```
exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=35303
 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_2 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] = 193.14 temp_best_value_gen = 193.14
36
     The No. 0 iteration is finished!
37
38
39 Beging the No. 1 iteration:
40
     obj[gen-1] = 193.14 temp_best_value_gen = 193.14
     No, maintain solution and \overline{obj}[\overline{gen}] = 1\overline{93.14}, and the tolerance counter = 1
41
42
     solution chromosome =
43
        first level: [ [ 4.53 6.74 3.66 5.52 3.28 4.2 3.02 3.04 3.85 3.3 2.22 4.86
    2.56 7.8 5.17 2.57 15. 13.5 10. 10. ]
44
        second\ level;\ [\ 0.\ \ 1.\ \ 5.\ \ 7.\ 11.\ \ 2.\ \ 4.\ \ 16.\ 19.\ 21.\ 15.\ 24.\ 25.\ 29.\ 31.\ 33.\ \ 1.\ \ 4.
45
46
    11. 21.]
47
       third level: [5. 5. 3. 2. 2. 5. 3. 2. 3. 2. 4. 6. 2. 5. 4. 2. 6. 2. 2. 2.]]
48
     The No. 1 iteration is finished!
49
50
   Beging the No. 2 iteration:
51
     obi[gen-1] = 193.14 temp best value gen = 193.14
     No, maintain solution and obj[gen] = 193.14, and the tolerance_counter = 2
52
53
     solution chromosome =
54
       first level: [ [ 4.53 6.74 3.66 5.52 3.28 4.2 3.02 3.04 3.85 3.3 2.22 4.86
55
    2.56 7.8 5.17 2.57 15. 13.5 10. 10. ]
56
        second level: [0, 1, 5, 7, 11, 2, 4, 16, 19, 21, 15, 24, 25, 29, 31, 33, 1, 4,
57
58
       third level: [5. 5. 3. 2. 2. 5. 3. 2. 3. 2. 4. 6. 2. 5. 4. 2. 6. 2. 2. 2.]]
59
     The No. 2 iteration is finished!
60
   Beging the No. 3 iteration:
61
     obi[gen-1] = 193.14 temp best value gen = 182.55
62
63
      Yes, update solution and obj[gen] = 182.55
64
     solution chromosome =
       first level: [ [ 2.58 8.16 2.37 5.87 3.58 6.87 3.23 4.27 5.4 2.43 2.06 5.77
65
    2.83 8.56 4.83 15. 6.4 3.46 16. 5. ]
66
67
        second level: [23. 3. 5. 1. 9. 13. 15. 18. 20. 24. 2. 22. 27. 5. 31. 3. 26. 34.
68
69
       third level: [3. 2. 1. 7. 2. 5. 1. 3. 4. 3. 3. 5. 2. 7. 2. 2. 5. 5. 2. 9.]]
     The No. 3 iteration is finished!
70
71
   Beging the No. 4 iteration:
73
     obj[gen-1] = 182.55 temp_best_value_gen = 182.55
74
     No, maintain solution and obj[gen] = 182.55, and the tolerance_counter = 1
75
     solution chromosome =
       first level: [ [ 2.58 8.16 2.37 5.87 3.58 6.87 3.23 4.27 5.4 2.43 2.06 5.77
76
    2.83 8.56 4.83 15. 6.4 3.46 16. 5. ]
77
        second level: [23. 3. 5. 1. 9. 13. 15. 18. 20. 24. 2. 22. 27. 5. 31. 3. 26. 34.
78
79
    6. 0.]
```

```
80
          third level: [3. 2. 1. 7. 2. 5. 1. 3. 4. 3. 3. 5. 2. 7. 2. 2. 5. 5. 2. 9.]]
 81
        The No. 4 iteration is finished!
 82
 83
     Beging the No. 5 iteration:
       obj[gen-1] = 182.55 temp best value gen = 182.55
 84
 85
       No, maintain solution and obj[gen] = 182.55, and the tolerance counter = 2
 86
       solution chromosome =
 87
          first level: [ [ 2.58 8.16 2.37 5.87 3.58 6.87 3.23 4.27 5.4 2.43 2.06 5.77
 88
      2.83 8.56 4.83 15. 6.4 3.46 16. 5. ]
          second level: [23, 3, 5, 1, 9, 13, 15, 18, 20, 24, 2, 22, 27, 5, 31, 3, 26, 34,
 89
 90
      6. 0.1
 91
          third level: [3. 2. 1. 7. 2. 5. 1. 3. 4. 3. 3. 5. 2. 7. 2. 2. 5. 5. 2. 9.]]
 92
        The No. 5 iteration is finished!
