Online Supplement for

Efficient Control for a Multi-Product Quasi-Batch Process via Stochastic Dynamic Programming

Ezgi C. Eren and Natarajan Gautam*
Department of Industrial and Systems Engineering
Texas A&M University
College Station, TX 77843-3131
{ezgi,gautam}@tamu.edu

*Corresponding Author

This is an online supplement for "Efficient Control for a Multi-Product Quasi-Batch Process via Stochastic Dynamic Programming" where we present complete list of numerical results discussed in Section 6 of the paper. Tables 1 through 4 provides the results for $N = 3$ case. The first column stands for the number assigned to the data set, which is used as a label for that data set later. The next five columns list the parameter values specific to the data set. The cost values are given in the order of optimal, traditional and alternative together with the percentage cost and energy/material savings obtained via the optimal policy against the traditional and alternative policies. Note that "energy" labels on the tables stand for "energy/material", which is abbreviated due to space constraints.

Tables 5 through 8 present the results for heuristics and optimal solution for the case of $N = 5$. The numbers in the first column correspond to those in the tables for $N = 3$ and represent the data set used in the experiment. The CPU time used (seconds) to generate the proposed policies by the exact value iteration algorithm and the heuristics are displayed in addition to the cost values. Computational times for Heuristic 2, Heuristic 3 are excluded due to space constraints as their results are quite similar to those of Heuristic 1. Decomposition of total cost into different components is provided as well as the total system-wide cost values. Note that the penalty cost is not provided for the optimal policy and the Decomposition Heuristic as it can be calculated using the given cost values. Similarly, the switching cost for the naive Heuristics can be calculated using the results for total cost and energy/material cost. Note that for those heuristics, there is no penalty cost listed, as under-processing is not allowed and that type of cost is not incurred.

Finally, Tables 9 to 12 list the results for the cases of $N = 15$ and $N = 100$, which are discussed in Section 6.2.1 of the paper.

	p	r	R	q	Q	optimal cost	traditional cost	% savings (w.r.t. trad.)	% energy sav. (w.r.t. trad.)	alternative cost	% savings (w.r.t. alt.)	% energy s (w.r.t. alt.)
1	1	2	2	0.5	1	250.69	302.5	17.13	26.79	276.87	9.45	14.06
2	1	2	2	0.5	2	266.69	303.5	12.13	26.10	290.06	8.06	13.25
3	1	2	2	0.5	4	295.24	305.5	3.36	19.69	316.45	6.70	5.72
4	1	2	2	0.5	8	303.30	309.5	2.00	2.01	369.22	17.85	-15.02
5	1	2	2	1	1	263.96	304	13.17	25.81	284.98	7.38	12.91
6	1	2	2	1	2	279.36	305	8.41	25.29	298.17	6.31	12.31
7	1	2	2	1	4	300.77	307	2.03	2.26	324.56	7.33	-14.74
8	1	2	2	1	8	304.77	311	2.00	2.01	377.33	19.23	-15.02
9	1	2	2	2	1	283.75	307	7.57	19.75	301.19	5.79	5.80
10	1	2	2	2	2	296.80	308	3.64	20.45	314.39	5.59	6.63
11	1	2	2	2	4	303.71	310	2.03	2.26	340.77	10.88	-14.74
12	1	2	2	2	8	307.71	314	2.00	2.01	393.55	21.81	-15.02
13	1	2	2	4	1	305.82	313	2.29	2.83	333.62	8.33	-14.06
14	1	2	2	4	2	307.28	314	2.14	2.49	346.82	11.40	-14.46
15	1	2	2	4	4	309.57	316	2.03	2.26	373.20	17.05	-14.74
16	1	2	2	4	8	313.59	320	2.00	2.01	425.98	26.38	-15.02
17	1	2	4	0.5	1	250.69	302.5	17.13	26.79	276.87	9.45	14.06
18	1	2	4	0.5	2	266.69	303.5	12.13	26.10	290.06	8.06	13.25
19	1	2	4	0.5	4	295.33	305.5	3.33	19.56	316.45	6.67	5.57
20	1	2	4	0.5	8	303.31	309.5	2.00	2.00	369.22	17.85	-15.03
21	1	2	4	1	1	263.96	304	13.17	25.81	284.98	7.38	12.91
22	1	2	4	1	2	279.36	305	8.41	25.29	298.17	6.31	12.31
23	1	2	4	1	4	300.78	307	2.02	2.22	324.56	7.32	-14.78
24	1	2	4	1	8	304.78	311	2.00	2.00	377.33	19.23	-15.03
25	1	2	4	2	1	283.75	307	7.57	19.75	301.19	5.79	5.80
26	1	2	4	2	2	296.99	308	3.57	19.71	314.39	5.53	5.76
27	1	2	4	2	4	303.72	310	2.03	2.22	340.77	10.87	-14.78
28	1	2	4	2	8	307.72	314	2.00	2.00	393.55	21.81	-15.03
29	1	2	4	4	1	305.88	313	2.28	2.59	333.62	8.32	-14.34
30	1	2	4	4	2	307.31	314	2.13	2.33	346.82	11.39	-14.65
31	1	2	4	4	4	309.59	316	2.03	2.22	373.20	17.05	-14.78
32	1	2	4	4	8	313.60	320	2.00	2.00	425.98	26.38	-15.03
33	1	2	8	0.5	1	250.69	302.5	17.13	26.79	276.87	9.45	14.06
34	1	2	8	0.5	2	266.69	303.5	12.13	26.10	290.06	8.06	13.25
35	1	2	8	0.5	4	295.33	305.5	3.33	19.56	316.45	6.67	5.57
36	1	2	8	0.5	8	303.31	309.5	2.00	2.00	369.22	17.85	-15.04
37	1	2	8	1	1	263.96	304	13.17	25.81	284.98	7.38	12.91
38	1	2	8	1	2	279.36	305	8.41	25.29	298.17	6.31	12.31
39	1	2	8	1	4	300.78	307	2.02	2.22	324.56	7.32	-14.78
40	1	2	8	1	8	304.78	311	2.00	2.00	377.33	19.23	-15.04
41	1	2	8	2	1	283.75	307	7.57	19.75	301.19	5.79	5.80
42	1	2	8	2	2	296.99	308	3.57	19.71	314.39	5.53	5.76
43	1	2	8	2	4	303.72	310	2.03	2.22	340.77	10.87	-14.78
44	1	2	8	2	8	307.72	314	2.00	2.00	393.55	21.81	-15.04
45	1	2	8	4	1	305.88	313	2.28	2.59	333.62	8.32	-14.34
46	1	2	8	4	2	307.31	314	2.13	2.33	346.82	11.39	-14.65
47	1	2	8	4	4	309.59	316	2.03	2.22	373.20	17.05	-14.78
48	1	2	8	4	8	313.60	320	2.00	2.00	425.98	26.38	-15.04
49	1	4	2	0.5	1	250.69	302.5	17.13	26.79	276.87	9.45	14.06
50	1	4	2	0.5	2	266.69	303.5	12.13	26.10	290.06	8.06	13.25
51	1	4	2	0.5	4	295.33	305.5	3.33	19.56	316.45	6.67	5.57
52	1	4	2	0.5	8	303.31	309.5	2.00	2.00	369.22	17.85	-15.03
53	1	4	2	1	1	263.96	304	13.17	25.81	284.98	7.38	12.91
54	1	4	2	1	2	279.36	305	8.41	25.29	298.17	6.31	12.31
55	1	4	2	1	4	300.78	307	2.02	2.22	324.56	7.32	-14.78
56	1	4	2	1	8	304.78	311	2.00	2.00	377.33	19.23	-15.03
57	1	4	2	2	1	283.75	307	7.57	19.75	301.19	5.79	5.80
58	1	4	2	2	2	296.99	308	3.57	19.71	314.39	5.53	5.76
59	1	4	2	2	4	303.72	310	2.03	2.22	340.77	10.87	-14.78
60	1	4	2	2	8	307.72	314	2.00	2.00	393.55	21.81	-15.03
61	1	4	2	4	1	305.88	313	2.28	2.59	333.62	8.32	-14.34
62	1	4	2	4	2	307.31	314	2.13	2.33	346.82	11.39	-14.65
63	1	4	2	4	4	309.59	316	2.03	2.22	373.20	17.05	-14.78
64	1	4	2	4	8	313.60	320	2.00	2.00	425.98	26.38	-15.03
65	1	4	4	0.5	1	250.69	302.5	17.13	26.79	276.87	9.45	14.06
66	1	4	4	0.5	2	266.69	303.5	12.13	26.10	290.06	8.06	13.25
67	1	4	4	0.5	4	295.33	305.5	3.33	19.56	316.45	6.67	5.57
68	1	4	4	0.5	8	303.31	309.5	2.00	2.00	369.22	17.85	-15.04
69	1	4	4	1	1	263.96	304	13.17	25.81	284.98	7.38	12.91
70	1	4	4	1	2	279.36	305	8.41	25.29	298.17	6.31	12.31
71	1	4	4	1	4	300.78	307	2.02	2.22	324.56	7.32	-14.78
72	1	4	4	1	8	304.78	311	2.00	2.00	377.33	19.23	-15.04

Table 1: Results for $N = 3$

	p	r	R	q	Q	optimal cost	traditional cost	% savings (w.r.t. trad.)	% energy sav. (w.r.t. trad.)	alternative cost	% savings (w.r.t. alt.)	% energy s (w.r.t. alt.)
73	1	4	4	2	1	283.75	307	7.57	19.75	301.19	5.79	5.80
74	1	4	4	2	2	296.99	308	3.57	19.71	314.39	5.53	5.76
75	1	4	4	2	4	303.72	310	2.03	2.22	340.77	10.87	-14.78
76	1	4	4	2	8	307.72	314	2.00	2.00	393.55	21.81	-15.04
77	1	4	4	4	1	305.88	313	2.28	2.59	333.62	8.32	-14.34
78	1	4	4	4	2	307.31	314	2.13	2.33	346.82	11.39	-14.65
79	1	4	4	4	4	309.59	316	2.03	2.22	373.20	17.05	-14.78
80	1	4	4	4	8	313.60	320	2.00	2.00	425.98	26.38	-15.04
81	1	4	8	0.5	1	250.69	302.5	17.13	26.79	276.87	9.45	14.06
82	1	4	8	0.5	2	266.69	303.5	12.13	26.10	290.06	8.06	13.25
83	1	4	8	0.5	4	295.33	305.5	3.33	19.56	316.45	6.67	5.57
84	1	4	8	0.5	8	303.31	309.5	2.00	2.00	369.22	17.85	-15.04
85	1	4	8	1	1	263.96	304	13.17	25.81	284.98	7.38	12.91
86	1	4	8	1	2	279.36	305	8.41	25.29	298.17	6.31	12.31
87	1	4	8	1	4	300.78	307	2.02	2.22	324.56	7.32	-14.78
88	1	4	8	1	8	304.78	311	2.00	2.00	377.33	19.23	-15.04
89	1	4	8	2	1	283.75	307	7.57	19.75	301.19	5.79	5.80
90	1	4	8	2	2	296.99	308	3.57	19.71	314.39	5.53	5.76
91	1	4	8	2	4	303.72	310	2.03	2.22	340.77	10.87	-14.78
92	1	4	8	2	8	307.72	314	2.00	2.00	393.55	21.81	-15.04
93	1	4	8	4	1	305.88	313	2.28	2.59	333.62	8.32	-14.34
94	1	4	8	4	2	307.31	314	2.13	2.33	346.82	11.39	-14.65
95	1	4	8	4	4	309.59	316	2.03	2.22	373.20	17.05	-14.78
96	1	4	8	4	8	313.60	320	2.00	2.00	425.98	26.38	-15.04
97	2	2	2	0.5	1	467.07	602.5	22.48	28.76	532.45	12.28	16.38
98	2	2	2	0.5	2	485.77	603.5	19.51	28.26	545.64	10.97	15.79
99	2	2	2	0.5	4	515.69	605.5	14.83	29.21	572.03	9.85	16.91
100	2	2	2	0.5	8	558.30	609.5	8.40	33.31	624.80	10.64	21.72
101	2	2	2	1	1	483.43	604	19.96	28.12	540.55	10.57	15.62
102	2	2	2	1	2	500.77	605	17.23	28.47	553.75	9.57	16.03
103	2	2	2	1	4	527.11	607	13.16	31.89	580.13	9.14	20.05
104	2	2	2	1	8	564.48	611	7.61	30.82	632.91	10.81	18.80
105	2	2	2	2	1	510.09	607	15.97	28.09	556.77	8.38	15.59
106	2	2	2	2	2	523.94	608	13.83	30.02	569.96	8.07	17.85
107	2	2	2	2	4	546.26	610	10.45	32.42	596.35	8.40	20.68
108	2	2	2	2	8	570.80	614	7.04	30.06	649.12	12.07	17.90
109	2	2	2	4	1	544.97	613	11.10	27.49	589.20	7.51	14.89
110	2	2	2	4	2	552.12	614	10.08	27.35	602.39	8.35	14.72
111	2	2	2	4	4	564.85	616	8.30	29.21	628.78	10.17	16.90
112	2	2	2	4	8	579.72	620	6.50	32.23	681.55	14.94	20.45
113	2	2	4	0.5	1	467.07	602.5	22.48	28.76	532.45	12.28	16.38
114	2	2	4	0.5	2	485.92	603.5	19.48	27.66	545.64	10.94	15.09
115	2	2	4	0.5	4	519.60	605.5	14.19	26.90	572.03	9.16	14.19
116	2	2	4	0.5	8	575.41	609.5	5.59	26.22	624.80	7.90	13.40
117	2	2	4	1	1	483.47	604	19.96	28.00	540.55	10.56	15.48
118	2	2	4	1	2	501.39	605	17.12	26.78	553.75	9.45	14.06
119	2	2	4	1	4	533.37	607	12.13	26.17	580.13	8.06	13.34
120	2	2	4	1	8	586.57	611	4.00	29.90	632.91	7.32	17.71
121	2	2	4	2	1	510.82	607	15.85	26.02	556.77	8.25	13.16
122	2	2	4	2	2	527.93	608	13.17	25.81	569.96	7.38	12.92
123	2	2	4	2	4	557.61	610	8.59	26.23	596.35	6.50	13.40
124	2	2	4	2	8	598.90	614	2.46	27.06	649.12	7.74	14.39
125	2	2	4	4	1	554.04	613	9.62	19.77	589.20	5.97	5.82
126	2	2	4	4	2	566.09	614	7.80	20.58	602.39	6.03	6.78
127	2	2	4	4	4	586.88	616	4.73	22.77	628.78	6.66	9.34
128	2	2	4	4	8	607.04	620	2.09	2.98	681.55	10.93	-13.88
129	2	2	8	0.5	1	467.07	602.5	22.48	28.76	532.45	12.28	16.38
130	2	2	8	0.5	2	485.92	603.5	19.48	27.66	545.64	10.94	15.09
131	2	2	8	0.5	4	519.60	605.5	14.19	26.89	572.03	9.16	14.18
132	2	2	8	0.5	8	578.64	609.5	5.06	19.56	624.80	7.39	5.57
133	2	2	8	1	1	483.47	604	19.96	28.00	540.55	10.56	15.48
134	2	2	8	1	2	501.39	605	17.12	26.78	553.75	9.45	14.06
135	2	2	8	1	4	533.38	607	12.13	26.10	580.13	8.06	13.25
136	2	2	8	1	8	590.68	611	3.33	19.56	632.91	6.67	5.57
137	2	2	8	2	1	510.82	607	15.84	26.02	556.77	8.25	13.16
138	2	2	8	2	2	527.93	608	13.17	25.81	569.96	7.37	12.91
139	2	2	8	2	4	558.74	610	8.40	25.29	596.35	6.31	12.31
140	2	2	8	2	8	601.58	614	2.02	2.22	649.12	7.32	-14.78
141	2	2	8	4	1	554.04	613	9.62	19.76	589.20	5.97	5.82
142	2	2	8	4	2	567.52	614	7.57	19.75	602.39	5.79	5.80
143	2	2	8	4	4	593.99	616	3.57	19.71	628.78	5.53	5.76
144	2	2	8	4	8	607.45	620	2.02	2.22	681.55	10.87	-14.78

