KFUPM - COMPUTER ENGINEERING DEPARTMENT

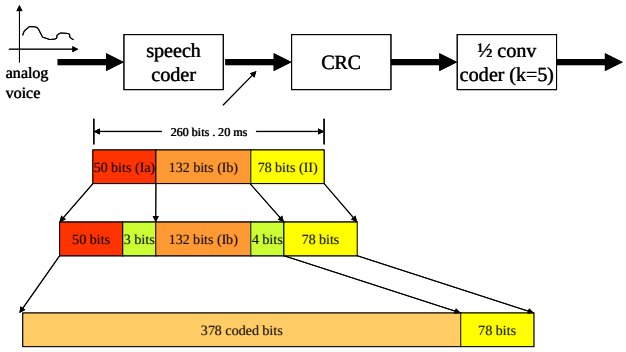
COE-543 – Mobile Computing and Wireless Networking

Assignment 3 – Due Dec 26th, 2011.

Problem	Total Points	Points
1	30	
2	30	
3	20	
4	30	
5	20	
Total	130	

Problem 1 (30 points):

1) Consider the GSM network and the channel structure (TDMA) adopted in the network. A 200 kHz carrier forms a TDMA frame of 270.833 kb/s that is divided into 8 slots. This translates to an overall user bit rate of 33.854 kb/s. The voice codec used in GSM produces 260 bits of payload every 20 msec as shown in the figure.



a) **(5 points)** What is the bit rate produced by the voice coder?

b) **(5 points)** What is purpose of the "1/2 conv coder" box? What is meant by rate 1/2 coding?

c) **(10 points)** Describe the voice payload coding? Mention the block sizes and timing assisted by the numbers shown in figure.

d) **(10 points)** The system employs two levels of bit interleaving. Specify those two levels and the purpose of interleaving?

Problem 2 (30 points):

1) Consider a cell site where N mobiles are communicating with the basestation using DS-CDMA technology. Assume the ideal conditions (perfect orthogonality, no multipath, no thermal noise, etc.) followed in class notes. Each of the mobiles is assigned a code $C_i(t)$ and has information signal $R_i(t)$.

a) (5 points) Write an expression for the received signal at the basestation $s_r(t)$.

b) (5 points) Show that the received *SNR* before the bank of correlators is equal to $1/(N\text{-}1)$.

c) (5 points) What would be the received *SNR* per branch after the correlator? Why?

d) (10 points) Show that the basestation is able to extract the mobile's information signal by multiplying with the corresponding code. Mention all necessary conditions.

e) (5 points) What is meant by "Interference Suppression"?

Problem 3 (20 points):

It is required to use the information of Section 4.2.2 to reproduce Figure 4.27 and Figure 4.29.

Problem 4 (30 points):

Consider the uplink reservation system shown in Figure where the basic frame consists of *N* mini contention slots followed by the data part. *K* users compete for the *N* mini contention slots by attempting to transmit a mini request packet for a selected mini slot. Request is considered successful only if one user transmits its request for a particular mini slot. Successful reservations lead to the respective users transmitting their fixed length data packets in the data part of the frame. Assume the basestation informs the users of the contention result indicating the order of transmission (i.e. schedule) for the users that succeeded in reserving a slot. Assume the length of mini slot is equal to one unit, while the length of the data packet occurring in the data part of the frame is d > 1 units.

a) What is the maximum efficiency for this reservation protocol assuming negligible collision possibilities on the mini slots?

b) What is the minimum efficiency for this system assuming one user has data for transmission?

c) Now assume all K users always have traffic to send and Let K = 10 users. Plot the efficiency of this protocol versus the number of mini slots.

d) For N very large – what would be a good approximation for the efficiency of this protocol?
Hint for very large N, most likely each of the terminals will pick a different mini slot and their reservation will be successful.

Problem 5 (20 points):

In the context of mobility management answer the following questions:

1) Mobile IP is one network layer solution for mobile terminals, how does IPv6's solution compare to that of Mobile IP? In other words, what is the solution adopted in IPv6?

2) Multi-Stream Control Transport Protocols (m-SCTP) is another solution for mobility management that operates at the transport layer. In your own words and using diagrams when possible/needed, explain briefly the basic operation and the approach adopted by each of these solutions. You need to include your references in the solution.