```
"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=7062

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_12_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 369516 rows, 97260 columns and 1094484 nonzeros
Model fingerprint: 0x5989cfc3
Variable types: 0 continuous, 97260 integer (82056 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, 9e+06]
Presolve removed 327070 rows and 4757 columns
Presolve time: 0.25s
Presolved: 42446 rows, 92503 columns, 126676 nonzeros
Variable types: 0 continuous, 92503 integer (77299 binary)
Found heuristic solution: objective 1156.0000000

Root relaxation: objective 4.731523e+02, 3536 iterations, 0.49 seconds (0.31 work units)

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

     0     0  473.15232    0 2422 1156.00000  473.15232  59.1%     -    3s
H    0     0                771.0000000  473.15232  38.6%     -    8s
H    0     0                766.0000000  473.15232  38.2%     -   11s
     0     0  492.22165    0 2335  766.00000  492.22165  35.7%     -   13s
     0     0  502.08688    0 2345  766.00000  502.08688  34.5%     -   20s
     0     0  502.12509    0 2429  766.00000  502.12509  34.4%     -   20s
     0     0  505.65933    0 2038  766.00000  505.65933  34.0%     -   20s
     0     0  506.21318    0 2358  766.00000  506.21318  33.9%     -   22s
     0     0  506.24285    0 2362  766.00000  506.24285  33.9%     -   22s
     0     0  506.24285    0 2366  766.00000  506.24285  33.9%     -   22s
     0     0  509.44328    0 1996  766.00000  509.44328  33.5%     -   23s
     0     0  509.63218    0 1756  766.00000  509.63218  33.5%     -   25s
     0     0  509.66519    0 2026  766.00000  509.66519  33.5%     -   25s
     0     0  509.67647    0 2027  766.00000  509.67647  33.5%     -   25s
     0     0  510.55249    0 1849  766.00000  510.55249  33.3%     -   26s
     0     0  511.67091    0 1813  766.00000  511.67091  33.2%     -   28s
     0     0  511.90044    0 2018  766.00000  511.90044  33.2%     -   28s
     0     0  511.96023    0 2015  766.00000  511.96023  33.2%     -   28s
     0     0  511.98002    0 2007  766.00000  511.98002  33.2%     -   28s
     0     0  512.41319    0 1798  766.00000  512.41319  33.1%     -   29s
H    0     0                765.0000000  512.65267  33.0%     -   30s
     0     0  512.65267    0 1949  765.00000  512.65267  33.0%     -   31s
     0     0  512.68198    0 1993  765.00000  512.68198  33.0%     -   31s
     0     0  513.26842    0 1869  765.00000  513.26842  32.9%     -   31s
     0     0  513.29646    0 1941  765.00000  513.29646  32.9%     -   33s
     0     0  514.00059    0 1803  765.00000  514.00059  32.8%     -   34s
     0     0  514.10405    0 1900  765.00000  514.10405  32.8%     -   36s
     0     0  514.10941    0 1891  765.00000  514.10941  32.8%     -   36s
     0     0  514.33698    0 1717  765.00000  514.33698  32.8%     -   36s
     0     0  514.36792    0 1704  765.00000  514.36792  32.8%     -   37s
     0     2  514.36792    0 1696  765.00000  514.36792  32.8%     -   41s
    31    18  516.35831    7 1719  765.00000  514.50050  32.7%   117   49s
H   32    18                764.0000000  514.50050  32.7%   114   49s
   115   106  516.91917   28 1696  764.00000  514.50050  32.7%  33.3   50s
   950   969  526.11607  223 1527  764.00000  514.50050  32.7%  10.9   55s
