


```
80     second level: [1. 4.]
81     third level: [3. 3.] ]
82     The No. 5 iteration is finished!
83
84 Beging the No. 6 iteration:
85     obj[gen-1] = 10.00   temp_best_value_gen = 10.00
86     No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 2
87     solution chromosome =
88         first level: [ [2. 8.]
89         second level: [1. 4.]
90         third level: [3. 3.] ]
91     The No. 6 iteration is finished!
92
93 Beging the No. 7 iteration:
94     obj[gen-1] = 10.00   temp_best_value_gen = 10.00
95     No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 3
96     solution chromosome =
97         first level: [ [2. 8.]
98         second level: [1. 4.]
99         third level: [3. 3.] ]
100    The No. 7 iteration is finished!
101
102 Beging the No. 8 iteration:
103     obj[gen-1] = 10.00   temp_best_value_gen = 10.00
104     No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 4
105     solution chromosome =
106         first level: [ [2. 8.]
107         second level: [1. 4.]
108         third level: [3. 3.] ]
109    The No. 8 iteration is finished!
110
111 Beging the No. 9 iteration:
112     obj[gen-1] = 10.00   temp_best_value_gen = 10.00
113     No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 5
114     solution chromosome =
115         first level: [ [2. 8.]
116         second level: [1. 4.]
117         third level: [3. 3.] ]
118    The No. 9 iteration is finished!
119
120 Beging the No. 10 iteration:
121     obj[gen-1] = 10.00   temp_best_value_gen = 10.00
122     No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 6
123     solution chromosome =
124         first level: [ [2. 8.]
125         second level: [1. 4.]
126         third level: [3. 3.] ]
127    The No. 10 iteration is finished!
128
129 Beging the No. 11 iteration:
130     obj[gen-1] = 10.00   temp_best_value_gen = 5.00
131     Yes, update solution and obj[gen] = 5.00
132     solution chromosome =
133         first level: [ [2. 8.]
134         second level: [1. 1.]
135         third level: [3. 3.] ]
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 = 1
141     solution chromosome =
142         first level: [ [2. 8.]
143         second level: [1. 1.]
144         third level: [3. 3.] ]
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 = 2
150     solution chromosome =
151         first level: [ [2. 8.]
152         second level: [1. 1.]
153         third level: [3. 3.] ]
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 = 3
159     solution chromosome =
160         first level: [ [2. 8.]
161         second level: [1. 1.]
162         third level: [3. 3.] ]
163    The No. 14 iteration is finished!
```

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164
165 Beging the No. 15 iteration:
166   obj[gen-1] = 5.00   temp_best_value_gen = 5.00
167   No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 4
168   solution chromosome =
169     first level: [ [2. 8.]
170     second level: [1. 1.]
171     third level: [3. 3.] ]
172   The No. 15 iteration is finished!
173
174 Beging the No. 16 iteration:
175   obj[gen-1] = 5.00   temp_best_value_gen = 5.00
176   No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 5
177   solution chromosome =
178     first level: [ [2. 8.]
179     second level: [1. 1.]
180     third level: [3. 3.] ]
181   The No. 16 iteration is finished!
182
183 Beging the No. 17 iteration:
184   obj[gen-1] = 5.00   temp_best_value_gen = 5.00
185   No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 6
186   solution chromosome =
187     first level: [ [2. 8.]
188     second level: [1. 1.]
189     third level: [3. 3.] ]
190   The No. 17 iteration is finished!
191
192 Beging the No. 18 iteration:
193   obj[gen-1] = 5.00   temp_best_value_gen = 5.00
194   No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 7
195   solution chromosome =
196     first level: [ [2. 8.]
197     second level: [1. 1.]
198     third level: [3. 3.] ]
199   The No. 18 iteration is finished!
200
201 Beging the No. 19 iteration:
202   obj[gen-1] = 5.00   temp_best_value_gen = 5.00
203   No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 8
204   solution chromosome =
205     first level: [ [2. 8.]
206     second level: [1. 1.]
207     third level: [3. 3.] ]
208   The No. 19 iteration is finished!
209
210 Beging the No. 20 iteration:
211   obj[gen-1] = 5.00   temp_best_value_gen = 5.00
212   No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 9
213   solution chromosome =
214     first level: [ [2. 8.]
215     second level: [1. 1.]
216     third level: [3. 3.] ]
217   The No. 20 iteration is finished!
218
219 Beging the No. 21 iteration:
220   obj[gen-1] = 5.00   temp_best_value_gen = 5.00
221   No, maintain solution and obj[gen] = 5.00 , and the tolerance_counter = 10
222   solution chromosome =
223     first level: [ [2. 8.]
224     second level: [1. 1.]
225     third level: [3. 3.] ]
226   The No. 21 iteration is finished!
227
228
229 -----
230 The iteration is terminated and then visulize the solution:
231   solution chromosome =
232     first level: [ [2. 8.]
233     second level: [1. 1.]
234     third level: [3. 3.] ]
235   Objective function values and some other indicators:
236   Obj0 = 3.00      Obj1 = 2.00      Obj0 + Obj1 = 5.00
237   Total movement of crane: 0.00
238   Total waiting time in berth position: 2.00
239   Total index of q during berthing: 37.00
240   Specific arrangement for each vessel:
241     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: 4.0
242     duration_time_i: 3.0      demand_i: 160.0      work load_i: 160.0      work load gap_i: 0
243     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: 3.0
244     duration_time_i: 2.0      demand_i: 120.0      work load_i: 120.0      work load gap_i: 0
245
244 Algorithm finished and the total CPU time: 190 s
245 End

```