

# A COMPARATIVE STUDY OF BIONIC ALGORITHMS FOR TACKLING THE TRAVELING SALESMAN PROBLEM

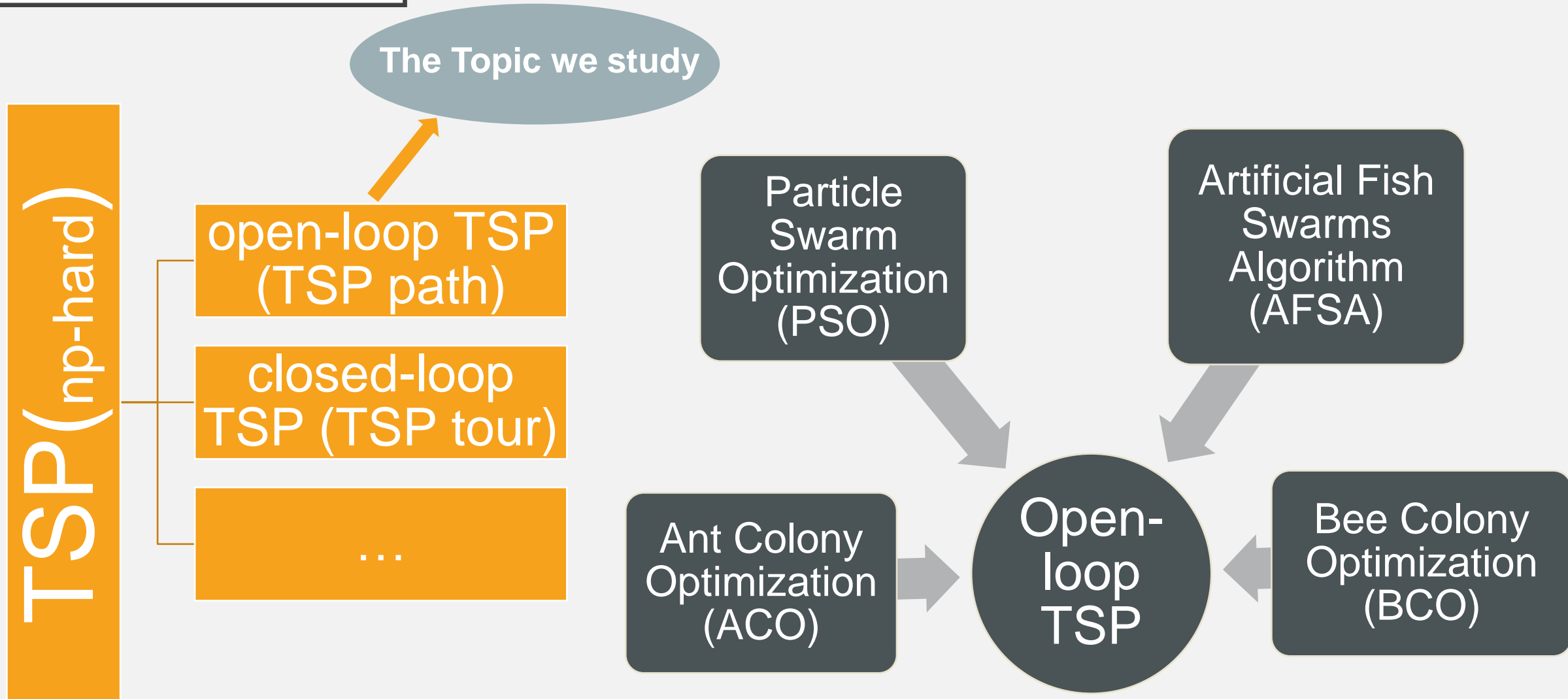
Yujun Wang (sc223yw)

Yifei Chen (sc22yc)

Kunyu Jiang (sc22kj2)

Fengyun Wang (ml18f2w)

# INTRODUCTION



# OPEN-LOOP TSP

The Chinese  
Postman  
Problem



Classic TSP  
(closed-loop)



Open-loop TSP



Modern post  
station site  
selection  
problems



# ANT COLONY OPTIMIZATION (ACO)

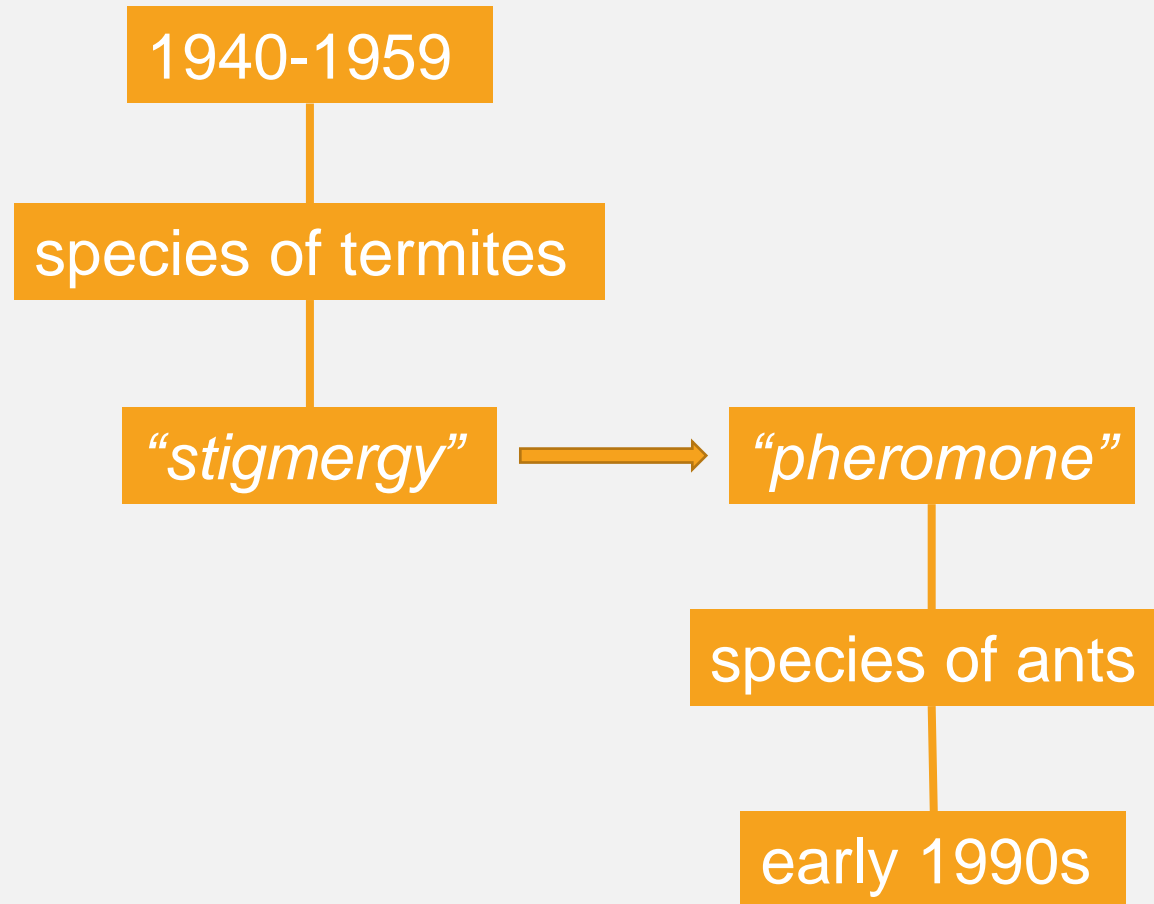
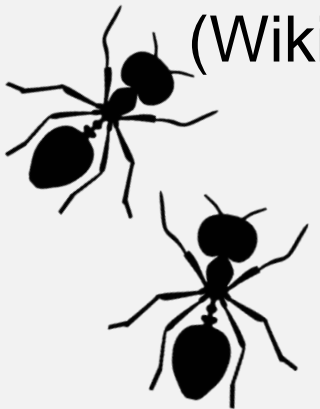
Yujun Wang (sc223yw)



# ANT COLONY OPTIMIZATION (ACO)



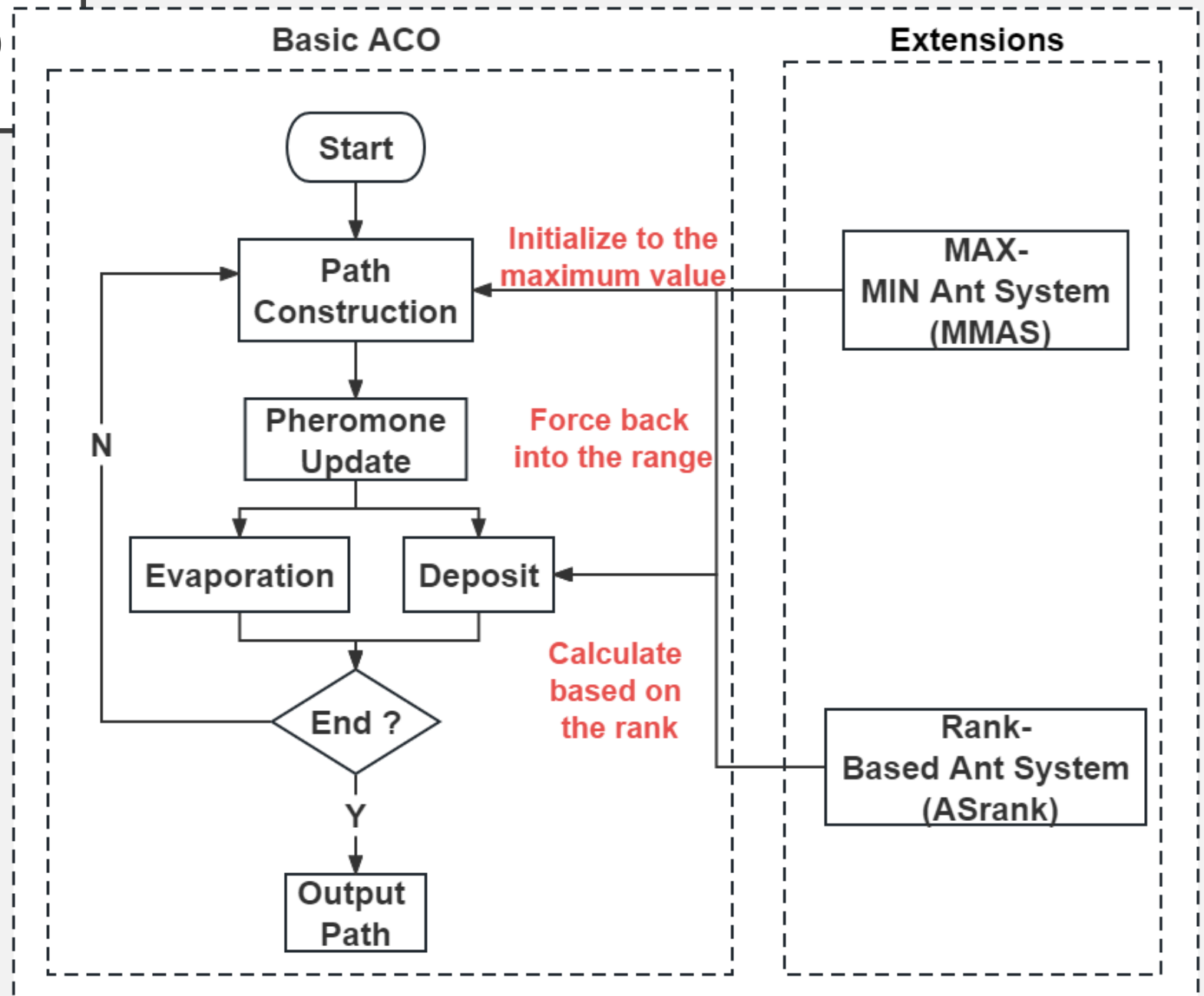
Pierre-Paul Grassé  
(Wikipedia, 2023)



Marco Dorigo  
(Wikipedia, 2023)

