BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Semester Midterm   Semester: Spring 2024
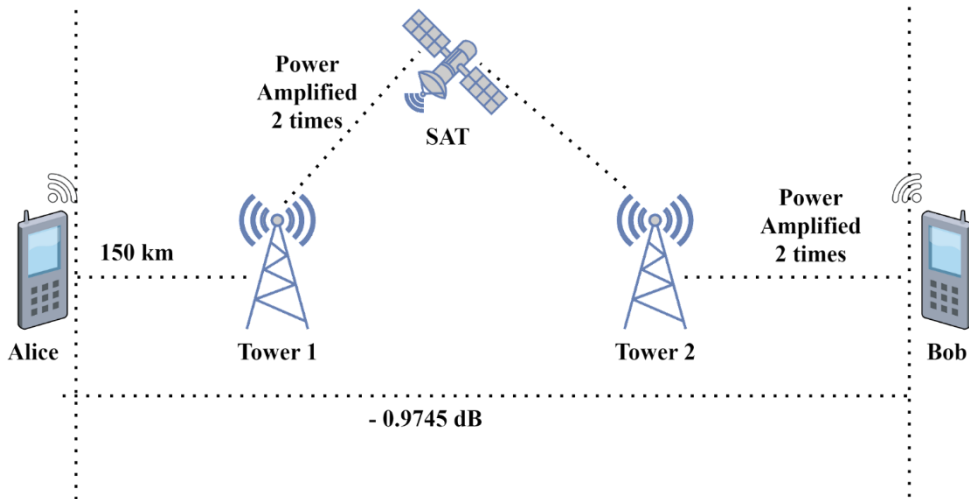Duration: 1 hour 30 min   Full Marks: 30

CSE 320: Data Communications
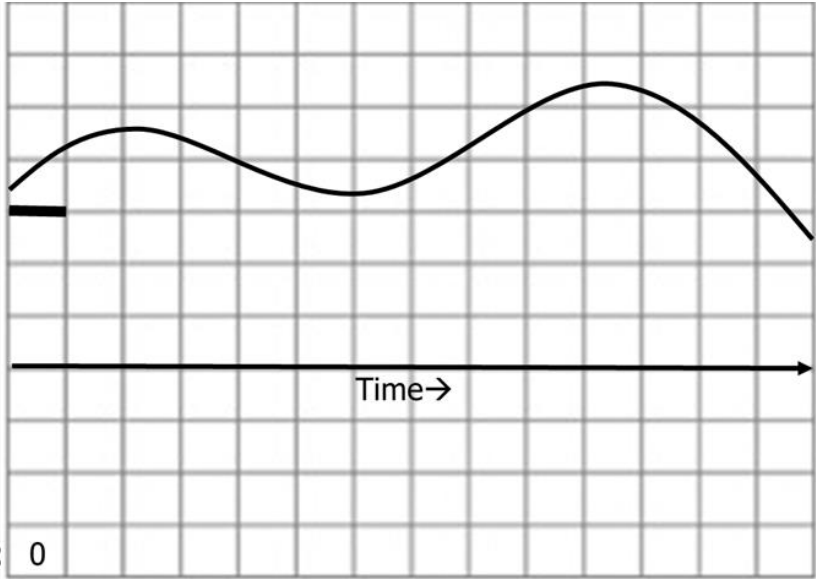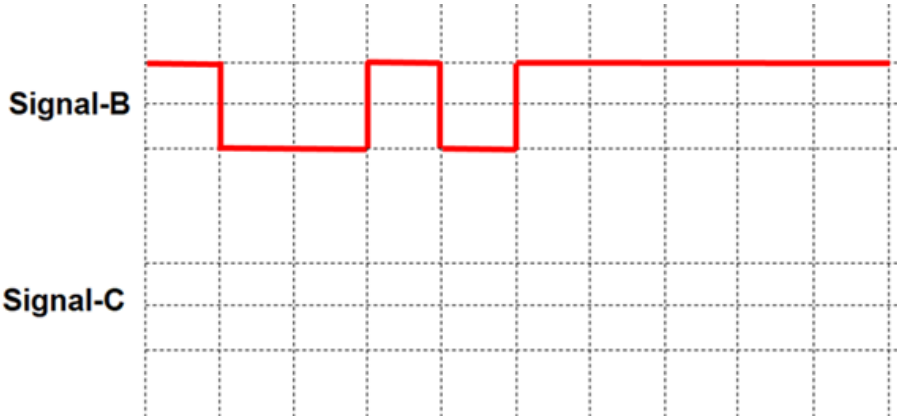
Answer the following questions.
Figures in the right margin indicate marks.

