

81	5098	5292	764.72363	348	1188	1016.00000	688.57242	32.2%	58.4	70s
82	5512	4777	923.13203	923	17268	1016.00000	688.57242	32.2%	55.3	80s
83	5514	4778	971.00000	763	1515	1016.00000	971.00000	4.43%	55.3	87s
84	5515	4779	971.00000	852	1736	1016.00000	971.00000	4.43%	55.3	102s
85	5516	4780	982.22559	1115	1887	1016.00000	982.22559	3.32%	55.3	112s
86	5517	4780	982.99538	675	1784	1016.00000	982.99538	3.25%	55.3	120s
87	5522	4784	986.00000	698	1959	1016.00000	986.00000	2.95%	55.2	135s
88	5523	4784	986.07725	5	1817	1016.00000	986.07725	2.95%	55.2	140s
89	5532	4790	986.30578	642	1673	1016.00000	986.30578	2.92%	55.1	148s
90	5541	4796	986.66466	301	1830	1016.00000	986.66466	2.89%	55.1	150s
91	5553	4804	986.90388	841	1686	1016.00000	986.90388	2.86%	54.9	156s
92	5554	4805	986.90388	897	1777	1016.00000	986.90388	2.86%	54.9	164s
93	5555	4806	987.04416	415	1783	1016.00000	987.04416	2.85%	54.9	165s
94	5569	4815	987.04416	303	1738	1016.00000	987.04416	2.85%	54.8	196s
95	5578	4821	987.51726	182	1754	1016.00000	987.51726	2.80%	54.7	201s
96	5579	4822	987.51726	191	1748	1016.00000	987.51726	2.80%	54.7	212s
97	5592	4830	987.67912	378	1771	1016.00000	987.67912	2.79%	54.6	216s
98	5593	4831	987.67912	775	1732	1016.00000	987.67912	2.79%	54.5	228s
99	5601	4836	987.86594	113	1708	1016.00000	987.86594	2.77%	54.5	230s
100	5608	4841	987.86594	54	1717	1016.00000	987.86594	2.77%	54.4	245s
101	5617	4847	988.14549	675	1726	1016.00000	988.14549	2.74%	54.3	251s
102	5618	4848	988.14607	420	1662	1016.00000	988.14607	2.74%	54.3	265s
103	5630	4856	988.20665	48	1684	1016.00000	988.20665	2.74%	54.2	286s
104	5638	4861	988.27162	115	1712	1016.00000	988.27162	2.73%	54.1	290s
105	5639	4862	988.27162	557	1656	1016.00000	988.27162	2.73%	54.1	299s
106	5643	4864	988.35691	7	1684	1016.00000	988.35691	2.72%	54.1	300s
107	5648	4868	988.39133	339	1705	1016.00000	988.39133	2.72%	54.0	316s
108	5663	4878	988.56444	293	1694	1016.00000	988.56444	2.70%	53.9	320s
109	5673	4884	988.56444	655	1741	1016.00000	988.56444	2.70%	53.8	327s
110	5674	4885	988.59025	140	1664	1016.00000	988.59025	2.70%	53.8	351s
111	5690	4896	988.81971	834	1713	1016.00000	988.81971	2.68%	53.6	359s
112	5691	4896	988.86583	86	1643	1016.00000	988.86583	2.67%	53.6	377s
113	5702	4904	988.96365	471	1696	1016.00000	988.96365	2.66%	53.5	380s
114	5711	4910	988.99120	432	1660	1016.00000	988.99120	2.66%	53.4	406s
115	5723	4918	989.08080	5	1706	1016.00000	989.08080	2.65%	53.3	411s
116	5724	4918	989.08080	555	1658	1016.00000	989.08080	2.65%	53.3	440s
117	5725	4919	989.20954	80	1717	1016.00000	989.20954	2.64%	53.3	449s
118	5726	4920	989.20954	1072	1693	1016.00000	989.20954	2.64%	53.3	450s
119	5736	4926	989.20954	260	1676	1016.00000	989.20954	2.64%	53.2	465s
120	5737	4927	989.20954	323	1904	1016.00000	989.20954	2.64%	53.2	507s
121	5739	4928	989.25134	557	1777	1016.00000	989.25134	2.63%	53.2	510s
122	5746	4933	989.25134	46	1898	1016.00000	989.25134	2.63%	53.1	515s
