```
1  "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=13336
2
3  import sys; print('Python %s on %s' % (sys.version, sys.platform))
4  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'])
5
6  PyDev console: starting.
7
8  Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
9  >>> 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')
10 Backend TkAgg is interactive backend. Turning interactive mode on.
11 Waiting 1s.....
12
13 This is the  R_4_6 _standerd_test.xlsx  optimization process solved by ENSGA-II algorithm.
14
15 Start
16
17 Before iteration:
18    Read basic data
19    Parameter setting:
20       trail =  58
21       Pop_size =  30
22       Tolerance_iteration_unchanged_number =  10
23       Chrom_size =  12
24       Iter_num_GA =  300
25       Select_rate =  0.85
26       Crossover_rate =  0.95
27       Mutation rate =  0.95
28       Mu_oper_type =  1
29       vessel_move_way =  2
30       coefficient for Obj1=  1.9
31       coefficient for Obj2=  0.10000000000000009
32       gen =  0
33
34  Iteration begin:
35  Beging the No. 0  iteration:
36     obj[0] = 10.20     temp_best_value_gen = 10.20
37     The No. 0  iteration is finished!
38
39  Beging the No. 1  iteration:
40     obj[gen-1] = 10.20   temp_best_value_gen = 10.20
41     No, maintain solution  and obj[gen] = 10.20 , and the tolerance_counter = 1
42     solution chromosome =
43        first level: [ [ 2.5  7.  11.  15. ]
44        second level:  [1. 1. 2. 3.]
45        third level:  [4. 2. 1. 2.] ]
46     The No. 1  iteration is finished!
47
48  Beging the No. 2  iteration:
49     obj[gen-1] = 10.20   temp_best_value_gen = 10.20
50     No, maintain solution  and obj[gen] = 10.20 , and the tolerance_counter = 2
51     solution chromosome =
52        first level: [ [ 2.5  7.  11.  15. ]
53        second level:  [1. 1. 2. 3.]
54        third level:  [4. 2. 1. 2.] ]
55     The No. 2  iteration is finished!
56
57  Beging the No. 3  iteration:
58     obj[gen-1] = 10.20   temp_best_value_gen = 10.20
59     No, maintain solution  and obj[gen] = 10.20 , and the tolerance_counter = 3
60     solution chromosome =
61        first level: [ [ 2.5  7.  11.  15. ]
62        second level:  [1. 1. 2. 3.]
63        third level:  [4. 2. 1. 2.] ]
64     The No. 3  iteration is finished!
65
66  Beging the No. 4  iteration:
67     obj[gen-1] = 10.20   temp_best_value_gen = 10.00
68     Yes, update solution and obj[gen] = 10.00
69     solution chromosome =
70        first level: [ [ 2.5  7.  11.  15. ]
71        second level:  [1. 1. 2. 1.]
72        third level:  [4. 2. 1. 2.] ]
73     The No. 4  iteration is finished!
74
75  Beging the No. 5  iteration:
76     obj[gen-1] = 10.00   temp_best_value_gen = 10.00
77     No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 1
78     solution chromosome =
79        first level: [ [ 2.5  7.  11.  15. ]
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 80      second level: [1. 1. 2. 1.]
 81      third level: [4. 2. 1. 2.] ]
 82    The No. 5  iteration is finished!
 83
 84  Beging the No. 6  iteration:
 85    obj[gen-1] = 10.00   temp_best_value_gen = 10.00
 86    No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 2
 87    solution chromosome =
 88      first level: [ [ 2.5  7.  11.  15. ]
 89      second level:  [1. 1. 2. 1.]
 90      third level:  [4. 2. 1. 2.] ]
 91    The No. 6  iteration is finished!
 92
 93  Beging the No. 7  iteration:
 94    obj[gen-1] = 10.00   temp_best_value_gen = 10.00
 95    No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 3
 96    solution chromosome =
 97      first level: [ [ 2.5  7.  11.  15. ]
 98      second level:  [1. 1. 2. 1.]
 99      third level:  [4. 2. 1. 2.] ]
100    The No. 7  iteration is finished!
101
102  Beging the No. 8  iteration:
103    obj[gen-1] = 10.00   temp_best_value_gen = 10.00
104    No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 4
105    solution chromosome =
106      first level: [ [ 2.5  7.  11.  15. ]
107      second level:  [1. 1. 2. 1.]
108      third level:  [4. 2. 1. 2.] ]
109    The No. 8  iteration is finished!
110
111  Beging the No. 9  iteration:
112    obj[gen-1] = 10.00   temp_best_value_gen = 10.00
113    No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 5
114    solution chromosome =
115      first level: [ [ 2.5  7.  11.  15. ]
116      second level:  [1. 1. 2. 1.]
117      third level:  [4. 2. 1. 2.] ]
118    The No. 9  iteration is finished!
119
120  Beging the No. 10  iteration:
121    obj[gen-1] = 10.00   temp_best_value_gen = 10.00
122    No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 6
123    solution chromosome =
124      first level: [ [ 2.5  7.  11.  15. ]
125      second level:  [1. 1. 2. 1.]
126      third level:  [4. 2. 1. 2.] ]
127    The No. 10  iteration is finished!
128
129  Beging the No. 11  iteration:
130    obj[gen-1] = 10.00   temp_best_value_gen = 10.00