# ANT COLONY OPTIMIZATION (ACO) METHODOLOGY

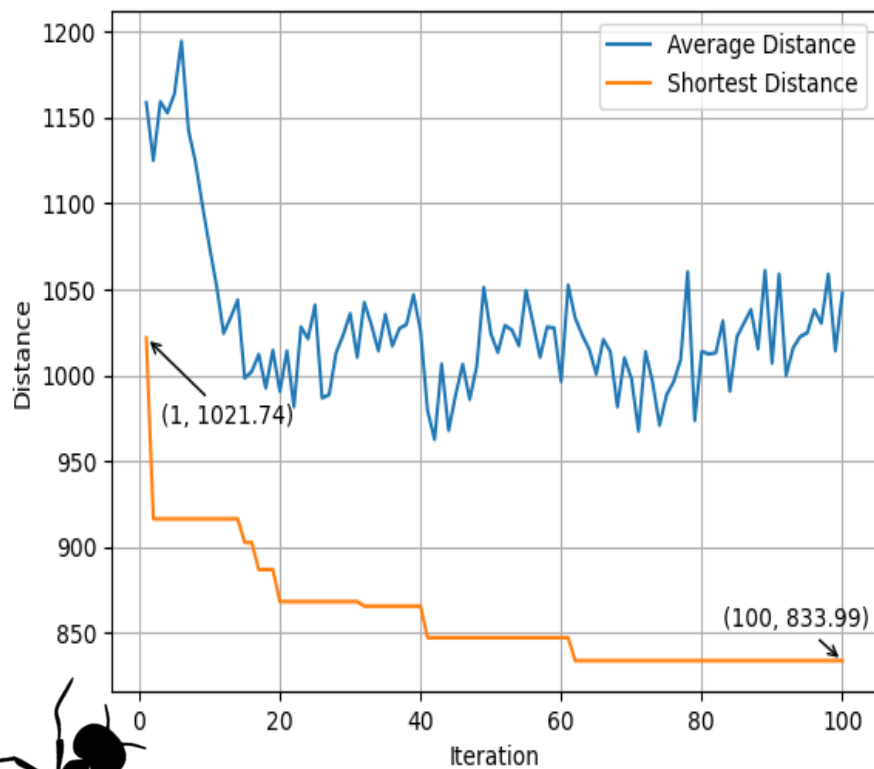
## Improved ACO



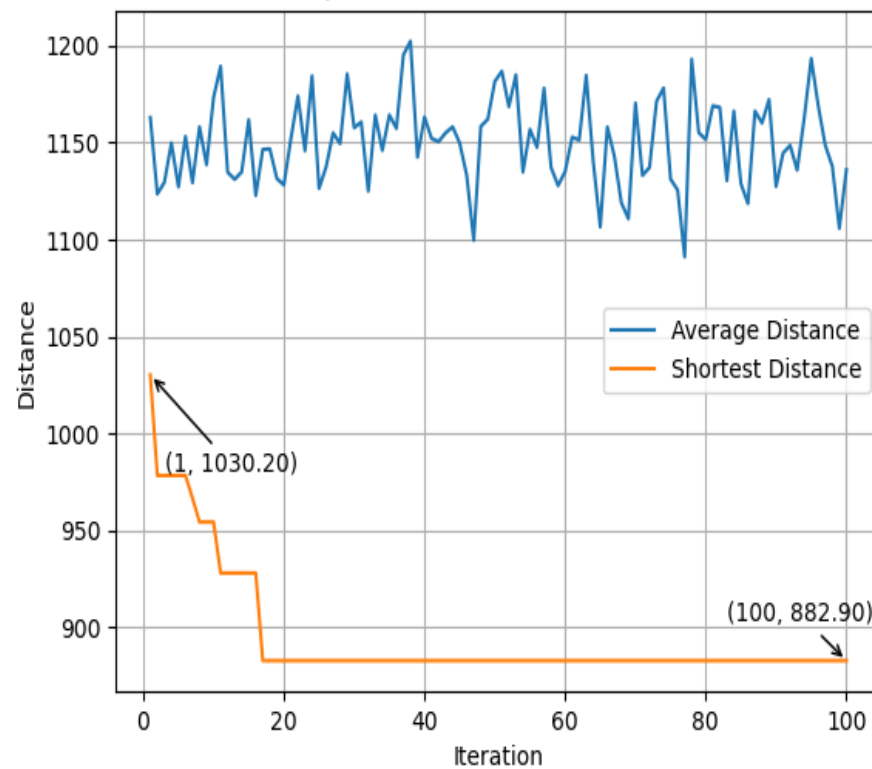
# ANT COLONY OPTIMIZATION (ACO) RESULT



Basic ACO TSP Performance



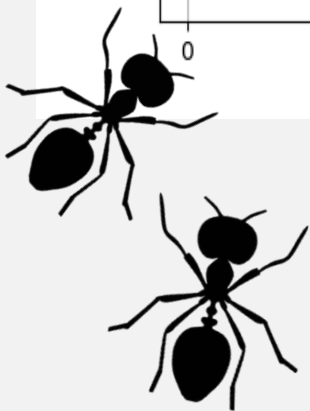
Improved ACO TSP Performance



**Basic ACO**  
**Best distance:**  
**833.99**



**Improved ACO**  
**Best distance:**  
**882.90**

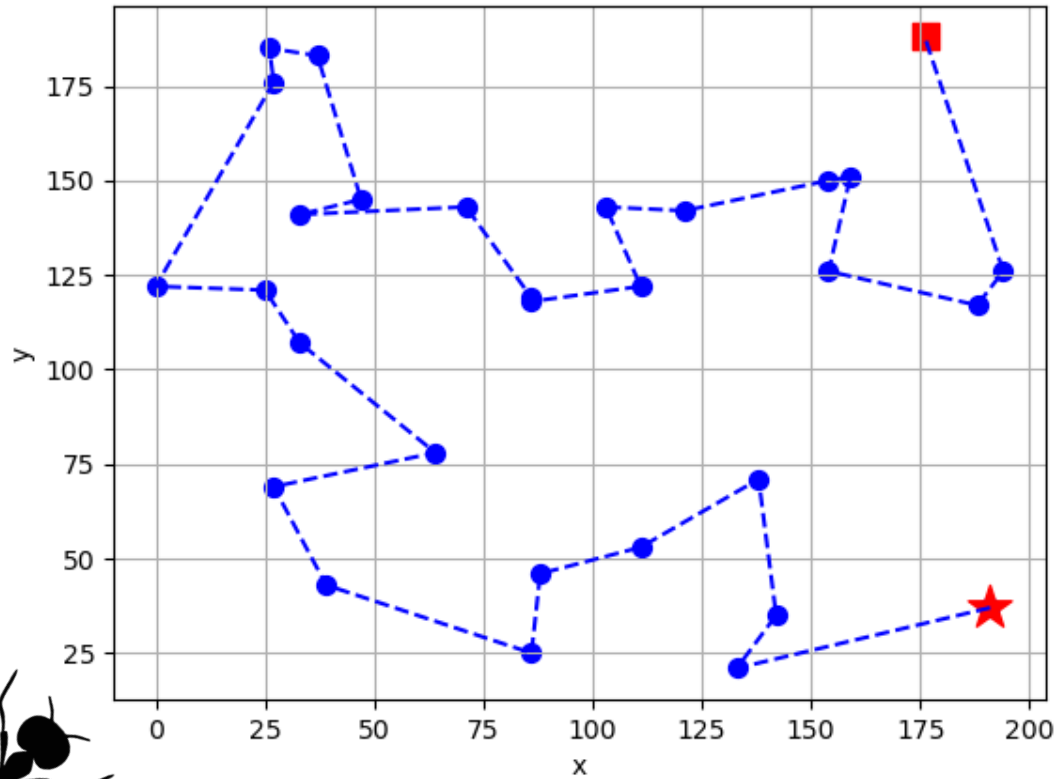


# ANT COLONY OPTIMIZATION (ACO) RESULT

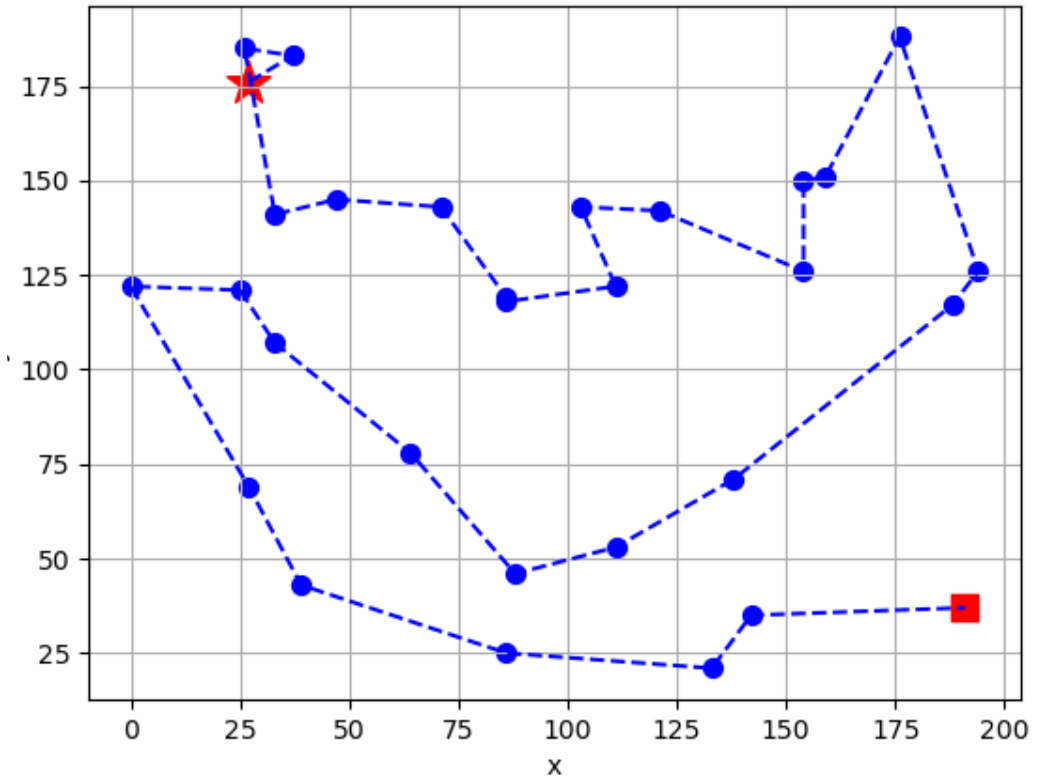
★ = Start    ■ = End



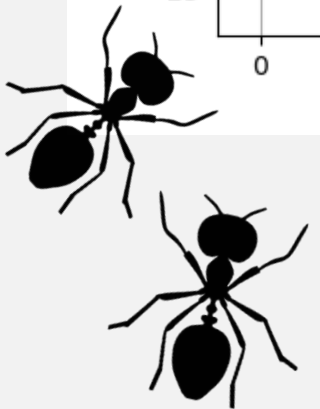
Basic ACO Algorithm Solution



Improved ACO TSP Solution



Possible Improvements:  
1) Hyperparameter fine-tuning.  
2) Applying other extensions.

