GATEFREAKS

GATE/NET/PSU

COMPUTER SCIENCE

Computer Networks and Network Security

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Data Link Layer

1. What is the distance of the following code 000000, 010101, 000111, 011001, 111111?
(A)2
(B)3
(C)4
(D)1

GATE 1995,1 MARK

2. Host A is sending data to host B over a full duplex link. A and B are using the sliding window protocol for flow control. The send and receive window sizes are 5 packets each. Data packets (sent only from A to B) are all 1000 bytes long and the transmission time for such a packet is 50 μ s Acknowledgement packets (sent only from B to A) are very small and require negligible transmission time. The propagation delay over the link is 200 μ s. What is the maximum achievable throughput in this communication?
(A) 7.69×10^6 bps
(B) 11.11×10^6 bps
(C) 12.33×10^6 bps
(D) 15.00×10^6 bps

GATE 2003,2 MARKS

3. Which one of the following statements is FALSE?
(A) Packet switching leads to better utilization of bandwidth resources than circuit switching
(B) Packet switching results in less variation in delay than circuit switching
(C) Packet switching requires more per-packet processing than circuit switching
(D) Packet switching can lead to reordering unlike in circuit switching

GATE2004-IT,1 MARK

4. In a data link protocol, the frame delimiter flag is given by 0111. Assuming that bit stuffing is employed, the transmitter sends the data sequence 01110110 as
(A)01101011
(B)011010110
(C)011101100
(D)0110101100

GATE2004-IT,2 MARKS

5. In a sliding window ARQ scheme, the transmitter's window size is N and the receiver's window size is M. The minimum number of distinct sequence numbers required to ensure correct operation of the ARQ scheme is
(A)min (M, N)
(B)max (M, N)
(C)M + N
(D)MN

GATE2004-IT,2 MARKS

6. A 20 Kbps satellite link has a propagation delay of 400 ms. The transmitter employs the "go back n ARQ" scheme with n set to 10. Assuming that each frame is 100 bytes long, what is the maximum data rate possible?
(A)5 Kbps
(B)10 Kbps
(C)15 Kbps
(D)20 Kbps

GATE2004-IT,2 MARKS

7. Consider a parity check code with three data bits and four parity check bits. Three of the code words are 0101011, 1001101 and 1110001. Which of the following are also code words?
I:0010111
II:0110110
III:1011010
IV:0111010
(A)I and III
(B)I, II and III
(C)II and IV
(D)I, II, III and IV

GATE2004-IT,2 MARKS

8. A channel has a bit rate of 4 kbps and one-way propagation delay of 20 ms. The channel uses stop and wait protocol. The transmission time of the acknowledgement frame is negligible. To get a channel efficiency of at least 50%, the minimum frame size should be
(A) 80 bytes
(B) 80 bits
(C) 160 bytes
(D) 160 bits

GATE2005-IT,2 MARKS

9. In a communication network, a packet of length L bits takes link L_1 with a probability of p_1 or link L_2 with a probability of p_2. Link L_1 and L_2 have bit error probability of b_1 and b_2 respectively. The probability that the packet will be received without error via either L_1 or L_2 is
(A) $(1-b_1)^L p_1 + (1-b_2)^L p_2$
(B) $[1-(b_1+b_2)^L]p_1 p_2$
(C) $(1-b_1)^L (1-b_2)^L p_1 p_2$
(D) $1-(b_1^L p_1 + b_2^L p_2)$

GATE2005-IT,2 MARKS

10. Consider the following message M = 1010001101. The cyclic redundancy check (CRC) for this message using the divisor polynomial $x^5 + x^4 + x^2 + 1$ is :
(A) 01110

(B) 01011
(C) 10101
(D) 10110

GATE2005-IT,2 MARKS

11. Suppose that it takes 1 unit of time to transmit a packet (of fixed size) on a communication link. The link layer uses a window flow control protocol with a window size of N packets. Each packet causes an ack or a nak to be generated by the receiver, and ack/nak transmission times are negligible. Further, the round trip time on the link is equal to N units. Consider time i > N. If only acks have been received till time i(no naks), then the goodput evaluated at the transmitter at time i(in packets per unit time) is
(A) 1- N/i
(B) i/(N + i)
(C) 1
(D) 1 -$e^{(i/N)}$

GATE2006-IT,2 MARKS

12. On a wireless link, the probability of packet error is 0.2. A stop and wait protocol is used to transfer data across the link. The channel condition is assumed to be independent from transmission to transmission. What is the average number of transmission attempts required to transfer 100 packets?
(A) 100
(B) 125
(C) 150
(D) 200

GATE2006-IT,2 MARKS

13. An error correcting code has the following code words: 00000000, 00001111, 01010101, 10101010, 11110000. What is the maximum number of bit errors that can be corrected?
(A) 0
(B) 1
(C) 2
(D) 3

GATE2007-IT,2 MARKS

14. A broadcast channel has 10 nodes and total capacity of 10 Mbps. It uses polling for medium access. Once a node finishes transmission, there is a polling delay of 80 μs to poll the next node. Whenever a node is polled, it is allowed to transmit a maximum of 1000 bytes. The maximum throughput of the broadcast channel is
(A) 1 Mbps
(B) 100/11 Mbps
(C) 10 Mbps
(D) 100 Mbps

GATE2007-IT,2 MARKS

15. A 1Mbps satellite link connects two ground stations. The altitude of the satellite is 36,504 km and speed of the signal is 3×10^8 m/s. What should be the packet size for a channel utilization of 25% for a satellite link using goback-127 sliding window protocol? Assume that the acknowledgment packets are negligible in size and that there are no errors during communication.
(A) 120 bytes
(B) 60 bytes
(C) 240 bytes
(D) 90 bytes

GATE2008-IT,2 MARKS

16. Data transmitted on a link uses the following 2D parity scheme for error detection: Each sequence of 28 bits is arranged in a 4×7 matrix (rows r_0 through r_3, and columns d_7 through d_1) and is padded with a column d_0 and row r_4 of parity bits computed using the Even parity scheme. Each bit of column d_0 (respectively, row r_4) gives the parity of the corresponding row (respectively, column). These 40 bits are transmitted over the data link.

