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Evaluating Different Scenarios in Wanets to Find Shortest Path Applying ACO

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Abstract: *The purpose of the routing protocols in networks is to find the shortest path for transferring the data and enhancing the overall throughput of the network. The paper emphasizes on conducting practical implementation of ACO algorithm to find out the shortest path under different scenarios differentiating in number of iterations, number of ants, and evaporation rate. The implemented algorithm may be used in large network with heavy loads in selecting the most appropriate path.Moreover, with the increase in the number of iterations, the chances of controlling the congestion effectively also increases.*

Keywords:*Ants, ACO, evaporation rate, iterations, shortest path*

1. Introduction

Each ant in the ant colony has its own job which it should be intended to perform. The task performed by different ants are integrated in such a manner that overall capability of solving complex problems is enhanced. The survival related problems like opting for shortest walking path, finding and storing food are handled by ant colony without any supervision. Ants observe pheromone trails to exchange and broadcast information regarding which path to follow. The tendency of ants is to follow the shortest path in order to make more trips and deliver food to the colony. More the ants follow a particular trail, more are the chances of following ants to follow the same path. This process is termed as positive feedback loop and the probability of an ant choosing a path is proportional to the number of ants which have already passed through that particular path. The research is been carried out to simulate the natural behavior of ants to solve real world problems like TSP (Travelling salesman problem) and data mining.

ACO is intended to solve the problems based on below mentioned concepts.

- Each and every path adopted by the ant has an association with the candidate solution to a given problem under study.
- Whenever an ant opts for a path, it drops several pheromone on that particular path in proportion with the worth of the corresponding candidate solution for the target problem.
- The path having more number of pheromones is more likely to be selected by the other ants.

2. Contribution and Implementation

This section describes the scenarios and reading obtained in accordance with finding shortest route length under different circumstances. The details of the parameters considered in doing so are given below.

Initial parameters of ACO

- Maximum number of iterations (maxIter = 500)
- Maximum number of ants (antNo = 50)
- Initial pheromone concentration [tau0 = 10 * 1 / (graph.n * mean(graph.edges(:)))]
- Pheromone matrix [tau = tau0 * ones(graph.n , graph.n)]

- Desirability of each edge [eta = 1./graph.edges]
- Evaporation rate [rho = 0.5]
- Pheromone exponential parameters [alpha = 1]
- Desirability exponential parameter [beta = 1]

An interface has been designed which have been fragmented in three sub sections; number of iterations, best tour, and displaying all pheromones.

Case1

maxIter = 500

antNo = 50

rho = 0.5

alpha = 1

beta = 1

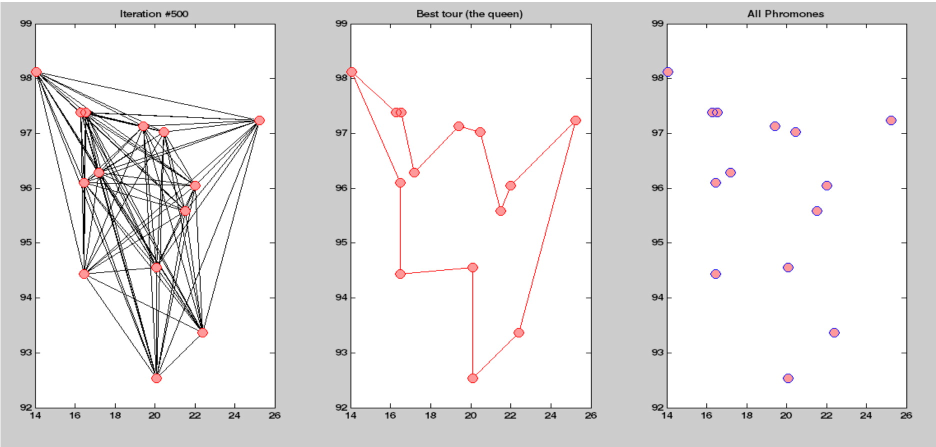


Fig1.*The figure shows the formed iterations, best tour, and all pheromones as per reading of Case1*

The shortest length in case 1 of 500 iterations with 50 ants at evaporation 0.5 comes out to be 30.8785 as shown by the readings obtained in Fig2.