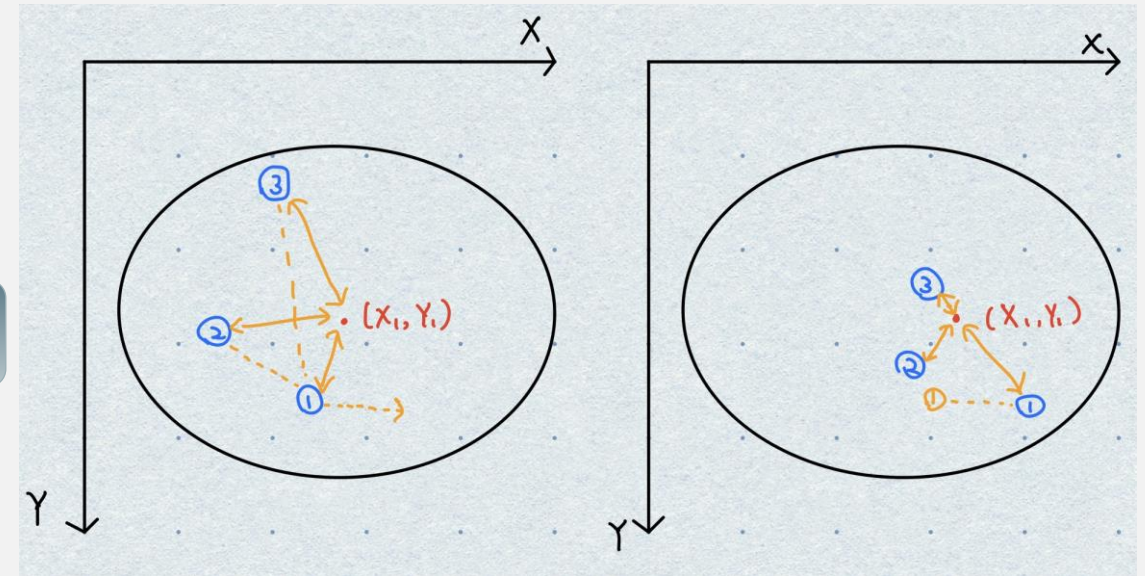
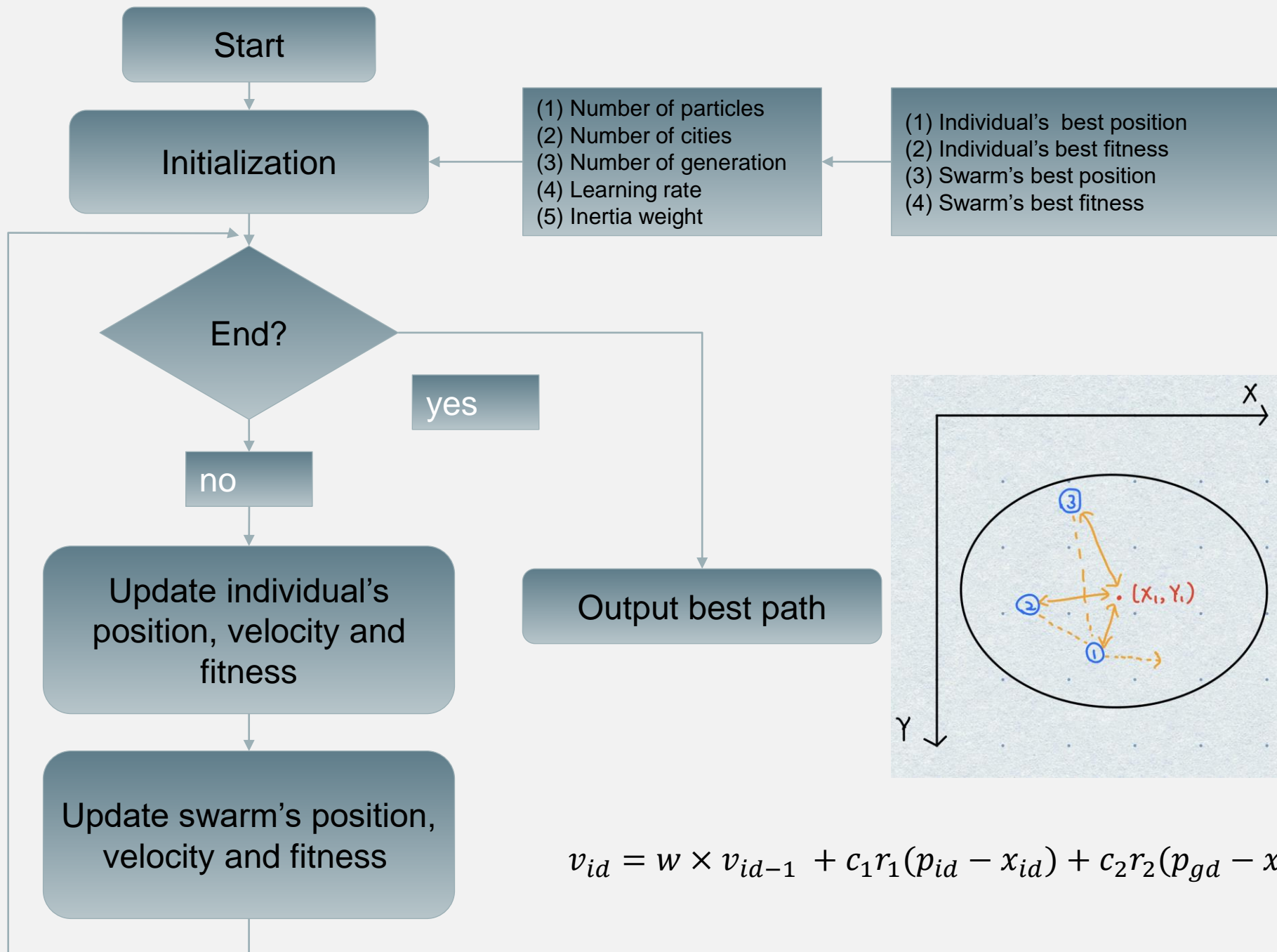






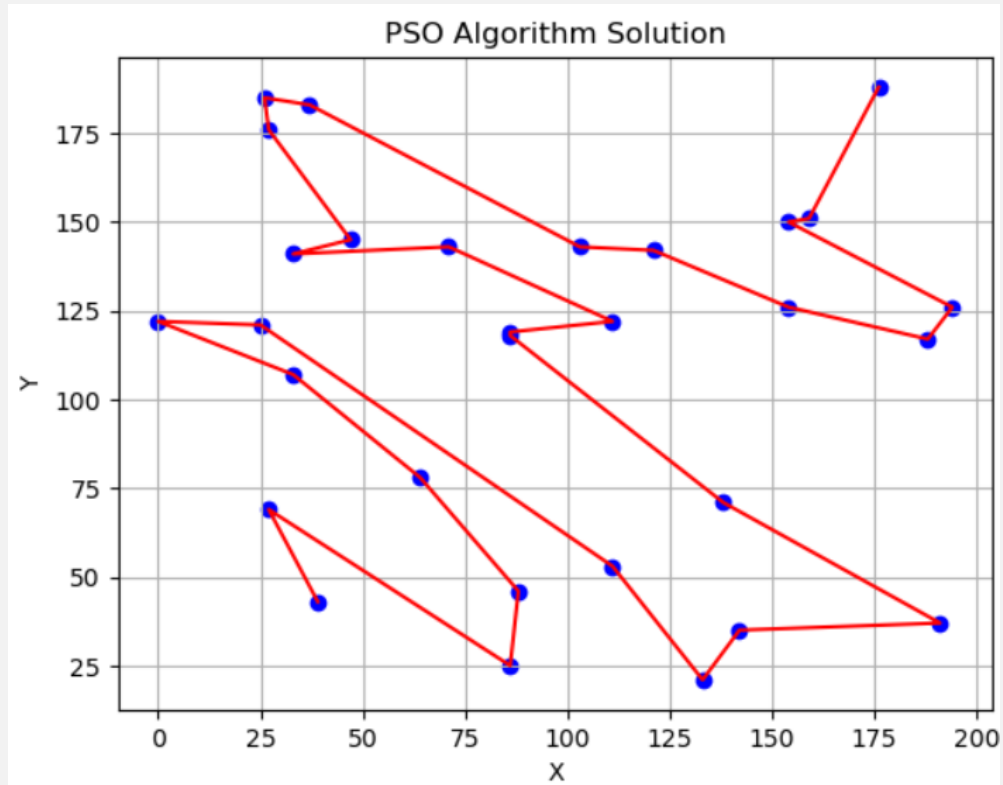
# Particle Swarm Optimization Algorithm

Kunyu Jiang (sc22kj2)

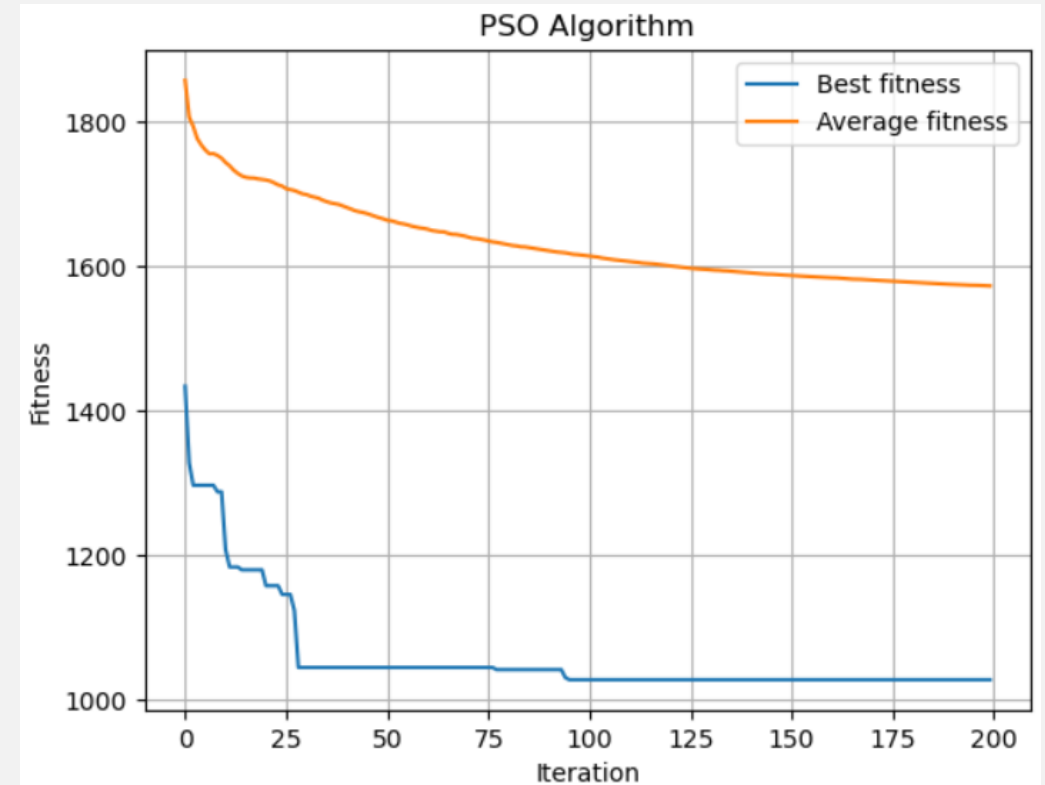


$$v_{id} = w \times v_{id-1} + c_1 r_1 (p_{id} - x_{id}) + c_2 r_2 (p_{gd} - x_{id})$$