	d_7	d_6	d_5	d_4	d_3	d_2	d_1	d_0
r_0	0	1	0	1	0	0	1	**1**
r_1	1	1	0	0	1	1	1	**0**
r_2	0	0	0	1	0	1	0	**0**
r_3	0	1	1	0	1	0	1	**0**
r_4	**1**	**1**	**0**	**0**	**0**	**1**	**1**	**0**

The table shows data received by a receiver and has n corrupted bits. What is the minimum possible value of n?
(A) 1
(B) 2
(C) 3
(D) 4

GATE2008-IT,2 MARKS

17. The maximum window size for data transmission using the selective reject protocol with n-bit frame sequence numbers is:
(A) 2^n
(B) 2^{n-1}
(C) 2^n-1
(D) 2^{n-2}

GATE 2005,1 MARK

18. In a packet switching network, packets are routed from source to destination along a single path having two intermediate nodes.If the message size is 24 bytes and each packet contains a header of 3 bytes, then the optimum packet size is:
(A) 4 (B) 6 (C) 7 (D) 9

GATE 2005,2 MARK

19. 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?
(A) 20
(B) 40
(C) 160
(D) 320

GATE 2006,2 MARKS

20. Station A needs to send a message consisting of 9 packets to Station B using a sliding window (window size 3) and go-back-n error control strategy. All packets are ready and immediately available for transmission. If every 5^{th} packet that A transmits gets lost (but no acks from B ever get lost), then what is the number of packets that A will transmit for sending the message to B?
(A) 12
(B) 14
(C) 16
(D) 18

GATE 2006,2 MARKS

21. The message 11001001 is to be transmitted using the CRC polynomial x^3+1 to protect it from errors. The message that should be transmitted is:
(A) 11001001000
(B) 11001001011
(C) 11001010
(D) 110010010011

GATE 2007,2 MARKS

22. The distance between two stations M and N is L kilometers. All frames are K bits long. The propagation delay per kilometer is t seconds. Let R bits/second be the channel capacity. Assuming that processing delay is negligible, the minimum number of bits for the sequence number field in a frame for maximum utilization, when the sliding window protocol is used, is:
(A) $\lceil log_2 \frac{2LtR+2K}{K} \rceil$
(B) $\lceil log_2 \frac{2LtR}{K} \rceil$
(C) $\lceil log_2 \frac{2LtR+K}{K} \rceil$
(D) $\lceil log_2 \frac{2LtR+K}{2K} \rceil$

GATE 2007,2 MARKS

23. Let G(x) be the generator polynomial used for CRC checking. What is the condition that should be satisfied by G(x) to detect odd number of bits in error?
(A) G(x) contains more than two terms
(B) G(x) does not divide $1+x^k$, for any k not exceeding the frame length
(C) 1+x is a factor of G(x)
(D) G(x) has an odd number of terms.

GATE 2009,2 MARKS

24. 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).

A. What is the minimum number of bits (l) that will be required to represent the sequence numbers distinctly? Assume that no time gap needs to be given between transmission of two frames.
(A) l=2
(B) l=3
(C) l=4
(D) l=5

GATE 2009,2 MARKS

B. Suppose that the sliding window protocol is used with the sender window size of 2^l, where l is the number of bits identified in the earlier part and acknowledgements are always piggy backed. After sending 2^l frames, what is the minimum time the sender will have to wait before starting transmission of the next frame? (Identify the closest choice ignoring the frame processing time.)
(A) 16ms
(B) 18ms
(C) 20ms
(D) 22ms

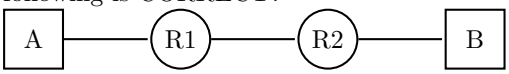
GATE 2009,2 MARKS

25. Consider a source computer (S) transmitting a file of size 10^6 bits to a destination computer (D) over a network of two routers (R1 and R2) and three links (L_1, L_2, and L_3). L_1 connects S to R_1; L_2 connects R_1 to R_2; and L_3 connects R_2 to D. Let each link be of length 100 km. Assume signals travel over each link at a speed of 10^8 meters per second. Assume that the link bandwidth on each link is 1Mbps. Let the file be broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D?
(A) 1005 ms
(B) 1010 ms
(C) 3000 ms
(D) 3003 ms

GATE 2012,2 MARKS

26. Consider the store and forward packet switched network given below. Assume that the bandwidth of

each link is 10^6 bytes / sec. A user on host A sends a file of size 10^3 bytes to host B through routers R1 and R2 in three different ways. In the first case a single packet containing the complete file is transmitted from A to B. In the second case, the file is split into 10 equal parts, and these packets are transmitted from A to B. In the third case, the file is split into 20 equal parts and these packets are sent from A to B. Each packet contains 100 bytes of header information along with the user data. Consider only transmission time and ignore processing, queuing and propagation delays. Also assume that there are no errors during transmission. Let T1, T2 and T3 be the times taken to transmit the file in the first, second and third case respectively. Which one of the following is CORRECT?



(A) $T1 < T2 < T3$
(B) $T1 > T2 > T3$
(C) $T2 = T3, T3 < T1$
(D) $T1 = T3, T3 > T2$

GATE 2014-II,2 MARKS

27. A bit-stuffing based framing protocol uses an 8-bit delimiter pattern of 01111110. If the output bit-string after stuffing is 01111100101, then the input bit-string is
(A) 0111110100
(B) 0111110101
(C) 0111111101
(D) 0111111111

GATE 2014-III,1 MARK

28. Suppose that the stop-and-wait protocol is used on a link with a bit rate of 64 kilobits per second and 20 milliseconds propagation delay. Assume that the transmission time for the acknowledgment and the processing time at nodes are negligible. Then the minimum frame size in bytes to achieve a link utilization of at least 50% is_____.
ANS: 320

GATE 2015-I,2 MARKS

29. A link has transmission speed of 10^6 bits/sec. It uses data packets of size 1000 bytes each. Assume that the acknowledgement has negligible transmission delay, and that its propagation delay is the same as the data propagation delay. Also assume that the processing delays at nodes are negligible. The efficiency of the stop-and-wait protocol in this setup is exactly 25%. The value of the one way propagation delay (in milliseconds) is_____

