Supplementary Materials: Solving Fuel-based Unit Commitment Problem Using Improved Binary Bald Eagle Search

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1 Best UC schedules obtained by IBBESS2 algorithm

Table 1 Unit Commitment schedule for the 4-unit problem.

Hour	Unit			
	1	2	3	4
1	1	1	0	0
2	1	1	1	0
3	1	1	1	1
4	1	1	1	0
5	1	1	0	0
6	1	1	0	0
7	1	1	0	0
8	1	1	0	0

Table 2 Power generation schedule (in MW) for the 4-unit problem.

Hour	Unit			
	1	2	3	4
1	300	150	0	0
2	300	205	25	0
3	300	250	30	20
4	300	215	25	0
5	276	124	0	0
6	196	84	0	0
7	203	87	0	0
8	300	200	0	0

Table 3 Cost breakdown for the 4-unit problem.

Hour	Load (MW)	Demand (MW)	Fuel ($/h)	Startup ($/h)	Total ($/h)
1	450	450	9,109	0	9,109
2	530	530	10,856	150	11,006
3	600	600	12,535	0	12,535
4	540	540	11,043	0	11,043
5	400	400	8,206	0	8,206
6	280	280	6,067	0	6,067
7	290	290	6,244	0	6,244
8	500	500	10,030	0	10,030

Table 4 Unit commitment schedule for the 10-unit problem.

Hour	**Unit**									
	1	2	3	4	5	6	7	8	9	10
1	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	1	0	0	0	0	0
4	1	1	0	0	1	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0
6	1	1	1	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	1	0	0	0
10	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	1	0	0	0
15	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	1	1	0	0
21	1	1	1	1	1	1	1	0	0	0
22	1	1	0	0	1	1	1	0	0	0
23	1	1	0	0	1	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0

Table 5 Power generation schedule (in MW) for the 10-unit problem.

Hour	**Unit**									
	1	2	3	4	5	6	7	8	9	10
1	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0
3	455	370	0	0	25	0	0	0	0	0
4	455	455	0	0	40	0	0	0	0	0
5	455	390	0	130	25	0	0	0	0	0
6	455	360	130	130	25	0	0	0	0	0
7	455	410	130	130	25	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	85	20	25	0	0	0
10	455	455	130	130	162	33	25	10	0	0
11	455	455	130	130	162	73	25	10	10	0
12	455	455	130	130	162	80	25	43	10	10
13	455	455	130	130	162	33	25	10	0	0
14	455	455	130	130	85	20	25	0	0	0
15	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	30	0	0	0	0	0
20	455	455	130	130	162	33	25	10	0	0
21	455	455	130	130	85	20	25	0	0	0
22	455	455	0	0	145	20	25	0	0	0
23	455	420	0	0	25	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0

Table 6 Cost breakdown for the 10-unit problem.

Hour	**Load** (MW)	**Demand** (MW)	**Fuel** ($/h)	**Startup** ($/h)	**Total** ($/h)
1	700	700	13,683	0	13,683
2	750	750	14,554	0	14,554
3	850	850	16,809	900	17,709
4	950	950	18,598	0	18,598
5	1,000	1,000	20,020	560	20,580
6	1,100	1,100	22,387	1,100	23,487
7	1,150	1,150	23,262	0	23,262
8	1,200	1,200	24,150	0	24,150
9	1,300	1,300	27,251	860	28,111
10	1,400	1,400	30,058	60	30,118
11	1,450	1,450	31,916	60	31,976
12	1,500	1,500	33,890	60	33,950
13	1,400	1,400	30,058	0	30,058
14	1,300	1,300	27,251	0	27,251
15	1,200	1,200	24,150	0	24,150
16	1,050	1,050	21,514	0	21,514
17	1,000	1,000	20,642	0	20,642
18	1,100	1,100	22,387	0	22,387
19	1,200	1,200	24,150	0	24,150
20	1,400	1,400	30,058	490	30,548
21	1,300	1,300	27,251	0	27,251
22	1,100	1,100	22,736	0	22,736
23	900	900	17,685	0	17,685
24	800	800	15,427	0	15,427

Table 7 Commitment schedule for the 20-unit problem.

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
6	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	1	0	0
22	1	1	0	1	1	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0
23	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 8 Power generation schedule (in MW) for the 20-unit problem.

