



81	0	0	284.35151	0 2441	467.00000	284.35151	39.1%	-	54s
82	0	0	284.35763	0 2445	467.00000	284.35763	39.1%	-	54s
83	0	0	284.56031	0 2146	467.00000	284.56031	39.1%	-	55s
84	H	0	0	446.0000000	284.56444	36.2%	-	80s	
85	0	0	284.62063	0 2364	446.00000	284.62063	36.2%	-	88s
86	0	0	284.63984	0 2380	446.00000	284.63984	36.2%	-	88s
87	0	0	284.64541	0 2378	446.00000	284.64541	36.2%	-	88s
88	0	0	284.81740	0 2120	446.00000	284.81740	36.1%	-	90s
89	0	0	284.89309	0 2320	446.00000	284.89309	36.1%	-	94s
90	0	0	284.91073	0 2274	446.00000	284.91073	36.1%	-	95s
91	0	0	284.91243	0 2319	446.00000	284.91243	36.1%	-	95s
92	0	0	285.12163	0 2277	446.00000	285.12163	36.1%	-	96s
93	0	0	285.14703	0 2314	446.00000	285.14703	36.1%	-	103s
94	0	0	285.14897	0 2320	446.00000	285.14897	36.1%	-	103s
95	0	0	285.38952	0 2213	446.00000	285.38952	36.0%	-	105s
96	0	0	285.42014	0 2268	446.00000	285.42014	36.0%	-	124s
97	0	0	285.42940	0 2267	446.00000	285.42940	36.0%	-	124s
98	0	0	286.21977	0 2261	446.00000	286.21977	35.8%	-	126s
99	0	0	286.25013	0 2227	446.00000	286.25013	35.8%	-	168s
100	0	0	286.25339	0 2079	446.00000	286.25339	35.8%	-	168s
101	0	0	286.92756	0 2066	446.00000	286.92756	35.7%	-	169s
102	0	0	286.95516	0 1991	446.00000	286.95516	35.7%	-	188s
103	0	0	286.96079	0 2103	446.00000	286.96079	35.7%	-	189s
104	0	0	287.11085	0 1990	446.00000	287.11085	35.6%	-	193s
105	0	0	287.46764	0 2110	446.00000	287.46764	35.5%	-	238s
106	0	0	287.82556	0 2020	446.00000	287.82556	35.5%	-	240s
107	0	0	287.85883	0 2150	446.00000	287.85883	35.5%	-	240s
108	0	0	287.86185	0 2147	446.00000	287.86185	35.5%	-	241s
109	0	0	288.03785	0 2087	446.00000	288.03785	35.4%	-	245s
110	0	0	288.07370	0 2118	446.00000	288.07370	35.4%	-	290s
111	0	0	288.07745	0 2128	446.00000	288.07745	35.4%	-	291s
112	0	0	288.25025	0 2061	446.00000	288.25025	35.4%	-	295s
113	0	0	288.29622	0 1951	446.00000	288.29622	35.4%	-	321s
114	0	0	288.29858	0 2078	446.00000	288.29858	35.4%	-	322s
115	0	0	288.44404	0 2011	446.00000	288.44404	35.3%	-	326s
116	0	0	288.44734	0 1828	446.00000	288.44734	35.3%	-	332s
117	0	2	288.45318	0 1780	446.00000	288.45318	35.3%	-	341s
118	11	14	307.89177	3 1731	446.00000	288.57848	35.3%	663	346s
119	23	18	289.20456	5 1681	446.00000	288.99275	35.2%	609	350s
120	H	29	22	445.0000000	288.99275	35.1%	486	387s	
121	H	30	22	435.0000000	288.99275	33.6%	470	387s	
122	172	175	290.77672	36 1686	435.00000	288.99275	33.6%	113	390s
123	629	653	292.22949	142 1590	435.00000	288.99275	33.6%	33.7	395s
124	1009	1025	301.36583	244 1560	435.00000	288.99275	33.6%	30.9	400s
125	1241	1332	315.88824	274 1444	435.00000	288.99275	33.6%	38.4	405s
126	1737	1797	319.17970	354 1206	435.00000	288.99275	33.6%	47.3	410s
127	2360	2405	322.00000	467 910	435.00000	288.99275	33.6%	54.0	416s
128	2630	2605	325.00000	531 816	435.00000	288.99275	33.6%	64.8	420s