GATE 2015-II,1 MARK

30. Two hosts are connected via a packet switch with 10^7 bits per second links. Each link has a propagation. Delay of 20 microseconds. The switch begins forwarding a packet 35 microseconds after it receives the same. If 10000 bits of data are to be transmitted between the two hosts using a packet size of 5000 bits, the time elapsed between the transmission of the first bit of data and the reception of the last of the data in microsecond is _____

GATE 2015-III,2 MARKS

31. Consider a network connected two systems located 8000 kilometers apart. The bandwidth of the network is 500×10^6 bits per second. The propagation speed of the media is 4×10^6 meters per second. It is needed to design a Go-Back-N sliding window protocol for this network. The average packet size is 10^7 bits. 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 ____

GATE 2015-III,2 MARKS

32. A sender uses the Stop-and-Wait ARQ protocol for reliable transmission of frames. Frames are of size 1000 bytes and the transmission rate at the sender is 80 Kbps (1Kbps = 1000 bits/second). Size of an acknowledgement is 100 bytes and the transmission rate at the receiver is 8 Kbps. The one-way propagation delay is 100 milliseconds. Assuming no frame is lost, the sender throughput is _____ bytes/second .

GATE 2016-I,2 MARKS

33. Consider a 128×10^3 bits/second satellite communication link with one way propagation delay of 150 milliseconds. Selective retransmission (repeat) protocol is used on this link to send data with a frame size of 1 kilobyte. Neglect the transmission time of acknowledgement. The minimum number of bits required for the sequence number field to achieve 100% utilization is_____.

GATE 2016-II,2 MARKS

34. A computer network uses polynomials over $GF(2)$ for error checking with 8 bits as information bits and uses $x^3 + x + 1$ as the generator polynomial to generate the check bits. In this network, the message 01011011 is transmitted as
(A) 01011011010
(B) 01011011011
(C) 01011011101
(D) 01011011100

GATE 2017-I,2 MARKS

35. The values of parameters for the Stop-and-Wait ARQ protocol are as given below:
Bit rate of the transmission channel = 1 Mbps.
Propagation delay from sender to receiver = 0.75 ms.
Time to process a frame = 0.25 ms.
Number of bytes in the information frame = 1980.
Number of bytes in the acknowledge frame = 20.
Number of overhead bytes in the information frame = 20.
Assume there are no transmission errors. Then, the transmission efficiency (expressed in percentage) of the Stop-and-Wait ARQ protocol for the above parameters is_____ (correct to 2 decimal places).

GATE 2017-I,2 MARKS

36. Consider the binary code that consists of only four valid codewords as given below:

00000, 01011, 10101, 11110

Let the minimum Hamming distance of the code p and the maximum number of erroneous bits that can be corrected by the code be q. Then the values of p and q are
(A)$p = 3$ and $q = 1$
(B)$p = 3$ and $q = 2$
(C)$p = 4$ and $q = 1$
(D)$p = 4$ and $q = 2$

GATE 2017-II,2 MARKS

37. Consider two hosts X and Y, connected by a single direct link of rate 10^6 bits/ser. The distance between the two hosts is 10,000 km and the propagation speed along the link is 2×10^8 m/sec. Host X sends a file of 50,000 bytes as one large message to host Y continuously. Let the transmission and propagation delays be p milliseconds and q milliseconds respectively. Then the value of p and q are
(A)p=50 and q=100
(B)p=50 and q=400
(C)p=100 and q=50
(D)p=400 and q=50

GATE 2017-II,2 MARKS

38. Bit stuffing refers to
(A)inserting a 0 in user stream to differentiate it with a flag
(B)inserting a 0 in flag stream to avoid ambiguity
(C)appending a nipple to the flag sequence
(D)appending a nipple to the use data stream

ISRO 2007

39. Which of the following is a MAC address?
(A) 192.166.200.50
(B) 00056A:01A01A5CCA7FF60
(C) 568, Airport Road
(D) 01:A5:BB:A7:FF:60

ISRO 2009

40. The hamming distance between the octets of 0xAA and 0x55 is
(A) 7
(B) 5
(C) 8
(D) 6

ISRO 2011

41. Data is transmitted continuously at 2.048 Mbps rate for 10 hours and received 512 bits errors. What is the bit error rate?
(A) 6.9 e^{-9}
(B) 6.9 e^{-6}
(C) 69 e^{-9}
(D) 4 e^{-9}

ISRO 2011

42. How many check bits are required for 16 bit data word to detect 2 bit errors and single bit correction using hamming code?
(A) 5
(B) 6
(C) 7
(D) 8

ISRO 2013

43. If the frame to be transmitted is 1101011011 and the CRC polynomial to be used for generating checksum is $x^4 + x + 1$, than what is the transmitted frame?
(A) 11010110111011
(B) 11010110111101
(C) 11010110111110
(D) 11010110111001

ISRO 2013

44. What will be the efficiency of a Stop and Wait protocol, if the transmission time for a frame is 20ns and the propagation time is 30ns?
(A) 20%
(B) 25%
(C) 40%
(D) 66%

ISRO 2013

45. 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?
(A) 250 milliseconds
(B) 20 milliseconds

(C) 520 milliseconds
(D) 270 milliseconds

ISRO 2014

46. In CRC if the data unit is 100111001 and the divisor is 1011 then what is dividend at the receiver?
(A) 100111001101
(B) 100111001011
(C) 100111001
(D) 100111001110

ISRO 2015

47. Which layers of the OSI reference model are host-to-host layers?
(A) Transport, session, presentation, application
(B) Session, presentation, application
(C) Datalink, transport, presentation, application
(D) Physical, datalink, network, transport

ISRO 2015

48. Bit stuffing refers to
(A) inserting a 0 in user stream to differentiate it with a flag
(B) inserting a 0 in flag stream to avoid ambiguity
(C) appending a nipple to the flag sequence
(D) appending a nipple to the use data stream

ISRO 2016

49. The message 11001001 is to be transmitted using the CRC polynomial $x^3 + 1$ to protect it from errors. The message that should be transmitted is:
(A) 11001001000
(B) 11001001011
(C) 11001010
(D) 110010010011

