MANIPAL INSTITUTE OF TECHNOLOGY

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THIRD SEMESTER B.TECH (INFORMATION TECHNOLOGY/COMPUTER AND COMMUNICATION ENGINEERING) END SEMESTER EXAMINATIONS, NOV 2019
PRINCIPLES OF DATA COMMUNICATION [ICT 2156]

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

Answer all the questions.
Instructions to Candidates: Answer ALL questions. Missing data may be suitably assumed.

1) A) A communication link uses a pair of 2 m transmitter and receiver dish antennas with efficiency of 50% each. The carrier frequency is 3 GHz, transmitter power is 2 W and distance between two antennas is 100 m. Given these specifications, compute the following.

i. Free space loss
ii. Power gain of each antenna
iii. Receiver power in dBm

(5)

B) What is the problem associated with the positional significance of the time slots for the asynchronous TDM frames? With the help of an example, explain how to address this problem, when there are multiple sources present. (3)

C) Which ARQ mechanism is used for satellite link? Justify your answer. A sender sends a series of frames to the same destination using 4-bit sequence numbers. If the sequence number starts with 0, what is the sequence number for 96th frame? (2)

2) A) Consider the topology given in Fig. 2A. Assume initial forwarding tables for the bridges B1, B2, and B3 are empty. Show the stepwise building of the forwarding table for the bridges B1, B2, B3 when packet exchange occurs in the order as given below. Draw the table for each bridge for the given packet exchanges. Give proper justification for each of the given entries.

a) A→B
b) A→D
c) G→K
d) I→C
e) F→A

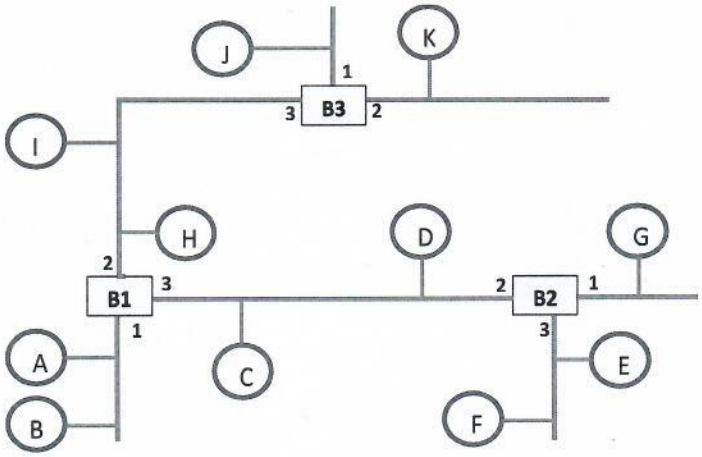

Fig. 2A (5)

B) A channel has a data rate of 200 kbps and a propagation delay of 24 ms.

i. For what range of frame sizes (in bytes) does stop-and-wait protocol (without ARQ) give an efficiency of at least 75%?

ii. If the frame size is fixed to the minimum value obtained in 2B (i), calculate the theoretical utilization of channel if sliding window protocol (without ARQ) is used with window size as 7.

iii. For the same window size as in 2B(i), if modulo 8 counting is used in sliding window flow control mechanism (with Go back N ARQ), show the exchange of frames using line diagram and depict the frames in the window at each step listed below. Consider sender 'A' needs to transmit 10 frames to receiver 'B'.

- A sends frames 0,1,2 and 3 to B
- B acknowledges frames 0, 1 and 2
- A sends frame 4, 5 and 6.
- B rejects frame 3 and asks A to retransmit from frame 3 onwards
- A transmits frame 3,4,5,6,and 7
- A transmits frames 0 and 1
- B acknowledges frames 0 and 1.

(3)

C) A digital signaling system is required to operate at 9600 bps.

i. If a signal element encodes a 4-bit word, what is the minimum required bandwidth of the channel?

ii. What will be the bandwidth, if 4 signal levels are used instead?

(2)

3) A) What are the persistent methods in CSMA? Draw a flowchart depicting the procedure for CSMA/CD protocol using p-persistent method. (5)

B) Consider the figure given in Fig. 3B. The data rate is 10 Mbps, the distance between station A and C is 2000 m, and the propagation speed is 2×10^8 m/s. Station A starts sending a long frame at time $t_1 = 0$; station C starts sending a long frame at time $t_2 = 3$ μs. The size of the frame is long enough to guarantee the detection of collision by both stations. Find:

i. The time when station C hears the collision (t3)

ii. The time when station A hears the collision (t4)

iii. The number of bits station A has sent before detecting the collision.

iv. The number of bits station C has sent before detecting the collision.

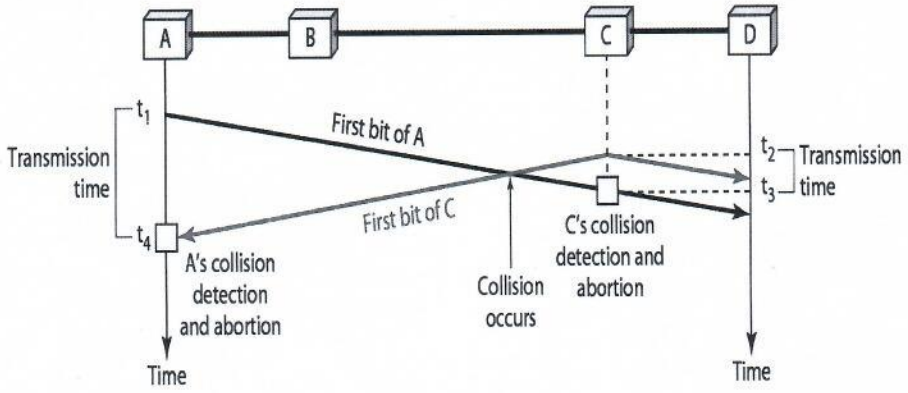

Fig. 3B

(3)

C) Represent the following signals using a time domain representation:

i. $s(t) = 5 \sin(6\pi t + \pi)$

ii. $s(t) = 7 \sin(10\pi t)$

(2)

4) A) Differentiate between error detection and correction techniques. Using polynomial method, generate CRC for 1010001101 and verify at the receiver's end using pattern 11011. (5)

B) With the help of an example, justify the window size for Selective Reject ARQ. (3)

C) Suppose that slotted ALOHA protocol is used in a 56-kbps channel. The frames are 1000 bits long. Find the maximum throughput of the system in frames/second. (2)

5) A) With a neat diagram, explain the HDLC frame format. Explain the need for bit stuffing with suitable example. (5)

B) What are synchronous and asynchronous transmissions? Explain with a suitable example. (3)

C) Session layer and presentation layer were not added to TCP/IP protocol suite even after the publication of OSI Model. Give proper justification. (2)