	Best 10	Avg 10	Best 10	T(min)	
A1	25	8	**229.89**	**229.89**	**229.89**	**229.89**	**229.89**	**229.89**	0.11	229.89
A2	25	5	**180.12**	**180.12**	**180.12**	**180.12**	**180.12**	**180.12**	0.12	180.12
A3	25	4	**163.41**	**163.41**	**163.41**	**163.41**	**163.41**	**163.41**	0.13	163.41
A4	25	3	**155.80**	**155.80**	**155.80**	**155.80**	**155.80**	**155.80**	0.16	155.80
B1	30	7	**239.08**	**239.08**	**239.08**	**239.08**	**239.08**	**239.08**	0.14	239.08
B2	30	5	**198.05**	**198.05**	**198.05**	**198.05**	**198.05**	**198.05**	0.15	198.05
B3	30	3	**169.37**	**169.37**	**169.37**	**169.37**	**169.37**	**169.37**	0.18	169.37
C1	40	7	**250.56**	**250.56**	**250.56**	**250.56**	**250.56**	**250.56**	0.22	250.56
C2	40	5	**215.02**	**215.02**	**215.02**	**215.02**	**215.02**	**215.02**	0.24	215.02
C3	40	5	**199.35**	**199.35**	**199.35**	**199.35**	**199.35**	**199.35**	0.23	199.35
C4	40	4	**195.37**	**195.37**	**195.37**	**195.37**	**195.37**	**195.37**	0.24	195.37
D1	38	12	**322.53**	**322.53**	**322.53**	**322.53**	**322.53**	**322.53**	0.18	322.53
D2	38	11	**316.71**	**316.71**	**316.71**	**316.71**	**316.71**	**316.71**	0.17	316.71
D3	38	7	**239.48**	**239.48**	**239.48**	**239.48**	**239.48**	**239.48**	0.19	239.48
D4	38	5	**205.83**	**205.83**	**205.83**	**205.83**	**205.83**	**205.83**	0.24	205.83
E1	45	7	**238.88**	**238.88**	**238.88**	**238.88**	**238.88**	**238.88**	0.27	238.88
E2	45	4	**212.26**	**212.26**	**212.26**	**212.26**	**212.26**	**212.26**	0.32	212.26
E3	45	4	**206.66**	**206.66**	**206.66**	**206.66**	**206.66**	**206.66**	0.36	206.66
F1	60	6	**263.17**	**263.17**	263.27	**263.17**	**263.17**	**263.17**	0.38	263.17
F2	60	7	**265.21**	**265.21**	265.66	**265.21**	**265.21**	**265.21**	0.39	265.21
F3	60	5	241.48	**241.12**	**241.12**	**241.12**	**241.12**	**241.12**	0.49	241.12
F4	60	4	**233.86**	**233.86**	234.60	**233.86**	**233.86**	**233.86**	0.54	233.86
G2	57	6	**245.44**	**245.44**	**245.44**	**245.44**	**245.44**	**245.44**	0.38	245.44
G3	57	5	**229.51**	**229.51**	229.97	**229.51**	**229.51**	**229.51**	0.43	229.51
G4	57	6	**232.52**	**232.52**	**232.52**	**232.52**	**232.52**	**232.52**	0.45	232.52
G5	57	5	**221.73**	**221.73**	**222.87**	**221.73**	**221.73**	**221.73**	0.46	221.73
G6	57	4	**213.46**	**213.46**	214.38	**213.46**	**213.46**	**213.46**	0.54	213.46
H1	68	6	269.00	**268.93**	270.06	**268.93**	**268.93**	**268.93**	0.62	268.93
H2	68	5	**253.37**	**253.37**	253.91	**253.37**	**253.37**	**253.37**	0.57	253.37
H3	68	4	**247.45**	**247.45**	**247.45**	**247.45**	**247.45**	**247.45**	0.64	247.45
H4	68	5	**250.22**	**250.22**	251.09	**250.22**	**250.22**	**250.22**	0.59	250.22
H5	68	4	**246.12**	**246.12**	**246.12**	**246.12**	**246.12**	**246.12**	0.62	246.12
H6	68	5	**249.14**	**249.14**	250.06	**249.14**	**249.14**	**249.14**	0.59	249.14
I1	90	10	350.40	**350.25**	351.08	**350.25**	350.37	**350.25**	0.89	350.25
I2	90	7	310.32	**309.94**	309.98	**309.94**	**309.94**	**309.94**	0.85	309.94
I3	90	5	294.84	**294.51**	294.79	**294.51**	**294.51**	**294.51**	0.99	294.51
I4	90	6	296.13	**295.99**	297.91	**295.99**	**295.99**	**295.99**	0.92	295.99
I5	90	7	301.83	**301.24**	303.49	**301.24**	**301.24**	**301.24**	0.82	301.24
J1	94	10	335.12	**335.01**	335.78	**335.01**	**335.01**	**335.01**	0.83	335.01
J2	94	8	**310.42**	**310.42**	312.51	**310.42**	**310.42**	**310.42**	0.84	310.42
J3	94	6	279.34	**279.22**	280.43	**279.22**	**279.22**	**279.22**	0.93	279.22
J4	94	7	296.58	**296.53**	298.32	**296.53**	**296.53**	**296.53**	1.12	296.53
K1	113	10	396.14	**394.07**	397.38	**394.07**	394.35	**394.07**	1.33	394.07
K2	113	8	362.56	**362.13**	365.46	**362.13**	**362.13**	**362.13**	1.40	362.13
K3	113	9	366.71	**365.69**	369.44	**365.69**	**365.69**	**365.69**	1.30	365.69
K4	113	7	350.32	**348.95**	349.72	**348.95**	**348.95**	**348.95**	1.29	348.95
L1	150	10	420.06	**417.90**	421.68	**417.90**	418.16	**417.90**	3.94	417.90
L2	150	8	401.36	**401.23**	405.20	**401.23**	**401.23**	**401.23**	2.96	401.23
L3	150	9	404.32	**402.68**	405.76	**402.68**	**402.68**	**402.68**	2.73	402.68
L4	150	7	384.83	**384.64**	388.14	**384.64**	**384.64**	**384.64**	2.35	384.64
L5	150	8	390.33	**387.56**	390.46	387.57	**387.56**	**387.56**	2.72	387.56
M1	125	11	399.12	**398.59**	400.50	**398.59**	398.66	**398.59**	1.58	398.59
M2	125	10	398.16	**396.92**	401.91	**396.92**	396.93	**396.92**	2.39	396.92
M3	125	9	377.81	**375.70**	378.07	**375.70**	375.93	**375.70**	2.70	375.70
M4	125	7	348.46	**348.14**	352.03	**348.14**	348.20	**348.14**	1.72	348.14
N1	150	11	408.17	**408.10**	411.72	**408.10**	**408.10**	**408.10**	2.72	408.10
N2	150	10	408.25	**408.07**	412.31	**408.07**	408.13	**408.07**	2.55	408.07
N3	150	9	394.70	**394.34**	398.76	**394.34**	394.94	**394.34**	2.46	394.34
N4	150	10	394.87	**394.79**	396.16	**394.79**	395.13	**394.79**	2.37	394.79
N5	150	7	374.12	**373.48**	376.90	**373.48**	373.55	**373.48**	3.12	373.48
N6	150	8	374.79	**373.76**	379.78	**373.76**	373.76	**373.76**	3.42	373.76
Time			1.13 min		1.09 min		0.99 min			
Gap			+0.09%	+0.00%	+0.38%	+0.00%	+0.01%	+0.00%		
CPU			T5500 1.67G		Xe 2.4G		Opt 2.4G			

Table 4: Results on the CCVRP, instances of Christofides et al. (1979)

Inst	**n**	**m**	**NPW10**		**RL12**		**UHGS**			**BKS**
			Avg 5	Best 5	Avg 5	Best 5	Avg 10	Best 10	T(min)	
p01	50	5	**2230.35**	**2230.35**	2235.27	**2230.35**	**2230.35**	**2230.35**	0.44	2230.35
p02	75	10	2443.07	2421.90	2401.72	**2391.63**	2394.00	**2391.63**	0.70	2391.63
p03	100	8	4073.12	4073.12	4063.98	**4045.42**	**4045.42**	**4045.42**	0.93	4045.42
p04	150	12	5020.75	**4987.52**	4994.93	**4987.52**	**4987.52**	**4987.52**	1.84	4987.52
p05	199	17	5842.00	5810.20	5857.76	5838.32	5809.94	**5806.02**	4.02	5810.12
p11	120	7	7395.83	7317.98	7341.28	7315.87	**7314.55**	**7314.55**	1.35	7315.87
p12	100	10	3559.23	**3558.92**	3566.06	**3558.92**	**3558.93**	**3558.93**	0.64	3558.93
Time			5.20 min		2.69 min		1.42 min			
Gap			+0.74%	+0.28%	+0.37%	+0.07%	+0.01%	-0.01%		
CPU			Core2 2G		Core2 2G		Opt 2.2G			

Table 5: Results on the CCVRP, instances of Golden et al. (1998)

Inst	**n**	**m**	**NPW10**[1]		**RL12**		**UHGS**			**BKS**
			Avg 5	Best 5	Avg 5	Best 5	Avg 10	Best 10	T(min)	
pr01	240	9	54878.25	54815.17	54853.76	54786.92	54742.20	**54739.85**	7.40	54786.92
pr02	320	10	100918.54	100836.90	100934.34	100662.53	100562.52	**100560.16**	11.00	100662.53
pr03	400	10	171400.35	171277.26	172231.14	171613.59	170964.42	**170923.53**	23.95	171277.26
pr04	480	10	262830.96	262584.23	265207.46	263433.03	262044.19	**261993.33**	26.14	262584.23
pr05	200	5	114237.00	114163.64	114846.27	114494.66	**114163.63**	**114163.63**	6.95	114163.64
pr06	280	7	140456.96	140430.09	140929.71	140804.64	**140430.08**	**140430.08**	12.65	140430.09
pr07	360	8	186702.15	183282.64	181610.82	180481.56	178976.20	**178880.44**	26.66	180481.56
pr08	440	10	194510.99	194312.60	195174.85	194988.74	193683.21	**193659.14**	26.07	194273.58
pr09	255	14	4740.42	4730.70	4728.05	4725.58	4724.01	**4722.06**	6.97	4725.58
pr10	323	16	6747.10	6732.36	6717.76	6713.92	6720.04	**6713.26**	10.30	6713.92
pr11	399	18	9259.66	9243.05	9216.60	**9214.07**	9222.92	9219.42	14.61	9214.07
pr12	483	19	12649.21	12629.37	12543.04	12526.17	12516.98	**12500.52**	28.66	12526.17
pr13	252	26	3660.93	3653.07	3638.50	3628.30	3632.63	**3627.45**	7.16	3628.30
pr14	320	29	6045.20	5770.02	5257.95	5216.80	5206.53	**5187.56**	16.25	5216.80
pr15	396	33	7140.11	7077.48	7023.12	7010.41	7015.51	**7005.47**	18.70	7010.41
pr16	480	37	9339.45	9300.74	9268.30	9250.98	9247.68	**9239.10**	27.28	9250.98
pr17	240	22	3103.99	3089.99	3068.29	3065.46	3061.28	**3060.14**	6.06	3065.46
pr18	300	27	4582.44	4528.16	4244.60	4221.14	4211.80	**4199.43**	11.64	4221.14
pr19	360	33	5589.12	5570.35	5531.78	5523.38	5502.59	**5496.39**	17.06	5523.38
pr20	420	38	7473.69	7413.58	7240.86	7223.08	7188.59	**7184.19**	21.82	7223.08
Time			94.13 min		21.11 min		17.16 min			
Gap			+2.03%	+1.38%	+0.34%	+0.07%	-0.14%	-0.23%		
CPU			Core2 2G		Core2 2G		Opt 2.2G			

Table 6: Results on the VRPSDP, instances of Salhi and Nagy (1999)

Inst	**n**	**ZTK10**	**SDBOF10**		**SUO13**		**UHGS**			**BKS**
		—	Avg 50	Best 50	Avg 10	Best 10	Avg 10	Best 10	T(min)	
CMT1X	50	469.80	**466.77**	**466.77**	**466.77**	**466.77**	**466.77**	**466.77**	0.72	466.77
CMT1Y	50	469.80	**466.77**	**466.77**	**466.77**	**466.77**	**466.77**	**466.77**	0.71	466.77
CMT2X	75	**684.21**	684.49	**684.21**	684.78	**684.21**	684.43	**684.21**	1.32	684.21
CMT2Y	75	**684.21**	684.43	**684.21**	684.59	**684.21**	684.36	**684.21**	1.35	684.21
CMT3X	100	**721.27**	**721.27**	**721.27**	721.46	**721.27**	**721.27**	**721.27**	1.69	721.27
CMT3Y	100	**721.27**	**721.27**	**721.27**	721.50	**721.27**	**721.27**	**721.27**	1.79	721.27
CMT12X	100	**662.22**	**662.22**	**662.22**	663.44	**662.22**	**662.22**	**662.22**	1.74	662.22
CMT12Y	100	**662.22**	662.25	**662.22**	663.12	**662.22**	**662.22**	**662.22**	1.69	662.22
CMT11X	120	**833.92**	842.78	**833.92**	848.65	846.23	**833.92**	**833.92**	2.75	833.92
CMT11Y	120	**833.92**	842.78	**833.92**	848.74	846.23	**833.92**	**833.92**	2.66	833.92
CMT4X	150	**852.46**	**852.46**	**852.46**	853.02	**852.46**	852.65	**852.46**	4.16	852.46
CMT4Y	150	**852.46**	**852.46**	**852.46**	852.73	**852.46**	852.72	**852.46**	3.95	852.46
CMT5X	199	1030.55	1029.66	**1029.25**	1029.52	**1029.25**	1029.60	**1029.25**	7.99	1029.25
CMT5Y	199	1030.55	1029.71	**1029.25**	**1029.25**	**1029.25**	1029.79	**1029.25**	6.60	1029.25
Time		—	256×0.36 min		—		2.79 min			
Gap		+0.11%	+0.16%	+0.00%	+0.30%	+0.21%	+0.01%	+0.00%		
CPU		T5500 1.66G	Xe 2.67G		I7 2.93G		Opt 2.4G			

Table 7: Results on the VRPSDP, instances of Montané and Galvão (2006)

Inst	**n**	**ZTK10**	**SDBOF10**		**SUO13**		**UHGS**			**BKS**
		—	Avg 50	Best 50	Avg 10	Best 10	Avg 10	Best 10	T(min)	
r101	100	**1009.95**	1010.54	**1009.95**	1010.08	**1009.95**	1011.60	**1009.95**	1.23	1009.95
r201	100	**666.20**	**666.20**	**666.20**	**666.20**	**666.20**	**666.20**	**666.20**	2.39	666.20
c101	100	1220.99	1220.64	**1220.18**	1220.43	**1220.18**	1220.99	1220.99	1.10	1220.18
c201	100	**662.07**	**662.07**	**662.07**	**662.07**	**662.07**	**662.07**	**662.07**	1.63	662.07
rc101	100	**1059.32**	**1059.32**	**1059.32**	**1059.32**	**1059.32**	**1059.32**	**1059.32**	1.21	1059.32
rc201	100	**672.92**	**672.92**	**672.92**	**672.92**	**672.92**	**672.92**	**672.92**	1.99	672.92
R1_2_1	200	3376.30	3369.93	3360.02	3355.04	**3353.80**	3364.40	3355.37	6.77	3353.80
R2_2_1	200	**1665.58**	**1665.58**	**1665.58**	**1665.58**	**1665.58**	**1665.58**	**1665.58**	8.95	1665.58
C1_2_1	200	3643.82	3635.87	3629.89	3636.53	**3628.51**	3639.00	3637.42	7.25	3628.51
C2_2_1	200	**1726.59**	**1726.59**	**1726.59**	**1726.59**	**1726.59**	**1726.59**	**1726.59**	5.52	1726.59
RC1_2_1	200	3323.56	3317.51	3306.00	3306.73	**3303.70**	3315.35	3304.39	8.10	3303.70
RC2_2_1	200	**1560.00**	**1560.00**	**1560.00**	**1560.00**	**1560.00**	**1560.00**	**1560.00**	7.35	1560.00
R1_4_1	400	9691.60	9647.24	9618.97	9539.56	**9519.45**	9594.08	9547.85	24.53	9519.45
R2_4_1	400	3572.38	3557.43	3551.38	3549.49	**3546.49**	3555.10	**3546.49**	24.57	3546.49
C1_4_1	400	11179.36	11118.98	11099.54	11075.60	**11047.19**	11113.63	11077.26	29.67	11047.19
C2_4_1	400	3549.27	3558.92	3546.10	3543.65	**3539.50**	3541.44	**3539.50**	29.76	3539.50
RC1_4_1	400	9645.27	9564.86	9536.77	9478.12	**9447.53**	9509.39	9469.44	29.84	9447.53
RC2_4_1	400	3423.62	3404.62	**3403.70**	**3403.70**	**3403.70**	3404.08	**3403.70**	24.10	3403.70
Time		—	256×3.11 min		7.23 min		12.00 min			
Gap		+0.47%	+0.30%	+0.17%	+0.08%	+0.00%	+0.20%	+0.07%		
CPU		T5500 1.66G	Xe 2.67G		I7 2.93G		Opt 2.4G			

Table 8: Results for the VRPMDP, instances of Salhi and Nagy (1999)

