```
1  "E:\1 □□□□\3 □□□□□\1 □□□□□□□\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=54708
2
3  import sys; print('Python %s on %s' % (sys.version, sys.platform))
4  sys.path.extend(['E:\\1 □□□□\\3 □□□□□\\1 □□□□□□□\\1 □□□□□□□□□\\1_□□□□□□_□□□□\\1_LW_□□□□□2\\6 □□□□\\2 python code\\
   01_My_Python_Code', 'E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□/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 □□□□□□□□□/1_□□□□□□_□□□□/1_LW_□□□□□2/6 □□□□/2 python code/01_My_Python_Code/
   main_BACASP_official_ENSGA-II.py', wdir='E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□/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_9_3 _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 =  27
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] = 35.30     temp_best_value_gen = 35.30
37     The No. 0  iteration is finished!
38
39  Beging the No. 1  iteration:
40     obj[gen-1] = 35.30   temp_best_value_gen = 32.20
41     Yes, update solution and obj[gen] = 32.20
42     solution chromosome =
43       first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
44       second level:  [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
45       third level:  [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
46     The No. 1  iteration is finished!
47
48  Beging the No. 2  iteration:
49     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
50     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 1
51     solution chromosome =
52       first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
53       second level:  [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
54       third level:  [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
55     The No. 2  iteration is finished!
56
57  Beging the No. 3  iteration:
58     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
59     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 2
60     solution chromosome =
61       first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
62       second level:  [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
63       third level:  [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
64     The No. 3  iteration is finished!
65
66  Beging the No. 4  iteration:
67     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
68     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 3
69     solution chromosome =
70       first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
71       second level:  [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
72       third level:  [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
73     The No. 4  iteration is finished!
74
75  Beging the No. 5  iteration:
76     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
77     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 4
78     solution chromosome =
79       first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
```

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 80      second level: [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
 81      third level: [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
 82    The No. 5  iteration is finished!
 83
 84  Beging the No. 6  iteration:
 85     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
 86     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 5
 87     solution chromosome =
 88      first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
 89      second level: [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
 90      third level: [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
 91    The No. 6  iteration is finished!
 92
 93  Beging the No. 7  iteration:
 94     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
 95     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 6
 96     solution chromosome =
 97      first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
 98      second level: [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
 99      third level: [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
100    The No. 7  iteration is finished!
101
102  Beging the No. 8  iteration:
103     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
104     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 7
105     solution chromosome =
106      first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
107      second level: [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
108      third level: [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
109    The No. 8  iteration is finished!
110
111  Beging the No. 9  iteration:
112     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
113     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 8
114     solution chromosome =
115      first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
116      second level: [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
117      third level: [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
118    The No. 9  iteration is finished!
119
120  Beging the No. 10  iteration:
121     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
122     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 9
123     solution chromosome =
124      first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
125      second level: [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
126      third level: [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
127    The No. 10  iteration is finished!
128
129  Beging the No. 11  iteration:
130     obj[gen-1] = 32.20   temp_best_value_gen = 32.20
131     No, maintain solution  and obj[gen] = 32.20 , and the tolerance_counter = 10
132     solution chromosome =
133      first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
134      second level: [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
135      third level: [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
136    The No. 11  iteration is finished!
137
138
139  --------------------------------------------------------------------------------------
140  The iteration is terminated and then visulize the solution:
141     solution chromosome =
142      first level: [ [ 1.5  5.   9.5 13.5  4.5 26.5 27.5  4.  19.5]
143      second level: [ 0.  4.  7.  8. 11.  0.  4.  8.  2.]
144      third level: [2. 2. 5. 3. 2. 2. 4. 3. 2.] ]
145     Objective function values and some other indicators:
146       Obj0 = 12.00          Obj1 = 94.00          Obj0 + Obj1 = 106.00
147       Total movement of crane: 50.00
148       Total waiting time in berth position: 44.00
149       Total index of q during berthing: 554.00
150     Specific arrangement for each vessel:
```

| 151 | V_id: 0 | li: 3.0 | xi: 1.5 | bow of i: 0.0 | tail of i: 3.0 | gama_i0: 0.0 | gama_i1: 4.0 |
| | | duration_time_i: 4.0 | demand_i: 140.0 | work load_i: 140.0 | work load gap_i: 0 | | |
| 152 | V_id: 1 | li: 4.0 | xi: 5.0 | bow of i: 3.0 | tail of i: 7.0 | gama_i0: 4.0 | gama_i1: 7.0 |
| | | duration_time_i: 3.0 | demand_i: 120.0 | work load_i: 120.0 | work load gap_i: 0 | | |
| 153 | V_id: 2 | li: 5.0 | xi: 9.5 | bow of i: 7.0 | tail of i: 12.0 | gama_i0: 7.0 | gama_i1: 8.0 |
| | | duration_time_i: 1.0 | demand_i: 80.0 | work load_i: 80.0 | work load gap_i: 0 | | |
| 154 | V_id: 3 | li: 3.0 | xi: 13.5 | bow of i: 12.0 | tail of i: 15.0 | gama_i0: 8.0 | gama_i1: 10.0 |
| | | duration_time_i: 2.0 | demand_i: 100.0 | work load_i: 100.0 | work load gap_i: 0 | | |
| 155 | V_id: 4 | li: 9.0 | xi: 4.5 | bow of i: 0.0 | tail of i: 9.0 | gama_i0: 11.0 | gama_i1: 13.0 |
| | | duration_time_i: 2.0 | demand_i: 80.0 | work load_i: 80.0 | work load gap_i: 0 | | |
| 156 | V_id: 5 | li: 5.0 | xi: 26.5 | bow of i: 24.0 | tail of i: 29.0 | gama_i0: 0.0 | gama_i1: 4.0 |
| | | duration_time_i: 4.0 | demand_i: 140.0 | work load_i: 140.0 | work load gap_i: 0 | | |
| 157 | V_id: 6 | li: 5.0 | xi: 27.5 | bow of i: 25.0 | tail of i: 30.0 | gama_i0: 4.0 | gama_i1: 6 |

| 157 | .0 | | duration_time_i: 2.0 | | demand_i: 160.0 | | work load_i: 160.0 | | work load gap_i: 0 | | |
|-----|----|---|----------------------|---|----------------|---|-------------------|---|--------------------|---|---|
| 158 | V_id: 7 | li: 8.0 | xi: 4.0 | | bow of i: 0.0 | | tail of i: 8.0 | | gama_i0: 8.0 | | gama_i1: 11.0 |
| | | duration_time_i: 3.0 | | demand_i: 160.0 | | work load_i: 160.0 | | work load gap_i: 0 | | | |
| 159 | V_id: 8 | li: 9.0 | xi: 19.5 | | bow of i: 15.0 | | tail of i: 24.0 | | gama_i0: 2.0 | | gama_i1: 6 |
| | .0 | | duration_time_i: 4.0 | | demand_i: 140.0 | | work load_i: 140.0 | | work load gap_i: 0 | | |
| 160 | | | | | | | | | | | |
| 161 | Algorithm finished and the total CPU time: 1110 s | | | | | | | | | | |
| 162 | End | | | | | | | | | | |
| 163 | | | | | | | | | | | |