```
"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=19878

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_5_2 _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 =  15
        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] = 18.87      temp_best_value_gen = 18.87
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 18.87   temp_best_value_gen = 18.30
    Yes, update solution and obj[gen] = 18.30
    solution chromosome =
        first level: [ [ 4.5 23.  17.5 11.5 25.5]
        second level:  [5. 5. 1. 1. 1.]
        third level:  [8. 2. 2. 2. 9.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 18.30   temp_best_value_gen = 18.30
    No, maintain solution  and obj[gen] = 18.30 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 4.5 23.  17.5 11.5 25.5]
        second level:  [5. 5. 1. 1. 1.]
        third level:  [8. 2. 2. 2. 9.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 18.30   temp_best_value_gen = 17.90
    Yes, update solution and obj[gen] = 17.90
    solution chromosome =
        first level: [ [ 4.5 23.  17.5 11.5 25.5]
        second level:  [1. 5. 1. 1. 1.]
        third level:  [5. 2. 2. 2. 9.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 17.90   temp_best_value_gen = 17.90
    No, maintain solution  and obj[gen] = 17.90 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 4.5 23.  17.5 11.5 25.5]
        second level:  [1. 5. 1. 1. 1.]
        third level:  [5. 2. 2. 2. 9.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 17.90   temp_best_value_gen = 17.90
    No, maintain solution  and obj[gen] = 17.90 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [ 4.5 23.  17.5 11.5 25.5]
```

```
      second level:  [1. 5. 1. 1. 1.]
      third level:  [5. 2. 2. 2. 9.] ]
   The No. 5  iteration is finished!

Beging the No. 6  iteration:
   obj[gen-1] = 17.90   temp_best_value_gen = 13.20
   Yes, update solution and obj[gen] = 13.20
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 6  iteration is finished!

Beging the No. 7  iteration:
   obj[gen-1] = 13.20   temp_best_value_gen = 13.20
   No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 1
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 7  iteration is finished!

Beging the No. 8  iteration:
   obj[gen-1] = 13.20   temp_best_value_gen = 13.20
   No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 2
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 8  iteration is finished!

Beging the No. 9  iteration:
   obj[gen-1] = 13.20   temp_best_value_gen = 13.20
   No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 3
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 9  iteration is finished!

Beging the No. 10  iteration:
   obj[gen-1] = 13.20   temp_best_value_gen = 13.20
   No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 4
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 10  iteration is finished!

Beging the No. 11  iteration:
   obj[gen-1] = 13.20   temp_best_value_gen = 13.20
   No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 5
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 11  iteration is finished!

Beging the No. 12  iteration:
   obj[gen-1] = 13.20   temp_best_value_gen = 13.20
   No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 6
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 12  iteration is finished!

Beging the No. 13  iteration:
   obj[gen-1] = 13.20   temp_best_value_gen = 13.20
   No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 7
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 13  iteration is finished!

Beging the No. 14  iteration:
   obj[gen-1] = 13.20   temp_best_value_gen = 13.20
   No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 8
   solution chromosome =
      first level: [ [ 4.5 11.5 17.5 23.  25.5]
      second level:  [1. 1. 2. 0. 4.]
      third level:  [5. 2. 4. 2. 9.] ]
   The No. 14  iteration is finished!
```

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164
165  Beging the No. 15  iteration:
166     obj[gen-1] = 13.20   temp_best_value_gen = 13.20
167     No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 9
168     solution chromosome =
169        first level: [ [ 4.5 11.5 17.5 23.  25.5]
170        second level:  [1. 1. 2. 0. 4.]
171        third level:  [5. 2. 4. 2. 9.] ]
172     The No. 15  iteration is finished!
173
174  Beging the No. 16  iteration:
175     obj[gen-1] = 13.20   temp_best_value_gen = 13.20
176     No, maintain solution  and obj[gen] = 13.20 , and the tolerance_counter = 10
177     solution chromosome =
178        first level: [ [ 4.5 11.5 17.5 23.  25.5]
179        second level:  [1. 1. 2. 0. 4.]
180        third level:  [5. 2. 4. 2. 9.] ]
181     The No. 16  iteration is finished!
182
183
184  ----------------------------------------------------------------------------
185  The iteration is terminated and then visulize the solution:
186     solution chromosome =
187        first level: [ [ 4.5 11.5 17.5 23.  25.5]
188        second level:  [1. 1. 2. 0. 4.]
189        third level:  [5. 2. 4. 2. 9.] ]
190     Objective function values and some other indicators:
191        Obj0 = 4.00              Obj1 = 56.00             Obj0 + Obj1 = 60.00
192        Total movement of crane: 48.00
193        Total waiting time in berth position: 8.00
194        Total index of q during berthing: 461.00
195     Specific arrangement for each vessel:
196        V_id:  0              li: 9.0              xi: 4.5              bow of i: 0.0              tail of i: 9.0              gama_i0: 1.0              gama_i1: 2.0
                      duration_time_i: 1.0              demand_i: 100.0              work load_i: 100.0              work load gap_i: 0
197        V_id:  1              li: 5.0              xi: 11.5              bow of i: 9.0              tail of i: 14.0              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
198        V_id:  2              li: 7.0              xi: 17.5              bow of i: 14.0              tail of i: 21.0              gama_i0: 2.0              gama_i1: 4
     .0                duration_time_i: 2.0              demand_i: 160.0              work load_i: 160.0              work load gap_i: 0
199        V_id:  3              li: 4.0              xi: 23.0              bow of i: 21.0              tail of i: 25.0              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
200        V_id:  4              li: 9.0              xi: 25.5              bow of i: 21.0              tail of i: 30.0              gama_i0: 4.0              gama_i1: 5
     .0                duration_time_i: 1.0              demand_i: 120.0              work load_i: 120.0              work load gap_i: 0
201
202  Algorithm finished and the total CPU time: 948 s
203  End
204
```