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	383	0	0	25	0	0	0	0	0	455	383	0	0	0	0	0	0	0	0
4	455	455	0	0	40	0	0	0	0	0	455	455	0	0	40	0	0	0	0	0
5	455	455	0	130	25	0	0	0	0	0	455	455	0	0	25	0	0	0	0	0
6	455	425	130	130	25	0	0	0	0	0	455	425	0	130	25	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	98	20	25	0	0	0	455	455	130	130	98	20	0	0	0	0
10	455	455	130	130	162	33	25	10	0	0	455	455	130	130	162	33	25	10	0	0
11	455	455	130	130	162	73	25	10	10	0	455	455	130	130	162	73	25	10	10	0
12	455	455	130	130	162	80	25	43	10	10	455	455	130	130	162	80	25	43	10	10
13	455	455	130	130	162	33	25	10	0	0	455	455	130	130	162	33	25	10	0	0
14	455	455	130	130	98	20	25	0	0	0	455	455	130	130	98	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
20	455	455	130	130	162	43	0	10	10	10	455	455	130	130	162	43	0	10	10	0
21	455	455	130	130	105	20	0	0	0	0	455	455	130	130	105	20	0	10	0	0
22	455	455	0	130	105	20	0	0	0	0	455	455	0	0	105	20	0	0	0	0
23	455	433	0	0	0	0	0	0	0	0	455	433	0	0	25	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 9 Cost breakdown for the 20-unit problem.

Hour	**Load** (MW)	**Demand** (MW)	**Fuel** ($/h)	**Startup** ($/h)	**Total** ($/h)
1	1,400	1,400	27,366	0	27,366
2	1,500	1,500	29,109	0	29,109
3	1,700	1,700	33,111	900	34,011
4	1,900	1,900	37,195	900	38,095
5	2,000	2,000	39,457	560	40,017
6	2,200	2,200	44,158	2,220	46,378
7	2,300	2,300	46,009	0	46,009
8	2,400	2,400	48,301	1,100	49,401
9	2,600	2,600	53,839	1,200	55,039
10	2,800	2,800	60,115	640	60,755
11	2,900	2,900	63,832	120	63,952
12	3,000	3,000	67,780	120	67,900
13	2,800	2,800	60,115	0	60,115
14	2,600	2,600	53,839	0	53,839
15	2,400	2,400	48,301	0	48,301
16	2,100	2,100	43,027	0	43,027
17	2,000	2,000	41,284	0	41,284
18	2,200	2,200	44,774	0	44,774
19	2,400	2,400	48,301	0	48,301
20	2,800	2,800	61,047	640	61,687
21	2,600	2,600	53,892	0	53,892
22	2,200	2,200	44,328	0	44,328
23	1,800	1,800	34,863	0	34,863
24	1,600	1,600	30,855	0	30,855

Table 10 Unit commitment schedule for the 40-unit problem (units 1–20).

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
6	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	0	0
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	0	1	0	1	0	0	0	0	1	1	0	1	1	1	0	0	0	0
23	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 11 Unit commitment schedule for the 40-unit problem (units 21–40).

Hour	**Unit**																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
5	1	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
6	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	0	0	0
22	1	1	0	1	1	1	0	0	0	0	1	1	0	1	0	1	1	0	0	0
23	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 12 Power generation schedule (in MW) for the 40-unit problem (units 1–20).

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	389	0	0	0	0	0	0	0	0	455	389	0	0	0	0	0	0	0	0
4	455	418	0	130	0	0	0	0	0	0	455	418	0	130	25	0	0	0	0	0
5	455	455	0	130	25	0	0	0	0	0	455	455	0	130	25	0	0	0	0	0
6	455	455	130	130	27	0	0	0	0	0	455	455	0	130	27	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	130	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	104	20	25	0	0	0	455	455	130	130	104	20	0	0	0	0
10	455	455	130	130	162	33	25	10	0	0	455	455	130	130	162	33	25	10	0	0
11	455	455	130	130	162	73	25	10	10	0	455	455	130	130	162	73	25	10	10	0
12	455	455	130	130	162	80	25	43	10	10	455	455	130	130	162	80	25	43	10	10
13	455	455	130	130	162	33	25	10	0	0	455	455	130	130	162	33	25	10	0	0
14	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
20	455	455	130	130	162	42	0	10	10	0	455	455	130	130	162	42	0	10	0	0
21	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
22	455	455	0	130	0	20	0	0	0	0	455	455	0	130	68	20	0	0	0	0
23	455	433	0	0	0	0	0	0	0	0	455	433	0	0	25	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 13 Power generation schedule (in MW) for the 40-unit problem (units 21–40).

