

```
1 /Users/bmalapat/Documents/GitHub/pythonProject/venv  
/bin/python /Users/bmalapat/Documents/GitHub/  
pythonProject/main.py  
2 Ant Colony Optimization - TSP Bays29  
3  
4 Running ACO with the following parameters:  
5  
6 population: 1  
7 pheromone decay constant: 0.5  
8 online pheromone update: True  
9 alpha: 1  
10 beta: 5  
11 Q: 2000  
12 max iterations: 500  
13  
14 Ant Colony Construction in Progress...  
15  
16 Initial Tour Cost: 24303.381607168383  
17 Iterations Completed: 100  
18 Iterations Completed: 200  
19 Iterations Completed: 300  
20 Iterations Completed: 400  
21  
22 Best Route Found by ACO for Bays29:  
23 [2, 28, 25, 8, 4, 20, 1, 19, 9, 12, 3, 14, 17, 13,  
16, 21, 10, 18, 24, 6, 22, 26, 7, 23, 15, 0, 27, 5  
, 11]  
24 Cost of Best Route is 8450.839713540605 found at  
Iteration 148 by an Ant  
25 Running ACO with the following parameters:  
26  
27 population: 1  
28 pheromone decay constant: 0.5  
29 online pheromone update: True  
30 alpha: 1  
31 beta: 5  
32 Q: 2000  
33 max iterations: 500  
34  
35 Ant Colony Construction in Progress...  
36
```

```
37 Initial Tour Cost: 22334.65106622088
38 Iterations Completed: 100
39 Iterations Completed: 200
40 Iterations Completed: 300
41 Iterations Completed: 400
42
43 Best Route Found by ACO for Bays29:
44 [7, 26, 23, 15, 12, 9, 19, 1, 20, 27, 0, 5, 11, 8,
   4, 25, 28, 2, 3, 14, 17, 16, 21, 13, 10, 18, 24, 6
   , 22]
45 Cost of Best Route is 9301.821829852028 found at
   Iteration 118 by an Ant
46 Running ACO with the following parameters:
47
48 population: 1
49 pheromone decay constant: 0.5
50 online pheromone update: True
51 alpha: 1
52 beta: 5
53 Q: 2000
54 max iterations: 500
55
56 Ant Colony Construction in Progress...
57
58 Initial Tour Cost: 26886.06815851214
59 Iterations Completed: 100
60 Iterations Completed: 200
61 Iterations Completed: 300
62 Iterations Completed: 400
63
64 Best Route Found by ACO for Bays29:
65 [15, 12, 1, 19, 9, 3, 14, 13, 17, 16, 21, 10, 18,
   24, 6, 22, 26, 7, 23, 0, 27, 5, 11, 8, 4, 20, 25,
   28, 2]
66 Cost of Best Route is 8686.701671658611 found at
   Iteration 492 by an Ant
67 Running ACO with the following parameters:
68
69 population: 1
70 pheromone decay constant: 0.5
71 online pheromone update: True
```

```
72 alpha: 1
73 beta: 5
74 Q: 2000
75 max iterations: 500
76
77 Ant Colony Construction in Progress...
78
79 Initial Tour Cost: 24089.145792614912
80 Iterations Completed: 100
81 Iterations Completed: 200
82 Iterations Completed: 300
83 Iterations Completed: 400
84
85 Best Route Found by ACO for Bays29:
86 [11, 27, 0, 7, 26, 23, 15, 18, 3, 14, 13, 17, 16,
   21, 10, 24, 6, 22, 12, 9, 19, 1, 20, 5, 8, 4, 25,
   28, 2]
87 Cost of Best Route is 9030.00212916076 found at
   Iteration 146 by an Ant
88 Running ACO with the following parameters:
89
90 population: 1
91 pheromone decay constant: 0.5
92 online pheromone update: True
93 alpha: 1
94 beta: 5
95 Q: 2000
96 max iterations: 500
97
98 Ant Colony Construction in Progress...
99
100 Initial Tour Cost: 28378.08315514807
101 Iterations Completed: 100
102 Iterations Completed: 200
103 Iterations Completed: 300
104 Iterations Completed: 400
105
106 Best Route Found by ACO for Bays29:
107 [6, 24, 18, 3, 14, 17, 13, 21, 16, 10, 15, 12, 9,
    19, 1, 20, 4, 5, 11, 8, 25, 28, 2, 0, 27, 7, 23,
    26, 22]
```

```
108 Cost of Best Route is 9467.094597967647 found at
    Iteration 173 by an Ant
109 Running ACO with the following parameters:
110
111 population: 1
112 pheromone decay constant: 0.5
113 online pheromone update: True
114 alpha: 1
115 beta: 5
116 Q: 2000
117 max iterations: 500
118
119 Ant Colony Construction in Progress...
120
121 Initial Tour Cost: 27380.485532651037
122 Iterations Completed: 100
123 Iterations Completed: 200
124 Iterations Completed: 300
125 Iterations Completed: 400
126
127 Best Route Found by ACO for Bays29:
128 [9, 19, 1, 20, 4, 25, 28, 2, 8, 11, 5, 27, 0, 23,
    15, 18, 14, 3, 17, 13, 21, 16, 10, 24, 6, 22, 7,
    26, 12]
129 Cost of Best Route is 9424.06227981398 found at
    Iteration 403 by an Ant
130 Running ACO with the following parameters:
131
132 population: 1
133 pheromone decay constant: 0.5
134 online pheromone update: True
135 alpha: 1
136 beta: 5
137 Q: 2000
138 max iterations: 500
139
140 Ant Colony Construction in Progress...
141
142 Initial Tour Cost: 25423.544939091942
143 Iterations Completed: 100
144 Iterations Completed: 200
```

```
145 Iterations Completed: 300
146 Iterations Completed: 400
147
148 Best Route Found by ACO for Bays29:
149 [25, 2, 28, 4, 8, 11, 5, 27, 0, 23, 26, 7, 15, 18
    , 14, 3, 9, 19, 1, 20, 12, 17, 13, 21, 16, 10, 24
    , 6, 22]
150 Cost of Best Route is 9347.052448314365 found at
    Iteration 421 by an Ant
151 Running ACO with the following parameters:
152
153 population: 1
154 pheromone decay constant: 0.5
155 online pheromone update: True
156 alpha: 1
157 beta: 5
158 Q: 2000
159 max iterations: 500
160
161 Ant Colony Construction in Progress...
162
163 Initial Tour Cost: 22895.33730658414
164 Iterations Completed: 100
165 Iterations Completed: 200
166 Iterations Completed: 300
167 Iterations Completed: 400
168
169 Best Route Found by ACO for Bays29:
170 [3, 14, 17, 16, 21, 13, 10, 24, 18, 12, 9, 19, 1,
    20, 4, 25, 2, 28, 8, 11, 5, 0, 27, 7, 26, 23, 15,
    22, 6]
171 Cost of Best Route is 9074.561826364274 found at
    Iteration 372 by an Ant
172 Running ACO with the following parameters:
173
174 population: 1
175 pheromone decay constant: 0.5
176 online pheromone update: True
177 alpha: 1
178 beta: 5
179 Q: 2000
```

```
180 max iterations: 500
181
182 Ant Colony Construction in Progress...
183
184 Initial Tour Cost: 27529.18481984048
185 Iterations Completed: 100
186 Iterations Completed: 200
187 Iterations Completed: 300
188 Iterations Completed: 400
189
190 Best Route Found by ACO for Bays29:
191 [12, 15, 26, 23, 27, 0, 20, 1, 19, 9, 3, 14, 13,
   17, 16, 21, 10, 18, 24, 6, 22, 7, 5, 11, 8, 4, 25
   , 28, 2]
192 Cost of Best Route is 8890.509914666407 found at
   Iteration 19 by an Ant
193 Running ACO with the following parameters:
194
195 population: 1
196 pheromone decay constant: 0.5
197 online pheromone update: True
198 alpha: 1
199 beta: 5
200 Q: 2000
201 max iterations: 500
202
203 Ant Colony Construction in Progress...
204
205 Initial Tour Cost: 23189.316075671773
206 Iterations Completed: 100
207 Iterations Completed: 200
208 Iterations Completed: 300
209 Iterations Completed: 400
210
211 Best Route Found by ACO for Bays29:
212 [23, 0, 27, 5, 11, 8, 4, 25, 28, 2, 1, 20, 12, 9,
   19, 3, 14, 17, 13, 21, 16, 10, 18, 24, 6, 22, 15,
   26, 7]
213 Cost of Best Route is 9153.177758892405 found at
   Iteration 230 by an Ant
214 Running ACO with the following parameters:
```

```
215
216 population: 1
217 pheromone decay constant: 0.5
218 online pheromone update: True
219 alpha: 1
220 beta: 5
221 Q: 2000
222 max iterations: 500
223
224 Ant Colony Construction in Progress...
225
226 Initial Tour Cost: 27300.503325125377
227 Iterations Completed: 100
228 Iterations Completed: 200
229 Iterations Completed: 300
230 Iterations Completed: 400
231
232 Best Route Found by ACO for Bays29:
233 [8, 25, 28, 2, 1, 9, 19, 20, 4, 5, 11, 27, 0, 26,
   7, 23, 15, 12, 3, 14, 17, 13, 16, 21, 10, 18, 24,
   6, 22]
234 Cost of Best Route is 9200.80285814776 found at
   Iteration 162 by an Ant
235 Running ACO with the following parameters:
236
237 population: 3
238 pheromone decay constant: 0.5
239 online pheromone update: True
240 alpha: 1
241 beta: 5
242 Q: 2000
243 max iterations: 500
244
245 Ant Colony Construction in Progress...
246
247 Initial Tour Cost: 23249.83766744639
248 Iterations Completed: 100
249 Iterations Completed: 200
250 Iterations Completed: 300
251 Iterations Completed: 400
252
```

```
253 Best Route Found by ACO for Bays29:  
254 [20, 0, 27, 11, 5, 4, 8, 25, 28, 2, 1, 19, 9, 3,  
    12, 15, 26, 23, 7, 22, 6, 24, 18, 14, 17, 13, 16,  
    21, 10]  
255 Cost of Best Route is 8858.475352255642 found at  
    Iteration 465 by an Ant  
256 Running ACO with the following parameters:  
257  
258 population: 3  
259 pheromone decay constant: 0.5  
260 online pheromone update: True  
261 alpha: 1  
262 beta: 5  
263 Q: 2000  
264 max iterations: 500  
265  
266 Ant Colony Construction in Progress...  
267  
268 Initial Tour Cost: 21938.5720147263  
269 Iterations Completed: 100  
270 Iterations Completed: 200  
271 Iterations Completed: 300  
272 Iterations Completed: 400  
273  
274 Best Route Found by ACO for Bays29:  
275 [18, 12, 15, 26, 7, 23, 0, 27, 11, 5, 8, 4, 25, 28  
    , 2, 20, 1, 19, 9, 3, 14, 13, 21, 16, 17, 10, 24,  
    6, 22]  
276 Cost of Best Route is 9051.611205986825 found at  
    Iteration 443 by an Ant  
277 Running ACO with the following parameters:  
278  
279 population: 3  
280 pheromone decay constant: 0.5  
281 online pheromone update: True  
282 alpha: 1  
283 beta: 5  
284 Q: 2000  
285 max iterations: 500  
286  
287 Ant Colony Construction in Progress...
```

```
288
289 Initial Tour Cost: 25060.603462202394
290 Iterations Completed: 100
291 Iterations Completed: 200
292 Iterations Completed: 300
293 Iterations Completed: 400
294
295 Best Route Found by ACO for Bays29:
296 [12, 9, 19, 1, 20, 4, 2, 28, 25, 8, 5, 11, 27, 0,
   7, 26, 23, 15, 18, 14, 3, 17, 13, 21, 16, 10, 24,
   6, 22]
297 Cost of Best Route is 8998.346699160616 found at
   Iteration 162 by an Ant
298 Running ACO with the following parameters:
299
300 population: 3
301 pheromone decay constant: 0.5
302 online pheromone update: True
303 alpha: 1
304 beta: 5
305 Q: 2000
306 max iterations: 500
307
308 Ant Colony Construction in Progress...
309
310 Initial Tour Cost: 27101.16948928104
311 Iterations Completed: 100
312 Iterations Completed: 200
313 Iterations Completed: 300
314 Iterations Completed: 400
315
316 Best Route Found by ACO for Bays29:
317 [17, 13, 16, 21, 10, 14, 18, 15, 26, 7, 23, 0, 27
   , 5, 11, 8, 4, 28, 2, 25, 20, 1, 19, 9, 3, 12, 24
   , 6, 22]
318 Cost of Best Route is 9003.349459810668 found at
   Iteration 497 by an Ant
319 Running ACO with the following parameters:
320
321 population: 3
322 pheromone decay constant: 0.5
```

```
323 online pheromone update: True
324 alpha: 1
325 beta: 5
326 Q: 2000
327 max iterations: 500
328
329 Ant Colony Construction in Progress...
330
331 Initial Tour Cost: 25433.47269822546
332 Iterations Completed: 100
333 Iterations Completed: 200
334 Iterations Completed: 300
335 Iterations Completed: 400
336
337 Best Route Found by ACO for Bays29:
338 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
     14, 17, 13, 21, 16, 10, 18, 24, 6, 15, 12, 23, 26
     , 7, 22]
339 Cost of Best Route is 8554.74095924186 found at
     Iteration 384 by an Ant
340 Running ACO with the following parameters:
341
342 population: 3
343 pheromone decay constant: 0.5
344 online pheromone update: True
345 alpha: 1
346 beta: 5
347 Q: 2000
348 max iterations: 500
349
350 Ant Colony Construction in Progress...
351
352 Initial Tour Cost: 24731.434806225563
353 Iterations Completed: 100
354 Iterations Completed: 200
355 Iterations Completed: 300
356 Iterations Completed: 400
357
358 Best Route Found by ACO for Bays29:
359 [19, 9, 3, 14, 18, 12, 1, 20, 4, 25, 28, 2, 8, 11
     , 5, 27, 0, 7, 26, 23, 15, 22, 6, 24, 10, 13, 17,
```

```
359 16, 21]
360 Cost of Best Route is 9247.926012412589 found at
    Iteration 230 by an Ant
361 Running ACO with the following parameters:
362
363 population: 3
364 pheromone decay constant: 0.5
365 online pheromone update: True
366 alpha: 1
367 beta: 5
368 Q: 2000
369 max iterations: 500
370
371 Ant Colony Construction in Progress...
372
373 Initial Tour Cost: 23069.081862558047
374 Iterations Completed: 100
375 Iterations Completed: 200
376 Iterations Completed: 300
377 Iterations Completed: 400
378
379 Best Route Found by ACO for Bays29:
380 [1, 20, 4, 25, 28, 2, 8, 11, 5, 27, 0, 23, 15, 26
    , 7, 22, 6, 24, 18, 14, 3, 12, 9, 19, 13, 17, 16,
    21, 10]
381 Cost of Best Route is 9180.994032715083 found at
    Iteration 480 by an Ant
382 Running ACO with the following parameters:
383
384 population: 3
385 pheromone decay constant: 0.5
386 online pheromone update: True
387 alpha: 1
388 beta: 5
389 Q: 2000
390 max iterations: 500
391
392 Ant Colony Construction in Progress...
393
394 Initial Tour Cost: 24127.725533935005
395 Iterations Completed: 100
```

```
396 Iterations Completed: 200
397 Iterations Completed: 300
398 Iterations Completed: 400
399
400 Best Route Found by ACO for Bays29:
401 [26, 7, 27, 0, 20, 4, 5, 11, 8, 25, 28, 2, 1, 19,
    9, 3, 14, 17, 13, 21, 16, 10, 18, 24, 15, 12, 23,
    22, 6]
402 Cost of Best Route is 9332.007062631365 found at
    Iteration 78 by an Ant
403 Running ACO with the following parameters:
404
405 population: 3
406 pheromone decay constant: 0.5
407 online pheromone update: True
408 alpha: 1
409 beta: 5
410 Q: 2000
411 max iterations: 500
412
413 Ant Colony Construction in Progress...
414
415 Initial Tour Cost: 23546.873821899848
416 Iterations Completed: 100
417 Iterations Completed: 200
418 Iterations Completed: 300
419 Iterations Completed: 400
420
421 Best Route Found by ACO for Bays29:
422 [28, 2, 25, 4, 8, 5, 11, 27, 0, 23, 26, 7, 15, 12
    , 9, 19, 1, 20, 3, 14, 17, 13, 16, 21, 10, 18, 24
    , 6, 22]
423 Cost of Best Route is 8915.236040432219 found at
    Iteration 127 by an Ant
424 Running ACO with the following parameters:
425
426 population: 3
427 pheromone decay constant: 0.5
428 online pheromone update: True
429 alpha: 1
430 beta: 5
```

```
431 Q: 2000
432 max iterations: 500
433
434 Ant Colony Construction in Progress...
435
436 Initial Tour Cost: 22304.109866820705
437 Iterations Completed: 100
438 Iterations Completed: 200
439 Iterations Completed: 300
440 Iterations Completed: 400
441
442 Best Route Found by ACO for Bays29:
443 [13, 17, 16, 21, 10, 14, 3, 9, 19, 12, 23, 7, 26,
   15, 18, 24, 6, 22, 0, 27, 5, 11, 8, 4, 20, 1, 28,
   25, 2]
