ECE6615: SENSOR NETWORKS

EXAM 1:
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Dr. Ian F. Akyildiz

Ken Byers Chair Professor in Telecommunications

Broadband Wireless Networking Lab

School of Electrical and Computer Engineering

Georgia Institute of Technology

Atlanta, GA 30332, USA

Tel: 404-894-5141; Fax: 404-894-7883;

Email: infocom@ece.gatech.edu

URL: http://www.ece.gatech.edu/research/labs/bwn

PUT A CODEWORD NEXT TO YOUR NAME!!!

THIS IS AN OPEN BOOK EXAM (EVERYTHING ALLOWED EXCEPT LAPTOPS AND CELL PHONES)

DURATION is 75 MINUTES

ANSWER THE QUESTIONS RIGHT TO THE POINT; AVOID LONG EXPLANATIONS!!

QUESTION 1. (15 points)
   a) What are the possible ways of saving energy in WSNs? Explain the four possibilities. (5 points)
   b) How can data be stored in sensor nodes? Explain the solutions and their shortcomings. (5 points)
   c) What is the basic and major shortcoming of SENSOR NETWORKS such that they did not become a "BILLION DOLLAR" industry so far? (5 points)

QUESTION 2. (10 points)

Consider the following tag query sent by node E:
SELECT AVG(Temp), Light/15
FROM sensors
GROUP BY Light/15

Temp = 45   A
Light = 75

Temp = 75
Light = 75   C

Temp = 105
Light = 90

Temp = 75
Light = 90

Temp = 30   B
Light = 45

D

F

Temp = 90
Light = 75   E

Temp = 60
Light = 75   G
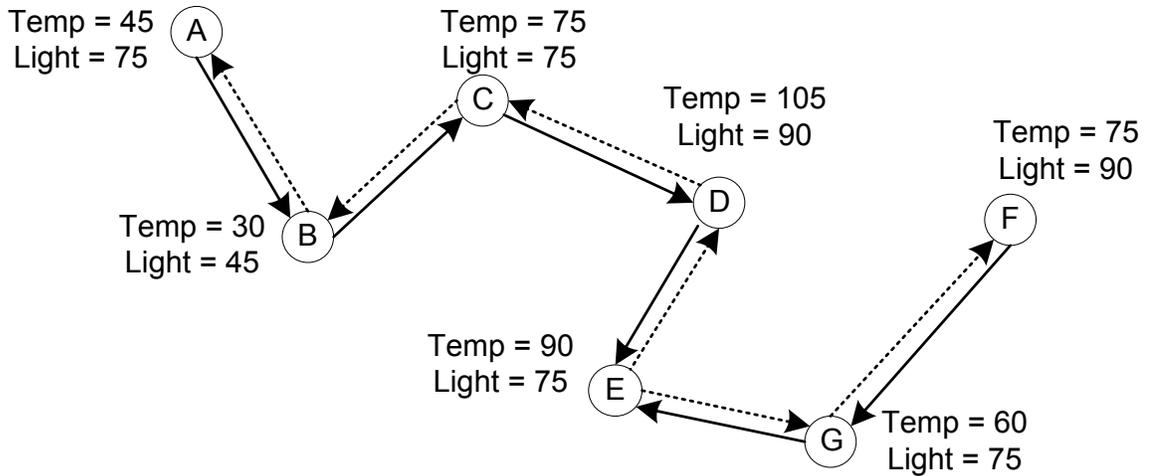
Assume that all the propagation delays from one node to the other are the same and the processing delay at each node is negligible.

Please fill out the aggregate entries at each node below after all the aggregation is complete:

B		C		D		E		G	
Group	Ave	Group	Ave	Group	Ave	Group	Ave	Group	Ave

2

QUESTION 3. (20 points)
 a) What is the DISTORTION FUNCTION based on spatial correlation used for ESRT is telling us? What is its interpretation? (5 points)
 b) What are the shortcomings of the assumptions for the derivation of the DISTORTION FUNCTION? (5 points)
 c) Why is the sensor to sink reliability notion defined in ESRT different from the conventional one-to-one reliability notion? (5 points)
 d) What are the shortcomings of ESRT? (5 points)

QUESTION 4. (25 points)
 a) Although SPIN and its spawned versions are simple, yet they are not heavily used for WSNs routing problems? Why? (5 points)
 b) In which cases does Directed Diffusion routing algorithm have problems? (5 points)
 c) What is Negative Reinforcement and how is it realized? (5 points)
 d) Why were Negative Reinforcement and Push Diffusion alternatives introduced? (5 points)
 e) What is your major criticism about Geographical Routing algorithms? (5 points)

QUESTION 5. (11 points)
  a) What are the problems of SMAC? (3 points)
  b) What is the benefit of having Clear Channel Assignment? (2 points)
  d) Why is Preamble Sampling used? (3 points)
  e) What is your criticism of Collaborative MAC (CC MAC) protocol? (3 points)

QUESTION 6. (9 points)
 a) Will XLM (Cross Layer Solution) work without Geographical Knowledge of the nodes in the network? Explain why. (3 points)
 b) What is your criticism of XLM? (3 points)
 c) How is Error Control realized in XLM? (3 points)

QUESTION 7:   (10 points)
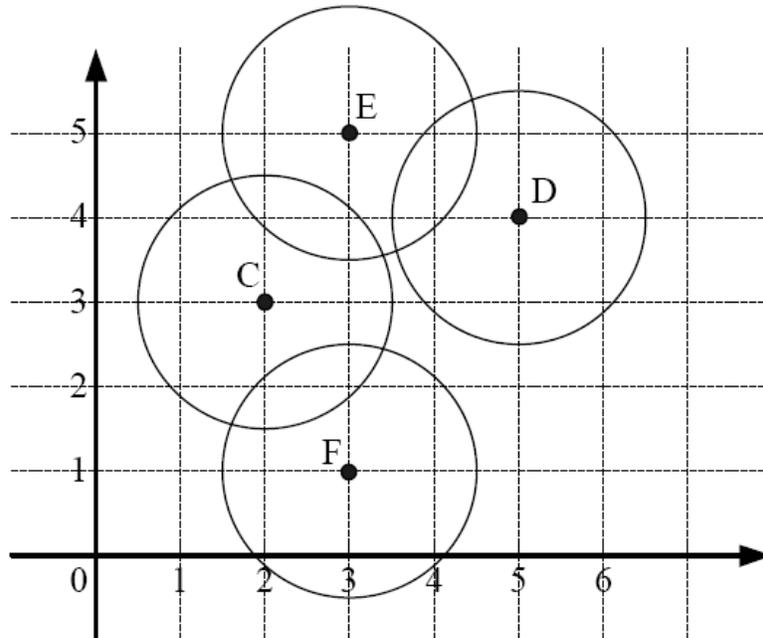
(Localization without distance estimation)

Assume that the distance between two nodes cannot be estimated but is guessed according to which nodes a particular node hears.

In the figure above, nodes A and B do not know their positions but they can hear each other. Node A knows its neighbors E and D. Moreover, node B can hear its neighbors C and F. The circular radio range of all nodes has a radius of 2 units. Calculate which positions in the following are valid for A and B.

    a. A (4,5); B(2,2).
    b. A (4,4); B(3,2).
    c. A (3,4); B(2,2).
    d. A (4,5); B(3,2)