```
D:\Python\Python\setroute\python.exe "D:\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Python\Pyt
       mode=client --port=24687
  3
       import sys; print('Python %s on %s' % (sys.version, sys.platform))
       paper', 'E:/1 | 0 | 0/3 | 0 | 0/1 | 0 | 0 | 0/1 | 0 | 0 | 0/1 | 0 | 0 | 0/1 | 0 | 0 | 0/1 | 0 | 0 | 0/1 | 0 | 0 | 0/1 | 0 | 0/1 | 0 | 0/1 | 0 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 0/1 | 
  6
      PyDev console: starting.
     Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
  8
      main_DM.py', wdir='E:/1 000/3 00000/1 000000/1 000000/1_000000/1_LW_0001/4 0000/3 python_code/9 Code for this
10
      Backend TkAgg is interactive backend. Turning interactive mode on.
11
       Waiting 5s.....
13
      Optimize the ./R_7_2.xlsx instance
14
15
      Set parameter TimeLimit to value 1200
16
      Set parameter PoolSolutions to value 3
17
18
      Set parameter PoolGap to value 0.05
19
       Set parameter PoolSearchMode to value 2
20
      Gurobi Optimizer version 11.0.0 build v11.0.0rc2 (win64 - Windows 10.0 (19045.2))
21
22
     CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
      Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
24
       Optimize a model with 133301 rows, 56000 columns and 390789 nonzeros
25
26
      Model fingerprint: 0x03e6598f
       Variable types: 0 continuous, 56000 integer (47131 binary)
28
      Coefficient statistics:
29
        Matrix range [1e+00, 5e+05]
        Objective range [1e+00, 1e+00]
        Bounds range
                                  [1e+00, 1e+00]
31
        RHS range
                                  [1e+00, 7e+06]
33
      Presolve removed 117026 rows and 2730 columns
      Presolve time: 0.15s
35
       Presolved: 16275 rows, 53270 columns, 47862 nonzeros
36
       Variable types: 0 continuous, 53270 integer (44401 binary)
      Found heuristic solution: objective 782.0000000
      Found heuristic solution: objective 672.0000000
38
39
40
      Root relaxation: objective 3.262851e+02, 1628 iterations, 0.25 seconds (0.14 work units)
41
           Nodes | Current Node | Objective Bounds
42

↓ Work

43
        Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
44
45
                  46
      H = 0 = 0
                                            526.0000000 326.28508 38.0% -
47
                  0 352.92344
                                           0 1226 526.00000 352.92344 32.9%
      Н
48
                                            525.0000000 353.16400 32.7% - 12s
                  0 370.00000 0 1350 525.00000 370.00000 29.5%
49
                                                                                                              - 12s
50
                  0 370.00000 0 1350 525.00000 370.00000 29.5%
                                                                                                              - 12s
51
                  0 370.00000 0 1021 525.00000 370.00000 29.5%
52
                  0 370.48902
                                          0 1196 525.00000 370.48902 29.4%
                                                                                                              - 13s
53
                  0 370.49409
                                          0 1195 525.00000 370.49409 29.4%
                                                                                                              - 13s
           0
54
                  - 14s
55
                  0 370.92774
                                           0 1144 525.00000 370.92774 29.3%
                  2 370.92774 0 1144 525.00000 370.92774 29.3%
56
                                                                                                               - 15s
57
          661 666 377.37206 171 1081 525.00000 370.92774 29.3% 5.9
58
         1679 1796 440.83478 383 882 525.00000 370.92774 29.3% 8.2
        3323 3168 501.00000 41 875 525.00000 501.00000 4.57% 6.7 31s
        3331 3174 509.45960 93 135 525.00000 509.45960 2.96% 6.7 35s
60
61
       H 3332 3015
                                                  524.0000000 510.60170 2.56% 6.7 36s
        3364 2886 514.84277 176 307 524.00000 514.84277 1.75% 6.6 40s
        3382 2898 516.28847 11 302 524.00000 516.28847 1.47% 6.6 45s
63
        3401 2763 517.37677 19 205 524.00000 517.37677 1.26% 6.6
64
        3432 2784 518.14581 130 116 524.00000 518.14581 1.12% 6.5 55s
66
                  2801 518.42657 81 221 524.00000 518.42657 1.06% 6.5
        3496 2827 518.60002 115 229 524.00000 518.60002 1.03% 6.4 65s
67
68
        3523 2845 518.68487 41 240 524.00000 518.68487 1.01% 6.3 70s
         3546 2860 518.76879 617 157 524.00000 518.76879 1.00% 6.3
70
        3571 2877 518.82265 300 168 524.00000 518.82265 0.99% 6.2
        3585 2886 518.84055 171 168 524.00000 518.84055 0.98% 6.2
                                                                                                                           85s
                                                                                                                           90s
         3608 2901 518.86731 251 246 524.00000 518.86731 0.98% 6.2
        3623\ 2911\ 518.88214\ 41\ 172\ 524.00000\ 518.88214\ 0.98\%\ 6.2\ 95s
74
        3644 2925 518.90436 373 151 524.00000 518.90436 0.97% 6.1 100s
75
        3669 2947 523.00000 556 57 524.00000 523.00000 0.19% 17.7 105s
76
77
      Cutting planes:
        Gomory: 7
78
79
        Implied bound: 2
80
        Clique: 4
```

```
unknown
  81
       MIR: 3
  82
       Flow cover: 10
       Zero half: 2
  83
  84
       Relax-and-lift: 5
  85
      Explored 3671 nodes (70294 simplex iterations) in 105.19 seconds (93.14 work units)
  86
      Thread count was 8 (of 8 available processors)
  87
  88
  89
      Solution count 3: 524 524 524
  90 No other solutions better than 524
  91
  92
      Optimal solution found (tolerance 1.00e-04)
     Best objective 5.240000000000e+02, best bound 5.24000000000e+02, gap 0.0000%
  93
  94
  95
     Output optimal solution and the Optimal Obj: 524.0
  96
  97
 98 Obj = 524.0
 99
 100 Solutions:
101
         The total pi = 115.0
         The total duration time in berth stage = 99.0
102
103
         The total duration time in quay crane scheduling stage = 27.0
104
         The total departure time in berth stage= 298.0
105
         The total departure time in quay crane scheduling stage = 226.0
         The total wasted crane work hour according QC0= 4.352919087860903
106
107
         The last depature time in quay crane scheduling stage = 59.0
108
109
     The specific solution are as follows:
110
        Vessel i: 0:
                       li: 6,
                                    pi: 28-34,
                                                             ai-di: 55-63,
                                                                                      taoi-deltai: 55-63,
