```
exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=8080
3
   import sys; print('Python %s on %s' % (sys.version, sys.platform))
   01_My_Python_Code'])
6
  PyDev console: starting.
8
  Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
  python code/01_My_Python_Code')
  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 = 28
20
21
       Pop\_size = 30
       Tolerance iteration unchanged number = 8
23
       Chrom size = 6
       Iter_num_GA = 300
24
25
       Select_rate = 0.95
26
       Crossover rate = 0.8
       Mutation rate = 0.75
27
28
       Mu_oper_type = 1
29
       vessel_move_way = 2
30
       coefficient for Obj1= 1.0
       coefficient for Obj2= 1.0
31
32
       gen = 0
33
   Iteration begin:
34
35
   Beging the No. 0 iteration:
36
     obj[0] = 14.09
                  temp_best_value_gen = 14.09
37
     The No. 0 iteration is finished!
38
39
   Beging the No. 1 iteration:
40
     obj[gen-1] = 14.09 temp_best_value_gen = 11.00
     Yes, update solution and obj[gen] = 11.00
41
     solution chromosome =
42
43
       first level: [ [2. 8.]
       second level: [4, 1,]
44
       third level: [3. 5.]]
45
     The No. 1 iteration is finished!
46
47
48
   Beging the No. 2 iteration:
     obj[gen-1] = 11.00 temp_best_value_gen = 11.00
49
50
     No, maintain solution and obj[gen] = 11.00, and the tolerance_counter = 1
51
     solution chromosome =
52
       first level: [ [2. 8.]
       second level: [4. 1.]
53
54
       third level: [3. 5.]]
55
     The No. 2 iteration is finished!
56
57
   Beging the No. 3 iteration:
58
     obi[gen-1] = 11.00 temp best value gen = 10.00
59
     Yes, update solution and obj[gen] = 10.00
60
     solution chromosome =
61
       first level: [ [8. 4.]
62
       second level: [1.4.]
       third level: [4. 3.]]
63
     The No. 3 iteration is finished!
64
65
   Beging the No. 4 iteration:
66
67
     obj[gen-1] = 10.00 temp\_best\_value\_gen = 7.00
68
     Yes, update solution and obj[gen] = 7.00
69
     solution chromosome =
70
       first level: [ [8. 4.]
       second level: [1. 3.]
71
       third level: [4. 6.]
73
     The No. 4 iteration is finished!
74
75
   Beging the No. 5 iteration:
     obi[gen-1] = 7.00 temp best value gen = 7.00
76
     No, maintain solution and obj[gen] = 7.00, and the tolerance counter = 1
77
     solution chromosome =
78
       first level: [[8. 4.]
```

```
second level: [1, 3,]
 81
          third level: [4. 6.]]
 82
        The No. 5 iteration is finished!
 83
     Beging the No. 6 iteration:
       obj[gen-1] = 7.00 temp_best_value_gen = 7.00
No, maintain solution_and_obj[gen] = 7.00, and the tolerance_counter = 2
 85
 86
 87
        solution chromosome =
 88
          first level: [ [8. 4.]
 89
          second level: [1. 3.]
 90
          third level: [4. 6.]]
 91
        The No. 6 iteration is finished!
 92
 93 Beging the No. 7 iteration:
        obj[gen-1] = 7.00 temp_best_value_gen = 7.00
 94
 95
        No, maintain solution and obj[gen] = 7.00, and the tolerance_counter = 3
 96
        solution chromosome =
 97
          first level: [ [8. 4.]
 98
          second level: [1.3.]
 99
          third level: [4. 6.]]
100
        The No. 7 iteration is finished!
101
102 Beging the No. 8 iteration:
        obj[gen-1] = 7.00 temp best value gen = 7.00
103
104
        No, maintain solution and obj[gen] = 7.00, and the tolerance_counter = 4
105
        solution chromosome
          first level: [ [8. 4.]
106
107
          second level: [1.3.]
108
          third level: [4. 6.]]
109
        The No. 8 iteration is finished!
110
111 Beging the No. 9 iteration:
112
        obj[gen-1] = 7.00 temp_best_value_gen = 7.00
113
        No, maintain solution and obj[gen] = 7.00, and the tolerance_counter = 5
        solution chromosome =
114
115
          first level: [ [8. 4.]
116
          second level: [1.3.]
          third level: [4, 6,]]
117
118
        The No. 9 iteration is finished!
119
120 Beging the No. 10 iteration:
121
        obj[gen-1] = 7.00 temp_best_value_gen = 7.00
        No, maintain solution and obj[gen] = 7.00, and the tolerance_counter = 6
122
123
        solution chromosome =
124
          first level: [ [8. 4.]
125
          second level: [1. 3.]
126
          third level: [4. 6.]]
127
        The No. 10 iteration is finished!
128
129 Beging the No. 11 iteration:
130
        obj[gen-1] = 7.00 temp_best_value_gen = 5.00
131
        Yes, update solution and obj[gen] = 5.00
132
        solution chromosome =
133
          first level: [ [8. 4.]
134
          second level: [0. 2.]
135
          third level: [4, 4,]]
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: [ [8. 4.]
143
          second level: [0. 2.]
          third level: [4. 4.]
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: [ [8. 4.]
152
          second level: [0. 2.]
153
          third level: [4, 4,]]
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: [ [8. 4.]
          second level: [0, 2,]
161
162
          third level: [4. 4.]]
163
        The No. 14 iteration is finished!
