Ant Colony Optimisation | Programming Assignment
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Assumption

The initial pheromone level of each edge is assumed to be 1, to avoid the problem not selecting a path due to zero pheromone.

Also the ants follow a strategy to choose a path randomly with a chance of 0.1.

Since all ants start randomly from a postition at any vertex, the best path does not account for the same cyclic paths that another ant starting from another vertex might have taken.

Methodology

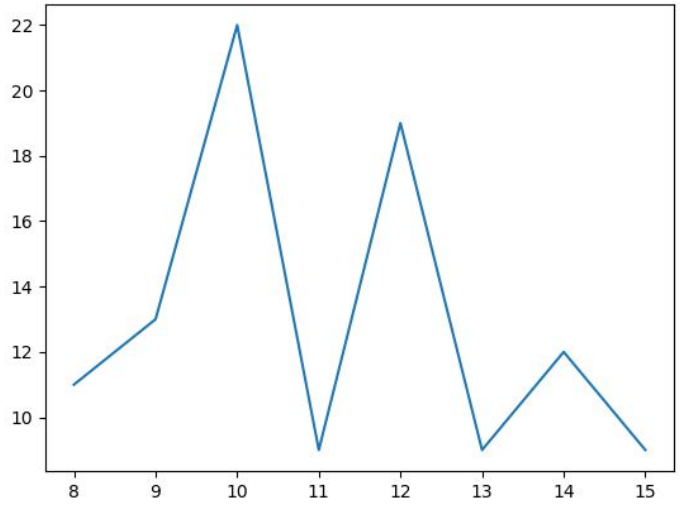
I have followed the standard ACO algorithm for TSP, by initially keeping all ants randomly at some vertex.

Algorithm

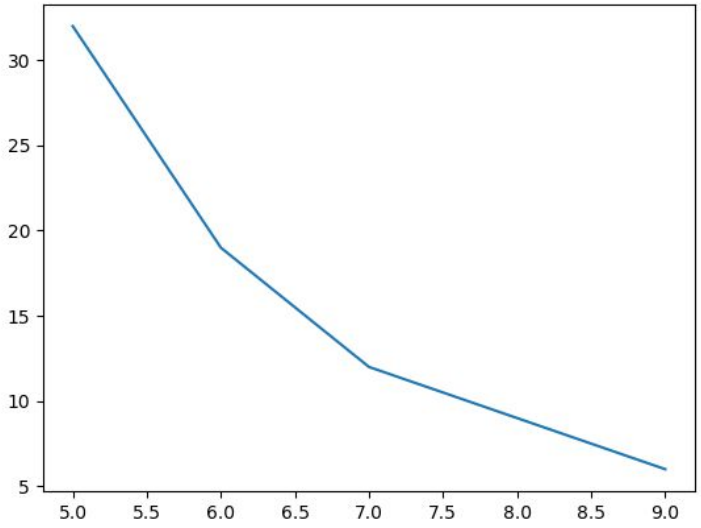
```
For MAX_ITERATIONS:
        RESET ALL ANTS
        While all ants complete their tour:
                Choose next destination for each ant based on pheromone level
        Calculate the best paths
Return best paths
```

Observations

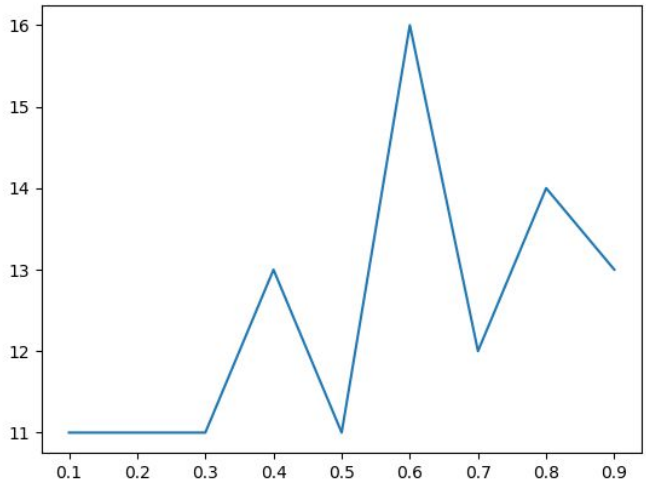
Various variations have been observed such as:



