

```

1 "E:\1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \_LW\_ \ \ \ \ \2\6 \ \ \ \ \2 python code\01_My_Python_Code\Scripts\python.
   exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=client --port=2747
2
3 import sys; print('Python %s on %s' % (sys.version, sys.platform))
4 sys.path.extend(['E:\1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \_LW\_ \ \ \ \ \2\6 \ \ \ \ \2 python code\
   01_My_Python_Code', 'E:/1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \_LW\_ \ \ \ \ \2\6 \ \ \ \ \2 python code/
   01_My_Python_Code'])
5
6 PyDev console: starting.
7
8 Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
9 >>> runfile('E:/1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \_LW\_ \ \ \ \ \2\6 \ \ \ \ \2 python code\01_My_Python_Code/
   main_BACASP_official_ENSGA-II.py', wdir='E:/1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \_LW\_ \ \ \ \ \2\6 \ \ \ \ \2
   python code\01_My_Python_Code')
10 Backend TkAgg is interactive backend. Turning interactive mode on.
11 Waiting 1s.....
12
13 This is the R_19_4_standerd_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
22     Tolerance_iteration_unchanged_number = 10
23     Chrom_size = 57
24     Iter_num_GA = 300
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
31     coefficient for Obj2= 0.100000000000000009
32     gen = 0
33
34 Iteration begin:
35 Beging the No. 0 iteration:
36   obj[0] = 96.39   temp_best_value_gen = 96.39
37   The No. 0 iteration is finished!
38
39 Beging the No. 1 iteration:
40   obj[gen-1] = 96.39   temp_best_value_gen = 96.39
41   No, maintain solution and obj[gen] = 96.39 , and the tolerance_counter = 1
42   solution chromosome =
43     first level: [ [ 4.7  3.37  7.96  5.08  7.2  4.23  3.93  3.91  1.6  1.74  4.6  5.88
44 5.98  6.87  3.16  7.1  14.  16.  14.5 ]
45 second level: [ 7.  5.  1.  9. 11. 12. 16. 19.  1. 20. 23. 25. 26. 27. 31. 33.  4.  2.
46 8.]
47 third level: [4. 3. 2. 3. 6. 2. 2. 4. 2. 2. 2. 5. 9. 2. 4. 4. 2. 4. 3.] ]
48 The No. 1 iteration is finished!
49
50 Beging the No. 2 iteration:
51   obj[gen-1] = 96.39   temp_best_value_gen = 96.39
52   No, maintain solution and obj[gen] = 96.39 , and the tolerance_counter = 2
53   solution chromosome =
54     first level: [ [ 4.7  3.37  7.96  5.08  7.2  4.23  3.93  3.91  1.6  1.74  4.6  5.88
55 5.98  6.87  3.16  7.1  14.  16.  14.5 ]
56 second level: [ 7.  5.  1.  9. 11. 12. 16. 19.  1. 20. 23. 25. 26. 27. 31. 33.  4.  2.
57 8.]
58 third level: [4. 3. 2. 3. 6. 2. 2. 4. 2. 2. 2. 5. 9. 2. 4. 4. 2. 4. 3.] ]
59 The No. 2 iteration is finished!
60
61 Beging the No. 3 iteration:
62   obj[gen-1] = 96.39   temp_best_value_gen = 96.39
63   No, maintain solution and obj[gen] = 96.39 , and the tolerance_counter = 3
64   solution chromosome =
65     first level: [ [ 4.7  3.37  7.96  5.08  7.2  4.23  3.93  3.91  1.6  1.74  4.6  5.88
66 5.98  6.87  3.16  7.1  14.  16.  14.5 ]
67 second level: [ 7.  5.  1.  9. 11. 12. 16. 19.  1. 20. 23. 25. 26. 27. 31. 33.  4.  2.
68 8.]
