```
"E:\1 □□□□\3 □□□□□\1 □□□□□□\1 □□□□□□□\1_□□□□□□_□□□□\1_LW _□□□□\4 □□□□\3 python_code\1 exzample\2 □□□□□□\9 Code for this paper\Scripts\python.exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=6982

import sys; print('Python %s on %s' % (sys.version, sys.platform))
sys.path.extend(['E:\\1 □□□□\\3 □□□□□\\1 □□□□□□□\\1 □□□□□□□□□\\1_□□□□□□_□□□□\\1_LW _□□□□\\4 □□□□\\3 python_code\\9 Code for this paper', 'E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper'])

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
>>> runfile('E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper/main_DM.py', wdir='E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper')
Backend TkAgg is interactive backend. Turning interactive mode on.
Waiting 5s.....

Optimize the  ./R_11_1.xlsx  instance

Set parameter TimeLimit to value 1200

Set parameter PoolSolutions to value 3
Set parameter PoolGap to value 0.05
Set parameter PoolSearchMode to value 2
Gurobi Optimizer version 11.0.0 build v11.0.0rc2 (win64 - Windows 10.0 (19045.2))

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

Optimize a model with 312841 rows, 88880 columns and 925441 nonzeros
Model fingerprint: 0x3305ae73
Variable types: 0 continuous, 88880 integer (74943 binary)
Coefficient statistics:
  Matrix range     [1e+00, 5e+05]
  Objective range  [1e+00, 1e+00]
  Bounds range     [1e+00, 1e+00]
  RHS range        [1e+00, 8e+06]
Presolve removed 270787 rows and 4227 columns
Presolve time: 0.16s
Presolved: 42054 rows, 84653 columns, 125565 nonzeros
Variable types: 0 continuous, 84653 integer (70716 binary)

Root relaxation: objective 5.303261e+02, 3296 iterations, 0.19 seconds (0.32 work units)

    Nodes    |    Current Node    |     Objective Bounds      |     Work
 Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time

     0     0  530.32609    0 2341          -  530.32609      -     -    1s
H    0     0                920.0000000  530.32609  42.4%     -    1s
H    0     0                915.0000000  551.99365  39.7%     -    3s
     0     0  551.99365    0 2216  915.00000  551.99365  39.7%     -    3s
H    0     0                888.0000000  552.02596  37.8%     -    7s
     0     0  562.42304    0 2278  888.00000  562.42304  36.7%     -    7s
     0     0  562.46336    0 2347  888.00000  562.46336  36.7%     -    7s
     0     0  562.46336    0 2347  888.00000  562.46336  36.7%     -    7s
     0     0  567.12512    0 2032  888.00000  567.12512  36.1%     -    8s
     0     0  576.84407    0 2282  888.00000  576.84407  35.0%     -    9s
     0     0  576.84407    0 2283  888.00000  576.84407  35.0%     -    9s
     0     0  577.51575    0 1771  888.00000  577.51575  35.0%     -   10s
     0     0  578.00000    0 1985  888.00000  578.00000  34.9%     -   12s
     0     0  578.00000    0 2045  888.00000  578.00000  34.9%     -   12s
     0     0  578.00000    0 2076  888.00000  578.00000  34.9%     -   12s
     0     0  578.00000    0 2076  888.00000  578.00000  34.9%     -   12s
     0     0  578.00000    0 1642  888.00000  578.00000  34.9%     -   13s
     0     0  578.00000    0 1637  888.00000  578.00000  34.9%     -   13s
     0     2  579.00000    0 1630  888.00000  579.00000  34.8%     -   16s
   529   547  583.64916  131 1880  888.00000  579.00000  34.8%  10.9   20s
H  946   943                887.0000000  579.00000  34.7%  14.2   35s
  1966  2042  629.45822  462 1568  887.00000  579.00000  34.7%  20.2   40s
  3195  3222  718.51830  666 1329  887.00000  579.00000  34.7%  25.2   45s
  4378  4440  777.95605  900 1150  887.00000  579.00000  34.7%  24.5   50s
  5238  4760  667.39085   81 16638  887.00000  579.00000  34.7%  28.5   62s
  5240  4761  856.00000  214 1588  887.00000  856.00000  3.49%  28.5   66s
  5241  4524  856.00000  116 1783  887.00000  856.00000  3.49%  28.5   74s
H 5241  4298                886.0000000  856.00000  3.39%  28.5   74s
  5243  4299  860.52883  535  272  886.00000  860.52883  2.87%  28.5   75s
  5256  4308  866.23829  173  579  886.00000  866.23829  2.23%  28.4   80s
  5267  4315  868.37173  456  831  886.00000  868.37173  1.99%  28.4   85s
  5277  4322  869.28462  733  803  886.00000  869.28462  1.89%  28.3   93s
  5280  4324  869.34105  109  761  886.00000  869.34105  1.88%  28.3   97s
  5282  4108  869.34123  364  763  886.00000  869.34123  1.88%  28.3  101s
  5285  4110  869.56414  648  842  886.00000  869.56414  1.86%  28.3  105s
  5287  4112  869.64237  518  774  886.00000  869.64237  1.85%  28.3  111s
H 5287  3905                885.0000000  869.64774  1.73%  28.3  111s
```

```
 5290  3907  869.68529  227  794  885.00000  869.68529  1.73%  28.3  118s
 5292  3908  869.69848  631  811  885.00000  869.69848  1.73%  28.2  124s
 5293  3909  869.79029  633  753  885.00000  869.79029  1.72%  28.2  131s
 5296  3911  869.82498  554  797  885.00000  869.82498  1.71%  28.2  138s
