```
exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=47319
3
   import sys; print('Python %s on %s' % (sys.version, sys.platform))
   01_My_Python_Code'])
6
  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
8
  python code/01_My_Python_Code')
  Backend TkAgg is interactive backend. Turning interactive mode on.
   Waiting 1s.....
12
13
  This is the R_2_1 _standard_test.xlsx optimization process solved by ENSGA-II algorithm.
14
15
   Start
16
17
   Before iteration:
18
     Read basic data
19
     Parameter setting:
       trail = 12
20
21
       Pop\_size = 10
       Tolerance iteration unchanged number = 10
23
       Chrom\_size = 6
       Iter_num_GA = 300
24
25
       Select_rate = 0.8
26
       Crossover rate = 0.8
27
       Mutation rate = 0.75
28
       Mu_oper_type = 1
29
       vessel\_move\_way = 2
30
       coefficient for Obj1= 1.0
       coefficient for Obj2= 1.0
31
       gen = 0
32
33
   Iteration begin:
34
35
   Beging the No. 0 iteration:
36
     obj[0] = 16.00
                  temp_best_value_gen = 16.00
37
     The No. 0 iteration is finished!
38
39
   Beging the No. 1 iteration:
40
     obj[gen-1] = 16.00 temp_best_value_gen = 16.00
41
     No, maintain solution and obj[gen] = 16.00, and the tolerance_counter = 1
42
     solution chromosome =
43
       first level: [ [2. 8.]
       second level: [4, 5,]
44
       third level: [3. 2.]]
45
     The No. 1 iteration is finished!
46
47
48
   Beging the No. 2 iteration:
     obj[gen-1] = 16.00 temp_best_value_gen = 11.00
49
50
     Yes, update solution and obj[gen] = 11.00
51
     solution chromosome =
       first level: [ [2. 8.]
52
       second level: [4. 1.]
53
54
       third level: [3. 3.]]
55
     The No. 2 iteration is finished!
56
57
   Beging the No. 3 iteration:
     obi[gen-1] = 11.00 temp best value gen = 11.00
59
     No, maintain solution and obj[gen] = 11.00, and the tolerance_counter = 1
60
     solution chromosome =
61
       first level: [ [2. 8.]
62
       second level: [4. 1.]
       third level: [3. 3.]]
63
     The No. 3 iteration is finished!
64
65
   Beging the No. 4 iteration:
66
67
     obj[gen-1] = 11.00 temp_best_value_gen = 10.00
68
     Yes, update solution and obj[gen] = 10.00
69
     solution chromosome =
70
       first level: [ [2. 8.]
       second level: [1. 4.]
71
       third level: [3. 3.]
73
     The No. 4 iteration is finished!
74
75
   Beging the No. 5 iteration:
     obi[gen-1] = 10.00 temp best value gen = 10.00
76
     No, maintain solution and obj[gen] = 10.00, and the tolerance counter = 1
77
     solution chromosome =
78
       first level: [ [2. 8.]
```

```
second level: [1, 4,]
 81
          third level: [3. 3.]]
 82
        The No. 5 iteration is finished!
 83
     Beging the No. 6 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
 85
 86
 87
        solution chromosome =
 88
          first level: [ [2. 8.]
 89
          second level: [1, 4,]
 90
          third level: [3. 3.]]
 91
        The No. 6 iteration is finished!
 92
 93 Beging the No. 7 iteration:
        obj[gen-1] = 10.00 temp_best_value_gen = 10.00
 94
 95
        No, maintain solution and obj[gen] = 10.00, and the tolerance_counter = 3
 96
        solution chromosome =
 97
          first level: [ [2. 8.]
 98
          second level: [1.4.]
 99
          third level: [3. 3.]
100
        The No. 7 iteration is finished!
101
102
     Beging the No. 8 iteration:
        obj[gen-1] = 10.00 temp best value gen = 10.00
103
104
        No, maintain solution and obj[gen] = 10.00, and the tolerance_counter = 4
105
        solution chromosome
          first level: [ [2. 8.]
106
107
          second level: [1.4.]
108
          third level: [3. 3.]]
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
        solution chromosome =
114
115
          first level: [ [2. 8.]
116
          second level: [1.4.]
117
          third level: [3. 3.]]
        The No. 9 iteration is finished!
118
119
120 Beging the No. 10 iteration:
121
        obj[gen-1] = 10.00 temp_best_value_gen = 10.00
        No, maintain solution and obj[gen] = 10.00, and the tolerance_counter = 6
122
123
        solution chromosome =
124
          first level: [ [2. 8.]
125
          second level: [1, 4.]
126
          third level: [3. 3.]]
127
        The No. 10 iteration is finished!
128
129 Beging the No. 11 iteration:
130
        obj[gen-1] = 10.00 temp\_best\_value\_gen = 5.00
131
        Yes, update solution and obj[gen] = 5.00
132
        solution chromosome =
133
          first level: [ [2. 8.]
134
          second level: [1.1.]
135
          third level: [3. 3.]]
136
        The No. 11 iteration is finished!