131    No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 7
132    solution chromosome =
133      first level: [ [ 2.5  7.  11.  15. ]
134      second level:  [1. 1. 2. 1.]
135      third level:  [4. 2. 1. 2.] ]
136    The No. 11  iteration is finished!
137
138  Beging the No. 12  iteration:
139    obj[gen-1] = 10.00   temp_best_value_gen = 10.00
140    No, maintain solution  and obj[gen] = 10.00 , and the tolerance_counter = 8
141    solution chromosome =
142      first level: [ [ 2.5  7.  11.  15. ]
143      second level:  [1. 1. 2. 1.]
144      third level:  [4. 2. 1. 2.] ]
145    The No. 12  iteration is finished!
146
147  Beging the No. 13  iteration:
148    obj[gen-1] = 10.00   temp_best_value_gen = 8.50
149    Yes, update solution and obj[gen] = 8.50
150    solution chromosome =
151      first level: [ [ 2.5  7.  15.  11. ]
152      second level:  [1. 1. 3. 4.]
153      third level:  [4. 3. 2. 4.] ]
154    The No. 13  iteration is finished!
155
156  Beging the No. 14  iteration:
157    obj[gen-1] = 8.50    temp_best_value_gen = 8.50
158    No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 1
159    solution chromosome =
160      first level: [ [ 2.5  7.  15.  11. ]
161      second level:  [1. 1. 3. 4.]
162      third level:  [4. 3. 2. 4.] ]
163    The No. 14  iteration is finished!
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164
165   Beging the No. 15  iteration:
166      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
167      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 2
168      solution chromosome =
169         first level: [ [ 2.5  7.  15.  11. ]
170         second level:  [1.  1.  3.  4.]
171         third level:  [4. 3. 2. 4.] ]
172      The No. 15  iteration is finished!
173
174   Beging the No. 16  iteration:
175      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
176      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 3
177      solution chromosome =
178         first level: [ [ 2.5  7.  15.  11. ]
179         second level:  [1.  1.  3.  4.]
180         third level:  [4. 3. 2. 4.] ]
181      The No. 16  iteration is finished!
182
183   Beging the No. 17  iteration:
184      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
185      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 4
186      solution chromosome =
187         first level: [ [ 2.5  7.  15.  11. ]
188         second level:  [1.  1.  3.  4.]
189         third level:  [4. 3. 2. 4.] ]
190      The No. 17  iteration is finished!
191
192   Beging the No. 18  iteration:
193      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
194      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 5
195      solution chromosome =
196         first level: [ [ 2.5  7.  15.  11. ]
197         second level:  [1.  1.  3.  4.]
198         third level:  [4. 3. 2. 4.] ]
199      The No. 18  iteration is finished!
200
201   Beging the No. 19  iteration:
202      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
203      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 6
204      solution chromosome =
205         first level: [ [ 2.5  7.  15.  11. ]
206         second level:  [1.  1.  3.  4.]
207         third level:  [4. 3. 2. 4.] ]
208      The No. 19  iteration is finished!
209
210   Beging the No. 20  iteration:
211      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
212      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 7
213      solution chromosome =
214         first level: [ [ 2.5  7.  15.  11. ]
215         second level:  [1.  1.  3.  4.]
216         third level:  [4. 3. 2. 4.] ]
217      The No. 20  iteration is finished!
218
219   Beging the No. 21  iteration:
220      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
221      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 8
222      solution chromosome =
223         first level: [ [ 2.5  7.  15.  11. ]
224         second level:  [1.  1.  3.  4.]
225         third level:  [4. 3. 2. 4.] ]
226      The No. 21  iteration is finished!
227
228   Beging the No. 22  iteration:
229      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
230      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 9
231      solution chromosome =
232         first level: [ [ 2.5  7.  15.  11. ]
233         second level:  [1.  1.  3.  4.]
234         third level:  [4. 3. 2. 4.] ]
235      The No. 22  iteration is finished!
236
237   Beging the No. 23  iteration:
238      obj[gen-1] = 8.50    temp_best_value_gen = 8.50
239      No, maintain solution  and obj[gen] = 8.50 , and the tolerance_counter = 10
240      solution chromosome =
241         first level: [ [ 2.5  7.  15.  11. ]
242         second level:  [1.  1.  3.  4.]
243         third level:  [4. 3. 2. 4.] ]
244      The No. 23  iteration is finished!
245
246
247   --------------------------------------------------------------------------------
```

