```
exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=27953
2
3
   import sys; print('Python %s on %s' % (sys.version, sys.platform))
   01_My_Python_Code'])
5
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_7_8 standard_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
       Tolerance iteration unchanged number = 10
23
       Chrom_size = 21
       Iter_num_GA = 300
24
25
       Select_rate = 0.85
26
       Crossover rate = 0.95
       Mutation rate = 0.95
27
28
       Mu_oper_type = 1
29
       vessel\_move\_way = 2
30
       coefficient for Obj1= 1.9
       coefficient for Obj2= 0.100000000000000009
31
32
33
   Iteration begin:
34
35
   Beging the No. 0 iteration:
     obj[0] = 26.10 temp_best_value_gen = 26.10
36
     The No. 0 iteration is finished!
37
38
39
   Beging the No. 1 iteration:
     obj[gen-1] = 26.10 temp_best_value_gen = 26.10
40
     No, maintain solution and obj[gen] = 26.10, and the tolerance_counter = 1
41
42
     solution chromosome =
43
       first level: [ [ 2.5 9.5 17.5 24. 27.5 2.5 2. ]
       second level: [2. 2. 4. 1. 4. 3. 7.]
44
       third level: [4. 2. 2. 2. 4. 2. 2.]
45
     The No. 1 iteration is finished!
46
47
   Beging the No. 2 iteration:
obj[gen-1] = 26.10 temp_best_value_gen = 26.10
48
49
50
     No, maintain solution and obj[gen] = 26.10, and the tolerance_counter = 2
51
     solution chromosome =
52
       first level: [ [ 2.5 9.5 17.5 24. 27.5 2.5 2. ]
       second level: [2. 2. 4. 1. 4. 3. 7.]
53
54
       third level: [4. 2. 2. 2. 4. 2. 2.]]
55
     The No. 2 iteration is finished!
56
57
   Beging the No. 3 iteration:
58
     obi[gen-1] = 26.10 temp best value gen = 26.10
     No, maintain solution and obj[gen] = \frac{1}{2}6.10, and the tolerance_counter = 3
59
60
     solution chromosome =
61
       first level: [ [ 2.5 9.5 17.5 24. 27.5 2.5 2. ]
       second level: [2. 2. 4. 1. 4. 3. 7.]
62
       third level: [4. 2. 2. 2. 4. 2. 2.]
63
     The No. 3 iteration is finished!
64
65
   Beging the No. 4 iteration:
66
67
     obj[gen-1] = 26.10 temp_best_value_gen = 25.80
68
     Yes, update solution and obj[gen] = 25.80
69
     solution chromosome =
70
       first level: [ [ 2.5 9.5 17.5 27. 24. 2.5 2. ]
       second level: [2. 2. 4. 4. 6. 3. 7.]
71
       third level: [4. 2. 2. 4. 2. 2. 2.]]
73
     The No. 4 iteration is finished!
74
75
   Beging the No. 5 iteration:
     obi[gen-1] = 25.80 temp best value gen = 25.80
76
     No, maintain solution and obj[gen] = 25.80, and the tolerance_counter = 1
77
78
     solution chromosome =
        first level: [ [ 2.5 9.5 17.5 27. 24. 2.5 2. ]
```

```
second level: [2. 2. 4. 4. 6. 3. 7.]
 80
          third level: [4. 2. 2. 4. 2. 2. 2.]
 81
 82
       The No. 5 iteration is finished!
 83
 84 Beging the No. 6 iteration:
 85
       obj[gen-1] = 25.80 temp best value gen = 24.40
 86
        Yes, update solution and obj[gen] = 24.40
 87
       solution chromosome =
 88
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
 89
          second level: [2. 1. 4. 2. 6. 3. 7.]
 90
          third level: [4. 4. 2. 2. 2. 2. 2.]]
 91
       The No. 6 iteration is finished!
 92
 93 Beging the No. 7 iteration:
       obj[gen-1] = 24.40 temp_best_value_gen = 24.40
 94
 95
       No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 1
 96
       solution chromosome =
 97
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
 98
          second level: [2. 1. 4. 2. 6. 3. 7.]
99
          third level: [4. 4. 2. 2. 2. 2. 2.]]
100
       The No. 7 iteration is finished!
101
102 Beging the No. 8 iteration:
       obj[gen-1] = 24.40 temp best value gen = 24.40
103
104
       No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 2
105
        solution chromosome =
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
106
          second level: [2. 1. 4. 2. 6. 3. 7.]
107
108
          third level: [4. 4. 2. 2. 2. 2. 2.]]
109
       The No. 8 iteration is finished!
110
111 Beging the No. 9 iteration:
112
       obj[gen-1] = 24.40 temp_best_value_gen = 24.40
113
       No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 3
       solution chromosome =
114
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
115
116
          second level: [2. 1. 4. 2. 6. 3. 7.]
          third level: [4. 4. 2. 2. 2. 2. 2.]]
117
       The No. 9 iteration is finished!
118
119
120 Beging the No. 10 iteration:
121
       obj[gen-1] = 24.40 temp\_best\_value\_gen = 24.40
122
       No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 4
123
        solution chromosome =
124
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
          second level: [2. 1. 4. 2. 6. 3. 7.]
125
126
          third level: [4. 4. 2. 2. 2. 2. 2.]]
127
       The No. 10 iteration is finished!