444 Cost of Best Route is 8980.135077579096 found at
   Iteration 42 by an Ant
445 Running ACO with the following parameters:
446
447 population: 3
448 pheromone decay constant: 0.5
449 online pheromone update: True
450 alpha: 1
451 beta: 5
452 Q: 2000
453 max iterations: 500
454
455 Ant Colony Construction in Progress...
456
457 Initial Tour Cost: 23069.266005859285
458 Iterations Completed: 100
459 Iterations Completed: 200
460 Iterations Completed: 300
461 Iterations Completed: 400
462
463 Best Route Found by ACO for Bays29:
464 [25, 28, 2, 4, 8, 5, 11, 27, 0, 23, 7, 26, 15, 12
   , 20, 1, 19, 9, 3, 14, 13, 21, 16, 17, 10, 18, 24
   , 6, 22]
465 Cost of Best Route is 8923.668089193716 found at
   Iteration 429 by an Ant
```

```
466 Running ACO with the following parameters:  
467  
468 population: 5  
469 pheromone decay constant: 0.5  
470 online pheromone update: True  
471 alpha: 1  
472 beta: 5  
473 Q: 2000  
474 max iterations: 500  
475  
476 Ant Colony Construction in Progress...  
477  
478 Initial Tour Cost: 24336.64205124949  
479 Iterations Completed: 100  
480 Iterations Completed: 200  
481 Iterations Completed: 300  
482 Iterations Completed: 400  
483  
484 Best Route Found by ACO for Bays29:  
485 [11, 5, 20, 0, 27, 7, 23, 15, 26, 22, 6, 24, 18,  
    10, 13, 17, 16, 21, 14, 3, 12, 9, 19, 1, 4, 8, 25  
    , 28, 2]  
486 Cost of Best Route is 8846.762949922595 found at  
    Iteration 496 by an Ant  
487 Running ACO with the following parameters:  
488  
489 population: 5  
490 pheromone decay constant: 0.5  
491 online pheromone update: True  
492 alpha: 1  
493 beta: 5  
494 Q: 2000  
495 max iterations: 500  
496  
497 Ant Colony Construction in Progress...  
498  
499 Initial Tour Cost: 24947.781761155842  
500 Iterations Completed: 100  
501 Iterations Completed: 200  
502 Iterations Completed: 300  
503 Iterations Completed: 400
```

```
504
505 Best Route Found by ACO for Bays29:
506 [9, 19, 1, 20, 28, 2, 25, 8, 4, 5, 11, 27, 0, 23,
    12, 3, 14, 18, 15, 26, 7, 22, 6, 24, 10, 21, 16,
    13, 17]
507 Cost of Best Route is 9063.25737928521 found at
    Iteration 155 by an Ant
508 Running ACO with the following parameters:
509
510 population: 5
511 pheromone decay constant: 0.5
512 online pheromone update: True
513 alpha: 1
514 beta: 5
515 Q: 2000
516 max iterations: 500
517
518 Ant Colony Construction in Progress...
519
520 Initial Tour Cost: 23417.774241477826
521 Iterations Completed: 100
522 Iterations Completed: 200
523 Iterations Completed: 300
524 Iterations Completed: 400
525
526 Best Route Found by ACO for Bays29:
527 [25, 28, 2, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12,
    23, 26, 7, 15, 18, 3, 14, 17, 13, 21, 16, 10, 24,
    6, 22]
528 Cost of Best Route is 9046.580916559766 found at
    Iteration 229 by an Ant
529 Running ACO with the following parameters:
530
531 population: 5
532 pheromone decay constant: 0.5
533 online pheromone update: True
534 alpha: 1
535 beta: 5
536 Q: 2000
537 max iterations: 500
538
```

```
539 Ant Colony Construction in Progress...
540
541 Initial Tour Cost: 24295.557581819412
542 Iterations Completed: 100
543 Iterations Completed: 200
544 Iterations Completed: 300
545 Iterations Completed: 400
546
547 Best Route Found by ACO for Bays29:
548 [23, 15, 26, 7, 27, 0, 5, 11, 8, 4, 25, 28, 2, 1,
   20, 12, 9, 19, 3, 14, 13, 17, 16, 21, 10, 18, 24,
   6, 22]
549 Cost of Best Route is 8940.28848541188 found at
   Iteration 212 by an Ant
550 Running ACO with the following parameters:
551
552 population: 5
553 pheromone decay constant: 0.5
554 online pheromone update: True
555 alpha: 1
556 beta: 5
557 Q: 2000
558 max iterations: 500
559
560 Ant Colony Construction in Progress...
561
562 Initial Tour Cost: 23463.969189037205
563 Iterations Completed: 100
564 Iterations Completed: 200
565 Iterations Completed: 300
566 Iterations Completed: 400
567
568 Best Route Found by ACO for Bays29:
569 [2, 28, 25, 4, 8, 11, 5, 27, 0, 20, 1, 19, 9, 12,
   23, 26, 7, 22, 6, 24, 15, 18, 14, 3, 17, 13, 21,
   16, 10]
570 Cost of Best Route is 8574.293578230041 found at
   Iteration 392 by an Ant
571 Running ACO with the following parameters:
572
573 population: 5
```

```
574 pheromone decay constant: 0.5
575 online pheromone update: True
576 alpha: 1
577 beta: 5
578 Q: 2000
579 max iterations: 500
580
581 Ant Colony Construction in Progress...
582
583 Initial Tour Cost: 23483.49665236525
584 Iterations Completed: 100
585 Iterations Completed: 200
586 Iterations Completed: 300
587 Iterations Completed: 400
588
589 Best Route Found by ACO for Bays29:
590 [2, 28, 25, 8, 11, 5, 4, 1, 20, 0, 27, 7, 26, 23,
   15, 12, 9, 19, 3, 14, 18, 17, 21, 16, 13, 10, 24,
   6, 22]
591 Cost of Best Route is 8986.85089507477 found at
   Iteration 206 by an Ant
592 Running ACO with the following parameters:
593
594 population: 5
595 pheromone decay constant: 0.5
596 online pheromone update: True
597 alpha: 1
598 beta: 5
599 Q: 2000
600 max iterations: 500
601
602 Ant Colony Construction in Progress...
603
604 Initial Tour Cost: 21703.1199933698
605 Iterations Completed: 100
606 Iterations Completed: 200
607 Iterations Completed: 300
608 Iterations Completed: 400
609
610 Best Route Found by ACO for Bays29:
611 [2, 28, 25, 4, 8, 11, 5, 27, 0, 20, 1, 9, 19, 3,
```

```
611 14, 13, 17, 16, 21, 10, 18, 24, 6, 22, 26, 7, 23,
612 15, 12]
612 Cost of Best Route is 8501.436989194806 found at
613 Iteration 145 by an Ant
613 Running ACO with the following parameters:
614
615 population: 5
616 pheromone decay constant: 0.5
617 online pheromone update: True
618 alpha: 1
619 beta: 5
620 Q: 2000
621 max iterations: 500
622
623 Ant Colony Construction in Progress...
624
625 Initial Tour Cost: 26163.441994669276
626 Iterations Completed: 100
627 Iterations Completed: 200
628 Iterations Completed: 300
629 Iterations Completed: 400
630
631 Best Route Found by ACO for Bays29:
632 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12,
633 3, 14, 17, 13, 21, 16, 10, 24, 18, 15, 26, 23, 7,
634 22, 6]
633 Cost of Best Route is 8555.132954182967 found at
634 Iteration 319 by an Ant
634 Running ACO with the following parameters:
635
636 population: 5
637 pheromone decay constant: 0.5
638 online pheromone update: True
639 alpha: 1
640 beta: 5
641 Q: 2000
642 max iterations: 500
643
644 Ant Colony Construction in Progress...
645
646 Initial Tour Cost: 22819.224282251344
```

```
647 Iterations Completed: 100
648 Iterations Completed: 200
649 Iterations Completed: 300
650 Iterations Completed: 400
651
652 Best Route Found by ACO for Bays29:
653 [26, 15, 12, 1, 19, 9, 3, 14, 17, 13, 21, 16, 10,
   18, 24, 6, 22, 7, 23, 27, 0, 5, 11, 8, 4, 20, 25,
   28, 2]
654 Cost of Best Route is 9126.70189854638 found at
   Iteration 188 by an Ant
655 Running ACO with the following parameters:
656
657 population: 5
658 pheromone decay constant: 0.5
659 online pheromone update: True
660 alpha: 1
661 beta: 5
662 Q: 2000
663 max iterations: 500
664
665 Ant Colony Construction in Progress...
666
667 Initial Tour Cost: 24283.088713860438
668 Iterations Completed: 100
669 Iterations Completed: 200
670 Iterations Completed: 300
671 Iterations Completed: 400
672
673 Best Route Found by ACO for Bays29:
674 [2, 28, 25, 4, 8, 11, 5, 27, 0, 23, 26, 7, 22, 15
   , 12, 20, 1, 19, 9, 3, 14, 17, 13, 16, 21, 10, 18
   , 24, 6]
675 Cost of Best Route is 8334.459195194753 found at
   Iteration 126 by an Ant
676 Running ACO with the following parameters:
677
678 population: 5
679 pheromone decay constant: 0.5
680 online pheromone update: True
681 alpha: 1
```

```
682 beta: 5
683 Q: 2000
684 max iterations: 500
685
686 Ant Colony Construction in Progress...
687
688 Initial Tour Cost: 25326.116743883533
689 Iterations Completed: 100
690 Iterations Completed: 200
691 Iterations Completed: 300
692 Iterations Completed: 400
693
694 Best Route Found by ACO for Bays29:
695 [28, 2, 25, 4, 8, 5, 11, 27, 0, 23, 7, 26, 15, 12
   , 20, 1, 19, 9, 3, 14, 13, 17, 16, 21, 10, 18, 24
   , 6, 22]
696 Cost of Best Route is 8572.763532058412 found at
   Iteration 228 by an Ant
697 Running ACO with the following parameters:
698
699 population: 7
700 pheromone decay constant: 0.5
701 online pheromone update: True
702 alpha: 1
703 beta: 5
704 Q: 2000
705 max iterations: 500
706
707 Ant Colony Construction in Progress...
708
709 Initial Tour Cost: 25535.96538446257
710 Iterations Completed: 100
711 Iterations Completed: 200
712 Iterations Completed: 300
713 Iterations Completed: 400
714
715 Best Route Found by ACO for Bays29:
716 [9, 19, 1, 20, 4, 25, 28, 2, 8, 5, 11, 27, 0, 7,
   26, 23, 12, 15, 18, 14, 3, 17, 13, 16, 21, 10, 24
   , 6, 22]
717 Cost of Best Route is 8957.497411126677 found at
```

```
717 Iteration 430 by an Ant
718 Running ACO with the following parameters:
719
720 population: 7
721 pheromone decay constant: 0.5
722 online pheromone update: True
723 alpha: 1
724 beta: 5
725 Q: 2000
726 max iterations: 500
727
728 Ant Colony Construction in Progress...
729
730 Initial Tour Cost: 22246.372019508497
731 Iterations Completed: 100
732 Iterations Completed: 200
733 Iterations Completed: 300
734 Iterations Completed: 400
735
736 Best Route Found by ACO for Bays29:
737 [0, 27, 5, 11, 8, 4, 25, 28, 2, 20, 1, 19, 9, 12,
    15, 23, 26, 7, 22, 6, 24, 18, 14, 3, 17, 13, 21,
    16, 10]
738 Cost of Best Route is 8947.979744234424 found at
    Iteration 192 by an Ant
739 Running ACO with the following parameters:
740
741 population: 7
742 pheromone decay constant: 0.5
743 online pheromone update: True
744 alpha: 1
745 beta: 5
746 Q: 2000
747 max iterations: 500
748
749 Ant Colony Construction in Progress...
750
751 Initial Tour Cost: 24555.800253515372
752 Iterations Completed: 100
753 Iterations Completed: 200
754 Iterations Completed: 300
```

```
755 Iterations Completed: 400
756
757 Best Route Found by ACO for Bays29:
758 [6, 24, 18, 14, 3, 9, 19, 1, 20, 4, 25, 28, 2, 8,
    5, 11, 27, 0, 23, 26, 7, 22, 15, 12, 10, 13, 17,
    21, 16]
759 Cost of Best Route is 9158.219314410704 found at
    Iteration 498 by an Ant
760 Running ACO with the following parameters:
761
762 population: 7
763 pheromone decay constant: 0.5
764 online pheromone update: True
765 alpha: 1
766 beta: 5
767 Q: 2000
768 max iterations: 500
769
770 Ant Colony Construction in Progress...
771
772 Initial Tour Cost: 21285.926638331082
773 Iterations Completed: 100
774 Iterations Completed: 200
775 Iterations Completed: 300
776 Iterations Completed: 400
777
778 Best Route Found by ACO for Bays29:
779 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
    14, 18, 12, 15, 23, 7, 26, 22, 6, 24, 10, 21, 13,
    17, 16]
780 Cost of Best Route is 8411.502686260328 found at
    Iteration 422 by an Ant
781 Running ACO with the following parameters:
782
783 population: 7
784 pheromone decay constant: 0.5
785 online pheromone update: True
786 alpha: 1
787 beta: 5
788 Q: 2000
789 max iterations: 500
```

```
790
791 Ant Colony Construction in Progress...
792
793 Initial Tour Cost: 21513.62405799123
794 Iterations Completed: 100
795 Iterations Completed: 200
796 Iterations Completed: 300
797 Iterations Completed: 400
798
799 Best Route Found by ACO for Bays29:
800 [15, 23, 0, 27, 11, 5, 8, 4, 25, 28, 2, 1, 20, 12
    , 9, 19, 3, 14, 13, 17, 16, 21, 10, 18, 24, 6, 22
    , 26, 7]
801 Cost of Best Route is 8988.309076764726 found at
    Iteration 142 by an Ant
802 Running ACO with the following parameters:
803
804 population: 7
805 pheromone decay constant: 0.5
806 online pheromone update: True
807 alpha: 1
808 beta: 5
809 Q: 2000
810 max iterations: 500
811
812 Ant Colony Construction in Progress...
813
814 Initial Tour Cost: 23004.68116575464
815 Iterations Completed: 100
816 Iterations Completed: 200
817 Iterations Completed: 300
818 Iterations Completed: 400
819
820 Best Route Found by ACO for Bays29:
821 [13, 17, 16, 21, 10, 14, 3, 12, 9, 19, 1, 20, 4, 8
    , 25, 28, 2, 5, 11, 27, 0, 7, 26, 23, 15, 18, 24,
    6, 22]
822 Cost of Best Route is 8902.79334414678 found at
    Iteration 488 by an Ant
823 Running ACO with the following parameters:
824
```

```
825 population: 7
826 pheromone decay constant: 0.5
827 online pheromone update: True
828 alpha: 1
829 beta: 5
830 Q: 2000
831 max iterations: 500
832
833 Ant Colony Construction in Progress...
834
835 Initial Tour Cost: 23289.71643089232
836 Iterations Completed: 100
837 Iterations Completed: 200
838 Iterations Completed: 300
839 Iterations Completed: 400
840
841 Best Route Found by ACO for Bays29:
842 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
   14, 17, 13, 21, 16, 10, 18, 24, 15, 12, 23, 26, 7
   , 22, 6]
843 Cost of Best Route is 8526.106302270218 found at
   Iteration 409 by an Ant
844 Running ACO with the following parameters:
845
846 population: 7
847 pheromone decay constant: 0.5
848 online pheromone update: True
849 alpha: 1
850 beta: 5
851 Q: 2000
852 max iterations: 500
853
854 Ant Colony Construction in Progress...
855
856 Initial Tour Cost: 22878.727602842016
857 Iterations Completed: 100
858 Iterations Completed: 200
859 Iterations Completed: 300
860 Iterations Completed: 400
861
862 Best Route Found by ACO for Bays29:
```

```
863 [22, 6, 24, 18, 3, 9, 19, 1, 20, 4, 25, 28, 2, 8,
      5, 11, 27, 0, 23, 26, 7, 15, 12, 14, 10, 13, 17,
      21, 16]
864 Cost of Best Route is 9056.061987442636 found at
     Iteration 406 by an Ant
865 Running ACO with the following parameters:
866
867 population: 7
868 pheromone decay constant: 0.5
869 online pheromone update: True
870 alpha: 1
871 beta: 5
872 Q: 2000
873 max iterations: 500
874
875 Ant Colony Construction in Progress...
876
877 Initial Tour Cost: 23157.78851645813
878 Iterations Completed: 100
879 Iterations Completed: 200
880 Iterations Completed: 300
881 Iterations Completed: 400
882
883 Best Route Found by ACO for Bays29:
884 [11, 5, 20, 1, 19, 9, 12, 3, 14, 17, 13, 21, 16,
      10, 18, 24, 6, 22, 15, 26, 23, 7, 27, 0, 4, 8, 25
      , 28, 2]
885 Cost of Best Route is 8814.981064265668 found at
     Iteration 84 by an Ant
886 Running ACO with the following parameters:
887
888 population: 7
889 pheromone decay constant: 0.5
890 online pheromone update: True
891 alpha: 1
892 beta: 5
893 Q: 2000
894 max iterations: 500
895
896 Ant Colony Construction in Progress...
897
```

```
898 Initial Tour Cost: 21453.574449263688
899 Iterations Completed: 100
900 Iterations Completed: 200
901 Iterations Completed: 300
902 Iterations Completed: 400
903
904 Best Route Found by ACO for Bays29:
905 [23, 12, 19, 9, 3, 14, 17, 13, 21, 16, 10, 18, 24
    , 6, 22, 15, 26, 7, 0, 27, 5, 11, 8, 4, 20, 1, 28
    , 25, 2]
