```
"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=4687

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 =  22
        Pop_size =  10
        Tolerance_iteration_unchanged_number =  10
        Chrom_size =  6
        Iter_num_GA =  300
        Select_rate =  0.75
        Crossover_rate =  0.85
        Mutation rate =  0.75
        Mu_oper_type =  2
        vessel_move_way =  1
        coefficient for Obj1=  0.5
        coefficient for Obj2=  1.5
        gen =  0

Iteration begin:
Beging the No. 0  iteration:
    obj[0] = 19.22      temp_best_value_gen = 19.22
    The No. 0  iteration is finished!

Beging the No. 1  iteration:
    obj[gen-1] = 19.22   temp_best_value_gen = 13.70
    Yes, update solution and obj[gen] = 13.70
    solution chromosome =
        first level: [ [2.   4.13]
        second level:  [0. 2.]
        third level:  [4. 4.] ]
    The No. 1  iteration is finished!

Beging the No. 2  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: [ [2.   4.13]
        second level:  [0. 2.]
        third level:  [4. 4.] ]
    The No. 2  iteration is finished!

Beging the No. 3  iteration:
    obj[gen-1] = 13.70   temp_best_value_gen = 13.70
    No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 2
    solution chromosome =
        first level: [ [2.   4.13]
        second level:  [0. 2.]
        third level:  [4. 4.] ]
    The No. 3  iteration is finished!

Beging the No. 4  iteration:
    obj[gen-1] = 13.70   temp_best_value_gen = 13.70
    No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 3
    solution chromosome =
        first level: [ [2.   4.13]
        second level:  [0. 2.]
        third level:  [4. 4.] ]
    The No. 4  iteration is finished!

Beging the No. 5  iteration:
    obj[gen-1] = 13.70   temp_best_value_gen = 13.70
    No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 4
    solution chromosome =
        first level: [ [2.   4.13]
```

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

Beging the No. 6  iteration:
   obj[gen-1] = 13.70   temp_best_value_gen = 13.70
   No, maintain solution  and obj[gen] = 13.70 , and the tolerance_counter = 5
   solution chromosome =
      first level: [ [2.   4.13]
      second level:  [0. 2.]
      third level:  [4. 4.] ]
   The No. 6  iteration is finished!

Beging the No. 7  iteration:
   obj[gen-1] = 13.70   temp_best_value_gen = 10.00
   Yes, update solution and obj[gen] = 10.00
   solution chromosome =
      first level: [ [2.   4.09]
      second level:  [0. 2.]
      third level:  [4. 7.] ]
   The No. 7  iteration is finished!

Beging the No. 8  iteration:
   obj[gen-1] = 10.00   temp_best_value_gen = 10.00
   No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 1
   solution chromosome =
      first level: [ [2.   4.09]
      second level:  [0. 2.]
      third level:  [4. 7.] ]
   The No. 8  iteration is finished!

Beging the No. 9  iteration:
   obj[gen-1] = 10.00   temp_best_value_gen = 10.00
   No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 2
   solution chromosome =
      first level: [ [2.   4.09]
      second level:  [0. 2.]
      third level:  [4. 7.] ]
   The No. 9  iteration is finished!

Beging the No. 10  iteration:
   obj[gen-1] = 10.00   temp_best_value_gen = 10.00
   No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 3
   solution chromosome =
      first level: [ [2.   4.09]
      second level:  [0. 2.]
      third level:  [4. 7.] ]
   The No. 10  iteration is finished!

Beging the No. 11  iteration:
   obj[gen-1] = 10.00   temp_best_value_gen = 10.00
   No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 4
   solution chromosome =
      first level: [ [2.   4.09]
      second level:  [0. 2.]
      third level:  [4. 7.] ]
   The No. 11  iteration is finished!