128
129 Beging the No. 11 iteration:
        obj[gen-1] = 24.40 temp_best_value_gen = 24.40
130
131
       No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 5
132
       solution chromosome =
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
133
134
          second level: [2. 1. 4. 2. 6. 3. 7.]
135
          third level: [4. 4. 2. 2. 2. 2. 2.]]
136
       The No. 11 iteration is finished!
137
138 Beging the No. 12 iteration:
139
       obj[gen-1] = 24.40 temp_best_value_gen = 24.40
140
       No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 6
141
        solution chromosome =
142
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
143
          second level: [2. 1. 4. 2. 6. 3. 7.]
          third level: [4. 4. 2. 2. 2. 2. 2.]]
144
145
       The No. 12 iteration is finished!
146
147 Beging the No. 13 iteration:
148
        obj[gen-1] = 24.40 temp_best_value_gen = 24.40
149
       No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 7
150
       solution chromosome =
151
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
152
          second level: [2. 1. 4. 2. 6. 3. 7.]
          third level: [4. 4. 2. 2. 2. 2. 2.]
153
154
       The No. 13 iteration is finished!
155
156 Beging the No. 14 iteration:
157
       obj[gen-1] = 24.40 temp_best_value_gen = 24.40
158
       No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 8
159
        solution chromosome =
160
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
          second level: [2. 1. 4. 2. 6. 3. 7.]
161
162
          third level: [4. 4. 2. 2. 2. 2. 2.]]
       The No. 14 iteration is finished!
163
```

```
164
165 Beging the No. 15 iteration:
        obj[gen-1] = 24.40 temp_best_value_gen = 24.40
166
167
        No, maintain solution and obj[gen] = 24.40, and the tolerance_counter = 9
168
        solution chromosome =
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
169
170
          second level: [2. 1. 4. 2. 6. 3. 7.]
171
          third level: [4. 4. 2. 2. 2. 2. 2.]]
172
        The No. 15 iteration is finished!
173
174
175
176
    The iteration is terminated and then visulize the solution:
177
        solution chromosome =
          first level: [ [ 2.5 25.5 17.5 9.5 24. 2.5 2. ]
178
179
          second level: [2. 1. 4. 2. 6. 3. 7.]
180
          third level: [4. 4. 2. 2. 2. 2. 2.]]
181
        Objective function values and some other indicators:
182
          Obj0 = 10.00
                                Obj1 = 54.00
                                                       Obj0 + Obj1 = 64.00
183
          Total movement of crane: 29.00
          Total waiting time in berth position: 25.00
184
185
          Total index of q during berthing: 350.00
186
        Specific arrangement for each vessel:
                                                                      bow of i: 0.0
187
          V_id: 0
                              li: 5.0
                                                  xi: 2.5
                                                                                                  tail of i: 5.0
                                                                                                                           gama i0: 2.0
                                                                                                                                                      gama_i1: 3.0
                                                       demand\_i{:}~80.0
                    duration_time_i: 1.0
                                                                                     work load_i: 80.0
                                                                                                                      work load gap_i: 0
          V_id: 1
188
                              li: 9.0
                                                  xi: 25.5
                                                                         bow of i: 21.0
                                                                                                    tail of i: 30.0
                                                                                                                                gama_i0: 1.0
                                                                                                                                                           gama_i1: 2
                       duration time i: 1.0
                                                          demand i: 80.0
                                                                                        work load i: 80.0
                                                                                                                        work load gap_i: 0
                                                                        bow of i: 14.0
                                                                                                                                gama_i0: 4.0
189
           V_id: 2
                              li: 7.0
                                                  xi: 17.5
                                                                                                    tail of i: 21.0
                                                                                                                                                           gama_i1: 7
                       duration\_time\_i{:}~3.0
                                                                                        work load_i: 100.0
                                                          demand_i: 100.0
                                                                                                                        work load gap_i: 0
190
           V_id: 3
                              li: 6.0
                                                  xi: 9.5
                                                                      bow of i: 6.5
                                                                                                  tail of i: 12.5
                                                                                                                             gama_i0: 2.0
                                                                                                                                                         gama_i1: 5.0
                    duration time i: 3.0
                                                       demand i: 100.0
                                                                                     work load i: 100.0
                                                                                                                      work load gap i: 0
191
                                                                        bow of i: 21.5
          V_id: 4
                                                  xi: 24.0
                                                                                                    tail of i: 26.5
                                                                                                                                gama_i0: 6.0
                              li: 5.0
                                                                                                                                                            gama_i1:
     10.0
                         duration_time_i: 4.0
                                                            demand_i: 140.0
                                                                                          work load_i: 140.0
                                                                                                                           work load gap_i: 0
          V_id: 5
192
                                                  xi: 2.5
                                                                      bow of i: 0.0
                                                                                                  tail of i: 5.0
                                                                                                                           gama_i0: 3.0
                                                                                                                                                      gama_i1: 7.0
                              li: 5.0
                    duration_time_i: 4.0
                                                       demand_i: 160.0
                                                                                     work load i: 160.0
                                                                                                                      work load gap_i: 0
193
                                                                      bow of i: 0.0
           V_id: 6
                                                  xi: 2.0
                                                                                                                                                      gama_i1: 11.0
                              li: 4.0
                                                                                                  tail of i: 4.0
                                                                                                                           gama_i0: 7.0
                    duration_time_i: 4.0
                                                       demand_i: 160.0
                                                                                     work load_i: 160.0
                                                                                                                      work load gap_i: 0
195 Algorithm finished and the total CPU time: 1260 s
196 End
197
```