# Particle Swarm Optimization Algorithm



Route map

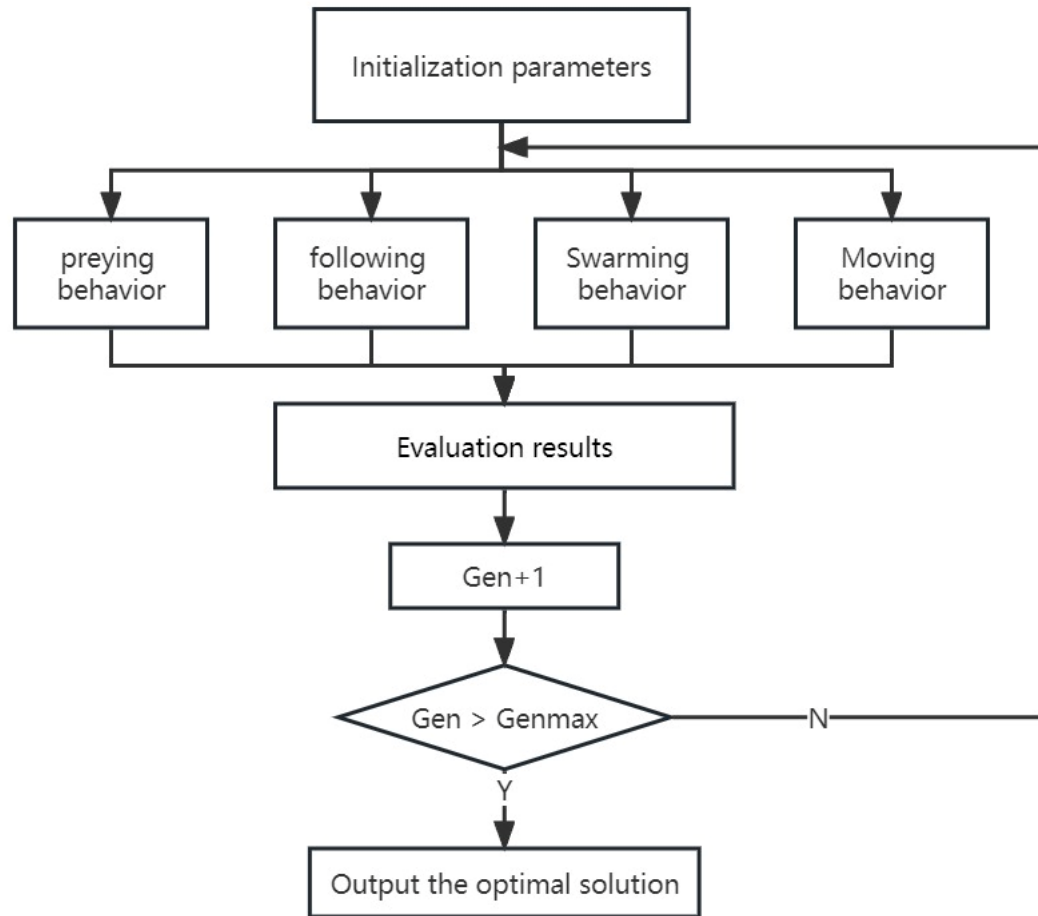


Fitness curve of PSO Algorithm

# ARTIFICIAL FISH SWARM ALGORITHM

Fengyun Wang (ml18f2w)

# STRUCTURE



1, Initialization parameters, including the population size of the fish, visible range, action step length and density;

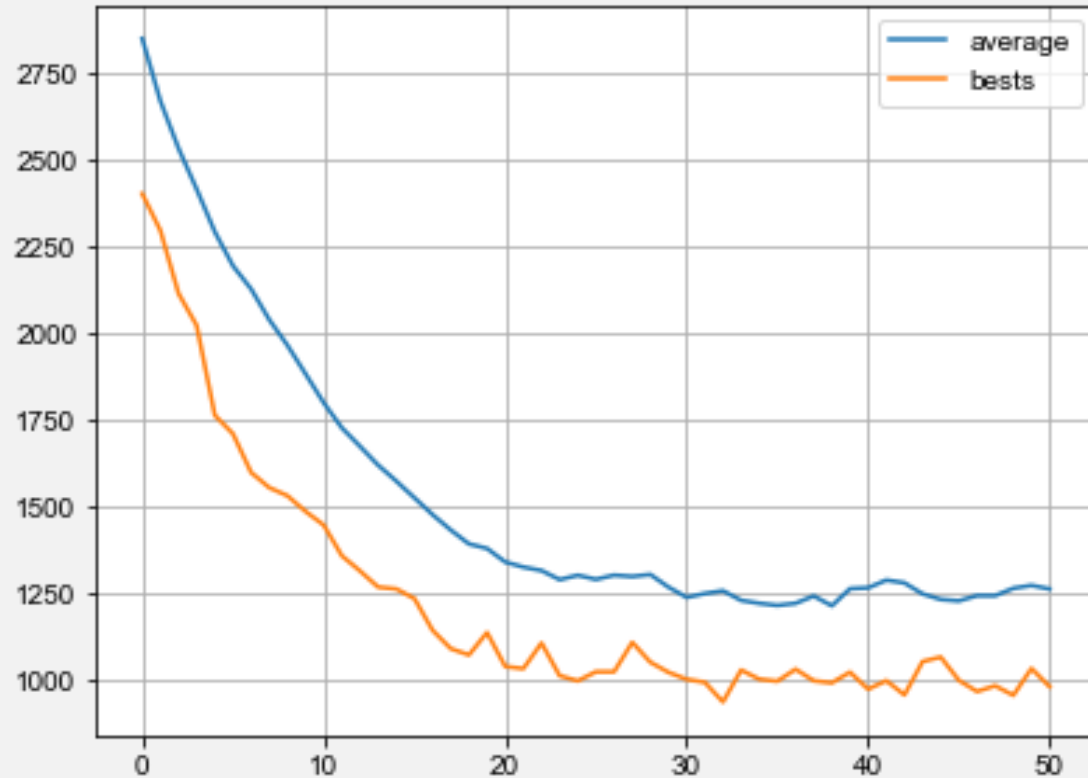
2, Conduct an iteration based on the behavioral logic of fish Preying, Following, Swarming and Moving;

3, Check the status of the current fish-swarm, save the optimal value, average value, and the corresponding fish-swarm status of the optimal value;

4, Check whether the iteration termination condition is met. If it is met, output the result. Otherwise, return to step 2 and continue the iteration;

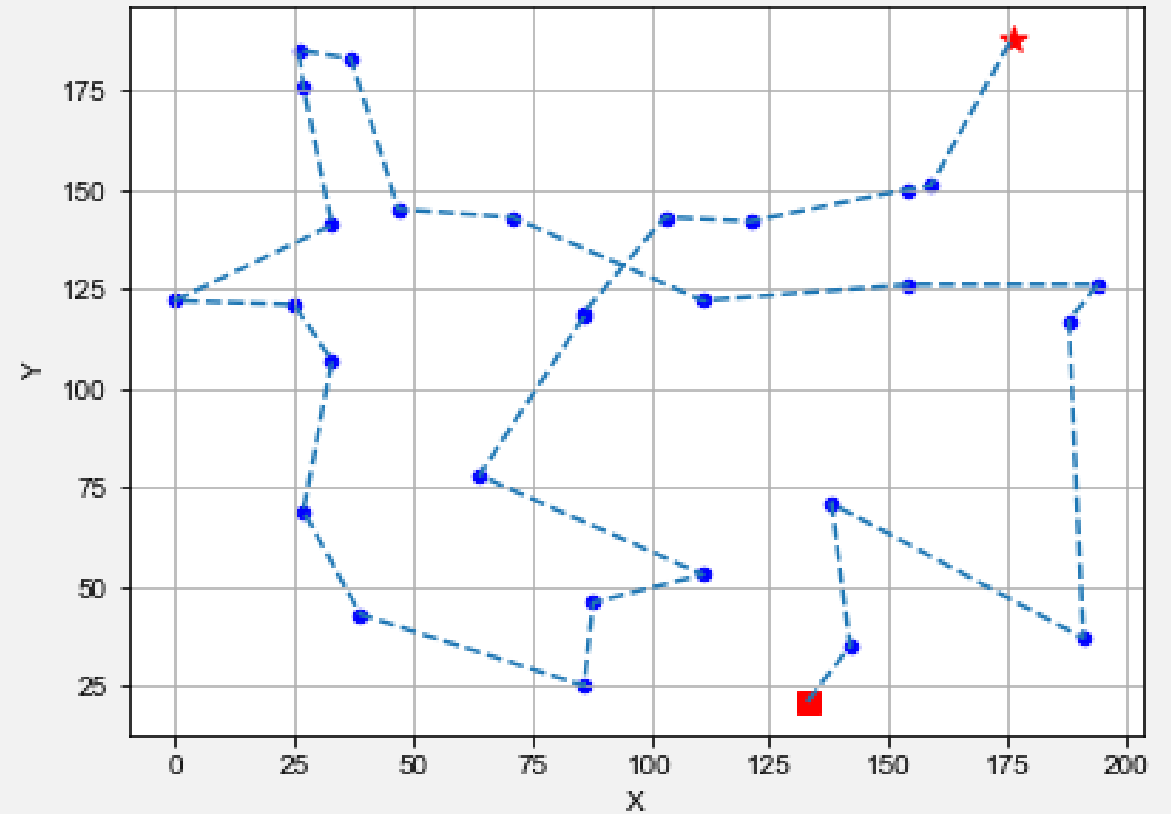
# RESULTS ANALYSIS

optim value map



Fitness curve graph

AFSA Algorithm Solution



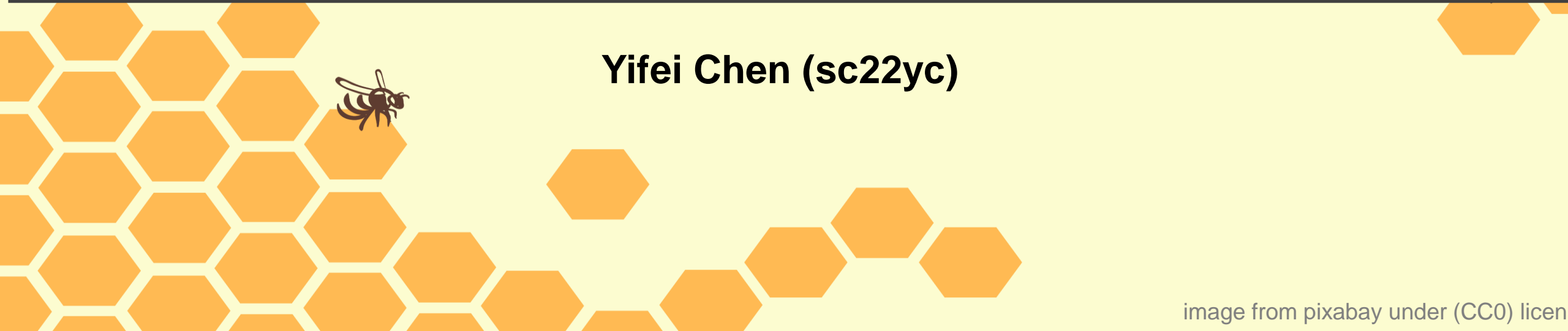
Route map

## IMPROVEMENT

- implement adaptive vision methods for improve the accuracy



# ARTIFICIAL BEE COLONY OPTIMIZATION



Yifei Chen (sc22yc)



**Start**

**Initialization**

**Employee Bee**

**Scout Bee**

**Onlooker Bee**

**End?**

no

yes

**Output best path**



What is my  
purpose?



