

A Path Relinking Approach with an Adaptive Mechanism to Control Parameters for the Vehicle Routing Problem with Time Windows — Detailed Computational Results —

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Below are the detailed computational results of our algorithm proposed in [3].

We conducted computational experiments to evaluate the proposed algorithm. The algorithm was coded in C and run on a PC (Xeon, 2.8 GHz, 1 GB memory). We used Solomon’s benchmark instances [12] and Gehring and Homberger’s benchmark instances [5].

As our algorithm deals with the problem with a fixed number of vehicles, we first set the number of vehicles in each instance to the known smallest number to the best of our knowledge, and repeat the followings. If the algorithm found a feasible solution and the number of vehicles is larger than a lower bound $\lceil \sum_{i \in V} a_i / u \rceil$, we ran the algorithm again after decrementing the number of vehicles by one. On the other hand, if the algorithm was not able to find a feasible solution, we ran the algorithm again after incrementing the number of vehicles by one. Among the 356 instances, the algorithm found a feasible solution in the first run for every instance except for six instances. Among the remaining six instances, it was able to find feasible solutions with one more vehicle for five instances and with two more vehicles for the one. The time limit for each run of the algorithm for 100, 200, 400, 600, 800 and 1000-customer instances are 1000, 2000, 4000, 6000, 8000 and 10000 seconds, respectively.

Tables 1 and 2 show the solution values obtained by our algorithm. We compared our solutions with those reported in the papers [1, 4, 6, 7, 9, 11] and on the SINTEF website (www.top.sintef.no/vrp/benchmarks.html), as of November 11, 2007. (Note that the SINTEF website includes the results of [2, 8, 10].) A value in boldface is a new best known solution.

References

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Table 1: The detailed results of our algorithm for the 100–400-customer instances

r1/100	r2/100	c1/100	c2/100	rc1/100	rc2/100
01/19/1650.80	01/4/1253.23	01/10/828.94	01/3/591.56	01/14/1696.95	01/4/1413.52
02/17/1486.12	02/3/1191.70	02/10/828.94	02/3/591.56	02/12/1554.75	02/3/1367.00
03/13/1292.68	03/3/949.66	03/10/828.06	03/3/591.17	03/11/1261.67	03/3/1068.60
04/9/1007.31	04/2/844.63	04/10/824.78	04/3/590.60	04/10/1135.48	04/3/816.33
05/14/1377.11	05/3/994.43	05/10/828.94	05/3/588.88	05/13/1629.44	05/4/1297.65
06/12/1252.03	06/3/929.49	06/10/828.94	06/3/588.49	06/11/1424.73	06/3/1207.75
07/10/1109.88	07/2/911.14	07/10/828.94	07/3/588.29	07/11/1230.48	07/3/1094.95
08/9/969.30	08/2/727.69	08/10/828.94	08/3/588.32	08/10/1139.82	08/3/841.18
09/11/1194.73	09/3/913.32	09/10/828.94			
10/10/1131.27	10/3/966.90				
11/10/1096.73	11/2/891.89				
12/9/1032.47					
r1/200	r2/200	c1/200	c2/200	rc1/200	rc2/200
01/20/4784.11	01/4/4504.88	01/20/2704.57	01/6/1931.44	01/18/3667.40	01/6/3102.30
02/18/4045.33	02/4/3655.26	02/18/2917.89	02/6/1863.16	02/18/3249.65	02/5/2827.43
03/18/3395.72	03/4/2945.24	03/18/2707.35	03/6/1777.56	03/18/3011.09	03/4/2623.02
04/18/3080.53	04/4/2025.06	04/18/2644.42	04/6/1716.20	04/18/2870.29	04/4/2164.55
05/18/4123.47	05/4/3400.49	05/20/2702.05	05/6/1878.85	05/18/3379.51	05/4/2911.46
06/18/3642.30	06/4/2954.85	06/20/2701.04	06/6/1857.35	06/18/3367.31	06/4/2880.06
07/18/3152.45	07/4/2476.50	07/20/2701.04	07/6/1849.46	07/18/3215.33	07/4/2563.62
08/18/3009.65	08/4/1887.98	08/19/2775.48	08/6/1820.53	08/18/3104.40	08/4/2325.73
09/18/3773.41	09/4/3125.55	09/18/2687.83	09/6/1830.05	09/18/3088.57	09/4/2270.31
10/18/3321.50	10/4/2694.35	10/18/2645.08	10/6/1806.58	10/18/3015.06	10/4/2057.02
r1/400	r2/400	c1/400	c2/400	rc1/400	rc2/400
01/40/10407.99	01/8/9297.61	01/40/7152.06	01/12/4116.14	01/36/8925.01	01/11/6682.37
02/36/9198.06	02/8/7662.52	02/36/7921.43	02/12/3930.05	02/36/8073.32	02/9/6407.92
03/36/7921.12	03/8/6190.56	03/36/7072.47	03/12/3774.30	03/36/7631.08	03/8/5054.14
04/36/7368.95	04/8/4329.59	04/36/6803.26	04/11/3939.40	04/36/7428.82	04/8/3648.30
05/36/9554.74	05/8/7160.08	05/40/7152.06	05/12/3943.03	05/36/8312.17	05/9/6005.94
06/36/8623.44	06/8/6215.73	06/40/7153.45	06/12/3875.94	06/36/8297.14	06/8/6045.96
07/36/7719.15	07/8/5153.95	07/39/7461.24	07/12/3894.16	07/36/8093.52	07/8/5558.01
08/36/7391.15	08/8/4113.46	08/37/7419.34	08/12/3792.76	08/36/7876.78	08/8/4946.25
09/36/8977.98	09/8/6500.77	09/36/7107.59	09/12/3870.80	09/36/7853.69	09/8/4569.14
10/36/8285.40	10/8/5999.98	10/36/6889.23	10/11/3964.56	10/36/7687.41	10/8/4350.64