906 Cost of Best Route is 8913.4578781475 found at
    Iteration 115 by an Ant
907 Running ACO with the following parameters:
908
909 population: 7
910 pheromone decay constant: 0.5
911 online pheromone update: True
912 alpha: 1
913 beta: 5
914 Q: 2000
915 max iterations: 500
916
917 Ant Colony Construction in Progress...
918
919 Initial Tour Cost: 25180.108881935426
920 Iterations Completed: 100
921 Iterations Completed: 200
922 Iterations Completed: 300
923 Iterations Completed: 400
924
925 Best Route Found by ACO for Bays29:
926 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
    14, 13, 17, 16, 21, 10, 18, 24, 6, 15, 12, 23, 26
    , 7, 22]
927 Cost of Best Route is 8470.33408947914 found at
    Iteration 133 by an Ant
928 Running ACO with the following parameters:
929
930 population: 9
931 pheromone decay constant: 0.5
932 online pheromone update: True
```

```
933 alpha: 1
934 beta: 5
935 Q: 2000
936 max iterations: 500
937
938 Ant Colony Construction in Progress...
939
940 Initial Tour Cost: 24030.2040767309
941 Iterations Completed: 100
942 Iterations Completed: 200
943 Iterations Completed: 300
944 Iterations Completed: 400
945
946 Best Route Found by ACO for Bays29:
947 [10, 21, 16, 13, 17, 14, 3, 9, 19, 1, 20, 4, 8, 25,
   , 28, 2, 5, 11, 27, 0, 7, 26, 23, 12, 15, 18, 24,
   6, 22]
948 Cost of Best Route is 8777.46709710778 found at
   Iteration 348 by an Ant
949 Running ACO with the following parameters:
950
951 population: 9
952 pheromone decay constant: 0.5
953 online pheromone update: True
954 alpha: 1
955 beta: 5
956 Q: 2000
957 max iterations: 500
958
959 Ant Colony Construction in Progress...
960
961 Initial Tour Cost: 23276.99480211163
962 Iterations Completed: 100
963 Iterations Completed: 200
964 Iterations Completed: 300
965 Iterations Completed: 400
966
967 Best Route Found by ACO for Bays29:
968 [2, 28, 25, 8, 4, 20, 1, 19, 9, 3, 14, 17, 13, 21
   , 16, 10, 18, 24, 6, 22, 26, 7, 23, 15, 12, 0, 27
   , 5, 11]
```

```
969 Cost of Best Route is 8457.437968952861 found at
    Iteration 322 by an Ant
970 Running ACO with the following parameters:
971
972 population: 9
973 pheromone decay constant: 0.5
974 online pheromone update: True
975 alpha: 1
976 beta: 5
977 Q: 2000
978 max iterations: 500
979
980 Ant Colony Construction in Progress...
981
982 Initial Tour Cost: 22845.297812395194
983 Iterations Completed: 100
984 Iterations Completed: 200
985 Iterations Completed: 300
986 Iterations Completed: 400
987
988 Best Route Found by ACO for Bays29:
989 [16, 13, 17, 21, 10, 14, 3, 9, 19, 1, 20, 5, 27,
    0, 12, 23, 26, 15, 18, 24, 6, 22, 7, 11, 8, 4, 25
    , 28, 2]
990 Cost of Best Route is 9066.358775887855 found at
    Iteration 289 by an Ant
991 Running ACO with the following parameters:
992
993 population: 9
994 pheromone decay constant: 0.5
995 online pheromone update: True
996 alpha: 1
997 beta: 5
998 Q: 2000
999 max iterations: 500
1000
1001 Ant Colony Construction in Progress...
1002
1003 Initial Tour Cost: 24065.400878905955
1004 Iterations Completed: 100
1005 Iterations Completed: 200
```

```
1006 Iterations Completed: 300
1007 Iterations Completed: 400
1008
1009 Best Route Found by ACO for Bays29:
1010 [20, 1, 19, 9, 3, 17, 13, 21, 16, 10, 14, 18, 24
     , 6, 22, 7, 23, 26, 15, 12, 0, 27, 5, 11, 8, 4,
     25, 28, 2]
1011 Cost of Best Route is 8701.665536202056 found at
     Iteration 236 by an Ant
1012 Running ACO with the following parameters:
1013
1014 population: 9
1015 pheromone decay constant: 0.5
1016 online pheromone update: True
1017 alpha: 1
1018 beta: 5
1019 Q: 2000
1020 max iterations: 500
1021
1022 Ant Colony Construction in Progress...
1023
1024 Initial Tour Cost: 24616.413329921965
1025 Iterations Completed: 100
1026 Iterations Completed: 200
1027 Iterations Completed: 300
1028 Iterations Completed: 400
1029
1030 Best Route Found by ACO for Bays29:
1031 [4, 20, 1, 19, 9, 12, 15, 18, 3, 14, 17, 13, 16,
     21, 10, 24, 6, 22, 26, 23, 7, 0, 27, 5, 11, 8, 25
     , 28, 2]
1032 Cost of Best Route is 8544.372161576734 found at
     Iteration 190 by an Ant
1033 Running ACO with the following parameters:
1034
1035 population: 9
1036 pheromone decay constant: 0.5
1037 online pheromone update: True
1038 alpha: 1
1039 beta: 5
1040 Q: 2000
```

```
1041 max iterations: 500
1042
1043 Ant Colony Construction in Progress...
1044
1045 Initial Tour Cost: 21949.335548298914
1046 Iterations Completed: 100
1047 Iterations Completed: 200
1048 Iterations Completed: 300
1049 Iterations Completed: 400
1050
1051 Best Route Found by ACO for Bays29:
1052 [11, 5, 27, 0, 23, 26, 7, 15, 18, 3, 14, 17, 13,
     16, 21, 10, 24, 6, 22, 12, 19, 9, 1, 20, 4, 8, 25
     , 28, 2]
1053 Cost of Best Route is 9063.241233134686 found at
     Iteration 170 by an Ant
1054 Running ACO with the following parameters:
1055
1056 population: 9
1057 pheromone decay constant: 0.5
1058 online pheromone update: True
1059 alpha: 1
1060 beta: 5
1061 Q: 2000
1062 max iterations: 500
1063
1064 Ant Colony Construction in Progress...
1065
1066 Initial Tour Cost: 22041.515717877082
1067 Iterations Completed: 100
1068 Iterations Completed: 200
1069 Iterations Completed: 300
1070 Iterations Completed: 400
1071
1072 Best Route Found by ACO for Bays29:
1073 [2, 28, 25, 4, 8, 11, 5, 27, 0, 20, 1, 19, 9, 3,
     14, 17, 13, 16, 21, 10, 24, 18, 15, 12, 23, 26, 7
     , 22, 6]
1074 Cost of Best Route is 8314.647226705987 found at
     Iteration 422 by an Ant
1075 Running ACO with the following parameters:
```

```
1076
1077 population: 9
1078 pheromone decay constant: 0.5
1079 online pheromone update: True
1080 alpha: 1
1081 beta: 5
1082 Q: 2000
1083 max iterations: 500
1084
1085 Ant Colony Construction in Progress...
1086
1087 Initial Tour Cost: 21118.034390434303
1088 Iterations Completed: 100
1089 Iterations Completed: 200
1090 Iterations Completed: 300
1091 Iterations Completed: 400
1092
1093 Best Route Found by ACO for Bays29:
1094 [3, 9, 19, 1, 20, 4, 25, 28, 2, 8, 5, 11, 27, 0,
     23, 7, 26, 15, 12, 18, 14, 13, 17, 16, 21, 10, 24
     , 6, 22]
1095 Cost of Best Route is 8930.921139552704 found at
     Iteration 494 by an Ant
1096 Running ACO with the following parameters:
1097
1098 population: 9
1099 pheromone decay constant: 0.5
1100 online pheromone update: True
1101 alpha: 1
1102 beta: 5
1103 Q: 2000
1104 max iterations: 500
1105
1106 Ant Colony Construction in Progress...
1107
1108 Initial Tour Cost: 21432.300069888955
1109 Iterations Completed: 100
1110 Iterations Completed: 200
1111 Iterations Completed: 300
1112 Iterations Completed: 400
1113
```

```
1114 Best Route Found by ACO for Bays29:  
1115 [26, 23, 7, 0, 27, 5, 11, 8, 25, 28, 2, 4, 20, 1  
, 19, 9, 3, 14, 17, 13, 16, 21, 10, 24, 18, 12,  
15, 22, 6]  
1116 Cost of Best Route is 8965.928757333792 found at  
Iteration 394 by an Ant  
1117 Running ACO with the following parameters:  
1118  
1119 population: 9  
1120 pheromone decay constant: 0.5  
1121 online pheromone update: True  
1122 alpha: 1  
1123 beta: 5  
1124 Q: 2000  
1125 max iterations: 500  
1126  
1127 Ant Colony Construction in Progress...  
1128  
1129 Initial Tour Cost: 23624.43544594198  
1130 Iterations Completed: 100  
1131 Iterations Completed: 200  
1132 Iterations Completed: 300  
1133 Iterations Completed: 400  
1134  
1135 Best Route Found by ACO for Bays29:  
1136 [13, 17, 16, 21, 10, 14, 3, 9, 19, 1, 20, 4, 25,  
28, 2, 8, 11, 5, 0, 23, 26, 7, 27, 12, 15, 18, 24  
, 6, 22]  
1137 Cost of Best Route is 9114.176765064421 found at  
Iteration 90 by an Ant  
1138 Running ACO with the following parameters:  
1139  
1140 population: 9  
1141 pheromone decay constant: 0.5  
1142 online pheromone update: True  
1143 alpha: 1  
1144 beta: 5  
1145 Q: 2000  
1146 max iterations: 500  
1147  
1148 Ant Colony Construction in Progress...
```

```
1149
1150 Initial Tour Cost: 22696.77100828895
1151 Iterations Completed: 100
1152 Iterations Completed: 200
1153 Iterations Completed: 300
1154 Iterations Completed: 400
1155
1156 Best Route Found by ACO for Bays29:
1157 [3, 14, 17, 13, 21, 16, 10, 18, 24, 6, 22, 26, 7
    , 27, 0, 23, 12, 15, 9, 19, 1, 20, 4, 5, 11, 8,
    25, 28, 2]
1158 Cost of Best Route is 8929.556703432569 found at
    Iteration 462 by an Ant
1159 Running ACO with the following parameters:
1160
1161 population: 11
1162 pheromone decay constant: 0.5
1163 online pheromone update: True
1164 alpha: 1
1165 beta: 5
1166 Q: 2000
1167 max iterations: 500
1168
1169 Ant Colony Construction in Progress...
1170
1171 Initial Tour Cost: 22340.01258998569
1172 Iterations Completed: 100
1173 Iterations Completed: 200
1174 Iterations Completed: 300
1175 Iterations Completed: 400
1176
1177 Best Route Found by ACO for Bays29:
1178 [20, 1, 19, 9, 12, 3, 14, 17, 13, 21, 16, 10, 15
    , 18, 24, 6, 22, 26, 23, 7, 27, 0, 5, 11, 8, 4,
    25, 28, 2]
1179 Cost of Best Route is 8897.012784067454 found at
    Iteration 221 by an Ant
1180 Running ACO with the following parameters:
1181
1182 population: 11
1183 pheromone decay constant: 0.5
```

```
1184 online pheromone update: True
1185 alpha: 1
1186 beta: 5
1187 Q: 2000
1188 max iterations: 500
1189
1190 Ant Colony Construction in Progress...
1191
1192 Initial Tour Cost: 22441.48096599039
1193 Iterations Completed: 100
1194 Iterations Completed: 200
1195 Iterations Completed: 300
1196 Iterations Completed: 400
1197
1198 Best Route Found by ACO for Bays29:
1199 [15, 26, 7, 23, 0, 27, 5, 11, 8, 4, 25, 28, 2, 20
    , 1, 19, 9, 12, 3, 14, 17, 13, 16, 21, 10, 18, 24
    , 6, 22]
1200 Cost of Best Route is 8635.403721278079 found at
    Iteration 137 by an Ant
1201 Running ACO with the following parameters:
1202
1203 population: 11
1204 pheromone decay constant: 0.5
1205 online pheromone update: True
1206 alpha: 1
1207 beta: 5
1208 Q: 2000
1209 max iterations: 500
1210
1211 Ant Colony Construction in Progress...
1212
1213 Initial Tour Cost: 21186.806165811326
1214 Iterations Completed: 100
1215 Iterations Completed: 200
1216 Iterations Completed: 300
1217 Iterations Completed: 400
1218
1219 Best Route Found by ACO for Bays29:
1220 [20, 1, 19, 9, 12, 15, 18, 14, 3, 17, 13, 21, 16
    , 10, 24, 6, 22, 26, 7, 23, 0, 27, 5, 11, 8, 4,
```

```
1220 25, 28, 2]
1221 Cost of Best Route is 8581.82826243094 found at
    Iteration 437 by an Ant
1222 Running ACO with the following parameters:
1223
1224 population: 11
1225 pheromone decay constant: 0.5
1226 online pheromone update: True
1227 alpha: 1
1228 beta: 5
1229 Q: 2000
1230 max iterations: 500
1231
1232 Ant Colony Construction in Progress...
1233
1234 Initial Tour Cost: 22906.31340631329
1235 Iterations Completed: 100
1236 Iterations Completed: 200
1237 Iterations Completed: 300
1238 Iterations Completed: 400
1239
1240 Best Route Found by ACO for Bays29:
1241 [2, 28, 25, 8, 4, 5, 11, 27, 0, 23, 7, 26, 15, 12
    , 9, 19, 1, 20, 3, 14, 17, 13, 21, 16, 10, 18, 24
    , 6, 22]
1242 Cost of Best Route is 8699.50841585838 found at
    Iteration 263 by an Ant
1243 Running ACO with the following parameters:
1244
1245 population: 11
1246 pheromone decay constant: 0.5
1247 online pheromone update: True
1248 alpha: 1
1249 beta: 5
1250 Q: 2000
1251 max iterations: 500
1252
1253 Ant Colony Construction in Progress...
1254
1255 Initial Tour Cost: 24841.297799919077
1256 Iterations Completed: 100
```

```
1257 Iterations Completed: 200
1258 Iterations Completed: 300
1259 Iterations Completed: 400
1260
1261 Best Route Found by ACO for Bays29:
1262 [11, 5, 27, 0, 20, 1, 19, 9, 3, 14, 17, 13, 16,
     21, 10, 24, 6, 22, 26, 7, 23, 15, 18, 12, 4, 8,
     25, 28, 2]
1263 Cost of Best Route is 8783.100658336662 found at
     Iteration 343 by an Ant
1264 Running ACO with the following parameters:
1265
1266 population: 11
1267 pheromone decay constant: 0.5
1268 online pheromone update: True
1269 alpha: 1
1270 beta: 5
1271 Q: 2000
1272 max iterations: 500
1273
1274 Ant Colony Construction in Progress...
1275
1276 Initial Tour Cost: 22551.748051266335
1277 Iterations Completed: 100
1278 Iterations Completed: 200
1279 Iterations Completed: 300
1280 Iterations Completed: 400
1281
1282 Best Route Found by ACO for Bays29:
1283 [2, 28, 25, 8, 4, 5, 11, 27, 0, 20, 1, 19, 9, 3,
     14, 17, 13, 21, 16, 10, 18, 24, 6, 22, 26, 23, 7
     , 15, 12]
1284 Cost of Best Route is 8632.680579096104 found at
     Iteration 117 by an Ant
1285 Running ACO with the following parameters:
1286
1287 population: 11
1288 pheromone decay constant: 0.5
1289 online pheromone update: True
1290 alpha: 1
1291 beta: 5
```

```
1292 Q: 2000
1293 max iterations: 500
1294
1295 Ant Colony Construction in Progress...
1296
1297 Initial Tour Cost: 22223.06839982178
1298 Iterations Completed: 100
1299 Iterations Completed: 200
1300 Iterations Completed: 300
1301 Iterations Completed: 400
1302
1303 Best Route Found by ACO for Bays29:
1304 [2, 28, 25, 8, 4, 5, 11, 27, 0, 23, 7, 26, 15, 12
     , 20, 1, 19, 9, 3, 14, 17, 13, 21, 16, 10, 18, 24
     , 6, 22]
1305 Cost of Best Route is 8429.016498426958 found at
      Iteration 241 by an Ant
1306 Running ACO with the following parameters:
1307
1308 population: 11
1309 pheromone decay constant: 0.5
1310 online pheromone update: True
1311 alpha: 1
1312 beta: 5
1313 Q: 2000
1314 max iterations: 500
1315
1316 Ant Colony Construction in Progress...
1317
1318 Initial Tour Cost: 22683.58038867052
1319 Iterations Completed: 100
1320 Iterations Completed: 200
1321 Iterations Completed: 300
1322 Iterations Completed: 400
1323
1324 Best Route Found by ACO for Bays29:
1325 [8, 4, 20, 1, 19, 9, 3, 12, 14, 13, 17, 16, 21,
     10, 18, 24, 6, 22, 7, 26, 15, 23, 0, 27, 5, 11,
     25, 28, 2]
1326 Cost of Best Route is 8973.336730144747 found at
      Iteration 493 by an Ant
```