**Start**

**Initialization**

**Employee Bee**

**Scout Bee**

**Onlooker Bee**

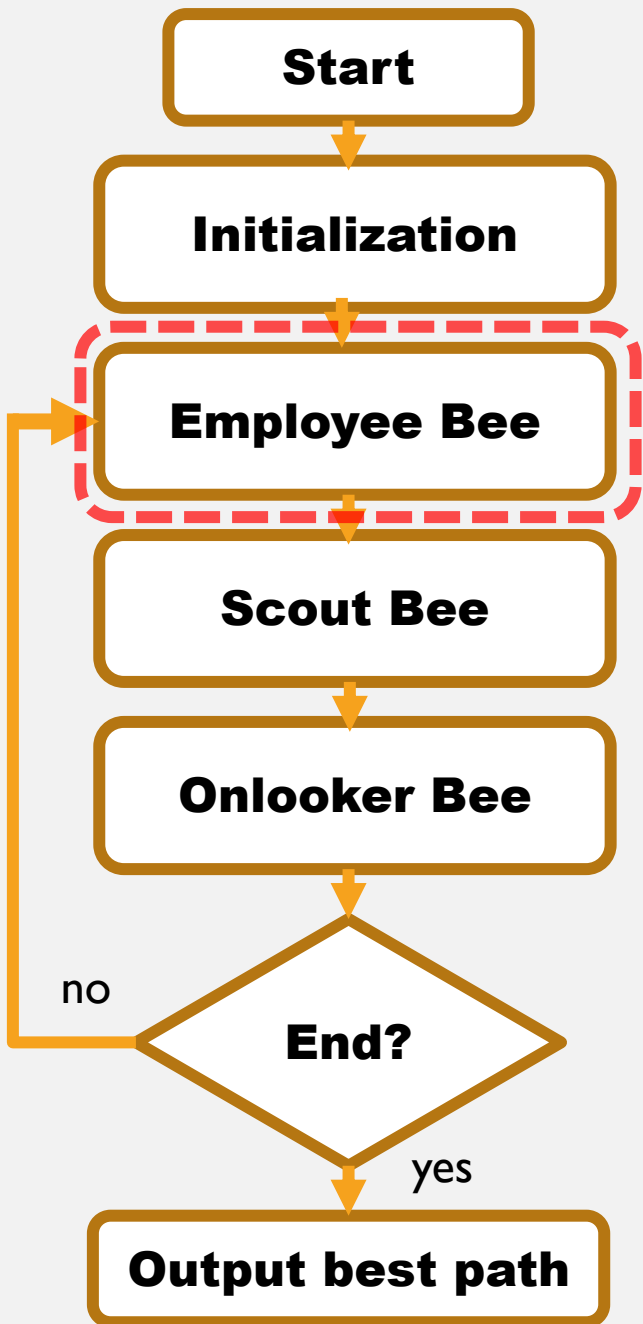
**End?**

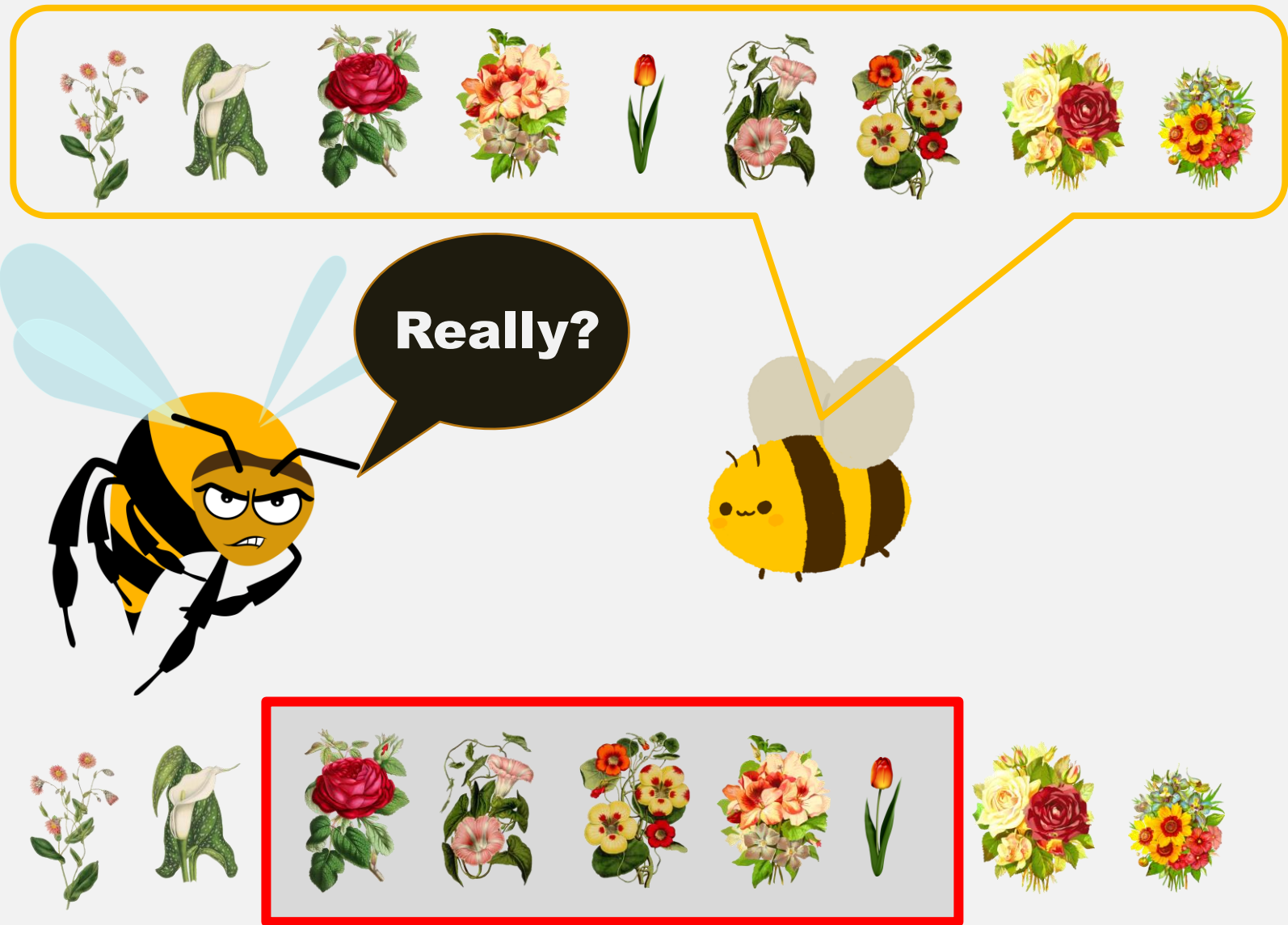
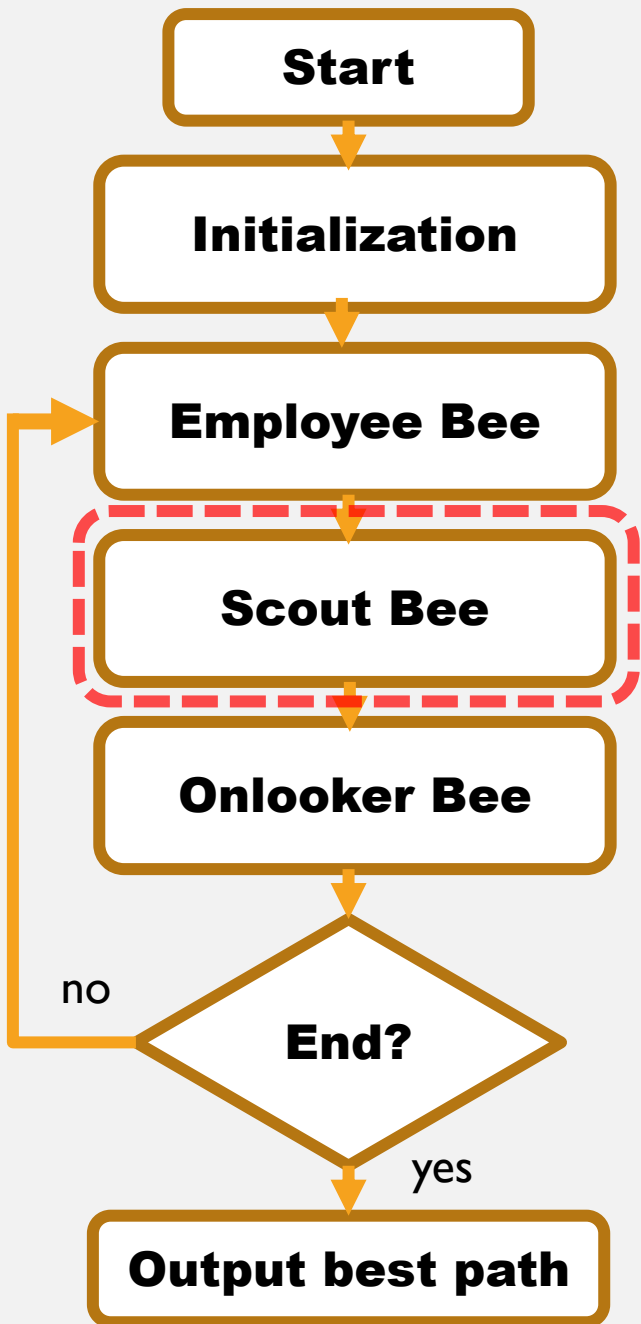
no

