```
exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=48947
 2
 3
   import sys; print('Python %s on %s' % (sys.version, sys.platform))
   01 My Python Code', 'E:/1 0000/3 00000/1 000000/1 0000000/1 000000 0000/1 LW 00002/6 0000/2 python code/
   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_20_7 standard_test.xlsx optimization process solved by ENSGA-II algorithm.
14
15
   Start
16
17 Before iteration:
     Read basic data
18
19
     Parameter setting:
20
       trail = 58
21
       Pop_size = 30
       Tolerance iteration unchanged number = 10
23
       Chrom size = 60
       Iter_num_GA = 300
24
25
       Select_rate = 0.85
26
       Crossover rate = 0.95
27
       Mutation rate = 0.95
28
       Mu_oper_type = 1
29
       vessel\_move\_way = 2
30
       coefficient for Obj1= 1.9
       coefficient for Obj2 = 0.100000000000000000
31
32
33
   Iteration begin:
34
35
   Beging the No. 0 iteration:
     obj[0] = 176.18 temp_best_value_gen = 176.18
36
     The No. 0 iteration is finished!
37
38
39 Beging the No. 1 iteration:
40
     obj[gen-1] = 176.18 temp_best_value_gen = 176.18
     No, maintain solution and obj[gen] = 176.18, and the tolerance counter = 1
41
42
     solution chromosome =
43
       2.79 6.56 7.71 5.34 16. 1.63 14.5 14.5 ]
44
       second level: [1. 8. 5. 12. 14. 16. 20. 22. 7. 0. 24. 25. 28. 30. 34. 32. 1. 7.
45
46
    2. 4.]
47
       third level: [2. 2. 2. 5. 2. 1. 5. 3. 6. 3. 4. 2. 2. 4. 2. 2. 7. 3. 5. 5.]]
48
     The No. 1 iteration is finished!
49
50
   Beging the No. 2 iteration:
51
     obi[gen-1] = 176.18 temp best value gen = 167.50
52
     Yes, update solution and obj[gen] = 167.50
53
     solution chromosome =
54
       first level: [ [ 4.86 1.79 3.94 5.21 5.57 4.89 6.62 3.96 4.93 2.27 4.61 2.15
55
    2.7 5.62 10. 8. 6.22 7.5 15.5 9. ]
56
       second level: [14. 1. 4. 7. 6. 10. 18. 22. 24. 25. 26. 27. 30. 32. 1. 2. 12. 3.
57
58
       third level: [2. 3. 3. 3. 5. 2. 2. 4. 6. 3. 8. 2. 2. 6. 6. 6. 9. 1. 6. 2.]]
59
     The No. 2 iteration is finished!
60
   Beging the No. 3 iteration:
61
62
     obi[gen-1] = 167.50 temp best value gen = 167.50
     No, maintain solution and obj[gen] = 167.50, and the tolerance_counter = 1
63
64
     solution chromosome =
       first level: [ [ 4.86 1.79 3.94 5.21 5.57 4.89 6.62 3.96 4.93 2.27 4.61 2.15
65
    2.7 5.62 10. 8. 6.22 7.5 15.5 9. ]
66
67
       second level: [14. 1. 4. 7. 6. 10. 18. 22. 24. 25. 26. 27. 30. 32. 1. 2. 12. 3.
68
69
       third level: [2. 3. 3. 3. 5. 2. 2. 4. 6. 3. 8. 2. 2. 6. 6. 6. 9. 1. 6. 2.]]
     The No. 3 iteration is finished!
70
71
   Beging the No. 4 iteration:
73
     obj[gen-1] = 167.50 temp_best_value_gen = 167.50
74
     No, maintain solution and obj[gen] = 167.50, and the tolerance_counter = 2
75
     solution chromosome =
       first level: [ [ 4.86 1.79 3.94 5.21 5.57 4.89 6.62 3.96 4.93 2.27 4.61 2.15
76
    2.7 5.62 10. 8. 6.22 7.5 15.5 9. ]
77
       second level: [14. 1. 4. 7. 6. 10. 18. 22. 24. 25. 26. 27. 30. 32. 1. 2. 12. 3.
78
79
    2. 27.]
```

```
80
          third level: [2. 3. 3. 3. 5. 2. 2. 4. 6. 3. 8. 2. 2. 6. 6. 6. 9. 1. 6. 2.]]
 81
       The No. 4 iteration is finished!
 82
 83
     Beging the No. 5 iteration:
       obj[gen-1] = 167.50 temp best value gen = 167.50
 84
 85
       No, maintain solution and obj[gen] = 167.50, and the tolerance counter = 3
 86
       solution chromosome =
 87
          first level: [ [ 4.86 1.79 3.94 5.21 5.57 4.89 6.62 3.96 4.93 2.27 4.61 2.15
 88
      2.7 5.62 10. 8. 6.22 7.5 15.5 9. ]
          second level: [14. 1. 4. 7. 6. 10. 18. 22. 24. 25. 26. 27. 30. 32. 1. 2. 12. 3.
