TD ANET

SENSOR NETWORKS - 1

Exercise I : Sensor Networks - class questions

For each exercise, a series of statements are provided. Circle every true statement and rule out every false statement. A statement that is neither circled nor ruled out does not bring or removal points. Every correct response brings x points, every incorrect response removes y points, with x > y > 0. Parameters x and y may be different depending on exercise. In every series, at least one statement is correct. For example :

A tautology is always true :

a) That's true.

b) That's false.

c) It depends on the moon phase.

1. With SPIN-EC, when all sensors have enough energy, they behave as with SPIN-PP.

   d) It's true.

   e) It's false.

2. The self-stabilizing unison tolerating collisions in sensor networks studied in class works with a central daemon only.

   a) It's true.

   b) It's false.

3. The self-stabilizing unison tolerating collisions in sensor networks studied in class ensures that, given any neighboring pair of sensors S_1 and S_2, eventually the clock values of S_1 and S_2 are equal.

   a) It's true.

   b) It's false.

   c) It depends of IDs of S_1 and S_2.

4. We consider the self-stabilizing TDMA algorithm studied in class. Let C be the number of colors in the neighborhood at distance 2 of a sensor S. Greater C is,

   a) higher the bandwidth assigned to S is.

   b) lower the number of slots assigned to S is.

   c) lower the number of neighbors of S is.

   d) higher the number of slots assigned to S is.

5. In the self-stabilizing TDMA algorithm, the construction of the Directed Acyclic Graph (DAG) is built assuming an underlaying Maximal Independent Set (MIS).

   a) It's true.

   b) It's true it the MIS contains at least two nodes.

   c) It's false.

6. With the definition of density studied in class:

   a) the density of a sensor is always greater than or equal to one.

   b) the density of a sensor is always strictly smaller than one.

   c) the density of a sensor cannot be greater than two.

d) the density of a sensor can be negative.

7. In sensor networks, it is necessary to synchronize the duty cycles:
   a) only when the sensors have no more energy.
   b) only in case of stormy weather.
   c) so that no two neighboring sensors are sleeping simultaneously.
   d) so that every two neighboring sensors are sleeping simultaneously.
8. The reinforcement mechanism used in the directed diffusion process aims to:
   a) reduce the bandwidth.
   b) minimize the total amount of messages.
   c) maximize the total number of motes involved by the returned data.
   d) optimize the total amount of consumed energy.

Exercise 2 : Sensor Networks - DAG

1. Given a network of sensors (each sensor has a unique ID), propose a strategy to construct a DAG (directed acyclic graph) on top of the network.
2. Given a rooted DAG propose a protocol to transmit a message from the root to every node in the network .
3. Given a rooted DAG propose a protocol to transmit a message from a given node to the root of the network. Optimize the protocol such that each transmission takes a minimal number of hops.

Exercise 3 : Sensor Networks - Covering Algorithms

1. Define MIS, DS and CDS.
2. An algorithm that computes a MIS computes also a DS? Is the vice-versa true?
3. A DS is also a CDS?
4. Consider a ring topology where nodes are idenfied from 1 to N. Execute the MIS distributed algorithm studied in class for this topology when N =7 and N=8.
5. Propose a distributed algorithm that computes a MIS on top of a tree topology. Prove the correctness of your algorithm.
6. Propose a distributed algorithm that computes a spanning tree on top of a connected network knowing that there is a root in the network.