yes

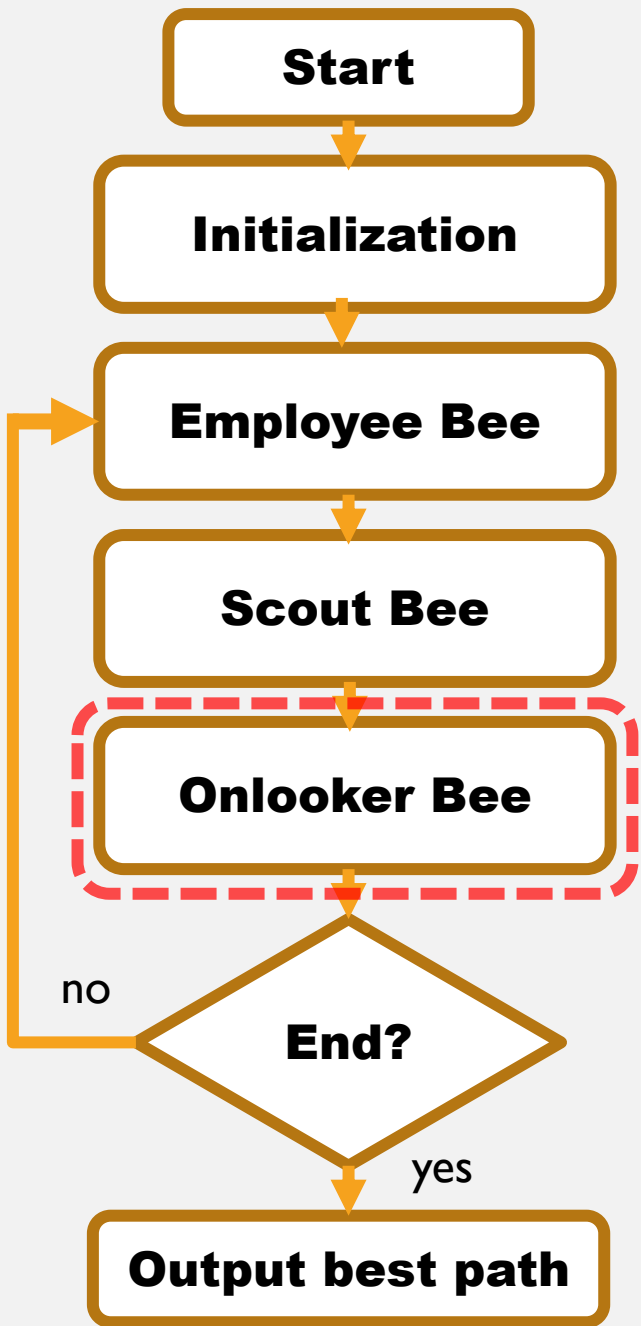
**Output best path**

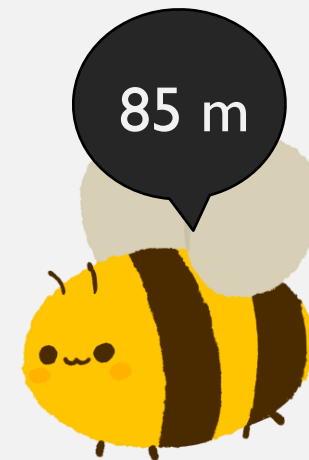
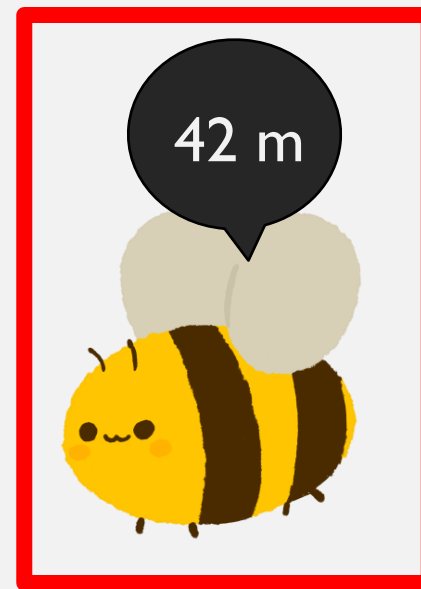
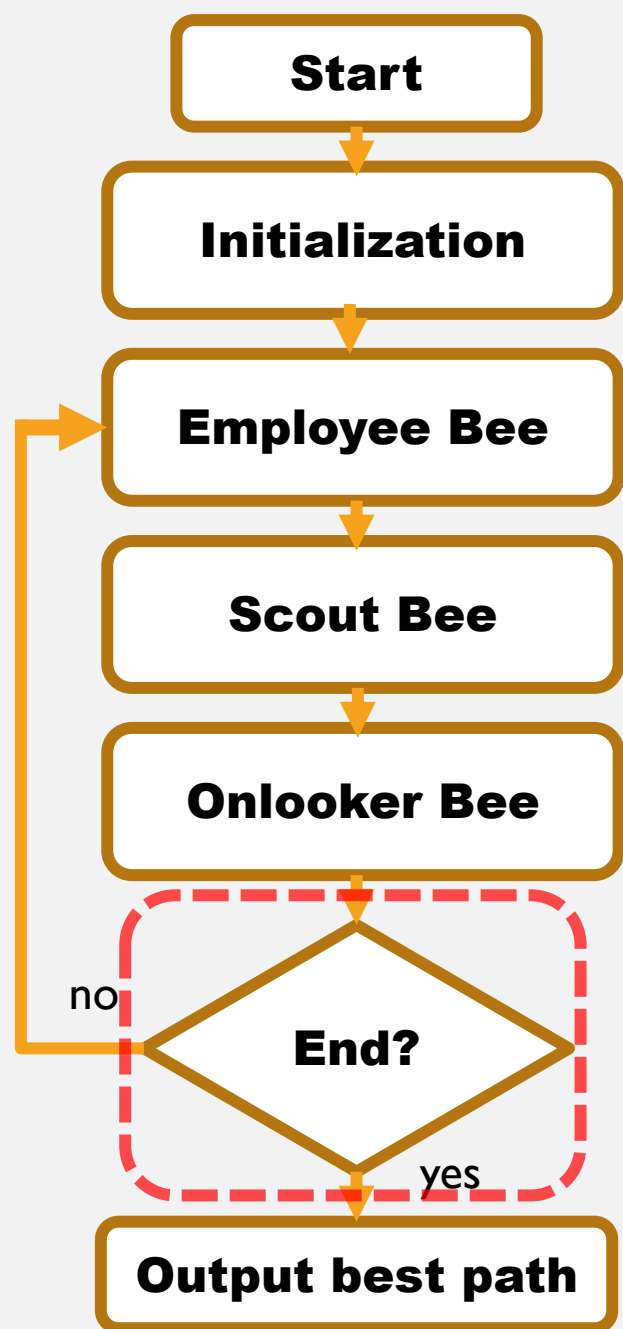


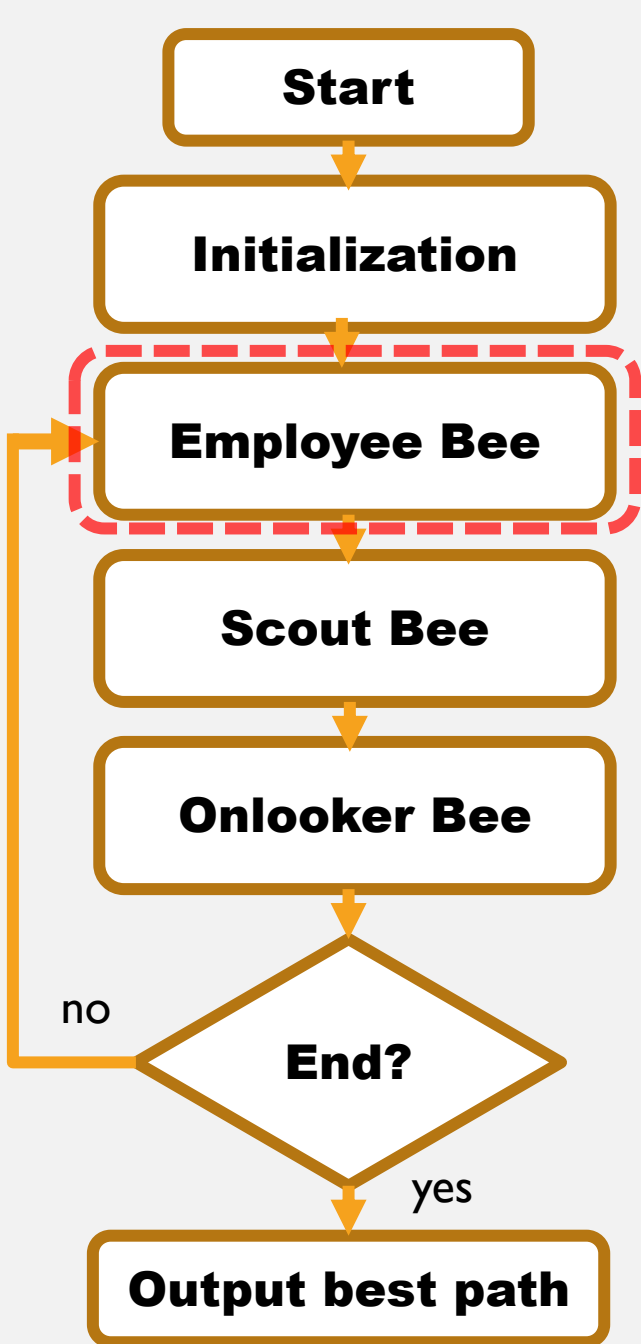




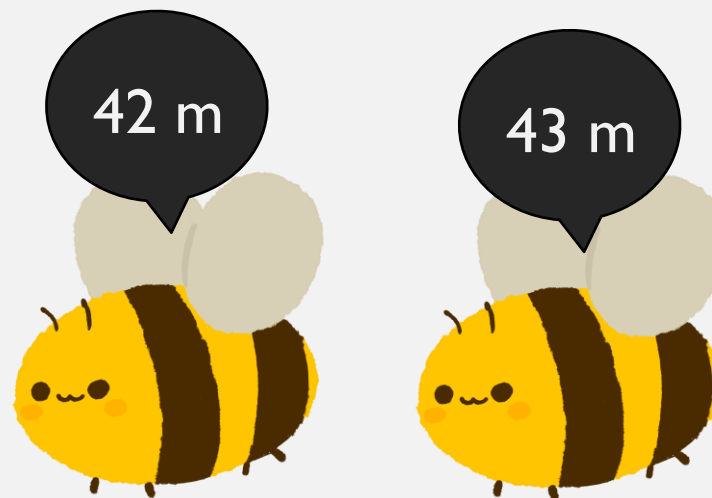




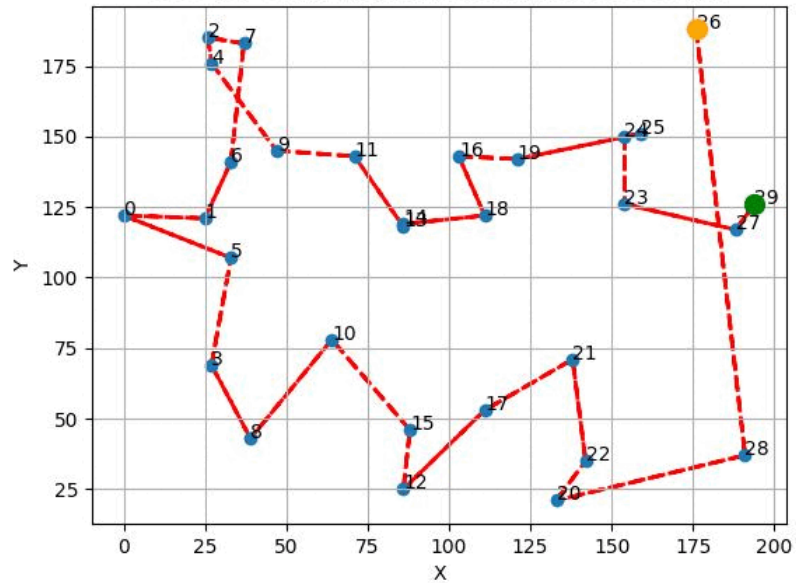




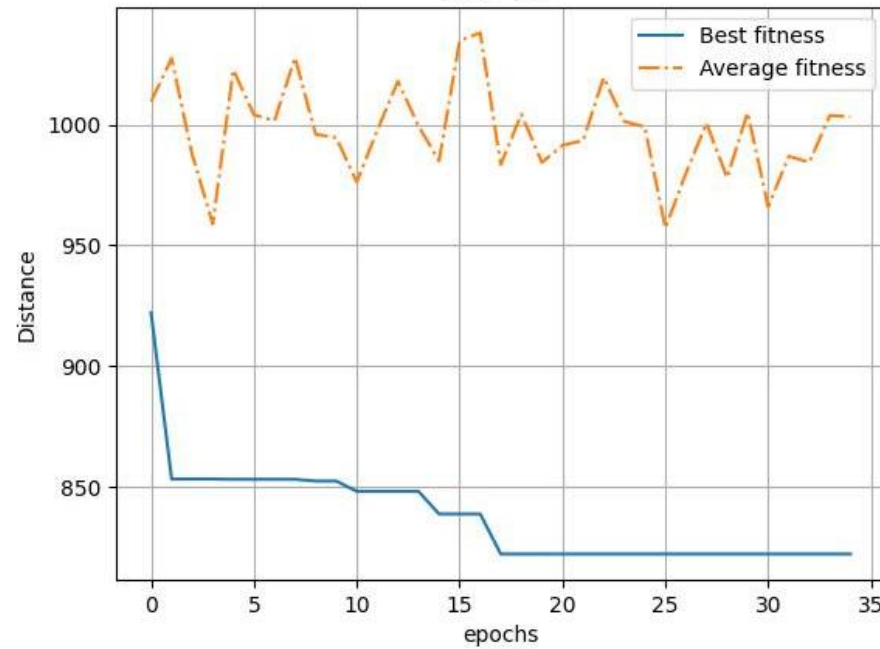
Elite Bee:



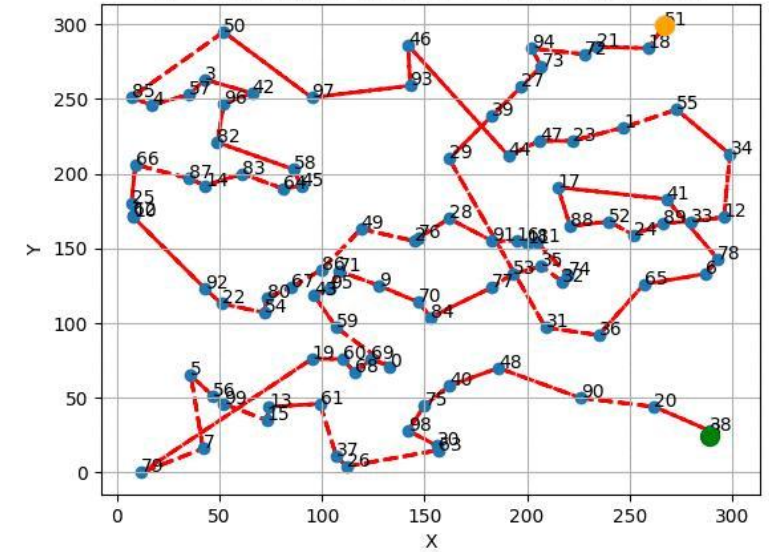
BCO TSP Solution distance: 922.1566605083212



