Student Name _____Model naswer_____ Code _____

Q-No.	Score	Grade
1	10	
2	8	
3	12	

Question One:

Mark the correct answers in the following table:

Choice/ Question	A	B	C	D
1	■	■	☐	☐
2	☐	■	☐	■
3	☐	☐	☐	■
4	☐	☐	☐	■
5	■	☐	☐	☐
6	☐	☐	☐	☐
7	■	☐	☐	☐
8	■	■	☐	■
9	☐	☐	☐	■
10	☐	☐	☐	■
11	☐	☐	☐	■

Question One: [12 marks] Choose All the Correct Answers

1. What is a protocol?
    a. It is a well-defined agreement between peers on how to communicate.
    b. It is the unambiguous set of rules governing the communication between peers.
    c. It is the APIs used by applications to send and receive data on each peer.
    d. It is the header structure of the packet
    e. None of the above

2. Consider the OSI reference model. Suppose the unit of data exchanged at the data link level is called a frame and the unit of data exchanged at the network level is called a packet. Which of the following (is) are (an) accurate descriptions of the relation between a packet and a frame?
    a. A packet encapsulates a frame
    b. A frame encapsulates a packet
    c. A packet has error detection and/or correction field in its header or trailer but a frame does not.
    d. A frame has error detection and/or correction field in its header or trailer but a packet does not
    e. None of the above

3. Which one of the following task is not done by data link layer? (d)
    a. Framing
    b. Error Control
    c. Flow Control
    d. Channel Coding

4. Header of a frame generally contains: (d)
    a. synchronization bytes
    b. addresses
    c. frame identifier
    d. all of the mentioned

5. Suppose the data link layer uses the character count algorithm for framing over a noisy channel. Suppose we have a perfect error detection algorithm. If the datalink layer delivers data to the network layer, then the delivered data is guaranteed to be error free
   a. TRUE
   b. FALSE

6. Automatic repeat request error management mechanism is provided by: (a)
   a. logical link control sublayer
   b. media access control sublayer
   c. network interface control sublayer
   d. none of the mentioned

7. The technique of temporarily delaying outgoing outgoing acknowledgements so that they can be hooked onto the next outgoing data frame is called: (a)
   a. piggybacking
   b. cyclic redundancy check
   c. fletcher's checksum
   d. none of the mentioned

8. Which of the following are the services of Data link layer? (d)
   a. Encapsulation of packets into frames
   b. Error control
   c. QoS control
   d. Flow control
   e. All of the above

9. Consider a 50 kbps satellite channel with a 500 milliseconds round trip propagation delay. If the sender wants to transmit 1000 bit frames, how much time will it take for the receiver to receive the frame? (d)
   a. 250 msec
   b. 20 msec
   c. 520 msec

d. 270 msec

10. Match the following: (d)

List - I		List - II	
(a)	Data link layer	(i)	Encryption
(b)	Network layer	(ii)	Connection control
(c)	Transport layer	(iii)	Routing
(d)	Presentation layer	(iv)	Framing

Code :

	(a)	(b)	(c)	(d)
(1)	(iv)	(iii)	(i)	(ii)
(2)	(iii)	(iv)	(ii)	(i)
(3)	(iv)	(ii)	(iii)	(i)
(4)	(iv)	(iii)	(ii)	(i)

a. 1
b. 2
c. 3
d. 4

11. You are designing a link layer protocol for a link with bandwidth of 1 Gbps (109 bits/second) over a fiber link with length of 800 km. Assume the speed of light in this medium is 200000 km/second. What is the propagation delay in this link? (d)

a. 1 millisecond
b. 2 milliseconds
c. 3 milliseconds
d. 4 milliseconds

Answer: Propagation delay : Time taken by the first bit to travel from sender to receiver end of the link.

Propagation delay = distance/transmission speed = d/s

Propagation delay = 800km/200000km/sec

=4ms

Question Two: [8 marks] Answer the following:

1. A bit-stuffing based framing protocol uses an 8-bit delimiter pattern of 01111110. If the output bit-string after stuffing is 0111101111100101, then the input bit-string is (b)
    a. 011111111100101
    b. 01111111110101
    c. 011110111110101
    d. 0111101111100101

2. The following character encoding is used to send the following character sequence

"HAESC?PY": H: 01101101 , A: 00011101 , P: 10010111 , Y: 10101010, ?:00111111
FLAG Byte: 01111110
ESC Byte: 00011011

Knowing that the data link layer uses **Flag with Byte stuffing** as a framing method, and that maximum frame size to be sent in bytes is **Four** bytes, and assuming in order delivery of frames.
Show in binary the bit sequence transmitted, mark the beginning of the frame.