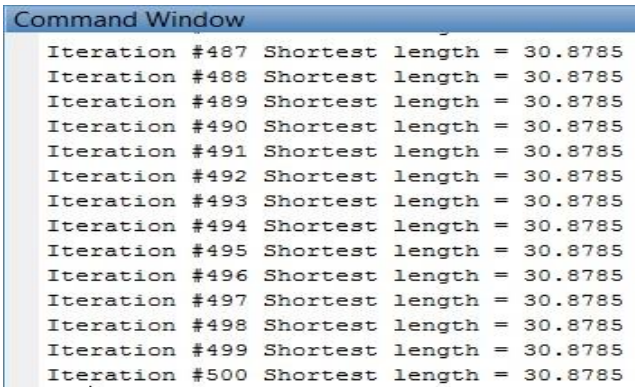


Fig2.*The shortest length in case 1 of 500 iterations with 50 ants at evaporation 0.5 comes out to be 30.8785*

Case2

maxIter = 100

antNo = 50

rho = 0.5

alpha = 1

beta = 1

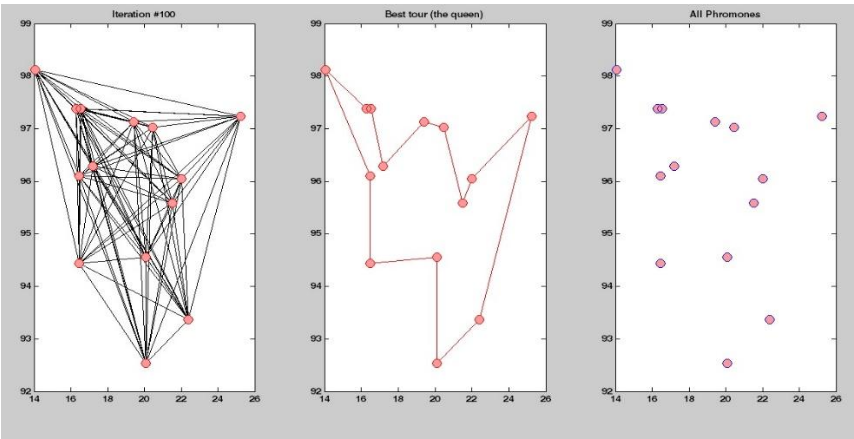
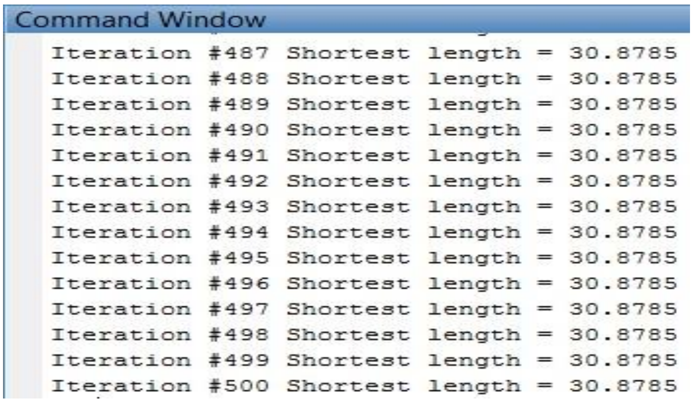


Fig3. *The figure shows the formed iterations, best tour, and all pheromones as per reading of case2*

The shortest length in case of 100 iterations with 50 ants at evaporation 0.5 comes out to be 30.8785 as shown in Fig4.


Command Window

```
Iteration #487 Shortest length = 30.8785
Iteration #488 Shortest length = 30.8785
Iteration #489 Shortest length = 30.8785
Iteration #490 Shortest length = 30.8785
Iteration #491 Shortest length = 30.8785
Iteration #492 Shortest length = 30.8785
Iteration #493 Shortest length = 30.8785
Iteration #494 Shortest length = 30.8785
Iteration #495 Shortest length = 30.8785
Iteration #496 Shortest length = 30.8785
Iteration #497 Shortest length = 30.8785
Iteration #498 Shortest length = 30.8785
Iteration #499 Shortest length = 30.8785
Iteration #500 Shortest length = 30.8785
```

Fig4.*The shortest length in case 2 of 100 iterations with 50 ants at evaporation 0.5 comes out to be 30.8785*