Hour	**Unit**																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	389	0	0	25	0	0	0	0	0	455	389	0	0	0	0	0	0	0	0
4	455	418	0	0	25	0	0	0	0	0	455	418	0	0	0	0	0	0	0	0
5	455	455	0	0	25	0	0	0	0	0	455	455	0	0	25	0	0	0	0	0
6	455	455	0	130	27	0	0	0	0	0	455	455	0	130	27	0	0	0	0	0
7	455	455	0	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
10	455	455	130	130	162	33	25	10	0	0	455	455	130	130	162	33	25	10	0	0
11	455	455	130	130	162	73	25	10	10	0	455	455	130	130	162	73	25	10	10	0
12	455	455	130	130	162	80	25	43	10	10	455	455	130	130	162	80	25	43	10	10
13	455	455	130	130	162	33	25	10	0	0	455	455	130	130	162	33	25	10	0	0
14	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	25	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
20	455	455	130	130	162	42	0	10	10	0	455	455	130	130	162	42	25	10	10	10
21	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	25	0	0	0
22	455	455	0	130	68	20	0	0	0	0	455	455	0	130	0	20	25	0	0	0
23	455	433	0	0	25	0	0	0	0	0	455	433	0	0	0	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 14 Cost breakdown for the 40-unit problem.

Hour	**Load** (MW)	**Demand** (MW)	**Fuel** ($/h)	**Startup** ($/h)	**Total** ($/h)
1	2,800	2,800	54,733	0	54,733
2	3,000	3,000	58,218	0	58,218
3	3,400	3,400	65,715	900	66,615
4	3,800	3,800	74,395	2,020	76,415
5	4,000	4,000	78,914	1,800	80,714
6	4,400	4,400	87,727	3,340	91,067
7	4,600	4,600	92,018	1,100	93,118
8	4,800	4,800	96,601	2,200	98,801
9	5,200	5,200	107,016	1,880	108,896
10	5,600	5,600	120,230	1,800	122,030
11	5,800	5,800	127,664	240	127,904
12	6,000	6,000	135,561	240	135,801
13	5,600	5,600	120,230	0	120,230
14	5,200	5,200	107,016	0	107,016
15	4,800	4,800	96,601	0	96,601
16	4,200	4,200	86,055	0	86,055
17	4,000	4,000	82,567	0	82,567
18	4,400	4,400	89,548	0	89,548
19	4,800	4,800	96,601	0	96,601
20	5,600	5,600	121,268	1,420	122,688
21	5,200	5,200	107,016	0	107,016
22	4,400	4,400	88,898	0	88,898
23	3,600	3,600	69,725	0	69,725
24	3,200	3,200	61,710	0	61,710

Table 15 Unit commitment schedule for the 60-unit problem (units 1–20).

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
6	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
21	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
22	1	1	0	1	1	1	1	0	0	0	1	1	0	1	0	1	1	0	0	0
23	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 16 Unit commitment schedule for the 60-unit problem (units 21–40).

Hour	**Unit**																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
6	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	0
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	0	1	0	1	0	0	0	0	1	1	0	1	1	1	0	0	0	0
23	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 17 Unit commitment schedule for the 60-unit problem (units 41–60).

Hour	**Unit**																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
5	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
6	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	1	1	1
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	0	1	1	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0
23	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 18 Power generation schedule (in MW) for the 60-unit problem (units 1–20).

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	391	0	0	0	0	0	0	0	0	455	391	0	0	0	0	0	0	0	0
4	455	435	0	0	25	0	0	0	0	0	455	435	0	0	0	0	0	0	0	0
5	455	412	0	130	25	0	0	0	0	0	455	412	0	0	25	0	0	0	0	0
6	455	455	0	130	38	0	0	0	0	0	455	455	0	130	38	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	130	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	102	20	25	0	0	0	455	455	130	130	102	20	25	0	0	0
10	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
11	455	455	130	130	162	75	25	10	10	0	455	455	130	130	162	75	25	10	10	0
12	455	455	130	130	162	80	25	45	10	10	455	455	130	130	162	80	25	45	10	10
13	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
14	455	455	130	130	102	20	25	0	0	0	455	455	130	130	102	20	25	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
20	455	455	130	130	162	41	25	10	10	10	455	455	130	130	162	41	25	10	10	0
21	455	455	130	130	102	20	25	0	0	0	455	455	130	130	102	20	25	0	0	0
22	455	455	0	130	63	20	25	0	0	0	455	455	0	130	0	20	25	0	0	0
23	455	433	0	0	25	0	0	0	0	0	455	433	0	0	0	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 19 Power generation schedule (in MW) for the 60-unit problem (units 21–40).

