```
exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=53934
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.
   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 = 52
20
21
       Pop\_size = 20
       Tolerance iteration unchanged number = 10
23
       Chrom size = 6
       Iter_num_GA = 300
24
25
       Select_rate = 0.8
26
       Crossover rate = 0.75
       Mutation rate = 0.85
27
28
       Mu_oper_type = 1
29
       vessel\_move\_way = 1
30
       coefficient for Obj1= 0.5
       coefficient for Obj2= 1.5
31
       gen = 0
32
33
   Iteration begin:
34
35
   Beging the No. 0 iteration:
     obj[0] = 13.31 temp_best_value_gen = 13.31
36
37
     The No. 0 iteration is finished!
38
39
   Beging the No. 1 iteration:
     obj[gen-1] = 13.31 temp_best_value_gen = 13.31
40
41
     No, maintain solution and obj[gen] = 13.31, and the tolerance_counter = 1
42
     solution chromosome =
43
       first level: [ [2.27 4.02]
       second level: [3, 2,]
44
       third level: [2. 8.]]
45
46
     The No. 1 iteration is finished!
47
48
   Beging the No. 2 iteration:
     obj[gen-1] = 13.31 temp_best_value_gen = 13.31
49
50
     No, maintain solution and obj[gen] = 13.31, and the tolerance_counter = 2
51
     solution chromosome =
52
       first level: [ [2.27 4.02]
53
       second level: [3. 2.]
54
       third level: [2. 8.]]
55
     The No. 2 iteration is finished!
56
57
   Beging the No. 3 iteration:
58
     obi[gen-1] = 13.31 temp best value gen = 13.31
59
     No, maintain solution and obj[gen] = 13.31, and the tolerance_counter = 3
60
     solution chromosome =
61
       first level: [ [2.27 4.02]
62
       second level: [3. 2.]
       third level: [2. 8.]]
63
     The No. 3 iteration is finished!
64
65
   Beging the No. 4 iteration:
66
67
     obj[gen-1] = 13.31 temp_best_value_gen = 12.50
68
     Yes, update solution and obj[gen] = 12.50
69
     solution chromosome =
70
       first level: [ [2. 8.]
71
       second level: [4. 2.]
       third level: [2. 8.]]
73
     The No. 4 iteration is finished!
74
75
   Beging the No. 5 iteration:
     obi[gen-1] = 12.50 temp best value gen = 12.50
76
     No, maintain solution and obj[gen] = 12.50, and the tolerance_counter = 1
77
     solution chromosome =
78
       first level: [ [2. 8.]
```

```
80
           second level: [4, 2,]
 81
          third level: [2. 8.]]
 82
        The No. 5 iteration is finished!
 83
     Beging the No. 6 iteration:
 85
        obj[gen-1] = 12.50 temp best value gen = 11.00
        Yes, update solution and obj[gen] = 11.00
 86
 87
        solution chromosome =
 88
          first level: [ [4. 8.]
 89
          second level: [4. 1.]
 90
          third level: [2. 2.]]
 91
        The No. 6 iteration is finished!
 92
 93 Beging the No. 7 iteration:
        obj[gen-1] = 11.00 temp_best_value_gen = 10.50
 94
 95
        Yes, update solution and obj[gen] = 10.50
 96
        solution chromosome =
 97
          first level: [ [4. 8.]
 98
          second level: [3. 2.]
 99
          third level: [2. 8.]]
        The No. 7 iteration is finished!
100
101
102
     Beging the No. 8 iteration:
        obj[gen-1] = 10.50 temp best value gen = 9.00
103
104
        Yes, update solution and obj[gen] = 9.00
105
        solution chromosome =
          first level: [ [8. 4.]
106
107
          second level: [0. 4.]
108
          third level: [2. 2.]]
109
        The No. 8 iteration is finished!
110
111 Beging the No. 9 iteration:
112
        obj[gen-1] = 9.00 temp_best_value_gen = 9.00
113
        No, maintain solution and obj[gen] = 9.00, and the tolerance_counter = 1
        solution chromosome =
114
115
          first level: [ [8. 4.]
116
          second level: [0. 4.]
          third level: [2, 2,]]
117
        The No. 9 iteration is finished!
118
119
120 Beging the No. 10 iteration:
121
        obj[gen-1] = 9.00 temp_best_value_gen = 9.00
        No, maintain solution and obj[\overline{gen}] = \overline{9.00}, and the tolerance_counter = 2
122
123
        solution chromosome =
124
          first level: [[8. 4.]
125
          second level: [0, 4.]
126
          third level: [2. 2.]]
127
        The No. 10 iteration is finished!
128
129 Beging the No. 11 iteration:
        obj[gen-1] = 9.00 temp_best_value_gen = 9.00
130
131
        No, maintain solution and obj[gen] = 9.00, and the tolerance_counter = 3
132
        solution chromosome =
133
          first level: [ [8. 4.]
134
          second level: [0. 4.]
135
          third level: [2. 2.]]
136
        The No. 11 iteration is finished!
137
138 Beging the No. 12 iteration:
        obj[gen-1] = 9.00 temp_best_value_gen = 9.00
139
140
        No, maintain solution and obj[gen] = 9.00, and the tolerance_counter = 4
141
        solution chromosome =
142
          first level: [ [8. 4.]
143
          second level: [0. 4.]
          third level: [2. 2.]]
144
145
        The No. 12 iteration is finished!