123	5751	4936	989.25134	588	1899	1016.00000	989.25134	2.63%	53.0	529s
124	5752	4937	989.25134	902	1819	1016.00000	989.25134	2.63%	53.0	589s
125	5753	4938	989.35397	841	1810	1016.00000	989.35397	2.62%	53.0	591s
126	5758	4941	989.37302	209	2021	1016.00000	989.37302	2.62%	53.0	595s
127	5767	4947	989.38876	1194	2056	1016.00000	989.38876	2.62%	52.9	602s
128	5768	4948	989.39058	721	1875	1016.00000	989.39058	2.62%	52.9	626s
129	5778	4954	989.47870	182	1653	1016.00000	989.47870	2.61%	52.8	630s
130	5785	4959	989.47870	561	2005	1016.00000	989.47870	2.61%	52.7	701s
131	5797	4967	990.00000	21	1912	1016.00000	990.00000	2.56%	52.6	707s
132	5798	4968	990.00000	412	1997	1016.00000	990.00000	2.56%	52.6	729s
133	5799	4968	990.00000	329	1878	1016.00000	990.00000	2.56%	52.6	730s
134	5811	4976	990.00000	432	1850	1016.00000	990.00000	2.56%	52.5	736s
135	5812	4977	990.00000	923	1901	1016.00000	990.00000	2.56%	52.5	752s
136	5823	4984	990.00000	5	1706	1016.00000	990.00000	2.56%	52.4	760s
137	5841	4996	990.00000	301	1940	1016.00000	990.00000	2.56%	52.2	765s
138	5844	4998	990.00000	46	2077	1016.00000	990.00000	2.56%	52.2	788s
139	5847	5000	990.00000	645	2099	1016.00000	990.00000	2.56%	52.2	790s
140	5858	5008	990.00000	209	2132	1016.00000	990.00000	2.56%	52.1	795s
141	5859	5008	990.00000	88	2007	1016.00000	990.00000	2.56%	52.1	809s
142	5862	5010	990.00000	140	2161	1016.00000	990.00000	2.56%	52.0	810s
143	5880	5022	990.00000	402	2194	1016.00000	990.00000	2.56%	51.9	817s
144	5881	5023	990.00000	342	1887	1016.00000	990.00000	2.56%	51.9	853s
145	5885	5026	991.00000	561	2107	1016.00000	991.00000	2.46%	51.8	855s
146	5898	5034	991.00000	412	2160	1016.00000	991.00000	2.46%	51.7	864s
147	5899	5035	991.00000	329	1962	1016.00000	991.00000	2.46%	51.7	914s
148	5900	5036	991.00000	235	2121	1016.00000	991.00000	2.46%	51.7	916s
149	5905	5039	991.00000	454	2127	1016.00000	991.00000	2.46%	51.7	920s
150	5916	5046	991.00000	1115	2151	1016.00000	991.00000	2.46%	51.6	943s
151	5917	5047	991.00000	675	2034	1016.00000	991.00000	2.46%	51.6	990s
152	5923	5051	991.00000	5	2186	1016.00000	991.00000	2.46%	51.5	995s
153	5931	5056	991.00000	874	2197	1016.00000	991.00000	2.46%	51.4	1017s
154	5932	5057	991.00000	642	2129	1016.00000	991.00000	2.46%	51.4	1055s
155	5955	5072	991.00000	415	2201	1016.00000	991.00000	2.46%	51.2	1064s
156	5957	5074	991.00000	655	2122	1016.00000	991.00000	2.46%	51.2	1065s
157	5974	5085	991.00000	140	2179	1016.00000	991.00000	2.46%	51.1	1073s
158	5975	5086	991.00000	1155	1994	1016.00000	991.00000	2.46%	51.1	1086s
159	5989	5095	991.00000	280	2191	1016.00000	991.00000	2.46%	50.9	1090s
160	5998	5101	991.00000	412	2202	1016.00000	991.00000	2.46%	50.9	1096s
161	5999	5102	991.00000	329	2127	1016.00000	991.00000	2.46%	50.9	1132s
162	6005	5106	991.00000	454	2146	1016.00000	991.00000	2.46%	50.8	1135s
163	6019	5115	991.00000	190	2180	1016.00000	991.00000	2.46%	50.7	1146s
164	6020	5116	991.00000	246	2083	1016.00000	991.00000	2.46%	50.7	1193s