Hour	**Unit**																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	391	0	0	0	0	0	0	0	0	455	391	0	0	0	0	0	0	0	0
4	455	435	0	0	25	0	0	0	0	0	455	435	0	0	0	0	0	0	0	0
5	455	412	0	130	25	0	0	0	0	0	455	412	0	0	25	0	0	0	0	0
6	455	455	0	130	38	0	0	0	0	0	455	455	0	130	38	0	0	0	0	0
7	455	455	0	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	102	20	0	0	0	0	455	455	130	130	102	20	0	0	0	0
10	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
11	455	455	130	130	162	75	25	10	10	0	455	455	130	130	162	75	25	10	10	0
12	455	455	130	130	162	80	25	45	10	10	455	455	130	130	162	80	25	45	10	10
13	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
14	455	455	130	130	102	20	0	0	0	0	455	455	130	130	102	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
20	455	455	130	130	162	41	0	10	10	10	455	455	130	130	162	41	0	0	0	0
21	455	455	130	130	102	20	0	0	0	0	455	455	130	130	102	20	0	0	0	0
22	455	455	0	130	0	20	0	0	0	0	455	455	0	130	63	20	0	0	0	0
23	455	433	0	0	0	0	0	0	0	0	455	433	0	0	25	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 20 Power generation schedule (in MW) for the 60-unit problem (units 41–60).

Hour	**Unit**																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	391	0	0	25	0	0	0	0	0	455	391	0	0	0	0	0	0	0	0
4	455	435	130	0	25	0	0	0	0	0	455	435	0	130	25	0	0	0	0	0
5	455	412	130	130	25	0	0	0	0	0	455	412	0	130	25	0	0	0	0	0
6	455	455	130	130	38	0	0	0	0	0	455	455	0	130	38	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	102	20	0	0	0	0	455	455	130	130	102	20	0	0	0	0
10	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	0	0	0
11	455	455	130	130	162	75	25	10	10	0	455	455	130	130	162	75	25	10	0	0
12	455	455	130	130	162	80	25	45	10	10	455	455	130	130	162	80	25	45	10	0
13	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	0	0	0
14	455	455	130	130	102	20	0	0	0	0	455	455	130	130	102	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
20	455	455	130	130	162	41	0	0	0	0	455	455	130	130	162	41	0	10	10	10
21	455	455	130	130	102	20	0	0	0	0	455	455	130	130	102	20	0	0	0	0
22	455	455	0	130	63	20	0	0	0	0	455	455	0	130	0	20	0	0	0	0
23	455	433	0	0	25	0	0	0	0	0	455	433	0	0	0	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 21 Cost breakdown for the 60-unit problem.

Hour	**Load** (MW)	**Demand** (MW)	**Fuel** ($/h)	**Startup** ($/h)	**Total** ($/h)
1	4,200	4,200	82,099	0	82,099
2	4,500	4,500	87,327	0	87,327
3	5,100	5,100	98,319	900	99,219
4	5,700	5,700	111,548	3,810	115,358
5	6,000	6,000	119,567	3,480	123,047
6	6,600	6,600	131,442	2,240	133,682
7	6,900	6,900	138,026	2,200	140,226
8	7,200	7,200	144,902	3,300	148,202
9	7,800	7,800	160,855	3,080	163,935
10	8,400	8,400	179,653	2,380	182,033
11	8,700	8,700	190,792	360	191,152
12	9,000	9,000	202,656	360	203,016
13	8,400	8,400	179,653	0	179,653
14	7,800	7,800	160,855	0	160,855
15	7,200	7,200	144,902	0	144,902
16	6,300	6,300	129,082	0	129,082
17	6,000	6,000	123,851	0	123,851
18	6,600	6,600	134,322	0	134,322
19	7,200	7,200	144,902	0	144,902
20	8,400	8,400	181,545	2,200	183,745
21	7,800	7,800	160,855	0	160,855
22	6,600	6,600	133,681	0	133,681
23	5,400	5,400	104,588	0	104,588
24	4,800	4,800	92,565	0	92,565

Table 22 Unit commitment schedule for the 80-unit problem (units 1–20).

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
5	1	1	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
6	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0
21	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	0	1	0	1	1	0	0	0	1	1	0	1	0	1	0	0	0	0
23	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 23 Unit commitment schedule for the 80-unit problem (units 21–40).

Hour	**Unit**																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
6	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	0	0	1	1
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	0	0	0	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0
23	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 24 Unit commitment schedule for the 80-unit problem (units 41–60).

Hour	**Unit**																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
6	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	1	1
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	1	1	1	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0
23	1	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 25 Unit commitment schedule for the 80-unit problem (units 61–80).

Hour	**Unit**																			
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
5	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
6	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0
20	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	0	0	0
22	1	1	1	1	1	1	0	0	0	0	1	1	0	1	1	1	0	0	0	0
23	1	1	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 26 Power generation schedule (in MW) for the 80-unit problem (units 1–20).

