

Wireless Networking aka “Wireless for IoT Class”

Course code: CS4222/CS5422

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TUTORIAL 7 for WEEK 11 (Starting 20th March 2023)

[1] **Question 1:** A node running BMAC spends its time in the following 4 states (1) sleeping (consumes 1mW), (2) idle listening (consumes 10mW) (3) receiving (consumes 20mW) and (4) transmission (consumes 20mW). Note that in the idle listening state, a node detects channel activity but does not receive data. In the receiving state, there is actual packet reception. By default, it wakes up every 250ms to sample the channel for a duration of 5ms. Every 5s, the node transmit or receive a packet with equal probability. Packet transmission or reception duration is always 5ms. On the average, what is the percentage of the energy spent on:

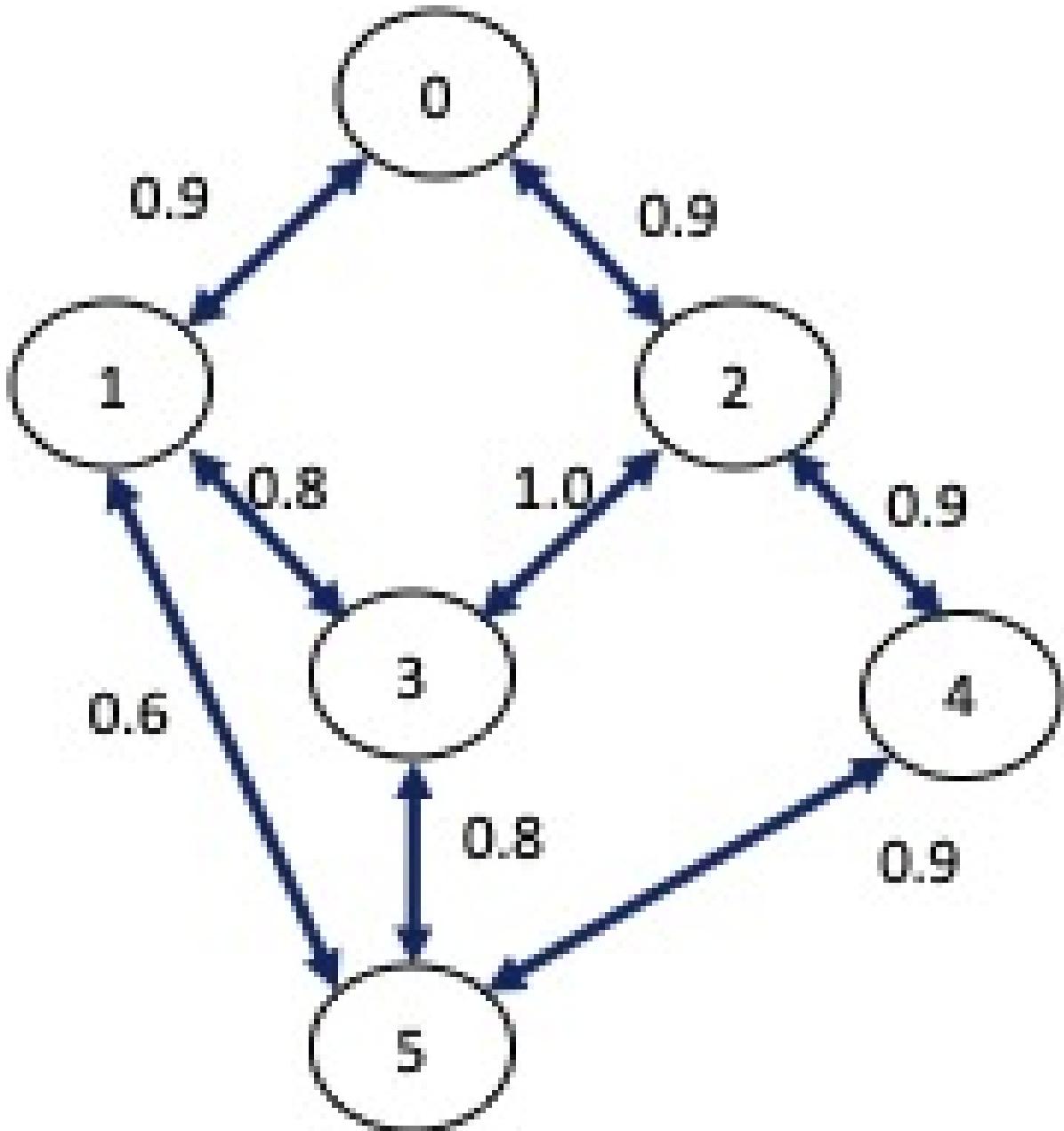
- sleeping,
- idle listening,
- receiving
- transmission?
- If the battery used provides 10KJ of energy, what is the lifetime of the node?

[2] **Question 2:** The per-hop packet error rate on a path with four hops are 0.25, 0.1, 0.5, and 0.2. What is the (a) path ETX and (b) the probability that a packet can traverse the path with no error/retransmission?

[3] **Question 3:** In the figure below, nodes indicate IoT devices and two devices can communicate if there is a link between them. The number associated with each link is the link quality measured in expected packet delivery ratio.

For the figure, find the shortest path from node 5 to node 0 using two different routing metric:

- Hop count
- Expected number of transmission (ETX). Show your working.
- Let the minimum useable link quality be set to 0.6. If the shortest hop count path is X , how long (in hop) can the path chosen by ETX be in terms of X ?



[4] **Question 4:** What are (1) wireless mesh network, (2) mobile ad hoc network and (3) delay/disruption tolerant network? What are the differences in the design of the respective routing protocols for each of these 3 different type of networks?

[5] **Question 5:** TBA