137
138 Beging the No. 12 iteration:
139
        obj[gen-1] = 5.00 temp_best_value_gen = 5.00
140
        No, maintain solution and obj[gen] = 5.00, and the tolerance_counter = 1
141
        solution chromosome =
142
          first level: [ [2. 8.]
          second level: [1. 1.]
143
          third level: [3. 3.]]
144
145
        The No. 12 iteration is finished!
146
147 Beging the No. 13 iteration:
        obj[gen-1] = 5.00 temp_best_value_gen = 5.00
148
149
        No, maintain solution and obj[gen] = 5.00, and the tolerance_counter = 2
150
        solution chromosome =
151
          first level: [ [2. 8.]
152
          second level: [1. 1.]
153
          third level: [3. 3.]]
154
        The No. 13 iteration is finished!
155
156 Beging the No. 14 iteration:
157
        obj[gen-1] = 5.00 temp_best_value_gen = 5.00
158
        No, maintain solution and obj[gen] = 5.00, and the tolerance_counter = 3
159
        solution chromosome =
160
          first level: [ [2. 8.]
          second level: [1, 1,]
161
162
          third level: [3. 3.]]
        The No. 14 iteration is finished!
163
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```
164
165 Beging the No. 15 iteration:
        obj[gen-1] = 5.00 temp_best_value_gen = 5.00
166
167
       No, maintain solution and obj[gen] = 5.00, and the tolerance_counter = 4
168
        solution chromosome =
169
          first level: [ [2, 8,]
170
          second level: [1. 1.]
171
          third level: [3. 3.]]
172
        The No. 15 iteration is finished!
173
174
     Beging the No. 16 iteration:
175
       obj[gen-1] = 5.00 temp_best_value_gen = 5.00
       No, maintain solution and obj[gen] = 5.00, and the tolerance counter = 5
176
177
       solution chromosome =
178
          first level: [ [2. 8.]
179
          second level: [1. 1.]
180
          third level: [3. 3.]]
181
        The No. 16 iteration is finished!
182
183
     Beging the No. 17 iteration:
       obj[gen-1] = 5.00 temp_best_value_gen = 5.00
184
185
        No, maintain solution and obj[gen] = 5.00, and the tolerance_counter = 6
186
        solution chromosome =
187
          first level: [ [2. 8.]
          second level: [1. 1.]
188
189
          third level: [3. 3.]]
190
        The No. 17 iteration is finished!
191
     Beging the No. 18 iteration:
192
193
       obj[gen-1] = 5.00 temp_best_value_gen = 5.00
194
       No, maintain solution and obj[gen] = 5.00, and the tolerance counter = 7
195
       solution chromosome =
196
          first level: [ [2. 8.]
197
          second level: [1. 1.]
198
          third level: [3. 3.]]
199
       The No. 18 iteration is finished!
200
201 Beging the No. 19 iteration:
202
       obj[gen-1] = 5.00 temp_best_value_gen = 5.00
203
        No, maintain solution and obj[gen] = 5.00, and the tolerance_counter = 8
204
        solution chromosome =
205
          first level: [ [2. 8.]
206
          second level: [1. 1.]
207
          third level: [3. 3.]]
208
        The No. 19 iteration is finished!
209
210 Beging the No. 20 iteration:
211
        obj[gen-1] = 5.00 temp_best_value_gen = 5.00
212
       No, maintain solution and obj[gen] = \overline{5.00}, and the tolerance_counter = 9
213
       solution chromosome =
214
          first level: [ [2. 8.]
215
          second level: [1. 1.]
216
          third level: [3. 3.]]
217
       The No. 20 iteration is finished!
218
219 Beging the No. 21 iteration:
       obj[gen-1] = 5.00 temp best value gen = 5.00
220
221
       No, maintain solution and obj[gen] = 5.00, and the tolerance_counter = 10
222
        solution chromosome
223
          first level: [ [2. 8.]
224
          second level: [1. 1.]
225
          third level: [3. 3.]]
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: [ [2. 8.]
233
          second level: [1. 1.]
234
          third level: [3.3.]
235
        Objective function values and some other indicators:
236
          Obj0 = 3.00
                                Obj1 = 2.00
                                                      Obj0 + Obj1 = 5.00
237
          Total movement of crane: 0.00
238
          Total waiting time in berth position: 2.00
239
          Total index of q during berthing: 37.00
240
        Specific arrangement for each vessel:
241
          V_id: 0
                              1i: 4.0
                                                  xi: 2.0
                                                                     bow of i: 0.0
                                                                                                tail of i: 4.0
                                                                                                                         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
                                                                     bow of i: 4.0
242
          V id: 1
                              li: 8.0
                                                  xi: 8.0
                                                                                                tail of i: 12.0
                                                                                                                            gama_i0: 1.0
                                                                                                                                                       gama_i1: 3.0
                                                      demand i: 120.0
                    duration time i: 2.0
                                                                                    work load i: 120.0
                                                                                                                    work load gap_i: 0
244 Algorithm finished and the total CPU time: 190 s
245 End
```