  1866  1845  560.39479  415 1148  764.00000  514.50050  32.7%  22.3   60s
```

80	2485	2497	537.25094	467	1351	764.00000	514.50050	32.7%	43.1	65s
81	2870	2877	541.00000	518	1278	764.00000	514.50050	32.7%	72.5	70s
82	3189	3170	565.00000	619	1199	764.00000	514.50050	32.7%	98.2	75s
83	3364	3304	576.74594	640	1215	764.00000	514.50050	32.7%	118	86s
84	3567	3539	586.87222	655	1151	764.00000	514.50050	32.7%	129	91s
85	3895	3825	620.42383	825	929	764.00000	514.50050	32.7%	141	95s
86	4141	4114	604.00000	850	905	764.00000	514.50050	32.7%	154	100s
87	4708	4742	610.23463	974	842	764.00000	514.50050	32.7%	152	105s
88	5173	5003	656.00000	1082	16806	764.00000	514.50050	32.7%	147	115s
89	5175	5004	729.00000	205	1602	764.00000	729.00000	4.58%	147	122s
90	5176	5005	729.00000	63	336	764.00000	729.00000	4.58%	147	128s
91	5181	5009	731.00000	299	306	764.00000	731.00000	4.32%	150	132s
92	5182	5010	731.38352	809	454	764.00000	731.38352	4.27%	150	135s
93	5185	5012	734.26334	570	721	764.00000	734.26334	3.89%	149	140s
94	5187	5013	737.93606	701	512	764.00000	737.93606	3.41%	149	146s
95	5190	5015	741.46934	443	741	764.00000	741.46934	2.95%	149	150s
96	5194	5018	746.05381	106	686	764.00000	746.05381	2.35%	149	155s
97	5200	5022	748.60287	541	689	764.00000	748.60287	2.02%	149	160s
98	5204	5025	748.83437	1072	570	764.00000	748.83437	1.99%	149	165s
99	5206	5026	748.89230	403	590	764.00000	748.89230	1.98%	149	170s
100	5210	5029	749.03880	204	635	764.00000	749.03880	1.96%	149	179s
101	5211	5029	749.11758	868	613	764.00000	749.11758	1.95%	149	180s
102	5213	5031	749.23599	1003	697	764.00000	749.23599	1.93%	149	185s
103	5214	5031	749.25575	59	697	764.00000	749.25575	1.93%	149	191s
104	5216	5033	749.31540	628	703	764.00000	749.31540	1.92%	149	195s
105	5219	5035	749.38675	134	635	764.00000	749.38675	1.91%	148	204s
106	5220	5035	749.40589	1138	650	764.00000	749.40589	1.91%	148	208s
107	5221	5036	749.43584	126	664	764.00000	749.43584	1.91%	148	210s
108	H 5221	4783				763.0000000	749.43975	1.78%	148	211s
109	5223	4544	749.46710	909	637	763.00000	749.46710	1.77%	148	222s
110	5224	4545	749.47586	273	636	763.00000	749.47586	1.77%	148	230s
111	5226	4546	749.51782	891	605	763.00000	749.51782	1.77%	148	237s
112	5228	4548	749.57794	234	650	763.00000	749.57794	1.76%	148	243s
113	5230	4549	749.63308	445	653	763.00000	749.63308	1.75%	148	249s
114	5231	4550	749.68964	240	560	763.00000	749.68964	1.74%	148	251s
115	5232	4550	749.79500	239	718	763.00000	749.79500	1.73%	148	255s
116	5234	4552	749.85363	29	605	763.00000	749.85363	1.72%	148	261s
117	5236	4553	749.89466	1091	603	763.00000	749.89466	1.72%	148	270s
118	5238	4554	749.94706	1083	572	763.00000	749.94706	1.71%	148	276s
119	H 5238	4325				760.0000000	750.00188	1.32%	148	290s
120	5240	4327	750.02196	909	512	760.00000	750.02196	1.31%	148	297s
121	5242	4328	750.08952	375	541	760.00000	750.08952	1.30%	148	302s
122	5244	4329	750.16559	687	521	760.00000	750.16559	1.29%	148	309s
123	5245	4330	750.23659	1030	570	760.00000	750.23659	1.28%	148	310s
124	5247	4331	750.31544	72	523	760.00000	750.31544	1.27%	148	317s
125	5248	4332	750.34890	394	620	760.00000	750.34890	1.27%	148	320s
126	5250	4333	750.43225	862	520	760.00000	750.43225	1.26%	148	328s
127	5252	4335	750.49904	690	604	760.00000	750.49904	1.25%	148	332s