 93
 94
     Beging the No. 6 iteration:
 95
       obj[gen-1] = 182.55 temp_best_value_gen = 182.55
       No, maintain solution and obj[gen] = 182.55, and the tolerance_counter = 3
 96
 97
        solution chromosome =
 98
          first level: [ [ 2.58 8.16 2.37 5.87 3.58 6.87 3.23 4.27 5.4 2.43 2.06 5.77
 99
      2.83 8.56 4.83 15. 6.4 3.46 16. 5. ]
100
          second level: [23. 3. 5. 1. 9. 13. 15. 18. 20. 24. 2. 22. 27. 5. 31. 3. 26. 34.
101
      6. 0.]
102
          third level: [3. 2. 1. 7. 2. 5. 1. 3. 4. 3. 3. 5. 2. 7. 2. 2. 5. 5. 2. 9.]]
103
        The No. 6 iteration is finished!
104
105
106
107
    The iteration is terminated and then visulize the solution:
108
        solution chromosome =
109
          first level: [ [ 2.58 8.16 2.37 5.87 3.58 6.87 3.23 4.27 5.4 2.43 2.06 5.77
110
      2.83 8.56 4.83 15. 6.4 3.46 16. 5. ]
111
          second level: [23. 3. 5. 1. 9. 13. 15. 18. 20. 24. 2. 22. 27. 5. 31. 3. 26. 34.
112
113
          third level: [3. 2. 1. 7. 2. 5. 1. 3. 4. 3. 3. 5. 2. 7. 2. 2. 5. 5. 2. 9.]]
114
       Objective function values and some other indicators:
                                                          Obj0 + Obj1 = 1195.50
115
          Obi0 = 35.00
                                 Obj1 = 1160.50
116
          Total movement of crane: 45.50
117
          Total waiting time in berth position: 287.00
118
          Total index of q during berthing: 400.00
119
        Specific arrangement for each vessel:
                                                                                                                            gama_i0: 23.0
120
          V_id: 0
                              li: 5.0
                                                                       bow of i: 0.1
                                                                                                   tail of i: 5.1
                                                                                                                                                        gama_i1: 24.0
                                                       demand_i: 60.0
                    duration_time_i: 1.0
                                                                                      work load i: 60.0
                                                                                                                       work load gap i: 0
          V_id: 1
121
                                                                                                                                                          gama_i1: 5.0
                              1i: 9.0
                                                   xi: 8.2
                                                                       bow of i: 3.7
                                                                                                   tail of i: 12.7
                                                                                                                              gama i0: 3.0
                    duration_time_i: 2.0
                                                        demand i: 80.0
                                                                                      work load i: 80.0
                                                                                                                       work load gap_i: 0
122
          V_id: 2
                              li: 3.0
                                                   xi: 2.4
                                                                       bow of i: 0.9
                                                                                                   tail of i: 3.9
                                                                                                                            gama_i0: 5.0
                                                                                                                                                        gama_i1: 9.0
                    duration_time_i: 4.0
                                                        demand\_i{:}~80.0
                                                                                      work load i: 80.0
                                                                                                                       work load gap_i: 0
123
          V_id: 3
                              li: 9.0
                                                   xi: 5.9
                                                                       bow of i: 1.4
                                                                                                   tail of i: 10.4
                                                                                                                              gama_i0: 1.0
                                                                                                                                                           gama_i1: 2.0
                    duration_time_i: 1.0
                                                        demand_i: 140.0
                                                                                      work load_i: 140.0
                                                                                                                       work load gap_i: 0
124
          V_id: 4
                                                                                                  tail of i: 6.1
                                                                                                                            gama i0: 9.0
                                                                                                                                                        gama i1: 13.0
                              li: 5.0
                                                   xi: 3.6
                                                                       bow of i: 1.1
                    duration_time_i: 4.0
                                                        demand i: 160.0
                                                                                      work load_i: 160.0
                                                                                                                       work load gap_i: 0
125
          V id: 5
                              li: 8.0
                                                   xi: 6.9
                                                                       bow of i: 2.9
                                                                                                   tail of i: 10.9
                                                                                                                               gama i0: 13.0
                                                                                                                                                           gama i1: 15.
