```
exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=12733
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')
10 Backend TkAgg is interactive backend. Turning interactive mode on.
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 = 34
20
       Pop\_size = 20
21
       Tolerance iteration unchanged number = 10
23
       Chrom size = 6
       Iter\_num\_GA = 300
24
25
       Select_rate = 0.85
26
       Crossover rate = 0.95
       Mutation rate = 0.8
27
28
       Mu_oper_type = 1
29
       vessel\_move\_way = 1
30
       coefficient for Obj1= 1.5
       coefficient for Obj2= 0.5
31
       gen = 0
32
33
   Iteration begin:
34
35
   Beging the No. 0 iteration:
     obj[0] = 9.00 temp_best_value_gen = 9.00
36
37
     The No. 0 iteration is finished!
38
39
   Beging the No. 1 iteration:
40
     obj[gen-1] = 9.00 temp_best_value_gen = 9.00
41
     No, maintain solution and obj[gen] = 9.00, and the tolerance counter = 1
42
     solution chromosome =
43
       first level: [ [2. 8.]
       second level: [2, 1,]
44
       third level: [2. 6.]]
45
     The No. 1 iteration is finished!
46
47
48
   Beging the No. 2 iteration:
     obj[gen-1] = 9.00 temp_best_value_gen = 9.00
49
50
     No, maintain solution and obj[gen] = 9.00, and the tolerance_counter = 2
51
     solution chromosome =
       first level: [ [2. 8.]
52
       second level: [2. 1.]
53
54
       third level: [2. 6.]]
55
     The No. 2 iteration is finished!
56
57
   Beging the No. 3 iteration:
58
     obi[gen-1] = 9.00 temp best value gen = 9.00
59
     No, maintain solution and obj[gen] = 9.00, and the tolerance counter = 3
60
     solution chromosome =
61
       first level: [ [2. 8.]
62
       second level: [2. 1.]
       third level: [2. 6.]]
63
     The No. 3 iteration is finished!
64
65
   Beging the No. 4 iteration:
66
67
     obj[gen-1] = 9.00 temp_best_value_gen = 5.50
68
     Yes, update solution and obj[gen] = 5.50
69
     solution chromosome =
70
       first level: [ [2. 8.]
       second level: [1. 1.]
71
       third level: [3. 6.]
73
     The No. 4 iteration is finished!
74
75
   Beging the No. 5 iteration:
     obj[gen-1] = 5.50 temp best value gen = 5.50
76
     No, maintain solution and obj[gen] = 5.50, and the tolerance counter = 1
77
     solution chromosome =
78
       first level: [ [2. 8.]
```

```
second level: [1, 1,]
 81
          third level: [3. 6.]]
 82
        The No. 5 iteration is finished!
 83
     Beging the No. 6 iteration:
       obj[gen-1] = 5.50 temp_best_value_gen = 5.50
No, maintain solution_and_obj[gen] = 5.50, and the tolerance_counter = 2
 85
 86
 87
        solution chromosome =
 88
          first level: [ [2. 8.]
 89
          second level: [1, 1,]
 90
          third level: [3. 6.]]
 91
        The No. 6 iteration is finished!
 92
 93 Beging the No. 7 iteration:
 94
        obj[gen-1] = 5.50 temp_best_value_gen = 2.00
 95
        Yes, update solution and obj[gen] = 2.00
 96
        solution chromosome =
 97
          first level: [ [2. 8.]
 98
          second level: [0. 1.]
 99
          third level: [4. 6.]]
100
        The No. 7 iteration is finished!
101
102 Beging the No. 8 iteration:
103
        obj[gen-1] = 2.00 temp best value gen = 2.00
104
        No, maintain solution and obj[gen] = 2.00, and the tolerance_counter = 1
105
        solution chromosome =
          first level: [ [2. 8.]
106
107
          second level: [0.1.]
          third level: [4. 6.]]
108
109
        The No. 8 iteration is finished!