Table 2: Results for $N = 3$ (continued)

	p	r	R	q	Q	optimal cost	traditional cost	% savings (w.r.t. trad.)	% energy sav. (w.r.t. trad.)	alternative cost	% savings (w.r.t. alt.)	% energy s (w.r.t. alt.)
145	2	4	2	0.5	1	467.07	602.5	22.48	28.76	532.45	12.28	16.38
146	2	4	2	0.5	2	485.92	603.5	19.48	27.66	545.64	10.94	15.09
147	2	4	2	0.5	4	519.60	605.5	14.19	26.90	572.03	9.16	14.19
148	2	4	2	0.5	8	577.35	609.5	5.27	24.72	624.80	7.59	11.63
149	2	4	2	1	1	483.47	604	19.96	28.00	540.55	10.56	15.48
150	2	4	2	1	2	501.39	605	17.12	26.78	553.75	9.45	14.06
151	2	4	2	1	4	533.38	607	12.13	26.13	580.13	8.06	13.29
152	2	4	2	1	8	589.64	611	3.50	21.31	632.91	6.84	7.63
153	2	4	2	2	1	510.82	607	15.84	26.02	556.77	8.25	13.16
154	2	4	2	2	2	527.93	608	13.17	25.81	569.96	7.37	12.91
155	2	4	2	2	4	557.92	610	8.54	25.73	596.35	6.44	12.81
156	2	4	2	2	8	601.46	614	2.04	2.40	649.12	7.34	-14.57
157	2	4	2	4	1	554.04	613	9.62	19.76	589.20	5.97	5.82
158	2	4	2	4	2	566.10	614	7.80	20.54	602.39	6.02	6.73
159	2	4	2	4	4	589.41	616	4.32	20.51	628.78	6.26	6.69
160	2	4	2	4	8	607.31	620	2.05	2.47	681.55	10.89	-14.48
161	2	4	4	0.5	1	467.07	602.5	22.48	28.76	532.45	12.28	16.38
162	2	4	4	0.5	2	485.92	603.5	19.48	27.66	545.64	10.94	15.09
163	2	4	4	0.5	4	519.60	605.5	14.19	26.89	572.03	9.16	14.18
164	2	4	4	0.5	8	578.52	609.5	5.08	20.75	624.80	7.41	6.98
165	2	4	4	1	1	483.47	604	19.96	28.00	540.55	10.56	15.48
166	2	4	4	1	2	501.39	605	17.12	26.78	553.75	9.45	14.06
167	2	4	4	1	4	533.38	607	12.13	26.10	580.13	8.06	13.25
168	2	4	4	1	8	590.49	611	3.36	19.68	632.91	6.70	5.72
169	2	4	4	2	1	510.82	607	15.84	26.02	556.77	8.25	13.16
170	2	4	4	2	2	527.93	608	13.17	25.81	569.96	7.37	12.91
171	2	4	4	2	4	558.74	610	8.40	25.29	596.35	6.31	12.31
172	2	4	4	2	8	601.56	614	2.03	2.25	649.12	7.33	-14.74
173	2	4	4	4	1	554.04	613	9.62	19.76	589.20	5.97	5.82
174	2	4	4	4	2	567.52	614	7.57	19.75	602.39	5.79	5.80
175	2	4	4	4	4	593.61	616	3.63	20.45	628.78	5.59	6.63
176	2	4	4	4	8	607.42	620	2.03	2.25	681.55	10.88	-14.74
177	2	4	8	0.5	1	467.07	602.5	22.48	28.76	532.45	12.28	16.38
178	2	4	8	0.5	2	485.92	603.5	19.48	27.66	545.64	10.94	15.09
179	2	4	8	0.5	4	519.60	605.5	14.19	26.89	572.03	9.16	14.18
180	2	4	8	0.5	8	578.64	609.5	5.06	19.56	624.80	7.39	5.57
181	2	4	8	1	1	483.47	604	19.96	28.00	540.55	10.56	15.48
182	2	4	8	1	2	501.39	605	17.12	26.78	553.75	9.45	14.06
183	2	4	8	1	4	533.38	607	12.13	26.10	580.13	8.06	13.25
184	2	4	8	1	8	590.68	611	3.33	19.56	632.91	6.67	5.57
185	2	4	8	2	1	510.82	607	15.84	26.02	556.77	8.25	13.16
186	2	4	8	2	2	527.93	608	13.17	25.81	569.96	7.37	12.91
187	2	4	8	2	4	558.74	610	8.40	25.29	596.35	6.31	12.31
188	2	4	8	2	8	601.58	614	2.02	2.22	649.12	7.32	-14.78
189	2	4	8	4	1	554.04	613	9.62	19.76	589.20	5.97	5.82
190	2	4	8	4	2	567.52	614	7.57	19.75	602.39	5.79	5.80
191	2	4	8	4	4	593.99	616	3.57	19.71	628.78	5.53	5.76
192	2	4	8	4	8	607.45	620	2.02	2.22	681.55	10.87	-14.78
193	4	2	2	0.5	1	813.52	1202.5	32.35	53.37	1043.60	21.06	45.93
194	4	2	2	0.5	2	834.20	1203.5	30.69	53.93	1056.79	20.33	48.68
195	4	2	2	0.5	4	862.98	1205.5	28.41	56.28	1083.18	20.66	49.21
196	4	2	2	0.5	8	901.28	1209.5	25.48	56.73	1135.95	20.83	45.89
197	4	2	2	1	1	832.62	1204	30.85	53.90	1051.71	20.18	48.15
198	4	2	2	1	2	849.97	1205	29.46	55.83	1064.90	19.81	49.58
199	4	2	2	1	4	875.09	1207	27.50	57.04	1091.29	20.66	49.79
200	4	2	2	1	8	907.75	1211	25.04	57.22	1144.06	19.51	49.59
201	4	2	2	2	1	859.58	1207	28.78	57.05	1067.92	19.24	49.78
202	4	2	2	2	2	873.12	1208	27.72	57.22	1081.12	19.39	49.94
203	4	2	2	2	4	892.76	1210	26.22	57.35	1107.50	20.89	53.43
204	4	2	2	2	8	917.84	1214	24.40	60.33	1160.28	18.90	50.46
205	4	2	2	4	1	892.41	1213	26.43	57.79	1100.35	19.07	49.41
206	4	2	2	4	2	901.20	1214	25.77	56.90	1113.55	19.75	50.49
207	4	2	2	4	4	914.83	1216	24.77	57.82	1139.93	22.37	60.71
208	4	2	2	4	8	925.93	1220	24.10	66.53	1192.71	18.53	39.13
209	4	2	4	0.5	1	850.23	1202.5	29.29	48.14	1043.60	17.29	39.53
210	4	2	4	0.5	2	874.03	1203.5	27.38	48.49	1056.79	16.05	38.85
211	4	2	4	0.5	4	909.37	1205.5	24.56	47.90	1083.18	15.55	35.09
212	4	2	4	0.5	8	959.27	1209.5	20.69	44.70	1135.95	17.00	40.07
213	4	2	4	1	1	872.92	1204	27.50	48.95	1051.71	16.12	39.38
214	4	2	4	1	2	893.27	1205	25.87	48.35	1064.90	15.21	36.68
215	4	2	4	1	4	925.29	1207	23.34	46.06	1091.29	15.27	35.09
216	4	2	4	1	8	969.39	1211	19.95	44.70	1144.06	15.17	38.10

Table 3: Results for $N = 3$ (continued)

