```
"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=49931

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_20_8 _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 =  60
        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] = 181.30    temp_best_value_gen = 181.30
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 181.30     temp_best_value_gen = 181.30
    No, maintain solution  and obj[gen] = 181.30 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 4.  10.  15.5  4.5 26.   2.5  4.5  4.  23.5  3.   4.5  2.5  1.5  3.5
  1.5  1.5  4.5 14.  13.5 13.5]
        second level:  [ 1.  5.  0.  3.  0.  7. 11.  5.  4.  0. 13. 15. 17. 21. 25. 29. 32.  3.
 16.  6.]
        third level:  [3. 4. 7. 5. 2. 2. 4. 5. 5. 6. 4. 5. 2. 2. 2. 2. 2. 2. 2.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 181.30     temp_best_value_gen = 181.30
    No, maintain solution  and obj[gen] = 181.30 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [ 4.  10.  15.5  4.5 26.   2.5  4.5  4.  23.5  3.   4.5  2.5  1.5  3.5
  1.5  1.5  4.5 14.  13.5 13.5]
        second level:  [ 1.  5.  0.  3.  0.  7. 11.  5.  4.  0. 13. 15. 17. 21. 25. 29. 32.  3.
 16.  6.]
        third level:  [3. 4. 7. 5. 2. 2. 4. 5. 5. 6. 4. 5. 2. 2. 2. 2. 2. 2. 2.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 181.30     temp_best_value_gen = 181.30
    No, maintain solution  and obj[gen] = 181.30 , and the tolerance_counter = 3
    solution chromosome =
        first level: [ [ 4.  10.  15.5  4.5 26.   2.5  4.5  4.  23.5  3.   4.5  2.5  1.5  3.5
  1.5  1.5  4.5 14.  13.5 13.5]
        second level:  [ 1.  5.  0.  3.  0.  7. 11.  5.  4.  0. 13. 15. 17. 21. 25. 29. 32.  3.
 16.  6.]
        third level:  [3. 4. 7. 5. 2. 2. 4. 5. 5. 6. 4. 5. 2. 2. 2. 2. 2. 2. 2.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 181.30     temp_best_value_gen = 181.30
    No, maintain solution  and obj[gen] = 181.30 , and the tolerance_counter = 4
    solution chromosome =
        first level: [ [ 4.  10.  15.5  4.5 26.   2.5  4.5  4.  23.5  3.   4.5  2.5  1.5  3.5
  1.5  1.5  4.5 14.  13.5 13.5]
        second level:  [ 1.  5.  0.  3.  0.  7. 11.  5.  4.  0. 13. 15. 17. 21. 25. 29. 32.  3.
 16.  6.]
```

```
      third level:  [3. 4. 7. 5. 2. 2. 4. 5. 5. 6. 4. 5. 2. 2. 2. 2. 2. 2. 2. 2.] ]
   The No. 4  iteration is finished!

Beging the No. 5  iteration:
   obj[gen-1] = 181.30     temp_best_value_gen = 181.30
   No, maintain solution  and obj[gen] = 181.30 , and the tolerance_counter = 5
   solution chromosome =
      first level: [ [ 4.  10.  15.5  4.5 26.   2.5  4.5  4.  23.5  3.   4.5  2.5  1.5  3.5
 1.5  1.5  4.5 14.  13.5 13.5]
      second level:  [ 1.  5.  0.  3.  0.  7. 11.  5.  4.  0. 13. 15. 17. 21. 25. 29. 32.  3.
 16.  6.]
      third level:  [3. 4. 7. 5. 2. 2. 4. 5. 5. 6. 4. 5. 2. 2. 2. 2. 2. 2. 2. 2.] ]
   The No. 5  iteration is finished!

Beging the No. 6  iteration:
   obj[gen-1] = 181.30     temp_best_value_gen = 181.30
   No, maintain solution  and obj[gen] = 181.30 , and the tolerance_counter = 6
   solution chromosome =
      first level: [ [ 4.  10.  15.5  4.5 26.   2.5  4.5  4.  23.5  3.   4.5  2.5  1.5  3.5
 1.5  1.5  4.5 14.  13.5 13.5]
      second level:  [ 1.  5.  0.  3.  0.  7. 11.  5.  4.  0. 13. 15. 17. 21. 25. 29. 32.  3.
 16.  6.]
      third level:  [3. 4. 7. 5. 2. 2. 4. 5. 5. 6. 4. 5. 2. 2. 2. 2. 2. 2. 2. 2.] ]
   The No. 6  iteration is finished!


---------------------------------------------------------------------------------
The iteration is terminated and then visulize the solution:
   solution chromosome =
      first level: [ [ 4.  10.  15.5  4.5 26.   2.5  4.5  4.  23.5  3.   4.5  2.5  1.5  3.5
 1.5  1.5  4.5 14.  13.5 13.5]
      second level:  [ 1.  5.  0.  3.  0.  7. 11.  5.  4.  0. 13. 15. 17. 21. 25. 29. 32.  3.