110
111 Beging the No. 9 iteration:
112
        obj[gen-1] = 2.00 temp_best_value_gen = 2.00
113
        No, maintain solution and obj[gen] = 2.00, and the tolerance_counter = 2
        solution chromosome =
114
115
          first level: [ [2. 8.]
116
          second level: [0. 1.]
          third level: [4, 6,]]
117
        The No. 9 iteration is finished!
118
119
120 Beging the No. 10 iteration:
121
        obj[gen-1] = 2.00 temp_best_value_gen = 2.00
        No, maintain solution and obj[gen] = 2.00, and the tolerance_counter = 3
122
123
        solution chromosome =
124
          first level: [ [2. 8.]
125
          second level: [0.1.]
126
          third level: [4. 6.]]
127
        The No. 10 iteration is finished!
128
129 Beging the No. 11 iteration:
130
        obj[gen-1] = 2.00 temp_best_value_gen = 2.00
131
        No, maintain solution and obj[gen] = 2.00, and the tolerance_counter = 4
132
        solution chromosome =
133
          first level: [ [2. 8.]
134
          second level: [0. 1.]
135
          third level: [4. 6.]]
136
        The No. 11 iteration is finished!
137
138 Beging the No. 12 iteration:
139
        obj[gen-1] = 2.00 temp_best_value_gen = 2.00
140
        No, maintain solution and obj[gen] = 2.00, and the tolerance_counter = 5
141
        solution chromosome =
142
          first level: [ [2. 8.]
143
          second level: [0.1.]
          third level: [4. 6.]]
144
145
        The No. 12 iteration is finished!
146
147 Beging the No. 13 iteration:
        obj[gen-1] = 2.00 temp_best_value_gen = 2.00
148
149
        No, maintain solution and obj[gen] = 2.00, and the tolerance_counter = 6
150
        solution chromosome =
151
          first level: [ [2. 8.]
152
          second level: [0. 1.]
153
          third level: [4. 6.]]
154
        The No. 13 iteration is finished!
155
156 Beging the No. 14 iteration:
157
        obj[gen-1] = 2.00 temp_best_value_gen = 2.00
158
        No, maintain solution and obj[gen] = 2.00, and the tolerance_counter = 7
159
        solution chromosome =
160
          first level: [ [2. 8.]
          second level: [0, 1,]
161
162
          third level: [4. 6.]]
163
        The No. 14 iteration is finished!
```

```
164
165 Beging the No. 15 iteration:
        obj[gen-1] = 2.00 temp_best_value_gen = 2.00
166
167
       No, maintain solution and obj[gen] = 2.00, and the tolerance_counter = 8
168
        solution chromosome =
169
          first level: [ [2, 8.]
170
          second level: [0.1.]
171
          third level: [4. 6.]]
172
        The No. 15 iteration is finished!
173
174 Beging the No. 16 iteration:
175
       obj[gen-1] = 2.00 temp_best_value_gen = 1.50
        Yes, update solution and obj[gen] = 1.50
176
177
       solution chromosome =
178
          first level: [ [2. 8.]
179
          second level: [0. 0.]
180
          third level: [4. 4.]]
181
        The No. 16 iteration is finished!
182
183 Beging the No. 17 iteration:
       obj[gen-1] = 1.50 temp_best_value_gen = 1.50
184
185
       No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 1
186
        solution chromosome =
187
          first level: [ [2. 8.]
          second level: [0. 0.]
188
          third level: [4. 4.]]
189
190
       The No. 17 iteration is finished!
191
192 Beging the No. 18 iteration:
193
       obj[gen-1] = 1.50 temp_best_value_gen = 1.50
194
       No, maintain solution and obj[gen] = 1.50, and the tolerance counter = 2
195
       solution chromosome =
196
          first level: [ [2. 8.]
197
          second level: [0. 0.]
          third level: [4, 4,]]
198
199
       The No. 18 iteration is finished!
200
201 Beging the No. 19 iteration:
202
       obj[gen-1] = 1.50 temp_best_value_gen = 1.50
203
       No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 3
204
       solution chromosome =
205
          first level: [ [2. 8.]