Beging the No. 12  iteration:
   obj[gen-1] = 10.00   temp_best_value_gen = 10.00
   No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 5
   solution chromosome =
      first level: [ [2.   4.09]
      second level:  [0. 2.]
      third level:  [4. 7.] ]
   The No. 12  iteration is finished!

Beging the No. 13  iteration:
   obj[gen-1] = 10.00   temp_best_value_gen = 10.00
   No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 6
   solution chromosome =
      first level: [ [2.   4.09]
      second level:  [0. 2.]
      third level:  [4. 7.] ]
   The No. 13  iteration is finished!

Beging the No. 14  iteration:
   obj[gen-1] = 10.00   temp_best_value_gen = 10.00
   No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 7
   solution chromosome =
      first level: [ [2.   4.09]
      second level:  [0. 2.]
      third level:  [4. 7.] ]
   The No. 14  iteration is finished!
```

```
164
165  Beging the No. 15  iteration:
166     obj[gen-1] = 10.00   temp_best_value_gen = 10.00
167     No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 8
168     solution chromosome =
169        first level: [ [2.   4.09]
170        second level:  [0. 2.]
171        third level:  [4. 7.] ]
172     The No. 15  iteration is finished!
173
174  Beging the No. 16  iteration:
175     obj[gen-1] = 10.00   temp_best_value_gen = 10.00
176     No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 9
177     solution chromosome =
178        first level: [ [2.   4.09]
179        second level:  [0. 2.]
180        third level:  [4. 7.] ]
181     The No. 16  iteration is finished!
182
183  Beging the No. 17  iteration:
184     obj[gen-1] = 10.00   temp_best_value_gen = 8.28
185     Yes, update solution and obj[gen] = 8.28
186     solution chromosome =
187        first level: [ [2.01 4.16]
188        second level:  [0. 3.]
189        third level:  [4. 2.] ]
190     The No. 17  iteration is finished!
191
192  Beging the No. 18  iteration:
193     obj[gen-1] = 8.28     temp_best_value_gen = 8.28
194     No, maintain solution  and obj[gen] = 8.28 , and the tolerance_counter = 1
195     solution chromosome =
196        first level: [ [2.01 4.16]
197        second level:  [0. 3.]
198        third level:  [4. 2.] ]
199     The No. 18  iteration is finished!
200
201  Beging the No. 19  iteration:
202     obj[gen-1] = 8.28     temp_best_value_gen = 8.28
203     No, maintain solution  and obj[gen] = 8.28 , and the tolerance_counter = 2
204     solution chromosome =
205        first level: [ [2.01 4.16]
206        second level:  [0. 3.]
207        third level:  [4. 2.] ]
208     The No. 19  iteration is finished!
209
210  Beging the No. 20  iteration:
211     obj[gen-1] = 8.28     temp_best_value_gen = 8.28
212     No, maintain solution  and obj[gen] = 8.28 , and the tolerance_counter = 3
213     solution chromosome =
214        first level: [ [2.01 4.16]
215        second level:  [0. 3.]
216        third level:  [4. 2.] ]
217     The No. 20  iteration is finished!
218
219  Beging the No. 21  iteration:
220     obj[gen-1] = 8.28     temp_best_value_gen = 8.28
221     No, maintain solution  and obj[gen] = 8.28 , and the tolerance_counter = 4
222     solution chromosome =
223        first level: [ [2.01 4.16]
224        second level:  [0. 3.]
225        third level:  [4. 2.] ]
226     The No. 21  iteration is finished!
227
228  Beging the No. 22  iteration:
229     obj[gen-1] = 8.28     temp_best_value_gen = 8.28
230     No, maintain solution  and obj[gen] = 8.28 , and the tolerance_counter = 5
231     solution chromosome =
232        first level: [ [2.01 4.16]
233        second level:  [0. 3.]
234        third level:  [4. 2.] ]
235     The No. 22  iteration is finished!
236
237  Beging the No. 23  iteration:
238     obj[gen-1] = 8.28     temp_best_value_gen = 8.28
239     No, maintain solution  and obj[gen] = 8.28 , and the tolerance_counter = 6
240     solution chromosome =
241        first level: [ [2.01 4.16]
242        second level:  [0. 3.]
243        third level:  [4. 2.] ]
244     The No. 23  iteration is finished!
245
246  Beging the No. 24  iteration:
247     obj[gen-1] = 8.28     temp_best_value_gen = 8.28
```