Case3

maxIter = 50

antNo = 50

rho = 0.5

alpha = 1

beta = 1

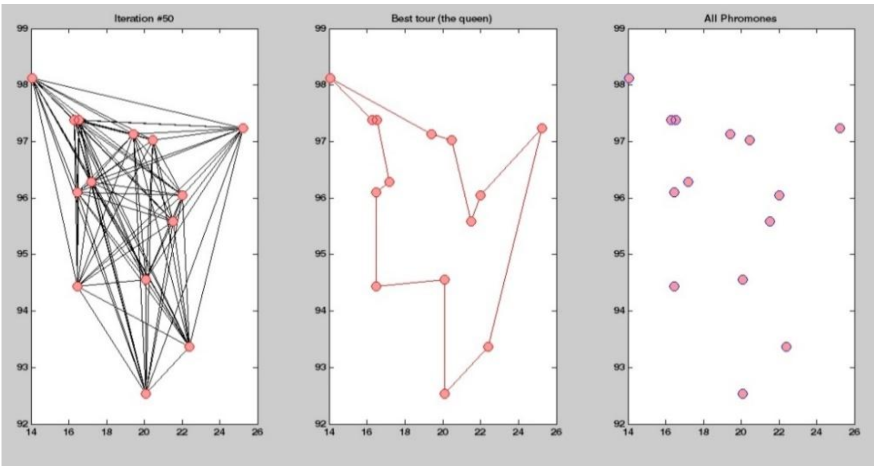


Fig5.*The figure shows the formed iterations, best tour, and all pheromones as per reading of case3*

The shortest length in case of 50 iterations with 50 ants at evaporation 0.5 comes out to be 31.567as shown in Fig 6.

```
Command Window
Iteration #37 Shortest length = 31.567
Iteration #38 Shortest length = 31.567
Iteration #39 Shortest length = 31.567
Iteration #40 Shortest length = 31.567
Iteration #41 Shortest length = 31.567
Iteration #42 Shortest length = 31.567
Iteration #43 Shortest length = 31.567
Iteration #44 Shortest length = 31.567
Iteration #45 Shortest length = 31.567
Iteration #46 Shortest length = 31.567
Iteration #47 Shortest length = 31.567
Iteration #48 Shortest length = 31.567
Iteration #49 Shortest length = 31.567
Iteration #50 Shortest length = 31.567
```

Fig6. *The shortest length in case3 of 50 iterations with 50 ants at evaporation 0.5 comes out to be 31.567*

Case 4

maxIter = 500

antNo = 50

rho = 0.8

alpha = 1

beta = 1

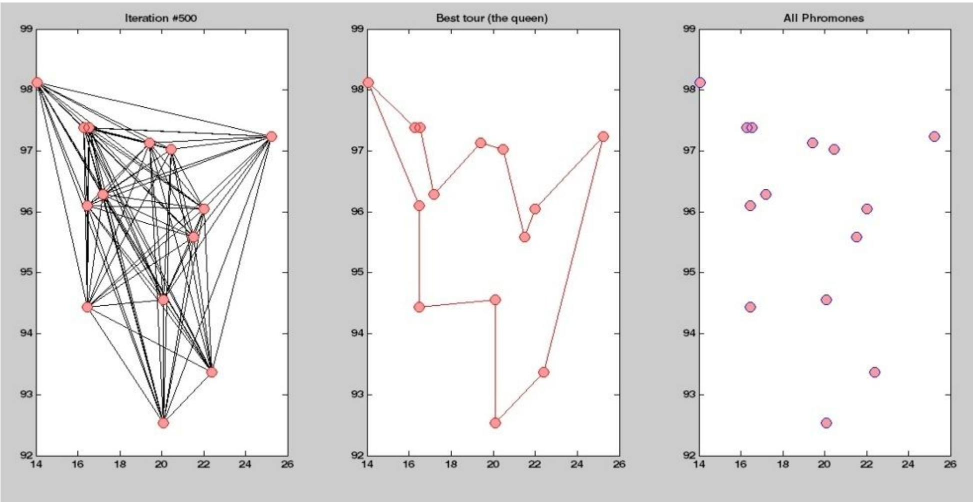


Fig7. *The figure shows the formed iterations, best tour, and all pheromones as per reading of Case4*

The shortest length in case of 500 iterations with 50 ants at 0.8 evaporation rate comes out to be 30.8785 as shown in Fig 8.

```
Command Window
Iteration #487 Shortest length = 30.8785
Iteration #488 Shortest length = 30.8785
Iteration #489 Shortest length = 30.8785
Iteration #490 Shortest length = 30.8785
Iteration #491 Shortest length = 30.8785
Iteration #492 Shortest length = 30.8785
Iteration #493 Shortest length = 30.8785
Iteration #494 Shortest length = 30.8785
Iteration #495 Shortest length = 30.8785
Iteration #496 Shortest length = 30.8785
Iteration #497 Shortest length = 30.8785
Iteration #498 Shortest length = 30.8785
Iteration #499 Shortest length = 30.8785
Iteration #500 Shortest length = 30.8785
```

