```
"E:\1 □□□□\3 □□□□□\1 □□□□□□\1 □□□□□□□\1_□□□□□□_□□□□\1_LW_□□□□2\6 □□□□\2 python code\01_My_Python_Code\Scripts\python.exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=52095

import sys; print('Python %s on %s' % (sys.version, sys.platform))
sys.path.extend(['E:\\1 □□□□\\3 □□□□□\\1 □□□□□□□\\1 □□□□□□□□□\\1_□□□□□□_□□□□\\1_LW_□□□□2\\6 □□□□\\2 python code\\01_My_Python_Code', 'E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□/1_□□□□□□_□□□□/1_LW_□□□□2/6 □□□□/2 python code/01_My_Python_Code'])

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_□□□□2/6 □□□□/2 python code/01_My_Python_Code/main_BACASP_official_ENSGA-II.py', wdir='E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□/1_□□□□□□_□□□□/1_LW_□□□□2/6 □□□□/2 python code/01_My_Python_Code')
Backend TkAgg is interactive backend. Turning interactive mode on.
Waiting 1s.....

This is the  R_7_1 _standerd_test.xlsx  optimization process solved by ENSGA-II algorithm.

Start

Before iteration:
    Read basic data
    Parameter setting:
        trail =  58
        Pop_size =  30
        Tolerance_iteration_unchanged_number =  10
        Chrom_size =  21
        Iter_num_GA =  300
        Select_rate =  0.85
        Crossover_rate =  0.95
        Mutation rate =  0.95
        Mu_oper_type =  1
        vessel_move_way =  2
        coefficient for Obj1=  1.9
        coefficient for Obj2=  0.10000000000000009
        gen =  0

Iteration begin:
Beging the No. 0  iteration:
    obj[0] = 21.00      temp_best_value_gen = 21.00
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 21.00   temp_best_value_gen = 21.00
    No, maintain solution  and obj[gen] = 21.00 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 2.   7.5 14.  21.  27.  27.5  3. ]
        second level:  [5. 5. 6. 3. 6. 1. 1.]
        third level:  [2. 2. 4. 2. 4. 2. 3.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 21.00   temp_best_value_gen = 21.00
    No, maintain solution  and obj[gen] = 21.00 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [ 2.   7.5 14.  21.  27.  27.5  3. ]
        second level:  [5. 5. 6. 3. 6. 1. 1.]
        third level:  [2. 2. 4. 2. 4. 2. 3.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 21.00   temp_best_value_gen = 21.00
    No, maintain solution  and obj[gen] = 21.00 , and the tolerance_counter = 3
    solution chromosome =
        first level: [ [ 2.   7.5 14.  21.  27.  27.5  3. ]
        second level:  [5. 5. 6. 3. 6. 1. 1.]
        third level:  [2. 2. 4. 2. 4. 2. 3.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 21.00   temp_best_value_gen = 18.80
    Yes, update solution and obj[gen] = 18.80
    solution chromosome =
        first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
        second level:  [5. 5. 1. 6. 3. 1. 6.]
        third level:  [2. 2. 3. 4. 2. 2. 4.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 18.80   temp_best_value_gen = 18.80
    No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
```

```
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 5  iteration is finished!

Beging the No. 6  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 2
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 6  iteration is finished!

Beging the No. 7  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 3
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 7  iteration is finished!

Beging the No. 8  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 4
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 8  iteration is finished!

Beging the No. 9  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 5
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 9  iteration is finished!

Beging the No. 10  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 6
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 10  iteration is finished!

Beging the No. 11  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 7
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 11  iteration is finished!

Beging the No. 12  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 8
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 12  iteration is finished!

Beging the No. 13  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 9
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 13  iteration is finished!

Beging the No. 14  iteration:
   obj[gen-1] = 18.80   temp_best_value_gen = 18.80
   No, maintain solution  and obj[gen] = 18.80 , and the tolerance_counter = 10
   solution chromosome =
      first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
      second level:  [5. 5. 1. 6. 3. 1. 6.]
      third level:  [2. 2. 3. 4. 2. 2. 4.] ]
   The No. 14  iteration is finished!
```

```
164
165
166 ---------------------------------------------------------------------------------
167 The iteration is terminated and then visulize the solution:
168     solution chromosome =
169         first level: [ [ 2.   7.5  3.  26.  21.  27.5 14. ]
170         second level:  [5. 5. 1. 6. 3. 1. 6.]
171         third level:  [2. 2. 3. 4. 2. 2. 4.] ]
172     Objective function values and some other indicators:
173         Obj0 = 7.00             Obj1 = 55.00            Obj0 + Obj1 = 62.00
174         Total movement of crane: 28.00
175         Total waiting time in berth position: 27.00
176         Total index of q during berthing: 404.00
177     Specific arrangement for each vessel:
178         V_id:  0        li: 4.0         xi: 2.0         bow of i: 0.0           tail of i: 4.0          gama_i0: 5.0            gama_i1: 8.0
                    duration_time_i: 3.0        demand_i: 120.0         work load_i: 120.0      work load gap_i: 0
179         V_id:  1        li: 7.0         xi: 7.5         bow of i: 4.0           tail of i: 11.0         gama_i0: 5.0            gama_i1: 8.0
                    duration_time_i: 3.0        demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
180         V_id:  2        li: 6.0         xi: 3.0         bow of i: 0.0           tail of i: 6.0          gama_i0: 1.0            gama_i1: 4.0
                    duration_time_i: 3.0        demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
181         V_id:  3        li: 8.0         xi: 26.0        bow of i: 22.0          tail of i: 30.0         gama_i0: 6.0            gama_i1: 8
    .0              duration_time_i: 2.0        demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
182         V_id:  4        li: 4.0         xi: 21.0        bow of i: 19.0          tail of i: 23.0         gama_i0: 3.0            gama_i1: 6
    .0              duration_time_i: 3.0        demand_i: 120.0         work load_i: 120.0      work load gap_i: 0
183         V_id:  5        li: 5.0         xi: 27.5        bow of i: 25.0          tail of i: 30.0         gama_i0: 1.0            gama_i1: 3
    .0              duration_time_i: 2.0        demand_i: 60.0          work load_i: 60.0       work load gap_i: 0
184         V_id:  6        li: 6.0         xi: 14.0        bow of i: 11.0          tail of i: 17.0         gama_i0: 6.0            gama_i1: 8
    .0              duration_time_i: 2.0        demand_i: 140.0         work load_i: 140.0      work load gap_i: 0
185
186 Algorithm finished and the total CPU time: 1160 s
187 End
188
```