

```

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=59220
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_2_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= 0.10000000000000009
32     gen = 0
33
34 Iteration begin:
35 Beging the No. 0 iteration:
36   obj[0] = 71.00   temp_best_value_gen = 71.00
37   The No. 0 iteration is finished!
38
39 Beging the No. 1 iteration:
40   obj[gen-1] = 71.00   temp_best_value_gen = 71.00
41   No, maintain solution and obj[gen] = 71.00 , and the tolerance_counter = 1
42   solution chromosome =
43     first level: [ [ 3. 8.5 15. 4.5 26.5 3. 4. 3.5 3.5 4. 1.5 23.5 2. 4.5
44 4. 4.5 3.5 3. 3. ]
45     second level: [ 1. 6. 0. 17. 3. 2. 4. 8. 9. 11. 14. 0. 6. 0. 19. 20. 21. 23.
46 25.]
47     third level: [6. 5. 2. 2. 2. 3. 3. 5. 3. 3. 2. 2. 4. 7. 6. 7. 3. 4. 3. ] ]
48   The No. 1 iteration is finished!
49
50 Beging the No. 2 iteration:
51   obj[gen-1] = 71.00   temp_best_value_gen = 71.00
52   No, maintain solution and obj[gen] = 71.00 , and the tolerance_counter = 2
53   solution chromosome =
54     first level: [ [ 3. 8.5 15. 4.5 26.5 3. 4. 3.5 3.5 4. 1.5 23.5 2. 4.5
55 4. 4.5 3.5 3. 3. ]
56     second level: [ 1. 6. 0. 17. 3. 2. 4. 8. 9. 11. 14. 0. 6. 0. 19. 20. 21. 23.
57 25.]
58     third level: [6. 5. 2. 2. 2. 3. 3. 5. 3. 3. 2. 2. 4. 7. 6. 7. 3. 4. 3. ] ]
59   The No. 2 iteration is finished!
60
61 Beging the No. 3 iteration:
62   obj[gen-1] = 71.00   temp_best_value_gen = 71.00
63   No, maintain solution and obj[gen] = 71.00 , and the tolerance_counter = 3
64   solution chromosome =
65     first level: [ [ 3. 8.5 15. 4.5 26.5 3. 4. 3.5 3.5 4. 1.5 23.5 2. 4.5
66 4. 4.5 3.5 3. 3. ]
67     second level: [ 1. 6. 0. 17. 3. 2. 4. 8. 9. 11. 14. 0. 6. 0. 19. 20. 21. 23.
68 25.]
69     third level: [6. 5. 2. 2. 2. 3. 3. 5. 3. 3. 2. 2. 4. 7. 6. 7. 3. 4. 3. ] ]
70   The No. 3 iteration is finished!
71
72 Beging the No. 4 iteration:
73   obj[gen-1] = 71.00   temp_best_value_gen = 71.00
74   No, maintain solution and obj[gen] = 71.00 , and the tolerance_counter = 4
75   solution chromosome =
76     first level: [ [ 3. 8.5 15. 4.5 26.5 3. 4. 3.5 3.5 4. 1.5 23.5 2. 4.5
77 4. 4.5 3.5 3. 3. ]
78     second level: [ 1. 6. 0. 17. 3. 2. 4. 8. 9. 11. 14. 0. 6. 0. 19. 20. 21. 23.
79 25.]

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80   third level: [6. 5. 2. 2. 2. 3. 3. 5. 3. 3. 2. 2. 4. 7. 6. 7. 3. 4. 3.]
81   The No. 4 iteration is finished!
82
83   Beging the No. 5 iteration:
84   obj[gen-1] = 71.00   temp_best_value_gen = 71.00
85   No, maintain solution and obj[gen] = 71.00 , and the tolerance_counter = 5
86   solution chromosome =
87   first level: [ [ 3. 8.5 15. 4.5 26.5 3. 4. 3.5 3.5 4. 1.5 23.5 2. 4.5
88   4. 4.5 3.5 3. 3. ]
89   second level: [ 1. 6. 0. 17. 3. 2. 4. 8. 9. 11. 14. 0. 6. 0. 19. 20. 21. 23.
90   25.]
91   third level: [6. 5. 2. 2. 2. 3. 3. 5. 3. 3. 2. 2. 4. 7. 6. 7. 3. 4. 3.]
92   The No. 5 iteration is finished!
93
94   Beging the No. 6 iteration:
95   obj[gen-1] = 71.00   temp_best_value_gen = 71.00
96   No, maintain solution and obj[gen] = 71.00 , and the tolerance_counter = 6
97   solution chromosome =
98   first level: [ [ 3. 8.5 15. 4.5 26.5 3. 4. 3.5 3.5 4. 1.5 23.5 2. 4.5
99   4. 4.5 3.5 3. 3. ]
100  second level: [ 1. 6. 0. 17. 3. 2. 4. 8. 9. 11. 14. 0. 6. 0. 19. 20. 21. 23.
101  25.]
102  third level: [6. 5. 2. 2. 2. 3. 3. 5. 3. 3. 2. 2. 4. 7. 6. 7. 3. 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: [ [ 3. 8.5 15. 4.5 26.5 3. 4. 3.5 3.5 4. 1.5 23.5 2. 4.5
110 4. 4.5 3.5 3. 3. ]
111 second level: [ 1. 6. 0. 17. 3. 2. 4. 8. 9. 11. 14. 0. 6. 0. 19. 20. 21. 23.
112 25.]