	p	r	R	q	Q	optimal cost	traditional cost	% savings (w.r.t. trad.)	% energy sav. (w.r.t. trad.)	alternative cost	% savings (w.r.t. alt.)	% energy s (w.r.t. alt.)
217	4	2	4	2	1	905.95	1207	24.94	47.27	1067.92	14.63	36.48
218	4	2	4	2	2	922.98	1208	23.59	45.89	1081.12	14.31	33.84
219	4	2	4	2	4	949.03	1210	21.57	43.64	1107.50	15.17	36.15
220	4	2	4	2	8	984.28	1214	18.92	45.61	1160.28	13.82	34.29
221	4	2	4	4	1	948.24	1213	21.83	44.02	1100.35	13.71	35.09
222	4	2	4	4	2	960.86	1214	20.85	44.70	1113.55	14.01	36.07
223	4	2	4	4	4	980.25	1216	19.39	45.53	1139.93	15.51	37.25
224	4	2	4	4	8	1007.66	1220	17.40	46.54	1192.71	15.30	24.40
225	4	2	8	0.5	1	883.97	1202.5	26.49	35.60	1043.60	13.89	22.96
226	4	2	8	0.5	2	910.05	1203.5	24.38	34.37	1056.79	12.42	22.73
227	4	2	8	0.5	4	948.64	1205.5	21.31	34.17	1083.18	11.23	25.50
228	4	2	8	0.5	8	1008.43	1209.5	16.62	36.53	1135.95	13.71	21.85
229	4	2	8	1	1	907.49	1204	24.63	33.42	1051.71	12.65	21.51
230	4	2	8	1	2	930.18	1205	22.81	33.13	1064.90	11.54	22.97
231	4	2	8	1	4	965.31	1207	20.02	34.37	1091.29	10.67	25.89
232	4	2	8	1	8	1022.00	1211	15.61	36.86	1144.06	11.79	20.82
233	4	2	8	2	1	941.98	1207	21.96	32.55	1067.92	11.05	20.52
234	4	2	8	2	2	961.64	1208	20.39	32.29	1081.12	10.18	20.18
235	4	2	8	2	4	994.73	1210	17.79	32.00	1107.50	10.05	24.70
236	4	2	8	2	8	1043.68	1214	14.03	35.85	1160.28	9.69	20.23
237	4	2	8	4	1	993.70	1213	18.08	32.04	1100.35	9.26	19.95
238	4	2	8	4	2	1010.39	1214	16.77	31.80	1113.55	8.85	24.30
239	4	2	8	4	4	1039.10	1216	14.55	35.51	1139.93	9.46	25.35
240	4	2	8	4	8	1079.85	1220	11.49	36.41	1192.71	15.05	18.71
241	4	4	2	0.5	1	886.56	1202.5	26.27	30.75	1043.60	13.60	19.39
242	4	4	2	0.5	2	913.09	1203.5	24.13	31.32	1056.79	12.30	18.88
243	4	4	2	0.5	4	949.95	1205.5	21.20	30.90	1083.18	11.78	21.19
244	4	4	2	0.5	8	1002.19	1209.5	17.14	32.86	1135.95	13.45	17.38
245	4	4	2	1	1	910.25	1204	24.40	29.61	1051.71	12.41	18.80
246	4	4	2	1	2	932.74	1205	22.59	30.82	1064.90	11.58	19.17
247	4	4	2	1	4	964.90	1207	20.06	31.14	1091.29	11.37	21.11
248	4	4	2	1	8	1014.03	1211	16.27	32.80	1144.06	11.56	17.24
249	4	4	2	2	1	944.47	1207	21.75	29.50	1067.92	10.93	20.02
250	4	4	2	2	2	962.98	1208	20.28	31.86	1081.12	10.58	21.12
251	4	4	2	2	4	990.34	1210	18.15	32.80	1107.50	10.83	22.72
252	4	4	2	2	8	1034.63	1214	14.78	34.17	1160.28	9.74	23.52
253	4	4	2	4	1	993.17	1213	18.12	34.85	1100.35	9.65	23.48
254	4	4	2	4	2	1006.13	1214	17.12	34.81	1113.55	9.76	23.36
255	4	4	2	4	4	1028.62	1216	15.41	34.71	1139.93	10.40	25.09
256	4	4	2	4	8	1068.70	1220	12.40	36.18	1192.71	15.05	18.71
257	4	4	4	0.5	1	886.56	1202.5	26.27	30.75	1043.60	13.53	17.53
258	4	4	4	0.5	2	913.76	1203.5	24.07	29.74	1056.79	11.86	15.66
259	4	4	4	0.5	4	954.72	1205.5	20.80	28.15	1083.18	10.40	17.19
260	4	4	4	0.5	8	1017.87	1209.5	15.84	29.45	1135.95	13.44	17.24
261	4	4	4	1	1	910.33	1204	24.39	29.49	1051.71	12.28	16.38
262	4	4	4	1	2	934.16	1205	22.48	28.76	1064.90	10.97	15.79
263	4	4	4	1	4	971.55	1207	19.51	28.26	1091.29	9.85	16.91
264	4	4	4	1	8	1031.39	1211	14.83	29.21	1144.06	11.45	16.19
265	4	4	4	2	1	945.69	1207	21.65	28.60	1067.92	10.57	15.62
266	4	4	4	2	2	966.88	1208	19.96	28.12	1081.12	9.57	16.03
267	4	4	4	2	4	1001.56	1210	17.23	28.47	1107.50	9.14	20.05
268	4	4	4	2	8	1054.24	1214	13.16	31.89	1160.28	8.92	14.61
269	4	4	4	4	1	1002.20	1213	17.38	27.25	1100.35	8.38	15.59
270	4	4	4	4	2	1020.19	1214	15.96	28.09	1113.55	8.07	17.85
271	4	4	4	4	4	1047.90	1216	13.82	30.01	1139.93	8.40	20.68
272	4	4	4	4	8	1092.52	1220	10.45	32.42	1192.71	15.05	18.71
273	4	4	8	0.5	1	886.56	1202.5	26.27	30.75	1043.60	13.53	17.53
274	4	4	8	0.5	2	913.76	1203.5	24.07	29.74	1056.79	11.85	15.32
275	4	4	8	0.5	4	954.85	1205.5	20.79	27.86	1083.18	9.89	14.31
276	4	4	8	0.5	8	1023.58	1209.5	15.37	27.00	1135.95	13.44	17.24
277	4	4	8	1	1	910.33	1204	24.39	29.49	1051.71	12.28	16.38
278	4	4	8	1	2	934.16	1205	22.48	28.76	1064.90	10.94	15.09
279	4	4	8	1	4	971.85	1207	19.48	27.66	1091.29	9.16	14.19
280	4	4	8	1	8	1039.21	1211	14.19	26.89	1144.06	11.44	16.16
281	4	4	8	2	1	945.71	1207	21.65	28.58	1067.92	10.56	15.48
282	4	4	8	2	2	966.95	1208	19.95	28.00	1081.12	9.45	14.06
283	4	4	8	2	4	1002.80	1210	17.12	26.78	1107.50	8.06	13.34
284	4	4	8	2	8	1066.75	1214	12.13	26.17	1160.28	8.91	14.24
285	4	4	8	4	1	1002.33	1213	17.37	26.94	1100.35	8.25	13.16
286	4	4	8	4	2	1021.65	1214	15.84	26.02	1113.55	7.38	12.92
287	4	4	8	4	4	1055.86	1216	13.17	25.81	1139.93	6.50	13.40
288	4	4	8	4	8	1115.23	1220	8.59	26.22	1192.71	11.25	11.09

Table 4: Results for $N = 3$ (continued)

	optimal				Heuristic 1			Heuristic 2		Heuristic 3		Decomposition Heuristic			
	time (sec)	total cost	energy cost	switch. cost	time (sec)	total cost	energy cost	total cost	energy cost	total cost	energy cost	time (sec)	total cost	energy cost	switch. cost
1	136.78	178.21	161.80	16.41	0.06	192.32	177.63	179.94	168.70	188.98	153.52	0.83	178.52	162.31	16.21
2	137.91	186.53	167.09	19.44	0.06	201.97	177.67	187.11	168.74	210.41	153.61	0.83	191.96	181.77	10.19
3	138.16	198.32	187.78	10.53	0.06	221.27	177.73	201.41	168.79	253.25	153.73	0.83	198.64	193.77	4.87
4	139.17	202.54	193.77	8.76	0.06	259.88	177.85	230.05	168.89	338.94	153.88	0.83	202.54	193.77	8.76
5	135.95	183.63	164.62	19.01	0.05	197.43	177.65	184.09	168.72	203.20	153.58	0.83	191.07	175.16	15.91
6	137.05	191.16	168.23	22.93	0.06	207.08	177.68	191.24	168.75	224.62	153.65	0.83	197.67	193.77	3.90
7	138.36	199.62	193.76	5.85	0.06	226.38	177.75	205.56	168.81	267.47	153.76	0.83	199.62	193.77	5.84
8	138.94	203.51	193.77	9.74	0.05	264.98	177.86	234.19	168.90	353.15	153.90	0.83	203.51	193.77	9.74
9	137.08	192.27	169.02	23.25	0.05	207.65	177.68	192.38	168.75	231.64	153.67	0.83	198.62	193.33	5.29
10	137.97	199.42	168.91	30.08	0.06	217.30	177.72	199.53	168.78	253.06	153.73	0.83	199.62	193.77	5.84
11	139.16	201.56	193.76	7.80	0.05	236.60	177.78	213.84	168.83	295.90	153.81	0.83	201.56	193.77	7.79
12	138.92	205.46	193.77	11.69	0.06	275.21	177.88	242.47	168.92	381.59	153.93	0.83	205.46	193.77	11.69
13	138.17	202.47	193.28	9.18	0.06	228.09	177.75	208.94	168.81	288.50	153.80	0.83	202.50	193.33	9.17
14	138.19	203.50	193.69	9.81	0.05	237.74	177.78	216.10	168.83	309.93	153.83	0.81	203.50	193.76	9.75
15	138.38	205.46	193.76	11.69	0.06	257.04	177.83	230.42	168.89	352.77	153.90	0.83	205.46	193.77	11.69
16	138.94	209.35	193.77	15.58	0.06	295.65	177.92	259.05	168.97	438.47	153.98	0.83	209.35	193.77	15.58
17	135.17	178.21	161.80	16.41	0.05	192.32	177.63	179.94	168.70	188.98	153.52	0.84	178.52	162.31	16.21
18	136.59	186.53	167.09	19.44	0.05	201.97	177.67	187.11	168.74	210.41	153.61	0.84	191.96	181.77	10.19
19	138.41	198.32	187.78	10.53	0.05	221.27	177.73	201.41	168.79	253.25	153.73	0.84	198.64	193.77	4.87
20	138.88	202.54	193.77	8.76	0.06	259.88	177.85	230.05	168.89	338.94	153.88	0.84	202.54	193.77	8.76
21	135.92	183.63	164.62	19.01	0.06	197.43	177.65	184.09	168.72	203.20	153.58	0.84	191.07	175.16	15.91
22	137.05	191.16	168.23	22.93	0.05	207.08	177.68	191.24	168.75	224.62	153.65	0.84	197.67	193.77	3.90
23	138.30	199.62	193.76	5.85	0.06	226.38	177.75	205.56	168.81	267.47	153.76	0.86	199.62	193.77	5.84
24	138.84	203.51	193.77	9.74	0.06	264.98	177.86	234.19	168.90	353.15	153.90	0.84	203.51	193.77	9.74
25	137.05	192.27	169.02	23.25	0.06	207.65	177.68	192.38	168.75	231.64	153.67	0.84	198.62	193.33	5.29
26	137.91	199.42	169.06	30.36	0.06	217.30	177.72	199.53	168.78	253.06	153.73	0.84	199.62	193.77	5.84
27	138.36	201.56	193.76	7.80	0.05	236.60	177.78	213.84	168.83	295.90	153.81	0.84	201.56	193.77	7.79
28	138.88	205.46	193.77	11.69	0.05	275.21	177.88	242.47	168.92	381.59	153.93	0.84	205.46	193.77	11.69
29	138.16	202.47	193.29	9.18	0.06	228.09	177.75	208.94	168.81	288.50	153.80	0.84	202.50	193.33	9.17
30	138.53	203.51	193.69	9.81	0.05	237.74	177.78	216.10	168.83	309.93	153.83	0.84	203.50	193.76	9.75
31	138.34	205.46	193.76	11.69	0.05	257.04	177.83	230.42	168.89	352.77	153.90	0.84	205.46	193.77	11.69
32	138.95	209.35	193.77	15.58	0.06	295.65	177.92	259.05	168.97	438.47	153.98	0.86	209.35	193.77	15.58
33	135.17	178.21	161.80	16.41	0.05	192.32	177.63	179.94	168.70	188.98	153.52	0.89	178.52	162.31	16.21
34	136.52	186.53	167.09	19.44	0.06	201.97	177.67	187.11	168.74	210.41	153.61	0.89	191.96	181.77	10.19
35	138.09	198.32	187.78	10.53	0.06	221.27	177.73	201.41	168.79	253.25	153.73	0.89	198.64	193.77	4.87
36	138.86	202.54	193.77	8.76	0.06	259.88	177.85	230.05	168.89	338.94	153.88	0.88	202.54	193.77	8.76
37	135.97	183.63	164.62	19.01	0.06	197.43	177.65	184.09	168.72	203.20	153.58	0.88	191.07	175.16	15.91
38	137.06	191.16	168.23	22.93	0.06	207.08	177.68	191.24	168.75	224.62	153.65	0.88	197.67	193.77	3.90
39	138.36	199.62	193.76	5.85	0.06	226.38	177.75	205.56	168.81	267.47	153.76	0.88	199.62	193.77	5.84
40	138.86	203.51	193.77	9.74	0.06	264.98	177.86	234.19	168.90	353.15	153.90	0.89	203.51	193.77	9.74
41	137.05	192.27	169.02	23.25	0.06	207.65	177.68	192.38	168.75	231.64	153.67	0.89	198.62	193.33	5.29
42	137.98	199.42	169.06	30.36	0.05	217.30	177.72	199.53	168.78	253.06	153.73	0.89	199.62	193.77	5.84
43	138.34	201.56	193.76	7.80	0.05	236.60	177.78	213.84	168.83	295.90	153.81	0.89	201.56	193.77	7.79
44	138.92	205.46	193.77	11.69	0.06	275.21	177.88	242.47	168.92	381.59	153.93	0.88	205.46	193.77	11.69
45	138.13	202.47	193.29	9.18	0.05	228.09	177.75	208.94	168.81	288.50	153.80	0.88	202.50	193.33	9.17
46	138.22	203.51	193.69	9.81	0.06	237.74	177.78	216.10	168.83	309.93	153.83	0.88	203.50	193.76	9.75
47	138.33	205.46	193.76	11.69	0.06	257.04	177.83	230.42	168.89	352.77	153.90	0.88	205.46	193.77	11.69
48	138.86	209.35	193.77	15.58	0.05	295.65	177.92	259.05	168.97	438.47	153.98	0.88	209.35	193.77	15.58
49	135.17	178.21	161.80	16.41	0.05	192.32	177.63	179.94	168.70	188.98	153.52	0.88	178.52	162.31	16.21
50	136.44	186.53	167.09	19.44	0.05	201.97	177.67	187.11	168.74	210.41	153.61	0.86	191.96	181.77	10.19
51	137.81	198.32	187.78	10.53	0.05	221.27	177.73	201.41	168.79	253.25	153.73	0.86	198.64	193.77	4.87
52	138.33	202.54	193.77	8.76	0.05	259.88	177.85	230.05	168.89	338.94	153.88	0.86	202.54	193.77	8.76
53	135.92	183.63	164.62	19.01	0.06	197.43	177.65	184.09	168.72	203.20	153.58	0.88	191.07	175.16	15.91
54	136.97	191.16	168.23	22.93	0.06	207.08	177.68	191.24	168.75	224.62	153.65	0.88	197.67	193.77	3.90
55	138.08	199.62	193.76	5.85	0.05	226.38	177.75	205.56	168.81	267.47	153.76	0.86	199.62	193.77	5.84
56	138.41	203.51	193.77	9.74	0.05	264.98	177.86	234.19	168.90	353.15	153.90	0.88	203.51	193.77	9.74
57	137.13	192.27	169.02	23.25	0.05	207.65	177.68	192.38	168.75	231.64	153.67	0.88	198.62	193.33	5.29
58	137.80	199.42	169.06	30.36	0.06	217.30	177.72	199.53	168.78	253.06	153.73	0.88	199.62	193.77	5.84
59	138.06	201.56	193.76	7.80	0.06	236.60	177.78	213.84	168.83	295.90	153.81	0.88	201.56	193.77	7.79
60	138.33	205.46	193.77	11.69	0.05	275.21	177.88	242.47	168.92	381.59	153.93	0.88	205.46	193.77	11.69
61	138.05	202.47	193.29	9.18	0.05	228.09	177.75	208.94	168.81	288.50	153.80	0.88	202.50	193.33	9.17
62	138.02	203.51	193.69	9.81	0.06	237.74	177.78	216.10	168.83	309.93	153.83	0.88	203.50	193.76	9.75
63	138.09	205.46	193.76	11.69	0.06	257.04	177.83	230.42	168.89	352.77	153.90	0.88	205.46	193.77	11.69
64	138.33	209.35	193.77	15.58	0.06	295.65	177.92	259.05	168.97	438.47	153.98	0.86	209.35	193.77	15.58
65	135.16	178.21	161.80	16.41	0.06	192.32	177.63	179.94	168.70	188.98	153.52	0.89	178.52	162.31	16.21
66	136.44	186.53	167.09	19.44	0.06	201.97	177.67	187.11	168.74	210.41	153.61	0.89	191.96	181.77	10.19
67	137.80	198.32	187.78	10.53	0.06	221.27	177.73	201.41	168.79	253.25	153.73	0.89	198.64	193.77	4.87
68	138.33	202.54	193.77	8.76	0.05	259.88	177.85	230.05	168.89	338.94	153.88	0.89	202.54	193.77	8.76
69	135.91	183.63	164.62	19.01	0.05	197.43	177.65	184.09	168.72	203.20	153.58	0.88	191.07	175.16	15.91
70	136.97	191.16	168.23	22.93	0.05	207.08	177.68	191.24	168.75	224.62	153.65	0.89	197.67	193.77	3.90
71	138.06	199.62	193.76	5.85	0.06	226.38	177.75	205.56	168.81	267.47	153.76	0.89	199.62	193.77	5.84
72	138.33	203.51	193.77	9.74	0.06	264.98	177.86	234.19	168.90	353.15	153.90	0.89	203.51	193.77	9.74

