


```

80     second level: [0. 2.]
81     third level: [4. 4.] ]
82     The No. 5 iteration is finished!
83
84     Beging the No. 6 iteration:
85     obj[gen-1] = 13.70 temp_best_value_gen = 13.70
86     No, maintain solution and obj[gen] = 13.70 , and the tolerance_counter = 5
87     solution chromosome =
88     first level: [ [2. 4.13]
89     second level: [0. 2.]
90     third level: [4. 4.] ]
91     The No. 6 iteration is finished!
92
93     Beging the No. 7 iteration:
94     obj[gen-1] = 13.70 temp_best_value_gen = 10.00
95     Yes, update solution and obj[gen] = 10.00
96     solution chromosome =
97     first level: [ [2. 4.09]
98     second level: [0. 2.]
99     third level: [4. 7.] ]
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 = 1
105    solution chromosome =
106    first level: [ [2. 4.09]
107    second level: [0. 2.]
108    third level: [4. 7.] ]
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 = 2
114    solution chromosome =
115    first level: [ [2. 4.09]
116    second level: [0. 2.]
117    third level: [4. 7.] ]
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 = 3
123    solution chromosome =
124    first level: [ [2. 4.09]
125    second level: [0. 2.]
126    third level: [4. 7.] ]
127    The No. 10 iteration is finished!
128
129    Beging the No. 11 iteration:
130    obj[gen-1] = 10.00 temp_best_value_gen = 10.00
131    No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 4
132    solution chromosome =
133    first level: [ [2. 4.09]
134    second level: [0. 2.]
135    third level: [4. 7.] ]
136    The No. 11 iteration is finished!
137
138    Beging the No. 12 iteration:
139    obj[gen-1] = 10.00 temp_best_value_gen = 10.00
140    No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 5
141    solution chromosome =
142    first level: [ [2. 4.09]
143    second level: [0. 2.]
144    third level: [4. 7.] ]
145    The No. 12 iteration is finished!
146
147    Beging the No. 13 iteration:
148    obj[gen-1] = 10.00 temp_best_value_gen = 10.00
149    No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 6
150    solution chromosome =
151    first level: [ [2. 4.09]
152    second level: [0. 2.]
153    third level: [4. 7.] ]
154    The No. 13 iteration is finished!
155
156    Beging the No. 14 iteration:
157    obj[gen-1] = 10.00 temp_best_value_gen = 10.00
158    No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 7
159    solution chromosome =
160    first level: [ [2. 4.09]
161    second level: [0. 2.]
162    third level: [4. 7.] ]
163    The No. 14 iteration is finished!

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164
165 Beging the No. 15 iteration:
166 obj[gen-1] = 10.00 temp_best_value_gen = 10.00
167 No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 8
168 solution chromosome =
169     first level: [ 2.  4.09]
170     second level: [0. 2.]
171     third level: [4. 7.] ]
172 The No. 15 iteration is finished!
173
174 Beging the No. 16 iteration:
175 obj[gen-1] = 10.00 temp_best_value_gen = 10.00
176 No, maintain solution and obj[gen] = 10.00 , and the tolerance_counter = 9
177 solution chromosome =
178     first level: [ 2.  4.09]
179     second level: [0. 2.]
180     third level: [4. 7.] ]
181 The No. 16 iteration is finished!
182
183 Beging the No. 17 iteration:
184 obj[gen-1] = 10.00 temp_best_value_gen = 8.28
185 Yes, update solution and obj[gen] = 8.28
186 solution chromosome =
187     first level: [ 2.01 4.16]
188     second level: [0. 3.]
189     third level: [4. 2.] ]
190 The No. 17 iteration is finished!
191
192 Beging the No. 18 iteration:
193 obj[gen-1] = 8.28 temp_best_value_gen = 8.28
194 No, maintain solution and obj[gen] = 8.28 , and the tolerance_counter = 1
195 solution chromosome =
196     first level: [ 2.01 4.16]
197     second level: [0. 3.]
198     third level: [4. 2.] ]
199 The No. 18 iteration is finished!
200
201 Beging the No. 19 iteration:
202 obj[gen-1] = 8.28 temp_best_value_gen = 8.28
203 No, maintain solution and obj[gen] = 8.28 , and the tolerance_counter = 2
204 solution chromosome =
205     first level: [ 2.01 4.16]
206     second level: [0. 3.]
207     third level: [4. 2.] ]
208 The No. 19 iteration is finished!
209
210 Beging the No. 20 iteration:
211 obj[gen-1] = 8.28 temp_best_value_gen = 8.28
212 No, maintain solution and obj[gen] = 8.28 , and the tolerance_counter = 3
213 solution chromosome =
214     first level: [ 2.01 4.16]
215     second level: [0. 3.]
216     third level: [4. 2.] ]
217 The No. 20 iteration is finished!
218
219 Beging the No. 21 iteration:
220 obj[gen-1] = 8.28 temp_best_value_gen = 8.28
221 No, maintain solution and obj[gen] = 8.28 , and the tolerance_counter = 4
222 solution chromosome =
223     first level: [ 2.01 4.16]
224     second level: [0. 3.]
225     third level: [4. 2.] ]
226 The No. 21 iteration is finished!
227
228 Beging the No. 22 iteration:
229 obj[gen-1] = 8.28 temp_best_value_gen = 8.28
230 No, maintain solution and obj[gen] = 8.28 , and the tolerance_counter = 5
231 solution chromosome =
232     first level: [ 2.01 4.16]
233     second level: [0. 3.]
