

Exercise 6, TEK5010 Multiagent systems 2018

Question 1

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