Fig8. *The shortest length in case 4 of 500 iterations with 50 ants at evaporation 0.8 comes out to be 30.8785*

Case 5

maxIter = 100

antNo = 50

rho = 0.8

alpha = 1

beta = 1

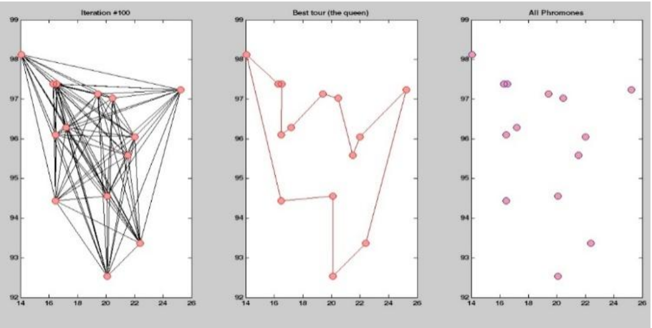
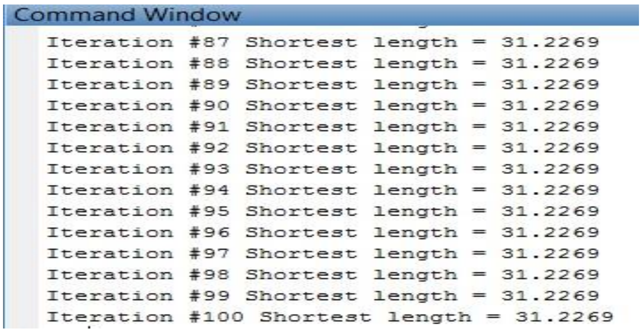


Fig9. *The figure shows the formed iterations, best tour, and all pheromones as per reading of Case5*

The shortest length in case of 100 iterations with 50 ants at 0.8 evaporation rate comes out to be 31.2269 as sown in Fig 10.



```
Command Window
Iteration #87 Shortest length = 31.2269
Iteration #88 Shortest length = 31.2269
Iteration #89 Shortest length = 31.2269
Iteration #90 Shortest length = 31.2269
Iteration #91 Shortest length = 31.2269
Iteration #92 Shortest length = 31.2269
Iteration #93 Shortest length = 31.2269
Iteration #94 Shortest length = 31.2269
Iteration #95 Shortest length = 31.2269
Iteration #96 Shortest length = 31.2269
Iteration #97 Shortest length = 31.2269
Iteration #98 Shortest length = 31.2269
Iteration #99 Shortest length = 31.2269
Iteration #100 Shortest length = 31.2269
```

Fig10. *The shortest length in case 5 of 100 iterations with 50 ants and 0.8 evaporation comes out to be 31.2269*

Case 6

maxIter = 50

antNo = 50

rho = 0.8

alpha = 1

beta = 1

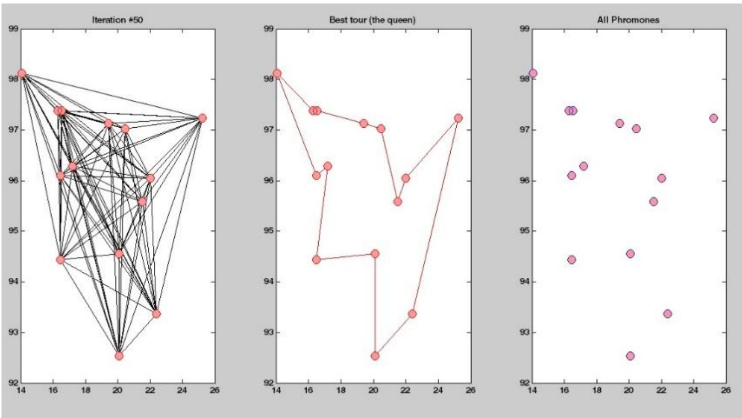
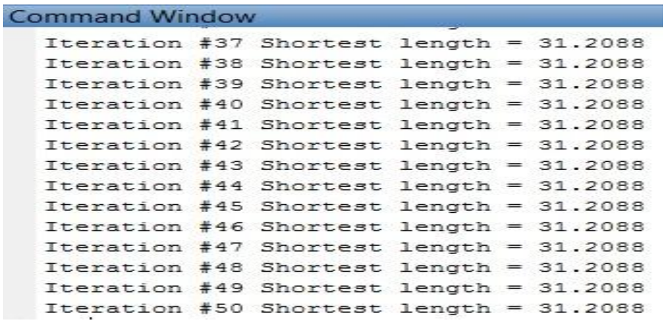


