Question Paper

Exam Date & Time: 15-Jan-2024 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

THIRD SEMESTER B.TECH. DEGREE EXAMINATIONS -JANUARY 2024
SUBJECT: ICT 2124- PRINCIPLES OF DATA COMMUNICATION

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1A)	Illustrate the concept of periodic signals with examples, emphasizing their role in both continuous and discrete forms. How does periodicity impact signal analysis? Differentiate between analog and digital signals in the time domain, providing suitable examples.	(5)
1B)	Discuss the trade-offs involved in optimizing SNR, especially in scenarios where bandwidth efficiency is a critical consideration?	(3)
1C)	Consider a base station communicating with a receiver at an operating frequency of 1.7 GHz. The height of transmitter and receiver antenna is 70 and 4 meters respectively. Assume a parabolic antenna transmits the data at a power of 30 dBW with a diameter of 3 meters. The effective area of a receiver is 2.75. Compute a power loss at the receiver in dBm, received signal at the receiver, and gain (db) at both sides.	(2)
2A)	Consider the bit stream 101011000101111100101000 i) Sketch the waveform using Differential Manchester Encoding (DME). ii) Is there any DC component (DME), if yes identify the bit positions. iii) Sketch the waveform using a High-Density Bipolar 3 Zeros scrambling technique. iv) Suppose a baseband channel with 8 MHz bandwidth. Calculate the data rate for the given channel if the Manchester encoding scheme is used. v) Analyze the Manchester line encoding scheme with Non-Return-to-Zero (NRZ) encoding and state the two technical disadvantages of Manchester line encoding scheme compared to NRZ	(5)
2B)	Illustrate the importance of aligning the playout clock with the transmitter clock within a playout buffer, taking into consideration how this synchronization influences the overall performance of the system and the quality of the broadcast.	(3)
2C)	Consider a communication system using VRC for error detection. Encode the ASCII character 'D' using the VRC technique. Show the step-by-step calculation of the parity bit and present the final encoded character.	(2)
3A)	Given a Hamming code sequence of length 15, with data bits at positions 1, 2, 4, 8, and 16, determine the values of the parity bits. Demonstrate the steps involved in the calculation and explain the significance of each parity bit.	(5)
3B)	Apply sliding-window protocol with two neighbouring nodes (A and B) using a 3-bit sequence number. As the ARQ mechanism, go-back-N is used with a window size of 5. Assuming A is transmitting, and B is receiving, show A's window positions for the following events: a) Before A sends any frames b) After A sends frames 0, 1, 2, and 3, receives an acknowledgment from B for 0, 1 and 2 c) After A sends frames 4, 5, and 6 and B acknowledges 5, and the ACK is received by A	(3)
3C)	Why is a statistical time division multiplexer more efficient than a synchronous time division multiplexer? Compare statistical TDM with synchronous TDM for the following example (Note that the characters are sent in the same order they are typed). The Source S_2 is silent	(2)

Source S_1 message: COME

Source S_2 message:

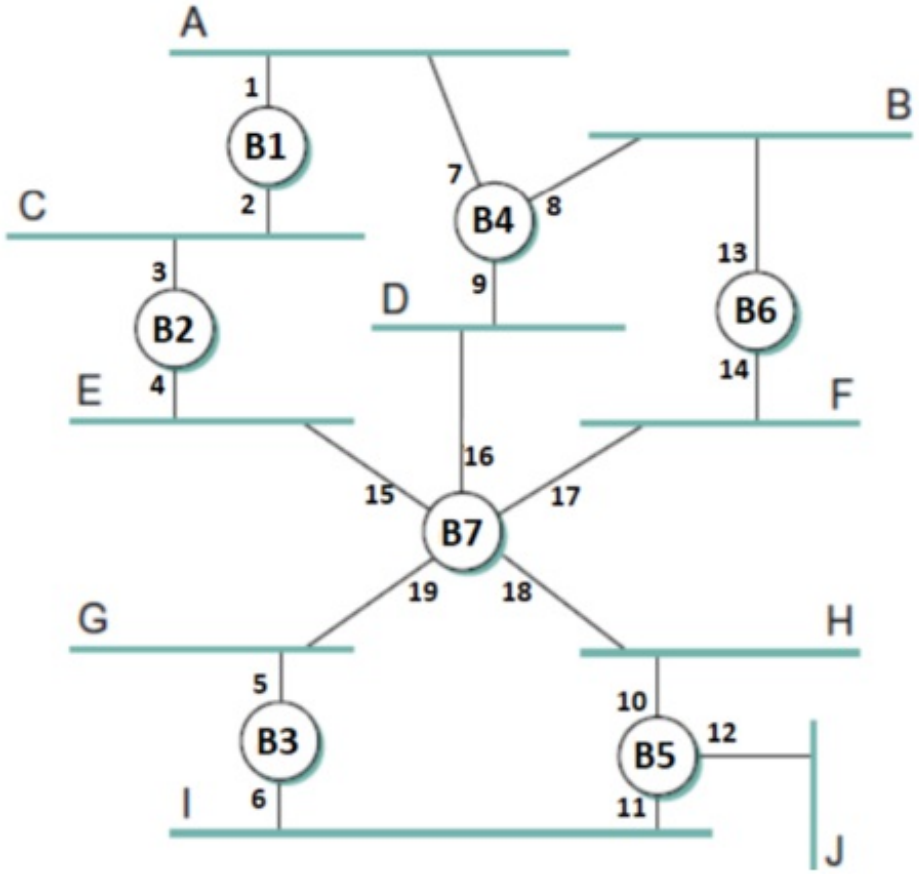
Source S_3 message: TO

Source S_4 message: MIT

4A) Consider the use of 1000-bit frames on a 1-Mbps satellite channel with a 270-ms delay. What is the maximum link utilization for (5)
i) Stop-and-wait flow control?
ii) Continuous flow control with a window size of 7?
iii) Continuous flow control with a window size of 127?
iv) Continuous flow control with a window size of 255?

4B) Suppose that a 1-Megabyte message is sent over a serial link using TCP over IP over PPP. If the speed of the line is 56 kbps and the maximum PPP payload is 500 bytes, how long does it take to send the message? (3)

4C) Consider the extended LAN topology shown below, where B1-B7 represent bridges, with their corresponding ports numbered. (2)



We denote a configuration message from node X in which it claims to be distance d from root node Y as (Y, d, X). For example, the first configuration message sent by bridge B7 is (B7, 0, B7). After the spanning tree algorithm converges, what are the configuration messages sent by bridge B2, B3 and B7, 4respectively?

Indicate which ports are deactivated by the spanning tree algorithm.

5A) i) Consider building a CSMA/CD network running at 10 Gbps over a 2.5-km cable with no repeaters. The signal speed in the cable is 200,000 km/sec. What is the minimum frame size? (5)
ii) Compare & Contrast FDMA, TDMA and CDMA
(3+2 = 5 marks)

5B) A sliding window protocol is designed for a 1 Mbps point to point link to the moon which has a one-way latency (delay) of 1.25 sec. Assuming that each frame carries 1 KB of data, what is the minimum number of bits needed for the sequence number? (3)

5C) Justify why some protocols are required for establishing the logical connection between two devices before transferring data. (2)

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