BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Semester Midterm | Semester: Summer 2023
Duration: 1 hour 10 min | Full Marks: 30

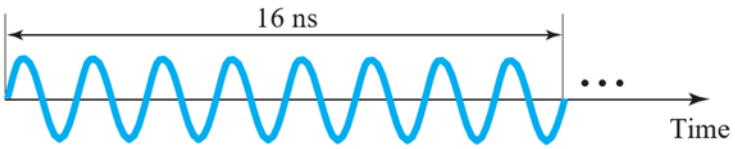
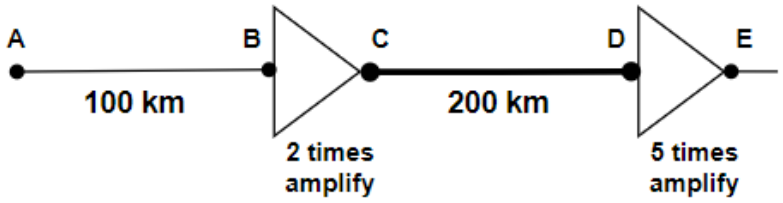
CSE 320: Data Communications

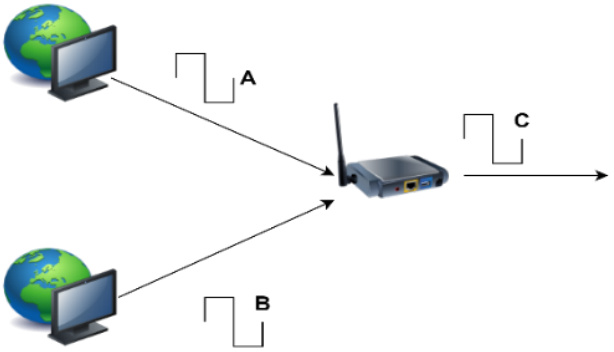
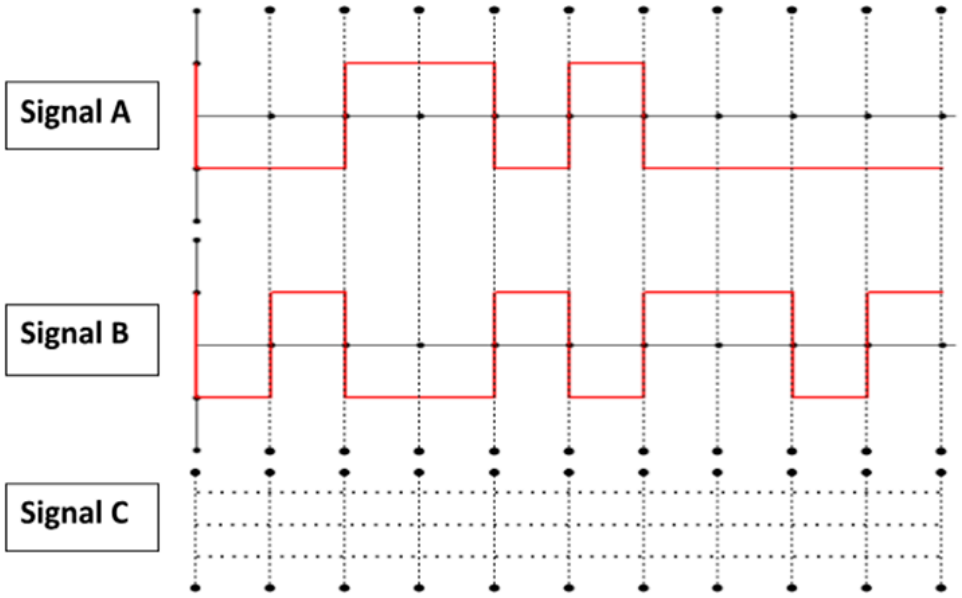
Answer the following questions.
Figures in the right margin indicate marks.