SET A

Name:	ID:	Section:

1. **[CO1]**	a)	You have been tasked to work with the network topology shown below. Assume the physical addresses to be the uppercase letters and the logical addresses to be the lowercase letters. For the Devices, use a Port number from the dynamic range (49152 - 65535).	[2+4]

> i.   How many networks are there in total? What is a hop-to-hop delivery and which layer of the OSI model is responsible for maintaining this?
>
> ii. Device E has a process running which is trying to receive a data frame from the web Server A. The Server is running at Port 80.
>
>   How many hops will there be? **Complete** Frame 1 below by writing the Destination and Source physical, logical and appropriate port addresses if the data frame is in its second hop.

Frame1	D. Mac	S. Mac	D. IP	S. IP	D. Port	S. Port	Data	Trailer

	b)	Suppose, a hospital has four buildings. Each building has an administration ward and a patient care ward. There are 3 nodes in each ward. Identify the topologies and draw the hybrid network **that satisfy the following criteria:**
		
		   i. Each ward can communicate with each other as they are connected centrally. If one ward gets disconnected, the other ward remains active.
		
		   ii. The devices in both wards use a central backbone line and are connected using multipoint connections only.
		
		   iii. Dedicated point to point connection is used to connect buildings with each other.
			[4]

2.
[CO2]
	a)	A document takes 0.5 minutes to download over a communication channel, assuming the channel is completely noiseless. The data rate of the channel is 10 Mbps and the bandwidth is 1.5 MHz, analyze the following aspects
		
		   i. **Calculate** the number of characters present in the document.
		
		   ii. **Determine** the value of the signal Level.
			[2+2]

	b)	Alice is calling Bob through a hybrid communication system as shown in the following figure. Suppose the signal power is 801 mW at Alice's phone. The power loss rate from Alice to Tower 1 is 2.14 mW/km. The final attenuation from Alice to Bob is -0.9745 dB. ● **Calculate** the attenuation for the signal transmitted from SAT to Tower 2. 	[3]
	c)	A periodic composite signal is characterized by a bandwidth of 20 kHz and a starting (minimum) frequency of 25 kHz. The signal exhibits peak amplitudes of 12 V, 18 V, and 24 V corresponding to the lowest, highest, and midpoint frequencies within its range, respectively. **Calculate** the maximum frequency. **Draw** the frequency domain plot.	[3]
3. **[CO2]**	a)	If the number of levels is increased in PCM, will the system perform better or not? **Justify** your answer.	[2]

3. [CO2]	b)	**Show** the staircase in the following graph and **generate** the digital data from the given analog signal using the Delta Modulation (DM) technique. *You must answer this question in the question paper only.*	[3]
	c)	Baseline wandering is a common problem in both NRZ-I and NRZ-L, however, it is twice in NRZ-L scheme. **Explain** why. Hint: Inspect the nature of the encoding scheme and what happens for 0s and 1s.	[2]
	d)	i. Decode the Signal B and **generate** the binary bit stream using NRZ-I line coding scheme. ii. Now from the extracted binary bits, **draw** the Signal-C using an appropriate line coding scheme so that there is no synchronization problem. (draw it in the question paper only)	[3]