	optimal				Heuristic 1			Heuristic 2		Heuristic 3		Decomposition Heuristic			
	time (sec)	total cost	energy cost	switch. cost	time (sec)	total cost	energy cost	total cost	energy cost	total cost	energy cost	time (sec)	total cost	energy cost	switch. cost
73	136.95	192.27	169.02	23.25	0.06	207.65	177.68	192.38	168.75	231.64	153.67	0.89	198.62	193.33	5.29
74	137.74	199.42	169.06	30.36	0.05	217.30	177.72	199.53	168.78	253.06	153.73	0.89	199.62	193.77	5.84
75	138.08	201.56	193.76	7.80	0.06	236.60	177.78	213.84	168.83	295.90	153.81	0.89	201.56	193.77	7.79
76	138.33	205.46	193.77	11.69	0.05	275.21	177.88	242.47	168.92	381.59	153.93	0.89	205.46	193.77	11.69
77	138.03	202.47	193.29	9.18	0.05	228.09	177.75	208.94	168.81	288.50	153.80	0.89	202.50	193.33	9.17
78	137.98	203.51	193.69	9.81	0.05	237.74	177.78	216.10	168.83	309.93	153.83	0.89	203.50	193.76	9.75
79	138.06	205.46	193.76	11.69	0.06	257.04	177.83	230.42	168.89	352.77	153.90	0.89	205.46	193.77	11.69
80	138.34	209.35	193.77	15.58	0.05	295.65	177.92	259.05	168.97	438.47	153.98	0.88	209.35	193.77	15.58
81	135.16	178.21	161.80	16.41	0.05	192.32	177.63	179.94	168.70	188.98	153.52	0.91	178.52	162.31	16.21
82	136.45	186.53	167.09	19.44	0.05	201.97	177.67	187.11	168.74	210.41	153.61	0.92	191.96	181.77	10.19
83	138.05	198.32	187.78	10.53	0.05	221.27	177.73	201.41	168.79	253.25	153.73	0.91	198.64	193.77	4.87
84	138.36	202.54	193.77	8.76	0.06	259.88	177.85	230.05	168.89	338.94	153.88	0.92	202.54	193.77	8.76
85	135.91	183.63	164.62	19.01	0.06	197.43	177.65	184.09	168.72	203.20	153.58	0.91	191.07	175.16	15.91
86	136.95	191.16	168.23	22.93	0.05	207.08	177.68	191.24	168.75	224.62	153.65	0.91	197.67	193.77	3.90
87	138.05	199.62	193.76	5.85	0.05	226.38	177.75	205.56	168.81	267.47	153.76	0.91	199.62	193.77	5.84
88	138.31	203.51	193.77	9.74	0.06	264.98	177.86	234.19	168.90	353.15	153.90	0.91	203.51	193.77	9.74
89	136.98	192.27	169.02	23.25	0.05	207.65	177.68	192.38	168.75	231.64	153.67	0.91	198.62	193.33	5.29
90	137.75	199.42	169.06	30.36	0.06	217.30	177.72	199.53	168.78	253.06	153.73	0.91	199.62	193.77	5.84
91	138.08	201.56	193.76	7.80	0.06	236.60	177.78	213.84	168.83	295.90	153.81	0.91	201.56	193.77	7.79
92	138.39	205.46	193.77	11.69	0.05	275.21	177.88	242.47	168.92	381.59	153.93	0.91	205.46	193.77	11.69
93	138.02	202.47	193.29	9.18	0.05	228.09	177.75	208.94	168.81	288.50	153.80	0.91	202.50	193.33	9.17
94	138.03	203.51	193.69	9.81	0.06	237.74	177.78	216.10	168.83	309.93	153.83	0.91	203.50	193.76	9.75
95	138.06	205.46	193.76	11.69	0.05	257.04	177.83	230.42	168.89	352.77	153.90	0.91	205.46	193.77	11.69
96	138.33	209.35	193.77	15.58	0.06	295.65	177.92	259.05	168.97	438.47	153.98	0.91	209.35	193.77	15.58
97	153.91	338.49	315.04	23.45	0.05	370.87	356.15	349.58	338.31	343.32	307.78	0.88	341.88	311.95	29.93
98	155.61	350.56	320.46	29.84	0.05	380.53	356.17	356.74	338.33	364.75	307.84	0.88	351.62	315.81	32.04
99	155.74	368.57	328.97	35.32	0.06	399.83	356.21	371.06	338.37	407.58	307.92	0.88	377.12	338.25	30.02
100	158.27	394.73	357.31	30.12	0.06	438.43	356.28	399.69	338.43	493.28	308.05	0.88	397.24	385.53	8.70
101	153.61	346.30	319.50	26.79	0.06	375.98	356.16	353.73	338.32	357.54	307.82	0.88	346.89	317.15	29.75
102	154.56	357.34	323.16	32.39	0.06	385.64	356.18	360.89	338.34	378.96	307.86	0.88	358.36	321.39	32.38
103	156.27	373.58	329.34	39.40	0.05	404.94	356.22	375.20	338.38	421.81	307.95	0.89	385.04	357.04	20.52
104	158.31	397.30	370.96	20.80	0.06	443.54	356.29	403.83	338.43	507.50	308.07	0.89	398.21	385.53	9.66
105	155.10	358.97	323.84	34.10	0.05	386.21	356.18	362.01	338.34	385.97	307.88	0.88	359.89	325.69	34.18
106	156.06	367.88	326.42	36.57	0.06	395.86	356.20	369.17	338.36	407.39	307.92	0.88	369.07	323.41	38.28
107	156.92	382.51	331.61	43.68	0.06	415.16	356.24	383.48	338.39	450.24	307.99	0.88	396.30	385.57	7.85
108	158.55	400.05	385.62	11.61	0.05	453.76	356.31	412.11	338.45	535.93	308.10	0.88	400.14	385.53	11.60
109	155.93	377.51	334.67	40.48	0.05	406.64	356.22	378.59	338.38	442.84	307.98	0.88	396.80	387.57	9.17
110	156.55	384.64	333.49	44.28	0.06	416.29	356.24	385.74	338.39	464.27	308.01	0.89	398.18	385.50	9.98
111	158.33	398.09	328.02	55.30	0.05	435.59	356.27	400.06	338.42	507.12	308.07	0.89	400.17	385.57	11.72
112	158.58	403.91	385.62	15.48	0.06	474.20	356.34	428.68	338.47	592.80	308.15	0.89	404.01	385.53	15.46
113	152.99	338.49	315.04	23.45	0.06	370.87	356.15	349.58	338.31	343.32	307.78	0.91	341.88	311.95	29.93
114	154.14	350.57	320.59	29.98	0.06	380.53	356.17	356.74	338.33	364.75	307.84	0.95	351.33	319.16	32.16
115	155.70	368.90	332.47	36.42	0.05	399.83	356.21	371.06	338.37	407.58	307.92	0.89	376.68	346.35	30.34
116	158.22	395.14	366.45	28.56	0.05	438.43	356.28	399.69	338.43	493.28	308.05	0.89	397.30	388.53	8.76
117	153.58	346.30	319.51	26.79	0.05	375.98	356.16	353.73	338.32	357.54	307.82	0.89	346.89	317.15	29.75
118	154.52	357.42	324.51	32.92	0.06	385.64	356.18	360.89	338.34	378.96	307.86	1.05	358.05	325.53	32.51
119	156.10	374.05	334.98	38.87	0.05	404.94	356.22	375.20	338.38	421.81	307.95	0.89	384.85	364.26	20.55
120	158.27	397.62	376.51	21.07	0.06	443.54	356.29	403.83	338.43	507.50	308.07	0.89	398.27	388.53	9.74
121	154.91	359.10	324.27	34.83	0.06	386.21	356.18	362.01	338.34	385.97	307.88	0.89	359.89	325.70	34.19
122	155.69	368.25	330.13	38.11	0.05	395.86	356.20	369.17	338.36	407.39	307.92	0.89	368.92	327.75	41.17
123	156.72	383.24	337.07	45.56	0.05	415.16	356.24	383.48	338.39	450.24	307.99	0.91	396.32	388.51	7.81
124	158.53	400.22	388.50	11.70	0.06	453.76	356.31	412.11	338.45	535.93	308.10	0.89	400.22	388.53	11.69
125	155.83	378.04	338.07	39.32	0.05	406.64	356.22	378.59	338.38	442.84	307.98	0.89	396.83	387.65	9.17
126	156.50	385.45	338.62	46.18	0.06	416.29	356.24	385.74	338.39	464.27	308.01	0.89	398.23	387.65	10.57
127	158.05	399.56	337.74	59.46	0.06	435.59	356.27	400.06	338.42	507.12	308.07	0.89	400.21	388.51	11.70
128	158.53	404.12	388.50	15.59	0.05	474.20	356.34	428.68	338.47	592.80	308.15	0.89	404.12	388.53	15.58
129	152.97	338.49	315.04	23.45	0.06	370.87	356.15	349.58	338.31	343.32	307.78	0.92	341.88	311.95	29.93
130	154.11	350.57	320.59	29.98	0.06	380.53	356.17	356.74	338.33	364.75	307.84	0.91	351.33	319.16	32.16
131	155.70	368.90	332.47	36.42	0.05	399.83	356.21	371.06	338.37	407.58	307.92	0.92	376.68	346.35	30.34
132	158.19	395.16	367.54	27.62	0.06	438.43	356.28	399.69	338.43	493.28	308.05	0.91	397.30	388.54	8.76
133	153.73	346.30	319.51	26.79	0.06	375.98	356.16	353.73	338.32	357.54	307.82	0.92	346.89	317.15	29.75
134	154.54	357.42	324.51	32.92	0.06	385.64	356.18	360.89	338.34	378.96	307.86	0.92	358.05	325.53	32.51
135	156.11	374.05	335.07	38.98	0.05	404.94	356.22	375.20	338.38	421.81	307.95	0.92	384.84	364.27	20.57
136	158.24	397.63	376.53	21.10	0.06	443.54	356.29	403.83	338.43	507.50	308.07	0.92	398.27	388.54	9.74
137	154.76	359.10	324.27	34.83	0.05	386.21	356.18	362.01	338.34	385.97	307.88	0.91	359.89	325.70	34.19
138	155.35	368.25	330.13	38.11	0.06	395.86	356.20	369.17	338.36	407.39	307.92	0.92	368.92	327.75	41.17
139	156.74	383.30	337.34	45.97	0.05	415.16	356.24	383.48	338.39	450.24	307.99	0.92	396.32	388.51	7.81
140	158.46	400.22	388.52	11.70	0.05	453.76	356.31	412.11	338.45	535.93	308.10	0.92	400.22	388.54	11.69
141	155.86	378.05	338.37	39.67	0.05	406.64	356.22	378.59	338.38	442.84	307.98	0.91	396.83	387.65	9.17
142	156.49	385.53	338.93	46.60	0.05	416.29	356.24	385.74	338.39	464.27	308.01	0.92	398.23	387.65	10.57
143	158.02	399.85	338.98	60.87	0.05	435.59	356.27	400.06	338.42	507.12	308.07	0.92	400.21	388.51	11.70
144	158.59	404.12	388.52	15.60	0.06	474.20	356.34	428.68	338.47	592.80	308.15	0.92	404.12	388.54	15.58