69 third level: [4. 3. 2. 3. 6. 2. 2. 4. 2. 2. 2. 5. 9. 2. 4. 4. 2. 4. 3.] ]
70 The No. 3 iteration is finished!
71
72 Beging the No. 4 iteration:
73   obj[gen-1] = 96.39   temp_best_value_gen = 96.39
74   No, maintain solution and obj[gen] = 96.39 , and the tolerance_counter = 4
75   solution chromosome =
76     first level: [ [ 4.7  3.37  7.96  5.08  7.2  4.23  3.93  3.91  1.6  1.74  4.6  5.88
77 5.98  6.87  3.16  7.1  14.  16.  14.5 ]
78 second level: [ 7.  5.  1.  9. 11. 12. 16. 19.  1. 20. 23. 25. 26. 27. 31. 33.  4.  2.
79 8.]

```

```

80   third level: [4. 3. 2. 3. 6. 2. 2. 4. 2. 2. 5. 9. 2. 4. 4. 2. 4. 3.] ]
81   The No. 4 iteration is finished!
82
83   Beging the No. 5 iteration:
84   obj[gen-1]=96.39 temp_best_value_gen=96.39
85   No, maintain solution and obj[gen]=96.39 , and the tolerance_counter = 5
86   solution chromosome =
87   first level: [ [ 4.7  3.37 7.96 5.08 7.2  4.23 3.93 3.91 1.6  1.74 4.6  5.88
88   5.98 6.87 3.16 7.1 14.  16.  14.5 ]
89   second level: [ 7.  5.  1.  9. 11. 12. 16. 19.  1. 20. 23. 25. 26. 27. 31. 33.  4.  2.
90   8.]
91   third level: [4. 3. 2. 3. 6. 2. 2. 4. 2. 2. 5. 9. 2. 4. 4. 2. 4. 3.] ]
92   The No. 5 iteration is finished!
93
94   Beging the No. 6 iteration:
95   obj[gen-1]=96.39 temp_best_value_gen=96.39
96   No, maintain solution and obj[gen]=96.39 , and the tolerance_counter = 6
97   solution chromosome =
98   first level: [ [ 4.7  3.37 7.96 5.08 7.2  4.23 3.93 3.91 1.6  1.74 4.6  5.88
99   5.98 6.87 3.16 7.1 14.  16.  14.5 ]
100  second level: [ 7.  5.  1.  9. 11. 12. 16. 19.  1. 20. 23. 25. 26. 27. 31. 33.  4.  2.
101  8.]
102  third level: [4. 3. 2. 3. 6. 2. 2. 4. 2. 2. 5. 9. 2. 4. 4. 2. 4. 3.] ]
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: [ [ 4.7  3.37 7.96 5.08 7.2  4.23 3.93 3.91 1.6  1.74 4.6  5.88
110 5.98 6.87 3.16 7.1 14.  16.  14.5 ]
111 second level: [ 7.  5.  1.  9. 11. 12. 16. 19.  1. 20. 23. 25. 26. 27. 31. 33.  4.  2.
112 8.]
113 third level: [4. 3. 2. 3. 6. 2. 2. 4. 2. 2. 5. 9. 2. 4. 4. 2. 4. 3.] ]
114 Objective function values and some other indicators:
115 Obj0 = 34.00      Obj1 = 317.92      Obj0 + Obj1 = 351.92
116 Total movement of crane: 37.92
117 Total waiting time in berth position: 280.00
118 Total index of q during berthing: 397.00
119 Specific arrangement for each vessel:
120 V_id: 0      li: 6.0      xi: 4.7      bow of i: 1.7      tail of i: 7.7      gama_i0: 7.0      gama_i1: 9.0
      duration_time_i: 2.0      demand_i: 140.0      work load_i: 140.0      work load gap_i: 0
121 V_id: 1      li: 5.0      xi: 3.4      bow of i: 0.9      tail of i: 5.9      gama_i0: 5.0      gama_i1: 7.0
      duration_time_i: 2.0      demand_i: 120.0      work load_i: 120.0      work load gap_i: 0
122 V_id: 2      li: 9.0      xi: 8.0      bow of i: 3.5      tail of i: 12.5      gama_i0: 1.0      gama_i1: 5.0
      duration_time_i: 4.0      demand_i: 140.0      work load_i: 140.0      work load gap_i: 0
123 V_id: 3      li: 8.0      xi: 5.1      bow of i: 1.1      tail of i: 9.1      gama_i0: 9.0      gama_i1: 11.0
      duration_time_i: 2.0      demand_i: 120.0      work load_i: 120.0      work load gap_i: 0