Fig11. *The figure shows the formed iterations, best tour, and all pheromones as per reading of Case5*

The shortest length in case of 50 iterations with 50 ants at 0.8 evaporation rate comes out to be 31.2088 as shown in Fig. 12.



```
Command Window
Iteration #37 Shortest length = 31.2088
Iteration #38 Shortest length = 31.2088
Iteration #39 Shortest length = 31.2088
Iteration #40 Shortest length = 31.2088
Iteration #41 Shortest length = 31.2088
Iteration #42 Shortest length = 31.2088
Iteration #43 Shortest length = 31.2088
Iteration #44 Shortest length = 31.2088
Iteration #45 Shortest length = 31.2088
Iteration #46 Shortest length = 31.2088
Iteration #47 Shortest length = 31.2088
Iteration #48 Shortest length = 31.2088
Iteration #49 Shortest length = 31.2088
Iteration #50 Shortest length = 31.2088
```

Fig12. *The shortest length in case6 of 50 iterations with 50 ants and 0.8 evaporation comes out to be 31.2088*

Case7

maxIter = 700

antNo = 50

rho = 0.5

alpha = 1

beta = 1

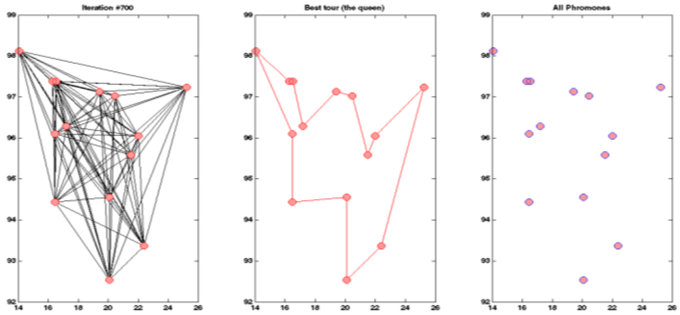
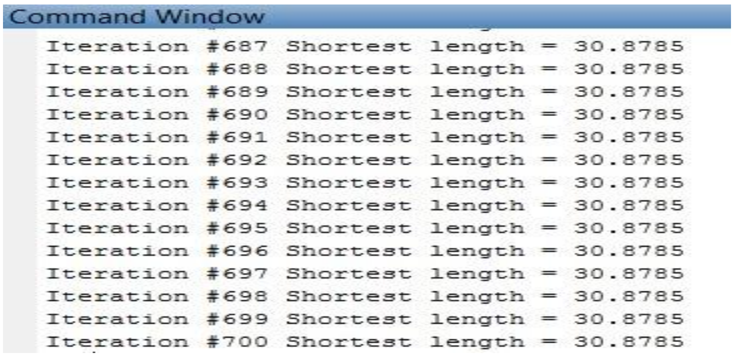


Fig13. *The figure shows the formed iterations, best tour, and all pheromones as per reading of Case7*

The shortest length in case of 700 iterations with 50 ants at 0.5 evaporation rate comes out to be 30.8785 as shown in Fig. 14.



```
Command Window
Iteration #687 Shortest length = 30.8785
Iteration #688 Shortest length = 30.8785
Iteration #689 Shortest length = 30.8785
Iteration #690 Shortest length = 30.8785
Iteration #691 Shortest length = 30.8785
Iteration #692 Shortest length = 30.8785
Iteration #693 Shortest length = 30.8785
Iteration #694 Shortest length = 30.8785
Iteration #695 Shortest length = 30.8785
Iteration #696 Shortest length = 30.8785
Iteration #697 Shortest length = 30.8785
Iteration #698 Shortest length = 30.8785
Iteration #699 Shortest length = 30.8785
Iteration #700 Shortest length = 30.8785
```

Fig14. *The shortest length in case 7 of 700 iterations with 50 ants and 0.5 evaporation comes out to be 30.8785*