Inst	n	m	ART13	SUO13		UHGS			BKS
			Best 5	Avg 10	Best 10	Avg 10	Best 10	T(min)	
CMT01H	50	4	**465.02**	465.03	**465.02**	**465.02**	**465.02**	0.69	465.02
CMT01Q	50	6	**489.74**	**489.74**	**489.74**	**489.74**	**489.74**	0.55	489.74
CMT01T	50	7	**520.06**	**520.06**	**520.06**	**520.06**	**520.06**	0.52	520.06
CMT02H	75	5	**662.63**	**662.63**	**662.63**	**662.63**	**662.63**	1.02	662.63
CMT02Q	75	7	**731.26**	731.40	**731.26**	731.45	**731.26**	1.46	731.26
CMT02T	75	9	**782.77**	**782.77**	**782.77**	**782.77**	**782.77**	0.83	782.77
CMT03H	100	3	**700.94**	**700.94**	**700.94**	**700.94**	**700.94**	1.94	700.94
CMT03Q	100	4	**747.15**	**747.15**	**747.15**	**747.15**	**747.15**	1.33	747.15
CMT03T	100	5	**798.07**	**798.07**	**798.07**	**798.07**	**798.07**	1.62	798.07
CMT04H	100	6	**828.12**	831.59	**828.12**	829.64	**828.12**	5.67	828.12
CMT04Q	100	8	915.27	915.27	915.27	915.46	915.27	4.18	913.93
CMT04T	100	9	**990.39**	**990.39**	**990.39**	**990.39**	**990.39**	2.50	990.39
CMT05H	120	4	980.63	**978.74**	**978.74**	980.58	**978.74**	4.95	978.74
CMT05Q	120	6	1113.31	1105.79	**1104.87**	1106.95	**1104.87**	5.79	1104.87
CMT05T	120	7	1225.48	1220.24	**1218.77**	1220.53	**1218.77**	5.96	1218.77
CMT06H	150	6	**555.43**	557.35	**555.43**	**555.43**	**555.43**	0.45	555.43
CMT06Q	150	9	**555.43**	557.15	**555.43**	**555.43**	**555.43**	0.45	555.43
CMT06T	150	11	**555.43**	556.64	**555.43**	**555.43**	**555.43**	0.46	555.43
CMT07H	200	9	**900.12**	900.84	900.54	900.59	**900.12**	1.03	900.12
CMT07Q	200	12	**900.69**	902.62	**900.69**	901.09	**900.69**	1.19	900.69
CMT07T	200	15	**903.05**	**903.05**	**903.05**	**903.05**	**903.05**	0.73	903.05
CMT08H	50	7	**865.50**	**865.50**	**865.50**	**865.50**	**865.50**	1.31	865.50
CMT08Q	50	7	**865.50**	**865.50**	**865.50**	**865.50**	**865.50**	1.32	865.50
CMT08T	50	7	**865.54**	**865.54**	**865.54**	**865.54**	**865.54**	1.31	865.54
CMT09H	75	13	1161.24	1162.17	**1160.68**	**1160.68**	**1160.68**	3.66	1160.68
CMT09Q	75	14	**1161.24**	1161.69	**1161.24**	1161.32	**1161.24**	3.46	1161.24
CMT09T	75	14	1162.89	1164.37	**1162.55**	**1162.55**	**1162.55**	3.68	1162.55
CMT10H	100	10	1378.73	1377.23	1372.52	1381.47	**<u>1372.47</u>**	6.56	1372.52
CMT10Q	100	10	1388.93	1379.47	**1374.18**	1378.41	**1374.18**	7.91	1374.18
CMT10T	100	10	1394.19	1388.17	**1381.04**	1390.82	**1381.04**	5.49	1381.04
CMT11H	100	11	**818.05**	818.06	**818.05**	**818.05**	**818.05**	4.53	818.05
CMT11Q	100	11	**939.36**	**939.36**	**939.36**	**939.36**	**939.36**	2.99	939.36
CMT11T	100	11	**998.80**	998.81	**998.80**	**998.80**	**998.80**	2.34	998.80
CMT12H	120	12	**629.37**	**629.37**	**629.37**	**629.37**	**629.37**	1.49	629.37
CMT12Q	120	12	**729.25**	**729.25**	**729.25**	**729.25**	**729.25**	1.53	729.25
CMT12T	120	12	**787.52**	**787.52**	**787.52**	**787.52**	**787.52**	0.95	787.52
CMT13H	150	16	1546.09	1544.54	**1542.86**	**1542.86**	**1542.86**	2.81	1542.86
CMT13Q	150	16	1546.96	1544.05	**1542.86**	**1542.86**	**1542.86**	2.85	1542.86
CMT13T	150	16	1543.43	1544.11	**1542.86**	1542.95	**1542.86**	2.86	1542.86
CMT14H	199	20	**821.75**	**821.75**	**821.75**	**821.75**	**821.75**	0.96	821.75
CMT14Q	199	20	**821.75**	**821.75**	**821.75**	**821.75**	**821.75**	0.97	821.75
CMT14T	199	20	**826.77**	**826.77**	**826.77**	**826.77**	**826.77**	1.15	826.77
Time			2.11 min	2.97 min		2.46 min			
Gap			+0.11%	+0.09%	+0.00%	+0.06%	+0.00%		
CPU			X7900 2.8G	I7 2.93G		Opt 2.2G			

Table 9: Results on the VFMP-F, only fixed vehicle costs, instances of Golden (1984)

Inst	**n**	**w**	**ISW09**	**P09**	**SPUO12**		**UHGS**			**BKS**
			Best 5-7	Best 5	Avg 10	Best 10	Avg 10	Best 10	T(min)	
F3	20	5	**961.03**	**961.03**	**961.03**	**961.03**	**961.03**	**961.03**	0.20	961.03
F4	20	3	**6437.33**	**6437.33**	**6437.33**	**6437.33**	**6437.33**	**6437.33**	0.23	6437.33
F5	20	5	**1007.05**	**1007.05**	1008.76	**1007.05**	**1007.05**	**1007.05**	0.23	1007.05
F6	20	3	**6516.47**	**6516.47**	**6516.47**	**6516.47**	**6516.47**	**6516.47**	0.23	6516.47
F13	50	6	**2406.36**	**2406.36**	2411.31	**2406.36**	2406.57	**2406.36**	1.02	2406.36
F14	50	3	**9119.03**	**9119.03**	**9119.03**	**9119.03**	**9119.03**	**9119.03**	0.88	9119.03
F15	50	3	**2586.37**	**2586.37**	**2586.37**	**2586.37**	**2586.37**	**2586.37**	0.73	2586.37
F16	50	3	**2720.43**	2729.08	2724.55	**2720.43**	**2720.43**	**2720.43**	0.66	2720.43
F17	75	4	1741.95	1746.09	1744.23	**1734.53**	1735.37	**1734.53**	1.75	1734.53
F18	75	6	**2369.65**	**2369.65**	2373.79	**2369.65**	2374.16	**2369.65**	1.73	2369.65
F19	100	3	8665.05	8665.12	8662.54	**8661.81**	8663.97	8662.86	3.70	8661.81
F20	100	3	4044.68	4044.78	4038.63	4032.81	4037.77	4034.42	2.26	4029.74
Time			8.34 min	0.71 min	0.15 min		1.13 min			
Gap			+0.07%	+0.12%	+0.13%	+0.01%	+0.04%	+0.01%		
CPU			PM 1.7G	PM 1.8G	I7 2.93G		Opt 2.4G			

Table 10: Results on the VFMP-V, only variable vehicle costs, instances of Golden (1984)

Inst	**n**	**w**	**ISW09**	**P09**	**SPUO12**		**UHGS**			**BKS**
			Best 5-7	Best 5	Avg 10	Best 10	Avg 10	Best 10	T(min)	
V3	20	5	NC	NC	**623.22**	**623.22**	**623.22**	**623.22**	0.17	623.22
V4	20	3	NC	NC	387.34	**387.18**	**387.18**	**387.18**	0.19	387.18
V5	20	5	NC	NC	**742.87**	**742.87**	**742.87**	**742.87**	0.20	742.87
V6	20	3	NC	NC	**415.03**	**415.03**	**415.03**	**415.03**	0.22	415.03
V13	50	6	**1491.86**	**1491.86**	1492.01	**1491.86**	**1491.86**	**1491.86**	0.72	1491.86
V14	50	3	**603.21**	**603.21**	605.00	**603.21**	**603.21**	**603.21**	0.56	603.21
V15	50	3	**999.82**	**999.82**	1001.03	**999.82**	**999.82**	**999.82**	0.61	999.82
V16	50	3	**1131.00**	**1131.00**	1131.85	**1131.00**	**1131.00**	**1131.00**	0.57	1131.00
V17	75	4	**1038.60**	**1038.60**	1042.48	**1038.60**	**1038.60**	**1038.60**	1.14	1038.60
V18	75	6	**1800.80**	**1800.80**	1802.89	**1800.80**	1801.40	1801.40	1.34	1800.80
V19	100	3	**1105.44**	**1105.44**	1106.71	**1105.44**	1106.93	**1105.44**	1.71	1105.44
V20	100	3	1533.24	1535.12	1534.23	**1530.43**	1531.82	**1530.43**	2.80	1530.43
Time			8.85 min	0.41 min	0.06 min		0.85 min			
Gap			+0.02%	+0.03%	+0.17%	+0.00%	+0.03%	+0.00%		
CPU			PM 1.7G	PM 1.8G	I7 2.93G		Opt 2.4G			

Table 11: Results on the VFMP-FV, fixed and variable vehicle costs, instances of Golden (1984)

Inst	**n**	**w**	**ISW09**	**P09**	**SPUO12**		**UHGS**			**BKS**
			Best 5-7	Best 5	Avg 10	Best 10	Avg 10	Best 10	T(min)	
FV3	20	5	**1144.22**	**1144.22**	**1144.22**	**1144.22**	**1144.22**	**1144.22**	0.17	1144.22
FV4	20	3	**6437.33**	**6437.33**	**6437.33**	**6437.33**	**6437.33**	**6437.33**	0.23	6437.33
FV5	20	5	**1322.26**	**1322.26**	**1322.26**	**1322.26**	**1322.26**	**1322.26**	0.17	1322.26
FV6	20	3	**6516.47**	**6516.47**	**6516.47**	**6516.47**	**6516.47**	**6516.47**	0.23	6516.47
FV13	50	6	**2964.65**	**2964.65**	**2964.65**	**2964.65**	**2964.65**	**2964.65**	0.51	2964.65
FV14	50	3	**9126.90**	**9126.90**	**9126.90**	**9126.90**	**9126.90**	**9126.90**	0.79	9126.90
FV15	50	3	**2634.96**	2635.21	**2634.96**	**2634.96**	2635.06	**2634.96**	0.71	2634.96
FV16	50	3	3169.10	3169.14	**3168.92**	**3168.92**	**3168.92**	**3168.92**	0.80	3168.92
FV17	75	4	2008.14	**2004.48**	2007.12	**2004.48**	2007.04	**2004.48**	1.33	2004.48
FV18	75	6	3157.20	3153.16	3148.91	**3147.99**	3148.99	3148.99	1.28	3147.99
FV19	100	3	8665.88	8664.67	8662.89	**8661.81**	8663.04	**8661.81**	3.91	8661.81
FV20	100	3	4154.87	4154.49	4153.12	**4153.02**	**4153.02**	**4153.02**	1.73	4153.02
Time			8.42 min	0.39 min	0.13 min		0.99 min			
Gap			+0.05%	+0.02%	+0.01%	+0.00%	+0.01%	+0.00%		
CPU			PM 1.7G	PM 1.8G	I7 2.93G		Opt 2.4G			

Table 12: Results on the LDVRP, instances of Christofides et al. (1979)

Inst	**n**	**XZKX12**		**UHGS**			**BKS**
		Avg 10	Best 10	Avg 10	Best 10	T(min)	
p01	50	751.43	751.11	<u>**746.39**</u>	<u>**746.39**</u>	0.50	751.11
p02	75	1188.62	1179.53	<u>**1172.62**</u>	<u>**1172.62**</u>	0.99	1179.53
p03	100	1153.56	**1147.83**	**1147.83**	**1147.83**	1.49	1147.83
p04	150	1461.69	1452.88	<u>**1446.64**</u>	<u>**1446.64**</u>	4.49	1452.88
p05	199	1865.30	1844.87	1840.54	<u>**1834.31**</u>	6.26	1844.87
p11	120	1516.42	1513.48	<u>**1511.99**</u>	<u>**1511.99**</u>	1.74	1513.48
p12	100	1175.59	**1174.02**	**1174.02**	**1174.02**	0.92	1174.02
Time		1.3 min		2.34 min			
Gap		+0.48%	+0.00%	-0.28%	-0.33%		
CPU		—		Opt 2.2G			

Table 13: Results for the LDVRP, instances of Golden et al. (1998)

Inst	**n**	**XZKX12**		**UHGS**			**BKS**
		Avg 10	Best 10	Avg 10	Best 10	T(min)	
pr01	240	7714.29	7683.952	7661.10	**7660.64**	12.24	7683.95
pr02	320	11195.02	11172.71	11178.93	**11148.74**	25.71	11172.71
pr03	400	14566.73	14497.64	14525.36	**14480.67**	25.90	14497.64
pr04	480	18605.37	18327.03	18225.56	**18206.84**	30.43	18327.03
pr05	200	8576.91	8561.53	8457.61	**8457.60**	5.71	8561.53
pr06	280	11121.04	11102.22	11056.72	**11056.47**	12.51	11102.22
pr07	360	13477.07	13422.16	13408.06	**13392.93**	27.56	13422.16
pr08	440	16098.60	15928.26	15538.15	**15491.34**	29.76	15928.26
pr09	255	858.34	850.80	835.55	**834.73**	23.17	850.80
pr10	323	1090.85	1083.00	1062.66	**1061.36**	27.86	1083.00
pr11	399	1360.20	1352.32	1319.47	**1316.59**	30.34	1352.32
pr12	483	1661.07	1630.81	1599.59	**1596.68**	30.02	1630.81
pr13	252	1269.37	1261.93	1235.32	**1232.99**	13.84	1261.93
pr14	320	1604.83	1595.48	1564.18	**1562.73**	22.87	1595.48
pr15	396	1987.76	1970.43	1934.13	**1930.84**	28.80	1970.43
pr16	480	2408.72	2391.12	2340.21	**2337.60**	30.00	2391.12
pr17	240	1033.88	1027.21	1018.17	**1018.02**	11.22	1027.21
pr18	300	1469.97	1462.31	1440.00	**1435.34**	20.15	1462.31
pr19	360	2014.26	2007.62	1967.85	**1966.77**	28.32	2007.62
pr20	420	2699.29	2687.85	2626.61	**2621.48**	30.18	2687.85
Time		3.3 min		23.81 min			
Gap		+0.66%	+0.00%	-1.38%	-1.52%		
CPU		—		Opt 2.2G			

Table 14: Results on the GVRP, instances of Bektas et al. (2011)

Inst	**n**	**c**	**m**	**BER11**	**MCL12**		**UHGS**		**BKS**
				Single	Single	Avg 10	Best 10	T(min)	
A-n32-k5-C16-V2	32	16	2	**519.00**	**519.00**	**519.00**	**519.00**	0.64	519.00
A-n33-k5-C17-V3	33	17	3	**451.00**	**451.00**	**451.00**	**451.00**	0.69	451.00
A-n33-k6-C17-V3	33	17	3	**465.00**	**465.00**	**465.00**	**465.00**	0.69	465.00
A-n34-k5-C17-V3	34	17	3	**489.00**	**489.00**	**489.00**	**489.00**	0.73	489.00
A-n36-k5-C18-V2	36	18	2	**505.00**	**505.00**	**505.00**	**505.00**	0.83	505.00
A-n37-k5-C19-V3	37	19	3	**432.00**	**432.00**	**432.00**	**432.00**	0.76	432.00
A-n37-k6-C19-V3	37	19	3	**584.00**	**584.00**	**584.00**	**584.00**	0.83	584.00
A-n38-k5-C19-V3	38	19	3	**476.00**	**476.00**	**476.00**	**476.00**	0.89	476.00
A-n39-k5-C20-V3	39	20	3	**557.00**	**557.00**	**557.00**	**557.00**	0.99	557.00
A-n39-k6-C20-V3	39	20	3	**544.00**	**544.00**	**544.00**	**544.00**	1.05	544.00
A-n44-k6-C22-V3	44	22	3	**608.00**	**608.00**	**608.00**	**608.00**	1.36	608.00
A-n45-k6-C23-V4	45	23	4	**613.00**	**613.00**	**613.00**	**613.00**	1.10	613.00
A-n45-k7-C23-V4	45	23	4	**674.00**	**674.00**	**674.00**	**674.00**	1.21	674.00
A-n46-k7-C23-V4	46	23	4	**593.00**	**593.00**	**593.00**	**593.00**	1.00	593.00
A-n48-k7-C24-V4	48	24	4	**667.00**	**667.00**	**667.00**	**667.00**	1.26	667.00
A-n53-k7-C27-V4	53	27	4	**603.00**	**603.00**	**603.00**	**603.00**	1.33	603.00
A-n54-k7-C27-V4	54	27	4	**690.00**	**690.00**	**690.00**	**690.00**	1.39	690.00
A-n55-k9-C28-V5	55	28	5	**699.00**	**699.00**	**699.00**	**699.00**	1.32	699.00
A-n60-k9-C30-V5	60	30	5	**769.00**	**769.00**	**769.00**	**769.00**	1.46	769.00
A-n61-k9-C31-V5	61	31	5	**638.00**	**638.00**	**638.00**	**638.00**	1.59	638.00
A-n62-k8-C31-V4	62	31	4	**740.00**	**740.00**	**740.00**	**740.00**	1.89	740.00
A-n63-k10-C32-V5	63	32	5	**801.00**	**801.00**	**801.00**	**801.00**	1.63	801.00
A-n63-k9-C32-V5	63	32	5	**912.00**	**912.00**	**912.00**	**912.00**	1.71	912.00
A-n64-k9-C32-V5	64	32	5	**763.00**	**763.00**	**763.00**	**763.00**	1.84	763.00
A-n65-k9-C33-V5	65	33	5	**682.00**	**682.00**	**682.00**	**682.00**	1.62	682.00
A-n69-k9-C35-V5	69	35	5	**680.00**	**680.00**	**680.00**	**680.00**	1.83	680.00
A-n80-k10-C40-V5	80	40	5	**997.00**	**997.00**	**997.00**	**997.00**	2.65	997.00
B-n31-k5-C16-V3	31	16	3	**441.00**	**441.00**	**441.00**	**441.00**	0.63	441.00
B-n34-k5-C17-V3	34	17	3	**472.00**	**472.00**	**472.00**	**472.00**	0.70	472.00
B-n35-k5-C18-V3	35	18	3	**626.00**	**626.00**	**626.00**	**626.00**	0.65	626.00
B-n38-k6-C19-V3	38	19	3	**451.00**	**451.00**	**451.00**	**451.00**	0.86	451.00
B-n39-k5-C20-V3	39	20	3	**357.00**	**357.00**	**357.00**	**357.00**	0.79	357.00
B-n41-k6-C21-V3	41	21	3	**481.00**	**481.00**	**481.00**	**481.00**	1.08	481.00
B-n43-k6-C22-V3	43	22	3	**483.00**	**483.00**	**483.00**	**483.00**	1.15	483.00
B-n44-k7-C22-V4	44	22	4	**540.00**	**540.00**	**540.00**	**540.00**	1.13	540.00
B-n45-k5-C23-V3	45	23	3	**497.00**	**497.00**	**497.00**	**497.00**	1.28	497.00
B-n45-k6-C23-V4	45	23	4	**478.00**	**478.00**	**478.00**	**478.00**	1.23	478.00
B-n50-k7-C25-V4	50	25	4	**449.00**	**449.00**	**449.00**	**449.00**	1.08	449.00
B-n50-k8-C25-V5	50	25	5	**916.00**	**916.00**	**916.00**	**916.00**	1.36	916.00
B-n51-k7-C26-V4	51	26	4	**651.00**	**651.00**	**651.00**	**651.00**	1.44	651.00
B-n52-k7-C26-V4	52	26	4	**450.00**	**450.00**	**450.00**	**450.00**	1.18	450.00
B-n56-k7-C28-V4	56	28	4	**486.00**	492.00	**486.00**	**486.00**	1.35	486.00
B-n57-k7-C29-V4	57	29	4	**751.00**	**751.00**	**751.00**	**751.00**	1.43	751.00
B-n57-k9-C29-V5	57	29	5	**942.00**	**942.00**	**942.00**	**942.00**	1.60	942.00
B-n63-k10-C32-V5	63	32	5	**816.00**	**816.00**	**816.00**	**816.00**	1.74	816.00
B-n64-k9-C32-V5	64	32	5	**509.00**	**509.00**	**509.00**	**509.00**	1.37	509.00
B-n66-k9-C33-V5	66	33	5	**808.00**	**808.00**	**808.00**	**808.00**	1.88	808.00
B-n67-k10-C34-V5	67	34	5	**673.00**	**673.00**	**673.00**	**673.00**	1.91	673.00
B-n68-k9-C34-V5	68	34	5	**704.00**	**704.00**	**704.00**	**704.00**	1.87	704.00
B-n78-k10-C39-V5	78	39	5	**803.00**	804.00	**803.00**	**803.00**	2.38	803.00
G-n262-k25-C131-V12	262	131	12	3249.00	3319.00	3241.80	**<u>3229.00</u>**	22.98	3249.00
M-n101-k10-C51-V5	101	51	5	**542.00**	**542.00**	**542.00**	**542.00**	2.85	542.00
M-n121-k7-C61-V4	121	61	4	**719.00**	720.00	**719.00**	**719.00**	5.45	719.00

