

19 级补考

1. In a star topology, how many links are required to connect four devices?
在星形拓扑中，连接四个设备需要多少个链路
A. 3
B. 4
C. 5
D. 6
2. Why does the TCP/IP protocol stack have multiple layers?
为什么 TCP/IP 协议栈有多层？
A. It helps with the understanding of a complex system
它有助于理解复杂的系统
B. It does not have multiple layers. There is only one layer
它没有多层。只有一层
C. It allows a network to operate over different channels
它允许网络在不同的信道上运行
D. Option A and B.
3. A receiver's clock can be synchronized using...?
A. A waveform with many transitions
具有多次转换的波形
B. A constant signal, say 5 volt
恒定信号，例如 5 伏
C. By transmitting multiple I and Q signals
通过传输多个 I 和 Q 信号
D. None of the above.
4. Which of the following is a valid modulation technique for transmission over an analog channel? 以下哪项是在模拟信道上传输的有效调制技术？
A. Amplitude Shift Keying (ASK) 幅移键控 (ASK)
B. Non Return to Zero (NRZ) 非归零码
C. NRZ-I 反向非归零编码
D. None the above.
9. Which of the following metric is important to a communication system?
以下哪项指标对通信系统很重要？
A. Throughput 吞吐量
B. Delay 延时
C. Reliability 可靠性
D. All of the above
10. During an authentication process, Alice is requesting Bob to prove that he knows a secret. How is this carried out?
A. Bob runs the Diffie-Hellman algorithm

B. Bob encrypts a random text with the secret and sends it to Alice

C. Bob runs TCP with a large congestion window

D. All of the above

11. Which method/protocol uses negative ACK?

A. Stop-and-Wait

B. Selective ARQ

C. Go-Back-N

D. None of the above.

12. A sender is using Selective ARQ with a window size of 4. What is the size of the receiver window?

A. 2

B. 4

C. 6

D. 8

13. Which of the following option is true about TCP sequence number?

A. It always start from zero

B. It is determined by the receiver

C. It identifies the byte first of each segment

D. All of the above.

14. Which modulation method has the lowest data rate?

A. 4-QAM

B. 8-QAM

C. 64-QAM

D. 128-QAM.

15. Alice has Bob's public key. Which of the following is correct?

A. To send an encrypted message to Bob, Alice encrypts the message using Bob's public key

B. Alice encrypts the message using Bob's private key whenever she wants to send him a message

C. Alice encrypts a message using her private key when communicating with Bob

D. Alice ask Bob for his private key.

16. The throughput between a sender and receiver can be increased by...

A. Running Go-Back-N, where N is some large value

B. By reducing the propagation delay or cable length

C. By using Stop-and-Wait

D. Option A and B.

17. Assume the sender is using odd parity. Which one of the following bitstring has an

error?

- A. 10101000
- B. 10001001
- C. 00110100
- D. None of the above

18. A receiver finds that the syndrome of a received bitstring is zero. This means there is no error. However, this is not always true. Why?

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

19. Which of the following option is true about a symbol?

- A. A symbol can represent multiple bits
- B. A symbol can have an I and Q component
- C. Multiple symbols can be used to represent one bit
- D. All of the above.

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

- A. Enables the generator polynomial to detect more errors
- B. Used to construct the divisor
- C. Does nothing. It's redundant
- D. None of the above.

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

- A. $X+1$
- B. X^3+X^2+X+1
- C. X^3
- D. X^2+X .

22. During channel access, why is back-off important?

- A. To ensure nodes experience another collision
- B. To reduce the probability of another collision
- C. To ensure there is no timeout
- D. To ensure nodes wait a long time before transmission.