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	389	0	0	0	0	0	0	0	0	455	389	0	0	0	0	0	0	0	0
4	455	455	0	130	0	0	0	0	0	0	455	455	0	0	32	0	0	0	0	0
5	455	445	0	130	0	0	0	0	0	0	455	445	0	130	25	0	0	0	0	0
6	455	455	130	130	0	0	0	0	0	0	455	455	130	130	31	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	130	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	104	20	25	0	0	0	455	455	130	130	104	20	25	0	0	0
10	455	455	130	130	162	34	25	10	0	0	455	455	130	130	162	34	25	10	0	0
11	455	455	130	130	162	74	25	10	10	0	455	455	130	130	162	74	25	10	10	0
12	455	455	130	130	162	80	25	44	10	10	455	455	130	130	162	80	25	44	10	10
13	455	455	130	130	162	34	25	10	0	0	455	455	130	130	162	34	25	10	0	0
14	455	455	130	130	104	20	25	0	0	0	455	455	130	130	104	20	25	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	27	0	0	0	0	0	455	455	130	130	27	0	0	0	0	0
20	455	455	130	130	162	42	25	10	10	0	455	455	130	130	162	42	0	10	10	0
21	455	455	130	130	104	20	25	0	0	0	455	455	130	130	104	20	0	0	0	0
22	455	455	0	130	0	20	25	0	0	0	455	455	0	130	0	20	0	0	0	0
23	455	364	0	0	0	0	0	0	0	0	455	364	0	130	0	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 27 Power generation schedule (in MW) for the 80-unit problem (units 21–40).

Hour	**Unit**																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	389	0	0	25	0	0	0	0	0	455	389	0	0	0	0	0	0	0	0
4	455	455	0	0	32	0	0	0	0	0	455	455	0	0	32	0	0	0	0	0
5	455	445	0	130	25	0	0	0	0	0	455	445	0	130	25	0	0	0	0	0
6	455	455	0	130	31	0	0	0	0	0	455	455	0	130	31	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	130	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
10	455	455	130	130	162	34	25	10	0	0	455	455	130	130	162	34	25	10	0	0
11	455	455	130	130	162	74	25	10	10	0	455	455	130	130	162	74	25	10	10	0
12	455	455	130	130	162	80	25	44	10	10	455	455	130	130	162	80	25	44	10	10
13	455	455	130	130	162	34	25	10	0	0	455	455	130	130	162	34	25	10	0	0
14	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	27	0	0	0	0	0	455	455	130	130	27	0	0	0	0	0
20	455	455	130	130	162	42	0	10	0	0	455	455	130	130	162	42	0	0	10	10
21	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
22	455	455	0	0	0	20	0	0	0	0	455	455	0	130	0	20	0	0	0	0
23	455	364	0	0	0	0	0	0	0	0	455	364	0	130	0	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 28 Power generation schedule (in MW) for the 80-unit problem (units 41–60).

Hour	**Unit**																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	389	0	0	0	0	0	0	0	0	455	389	0	0	0	0	0	0	0	0
4	455	455	0	0	32	0	0	0	0	0	455	455	0	0	32	0	0	0	0	0
5	455	445	0	130	25	0	0	0	0	0	455	445	0	0	25	0	0	0	0	0
6	455	455	0	130	31	0	0	0	0	0	455	455	0	130	31	0	0	0	0	0
7	455	455	0	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
10	455	455	130	130	162	34	25	10	0	0	455	455	130	130	162	34	25	10	0	0
11	455	455	130	130	162	74	25	10	10	0	455	455	130	130	162	74	25	10	10	0
12	455	455	130	130	162	80	25	44	10	10	455	455	130	130	162	80	25	44	10	10
13	455	455	130	130	162	34	25	10	0	0	455	455	130	130	162	34	25	10	0	0
14	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	27	0	0	0	0	0	455	455	130	130	27	0	0	0	0	0
20	455	455	130	130	162	42	0	0	10	10	455	455	130	130	162	42	0	0	10	10
21	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
22	455	455	130	130	74	20	0	0	0	0	455	455	0	0	74	20	0	0	0	0
23	455	364	0	130	0	0	0	0	0	0	455	364	0	0	0	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 29 Power generation schedule (in MW) for the 80-unit problem (units 61–80).

