TEK5010 Multiagent systems

Lecture 3: Swarm intelligence

Exercise: ACO

Question 1

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

Optional:

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