```
"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=8512

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_7 _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] = 22.56      temp_best_value_gen = 22.56
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 22.56   temp_best_value_gen = 21.60
    Yes, update solution and obj[gen] = 21.60
    solution chromosome =
        first level: [ [ 4.  19.  12.  25.5  3.5]
        second level:  [8. 5. 1. 1. 0.]
        third level:  [7. 5. 6. 5. 5.] ]
    The No. 1  iteration is finished!

Beging the No. 2  iteration:
    obj[gen-1] = 21.60   temp_best_value_gen = 21.60
    No, maintain solution  and obj[gen] = 21.60 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [ 4.  19.  12.  25.5  3.5]
        second level:  [8. 5. 1. 1. 0.]
        third level:  [7. 5. 6. 5. 5.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 21.60   temp_best_value_gen = 18.38
    Yes, update solution and obj[gen] = 18.38
    solution chromosome =
        first level: [ [4.14 5.22 4.75 8.61 3.57]
        second level:  [1. 5. 8. 4. 0.]
        third level:  [6. 5. 6. 5. 5.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 18.38   temp_best_value_gen = 18.38
    No, maintain solution  and obj[gen] = 18.38 , and the tolerance_counter = 1
    solution chromosome =
        first level: [ [4.14 5.22 4.75 8.61 3.57]
        second level:  [1. 5. 8. 4. 0.]
        third level:  [6. 5. 6. 5. 5.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 18.38   temp_best_value_gen = 18.38
    No, maintain solution  and obj[gen] = 18.38 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [4.14 5.22 4.75 8.61 3.57]
```

```
      second level:  [1. 5. 8. 4. 0.]
      third level:  [6. 5. 6. 5. 5.] ]
   The No. 5  iteration is finished!

Beging the No. 6  iteration:
   obj[gen-1] = 18.38   temp_best_value_gen = 18.38
   No, maintain solution  and obj[gen] = 18.38 , and the tolerance_counter = 3
   solution chromosome =
      first level: [ [4.14 5.22 4.75 8.61 3.57]
      second level:  [1. 5. 8. 4. 0.]
      third level:  [6. 5. 6. 5. 5.] ]
   The No. 6  iteration is finished!

Beging the No. 7  iteration:
   obj[gen-1] = 18.38   temp_best_value_gen = 16.70
   Yes, update solution and obj[gen] = 16.70
   solution chromosome =
      first level: [ [ 4.   4.  19.  25.5 12. ]
      second level:  [1. 4. 5. 1. 2.]
      third level:  [5. 5. 5. 5. 2.] ]
   The No. 7  iteration is finished!

Beging the No. 8  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: [ [ 4.   4.  19.  25.5 12. ]
      second level:  [1. 4. 5. 1. 2.]
      third level:  [5. 5. 5. 5. 2.] ]
   The No. 8  iteration is finished!

Beging the No. 9  iteration:
   obj[gen-1] = 16.70   temp_best_value_gen = 16.70
   No, maintain solution  and obj[gen] = 16.70 , and the tolerance_counter = 2
   solution chromosome =
      first level: [ [ 4.   4.  19.  25.5 12. ]
      second level:  [1. 4. 5. 1. 2.]
      third level:  [5. 5. 5. 5. 2.] ]
   The No. 9  iteration is finished!

Beging the No. 10  iteration:
   obj[gen-1] = 16.70   temp_best_value_gen = 16.70
   No, maintain solution  and obj[gen] = 16.70 , and the tolerance_counter = 3
   solution chromosome =
      first level: [ [ 4.   4.  19.  25.5 12. ]
      second level:  [1. 4. 5. 1. 2.]
      third level:  [5. 5. 5. 5. 2.] ]
   The No. 10  iteration is finished!

Beging the No. 11  iteration:
   obj[gen-1] = 16.70   temp_best_value_gen = 14.10
   Yes, update solution and obj[gen] = 14.10
   solution chromosome =
      first level: [ [ 4.   4.  12.  25.5 19. ]
      second level:  [1. 4. 2. 1. 5.]
      third level:  [5. 5. 2. 5. 5.] ]
   The No. 11  iteration is finished!

Beging the No. 12  iteration:
   obj[gen-1] = 14.10   temp_best_value_gen = 14.10
   No, maintain solution  and obj[gen] = 14.10 , and the tolerance_counter = 1
   solution chromosome =
      first level: [ [ 4.   4.  12.  25.5 19. ]
      second level:  [1. 4. 2. 1. 5.]
      third level:  [5. 5. 2. 5. 5.] ]
   The No. 12  iteration is finished!

Beging the No. 13  iteration:
   obj[gen-1] = 14.10   temp_best_value_gen = 13.70
   Yes, update solution and obj[gen] = 13.70
   solution chromosome =
      first level: [ [ 4.   4.  12.  19.  25.5]
      second level:  [1. 4. 2. 5. 1.]
      third level:  [5. 5. 2. 5. 5.] ]
   The No. 13  iteration is finished!