Table 2: The detailed results of our algorithm for the 600–1000-customer instances

r1/600	r2/600	c1/600	c2/600	rc1/600	rc2/600
01/59/21713.75	01/11/18774.60	01/60/14095.64	01/18/7774.16	01/55/17586.75	01/14/13691.04
02/54/19493.96	02/11/15106.93	02/56/14604.33	02/ 17/8347.09	02/55/16233.10	02/12/11763.41
03/54/17471.73	03/11/11599.34	03/56/13850.66	03/17/7666.95	03/55/15413.87	03/11/9807.61
04/54/16037.12	04/11/8285.24	04/56/13628.62	04/ 17/6983.26	04/55/15000.79	04/11/7377.47
05/54/20681.01	05/11/15486.82	05/60/14085.72	05/18/7575.20	05/55/17045.97	05/12/12405.59
06/54/18616.76	06/11/12779.53	06/60/14089.66	06/18/7479.48	06/55/17136.28	06/11/12491.87
07/54/17114.55	07/11/10389.22	07/58/15069.55	07/18/7517.63	07/55/16511.30	07/ 11/10928.52
08/54/15884.43	08/11/7969.11	08/56/14797.70	08/ 17/7694.69	08/55/16237.07	08/11/10436.44
09/54/19837.64	09/11/13871.90	09/56/13735.89	09/ 17/8465.73	09/55/16325.51	09/11/10096.96
10/54/18383.25	10/11/12527.23	10/56/13677.35	10/ 17/7280.70	10/55/16034.97	10/11/9413.25
r1/800	r2/800	c1/800	c2/800	rc1/800	rc2/800
01/80/37400.64	01/15/28839.78	01/80/25184.38	01/24/11662.08	01/ 72/34551.38	01/ 18/21154.34
02/72/33573.64	02/15/23157.11	02/ 72/27012.87	02/23/12460.76	02/ 72/31308.67	02/16/18799.25
03/72/30349.76	03/15/18265.81	03/72/24558.69	03/23/11770.80	03/ 72/29152.99	03/15/14939.88
04/72/28459.74	04/15/13759.46	04/72/23959.50	04/23/11160.68	04/ 72/27449.31	04/15/11410.24
05/72/34855.19	05/15/24779.24	05/80/25166.28	05/24/11428.66	05/ 72/34173.25	05/ 15/19497.33
06/72/31798.47	06/15/20775.72	06/80/25160.85	06/ 23/12673.80	06/ 72/32434.12	06/15/18769.39
07/72/29655.26	07/15/17102.33	07/78/26003.16	07/ 24/11370.84	07/ 72/32064.83	07/15/17196.55
08/72/28349.07	08/15/13059.96	08/74/25844.26	08/ 23/11363.96	08/ 72/31042.27	08/15/16239.34
09/72/33468.43	09/15/23017.30	09/72/24793.22	09/ 23/11835.04	09/ 72/30910.06	09/ 15/15556.86
10/72/31871.25	10/15/21074.60	10/72/24522.58	10/ 23/11163.36	10/ 72/30348.47	10/15/14726.07
r1/1000	r2/1000	c1/1000	c2/1000	rc1/1000	rc2/1000
01/100/54955.74	01/19/43054.76	01/100/42478.95	01/30/16879.24	01/90/48248.59	01/ 20/30912.50
02/91/52208.39	02/19/34293.42	02/ 90/43355.70	02/29/17452.36	02/90/45344.22	02/19/26597.14
03/91/46574.96	03/19/25934.52	03/90/40548.32	03/ 28/17519.99	03/90/43261.35	03/18/20698.99
04/91/43696.02	04/19/18629.76	04/90/39908.25	04/ 28/16783.84	04/90/42625.25	04/18/16402.21
05/91/55002.93	05/19/37357.94	05/100/42469.18	05/30/16563.10	05/90/47247.58	05/ 18/27715.20
06/91/50124.16	06/19/30879.06	06/100/42471.28	06/ 29/17491.11	06/90/46651.17	06/18/28256.73
07/91/46193.38	07/19/24075.04	07/ 97/43867.54	07/ 29/18727.92	07/90/46061.01	07/18/25763.52
08/91/43264.54	08/19/18229.89	08/93/43120.86	08/ 28/16839.40	08/90/45524.59	08/18/24454.85
09/91/53848.20	09/19/34224.22	09/90/42731.02	09/ 29/16680.50	09/90/45508.55	09/18/23802.84
10/91/50639.84	10/19/31390.03	10/90/40624.36	10/ 28/16584.54	10/90/44918.74	10/ 18/22365.07

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