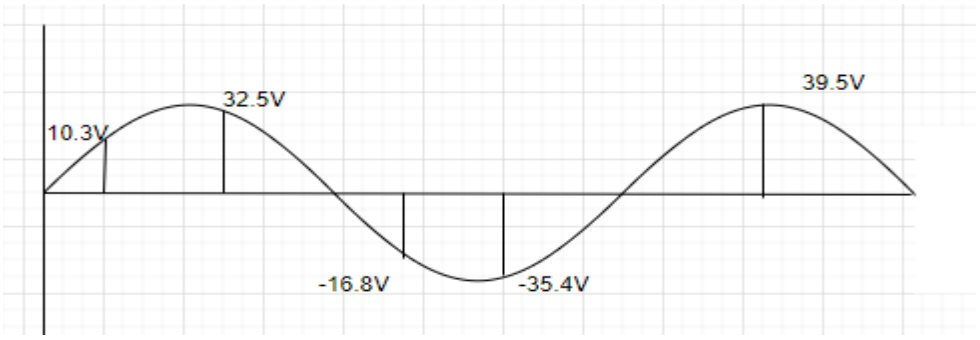
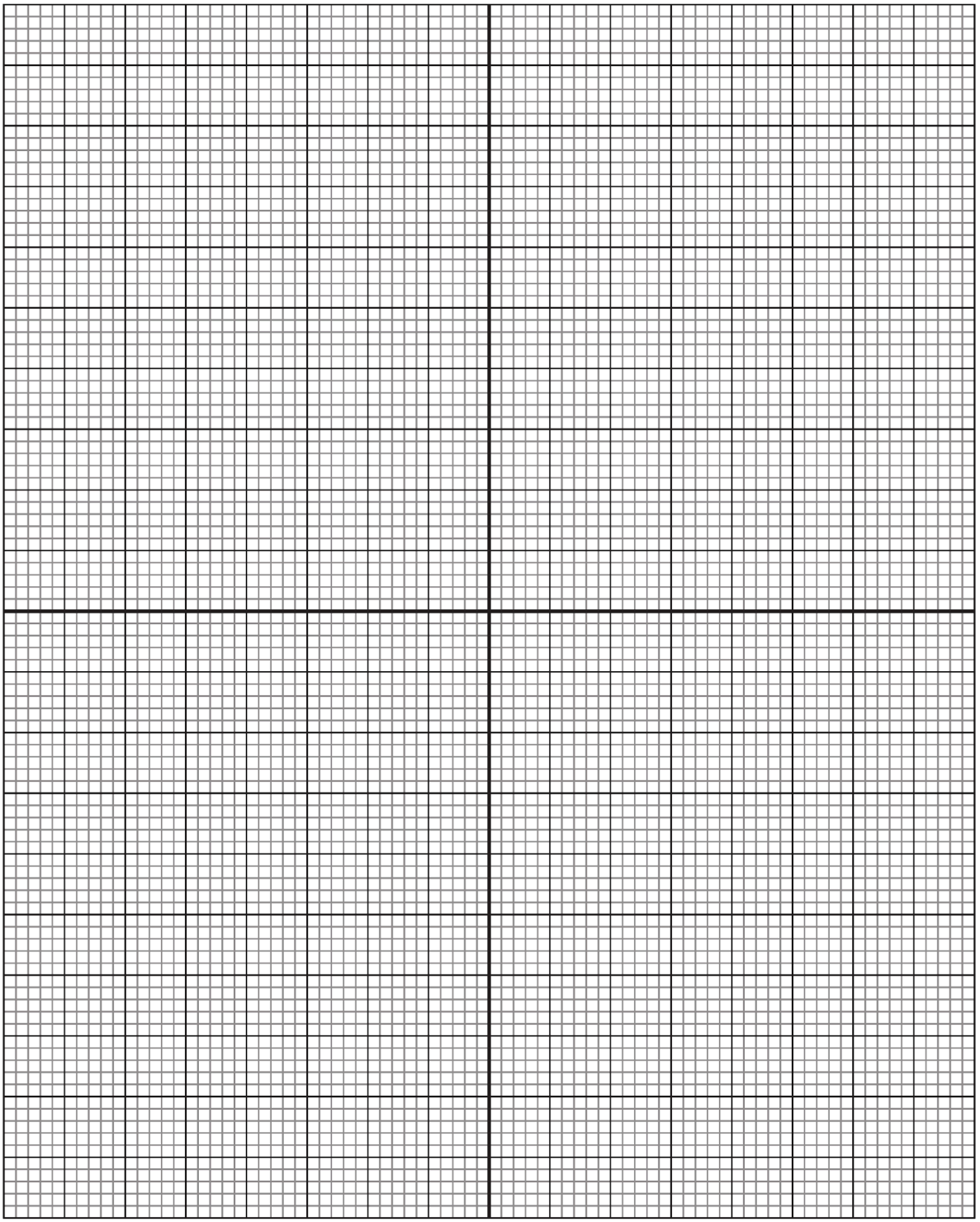
SET A

Name:	ID:	Section:

1. [CO1]	a)	Suppose there are 4 buildings in BRACU's new campus. Buildings are connected using bus topology. Each building has 3 CSE Labs. Each Lab has 4 computers. The computers are connected using mesh topology but the Labs of a single building are connected using star topology. **Draw** the BRACU new campus hybrid topology. How many links will there be (links are using full-duplex transmission mode)?	[5]
	b)	**Identify** the name of the **TCP/IP model** layers based on the following functionalities. ● Enables resource sharing and remote file access among network users. ● Responsible for converting data into signals for transmission over a physical medium. ● Responsible for establishing and terminating communication sessions. ● Ensure reliable hop to hop transmission.	[2]
	c)	**Identify** at least 2 differences amongst logical, physical and port addresses. Explain with an example why all these addresses are needed?	[3]

2. [CO2]	a)	 **Figure 2.a: Analog Signal (time Vs Amplitude)** In the above Figure 2.a, **determine** the time period and frequency of the analog signal. Also show the frequency domain representation of the signal if the maximum amplitude is 20V.	[3]
	b)	Suppose the signal power is 5 MW at point A. The power loss rate at the wire from A to B is 5 kW/km and from C to D is 0.05 dB/km. **Calculate** the total change of signal power in decibel and comment if the power is being amplified/attenuated. 	[3]
	c)	Consider a communication channel that requires to send 108 GB within 6 hours. The link operates on signals with frequency range from 900 KHz to 14 MHz. If the link is perfect, i.e., no noise is introduced in the link, • **Determine** the number of voltage levels needed to fulfill the requirement. • In practice, there is no noise free channel. Suppose, the strength of the noise power is 20mW which is 60 times weaker than the signal power. **What** will be the channel capacity considering the noise?	[2+2]

3. **[CO2]**	a)	Two devices A and B are sending digital signals using the NRZ-I-line coding scheme. Device C is receiving the signal simultaneously and combining them using bitwise AND operation. Then produces the final digital signal using a line coding scheme that doesn't have the consecutive 0 problem. Illustrate the final signal produced by C. [You can use any valid line coding scheme for C] [Draw it in the question paper only.]  	[5]

	b)	The following figure depicts a sampled analog signal for digital signal representation. By applying the concept of **Pulse Code Modulation**, assume there will be **3-bit** code words for each sampled amplitude. **Show** the **normalized Quantized** value and **quantization code** for the given analog signal value at different time stamps. Assume that the sampling amplitudes are between -40V to +40V.  	[5]