Table 15: Results on the GVRP, instances of Bektas et al. (2011) (continued)

Inst	n	c	m	BER11	MCL12	UHGS			BKS
				Single	Single	Avg 10	Best 10	T(min)	
M-n151-k12-C76-V6	151	76	6	**659.00**	**659.00**	**659.00**	**659.00**	4.94	659.00
M-n200-k16-C100-V8	200	100	8	**791.00**	805.00	**786.00**	**786.00**	11.47	791.00
P-n101-k4-C51-V2	101	51	2	**455.00**	**455.00**	**455.00**	**455.00**	4.83	455.00
P-n16-k8-C8-V5	16	8	5	**239.00**	**239.00**	**239.00**	**239.00**	0.09	239.00
P-n19-k2-C10-V2	19	10	2	**147.00**	**147.00**	**147.00**	**147.00**	0.15	147.00
P-n20-k2-C10-V2	20	10	2	**154.00**	**154.00**	**154.00**	**154.00**	0.15	154.00
P-n21-k2-C11-V2	21	11	2	**160.00**	162.00	**160.00**	**160.00**	0.19	160.00
P-n22-k2-C11-V2	22	11	2	**162.00**	163.00	**162.00**	**162.00**	0.24	162.00
P-n22-k8-C11-V5	22	11	5	**314.00**	**314.00**	**314.00**	**314.00**	0.18	314.00
P-n23-k8-C12-V5	23	12	5	**312.00**	**312.00**	**312.00**	**312.00**	0.23	312.00
P-n40-k5-C20-V3	40	20	3	**294.00**	**294.00**	**294.00**	**294.00**	1.00	294.00
P-n45-k5-C23-V3	45	23	3	**337.00**	**337.00**	**337.00**	**337.00**	1.13	337.00
P-n50-k10-C25-V5	50	25	5	**410.00**	**410.00**	**410.00**	**410.00**	1.08	410.00
P-n50-k7-C25-V4	50	25	4	**353.00**	**353.00**	**353.00**	**353.00**	1.23	353.00
P-n50-k8-C25-V4	50	25	4	**392.00**	421.00	**392.00**	**392.00**	1.39	392.00
P-n51-k10-C26-V6	51	26	6	**427.00**	**427.00**	**427.00**	**427.00**	1.04	427.00
P-n55-k10-C28-V5	55	28	5	**415.00**	**415.00**	**415.00**	**415.00**	1.22	415.00
P-n55-k15-C28-V8	55	28	8	**555.00**	565.00	**555.00**	**555.00**	1.07	555.00
P-n55-k7-C28-V4	55	28	4	**361.00**	**361.00**	**361.00**	**361.00**	1.41	361.00
P-n55-k8-C28-V4	55	28	4	**361.00**	**361.00**	**361.00**	**361.00**	1.36	361.00
P-n60-k10-C30-V5	60	30	5	**443.00**	**443.00**	**443.00**	**443.00**	1.52	443.00
P-n60-k15-C30-V8	60	30	8	**565.00**	**565.00**	**565.00**	**565.00**	1.24	565.00
P-n65-k10-C33-V5	65	33	5	**487.00**	**487.00**	**487.00**	**487.00**	1.55	487.00
P-n70-k10-C35-V5	70	35	5	**485.00**	**485.00**	**485.00**	**485.00**	1.74	485.00
P-n76-k4-C38-V2	76	38	2	**383.00**	**383.00**	**383.00**	**383.00**	2.80	383.00
P-n76-k5-C38-V3	76	38	3	**405.00**	**405.00**	**405.00**	**405.00**	2.44	405.00
A-n32-k5-C11-V2	32	11	2	**386.00**	**386.00**	**386.00**	**386.00**	0.33	386.00
A-n33-k5-C11-V2	33	11	2	318.00	**315.00**	**315.00**	**315.00**	0.30	315.00
A-n33-k6-C11-V2	33	11	2	**370.00**	**370.00**	**370.00**	**370.00**	0.28	370.00
A-n34-k5-C12-V2	34	12	2	**419.00**	**419.00**	**419.00**	**419.00**	0.39	419.00
A-n36-k5-C12-V2	36	12	2	**396.00**	**396.00**	**396.00**	**396.00**	0.39	396.00
A-n37-k5-C13-V2	37	13	2	**347.00**	**347.00**	**347.00**	**347.00**	0.42	347.00
A-n37-k6-C13-V2	37	13	2	**431.00**	**431.00**	**431.00**	**431.00**	0.47	431.00
A-n38-k5-C13-V2	38	13	2	**367.00**	**367.00**	**367.00**	**367.00**	0.46	367.00
A-n39-k5-C13-V2	39	13	2	**364.00**	**364.00**	**364.00**	**364.00**	0.43	364.00
A-n39-k6-C13-V2	39	13	2	**403.00**	**403.00**	**403.00**	**403.00**	0.53	403.00
A-n44-k6-C15-V2	44	15	2	**503.00**	**503.00**	**503.00**	**503.00**	0.74	503.00
A-n45-k6-C15-V3	45	15	3	**474.00**	**474.00**	**474.00**	**474.00**	0.65	474.00
A-n45-k7-C15-V3	45	15	3	**475.00**	**475.00**	**475.00**	**475.00**	0.62	475.00
A-n46-k7-C16-V3	46	16	3	**462.00**	**462.00**	**462.00**	**462.00**	0.87	462.00
A-n48-k7-C16-V3	48	16	3	**451.00**	**451.00**	**451.00**	**451.00**	0.90	451.00
A-n53-k7-C18-V3	53	18	3	**440.00**	**440.00**	**440.00**	**440.00**	1.10	440.00
A-n54-k7-C18-V3	54	18	3	**482.00**	**482.00**	**482.00**	**482.00**	1.04	482.00
A-n55-k9-C19-V3	55	19	3	**473.00**	**473.00**	**473.00**	**473.00**	1.10	473.00
A-n60-k9-C20-V3	60	20	3	**595.00**	**595.00**	**595.00**	**595.00**	1.33	595.00
A-n61-k9-C21-V4	61	21	4	**473.00**	**473.00**	**473.00**	**473.00**	1.18	473.00
A-n62-k8-C21-V3	62	21	3	**596.00**	**596.00**	**596.00**	**596.00**	1.61	596.00
A-n63-k10-C21-V4	63	21	4	**593.00**	**593.00**	**593.00**	**593.00**	1.33	593.00
A-n63-k9-C21-V3	63	21	3	**642.00**	643.00	**642.00**	**642.00**	1.51	642.00
A-n64-k9-C22-V3	64	22	3	**536.00**	**536.00**	**536.00**	**536.00**	1.64	536.00
A-n65-k9-C22-V3	65	22	3	**500.00**	**500.00**	**500.00**	**500.00**	1.53	500.00
A-n69-k9-C23-V3	69	23	3	**520.00**	**520.00**	**520.00**	**520.00**	1.60	520.00
A-n80-k10-C27-V4	80	27	4	**710.00**	**710.00**	**710.00**	**710.00**	2.14	710.00
B-n31-k5-C11-V2	31	11	2	**356.00**	**356.00**	**356.00**	**356.00**	0.35	356.00

Table 16: Results on the GVRP, instances of Bektas et al. (2011) (continued)

Inst	n	c	m	BER11	MCL12	UHGS			BKS
				Single	Single	Avg 10	Best 10	T(min)	
B-n34-k5-C12-V2	34	12	2	**369.00**	**369.00**	**369.00**	**369.00**	0.35	369.00
B-n35-k5-C12-V2	35	12	2	**501.00**	**501.00**	**501.00**	**501.00**	0.36	501.00
B-n38-k6-C13-V2	38	13	2	**370.00**	**370.00**	**370.00**	**370.00**	0.53	370.00
B-n39-k5-C13-V2	39	13	2	**280.00**	**280.00**	**280.00**	**280.00**	0.42	280.00
B-n41-k6-C14-V2	41	14	2	**407.00**	**407.00**	**407.00**	**407.00**	0.57	407.00
B-n43-k6-C15-V2	43	15	2	**343.00**	**343.00**	**343.00**	**343.00**	0.73	343.00
B-n44-k7-C15-V3	44	15	3	**395.00**	**395.00**	**395.00**	**395.00**	0.54	395.00
B-n45-k5-C15-V2	45	15	2	422.00	**410.00**	**410.00**	**410.00**	0.73	410.00
B-n45-k6-C15-V2	45	15	2	**336.00**	**336.00**	**336.00**	**336.00**	0.76	336.00
B-n50-k7-C17-V3	50	17	3	**393.00**	**393.00**	**393.00**	**393.00**	1.00	393.00
B-n50-k8-C17-V3	50	17	3	**598.00**	**598.00**	**598.00**	**598.00**	0.98	598.00
B-n51-k7-C17-V3	51	17	3	**511.00**	**511.00**	**511.00**	**511.00**	0.72	511.00
B-n52-k7-C18-V3	52	18	3	**359.00**	**359.00**	**359.00**	**359.00**	0.99	359.00
B-n56-k7-C19-V3	56	19	3	**356.00**	**356.00**	**356.00**	**356.00**	1.10	356.00
B-n57-k7-C19-V3	57	19	3	**558.00**	**558.00**	**558.00**	**558.00**	1.26	558.00
B-n57-k9-C19-V3	57	19	3	**681.00**	**681.00**	**681.00**	**681.00**	1.18	681.00
B-n63-k10-C21-V3	63	21	3	**599.00**	**599.00**	**599.00**	**599.00**	1.61	599.00
B-n64-k9-C22-V4	64	22	4	**452.00**	**452.00**	**452.00**	**452.00**	1.34	452.00
B-n66-k9-C22-V3	66	22	3	**609.00**	**609.00**	**609.00**	**609.00**	1.43	609.00
B-n67-k10-C23-V4	67	23	4	**558.00**	**558.00**	**558.00**	**558.00**	1.37	558.00
B-n68-k9-C23-V3	68	23	3	**523.00**	**523.00**	**523.00**	**523.00**	1.71	523.00
B-n78-k10-C26-V4	78	26	4	**606.00**	**606.00**	**606.00**	**606.00**	1.83	606.00
G-n262-k25-C88-V9	262	88	9	2476.00	2463.00	2469.00	**2460.00**	13.80	2463.00
M-n101-k10-C34-V4	101	34	4	**458.00**	**458.00**	**458.00**	**458.00**	2.62	458.00
M-n121-k7-C41-V3	121	41	3	**527.00**	**527.00**	**527.00**	**527.00**	4.18	527.00
M-n151-k12-C51-V4	151	51	4	**483.00**	**483.00**	**483.00**	**483.00**	5.19	483.00
M-n200-k16-C67-V6	200	67	6	**605.00**	**605.00**	**605.00**	**605.00**	6.06	605.00
P-n101-k4-C34-V2	101	34	2	374.00	**370.00**	**370.00**	**370.00**	3.26	370.00
P-n16-k8-C6-V4	16	6	4	**170.00**	**170.00**	**170.00**	**170.00**	0.05	170.00
P-n19-k2-C7-V1	19	7	1	**111.00**	**111.00**	**111.00**	**111.00**	0.07	111.00
P-n20-k2-C7-V1	20	7	1	**117.00**	**117.00**	**117.00**	**117.00**	0.07	117.00
P-n21-k2-C7-V1	21	7	1	**117.00**	**117.00**	**117.00**	**117.00**	0.07	117.00
P-n22-k2-C8-V1	22	8	1	**111.00**	**111.00**	**111.00**	**111.00**	0.10	111.00
P-n22-k8-C8-V4	22	8	4	**249.00**	**249.00**	**249.00**	**249.00**	0.12	249.00
P-n23-k8-C8-V3	23	8	3	**174.00**	**174.00**	**174.00**	**174.00**	0.13	174.00
P-n40-k5-C14-V2	40	14	2	**213.00**	**213.00**	**213.00**	**213.00**	0.55	213.00
P-n45-k5-C15-V2	45	15	2	**238.00**	**238.00**	**238.00**	**238.00**	0.71	238.00
P-n50-k10-C17-V4	50	17	4	**292.00**	**292.00**	**292.00**	**292.00**	0.69	292.00
P-n50-k7-C17-V3	50	17	3	**261.00**	**261.00**	**261.00**	**261.00**	0.84	261.00
P-n50-k8-C17-V3	50	17	3	**262.00**	**262.00**	**262.00**	**262.00**	0.84	262.00
P-n51-k10-C17-V4	51	17	4	**309.00**	**309.00**	**309.00**	**309.00**	0.73	309.00
P-n55-k10-C19-V4	55	19	4	**301.00**	**301.00**	**301.00**	**301.00**	1.01	301.00
P-n55-k15-C19-V6	55	19	6	**378.00**	**378.00**	**378.00**	**378.00**	0.76	378.00
P-n55-k7-C19-V3	55	19	3	**271.00**	**271.00**	**271.00**	**271.00**	1.15	271.00
P-n55-k8-C19-V3	55	19	3	**274.00**	**274.00**	**274.00**	**274.00**	1.15	274.00
P-n60-k10-C20-V4	60	20	4	**325.00**	**325.00**	**325.00**	**325.00**	1.31	325.00
P-n60-k15-C20-V5	60	20	5	**382.00**	**382.00**	**382.00**	**382.00**	1.10	382.00
P-n65-k10-C22-V4	65	22	4	**372.00**	**372.00**	**372.00**	**372.00**	1.25	372.00
P-n70-k10-C24-V4	70	24	4	**385.00**	**385.00**	**385.00**	**385.00**	1.55	385.00
P-n76-k4-C26-V2	76	26	2	320.00	**309.00**	**309.00**	**309.00**	2.02	309.00
P-n76-k5-C26-V2	76	26	2	**309.00**	**309.00**	**309.00**	**309.00**	2.31	309.00
Time				0.01 min	0.34 min		1.53 min		
Gap				+0.06%	+0.11%	+0.00%	-0.01%		
CPU				Opt 2.4G	Duo 1.83G		Opt 2.4G		

Table 17: Results on the OVRP, instances of Christofides et al. (1979) and Fisher (1994)

Inst	**n**	**m$_{BKS}$**	**ZK10**		**RTBI10**	**SUO13**		**UHGS**			**BKS**
			Avg 10	Best 10	Single	Avg 10	Best 10	Avg 10	Best 10	T(min)	
p01	50	5	**416.06**	**416.06**	**416.06**	**416.06**	**416.06**	**416.06**	**416.06**	0.41	416.06
p02	75	10	568.38	**567.14**	**567.14**	**567.14**	**567.14**	568.15	**567.14**	0.51	567.14
p03	100	8	639.98	**639.74**	**639.74**	639.81	**639.74**	**639.74**	**639.74**	0.85	639.74
p04	150	12	733.93	**733.13**	**733.13**	**733.13**	**733.13**	**733.13**	**733.13**	1.73	733.13
p05	199	16	895.62	893.39	894.11	895.55	**883.50**	890.15	884.08	4.13	883.50
p06	50	6	—	—	**412.96**	**412.96**	**412.96**	**412.96**	**412.96**	0.55	412.96
p07	75	10	—	—	584.15	*582.07**	**583.19**	584.59	**583.19**	0.77	583.19
p08	100	9	—	—	**644.63**	644.95	**644.63**	644.79	**644.63**	1.79	644.63
p09	150	13	—	—	764.56	759.38	757.91	760.75	<u>**757.07**</u>	5.18	757.84
p10	199	17	—	—	888.46	877.68	**874.71**	875.49	**874.71**	6.10	874.71
p11	120	7	682.34	**682.12**	**682.12**	**682.12**	**682.12**	**682.12**	**682.12**	1.51	682.12
p12	100	10	**534.24**	**534.24**	**534.24**	**534.24**	**534.24**	**534.24**	**534.24**	0.61	534.24
p13	120	11	—	—	910.26	904.02	**899.16**	900.22	**899.16**	3.39	899.16
p14	100	11	—	—	**591.87**	**591.87**	**591.87**	**591.87**	**591.87**	1.70	591.87
f11	71	4	**177.00**	**177.00**	**177.00**	177.21	**177.00**	**177.00**	**177.00**	0.65	177.00
f12	134	7	770.57	**769.55**	**769.55**	770.00	**769.55**	769.68	**769.55**	1.71	769.55
Time			—		9.54 min	2.39 min		1.97 min			
Gap			—	—	+0.32%	*+0.16%**	+0.00%	+0.11%	+0.00%		
CPU			T5500 1.66G		P-IV 2.8G	I7 2.93G		Opt 2.4G			

∗ The minimum fleet size was not attained by SUO13 on all runs.