Case8

maxIter = 700

antNo = 50

rho = 0.8

alpha = 1

beta = 1

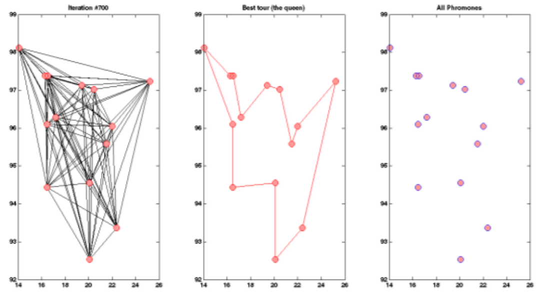


Fig15. *The figure shows the formed iterations, best tour, and all pheromones as per reading of Cas 8*

The shortest length in case of 700 iterations with 50 ants at 0.8 evaporation rate comes out to be 30.8785 as shown in Fig 16.

```
Command Window
Iteration #687 Shortest length = 30.8785
Iteration #688 Shortest length = 30.8785
Iteration #689 Shortest length = 30.8785
Iteration #690 Shortest length = 30.8785
Iteration #691 Shortest length = 30.8785
Iteration #692 Shortest length = 30.8785
Iteration #693 Shortest length = 30.8785
Iteration #694 Shortest length = 30.8785
Iteration #695 Shortest length = 30.8785
Iteration #696 Shortest length = 30.8785
Iteration #697 Shortest length = 30.8785
Iteration #698 Shortest length = 30.8785
Iteration #699 Shortest length = 30.8785
Iteration #700 Shortest length = 30.8785
```

Fig16. *The shortest length in case 8 of 700 iterations with 50 ants and 0.8 evaporation comes out to be 30.8785*

Case9

maxIter = 1000

antNo = 50

rho = 0.5

alpha = 1

beta = 1

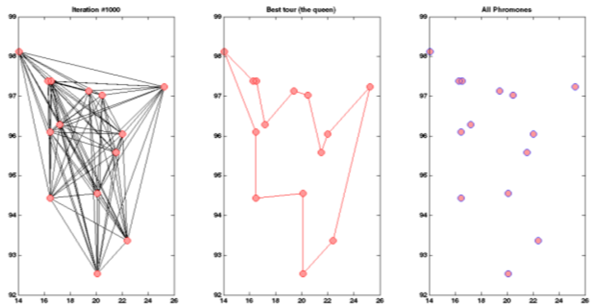


Fig17. *The figure shows the formed iterations, best tour, and all pheromones as per reading of Case9*

The shortest length in case of 1000 iterations with 50 ants at 0.5 evaporation rate comes out to be 30.8785 as shown in Fig 18.

```
Command Window
Iteration #987 Shortest length = 30.8785
Iteration #988 Shortest length = 30.8785
Iteration #989 Shortest length = 30.8785
Iteration #990 Shortest length = 30.8785
Iteration #991 Shortest length = 30.8785
Iteration #992 Shortest length = 30.8785
Iteration #993 Shortest length = 30.8785
Iteration #994 Shortest length = 30.8785
Iteration #995 Shortest length = 30.8785
Iteration #996 Shortest length = 30.8785
Iteration #997 Shortest length = 30.8785
Iteration #998 Shortest length = 30.8785
Iteration #999 Shortest length = 30.8785
Iteration #1000 Shortest length = 30.8785
```

Fig18.*The shortest length in case 9 of 1000 iterations with 50 ants and 0.5 evaporation comes out to be 30.8785*

Case10

maxIter = 1000

antNo = 50

rho = 0.8

alpha = 1

beta = 1

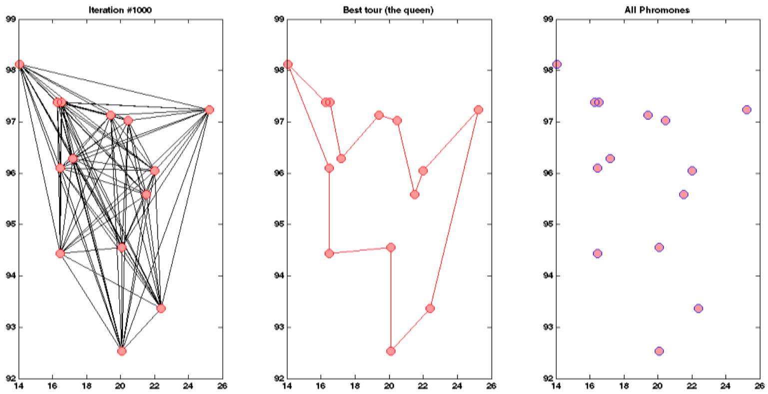


Fig19. *The figure shows the formed iterations, best tour, and all pheromones as per reading of Case10*