129	2889	2850	338.00000	585 783	435.00000	288.99275	33.6%	84.2	425s
130	H 3233	3068		434.0000000	288.99275	33.4%	91.4	447s	
131	3234	2769	347.00000	606 1828	434.00000	288.99275	33.4%	91.3	451s
132	3236	2770	324.37851	14 1918	434.00000	288.99275	33.4%	91.3	464s
133	H 3236	2632		433.0000000	406.00000	6.24%	91.3	476s	
134	3241	2260	406.00000	364 1828	433.00000	406.00000	6.24%	99.3	480s
135	3246	2044	408.40472	567 1828	433.00000	408.40472	5.68%	102	485s
136	3253	1850	409.10231	241 181	433.00000	409.10231	5.52%	105	490s
137	H 3253	1757		432.0000000	409.46113	5.22%	105	492s	
138	H 3253	1669		431.0000000	409.50111	4.99%	105	494s	
139	3256	1671	410.13218	51 420	431.00000	410.13218	4.84%	105	495s
140	3259	1673	410.51939	34 510	431.00000	410.51939	4.75%	105	500s
141	H 3259	1589		430.0000000	410.54621	4.52%	105	503s	
142	3262	1512	410.73517	11 643	430.00000	410.73517	4.48%	105	505s
143	3263	1513	410.84554	407 617	430.00000	410.84554	4.45%	105	510s
144	H 3268	1440		428.0000000	411.23633	3.92%	104	516s	
145	H 3269	1368		427.0000000	411.23633	3.69%	104	517s	
146	3273	1371	411.55690	365 709	427.00000	411.55690	3.62%	104	522s
147	3276	1373	411.61767	587 731	427.00000	411.61767	3.60%	104	525s
148	3281	1376	411.74421	155 647	427.00000	411.74421	3.57%	104	532s
149	3282	1377	411.80180	21 656	427.00000	411.80180	3.56%	104	537s
150	3284	1378	411.84558	423 660	427.00000	411.84558	3.55%	104	540s
151	H 3286	1310		426.0000000	412.03250	3.28%	104	563s	
152	3288	1312	412.07142	233 626	426.00000	412.07142	3.27%	104	565s
153	3291	1314	412.15491	35 647	426.00000	412.15491	3.25%	104	572s
154	3294	1316	412.22591	269 719	426.00000	412.22591	3.23%	104	575s
155	3296	1317	412.29214	61 712	426.00000	412.29214	3.22%	104	580s
156	3301	1320	412.34716	173 733	426.00000	412.34716	3.20%	103	587s
157	3302	1321	412.43858	240 734	426.00000	412.43858	3.18%	103	591s
158	3304	1322	412.47503	262 726	426.00000	412.47503	3.17%	103	595s
159	3306	1324	412.96350	21 685	426.00000	412.96350	3.06%	103	601s
160	3309	1326	412.99584	12 736	426.00000	412.99584	3.05%	103	609s
161	3310	1326	413.15606	53 638	426.00000	413.15606	3.02%	103	615s
162	3311	1327	413.17689	89 678	426.00000	413.17689	3.01%	103	620s
163	3313	1328	413.18284	4 698	426.00000	413.18284	3.01%	103	626s
164	3314	1329	413.30945	412 657	426.00000	413.30945	2.98%	103	633s

165	3315	1330	413.31645	184	671	426.00000	413.31645	2.98%	103	636s
166	3317	1331	413.32096	534	719	426.00000	413.32096	2.98%	103	644s
167	3318	1332	413.39120	232	579	426.00000	413.39120	2.96%	103	656s
168	3320	1333	413.42418	198	680	426.00000	413.42418	2.95%	103	664s
169	3321	1334	413.42918	366	685	426.00000	413.42918	2.95%	103	667s
170	3322	1334	413.43025	12	740	426.00000	413.43025	2.95%	103	677s
171	3323	1335	413.60865	607	712	426.00000	413.60865	2.91%	103	689s