```
1327 Running ACO with the following parameters:  
1328  
1329 population: 11  
1330 pheromone decay constant: 0.5  
1331 online pheromone update: True  
1332 alpha: 1  
1333 beta: 5  
1334 Q: 2000  
1335 max iterations: 500  
1336  
1337 Ant Colony Construction in Progress...  
1338  
1339 Initial Tour Cost: 21684.41695653356  
1340 Iterations Completed: 100  
1341 Iterations Completed: 200  
1342 Iterations Completed: 300  
1343 Iterations Completed: 400  
1344  
1345 Best Route Found by ACO for Bays29:  
1346 [1, 20, 4, 25, 28, 2, 8, 11, 5, 27, 0, 23, 26, 15  
    , 12, 9, 19, 3, 14, 17, 13, 16, 21, 10, 18, 24, 6  
    , 22, 7]  
1347 Cost of Best Route is 8926.590643535306 found at  
    Iteration 262 by an Ant  
1348 Running ACO with the following parameters:  
1349  
1350 population: 11  
1351 pheromone decay constant: 0.5  
1352 online pheromone update: True  
1353 alpha: 1  
1354 beta: 5  
1355 Q: 2000  
1356 max iterations: 500  
1357  
1358 Ant Colony Construction in Progress...  
1359  
1360 Initial Tour Cost: 22601.385502315086  
1361 Iterations Completed: 100  
1362 Iterations Completed: 200  
1363 Iterations Completed: 300  
1364 Iterations Completed: 400
```

```
1365
1366 Best Route Found by ACO for Bays29:
1367 [2, 28, 25, 4, 8, 11, 5, 0, 27, 7, 23, 26, 15, 12
     , 20, 1, 9, 19, 3, 14, 17, 16, 21, 13, 10, 18, 24
     , 6, 22]
1368 Cost of Best Route is 8637.114555221115 found at
     Iteration 202 by an Ant
1369 Running ACO with the following parameters:
1370
1371 population: 11
1372 pheromone decay constant: 0.5
1373 online pheromone update: True
1374 alpha: 1
1375 beta: 5
1376 Q: 2000
1377 max iterations: 500
1378
1379 Ant Colony Construction in Progress...
1380
1381 Initial Tour Cost: 22022.544758395597
1382 Iterations Completed: 100
1383 Iterations Completed: 200
1384 Iterations Completed: 300
1385 Iterations Completed: 400
1386
1387 Best Route Found by ACO for Bays29:
1388 [15, 12, 3, 9, 19, 17, 13, 21, 16, 10, 14, 18, 24
     , 6, 22, 7, 26, 23, 0, 27, 5, 11, 8, 4, 20, 1, 25
     , 28, 2]
1389 Cost of Best Route is 8896.491874307336 found at
     Iteration 244 by an Ant
1390 Running ACO with the following parameters:
1391
1392 population: 13
1393 pheromone decay constant: 0.5
1394 online pheromone update: True
1395 alpha: 1
1396 beta: 5
1397 Q: 2000
1398 max iterations: 500
1399
```

```
1400 Ant Colony Construction in Progress...
1401
1402 Initial Tour Cost: 23490.365039193293
1403 Iterations Completed: 100
1404 Iterations Completed: 200
1405 Iterations Completed: 300
1406 Iterations Completed: 400
1407
1408 Best Route Found by ACO for Bays29:
1409 [20, 1, 19, 9, 3, 14, 13, 17, 21, 16, 10, 18, 12
     , 23, 15, 24, 6, 22, 26, 7, 0, 27, 5, 11, 8, 4,
     25, 28, 2]
1410 Cost of Best Route is 8850.748063064262 found at
     Iteration 384 by an Ant
1411 Running ACO with the following parameters:
1412
1413 population: 13
1414 pheromone decay constant: 0.5
1415 online pheromone update: True
1416 alpha: 1
1417 beta: 5
1418 Q: 2000
1419 max iterations: 500
1420
1421 Ant Colony Construction in Progress...
1422
1423 Initial Tour Cost: 23478.76179886004
1424 Iterations Completed: 100
1425 Iterations Completed: 200
1426 Iterations Completed: 300
1427 Iterations Completed: 400
1428
1429 Best Route Found by ACO for Bays29:
1430 [10, 17, 13, 21, 16, 14, 3, 9, 19, 1, 20, 12, 18
     , 15, 24, 6, 22, 7, 26, 23, 0, 27, 11, 5, 8, 4,
     25, 28, 2]
1431 Cost of Best Route is 8863.596378218153 found at
     Iteration 220 by an Ant
1432 Running ACO with the following parameters:
1433
1434 population: 13
```

```
1435 pheromone decay constant: 0.5
1436 online pheromone update: True
1437 alpha: 1
1438 beta: 5
1439 Q: 2000
1440 max iterations: 500
1441
1442 Ant Colony Construction in Progress...
1443
1444 Initial Tour Cost: 23419.65028779114
1445 Iterations Completed: 100
1446 Iterations Completed: 200
1447 Iterations Completed: 300
1448 Iterations Completed: 400
1449
1450 Best Route Found by ACO for Bays29:
1451 [25, 28, 2, 1, 20, 4, 8, 11, 5, 27, 0, 7, 26, 23
    , 15, 12, 9, 19, 3, 14, 13, 17, 16, 21, 10, 18,
    24, 6, 22]
1452 Cost of Best Route is 8702.248766682049 found at
    Iteration 111 by an Ant
1453 Running ACO with the following parameters:
1454
1455 population: 13
1456 pheromone decay constant: 0.5
1457 online pheromone update: True
1458 alpha: 1
1459 beta: 5
1460 Q: 2000
1461 max iterations: 500
1462
1463 Ant Colony Construction in Progress...
1464
1465 Initial Tour Cost: 22413.31440415317
1466 Iterations Completed: 100
1467 Iterations Completed: 200
1468 Iterations Completed: 300
1469 Iterations Completed: 400
1470
1471 Best Route Found by ACO for Bays29:
1472 [13, 17, 16, 21, 10, 14, 3, 9, 19, 1, 20, 12, 15
```

```
1472 , 18, 24, 6, 22, 26, 7, 23, 0, 27, 5, 11, 8, 4,
    25, 28, 2]
1473 Cost of Best Route is 8359.946702577803 found at
    Iteration 424 by an Ant
1474 Running ACO with the following parameters:
1475
1476 population: 13
1477 pheromone decay constant: 0.5
1478 online pheromone update: True
1479 alpha: 1
1480 beta: 5
1481 Q: 2000
1482 max iterations: 500
1483
1484 Ant Colony Construction in Progress...
1485
1486 Initial Tour Cost: 23610.58268109584
1487 Iterations Completed: 100
1488 Iterations Completed: 200
1489 Iterations Completed: 300
1490 Iterations Completed: 400
1491
1492 Best Route Found by ACO for Bays29:
1493 [6, 22, 26, 7, 23, 0, 27, 5, 11, 8, 4, 20, 19, 9
    , 3, 14, 17, 13, 16, 21, 10, 18, 24, 15, 12, 1,
    25, 28, 2]
1494 Cost of Best Route is 8799.31419829158 found at
    Iteration 280 by an Ant
1495 Running ACO with the following parameters:
1496
1497 population: 13
1498 pheromone decay constant: 0.5
1499 online pheromone update: True
1500 alpha: 1
1501 beta: 5
1502 Q: 2000
1503 max iterations: 500
1504
1505 Ant Colony Construction in Progress...
1506
1507 Initial Tour Cost: 21947.93500242642
```

```
1508 Iterations Completed: 100
1509 Iterations Completed: 200
1510 Iterations Completed: 300
1511 Iterations Completed: 400
1512
1513 Best Route Found by ACO for Bays29:
1514 [5, 11, 8, 4, 25, 28, 2, 1, 20, 27, 0, 23, 7, 26,
     , 15, 12, 9, 19, 3, 17, 13, 16, 21, 10, 14, 18,
     24, 6, 22]
1515 Cost of Best Route is 8850.130787460588 found at
     Iteration 0 by an Ant
1516 Running ACO with the following parameters:
1517
1518 population: 13
1519 pheromone decay constant: 0.5
1520 online pheromone update: True
1521 alpha: 1
1522 beta: 5
1523 Q: 2000
1524 max iterations: 500
1525
1526 Ant Colony Construction in Progress...
1527
1528 Initial Tour Cost: 21998.144030532545
1529 Iterations Completed: 100
1530 Iterations Completed: 200
1531 Iterations Completed: 300
1532 Iterations Completed: 400
1533
1534 Best Route Found by ACO for Bays29:
1535 [10, 21, 16, 13, 17, 14, 3, 9, 19, 1, 20, 5, 4,
     25, 28, 2, 8, 11, 27, 0, 23, 7, 26, 22, 15, 12,
     18, 24, 6]
1536 Cost of Best Route is 8806.288430847155 found at
     Iteration 387 by an Ant
1537 Running ACO with the following parameters:
1538
1539 population: 13
1540 pheromone decay constant: 0.5
1541 online pheromone update: True
1542 alpha: 1
```

```
1543 beta: 5
1544 Q: 2000
1545 max iterations: 500
1546
1547 Ant Colony Construction in Progress...
1548
1549 Initial Tour Cost: 20616.945863043493
1550 Iterations Completed: 100
1551 Iterations Completed: 200
1552 Iterations Completed: 300
1553 Iterations Completed: 400
1554
1555 Best Route Found by ACO for Bays29:
1556 [20, 1, 19, 9, 3, 14, 17, 13, 21, 16, 10, 18, 24,
     , 6, 22, 26, 7, 23, 12, 15, 27, 0, 5, 11, 8, 4,
     25, 28, 2]
1557 Cost of Best Route is 8855.236245174192 found at
    Iteration 310 by an Ant
1558 Running ACO with the following parameters:
1559
1560 population: 13
1561 pheromone decay constant: 0.5
1562 online pheromone update: True
1563 alpha: 1
1564 beta: 5
1565 Q: 2000
1566 max iterations: 500
1567
1568 Ant Colony Construction in Progress...
1569
1570 Initial Tour Cost: 24082.753876118244
1571 Iterations Completed: 100
1572 Iterations Completed: 200
1573 Iterations Completed: 300
1574 Iterations Completed: 400
1575
1576 Best Route Found by ACO for Bays29:
1577 [20, 1, 19, 9, 3, 14, 13, 17, 16, 21, 10, 18, 12
     , 23, 15, 24, 6, 22, 26, 7, 27, 0, 5, 11, 8, 4,
     25, 28, 2]
1578 Cost of Best Route is 8637.011317115312 found at
```

```
1578 Iteration 177 by an Ant
1579 Running ACO with the following parameters:
1580
1581 population: 13
1582 pheromone decay constant: 0.5
1583 online pheromone update: True
1584 alpha: 1
1585 beta: 5
1586 Q: 2000
1587 max iterations: 500
1588
1589 Ant Colony Construction in Progress...
1590
1591 Initial Tour Cost: 23835.88897346429
1592 Iterations Completed: 100
1593 Iterations Completed: 200
1594 Iterations Completed: 300
1595 Iterations Completed: 400
1596
1597 Best Route Found by ACO for Bays29:
1598 [1, 20, 19, 9, 14, 3, 13, 17, 16, 21, 10, 18, 24
     , 6, 22, 26, 7, 23, 15, 12, 0, 27, 5, 11, 8, 4,
     25, 28, 2]
1599 Cost of Best Route is 8963.447663138255 found at
      Iteration 255 by an Ant
1600 Running ACO with the following parameters:
1601
1602 population: 13
1603 pheromone decay constant: 0.5
1604 online pheromone update: True
1605 alpha: 1
1606 beta: 5
1607 Q: 2000
1608 max iterations: 500
1609
1610 Ant Colony Construction in Progress...
1611
1612 Initial Tour Cost: 19852.982263468883
1613 Iterations Completed: 100
1614 Iterations Completed: 200
1615 Iterations Completed: 300
```

```
1616 Iterations Completed: 400
1617
1618 Best Route Found by ACO for Bays29:
1619 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
     , 23, 26, 7, 15, 18, 3, 14, 17, 13, 21, 16, 10,
     24, 6, 22]
1620 Cost of Best Route is 8612.617981010506 found at
     Iteration 219 by an Ant
1621 Running ACO with the following parameters:
1622
1623 population: 15
1624 pheromone decay constant: 0.5
1625 online pheromone update: True
1626 alpha: 1
1627 beta: 5
1628 Q: 2000
1629 max iterations: 500
1630
1631 Ant Colony Construction in Progress...
1632
1633 Initial Tour Cost: 22663.598849121507
1634 Iterations Completed: 100
1635 Iterations Completed: 200
1636 Iterations Completed: 300
1637 Iterations Completed: 400
1638
1639 Best Route Found by ACO for Bays29:
1640 [16, 17, 13, 21, 10, 14, 3, 12, 9, 19, 1, 20, 4,
     25, 28, 2, 8, 11, 5, 27, 0, 23, 26, 15, 7, 22, 6
     , 24, 18]
1641 Cost of Best Route is 8933.435412622966 found at
     Iteration 109 by an Ant
1642 Running ACO with the following parameters:
1643
1644 population: 15
1645 pheromone decay constant: 0.5
1646 online pheromone update: True
1647 alpha: 1
1648 beta: 5
1649 Q: 2000
1650 max iterations: 500
```

```
1651
1652 Ant Colony Construction in Progress...
1653
1654 Initial Tour Cost: 22207.67968996778
1655 Iterations Completed: 100
1656 Iterations Completed: 200
1657 Iterations Completed: 300
1658 Iterations Completed: 400
1659
1660 Best Route Found by ACO for Bays29:
1661 [1, 20, 4, 25, 28, 2, 8, 5, 11, 27, 0, 23, 26, 15
     , 12, 9, 19, 3, 14, 13, 17, 16, 21, 10, 18, 24, 6
     , 22, 7]
1662 Cost of Best Route is 9044.182286305797 found at
     Iteration 188 by an Ant
1663 Running ACO with the following parameters:
1664
1665 population: 15
1666 pheromone decay constant: 0.5
1667 online pheromone update: True
1668 alpha: 1
1669 beta: 5
1670 Q: 2000
1671 max iterations: 500
1672
1673 Ant Colony Construction in Progress...
1674
1675 Initial Tour Cost: 22056.924460687133
1676 Iterations Completed: 100
1677 Iterations Completed: 200
1678 Iterations Completed: 300
1679 Iterations Completed: 400
1680
1681 Best Route Found by ACO for Bays29:
1682 [12, 15, 26, 7, 23, 0, 27, 5, 11, 8, 25, 28, 2, 4
     , 20, 1, 19, 9, 3, 14, 13, 10, 21, 16, 17, 18, 24
     , 6, 22]
1683 Cost of Best Route is 8957.274431963044 found at
     Iteration 38 by an Ant
1684 Running ACO with the following parameters:
1685
```

```
1686 population: 15
1687 pheromone decay constant: 0.5
1688 online pheromone update: True
1689 alpha: 1
1690 beta: 5
1691 Q: 2000
1692 max iterations: 500
1693
1694 Ant Colony Construction in Progress...
1695
1696 Initial Tour Cost: 22301.181675598124
1697 Iterations Completed: 100
1698 Iterations Completed: 200
1699 Iterations Completed: 300
1700 Iterations Completed: 400
1701
1702 Best Route Found by ACO for Bays29:
1703 [28, 4, 20, 1, 19, 9, 3, 14, 13, 17, 16, 21, 10,
     18, 24, 6, 22, 26, 7, 23, 15, 12, 0, 27, 5, 11, 8
     , 25, 2]
1704 Cost of Best Route is 8829.771738305666 found at
     Iteration 73 by an Ant
1705 Running ACO with the following parameters:
1706
1707 population: 15
1708 pheromone decay constant: 0.5
1709 online pheromone update: True
1710 alpha: 1
1711 beta: 5
1712 Q: 2000
1713 max iterations: 500
1714
1715 Ant Colony Construction in Progress...
1716
1717 Initial Tour Cost: 22877.141457983496
1718 Iterations Completed: 100
1719 Iterations Completed: 200
1720 Iterations Completed: 300
1721 Iterations Completed: 400
1722
1723 Best Route Found by ACO for Bays29:
```

```
1724 [9, 19, 1, 20, 23, 26, 15, 12, 3, 14, 17, 13, 16
      , 21, 10, 18, 24, 6, 22, 7, 27, 0, 5, 11, 8, 4,
      25, 28, 2]
1725 Cost of Best Route is 8764.59508378235 found at
      Iteration 152 by an Ant
1726 Running ACO with the following parameters:
1727
1728 population: 15
1729 pheromone decay constant: 0.5
1730 online pheromone update: True
1731 alpha: 1
1732 beta: 5
1733 Q: 2000
1734 max iterations: 500
1735
1736 Ant Colony Construction in Progress...
1737
1738 Initial Tour Cost: 23315.07236835901
1739 Iterations Completed: 100
1740 Iterations Completed: 200
1741 Iterations Completed: 300
1742 Iterations Completed: 400
1743
1744 Best Route Found by ACO for Bays29:
1745 [20, 1, 19, 9, 3, 14, 17, 13, 21, 16, 10, 18, 24
      , 6, 22, 7, 26, 23, 15, 12, 0, 27, 5, 11, 8, 4,
      25, 28, 2]