	optimal				Heuristic 1			Heuristic 2		Heuristic 3		Decomposition Heuristic			
	time (sec)	total cost	energy cost	switch. cost	time (sec)	total cost	energy cost	total cost	energy cost	total cost	energy cost	time (sec)	total cost	energy cost	switch. cost
145	152.75	338.49	315.04	23.45	0.06	370.87	356.15	349.58	338.31	343.32	307.78	0.91	341.88	311.95	29.93
146	153.60	350.57	320.59	29.98	0.06	380.53	356.17	356.74	338.33	364.75	307.84	0.91	351.82	318.75	33.07
147	154.99	368.90	332.47	36.42	0.06	399.83	356.21	371.06	338.37	407.58	307.92	0.91	376.80	346.54	30.10
148	156.67	395.14	366.99	28.08	0.06	438.43	356.28	399.69	338.43	493.28	308.05	0.92	397.30	388.53	8.76
149	153.10	346.30	319.51	26.79	0.06	375.98	356.16	353.73	338.32	357.54	307.82	0.91	346.89	317.15	29.75
150	153.88	357.42	324.51	32.92	0.05	385.64	356.18	360.89	338.34	378.96	307.86	0.91	358.05	325.53	32.51
151	155.22	374.05	334.98	38.87	0.05	404.94	356.22	375.20	338.38	421.81	307.95	0.91	384.93	364.49	20.40
152	156.72	397.62	376.53	21.07	0.06	443.54	356.29	403.83	338.43	507.50	308.07	0.91	398.27	388.53	9.74
153	154.19	359.10	324.27	34.83	0.06	386.21	356.18	362.01	338.34	385.97	307.88	0.91	361.31	323.72	37.59
154	154.66	368.25	330.13	38.11	0.06	395.86	356.20	369.17	338.36	407.39	307.92	0.91	383.13	351.24	31.88
155	155.75	383.24	337.07	45.56	0.05	415.16	356.24	383.48	338.39	450.24	307.99	0.91	396.32	388.53	7.80
156	156.95	400.22	388.52	11.70	0.05	453.76	356.31	412.11	338.45	535.93	308.10	0.91	400.22	388.53	11.69
157	155.20	378.04	338.07	39.32	0.06	406.64	356.22	378.59	338.38	442.84	307.98	0.91	396.83	387.65	9.17
158	155.75	385.45	338.62	46.18	0.06	416.29	356.24	385.74	338.39	464.27	308.01	0.91	398.23	387.65	10.57
159	156.65	399.62	338.63	60.22	0.06	435.59	356.27	400.06	338.42	507.12	308.07	0.91	400.22	388.53	11.69
160	157.01	404.12	388.52	15.59	0.06	474.20	356.34	428.68	338.47	592.80	308.15	0.91	404.12	388.53	15.58
161	152.58	338.49	315.04	23.45	0.06	370.87	356.15	349.58	338.31	343.32	307.78	0.91	341.88	311.95	29.93
162	153.65	350.57	320.59	29.98	0.06	380.53	356.17	356.74	338.33	364.75	307.84	0.91	351.82	318.75	33.07
163	154.98	368.90	332.47	36.42	0.06	399.83	356.21	371.06	338.37	407.58	307.92	0.91	376.76	346.55	30.21
164	156.74	395.15	367.04	28.10	0.06	438.43	356.28	399.69	338.43	493.28	308.05	0.91	397.30	388.54	8.76
165	153.08	346.30	319.51	26.79	0.06	375.98	356.16	353.73	338.32	357.54	307.82	0.91	346.89	317.15	29.75
166	153.86	357.42	324.51	32.92	0.06	385.64	356.18	360.89	338.34	378.96	307.86	0.92	358.05	325.53	32.51
167	155.22	374.05	335.07	38.98	0.05	404.94	356.22	375.20	338.38	421.81	307.95	0.92	384.92	364.50	20.43
168	156.94	397.63	376.53	21.09	0.05	443.54	356.29	403.83	338.43	507.50	308.07	0.92	398.27	388.54	9.74
169	154.14	359.10	324.27	34.83	0.05	386.21	356.18	362.01	338.34	385.97	307.88	0.92	361.31	323.72	37.59
170	154.69	368.25	330.13	38.11	0.05	395.86	356.20	369.17	338.36	407.39	307.92	0.92	383.13	351.24	31.88
171	155.74	383.30	337.34	45.97	0.06	415.16	356.24	383.48	338.39	450.24	307.99	0.92	396.32	388.53	7.80
172	156.94	400.22	388.52	11.70	0.06	453.76	356.31	412.11	338.45	535.93	308.10	0.92	400.22	388.54	11.69
173	155.25	378.05	338.37	39.67	0.05	406.64	356.22	378.59	338.38	442.84	307.98	0.92	396.83	387.65	9.17
174	155.77	385.53	338.93	46.60	0.06	416.29	356.24	385.74	338.39	464.27	308.01	0.92	398.23	387.65	10.57
175	156.63	399.85	338.68	60.31	0.05	435.59	356.27	400.06	338.42	507.12	308.07	0.91	400.22	388.54	11.69
176	156.97	404.12	388.52	15.60	0.05	474.20	356.34	428.68	338.47	592.80	308.15	0.92	404.12	388.54	15.58
177	152.56	338.49	315.04	23.45	0.06	370.87	356.15	349.58	338.31	343.32	307.78	0.92	341.88	311.95	29.93
178	153.59	350.57	320.59	29.98	0.06	380.53	356.17	356.74	338.33	364.75	307.84	0.94	351.82	318.75	33.07
179	154.97	368.90	332.47	36.42	0.06	399.83	356.21	371.06	338.37	407.58	307.92	0.95	376.76	346.55	30.21
180	156.74	395.16	367.54	27.62	0.05	438.43	356.28	399.69	338.43	493.28	308.05	0.94	397.30	388.54	8.76
181	153.09	346.30	319.51	26.79	0.05	375.98	356.16	353.73	338.32	357.54	307.82	0.94	346.89	317.15	29.75
182	153.85	357.42	324.51	32.92	0.05	385.64	356.18	360.89	338.34	378.96	307.86	0.92	358.05	325.53	32.51
183	155.20	374.05	335.07	38.98	0.06	404.94	356.22	375.20	338.38	421.81	307.95	0.94	384.92	364.50	20.43
184	156.75	397.63	376.53	21.10	0.06	443.54	356.29	403.83	338.43	507.50	308.07	0.94	398.27	388.54	9.74
185	154.08	359.10	324.27	34.83	0.06	386.21	356.18	362.01	338.34	385.97	307.88	0.94	361.31	323.72	37.59
186	154.68	368.25	330.13	38.11	0.06	395.86	356.20	369.17	338.36	407.39	307.92	0.94	383.13	351.24	31.88
187	155.77	383.30	337.34	45.97	0.05	415.16	356.24	383.48	338.39	450.24	307.99	0.94	396.32	388.53	7.80
188	156.99	400.22	388.52	11.70	0.05	453.76	356.31	412.11	338.45	535.93	308.10	0.94	400.22	388.54	11.69
189	155.22	378.05	338.37	39.67	0.06	406.64	356.22	378.59	338.38	442.84	307.98	0.94	396.83	387.65	9.17
190	155.76	385.53	338.93	46.60	0.06	416.29	356.24	385.74	338.39	464.27	308.01	0.94	398.23	387.65	10.57
191	156.88	399.85	338.98	60.87	0.06	435.59	356.27	400.06	338.42	507.12	308.07	0.94	400.22	388.54	11.69
192	157.04	404.12	388.52	15.60	0.05	474.20	356.34	428.68	338.47	592.80	308.15	0.94	404.12	388.54	15.58
193	173.20	623.86	507.74	30.66	0.06	727.98	713.24	688.87	677.58	651.99	616.40	0.94	647.24	449.95	36.92
194	172.11	639.63	509.02	39.48	0.06	737.64	713.26	696.03	677.59	673.42	616.44	0.94	667.45	448.25	46.78
195	173.83	663.75	506.14	49.20	0.05	756.94	713.27	710.34	677.61	716.27	616.49	0.94	688.80	465.92	52.60
196	175.75	697.08	513.91	58.51	0.05	795.53	713.31	738.97	677.64	801.96	616.58	0.95	717.10	499.37	52.39
197	172.02	635.52	510.24	36.77	0.05	733.09	713.25	693.01	677.58	666.22	616.43	0.94	661.81	446.67	46.59
198	172.80	649.43	511.57	42.05	0.06	742.74	713.26	700.16	677.59	687.64	616.46	0.94	673.96	456.86	48.25
199	175.11	670.91	507.34	51.36	0.05	762.04	713.27	714.48	677.61	730.49	616.51	0.95	696.57	470.22	56.31
200	175.88	701.32	516.14	56.74	0.06	800.65	713.32	743.11	677.65	816.17	616.59	0.94	716.83	501.94	47.66
201	173.09	653.11	511.67	41.95	0.06	743.31	713.26	701.29	677.59	694.65	616.47	0.94	675.81	473.63	48.13
202	173.52	664.39	509.21	45.82	0.06	752.96	713.26	708.45	677.60	716.08	616.49	0.94	687.70	480.73	49.34
203	174.70	682.40	511.70	51.23	0.05	772.27	713.29	722.77	677.62	758.91	616.54	0.94	704.31	493.81	53.87
204	176.33	708.87	510.70	56.92	0.06	810.87	713.33	751.40	677.66	844.61	616.62	0.94	725.44	461.82	34.12
205	173.95	676.66	512.46	48.30	0.06	763.75	713.27	717.86	677.61	751.52	616.53	0.94	694.83	500.69	49.13
206	174.59	685.11	511.04	50.84	0.05	773.41	713.29	725.02	677.62	772.94	616.55	0.94	701.58	504.95	49.24
207	175.58	699.47	508.40	55.46	0.06	792.71	713.31	739.34	677.64	815.79	616.59	0.95	713.34	499.44	41.92
208	176.83	720.79	511.67	56.13	0.05	831.31	713.35	767.96	677.67	901.48	616.66	0.94	739.70	419.20	20.68
209	171.50	639.84	540.72	31.39	0.05	727.98	713.24	688.87	677.58	651.99	616.40	0.94	652.29	527.61	36.87
210	172.64	656.30	545.74	41.92	0.05	737.64	713.26	696.03	677.59	673.42	616.44	0.94	670.24	541.02	39.32
211	173.91	681.42	566.98	52.70	0.06	756.94	713.27	710.34	677.61	716.27	616.49	0.95	691.00	563.05	50.30
212	176.05	716.46	595.55	62.84	0.05	795.53	713.31	738.97	677.64	801.96	616.58	0.95	727.18	575.05	69.54
213	172.28	651.79	547.50	38.44	0.06	733.09	713.25	693.01	677.58	666.22	616.43	0.94	664.39	543.29	41.87
214	173.11	666.59	557.22	44.37	0.05	742.74	713.26	700.16	677.59	687.64	616.46	0.95	676.77	552.17	41.66
215	174.33	689.23	576.15	53.67	0.06	762.04	713.27	714.48	677.61	730.49	616.51	0.95	698.20	561.65	56.85
216	176.41	721.52	596.01	65.37	0.05	800.65	713.32	743.11	677.65	816.17	616.59	0.95	732.59	576.53	72.33