172	3324	1336	413.62416	399	650	426.00000	413.62416	2.91%	103	693s
173	3325	1336	413.64029	609	634	426.00000	413.64029	2.90%	103	700s
174	3327	1338	413.65138	59	609	426.00000	413.65138	2.90%	103	706s
175	3328	1338	413.65370	29	629	426.00000	413.65370	2.90%	103	713s
176	3329	1339	413.72599	208	654	426.00000	413.72599	2.88%	103	725s
177	3330	1340	413.72599	211	676	426.00000	413.72599	2.88%	103	733s
178	3331	1340	413.73575	424	690	426.00000	413.73575	2.88%	102	742s
179	3332	1341	413.74051	390	679	426.00000	413.74051	2.88%	102	747s
180	3333	1273	413.77329	17	614	426.00000	413.77329	2.87%	102	758s
181	3334	1273	413.78049	606	658	426.00000	413.78049	2.87%	102	763s
182	3335	1274	413.78176	495	636	426.00000	413.78176	2.87%	102	771s
183	3336	1275	413.91606	14	580	426.00000	413.91606	2.84%	102	778s
184	3338	1276	413.95378	332	602	426.00000	413.95378	2.83%	102	780s
185	3343	1279	414.00548	520	594	426.00000	414.00548	2.82%	102	785s
186	3347	1282	414.04844	300	614	426.00000	414.04844	2.81%	102	790s
187	3352	1285	414.16469	292	603	426.00000	414.16469	2.78%	102	795s
188	H 3353	1220				425.0000000	414.77054	2.41%	102	801s
189	3356	1222	414.78520	51	512	425.00000	414.78520	2.40%	102	806s
190	3358	1223	414.80315	270	513	425.00000	414.80315	2.40%	102	811s
191	3360	1225	414.82783	231	533	425.00000	414.82783	2.39%	102	817s
192	3362	1226	414.83385	11	535	425.00000	414.83385	2.39%	102	821s
193	3363	1227	414.85263	407	523	425.00000	414.85263	2.39%	101	833s
194	3364	1227	414.85923	301	533	425.00000	414.85923	2.39%	101	836s
195	3367	1166	414.87560	370	507	425.00000	414.87560	2.38%	101	842s
196	3369	1168	414.88322	41	540	425.00000	414.88322	2.38%	101	846s
197	3371	1169	414.89640	81	543	425.00000	414.89640	2.38%	101	851s
198	3373	1170	414.90623	365	522	425.00000	414.90623	2.38%	101	856s
199	3375	1172	414.92154	508	557	425.00000	414.92154	2.37%	101	861s
200	3381	1062	414.92154	155	500	425.00000	414.92154	2.37%	202	868s
201	3382	1063	414.92154	21	451	425.00000	414.92154	2.37%	202	872s
202	3384	1064	414.92554	423	437	425.00000	414.92554	2.37%	202	875s
203	3386	1065	414.92554	358	518	425.00000	414.92554	2.37%	202	880s
204	3389	1067	414.94550	139	555	425.00000	414.94550	2.37%	202	887s
205	3392	1069	415.00220	303	533	425.00000	415.00220	2.35%	202	894s
206	3393	1070	415.00543	462	503	425.00000	415.00543	2.35%	202	895s
207	3396	1072	415.20446	61	500	425.00000	415.20446	2.30%	201	901s
208	3399	1020	415.74866	351	491	425.00000	415.74866	2.18%	201	907s
209	3402	1022	415.90373	240	493	425.00000	415.90373	2.14%	201	911s
210	3406	1025	415.93145	21	528	425.00000	415.93145	2.13%	201	915s
211	3407	1025	415.95264	120	459	425.00000	415.95264	2.13%	201	920s
212	3410	1027	415.97519	53	494	425.00000	415.97519	2.12%	201	926s
213	3414	1030	416.00637	412	492	425.00000	416.00637	2.12%	200	943s