234     third level: [4. 2.] ]
235 The No. 22 iteration is finished!
236
237 Beging the No. 23 iteration:
238 obj[gen-1] = 8.28 temp_best_value_gen = 8.28
239 No, maintain solution and obj[gen] = 8.28 , and the tolerance_counter = 6
240 solution chromosome =
241     first level: [ 2.01 4.16]
242     second level: [0. 3.]
243     third level: [4. 2.] ]
244 The No. 23 iteration is finished!
245
246 Beging the No. 24 iteration:
247 obj[gen-1] = 8.28 temp_best_value_gen = 8.28
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248 No, maintain solution and obj[gen] = 8.28 , and the tolerance_counter = 7
249 solution chromosome =
250 first level: [ [2.01 4.16]
251 second level: [0. 3.]
252 third level: [4. 2.] ]
253 The No. 24 iteration is finished!
254
255 Beging the No. 25 iteration:
256 obj[gen-1] = 8.28 temp_best_value_gen = 6.12
257 Yes, update solution and obj[gen] = 6.12
258 solution chromosome =
259 first level: [ [2.01 4.13]
260 second level: [0. 2.]
261 third level: [4. 2.] ]
262 The No. 25 iteration is finished!
263
264 Beging the No. 26 iteration:
265 obj[gen-1] = 6.12 temp_best_value_gen = 6.12
266 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 1
267 solution chromosome =
268 first level: [ [2.01 4.13]
269 second level: [0. 2.]
270 third level: [4. 2.] ]
271 The No. 26 iteration is finished!
272
273 Beging the No. 27 iteration:
274 obj[gen-1] = 6.12 temp_best_value_gen = 6.12
275 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 2
276 solution chromosome =
277 first level: [ [2.01 4.13]
278 second level: [0. 2.]
279 third level: [4. 2.] ]
280 The No. 27 iteration is finished!
281
282 Beging the No. 28 iteration:
283 obj[gen-1] = 6.12 temp_best_value_gen = 6.12
284 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 3
285 solution chromosome =
286 first level: [ [2.01 4.13]
287 second level: [0. 2.]
288 third level: [4. 2.] ]
289 The No. 28 iteration is finished!
290
291 Beging the No. 29 iteration:
292 obj[gen-1] = 6.12 temp_best_value_gen = 6.12
293 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 4
294 solution chromosome =
295 first level: [ [2.01 4.13]
296 second level: [0. 2.]
297 third level: [4. 2.] ]
298 The No. 29 iteration is finished!
299
300 Beging the No. 30 iteration:
301 obj[gen-1] = 6.12 temp_best_value_gen = 6.12
302 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 5
303 solution chromosome =
304 first level: [ [2.01 4.13]
305 second level: [0. 2.]
306 third level: [4. 2.] ]
307 The No. 30 iteration is finished!
308
309 Beging the No. 31 iteration:
310 obj[gen-1] = 6.12 temp_best_value_gen = 6.12
311 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 6
312 solution chromosome =
313 first level: [ [2.01 4.13]
314 second level: [0. 2.]
315 third level: [4. 2.] ]
316 The No. 31 iteration is finished!
317
318 Beging the No. 32 iteration:
319 obj[gen-1] = 6.12 temp_best_value_gen = 6.12
320 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 7
321 solution chromosome =
322 first level: [ [2.01 4.13]
323 second level: [0. 2.]
324 third level: [4. 2.] ]
325 The No. 32 iteration is finished!
326
327 Beging the No. 33 iteration:
328 obj[gen-1] = 6.12 temp_best_value_gen = 6.12
329 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 8
330 solution chromosome =
331 first level: [ [2.01 4.13]
```

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332     second level: [0. 2.]
333     third level: [4. 2.] ]
334 The No. 33 iteration is finished!
335
336 Beging the No. 34 iteration:
337 obj[gen-1] = 6.12   temp_best_value_gen = 6.12
338 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 9
339 solution chromosome =
340     first level: [ [2.01 4.13]
341     second level: [0. 2.]
342     third level: [4. 2.] ]
343 The No. 34 iteration is finished!
344
345 Beging the No. 35 iteration:
346 obj[gen-1] = 6.12   temp_best_value_gen = 6.12
347 No, maintain solution and obj[gen] = 6.12 , and the tolerance_counter = 10
348 solution chromosome =
349     first level: [ [2.01 4.13]
350     second level: [0. 2.]
351     third level: [4. 2.] ]
352 The No. 35 iteration is finished!
353
354
355 -----
356 The iteration is terminated and then visulize the solution:
357 solution chromosome =
358     first level: [ [2.01 4.13]
359     second level: [0. 2.]
360     third level: [4. 2.] ]
361 Objective function values and some other indicators:
362 Obj0 = 4.00      Obj1 = 2.74      Obj0 + Obj1 = 6.74
363 Total movement of crane: 0.74
364 Total waiting time in berth position: 2.00
365 Total index of q during berthing: 15.00
366 Specific arrangement for each vessel:
367   V_id: 0          li: 4.0          xi: 2.0          bow of i: 0.0          tail of i: 4.0          gama_i0: 0.0          gama_i1: 2.0
368           duration_time_i: 2.0          demand_i: 160.0          work load_i: 160.0          work load gap_i: 0
369           li: 8.0          xi: 4.1          bow of i: 0.1          tail of i: 8.1          gama_i0: 2.0          gama_i1: 5.0
370           duration_time_i: 3.0          demand_i: 120.0          work load_i: 120.0          work load gap_i: 0
371
370 Algorithm finished and the total CPU time: 283 s
371 End
372

```