1746 Cost of Best Route is 8573.876808770561 found at
      Iteration 239 by an Ant
1747 Running ACO with the following parameters:
1748
1749 population: 15
1750 pheromone decay constant: 0.5
1751 online pheromone update: True
1752 alpha: 1
1753 beta: 5
1754 Q: 2000
1755 max iterations: 500
1756
1757 Ant Colony Construction in Progress...
1758
```

```
1759 Initial Tour Cost: 21092.545536021415
1760 Iterations Completed: 100
1761 Iterations Completed: 200
1762 Iterations Completed: 300
1763 Iterations Completed: 400
1764
1765 Best Route Found by ACO for Bays29:
1766 [22, 26, 7, 23, 0, 27, 5, 11, 8, 4, 25, 28, 2, 1
    , 20, 19, 9, 12, 3, 14, 13, 17, 16, 21, 10, 18,
    24, 15, 6]
1767 Cost of Best Route is 8956.79043102599 found at
    Iteration 253 by an Ant
1768 Running ACO with the following parameters:
1769
1770 population: 15
1771 pheromone decay constant: 0.5
1772 online pheromone update: True
1773 alpha: 1
1774 beta: 5
1775 Q: 2000
1776 max iterations: 500
1777
1778 Ant Colony Construction in Progress...
1779
1780 Initial Tour Cost: 22389.146892444984
1781 Iterations Completed: 100
1782 Iterations Completed: 200
1783 Iterations Completed: 300
1784 Iterations Completed: 400
1785
1786 Best Route Found by ACO for Bays29:
1787 [10, 17, 13, 21, 16, 3, 14, 18, 24, 6, 22, 15, 12
    , 9, 19, 1, 20, 0, 23, 26, 7, 27, 5, 11, 8, 4, 25
    , 28, 2]
1788 Cost of Best Route is 8842.200368895614 found at
    Iteration 83 by an Ant
1789 Running ACO with the following parameters:
1790
1791 population: 15
1792 pheromone decay constant: 0.5
1793 online pheromone update: True
```

```
1794 alpha: 1
1795 beta: 5
1796 Q: 2000
1797 max iterations: 500
1798
1799 Ant Colony Construction in Progress...
1800
1801 Initial Tour Cost: 22058.59486129649
1802 Iterations Completed: 100
1803 Iterations Completed: 200
1804 Iterations Completed: 300
1805 Iterations Completed: 400
1806
1807 Best Route Found by ACO for Bays29:
1808 [3, 14, 17, 13, 16, 21, 10, 24, 18, 15, 23, 12, 9
     , 19, 1, 20, 4, 25, 28, 2, 8, 5, 11, 27, 0, 7, 26
     , 22, 6]
1809 Cost of Best Route is 8899.690219394019 found at
      Iteration 90 by an Ant
1810 Running ACO with the following parameters:
1811
1812 population: 15
1813 pheromone decay constant: 0.5
1814 online pheromone update: True
1815 alpha: 1
1816 beta: 5
1817 Q: 2000
1818 max iterations: 500
1819
1820 Ant Colony Construction in Progress...
1821
1822 Initial Tour Cost: 22220.207468367236
1823 Iterations Completed: 100
1824 Iterations Completed: 200
1825 Iterations Completed: 300
1826 Iterations Completed: 400
1827
1828 Best Route Found by ACO for Bays29:
1829 [2, 28, 25, 4, 8, 5, 11, 27, 0, 23, 7, 26, 15, 22
     , 6, 24, 18, 10, 13, 17, 16, 21, 14, 3, 9, 19, 1
     , 20, 12]
```

```
1830 Cost of Best Route is 8714.365730672333 found at
    Iteration 43 by an Ant
1831 Running ACO with the following parameters:
1832
1833 population: 15
1834 pheromone decay constant: 0.5
1835 online pheromone update: True
1836 alpha: 1
1837 beta: 5
1838 Q: 2000
1839 max iterations: 500
1840
1841 Ant Colony Construction in Progress...
1842
1843 Initial Tour Cost: 23242.378420669414
1844 Iterations Completed: 100
1845 Iterations Completed: 200
1846 Iterations Completed: 300
1847 Iterations Completed: 400
1848
1849 Best Route Found by ACO for Bays29:
1850 [2, 25, 28, 1, 20, 4, 8, 11, 5, 27, 0, 7, 26, 15
    , 23, 12, 9, 19, 3, 14, 17, 13, 21, 16, 10, 18,
    24, 6, 22]
1851 Cost of Best Route is 8648.581060410806 found at
    Iteration 346 by an Ant
1852 Running ACO with the following parameters:
1853
1854 population: 17
1855 pheromone decay constant: 0.5
1856 online pheromone update: True
1857 alpha: 1
1858 beta: 5
1859 Q: 2000
1860 max iterations: 500
1861
1862 Ant Colony Construction in Progress...
1863
1864 Initial Tour Cost: 21647.872461651372
1865 Iterations Completed: 100
1866 Iterations Completed: 200
```

```
1867 Iterations Completed: 300
1868 Iterations Completed: 400
1869
1870 Best Route Found by ACO for Bays29:
1871 [2, 28, 25, 8, 4, 5, 11, 27, 0, 23, 7, 26, 15, 12
     , 20, 1, 19, 9, 3, 14, 17, 13, 21, 16, 10, 18, 24
     , 6, 22]
1872 Cost of Best Route is 8429.016498426958 found at
    Iteration 203 by an Ant
1873 Running ACO with the following parameters:
1874
1875 population: 17
1876 pheromone decay constant: 0.5
1877 online pheromone update: True
1878 alpha: 1
1879 beta: 5
1880 Q: 2000
1881 max iterations: 500
1882
1883 Ant Colony Construction in Progress...
1884
1885 Initial Tour Cost: 22362.899015939933
1886 Iterations Completed: 100
1887 Iterations Completed: 200
1888 Iterations Completed: 300
1889 Iterations Completed: 400
1890
1891 Best Route Found by ACO for Bays29:
1892 [20, 1, 19, 9, 12, 3, 14, 13, 17, 21, 16, 10, 18
     , 24, 6, 22, 15, 26, 7, 23, 0, 27, 5, 11, 8, 4,
     25, 28, 2]
1893 Cost of Best Route is 8682.317481622367 found at
    Iteration 428 by an Ant
1894 Running ACO with the following parameters:
1895
1896 population: 17
1897 pheromone decay constant: 0.5
1898 online pheromone update: True
1899 alpha: 1
1900 beta: 5
1901 Q: 2000
```

```
1902 max iterations: 500
1903
1904 Ant Colony Construction in Progress...
1905
1906 Initial Tour Cost: 22306.024188142266
1907 Iterations Completed: 100
1908 Iterations Completed: 200
1909 Iterations Completed: 300
1910 Iterations Completed: 400
1911
1912 Best Route Found by ACO for Bays29:
1913 [15, 26, 23, 7, 22, 6, 24, 18, 14, 3, 17, 13, 16
     , 21, 10, 12, 9, 19, 1, 20, 0, 27, 5, 11, 8, 4,
     25, 28, 2]
1914 Cost of Best Route is 8753.994322725332 found at
     Iteration 174 by an Ant
1915 Running ACO with the following parameters:
1916
1917 population: 17
1918 pheromone decay constant: 0.5
1919 online pheromone update: True
1920 alpha: 1
1921 beta: 5
1922 Q: 2000
1923 max iterations: 500
1924
1925 Ant Colony Construction in Progress...
1926
1927 Initial Tour Cost: 21144.74304827212
1928 Iterations Completed: 100
1929 Iterations Completed: 200
1930 Iterations Completed: 300
1931 Iterations Completed: 400
1932
1933 Best Route Found by ACO for Bays29:
1934 [2, 28, 25, 4, 8, 5, 20, 1, 19, 9, 12, 15, 18, 14
     , 3, 17, 13, 16, 21, 10, 24, 6, 22, 26, 23, 7, 27
     , 0, 11]
1935 Cost of Best Route is 8782.716053328837 found at
     Iteration 114 by an Ant
1936 Running ACO with the following parameters:
```

```
1937
1938 population: 17
1939 pheromone decay constant: 0.5
1940 online pheromone update: True
1941 alpha: 1
1942 beta: 5
1943 Q: 2000
1944 max iterations: 500
1945
1946 Ant Colony Construction in Progress...
1947
1948 Initial Tour Cost: 19564.203803109467
1949 Iterations Completed: 100
1950 Iterations Completed: 200
1951 Iterations Completed: 300
1952 Iterations Completed: 400
1953
1954 Best Route Found by ACO for Bays29:
1955 [2, 28, 25, 8, 4, 5, 11, 27, 0, 23, 7, 26, 15, 12
    , 1, 20, 19, 9, 3, 14, 17, 13, 21, 16, 10, 18, 24
    , 6, 22]
1956 Cost of Best Route is 8620.201657246069 found at
    Iteration 466 by an Ant
1957 Running ACO with the following parameters:
1958
1959 population: 17
1960 pheromone decay constant: 0.5
1961 online pheromone update: True
1962 alpha: 1
1963 beta: 5
1964 Q: 2000
1965 max iterations: 500
1966
1967 Ant Colony Construction in Progress...
1968
1969 Initial Tour Cost: 22028.89191968406
1970 Iterations Completed: 100
1971 Iterations Completed: 200
1972 Iterations Completed: 300
1973 Iterations Completed: 400
1974
```

```
1975 Best Route Found by ACO for Bays29:  
1976 [20, 1, 19, 9, 12, 23, 26, 15, 18, 3, 14, 17, 13  
, 16, 21, 10, 24, 6, 22, 7, 0, 27, 5, 11, 8, 4,  
25, 28, 2]  
1977 Cost of Best Route is 8572.073580487493 found at  
Iteration 310 by an Ant  
1978 Running ACO with the following parameters:  
1979  
1980 population: 17  
1981 pheromone decay constant: 0.5  
1982 online pheromone update: True  
1983 alpha: 1  
1984 beta: 5  
1985 Q: 2000  
1986 max iterations: 500  
1987  
1988 Ant Colony Construction in Progress...  
1989  
1990 Initial Tour Cost: 22306.837028425027  
1991 Iterations Completed: 100  
1992 Iterations Completed: 200  
1993 Iterations Completed: 300  
1994 Iterations Completed: 400  
1995  
1996 Best Route Found by ACO for Bays29:  
1997 [22, 26, 7, 23, 0, 27, 5, 11, 8, 4, 25, 28, 2, 1  
, 20, 12, 9, 19, 3, 14, 17, 13, 16, 21, 10, 18,  
24, 6, 15]  
1998 Cost of Best Route is 8877.282250773831 found at  
Iteration 447 by an Ant  
1999 Running ACO with the following parameters:  
2000  
2001 population: 17  
2002 pheromone decay constant: 0.5  
2003 online pheromone update: True  
2004 alpha: 1  
2005 beta: 5  
2006 Q: 2000  
2007 max iterations: 500  
2008  
2009 Ant Colony Construction in Progress...
```

```
2010
2011 Initial Tour Cost: 20124.109715747476
2012 Iterations Completed: 100
2013 Iterations Completed: 200
2014 Iterations Completed: 300
2015 Iterations Completed: 400
2016
2017 Best Route Found by ACO for Bays29:
2018 [10, 21, 16, 13, 17, 14, 3, 9, 19, 1, 20, 4, 8,
      11, 5, 27, 0, 23, 15, 26, 7, 22, 6, 24, 18, 12,
      25, 28, 2]
2019 Cost of Best Route is 8836.89208024309 found at
      Iteration 157 by an Ant
2020 Running ACO with the following parameters:
2021
2022 population: 17
2023 pheromone decay constant: 0.5
2024 online pheromone update: True
2025 alpha: 1
2026 beta: 5
2027 Q: 2000
2028 max iterations: 500
2029
2030 Ant Colony Construction in Progress...
2031
2032 Initial Tour Cost: 22084.001956085773
2033 Iterations Completed: 100
2034 Iterations Completed: 200
2035 Iterations Completed: 300
2036 Iterations Completed: 400
2037
2038 Best Route Found by ACO for Bays29:
2039 [16, 21, 10, 13, 17, 14, 3, 18, 24, 6, 22, 26, 7
      , 23, 15, 12, 9, 19, 1, 20, 27, 0, 5, 11, 8, 4,
      25, 28, 2]
2040 Cost of Best Route is 8397.597008312312 found at
      Iteration 108 by an Ant
2041 Running ACO with the following parameters:
2042
2043 population: 17
2044 pheromone decay constant: 0.5
```

```
2045 online pheromone update: True
2046 alpha: 1
2047 beta: 5
2048 Q: 2000
2049 max iterations: 500
2050
2051 Ant Colony Construction in Progress...
2052
2053 Initial Tour Cost: 22990.100299541016
2054 Iterations Completed: 100
2055 Iterations Completed: 200
2056 Iterations Completed: 300
2057 Iterations Completed: 400
2058
2059 Best Route Found by ACO for Bays29:
2060 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 9, 19, 12
     , 23, 7, 26, 15, 22, 6, 24, 18, 3, 14, 10, 21, 16
     , 13, 17]
2061 Cost of Best Route is 8587.588548794536 found at
      Iteration 329 by an Ant
2062 Running ACO with the following parameters:
2063
2064 population: 17
2065 pheromone decay constant: 0.5
2066 online pheromone update: True
2067 alpha: 1
2068 beta: 5
2069 Q: 2000
2070 max iterations: 500
2071
2072 Ant Colony Construction in Progress...
2073
2074 Initial Tour Cost: 22808.670363032754
2075 Iterations Completed: 100
2076 Iterations Completed: 200
2077 Iterations Completed: 300
2078 Iterations Completed: 400
2079
2080 Best Route Found by ACO for Bays29:
2081 [20, 1, 19, 9, 12, 15, 18, 3, 14, 17, 13, 21, 16
     , 10, 24, 6, 22, 7, 26, 23, 0, 27, 5, 11, 8, 4,
```

```
2081 25, 28, 2]
2082 Cost of Best Route is 8585.117731701004 found at
    Iteration 231 by an Ant
2083 Running ACO with the following parameters:
2084
2085 population: 19
2086 pheromone decay constant: 0.5
2087 online pheromone update: True
2088 alpha: 1
2089 beta: 5
2090 Q: 2000
2091 max iterations: 500
2092
2093 Ant Colony Construction in Progress...
2094
2095 Initial Tour Cost: 23167.989636343762
2096 Iterations Completed: 100
2097 Iterations Completed: 200
2098 Iterations Completed: 300
2099 Iterations Completed: 400
2100
2101 Best Route Found by ACO for Bays29:
2102 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
    , 15, 23, 26, 7, 22, 6, 24, 18, 3, 14, 17, 13, 21
    , 16, 10]
2103 Cost of Best Route is 8408.395557649203 found at
    Iteration 441 by an Ant
2104 Running ACO with the following parameters:
2105
2106 population: 19
2107 pheromone decay constant: 0.5
2108 online pheromone update: True
2109 alpha: 1
2110 beta: 5
2111 Q: 2000
2112 max iterations: 500
2113
2114 Ant Colony Construction in Progress...
2115
2116 Initial Tour Cost: 21245.416080212482
2117 Iterations Completed: 100
```

```
2118 Iterations Completed: 200
2119 Iterations Completed: 300
2120 Iterations Completed: 400
2121
2122 Best Route Found by ACO for Bays29:
2123 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
      14, 21, 13, 17, 16, 10, 18, 12, 15, 23, 26, 7, 22
      , 6, 24]
2124 Cost of Best Route is 8852.82671007159 found at
      Iteration 28 by an Ant
2125 Running ACO with the following parameters:
2126
2127 population: 19
2128 pheromone decay constant: 0.5
2129 online pheromone update: True
2130 alpha: 1
2131 beta: 5
2132 Q: 2000
2133 max iterations: 500
2134
2135 Ant Colony Construction in Progress...
2136
2137 Initial Tour Cost: 23073.488520361414
2138 Iterations Completed: 100
2139 Iterations Completed: 200
2140 Iterations Completed: 300
2141 Iterations Completed: 400
2142
2143 Best Route Found by ACO for Bays29:
2144 [2, 28, 25, 4, 8, 5, 11, 27, 0, 23, 20, 1, 19, 9
      , 3, 14, 18, 12, 15, 26, 7, 22, 6, 24, 10, 21, 16
      , 13, 17]
2145 Cost of Best Route is 8724.624052843494 found at
      Iteration 9 by an Ant
2146 Running ACO with the following parameters:
2147
2148 population: 19
2149 pheromone decay constant: 0.5
2150 online pheromone update: True
2151 alpha: 1
2152 beta: 5
```

```
2153 Q: 2000
2154 max iterations: 500
2155
2156 Ant Colony Construction in Progress...
2157
2158 Initial Tour Cost: 20794.77358887381
2159 Iterations Completed: 100
2160 Iterations Completed: 200
2161 Iterations Completed: 300
2162 Iterations Completed: 400
2163
2164 Best Route Found by ACO for Bays29:
2165 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
     14, 13, 17, 16, 21, 10, 24, 18, 12, 15, 23, 26, 7
     , 22, 6]
2166 Cost of Best Route is 8451.37267991026 found at
     Iteration 208 by an Ant
2167 Running ACO with the following parameters:
2168
2169 population: 19
2170 pheromone decay constant: 0.5
2171 online pheromone update: True
2172 alpha: 1
2173 beta: 5
2174 Q: 2000
2175 max iterations: 500
2176
2177 Ant Colony Construction in Progress...
2178
2179 Initial Tour Cost: 22827.045916977368
2180 Iterations Completed: 100
2181 Iterations Completed: 200
2182 Iterations Completed: 300
2183 Iterations Completed: 400
2184
2185 Best Route Found by ACO for Bays29:
2186 [20, 1, 19, 9, 12, 23, 15, 18, 14, 3, 17, 13, 21
     , 16, 10, 24, 6, 22, 26, 7, 0, 27, 5, 11, 8, 4,
     25, 28, 2]
2187 Cost of Best Route is 8691.053780119788 found at
     Iteration 65 by an Ant
```