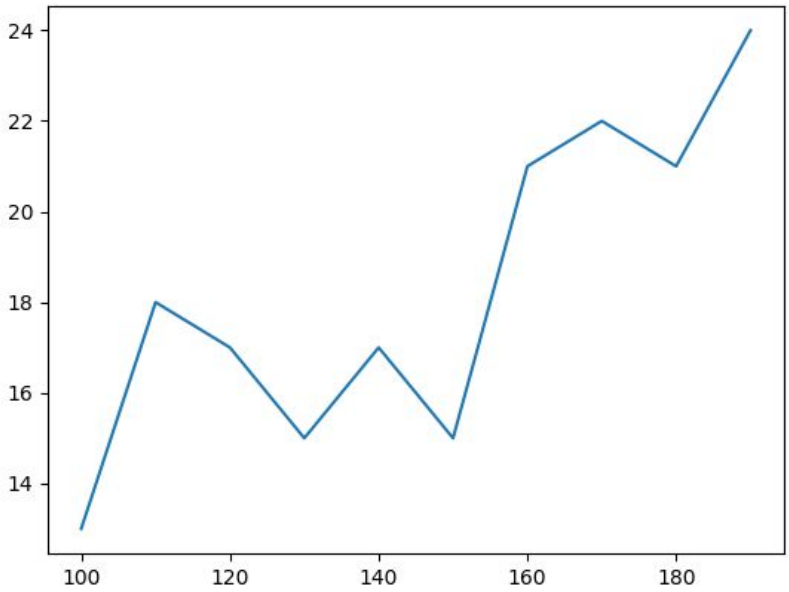
Sparsity vs Num ants following the max confidence path



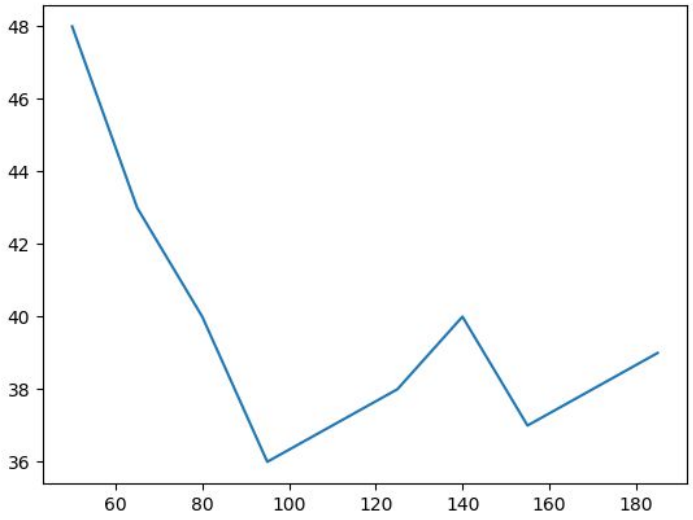
Number of cities vs Num ants following the max confidence path



Evaporation Rate vs Num ants following the max confidence path



Total Ants vs Num ants following the max confidence path



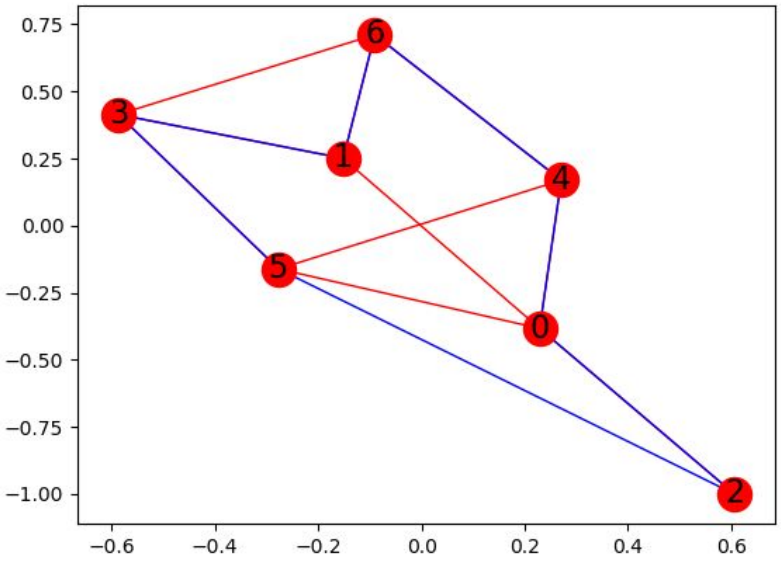
Number of Max Iterations vs Num ants following the max confidence path