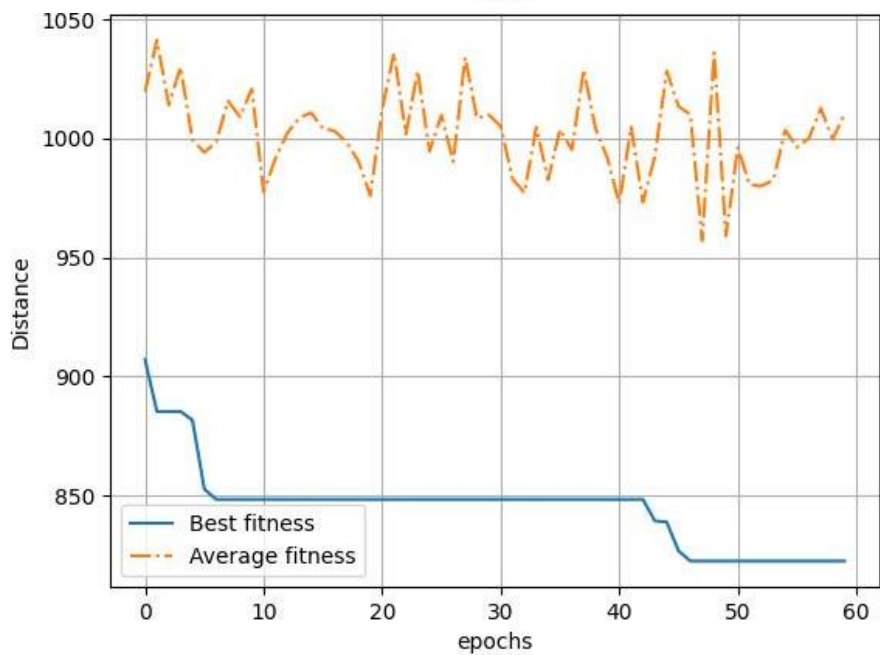
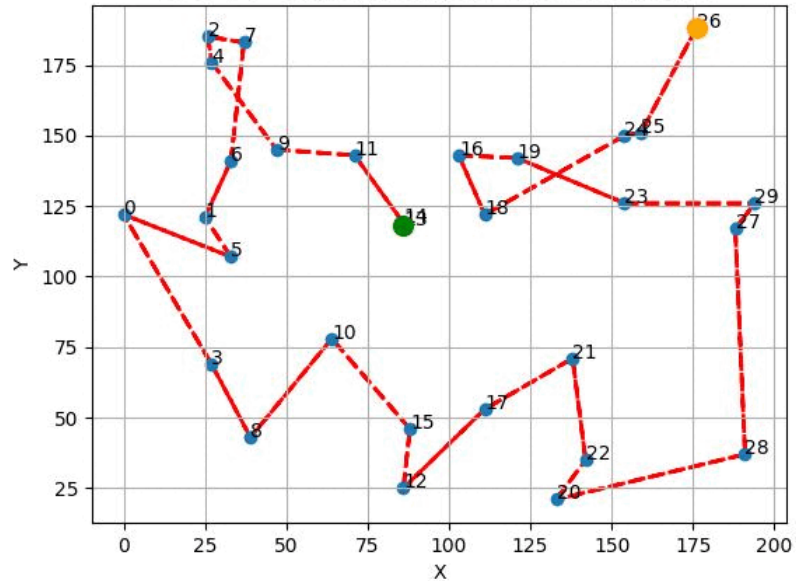
BCO TSP



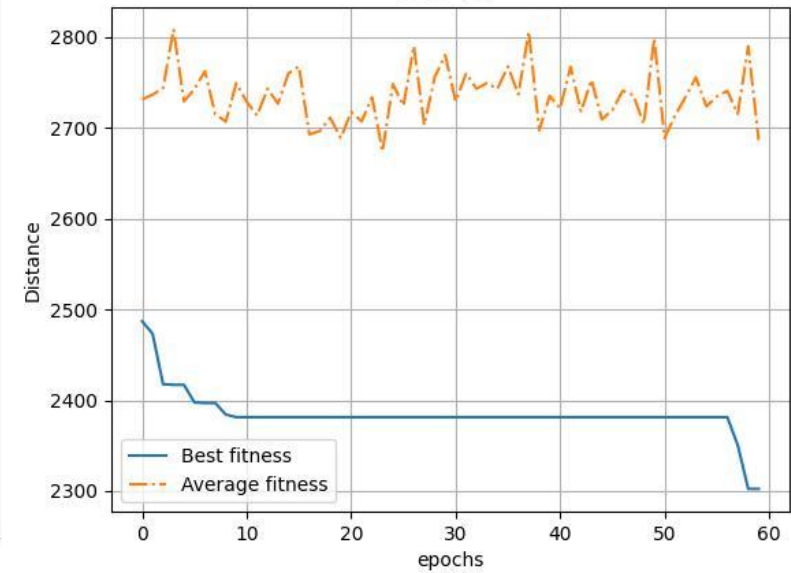
BCO TSP Solution distance: 2487.0309825751324



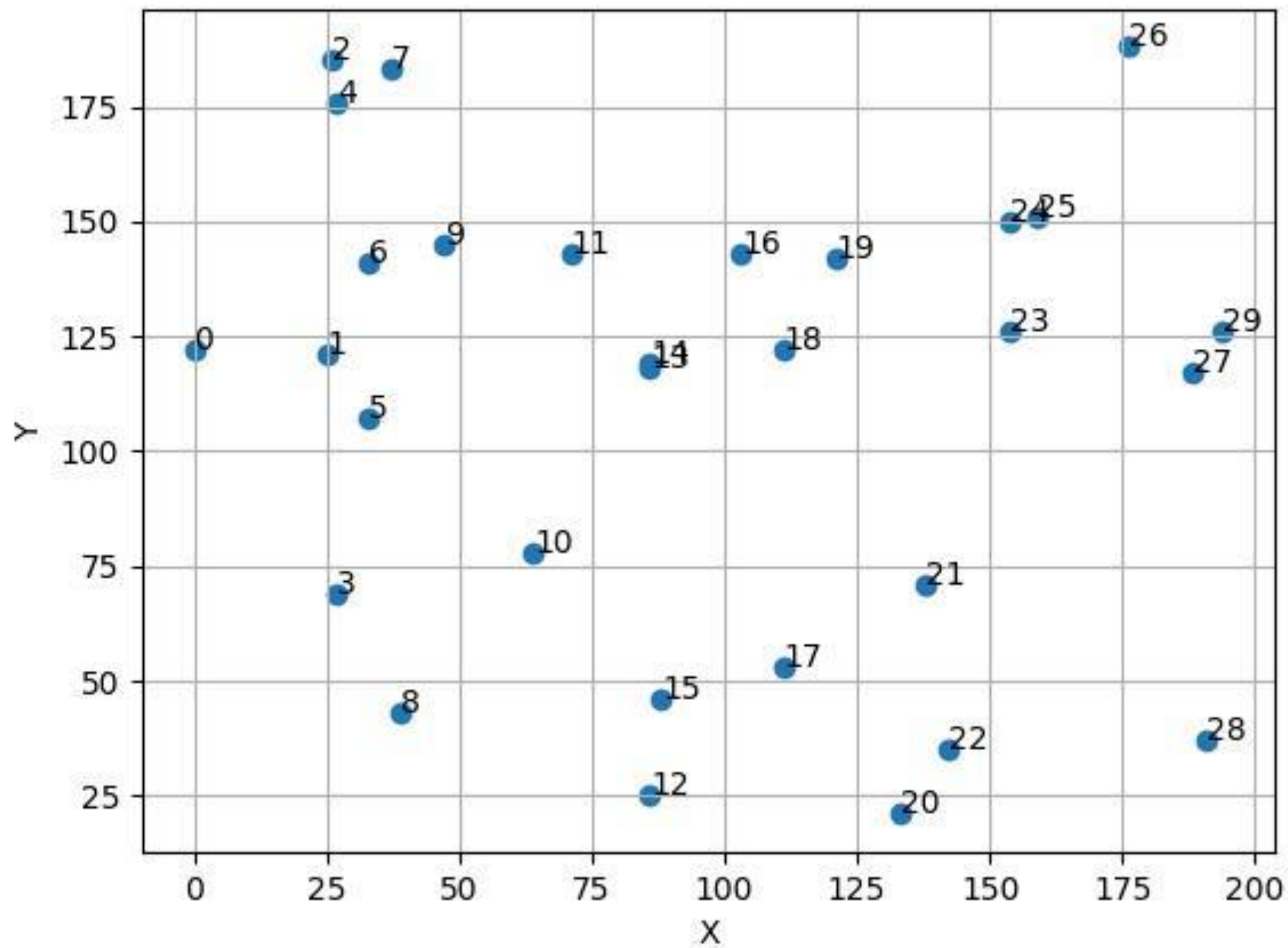
BCO TSP Solution distance: 907.035653770049