The shortest length in case of 1000 iterations with 50 ants at 0.8 evaporation rate comes out to be 30.8785 as shown in Fig 20.

```
Command Window
Iteration #987 Shortest length = 30.8785
Iteration #988 Shortest length = 30.8785
Iteration #989 Shortest length = 30.8785
Iteration #990 Shortest length = 30.8785
Iteration #991 Shortest length = 30.8785
Iteration #992 Shortest length = 30.8785
Iteration #993 Shortest length = 30.8785
Iteration #994 Shortest length = 30.8785
Iteration #995 Shortest length = 30.8785
Iteration #996 Shortest length = 30.8785
Iteration #997 Shortest length = 30.8785
Iteration #998 Shortest length = 30.8785
Iteration #999 Shortest length = 30.8785
Iteration #1000 Shortest length = 30.8785
```

Fig20. *The shortest length in case 10 of 1000 iterations with 50 ants and 0.8 evaporation comes out to be 30.8785*

3. Comparative Evaluation of Different Cases under Study

This section is intended to perform the comparatively analyzing the different cases studied in above section (Section II) of the research paper. The table has been constructed on the basis of findings calculated in section II of the research paper.

Table1.*Comparative readings under different scenarios in ACO*

Case	maxIter	antNo	Rho	Shortest_Length
1	500	50	0.5	30.8785
2	100	50	0.5	30.8785
3	50	50	0.5	31.567
4	500	50	0.8	30.8785
5	100	50	0.8	31.2269
6	50	50	0.8	31.2088
7	700	50	0.5	30.8785
8	700	50	0.8	30.8785
9	1000	50	0.5	30.8785
10	1000	50	0.8	30.8785

Fig21shows the graphical representation of Table1.