ISRO 2016

50. 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 (I) that will be required to represent the sequence numbers distinctly? Assume that no time gap needs to be given between transmission of two frames.
(A) I=2
(B) I=3
(C) I=4
(D) I=5

ISRO 2016

51. Networks that use different technologies can be connected by using
(A) Packets
(B) Switches
(C) Bridges
(D) Routers

UGCNET2012-II(JUN)

52. Check sum used along with each packet computes the sum of the data, where data is treated as a sequence of
(A) Integer
(B) Character
(C) Real numbers
(D) Bits

UGCNET2012-II(JUN)

53. The design issue of Datalink Layer in OSI Reference Model is
(A) Framing
(B) Representation of bits
(C) Synchronization of bits
(D) Connection control

UGCNET2012-II(Dec)

54. The technique of temporarily delaying outgoing acknowledgements so that they can be hooked onto the next outgoing data frame is known as
(A) Bit stuffing
(B) Piggy backing
(C) Pipelining
(D) Broadcasting

UGCNET2012-III(Dec)

55. An image is 1024*800 pixels with 3 bytes/pixel. Assume the image is uncompressed. How long does it take to transmit it over a 10-Mbps Ethernet ?
(A) 196.6 seconds
(B) 19.66 seconds
(C) 1.966 seconds
(D) 0.1966 seconds

UGCNET2013-III(JUN)

56. Hamming distance between 100101000110 and 110111101101 is
(A) 3
(B) 4
(C) 5
(D) 6

UGCNET2013-III(JUN)

57. Given code word 1110001010 is to be transmitted with even parity check bit. The encoded word to be transmitted for this code is
(A) 11100010101
(B) 11100010100
(C) 1110001010
(D) 111000101

UGCNET2013-III(JUN)

58. A bridge has access to .....address in the same network.
(A) Physical
(B) Network
(C) Datalink
(D) Application
UGCNET2014-II(Jun)

59. In a digital transmission, the receiver clock is 0.1 percent faster than the sender clock. How many extra bits per second does the receiver receive if the data rate is 1 Mbps ?
(A) 10 bps
(B) 100 bps
(C) 1000 bps
(D) 10000 bps
UGCNET2014-III(Jun)

60. Consider a code with five valid code words of length ten : 0000000000, 0000011111, 1111100000, 1110000011, 1111111111 Hamming distance of the code is
(A) 5
(B) 10
(C) 8
(D) 9
UGCNET2014-III(Jun)

61. Four bits are used for packed sequence numbering in a sliding window protocol used in a computer network. What is the maximum window size ?
(A) 4
(B) 8
(C) 15
(D) 16
UGCNET2014-III(Jun)

62. For n devices in a network, the number of duplex-mode links are required for a mesh topology is
(A) n(n + 1)
(B) n (n - 1)
(C) n(n + 1)/2
(D) n(n - 1)/2
UGCNET2014-III(Dec)

63. What is the propagation time if the distance between the two points is 48,000 ? Assume the propagation speed to be 2.4×10^8 metre/second in cable.
(A) 0.5 ms
(B) 20 ms
(C) 50 ms
(D) 200 ms
UGCNET2014-III(Dec)

64. _____ is a bit-oriented protocol for communication over point-to-point and multipoint links.
(A) Stop-and-wait
(B) HDLC
(C) Sliding window
(D) Go-back-N
UGCNET2014-III(Dec)

65. In a binary Hamming Code the number of check digits is r then number of message digits is equal to
(A) $2^r - 1$
(B) $2^r - r - 1$
(C) $2^r - r + 1$
(D) $2^r + r - 1$
UGCNET2015-III(jun)

66. A network with bandwidth of 10 Mbps can pass only an average of 15,000 frames per minute with each frame carrying an average of 8,000 bits. What is the throughput of this network ?
(A) 2 Mbps (B) 60 Mbps (C) 120 Mbps (D) 10 Mbps
UGCNET2015-III(dec.)

67. A device is sending out data at the rate of 2000 bps. How long does it take to send a file of 1,00,000 characters ?
(A) 50 (B) 200 (C) 400 (D) 800
UGCNET2015-III(dec.)

68. A network with bandwidth of 10 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. What is the throughput of this network ?
(A) 1 Mbps
(B) 2 Mbps
(C) 10 Mbps
(D) 12 Mbps
UGCNET2016-II(aug.)

69. In CRC checksum method, assume that given frame for transmission is 1101011011 and the generator polynomial is $G(x) = x^4 + x + 1$. After implementing CRC encoder, the encoded word sent from sender side is.....
(A) 11010110111110
(B) 11101101011011
(C) 110101111100111
(D) 110101111001111
UGCNET2016-III(aug.)

70. Station A uses 32 byte packets to transmit messages to station B using sliding window protocol. The round trip delay between A and B is 40 milliseconds and the bottleneck bandwidth on the path between A and B is 64 kbps. The optimal window size of A

is .....
(A) 20
(B) 10
(C) 30
(D) 40

UGCNET2016-III(dec.)

71. Let G(x) be generator polynomial used for CRC checking. The condition that should be satisfied by G(x) to correct odd numbered error bits, will be :
(A) (1 + x) is factor of G(x)
(B) (1 - x) is factor of G(x)
(C) $(1 + x^2)$ is factor of G(x)
(D) x is factor of G(x)

UGCNET2016-III(dec.)

72. In a packet switching network, if the message size is 48 bytes and each packet contains a header of 3 bytes. If 24 packets are required to transmit the message, the packet size is .....
(A) 2 bytes
(B) 1 byte
(C) 4 bytes
(D) 5 bytes

UGCNET2016-III(dec.)

73. Let C be a binary linear code with minimum distance 2t + 1 then it can correct upto..... bits of error.
(A) t + 1
(B) t
(C) t - 2
(D) $\frac{t}{2}$

UGCNET2016-III(dec.)

74. A t-error correcting q-nary linear code must satisfy:
$M\Sigma_{i=0}^{t}\binom{n}{I}(q-1)^i \leq X$
Where M is the number of code words and X is
(A) q^n
(B) q^t
(C) q^{-n}
(D) q^{-t}

UGCNET2016-III(dec.)

