EEL 4781 – Midterm examination - 1

Date:September 29, 2009

Name:

Instructions:

- This exam is open book and open notes. Allotted time is 75 minutes.
- Explicitly state all your assumptions.
- Don't just give answers, always try to write down the way you were thinking. Even if you can not find a solution, write down the paths you have tried.
- Note that the points add up to 100 + 20 bonus points.

Problem 1 (20 pts):

Can we multiplex phone conversations using both FDMA and CDMA at the same time? Is it possible? Is it advantageous? Discuss. (max 5 sentences)

Problem 2 (25pts):

Let us assume a CDMA system in which the chip sequence of the stations are:

```
A: -1 -1 -1 +1 +1 -1 +1 +1
B: -1 -1 +1 -1 +1 +1 +1 -1
C: -1 +1 -1 -1 -1 -1 +1 -1
D: -1 +1 -1 +1 +1 +1 -1 -1
```

A CDMA receiver gets the following chips:

```
0 -2 0 0 0 -2 2 2
```

Which stations transmitted, and what bits they have each transmitted?

Problem 3 (25pts):

The following encoding is used in a data link protocol:

```
A:    01000011
B:    11000011
C:    10101111
FLAG: 01111110
ESC:  11100000
```

Show the bit sequence transmitted for the frame "C B FLAG" (FLAG is part of the frame).

What is the output if the framing method is:

(a) Character count.

(b) Flag bytes with byte stuffing.

(c) Starting and ending flag bytes with bit stuffing.

Problem 4 (25pts):

(a) Find the CRC of 111101 with the generator polynomial x^3+1 (1001).
(b) Show the actual bit stream transmitted.
(c) Show how the receiver side verifies that there was no error in the transmission.
(d) Assume that the second bit from left is flipped in the transmission due to noise. Show how the error is detected at the receiving side.

Problem 5 (25pts):

Trace the operation of a sliding window protocol with a window size 2 and selective retransmission for the transmission of 5 packets P1,P2… P5. The latency is 2 timeslots (that is, the first packet sent at time 0 arrives at time 2, as already drawn in the figure below). Assume that the packet P3 and the acknowledgement of packet are lost due to transmission errors.