```
"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=32308

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_2_1 _standerd_test.xlsx  optimization process solved by ENSGA-II algorithm.

Start

Before iteration:
    Read basic data
    Parameter setting:
        trail =  16
        Pop_size =  20
        Tolerance_iteration_unchanged_number =  6
        Chrom_size =  6
        Iter_num_GA =  300
        Select_rate =  0.95
        Crossover_rate =  0.9
        Mutation rate =  0.95
        Mu_oper_type =  2
        vessel_move_way =  2
        coefficient for Obj1=  0.5
        coefficient for Obj2=  1.5
        gen =  0

Iteration begin:
Beging the No. 0  iteration:
    obj[0] = 17.95      temp_best_value_gen = 17.95
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 17.95   temp_best_value_gen = 17.95
    No, maintain solution  and obj[gen] = 17.95 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [3.02 7.16]
        second level:  [1. 3.]
        third level:  [4. 2.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 17.95   temp_best_value_gen = 17.95
    No, maintain solution  and obj[gen] = 17.95 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [3.02 7.16]
        second level:  [1. 3.]
        third level:  [4. 2.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 17.95   temp_best_value_gen = 17.95
    No, maintain solution  and obj[gen] = 17.95 , and the tolerance_counter = 3
    solution chromosome =
        first level: [ [3.02 7.16]
        second level:  [1. 3.]
        third level:  [4. 2.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 17.95   temp_best_value_gen = 13.20
    Yes, update solution and obj[gen] = 13.20
    solution chromosome =
        first level: [ [2.   4.07]
        second level:  [4. 0.]
        third level:  [4. 5.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 13.20   temp_best_value_gen = 8.98
    Yes, update solution and obj[gen] = 8.98
    solution chromosome =
        first level: [ [2.32 4.05]
```

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

Beging the No. 6  iteration:
   obj[gen-1] = 8.98     temp_best_value_gen = 6.27
   Yes, update solution and obj[gen] = 6.27
   solution chromosome =
      first level: [ [2.   4.05]
      second level:  [1. 0.]
      third level:  [4. 6.] ]
   The No. 6  iteration is finished!

Beging the No. 7  iteration:
   obj[gen-1] = 6.27     temp_best_value_gen = 6.27
   No, maintain solution  and obj[gen] = 6.27 , and the tolerance_counter = 1
   solution chromosome =
      first level: [ [2.   4.05]
      second level:  [1. 0.]
      third level:  [4. 6.] ]
   The No. 7  iteration is finished!

Beging the No. 8  iteration:
   obj[gen-1] = 6.27     temp_best_value_gen = 6.27
   No, maintain solution  and obj[gen] = 6.27 , and the tolerance_counter = 2
   solution chromosome =
      first level: [ [2.   4.05]
      second level:  [1. 0.]
      third level:  [4. 6.] ]
   The No. 8  iteration is finished!

Beging the No. 9  iteration:
   obj[gen-1] = 6.27     temp_best_value_gen = 6.27
   No, maintain solution  and obj[gen] = 6.27 , and the tolerance_counter = 3
   solution chromosome =
      first level: [ [2.   4.05]
      second level:  [1. 0.]
      third level:  [4. 6.] ]
   The No. 9  iteration is finished!

Beging the No. 10  iteration:
   obj[gen-1] = 6.27     temp_best_value_gen = 6.27
   No, maintain solution  and obj[gen] = 6.27 , and the tolerance_counter = 4
   solution chromosome =
      first level: [ [2.   4.05]
      second level:  [1. 0.]
      third level:  [4. 6.] ]
   The No. 10  iteration is finished!

Beging the No. 11  iteration:
   obj[gen-1] = 6.27     temp_best_value_gen = 6.27
   No, maintain solution  and obj[gen] = 6.27 , and the tolerance_counter = 5
   solution chromosome =
      first level: [ [2.   4.05]
      second level:  [1. 0.]
      third level:  [4. 6.] ]
   The No. 11  iteration is finished!

Beging the No. 12  iteration:
   obj[gen-1] = 6.27     temp_best_value_gen = 6.27
   No, maintain solution  and obj[gen] = 6.27 , and the tolerance_counter = 6
   solution chromosome =
      first level: [ [2.   4.05]
      second level:  [1. 0.]
      third level:  [4. 6.] ]
   The No. 12  iteration is finished!


--------------------------------------------------------------------------------
The iteration is terminated and then visulize the solution:
   solution chromosome =
      first level: [ [2.   4.05]
      second level:  [1. 0.]
      third level:  [4. 6.] ]
   Objective function values and some other indicators:
      Obj0 = 2.00          Obj1 = 3.51          Obj0 + Obj1 = 5.51
      Total movement of crane: 2.51
      Total waiting time in berth position: 1.00
      Total index of q during berthing: 27.00
   Specific arrangement for each vessel:
      V_id:  0          li: 4.0          xi: 2.0          bow of i: 0.0          tail of i: 4.0          gama_i0: 1.0          gama_i1: 3.0
                duration_time_i: 2.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
      V_id:  1          li: 8.0          xi: 4.1          bow of i: 0.1          tail of i: 8.1          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
```

```
162
163   Algorithm finished and the total CPU time: 223 s
164   End
165
```