75. Which of the following devices takes data sent from one network device and forwards it to the destination node based on MAC address ?
(A) Hub
(B) Modem
(C) Switch
(D) Gateway

UGCNET2017-II(Nov.)

76. Suppose we want to download text documents at the rate of 100 pages per second. Assume that a page consists of an average of 24 lines with 80 characters in each line. What is the required bit rate of the channel ?
(A) 192 kbps
(B) 512 kbps
(C) 1.248 Mbps
(D) 1.536 Mbps

UGCNET2017-III(Nov.)

77. If a file consisting of 50,000 characters takes 40 seconds to send, then the data rate is.....
(A) 1 kbps
(B) 1.25 kbps
(C) 2 kbps
(D) 10 kbps

UGCNET2017-III(Nov.)

Solutions

1. Ans:a
   Hamming distance = minimum distance between keywords.Here minimum distance occur between 010101 and 011001.

2. Ans:b
   Throughput $= \dfrac{W \times D}{t_t + 2 * t_p}$
   W:Window size.
   D:Data size.
   t_t:Transmission time.
   t_p:Propagation time.
   D=$1000 \times 5 \times 8$ bits = 40000 bits
   Transmission time =50 μ sec
   Propagation time =200 μ sec
   Throughput=$\left(\dfrac{40000}{450}\right) \times 10^6$ bits
   $= 88.88 \times 10^6$bits per sec
   $= 11.11 \times 10^6$ bytes per sec

3. Ans:c
   .

4. Ans:d
   .

5. Ans:c
   Let W_s is size of sender window and W_r is receiver window size. So, $W_s + W_r \leq$ Sequence numbers
   Only option d is matching with the given condition.

6. Ans:b
   Transmission Time$(t_t) = \dfrac{100 \times 8\text{bits}}{20 \text{ Kbps}} = 40\ ms$
   Propagation Time$(t_p) = 400\ ms$
   Efficiency $= \dfrac{W \times t_t}{(t_t + 2 \times t_p)}$
   $= \dfrac{10 \times 40}{(40 + 2 \times 400)} = 0.476$
   Maximum Data Rate= 0.476×20 Kbps = 9.52 Kbps

7. Ans:a
   Let X_1, X_2 and X_3 are data bits, and C_1, C_2, C_3 and C_4 are parity check bits.
   Given transmitted codewords are

X_1	X_2	X_3	C_1	C_2	C_3	C_4
0	1	0	1	0	1	1
1	0	0	1	1	0	1
1	1	1	0	0	0	1

   By analysing the entries in the above table , we can write:
   C_1=$X_1 \oplus X_2$
   C_2=$X_1 \oplus X_3$
   C_3=$X_2 \oplus X_3$
   C_4=$X_1 \oplus X_2 \oplus X_3$
   In the given keywords, only I and III satisfy the above condition , So option a is correct.

8. Ans:d
   Utilization $= \dfrac{W \times t_t}{(t_t + 2 \times t_p)}$
   Utilization=50%(Given)
   $\dfrac{t_t}{(t_t + 2t_p)} = \dfrac{1}{2}$
   $2t_t = t_t + 2t_p$
   $t_t = 2t_p$
   $\dfrac{L}{B} = 2 \times t_p$
   $L = 2 \times t_p \times B$
   $L = 2 \times 20 \times 10^{-3} \times 4 \times 10^3 = 160$ bits

9. Ans:a
   Probability of choosing link $L_1 = p_1$
   Probability of no bit error $= (1 - b_1)$
   Probability of choosing link $L_2 = p_2$
   Probability of no bit error $= (1 - b_2)$
   Probability packet will be received without any error $= (1 - b_1)^L p_1 + (1 - b_2)^L p_2$.

10. Ans:a

$$
\begin{array}{r}
110101\overline{)101000110100000} \\
\underline{110101} \\
111011 \\
\underline{110101} \\
111010 \\
\underline{110101} \\
111110 \\
\underline{110101} \\
101100 \\
\underline{110101} \\
110010 \\
\underline{110101} \\
01110
\end{array}
$$

11. Ans:a
Goodput/throughput
$=\frac{\text{Number of frame successfully delivered}}{\text{Time}}$
Round trip time $=N$ unit
At time $N+1$:
number of packet successfully delivered=1
At time $N+i$:
number of packet successfully delivered=i
At time i :
number of packet successfully delivered=$i-N$
Goodput $=\frac{(i-N)}{i}$
$=1-\frac{N}{i}$.

12. Ans:b
Probability of error= p
Number of re-transmissions for one frame=$\frac{1}{(1-p)}$
p=0.2
$=\frac{1}{(1-0.2)}=1.25$ per frame.
Here we have 100 frames,hence $100\times 1.25=125$.

13. Ans:b
Number of bit corrections
$=\left\lfloor\frac{(HammingDistance-1)}{2}\right\rfloor$
Hamming distance in the given bits =4
$=\lfloor 1.5\rfloor=1$ bit error.

14. Ans:b
Throughput=$\frac{\text{Data}}{Totaltime}$
Transmission time=$\frac{1000*8\text{bits}}{10\text{Mbps}}=800\mu s$.
polling time =80 μs
Troughput=$\frac{1000*8\text{bits}}{800+80}=\frac{100}{11}$ Mbps

15. Ans:a
In the given scenario, all the communications took place using satellite . Suppose there are 2 stations A and B and satellite S . Distance between A to S is 36504 KM and S to B is also 36504 KM. Hence Distance between A to B is 73008 KM.
Speed of signal is $=3\times 10^8$ m/s
Propagation Time(t_p)=$\frac{73008\times 10^3}{3\times 10^8}=0.24336$ s.
Transmission time(t_t) $=\frac{L}{B}$
Efficiency= $\frac{W\times t_t}{(t_t+2\times t_p)}$
Efficiency=0.25(given)
$0.25=\frac{127\times L}{L+2\times 0.24336\times B}$
$0.25L+0.25\times 2\times 0.24336\times B=127L$
$121680=126.75L$
$L=9.6\times 10^{-4}\times 10^6=960$ bits
Packet Size = 960 bits = 120 Bytes