```

165 6026 5120 991.00000 1072 2137 1016.00000 991.00000 2.46% 50.6 1195s
166
167 Cutting planes:
168 Learned: 110
169 Implied bound: 6
170 MIR: 380
171 Mixing: 1
172 Flow cover: 1073
173 Zero half: 3
174 RLT: 2
175 Relax-and-lift: 2593
176
177 Explored 6040 nodes (480952 simplex iterations) in 1200.83 seconds (960.59 work units)
178 Thread count was 8 (of 8 available processors)
179
180 Solution count 3: 1016 1018 1025
181
182 Time limit reached
183 Best objective 1.016000000000e+03, best bound 9.910000000000e+02, gap 2.4606%
184
185 Output one feasible solution with limited computation time
186
187 Optimization was stopped with status 9
188
189 Number of solution stored: 3
190 1016 1018 1025
191
192 Obj = 1016.0
193
194 Solutions:
195 The total pi = 172.0
196 The total duration time in berth stage = 202.0
197 The total duration time in quay crane scheduling stage = 52.0
198 The total departure time in berth stage= 583.0
199 The total departure time in quay crane scheduling stage = 433.0
200 The total wasted crane work hour according QC0= 15.432507472197358
201 The last departure time in quay crane scheduling stage = 68.0
202
203 The specific solution are as follows:
204 Vessel i: 0: li: 5, pi: 29-34, ai-di: 48-67, taoi-deltai: 48-67, periodi: 19, taoPi_SP-
deltaPi_SP: 48-54, periodPi: 6, c_i: 4999375, dowork: 5536524, fa_i: 2
205 Vessel i: 1: li: 4, pi: 24-28, ai-di: 17-29, taoi-deltai: 17-29, periodi: 12, taoPi_SP-
deltaPi_SP: 17-19, periodPi: 2, c_i: 2974108, dowork: 3163728, fa_i: 4
206 Vessel i: 2: li: 7, pi: 22-29, ai-di: 43-62, taoi-deltai: 43-62, periodi: 19, taoPi_SP-
deltaPi_SP: 43-46, periodPi: 3, c_i: 4775116, dowork: 6854744, fa_i: 7
207 Vessel i: 3: li: 5, pi: 14-19, ai-di: 5-31, taoi-deltai: 5-31, periodi: 26, taoPi_SP-deltaPi_SP
: 5-15, periodPi: 10, c_i: 6615975, dowork: 6854744, fa_i: 2
208 Vessel i: 4: li: 7, pi: 7-14, ai-di: 29-47, taoi-deltai: 29-47, periodi: 18, taoPi_SP-deltaPi_SP
: 29-34, periodPi: 5, c_i: 4538343, dowork: 4613770, fa_i: 2
209 Vessel i: 5: li: 7, pi: 5-12, ai-di: 61-83, taoi-deltai: 61-82, periodi: 21, taoPi_SP-deltaPi_SP
: 61-65, periodPi: 4, c_i: 5372244, dowork: 5404702, fa_i: 6
210 Vessel i: 6: li: 5, pi: 19-24, ai-di: 5-31, taoi-deltai: 5-27, periodi: 22, taoPi_SP-deltaPi_SP
: 5-10, periodPi: 5, c_i: 5722539, dowork: 5800168, fa_i: 3
211 Vessel i: 7: li: 6, pi: 12-18, ai-di: 61-83, taoi-deltai: 61-87, periodi: 26, taoPi_SP-
deltaPi_SP: 61-68, periodPi: 7, c_i: 6601917, dowork: 6722922, fa_i: 3
212 Vessel i: 8: li: 7, pi: 22-29, ai-di: 65-83, taoi-deltai: 65-77, periodi: 12, taoPi_SP-
deltaPi_SP: 65-67, periodPi: 2, c_i: 2902377, dowork: 3163728, fa_i: 4
213 Vessel i: 9: li: 4, pi: 18-22, ai-di: 47-79, taoi-deltai: 47-74, periodi: 27, taoPi_SP-
deltaPi_SP: 47-55, periodPi: 8, c_i: 6926380, dowork: 7382032, fa_i: 3
214 TimeSolveModel: 1211.000000
215
216 TimeAll: 1215.000000
217
218

```