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Solution Report For Computer Networks-1

Represent whole test solution with correct and incorrect answers.

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Q. No	Question Status

Q.1

The best effort delivery services such as an IP does not include

a. error checking
b. datagram acknowledgment
c. error correction
d. All of these

Attempt | Correct **Correct Ans.** | d | FAQ? | Have any doubt?

Solution. 1

(d)

• Error checking is only for header part.

• There is no acknowledgment for packets reaching the destination.
• IP has minimal error control and there is no concept of error correction for IP datagram.

Q.2

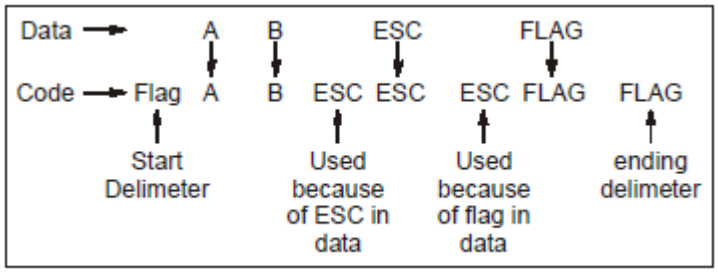
In a data link protocol, the following character encoding is used:
A → 01000111 B → 11100011 FLAG → 01111110 ESC → 11100000
Assuming that byte stuffing is employed for the four character frame A B ESC FLAG, transmitter sends it as

a. 01111110 01000111 11100011 11100000 11100000 01111110
b. 01111110 01000111 11100011 11100000 11100000 01111110 01111110
c. 01111110 01000111 11100011 11100000 11100000 11100000 01111110 01111110
d. None of these

Attempt | **Incorrect** **Your Ans.** **b** **Correct Ans.** **c** | FAQ? | Have any doubt?

Solution. 2

(c)
Under byte stuffing flag bits are used as starting and ending delimiters. Apart from this if the code for flag is there in the data, ESC character is used with the flag. If 'ESC' is also there in the code then one more 'ESC' character is used. So,



Q.3

Consider the following statements:

Which of the above statement is correct?

a. Hidden terminals can be handled by using either of RTS or CTS control frame.
b. RTS/CTS exchange helps in reducing collisions and leads to efficient use of channel resources.
c. 802.11 frame has three address fields.
d. By the help of 802.11 frame, we can come to known whether encryption is used on not.

Attempt | **Incorrect** **Your Ans.** a | **Correct Ans.** d | FAQ? | Have any doubt?

Solution. 3

(d)
• Both RTS and CTS control frames are required to deal with hidden terminals.
• RTS/CTS exchange can help reduce collisions but consume channel resources.
• 802.11 frame has 4 address fields.
• WEP field of 802.11 frame indicates whether encryption is being used or not.

Q.4

Consider the following statements:

S_1: Manchester and differential Manchester encoding has a transition at the middle of each bit.

S_2: Nyquist theorem specifies the minimum sampling rate to the twice the bandwidth of the signal.

S_3: The signal rate is sometimes called the bit rate.

S_4: In synchronous transmission, we send 1 start bit at the beginning and 1 or more stop bits at the end of each byte.

Which of the above are false?

a. only S_2 and S_1
b. only S_2 and S_4
c. only S_3 and S_4
d. only S_2, S_3 and S_4

Attempt | **Incorrect** **Your Ans.** b **Correct Ans.** c | FAQ? | Have any doubt?

Solution. 4

(c)

• Manchester and differential Manchester encoding has a transition at the middle of each bit.

• Nyquist theorem specifies the minimum sampling rate to the twice the bandwidth of the signal.

• The signal rate is sometimes called as baud rate, whereas the data rate is sometimes called as bit rate.

• In synchronous transmission, we send bits one after another without start or stop. It is the responsibility of the receiver to group the bits.

Q.5 **The maximum length of the cable (in km) for transmitting data at a rate of 10 Mbps in an ethernet LAN with frames of size 288 bits and the speed of propagation is 200 m/μsec _____. (Upto 1 decimal place)**

Attempt | **Correct** **Correct Ans.** | **2.8** | FAQ? | Have any doubt?