	optimal				Heuristic 1			Heuristic 2		Heuristic 3		Decomposition Heuristic			
	time (sec)	total cost	energy cost	switch. cost	time (sec)	total cost	energy cost	total cost	energy cost	total cost	energy cost	time (sec)	total cost	energy cost	switch. cost
217	173.13	670.51	564.15	44.57	0.05	743.31	713.26	701.29	677.59	694.65	616.47	0.95	680.65	552.21	44.65
218	173.72	682.35	571.79	49.45	0.06	752.96	713.26	708.45	677.60	716.08	616.49	0.95	692.46	562.16	51.44
219	175.08	701.44	591.76	56.57	0.05	772.27	713.29	722.77	677.62	758.91	616.54	0.95	709.77	586.25	58.23
220	176.86	730.17	605.64	63.60	0.06	810.87	713.33	751.40	677.66	844.61	616.62	0.97	738.72	573.77	70.50
221	174.45	695.72	594.24	50.85	0.06	763.75	713.27	717.86	677.61	751.52	616.53	0.95	703.69	569.24	56.57
222	174.69	704.80	593.81	57.06	0.06	773.41	713.29	725.02	677.62	772.94	616.55	0.95	712.77	585.80	58.46
223	175.72	720.45	600.22	60.36	0.05	792.71	713.31	739.34	677.64	815.79	616.59	0.97	727.04	581.18	63.44
224	177.28	744.50	600.69	70.93	0.05	831.31	713.35	767.96	677.67	901.48	616.66	0.95	755.69	573.22	84.36
225	171.63	650.71	610.22	31.13	0.06	727.98	713.24	688.87	677.58	651.99	616.40	0.95	651.98	616.77	35.21
226	172.72	667.39	613.18	41.73	0.06	737.64	713.26	696.03	677.59	673.42	616.44	0.95	669.65	630.97	38.68
227	174.23	692.78	624.93	53.72	0.05	756.94	713.27	710.34	677.61	716.27	616.49	0.97	694.93	632.96	55.76
228	176.16	731.07	624.60	69.08	0.05	795.53	713.31	738.97	677.64	801.96	616.58	0.97	735.55	641.97	80.50
229	172.44	661.58	616.99	36.57	0.06	733.09	713.25	693.01	677.58	666.22	616.43	0.97	664.31	619.40	44.91
230	173.16	677.21	619.79	46.15	0.05	742.74	713.26	700.16	677.59	687.64	616.46	0.95	678.75	630.98	47.77
231	174.56	700.79	628.31	59.56	0.05	762.04	713.27	714.48	677.61	730.49	616.51	0.97	703.43	631.30	64.20
232	176.23	736.26	629.23	67.03	0.06	800.65	713.32	743.11	677.65	816.17	616.59	0.98	742.59	641.50	87.00
233	173.36	680.11	621.32	49.29	0.05	743.31	713.26	701.29	677.59	694.65	616.47	0.97	681.18	631.28	49.63
234	173.81	692.74	629.29	52.74	0.06	752.96	713.26	708.45	677.60	716.08	616.49	0.97	694.38	635.91	58.19
235	174.99	714.41	636.33	65.05	0.06	772.27	713.29	722.77	677.62	758.91	616.54	0.98	716.98	644.09	65.15
236	176.84	745.90	632.54	70.11	0.06	810.87	713.33	751.40	677.66	844.61	616.62	0.97	751.98	649.43	89.22
237	174.30	707.31	635.22	61.53	0.05	763.75	713.27	717.86	677.61	751.52	616.53	0.97	710.64	641.14	69.50
238	174.95	718.05	639.08	68.24	0.06	773.41	713.29	725.02	677.62	772.94	616.55	0.97	720.81	652.19	68.42
239	175.95	735.51	627.05	69.13	0.06	792.71	713.31	739.34	677.64	815.79	616.59	0.97	737.73	651.81	79.48
240	177.33	762.48	635.42	81.57	0.06	831.31	713.35	767.96	677.67	901.48	616.66	0.99	782.89	717.35	54.43
241	170.27	651.18	619.82	31.36	0.05	727.98	713.24	688.87	677.58	651.99	616.40	0.95	651.99	616.40	35.59
242	171.49	667.91	620.29	40.62	0.06	737.64	713.26	696.03	677.59	673.42	616.44	0.95	674.55	605.40	53.24
243	172.14	692.66	630.87	52.50	0.06	756.94	713.27	710.34	677.61	716.27	616.49	0.97	702.83	616.80	63.82
244	173.89	729.97	639.55	69.57	0.06	795.53	713.31	738.97	677.64	801.96	616.58	0.97	747.71	665.54	56.22
245	170.84	662.08	625.25	36.81	0.06	733.09	713.25	693.01	677.58	666.22	616.43	0.95	666.22	616.43	49.79
246	171.55	677.67	625.07	44.77	0.06	742.74	713.26	700.16	677.59	687.64	616.46	0.95	686.47	612.97	55.75
247	172.45	700.17	630.04	56.90	0.06	762.04	713.27	714.48	677.61	730.49	616.51	0.97	708.58	619.48	66.23
248	174.19	735.36	641.24	72.47	0.06	800.65	713.32	743.11	677.65	816.17	616.59	0.95	751.97	674.12	57.90
249	171.73	680.65	630.29	48.93	0.05	743.31	713.26	701.29	677.59	694.65	616.47	0.95	684.77	627.61	56.72
250	172.17	693.07	632.41	50.43	0.06	752.96	713.26	708.45	677.60	716.08	616.49	0.95	696.16	625.51	54.84
251	173.14	713.52	635.31	60.67	0.05	772.27	713.29	722.77	677.62	758.91	616.54	0.95	716.33	639.06	62.72
252	174.63	744.96	648.14	74.80	0.05	810.87	713.33	751.40	677.66	844.61	616.62	0.97	765.95	691.62	53.48
253	172.69	707.27	641.71	58.96	0.05	763.75	713.27	717.86	677.61	751.52	616.53	0.95	712.52	633.30	72.38
254	173.14	717.37	636.45	62.92	0.05	773.41	713.29	725.02	677.62	772.94	616.55	0.95	723.52	638.36	70.52
255	174.06	734.02	642.05	69.75	0.06	792.71	713.31	739.34	677.64	815.79	616.59	0.95	739.24	641.27	81.34
256	175.27	762.14	639.23	81.09	0.05	831.31	713.35	767.96	677.67	901.48	616.66	0.97	792.73	772.04	15.46
257	170.27	651.18	619.82	31.36	0.05	727.98	713.24	688.87	677.58	651.99	616.40	0.95	651.99	616.40	35.59
258	171.13	668.16	625.79	42.37	0.05	737.64	713.26	696.03	677.59	673.42	616.44	0.97	673.42	616.44	56.98
259	172.28	694.12	639.84	54.28	0.05	756.94	713.27	710.34	677.61	716.27	616.49	0.97	698.30	635.17	63.13
260	174.00	732.86	651.79	72.46	0.05	795.53	713.31	738.97	677.64	801.96	616.58	0.97	748.94	678.99	54.20
261	170.83	662.08	625.26	36.82	0.06	733.09	713.25	693.01	677.58	666.22	616.43	0.95	666.22	616.43	49.79
262	171.41	677.98	631.01	46.97	0.05	742.74	713.26	700.16	677.59	687.64	616.46	0.97	684.77	624.82	59.94
263	172.94	702.11	641.83	59.77	0.05	762.04	713.27	714.48	677.61	730.49	616.51	0.97	704.24	632.51	64.17
264	174.11	738.13	658.85	70.72	0.06	800.65	713.32	743.11	677.65	816.17	616.59	0.97	755.25	677.41	60.11
265	171.77	680.73	630.99	49.73	0.06	743.31	713.26	701.29	677.59	694.65	616.47	0.97	684.64	627.80	56.84
266	172.06	693.60	639.93	53.65	0.06	752.96	713.26	708.45	677.60	716.08	616.49	0.97	694.79	635.21	59.58
267	173.03	715.68	647.23	64.87	0.06	772.27	713.29	722.77	677.62	758.91	616.54	0.97	717.71	643.68	64.84
268	174.70	748.14	659.56	78.89	0.05	810.87	713.33	751.40	677.66	844.61	616.62	0.97	771.07	715.02	41.08
269	172.70	708.21	645.31	61.67	0.06	763.75	713.27	717.86	677.61	751.52	616.53	0.97	712.81	636.18	76.36
270	173.38	718.93	648.59	68.28	0.06	773.41	713.29	725.02	677.62	772.94	616.55	0.97	720.78	652.28	68.45
271	173.92	736.75	653.74	73.23	0.06	792.71	713.31	739.34	677.64	815.79	616.59	0.98	739.13	647.71	76.64
272	175.41	766.01	664.10	87.46	0.05	831.31	713.35	767.96	677.67	901.48	616.66	0.97	793.60	772.13	15.71
273	170.30	651.18	619.82	31.36	0.06	727.98	713.24	688.87	677.58	651.99	616.40	0.97	651.99	616.40	35.59
274	171.13	668.16	625.79	42.37	0.06	737.64	713.26	696.03	677.59	673.42	616.44	0.97	673.42	616.44	56.98
275	172.30	694.12	639.84	54.29	0.05	756.94	713.27	710.34	677.61	716.27	616.49	0.98	698.30	635.17	63.13
276	173.98	733.39	658.18	75.21	0.05	795.53	713.31	738.97	677.64	801.96	616.58	0.98	748.37	693.61	54.77
277	170.84	662.08	625.26	36.82	0.05	733.09	713.25	693.01	677.58	666.22	616.43	0.97	666.22	616.43	49.79
278	171.44	677.98	631.01	46.97	0.05	742.74	713.26	700.16	677.59	687.64	616.46	0.98	684.77	624.82	59.94
279	172.61	702.13	642.09	60.04	0.06	762.04	713.27	714.48	677.61	730.49	616.51	0.99	703.65	639.23	64.41
280	173.98	738.77	665.83	72.94	0.06	800.65	713.32	743.11	677.65	816.17	616.59	0.98	754.36	693.62	60.75
281	171.77	680.73	631.00	49.73	0.05	743.31	713.26	701.29	677.59	694.65	616.47	0.97	684.64	627.80	56.84
282	172.08	693.60	639.94	53.66	0.06	752.96	713.26	708.45	677.60	716.08	616.49	0.98	694.79	635.21	59.58
283	173.08	715.85	649.93	65.92	0.06	772.27	713.29	722.77	677.62	758.91	616.54	0.99	717.09	651.98	65.11
284	174.83	749.09	670.86	77.84	0.05	810.87	713.33	751.40	677.66	844.61	616.62	0.98	770.70	729.48	41.14
285	172.72	708.25	645.93	62.33	0.06	763.75	713.27	717.86	677.61	751.52	616.53	0.99	712.74	636.30	76.44
286	173.33	719.19	649.44	69.75	0.05	773.41	713.29	725.02	677.62	772.94	616.55	0.98	720.76	652.31	68.46
287	173.89	737.49	661.17	76.32	0.06	792.71	713.31	739.34	677.64	815.79	616.59	0.98	738.83	656.40	82.43
288	175.36	767.47	675.02	91.23	0.05	831.31	713.35	767.96	677.67	901.48	616.66	0.98	793.62	778.00	15.62

	N=15					N=100				
	time (sec)	**total cost**	**energy cost**	**% cost saving**	**% energy saving**	**time (sec)**	**total cost**	**energy cost**	**% cost saving**	**% energy saving**
1	107.08	171.59	163.08	15.05	18.46	108.21	167.54	3.67	15.25	16.23
2	108.24	176.69	165.64	12.96	17.18	108.61	168.03	5.51	14.51	15.98
3	110.88	186.25	170.38	9.14	14.81	111.04	170.12	10.75	11.77	14.94
4	112.67	197.52	188.98	5.49	5.51	113.29	166.44	18.78	11.38	16.78
5	108.33	177.09	166.26	12.76	16.87	109.41	169.73	5.06	13.90	15.14
6	110.21	178.45	163.89	12.53	18.06	109.94	166.74	7.59	14.55	16.63
7	112.82	188.53	170.29	8.48	14.85	112.32	167.94	11.49	12.90	16.03
8	113.46	200.22	190.62	4.66	4.69	113.72	166.18	21.42	10.67	16.91
9	110.15	182.77	166.76	10.85	16.62	110.58	168.29	8.16	13.93	15.86
10	111.60	187.38	166.24	9.04	16.88	111.56	169.98	10.16	12.56	15.01
11	113.52	196.62	189.06	5.47	5.47	113.14	170.83	14.62	10.84	14.58
12	113.40	199.63	188.33	5.84	5.84	113.08	168.61	22.89	9.67	15.70
13	112.35	192.98	168.90	7.67	15.55	112.16	168.34	13.95	12.78	15.83
14	113.01	199.47	189.00	5.02	5.50	112.83	169.29	15.88	11.83	15.36
15	112.97	200.89	189.52	5.24	5.24	112.92	169.51	20.18	10.53	15.25
16	113.27	205.08	189.89	5.05	5.05	113.66	169.95	29.68	7.58	15.03
17	107.36	173.66	165.20	14.03	17.40	107.90	164.69	3.58	16.70	17.65
18	109.30	177.00	165.72	12.81	17.14	109.05	169.11	6.02	13.73	15.44
19	111.69	186.17	168.11	9.19	15.95	111.64	170.60	10.03	11.89	14.70
20	113.43	198.62	190.06	4.97	4.97	113.32	167.59	19.66	10.41	16.21
21	108.54	175.49	164.31	13.55	17.85	108.68	168.38	5.14	14.52	15.81
22	109.56	178.80	164.86	12.35	17.57	110.23	166.00	7.25	15.07	17.00
23	112.20	188.37	170.77	8.56	14.61	112.16	167.21	11.64	13.18	16.39
24	113.44	198.45	189.00	5.50	5.50	113.49	168.19	20.86	9.97	15.90
25	110.21	182.64	166.75	10.91	16.62	110.39	169.43	8.17	13.37	15.29
26	111.48	186.53	166.00	9.45	17.00	111.37	170.38	10.27	12.30	14.81
27	113.21	196.85	189.28	5.36	5.36	113.25	168.56	14.45	12.01	15.72
28	113.44	200.99	189.62	5.19	5.19	113.69	167.44	23.77	9.81	16.28
29	112.36	190.98	167.38	8.62	16.31	112.91	168.29	13.64	12.95	15.85
30	113.17	199.15	188.91	5.17	5.54	113.38	166.80	15.96	12.97	16.60
31	113.42	199.87	188.55	5.72	5.72	113.41	167.54	20.18	11.46	16.23
32	113.40	204.53	189.38	5.31	5.31	113.78	169.49	30.12	7.59	15.26
33	107.47	172.17	163.52	14.77	18.24	107.72	169.08	3.63	14.50	15.46
34	109.01	177.50	166.36	12.56	16.82	108.19	169.63	5.90	13.53	15.19
35	111.37	186.14	169.49	9.20	15.25	110.83	169.89	10.65	11.93	15.05
36	113.69	198.05	189.52	5.24	5.24	112.56	167.28	19.15	10.80	16.36
37	108.93	177.11	166.00	12.75	17.00	107.91	169.28	5.22	14.04	15.36
38	110.19	181.93	167.92	10.82	16.04	109.06	170.42	7.57	12.75	14.79
39	112.65	187.09	169.81	9.18	15.09	111.41	166.93	11.41	13.42	16.53
40	113.87	199.89	190.37	4.82	4.82	112.64	166.67	20.28	10.98	16.67
41	110.59	182.06	166.66	11.19	16.67	109.51	171.46	8.02	12.45	14.27
42	111.89	187.00	166.08	9.22	16.96	110.59	166.37	10.05	14.36	16.81
43	112.53	196.93	189.36	5.32	5.32	112.22	169.07	14.53	11.73	15.47
44	112.76	200.92	189.55	5.22	5.22	112.59	170.35	23.84	8.40	14.82
45	111.66	191.72	167.87	8.27	16.07	111.68	167.70	13.47	13.32	16.15
46	112.34	199.39	189.24	5.05	5.38	112.17	168.83	16.39	11.80	15.59
47	112.47	200.93	189.55	5.22	5.22	112.25	170.26	19.91	10.30	14.87
48	112.81	205.59	190.36	4.82	4.82	112.63	166.71	28.65	9.55	16.64
49	106.81	172.72	164.22	14.50	17.89	106.94	168.09	3.67	14.97	15.95
50	108.10	176.45	165.53	13.08	17.23	108.10	167.27	5.65	14.82	16.37
51	110.56	186.39	169.14	9.08	15.43	110.52	168.56	10.20	12.80	15.72
52	112.30	197.21	188.72	5.64	5.64	112.15	173.10	18.98	8.10	13.45
53	107.84	177.09	165.89	12.76	17.05	107.86	168.78	5.01	14.39	15.61
54	108.93	179.80	165.60	11.86	17.20	108.94	169.79	7.22	13.23	15.10
55	111.33	187.98	168.96	8.75	15.52	111.12	166.79	11.27	13.57	16.61
56	112.31	199.34	189.85	5.07	5.07	112.27	169.03	20.79	9.61	15.48
57	109.32	183.42	168.23	10.53	15.88	109.35	168.78	8.10	13.72	15.61
58	110.63	186.30	165.44	9.56	17.28	110.40	168.14	10.28	13.39	15.93
59	112.17	196.28	188.74	5.63	5.63	111.96	169.03	14.46	11.79	15.49
60	112.32	199.60	188.30	5.85	5.85	112.15	168.63	22.89	9.66	15.68
61	111.56	193.45	169.75	7.44	15.13	111.55	166.15	13.63	13.98	16.93
62	112.10	198.88	188.70	5.29	5.65	111.98	168.52	16.39	11.94	15.74
63	112.20	201.01	189.63	5.19	5.19	111.96	167.04	20.21	11.67	16.48
64	112.40	204.34	189.21	5.40	5.40	112.17	169.76	29.60	7.71	15.12
65	106.81	172.23	163.67	14.74	18.17	106.81	169.47	3.68	14.28	15.26
66	108.09	177.13	165.86	12.74	17.07	108.09	168.36	5.63	14.29	15.82
67	110.54	185.90	168.58	9.32	15.71	110.52	167.62	10.67	13.03	16.19
68	112.34	197.47	188.96	5.52	5.52	112.11	168.02	19.36	10.34	15.99
69	107.84	177.17	165.58	12.72	17.21	107.86	168.22	4.96	14.69	15.89
70	108.92	179.69	165.08	11.92	17.46	108.94	166.74	7.20	14.74	16.63
71	111.33	190.09	172.53	7.72	13.74	111.15	167.33	11.49	13.19	16.33
72	112.32	198.30	188.85	5.57	5.57	112.16	169.86	20.05	9.56	15.07

