BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Semester Final | Semester: Spring 2023
Duration: 2 hours | Full Marks: 50

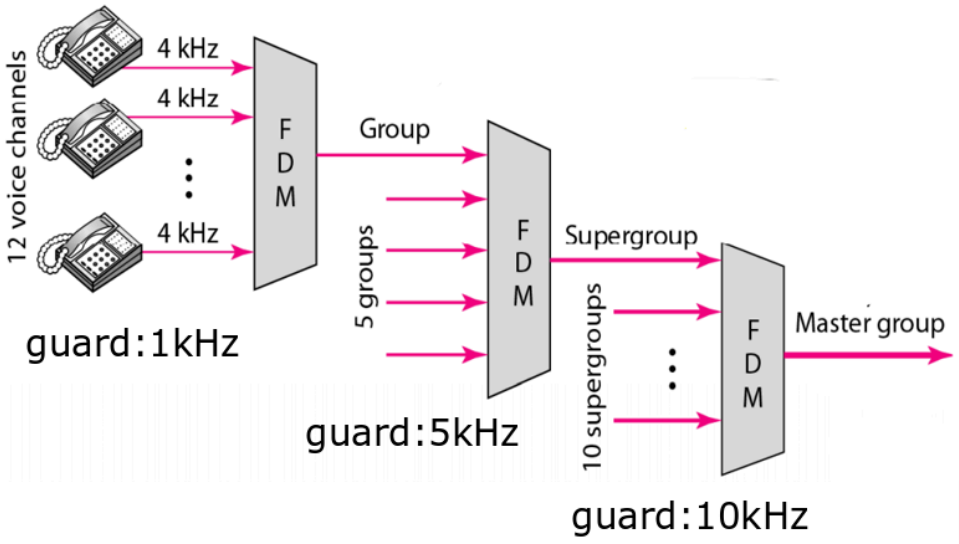
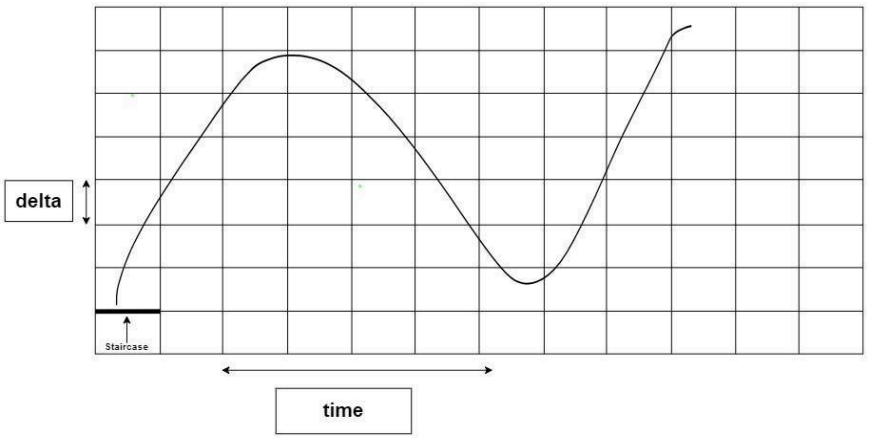
CSE 320/EEE361/ECE361: Data Communications

Answer the following questions.
Figures in the right margin indicate marks.

SET A

Name:	ID:	Section:

1. [CO5]	a)	Assume a packet is made only of four 16-bit words $(3046)_{16}$, $(ABDC)_{16}$, $(2B5)_{16}$, and $(E30)_{16}$. I. **Show** the checksum at the sender. II. If the first data item is changed to $(3047)_{16}$ and the third data item is changed to $(2B4)_{16}$ during transmission, check if the receiver can detect any error in this case? III. Explain the reasons of the receiver's error detection state in (II) *(Hint: The given words are in hexa-decimal value, that means, each digit can be represented by 4 bits. Remember hexadecimal values range from 0000 – FFFF).*	6
	b)	Channelization protocols do not require any central controller to ensure multiple access resolution - True/False? **Justify.** How can you calculate the vulnerable time of CSMA?	4
2. [CO3]	a)	**Consider**, Five channels, two with a bit rate of 240 kbps and three with a bit rate of 180 kbps, are to be multiplexed with one synchronization bit. **Write** the following answers: I. What is the size of a frame in bits? II. What is the frame rate? III. What is the duration of a frame? IV. What is the output data rate? V. What is the output bit duration? VI. How many input channels are there after doing multiplexing?	6

	b)	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 bandwidth for the multiplexing?  	4
3. [CO2]	a)	**Show** the staircase in the following graph and generate the digital data from the given analog signal using the Delta Modulation (DM) technique. You have to answer this question in the question paper only. 1  1	6
[CO4]	b)	Suppose, you are using fiber optic cable and you want the density of the core to remain constant from the center to the edges. **Illustrate** the diagram. What will the figure look like if you vary the densities?	4
4. [CO5]	a)	**List** some strategies in CSMA/CA that are used to avoid collision.	3

<table>
<tr><td></td><td>b)</td><td>In CSMA/CD, what happens when two nodes sense the carrier at the same time? How can we stop the nodes from sensing the channel at the same time?</td><td>3</td></tr>
<tr><td></td><td>c)</td><td>The 2 bit datawords are converted to the following 5 bit codewords. For how many bits can we successfully detect and correct errors using this scheme?

<table><tr><td>Dataword</td><td>Codeword</td></tr><tr><td>00</td><td>00000</td></tr><tr><td>01</td><td>01011</td></tr><tr><td>10</td><td>10101</td></tr><tr><td>11</td><td>11110</td></tr></table></td><td>4</td></tr>
<tr><td>5. [CO3]</td><td>a)</td><td>What is the minimum number of bits in a PN sequence if we use FHSS with a channel bandwidth of B = 5Hz and bandwidth of spread spectrum Bss = 250 KHz?</td><td>3</td></tr>
<tr><td></td><td>b)</td><td>Suppose, you are given with the k-bit pattern and Carrier Frequency as follows:

k-bit pattern
<table><tr><td>11 00 01 10</td></tr></table>
<table><tr><th>k-bit</th><th>Carrier Frequency</th></tr><tr><td>00</td><td>100 kHz</td></tr><tr><td>01</td><td>300 kHz</td></tr><tr><td>10</td><td>400 kHz</td></tr><tr><td>11</td><td>200 kHz</td></tr></table>
Draw FHSS cycle 2 times using the above pseudo random generated k-bit pattern and given frequency table. (** Hint: Draw the Carrier frequency graph against hop period)</td><td>4</td></tr>
<tr><td></td><td>c)</td><td>Suppose you have two channels among which 1 channel has a bandwidth of 1500 kbps and one with 1200 kbps. What is the smartest way to multiplex these channels without involving too many extra bits? Draw and validate with visual representation to aid your reasoning.</td><td>3</td></tr>
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