➢ General Instructions:

- The submission due date of this assignment is **to be announced.**
- Write a report (*i.e. in a word document*) that illustrates your main solution steps and screenshots of your plots.
- Zip your code and the report in a file entitled [**YourName_YourID_AssignmentNumber**], submissions will be made following the instructions **to be announced**.
- This assignment should be delivered and discussed INDIVIDUALLY

➢ Requirements:

- In light of the data in the accompanying txt file entitled (***TSPDATA.txt***), you are required to implement Ant Colony System (ACS) to solve the problem of the TSP. There are 30 cities, and the data in the text file represents (x, y) coordinates of each city. You are requested to compute the shortest tour starting at every city. A tour is described by starting at a city, visit all other cities "only once", then return back to the starting city.

- The Algorithm for ACS is described as follows:

1. Initialization
    a. Calculate the Euclidean distance between every two cities and store them in matrix *dist* of size *n*n*, where *n* is the number of nodes (i.e., cities) in your network.
    b. Create a matrix *eta* which store the reciprocal of the distances, where *eta(i,j) = 1/dist(i,j).*
    c. Calculate the tour length using nearest neighbor heuristic *Lnn* (*i.e. start at any city and move from city to city by finding the one that is closest to you until you finish completing the tour*).
    d. Set *tau_0 = 1/(n*Lnn)*. n: #cities Lnn: tour length
    e. Create an *n*n* matrix of pheromones and set *tau(i,j) = tau_0*.
    f. Generate m ants and place them over the cities, but make sure that no city has more than one ant.

2. While ants have not constructed a complete tour, for each ant, apply the state transition rule to find the next city to visit.
3. When each ant has constructed a complete tour, remove the cycles in the tour (i.e., generate acyclic tours).
4. Based on the (acyclic) tours constructed by the ants, apply pheromone update rules to update the pheromones matrix *tau*.
5. Repeat steps 2 to 4 for 20 times.

After implementation:

- Decide on the suitable m (number of ants) to use.
- Make several runs to investigate the effect of the control parameters α and β, and the evaporation rate ρ.
- Plot the initial location of the cities and the shortest tours you determined.

BEST OF LUCK!