Solution. 5

2.8

In a Ethernet LAN

$$\Rightarrow \text{Transmission time} \geq 2 * \text{Propagation delay}$$

$$\Rightarrow \frac{288b}{10\times10^6 \text{ bps}} \geq 2\times\frac{x \quad \text{m}}{200\times10^6 \text{ m/sec}}$$

$$\Rightarrow \frac{288\times100\times10^6}{10\times10^6} \geq x$$

$$\Rightarrow x \leq 2880$$

$$\Rightarrow x \leq 2880 \text{ m}$$

$$\Rightarrow x \leq 2.8 \text{ km}$$

Q.6 **Consider a network connecting two systems located 4000 kilometers apart. The bandwidth of the network is 64 Mbps. The propagation speed of the media is 2/3 of the speed of light in vacuum. It is needed to design selective repeat sliding window protocol for this network. The average packet size is of 8 Kb. The network is to be used to its full capacity. Assume that processing delays at nodes are negligible. Then, the minimum size in bits of the sequence number field has to be _____.**

Attempt Correct **Correct Ans.** 10 FAQ? Have any doubt?

Solution. 6

10

$$\text{Distance (d)} = 4000\,\text{km}$$
$$\text{Speed (s)} = 2/3 \times 3 \times 10^8 = 2 \times 10^8\,\text{m/s}$$
$$\text{Bandwidth (B)} = 64\,\text{Mbps}$$
$$\text{Propagation delay } (T_p) = \frac{4000 \times 10^3\,\text{m}}{2 \times 10^8\,\text{m/sec}} = 20\,\text{msec}$$
$$\text{Packet size} = 8 \times 10^3\,\text{bits}$$

$$\text{Transmission delay } (T_d) = \frac{8\times10^3 \text{ bits}}{64\times10^6 \text{ bps}} = \frac{10^{-3}\times8}{64}$$

$$= \frac{1\times10^{-3}}{8}\text{sec} = \frac{1}{8}\text{ms} = 0.125 \text{ ms}$$

$$A = \frac{T_p}{T_d} = \frac{20 \text{ msec}}{0.125 \text{ msec}} = 160$$

$$\text{Utilization} = 100\%$$

$$1 = \frac{W}{1+2\times160} = \frac{W}{321} \qquad [\because\ W = \text{Window size}]$$

$$W = 321$$

Since there is selective repeat protocol hence,

$$\text{Number of sequence bits} = \lceil 2 \times \log_2 W \rceil = 10 \text{ bits.}$$

Q.7 **Consider a wireless link, where the probability of packet error is 0.6. To transfer data across the links, Stop and Wait protocol is used. The channel condition is assumed to be independent from transmission to transmission. The average number of transmission attempts required to transfer *x* packets is 500. The value of *x* is _____.**

Not Attempt | **Correct Ans.** | **200** | FAQ? | Have any doubt?

Solution. 7

200

Number of retransmissions for one frame $= \frac{1}{1-p}$.

Number of retransmissions for x frame $= \frac{x}{1-p}$

$$\Rightarrow \quad 500 = \frac{x}{0.4}$$

$$\Rightarrow \quad x = 500 \times 0.4 = 200$$

Q.8

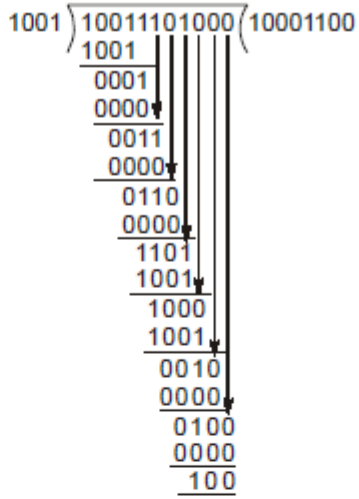
A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is x^3 +1. Receiver receives the bit stream 10111101100. With respect to the above scenario, which of the following statements is correct?

a. There was no error in the received data hence receiver accept the data received.
b. There was error in the received data, but the received bit stream is a multiple of 1001, hence error was not detected.
c. There was an error in the third bit from the left. Dividing that the generator yields 100.
d. None of these

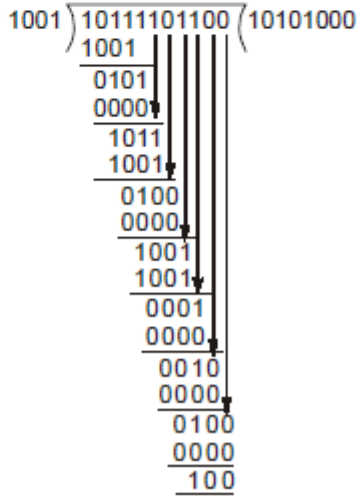
Attempt | **Correct** **Correct Ans.** | **c** | FAQ? | Have any doubt?

Solution. 8

(c)



Received data must be 10011101100.
It shows that there is an error in third bit of the data.
Hence dividing the received data with the generator:



Hence option (c) is correct.