```
    No, maintain solution  and obj[gen] = 8.28 , and the tolerance_counter = 7
    solution chromosome =
       first level: [ [2.01 4.16]
       second level:  [0. 3.]
       third level:  [4. 2.] ]
    The No. 24  iteration is finished!

Beging the No. 25  iteration:
    obj[gen-1] = 8.28     temp_best_value_gen = 6.12
    Yes, update solution and obj[gen] = 6.12
    solution chromosome =
       first level: [ [2.01 4.13]
       second level:  [0. 2.]
       third level:  [4. 2.] ]
    The No. 25  iteration is finished!

Beging the No. 26  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 1
    solution chromosome =
       first level: [ [2.01 4.13]
       second level:  [0. 2.]
       third level:  [4. 2.] ]
    The No. 26  iteration is finished!

Beging the No. 27  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 2
    solution chromosome =
       first level: [ [2.01 4.13]
       second level:  [0. 2.]
       third level:  [4. 2.] ]
    The No. 27  iteration is finished!

Beging the No. 28  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 3
    solution chromosome =
       first level: [ [2.01 4.13]
       second level:  [0. 2.]
       third level:  [4. 2.] ]
    The No. 28  iteration is finished!

Beging the No. 29  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 4
    solution chromosome =
       first level: [ [2.01 4.13]
       second level:  [0. 2.]
       third level:  [4. 2.] ]
    The No. 29  iteration is finished!

Beging the No. 30  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 5
    solution chromosome =
       first level: [ [2.01 4.13]
       second level:  [0. 2.]
       third level:  [4. 2.] ]
    The No. 30  iteration is finished!

Beging the No. 31  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 6
    solution chromosome =
       first level: [ [2.01 4.13]
       second level:  [0. 2.]
       third level:  [4. 2.] ]
    The No. 31  iteration is finished!

Beging the No. 32  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 7
    solution chromosome =
       first level: [ [2.01 4.13]
       second level:  [0. 2.]
       third level:  [4. 2.] ]
    The No. 32  iteration is finished!

Beging the No. 33  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 8
    solution chromosome =
       first level: [ [2.01 4.13]
```

```
        second level:  [0. 2.]
        third level:  [4. 2.] ]
    The No. 33  iteration is finished!

Beging the No. 34  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 9
    solution chromosome =
        first level: [ [2.01 4.13]
        second level:  [0. 2.]
        third level:  [4. 2.] ]
    The No. 34  iteration is finished!

Beging the No. 35  iteration:
    obj[gen-1] = 6.12     temp_best_value_gen = 6.12
    No, maintain solution  and obj[gen] = 6.12 , and the tolerance_counter = 10
    solution chromosome =
        first level: [ [2.01 4.13]
        second level:  [0. 2.]
        third level:  [4. 2.] ]
    The No. 35  iteration is finished!


 ----------------------------------------------------------------------------------
The iteration is terminated and then visulize the solution:
    solution chromosome =
        first level: [ [2.01 4.13]
        second level:  [0. 2.]
        third level:  [4. 2.] ]
    Objective function values and some other indicators:
        Obj0 = 4.00             Obj1 = 2.74             Obj0 + Obj1 = 6.74
        Total movement of crane: 0.74
        Total waiting time in berth position: 2.00
        Total index of q during berthing: 15.00
    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: 0.0            gama_i1: 2.0
                    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: 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

Algorithm finished and the total CPU time: 283 s
End
```