	N=15					N=100				
	time (sec)	**total cost**	**energy cost**	**% cost saving**	**% energy saving**	**time (sec)**	**total cost**	**energy cost**	**% cost saving**	**% energy saving**
73	109.34	182.21	166.78	11.12	16.61	109.37	170.35	7.94	13.03	14.82
74	110.61	186.16	165.46	9.63	17.27	110.40	166.35	10.09	14.35	16.82
75	112.18	197.07	189.49	5.25	5.25	111.97	167.54	14.43	12.51	16.23
76	112.34	200.89	189.52	5.24	5.24	112.16	168.20	23.66	9.50	15.90
77	111.54	191.32	167.69	8.46	16.16	111.56	170.15	13.91	11.93	14.92
78	112.08	199.24	188.87	5.12	5.57	111.92	166.61	16.10	13.00	16.70
79	112.17	200.57	189.22	5.39	5.39	111.97	168.68	20.03	10.99	15.66
80	112.36	204.35	189.21	5.39	5.39	112.14	169.90	29.37	7.75	15.05
81	106.80	171.57	162.97	15.06	18.52	106.80	168.72	3.75	14.62	15.64
82	108.05	176.89	165.78	12.86	17.11	108.09	165.65	5.73	15.58	17.17
83	110.46	184.86	168.10	9.82	15.95	110.50	166.37	10.19	13.87	16.81
84	112.34	197.07	188.58	5.71	5.71	112.15	171.63	18.84	8.87	14.18
85	107.85	177.18	166.03	12.72	16.98	107.86	169.77	5.17	13.82	15.12
86	108.93	180.00	165.52	11.76	17.24	108.93	168.67	7.25	13.77	15.67
87	111.31	190.23	172.56	7.66	13.72	111.15	166.23	10.92	14.01	16.89
88	112.32	198.55	189.10	5.45	5.45	112.22	168.01	21.04	9.98	16.00
89	109.33	182.23	166.20	11.11	16.90	109.39	168.66	8.14	13.75	15.67
90	110.61	186.54	166.61	9.45	16.69	110.42	168.58	10.12	13.25	15.71
91	112.16	197.88	190.27	4.86	4.86	111.95	166.43	14.10	13.21	16.79
92	112.32	201.53	190.12	4.94	4.94	112.15	167.83	22.66	10.15	16.08
93	111.52	192.42	168.70	7.93	15.65	111.57	167.49	13.76	13.28	16.26
94	112.08	200.24	190.12	4.65	4.94	111.91	167.57	15.78	12.69	16.22
95	112.16	201.03	189.66	5.17	5.17	111.95	167.43	19.85	11.66	16.29
96	112.33	203.99	188.88	5.56	5.56	112.16	167.94	28.26	9.17	16.03
97	120.69	332.55	321.57	17.28	19.61	120.21	334.88	3.68	15.78	16.28
98	121.18	340.45	326.57	15.52	18.36	121.07	335.17	5.91	15.36	16.21
99	122.81	352.03	327.93	13.08	18.02	122.64	337.30	10.31	14.17	15.67
100	125.03	371.06	314.09	9.28	21.48	125.80	336.09	18.46	13.31	15.98
101	121.81	341.04	327.39	15.37	18.15	122.25	340.98	5.04	14.14	14.75
102	123.12	342.32	320.87	15.27	19.78	122.03	338.44	7.41	14.39	15.39
103	124.67	354.70	327.60	12.64	18.10	124.29	341.25	11.64	13.08	14.69
104	126.04	377.65	314.97	7.89	21.26	126.34	338.59	20.94	12.31	15.35
105	123.27	349.13	327.95	13.80	18.01	122.81	339.81	8.15	14.08	15.05
106	124.29	353.63	329.04	12.90	17.74	123.29	332.77	10.06	15.56	16.81
107	125.06	364.57	313.09	10.65	21.73	124.27	335.36	14.42	14.27	16.16
108	127.04	378.81	312.27	8.05	21.93	126.36	334.57	24.61	12.82	16.36
109	124.65	361.89	330.15	11.52	17.46	124.37	336.02	13.64	14.51	16.00
110	125.11	369.19	313.25	9.95	21.69	124.89	331.89	15.99	15.15	17.03
111	126.02	379.17	315.16	7.97	21.21	126.24	336.33	20.17	13.47	15.92
112	127.70	396.91	304.20	4.59	23.95	127.67	334.68	28.82	12.62	16.33
113	121.71	334.57	316.74	16.77	20.82	120.93	333.44	3.63	16.15	16.64
114	122.22	340.95	327.45	15.40	18.14	121.84	340.37	5.72	14.12	14.91
115	123.65	351.33	330.00	13.25	17.50	123.54	336.88	10.12	14.32	15.78
116	126.43	371.03	338.53	9.28	15.37	126.33	336.20	19.14	13.12	15.95
117	121.88	337.98	323.53	16.13	19.12	121.37	335.70	4.96	15.47	16.08
118	122.55	342.99	325.88	15.10	18.53	122.69	339.08	7.41	14.23	15.23
119	124.21	354.80	332.27	12.61	16.93	124.09	341.27	11.65	13.08	14.68
120	126.77	369.50	329.33	9.88	17.67	126.78	339.63	20.57	12.15	15.09
121	123.08	348.90	328.48	13.85	17.88	123.18	334.12	8.10	15.50	16.47
122	123.78	352.97	331.01	13.06	17.25	124.05	335.52	10.21	14.84	16.12
123	125.13	360.74	331.50	11.58	17.13	125.45	334.20	14.41	14.56	16.45
124	127.87	376.91	332.10	8.52	16.97	127.79	340.88	23.24	11.62	14.78
125	125.31	357.35	329.33	12.63	17.67	125.13	334.85	14.02	14.70	16.29
126	125.26	362.98	330.38	11.47	17.41	124.96	332.00	16.06	15.11	17.00
127	126.83	369.78	333.70	10.25	16.57	125.40	339.23	20.28	12.74	15.19
128	128.81	398.57	315.53	4.19	21.12	127.42	333.93	28.53	12.87	16.52
129	121.32	332.96	314.51	17.17	21.37	120.02	337.97	3.62	15.03	15.51
130	122.62	341.94	328.63	15.15	17.84	120.97	338.92	5.55	14.52	15.27
131	124.05	353.06	333.73	12.83	16.57	122.47	334.43	10.48	14.84	16.39
132	126.97	367.98	336.57	10.03	15.86	125.25	334.89	18.94	13.49	16.28
133	122.39	341.28	326.94	15.32	18.26	120.71	334.89	5.15	15.62	16.28
134	123.07	348.73	331.63	13.68	17.09	121.42	335.08	7.54	15.19	16.23
135	124.55	352.25	330.23	13.24	17.44	122.95	340.07	11.36	13.44	14.98
136	126.05	372.74	339.03	9.09	15.24	125.68	337.85	21.06	12.46	15.54
137	122.15	348.20	328.22	14.03	17.95	121.87	332.98	8.07	15.79	16.75
138	122.81	353.50	330.98	12.93	17.26	122.53	338.59	10.37	14.05	15.35
139	124.16	361.51	333.96	11.40	16.51	123.83	341.97	15.31	12.43	14.51
140	126.92	378.36	342.30	8.17	14.43	126.63	334.16	22.93	13.33	16.46
141	124.21	358.58	330.83	12.33	17.29	123.58	338.32	13.88	13.89	15.42
142	124.55	363.55	332.25	11.33	16.94	124.20	334.70	15.96	14.47	16.32
143	125.92	373.72	333.19	9.29	16.70	125.39	335.00	20.20	13.79	16.25
144	128.00	395.96	380.73	4.82	4.82	127.63	335.22	28.75	12.51	16.19