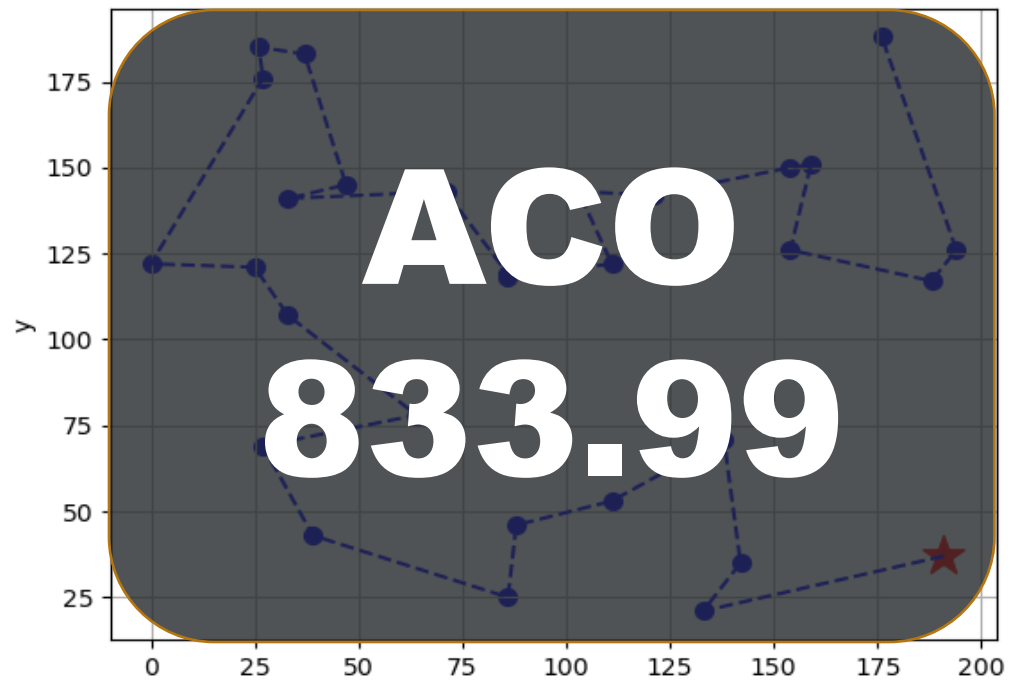
BCO TSP



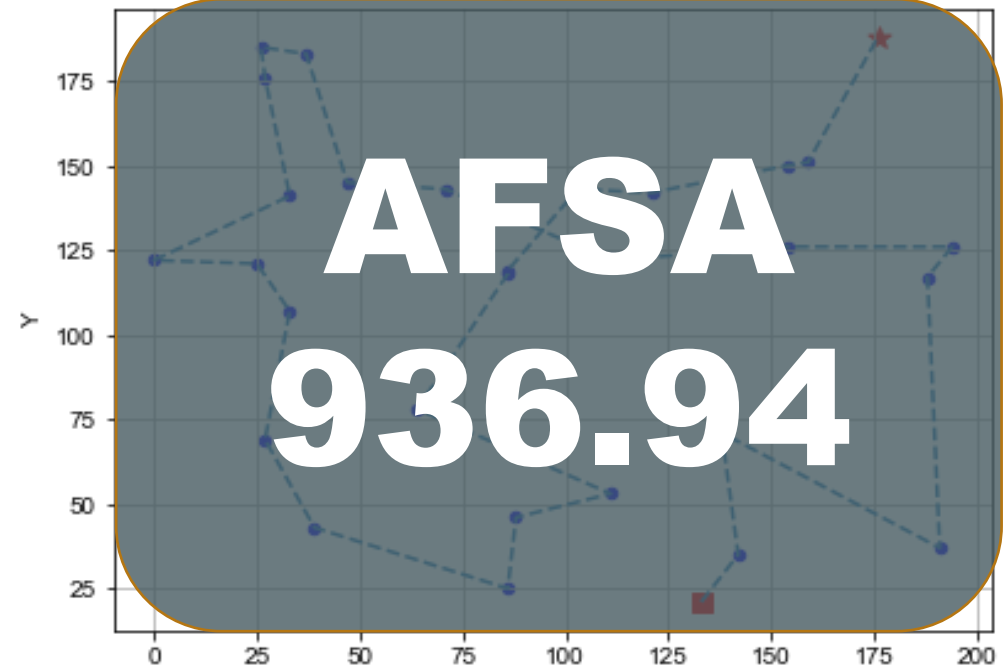




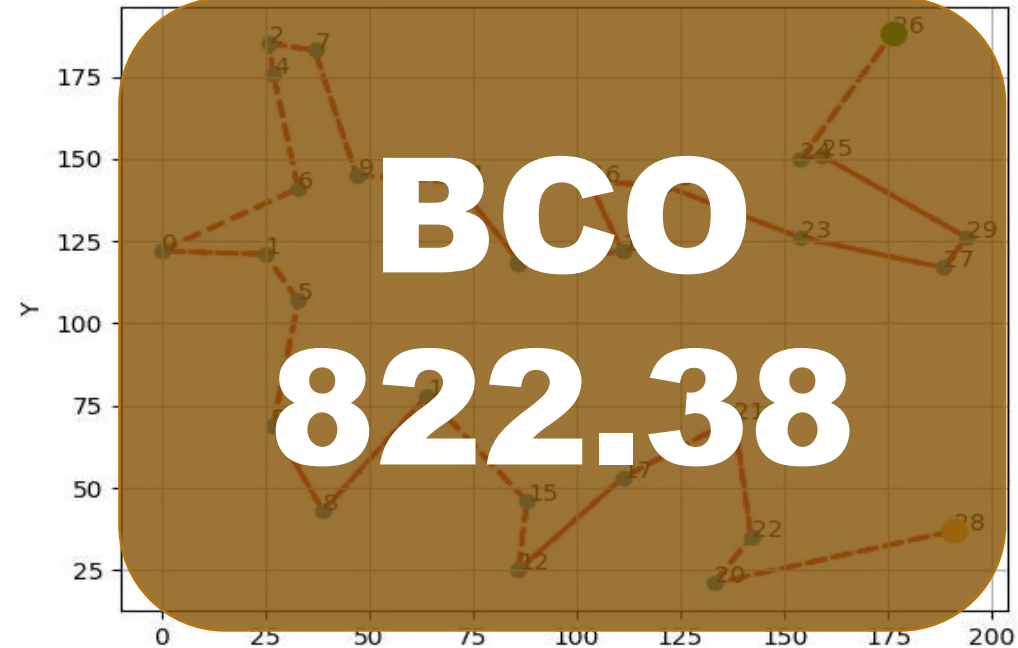
Basic ACO Algorithm Solution



AFSA Algorithm Solution



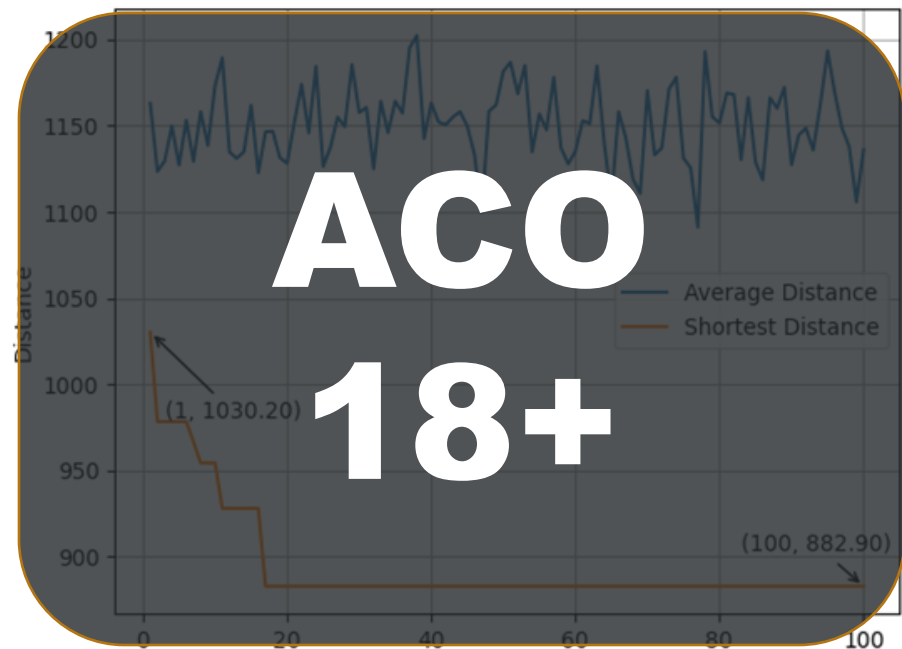
BCO Algorithm Solution



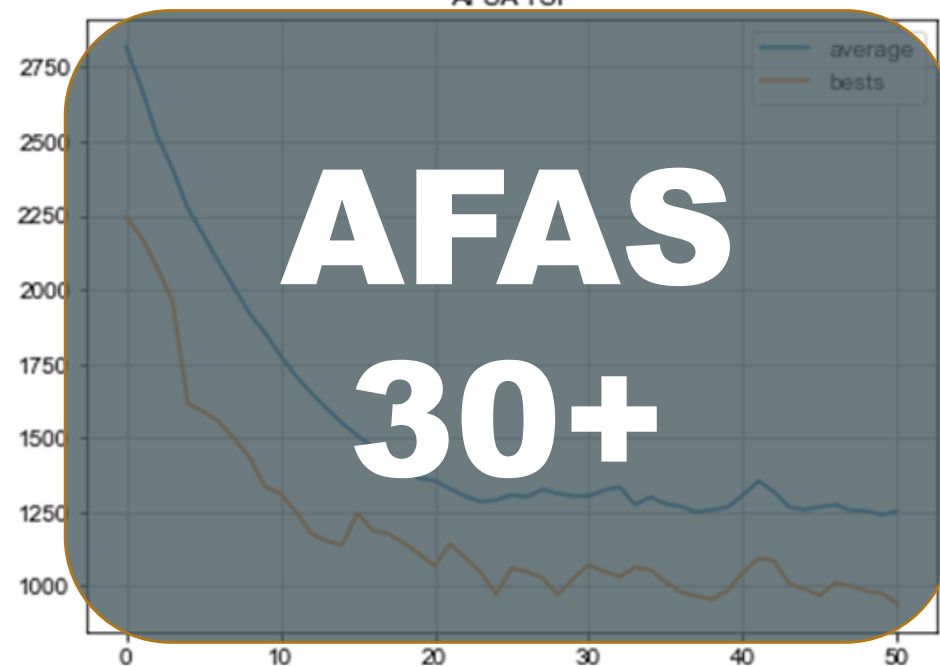
PSO Algorithm Solution



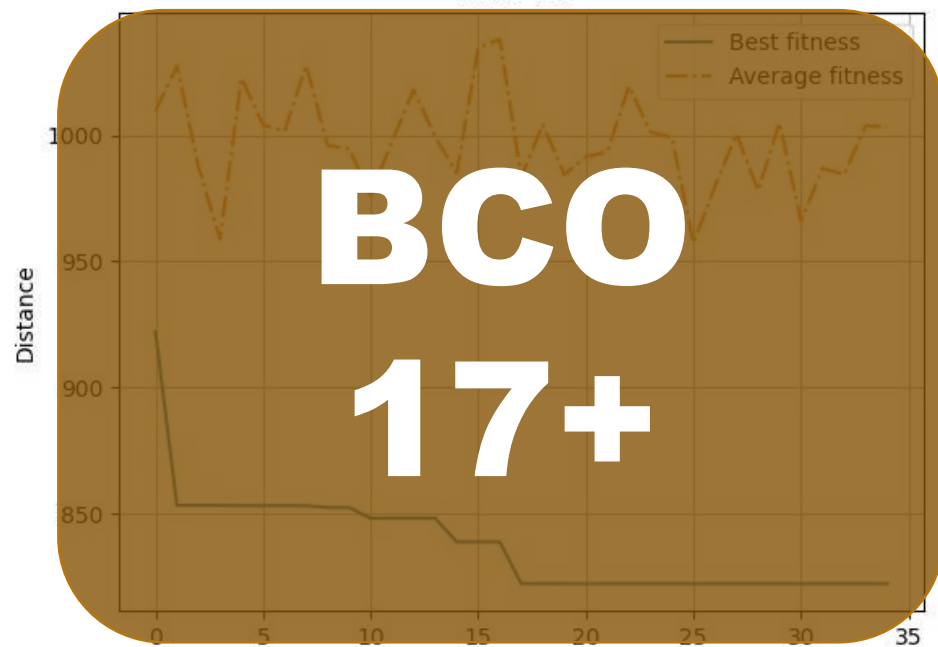
Improved ACO TSP Performance



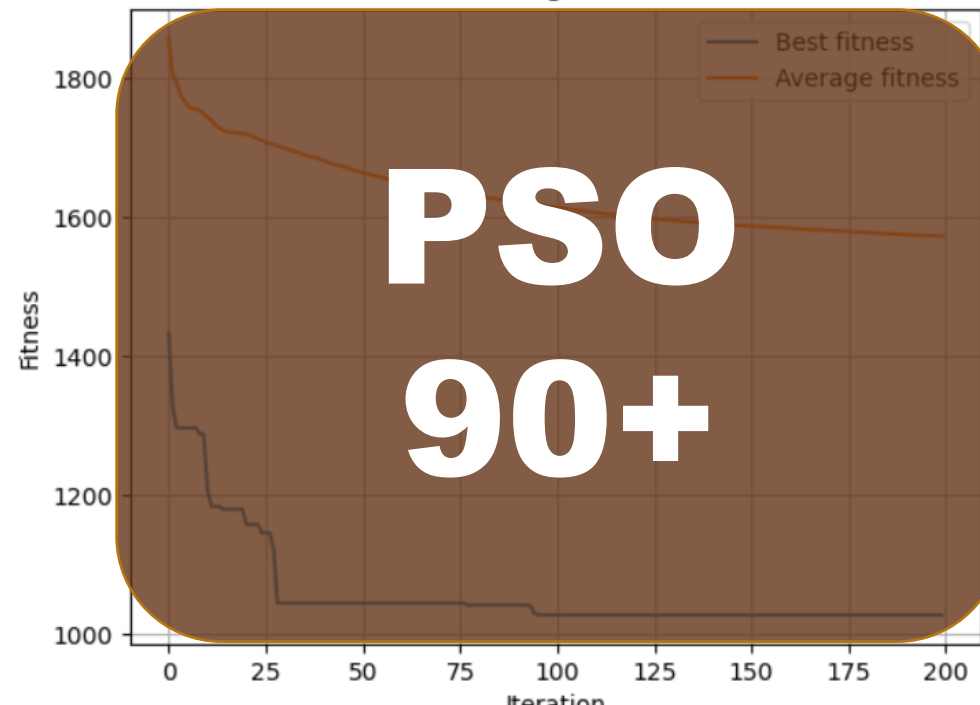
AFSA TSP



BCO TSP



PSO Algorithm



QUESTIONS

## REFERENCE

- [1] Wikipedia. 2023. Pierre-Paul Grassé. [Online]. [Accessed 14 May 2023]. Available from: [https://en.wikipedia.org/wiki/Pierre-Paul\\_Grass%C3%A9](https://en.wikipedia.org/wiki/Pierre-Paul_Grass%C3%A9)
- [2] Wikipedia. 2023. Marco Dorigo. [Online]. [Accessed 14 May 2023]. Available from: [https://en.wikipedia.org/wiki/Marco\\_Dorigo](https://en.wikipedia.org/wiki/Marco_Dorigo)
- [3] Dorigo, M., Birattari, M. and Stutzle, T., 2006. Ant colony optimization. IEEE computational intelligence magazine, 1(4), pp.28-39.

THANK YOU