 5297  3911  869.87639  597  773  885.00000  869.87639  1.71%  28.2  145s
 5299  3913  869.94515   99  685  885.00000  869.94515  1.70%  28.2  154s
H 5299  3717                    882.0000000  869.95561  1.37%  28.2  154s
 5301  3718  869.96239  162  744  882.00000  869.96239  1.36%  28.2  157s
 5302  3532  870.04737  577  700  882.00000  870.04737  1.36%  28.2  176s
 5305  3534  870.12568  196  720  882.00000  870.12568  1.35%  28.2  191s
 5310  3193  870.18964  350 6975  882.00000  870.18964  1.34%  37.8  195s
 5313  3035  871.13184  601  446  882.00000  871.13184  1.23%  37.8  200s
 5320  3041  878.40142  461  137  882.00000  878.40142  0.41%  39.1  205s

Cutting planes:
  Learned: 3
  Gomory: 40
  Lift-and-project: 1
  Cover: 3
  Implied bound: 8
  Clique: 4
  MIR: 23
  StrongCG: 4
  Flow cover: 63
  Zero half: 49
  RLT: 12
  Relax-and-lift: 33

Explored 5327 nodes (221065 simplex iterations) in 207.83 seconds (165.16 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 882 882 882
No other solutions better than 882

Optimal solution found (tolerance 1.00e-04)
Best objective 8.820000000000e+02, best bound 8.820000000000e+02, gap 0.0000%

Output optimal solution and the Optimal Obj:  882.0


Obj = 882.0

Solutions:
    The total pi =  145.0
    The total duration time in berth stage =  165.0
    The total duration time in quay crane scheduling stage =  37.0
    The total departure time in berth stage=  505.0
    The total departure time in quay crane scheduling stage =  377.0
    The total wasted crane work hour according QC0=  8.725315197766685
    The last depature time in quay crane scheduling stage =  73.0

The specific solution are as follows:
    Vessel i: 0:      li: 5,          pi: 9-14,               ai-di: 72-81,              taoi-deltai: 72-77,              periodi: 5,              taoPi_SP-deltaPi_SP: 72-73,                periodPi: 1,              c_i: 1057366,              dowork: 1318220,              fa_i: 3
    Vessel i: 1:      li: 6,          pi: 22-28,              ai-di: 2-15,               taoi-deltai: 2-15,               periodi: 13,             taoPi_SP-deltaPi_SP: 2-5,                  periodPi: 3,              c_i: 3325804,              dowork: 3559194,              fa_i: 4
    Vessel i: 2:      li: 6,          pi: 8-14,               ai-di: 14-36,              taoi-deltai: 14-37,              periodi: 23,             taoPi_SP-deltaPi_SP: 14-18,                periodPi: 4,              c_i: 6030336,              dowork: 6063812,              fa_i: 4
    Vessel i: 3:      li: 7,          pi: 1-8,                ai-di: 14-25,              taoi-deltai: 14-21,              periodi: 7,              taoPi_SP-deltaPi_SP: 14-16,                periodPi: 2,              c_i: 1637737,              dowork: 1845508,              fa_i: 4
    Vessel i: 4:      li: 5,          pi: 29-34,              ai-di: 20-44,              taoi-deltai: 20-41,              periodi: 21,             taoPi_SP-deltaPi_SP: 20-25,                periodPi: 5,              c_i: 5351141,              dowork: 5668346,              fa_i: 3
    Vessel i: 5:      li: 7,          pi: 20-27,              ai-di: 24-30,              taoi-deltai: 24-29,              periodi: 5,              taoPi_SP-deltaPi_SP: 24-26,                periodPi: 2,              c_i: 1201427,              dowork: 1318220,              fa_i: 2
    Vessel i: 6:      li: 6,          pi: 14-20,              ai-di: 29-48,              taoi-deltai: 29-47,              periodi: 18,             taoPi_SP-deltaPi_SP: 29-33,                periodPi: 4,              c_i: 4500077,              dowork: 5141058,              fa_i: 3
    Vessel i: 7:      li: 6,          pi: 20-26,              ai-di: 34-63,              taoi-deltai: 34-63,              periodi: 29,             taoPi_SP-deltaPi_SP: 34-39,                periodPi: 5,              c_i: 7630244,              dowork: 7645676,              fa_i: 4
    Vessel i: 8:      li: 6,          pi: 0-6,                ai-di: 34-43,              taoi-deltai: 34-41,              periodi: 7,              taoPi_SP-deltaPi_SP: 34-36,                periodPi: 2,              c_i: 1705681,              dowork: 1845508,              fa_i: 4
    Vessel i: 9:      li: 6,          pi: 8-14,               ai-di: 47-66,              taoi-deltai: 47-67,              periodi: 20,             taoPi_SP-deltaPi_SP: 47-51,                periodPi: 4,              c_i: 5229391,              dowork: 5272880,              fa_i: 4
    Vessel i: 10:     li: 6,          pi: 14-20,              ai-di: 50-68,              taoi-deltai: 50-67,              periodi: 17,             taoPi_SP-deltaPi_SP: 50-55,                periodPi: 5,              c_i: 4322611,              dowork: 4613770,              fa_i: 2
TimeSolveModel: 219.000000

TimeAll: 223.000000
```