Beging the No. 14  iteration:
   obj[gen-1] = 13.70   temp_best_value_gen = 13.70
   No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 1
   solution chromosome =
      first level: [ [ 4.   4.  12.  19.  25.5]
      second level:  [1. 4. 2. 5. 1.]
      third level:  [5. 5. 2. 5. 5.] ]
   The No. 14  iteration is finished!
```

```
164
165  Beging the No. 15  iteration:
166      obj[gen-1] = 13.70   temp_best_value_gen = 13.70
167      No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 2
168      solution chromosome =
169          first level: [ [ 4.   4.  12.  19.  25.5]
170          second level:  [1. 4. 2. 5. 1.]
171          third level:  [5. 5. 2. 5. 5.] ]
172      The No. 15  iteration is finished!
173
174  Beging the No. 16  iteration:
175      obj[gen-1] = 13.70   temp_best_value_gen = 13.70
176      No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 3
177      solution chromosome =
178          first level: [ [ 4.   4.  12.  19.  25.5]
179          second level:  [1. 4. 2. 5. 1.]
180          third level:  [5. 5. 2. 5. 5.] ]
181      The No. 16  iteration is finished!
182
183  Beging the No. 17  iteration:
184      obj[gen-1] = 13.70   temp_best_value_gen = 13.70
185      No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 4
186      solution chromosome =
187          first level: [ [ 4.   4.  12.  19.  25.5]
188          second level:  [1. 4. 2. 5. 1.]
189          third level:  [5. 5. 2. 5. 5.] ]
190      The No. 17  iteration is finished!
191
192  Beging the No. 18  iteration:
193      obj[gen-1] = 13.70   temp_best_value_gen = 13.70
194      No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 5
195      solution chromosome =
196          first level: [ [ 4.   4.  12.  19.  25.5]
197          second level:  [1. 4. 2. 5. 1.]
198          third level:  [5. 5. 2. 5. 5.] ]
199      The No. 18  iteration is finished!
200
201  Beging the No. 19  iteration:
202      obj[gen-1] = 13.70   temp_best_value_gen = 13.70
203      No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 6
204      solution chromosome =
205          first level: [ [ 4.   4.  12.  19.  25.5]
206          second level:  [1. 4. 2. 5. 1.]
207          third level:  [5. 5. 2. 5. 5.] ]
208      The No. 19  iteration is finished!
209
210  Beging the No. 20  iteration:
211      obj[gen-1] = 13.70   temp_best_value_gen = 13.70
212      No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 7
213      solution chromosome =
214          first level: [ [ 4.   4.  12.  19.  25.5]
215          second level:  [1. 4. 2. 5. 1.]
216          third level:  [5. 5. 2. 5. 5.] ]
217      The No. 20  iteration is finished!
218
219  Beging the No. 21  iteration:
220      obj[gen-1] = 13.70   temp_best_value_gen = 13.70
221      No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 8
222      solution chromosome =
223          first level: [ [ 4.   4.  12.  19.  25.5]
224          second level:  [1. 4. 2. 5. 1.]
225          third level:  [5. 5. 2. 5. 5.] ]
226      The No. 21  iteration is finished!
227
228
229  ----------------------------------------------------------------------------------
230  The iteration is terminated and then visulize the solution:
231      solution chromosome =
232          first level: [ [ 4.   4.  12.  19.  25.5]
233          second level:  [1. 4. 2. 5. 1.]
234          third level:  [5. 5. 2. 5. 5.] ]
235      Objective function values and some other indicators:
236          Obj0 = 5.00              Obj1 = 42.00              Obj0 + Obj1 = 47.00
237          Total movement of crane: 29.00
238          Total waiting time in berth position: 13.00
239          Total index of q during berthing: 265.00
240      Specific arrangement for each vessel:
241          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: 4.0
                     duration_time_i: 3.0              demand_i: 280.0              work load_i: 280.0              work load gap_i: 0
242          V_id:  1              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: 200.0              work load_i: 200.0              work load gap_i: 0
243          V_id:  2              li: 6.0              xi: 12.0              bow of i: 9.0              tail of i: 15.0              gama_i0: 2.0              gama_i1: 5
     .0                duration_time_i: 3.0              demand_i: 120.0              work load_i: 120.0              work load gap_i: 0
244          V_id:  3              li: 9.0              xi: 19.0              bow of i: 14.5              tail of i: 23.5              gama_i0: 5.0              gama_i1: 6
```

```
.0                  duration_time_i: 1.0            demand_i: 100.0         work load_i: 100.0      work load gap_i: 0
      V_id:  4            li: 7.0         xi: 25.5        bow of i: 22.0          tail of i: 29.0         gama_i0: 1.0        gama_i1: 2
.0                  duration_time_i: 1.0            demand_i: 80.0          work load_i: 80.0       work load gap_i: 0

Algorithm finished and the total CPU time: 1225 s
End
```