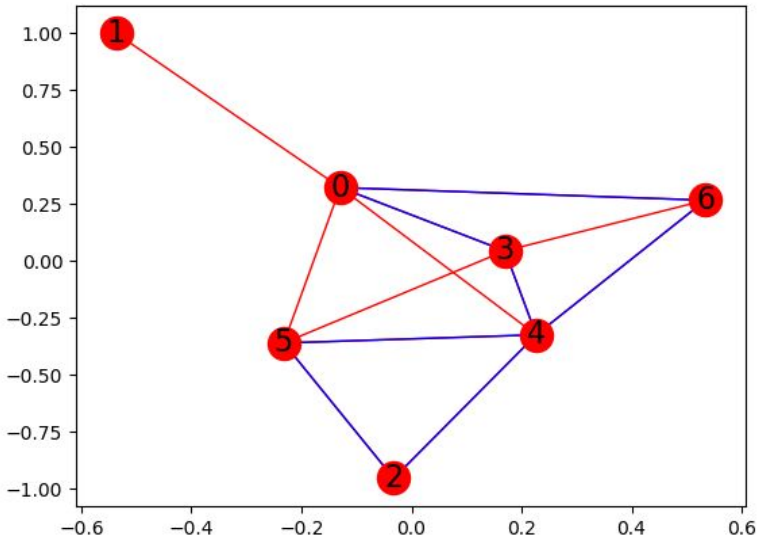
Inferences

Thus we can infer that in ACO:

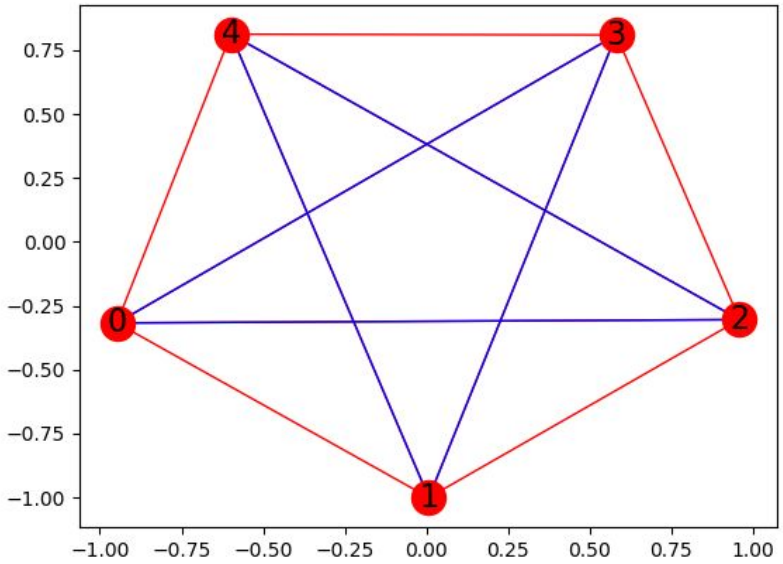
a) The number of ants following the best path found decreases as the sparsity increases This can be attributed to the graph being disconnected and thus ants not being able to travel via some paths
b) The number of ants following best path decreases as the number of cities is increased.
c) The number of ants following best path roughly increases as the evaporation rate is increased.
d) The number of ants following best path increases as the total number of ants are increased.
e) The number of ants following best path decreases as the maximum number of iterations are increased. This is probably because the ants get time to stabilise and distribute properly.

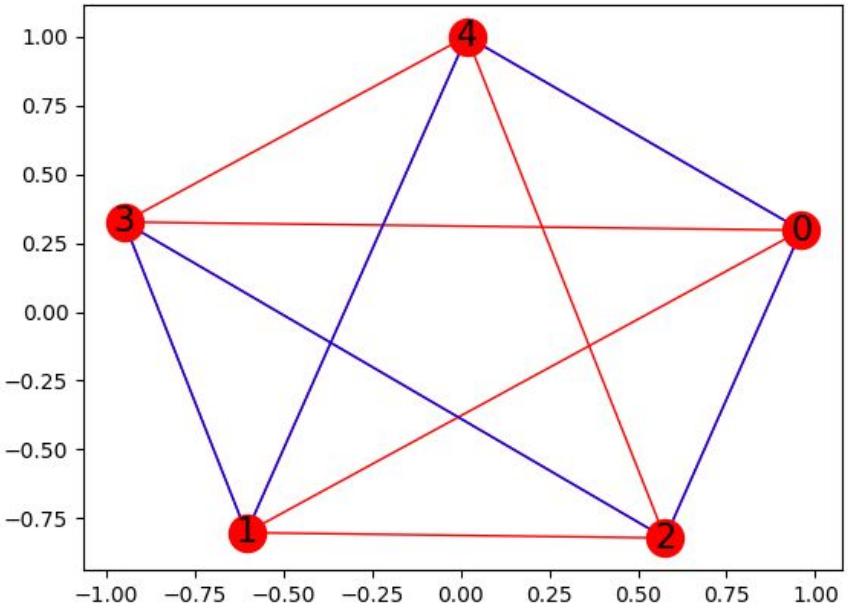
Some sample paths on graphs:
(Blue lines is the final best path found by the ants)
Sparse Graphs:





Fully Connected Graphs


4
3
0
2
1
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00


4
3
0
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