



```
81 5781 3301 419.00000 158 462 420.00000 419.00000 0.24% 66.7 55s
82 8494 4660 419.00000 338 367 420.00000 419.00000 0.24% 61.1 60s
83 11257 6561 419.00000 19 464 420.00000 419.00000 0.24% 53.5 65s
84
85 Cutting planes:
86 Learned: 139
87 Gomory: 42
88 Implied bound: 14
89 Projected implied bound: 13
90 MIR: 706
91 StrongCG: 120
92 Flow cover: 1225
93 Inf proof: 1
94 Zero half: 57
95 RLT: 201
96 Relax-and-lift: 2421
97
98 Explored 13130 nodes (671883 simplex iterations) in 68.75 seconds (113.39 work units)
99 Thread count was 8 (of 8 available processors)
100
101 Solution count 3: 419 419 419
102 No other solutions better than 419
103
104 Optimal solution found (tolerance 1.00e-04)
105 Best objective 4.190000000000e+02, best bound 4.190000000000e+02, gap 0.0000%
106
107 Output optimal solution and the Optimal Obj: 419.0
108
109
110 Obj = 419.0
111
112 Solutions:
113 The total pi = 84.0
114 The total duration time in berth stage = 100.0
115 The total duration time in quay crane scheduling stage = 27.0
116 The total departure time in berth stage= 246.0
117 The total departure time in quay crane scheduling stage = 173.0
118 The total wasted crane work hour according QC0= 16.441652379724175
119 The last depature time in quay crane scheduling stage = 60.0
120
121 The specific solution are as follows:
122 Vessel i: 0: li: 6, pi: 16-22, ai-di: 57-73, taoi-deltai: 57-71, periodi: 14, taoPi_SP-
deltaPi_SP: 57-60, periodPi: 3, c_i: 3449733, dowork: 4745592, fa_i: 4
123 Vessel i: 1: li: 4, pi: 22-26, ai-di: 3-31, taoi-deltai: 3-29, periodi: 26, taoPi_SP-deltaPi_SP
: 3-9, periodPi: 6, c_i: 6779551, dowork: 7909320, fa_i: 3
124 Vessel i: 2: li: 7, pi: 22-29, ai-di: 41-68, taoi-deltai: 41-66, periodi: 25, taoPi_SP-
deltaPi_SP: 41-49, periodPi: 8, c_i: 6529882, dowork: 6591100, fa_i: 2
125 Vessel i: 3: li: 5, pi: 17-22, ai-di: 9-38, taoi-deltai: 9-36, periodi: 27, taoPi_SP-deltaPi_SP
: 9-17, periodPi: 8, c_i: 6978953, dowork: 7250210, fa_i: 2
126 Vessel i: 4: li: 7, pi: 7-14, ai-di: 36-50, taoi-deltai: 36-44, periodi: 8, taoPi_SP-deltaPi_SP:
36-38, periodPi: 2, c_i: 1982554, dowork: 3559194, fa_i: 5
127 TimeSolveModel: 75.000000
128
129 TimeAll: 78.000000
130
131
```