```
2188 Running ACO with the following parameters:  
2189  
2190 population: 19  
2191 pheromone decay constant: 0.5  
2192 online pheromone update: True  
2193 alpha: 1  
2194 beta: 5  
2195 Q: 2000  
2196 max iterations: 500  
2197  
2198 Ant Colony Construction in Progress...  
2199  
2200 Initial Tour Cost: 21590.645831081885  
2201 Iterations Completed: 100  
2202 Iterations Completed: 200  
2203 Iterations Completed: 300  
2204 Iterations Completed: 400  
2205  
2206 Best Route Found by ACO for Bays29:  
2207 [17, 13, 21, 16, 10, 14, 3, 18, 24, 6, 22, 26, 23  
    , 0, 27, 7, 15, 12, 9, 19, 1, 20, 5, 11, 8, 4, 25  
    , 28, 2]  
2208 Cost of Best Route is 8700.039860332652 found at  
    Iteration 467 by an Ant  
2209 Running ACO with the following parameters:  
2210  
2211 population: 19  
2212 pheromone decay constant: 0.5  
2213 online pheromone update: True  
2214 alpha: 1  
2215 beta: 5  
2216 Q: 2000  
2217 max iterations: 500  
2218  
2219 Ant Colony Construction in Progress...  
2220  
2221 Initial Tour Cost: 20940.486575143834  
2222 Iterations Completed: 100  
2223 Iterations Completed: 200  
2224 Iterations Completed: 300  
2225 Iterations Completed: 400
```

```
2226
2227 Best Route Found by ACO for Bays29:
2228 [16, 21, 13, 17, 10, 14, 3, 9, 19, 1, 20, 4, 8,
     25, 28, 2, 5, 11, 27, 0, 7, 26, 23, 12, 15, 18,
     24, 6, 22]
2229 Cost of Best Route is 8883.12762984243 found at
     Iteration 172 by an Ant
2230 Running ACO with the following parameters:
2231
2232 population: 19
2233 pheromone decay constant: 0.5
2234 online pheromone update: True
2235 alpha: 1
2236 beta: 5
2237 Q: 2000
2238 max iterations: 500
2239
2240 Ant Colony Construction in Progress...
2241
2242 Initial Tour Cost: 22094.55510405077
2243 Iterations Completed: 100
2244 Iterations Completed: 200
2245 Iterations Completed: 300
2246 Iterations Completed: 400
2247
2248 Best Route Found by ACO for Bays29:
2249 [8, 4, 20, 1, 19, 9, 3, 14, 17, 13, 21, 16, 10,
     18, 24, 6, 22, 26, 7, 23, 15, 12, 0, 27, 5, 11,
     25, 28, 2]
2250 Cost of Best Route is 8831.410270822427 found at
     Iteration 481 by an Ant
2251 Running ACO with the following parameters:
2252
2253 population: 19
2254 pheromone decay constant: 0.5
2255 online pheromone update: True
2256 alpha: 1
2257 beta: 5
2258 Q: 2000
2259 max iterations: 500
2260
```

```
2261 Ant Colony Construction in Progress...
2262
2263 Initial Tour Cost: 21791.93950017691
2264 Iterations Completed: 100
2265 Iterations Completed: 200
2266 Iterations Completed: 300
2267 Iterations Completed: 400
2268
2269 Best Route Found by ACO for Bays29:
2270 [2, 28, 25, 8, 4, 20, 1, 19, 9, 3, 14, 17, 13, 16
     , 21, 10, 18, 12, 15, 23, 0, 27, 5, 11, 7, 26, 22
     , 6, 24]
2271 Cost of Best Route is 8710.96850359592 found at
    Iteration 325 by an Ant
2272 Running ACO with the following parameters:
2273
2274 population: 19
2275 pheromone decay constant: 0.5
2276 online pheromone update: True
2277 alpha: 1
2278 beta: 5
2279 Q: 2000
2280 max iterations: 500
2281
2282 Ant Colony Construction in Progress...
2283
2284 Initial Tour Cost: 20888.06903156425
2285 Iterations Completed: 100
2286 Iterations Completed: 200
2287 Iterations Completed: 300
2288 Iterations Completed: 400
2289
2290 Best Route Found by ACO for Bays29:
2291 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
     , 15, 23, 26, 7, 22, 6, 24, 18, 14, 3, 17, 13, 10
     , 21, 16]
2292 Cost of Best Route is 8363.599952578017 found at
    Iteration 39 by an Ant
2293 Running ACO with the following parameters:
2294
2295 population: 19
```

```
2296 pheromone decay constant: 0.5
2297 online pheromone update: True
2298 alpha: 1
2299 beta: 5
2300 Q: 2000
2301 max iterations: 500
2302
2303 Ant Colony Construction in Progress...
2304
2305 Initial Tour Cost: 23130.74614053625
2306 Iterations Completed: 100
2307 Iterations Completed: 200
2308 Iterations Completed: 300
2309 Iterations Completed: 400
2310
2311 Best Route Found by ACO for Bays29:
2312 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
     12, 15, 26, 23, 7, 22, 6, 24, 18, 14, 17, 13, 21
     , 16, 10]
2313 Cost of Best Route is 8489.457073734493 found at
     Iteration 195 by an Ant
2314 Running ACO with the following parameters:
2315
2316 population: 21
2317 pheromone decay constant: 0.5
2318 online pheromone update: True
2319 alpha: 1
2320 beta: 5
2321 Q: 2000
2322 max iterations: 500
2323
2324 Ant Colony Construction in Progress...
2325
2326 Initial Tour Cost: 22349.98129263888
2327 Iterations Completed: 100
2328 Iterations Completed: 200
2329 Iterations Completed: 300
2330 Iterations Completed: 400
2331
2332 Best Route Found by ACO for Bays29:
2333 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
```

```
2333 , 3, 14, 17, 13, 21, 16, 10, 18, 24, 15, 23, 26,
    7, 22, 6]
2334 Cost of Best Route is 8528.941174793916 found at
    Iteration 433 by an Ant
2335 Running ACO with the following parameters:
2336
2337 population: 21
2338 pheromone decay constant: 0.5
2339 online pheromone update: True
2340 alpha: 1
2341 beta: 5
2342 Q: 2000
2343 max iterations: 500
2344
2345 Ant Colony Construction in Progress...
2346
2347 Initial Tour Cost: 23242.262047880184
2348 Iterations Completed: 100
2349 Iterations Completed: 200
2350 Iterations Completed: 300
2351 Iterations Completed: 400
2352
2353 Best Route Found by ACO for Bays29:
2354 [2, 28, 25, 4, 8, 11, 5, 27, 0, 20, 1, 19, 9, 12,
    , 23, 26, 7, 22, 15, 18, 3, 17, 13, 21, 16, 14,
    10, 24, 6]
2355 Cost of Best Route is 8794.766567918363 found at
    Iteration 446 by an Ant
2356 Running ACO with the following parameters:
2357
2358 population: 21
2359 pheromone decay constant: 0.5
2360 online pheromone update: True
2361 alpha: 1
2362 beta: 5
2363 Q: 2000
2364 max iterations: 500
2365
2366 Ant Colony Construction in Progress...
2367
2368 Initial Tour Cost: 22532.66094104608
```

```
2369 Iterations Completed: 100
2370 Iterations Completed: 200
2371 Iterations Completed: 300
2372 Iterations Completed: 400
2373
2374 Best Route Found by ACO for Bays29:
2375 [2, 28, 25, 8, 4, 20, 1, 19, 9, 12, 23, 0, 27, 5
     , 11, 7, 26, 22, 15, 18, 3, 14, 13, 17, 16, 21,
     10, 24, 6]
2376 Cost of Best Route is 8795.221858493936 found at
     Iteration 113 by an Ant
2377 Running ACO with the following parameters:
2378
2379 population: 21
2380 pheromone decay constant: 0.5
2381 online pheromone update: True
2382 alpha: 1
2383 beta: 5
2384 Q: 2000
2385 max iterations: 500
2386
2387 Ant Colony Construction in Progress...
2388
2389 Initial Tour Cost: 22098.176805153198
2390 Iterations Completed: 100
2391 Iterations Completed: 200
2392 Iterations Completed: 300
2393 Iterations Completed: 400
2394
2395 Best Route Found by ACO for Bays29:
2396 [11, 5, 4, 8, 25, 28, 2, 1, 20, 0, 27, 7, 26, 23
     , 15, 12, 9, 19, 3, 14, 13, 17, 16, 21, 10, 18,
     24, 6, 22]
2397 Cost of Best Route is 8696.243881501587 found at
     Iteration 178 by an Ant
2398 Running ACO with the following parameters:
2399
2400 population: 21
2401 pheromone decay constant: 0.5
2402 online pheromone update: True
2403 alpha: 1
```

```
2404 beta: 5
2405 Q: 2000
2406 max iterations: 500
2407
2408 Ant Colony Construction in Progress...
2409
2410 Initial Tour Cost: 21995.025552915227
2411 Iterations Completed: 100
2412 Iterations Completed: 200
2413 Iterations Completed: 300
2414 Iterations Completed: 400
2415
2416 Best Route Found by ACO for Bays29:
2417 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
     , 3, 14, 13, 17, 16, 21, 10, 18, 24, 6, 22, 7, 26
     , 23, 15]
2418 Cost of Best Route is 8430.135113928243 found at
     Iteration 105 by an Ant
2419 Running ACO with the following parameters:
2420
2421 population: 21
2422 pheromone decay constant: 0.5
2423 online pheromone update: True
2424 alpha: 1
2425 beta: 5
2426 Q: 2000
2427 max iterations: 500
2428
2429 Ant Colony Construction in Progress...
2430
2431 Initial Tour Cost: 21351.909006135316
2432 Iterations Completed: 100
2433 Iterations Completed: 200
2434 Iterations Completed: 300
2435 Iterations Completed: 400
2436
2437 Best Route Found by ACO for Bays29:
2438 [11, 5, 4, 8, 25, 28, 2, 1, 20, 0, 27, 7, 26, 15
     , 23, 12, 9, 19, 3, 14, 17, 13, 16, 21, 10, 18,
     24, 6, 22]
2439 Cost of Best Route is 8682.638431927215 found at
```

```
2439 Iteration 314 by an Ant
2440 Running ACO with the following parameters:
2441
2442 population: 21
2443 pheromone decay constant: 0.5
2444 online pheromone update: True
2445 alpha: 1
2446 beta: 5
2447 Q: 2000
2448 max iterations: 500
2449
2450 Ant Colony Construction in Progress...
2451
2452 Initial Tour Cost: 20706.354890951614
2453 Iterations Completed: 100
2454 Iterations Completed: 200
2455 Iterations Completed: 300
2456 Iterations Completed: 400
2457
2458 Best Route Found by ACO for Bays29:
2459 [17, 13, 16, 21, 10, 14, 3, 9, 19, 1, 20, 4, 25,
     28, 2, 8, 5, 11, 27, 0, 23, 26, 7, 15, 12, 18, 24
     , 6, 22]
2460 Cost of Best Route is 8764.509086321064 found at
     Iteration 484 by an Ant
2461 Running ACO with the following parameters:
2462
2463 population: 21
2464 pheromone decay constant: 0.5
2465 online pheromone update: True
2466 alpha: 1
2467 beta: 5
2468 Q: 2000
2469 max iterations: 500
2470
2471 Ant Colony Construction in Progress...
2472
2473 Initial Tour Cost: 22083.577038123156
2474 Iterations Completed: 100
2475 Iterations Completed: 200
2476 Iterations Completed: 300
```

```
2477 Iterations Completed: 400
2478
2479 Best Route Found by ACO for Bays29:
2480 [2, 28, 25, 8, 4, 20, 1, 19, 9, 3, 14, 17, 13, 21
     , 16, 10, 18, 24, 6, 22, 26, 7, 23, 15, 12, 0, 27
     , 5, 11]
2481 Cost of Best Route is 8457.437968952861 found at
     Iteration 332 by an Ant
2482 Running ACO with the following parameters:
2483
2484 population: 21
2485 pheromone decay constant: 0.5
2486 online pheromone update: True
2487 alpha: 1
2488 beta: 5
2489 Q: 2000
2490 max iterations: 500
2491
2492 Ant Colony Construction in Progress...
2493
2494 Initial Tour Cost: 24152.468350832376
2495 Iterations Completed: 100
2496 Iterations Completed: 200
2497 Iterations Completed: 300
2498 Iterations Completed: 400
2499
2500 Best Route Found by ACO for Bays29:
2501 [20, 1, 19, 9, 3, 14, 13, 17, 16, 21, 10, 18, 24
     , 6, 22, 7, 26, 23, 15, 12, 0, 27, 11, 5, 8, 4,
     25, 28, 2]
2502 Cost of Best Route is 8533.546440218615 found at
     Iteration 394 by an Ant
2503 Running ACO with the following parameters:
2504
2505 population: 21
2506 pheromone decay constant: 0.5
2507 online pheromone update: True
2508 alpha: 1
2509 beta: 5
2510 Q: 2000
2511 max iterations: 500
```

```
2512
2513 Ant Colony Construction in Progress...
2514
2515 Initial Tour Cost: 19753.2053407693
2516 Iterations Completed: 100
2517 Iterations Completed: 200
2518 Iterations Completed: 300
2519 Iterations Completed: 400
2520
2521 Best Route Found by ACO for Bays29:
2522 [8, 5, 11, 27, 0, 7, 26, 22, 6, 24, 18, 15, 23,
     12, 17, 13, 16, 21, 10, 14, 3, 9, 19, 1, 20, 4,
     25, 28, 2]
2523 Cost of Best Route is 8746.115292775949 found at
     Iteration 99 by an Ant
2524 Running ACO with the following parameters:
2525
2526 population: 21
2527 pheromone decay constant: 0.5
2528 online pheromone update: True
2529 alpha: 1
2530 beta: 5
2531 Q: 2000
2532 max iterations: 500
2533
2534 Ant Colony Construction in Progress...
2535
2536 Initial Tour Cost: 21322.102845933598
2537 Iterations Completed: 100
2538 Iterations Completed: 200
2539 Iterations Completed: 300
2540 Iterations Completed: 400
2541
2542 Best Route Found by ACO for Bays29:
2543 [23, 26, 15, 12, 9, 19, 3, 14, 17, 13, 21, 16, 10
     , 18, 24, 6, 22, 7, 0, 27, 5, 11, 8, 4, 20, 1, 28
     , 25, 2]
2544 Cost of Best Route is 8884.149714836034 found at
     Iteration 152 by an Ant
2545 Running ACO with the following parameters:
2546
```

```
2547 population: 23
2548 pheromone decay constant: 0.5
2549 online pheromone update: True
2550 alpha: 1
2551 beta: 5
2552 Q: 2000
2553 max iterations: 500
2554
2555 Ant Colony Construction in Progress...
2556
2557 Initial Tour Cost: 22044.13096074067
2558 Iterations Completed: 100
2559 Iterations Completed: 200
2560 Iterations Completed: 300
2561 Iterations Completed: 400
2562
2563 Best Route Found by ACO for Bays29:
2564 [15, 12, 9, 19, 1, 20, 4, 25, 28, 2, 8, 11, 5, 27
    , 0, 23, 26, 7, 22, 6, 24, 18, 3, 14, 13, 17, 16
    , 21, 10]
2565 Cost of Best Route is 8749.00434827182 found at
    Iteration 50 by an Ant
2566 Running ACO with the following parameters:
2567
2568 population: 23
2569 pheromone decay constant: 0.5
2570 online pheromone update: True
2571 alpha: 1
2572 beta: 5
2573 Q: 2000
2574 max iterations: 500
2575
2576 Ant Colony Construction in Progress...
2577
2578 Initial Tour Cost: 21503.14652949978
2579 Iterations Completed: 100
2580 Iterations Completed: 200
2581 Iterations Completed: 300
2582 Iterations Completed: 400
2583
2584 Best Route Found by ACO for Bays29:
```

```
2585 [2, 28, 25, 4, 8, 11, 5, 27, 0, 20, 1, 19, 9, 3,
      14, 13, 17, 16, 21, 10, 24, 18, 15, 26, 12, 23, 7
      , 22, 6]
2586 Cost of Best Route is 8665.41468242621 found at
      Iteration 59 by an Ant
2587 Running ACO with the following parameters:
2588
2589 population: 23
2590 pheromone decay constant: 0.5
2591 online pheromone update: True
2592 alpha: 1
2593 beta: 5
2594 Q: 2000
2595 max iterations: 500
2596
2597 Ant Colony Construction in Progress...
2598
2599 Initial Tour Cost: 21265.128152800797
2600 Iterations Completed: 100
2601 Iterations Completed: 200
2602 Iterations Completed: 300
2603 Iterations Completed: 400
2604
2605 Best Route Found by ACO for Bays29:
2606 [2, 28, 25, 4, 8, 11, 5, 27, 0, 23, 7, 26, 15, 12
      , 9, 19, 1, 20, 3, 14, 17, 13, 16, 21, 10, 18, 24
      , 6, 22]