214	3415	1031	416.02340	184	532	425.00000	416.02340	2.11%	200	947s
215	3417	1032	416.03525	534	512	425.00000	416.03525	2.11%	200	951s
216	3419	1033	416.04870	410	523	425.00000	416.04870	2.11%	200	955s
217	3421	1035	416.06773	366	460	425.00000	416.06773	2.10%	200	961s
218	3425	1037	416.10255	609	488	425.00000	416.10255	2.09%	200	966s
219	3428	1039	416.11702	29	506	425.00000	416.11702	2.09%	199	971s
220	3431	1041	416.14452	424	507	425.00000	416.14452	2.08%	199	975s
221	3434	1043	416.16702	606	499	425.00000	416.16702	2.08%	199	980s
222	3437	1045	416.27617	54	500	425.00000	416.27617	2.05%	199	987s
223	3440	1047	416.32781	103	505	425.00000	416.32781	2.04%	199	991s
224	3442	1049	416.65225	333	471	425.00000	416.65225	1.96%	199	995s
225	3444	1050	416.86101	408	422	425.00000	416.86101	1.92%	199	1001s
226	3447	1052	416.87050	300	418	425.00000	416.87050	1.91%	198	1006s
227	3450	1054	416.87986	604	439	425.00000	416.87986	1.91%	198	1010s
228	3454	1057	416.88498	529	413	425.00000	416.88498	1.91%	198	1031s
229	3455	1058	infeasible	65		425.00000	416.88498	1.91%	257	1046s
230	3457	1060	417.52351	66	311	425.00000	417.04465	1.87%	261	1050s
231	3475	1067	417.90778	70	255	425.00000	417.58466	1.74%	267	1055s
232	3581	1090	418.02929	80	249	425.00000	417.65415	1.73%	284	1060s
233	3663	1108	418.20127	89	258	425.00000	417.66943	1.72%	297	1065s
234	3751	1135	418.36608	102	290	425.00000	417.66943	1.72%	316	1070s
235	3888	1150	418.57305	119	294	425.00000	417.66943	1.72%	339	1075s
236	4052	1161	422.75456	136	193	425.00000	417.66943	1.72%	352	1080s
237	4238	1162	419.90048	157	193	425.00000	417.66943	1.72%	361	1085s
238	4359	1174	420.23790	172	166	425.00000	417.69015	1.72%	380	1090s
239	4581	1270	418.00000	99	206	425.00000	417.71118	1.72%	397	1096s
240	4842	1395	419.00000	128	193	425.00000	417.71118	1.72%	394	1101s
241	4989	1442	420.00000	149	144	425.00000	417.71118	1.72%	399	1107s
242	5070	1463	cutoff	163		425.00000	418.00000	1.65%	402	1112s
243	5179	1487	421.00000	115	121	425.00000	418.00000	1.65%	402	1118s
244	5265	1517	420.00000	112	161	425.00000	418.00000	1.65%	407	1124s
245	5366	1579	424.00000	87	124	425.00000	418.00000	1.65%	411	1133s
246	5521	1602	cutoff	104		425.00000	418.00000	1.65%	412	1146s
247	5631	1634	420.08826	132	172	425.00000	418.00000	1.65%	415	1159s
248	5738	1684	418.00735	79	259	425.00000	418.00000	1.65%	419	1171s

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249 5838 1724 419.00000 106 182 425.00000 418.33643 1.57% 424 1182s
250 5956 1749 421.36625 80 233 425.00000 418.70645 1.48% 430 1195s
251 6100 1742 420.00000 125 156 425.00000 418.72048 1.48% 437 1200s
252
253 Cutting planes:
254 Learned: 82
255 Gomory: 6
256 Lift-and-project: 13
257 Cover: 1
258 Implied bound: 44
259 Clique: 1
260 MIR: 255
261 Mixing: 1