124 V_id: 4      li: 9.0      xi: 7.2      bow of i: 2.7      tail of i: 11.7      gama_i0: 11.0      gama_i1: 12.
0      duration_time_i: 1.0      demand_i: 80.0      work load_i: 80.0      work load gap_i: 0
125 V_id: 5      li: 6.0      xi: 4.2      bow of i: 1.2      tail of i: 7.2      gama_i0: 12.0      gama_i1: 16.0
      duration_time_i: 4.0      demand_i: 160.0      work load_i: 160.0      work load gap_i: 0
126 V_id: 6      li: 7.0      xi: 3.9      bow of i: 0.4      tail of i: 7.4      gama_i0: 16.0      gama_i1: 19.0
      duration_time_i: 3.0      demand_i: 100.0      work load_i: 100.0      work load gap_i: 0
127 V_id: 7      li: 5.0      xi: 3.9      bow of i: 1.4      tail of i: 6.4      gama_i0: 19.0      gama_i1: 20.0
      duration_time_i: 1.0      demand_i: 60.0      work load_i: 60.0      work load gap_i: 0
128 V_id: 8      li: 3.0      xi: 1.6      bow of i: 0.1      tail of i: 3.1      gama_i0: 1.0      gama_i1: 4.0
      duration_time_i: 3.0      demand_i: 100.0      work load_i: 100.0      work load gap_i: 0
129 V_id: 9      li: 3.0      xi: 1.7      bow of i: 0.2      tail of i: 3.2      gama_i0: 20.0      gama_i1: 23.0
      duration_time_i: 3.0      demand_i: 120.0      work load_i: 120.0      work load gap_i: 0
130 V_id: 10     li: 7.0      xi: 4.6      bow of i: 1.1      tail of i: 8.1      gama_i0: 23.0      gama_i1: 25.
0      duration_time_i: 2.0      demand_i: 60.0      work load_i: 60.0      work load gap_i: 0
131 V_id: 11     li: 7.0      xi: 5.9      bow of i: 2.4      tail of i: 9.4      gama_i0: 25.0      gama_i1: 26.
0      duration_time_i: 1.0      demand_i: 60.0      work load_i: 60.0      work load gap_i: 0
132 V_id: 12     li: 9.0      xi: 6.0      bow of i: 1.5      tail of i: 10.5      gama_i0: 26.0      gama_i1:
27.0      duration_time_i: 1.0      demand_i: 80.0      work load_i: 80.0      work load gap_i: 0
133 V_id: 13     li: 8.0      xi: 6.9      bow of i: 2.9      tail of i: 10.9      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
134 V_id: 14     li: 6.0      xi: 3.2      bow of i: 0.2      tail of i: 6.2      gama_i0: 31.0      gama_i1: 33.
0      duration_time_i: 2.0      demand_i: 160.0      work load_i: 160.0      work load gap_i: 0
135 V_id: 15     li: 9.0      xi: 7.1      bow of i: 2.6      tail of i: 11.6      gama_i0: 33.0      gama_i1:
35.0      duration_time_i: 2.0      demand_i: 160.0      work load_i: 160.0      work load gap_i: 0
136 V_id: 16     li: 3.0      xi: 14.0      bow of i: 12.5      tail of i: 15.5      gama_i0: 4.0      gama_i1
: 8.0      duration_time_i: 4.0      demand_i: 160.0      work load_i: 160.0      work load gap_i: 0
137 V_id: 17     li: 7.0      xi: 16.0      bow of i: 12.5      tail of i: 19.5      gama_i0: 2.0      gama_i1
: 4.0      duration_time_i: 2.0      demand_i: 100.0      work load_i: 100.0      work load gap_i: 0
138 V_id: 18     li: 4.0      xi: 14.5      bow of i: 12.5      tail of i: 16.5      gama_i0: 8.0      gama_i1
: 10.0      duration_time_i: 2.0      demand_i: 80.0      work load_i: 80.0      work load gap_i: 0
139
140 Algorithm finished and the total CPU time: 1324 s
141 End
142

```