	N=15					N=100				
	time (sec)	**total cost**	**energy cost**	**% cost saving**	**% energy saving**	**time (sec)**	**total cost**	**energy cost**	**% cost saving**	**% energy saving**
145	120.15	335.12	324.23	16.64	18.94	119.90	334.28	3.60	15.95	16.43
146	120.99	340.29	327.32	15.56	18.17	120.72	338.57	5.92	14.52	15.36
147	122.32	352.93	332.59	12.86	16.85	122.04	338.95	10.71	13.67	15.26
148	124.86	366.92	335.41	10.29	16.15	124.52	338.36	19.75	12.44	15.41
149	120.77	341.24	326.66	15.33	18.34	120.51	337.43	5.11	15.00	15.64
150	121.42	344.68	327.67	14.68	18.08	121.15	334.46	7.24	15.42	16.38
151	122.71	352.42	328.94	13.20	17.77	122.49	338.09	11.53	13.89	15.48
152	125.33	372.78	337.76	9.08	15.56	124.78	339.07	20.77	12.23	15.23
153	121.92	350.64	330.77	13.42	17.31	121.57	341.51	8.12	13.67	14.62
154	122.47	352.42	329.79	13.20	17.55	122.21	334.87	10.09	15.04	16.28
155	123.62	357.38	328.01	12.41	18.00	123.30	342.51	14.46	12.51	14.37
156	125.94	376.34	333.53	8.65	16.62	125.67	338.04	24.10	12.10	15.49
157	123.42	362.54	334.84	11.36	16.29	123.13	333.65	13.65	15.09	16.59
158	124.10	362.40	329.49	11.61	17.63	123.76	334.18	16.19	14.54	16.45
159	125.16	371.38	335.68	9.86	16.08	124.87	335.46	20.02	13.72	16.13
160	127.00	393.55	378.41	5.40	5.40	126.51	334.53	27.97	12.86	16.37
161	120.17	334.33	323.44	16.83	19.14	119.90	335.16	3.54	15.75	16.21
162	121.00	341.74	328.55	15.20	17.86	120.72	339.04	5.97	14.39	15.24
163	122.31	352.33	332.61	13.00	16.85	122.00	337.03	10.22	14.26	15.74
164	124.82	367.72	335.85	10.09	16.04	124.55	334.06	19.31	13.60	16.49
165	120.76	340.66	314.74	15.47	21.31	120.51	336.80	5.07	15.17	15.80
166	121.43	344.03	326.36	14.85	18.41	121.14	334.33	7.33	15.43	16.42
167	122.74	358.08	336.12	11.80	15.97	122.46	335.69	11.86	14.40	16.08
168	125.27	371.55	340.62	9.38	14.84	124.94	336.82	19.62	13.06	15.79
169	121.87	348.38	328.58	13.98	17.85	121.57	336.41	8.13	14.93	15.90
170	122.47	352.19	329.85	13.25	17.54	122.19	339.19	10.52	13.86	15.20
171	123.59	360.75	332.38	11.58	16.90	123.31	334.80	14.42	14.41	16.30
172	125.90	377.08	340.53	8.48	14.87	125.63	341.49	23.67	11.37	14.63
173	123.44	357.89	330.46	12.50	17.39	123.14	336.92	14.09	14.18	15.77
174	124.05	362.70	330.19	11.54	17.45	123.77	340.66	16.11	12.98	14.83
175	125.16	373.41	331.48	9.37	17.13	124.84	338.06	20.44	12.99	15.49
176	127.03	393.56	378.42	5.39	5.39	126.50	336.25	28.90	12.22	15.94
177	120.16	332.78	321.80	17.22	19.55	119.87	332.17	3.60	16.47	16.96
178	121.00	340.75	327.50	15.45	18.13	120.70	336.24	5.65	15.16	15.94
179	122.28	350.26	330.91	13.52	17.27	122.02	334.23	10.59	14.86	16.44
180	124.81	364.60	333.06	10.86	16.73	124.59	337.07	18.39	13.09	15.73
181	120.84	341.11	326.67	15.36	18.33	120.51	339.44	5.10	14.51	15.14
182	121.43	344.54	327.38	14.72	18.15	121.13	335.48	7.00	15.23	16.13
183	122.70	357.79	335.44	11.88	16.14	122.47	333.11	11.80	15.05	16.72
184	125.27	371.27	336.95	9.45	15.76	124.93	340.01	20.71	12.02	15.00
185	121.84	347.81	327.47	14.12	18.13	121.57	333.10	8.20	15.73	16.72
186	122.48	353.66	332.23	12.89	16.94	122.20	343.71	10.19	12.83	14.07
187	123.61	361.64	333.50	11.36	16.63	123.31	336.87	14.14	13.97	15.78
188	126.11	378.94	342.54	8.03	14.37	125.61	337.75	23.42	12.34	15.56
189	123.43	360.15	332.72	11.94	16.82	123.11	338.81	14.14	13.71	15.30
190	124.06	365.74	334.12	10.80	16.47	123.77	341.35	16.12	12.81	14.66
191	125.38	375.01	335.43	8.98	16.14	124.88	341.56	20.13	12.21	14.61
192	126.97	392.86	377.75	5.56	5.56	126.46	339.65	28.75	11.44	15.09
193	131.83	646.05	474.22	19.45	40.72	131.63	669.88	3.58	16.03	16.27
194	132.47	662.37	447.91	17.51	44.01	132.46	673.33	5.71	15.44	15.83
195	133.88	691.02	425.86	14.16	46.77	134.57	672.72	10.55	15.12	15.91
196	136.00	726.58	396.22	10.19	50.47	137.08	672.85	19.46	14.42	15.89
197	134.75	658.46	465.44	18.00	41.82	133.56	679.44	5.22	14.74	15.07
198	134.67	667.61	437.01	16.96	45.37	133.97	667.99	7.34	16.00	16.50
199	135.41	694.00	634.67	13.90	20.67	135.67	678.41	11.90	14.35	15.20
200	137.70	743.06	640.62	8.26	19.92	137.13	671.62	19.72	14.65	16.05
201	135.13	680.32	640.44	15.49	19.95	134.31	668.62	8.06	15.94	16.42
202	135.15	691.84	640.99	14.16	19.88	134.86	669.09	10.50	15.68	16.36
203	136.16	711.69	637.00	11.92	20.37	135.89	673.58	14.53	14.84	15.80
204	137.66	741.77	402.54	8.65	49.68	137.19	669.35	22.68	14.77	16.33
205	136.16	705.90	635.38	12.74	20.58	136.17	676.88	13.49	14.66	15.39
206	136.77	718.02	638.08	11.36	20.24	136.91	659.22	16.43	16.59	17.60
207	138.31	739.04	636.13	8.98	20.48	137.41	676.71	20.54	14.13	15.41
208	138.67	777.43	382.07	4.73	52.24	138.27	676.61	28.75	13.56	15.42
209	133.88	654.71	636.58	18.37	20.43	133.78	671.05	3.68	15.87	16.12
210	134.77	660.87	494.69	17.70	38.16	134.37	682.00	6.02	14.32	14.75
211	136.06	683.47	631.63	15.10	21.05	135.57	675.75	10.35	14.77	15.53
212	138.32	711.03	486.53	12.11	39.18	138.08	665.65	18.11	15.48	16.79
213	134.64	659.91	494.57	17.82	38.18	134.31	670.64	5.09	15.85	16.17
214	135.45	669.06	484.70	16.78	39.41	134.92	677.76	7.27	14.80	15.28
215	136.97	685.94	488.57	14.90	38.93	136.53	671.74	12.05	15.16	16.03
216	138.60	708.07	503.31	12.58	37.09	138.41	676.79	20.45	13.92	15.40

	N=15					N=100				
	time (sec)	**total cost**	**energy cost**	**% cost saving**	**% energy saving**	**time (sec)**	**total cost**	**energy cost**	**% cost saving**	**% energy saving**
217	136.16	678.60	638.84	15.70	20.15	135.38	675.72	8.33	15.02	15.53
218	136.81	688.11	486.27	14.63	39.22	136.00	672.82	9.92	15.29	15.90
219	137.92	694.15	496.60	14.09	37.93	137.22	678.36	14.65	14.23	15.21
220	139.76	712.93	527.82	12.20	34.02	139.41	675.01	22.06	14.15	15.62
221	138.02	686.91	489.72	15.09	38.78	137.63	677.80	13.93	14.50	15.28
222	137.36	699.69	503.98	13.62	37.00	137.84	673.32	15.67	14.94	15.83
223	136.92	699.02	538.19	13.91	32.73	138.73	663.94	20.43	15.72	17.01
224	138.18	735.64	511.82	9.85	36.02	139.96	675.32	29.34	13.64	15.58
225	133.80	647.31	600.47	19.29	24.94	134.08	668.34	3.64	16.21	16.46
226	134.44	658.20	601.31	18.03	24.84	134.77	672.07	5.73	15.59	15.99
227	135.85	687.66	578.55	14.58	27.68	135.94	667.96	10.12	15.77	16.50
228	137.37	700.48	581.80	13.41	27.28	137.84	686.72	19.17	12.74	14.16
229	134.40	655.81	599.32	18.33	25.09	134.48	676.49	5.05	15.13	15.44
230	134.97	670.30	606.66	16.63	24.17	135.28	675.65	6.96	15.10	15.54
231	136.09	680.12	580.83	15.62	27.40	136.26	679.64	11.55	14.24	15.05
232	137.80	704.20	600.24	13.06	24.97	138.18	679.90	20.73	13.50	15.01
233	135.39	668.91	607.16	16.91	24.11	135.34	669.07	7.82	15.91	16.37
234	135.87	676.72	605.32	16.04	24.34	136.16	668.97	10.05	15.75	16.38
235	136.88	698.58	592.31	13.54	25.96	137.02	682.13	14.64	13.77	14.73
236	138.32	709.29	587.63	12.65	26.55	138.53	672.82	24.34	14.14	15.90
237	136.60	690.82	577.70	14.61	27.79	136.69	679.75	13.72	14.28	15.03
238	137.06	695.13	594.56	14.18	25.68	137.20	666.60	15.81	15.75	16.68
239	137.89	705.53	596.03	13.11	25.50	138.06	676.41	20.91	14.12	15.45
240	139.15	723.56	603.96	11.33	24.51	139.40	669.31	29.31	14.39	16.34
241	133.27	654.64	636.20	18.37	20.47	133.54	678.44	3.63	14.95	15.19
242	134.01	660.72	631.20	17.72	21.10	134.30	668.96	5.90	15.96	16.38
243	135.19	681.73	642.81	15.31	19.65	135.27	678.36	10.21	14.46	15.20
244	136.68	703.20	633.75	13.08	20.78	136.81	675.02	18.48	14.28	15.62
245	133.96	660.80	640.54	17.71	19.93	134.02	673.94	5.16	15.43	15.76
246	134.40	671.01	639.61	16.54	20.05	134.46	674.37	7.39	15.20	15.70
247	135.35	678.57	639.53	15.81	20.06	135.44	680.87	12.18	14.01	14.89
248	136.91	709.70	638.50	12.38	20.19	137.00	674.75	20.61	14.15	15.66
249	134.67	678.27	636.71	15.74	20.41	134.71	683.15	8.10	14.13	14.61
250	135.12	676.19	639.48	16.11	20.07	135.16	665.32	10.43	16.16	16.83
251	135.83	684.87	639.61	15.24	20.05	136.13	672.25	14.83	14.96	15.97
252	137.18	718.12	634.48	11.56	20.69	137.27	665.47	23.79	15.12	16.82
253	135.81	697.12	647.85	13.83	19.02	135.91	673.99	13.57	15.01	15.75
254	136.23	702.70	618.31	13.25	22.71	136.33	680.36	16.43	13.98	14.96
255	136.77	718.18	604.83	11.55	24.40	136.85	680.40	20.50	13.68	14.95
256	138.07	730.21	609.88	10.51	23.76	138.20	678.94	28.95	13.25	15.13
257	133.27	649.37	630.89	19.03	21.14	133.58	664.42	3.61	16.70	16.95
258	134.18	663.80	644.24	17.33	19.47	134.22	676.90	5.64	15.00	15.39
259	135.10	681.35	657.45	15.36	17.82	135.17	674.09	10.25	14.99	15.74
260	136.91	697.63	648.75	13.77	18.91	137.01	679.15	19.63	13.62	15.11
261	133.93	659.39	639.97	17.88	20.00	134.03	680.59	5.19	14.60	14.93
262	134.41	666.46	644.20	17.11	19.48	134.68	667.37	7.04	16.12	16.58
263	135.55	691.30	664.47	14.23	16.94	135.62	667.21	11.50	15.79	16.60
264	137.15	703.02	655.59	13.21	18.05	137.25	667.48	19.48	15.19	16.57
265	134.67	673.63	649.80	16.32	18.77	134.74	667.53	8.10	16.07	16.56
266	135.27	678.24	650.24	15.85	18.72	135.35	662.35	9.96	16.59	17.21
267	136.13	691.98	652.61	14.36	18.42	136.07	671.87	14.78	15.02	16.02
268	137.66	709.60	656.26	12.61	17.97	137.72	671.39	22.94	14.49	16.08
269	136.07	688.48	650.71	14.90	18.66	136.20	675.12	14.32	14.78	15.61
270	136.43	691.58	649.33	14.62	18.83	136.32	673.62	16.28	14.83	15.80
271	136.95	704.80	656.74	13.20	17.91	137.02	670.60	21.20	14.80	16.18
272	138.33	730.60	631.93	10.47	21.01	138.39	667.71	28.46	14.69	16.54
273	133.30	650.19	636.04	18.93	20.50	133.56	677.13	3.69	15.11	15.36
274	134.20	662.60	643.33	17.48	19.58	134.24	670.14	5.83	15.82	16.23
275	135.12	676.79	653.91	15.93	18.26	135.18	670.10	10.06	15.51	16.24
276	136.88	690.55	649.71	14.64	18.79	136.94	671.99	18.99	14.59	16.00
277	133.94	660.67	641.24	17.73	19.84	134.02	677.55	5.17	14.98	15.31
278	134.43	668.14	646.32	16.90	19.21	134.72	661.38	7.35	16.82	17.33
279	135.54	689.17	662.53	14.50	17.18	135.64	670.98	12.17	15.24	16.13
280	137.07	703.11	662.81	13.20	17.15	137.15	670.35	20.93	14.66	16.21
281	134.65	672.41	648.16	16.47	18.98	134.73	673.04	8.04	15.39	15.87
282	135.35	682.10	654.26	15.37	18.22	135.38	676.84	9.99	14.78	15.39
283	136.06	693.30	659.09	14.20	17.61	136.13	674.88	14.33	14.70	15.64
284	137.57	712.95	666.70	12.20	16.66	137.67	679.27	23.20	13.49	15.09
285	136.07	690.30	655.84	14.67	18.02	136.16	682.62	13.63	13.94	14.67
286	136.47	697.81	656.49	13.85	17.94	136.53	675.19	15.91	14.68	15.60
287	137.15	711.17	669.18	12.42	16.35	137.22	681.21	20.53	13.58	14.85
288	138.45	721.03	663.40	11.64	17.07	138.52	666.10	28.98	14.82	16.74