262 StrongCG: 39
263 Flow cover: 416
264 Zero half: 166
265 RLT: 39
266 Relax-and-lift: 868
267 BQP: 2
268 PSD: 1
269
270 Explored 6155 nodes (2728947 simplex iterations) in 1200.20 seconds (1097.96 work units)
271 Thread count was 8 (of 8 available processors)
272
273 Solution count 3: 425 425 425
274
275 Time limit reached
276 Best objective 4.250000000000e+02, best bound 4.190000000000e+02, gap 1.4118%
277
278 Output one feasible solution with limited computation time
279
280 Optimization was stopped with status 9
281
282 Number of solution stored: 3
283 425 425 425
284
285 Obj = 425.0
286
287 Solutions:
288 The total pi = 166.0
289 The total duration time in berth stage = 116.0
290 The total duration time in quay crane scheduling stage = 33.0
291 The total departure time in berth stage= 254.0
292 The total departure time in quay crane scheduling stage = 171.0
293 The total wasted crane work hour according QC0= 6.120249275538225
294 The last depature time in quay crane scheduling stage = 27.0
295
296 The specific solution are as follows:
297 Vessel i: 0: li: 4, pi: 20-24, ai-di: 10-34, taoi-deltai: 10-34, periodi: 24, taoPi_SP-
deltaPi_SP: 10-18, periodPi: 8, c_i: 6248261, dowork: 6327456, fa_i: 3
298 Vessel i: 1: li: 5, pi: 0-5, ai-di: 18-39, taoi-deltai: 18-25, periodi: 7, taoPi_SP-deltaPi_SP:
18-20, periodPi: 2, c_i: 1704076, dowork: 1845508, fa_i: 4
299 Vessel i: 2: li: 5, pi: 10-15, ai-di: 23-44, taoi-deltai: 24-38, periodi: 14, taoPi_SP-
deltaPi_SP: 24-27, periodPi: 3, c_i: 3666311, dowork: 3954660, fa_i: 4
300 Vessel i: 3: li: 5, pi: 5-10, ai-di: 9-33, taoi-deltai: 9-24, periodi: 15, taoPi_SP-deltaPi_SP: 9
-13, periodPi: 4, c_i: 3824308, dowork: 3954660, fa_i: 4
301 Vessel i: 4: li: 5, pi: 29-34, ai-di: 19-43, taoi-deltai: 19-27, periodi: 8, taoPi_SP-deltaPi_SP
: 19-21, periodPi: 2, c_i: 1967956, dowork: 2240974, fa_i: 4
302 Vessel i: 5: li: 5, pi: 10-15, ai-di: 15-39, taoi-deltai: 15-23, periodi: 8, taoPi_SP-deltaPi_SP
: 15-17, periodPi: 2, c_i: 1964240, dowork: 2109152, fa_i: 4
303 Vessel i: 6: li: 5, pi: 24-29, ai-di: 17-38, taoi-deltai: 17-24, periodi: 7, taoPi_SP-deltaPi_SP
: 17-19, periodPi: 2, c_i: 1761269, dowork: 1845508, fa_i: 4
304 Vessel i: 7: li: 5, pi: 15-20, ai-di: 9-63, taoi-deltai: 9-27, periodi: 18, taoPi_SP-deltaPi_SP
: 9-15, periodPi: 6, c_i: 4521820, dowork: 4745592, fa_i: 4
305 Vessel i: 8: li: 5, pi: 24-29, ai-di: 8-50, taoi-deltai: 8-15, periodi: 7, taoPi_SP-deltaPi_SP: 8
-10, periodPi: 2, c_i: 1643192, dowork: 1713686, fa_i: 4
306 Vessel i: 9: li: 5, pi: 29-34, ai-di: 9-54, taoi-deltai: 9-17, periodi: 8, taoPi_SP-deltaPi_SP: 9
-11, periodPi: 2, c_i: 2063170, dowork: 2240974, fa_i: 4
307 TimeSolveModel: 1210.000000
308
309 TimeAll: 1216.000000
310
311

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