ECE8863: WIRELESS SENSOR NETWORKS

EXAM 2

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THIS IS AN OPEN BOOK TEST!!
EVERYTHING IS ALLOWED EXCEPT LAPTOPS.
ALL QUESTIONS HAVE THE SAME WEIGHT.
PLEASE WRITE YOUR NAME AND CODEWORD ON EVERY SHEET!!!

QUESTION 1.

a) Derive the packet error rate (PER) for a packet with a payload of L bits and a header of A bits as a function of internode distance (d) for ARQ with x retransmissions and a BCH code with BCH(n,k,t). Discuss qualitatively how internode distance and payload length affect PER for these two error control techniques.
b) Briefly explain the three approaches for error control in WSNs. What are the pros and cons of each approach?
c) Explain the notion of the energy channel in the packet size optimization paper and explain how the energy efficiency metric is derived.
d) What is you criticism of the packet size optimization paper?

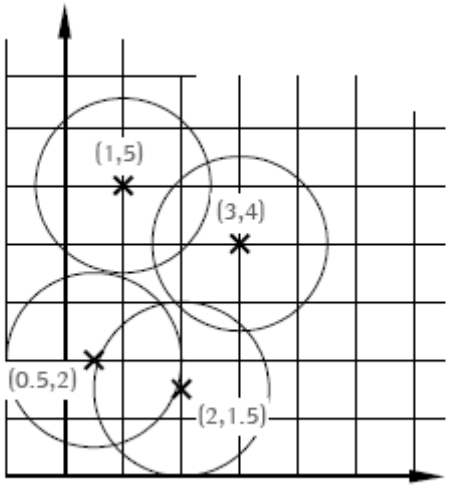
QUESTION 2.

a) List and briefly explain the cross-layer interactions among each layer of the conventional protocol stack (e.g. 1. PHY & MAC layers, 2. MAC + routing, etc…). How does the functionality of each layer affect other layers?
b) Explain the difference between protocols exploiting cross-layer interactions among protocol layers and a unified cross-layer module. Discuss the pros and cons of each approach for WSNs.
c) What is your criticism of XLM?

QUESTION 3.

a) Which are the synchronization schemes that are most suitable in wireless sensor networks? Why? Detail your answer, and provide few examples.
b) Assume that a wireless sensor network is organized in clusters. How would you achieve synchronization among nodes? Discuss pros and cons of this approach.

QUESTION 4.



(Localization without distance estimation.) In the following questions assume that the distance between two nodes cannot be estimated but is guessed according to which nodes a particular node hears.

a) In the figure above, nodes A and B do not know their positions but they can hear one another. Node A knows its neighbors (1,5) and (3,4) and B can hear its neighbors (0.5,2) and (2,1.5). The circular radios range of all nodes has a radios of 1.5 units. Calculate whether (2,4) or (2,5) is a valid position for A.
b) In another setting only one node C is not positioned and a couple of neighbors exist with known positions. Again the distance between nodes can not be estimated but the position of C should be guessed (within its valid area). The radio range of all nodes is known. What is the upper limit for the error between the estimated node position and its true position and where do the positioned nodes have to be located so that the maximum error can occur?