



```
80     second level: [4. 1.]
81     third level: [2. 2.] ]
82     The No. 5 iteration is finished!
83
84     Beging the No. 6 iteration:
85     obj[gen-1] = 11.00   temp_best_value_gen = 11.00
86     No, maintain solution and obj[gen] = 11.00 , and the tolerance_counter = 2
87     solution chromosome =
88     first level: [ [2. 8.]
89     second level: [4. 1.]
90     third level: [2. 2.] ]
91     The No. 6 iteration is finished!
92
93     Beging the No. 7 iteration:
94     obj[gen-1] = 11.00   temp_best_value_gen = 11.00
95     No, maintain solution and obj[gen] = 11.00 , and the tolerance_counter = 3
96     solution chromosome =
97     first level: [ [2. 8.]
98     second level: [4. 1.]
99     third level: [2. 2.] ]
100    The No. 7 iteration is finished!
101
102    Beging the No. 8 iteration:
103    obj[gen-1] = 11.00   temp_best_value_gen = 11.00
104    No, maintain solution and obj[gen] = 11.00 , and the tolerance_counter = 4
105    solution chromosome =
106    first level: [ [2. 8.]
107    second level: [4. 1.]
108    third level: [2. 2.] ]
109    The No. 8 iteration is finished!
110
111    Beging the No. 9 iteration:
112    obj[gen-1] = 11.00   temp_best_value_gen = 5.00
113    Yes, update solution and obj[gen] = 5.00
114    solution chromosome =
115    first level: [ [2. 8.]
116    second level: [1. 1.]
117    third level: [2. 2.] ]
118    The No. 9 iteration is finished!
119
120    Beging the No. 10 iteration:
121    obj[gen-1] = 5.00   temp_best_value_gen = 5.00
122    No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 1
123    solution chromosome =
124    first level: [ [2. 8.]
125    second level: [1. 1.]
126    third level: [2. 2.] ]
127    The No. 10 iteration is finished!
128
129    Beging the No. 11 iteration:
130    obj[gen-1] = 5.00   temp_best_value_gen = 5.00
131    No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 2
132    solution chromosome =
133    first level: [ [2. 8.]
134    second level: [1. 1.]
135    third level: [2. 2.] ]
136    The No. 11 iteration is finished!
137
138    Beging the No. 12 iteration:
139    obj[gen-1] = 5.00   temp_best_value_gen = 5.00
140    No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 3
141    solution chromosome =
142    first level: [ [2. 8.]
143    second level: [1. 1.]
144    third level: [2. 2.] ]
145    The No. 12 iteration is finished!
146
147    Beging the No. 13 iteration:
148    obj[gen-1] = 5.00   temp_best_value_gen = 5.00
149    No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 4
150    solution chromosome =
151    first level: [ [2. 8.]
152    second level: [1. 1.]
153    third level: [2. 2.] ]
154    The No. 13 iteration is finished!
155
156    Beging the No. 14 iteration:
157    obj[gen-1] = 5.00   temp_best_value_gen = 5.00
158    No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 5
159    solution chromosome =
160    first level: [ [2. 8.]
161    second level: [1. 1.]
162    third level: [2. 2.] ]
163    The No. 14 iteration is finished!
```

```
164
165
166 -----
167 The iteration is terminated and then visulize the solution:
168   solution chromosome =
169     first level: [ [2. 8.]
170     second level: [1. 1.]
171     third level: [2. 2.] ]
172 Objective function values and some other indicators:
173   Obj0 = 4.00      Obj1 = 2.00      Obj0 + Obj1 = 6.00
174   Total movement of crane: 0.00
175   Total waiting time in berth position: 2.00
176   Total index of q during berthing: 31.00
177 Specific arrangement for each vessel:
178   V_id: 0          li: 4.0          xi: 2.0          bow of i: 0.0          tail of i: 4.0          gama_i0: 1.0          gama_i1: 5.0
179               duration_time_i: 4.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
179   V_id: 1          li: 8.0          xi: 8.0          bow of i: 4.0          tail of i: 12.0          gama_i0: 1.0          gama_i1: 4.0
179               duration_time_i: 3.0          demand_i: 120.0          work load_i: 120.0          work load gap_i: 0
180
181 Algorithm finished and the total CPU time: 114 s
182 End
183
```