```
"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=15123

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_8_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 =  24
        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] = 16.70      temp_best_value_gen = 16.70
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 16.70   temp_best_value_gen = 16.70
    No, maintain solution  and obj[gen] = 16.70 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [26.   6.5 12.  16.5 20.5 25.   4.   2. ]
        second level:  [1. 0. 0. 0. 1. 4. 2. 6.]
        third level:  [3. 4. 4. 2. 3. 2. 2. 4.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 16.70   temp_best_value_gen = 16.10
    Yes, update solution and obj[gen] = 16.10
    solution chromosome =
        first level: [ [16.5  6.5 12.  26.  20.5 25.   4.   2. ]
        second level:  [0. 0. 0. 1. 1. 4. 2. 6.]
        third level:  [2. 4. 4. 3. 3. 2. 2. 4.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 16.10   temp_best_value_gen = 14.00
    Yes, update solution and obj[gen] = 14.00
    solution chromosome =
        first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
        second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
        third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 14.00   temp_best_value_gen = 14.00
    No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
        second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
        third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 14.00   temp_best_value_gen = 14.00
    No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
```

```
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 5  iteration is finished!

Beging the No. 6  iteration:
   obj[gen-1] = 14.00   temp_best_value_gen = 14.00
   No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 3
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 6  iteration is finished!

Beging the No. 7  iteration:
   obj[gen-1] = 14.00   temp_best_value_gen = 14.00
   No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 4
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 7  iteration is finished!

Beging the No. 8  iteration:
   obj[gen-1] = 14.00   temp_best_value_gen = 14.00
   No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 5
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 8  iteration is finished!

Beging the No. 9  iteration:
   obj[gen-1] = 14.00   temp_best_value_gen = 14.00
   No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 6
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 9  iteration is finished!

Beging the No. 10  iteration:
   obj[gen-1] = 14.00   temp_best_value_gen = 14.00
   No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 7
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 10  iteration is finished!

Beging the No. 11  iteration:
   obj[gen-1] = 14.00   temp_best_value_gen = 14.00
   No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 8
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 11  iteration is finished!

Beging the No. 12  iteration:
   obj[gen-1] = 14.00   temp_best_value_gen = 14.00
   No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 9
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 12  iteration is finished!

Beging the No. 13  iteration:
   obj[gen-1] = 14.00   temp_best_value_gen = 14.00
   No, maintain solution  and obj[gen] = 14.00 , and the tolerance_counter = 10
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   The No. 13  iteration is finished!


--------------------------------------------------------------------------------
The iteration is terminated and then visulize the solution:
   solution chromosome =
      first level: [ [16.5  6.5 12.  26.  20.5  3.   4.  25. ]
      second level:  [0. 0. 0. 1. 1. 2. 4. 4.]
      third level:  [2. 4. 4. 3. 3. 4. 6. 2.] ]
   Objective function values and some other indicators:
```

```
164         Obj0 = 5.00             Obj1 = 45.00            Obj0 + Obj1 = 50.00
165         Total movement of crane: 33.00
166         Total waiting time in berth position: 12.00
167         Total index of q during berthing: 555.00
168       Specific arrangement for each vessel:
169         V_id:  0            li: 3.0             xi: 16.5            bow of i: 15.0          tail of i: 18.0         gama_i0: 0.0            gama_i1: 4
    .0              duration_time_i: 4.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
170         V_id:  1            li: 7.0             xi: 6.5             bow of i: 3.0           tail of i: 10.0         gama_i0: 0.0            gama_i1: 2.0
                    duration_time_i: 2.0            demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
171         V_id:  2            li: 4.0             xi: 12.0            bow of i: 10.0          tail of i: 14.0         gama_i0: 0.0            gama_i1: 1
    .0              duration_time_i: 1.0            demand_i: 80.0          work load_i: 80.0       work load gap_i: 0
172         V_id:  3            li: 5.0             xi: 26.0            bow of i: 23.5          tail of i: 28.5         gama_i0: 1.0            gama_i1: 3
    .0              duration_time_i: 2.0            demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
173         V_id:  4            li: 3.0             xi: 20.5            bow of i: 19.0          tail of i: 22.0         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
174         V_id:  5            li: 6.0             xi: 3.0             bow of i: 0.0           tail of i: 6.0          gama_i0: 2.0            gama_i1: 4.0
                    duration_time_i: 2.0            demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
175         V_id:  6            li: 8.0             xi: 4.0             bow of i: 0.0           tail of i: 8.0          gama_i0: 4.0            gama_i1: 6.0
                    duration_time_i: 2.0            demand_i: 160.0         work load_i: 160.0      work load gap_i: 0
176         V_id:  7            li: 4.0             xi: 25.0            bow of i: 23.0          tail of i: 27.0         gama_i0: 4.0            gama_i1: 6
    .0              duration_time_i: 2.0            demand_i: 80.0          work load_i: 80.0       work load gap_i: 0
177
178   Algorithm finished and the total CPU time: 1163 s
179   End
180
```