Table 18: Results on the OVRP, instances of Golden et al. (1998)

Inst	**n**	**m***	**ZK10**		**RTBI10**	**SUO13**		**UHGS**			**BKS**
			Avg 10	Best 10	Single	Avg 10	Best 10	Avg 10	Best 10	T(min)	
pr01	240	9	4562.88	4557.38	4583.70	4551.74	4544.46	4546.35	<u>**4543.00**</u>	8.20	4544.46
pr02	320	10	7264.32	7253.20	7271.24	7229.56	7215.48	7218.41	<u>**7213.56**</u>	14.94	7215.48
pr03	400	9	9824.44	9793.72	9821.09	9784.52	9773.83	9763.39	<u>**9750.63**</u>	22.66	9773.83
pr04	480	10	12430.06	12415.36	12428.20	12393.40	12389.43	12387.82	<u>**12380.66**</u>	26.41	12389.43
pr05	200	5	**6018.52**	**6018.52**	**6018.52**	**6018.52**	**6018.52**	**6018.52**	**6018.52**	5.71	6018.52
pr06	280	7	7735.10	7731.00	7733.77	7728.77	7721.16	7704.91	<u>**7704.59**</u>	11.23	7721.16
pr07	360	8	9243.69	9193.15	9254.15	9205.01	9180.93	9132.27	<u>**9127.70**</u>	19.01	9180.93
pr08	440	10	10363.28	10347.70	10363.40	10342.10	10326.57	10316.60	<u>**10289.70**</u>	26.43	10326.57
Time			14.79 min		17.53 min	64.07 min		16.82 min			
Gap			+0.39%	+0.21%	+0.47%	+0.13%	+0.00%	-0.11%	-0.19%		
CPU			T5500 1.66G		P-IV 2.8G	I7 2.93G		Opt 2.4G			

Table 19: Results on the OVRPTW, instances of Solomon (1987)

Inst	**n**	**RTI09**		KTDHS12		**UHGS**			**BKS**
		Avg 10	Best 10	Avg 10	Best 10	Avg 10	Best 10	T(min)	
R101	100	**19.00/1192.85**	**19/1192.85**	**19.00/1192.95**	**19/1192.85**	**19.00/1192.85**	**19/1192.85**	2.86	19/1192.85
R102	100	17.00/1081.65	**17/1079.39**	**17.00/1079.39**	**17/1079.39**	**17.00/1079.39**	**17/1079.39**	2.81	17/1079.39
R103	100	13.00/1017.28	**13/1016.78**	13.00/1016.83	**13/1016.78**	**13.00/1016.78**	**13/1016.78**	3.57	13/1016.78
R104	100	9.53/844.32	9/869.63	9.00/837.28	9/834.44	9.00/833.52	**9/832.50**	4.86	9/834.44
R105	100	14.00/1055.98	**14/1055.04**	14.00/1055.34	**14/1055.04**	**14.00/1055.04**	**14/1055.04**	3.92	14/1055.04
R106	100	12.00/1001.04	12/1000.95	12.00/1003.15	12/1001.41	12.00/1000.93	**12/1000.36**	4.88	12/1000.95
R107	100	10.00/915.82	10/912.99	10.00/918.47	**10/910.75**	10.00/914.75	10/912.08	6.14	10/910.75
R108	100	9.00/760.30	9/760.30	9.00/765.63	9/760.30	9.00/760.32	**9/759.86**	4.80	9/760.30
R109	100	11.00/934.77	11/934.53	11.00/937.86	**11/934.15**	11.00/934.52	**11/934.15**	4.36	11/934.15
R110	100	10.00/851.01	**10/846.49**	10.00/881.91	10/874.64	10.00/885.18	**10/873.75**	5.08	10/846.49
R111	100	10.00/902.45	**10/895.21**	10.00/904.25	10/895.56	**10.00/895.21**	**10/895.21**	5.34	10/895.21
R112	100	9.47/814.33	9/811.73	9.00/815.43	9/805.17	9.00/811.76	**9/801.43**	5.81	9/805.17
C101	100	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	0.67	10/556.18
C102	100	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	1.00	10/556.18
C103	100	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	1.10	10/556.18
C104	100	**10.00/555.41**	**10/555.41**	**10.00/555.41**	**10/555.41**	**10.00/555.41**	**10/555.41**	1.06	10/555.41
C105	100	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	0.83	10/556.18
C106	100	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	0.85	10/556.18
C107	100	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	**10.00/556.18**	**10/556.18**	0.84	10/556.18
C108	100	**10.00/555.80**	**10/555.80**	**10.00/555.80**	**10/555.80**	**10.00/555.80**	**10/555.80**	0.95	10/555.80
C109	100	**10.00/555.80**	**10/555.80**	**10.00/555.80**	**10/555.80**	**10.00/555.80**	**10/555.80**	0.97	10/555.80
RC101	100	14.00/1228.76	**14/1227.37**	**14.00/1227.37**	**14/1227.37**	**14.00/1227.37**	**14/1227.37**	3.37	14/1227.37
RC102	100	12.00/1205.65	12/1203.05	12.00/1197.16	**12/1185.43**	12.50/1125.04	12/1195.20	4.12	12/1185.43
RC103	100	11.00/927.62	11/923.15	11.00/919.32	**11/918.65**	**11.00/918.65**	**11/918.65**	3.92	11/918.65
RC104	100	10.00/789.21	**10/787.02**	10.00/790.58	**10/787.02**	**10.00/787.02**	**10/787.02**	4.51	10/787.02
RC105	100	13.00/1220.96	13/1195.20	13.00/1201.73	13/1195.20	13.10/1186.34	**13/1185.43**	4.45	13/1195.20
RC106	100	11.00/1113.20	11/1095.65	11.00/1073.78	**11/1071.83**	11.00/1074.52	**11/1071.83**	4.24	11/1071.83
RC107	100	11.00/862.44	11/861.28	11.00/862.88	11/861.28	11.00/860.62	**11/860.62**	4.03	11/861.28
RC108	100	10.00/832.05	**10/831.09**	10.00/837.38	10/833.03	10.00/832.27	**10/831.09**	4.31	10/831.09
R201	100	**4.00/1182.43**	**4/1182.43**	4.00/1187.99	**4/1182.43**	**4.00/1182.43**	**4/1182.43**	5.80	4/1182.43
R202	100	3.00/1150.07	**3/1149.59**	3.00/1152.70	3/1151.14	**3.00/1149.59**	**3/1149.59**	9.73	3/1149.59
R203	100	3.00/894.34	**3/889.12**	3.00/900.51	3/894.40	3.00/890.02	**3/889.12**	11.72	3/889.12
R204	100	2.00/803.54	2/801.46	2.00/821.67	2/803.50	2.00/798.13	**2/797.83**	7.67	2/801.46
R205	100	3.00/950.21	**3/943.33**	3.00/966.18	3/952.83	**3.00/943.33**	**3/943.33**	11.21	3/943.33
R206	100	3.00/870.96	3/869.27	3.00/883.18	3/874.78	**3.00/865.32**	**3/865.32**	13.01	3/869.27
R207	100	2.77/865.93	2/857.08	2.00/880.56	2/857.08	**2.00/854.40**	**2/854.40**	6.65	2/857.08
R208	100	2.00/700.67	2/700.53	2.00/710.74	2/700.63	2.00/694.67	**2/694.24**	8.00	2/700.53
R209	100	3.00/853.86	**3/851.69**	3.00/864.91	**3/851.69**	3.00/852.42	**3/851.69**	11.57	3/851.69
R210	100	3.00/894.38	3/892.45	3.00/908.77	3/901.87	3.00/891.23	**3/890.02**	11.00	3/892.45
R211	100	2.00/887.41	2/886.90	2.00/894.55	2/874.49	2.00/852.15	**2/846.92**	8.14	2/874.49
C201	100	**3.00/548.51**	**3/548.51**	**3.00/548.51**	**3/548.51**	**3.00/548.51**	**3/548.51**	1.33	3/548.51
C202	100	**3.00/548.51**	**3/548.51**	**3.00/548.51**	**3/548.51**	**3.00/548.51**	**3/548.51**	2.09	3/548.51
C203	100	**3.00/548.13**	**3/548.13**	**3.00/548.13**	**3/548.13**	**3.00/548.13**	**3/548.13**	2.73	3/548.13
C204	100	**3.00/547.55**	**3/547.55**	3.00/549.02	**3/547.55**	**3.00/547.55**	**3/547.55**	3.21	3/547.55
C205	100	**3.00/545.83**	**3/545.83**	**3.00/545.83**	**3/545.83**	**3.00/545.83**	**3/545.83**	1.76	3/545.83
C206	100	**3.00/545.45**	**3/545.45**	**3.00/545.45**	**3/545.45**	**3.00/545.45**	**3/545.45**	1.87	3/545.45
C207	100	**3.00/545.24**	**3/545.24**	**3.00/545.24**	**3/545.24**	**3.00/545.24**	**3/545.24**	1.92	3/545.24
C208	100	**3.00/545.28**	**3/545.28**	**3.00/545.28**	**3/545.28**	**3.00/545.28**	**3/545.28**	2.16	3/545.28
RC201	100	4.00/1309.06	**4/1303.73**	4.00/1321.87	4/1304.50	**4.00/1303.73**	**4/1303.73**	6.50	4/1303.73
RC202	100	3.00/1329.52	3/1321.43	3.00/1335.13	3/1292.35	3.00/1289.86	**3/1289.04**	10.92	3/1292.35
RC203	100	3.00/995.02	3/993.29	3.00/1004.88	3/993.22	3.00/987.28	**3/977.56**	10.81	3/993.22
RC204	100	3.00/719.92	**3/718.97**	3.00/736.97	3/722.20	**3.00/718.97**	**3/718.97**	9.52	3/718.97
RC205	100	4.00/1190.67	**4/1189.84**	4.00/1193.05	**4/1189.84**	**4.00/1189.84**	**4/1189.84**	7.92	4/1189.84
RC206	100	3.00/1092.09	3/1091.79	3.00/1102.53	3/1092.66	**3.00/1087.97**	**3/1087.97**	10.72	3/1091.79
RC207	100	3.00/1005.32	**3/998.70**	3.00/1015.46	3/1006.06	3.00/999.29	**3/998.70**	9.43	3/998.70
RC208	100	3.00/772.76	3/769.40	3.00/786.41	3/778.32	3.00/769.12	**3/768.75**	11.94	3/769.40
Time		10.0 min		10.0 min		5.27 min			
Gap		+0.89%/+0.42%	0%/+0.24%	0%/+0.79%	0%/+0.18%	+0.09%/-0.10%	0%/-0.10%		
CPU		P-IV 3G		Xe 2.67G		Opt 2.2G			

Table 20: Results on the VRPBTW, instances of Gélinas et al. (1995)

Inst	**n**	**RP06**		**ART13**	**UHGS**			**BKS**
		Avg 10	Best 10	Best 3	Avg 10	Best 10	T(min)	
BHR101A	100	22.0	**22/1818.86**	**22/1818.86**	**22.0/1818.86**	**22/1818.86**	3.31	22/1818.86
BHR101B	100	23.0	23/1959.56	**23/1959.52**	**23.0/1959.52**	**23/1959.52**	4.40	23/1959.52
BHR101C	100	24.0	**24/1939.10**	**24/1939.10**	**24.0/1939.10**	**24/1939.10**	3.26	24/1939.10
BHR102A	100	19.0	19/1653.19	**19/1653.18**	**19.0/1653.18**	**19/1653.18**	3.38	19/1653.18
BHR102B	100	22.0	**22/1750.70**	22/1752.28	**22.0/1750.70**	**22/1750.70**	2.98	22/1750.70
BHR102C	100	22.0	**22/1775.76**	**22/1775.76**	**22.0/1775.76**	**22/1775.76**	3.02	22/1775.76
BHR103A	100	15.0	15/1387.57	**15/1385.38**	**15.0/1385.38**	**15/1385.38**	3.59	15/1385.38
BHR103B	100	15.0	15/1390.33	**15/1390.32**	**15.0/1390.32**	**15/1390.32**	3.67	15/1390.32
BHR103C	100	17.0	**17/1456.48**	**17/1456.48**	**17.0/1456.48**	**17/1456.48**	3.37	17/1456.48
BHR104A	100	11.0	11/1084.17	**10/1203.44**	10.4/1157.92	10/1204.57	4.69	10/1203.44
BHR104B	100	11.0	**11/1154.84**	**11/1154.84**	11.0/1155.71	**11/1154.84**	4.45	11/1154.84
BHR104C	100	11.0	11/1191.38	11/1194.73	11.0/1190.93	**11/1190.20**	6.13	11/1191.38
BHR105A	100	15.4	15/1561.28	**15/1560.15**	15.0/1561.61	**15/1560.15**	5.24	15/1560.15
BHR105B	100	16.0	**16/1583.30**	**16/1583.30**	**16.0/1583.30**	**16/1583.30**	4.45	16/1583.30
BHR105C	100	16.5	16/1710.19	**16/1709.66**	16.0/1709.88	**16/1709.66**	5.48	16/1709.66
Time		1.90 min		1.42 min	4.10 min			
Gap		+1.05%	+0.67%/-0.64%	0%/+0.02%	+0.27%/-0.24%	0%/0%		
CPU		P-IV 1.5G		X7900 2.8G	Opt 2.2G			

Table 21: Results on the TDVRPTW, scenario 1. Instances of Solomon (1987).

Inst	n	m	KTDHS12		UHGS			BKS
			Avg 10	Best 10	Avg 10	Best 10	T(min)	
C101	100	10	**755.86**	**755.86**	**755.86**	**755.86**	2.87	755.86
C102	100	10	**738.87**	**738.87**	**738.87**	**738.87**	3.33	738.87
C103	100	10	713.82	**713.50**	**713.50**	**713.50**	3.32	713.50
C104	100	10	683.96	**683.27**	**683.27**	**683.27**	3.22	683.27
C105	100	10	**747.41**	**747.41**	**747.41**	**747.41**	3.35	747.41
C106	100	10	**741.08**	**741.08**	**741.08**	**741.08**	3.27	741.08
C107	100	10	**735.84**	**735.84**	**735.84**	**735.84**	3.16	735.84
C108	100	10	**705.61**	**705.61**	**705.61**	**705.61**	2.99	705.61
C109	100	10	691.57	691.26	**691.16**	**691.16**	3.61	691.26
R101	100	17	1320.22	1311.57	**1310.20**	**1310.20**	3.68	1311.57
R102	100	16	1132.68	1130.36	**1128.23**	**1128.23**	3.16	1130.36
R103	100	13	926.72	918.03	912.23	**911.74**	4.85	918.03
R104	100	10	761.08	754.67	753.04	**752.73**	6.25	754.67
R105	100	14	1033.27	1020.20	1020.43	**1020.16**	4.90	1020.20
R106	100	12	949.94	940.86	939.38	**939.19**	5.16	940.86
R107	100	10	843.05	837.10	831.69	**831.50**	6.86	837.10
R108	100	9	741.89	734.76	726.33	**725.08**	8.71	734.76
R109	100	11	842.03	833.93	**829.39**	**829.39**	5.14	833.93
R110	100	10	817.95	806.34	796.76	**795.00**	7.21	806.34
R111	100	10	808.21	798.35	797.70	**797.50**	7.80	798.35
R112	100	9	739.17	723.25	717.74	**714.75**	7.28	723.25
RC101	100	15	1241.72	**1236.04**	**1236.04**	**1236.04**	4.14	1236.04
RC102	100	13	1085.29	**1072.60**	1073.20	**1072.60**	4.79	1072.60
RC103	100	11	937.77	931.49	**928.22**	**928.22**	4.23	931.49
RC104	100	10	864.99	858.35	844.62	**844.57**	5.42	858.35
RC105	100	14	1161.43	1151.13	1148.75	**1147.51**	5.03	1151.13
RC106	100	12	997.20	994.23	989.83	**988.73**	6.14	994.23
RC107	100	11	915.44	907.27	899.97	**898.27**	6.12	907.27
RC108	100	10	853.37	843.04	**838.10**	**838.10**	5.52	843.04
C201	100	3	**620.77**	**620.77**	**620.77**	**620.77**	9.19	620.77
C202	100	3	601.93	**601.19**	**601.19**	**601.19**	10.32	601.19
C203	100	3	589.01	585.76	**585.75**	**585.75**	10.70	585.76
C204	100	3	574.05	568.48	**566.07**	**566.07**	14.23	568.48
C205	100	3	**595.79**	**595.79**	**595.79**	**595.79**	10.27	595.79
C206	100	3	**571.07**	**571.07**	**571.07**	**571.07**	8.21	571.07
C207	100	3	577.03	**577.02**	**577.02**	**577.02**	8.47	577.02
C208	100	3	565.75	**565.74**	**565.74**	**565.74**	8.14	565.74
R201	100	4	996.46	984.55	981.00	**980.95**	15.01	984.55
R202	100	3	947.05	933.24	920.36	**910.46**	28.28	933.24
R203	100	3	762.06	752.14	739.98	**738.55**	27.16	752.14
R204	100	2	644.02	636.21	616.33	**615.83**	29.64	636.21
R205	100	3	789.42	767.56	**758.00**	**758.00**	18.40	767.56
R206	100	3	735.59	719.59	703.65	**703.14**	24.68	719.59
R207	100	2	719.74	691.36	669.18	**669.10**	30.00	691.36
R208	100	2	580.47	569.78	557.38	**556.37**	27.14	569.78
R209	100	3	684.13	666.75	657.91	**656.62**	20.26	666.75
R210	100	3	748.70	735.30	718.03	**711.94**	22.17	735.30
R211	100	2	706.45	691.10	651.23	**649.69**	29.96	691.10
RC201	100	4	1171.56	1164.73	**1146.39**	**1146.39**	11.96	1164.73
RC202	100	3	1056.94	1037.16	1025.99	**1025.07**	22.89	1037.16
RC203	100	3	826.91	814.80	803.39	**803.18**	21.21	814.80
RC204	100	3	649.31	642.18	**623.96**	**623.96**	19.83	642.18
RC205	100	4	1034.77	1024.01	991.45	**989.01**	21.33	1024.01
RC206	100	3	922.09	910.09	894.04	**893.92**	21.02	910.09
RC207	100	3	809.39	777.23	764.24	**762.47**	20.89	777.23
RC208	100	3	643.09	628.81	603.76	**600.85**	16.24	628.81
Time			10.00 min		11.59 min			
Gap			+1.03%	+0.00%	-0.93%	-1.03%		
CPU			Xe 2.67G		Opt 2.2G			

Table 22: Results on the TDVRPTW, scenario 2. Instances of Solomon (1987).

