NCN-11
2

B 1.In a mesh topology, how many links are required to connect four (4) devices?

- A 5
- B 6
- C 4
- D 3

D A 2.Which of the following is a reason for dividing the protocol stack into multiple layers?

- A It helps with the understanding of a complex system
- B Option A and B.
- C It helps determine the key features/functions of a communication system
- D It allows a network to operate over different channels

B 3.Which of the following method(s) can be used to synchronize a receiver's clock?

- A A sender transmits a constant signal
- B A sender transmits a waveform with many transitions
- C None of the above.
- D By transmitting multiple I and Q signals

B 4.Which of the following is a valid modulation technique for transmission over an analog channel?

- A All of the above.
- B Amplitude Shift Keying (ASK)
- C Manchester
- D Non Return to Zero (NRZ)

D 5.The sequence number in an acknowledgment or ACK packet indicates ...

- A The previous packet is missing
- B The receiver's window size
- C The timeout value of the sender
- D None of the above.

A 6.Which of the following is true about full duplex communication?

- A Both the sender and receiver can transmit simultaneously
- B The communication is only one way
- C The sender uses a sliding window.
- D Both sender and receiver must use TCP

A 7.A sender is experiencing one of the following scenarios: (i) a missing frame, (ii) a missing acknowledgement, or (iii) its transmitted frame is received with error. What happens next?

- A The sender waits for a timeout.
- B The receiver timeouts
- C The sender retransmits an acknowledgement
- D The receiver retransmits an acknowledgement

C 8.In the TCP/IP protocol stack, which of the following is correct about layer-2?

- A It uses an identifier or number to identify a receiver
- B Option B and C.
- C It is responsible for error checking
- D It is responsible for routing

D 9.When designing a protocol in a communication system, a network engineer aims to meet which of the following characteristics?

- A The protocol ensures all bits/packets arrive in order
- B The protocol ensures all bits/packets arrive on time
- C The protocol must deliver data to the correct destination(s)
- D All of the above.

C 10.A sender just received an ACK message from a receiver. Which of the following option(s) is true?

- A The previous message/frame has arrived successfully at the receiver
- B The receiver is waiting for the next frame
- C All of the above.
- D The CRC/FCS of the previous frame is correct

C 11.Why does negative ACK help improve throughput?

- A There is no reason. It does not help improve throughput
- B All of the above.
- C A missing packet can be recovered without using a timeout
- D The sender can retransmit multiple packets quicker

A 12.A sender is using Selective ARQ with a window size of 8. What is the size of the receiver window?

- A 8.
- B 3
- C 6
- D 2

B 13.Which of the following concept(s) is located at the physical layer?

- A All of the above.
- B NRZ-I
- C ARP data link
- D TCP

D 14.Which modulation method has the highest data rate?

1bit 2 symbol
1 : 1

- A Manchester
- B NRZ-I.

3bit 1symbol

- C 8-QAM

6bit 1symbol

- D 64-QAM

15.Two users who have never met want to derive/compute a common key. Which protocol/method can they use?

- A Hash function
- B Diffie-Hellman
- C ARP
- D Rivest-Shamir-Adleman (RSA)

B 16.A channel has a capacity of 24 Mbps. Which of the following is true?

A A 100 Mbyte file will take 33.33 seconds to transmit
B It can transmit 24 million bits in one second
C Option A and B.
D It can only run Manchester encoding

D 17.Assume the sender is using even parity. Which one of the following bitstring has an error?

A 10001001
B 10101000
C 00110100
D All of the above.

C 18.After computing the parity of a bitstring, a receiver finds that there is no error. This is not always true. Why?

A The channel never changes a bitstring
B A channel may have re-ordered the transmitted bits
C It could have an error pattern that leads to the correct parity.
D The sender could have used a different parity calculation

D 19.Why is it important for a receiver to know the start and end of a bit or symbol?

A It allows a receiver to detect the encoding method used by a sender
B It allows the receiver to detect errors
C None of the above.
D It allows a receiver to synchronize its clock

B 20.When computing the CRC or FCS, the operation $X^4(X^3+X+1)$ does what?

A Shifts the bitstring to the right by 4
B Provide space for FCS/CRC or remainder
C Enables the generator polynomial to detect more errors
D Does nothing. It's redundant

A receiver is calculating the CRC of a bitstring using the divisor X^3+X^2+X+1. For the bitstring X^3+1, what is its remainder?