206
          second level: [0. 0.]
207
          third level: [4. 4.]]
208
        The No. 19 iteration is finished!
209
210 Beging the No. 20 iteration:
211
       obj[gen-1] = 1.50 temp_best_value_gen = 1.50
212
       No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 4
       solution chromosome =
213
214
          first level: [ [2. 8.]
215
          second level: [0. 0.]
216
          third level: [4. 4.]]
       The No. 20 iteration is finished!
217
218
219 Beging the No. 21 iteration:
       obj[gen-1] = 1.50 temp_best_value_gen = 1.50
220
221
       No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 5
222
       solution chromosome
223
          first level: [ [2. 8.]
224
          second level: [0. 0.]
225
          third level: [4. 4.]]
226
       The No. 21 iteration is finished!
227
228 Beging the No. 22 iteration:
229
       obj[gen-1] = 1.50 temp_best_value_gen = 1.50
230
       No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 6
231
       solution chromosome =
232
          first level: [ [2. 8.]
233
          second level: [0. 0.]
234
          third level: [4, 4,]]
235
       The No. 22 iteration is finished!
236
237 Beging the No. 23 iteration:
238
       obj[gen-1] = 1.50 temp_best_value_gen = 1.50
239
       No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 7
240
       solution chromosome
241
          first level: [ [2. 8.]
242
          second level: [0. 0.]
243
          third level: [4. 4.]]
244
       The No. 23 iteration is finished!
245
246 Beging the No. 24 iteration:
247
       obj[gen-1] = 1.50 temp_best_value_gen = 1.50
```

```
unknown
        No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 8
248
249
        solution chromosome =
           first level: [ [2. 8.]
250
251
           second level: [0. 0.]
252
           third level: [4. 4.]]
253
        The No. 24 iteration is finished!
254
255 Beging the No. 25 iteration:
256
        obj[gen-1] = 1.50 temp best value gen = 1.50
        No, maintain solution and obj[gen] = \overline{1.50}, and the tolerance_counter = 9
257
258
        solution chromosome =
259
           first level: [ [2. 8.]
260
           second level: [0. 0.]
261
           third level: [4. 4.]]
262
         The No. 25 iteration is finished!
263
Beging the No. 26 iteration:

265 obj[gen-1] = 1.50 temp_best_value_gen = 1.50
266
        No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 10
267
        solution chromosome =
268
           first level: [ [2. 8.]
269
           second level: [0. 0.]
270
           third level: [4. 4.]]
271
        The No. 26 iteration is finished!
272
273
274 ---
275 The iteration is terminated and then visulize the solution:
276
        solution chromosome =
277
           first level: [ [2. 8.]
           second level: [0. 0.]
third level: [4. 4.]
278
279
280
        Objective function values and some other indicators:
281
           Obj0 = 1.00
                                  Obj1 = 0.00
                                                         Obj0 + Obj1 = 1.00
           Total movement of crane: 0.00
282
283
           Total waiting time in berth position: 0.00
284
           Total index of q during berthing: 43.00
285
         Specific arrangement for each vessel:
                                                                                                    tail of i: 4.0
286
           V_id: 0
                                                    xi: 2.0
                                                                        bow of i: 0.0
                                                                                                                              gama_i0: 0.0
                                                                                                                                                          gama_i1: 2.0
                               li: 4.0
                     duration\_time\_i{:}~2.0
                                                         demand_i: 160.0
                                                                                       work load_i: 160.0
                                                                                                                         work load gap_i: 0
                                                                        bow of i: 4.0
287
           V_id: 1
                               1i: 8.0
                                                                                                    tail of i: 12.0
                                                                                                                                gama_i0: 0.0
                                                                                                                                                            gama_i1: 2.0
                     duration_time_i: 2.0
                                                         demand i: 120.0
                                                                                       work load i: 120.0
                                                                                                                        work load gap_i: 0
288
289 Algorithm finished and the total CPU time: 480 s
290 End
291
```