Hour	**Unit**																			
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	295	0	0	0	0	0	0	0	0	455	295	0	0	0	0	0	0	0	0
3	455	389	0	0	25	0	0	0	0	0	455	389	0	0	0	0	0	0	0	0
4	455	455	0	0	32	0	0	0	0	0	455	455	0	0	0	0	0	0	0	0
5	455	445	0	0	25	0	0	0	0	0	455	445	0	0	0	0	0	0	0	0
6	455	455	0	130	31	0	0	0	0	0	455	455	0	130	31	0	0	0	0	0
7	455	455	0	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
10	455	455	130	130	162	34	25	10	0	0	455	455	130	130	162	34	25	0	0	0
11	455	455	130	130	162	74	25	10	10	0	455	455	130	130	162	74	25	10	0	0
12	455	455	130	130	162	80	25	44	10	10	455	455	130	130	162	80	25	44	10	0
13	455	455	130	130	162	34	25	10	0	0	455	455	130	130	162	34	25	0	0	0
14	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	27	0	0	0	0	0	455	455	130	130	27	0	25	0	0	0
20	455	455	130	130	162	42	0	0	10	10	455	455	130	130	162	42	25	10	10	10
21	455	455	130	130	104	20	0	0	0	0	455	455	130	130	104	20	25	0	0	0
22	455	455	130	130	74	20	0	0	0	0	455	455	0	130	74	20	0	0	0	0
23	455	364	0	130	0	0	0	0	0	0	455	364	0	130	0	0	0	0	0	0
24	455	345	0	0	0	0	0	0	0	0	455	345	0	0	0	0	0	0	0	0

Table 30 Cost breakdown for the 80-unit problem.

Hour	**Load** (MW)	**Demand** (MW)	**Fuel** ($/h)	**Startup** ($/h)	**Total** ($/h)
1	5,600	5,600	109,465	0	109,465
2	6,000	6,000	116,436	0	116,436
3	6,800	6,800	131,430	1,800	133,230
4	7,600	7,600	148,154	4,160	152,314
5	8,000	8,000	157,397	2,240	159,637
6	8,800	8,800	175,007	7,360	182,367
7	9,200	9,200	184,035	4,000	188,035
8	9,600	9,600	193,203	4,400	197,603
9	10,400	10,400	214,032	3,760	217,792
10	11,200	11,200	239,768	3,540	243,308
11	11,600	11,600	254,624	480	255,104
12	12,000	12,000	270,436	480	270,916
13	11,200	11,200	239,768	0	239,768
14	10,400	10,400	214,032	0	214,032
15	9,600	9,600	193,203	0	193,203
16	8,400	8,400	172,109	0	172,109
17	8,000	8,000	165,135	0	165,135
18	8,800	8,800	179,096	0	179,096
19	9,600	9,600	193,879	260	194,139
20	11,200	11,200	242,639	2,580	245,219
21	10,400	10,400	214,032	0	214,032
22	8,800	8,800	177,190	0	177,190
23	7,200	7,200	140,345	0	140,345
24	6,400	6,400	123,419	0	123,419

Table 31 Unit commitment schedule for the 100-unit problem (units 1–20).

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	1	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
6	1	1	1	1	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
21	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
22	1	1	1	1	0	1	1	0	0	0	1	1	1	1	0	1	1	0	0	0
23	1	1	0	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 32 Unit commitment schedule for the 100-unit problem (units 21–40).

Hour	**Unit**																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
4	1	1	0	1	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
5	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
6	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	0	1	1	1
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	0	1	0	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0
23	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 33 Unit commitment schedule for the 100-unit problem (units 41–60).

Hour	**Unit**																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
5	1	1	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
6	1	1	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	1	1
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	0	1	1	1	0	0	0	0	1	1	0	1	0	1	0	0	0	0
23	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 34 Unit commitment schedule for the 100-unit problem (units 61–80).

Hour	**Unit**																			
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
5	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
6	1	1	0	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	0	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
11	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
12	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
20	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	1	1	0	0
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	0	0	0
22	1	1	0	1	1	1	0	0	0	0	1	1	0	1	0	1	1	0	0	0
23	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

Table 35 Unit commitment schedule for the 100-unit problem (units 81–100).

Hour	**Unit**																			
	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
5	1	1	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
6	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
7	1	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0
8	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
9	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
11	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0
12	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	0	0
14	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
15	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
16	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
17	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
18	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0
19	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0
20	1	1	1	1	1	1	0	1	0	0	1	1	1	1	1	1	0	0	1	0
21	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0	0	0	0
22	1	1	0	1	1	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0
23	1	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24	1	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Table 36 Power generation schedule (in MW) for the 100-unit problem (units 1–20).