A X^2+X
B X^3
C X^3+X^2+X+1
D X^3+1

$x^3(x^3+1)$
x^6+x^3
x^3+x^2+1
$x^3+x^2+x+1 \;\overline{)\; x^6+x^5+x^4+x^3}$
x^5+x^4
$x^5+x^4+x^3+x^2$
x^3+x^2
x^3+x^2+x+1
$x+1$

B 22.When accessing a channel, computers need to carry out back-off. Why?

A To ensure nothing is transmitted
B To reduce the probability of another collision
C To ensure they experience another collision
D To ensure they wait a long time before transmission.

B 23.Consider the (12,8) Hamming code. Which of the following option(s) is true?

A It uses AND operation when calculating parity bits
B There are 2^8 possible valid codewords
C Option A and B
D Valid codewords are 12 bits in length

C 24.Which of the following protocol should be used over a channel with a large propagation delay and low errors to ensure the highest throughput?

A Go-Back-10
B Go-Back-20
C Go-Back-100.
D Go-Back-1 or Stop-and-Wait

B 25.Which of the following IP address is wrong?

A 200.130.1.1
B None of the above.
C 0.0.0.0
D 130.130.10.1

B 26.Consider the following notation: 130.130.10.1/18. What does the 18 refer to?

A The port number of the server
B None of the above.
C The number of addresses in the address block
D The number of subnets

B 27.Which of the following address blocks has exactly two addresses?

A 10.13.1.1/32
B 130.130.1.1/31
C 1.0.0.0/8.
D 10.1.20.30/24

D 28.Which of the following address blocks allow an engineer to create 1000 subnets?

A 10.1.20.30/30
B 10.13.1.1/32
C 130.130.1.1/31
D 1.0.0.0/8.

1024
2^{10}

B 29.The DNS protocol can be used to ....?

A All of the above.
B Obtain an IPv4 address for a host
C Determine the hostname for an IP address
D Obtain the name server responsible for a zone

A 30.A TCP senders encounter a timeout. This means ...?

A Congestion is severe (very bad)
B Congestion is mild (channel is not 100% full)
C None of the above.
D There is no congestion

C 31.Which of the following option(s) is correct about TCP's slow start phase?

A There is no packet loss during the slow-start phase

B The congestion window increases much slower than the congestion avoidance phase

C Each acknowledgment increases the sender's congestion window by one

D Option A and B.

C 32.What is the main purpose (or functionality) of the Domain Name System (DNS)?

A To obtain the port number of an application

B To obtain the IP address given a machine's physical address

C To obtain the IP address of a machine given its name

D To obtain the password to access a machine.

33.The XOR operation is used in which of the following calculation?

A CRC/FCS

B All of the above.

C When computing the syndrome of a Hamming code

D Encryption and decryption

D 34.Bob has Alice's public key. How does Bob use it to authenticate Alice?

A Bob asks Alice for her name

B Bob asks Alice to use the Diffie-Hellman algorithm

C Bob sends Alice her public key

D None of the above.

C 35.Why does CSMA have better performance as compared to Aloha?

A The sender can transmit whenever it has a message

B The sender uses CRC

C The sender can first check whether the channel is busy before transmission

D The sender can send multiple messages at the same time.

A 36.The forwarding table of a switch contains which of the following information?

A All of the above.

B The number of machines on a channel or port

C Port number

D MAC address

A 37.How does Alice prove to Bob that they know each other?

A None of the above.

B By using DNS

C By proving they know a shared secret

D By using the Diffie-Helmman algorithm

B 38.Which of the following option(s) is true about the Dijsktra algorithm?

A It uses TCP

B A node/router knows the exact path to a destination node

C Option A and B.

D It works together with the Bellman-Ford algorithm

A 39.Which of the following option is true?

A In framed Slotted Aloha, all nodes transmit at most once in each frame

B All of the above.

C Slotted Aloha requires all nodes to know the start of a time slot

D Both Aloha and CSMA use back-off

C 40.Why do we need layer-3 or IP layer?

A It allows TCP to over channel with a long propagation delay

B g., delays less than 100ms.