16. Ans:c
.

17. Ans:b
Window size for
Selective Repeat=2^{n-1}
Go-Back-N=2^n-1.

18. Ans:d
Consider we have y bytes of data , packet size =$y+3$,
and Number of packets $(N)=\lceil\frac{24}{y}\rceil$.
Transmission time of 1st packet =
3 (source + two intermediate node) $\times$
transmission time
Transmission time= $\frac{\text{y+3}}{B}$
B:bandwidth
Total time =$\frac{3*(y+3)}{B}+\frac{(N-1)*(y+3)}{B}$
Total time = $\frac{2y+3N+Ny+6}{B}$
Total time
$=\frac{1}{B}*\left(2y+\left(\frac{3\times 24}{y}\right)+\left(\frac{24}{y\times y}\right)+6\right)$
Total time = $\frac{1}{B}*\left(\frac{2y+72}{y+30}\right)$
Diffrentiation w.r.t y should be 0 to minimize time.
$2-\frac{72}{y^2}=0$
$y=6$.
Packet size=6+3=9 Bytes.

19. Ans:b
Round Trip Time = $80ms$
Frame size = 32×8 bits
Bandwidth = 128 kbps
Transmission Time = $\frac{32\times 8}{128}$ $ms=2$ ms
Let W be the window size. For optimal window size , utilization should be maximum i.e. 100%
Utilization= $\frac{W\times t_t}{(t_t+2\times t_p)}$
1=$\frac{W\times 2}{2+80}$
W=41.

20. Ans:c
.

21. Ans:b
Message =11001001.
Degree of generator polynomial =3.
1001)11001001000
1001
1011
1001
1000
1001
1100
1001
1010
1001
011
Message to be forwarded =11001001011

22. Ans:c
Round Trip Time $= 2 * L * t$
Frame size $= K$ bits
Bandwidth $= R$ bps
Transmission Time $= \frac{K}{R}$ s
Let W be the window size. For optimal window size , utilization should be maximum i.e. 100%
Utilization= $\frac{W \times t_t}{(t_t + 2 \times t_p)}$
1=$\frac{W \times t_t}{(t_t + 2 \times t_p)}$
W=$\frac{(t_t + 2 \times t_p)}{t_t}$
Number of bits for sequence number= $\log_2 \frac{(t_t + 2 \times t_p)}{t_t}$
$= \left\lceil \log_2 \left(\frac{\frac{K}{R} + 2Lt}{\frac{K}{R}} \right) \right\rceil = \left\lceil \log_2 \left(\frac{K + 2LtR}{K} \right) \right\rceil$.

23. Ans:c
.

24. AnsA:d,AnsB:c
A.
As link is duplex, so both hosts can send data at same time and .
Transmission delay of the frame = 1ms
Propagation delay =25 ms .
To maximally fill the transit , sender should send for 25 ms. Hence window size should be 25. Number of bits required for sequence numbers=$\log_2 25$=5
B.
Sender will send 2^l packets and then wait for acknowledgement. As soon as sender will receive the acknowledgement for any frame,it will slide the window and start transmission of new frames.
Time for transmission of 2^l frames=32ms
Time after which sender will receive the acknowledgement = Transmission time for one frame + Propagation time for frame + Transmission time for ACK + Propagation time for ACK.
=1+25+1+25 = 52ms.
Time for sender has to wait for the transmission of new frame = 52-32 = 20ms.

25. Ans:a
Routers are store and forward devices so packet will be transmitted at every intermediate router. When sender is transmitting kth packet ,$k-1$ packets are either in the transit or received by the receiver. So if there are n packets , we don't need to consider the propagation time and transmission time on intermediate router for n-1 packets .
Total time= transmission time on sender(TT_s) for n-1 packets+ TT_s for last packet +propagation time for last packet + transmission time on intermediate routers for last packet.
Propagation time = $\frac{100\ km}{10^8\ m/s}$ = 1 milli second
Transmission time for a pocket = $\frac{1000}{10^6}$ = 1 milli second
Total time=999 ms +1 ms (TT at sender)
+ 1 ms (PT from sender to R1) + 1ms (TT at R1)
+ 1ms(PT from R1 to R2) + 1ms (TT at R2) + 1ms (PT from R2 to destination)
=1005 ms

26. Ans:d
In second and Third case, Last packet will take $3 \times T_t$ time and all previous packets will take one T_t time.
$T_1 = 3 \times T_{t^1} = 3 \times \frac{(1000 + 100)}{B}$
$T_{t^1} = \frac{(\text{data + header})}{\text{Bandwidth}}$
data = 1000 Bytes; header = 100 Bytes
$T_1 = \frac{3300}{B}$ seconds
$T_2 = 3 \times T_{t^2} + 9 \times T_{t^2} = 12 \times T_{t^2}$
$T_{t^2} = \frac{(\text{data + header})}{\text{Bandwidth}}$
$T_2 = \frac{12 \times (100 + 100)}{B} = \frac{2400}{B}$ seconds
$T_3 = 3 \times T_{t^3} + 19 \times T_{t^3} = 22 \times T_{t^3}$
$T_{t^3} = \frac{(50 + 100)}{B}$
$T_3 = \frac{22 \times 150}{B} = \frac{3300}{B}$
So $T_1 = T_3$ and $T_3 > T_2$;.

27. Ans:b
As 01111110 is the delimiter(start/end),hence it can't be the part of the message. In order to avoid the occurrence of delimiter in the message , we will add '0' after every occurrence of 0111111. So option b is correct.

28. Ans:320
Transmission time(t_t) = $\frac{\text{packet size}}{\text{bandwidth}} = \frac{L}{B}$
Propagation time(t_p) = $\frac{\text{distance}}{\text{speed}} = \frac{d}{v}$
Efficiency= $\frac{t_t}{(t_t + 2 \times t_p)}$
Efficiency=50%(Given)
$50\% = \frac{t_t}{(t_t + 2 \times t_p)}$
$1 = 2\left(\frac{t_p}{t_t}\right)$
$t_t = 2 \times t_p$
$\frac{L}{B} = 2 \times 20\ ms$
$L = 2 \times 20\ ms \times B = 2 \times 20 \times 10^{-3} \times 64$ k bits
$= 2 \times 20 \times 10^{-3} \times 64 \times 10^3\ bits$
$L = 40 \times 64\ bits = 40 \times \frac{64}{8}\ bytes = 40 \times 8\ bytes =$ 320 bytes .