 16.  6.]
      third level:  [3. 4. 7. 5. 2. 2. 4. 5. 5. 6. 4. 5. 2. 2. 2. 2. 2. 2. 2. 2.] ]
   Objective function values and some other indicators:
      Obj0 = 34.00          Obj1 = 1167.00          Obj0 + Obj1 = 1201.00
      Total movement of crane: 25.00
      Total waiting time in berth position: 213.00
      Total index of q during berthing: 713.00
   Specific arrangement for each vessel:
      V_id:  0          li: 8.0          xi: 4.0          bow of i: 0.0          tail of i: 8.0          gama_i0: 1.0          gama_i1: 3.0
                duration_time_i: 2.0          demand_i: 80.0          work load_i: 80.0          work load gap_i: 0
      V_id:  1          li: 4.0          xi: 10.0          bow of i: 8.0          tail of i: 12.0          gama_i0: 5.0          gama_i1: 7
.0          duration_time_i: 2.0          demand_i: 120.0          work load_i: 120.0          work load gap_i: 0
      V_id:  2          li: 7.0          xi: 15.5          bow of i: 12.0          tail of i: 19.0          gama_i0: 0.0          gama_i1: 1
.0          duration_time_i: 1.0          demand_i: 120.0          work load_i: 120.0          work load gap_i: 0
      V_id:  3          li: 9.0          xi: 4.5          bow of i: 0.0          tail of i: 9.0          gama_i0: 3.0          gama_i1: 4.0
                duration_time_i: 1.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  4          li: 8.0          xi: 26.0          bow of i: 22.0          tail of i: 30.0          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
      V_id:  5          li: 5.0          xi: 2.5          bow of i: 0.0          tail of i: 5.0          gama_i0: 7.0          gama_i1: 11.0
                duration_time_i: 4.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
      V_id:  6          li: 9.0          xi: 4.5          bow of i: 0.0          tail of i: 9.0          gama_i0: 11.0          gama_i1: 13.0
                duration_time_i: 2.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  7          li: 8.0          xi: 4.0          bow of i: 0.0          tail of i: 8.0          gama_i0: 5.0          gama_i1: 6.0
                duration_time_i: 1.0          demand_i: 80.0          work load_i: 80.0          work load gap_i: 0
      V_id:  8          li: 6.0          xi: 23.5          bow of i: 20.5          tail of i: 26.5          gama_i0: 4.0          gama_i1: 5
.0          duration_time_i: 1.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  9          li: 6.0          xi: 3.0          bow of i: 0.0          tail of i: 6.0          gama_i0: 0.0          gama_i1: 1.0
                duration_time_i: 1.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  10          li: 9.0          xi: 4.5          bow of i: 0.0          tail of i: 9.0          gama_i0: 13.0          gama_i1: 15.
0          duration_time_i: 2.0          demand_i: 120.0          work load_i: 120.0          work load gap_i: 0
      V_id:  11          li: 5.0          xi: 2.5          bow of i: 0.0          tail of i: 5.0          gama_i0: 15.0          gama_i1: 17.
0          duration_time_i: 2.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
      V_id:  12          li: 3.0          xi: 1.5          bow of i: 0.0          tail of i: 3.0          gama_i0: 17.0          gama_i1: 21.
0          duration_time_i: 4.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  13          li: 7.0          xi: 3.5          bow of i: 0.0          tail of i: 7.0          gama_i0: 21.0          gama_i1: 25.
0          duration_time_i: 4.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  14          li: 3.0          xi: 1.5          bow of i: 0.0          tail of i: 3.0          gama_i0: 25.0          gama_i1: 29.
0          duration_time_i: 4.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  15          li: 3.0          xi: 1.5          bow of i: 0.0          tail of i: 3.0          gama_i0: 29.0          gama_i1: 32.
0          duration_time_i: 3.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  16          li: 9.0          xi: 4.5          bow of i: 0.0          tail of i: 9.0          gama_i0: 32.0          gama_i1: 35.
0          duration_time_i: 3.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  17          li: 4.0          xi: 14.0          bow of i: 12.0          tail of i: 16.0          gama_i0: 3.0          gama_i1
: 6.0          duration_time_i: 3.0          demand_i: 100.0          work load_i: 100.0          work load gap_i: 0
      V_id:  18          li: 3.0          xi: 13.5          bow of i: 12.0          tail of i: 15.0          gama_i0: 16.0          gama_i1
: 20.0          duration_time_i: 4.0          demand_i: 140.0          work load_i: 140.0          work load gap_i: 0
      V_id:  19          li: 3.0          xi: 13.5          bow of i: 12.0          tail of i: 15.0          gama_i0: 6.0          gama_i1
: 9.0          duration_time_i: 3.0          demand_i: 120.0          work load_i: 120.0          work load gap_i: 0

Algorithm finished and the total CPU time: 1318 s
End
```