 89
 90
      2.27.1
 91
          third level: [2. 3. 3. 3. 5. 2. 2. 4. 6. 3. 8. 2. 2. 6. 6. 6. 9. 1. 6. 2.]]
 92
        The No. 5 iteration is finished!
 93
 94
     Beging the No. 6 iteration:
 95
       obj[gen-1] = 167.50 temp_best_value_gen = 167.50
       No, maintain solution and obj[gen] = 167.50, and the tolerance_counter = 4
 96
 97
        solution chromosome =
 98
          first level: [ [ 4.86 1.79 3.94 5.21 5.57 4.89 6.62 3.96 4.93 2.27 4.61 2.15
 99
      2.7 5.62 10. 8. 6.22 7.5 15.5 9. ]
100
          second level: [14. 1. 4. 7. 6. 10. 18. 22. 24. 25. 26. 27. 30. 32. 1. 2. 12. 3.
101
      2.27.]
          third level: [2. 3. 3. 3. 5. 2. 2. 4. 6. 3. 8. 2. 2. 6. 6. 6. 9. 1. 6. 2.]]
102
103
        The No. 6 iteration is finished!
104
105
106
107
    The iteration is terminated and then visulize the solution:
108
        solution chromosome =
          first level: [ [ 4.86 1.79 3.94 5.21 5.57 4.89 6.62 3.96 4.93 2.27 4.61 2.15
109
110
          5.62 10. 8. 6.22 7.5 15.5 9. ]
          second level: [14. 1. 4. 7. 6. 10. 18. 22. 24. 25. 26. 27. 30. 32. 1. 2. 12. 3.
111
112
      2.27.]
113
          third level: [2. 3. 3. 3. 5. 2. 2. 4. 6. 3. 8. 2. 2. 6. 6. 6. 9. 1. 6. 2.]]
114
       Objective function values and some other indicators:
                                                          Obj0 + Obj1 = 1081.04
115
          Obi0 = 33.00
                                 Obj1 = 1048.04
116
          Total movement of crane: 44.04
117
          Total waiting time in berth position: 293.00
118
          Total index of q during berthing: 374.00
119
        Specific arrangement for each vessel:
                              1i: 9.0
                                                                                                                            gama_i0: 14.0
120
          V_id: 0
                                                  xi: 4.9
                                                                       bow of i: 0.4
                                                                                                   tail of i: 9.4
                                                                                                                                                        gama_i1: 18.0
                                                        demand_i: 140.0
                                                                                      work load i: 140.0
                    duration time i: 4.0
                                                                                                                       work load gap i: 0
121
          V id: 1
                                                   xi: 1.8
                              1i: 3.0
                                                                       bow of i: 0.3
                                                                                                   tail of i: 3.3
                                                                                                                            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
122
          V_id: 2
                              li: 4.0
                                                   xi: 3.9
                                                                       bow of i: 1.9
                                                                                                   tail of i: 5.9
                                                                                                                            gama_i0: 4.0
                                                                                                                                                        gama_i1: 6.0
                    duration_time_i: 2.0
                                                        demand i: 80.0
                                                                                      work load i: 80.0
                                                                                                                       work load gap_i: 0
123
          V_id: 3
                              li: 7.0
                                                   xi: 5.2
                                                                       bow of i: 1.7
                                                                                                   tail of i: 8.7
                                                                                                                            gama_i0: 7.0
                                                                                                                                                        gama_i1: 10.0
                    duration_time_i: 3.0
                                                        demand_i: 140.0
                                                                                      work load_i: 140.0
                                                                                                                       work load gap_i: 0
124
          V_id: 4
                              li: 5.0
                                                   xi: 5.6
                                                                                                  tail of i: 8.1
                                                                                                                            gama i0: 6.0
                                                                       bow of i: 3.1
                                                                                                                                                        gama i1: 7.0
                    duration_time_i: 1.0
                                                        demand i: 80.0
                                                                                      work load_i: 80.0
                                                                                                                       work load gap_i: 0
                                                   xi: 4.9
125
          V id: 5
                              li: 3.0
                                                                       bow of i: 3.4
                                                                                                   tail of i: 6.4
                                                                                                                            gama i0: 10.0
                                                                                                                                                        gama i1: 12.0
                    duration_time_i: 2.0
                                                        demand_i: 80.0
                                                                                      work load_i: 80.0
                                                                                                                       work load gap_i: 0
                                                                                                                              gama i0: 18.0
126
          V id: 6
                              li: 7.0
                                                   xi: 6.6
                                                                       bow of i: 3.1
                                                                                                   tail of i: 10.1
                                                                                                                                                           gama i1: 22.