128	5254	4336	750.58890	322	572	760.00000	750.58890	1.24%	147	336s
129	5256	4337	750.68003	966	551	760.00000	750.68003	1.23%	147	341s
130	5258	4339	750.81115	74	620	760.00000	750.81115	1.21%	147	345s
131	5260	4340	750.93097	574	619	760.00000	750.93097	1.19%	147	350s
132	5262	4341	751.01083	492	572	760.00000	751.01083	1.18%	147	358s
133	5263	4342	751.03772	92	592	760.00000	751.03772	1.18%	147	361s
134	5264	4343	751.05691	161	575	760.00000	751.05691	1.18%	147	365s
135	5266	4344	751.13418	757	627	760.00000	751.13418	1.17%	147	372s
136	5268	4345	751.20144	1057	537	760.00000	751.20144	1.16%	147	376s
137	5274	4349	751.29365	832	493	760.00000	751.29365	1.15%	147	380s
138	5280	4134	751.36828	805	474	760.00000	751.36828	1.14%	147	385s
139	5286	4138	751.45027	945	490	760.00000	751.45027	1.12%	147	390s
140	5292	3933	751.51450	936	473	760.00000	751.51450	1.12%	146	395s
141	5299	3938	751.68539	266	566	760.00000	751.68539	1.09%	146	404s
142	5300	3939	751.69261	541	629	760.00000	751.69261	1.09%	146	407s
143	5303	3941	751.74412	159	601	760.00000	751.74412	1.09%	146	410s
144	5308	3944	751.79630	266	563	760.00000	751.79630	1.08%	146	415s
145	5314	3948	751.86194	59	635	760.00000	751.86194	1.07%	146	420s
146	5319	3951	751.91680	134	635	760.00000	751.91680	1.06%	146	431s
147	5320	3952	751.92328	1138	579	760.00000	751.92328	1.06%	146	437s
148	5323	3954	751.95026	909	582	760.00000	751.95026	1.06%	146	440s
149	5326	3956	751.97465	891	588	760.00000	751.97465	1.06%	145	445s
150	5330	3959	751.99807	445	582	760.00000	751.99807	1.05%	145	450s
151	5335	3962	752.02822	161	630	760.00000	752.02822	1.05%	145	455s
152	5339	3965	752.04362	668	580	760.00000	752.04362	1.05%	145	463s
153	5340	3965	752.04835	909	613	760.00000	752.04835	1.05%	145	465s
154	5346	3969	752.08033	937	607	760.00000	752.08033	1.04%	145	470s
155	5352	3973	752.11811	690	622	760.00000	752.11811	1.04%	145	475s
156	5357	3977	752.13931	232	658	760.00000	752.13931	1.03%	145	480s
157	5359	3978	752.15252	7	646	760.00000	752.15252	1.03%	145	486s
158	5363	3981	752.17356	92	661	760.00000	752.17356	1.03%	144	490s
159	5368	3984	752.20441	1057	630	760.00000	752.20441	1.03%	144	495s
160	5369	3985	752.21232	500	700	760.00000	752.21232	1.02%	144	501s
161	5372	3987	752.24094	752	689	760.00000	752.24094	1.02%	144	505s
162	5378	3991	752.27404	95	659	760.00000	752.27404	1.02%	144	510s
163	5390	4001	754.74448	443	231	760.00000	754.74448	0.69%	172	515s

```
  5403  4010  757.68024  159  153  760.00000  757.68024  0.31%   172  520s
  5422  4023  757.87596  909  169  760.00000  757.87596  0.28%   171  525s
  5444  4037  757.96368  687  159  760.00000  757.96368  0.27%   171  530s
  5479  4062  758.41096  612  108  760.00000  758.41096  0.21%   173  535s

Cutting planes:
  Gomory: 5
  Lift-and-project: 1
  Cover: 4
  Implied bound: 1
  MIR: 3
  StrongCG: 1
  Flow cover: 52
  Zero half: 4
  RLT: 8
  Relax-and-lift: 24

Explored 5484 nodes (961632 simplex iterations) in 536.00 seconds (364.25 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 760 760 760
No other solutions better than 760

Optimal solution found (tolerance 1.00e-04)
Best objective 7.600000000000e+02, best bound 7.600000000000e+02, gap 0.0000%

Output optimal solution and the Optimal Obj:  760.0


Obj = 760.0

Solutions:
    The total pi =  192.0
    The total duration time in berth stage =  183.0