146
147 Beging the No. 13 iteration:
        obj[gen-1] = 9.00 temp_best_value_gen = 9.00
148
149
        No, maintain solution and obj[gen] = 9.00, and the tolerance_counter = 5
150
        solution chromosome =
151
          first level: [ [8. 4.]
152
          second level: [0. 4.]
153
          third level: [2. 2.]]
154
        The No. 13 iteration is finished!
155
156 Beging the No. 14 iteration:
157
        obj[gen-1] = 9.00 temp_best_value_gen = 3.00
158
        Yes, update solution and obj[gen] = 3.00
159
        solution chromosome =
160
          first level: [ [2. 8.]
          second level: [0, 1,]
161
162
          third level: [2. 2.]]
163
        The No. 14 iteration is finished!
```

```
164
165 Beging the No. 15 iteration:
        obj[gen-1] = 3.00 temp_best_value_gen = 3.00
166
167
       No, maintain solution and obj[gen] = 3.00, and the tolerance_counter = 1
168
        solution chromosome =
169
          first level: [ [2, 8.]
170
          second level: [0. 1.]
171
          third level: [2. 2.]]
172
        The No. 15 iteration is finished!
173
174 Beging the No. 16 iteration:
175
       obj[gen-1] = 3.00 temp_best_value_gen = 3.00
       No, maintain solution and obj[gen] = 3.00, and the tolerance counter = 2
176
177
       solution chromosome =
178
          first level: [ [2. 8.]
179
          second level: [0. 1.]
180
          third level: [2. 2.]]
181
        The No. 16 iteration is finished!
182
183 Beging the No. 17 iteration:
       obj[gen-1] = 3.00 temp_best_value_gen = 3.00
184
185
       No, maintain solution and obj[gen] = 3.00, and the tolerance_counter = 3
186
        solution chromosome =
187
          first level: [ [2. 8.]
          second level: [0. 1.]
188
          third level: [2. 2.]]
189
190
       The No. 17 iteration is finished!
191
192 Beging the No. 18 iteration:
193
       obj[gen-1] = 3.00 temp_best_value_gen = 3.00
194
       No, maintain solution and obj[gen] = 3.00, and the tolerance counter = 4
195
       solution chromosome =
196
          first level: [ [2. 8.]
197
          second level: [0. 1.]
198
          third level: [2. 2.]]
199
       The No. 18 iteration is finished!
200
201 Beging the No. 19 iteration:
202
       obj[gen-1] = 3.00 temp_best_value_gen = 1.50
203
        Yes, update solution and obj[gen] = 1.50
204
       solution chromosome =
205
          first level: [ [2. 8.]
206
          second level: [0. 0.]
207
          third level: [2. 2.]]
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 = 1
       solution chromosome =
213
214
          first level: [ [2. 8.]
215
          second level: [0. 0.]
216
          third level: [2. 2.]]
       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 = 2
222
       solution chromosome
223
          first level: [ [2. 8.]
224
          second level: [0. 0.]
225
          third level: [2. 2.]]
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 = 3
231
       solution chromosome =
232
          first level: [ [2. 8.]
233
          second level: [0. 0.]
234
          third level: [2. 2.]
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 = 4
240
       solution chromosome
241
          first level: [ [2. 8.]
242
          second level: [0. 0.]
243
          third level: [2. 2.]]
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
```

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248
        No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 5
249
        solution chromosome =
          first level: [ [2. 8.]
250
251
          second level: [0. 0.]
252
          third level: [2. 2.]]
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
257
        No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 6
258
        solution chromosome =
259
          first level: [ [2. 8.]
260
          second level: [0. 0.]
261
          third level: [2. 2.]]
262
        The No. 25 iteration is finished!
263
264 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 = 7
267
        solution chromosome =
268
          first level: [ [2. 8.]
269
          second level: [0. 0.]
270
          third level: [2. 2.]]
271
        The No. 26 iteration is finished!
272
273 Beging the No. 27 iteration:
274
        obj[gen-1] = 1.50 temp best value gen = 1.50
275
        No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 8
276
        solution chromosome =
277
          first level: [ [2. 8.]
          second level: [0. 0.] third level: [2. 2.]]
278
279
280
        The No. 27 iteration is finished!
281
282 Beging the No. 28 iteration:
        obj[gen-1] = 1.50 temp_best_value_gen = 1.50
283
284
        No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 9
285
        solution chromosome =
286
          first level: [ [2. 8.]
287
          second level: [0. 0.]
288
          third level: [2. 2.]]
289
        The No. 28 iteration is finished!
290
291
     Beging the No. 29 iteration:
292
        obj[gen-1] = 1.50 temp_best_value_gen = 1.50
293
        No, maintain solution and obj[gen] = 1.50, and the tolerance_counter = 10
294
        solution chromosome =
295
          first level: [ [2. 8.]
296
          second level: [0, 0,]
297
          third level: [2. 2.]]
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: [2. 2.]]
        Objective function values and some other indicators:
307
                                 Obj1 = 0.00
308
          Obj0 = 3.00
                                                       Obj0 + Obj1 = 3.00
309
          Total movement of crane: 0.00
310
          Total waiting time in berth position: 0.00
          Total index of q during berthing: 31.00
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: 4.0
                    duration time i: 4.0
                                                       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: 3.0
                                                       demand i: 120.0
                                                                                      work load i: 120.0
                                                                                                                      work load gap_i: 0
                    duration time i: 3.0
316 Algorithm finished and the total CPU time: 466 s
317 End
318
```