Name Removed

Wireless and Mobile Networking

Homework 9

**P14.3**

Sensing power = 0.5

Idle power = 0.5

Aggregation power = 5

Communication to cluster head power = 100

Communication to BS = 1000  
Number nodes = n

Number cluster heads = m

Number bits in frame = b

1. Total sensing Power = (0.5\*(m + n))/2

Total aggregation power = (5\*m)/2

Total communication to cluster head power = (100\*n)/2

Total communication to BS power = 1000\*m

Total communication power = ((100\*n)/2 + 1000\*m)\*b

Total power = (0.5\*(m+n))/2 + (5\*m)/2 + ((100\*n)/2 + 1000\*m))\*b

= 0.25\*(m+n) + 2.5\*m + (50\*n + 1000\*m)\*b

= 0.25\*m + 0.25\*n + 2.5\*m + 50\*n\*b + 1000\*m\*b

= 0.25\*n + 2.75\*m + 50\*n\*b + 1000\*m\*b

1. Total idle power = 0.5\*(m+n)
2. Different actions:

* No sensing, no communication to CH

Energy = 0.5\*(m+n)

* Sensing, no communication to CH

Energy = 0.5\*(m+n)

* No sensing, communication to CH

Energy = 100\*n\*b

* Sensing, communication to CH

Energy = 0.5\*(n+m) + 100\*(n+m)

1. Number clusters = 10

Number sensor nodes in cluster = 8

Different actions:

* Sensing, no aggregation, no communication to BS

Energy = 0.5\*(m+n)

* Sensing, aggregation, no communication to BS

Energy (sensing) = 0.5\*m

Energy (aggregation) = 5\*m

Total energy = 0.5\*m + 5\*m

= 5.5\*m

* Sensing, no aggregation, communication to BS

Energy (sensing) = 0.5\*m

Energy (communication to BS) = 1000\*m

Total energy = 0.5\*m + 1000\*m

=1000.5\*m

* Sensing, aggregation, communication to BS

Energy (sensing) = 0.5\*m

Energy (aggregation) = 5\*m

Energy(communication to BS) = 1000\*m

Total energy = 0.5\*m + 5\*m + 1000\*m

= 1005.5\*m

**P14.7**

4x4 cluster = TDMA – each node given specific times to transmit

8x8 cluster = CDMA – each cluster head given code to transmit with

When using TEEN, the individual nodes do not transmit until the hard threshold is hit or the difference between values equals or exceeds the soft threshold. Therefore, time slots should be distributed on a first-request, first-serve basis. Or, timeslots can be pre-assigned and each node will wait until its assigned time slot to transmit. Cluster heads should transmit whenever they receive data using their assigned code for CDMA.

**P14.8**

Nodes in cluster = 8

Number clusters = 4

1. Energy for transmission to CH (if transmitting every frame) = 100\*8\*4

Energy for transmission to CH (if using TEEN) = 100\*n (where n = number of nodes that need to transmit data)

1. Energy for transmitting to BS (if transmitting every frame) = 1000\*4

Energy for transmitting to BS (if using TEEN) = 1000\*m (where m = number of cluster heads that need to transmit data)

1. A good location for the BS would be close to all of the cluster heads (so closer to the center) in order to minimize distance that data needs to travel from the cluster head to the base station.

**P14.13**

An efficient arrangement of the sensors (if one wanted to cover every part of the building) would be to have a large grid of sensors where the distance between them is 4m (2m radius of sensor 1 + 2m radius of sensor 2).

As for the number of sensors needed:

Width = 50m

Length = 50m

Height = 50m

Width Sensors = with – edge radius/diameter + 1 = 50 – 2/4 + 1 = 13 sensors

Length sensors = width sensors (same dimensions) = 13 sensors

Height sensors = height/diameter + 2 = 25/4 + 1 = 7.25 = 8 sensors

Total sensors = width\*length\*height = 13\*13\*8 = 1352 sensors

So, the best coverage would be found with 1356 sensors in a full grid across the entire plant.