Inst	**n**	**m**	**KTDHS12**		**UHGS**			**BKS**
			Avg 10	Best 10	Avg 10	Best 10	T(min)	
C101	100	10	**764.03**	**764.03**	**764.03**	**764.03**	3,18	764.03
C102	100	10	718.92	**715.31**	715.48	**715.31**	3,99	715.31
C103	100	10	672.71	663.36	659.41	**658.72**	4,17	663.36
C104	100	10	612.49	603.71	599.83	**599.13**	5,52	603.71
C105	100	10	746.40	**746.32**	**746.32**	**746.32**	3,89	746.32
C106	100	10	732.78	**731.99**	**731.99**	**731.99**	4,04	731.99
C107	100	10	715.35	**714.99**	**714.99**	**714.99**	3,39	714.99
C108	100	10	670.74	**669.33**	**669.33**	**669.33**	4,24	669.33
C109	100	10	629.12	620.83	**619.51**	**619.51**	3,95	620.83
R101	100	19	NF	NF	NF	NF	NF	NF
R102	100	19	NF	NF	NF	NF	NF	NF
R103	100	14	751.81	746.01	735.75	**732.36**	6,80	746.01
R104	100	10	635.86	625.36	607.71	**605.50**	8,44	625.36
R105	100	14	821.49	811.42	802.98	**800.78**	6,72	811.42
R106	100	12	755.56	742.81	734.75	**730.65**	7,74	742.81
R107	100	10	659.81	652.02	631.40	**630.14**	9,56	652.02
R108	100	9	597.09	587.72	568.98	**566.40**	9,54	587.72
R109	100	11	654.32	650.01	634.95	**634.57**	6,42	650.01
R110	100	10	632.51	625.43	599.93	**597.80**	8,77	625.43
R111	100	10	627.52	621.01	595.14	**593.28**	8,50	621.01
R112	100	9	575.88	564.50	547.51	**545.16**	8,84	564.50
RC101	100	15	1026.17	1018.11	1005.31	**1005.30**	5,02	1018.11
RC102	100	13	876.38	867.08	856.86	**855.51**	6,00	867.08
RC103	100	11	759.96	747.33	733.28	**732.82**	5,82	747.33
RC104	100	10	689.16	684.81	660.84	**654.81**	10,68	684.81
RC105	100	14	922.95	916.50	901.57	**897.46**	6,23	916.50
RC106	100	12	783.52	770.60	761.02	**758.36**	6,76	770.60
RC107	100	11	720.60	701.89	679.38	**678.92**	6,85	701.89
RC108	100	10	653.09	632.62	623.50	**623.36**	8,43	632.62
C201	100	3	**697.20**	**697.20**	**697.20**	**697.20**	9,50	697.20
C202	100	3	627.01	620.35	**617.86**	**617.86**	14,04	620.35
C203	100	3	583.87	572.65	**566.61**	**566.61**	14,89	572.65
C204	100	3	545.26	531.48	510.99	**510.59**	20,87	531.48
C205	100	3	**596.17**	**596.17**	**596.17**	**596.17**	10,74	596.17
C206	100	3	545.21	**545.08**	**545.08**	**545.08**	10,58	545.08
C207	100	3	554.77	554.32	**553.27**	**553.27**	12,77	554.32
C208	100	3	533.80	**532.02**	**532.02**	**532.02**	9,70	532.02
R201	100	4	852.81	844.66	**823.87**	**823.87**	16,56	844.66
R202	100	3	793.88	781.88	759.13	**755.61**	29,72	781.88
R203	100	3	643.09	630.52	615.90	**613.07**	27,64	630.52
R204	100	2	517.27	507.12	482.10	**481.46**	30,00	507.12
R205	100	3	643.97	632.85	605.37	**603.15**	28,55	632.85
R206	100	3	598.40	586.96	555.28	**547.38**	29,13	586.96
R207	100	2	571.91	538.92	523.27	**521.76**	30,03	538.92
R208	100	2	461.51	454.63	427.68	**427.63**	29,06	454.63
R209	100	3	536.58	525.55	492.47	**490.36**	25,09	525.55
R210	100	3	584.04	569.43	544.01	**540.99**	27,76	569.43
R211	100	2	543.88	526.89	488.20	**484.73**	30,02	526.89
RC201	100	4	1033.70	1018.62	999.00	**998.43**	25,58	1018.62
RC202	100	3	889.10	871.72	847.05	**843.30**	28,33	871.72
RC203	100	3	698.44	664.98	**653.55**	**653.55**	19,65	664.98
RC204	100	3	524.64	513.94	502.12	**500.32**	23,06	513.94
RC205	100	4	877.67	856.88	816.33	**815.50**	26,04	856.88
RC206	100	3	774.43	743.50	720.53	**717.99**	27,33	743.50
RC207	100	3	647.10	624.43	587.93	**582.32**	25,36	624.43
RC208	100	3	503.48	492.95	453.62	**450.33**	27,83	492.95
Time			10.00 min		14.51 min			
Gap			+1.58%	+0.00%	-2.37%	-2.62%		
CPU			Xe 2.67G		Opt 2.2G			

Table 23: Results on the TDVRPTW, scenario 3. Instances of Solomon (1987).

Inst	**n**	**m**	**KTDHS12**		**UHGS**			**BKS**
			Avg 10	Best 10	Avg 10	Best 10	T(min)	
C101	100	12	NF	NF	NF	NF	NF	NF
C102	100	10	909.53	900.45	896.39	**894.47**	8.48	900.45
C103	100	10	755.38	742.76	710.18	**710.02**	10.01	742.76
C104	100	10	662.57	647.76	617.49	**617.00**	8.09	647.76
C105	100	10	895.23	**895.00**	**895.00**	**895.00**	4.04	895.00
C106	100	10	932.83	**915.17**	**915.17**	**915.17**	9.68	915.17
C107	100	10	877.13	871.64	**870.94**	**870.94**	5.50	871.64
C108	100	10	766.17	**734.56**	736.55	**734.56**	6.90	734.56
C109	100	10	665.18	648.99	**632.93**	**632.93**	5.36	648.99
R101	100	19	NF	NF	NF	NF	NF	NF
R102	100	19	NF	NF	NF	NF	NF	NF
R103	100	14	713.96	704.73	699.58	**692.73**	7.20	704.73
R104	100	10	592.24	578.29	550.56	**549.02**	8.54	578.29
R105	100	14	678.92	671.42	654.26	**653.72**	5.87	671.42
R106	100	12	636.94	627.92	612.98	**610.20**	6.26	627.92
R107	100	10	560.92	547.57	520.70	**519.85**	9.41	547.57
R108	100	9	515.95	507.93	482.40	**480.52**	14.30	507.93
R109	100	11	577.02	565.35	540.73	**538.17**	10.25	565.35
R110	100	10	530.49	518.05	498.94	**497.33**	13.86	518.05
R111	100	10	525.84	508.77	482.45	**482.18**	9.11	508.77
R112	100	9	474.68	464.66	439.45	**438.07**	7.53	464.66
RC101	100	15	896.67	871.50	850.99	**846.58**	4.48	871.50
RC102	100	13	795.23	779.95	766.33	**762.66**	5.08	779.95
RC103	100	11	683.87	667.22	646.99	**645.27**	10.32	667.22
RC104	100	10	621.89	615.30	568.14	**564.99**	5.60	615.30
RC105	100	14	803.68	790.01	771.59	**769.48**	5.60	790.01
RC106	100	12	672.92	662.02	639.56	**634.64**	6.44	662.02
RC107	100	11	623.29	615.01	577.75	**569.49**	11.07	615.01
RC108	100	10	559.53	548.45	521.27	**521.11**	7.73	548.45
C201	100	4	834.21	**833.41**	**833.41**	**833.41**	9.65	833.41
C202	100	3	802.68	780.32	771.39	**766.15**	24.02	780.32
C203	100	3	670.12	638.98	**621.15**	**621.15**	25.44	638.98
C204	100	3	579.54	553.86	515.93	**515.48**	19.61	553.86
C205	100	3	**688.00**	**688.00**	**688.00**	**688.00**	14.56	688.00
C206	100	3	626.80	619.51	618.35	**618.17**	24.32	619.51
C207	100	3	646.75	630.40	**630.15**	**630.15**	20.85	630.40
C208	100	3	589.41	583.48	**578.45**	**578.45**	18.85	583.48
R201	100	4	815.22	803.84	794.53	**794.52**	21.92	803.84
R202	100	3	759.19	744.39	724.60	**706.64**	30.01	744.39
R203	100	3	629.25	608.87	593.41	**588.95**	30.00	608.87
R204	100	2	436.63	434.01	415.63	**414.71**	30.01	434.01
R205	100	3	518.43	507.67	477.15	**475.00**	30.00	507.67
R206	100	3	471.43	455.64	437.02	**435.85**	23.51	455.64
R207	100	2	460.94	444.56	412.53	**404.39**	30.00	444.56
R208	100	2	355.43	343.58	330.52	**326.62**	30.00	343.58
R209	100	3	408.84	394.44	369.08	**366.55**	30.13	394.44
R210	100	3	477.47	466.98	448.51	**447.80**	30.00	466.98
R211	100	2	412.42	394.92	364.25	**359.12**	30.01	394.92
RC201	100	4	1088.85	1082.22	1061.11	**1059.61**	30.00	1082.22
RC202	100	3	860.34	848.82	823.13	**822.73**	30.00	848.82
RC203	100	3	703.90	693.24	670.62	**661.74**	30.00	693.24
RC204	100	3	470.95	468.12	446.66	**440.64**	30.00	468.12
RC205	100	4	850.53	837.65	817.76	**815.48**	28.73	837.65
RC206	100	3	617.77	602.13	561.78	**558.25**	30.00	602.13
RC207	100	3	501.67	488.64	443.57	**435.80**	25.12	488.64
RC208	100	3	368.92	359.30	337.83	**333.68**	30.00	359.30
Time			10.00 min		17.24 min			
Gap			+2.10%	+0.00%	-3.42%	-3.88%		
CPU			Xe 2.67G		Opt 2.2G			

Table 24: Results on the VFMPTW, minimization of duration, type A fleet, instances of Liu and Shen (1999)

Inst	**n**	**w**	**BDHMG08**	**RT10**	**UHGS**			**BKS**
			Best 3	Single	Avg 10	Best 10	T(min)	
R101	100	5	4631.31	**4536.40**	4617.95	4608.62	6.03	4536.40
R102	100	5	4401.30	**4348.92**	4376.11	4369.74	6.38	4348.92
R103	100	5	4182.16	**4119.04**	4149.67	4145.68	4.65	4119.04
R104	100	5	3981.28	3986.35	3965.21	**3961.39**	5.23	3981.28
R105	100	5	4236.84	4229.67	4215.84	**4209.84**	5.11	4229.67
R106	100	5	4118.48	4130.82	4112.20	**4109.08**	6.32	4118.48
R107	100	5	4035.96	4031.16	4012.58	**4007.87**	5.45	4031.16
R108	100	5	3970.26	3962.20	3936.47	**3934.48**	5.12	3962.20
R109	100	5	4060.17	4052.21	4037.40	**4020.75**	5.06	4052.21
R110	100	5	3995.18	3999.09	3971.53	**3965.88**	5.30	3995.18
R111	100	5	4017.81	4016.19	3992.07	**3985.68**	6.05	4016.19
R112	100	5	3947.30	3954.65	3923.21	**3918.88**	6.77	3947.30
C101	100	3	**7226.51**	**7226.51**	**7226.51**	**7226.51**	3.19	7226.51
C102	100	3	**7119.35**	7137.79	**7119.35**	**7119.35**	2.82	7119.35
C103	100	3	7107.01	7141.03	7104.46	**7102.86**	2.46	7107.01
C104	100	3	**7081.50**	7086.70	7081.51	7081.51	2.22	7081.50
C105	100	3	7199.36	**7169.08**	7196.06	7196.06	3.40	7169.08
C106	100	3	7180.03	**7157.13**	7177.41	7176.68	3.67	7157.13
C107	100	3	7149.17	**7135.38**	7144.73	7144.49	3.19	7135.38
C108	100	3	7115.81	7113.57	**7111.23**	**7111.23**	2.78	7113.57
C109	100	3	7094.65	7092.49	**7091.66**	**7091.66**	2.39	7092.49
RC101	100	4	5253.97	5237.19	5225.17	**5217.90**	5.03	5237.19
RC102	100	4	5059.58	5053.62	5044.63	**5018.47**	5.71	5053.48
RC103	100	4	4868.94	4885.58	4830.08	**4822.21**	6.03	4868.94
RC104	100	4	4762.85	4761.28	4741.69	**4737.00**	4.10	4761.28
RC105	100	4	5119.80	5110.86	5110.51	**5097.35**	5.61	5110.86
RC106	100	4	4960.78	4966.27	4947.46	**4935.91**	6.60	4960.78
RC107	100	4	4828.17	4819.91	4791.19	**4783.08**	5.32	4819.91
RC108	100	4	4734.15	4749.44	4710.71	**4708.85**	5.17	4734.15
R201	100	4	3922.00	**3753.42**	3791.54	3782.88	7.66	3753.42
R202	100	4	3610.38	3551.12	3540.39	**3540.03**	13.37	3551.12
R203	100	4	3350.18	3336.60	3314.09	**3311.35**	9.07	3334.08
R204	100	4	3390.14	3103.84	3076.13	**3075.95**	8.87	3103.84
R205	100	4	3465.81	3367.90	3334.35	**3334.27**	9.25	3367.90
R206	100	4	3268.36	3264.70	3246.09	**3242.40**	9.01	3264.70
R207	100	4	3231.26	3158.69	3145.79	**3145.08**	9.40	3158.69
R208	100	4	3063.10	3056.45	3020.52	**3017.12**	8.07	3056.45
R209	100	4	3192.95	3194.74	3186.18	**3183.36**	9.49	3191.63
R210	100	4	3375.38	3325.28	3288.82	**3287.66**	10.21	3325.28
R211	100	4	3042.48	3053.08	3021.67	**3019.93**	9.08	3042.48
C201	100	4	5891.45	**5820.78**	5878.54	5878.54	5.17	5820.78
C202	100	4	5850.26	5783.76	**5776.88**	**5776.88**	5.15	5779.59
C203	100	4	5741.90	**5736.94**	5741.82	5741.12	5.72	5736.94
C204	100	4	5691.51	5718.49	**5680.46**	**5680.46**	4.31	5691.51
C205	100	4	5786.71	**5747.67**	5782.53	5781.15	6.56	5747.67
C206	100	4	5795.15	**5738.09**	5767.70	5767.70	4.74	5738.09
C207	100	4	5743.52	**5721.16**	5731.54	5731.44	5.14	5721.16
C208	100	4	5884.20	5732.95	**5725.03**	**5725.03**	4.52	5732.95
RC201	100	6	4740.21	**4701.88**	4740.49	4737.59	5.28	4701.88
RC202	100	6	4522.36	4509.11	**4487.48**	**4487.48**	4.48	4509.11
RC203	100	6	4312.52	4313.42	4305.63	**4305.49**	5.88	4312.52
RC204	100	6	4141.04	4157.32	4140.16	**4137.93**	6.68	4141.04
RC205	100	6	4652.57	**4585.20**	4625.21	4615.04	6.40	4585.20
RC206	100	6	4431.64	4427.73	4408.63	**4405.16**	5.14	4416.95
RC207	100	6	4310.11	4313.07	4295.07	**4290.14**	6.52	4310.11
RC208	100	6	4091.92	4103.31	4076.12	**4075.04**	5.74	4091.92
Time			13.14 min	16.67 min	5.86 min			
Gap			+0.72%	+0.08%	-0.13%	-0.21%		
CPU			Ath 2.6G	P-IV 3.4G	Opt 2.2G			

Table 25: Results on the VFMPTW, minimization of duration, type B fleet, instances of Liu and Shen (1999)