Q.9 **Match List-I with List-II and select the correct answer using the codes given below the lists:**

List-I

A. Passive scanning
B. Active scanning
C. Association

List-II

1. Assigning a one or two word SSID to the access point.
2. Creating a virtual wire between itself and AP by the wireless station.
3. Scanning channels and listening for beacon frames.
4. Broadcasting a probe frame that will be received by all APs within the wireless Host's range.

Codes:

	A	B	C
(a)	3	2	1
(b)	3	4	2
(c)	4	2	1
(d)	4	3	1

a. a
b. b
c. c
d. d

Attempt | **Incorrect** **Your Ans.** a | **Correct Ans.** b | FAQ? | Have any doubt?

Solution. 9

(b)

• Passive scanning is a process of scanning channels and listening for beacon frames.
• A wireless host can perform active scanning by broadcasting a probe frame that will be received by all APs within the wireless host range.
• Associating means the wireless station creates a virtual wire between itself and the APs.

Q.10

Consider the following statements with respect to digital signatures:

S_1: Digital signature ensures authenticity of the sender but not integrity of the message.

S_2: A single secret key can be used by the sender to sign multiple documents for multiple receiver.

S_3: Using a public-key system, the signer signs using his private key and the verifier verifies using his public key.

S_4: Both RSA cryptosystem and RSA digital signature scheme uses same set of keys.

Which of the following is true?

a. S_1 only
b. S_1 and S_2
c. S_2, S_3 and S_4
d. None of these

Attempt | **Incorrect** **Your Ans.** **b** **Correct Ans.** **d** | FAQ? | Have any doubt?

Solution. 10

(d)
• The integrity of the message is preserved, even if we sign the whole message because we can not get the same signature, if the message is changed. Hence apart from authenticity, integrity is also ensured in digital signature.
• No, A secret key is known by only two entities (Alice and BoB for eg.). So, if alice needs to sign another document and send it to Ted, she needs to use another secret key.
• The signer signs using his private key and the verifies using signer's public key.
• No, RSA digital signature scheme uses public and private key of sender not receiver.

Q.11

Consider the following statements with respect to networking devices

S_1: They transmit the data to all the ports on the devices.

S_2: They build the connection with the other networks which use the same protocol.

S_3: They transmit the data only to that port which is connected to the destination device.

S_4: By checking the header of the packet, it forwards the packet to the higher hop on the path to destination.

Which of the following is true?

	S_1	S_2	S_3	S_4
(a)	Switch	Router	Hub	Gateway
(b)	Switch	Gateway	Hub	Bridge
(c)	Hub	Bridge	Switch	Gateway
(d)	Hub	Bridge	Switch	Router

a. a
b. b
c. c
d. d

Attempt | **Correct** **Correct Ans.** | **d** | FAQ? | Have any doubt?

Solution. 11

(d)

• Hubs are designed to transmit the packet to other appended devices regardless of the fact if data packets is destined for the device connected or not.

• Bridge connects two LAN; two physical LANs into larger logical LAN or two segments of the same LAN, that uses the same protocol.

• Just as hub, devices in switches are connected to them through twisted pair cabling. But difference is unlike hub, switch forwards the packets just to the destination device.

• When a router receives a packet, it determines the destination address by reading the header of the packet, then search the routing table to search the route and forward the packet to higher hop.

Q.12

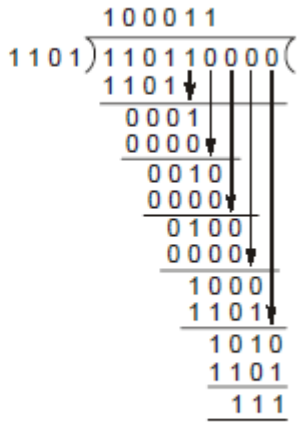
Let $g(x) = x^3 + x^2 + 1$. Consider the information bits (1, 1, 0, 1, 1, 0). Find the codeword corresponding to these information bits if $g(x)$ is used as the generating polynomial.

a. 110110111
b. 110110110
c. 110110100
d. 110110101

Attempt | **Correct** | **Correct Ans.** **a** | FAQ? | Have any doubt?

Solution. 12

(a)



Hence, the codeword will be 110110111.

Q.13 **Ten thousand airline reservations stations are competing for the use of single slotted ALOHA channel. On an average 36 request are made per hour by a station. A slot is of 200 μsec. The approximate total channel load is _____ (in %).**

Not Attempt | **Correct Ans.** | **2** | FAQ? | Have any doubt?