248   The iteration is terminated and then visulize the solution:
249   solution chromosome =
250   first level: [[2.5 7. 15. 11.]
251   second level: [1. 1. 3. 4.]
252   third level: [4. 3. 2. 4.]]
253   Objective function values and some other indicators:
254   Obj0 = 4.00   Obj1 = 9.00   Obj0 + Obj1 = 13.00
255   Total movement of crane: 0.00
256   Total waiting time in berth position: 9.00
257   Total index of q during berthing: 150.00
258   Specific arrangement for each vessel:

259   V_id: 0 l_i: 5.0 x_i: 2.5   bow of i: 0.0   tail of i: 5.0 $gama\_i0$: 1.0 $gama\_i1$: 3.0
                    $duration\_time\_i$: 2.0 $demand\_i$: 120.0   work load_i: 120.0   work load gap_i: 0

260   V_id: 1 l_i: 4.0 x_i: 7.0   bow of i: 5.0   tail of i: 9.0 $gama\_i0$: 1.0 $gama\_i1$: 4.0
                    $duration\_time\_i$: 3.0 $demand\_i$: 160.0   work load_i: 160.0   work load gap_i: 0

261   V_id: 2 l_i: 4.0 x_i: 15.0   bow of i: 13.0   tail of i: 17.0 $gama\_i0$: 3.0 $gama\_i1$: 5
   .0 $duration\_time\_i$: 2.0 $demand\_i$: 80.0   work load_i: 80.0   work load gap_i: 0

262   V_id: 3 l_i: 4.0 x_i: 11.0   bow of i: 9.0   tail of i: 13.0 $gama\_i0$: 4.0 $gama\_i1$: 5
   .0 $duration\_time\_i$: 1.0 $demand\_i$: 80.0   work load_i: 80.0   work load gap_i: 0

263
264 Algorithm finished and the total CPU time: 1033 s
265 End
266