Hour	**Unit**																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	293	0	0	0	0	0	0	0	0	455	293	0	0	0	0	0	0	0	0
3	455	390	0	0	0	0	0	0	0	0	455	390	0	0	0	0	0	0	0	0
4	455	441	0	130	25	0	0	0	0	0	455	441	0	130	0	0	0	0	0	0
5	455	450	0	130	25	0	0	0	0	0	455	450	0	130	0	0	0	0	0	0
6	455	443	130	130	25	0	0	0	0	0	455	443	130	130	0	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	130	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	103	20	25	0	0	0	455	455	130	130	103	20	25	0	0	0
10	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
11	455	455	130	130	162	75	25	10	10	0	455	455	130	130	162	75	25	10	10	0
12	455	455	130	130	162	80	25	45	10	10	455	455	130	130	162	80	25	45	10	10
13	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
14	455	455	130	130	103	20	25	0	0	0	455	455	130	130	103	20	25	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	28	0	0	0	0	0	455	455	130	130	28	0	0	0	0	0
20	455	455	130	130	162	42	25	10	10	10	455	455	130	130	162	42	25	10	10	10
21	455	455	130	130	103	20	25	0	0	0	455	455	130	130	103	20	25	0	0	0
22	455	455	130	130	0	20	25	0	0	0	455	455	130	130	0	20	25	0	0	0
23	455	410	0	130	0	0	0	0	0	0	455	410	0	130	0	0	0	0	0	0
24	455	381	0	0	0	0	0	0	0	0	455	381	0	0	0	0	0	0	0	0

Table 37 Power generation schedule (in MW) for the 100-unit problem (units 21–40).

Hour	**Unit**																			
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	293	0	0	25	0	0	0	0	0	455	293	0	0	0	0	0	0	0	0
3	455	390	0	0	25	0	0	0	0	0	455	390	0	0	25	0	0	0	0	0
4	455	441	0	130	25	0	0	0	0	0	455	441	0	0	25	0	0	0	0	0
5	455	450	0	130	25	0	0	0	0	0	455	450	0	130	25	0	0	0	0	0
6	455	443	130	130	25	0	0	0	0	0	455	443	0	130	25	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	103	20	25	0	0	0	455	455	130	130	103	20	0	0	0	0
10	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
11	455	455	130	130	162	75	25	10	10	0	455	455	130	130	162	75	25	10	10	0
12	455	455	130	130	162	80	25	45	10	10	455	455	130	130	162	80	25	45	10	10
13	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
14	455	455	130	130	103	20	25	0	0	0	455	455	130	130	103	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	28	0	0	0	0	0	455	455	130	130	28	0	0	0	0	0
20	455	455	130	130	162	42	0	10	0	0	455	455	130	130	162	42	0	10	10	10
21	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
22	455	455	0	130	0	20	0	0	0	0	455	455	0	130	0	20	0	0	0	0
23	455	410	0	0	0	0	0	0	0	0	455	410	0	0	0	0	0	0	0	0
24	455	381	0	0	0	0	0	0	0	0	455	381	0	0	0	0	0	0	0	0

Table 38 Power generation schedule (in MW) for the 100-unit problem (units 41–60).

Hour	**Unit**																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	293	0	0	0	0	0	0	0	0	455	293	0	0	0	0	0	0	0	0
3	455	390	0	0	0	0	0	0	0	0	455	390	0	0	0	0	0	0	0	0
4	455	441	0	0	0	0	0	0	0	0	455	441	0	0	25	0	0	0	0	0
5	455	450	0	130	0	0	0	0	0	0	455	450	0	130	25	0	0	0	0	0
6	455	443	0	130	0	0	0	0	0	0	455	443	0	130	25	0	0	0	0	0
7	455	455	0	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
10	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
11	455	455	130	130	162	75	25	10	10	0	455	455	130	130	162	75	25	10	10	0
12	455	455	130	130	162	80	25	45	10	10	455	455	130	130	162	80	25	45	10	10
13	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
14	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	28	0	0	0	0	0	455	455	130	130	28	0	0	0	0	0
20	455	455	130	130	162	42	0	0	10	10	455	455	130	130	162	42	0	10	10	10
21	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
22	455	455	0	130	28	20	0	0	0	0	455	455	0	130	0	20	0	0	0	0
23	455	410	0	0	25	0	0	0	0	0	455	410	0	0	0	0	0	0	0	0
24	455	381	0	0	0	0	0	0	0	0	455	381	0	0	0	0	0	0	0	0

Table 39 Power generation schedule (in MW) for the 100-unit problem (units 61–80).

