**CS 5197/6097 Wireless and Mobile Networking**

**Homework No. 9 dated Wednesday November 8, 2017**

**P14.3.** In a sensor network, the energy consumed by different functions by a sensor is as follows:

|  |  |
| --- | --- |
| **Mode** | **Energy Consumed (in nJ/bit)** |
| Sleeping mode | 0 |
| Sensing or idle mode | 0.5 |
| Aggregation | 5 |
| Communication to cluster head | 100 |
| Cluster head to BS | 1000 |

Assume the total number of nodes as *P*, the number of cluster heads to be *m*, the number of sensor nodes which send their data to different cluster heads as *n*, and the frame size to be *B* bits.

1. Find the power consumption, during a frame time period if sensing and communication is done during every frame, assuming the other half of the nodes are sleeping at that time.
2. Find the power consumption in the idle frame when sensing and communication to the CH is done in every alternate frame. Remember that power is consumed even in the sleeping mode of the cycles, when sensing is not carried out.
3. Find the total power consumption in different frames if sensing is done every other cycle, while transmission to CH is done every fourth frame.
4. Repeat part (b) if there are 10 clusters, with each cluster consisting of 8 sensor nodes and aggregation done by CH every 8 frames while CH to base station communication takes place every 16 frames.

**P14.7.** Assume that CDMA/TDMA is used for each cluster of 4x4 size within a given 8x8 grid. Can you come up with a time-slot schedule for each cluster of the sensor network when the TEEN protocol is to be used? Assume that two levels of clustering are present. Remember that CHs need to communicate with the base station as well, using a different CDMA code.



**Figure 14.21** Figure for Problem P14.7.

**P14.8.** Using the energy consumption by different functions in a sensor of Problem P14.3, determine the energy consumption in the following topologies:

* 1. How much energy is consumed for transmission to the CH?
  2. How much energy is consumed to send data to the BS?
  3. What is a good location of the BS? Justify your answer.



Figure 14.22 for Problem 14.8.

**P14.13.** A wireless sensor has a transmitter/receiver range of 2 m, and many such sensors need to be installed in a nuclear plant building of size 50 mx50 m with the height of 25 m. Can you think of an efficient arrangement of the sensor arrays assuming sensors can be placed anywhere in the plant? Explain clearly.