    The total duration time in quay crane scheduling stage =  41.0
    The total departure time in berth stage=  451.0
    The total departure time in quay crane scheduling stage =  309.0
    The total wasted crane work hour according QC0=  5.389809743441914
    The last depature time in quay crane scheduling stage =  52.0

The specific solution are as follows:
    Vessel i: 0:    li: 6,        pi: 14-20,          ai-di: 2-14,          taoi-deltai: 2-21,          periodi: 19,          taoPi_SP-deltaPi_SP: 2-6,          periodPi: 4,          c_i: 4827990,          dowork: 5009236,          fa_i: 4
    Vessel i: 1:    li: 7,        pi: 27-34,          ai-di: 5-15,          taoi-deltai: 5-21,          periodi: 16,          taoPi_SP-deltaPi_SP: 5-9,          periodPi: 4,          c_i: 3973929,          dowork: 4086482,          fa_i: 3
    Vessel i: 2:    li: 7,        pi: 6-13,          ai-di: 9-24,          taoi-deltai: 9-34,          periodi: 25,          taoPi_SP-deltaPi_SP: 9-14,          periodPi: 5,          c_i: 6489910,          dowork: 6591100,          fa_i: 4
    Vessel i: 3:    li: 6,        pi: 0-6,          ai-di: 10-14,          taoi-deltai: 10-14,          periodi: 4,          taoPi_SP-deltaPi_SP: 10-12,          periodPi: 2,          c_i: 1036688,          dowork: 1054576,          fa_i: 2
    Vessel i: 4:    li: 7,        pi: 20-27,          ai-di: 13-18,          taoi-deltai: 13-18,          periodi: 5,          taoPi_SP-deltaPi_SP: 13-15,          periodPi: 2,          c_i: 1300263,          dowork: 1450042,          fa_i: 2
    Vessel i: 5:    li: 5,        pi: 29-34,          ai-di: 22-27,          taoi-deltai: 22-29,          periodi: 7,          taoPi_SP-deltaPi_SP: 22-24,          periodPi: 2,          c_i: 1714644,          dowork: 1845508,          fa_i: 2
    Vessel i: 6:    li: 5,        pi: 22-27,          ai-di: 23-33,          taoi-deltai: 23-28,          periodi: 5,          taoPi_SP-deltaPi_SP: 23-24,          periodPi: 1,          c_i: 1171409,          dowork: 1186398,          fa_i: 4
    Vessel i: 7:    li: 6,        pi: 14-20,          ai-di: 27-60,          taoi-deltai: 27-56,          periodi: 29,          taoPi_SP-deltaPi_SP: 27-33,          periodPi: 6,          c_i: 7632041,          dowork: 7645676,          fa_i: 4
    Vessel i: 8:    li: 6,        pi: 26-32,          ai-di: 30-70,          taoi-deltai: 30-65,          periodi: 35,          taoPi_SP-deltaPi_SP: 30-37,          periodPi: 7,          c_i: 8969412,          dowork: 9227540,          fa_i: 4
    Vessel i: 9:    li: 6,        pi: 20-26,          ai-di: 34-60,          taoi-deltai: 34-56,          periodi: 22,          taoPi_SP-deltaPi_SP: 34-39,          periodPi: 5,          c_i: 5766334,          dowork: 5931990,          fa_i: 4
    Vessel i: 10:    li: 7,        pi: 6-13,          ai-di: 43-55,          taoi-deltai: 43-48,          periodi: 5,          taoPi_SP-deltaPi_SP: 43-44,          periodPi: 1,          c_i: 1218429,          dowork: 1318220,          fa_i: 4
    Vessel i: 11:    li: 6,        pi: 8-14,          ai-di: 50-63,          taoi-deltai: 50-61,          periodi: 11,          taoPi_SP-deltaPi_SP: 50-52,          periodPi: 2,          c_i: 2724812,          dowork: 2900084,          fa_i: 4
TimeSolveModel: 555.000000

TimeAll: 559.000000
```