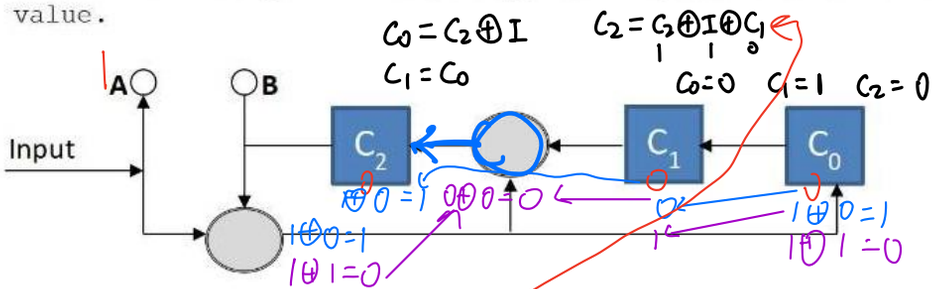
C It allows nodes connected using different layer-2 and layer-1 technologies to communicate with one another

D It allows a node to have a higher throughput

E It ensures packets are transmitted over channels with some guarantees,

QUESTION 1B - (10 marks)

(a) Complete the table below for the input below. The circle denotes an XOR gate. Initially, the registers have a zero value.



C_2	C_1	C_0	I=Input
0	0	0	1
1	0	1	1
0	1	0	1

Note: show the value of each register after a given input.

(5 marks)

(b) Write the corresponding polynomial for the Linear Feedback Shift Register (LFSR) above.

(3 marks)

x^3+x^2+1

(c) How many bits are in the remainder?

(2 marks)

3bits

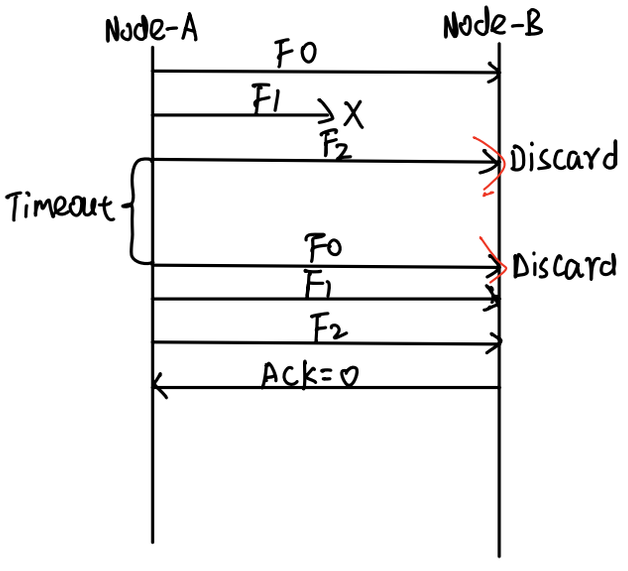
QUESTION 2B - (5 Marks)

Assume that Node-A has **three (3)** packets for Node-B and both nodes use **Go-Back-N**, with N=2. Show the sequence of transmissions between the two nodes and show what happens when the second packet is lost.

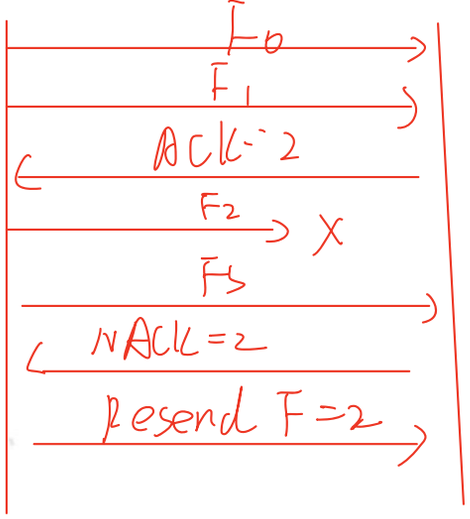
(3 marks)

Assume a device is using CSMA. Its current contention window is 64. In other words, it selects a backoff value from the range [0,1,..,63] Upon experiencing a collision, its contention window increases to what value?
(2 marks)

128

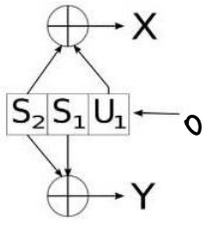


Selective Repeat ARQ 一次发2个



QUESTION 3B - (10 Marks)

Consider the following encoder, and answer the questions below.



2个寄存器

(i) Assume the registers are initially zero. What is the output (XY) for the following bitstring: 101.

(2 mark)

(ii) Complete the following tables for the encoder on the previous page.

