Question Paper

Exam Date & Time: 30-Jan-2023 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

THIRD SEMESTER B.TECH. (INFORMATION TECHNOLOGY) EXAMINATIONS - JAN/FEB 2023
SUBJECT : ICT 2156 - PRINCIPLES OF DATA COMMUNICATION
(MAKEUP)

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

Answer all the questions.

1A) Two neighboring nodes (A and B) use a sliding-window protocol with a 3-bit sequence number. As the ARQ mechanism, go-back-N is used with a window size of 4. Assuming A is transmitting and B is receiving, show the window positions for the following succession of events: (5)
a) Before A sends any frames
b) After A sends frames 0, 1, 2 and receives acknowledgment from B for 0 and 1
c) After A sends frames 3, 4, and 5 and B acknowledges 4 and the ACK is received by A
d) A fails to receive multiple RR form B.

1B) Suppose a transmitter produces 50 W of power. (3)
a) Express the transmit power in units of dBm and dBW.
b) If the transmitter's power is applied to a unity gain antenna with a 900-MHz carrier frequency, what is the received power in dBm at a free space distance of 100 m?
c. Repeat (b) for a distance of 10 km.

1C) Compute thermal noise level at the receiver's output for an effective noise temperature of 294K and with 15MHz bandwidth. Given Boltzmann's constant k= 1.38 X 10^{-23} J/K. (2)

2A) A CRC is constructed to generate a 4-bit FCS for a 10-bit message. The generator polynomial is X^4+X^2+X+1. Draw the shift register circuit and encode the data bit sequence 1101100110 and give the codeword. (5)

2B) A channel has a data rate of 6 kbps and a propagation time of 40 ms. Identify range of frame sizes does stop-and-wait give a line efficiency of at least 50%? (3)

2C) The bipolar-AMI waveform representing the binary sequence 0100101011 is transmitted over a noisy channel. The received waveform is shown in Figure Q2C it contains a single error. Locate the position of this error and justify. (2)

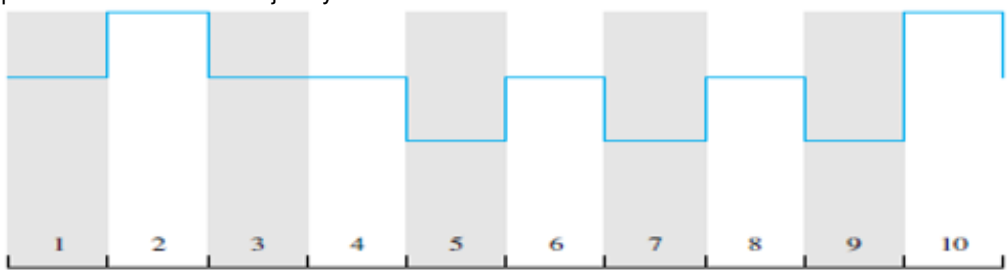

Figure Q2C.

3A) Illustrate QPSK and OQPSK with a neat diagram and draw QPSK and OQPSK waveform for the following sequence 1011000111. (5)

3B) Obtain the set of valid codewords to transit the following dataset using Hamming code Generation Technique: (3)

(i) 11001101
(ii) 10101000
(iii) 01001001

3C) A character-interleaved time division multiplexer is used to combine the data streams of a number of 110-bps asynchronous terminals for data transmission over a 2400-bps digital line. Each terminal sends asynchronous characters consisting of 7 data bits, 1 parity bit, 1 start bit, and 2 stop bits. Assume that one synchronization character is sent every 19 data characters and, in addition, at least 3% of the line capacity is reserved for pulse stuffing to accommodate speed variations from the various terminals. (2)
a) Determine the number of bits per character.
b) Determine the number of terminals that can be accommodated by the multiplexer.

4A) Distinguish between any two multiplexing techniques with respect to the Analog and digital data. (5)

4B) In a CSMA/CD network with a data rate of 100 Mbps, the minimum frame size is found to be 512 bits for the correct operation of the collision detection process. What should be the minimum frame size if we increase the data rate to 10 Gbps? (3)

4C) A periodic signal has a bandwidth of 45 Hz. The highest frequency is 80 Hz. What is the lowest frequency? Draw the spectrum if the signal contains all frequencies of the same amplitude. (2)

5A) (5)

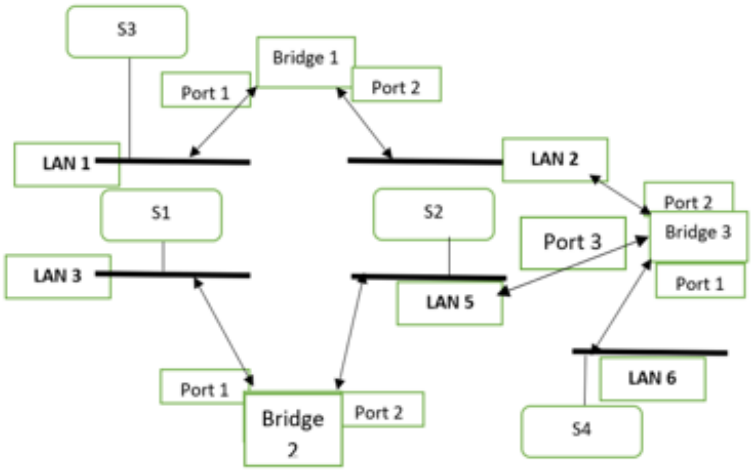

Figure: Q5A

Compute the forwarding table for Bridge 1,2,3 (assuming the forwarding tables are empty initially) with appropriate entries after the following frames are completely transferred as given below.
S1 transmit to S2, S3 transmit to S4, S1 transmit to S3
S2 transmit to S4, S2 transmit to S3,S1 transmit to S4.

5B) Identify the mechanism of Amplitude modulation in detail. (3)

5C) Demonstrate the working of Longitudinal Redundancy Check taking suitable example. (2)

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