29. Ans:12
Transmission time(t_t) = $\frac{\text{packet size}}{\text{bandwidth}} = \frac{L}{B}$
L=1000 Bytes =8000 bits.
B=10^6 bits per second.
t_t=8ms.
Propagation delay(t_p)=?
Efficiency = $\frac{t_t}{(t_t + 2 \times t_p)} = \frac{8}{2t_p + 8ms}$
$= \frac{4}{t_p + 4} = 0.25$(Given)
$t_p + 4 = 16, t_p = 12ms.$

30. Ans:1575
Total time =Transmission time of all packets + Propagation time for first link for last packet + Switch Delay + Transmission time of last packet for Switch + propagation time for second link for last packet.
$= 1000 + 20 + 35 + 500 + 20 = 1575\mu s.$

31. Ans:8
Propagation time(t_p) = $\frac{8000 \times 10^3}{(4 \times 10^6)}$ = 2 secs Transmission time(t_t) = $\frac{10^7}{(500 \times 10^6)}$ = 0.02 secs As network is to be used to its full capacity so utilization is 100%. Efficiency(utilization) = $\frac{W \times t_t}{(t_t + 2 \times t_p)}$
$= \frac{W \times 0.02}{(0.02 + 2 \times 400)} = 1(given)$ W=201
In Go-back-N , if n bits are used for sequence number then window size(W)=$2^n - 1$

So, 2^n=202
$n = \log_2 202$=8

32. Ans:2500
Sender transmission time = $\frac{1000 \times 8}{(80 \times 1000)} = 0.1$ sec = 100 ms
Receiver transmission time = $\frac{1000 \times 8}{(80 \times 1000)}$ = 0.1 sec = 100 ms
Total transmission time(t_t)= Sender transmission time + Receiver transmission time
Propagation delay(t_p)=100ms
Throughput = $\frac{W \times L}{t_t + 2 * t_p}$
$= \frac{1000}{(400 \times 10^{-3})} = 2500$ bytes / sec

33. Ans:4
Bandwidth(B)=128×10^3 bits/sec
Data(L)=1 KB=8×1024bits.
Transmission time(t_t) = $\frac{L}{B} = \frac{8 \times 1024}{128 \times 10^3}$ Propagation delay=150×10^{-3} sec
Utilization = $\frac{W \times t_t}{(t_t + 2 \times t_p)}$
1= $\frac{W \times t_t}{(t_t + 2 \times t_p)}$
$W = 1 + 2 * \frac{150}{1024 \times \frac{8}{128}} = 5.68 \approx 6$
In Selective repeat, if n bits are used for sequence number then window size(W)=2^{n-1}
$2^{n-1} = 6$
$n = 4$

34. Ans:c
Message:01011011
Polynomial:$x^2 + x + 1$=1011
1011)01011011000
0000
1011
1011
1100
1011
1110
1011
101
Message to be transmitted is =01011011101.

35. Ans:86.5-89.5
No of Bytes in the Information frame = 1980 Bytes
No of OverHead Bytes = 20 *Bytes*
Total Frame Size =No of Bytes in the Information frame + No of OverHead Bytes = 2000 B
Frame Transmission Time = $\frac{\text{Frame Size}}{\text{Bandwidth}}$
$= \frac{2000 \times 8 \times 10^3}{1 \times 10^6} = 16\ ms$
Acknowledge Transmission Time = $\frac{20 * 10^3}{1 * 10^6}$ = 0.16 *ms*
Propagation delay(t_p)=0.75
processing delay=0.25
Efficiency = $\frac{16}{16.16 + 2 * 0.75 + 0.25 + 0.16}$
= 89.34%.

36. Ans:a
Hamming distance = min of all hamming distances =3(code1 & code3)
Number of bit error could be corrected:
$\left\lfloor \frac{(\text{Hamming Distance} - 1)}{2} \right\rfloor = 1.$

37. Ans:d
Transmission Delay(T_t) = $\frac{\text{File size}}{\text{Bandwidth}} = \frac{50000 bytes}{10^6 bits/sec} = \frac{50000*8 bits}{10^6 bits/sec} = 0.4 sec = 400 msec$

Propagation Delay(T_p) = $\frac{\text{Distance}}{\text{Speed}} = \frac{10000 km}{2*10^8 m/sec} = \frac{10000*1000 m}{2*10^8 m/sec} = 0.05 sec = 50 msec.$

38. Ans:a
In bit stuffing 0 is inserted in the data stream to differentiate it with start and end delimiter.

39. Ans:d
Mac address is 48 bit address (embedded on network interface card of the motherboard) represented in 6 group of 2 hexadecimal digits separated by colons(:) or hyphens(-) .Address corresponds to option d is MAC address.

40. Ans:c
0xAA=1010 1010
0x55=0101 0101
1010 1010 $\oplus$ 0101 0101=1111 1111 So hamming distance is 8.

41. Ans:a
Bit error rate defines the number of error/bit.
Bit rate=2.048 Mbps
Data transmitted in 10 hours(36,000 seconds) = $2.048 \times 36 \times 10^9$ bits
$=73.72 \times 10^9$ bits
There are 512 bits error in 73.72×10^9 bits.
Bit error rate= $\frac{512}{73.72 \times 10^9} = 6.94 \times 10^{-9}$
As given number is very small , so on the computation machines(calculator), it is represented as 6.94 e-9.

42. Ans:a
.

43. Ans:c
Message:1101011011 Polynomial Generator:$x^4 + x + 1$=10011

```
10011)11010110110000
      10011
       10011
       10011
           10110
           10011
             10100
             10011
                1110
```

Message to be forwarded=11010110111110.

44. Ans:b
Transmission delay(t_t)=20ms
Propagation delay(t_p)=30ms
Efficiency = $\frac{W \times t_t}{(t_t + 2 \times t_p)} = \frac{20}{80}$
=25%.