```

```
164
165 Beging the No. 15 iteration:
        obj[gen-1] = 5.00 temp_best_value_gen = 4.00
166
167
        Yes, update solution and obj[gen] = 4.00
168
       solution chromosome =
169
          first level: [ [4. 8.]
170
          second level: [0. 2.]
171
          third level: [4. 6.]]
172
        The No. 15 iteration is finished!
173
174 Beging the No. 16 iteration:
175
       obj[gen-1] = 4.00 temp_best_value_gen = 4.00
       No, maintain solution and obj[gen] = 4.00, and the tolerance counter = 1
176
177
       solution chromosome =
178
          first level: [ [4. 8.]
179
          second level: [0. 2.]
180
          third level: [4. 6.]]
181
        The No. 16 iteration is finished!
182
183 Beging the No. 17 iteration:
       obj[gen-1] = 4.00 temp_best_value_gen = 4.00
184
185
       No, maintain solution and obj[gen] = 4.00, and the tolerance_counter = 2
186
        solution chromosome =
187
          first level: [ [4. 8.]
          second level: [0. 2.]
188
          third level: [4. 6.]]
189
190
       The No. 17 iteration is finished!
191
192 Beging the No. 18 iteration:
193
       obj[gen-1] = 4.00 temp_best_value_gen = 4.00
194
       No, maintain solution and obj[gen] = 4.00, and the tolerance counter = 3
195
       solution chromosome =
196
          first level: [ [4. 8.]
197
          second level: [0. 2.]
198
          third level: [4. 6.]]
199
       The No. 18 iteration is finished!
200
201 Beging the No. 19 iteration:
202
       obj[gen-1] = 4.00 temp_best_value_gen = 4.00
203
       No, maintain solution and obj[gen] = 4.00, and the tolerance_counter = 4
204
       solution chromosome =
205
          first level: [ [4. 8.]
206
          second level: [0. 2.]
207
          third level: [4. 6.]]
208
        The No. 19 iteration is finished!
209
210 Beging the No. 20 iteration:
211
       obj[gen-1] = 4.00 temp_best_value_gen = 4.00
212
       No, maintain solution and obj[\overline{gen}] = \overline{4.00}, and the tolerance_counter = 5
213
       solution chromosome =
214
          first level: [ [4. 8.]
215
          second level: [0. 2.]
216
          third level: [4. 6.]]
217
       The No. 20 iteration is finished!
218
219 Beging the No. 21 iteration:
       obj[gen-1] = 4.00 temp_best_value_gen = 1.00
220
221
        Yes, update solution and obj[gen] = 1.00
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] = 1.00 temp_best_value_gen = 1.00
230
       No, maintain solution and obj[gen] = 1.00, and the tolerance_counter = 1
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] = 1.00 temp_best_value_gen = 1.00
239
       No, maintain solution and obj[gen] = 1.00, and the tolerance_counter = 2
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] = 1.00 temp_best_value_gen = 1.00
```

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248
        No, maintain solution and obj[gen] = 1.00, and the tolerance_counter = 3
249
        solution chromosome =
250
          first level: [ [2. 8.]
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] = 1.00 temp best value gen = 1.00
257
        No, maintain solution and obj[gen] = 1.00, and the tolerance_counter = 4
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
264 Beging the No. 26 iteration:
265 obj[gen-1] = 1.00 temp_best_value_gen = 1.00
266
        No, maintain solution and obj[gen] = 1.00, and the tolerance_counter = 5
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 Beging the No. 27 iteration:
274
        obj[gen-1] = 1.00 temp best value gen = 1.00
275
        No, maintain solution and obj[gen] = 1.00, and the tolerance_counter = 6
276
        solution chromosome
277
          first level: [ [2. 8.]
278
          second level: [0. 0.]
          third level: [4, 4,]]
279
280
        The No. 27 iteration is finished!
281
282 Beging the No. 28 iteration:
        obj[gen-1] = 1.00 temp_best_value_gen = 1.00
283
284
        No, maintain solution and obj[gen] = 1.00, and the tolerance_counter = 7
285
        solution chromosome =
286
          first level: [ [2. 8.]
287
          second level: [0. 0.]
288
          third level: [4. 4.]]
289
        The No. 28 iteration is finished!
290
291
     Beging the No. 29 iteration:
292
        obj[gen-1] = 1.00 temp_best_value_gen = 1.00
293
        No, maintain solution and obj[gen] = 1.00, and the tolerance_counter = 8
294
        solution chromosome =
295
          first level: [ [2. 8.]
296
          second level: [0, 0,]
          third level: [4. 4.]]
297
298
        The No. 29 iteration is finished!
299
300
301
302 The iteration is terminated and then visulize the solution:
        solution chromosome
303
304
          first level: [ [2. 8.]
305
          second level: [0. 0.]
306
          third level: [4. 4.]]
        Objective function values and some other indicators:
307
          Obj0 = 1.00
                                Obj1 = 0.00
308
                                                       Obj0 + Obj1 = 1.00
          Total movement of crane: 0.00
309
310
          Total waiting time in berth position: 0.00
          Total index of q during berthing: 43.00
311
312
        Specific arrangement for each vessel:
313
           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
                                                                      bow of i: 4.0
314
                                                                                                                             gama_i0: 0.0
          V_id: 1
                              li: 8.0
                                                  xi: 8.0
                                                                                                 tail of i: 12.0
                                                                                                                                                        gama_i1: 2.0
                                                       demand i: 120.0
                                                                                     work load i: 120.0
                                                                                                                     work load gap_i: 0
                    duration time i: 2.0
316 Algorithm finished and the total CPU time: 708 s
317 End
318
```