                                                                                                                       periodi: 8,
                                                                                                                                                  taoPi_SP-deltaPi_SP
                                                                    c i: 2094947,
       55-59.
                                 periodPi: 4,
                                                                                                          dowork: 2109152,
                                                                                                                                                       fa i: 1
                                                          ai-di: 20-28,
111
                                   pi: 8-14,
                                                                                                                    periodi: 8,
                                                                                                                                                taoPi SP-deltaPi SP:
        Vessel i: 1:
                       li: 6,
                                                                                   taoi-deltai: 20-28.
      20-22,
                                 periodPi: 2,
                                                                    c_i: 2103876,
                                                                                                          dowork: 2109152,
                                                                                                                                                       fa_i: 3
        Vessel i: 2:
                       li: 6,
                                                             ai-di: 23-49,
                                                                                      taoi-deltai: 23-49,
                                                                                                                       periodi: 26,
                                                                                                                                                     taoPi_SP-
                                   pi: 26-32,
                                                                              c i: 6799974,
      deltaPi SP: 23-31,
                                           periodPi: 8,
                                                                                                                    dowork: 6986566,
                                                                                                                                                                 fa i: 2
                                    pi. 14-21,
                                                                                                                                                  taoPi_SP-deltaPi_SP
                                                                                                                       periodi: 8,
113
        Vessel i: 3:
                                                             ai-di: 34-42,
                       li: 7,
                                                                                      taoi-deltai: 34-42,
      : 34-35,
                                 periodPi: 1,
                                                                    c_i: 1978935,
                                                                                                          dowork: 2109152,
                                                                                                                                                       fa_i: 6
        Vessel i: 4:
                       li: 5,
                                                             ai-di: 24-42,
                                                                                      taoi-deltai: 24-39,
                                                                                                                      periodi: 15,
                                    pi: 21-26,
                                                                                                                                                    taoPi SP-
      deltaPi SP: 24-30,
                                           periodPi: 6,
                                                                              c i: 3727432,
                                                                                                                    dowork: 3822838,
                                                                                                                                                                 fa i: 2
                                                                                                                                                  taoPi_SP-deltaPi_SP
115
        Vessel i: 5:
                       li: 4,
                                    pi: 10-14,
                                                             ai-di: 1-18,
                                                                                    taoi-deltai: 1-11,
                                                                                                                    periodi: 10,
      : 1-3,
                               periodPi: 2,
                                                                  c_i: 2561723,
                                                                                                        dowork: 2636440,
                                                                                                                                                     fa_i: 3
116
                       li: 6,
                                   pi: 8-14,
                                                          ai-di: 42-74,
                                                                                   taoi-deltai: 42-66,
                                                                                                                    periodi: 24,
                                                                                                                                                  taoPi SP-deltaPi SP
        Vessel i: 6:
                                                                    c_i: 6213536,
                                                                                                          dowork: 6854744,
                                                                                                                                                       fa_i: 5
       42-46
                                  periodPi: 4,
117
     TimeSolveModel: 118.000000
119 TimeAll: 121.000000
120
121
```