Inst	**n**	**w**	**BDHMG08**	**RT10**	**UHGS**			**BKS**
			Best 3	Single	Avg 10	Best 10	T(min)	
R101	100	5	2486.76	**2421.19**	2487.11	2486.77	3.89	2421.19
R102	100	5	2227.48	**2209.50**	2223.80	2222.15	4.31	2209.50
R103	100	5	1938.93	1953.50	1931.17	**1930.21**	4.18	1938.93
R104	100	5	1714.73	1713.36	1694.06	**1688.12**	4.34	1713.36
R105	100	5	2027.98	2030.83	**2017.56**	**2017.56**	3.83	2027.98
R106	100	5	1919.03	1919.02	1916.36	**1913.84**	5.10	1919.02
R107	100	5	1789.58	1780.52	1775.34	**1774.50**	4.27	1780.52
R108	100	5	**1649.24**	1665.78	1657.01	1654.68	5.83	1649.24
R109	100	5	1828.63	1840.54	1818.15	**1818.15**	5.09	1828.63
R110	100	5	1774.46	1788.18	1765.50	**1761.53**	5.77	1774.46
R111	100	5	1769.71	1772.51	1757.34	**1751.10**	5.57	1769.71
R112	100	5	1669.78	1667.00	1664.36	**1663.09**	6.33	1667.00
C101	100	3	**2417.52**	**2417.52**	**2417.52**	**2417.52**	2.06	2417.52
C102	100	3	2350.55	**2350.54**	2350.55	2350.55	2.98	2350.54
C103	100	3	2353.64	2347.99	2345.31	**2345.31**	4.02	2347.99
C104	100	3	2328.62	**2325.78**	2327.84	2327.84	2.43	2325.78
C105	100	3	**2373.53**	2375.04	**2373.53**	**2373.53**	3.35	2373.53
C106	100	3	2404.56	**2381.14**	2386.03	2386.03	3.17	2381.14
C107	100	3	2370.01	2357.67	2364.21	2364.21	3.10	2357.52
C108	100	3	**2346.38**	**2346.38**	**2346.38**	**2346.38**	3.28	2346.38
C109	100	3	2339.89	**2336.29**	**2336.29**	**2336.29**	2.60	2336.29
RC101	100	4	2462.60	2464.66	2461.29	**2456.10**	4.69	2462.60
RC102	100	4	2263.45	2272.68	2261.83	**2259.25**	4.24	2263.45
RC103	100	4	2035.62	2041.24	2028.38	**2025.30**	4.74	2035.62
RC104	100	4	1905.06	1916.85	1901.04	**1901.04**	4.37	1905.06
RC105	100	4	**2308.59**	2325.99	2329.30	2329.14	4.76	2308.59
RC106	100	4	2149.56	2160.45	2152.58	**2146.00**	3.68	2149.56
RC107	100	4	2000.77	2003.26	1990.20	**1989.34**	4.09	2000.77
RC108	100	4	1910.83	1908.72	1900.80	**1898.96**	3.26	1906.69
R201	100	4	2002.53	**1953.42**	1975.28	1973.43	6.39	1953.42
R202	100	4	1790.38	1751.12	1747.39	**1740.03**	8.05	1751.12
R203	100	4	1541.19	1536.60	1513.38	**1511.35**	6.44	1535.08
R204	100	4	1284.33	1303.84	1276.31	**1275.95**	7.58	1284.33
R205	100	4	1563.62	1560.07	**1534.27**	**1534.27**	6.45	1560.07
R206	100	4	1464.53	1464.70	1443.43	**1441.35**	5.92	1464.53
R207	100	4	1380.41	1358.69	1345.42	**1345.08**	6.97	1358.69
R208	100	4	1244.74	1256.45	1219.25	**1217.12**	6.00	1244.74
R209	100	4	1431.37	1394.74	1382.44	**1380.79**	7.75	1394.74
R210	100	4	1516.66	1525.28	1486.85	**1485.65**	7.72	1516.66
R211	100	4	1255.06	1253.08	1220.46	**1219.93**	7.36	1253.08
C201	100	4	1820.64	**1816.14**	1820.64	1820.64	2.90	1816.14
C202	100	4	1795.40	**1768.51**	1775.21	**1768.51**	5.22	1768.51
C203	100	4	**1733.63**	1734.82	**1733.63**	**1733.63**	3.29	1733.63
C204	100	4	1708.69	1716.18	**1680.46**	**1680.46**	3.30	1708.69
C205	100	4	1782.74	**1747.68**	1778.30	1778.30	5.48	1747.68
C206	100	4	1772.87	**1756.01**	1767.70	1767.70	3.84	1756.01
C207	100	4	1729.49	**1729.39**	1729.49	1729.49	3.48	1729.39
C208	100	4	1724.20	**1723.20**	1724.20	1724.20	3.40	1723.20
RC201	100	6	2343.79	**2230.54**	2331.33	2329.59	4.34	2230.54
RC202	100	6	2091.53	2022.15	2059.81	2057.66	6.69	2002.62
RC203	100	6	1852.74	1841.26	1825.14	**1824.54**	5.33	1841.26
RC204	100	6	1565.31	1575.18	1557.77	**1555.75**	5.50	1565.31
RC205	100	6	2195.75	**2166.62**	2179.31	2174.74	5.43	2166.62
RC206	100	6	1923.56	1893.13	**1883.08**	**1883.08**	4.33	1887.23
RC207	100	6	1745.85	1743.23	1719.07	**1714.14**	5.65	1743.23
RC208	100	6	1488.19	1526.78	**1483.20**	**1483.20**	4.80	1488.19
Time			9.12 min	16.67 min		4.80 min		
Gap			+0.59%	+0.23%	-0.16%	-0.25%		
CPU			Ath 2.6G	P-IV 3.4G		Opt 2.2G		

Table 26: Results on the VFMPTW, minimization of duration, type C fleet, instances of Liu and Shen (1999)

Inst	n	w	BDHMG08	RT10	UHGS			BKS
			Best 3	Single	Avg 10	Best 10	T(min)	
R101	100	5	2199.78	**2134.90**	2199.79	2199.79	3.38	2134.90
R102	100	5	1925.55	**1913.37**	1926.50	1925.56	5.06	1913.37
R103	100	5	**1609.94**	1631.47	1616.42	1615.38	3.62	1609.94
R104	100	5	1370.84	1377.81	1365.32	**1363.26**	4.58	1370.84
R105	100	5	**1722.05**	1729.57	**1722.05**	**1722.05**	3.60	1722.05
R106	100	5	1602.87	1607.96	1603.06	**1599.04**	4.77	1602.87
R107	100	5	1456.02	1452.52	1447.86	**1442.97**	3.72	1452.52
R108	100	5	1336.28	1330.28	1321.96	**1321.68**	5.44	1330.28
R109	100	5	1507.77	1519.37	1508.36	**1506.59**	5.02	1507.77
R110	100	5	1446.41	1457.43	1446.96	**1443.92**	5.73	1446.41
R111	100	5	1447.88	1443.34	1427.82	**1423.47**	6.99	1443.34
R112	100	5	1335.41	1339.44	1329.24	**1329.07**	4.77	1335.41
C101	100	3	**1628.31**	1628.94	1628.94	1628.94	1.83	1628.31
C102	100	3	**1610.96**	**1610.96**	**1610.96**	**1610.96**	2.43	1610.96
C103	100	3	1619.68	**1607.14**	**1607.14**	**1607.14**	2.77	1607.14
C104	100	3	1613.96	**1598.50**	1599.90	1599.90	2.70	1598.50
C105	100	3	**1628.38**	1628.94	1628.94	1628.94	1.88	1628.38
C106	100	3	**1628.94**	**1628.94**	**1628.94**	**1628.94**	1.88	1628.94
C107	100	3	**1628.38**	1628.94	1628.94	1628.94	1.96	1628.38
C108	100	3	**1622.89**	**1622.89**	**1622.89**	**1622.89**	3.00	1622.89
C109	100	3	**1614.99**	**1614.99**	1615.93	1615.93	3.62	1614.99
RC101	100	4	2084.48	2089.37	2084.16	**2082.95**	4.91	2084.48
RC102	100	4	1895.92	1906.68	1898.52	**1895.05**	4.28	1895.92
RC103	100	4	1660.62	1666.24	1661.76	**1650.30**	3.98	1660.62
RC104	100	4	1537.09	1540.13	**1526.04**	**1526.04**	3.57	1537.09
RC105	100	4	1957.52	**1953.99**	1962.82	1957.14	4.71	1953.99
RC106	100	4	1776.08	1787.69	1775.84	**1774.94**	3.80	1776.08
RC107	100	4	1614.04	1622.90	1611.28	**1607.11**	3.83	1614.04
RC108	100	4	1535.14	1531.69	1524.10	**1523.96**	3.38	1531.69
R201	100	4	1729.92	1728.42	**1716.02**	**1716.02**	4.54	1728.42
R202	100	4	1537.35	1527.92	1524.96	**1515.03**	8.84	1527.92
R203	100	4	1308.70	1311.60	1287.36	**1286.35**	6.24	1308.70
R204	100	4	1062.46	1085.71	1051.19	**1050.95**	7.62	1062.46
R205	100	4	1311.84	1335.07	1309.29	**1309.27**	6.44	1311.84
R206	100	4	1251.51	1239.70	1216.87	**1216.35**	5.34	1239.70
R207	100	4	1149.23	1139.61	**1120.08**	**1120.08**	7.23	1139.61
R208	100	4	1009.26	1022.11	992.66	**992.12**	6.01	1009.26
R209	100	4	1178.45	1171.41	1156.97	**1155.79**	7.50	1171.41
R210	100	4	1289.35	1281.08	1259.42	**1257.89**	6.54	1281.08
R211	100	4	1013.84	1028.08	995.54	**994.93**	6.59	1013.84
C201	100	4	**1269.41**	**1269.41**	**1269.41**	**1269.41**	2.86	1269.41
C202	100	4	1242.66	1244.54	**1239.54**	**1239.54**	3.85	1242.66
C203	100	4	**1193.63**	1203.42	**1193.63**	**1193.63**	3.03	1193.63
C204	100	4	**1176.52**	1188.18	**1176.52**	**1176.52**	3.90	1176.52
C205	100	4	1245.62	1239.60	**1238.30**	**1238.30**	4.36	1239.60
C206	100	4	1245.05	**1229.23**	1238.30	1238.30	4.87	1229.23
C207	100	4	1215.42	1213.07	**1209.49**	**1209.49**	3.00	1213.07
C208	100	4	**1204.20**	1205.18	**1204.20**	**1204.20**	3.03	1204.20
RC201	100	6	2004.53	**1915.42**	1996.79	1996.79	3.67	1915.42
RC202	100	6	1766.52	**1677.62**	1733.23	1732.66	6.53	1677.62
RC203	100	6	1517.98	1504.35	1496.48	**1496.11**	6.15	1504.35
RC204	100	6	1238.66	1241.45	**1220.75**	**1220.75**	5.45	1238.66
RC205	100	6	1854.22	**1822.07**	1844.74	1844.74	5.07	1822.07
RC206	100	6	1590.22	1586.61	1557.19	**1553.65**	4.45	1586.61
RC207	100	6	1396.16	1406.26	1382.17	**1377.52**	6.06	1396.16
RC208	100	6	1145.84	1175.23	1141.47	**1140.10**	6.32	1145.84
Time			8.18 min	16.67 min		4.58 min		
Gap			+0.45%	+0.35%	-0.17%	-0.25%		
CPU			Ath 2.6G	P-IV 3.4G		Opt 2.2G		

Table 27: Results on the VFMPTW, minimization of distance, type A fleet, instances of Liu and Shen (1999)

Inst	**n**	**w**	**BDHMG08**	**BPDRT09**	**UHGS**			**BKS**
			Best 3	Best 5	Avg 10	Best 10	T(min)	
R101	100	5	4349.80	4342.72	4322.04	**<u>4314.36</u>**	4.61	4342.72
R102	100	5	4196.46	4189.21	4175.05	**<u>4166.28</u>**	6.03	4182.47
R103	100	5	4052.85	4051.62	4034.88	**<u>4027.36</u>**	5.35	4051.62
R104	100	5	3973.48	3972.65	3938.92	**<u>3936.40</u>**	4.81	3972.65
R105	100	5	4161.72	4152.50	4130.71	**<u>4122.50</u>**	6.49	4152.50
R106	100	5	4095.20	4085.30	4058.95	**<u>4048.59</u>**	5.57	4085.07
R107	100	5	4006.61	3996.74	3979.18	**<u>3970.51</u>**	5.56	3996.74
R108	100	5	3961.38	3949.50	3932.46	**<u>3928.12</u>**	4.68	3949.50
R109	100	5	4048.29	4035.89	4020.93	**<u>4015.71</u>**	4.80	4035.89
R110	100	5	3997.88	3991.63	3966.47	**<u>3961.68</u>**	6.49	3991.63
R111	100	5	4011.63	4009.61	3973.49	**<u>3964.99</u>**	5.28	4008.88
R112	100	5	3962.73	3954.19	3926.32	**<u>3918.88</u>**	4.92	3954.19
C101	100	3	7098.04	7097.93	**<u>7093.45</u>**	**<u>7093.45</u>**	2.96	7097.13
C102	100	3	7086.11	7085.47	**<u>7080.17</u>**	**<u>7080.17</u>**	2.14	7085.47
C103	100	3	7080.35	7080.41	**<u>7079.21</u>**	**<u>7079.21</u>**	2.09	7080.35
C104	100	3	7076.90	**7075.06**	**7075.06**	**7075.06**	2.19	7075.06
C105	100	3	7096.19	7096.22	**<u>7093.45</u>**	**<u>7093.45</u>**	3.33	7095.13
C106	100	3	7086.91	7088.35	**<u>7083.87</u>**	**<u>7083.87</u>**	2.28	7086.91
C107	100	3	7084.92	7090.91	**<u>7084.61</u>**	**<u>7084.61</u>**	2.23	7084.92
C108	100	3	7082.49	7081.18	**<u>7079.66</u>**	**<u>7079.66</u>**	2.19	7081.18
C109	100	3	7078.13	7077.68	**<u>7077.30</u>**	**<u>7077.30</u>**	2.04	7077.68
RC101	100	4	5180.74	5168.23	5154.95	**<u>5150.86</u>**	5.21	5168.23
RC102	100	4	5029.59	5025.22	5000.28	**<u>4987.24</u>**	4.81	5025.22
RC103	100	4	4895.57	4888.53	4821.61	**<u>4804.61</u>**	7.08	4888.53
RC104	100	4	4760.56	4747.38	4724.10	**<u>4717.63</u>**	5.30	4747.38
RC105	100	4	5060.37	5068.54	5035.76	**<u>5035.35</u>**	5.57	5060.37
RC106	100	4	4997.86	4972.11	4944.74	**<u>4936.74</u>**	5.63	4972.11
RC107	100	4	4865.76	4861.04	4795.35	**<u>4788.69</u>**	5.08	4861.04
RC108	100	4	4765.37	4753.12	4709.09	**<u>4708.85</u>**	4.78	4753.12
R201	100	4	3484.95	3530.24	**<u>3446.78</u>**	**<u>3446.78</u>**	6.51	3484.95
R202	100	4	3335.74	3335.61	**<u>3308.16</u>**	**<u>3308.16</u>**	7.68	3335.61
R203	100	4	3173.95	3164.03	**<u>3141.09</u>**	**<u>3141.09</u>**	5.65	3162.84
R204	100	4	3065.15	3029.83	3018.83	**<u>3018.14</u>**	6.96	3029.83
R205	100	4	3277.69	3261.19	3220.56	**<u>3218.97</u>**	6.40	3252.43
R206	100	4	3173.30	3165.85	3150.61	**<u>3146.34</u>**	10.30	3165.85
R207	100	4	3136.47	3102.79	3080.64	**<u>3077.58</u>**	8.70	3100.64
R208	100	4	3050.00	3009.13	2999.35	**<u>2997.24</u>**	5.37	3009.13
R209	100	4	3155.73	3155.60	3123.30	**<u>3122.42</u>**	6.37	3141.17
R210	100	4	3219.23	3206.09	3178.57	**<u>3174.85</u>**	6.93	3206.09
R211	100	4	3055.04	3026.02	3021.67	**<u>3019.93</u>**	9.10	3026.02
C201	100	4	5701.45	5700.87	**5695.02**	**5695.02**	3.71	5695.02
C202	100	4	5689.70	5689.70	**<u>5685.24</u>**	**<u>5685.24</u>**	3.78	5687.07
C203	100	4	5685.82	**5681.55**	**5681.55**	**5681.55**	4.21	5681.55
C204	100	4	5690.30	5677.69	**5677.66**	**5677.66**	4.27	5677.66
C205	100	4	5691.70	5691.70	**<u>5691.36</u>**	**<u>5691.36</u>**	3.98	5691.70
C206	100	4	5691.70	5691.70	**<u>5689.32</u>**	**<u>5689.32</u>**	3.82	5691.70
C207	100	4	5689.82	5692.36	**<u>5687.35</u>**	**<u>5687.35</u>**	4.24	5689.82
C208	100	4	5686.50	5689.59	**5686.50**	**5686.50**	3.86	5686.50
RC201	100	6	4407.68	4404.07	4378.21	**<u>4374.09</u>**	5.92	4398.21
RC202	100	6	4277.67	4266.96	4244.65	**<u>4244.63</u>**	4.63	4266.96
RC203	100	6	4204.85	4189.94	4171.47	**<u>4170.17</u>**	7.73	4185.70
RC204	100	6	4109.86	4098.34	**<u>4087.11</u>**	**<u>4087.11</u>**	5.79	4098.34
RC205	100	6	4329.96	4304.52	4295.41	**<u>4291.93</u>**	5.46	4304.52
RC206	100	6	4272.08	4272.82	4253.57	**<u>4251.88</u>**	5.12	4272.08
RC207	100	6	4232.81	4219.52	4186.43	**<u>4185.98</u>**	4.82	4213.66
RC208	100	6	4095.71	4093.83	4076.27	**<u>4075.04</u>**	4.08	4082.58
Time			4.13 min	—		5.09 min		
Gap			+0.25%	+0.06%	-0.41%	-0.48%		
CPU			Ath 2.6G	Duo 2.4G		Opt 2.2G		

Table 28: Results on the VFMPTW, minimization of distance, type B fleet, instances of Liu and Shen (1999)