                    duration_time_i: 2.0
                                                        demand_i: 120.0
                                                                                      work load_i: 120.0
                                                                                                                       work load gap_i: 0
126
          V_id: 6
                                                                                                                            gama_i0: 15.0
                              li: 4.0
                                                   xi: 3.2
                                                                       bow of i: 1.2
                                                                                                   tail of i: 5.2
                                                                                                                                                        gama i1: 18.0
                    duration_time_i: 3.0
                                                        demand_i: 60.0
                                                                                      work load i: 60.0
                                                                                                                       work load gap_i: 0
127
          V_id: 7
                                                                       bow of i: 1.3
                                                                                                   tail of i: 7.3
                                                                                                                            gama_i0: 18.0
                                                                                                                                                        gama_i1: 20.0
                              li: 6.0
                                                   xi: 4.3
                                                       demand i: 100.0
                                                                                      work load i: 100.0
                                                                                                                       work load gap i: 0
                    duration time i: 2.0
128
          V id: 8
                                                   xi: 5.4
                                                                       bow of i: 1.9
                                                                                                   tail of i: 8.9
                                                                                                                            gama i0: 20.0
                                                                                                                                                        gama i1: 22.0
                              li: 7.0
                    duration_time_i: 2.0
                                                        demand_i: 100.0
                                                                                      work load_i: 100.0
                                                                                                                       work load gap_i: 0
129
          V_id: 9
                              li: 4.0
                                                   xi: 2.4
                                                                       bow of i: 0.4
                                                                                                   tail of i: 4.4
                                                                                                                            gama_i0: 24.0
                                                                                                                                                        gama_i1: 26.0
                    duration_time_i: 2.0
                                                       demand_i: 120.0
                                                                                      work load_i: 120.0
                                                                                                                       work load gap_i: 0
                                                                                                     tail of i: 4.1
130
          V id: 10
                                 li: 4.0
                                                     xi: 2.1
                                                                         bow of i: 0.1
                                                                                                                               gama_i0: 2.0
                                                                                                                                                           gama_i1: 3.0
                                                        demand i: 60.0
                                                                                      work load_i: 60.0
                                                                                                                       work load gap_i: 0
                    duration_time_i: 1.0
131
          V id: 11
                                 li: 6.0
                                                     xi: 5.8
                                                                         bow of i: 2.8
                                                                                                     tail of i: 8.8
                                                                                                                              gama i0: 22.0
                                                                                                                                                          gama i1: 23.
     0
                                                       demand_i: 100.0
                                                                                      work load_i: 100.0
                    duration_time_i: 1.0
                                                                                                                       work load gap_i: 0
132
                                                     xi: 2.8
          V_id: 12
                                 li: 3.0
                                                                         bow of i: 1.3
                                                                                                     tail of i: 4.3
                                                                                                                              gama_i0: 27.0
                                                                                                                                                           gama_i1: 31.
     0
                    duration_time_i: 4.0
                                                        demand_i: 160.0
                                                                                      work load_i: 160.0
                                                                                                                       work load gap_i: 0
133
          V id: 13
                                 1i: 9.0
                                                                         bow of i: 4.1
                                                                                                                                 gama i0: 5.0
                                                     xi: 8.6
                                                                                                     tail of i: 13.1
                                                                                                                                                             gama_i1: 7
                                                          demand i: 160.0
     .0
                       duration_time_i: 2.0
                                                                                         work load i: 160.0
                                                                                                                          work load gap_i: 0
                                                     xi: 4.8
134
          V id: 14
                                 li: 6.0
                                                                         bow of i: 1.8
                                                                                                     tail of i: 7.8
                                                                                                                              gama i0: 31.0
                                                                                                                                                           gama_i1: 34.
     0
                                                       demand_i: 120.0
                    duration_time_i: 3.0
                                                                                      work load_i: 120.0
                                                                                                                       work load gap_i: 0
135
          V_id: 15
                                                                            bow of i: 13.5
                                                                                                       tail of i: 16.5
                                                                                                                                   gama_i0: 3.0
                                li: 3.0
                                                     xi: 15.0
                                                                                                                                                               gama_i1
                         duration_time_i: 3.0
                                                                                                                            work load gap_i: 0
     : 6.0
                                                             demand_i: 120.0
                                                                                           work load i: 120.0
136
                                                     xi: 6.4
                                                                                                                              gama_i0: 26.0
                                                                                                                                                           gama_i1: 27.
          V_id: 16
                                 li: 7.0
                                                                         bow of i: 2.9
                                                                                                     tail of i: 9.9
     0
                                                       demand i: 80.0
                                                                                      work load i: 80.0
                                                                                                                       work load gap i: 0
                    duration_time_i: 1.0
137
          V_id: 17
                                                                         bow of i: 0.5
                                                                                                                              gama_i0: 34.0
                                                                                                                                                           gama_i1: 36.
                                 li: 6.0
                                                     xi: 3.5
                                                                                                     tail of i: 6.5
     0
                    duration time i: 2.0
                                                        demand i: 160.0
                                                                                      work load i: 160.0
                                                                                                                       work load gap_i: 0
138
          V_id: 18
                                li: 5.0
                                                     xi: 16.0
                                                                            bow of i: 13.5
                                                                                                       tail of i: 18.5
                                                                                                                                   gama_i0: 6.0
                                                                                                                                                               gama_i1
                                                                                                                            work load gap_i: 0
     : 9.0
                         duration time i: 3.0
                                                            demand i: 120.0
                                                                                           work load i: 120.0
139
                                                     xi: 5.0
          V id: 19
                                 li: 9.0
                                                                         bow of i: 0.5
                                                                                                     tail of i: 9.5
                                                                                                                              gama_i0: 0.0
                                                                                                                                                           gama_i1: 1.0
                    duration_time_i: 1.0
                                                        demand i: 80.0
                                                                                      work load i: 80.0
                                                                                                                       work load gap_i: 0
140
141 Algorithm finished and the total CPU time: 1326 s
142 End
143
```