2607 Cost of Best Route is 8472.383859209076 found at
      Iteration 248 by an Ant
2608 Running ACO with the following parameters:
2609
2610 population: 23
2611 pheromone decay constant: 0.5
2612 online pheromone update: True
2613 alpha: 1
2614 beta: 5
2615 Q: 2000
2616 max iterations: 500
2617
2618 Ant Colony Construction in Progress...
2619
```

```
2620 Initial Tour Cost: 23557.287265526695
2621 Iterations Completed: 100
2622 Iterations Completed: 200
2623 Iterations Completed: 300
2624 Iterations Completed: 400
2625
2626 Best Route Found by ACO for Bays29:
2627 [18, 14, 3, 13, 17, 16, 21, 10, 24, 6, 22, 7, 26
     , 23, 15, 12, 9, 19, 1, 20, 0, 27, 11, 5, 4, 8,
     25, 28, 2]
2628 Cost of Best Route is 8683.71758300744 found at
     Iteration 300 by an Ant
2629 Running ACO with the following parameters:
2630
2631 population: 23
2632 pheromone decay constant: 0.5
2633 online pheromone update: True
2634 alpha: 1
2635 beta: 5
2636 Q: 2000
2637 max iterations: 500
2638
2639 Ant Colony Construction in Progress...
2640
2641 Initial Tour Cost: 21472.192243248108
2642 Iterations Completed: 100
2643 Iterations Completed: 200
2644 Iterations Completed: 300
2645 Iterations Completed: 400
2646
2647 Best Route Found by ACO for Bays29:
2648 [17, 13, 21, 16, 10, 14, 3, 9, 19, 1, 20, 4, 25,
     28, 2, 8, 11, 5, 27, 0, 23, 26, 7, 22, 15, 12, 18
     , 24, 6]
2649 Cost of Best Route is 8865.426117347723 found at
     Iteration 105 by an Ant
2650 Running ACO with the following parameters:
2651
2652 population: 23
2653 pheromone decay constant: 0.5
2654 online pheromone update: True
```

```
2655 alpha: 1
2656 beta: 5
2657 Q: 2000
2658 max iterations: 500
2659
2660 Ant Colony Construction in Progress...
2661
2662 Initial Tour Cost: 21965.94487735372
2663 Iterations Completed: 100
2664 Iterations Completed: 200
2665 Iterations Completed: 300
2666 Iterations Completed: 400
2667
2668 Best Route Found by ACO for Bays29:
2669 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
     , 3, 14, 18, 24, 6, 22, 26, 7, 23, 15, 10, 13, 17
     , 21, 16]
2670 Cost of Best Route is 8710.456882426544 found at
     Iteration 242 by an Ant
2671 Running ACO with the following parameters:
2672
2673 population: 23
2674 pheromone decay constant: 0.5
2675 online pheromone update: True
2676 alpha: 1
2677 beta: 5
2678 Q: 2000
2679 max iterations: 500
2680
2681 Ant Colony Construction in Progress...
2682
2683 Initial Tour Cost: 19414.87988961728
2684 Iterations Completed: 100
2685 Iterations Completed: 200
2686 Iterations Completed: 300
2687 Iterations Completed: 400
2688
2689 Best Route Found by ACO for Bays29:
2690 [16, 13, 21, 10, 14, 17, 3, 9, 19, 1, 20, 4, 28,
     2, 25, 8, 5, 11, 27, 0, 7, 26, 23, 15, 12, 18, 24
     , 6, 22]
```

```
2691 Cost of Best Route is 8821.570588108556 found at
    Iteration 44 by an Ant
2692 Running ACO with the following parameters:
2693
2694 population: 23
2695 pheromone decay constant: 0.5
2696 online pheromone update: True
2697 alpha: 1
2698 beta: 5
2699 Q: 2000
2700 max iterations: 500
2701
2702 Ant Colony Construction in Progress...
2703
2704 Initial Tour Cost: 20960.525743213566
2705 Iterations Completed: 100
2706 Iterations Completed: 200
2707 Iterations Completed: 300
2708 Iterations Completed: 400
2709
2710 Best Route Found by ACO for Bays29:
2711 [9, 19, 12, 15, 18, 14, 3, 17, 13, 16, 21, 10, 24
    , 6, 22, 7, 26, 23, 0, 27, 5, 11, 8, 4, 20, 1, 28
    , 25, 2]
2712 Cost of Best Route is 8852.812223190855 found at
    Iteration 253 by an Ant
2713 Running ACO with the following parameters:
2714
2715 population: 23
2716 pheromone decay constant: 0.5
2717 online pheromone update: True
2718 alpha: 1
2719 beta: 5
2720 Q: 2000
2721 max iterations: 500
2722
2723 Ant Colony Construction in Progress...
2724
2725 Initial Tour Cost: 22414.61691212003
2726 Iterations Completed: 100
2727 Iterations Completed: 200
```

```
2728 Iterations Completed: 300
2729 Iterations Completed: 400
2730
2731 Best Route Found by ACO for Bays29:
2732 [2, 28, 25, 8, 4, 5, 11, 27, 0, 20, 1, 19, 9, 23
     , 7, 26, 15, 12, 3, 14, 17, 13, 16, 21, 10, 18,
     24, 6, 22]
2733 Cost of Best Route is 8550.416342219223 found at
     Iteration 58 by an Ant
2734 Running ACO with the following parameters:
2735
2736 population: 23
2737 pheromone decay constant: 0.5
2738 online pheromone update: True
2739 alpha: 1
2740 beta: 5
2741 Q: 2000
2742 max iterations: 500
2743
2744 Ant Colony Construction in Progress...
2745
2746 Initial Tour Cost: 20924.708666545146
2747 Iterations Completed: 100
2748 Iterations Completed: 200
2749 Iterations Completed: 300
2750 Iterations Completed: 400
2751
2752 Best Route Found by ACO for Bays29:
2753 [20, 1, 19, 9, 3, 18, 14, 13, 17, 16, 21, 10, 24
     , 6, 22, 26, 7, 23, 15, 12, 0, 27, 5, 11, 8, 4,
     25, 28, 2]
2754 Cost of Best Route is 8621.029463210658 found at
     Iteration 279 by an Ant
2755 Running ACO with the following parameters:
2756
2757 population: 23
2758 pheromone decay constant: 0.5
2759 online pheromone update: True
2760 alpha: 1
2761 beta: 5
2762 Q: 2000
```

```
2763 max iterations: 500
2764
2765 Ant Colony Construction in Progress...
2766
2767 Initial Tour Cost: 21831.40895703239
2768 Iterations Completed: 100
2769 Iterations Completed: 200
2770 Iterations Completed: 300
2771 Iterations Completed: 400
2772
2773 Best Route Found by ACO for Bays29:
2774 [2, 28, 25, 8, 4, 1, 20, 5, 11, 27, 0, 7, 26, 23
     , 15, 12, 9, 19, 3, 14, 17, 13, 21, 16, 10, 18,
     24, 6, 22]
2775 Cost of Best Route is 8599.013469050167 found at
     Iteration 230 by an Ant
2776 Running ACO with the following parameters:
2777
2778 population: 25
2779 pheromone decay constant: 0.5
2780 online pheromone update: True
2781 alpha: 1
2782 beta: 5
2783 Q: 2000
2784 max iterations: 500
2785
2786 Ant Colony Construction in Progress...
2787
2788 Initial Tour Cost: 21408.434874296312
2789 Iterations Completed: 100
2790 Iterations Completed: 200
2791 Iterations Completed: 300
2792 Iterations Completed: 400
2793
2794 Best Route Found by ACO for Bays29:
2795 [2, 28, 25, 4, 20, 1, 19, 9, 3, 14, 17, 13, 21,
     16, 10, 18, 24, 6, 22, 15, 12, 23, 26, 7, 0, 27,
     5, 11, 8]
2796 Cost of Best Route is 8587.460805766781 found at
     Iteration 152 by an Ant
2797 Running ACO with the following parameters:
```

```
2798
2799 population: 25
2800 pheromone decay constant: 0.5
2801 online pheromone update: True
2802 alpha: 1
2803 beta: 5
2804 Q: 2000
2805 max iterations: 500
2806
2807 Ant Colony Construction in Progress...
2808
2809 Initial Tour Cost: 21781.00921528385
2810 Iterations Completed: 100
2811 Iterations Completed: 200
2812 Iterations Completed: 300
2813 Iterations Completed: 400
2814
2815 Best Route Found by ACO for Bays29:
2816 [2, 28, 25, 4, 8, 11, 5, 0, 27, 20, 1, 19, 9, 3,
     14, 17, 13, 16, 21, 10, 24, 18, 12, 15, 23, 26, 7
     , 22, 6]
2817 Cost of Best Route is 8518.078475701384 found at
     Iteration 20 by an Ant
2818 Running ACO with the following parameters:
2819
2820 population: 25
2821 pheromone decay constant: 0.5
2822 online pheromone update: True
2823 alpha: 1
2824 beta: 5
2825 Q: 2000
2826 max iterations: 500
2827
2828 Ant Colony Construction in Progress...
2829
2830 Initial Tour Cost: 21734.830987081885
2831 Iterations Completed: 100
2832 Iterations Completed: 200
2833 Iterations Completed: 300
2834 Iterations Completed: 400
2835
```

```
2836 Best Route Found by ACO for Bays29:  
2837 [11, 27, 0, 23, 12, 15, 26, 7, 22, 6, 24, 18, 14  
, 17, 13, 16, 21, 10, 3, 9, 19, 1, 20, 4, 8, 5,  
25, 28, 2]  
2838 Cost of Best Route is 8856.694276206255 found at  
Iteration 406 by an Ant  
2839 Running ACO with the following parameters:  
2840  
2841 population: 25  
2842 pheromone decay constant: 0.5  
2843 online pheromone update: True  
2844 alpha: 1  
2845 beta: 5  
2846 Q: 2000  
2847 max iterations: 500  
2848  
2849 Ant Colony Construction in Progress...  
2850  
2851 Initial Tour Cost: 22340.468744079008  
2852 Iterations Completed: 100  
2853 Iterations Completed: 200  
2854 Iterations Completed: 300  
2855 Iterations Completed: 400  
2856  
2857 Best Route Found by ACO for Bays29:  
2858 [2, 28, 25, 4, 8, 11, 5, 27, 0, 20, 1, 19, 9, 3,  
12, 18, 24, 6, 22, 7, 26, 23, 15, 14, 17, 13, 21  
, 16, 10]  
2859 Cost of Best Route is 8780.550277945087 found at  
Iteration 277 by an Ant  
2860 Running ACO with the following parameters:  
2861  
2862 population: 25  
2863 pheromone decay constant: 0.5  
2864 online pheromone update: True  
2865 alpha: 1  
2866 beta: 5  
2867 Q: 2000  
2868 max iterations: 500  
2869  
2870 Ant Colony Construction in Progress...
```

```
2871
2872 Initial Tour Cost: 22170.514322203122
2873 Iterations Completed: 100
2874 Iterations Completed: 200
2875 Iterations Completed: 300
2876 Iterations Completed: 400
2877
2878 Best Route Found by ACO for Bays29:
2879 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
     14, 17, 13, 21, 16, 10, 18, 12, 23, 7, 26, 15, 24
     , 6, 22]
2880 Cost of Best Route is 8498.36904901459 found at
     Iteration 193 by an Ant
2881 Running ACO with the following parameters:
2882
2883 population: 25
2884 pheromone decay constant: 0.5
2885 online pheromone update: True
2886 alpha: 1
2887 beta: 5
2888 Q: 2000
2889 max iterations: 500
2890
2891 Ant Colony Construction in Progress...
2892
2893 Initial Tour Cost: 22829.79419743793
2894 Iterations Completed: 100
2895 Iterations Completed: 200
2896 Iterations Completed: 300
2897 Iterations Completed: 400
2898
2899 Best Route Found by ACO for Bays29:
2900 [9, 19, 1, 20, 4, 25, 28, 2, 8, 11, 5, 27, 0, 7,
     26, 23, 15, 18, 12, 3, 14, 17, 13, 16, 21, 10, 24
     , 6, 22]
2901 Cost of Best Route is 8886.574813741521 found at
     Iteration 397 by an Ant
2902 Running ACO with the following parameters:
2903
2904 population: 25
2905 pheromone decay constant: 0.5
```

```
2906 online pheromone update: True
2907 alpha: 1
2908 beta: 5
2909 Q: 2000
2910 max iterations: 500
2911
2912 Ant Colony Construction in Progress...
2913
2914 Initial Tour Cost: 21409.53313612386
2915 Iterations Completed: 100
2916 Iterations Completed: 200
2917 Iterations Completed: 300
2918 Iterations Completed: 400
2919
2920 Best Route Found by ACO for Bays29:
2921 [10, 13, 21, 16, 17, 14, 3, 9, 19, 1, 20, 4, 25,
     28, 2, 8, 5, 11, 27, 0, 23, 15, 12, 18, 24, 6, 22
     , 26, 7]
2922 Cost of Best Route is 8819.220034033851 found at
     Iteration 43 by an Ant
2923 Running ACO with the following parameters:
2924
2925 population: 25
2926 pheromone decay constant: 0.5
2927 online pheromone update: True
2928 alpha: 1
2929 beta: 5
2930 Q: 2000
2931 max iterations: 500
2932
2933 Ant Colony Construction in Progress...
2934
2935 Initial Tour Cost: 22014.90835813262
2936 Iterations Completed: 100
2937 Iterations Completed: 200
2938 Iterations Completed: 300
2939 Iterations Completed: 400
2940
2941 Best Route Found by ACO for Bays29:
2942 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
     , 23, 7, 26, 15, 22, 6, 24, 18, 3, 14, 13, 17, 10
```

```
2942 , 21, 16]
2943 Cost of Best Route is 8520.5582386088 found at
    Iteration 269 by an Ant
2944 Running ACO with the following parameters:
2945
2946 population: 25
2947 pheromone decay constant: 0.5
2948 online pheromone update: True
2949 alpha: 1
2950 beta: 5
2951 Q: 2000
2952 max iterations: 500
2953
2954 Ant Colony Construction in Progress...
2955
2956 Initial Tour Cost: 20711.049546401482
2957 Iterations Completed: 100
2958 Iterations Completed: 200
2959 Iterations Completed: 300
2960 Iterations Completed: 400
2961
2962 Best Route Found by ACO for Bays29:
2963 [10, 21, 16, 13, 17, 14, 3, 9, 19, 1, 20, 4, 25,
    28, 2, 8, 11, 5, 0, 27, 7, 26, 23, 12, 15, 18, 24
    , 6, 22]
2964 Cost of Best Route is 8587.063083677445 found at
    Iteration 230 by an Ant
2965 Running ACO with the following parameters:
2966
2967 population: 25
2968 pheromone decay constant: 0.5
2969 online pheromone update: True
2970 alpha: 1
2971 beta: 5
2972 Q: 2000
2973 max iterations: 500
2974
2975 Ant Colony Construction in Progress...
2976
2977 Initial Tour Cost: 21087.852958537565
2978 Iterations Completed: 100
```

```
2979 Iterations Completed: 200
2980 Iterations Completed: 300
2981 Iterations Completed: 400
2982
2983 Best Route Found by ACO for Bays29:
2984 [2, 28, 25, 4, 8, 5, 11, 0, 27, 20, 1, 19, 9, 12
     , 23, 26, 7, 22, 15, 18, 14, 3, 17, 13, 16, 21,
     10, 24, 6]
2985 Cost of Best Route is 8765.415568608929 found at
     Iteration 465 by an Ant
2986 Running ACO with the following parameters:
2987
2988 population: 25
2989 pheromone decay constant: 0.5
2990 online pheromone update: True
2991 alpha: 1
2992 beta: 5
2993 Q: 2000
2994 max iterations: 500
2995
2996 Ant Colony Construction in Progress...
2997
2998 Initial Tour Cost: 23019.511211758687
2999 Iterations Completed: 100
3000 Iterations Completed: 200
3001 Iterations Completed: 300
3002 Iterations Completed: 400
3003
3004 Best Route Found by ACO for Bays29:
3005 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
     , 3, 14, 17, 13, 21, 16, 10, 18, 24, 6, 22, 26, 7
     , 23, 15]
3006 Cost of Best Route is 8459.78530824766 found at
     Iteration 377 by an Ant
3007 Running ACO with the following parameters:
3008
3009 population: 27
3010 pheromone decay constant: 0.5
3011 online pheromone update: True
3012 alpha: 1
3013 beta: 5
```

```
3014 Q: 2000
3015 max iterations: 500
3016
3017 Ant Colony Construction in Progress...
3018
3019 Initial Tour Cost: 22347.17840596651
3020 Iterations Completed: 100
3021 Iterations Completed: 200
3022 Iterations Completed: 300
3023 Iterations Completed: 400
3024
3025 Best Route Found by ACO for Bays29:
3026 [2, 28, 25, 4, 8, 5, 11, 27, 0, 23, 7, 26, 15, 12
     , 1, 20, 9, 19, 3, 14, 17, 13, 16, 21, 10, 18, 24
     , 6, 22]
3027 Cost of Best Route is 8580.538393652108 found at
      Iteration 88 by an Ant
3028 Running ACO with the following parameters:
3029
3030 population: 27
3031 pheromone decay constant: 0.5
3032 online pheromone update: True
3033 alpha: 1
3034 beta: 5
3035 Q: 2000
3036 max iterations: 500
3037
3038 Ant Colony Construction in Progress...
3039
3040 Initial Tour Cost: 22112.182117548506
3041 Iterations Completed: 100
3042 Iterations Completed: 200
3043 Iterations Completed: 300
3044 Iterations Completed: 400
3045
3046 Best Route Found by ACO for Bays29:
3047 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
     , 3, 14, 13, 17, 16, 21, 10, 24, 18, 15, 26, 23,
     7, 22, 6]
3048 Cost of Best Route is 8470.726084420246 found at
      Iteration 84 by an Ant
```