Inst	**n**	**w**	**BDHMG08**	**BPDRT09**	**UHGS**			**BKS**
			Best 3	Best 5	Avg 10	Best 10	T(min)	
R101	100	5	**2226.94**	—	2229.24	2228.67	5.05	2226.94
R102	100	5	**2071.90**	—	2073.91	2073.63	3.59	2071.90
R103	100	5	1857.22	—	1855.83	**1853.66**	4.57	1857.22
R104	100	5	1707.31	—	1686.09	**1683.33**	5.37	1707.31
R105	100	5	1995.07	—	**1988.86**	**1988.86**	3.30	1995.07
R106	100	5	1903.95	—	1889.58	**1888.31**	4.64	1903.95
R107	100	5	1766.18	—	1754.75	**1753.35**	4.15	1766.18
R108	100	5	1666.89	—	1651.75	**1647.88**	4.54	1666.89
R109	100	5	1833.54	—	1819.14	**1818.15**	3.66	1833.54
R110	100	5	1781.15	—	1765.34	**1758.64**	5.11	1781.15
R111	100	5	1768.74	—	1747.08	**1740.86**	5.32	1768.74
R112	100	5	1675.76	—	1664.41	**1661.85**	5.36	1675.76
C101	100	3	2340.98	—	**2340.15**	**2340.15**	3.12	2340.98
C102	100	3	2326.53	—	**2325.70**	**2325.70**	2.61	2326.53
C103	100	3	2325.61	—	**2324.60**	**2324.60**	3.03	2325.61
C104	100	3	**2318.04**	—	**2318.04**	**2318.04**	2.44	2318.04
C105	100	3	2344.64	—	**2340.15**	**2340.15**	3.00	2344.64
C106	100	3	2345.85	—	**2340.15**	**2340.15**	3.46	2345.85
C107	100	3	2345.60	—	**2340.15**	**2340.15**	3.20	2345.60
C108	100	3	2340.17	—	**2338.58**	**2338.58**	3.18	2340.17
C109	100	3	**2328.55**	—	**2328.55**	**2328.55**	2.72	2328.55
RC101	100	4	2417.16	—	2416.23	**2412.71**	4.16	2417.16
RC102	100	4	2234.47	—	2213.93	**2213.92**	5.86	2234.47
RC103	100	4	2025.74	—	2016.28	**2016.28**	3.50	2025.74
RC104	100	4	1912.65	—	1908.66	**1897.04**	4.07	1912.65
RC105	100	4	2296.16	—	2293.21	**2287.51**	4.54	2296.16
RC106	100	4	2157.84	—	2141.32	**2140.86**	3.95	2157.84
RC107	100	4	2008.02	—	1990.13	**1989.34**	2.99	2008.02
RC108	100	4	1920.91	—	1900.72	**1898.96**	3.91	1920.91
R201	100	4	1687.44	—	1721.54	**1646.78**	5.96	1687.44
R202	100	4	1527.74	—	1509.06	**1508.16**	9.15	1527.74
R203	100	4	1379.15	—	**1341.09**	**1341.09**	3.75	1379.15
R204	100	4	1243.56	—	1218.47	**1218.14**	5.11	1243.56
R205	100	4	1471.97	—	1419.52	**1418.97**	7.28	1471.97
R206	100	4	1400.84	—	1350.32	**1346.34**	7.23	1400.84
R207	100	4	1333.53	—	1279.63	**1277.58**	6.28	1333.53
R208	100	4	1225.37	—	1198.41	**1197.24**	4.33	1225.37
R209	100	4	1370.30	—	1323.60	**1322.42**	6.15	1370.30
R210	100	4	1418.54	—	1376.24	**1374.31**	6.97	1418.54
R211	100	4	1263.72	—	1219.99	**1219.93**	6.79	1263.72
C201	100	4	1700.87	—	**1695.02**	**1695.02**	2.97	1700.87
C202	100	4	1687.84	—	**1685.24**	**1685.24**	2.83	1687.84
C203	100	4	1696.25	—	**1681.55**	**1681.55**	3.36	1696.25
C204	100	4	1705.94	—	**1677.66**	**1677.66**	3.47	1705.94
C205	100	4	1711.00	—	**1691.36**	**1691.36**	3.21	1711.00
C206	100	4	1691.70	—	**1689.32**	**1689.32**	2.99	1691.70
C207	100	4	1704.88	—	**1687.35**	**1687.35**	3.44	1704.88
C208	100	4	1689.59	—	**1686.50**	**1686.50**	3.24	1689.59
RC201	100	6	1965.31	—	1942.19	**1938.36**	5.94	1965.31
RC202	100	6	**1771.87**	—	1773.04	1772.81	5.92	1771.87
RC203	100	6	1619.55	—	1606.56	**1604.04**	5.99	1619.55
RC204	100	6	1501.10	—	**1490.25**	**1490.25**	4.28	1501.10
RC205	100	6	1853.58	—	1835.74	**1832.53**	5.11	1853.58
RC206	100	6	1761.49	—	**1725.44**	**1725.44**	5.79	1761.49
RC207	100	6	1666.03	—	1651.09	**1646.37**	5.65	1666.03
RC208	100	6	1494.11	—	**1483.20**	**1483.20**	4.39	1494.11
Time			3.45 min	—		4.50 min		
Gap			+0.00%	—	-0.94%	-1.10%		
CPU			Ath 2.6G	Duo 2.4G		Opt 2.2G		

Table 29: Results on the VFMPTW, minimization of distance, type C fleet, instances of Liu and Shen (1999)

Inst	**n**	**w**	**BDHMG08**	**BPDRT09**	**UHGS**			**BKS**
			Best 3	Best 5	Avg 10	Best 10	T(min)	
R101	100	5	**1951.20**	1951.89	**1951.20**	**1951.20**	4.60	1951.20
R102	100	5	**1770.40**	1778.29	1785.35	1785.35	2.92	1770.40
R103	100	5	1558.17	1555.26	1552.64	**1552.34**	3.55	1555.26
R104	100	5	1367.82	1372.08	1356.70	**1355.15**	5.37	1361.46
R105	100	5	1696.67	1698.26	**1694.56**	**1694.56**	3.25	1696.67
R106	100	5	1589.25	1590.11	1590.25	**1583.17**	4.12	1589.25
R107	100	5	1435.21	1439.81	1433.44	**1428.08**	5.36	1435.21
R108	100	5	1334.75	1334.68	1315.47	**1314.88**	5.32	1334.68
R109	100	5	1515.22	1514.13	1507.97	**1506.59**	4.68	1507.10
R110	100	5	1457.42	1461.85	1448.83	**1443.92**	5.06	1457.42
R111	100	5	1439.43	1439.14	1423.43	**1420.15**	5.58	1435.93
R112	100	5	1358.17	1343.26	1329.70	**1327.58**	4.97	1337.68
C101	100	3	**1628.94**	**1628.94**	**1628.94**	**1628.94**	2.12	1628.94
C102	100	3	**1597.66**	**1597.66**	**1597.66**	**1597.66**	2.35	1597.66
C103	100	3	**1596.56**	**1596.56**	**1596.56**	**1596.56**	2.88	1596.56
C104	100	3	1594.06	1590.86	**1590.76**	**1590.76**	2.32	1590.86
C105	100	3	**1628.94**	**1628.94**	**1628.94**	**1628.94**	1.96	1628.94
C106	100	3	**1628.94**	**1628.94**	**1628.94**	**1628.94**	2.05	1628.94
C107	100	3	**1628.94**	**1628.94**	**1628.94**	**1628.94**	2.17	1628.94
C108	100	3	**1622.75**	**1622.75**	**1622.75**	**1622.75**	3.20	1622.75
C109	100	3	**1614.99**	**1614.99**	1615.93	1615.93	3.88	1614.99
RC101	100	4	2048.44	2053.55	2047.33	**2043.48**	4.39	2048.44
RC102	100	4	1860.48	1872.49	1849.38	**1847.92**	4.10	1860.48
RC103	100	4	1660.81	1663.08	1654.30	**1646.35**	4.19	1660.81
RC104	100	4	1536.24	1540.61	1523.42	**1522.04**	5.64	1536.24
RC105	100	4	1913.09	1929.89	1925.66	**1913.06**	4.01	1913.09
RC106	100	4	1772.05	1776.52	1770.95	1770.95	3.77	1761.63
RC107	100	4	1615.74	1633.29	1609.88	**1607.11**	4.08	1615.74
RC108	100	4	1527.35	1527.87	1524.10	**1523.96**	3.35	1527.35
R201	100	4	1441.46	1466.13	1462.03	1443.41	4.90	1439.76
R202	100	4	1298.10	1296.78	1297.43	**1283.16**	7.91	1288.70
R203	100	4	1145.38	1127.28	**1116.09**	**1116.09**	3.95	1127.28
R204	100	4	1019.77	1000.89	993.16	**993.14**	6.63	1000.89
R205	100	4	1222.03	1240.74	1196.73	**1193.97**	7.33	1222.03
R206	100	4	1138.26	1141.13	1123.21	**1121.34**	6.00	1138.26
R207	100	4	1086.42	1067.97	1055.39	**1052.58**	6.97	1067.97
R208	100	4	976.11	979.50	971.36	**969.90**	5.78	976.11
R209	100	4	1140.96	1140.38	1098.89	**1097.42**	5.94	1123.19
R210	100	4	1161.87	1170.29	1153.34	**1149.85**	6.80	1161.87
R211	100	4	1015.84	1008.54	**994.93**	**994.93**	6.51	1008.54
C201	100	4	**1194.33**	**1194.33**	**1194.33**	**1194.33**	4.82	1194.33
C202	100	4	1189.35	**1185.24**	**1185.24**	**1185.24**	2.57	1185.24
C203	100	4	**1176.25**	**1176.25**	**1176.25**	**1176.25**	3.60	1176.25
C204	100	4	1176.55	1176.55	**1175.37**	**1175.37**	4.32	1176.55
C205	100	4	**1190.36**	**1190.36**	**1190.36**	**1190.36**	4.46	1190.36
C206	100	4	**1188.62**	**1188.62**	**1188.62**	**1188.62**	4.01	1188.62
C207	100	4	**1184.88**	1187.71	**1184.88**	**1184.88**	3.66	1184.88
C208	100	4	1187.86	**1186.50**	**1186.50**	**1186.50**	2.99	1186.50
RC201	100	6	1632.41	1630.53	1623.78	**1623.36**	6.81	1630.53
RC202	100	6	1459.84	1461.44	1450.70	**1447.27**	5.29	1459.84
RC203	100	6	1295.07	1292.92	**1274.04**	**1274.04**	4.49	1292.92
RC204	100	6	1171.26	1162.91	1159.37	**1159.00**	6.01	1162.91
RC205	100	6	1525.28	1532.67	1517.09	**1512.53**	5.24	1525.28
RC206	100	6	1425.15	1420.89	1400.62	**1395.18**	3.92	1420.89
RC207	100	6	1332.40	1328.29	1319.56	**1314.44**	6.24	1328.29
RC208	100	6	1155.02	1152.92	**1140.10**	**1140.10**	6.81	1152.92
Time			3.08 min	—	4.56 min			
Gap			+0.26%	+0.27%	-0.36%	-0.51%		
CPU			Ath 2.6G	Duo 2.4G	Opt 2.2G			

Table 30: Results on the type 1 VRPSTW (only lateness) with $\alpha = 100$, hierarchical objective involving first the minimization of the Fleet Size "Fleet", then the number of customers serviced outside of their time windows "TW", then the overall lateness "L", and finally distance "Dist". Instances of Solomon (1987)

Inst	**n**	**F10**				**UHGS**								
		Single				Avg 10				Best 10				
		Fleet	TW	L	Dist	Fleet	TW	L	Dist	Fleet	TW	L	Dist	T(min)
R101	100	12	56	—	1128.70	11.00	27.70	1644.70	1329.70	11	27	1720.97	1331.85	11.78
R102	100	11	46	—	1058.70	10.00	22.20	1069.17	1226.84	10	21	1206.72	1252.78	18.64
R103	100	10	34	—	1027.40	9.80	7.50	258.62	1171.84	9	5	90.68	1208.63	11.05
R104	100	9	18	—	947.30	9.00	0.50	17.15	1009.30	9	0	0.00	1007.31	7.79
R105	100	11	42	—	1073.50	10.20	19.50	1106.53	1239.15	10	9	680.04	1381.88	13.74
R106	100	10	33	—	1047.40	9.90	8.10	433.32	1236.89	9	6	358.86	1259.11	12.59
R107	100	10	24	—	987.60	9.00	7.00	354.81	1029.30	9	7	343.45	1042.96	11.24
R108	100	9	14	—	947.20	9.00	0.00	0.00	963.50	9	0	0.00	960.88	8.10
R109	100	10	28	—	1001.40	10.00	5.00	208.62	1194.64	10	5	200.72	1183.42	8.80
R110	100	9	29	—	1013.40	9.20	9.50	461.42	1043.08	9	0	0.00	1118.84	12.57
R111	100	10	26	—	983.30	9.00	7.80	385.46	1038.01	9	6	443.34	1047.09	12.72
R112	100	9	17	—	940.90	9.00	0.00	0.00	988.59	9	0	0.00	982.14	9.96
R201	100	3	56	—	984.00	3.00	2.00	197.62	1502.80	3	2	174.47	1497.06	27.05
R202	100	3	40	—	943.50	2.00	21.30	4703.07	991.60	2	20	4757.71	991.27	30.61
R203	100	2	30	—	901.80	2.00	6.10	1124.60	991.09	2	6	1076.65	995.76	30.04
R204	100	2	19	—	836.30	2.00	0.00	0.00	830.79	2	0	0.00	825.52	26.74
R205	100	3	36	—	911.90	2.00	14.40	2998.08	983.30	2	14	2767.13	973.84	26.49
R206	100	2	25	—	956.90	2.00	3.50	652.23	994.39	2	3	465.02	993.13	29.92
R207	100	2	18	—	876.60	2.00	0.00	0.00	893.85	2	0	0.00	893.33	29.54
R208	100	2	11	—	833.40	2.00	0.00	0.00	727.17	2	0	0.00	726.82	14.16
R209	100	2	26	—	950.50	2.00	7.30	1814.72	990.71	2	7	1386.37	994.41	29.28
R210	100	2	29	—	963.80	2.00	6.00	1339.34	995.19	2	6	1264.94	997.75	29.75
R211	100	2	14	—	906.80	2.00	0.00	0.00	900.56	2	0	0.00	892.72	27.23
C101	100	—	—	—	—	10.00	0.00	0.00	828.94	10	0	0.00	828.94	2.32
C102	100	—	—	—	—	10.00	0.00	0.00	828.94	10	0	0.00	828.94	2.28
C103	100	—	—	—	—	10.00	0.00	0.00	828.06	10	0	0.00	828.06	2.12
C104	100	—	—	—	—	10.00	0.00	0.00	824.78	10	0	0.00	824.78	1.96
C105	100	—	—	—	—	10.00	0.00	0.00	828.94	10	0	0.00	828.94	2.73
C106	100	—	—	—	—	10.00	0.00	0.00	828.94	10	0	0.00	828.94	2.56
C107	100	—	—	—	—	10.00	0.00	0.00	828.94	10	0	0.00	828.94	2.48
C108	100	—	—	—	—	10.00	0.00	0.00	828.94	10	0	0.00	828.94	2.19
C109	100	—	—	—	—	10.00	0.00	0.00	828.94	10	0	0.00	828.94	2.05
C201	100	—	—	—	—	3.00	0.00	0.00	591.56	3	0	0.00	591.56	5.82
C202	100	—	—	—	—	3.00	0.00	0.00	591.56	3	0	0.00	591.56	8.35
C203	100	—	—	—	—	3.00	0.00	0.00	591.17	3	0	0.00	591.17	9.79
C204	100	—	—	—	—	3.00	0.00	0.00	590.60	3	0	0.00	590.60	8.08
C205	100	—	—	—	—	3.00	0.00	0.00	588.88	3	0	0.00	588.88	6.40
C206	100	—	—	—	—	3.00	0.00	0.00	588.49	3	0	0.00	588.49	6.53
C207	100	—	—	—	—	3.00	0.00	0.00	588.29	3	0	0.00	588.29	6.54
C208	100	—	—	—	—	3.00	0.00	0.00	588.32	3	0	0.00	588.32	6.51
RC101	100	11	44	—	1255.30	11.00	12.10	789.34	1486.11	11	12	808.44	1486.99	7.01
RC102	100	10	32	—	1230.10	10.30	10.80	476.57	1399.34	10	4	41.41	1539.29	10.51
RC103	100	10	25	—	1154.60	10.00	1.20	18.41	1320.22	10	1	4.18	1333.71	8.03
RC104	100	10	12	—	1083.90	10.00	0.00	0.00	1135.48	10	0	0.00	1135.48	5.57
RC105	100	11	38	—	1219.70	10.90	7.20	345.49	1516.88	10	6	278.42	1538.72	6.89
RC106	100	10	27	—	1150.30	10.00	7.60	308.59	1310.32	10	7	344.38	1307.76	8.85
RC107	100	10	28	—	1123.00	10.00	1.50	65.46	1300.57	10	1	64.05	1325.19	9.70
RC108	100	10	10	—	1071.60	10.00	0.00	0.00	1139.82	10	0	0.00	1139.82	6.97
RC201	100	3	48	—	1147.40	3.00	3.00	482.47	1663.69	3	3	482.47	1663.69	32.65
RC202	100	3	35	—	1073.50	3.00	0.00	0.00	1377.25	3	0	0.00	1365.65	26.22
RC203	100	3	29	—	906.30	2.10	13.80	3013.28	929.95	2	0	0.00	1064.14	30.49
RC204	100	2	14	—	850.70	2.00	2.00	261.17	915.94	2	2	257.81	916.79	29.27
RC205	100	3	40	—	1158.40	3.00	1.00	87.83	1623.09	3	1	9.38	1605.20	32.78
RC206	100	3	40	—	978.40	3.00	0.00	0.00	1149.37	3	0	0.00	1146.32	24.48
RC207	100	3	33	—	986.40	3.00	0.00	0.00	1061.49	3	0	0.00	1061.14	24.51
RC208	100	2	21	—	885.50	2.00	6.40	946.83	910.34	2	6	949.50	917.64	22.51
Time		9.69 min				18.62 min								
CPU		P-M 1.6G				Opt 2.2G								

Table 31: Results on the type 1 VRPSTW (only lateness) with $\alpha = 1$. Minimization of the sum of distance and lateness under a fleet size limit. Instances of Solomon (1987).