Solution. 13

2

Request made by 10 k stations

$$= \frac{10^4 \times 36}{60 \times 60} \text{request/sec}$$

$$= \frac{10^4 \times 36}{3600} \text{request/sec} = 100 \text{request/sec}$$

$$\text{Slot time} = 200\,\mu\text{sec}$$

$$1 \text{ slot} = 200 \times 10^{-6} \text{ sec}$$

$$\frac{1}{200 \times 10^{-6}} \text{slot} = 1 \text{ sec}$$

$$\text{Number of slots} = 5000 \text{ slots/sec}$$

$$\text{G = Channel load} = \frac{\text{No. of request / sec}}{\text{No. of slots / sec}}$$

$$= \frac{100}{5000} = \frac{1}{50} = 0.02$$

$$\text{In percentage} = 0.02 \times 100 = 2\%$$

Q.14 **Assume that X and Y are the only two stations on an Ethernet. Each has a steady queue of frames to send. Both X and Y attempt to transmit a frame, they wait to get the control of channel using binary exponential algorithm. The probability**

that both were successfully allowed to send the frame on fifth round of the algorithm (assuming every time both X and Y will collide in back-off race till 4^{th} round) is _____.

Attempt | **Incorrect** **Your Ans.** **.03125** | **Correct Ans.** **0.0145** | FAQ? | Have any doubt?

Solution. 14

0.0145

At attempt 1, both will try and will result in a collision.

At attempt 2, number of slots will be 2 i.e., 0, 1. Similarly for attempt 3, number of slots will be 4 i.e., 2, 3.

So, on attempt 'i', number of slots 2^{i-1}. Probability of collision = $2^{-(i-1)}$ for the failure in 4 rounds.

Failure in 1^{st} round × Failure in 2^{nd} round × Failure in 3^{rd} round × Failure in 4^{th} round × Success in 5^{th} r

$= 2^{-(1-1)} * 2^{-(2-1)} * 2^{-(3-1)} * 2^{-(4-1)} \times [1 - 2^{-(5-1)}]$

$= \{1 * 2^{-1} * 2^{-2} * 2^{-3} \times [1 - 2^{-4}]\}$

$= \{1 * 0.5 * 0.25 * 0.125 * 0.9375\}$

$= 0.0145$

Q.15

Consider the following statements :

S_1 : An absence of DHCP server can create trouble while using IPv6 protocol.

S_2 : IPv6 does not support broadcasting.

S_3 : By the use of handshake frames (RTS and CTS), the hidden station problem of IEEE802.11 can be eliminated.

The number of correct statements are _____.

Attempt | **Incorrect** **Your Ans.** **1** | **Correct Ans.** **2** | FAQ? | Have any doubt?

Solution. 15

2

Considering each statements,

S_1 : IPv6 supports both stateful and stateless auto configuration mode of its host devices. So, the abs
of DHCP servers does not create trouble.

S_2 : Through Ethernet/Token ring are considered as broadcast network because they support broadcas
IPv6 does not have any broadcast support. Although it supports both multicast and anycast serv

S_3 : The solution to the hidden station problem is the use of the handshake frame (RTS and CTS). The
frame in CSMA/CA handshake can present collision from a hidden station.

Q.16 **Assume 100 nodes are connected to a 10000 meter length of coaxial cable. Using some protocol, each node can transmit 100 frames / seconds, where the average frame length is 2500 bits. The transmission rate of the system is 10^8 bps. The efficiency of the protocol in percentage is _____.**

Not Attempt | **Correct Ans.** | **25** | FAQ? | Have any doubt?

Solution. 16

25

Per node throughput = 100 frames / seconds

System throughput = 100 * (Node throughput)

= 100 * 100 = 10000 frames / second

Maximum system rate $\Rightarrow 10^8$ bits $\rightarrow$ 1 sec

1 bit $\rightarrow 1/10^8$ sec

$$2500 \text{ bits} \rightarrow \frac{2500}{10^8}\text{sec} \Rightarrow 1 \text{ frame} = 25 \times 10^{-6} \text{ sec}$$

$$25 \times 10^{-6}\text{ sec} \rightarrow 1 \text{ Frame}$$

$$1 \text{ sec} \rightarrow \frac{1}{25 \times 10^{-6}} \text{frame}$$

$$\rightarrow \frac{10^6}{25} \text{frames}$$

$$\rightarrow \frac{100 \times 10^4}{25} \text{frames}$$

$$\rightarrow 40000 \text{ frames / sec}$$

$$\text{Efficiency} = \frac{10000}{40000} = 0.25 = 25\%$$