45. Ans:d
Round trip time =500 ms
Propagation time =$\frac{500}{2}$= 250 ms
Transmission time = $\frac{1000}{50 \times 10^3}$ = 20 ms
Time to receive the frame by the receiver = 250 + 20 = 270 ms.

46. Ans:b
Message:100111001
Divisor:1011

```
1011)100111001000
     1011
      1011
      1011
           1000
           1011
            011
```

Message to be forwarded=100111001011.

47. Ans:a
.

48. Ans:a
.

49. Ans:b
Message =11001001.
Degree of generator polynomial =3.

```
1001)11001001000
     1001
      1011
      1001
        1000
        1001
          1100
          1001
           1010
           1001
            011
```

Message to be forwarded =11001001011

50. Ans:d
As link is duplex, so both hosts can send data at same time and .
Transmission delay of the frame = 1ms
Propagation delay =25 ms .
To maximally fill the transit , sender should send for 25 ms. Hence window size should be 25. Number of bits required for sequence numbers=$\log_2 25$=5.

51. Ans:d
A:Packets are not the network devices.
B:Switches are used for communication between computers not networks.

C:Bridges are used to connect ethernets
D:Routers are used to connect different networks.

52. Ans:d
.

53. Ans:a
Data link layer is responsible for framing.Transport layer is responsible for end-to-end connection (connection oriented).Bit representation and synchronization is done at physical layer.

54. Ans:b
The delayed acknowledgement is then attached to this outgoing data frame is known as piggy backing.

55. Ans:c
Transmission time(t_t) =$\frac{L}{B}$ L:Data size.
B:Bandwidth.
= $\frac{1024 * 800 * 3 * 8}{10 * 10^6}$
=1.9660 sec

56. Ans:6
Code1:1001 0100 0110
Code2:1101 1110 1101
Hamming distance =number of 1's in code1$\oplus$ code2
1001 0100 0110 $\oplus$ 1101 1110 1101=0100 1010 1011
Hamming distance =number of 1's in the result = 6.

57. Ans:a
In case of even parity , number of 1's in the transmitted message should be even. So message is checked for number of 1's . If number of 1's are even in the original message then attach 0 to LSB else attach 1 to LSB.

58. Ans:a
Bridge works on the datalink layer of the OSI model. Datalink layer work with Mac/Physcal address .

59. Ans:c
Bandwidth= 1 Mbps = 1000000 bps
Receiver clock is 0.1% faster than sender clock,Hence
Extra bits received by receiver = $\frac{1000000 * 0.1}{100}$
=1000 bits.

60. Ans:n/a
Hamming distance between code3 and code4 is 4 , which is not in the option.
1 1 1 1 1 0 0 0 0 0 $\oplus$ 1 1 1 0 0 0 0 0 1 1= 0 0 0 1 1 0 0 0 1 1.

61. Ans:c
There are 2 protocols to implement sliding window:
1. Go-Back-N
2.Selective Repeat.
If n bits are used for sequence number then size of window in case of Go-back-N is 2^n-1 and for selective repeat is 2^{n-1}
Here n=4, Hence window size for
Go-Back-N:15
Selective Repeat:8.

62. Ans:d
Degree of every node will be (n-1) in the mesh . Apply handshaking theorm
$\sum$ degree=2*number of edges.
$\sum$ degree=n*(n-1)
Number of edges=n*(n-1)/2.

63. Ans:d
Given data is incomplete. Unit for distance is not given but here we will consider unit as KM.
Propagation time(t_p) = $\frac{\text{distance}}{\text{speed}} = \frac{d}{v}$
=$\frac{480 \times 10^5}{2.4 \times 10^8}$=200ms

64. Ans:b
HDLC(high level data link control) is a bit oriented synchronous data link layer protocol which provide connection-oriented and connectionless service,Also it can be used for point to multipoint connections.

65. Ans:b
.

66. Ans:a
Capacity=15000 frame /mintue
=250 frame/sec
Size of each frame=8000bits /frame
Throughput 250 frame/sec *8000 bits/frame=2Mbps.

67. Ans:c
Size of character=1 Byte
Data size =100000 Bytes=800000 bits
Bandwidth=2000 bps
Transmission delay=$\frac{800000}{2000}$=400s.

68. Ans:b
Capacity=12,000 frame /mintue
=200 frame/sec
Size of each frame=10,000bits /frame
Throughput 200 frame/sec *10,000 bits/frame=2Mbps.

69. Ans:a
Message:1101011011 Polynomial Generator:$x^4 + x + 1$=10011

```
10011)11010110110000
      10011
       10011
       10011
           10110
           10011
            10100
            10011
              1110
```

Message to be forwarded=11010110111110.

70. Ans:b
Data=32 Bytes
Round trip delay($2t_p$)=40 ms
Bandwidth=64 kbps= 64×10^3 bps

Transmission delay(t_t)=$\frac{32*8}{64\times10^3}$ = 4ms

we need to choose window such that utilization is 100%

Utilization = $\frac{W\times t_t}{(t_t+2\times t_p)}$

1= $\frac{W\times t_t}{(t_t+2\times t_p)}$

W= $\frac{t_t+2\times t_p}{t_t}$

== $\frac{4+40}{4}=11\approx10.$

71. Ans:a
.

72. Ans:d
Given message of 48 bytes is divided into 24 packets and then 3 bytes header is attached .
Size of the data packet =$\frac{48}{24}+3$=5.

73. Ans:b
Number of bit that can be corrected

=$\lfloor\frac{(\text{Hamming Distance}-1)}{2}\rfloor$

=$\lfloor\frac{(2t+1-1)}{2}\rfloor$

=t

74. Ans:b
.

75. Ans:c
.

76. Ans:d
Size of character=1 Byte
Size of each page =24*80*1 Bytes
Bandwith=100 page/sec
=100*24*80 bytes/sec
=192 KBps
=1.536 Mbps.

77. Ans:d
Transmission time(t_t) =$\frac{L}{B}$
L:Data size.
B:Bandwidth.
40=$\frac{50,000\text{Bytes}}{B}$

B=$\frac{50,000*8\text{bits}}{40}$

=10kbps.

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