```
3049 Running ACO with the following parameters:  
3050  
3051 population: 27  
3052 pheromone decay constant: 0.5  
3053 online pheromone update: True  
3054 alpha: 1  
3055 beta: 5  
3056 Q: 2000  
3057 max iterations: 500  
3058  
3059 Ant Colony Construction in Progress...  
3060  
3061 Initial Tour Cost: 23138.775409381316  
3062 Iterations Completed: 100  
3063 Iterations Completed: 200  
3064 Iterations Completed: 300  
3065 Iterations Completed: 400  
3066  
3067 Best Route Found by ACO for Bays29:  
3068 [12, 15, 23, 26, 7, 0, 27, 5, 11, 8, 25, 2, 28, 4  
    , 20, 1, 19, 9, 3, 14, 13, 21, 16, 17, 10, 18, 24  
    , 6, 22]  
3069 Cost of Best Route is 8776.164677008292 found at  
    Iteration 181 by an Ant  
3070 Running ACO with the following parameters:  
3071  
3072 population: 27  
3073 pheromone decay constant: 0.5  
3074 online pheromone update: True  
3075 alpha: 1  
3076 beta: 5  
3077 Q: 2000  
3078 max iterations: 500  
3079  
3080 Ant Colony Construction in Progress...  
3081  
3082 Initial Tour Cost: 21603.165144717932  
3083 Iterations Completed: 100  
3084 Iterations Completed: 200  
3085 Iterations Completed: 300  
3086 Iterations Completed: 400
```

```
3087
3088 Best Route Found by ACO for Bays29:
3089 [2, 28, 25, 4, 20, 1, 19, 9, 12, 23, 26, 15, 18,
      3, 14, 17, 13, 21, 16, 10, 24, 6, 22, 7, 0, 27, 5
      , 11, 8]
3090 Cost of Best Route is 8768.572651386063 found at
      Iteration 146 by an Ant
3091 Running ACO with the following parameters:
3092
3093 population: 27
3094 pheromone decay constant: 0.5
3095 online pheromone update: True
3096 alpha: 1
3097 beta: 5
3098 Q: 2000
3099 max iterations: 500
3100
3101 Ant Colony Construction in Progress...
3102
3103 Initial Tour Cost: 20796.41949471821
3104 Iterations Completed: 100
3105 Iterations Completed: 200
3106 Iterations Completed: 300
3107 Iterations Completed: 400
3108
3109 Best Route Found by ACO for Bays29:
3110 [10, 21, 13, 17, 16, 12, 15, 23, 7, 26, 22, 6, 24
      , 18, 14, 3, 9, 19, 1, 20, 0, 27, 5, 11, 8, 4, 25
      , 28, 2]
3111 Cost of Best Route is 8812.052300634066 found at
      Iteration 454 by an Ant
3112 Running ACO with the following parameters:
3113
3114 population: 27
3115 pheromone decay constant: 0.5
3116 online pheromone update: True
3117 alpha: 1
3118 beta: 5
3119 Q: 2000
3120 max iterations: 500
3121
```

```
3122 Ant Colony Construction in Progress...
3123
3124 Initial Tour Cost: 21532.21825532017
3125 Iterations Completed: 100
3126 Iterations Completed: 200
3127 Iterations Completed: 300
3128 Iterations Completed: 400
3129
3130 Best Route Found by ACO for Bays29:
3131 [2, 28, 25, 8, 4, 5, 11, 27, 0, 20, 1, 19, 9, 3,
     14, 13, 17, 16, 21, 10, 18, 24, 12, 23, 15, 26, 7
     , 22, 6]
3132 Cost of Best Route is 8717.538957649393 found at
     Iteration 76 by an Ant
3133 Running ACO with the following parameters:
3134
3135 population: 27
3136 pheromone decay constant: 0.5
3137 online pheromone update: True
3138 alpha: 1
3139 beta: 5
3140 Q: 2000
3141 max iterations: 500
3142
3143 Ant Colony Construction in Progress...
3144
3145 Initial Tour Cost: 21341.608786284378
3146 Iterations Completed: 100
3147 Iterations Completed: 200
3148 Iterations Completed: 300
3149 Iterations Completed: 400
3150
3151 Best Route Found by ACO for Bays29:
3152 [11, 5, 27, 0, 23, 26, 7, 15, 12, 20, 4, 8, 25,
     28, 2, 1, 19, 9, 3, 14, 17, 13, 16, 21, 10, 18,
     24, 6, 22]
3153 Cost of Best Route is 8787.519755632853 found at
     Iteration 475 by an Ant
3154 Running ACO with the following parameters:
3155
3156 population: 27
```

```
3157 pheromone decay constant: 0.5
3158 online pheromone update: True
3159 alpha: 1
3160 beta: 5
3161 Q: 2000
3162 max iterations: 500
3163
3164 Ant Colony Construction in Progress...
3165
3166 Initial Tour Cost: 20149.870530998374
3167 Iterations Completed: 100
3168 Iterations Completed: 200
3169 Iterations Completed: 300
3170 Iterations Completed: 400
3171
3172 Best Route Found by ACO for Bays29:
3173 [3, 14, 13, 17, 16, 21, 10, 18, 24, 6, 22, 26, 7
     , 23, 15, 12, 9, 19, 1, 20, 27, 0, 5, 11, 8, 4,
     28, 25, 2]
3174 Cost of Best Route is 8758.19008404004 found at
     Iteration 43 by an Ant
3175 Running ACO with the following parameters:
3176
3177 population: 27
3178 pheromone decay constant: 0.5
3179 online pheromone update: True
3180 alpha: 1
3181 beta: 5
3182 Q: 2000
3183 max iterations: 500
3184
3185 Ant Colony Construction in Progress...
3186
3187 Initial Tour Cost: 21056.92236863743
3188 Iterations Completed: 100
3189 Iterations Completed: 200
3190 Iterations Completed: 300
3191 Iterations Completed: 400
3192
3193 Best Route Found by ACO for Bays29:
3194 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
```

```
3194 14, 18, 12, 15, 26, 23, 7, 22, 6, 24, 10, 13, 17
      , 21, 16]
3195 Cost of Best Route is 8591.553390504208 found at
      Iteration 307 by an Ant
3196 Running ACO with the following parameters:
3197
3198 population: 27
3199 pheromone decay constant: 0.5
3200 online pheromone update: True
3201 alpha: 1
3202 beta: 5
3203 Q: 2000
3204 max iterations: 500
3205
3206 Ant Colony Construction in Progress...
3207
3208 Initial Tour Cost: 21750.22968939738
3209 Iterations Completed: 100
3210 Iterations Completed: 200
3211 Iterations Completed: 300
3212 Iterations Completed: 400
3213
3214 Best Route Found by ACO for Bays29:
3215 [14, 3, 17, 16, 13, 21, 10, 18, 24, 6, 22, 7, 27
      , 0, 23, 26, 15, 12, 9, 19, 1, 20, 4, 5, 11, 8,
      25, 28, 2]
3216 Cost of Best Route is 8709.306344509148 found at
      Iteration 461 by an Ant
3217 Running ACO with the following parameters:
3218
3219 population: 27
3220 pheromone decay constant: 0.5
3221 online pheromone update: True
3222 alpha: 1
3223 beta: 5
3224 Q: 2000
3225 max iterations: 500
3226
3227 Ant Colony Construction in Progress...
3228
3229 Initial Tour Cost: 20946.445321846935
```

```
3230 Iterations Completed: 100
3231 Iterations Completed: 200
3232 Iterations Completed: 300
3233 Iterations Completed: 400
3234
3235 Best Route Found by ACO for Bays29:
3236 [6, 24, 18, 10, 21, 13, 17, 16, 14, 3, 9, 19, 1,
      20, 23, 26, 7, 22, 15, 12, 0, 27, 5, 11, 8, 4, 25
      , 28, 2]
3237 Cost of Best Route is 8856.975797892897 found at
      Iteration 75 by an Ant
3238 Running ACO with the following parameters:
3239
3240 population: 29
3241 pheromone decay constant: 0.5
3242 online pheromone update: True
3243 alpha: 1
3244 beta: 5
3245 Q: 2000
3246 max iterations: 500
3247
3248 Ant Colony Construction in Progress...
3249
3250 Initial Tour Cost: 20966.346313246235
3251 Iterations Completed: 100
3252 Iterations Completed: 200
3253 Iterations Completed: 300
3254 Iterations Completed: 400
3255
3256 Best Route Found by ACO for Bays29:
3257 [12, 15, 23, 26, 7, 22, 6, 24, 18, 10, 13, 21, 16
      , 17, 14, 3, 9, 19, 1, 20, 0, 27, 5, 11, 8, 4, 25
      , 28, 2]
3258 Cost of Best Route is 8375.32035575205 found at
      Iteration 390 by an Ant
3259 Running ACO with the following parameters:
3260
3261 population: 29
3262 pheromone decay constant: 0.5
3263 online pheromone update: True
3264 alpha: 1
```

```
3265 beta: 5
3266 Q: 2000
3267 max iterations: 500
3268
3269 Ant Colony Construction in Progress...
3270
3271 Initial Tour Cost: 21008.38901128514
3272 Iterations Completed: 100
3273 Iterations Completed: 200
3274 Iterations Completed: 300
3275 Iterations Completed: 400
3276
3277 Best Route Found by ACO for Bays29:
3278 [10, 21, 16, 17, 13, 14, 3, 9, 19, 1, 20, 12, 15,
     , 18, 24, 6, 22, 26, 23, 7, 0, 27, 11, 5, 8, 4,
     25, 28, 2]
3279 Cost of Best Route is 8440.01513895657 found at
      Iteration 271 by an Ant
3280 Running ACO with the following parameters:
3281
3282 population: 29
3283 pheromone decay constant: 0.5
3284 online pheromone update: True
3285 alpha: 1
3286 beta: 5
3287 Q: 2000
3288 max iterations: 500
3289
3290 Ant Colony Construction in Progress...
3291
3292 Initial Tour Cost: 21570.51556735314
3293 Iterations Completed: 100
3294 Iterations Completed: 200
3295 Iterations Completed: 300
3296 Iterations Completed: 400
3297
3298 Best Route Found by ACO for Bays29:
3299 [2, 25, 28, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 12
     , 23, 7, 26, 22, 6, 24, 15, 18, 3, 14, 10, 21, 16
     , 13, 17]
3300 Cost of Best Route is 8650.88487621996 found at
```

```
3300 Iteration 275 by an Ant
3301 Running ACO with the following parameters:
3302
3303 population: 29
3304 pheromone decay constant: 0.5
3305 online pheromone update: True
3306 alpha: 1
3307 beta: 5
3308 Q: 2000
3309 max iterations: 500
3310
3311 Ant Colony Construction in Progress...
3312
3313 Initial Tour Cost: 22005.08016816348
3314 Iterations Completed: 100
3315 Iterations Completed: 200
3316 Iterations Completed: 300
3317 Iterations Completed: 400
3318
3319 Best Route Found by ACO for Bays29:
3320 [2, 28, 25, 4, 8, 11, 5, 27, 0, 20, 1, 19, 9, 12
     , 3, 14, 17, 13, 21, 16, 10, 24, 18, 15, 26, 23,
     7, 22, 6]
3321 Cost of Best Route is 8511.056452972192 found at
      Iteration 137 by an Ant
3322 Running ACO with the following parameters:
3323
3324 population: 29
3325 pheromone decay constant: 0.5
3326 online pheromone update: True
3327 alpha: 1
3328 beta: 5
3329 Q: 2000
3330 max iterations: 500
3331
3332 Ant Colony Construction in Progress...
3333
3334 Initial Tour Cost: 20802.31575658822
3335 Iterations Completed: 100
3336 Iterations Completed: 200
3337 Iterations Completed: 300
```

```
3338 Iterations Completed: 400
3339
3340 Best Route Found by ACO for Bays29:
3341 [2, 28, 25, 4, 8, 5, 11, 0, 27, 20, 1, 19, 9, 3,
     14, 12, 15, 23, 7, 26, 22, 6, 24, 18, 10, 21, 13
     , 17, 16]
3342 Cost of Best Route is 8719.566612719891 found at
     Iteration 472 by an Ant
3343 Running ACO with the following parameters:
3344
3345 population: 29
3346 pheromone decay constant: 0.5
3347 online pheromone update: True
3348 alpha: 1
3349 beta: 5
3350 Q: 2000
3351 max iterations: 500
3352
3353 Ant Colony Construction in Progress...
3354
3355 Initial Tour Cost: 20621.44570722351
3356 Iterations Completed: 100
3357 Iterations Completed: 200
3358 Iterations Completed: 300
3359 Iterations Completed: 400
3360
3361 Best Route Found by ACO for Bays29:
3362 [18, 3, 14, 17, 13, 21, 16, 10, 24, 6, 22, 7, 26
     , 23, 15, 12, 9, 19, 1, 20, 0, 27, 11, 5, 8, 4,
     25, 28, 2]
3363 Cost of Best Route is 8621.150019057754 found at
     Iteration 36 by an Ant
3364 Running ACO with the following parameters:
3365
3366 population: 29
3367 pheromone decay constant: 0.5
3368 online pheromone update: True
3369 alpha: 1
3370 beta: 5
3371 Q: 2000
3372 max iterations: 500
```

```
3373
3374 Ant Colony Construction in Progress...
3375
3376 Initial Tour Cost: 20268.240972437354
3377 Iterations Completed: 100
3378 Iterations Completed: 200
3379 Iterations Completed: 300
3380 Iterations Completed: 400
3381
3382 Best Route Found by ACO for Bays29:
3383 [2, 28, 25, 4, 8, 11, 5, 27, 0, 23, 7, 26, 15, 12
     , 20, 1, 19, 9, 3, 18, 14, 17, 13, 16, 21, 10, 24
     , 6, 22]
3384 Cost of Best Route is 8388.208141423778 found at
     Iteration 455 by an Ant
3385 Running ACO with the following parameters:
3386
3387 population: 29
3388 pheromone decay constant: 0.5
3389 online pheromone update: True
3390 alpha: 1
3391 beta: 5
3392 Q: 2000
3393 max iterations: 500
3394
3395 Ant Colony Construction in Progress...
3396
3397 Initial Tour Cost: 20828.59368917937
3398 Iterations Completed: 100
3399 Iterations Completed: 200
3400 Iterations Completed: 300
3401 Iterations Completed: 400
3402
3403 Best Route Found by ACO for Bays29:
3404 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
     14, 17, 13, 21, 16, 10, 18, 12, 15, 23, 26, 7, 22
     , 6, 24]
3405 Cost of Best Route is 8588.951288587203 found at
     Iteration 206 by an Ant
3406 Running ACO with the following parameters:
3407
```

```
3408 population: 29
3409 pheromone decay constant: 0.5
3410 online pheromone update: True
3411 alpha: 1
3412 beta: 5
3413 Q: 2000
3414 max iterations: 500
3415
3416 Ant Colony Construction in Progress...
3417
3418 Initial Tour Cost: 20960.141298247825
3419 Iterations Completed: 100
3420 Iterations Completed: 200
3421 Iterations Completed: 300
3422 Iterations Completed: 400
3423
3424 Best Route Found by ACO for Bays29:
3425 [17, 13, 16, 21, 10, 14, 3, 9, 19, 1, 20, 4, 8,
     25, 28, 2, 11, 5, 27, 0, 7, 26, 23, 15, 12, 18,
     24, 6, 22]
3426 Cost of Best Route is 8904.315738227522 found at
     Iteration 79 by an Ant
3427 Running ACO with the following parameters:
3428
3429 population: 29
3430 pheromone decay constant: 0.5
3431 online pheromone update: True
3432 alpha: 1
3433 beta: 5
3434 Q: 2000
3435 max iterations: 500
3436
3437 Ant Colony Construction in Progress...
3438
3439 Initial Tour Cost: 21213.79864544147
3440 Iterations Completed: 100
3441 Iterations Completed: 200
3442 Iterations Completed: 300
3443 Iterations Completed: 400
3444
3445 Best Route Found by ACO for Bays29:
```

```
3446 [15, 12, 18, 14, 3, 9, 19, 1, 20, 4, 25, 28, 2, 8
      , 11, 5, 27, 0, 23, 26, 7, 22, 6, 24, 10, 21, 13
      , 17, 16]
3447 Cost of Best Route is 8891.275022088968 found at
      Iteration 196 by an Ant
3448 Running ACO with the following parameters:
3449
3450 population: 29
3451 pheromone decay constant: 0.5
3452 online pheromone update: True
3453 alpha: 1
3454 beta: 5
3455 Q: 2000
3456 max iterations: 500
3457
3458 Ant Colony Construction in Progress...
3459
3460 Initial Tour Cost: 23020.683212164407
3461 Iterations Completed: 100
3462 Iterations Completed: 200
3463 Iterations Completed: 300
3464 Iterations Completed: 400
3465
3466 Best Route Found by ACO for Bays29:
3467 [2, 28, 25, 4, 8, 5, 11, 27, 0, 20, 1, 19, 9, 3,
      14, 17, 13, 21, 16, 10, 18, 24, 6, 22, 15, 26, 23
      , 7, 12]
3468 Cost of Best Route is 8809.471330393257 found at
      Iteration 375 by an Ant
3469 [1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25,
      27, 29]
3470 [9093.329729852621, 9004.226362856334, 8777.
      13897942378, 8831.567536231709, 8805.979396813767
      , 8735.64406570028, 8754.598775779987, 8833.
      160324740831, 8647.70883760562, 8646.07964286366
      , 8664.882321060708, 8690.113232588024, 8661.
      797266504755, 8711.739857939028, 8627.29227058174
      ]
3471
3472 Process finished with exit code 0
3473
```