Hour	**Unit**																			
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	293	0	0	0	0	0	0	0	0	455	293	0	0	0	0	0	0	0	0
3	455	390	0	0	0	0	0	0	0	0	455	390	0	0	0	0	0	0	0	0
4	455	441	0	0	0	0	0	0	0	0	455	441	0	0	25	0	0	0	0	0
5	455	450	0	0	0	0	0	0	0	0	455	450	0	0	25	0	0	0	0	0
6	455	443	0	130	25	0	0	0	0	0	455	443	0	130	25	0	0	0	0	0
7	455	455	0	130	45	0	0	0	0	0	455	455	130	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
10	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
11	455	455	130	130	162	75	25	10	10	0	455	455	130	130	162	75	25	10	10	0
12	455	455	130	130	162	80	25	45	10	0	455	455	130	130	162	80	25	45	10	10
13	455	455	130	130	162	35	25	10	0	0	455	455	130	130	162	35	25	10	0	0
14	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	28	0	0	0	0	0	455	455	130	130	28	0	0	0	0	0
20	455	455	130	130	162	42	0	10	0	0	455	455	130	130	162	42	25	10	0	0
21	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	25	0	0	0
22	455	455	0	130	28	20	0	0	0	0	455	455	0	130	0	20	25	0	0	0
23	455	410	0	0	25	0	0	0	0	0	455	410	0	0	0	0	0	0	0	0
24	455	381	0	0	0	0	0	0	0	0	455	381	0	0	0	0	0	0	0	0

Table 40 Power generation schedule (in MW) for the 100-unit problem (units 81–100).

Hour	**Unit**																			
Hour	Unit 81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	455	245	0	0	0	0	0	0	0	0	455	245	0	0	0	0	0	0	0	0
2	455	293	0	0	0	0	0	0	0	0	455	293	0	0	0	0	0	0	0	0
3	455	390	0	0	0	0	0	0	0	0	455	390	0	0	0	0	0	0	0	0
4	455	441	0	0	0	0	0	0	0	0	455	441	0	0	25	0	0	0	0	0
5	455	450	0	0	25	0	0	0	0	0	455	450	0	0	25	0	0	0	0	0
6	455	443	130	130	25	0	0	0	0	0	455	443	0	130	25	0	0	0	0	0
7	455	455	130	130	45	0	0	0	0	0	455	455	0	130	45	0	0	0	0	0
8	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
9	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
10	455	455	130	130	162	35	25	0	0	0	455	455	130	130	162	35	25	0	0	0
11	455	455	130	130	162	75	25	10	0	0	455	455	130	130	162	75	25	10	0	0
12	455	455	130	130	162	80	25	45	10	0	455	455	130	130	162	80	25	45	10	10
13	455	455	130	130	162	35	25	0	0	0	455	455	130	130	162	35	25	0	0	0
14	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
15	455	455	130	130	30	0	0	0	0	0	455	455	130	130	30	0	0	0	0	0
16	455	310	130	130	25	0	0	0	0	0	455	310	130	130	25	0	0	0	0	0
17	455	260	130	130	25	0	0	0	0	0	455	260	130	130	25	0	0	0	0	0
18	455	360	130	130	25	0	0	0	0	0	455	360	130	130	25	0	0	0	0	0
19	455	455	130	130	28	0	0	0	0	0	455	455	130	130	28	20	0	0	0	0
20	455	455	130	130	162	42	0	10	0	0	455	455	130	130	162	42	0	0	10	0
21	455	455	130	130	103	20	0	0	0	0	455	455	130	130	103	20	0	0	0	0
22	455	455	0	130	28	20	0	0	0	0	455	455	0	130	0	0	0	0	0	0
23	455	410	0	0	25	20	0	0	0	0	455	410	0	0	0	0	0	0	0	0
24	455	381	0	0	25	0	0	0	0	0	455	0	0	0	0	0	0	0	0	0

Table 41 Cost breakdown for the 100-unit problem.

Hour	**Load** (MW)	**Demand** (MW)	**Fuel** ($/h)	**Startup** ($/h)	**Total** ($/h)
1	7,000	7,000	136,831	0	136,831
2	7,500	7,500	146,054	900	146,954
3	8,500	8,500	164,034	900	164,934
4	9,500	9,500	185,330	5,280	190,610
5	10,000	10,000	196,347	2,580	198,927
6	11,000	11,000	219,162	10,680	229,842
7	11,500	11,500	230,044	4,700	234,744
8	12,000	12,000	241,503	5,500	247,003
9	13,000	13,000	267,871	4,960	272,831
10	14,000	14,000	299,191	4,120	303,311
11	14,500	14,500	317,751	600	318,351
12	15,000	15,000	337,531	600	338,131
13	14,000	14,000	299,191	0	299,191
14	13,000	13,000	267,871	0	267,871
15	12,000	12,000	241,503	0	241,503
16	10,500	10,500	215,137	0	215,137
17	10,000	10,000	206,418	0	206,418
18	11,000	11,000	223,870	0	223,870
19	12,000	12,000	241,923	170	242,093
20	14,000	14,000	302,823	3,710	306,533
21	13,000	13,000	267,871	0	267,871
22	11,000	11,000	221,842	0	221,842
23	9,000	9,000	174,932	0	174,932
24	8,000	8,000	153,853	0	153,853