Inst	**n**	**m**	**KTDHS12**		**UHGS**			**BKS**
			Avg 10	Best 10	Avg 10	Best 10	T(min)	
R101	100	19	1562.98	**1562.58**	1562.89	**1562.58**	1.93	1562.58
R102	100	17	1379.62	**1379.11**	1379.21	**1379.11**	1.90	1379.11
R103	100	13	1160.64	1159.54	1159.51	**1159.28**	3.34	1159.54
R104	100	9	1009.02	1003.73	**999.77**	**999.77**	3.93	1003.73
R105	100	14	1348.89	**1347.75**	**1347.75**	**1347.75**	2.17	1347.75
R106	100	12	1237.29	**1236.58**	**1236.58**	**1236.58**	2.91	1236.58
R107	100	10	1089.84	1084.96	**1083.62**	**1083.62**	4.55	1084.96
R108	100	9	951.24	949.94	947.04	**946.60**	4.20	949.94
R109	100	11	1176.40	**1173.21**	**1173.21**	**1173.21**	3.54	1173.21
R110	100	10	1114.66	**1106.66**	1111.57	1107.26	3.55	1106.66
R111	100	10	1086.36	1080.25	1076.41	**1074.84**	4.97	1080.25
R112	100	9	981.82	972.11	975.78	**971.31**	5.13	972.11
C101	100	10	**828.94**	**828.94**	**828.94**	**828.94**	2.10	828.94
C102	100	10	**828.94**	**828.94**	**828.94**	**828.94**	2.15	828.94
C103	100	10	828.07	828.07	**828.06**	**828.06**	2.02	828.07
C104	100	10	**824.78**	**824.78**	**824.78**	**824.78**	1.96	824.78
C105	100	10	**828.94**	**828.94**	**828.94**	**828.94**	2.12	828.94
C106	100	10	**828.94**	**828.94**	**828.94**	**828.94**	1.91	828.94
C107	100	10	**828.94**	**828.94**	**828.94**	**828.94**	1.89	828.94
C108	100	10	**828.94**	**828.94**	**828.94**	**828.94**	1.94	828.94
C109	100	10	**828.94**	**828.94**	**828.94**	**828.94**	1.90	828.94
RC101	100	14	1591.59	**1590.22**	**1590.22**	**1590.22**	2.57	1590.22
RC102	100	12	1429.90	**1428.21**	**1428.21**	**1428.21**	2.83	1428.21
RC103	100	11	1242.33	**1239.54**	1239.73	**1239.54**	3.09	1239.54
RC104	100	10	1128.74	**1126.31**	**1126.31**	**1126.31**	3.25	1126.31
RC105	100	13	1451.38	**1450.84**	**1450.84**	**1450.84**	2.59	1450.84
RC106	100	11	1350.17	**1349.30**	1349.72	**1349.30**	3.55	1349.30
RC107	100	11	1208.96	**1208.81**	1208.98	**1208.81**	3.37	1208.81
RC108	100	10	1119.61	**1118.00**	1118.31	**1118.00**	3.72	1118.00
R201	100	4	1237.17	**1237.11**	**1237.11**	**1237.11**	4.13	1237.11
R202	100	3	1169.23	**1165.32**	**1165.32**	**1165.32**	6.19	1165.32
R203	100	3	942.96	937.35	934.01	**933.52**	10.55	937.35
R204	100	2	840.79	832.38	824.73	**824.02**	24.72	832.38
R205	100	3	1006.79	**994.43**	**994.43**	**994.43**	6.53	994.43
R206	100	3	920.13	912.81	**906.14**	**906.14**	7.39	912.81
R207	100	2	1044.87	908.70	888.44	**887.28**	24.63	908.70
R208	100	2	735.26	728.92	727.08	**726.82**	13.72	728.92
R209	100	3	917.21	909.30	**909.16**	**909.16**	6.98	909.30
R210	100	3	958.58	948.80	941.95	**938.34**	8.57	948.80
R211	100	2	923.85	901.18	892.50	**885.71**	19.66	901.18
C201	100	3	**591.56**	**591.56**	**591.56**	**591.56**	4.62	591.56
C202	100	3	**591.56**	**591.56**	**591.56**	**591.56**	6.90	591.56
C203	100	3	**591.17**	**591.17**	**591.17**	**591.17**	7.67	591.17
C204	100	3	**590.60**	**590.60**	**590.60**	**590.60**	6.84	590.60
C205	100	3	**588.88**	**588.88**	**588.88**	**588.88**	5.24	588.88
C206	100	3	**588.49**	**588.49**	**588.49**	**588.49**	5.84	588.49
C207	100	3	**588.29**	**588.29**	**588.29**	**588.29**	5.25	588.29
C208	100	3	**588.32**	**588.32**	**588.32**	**588.32**	5.89	588.32
RC201	100	4	1380.47	**1380.33**	**1380.33**	**1380.33**	4.34	1380.33
RC202	100	3	1322.17	**1317.28**	**1317.28**	**1317.28**	9.59	1317.28
RC203	100	3	1057.10	1046.05	1045.00	**1040.77**	10.73	1046.05
RC204	100	3	809.09	797.41	**797.04**	**797.04**	6.71	797.41
RC205	100	4	1305.97	1299.61	**1298.00**	**1297.65**	6.34	1299.61
RC206	100	3	1135.90	**1135.26**	**1135.26**	**1135.26**	6.56	1135.26
RC207	100	3	1073.58	1061.14	1058.16	**1056.88**	7.43	1061.14
RC208	100	3	834.82	829.00	827.90	**827.67**	7.98	829.00
Time			10.00 min		5.82 min			
Gap			+0.62%	+0.00%	-0.13%	-0.18%		
CPU			Xe 2.67G		Opt 2.2G			

Table 32: Results on type 2 VRPSTW (earliness and lateness) with $\alpha = 100$, hierarchical objective involving first the minimization of the Fleet Size "Fleet", then the number of customers serviced outside of their time windows "TW", then the overall earliness plus lateness "E+L", and finally distance "Dist". Instances of Solomon (1987)

Inst	**n**	**FEL07**				**UHGS**								
		Best X				Avg 10				Best 10				
		Fleet	TW	E+L	Dist	Fleet	TW	E+L	Dist	Fleet	TW	E+L	Dist	T(min)
R101	100	14	44	—	1872.94	9.00	57.30	2998.08	1025.65	9	56	2742.45	1018.58	61.19
R102	100	13	29	—	1732.54	9.00	38.70	1825.32	1018.77	9	37	1934.47	1012.28	60.94
R103	100	12	9	—	1542.79	9.00	17.30	676.55	1020.72	9	16	621.25	1022.96	60.65
R104	100	10	0	—	1107.18	9.00	1.60	44.39	1014.39	9	1	19.05	1013.65	60.44
R105	100	—	—	—	—	9.00	39.10	2008.68	1030.78	9	37	2050.22	1037.70	61.04
R106	100	—	—	—	—	9.00	24.30	1107.09	1035.12	9	24	972.07	1021.48	60.73
R107	100	—	—	—	—	9.00	7.90	341.56	1031.17	9	7	294.55	1033.97	60.58
R108	100	10	0	—	968.34	9.00	0.00	0.00	980.60	9	0	0.00	970.15	60.37
R109	100	11	4	—	1379.87	9.00	22.40	961.34	1023.20	9	21	833.92	1028.18	60.66
R110	100	—	—	—	—	9.00	12.60	572.97	1025.82	9	11	552.12	1034.03	60.49
R111	100	—	—	—	—	9.00	8.10	334.60	1015.26	9	7	248.93	1013.65	60.65
R112	100	—	—	—	—	9.00	1.10	30.57	1018.88	9	1	1.25	1025.86	60.30
C101	100	10	0	—	828.94	10.00	0.00	0.00	828.94	10	0	0.00	828.94	30.55
C102	100	10	0	—	828.94	10.00	0.00	0.00	828.94	10	0	0.00	828.94	30.25
C103	100	10	0	—	918.08	10.00	0.00	0.00	828.06	10	0	0.00	828.06	30.15
C104	100	10	0	—	899.00	10.00	0.00	0.00	824.78	10	0	0.00	824.78	30.32
C105	100	10	0	—	828.94	10.00	0.00	0.00	828.94	10	0	0.00	828.94	30.43
C106	100	10	0	—	828.94	10.00	0.00	0.00	828.94	10	0	0.00	828.94	30.78
C107	100	10	0	—	828.94	10.00	0.00	0.00	828.94	10	0	0.00	828.94	30.55
C108	100	10	0	—	828.94	10.00	0.00	0.00	828.94	10	0	0.00	828.94	30.18
C109	100	10	0	—	828.94	10.00	0.00	0.00	828.94	10	0	0.00	828.94	30.15
RC101	100	13	26	—	1851.22	9.00	46.70	2631.68	1120.65	9	44	2787.38	1122.73	39.23
RC102	100	13	1	—	1772.42	9.00	31.30	1573.76	1123.74	9	29	1508.22	1119.92	38.13
RC103	100	11	0	—	1416.81	9.00	17.30	698.94	1125.40	9	16	640.61	1131.62	37.56
RC104	100	10	0	—	1262.55	9.00	5.80	155.00	1117.95	9	5	161.57	1126.69	33.99
RC105	100	12	1	—	1531.57	9.00	34.60	1648.93	1130.18	9	33	1580.23	1127.29	39.71
RC106	100	11	0	—	1224.72	9.00	28.63	1161.00	1123.24	9	28	1207.60	1111.51	38.08
RC107	100	—	—	—	—	9.00	18.67	720.80	1112.72	9	18	601.38	1106.99	35.73
RC108	100	—	—	—	—	9.00	11.20	352.37	1107.38	9	10	284.23	1123.11	35.30
R201	100	—	—	—	—	2.00	41.20	9159.21	985.32	2	40	8583.79	988.84	31.01
R202	100	—	—	—	—	2.00	25.90	4631.88	986.18	2	24	5062.88	986.21	31.00
R203	100	—	—	—	—	2.00	10.80	1924.46	979.73	2	10	1514.13	988.64	30.89
R204	100	—	—	—	—	2.00	0.00	0.00	873.07	2	0	0.00	851.66	30.96
R205	100	—	—	—	—	2.00	20.00	3979.80	985.48	2	19	3289.15	979.97	30.89
R206	100	—	—	—	—	2.00	9.00	1699.39	983.37	2	7	1624.34	988.52	30.89
R207	100	—	—	—	—	2.00	1.50	135.63	973.57	2	1	26.44	933.74	30.91
R208	100	—	—	—	—	2.00	0.00	0.00	741.26	2	0	0.00	730.54	30.69
R209	100	—	—	—	—	2.00	12.70	2383.53	980.17	2	10	1910.46	963.47	30.85
R210	100	—	—	—	—	2.00	12.30	2352.23	981.78	2	11	2015.68	983.07	30.88
R211	100	—	—	—	—	2.00	0.70	40.99	968.68	2	0	0.00	931.99	30.90
C201	100	—	—	—	—	3.00	0.00	0.00	591.56	3	0	0.00	591.56	30.19
C202	100	—	—	—	—	3.00	0.00	0.00	591.56	3	0	0.00	591.56	30.33
C203	100	—	—	—	—	3.00	0.00	0.00	591.17	3	0	0.00	591.17	30.38
C204	100	—	—	—	—	3.00	0.00	0.00	590.93	3	0	0.00	590.60	30.37
C205	100	—	—	—	—	3.00	0.00	0.00	588.88	3	0	0.00	588.88	30.17
C206	100	—	—	—	—	3.00	0.00	0.00	588.49	3	0	0.00	588.49	30.22
C207	100	—	—	—	—	3.00	0.00	0.00	588.29	3	0	0.00	588.29	30.18
C208	100	—	—	—	—	3.00	0.00	0.00	588.32	3	0	0.00	588.32	30.24
RC201	100	—	—	—	—	2.00	52.70	12622.22	908.21	2	50	12420.98	912.51	31.01
RC202	100	—	—	—	—	2.00	33.80	7893.30	911.08	2	33	7335.92	907.59	30.98
RC203	100	—	—	—	—	2.00	16.30	3181.25	907.44	2	15	2418.65	910.63	30.89
RC204	100	—	—	—	—	2.00	3.40	601.79	902.05	2	2	460.90	894.01	30.72
RC205	100	—	—	—	—	2.00	39.30	8993.74	909.28	2	37	8706.52	911.66	30.96
RC206	100	—	—	—	—	2.00	35.30	8265.45	906.10	2	33	7424.35	913.25	30.82
RC207	100	—	—	—	—	2.00	25.00	5291.51	908.94	2	24	4805.29	908.80	30.85
RC208	100	—	—	—	—	2.00	12.70	1828.13	911.30	2	11	1694.30	912.64	30.74
Time		5.98 min				41.16 min								
CPU		P-II 0.6G				Opt 2.2G								

Table 33: Results on type 2 VRPSTW (earliness and lateness) with $\alpha = 1$. Minimization of the sum of distance, earliness and lateness under a fleet size limit. Instances of Solomon (1987)

Inst	**n**	**m**	**UHGS**		
			Avg 10	Best 10	T(min)
R101	19	100	1546.91	1546.91	24.13
R102	17	100	1377.38	1377.38	26.93
R103	13	100	1158.83	1158.31	30.14
R104	9	100	1004.57	1000.33	30.10
R105	14	100	1342.57	1342.57	30.03
R106	12	100	1223.09	1223.09	30.12
R107	10	100	1080.90	1079.12	30.43
R108	9	100	948.23	945.64	30.08
R109	11	100	1164.68	1164.68	30.11
R110	10	100	1108.30	1104.59	30.16
R111	10	100	1065.76	1065.76	30.08
R112	9	100	991.50	969.91	30.10
C101	10	100	828.94	828.94	30.10
C102	10	100	828.94	828.94	30.08
C103	10	100	828.06	828.06	30.20
C104	10	100	824.78	824.78	29.34
C105	10	100	828.94	828.94	30.12
C106	10	100	828.94	828.94	30.07
C107	10	100	828.94	828.94	30.07
C108	10	100	828.94	828.94	30.33
C109	10	100	828.94	828.94	30.09
RC101	14	100	1584.20	1584.20	29.67
RC102	12	100	1409.36	1409.36	30.07
RC103	11	100	1231.67	1231.67	30.16
RC104	10	100	1123.25	1121.84	30.12
RC105	13	100	1433.37	1433.37	30.18
RC106	11	100	1334.89	1334.89	30.39
RC107	11	100	1203.06	1203.06	30.45
RC108	10	100	1115.44	1115.44	30.12
R201	4	100	1235.14	1235.14	30.28
R202	3	100	1159.76	1159.76	30.13
R203	3	100	937.04	934.10	30.15
R204	2	100	837.21	820.90	30.18
R205	3	100	996.24	994.43	30.12
R206	3	100	910.99	906.54	30.11
R207	2	100	937.79	906.81	30.19
R208	2	100	735.31	730.52	30.13
R209	3	100	911.61	909.16	30.11
R210	3	100	948.91	938.77	30.14
R211	2	100	921.81	912.39	30.17
C201	3	100	591.56	591.56	30.09
C202	3	100	591.56	591.56	30.11
C203	3	100	591.17	591.17	30.11
C204	3	100	590.60	590.60	30.09
C205	3	100	588.88	588.88	30.12
C206	3	100	588.49	588.49	30.13
C207	3	100	588.29	588.29	30.11
C208	3	100	588.32	588.32	30.11
RC201	4	100	1380.33	1380.33	30.12
RC202	3	100	1312.05	1312.05	30.10
RC203	3	100	1047.43	1044.74	30.13
RC204	3	100	796.91	796.68	30.13
RC205	4	100	1300.98	1297.86	30.11
RC206	3	100	1135.44	1135.26	30.12
RC207	3	100	1061.92	1056.88	30.12
RC208	3	100	832.30	827.67	30.13
Time			29.96 min		
Gap			+0.26%	+0.00%	
CPU			Opt 2.2G		

Table 34: Results on the new MDPVRPTW instances.

Inst	n	m	t	d	UHGS		
					Avg 10	Best 10	T(min)
pr01	48	1	4	4	2483.81	2482.78	0.87
pr02	96	2	4	4	4474.72	4468.60	2.93
pr03	144	3	4	4	5758.43	5735.59	6.93
pr04	192	4	4	4	6708.98	6680.76	18.96
pr05	240	4	4	4	7275.26	7202.79	29.02
pr06	288	5	4	4	8263.29	8207.18	29.68
pr07	72	1	6	6	5497.20	5496.76	2.06
pr08	144	2	6	6	7791.98	7716.08	11.21
pr09	216	3	6	6	10579.81	10504.77	29.49
pr10	288	4	6	6	13612.91	13343.55	30.00
pr11	48	1	4	4	2043.74	2043.74	0.85
pr12	96	2	4	4	3851.07	3825.34	3.47
pr13	144	3	4	4	4781.02	4755.10	9.48
pr14	192	4	4	4	5535.82	5471.17	21.36
pr15	240	4	4	4	5871.13	5830.71	30.00
pr16	288	5	4	4	6913.56	6832.53	30.01
pr17	72	1	6	6	4787.41	4782.74	2.47
pr18	144	2	6	6	6465.43	6402.79	21.78
pr19	216	3	6	6	8940.97	8785.80	30.01
pr20	288	3	6	6	10930.86	10662.62	30.00
pr01b	48	1	4	4	2423.29	2423.29	0.64
pr02b	96	2	4	4	4521.26	4486.88	2.84
pr03b	144	3	4	4	5664.54	5649.74	7.20
pr04b	192	4	4	4	6724.52	6694.32	16.69
pr05b	240	4	4	4	7345.82	7284.81	28.18
pr06b	288	5	4	4	8591.64	8551.01	30.00
pr07b	72	1	6	6	5255.06	5255.06	1.67
pr08b	144	2	6	6	7468.25	7444.70	10.10
pr09b	216	3	6	6	10930.40	10797.34	29.67
pr10b	288	4	6	6	12673.68	12494.65	30.00
pr11b	48	1	4	4	2100.23	2100.23	0.80
pr12b	96	2	4	4	3782.07	3748.45	2.85
pr13b	144	3	4	4	4891.31	4883.31	9.40
pr14b	192	4	4	4	5474.16	5442.94	21.13
pr15b	240	4	4	4	5902.56	5809.17	29.71
pr16b	288	5	4	4	6992.78	6941.25	29.90
pr17b	72	1	6	6	4794.89	4794.89	1.86
pr18b	144	2	6	6	6332.54	6288.46	22.25
pr19b	216	3	6	6	9003.87	8825.36	30.00
pr20b	288	3	6	6	10998.39	10774.34	30.00
Time					16.09 min		
Gap					+0.77%	+0.00%	
CPU					Opt 2.2G		

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