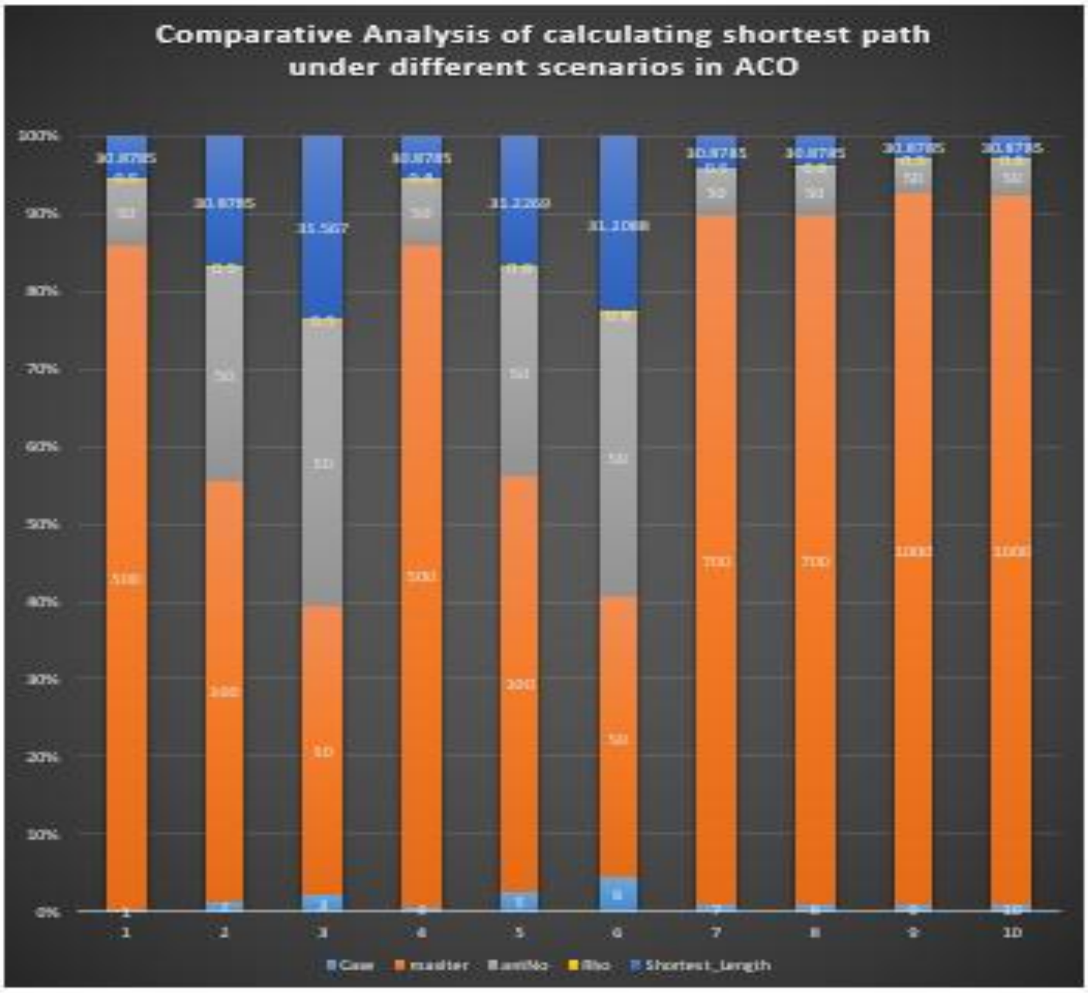


Fig21.*The figure shows the graphical representation of Table1*

4. Conclusion

On the basis of the conducted study and implementation, it can be concluded that the calculation of the shortest path depends upon several factors as used above in the implementation. On the basis of analyzing different results, it can be declared that as the number of the iterations increases, so the chances of finding the shortest path enhances.

References

[1] Raghavendra BV, Solving Travelling Salesman Problem using Ant Colony Optimization Algorithm, J Appl Computat Math 2015, 4:6, http://dx.doi.org/10.4172/2168-9679.1000260

[2] M. Pedemonte, S. Nesmachnow, H. Cancela, A survey on parallel ant colony optimization, Applied Soft Computing, 11 (8) (2011), pp. 5181–5197.

[3] M. Pedemonte, H. Cancela, A cellular ant colony optimization for the generalized steiner problem, International Journal of Innovative Computing and Applications, 2 (3), (2010), pp. 188–201.

[4] M. Subotic, M. Tuba, N. Stanarevic, Different approaches in parallelization of the artificial bee colony algorithm, International Journal of Mathematical Models and Methods in Applied Sciences, 5 (4), (2011), pp. 755–762.

[5] Jagdev, G. (2018). Scrutinizing and Execution of AODV and DVR Routing Protocols in Wireless Ad-hoc Networks. International Journal of Research Studies in Computer Science and Engineering (IJRSCSE), 5(3), pp.15-22. http://dx.doi.org/10.20431/ 2349-4859.0503003.

[6] Jagdev, G. (2018). Analyzing and Implementation of Ant Colony Optimization in Relevance with Travelling Salesman Problem. International Journal of Research Studies in Computer Science and Engineering (IJRSCSE), 5(4), pp.22-29. http://dx.doi.org/10.20431/2349-4859.0504003.

[7] J. Chintalapati, M. Arvind, S. Priyanka, N. Mangala, J. Valadi, Parallel ant-miner (pam) on high performance clusters, in: Swarm, Evolutionary, and Memetic Computing, Vol. 6466 of Lecture Notes on Computer Science, Springer, 2010, pp. 270–277.

[8] S. Ilie, M. Ivanovic et al., Optimizing communication costs in acoda using simulated annealing: Initial experiments, in: N. T. Nguyen, K. Hoang, P. Jedrzejowicz (Eds.), Proc.4th International Conference o Computational Collective Intelligence. Technologies and applications, ICCCI 2012 (1), Vol. 7653 of Lecture Notes in Computer Science, Springer, 2012, pp. 298–307.

[9] Retno S and Rosita K 2015 Proc. Int. on Research and Education Mathematics vol.7 (Malaysia: Kuala Lumpur/ IEEE Xplore).

[10] Marco Dorigo and Luca Maria Gambardella. Ant colony system: a cooperative learning approach to the traveling salesman problem. IEEE Transactions on evolutionary computation, 1(1):53{66, 1997.

[11] Alers S, Tuyls K, Ranjbar-Sahraei B, Claes D, and Weiss G. Insect-inspired robot coordination:Foraging and coverage. Arti_cial Life, 14:761-768, 2014.

[12] Alers S, Claes D, Tuyls K, and Weiss G. Biologically inspired multi-robot foraging. In Proceedings of the 2014 international conference on Autonomous agents and multi-agent systems, pages 1683{1684. International Foundation for Autonomous Agents and Multiagent Systems, 2014.

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