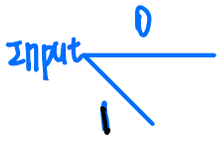
S2	S1	U1	X	Y	S2	S1
0	0	0	0	0	0	0
0	1	0	0	1	1	0
1	0	0	1	1	0	0
1	1	0	1	0	1	0

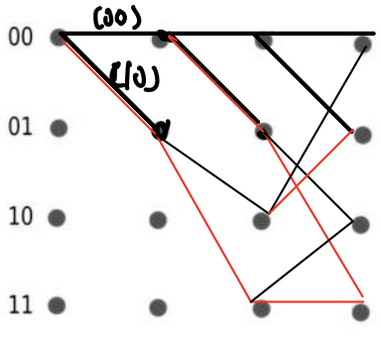
S2	S1	U1	X	Y	S2	S1
0	0	1	1	0	0	1
0	1	1	1	1	1	1
1	0	1	0	1	0	1
1	1	1	0	0	1	1

1 0 0 1
1 1 1 1
0 1 0 1
1 1

(4 mark)

(iii) Complete the Trellis diagram below. Note, you do not need to draw a complete Trellis diagram.





(4 mark)

QUESTION 4B – (4 marks)

(a) Consider Figure 1B. Answer the following questions:

(i) At RTT=5, each ACK increases the congestion window by one?

(2 Marks)

(ii) At RTT=6 and RTT=18, the congestion window reduces to one. Why?

(2 Marks)

timeout

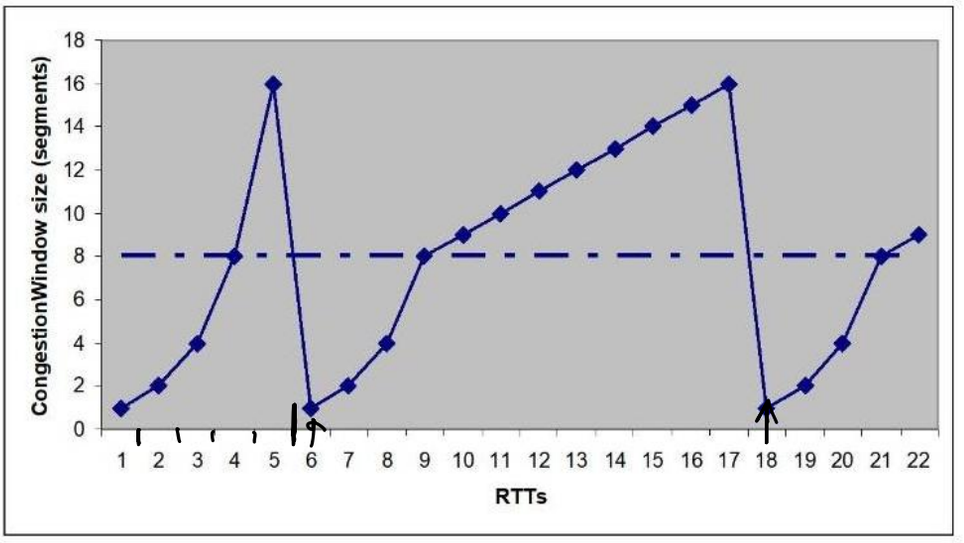


Figure 1B

Question 5B (6 Marks)

Consider Figure 2B below. Answer the questions below:

(i) What is the ssthresh value at RTT=16? Note, the highest congestion window (cwnd) has value 42. (2 mark)

(ii) What is the *throughput* between RTT=6 (cwnd=32) and RTT=16 (cwnd=42). Assume each RTT is 100 ms and the packet size is 1024 bytes. (4 mark)