     0
                    duration_time_i: 4.0
                                                        demand_i: 160.0
                                                                                      work load_i: 160.0
                                                                                                                       work load gap_i: 0
127
          V_id: 7
                              li: 7.0
                                                                       bow of i: 0.5
                                                                                                   tail of i: 7.5
                                                                                                                            gama_i0: 22.0
                                                                                                                                                        gama_i1: 24.0
                                                   xi: 4.0
                                                        demand i: 120.0
                                                                                      work load i: 120.0
                                                                                                                       work load gap i: 0
                    duration time i: 2.0
128
          V id: 8
                                                   xi: 4.9
                                                                       bow of i: 0.9
                                                                                                   tail of i: 8.9
                                                                                                                            gama i0: 24.0
                                                                                                                                                        gama i1: 25.0
                              li: 8.0
                    duration_time_i: 1.0
                                                        demand_i: 100.0
                                                                                      work load_i: 100.0
                                                                                                                       work load gap_i: 0
129
          V_id: 9
                              li: 3.0
                                                   xi: 2.3
                                                                       bow of i: 0.8
                                                                                                   tail of i: 3.8
                                                                                                                            gama_i0: 25.0
                                                                                                                                                        gama_i1: 26.0
                                                                                      work load_i: 60.0
                    duration_time_i: 1.0
                                                       demand_i: 60.0
                                                                                                                       work load gap_i: 0
130
          V id: 10
                                 li: 8.0
                                                     xi: 4.6
                                                                         bow of i: 0.6
                                                                                                     tail of i: 8.6
                                                                                                                               gama_i0: 26.0
                                                                                                                                                           gama_i1: 27.
     0
                                                        demand i: 80.0
                                                                                      work load i: 80.0
                                                                                                                       work load gap_i: 0
                    duration time i: 1.0
131
                                 li: 3.0
                                                     xi: 2.1
                                                                                                     tail of i: 3.6
          V id: 11
                                                                         bow of i: 0.6
                                                                                                                              gama i0: 27.0
                                                                                                                                                           gama i1: 30.
     0
                                                       demand_i: 120.0
                                                                                      work load_i: 120.0
                                                                                                                       work load gap_i: 0
                    duration_time_i: 3.0
          V_id: 12
                                                     xi: 2.7
                                                                         bow of i: 1.2
132
                                 li: 3.0
                                                                                                     tail of i: 4.2
                                                                                                                               gama_i0: 30.0
                                                                                                                                                           gama_i1: 32.
     0
                    duration_time_i: 2.0
                                                        demand_i: 80.0
                                                                                      work load i: 80.0
                                                                                                                       work load gap_i: 0
133
          V id: 13
                                                                                                                              gama i0: 32.0
                                 li: 8.0
                                                     xi: 5.6
                                                                         bow of i: 1.6
                                                                                                     tail of i: 9.6
                                                                                                                                                           gama i1: 34.
     0
                                                                                      work load_i: 160.0
                    duration_time_i: 2.0
                                                       demand i: 160.0
                                                                                                                       work load gap_i: 0
                                                                                                                                   gama_i0: 1.0
134
          V id: 14
                                 li: 8.0
                                                     xi: 10.0
                                                                            bow of i: 6.0
                                                                                                        tail of i: 14.0
                                                                                                                                                               gama il
                                                            demand_i: 120.0
                                                                                                                            work load gap_i: 0
     : 2.0
                         duration_time_i: 1.0
                                                                                           work load_i: 120.0
135
                                                     xi: 8.0
                                                                                                                                 gama_i0: 2.0
          V_id: 15
                                 li: 9.0
                                                                         bow of i: 3.5
                                                                                                     tail of i: 12.5
                                                                                                                                                             gama_i1: 3
     .0
                       duration_time_i: 1.0
                                                          demand_i: 60.0
                                                                                         work load_i: 60.0
                                                                                                                         work load gap_i: 0
136
          V_id: 16
                                                                         bow of i: 1.7
                                 li: 9.0
                                                     xi: 6.2
                                                                                                     tail of i: 10.7
                                                                                                                                 gama_i0: 12.0
                                                                                                                                                             gama_i1:
                                                             demand i: 60.0
                                                                                           work load i: 60.0
                                                                                                                            work load gap i: 0
     13.0
                         duration time i: 1.0
          V_id: 17
137
                                                     xi: 7.5
                                                                         bow of i: 6.0
                                                                                                     tail of i: 90
                                 li: 3.0
                                                                                                                              gama_i0: 3.0
                                                                                                                                                           gama_i1: 6.0
                    duration time i: 3.0
                                                       demand i: 60.0
                                                                                      work load i: 60.0
                                                                                                                       work load gap_i: 0
138
          V_id: 18
                                 li: 6.0
                                                                            bow of i: 12.5
                                                                                                       tail of i: 18.5
                                                                                                                                   gama_i0: 2.0
                                                                                                                                                               gama_i1
                                                     xi: 15.5
                                                                                                                            work load gap_i: 0
     : 4.0
                         duration time i: 2.0
                                                             demand i: 140.0
                                                                                           work load i: 140.0
139
                                                     xi: 9.0
                                                                         bow of i: 6.0
                                                                                                                                 gama_i0: 27.0
          V_id: 19
                                 li: 6.0
                                                                                                     tail of i: 12.0
                                                                                                                                                             gama_i1:
     30.0
                         duration_time_i: 3.0
                                                             demand_i: 120.0
                                                                                           work load_i: 120.0
                                                                                                                            work load gap_i: 0
140
141 Algorithm finished and the total CPU time: 1333 s
142 End
143
```