Exercises from lecture 9 (swarm intelligence) TEK5010 Multiagent systems 2019

Question 1

The Ant System (ACO-AS) algorithm is applied to the Traveling Salesman Problem (TSP) of 4 cities $v = \{v_1, v_2, v_3, v_4\}$ of distances $d = \{d_{12}, d_{23}, d_{34}, d_{14}, d_{13}, d_{24}\}$ where d_{ij} is distance between city i and city j.

a. What is the transition rule (the probability of going to city j) in AS? Explain the variables and parameters.

b. What is the pheromone update rule in AS? Also here explain the variables and parameters.

c. Calculate a tour of one of the ants in the TSP using ACO-AS assuming:

$$v_1 = (1,5)$$
$$v_2 = (6,4)$$
$$v_3 = (5,1)$$
$$v_4 = (1,3)$$

and $\alpha = 1, \beta = 5, \rho = 0.5, Q = 100, \tau_0 = 10^{-6}$ and simulate the required probabilities.

d. Calculate the tours of the rest of the ants assuming $m = n$ where m is number of ants and n is number of cities.

e. Apply the AS pheromone update rule to the system. What is the best tour now?

f. Simulate the next iterations in this ACO-TSP, either by own code or by some third-party code. What is the optimal tour after 10 iterations?

g. Optional:
    Experiment with different parameters, city configurations and other ACO methods (MMAS or ACO).