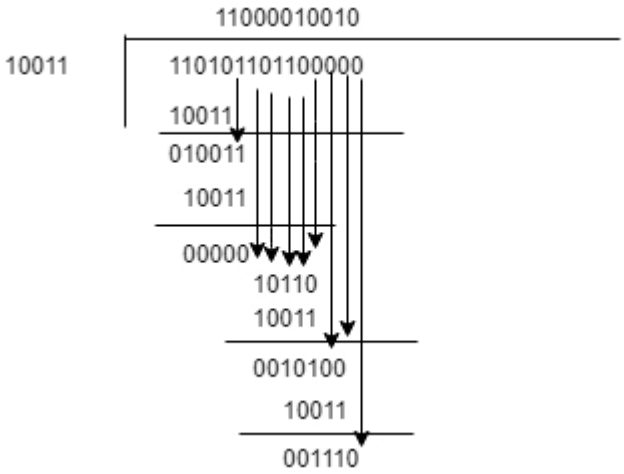
Frame1	FLAG H A FLAG
Frame2	FLAG ESC ? FLAG
Frame3	FLAG P Y FLAG

3. The following Hamming coded (single bit correction) string was received: 010101010111. Assuming odd parity.
   a. What is the number of parity bits needed to transmit this message? 4
   b. Is there an error? If yes, in which position? Show your work step by step.

P0	0
P1	1
P2	0
P3	1
ERROR IN POSITION	10

4. In CRC checksum method, assume that given frame for transmission is 1101011011 and the generator polynomial is G(x) = x4 + x + 1. After implementing CRC encoder, the encoded word sent from sender side is _____. (a)
   a. 11010110111110
   b. 11101101011011
   c. 110101111100111
   d. 11010111100111

Answer: Given frame for transmission is 1101011011 and generator polynomial is G(x) = x^4 + x + 1 i.e. 10011. We have to append 4 0's (1 0's less then divisor



according to CRC): We have to append 1110 to the frame. Now our frame for transmission is 11010110111110. So, option (A) is correct.

Question Three: [12 marks] Answer the following:

1. Frames of 1000 bits are sent over a 10^6 bps duplex link between two hosts. The propagation time is 25ms. Frames are to be transmitted into this link to maximally pack them in transit (within the link). What is the minimum number of bits that will be required to represent the sequence numbers distinctly? Assume that no time gap needs to be given between transmission of two frames. (d)
   a. I=2
   b. I=3
   c. I=4
   d. I=5

   Answer: **(D)**
   Explanation: Transmission delay for 1 frame = 1000/(10^6) = 1 ms
   Propagation time = 25 ms
   The sender can at most transfer 25 frames before the first frame reaches the destination.
   The number of bits needed for representing 25 different frames = 5

2. Station A uses 32 byte packets to transmit messages to Station B using a sliding window protocol. The round trip delay between A and B is 80 milliseconds and the bottleneck bandwidth on the path between A and B is 128 kbps. What is the optimal window size that A should use? (b)
   a. 20
   b. 41
   c. 162
   d. 320

Answer : (b) Round Trip propagation delay = 80ms
Frame size = 32*8 bits

Bandwidth = 128kbps
Transmission Time = 32*8/(128) ms = 2 ms
Let n be the window size.

UtiliZation = n/(1+2a) where a
= Propagation time /
transmission time
= n/(1+80/2)

For maximum utilization: n = 41

3. Consider a network topology using **STOP and WAIT protocol** A---------R---------B (here R is **STORE and FORWARD ROUTER)**
Tp=1uS, Tx(data)=1000uS, Tx(ack)=10uS File Size =10000bits, Packet size=1000bits. How long will it take for A to send whole file to B?
   a. 30.24 msec
   b. 20.24 msec
   c. 34.3 msec
   d. 44.48 msec

Answer:
Since it is Stop and Wait Protocol, next packet will be sent only upon receipt of acknowledgement of previous packet from reciever/Host, not router.
Here total no. of packets = 10.
For 1 packet, total time taken to complete one cycle = TxAR + TpAR + TxRB + TpRB + TxackBR + TpackBR + TxackRA + TpackRA
(AR : A->R link, RB: R->B link, etc)
= 1000us + 1us + 1000us + 1 us + 10us + 1 us + 10us + 1us = 2024us
For 10 packets, total time taken = 2024*10 us = 20240us = 20.24 ms.