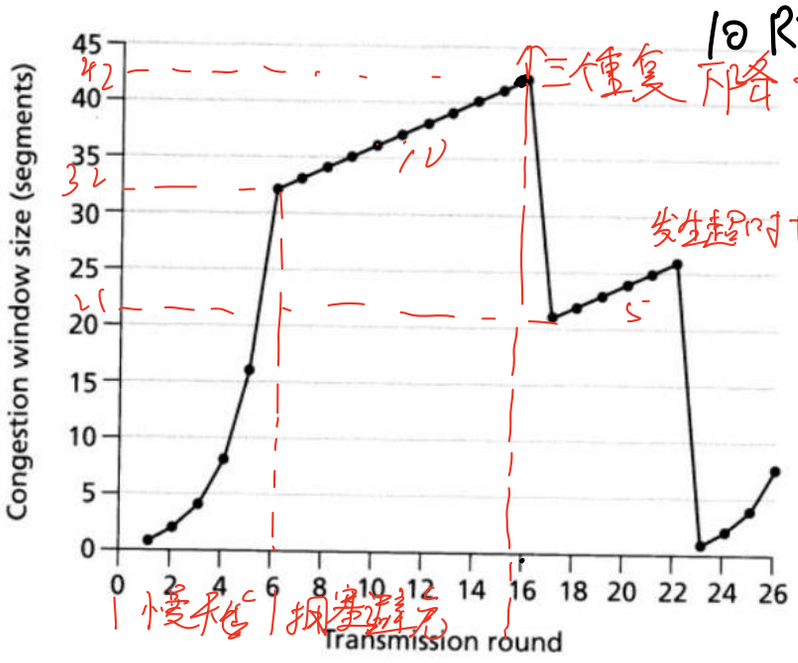


Figure 2B

QUESTION 5B - (20 Marks)

(a) Consider the network shown in Figure 3B. Use Dijkstra's shortest-path algorithm to compute the least cost path from **node-1** to all network nodes. Fil in the table below.

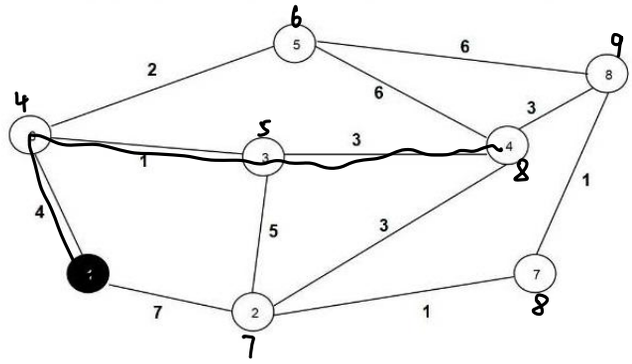


Figure 3B

T	2	3	4	5	6	7	8
1	7	∞	∞	∞	4	∞	∞
1,6	7	5	∞	6	4	∞	∞
1,6,3	7	5	8	6	4	∞	∞
1,6,3,5	7	5	8	6	4	∞	12
1,6,3,5,2	7	5	8	6	4	8	12
1,6,3,5,2,7	7	5	8	6	4	8	9
1,6,3,5,2,7,4	7	5	8	6	4	8	9
1,6,3,5,2,7,4,8	7	5	8	6	4	8	9

T 2 3 4 5 6 7 8
1 7 ∞ ∞ ∞ 4 ∞ ∞
16 7 5 ∞ 6 4 ∞ ∞
163 7 5 8 6 4 ∞ ∞
1635 7 5 8 6 4 ∞ 12
16352 7 5 8 6 4 8 12
163527 7 5 8 6 4 8 9
1631274 7 5 8 6 4 8 9

(10 Marks)

(c) Router A using distance vector routing has the following routing table (assume all link cost is 1):

Dest	Cost	Next-Hop
Net2	6	A
Net3	4	E
Net4	4	A
Net6	8	D
Net7	1	B

① 修改发送的报文 距离+1 下一跳都为 x
② 对比 { 没有 → 加入
相同下一跳 → 更新
不同下一跳 { d 更短 → 更新
d 同 → 不变
d 更大 → 不变

(i) Router A receives the following route advertisement datagram/packet from router B. Show the updated routing table of Router A. (3 Marks)

Net8	2 3
Net9	1 2

B 上表中无 接口

(ii) After that, router A receives the following route advertisement from router E. Show the updated routing table at router A. (3 Marks)

Net3	2
Net9	1

N3 3 E 与表中下一跳相同均是E，更新
N1 2 E 下一跳不同 比一样 不变

(iii) Define route convergence. (2 Marks)

route convergence mean all routing table do not change.

(iv) In distance vector routing, a router does not know the path used by a neighboring router to reach a destination. True/False? (1 Mark)

True.

(v) In link state routing, all routers/nodes must run the Dikjstra algorithm. True/False? (1 Mark)

True

QUESTION 6B - (5 Marks)

Explain the rules used by the following methods to encode bits.

- NRZ-I
- Manchester
- 16-QAM
- FSK
- ASK

① Rule: 1 (transition) 0 (stay at current signal)

② Rule: Negative to positive "⌐¬" is 1

positive to Negative "¬⌐" is 0

③ Rule: combines Ask with Psk

changes both Amplitude and phase to represent a 0 and 1 by 4 bits

④ Rule: Frequency of the signal is changed to represent a 0 and 1

⑤ Rule: Amplitude of the signal is changed to represent a 0 and 1