113 third level: [6. 5. 2. 2. 2. 3. 3. 5. 3. 3. 2. 2. 4. 7. 6. 7. 3. 4. 3.]
114 Objective function values and some other indicators:
115 Obj0 = 27.00   Obj1 = 197.00   Obj0 + Obj1 = 224.00
116 Total movement of crane: 8.00
117 Total waiting time in berth position: 189.00
118 Total index of q during berthing: 444.00
119 Specific arrangement for each vessel:
120 V_id: 0   li: 6.0   xi: 3.0   bow of i: 0.0   tail of i: 6.0   gama_i0: 1.0   gama_i1: 2.0
      duration_time_i: 1.0   demand_i: 80.0   work load_i: 80.0   work load gap_i: 0
121 V_id: 1   li: 5.0   xi: 8.5   bow of i: 6.0   tail of i: 11.0   gama_i0: 6.0   gama_i1: 8.0
      duration_time_i: 2.0   demand_i: 160.0   work load_i: 160.0   work load gap_i: 0
122 V_id: 2   li: 8.0   xi: 15.0   bow of i: 11.0   tail of i: 19.0   gama_i0: 0.0   gama_i1: 2
      duration_time_i: 2.0   demand_i: 60.0   work load_i: 60.0   work load gap_i: 0
123 V_id: 3   li: 9.0   xi: 4.5   bow of i: 0.0   tail of i: 9.0   gama_i0: 17.0   gama_i1: 19.0
      duration_time_i: 2.0   demand_i: 60.0   work load_i: 60.0   work load gap_i: 0
124 V_id: 4   li: 7.0   xi: 26.5   bow of i: 23.0   tail of i: 30.0   gama_i0: 3.0   gama_i1: 7
      duration_time_i: 4.0   demand_i: 160.0   work load_i: 160.0   work load gap_i: 0
125 V_id: 5   li: 6.0   xi: 3.0   bow of i: 0.0   tail of i: 6.0   gama_i0: 2.0   gama_i1: 4.0
      duration_time_i: 2.0   demand_i: 120.0   work load_i: 120.0   work load gap_i: 0
126 V_id: 6   li: 8.0   xi: 4.0   bow of i: 0.0   tail of i: 8.0   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
127 V_id: 7   li: 7.0   xi: 3.5   bow of i: 0.0   tail of i: 7.0   gama_i0: 8.0   gama_i1: 9.0
      duration_time_i: 1.0   demand_i: 80.0   work load_i: 80.0   work load gap_i: 0
128 V_id: 8   li: 7.0   xi: 3.5   bow of i: 0.0   tail of i: 7.0   gama_i0: 9.0   gama_i1: 11.0
      duration_time_i: 2.0   demand_i: 100.0   work load_i: 100.0   work load gap_i: 0
129 V_id: 9   li: 8.0   xi: 4.0   bow of i: 0.0   tail of i: 8.0   gama_i0: 11.0   gama_i1: 14.0
      duration_time_i: 3.0   demand_i: 160.0   work load_i: 160.0   work load gap_i: 0
130 V_id: 10  li: 3.0   xi: 1.5   bow of i: 0.0   tail of i: 3.0   gama_i0: 14.0   gama_i1: 17.
      duration_time_i: 3.0   demand_i: 100.0   work load_i: 100.0   work load gap_i: 0
131 V_id: 11  li: 7.0   xi: 23.5   bow of i: 20.0   tail of i: 27.0   gama_i0: 0.0   gama_i1
      duration_time_i: 2.0   demand_i: 80.0   work load_i: 80.0   work load gap_i: 0
132 V_id: 12  li: 4.0   xi: 2.0   bow of i: 0.0   tail of i: 4.0   gama_i0: 6.0   gama_i1: 7.0
      duration_time_i: 1.0   demand_i: 60.0   work load_i: 60.0   work load gap_i: 0
133 V_id: 13  li: 9.0   xi: 4.5   bow of i: 0.0   tail of i: 9.0   gama_i0: 0.0   gama_i1: 1.0
      duration_time_i: 1.0   demand_i: 140.0   work load_i: 140.0   work load gap_i: 0
134 V_id: 14  li: 8.0   xi: 4.0   bow of i: 0.0   tail of i: 8.0   gama_i0: 19.0   gama_i1: 20.
      duration_time_i: 1.0   demand_i: 120.0   work load_i: 120.0   work load gap_i: 0
135 V_id: 15  li: 9.0   xi: 4.5   bow of i: 0.0   tail of i: 9.0   gama_i0: 20.0   gama_i1: 21.
      duration_time_i: 1.0   demand_i: 60.0   work load_i: 60.0   work load gap_i: 0
136 V_id: 16  li: 7.0   xi: 3.5   bow of i: 0.0   tail of i: 7.0   gama_i0: 21.0   gama_i1: 23.
      duration_time_i: 2.0   demand_i: 120.0   work load_i: 120.0   work load gap_i: 0
137 V_id: 17  li: 6.0   xi: 3.0   bow of i: 0.0   tail of i: 6.0   gama_i0: 23.0   gama_i1: 25.
      duration_time_i: 2.0   demand_i: 100.0   work load_i: 100.0   work load gap_i: 0
138 V_id: 18  li: 6.0   xi: 3.0   bow of i: 0.0   tail of i: 6.0   gama_i0: 25.0   gama_i1: 28.
      duration_time_i: 3.0   demand_i: 140.0   work load_i: 140.0   work load gap_i: 0
139
140 Algorithm finished and the total CPU time: 1314 s
141 End
142

```