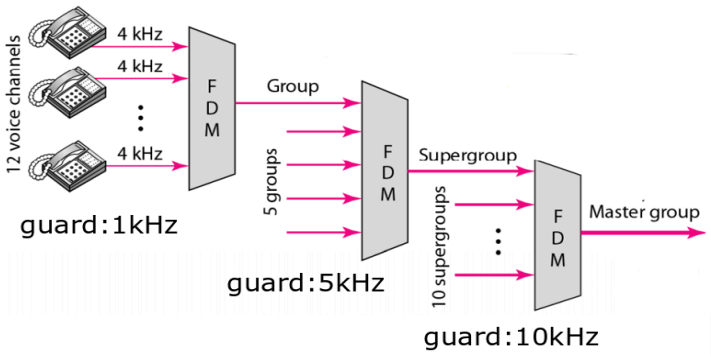
CSE320
Assignment 04
Deadline: April 30, 2024, 11:59 PM
Submission: Google form link

Chapter 6 - Multexing and Spreading

1. Consider there are five channels, two with a bit rate of 400 kbps and three with a bit rate of 200 kbps are to be multiplexed using multiple-slot TDM with one synchronization bit. The interleaved unit is 2 bits.
   - **a.** How many input channels are there after doing multi-slot TDM?
   - **b.** What is the input bit duration before multiplexing?
   - **c.** What is the size of a frame in bits?
   - **d.** What is the frame rate?
   - **e.** What is the duration of a frame?
   - **f.** What is the data rate/transmission rate/bit rate of the link?
   - **g.** What is output slot duration?
   - **h.** What is the output bit duration?

2. The following **FDM** hierarchy has been used by a telephone company. How many voice channels can be multiplexed together in the master group? What is the required minimum bandwidth for the multiplexing?



3. Sketch the **Spread Signal** from the following Original Signal (**110**) and the given spreading code (**100011**). How many times has the data rate increased and why? *Follow Figure 6.33 of the slide to answer this question.*

CSE320
Assignment 04
Deadline: April 30, 2024, 11:59 PM

Chapter 10 - Error Detection

4. a) Given the dataword $x^9 + x^5 + x^3 + x^2 + 1$ and the divisor 10111, **show** the generation of the CRC codeword at the **sender** side **using binary division**.

b) After sending the codeword to the **receiver**, suppose the **second bit from MSB (left) to LSB (right)** is corrupted (0 to 1 or vice-versa) during transmission. **Show** the calculation at the receiver side using **polynomial division. Comment** if CRC can detect the error or not. **Online tool:** CRC online calculator

c) Mention one failure case of CRC referencing error detection capability.

5. How many changing bits can we successfully **detect and correct** errors using this 2B/6B scheme? Show the calculation.

Dataword	Codeword
00	101101
01	110100
10	000010
11	011000

6. a) Assume a packet is made only of five $\text{decimal}_{(\text{base } 10)}$ words: **7, 8, 5, 9, 21**. Represent the data in a 4-bit binary sequence. **Show** the checksum at the sender side using a 4-bit binary representation.

b) Now change the second data to 9 and the third data to 6. **Show** the calculation on the receiver side. **Comment** on the error detection.

7. a) Assume a packet is made only of four 16-bit words $(56E)_{16}$, $(DB2)_{16}$, $(94)_{16}$, and $(DD)_{16}$. **Show** the checksum at the sender side.

b) If the second data item is changed to $(C0)_{16}$ and the last data item is changed to $(E1)_{16}$ during transmission, check if the receiver can detect any error or not.

(Hint: The given words are in hexadecimal value, meaning each digit can be represented by 4 bits. Remember, hexadecimal values range from 0000 – FFFF).