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

- A. There are 2^{12} possible valid codewords (2^k)
- B. Valid codewords are 12 bits in length
- C. It uses AND operation when calculating parity bits
- D. Option A and B

24. Which of the following protocol has the lowest throughput?

A. Go-Back-1 or Stop-and-Wait

B. Go-Back-10

C. Go-Back-20

D. Go-Back-100.

25. Which of the following IP address is wrong?

A. 130.130.10.1

B. 200.130.1.1

C. 127.0.0.1

D. 500.1.2.3.

1-126 A

128-191 B

192-223 C

224-239 D 多播地址

240-255 E 保留地址

主机号全 0 的地址是网络地址

主机号全 1 的地址是广播地址

26. Consider the following address block: 130.130.10.1/30. What is the available number of addresses?

A. 2

B. 4

C. 6

D. 8

27. Which of the following address block(s) has exactly two addresses?

A. 10.13.1.1/32

B. 130.130.1.1/31

C. 10.1.20.30/24

D. 1.0.0.0/8.

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

A. 10.13.1.1/32

B. 130.130.1.1/31

C. 10.1.20.30/30

D. None of the above

29. The ARP protocol can be used to?

A. Obtain an IPv4 address for a host

B. Obtain the name server responsible for a zone

C. Determine the hostname for an IP address

D. Obtain the MAC or physical address of a machine.

30. A TCP sender received three duplicated acknowledgment messages. This means ...?

A. There is no congestion

B. Congestion is severe (very bad)

C. Congestion is mild (channel is not 100% full)

D. The receiver is sending acknowledgment messages too quickly.

31. Which of the following option(s) is correct about TCP's congestion avoidance phase?

A. Each acknowledgment increases the sender's congestion window by one

B. The congestion window increases much slower than the slow start phase

C. There is no packet loss during the congestion avoidance phase

D. The receiver stops sending acknowledgment messages.

32. Which of the following is a TCP rule used to send acknowledgment (ACK) messages?

A. Send an ACK if an out-of-order segment is received

B. Send an ACK after every two segments

C. Send an ACK after waiting 500 ms

D. All of the above.

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

A. Encryption and decryption

B. CRC/FCS

C. To lookup the next hop of an IP packet

D. All of the above.

掩码运算

34. A public key has a digital signature. It can be trusted because ...

A. It is downloaded from the Internet

B. It has the correct number of bits

C. It has the name of the person who signed the public key

D. It is signed by a trusted certificate authority.

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. It listens to the channel first before a transmission

D. It uses backoff.

36. A switch maintains the following information?

A. MAC address

B. Port number

C. IP address

D. Option A and B

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

A. By checking Bob's IP address

B. By using DNS

C. By using the Diffie-Hellman algorithm

D. None of the above.

为了证明彼此的了解，Alice 和 Bob 可能使用一些方法，例如共享个人信息，交换秘密问题或答案，出示身份文件，或使用数字签名或证书等加密机制。

38. The Dijkstra algorithm requires the following information?

A. A map of the network topology

B. The cost of each link

C. The MAC address of each node

D. Option A and B.

39. Which of the following option is true?

A. Slotted Aloha uses acknowledgment messages

B. Both Aloha and CSMA use back-off

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

D. All of the above

把时间分成若干个相同大小的时间片，所有用户在时间片开始时同步接入网络信道，若冲突，等待下一个时间片再发送
ALOHA 用的是超时重传

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

A. It allows a node to have a higher throughput

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

C. It allows TCP to overcome channel with a long propagation delay

D. It ensures packets are transmitted over channels with some guarantees, e.g., delays less than 10ms.

o



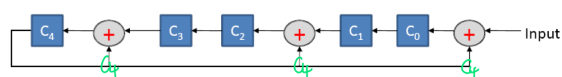
Zhengzhou University

①寄存器个数生成多项式阶数
②④是计算后是数生成多项式阶数

CRC Digital Logic



$$X^3 + X + 1$$



Polynomial?
 $X^5 + X^4 + X^2 + 1$

$$X^{10} + X^9 + X^5 + X^4 + X + 1$$

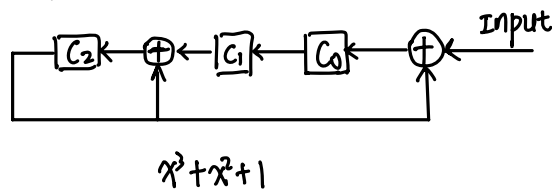
How many registers (FFs) and XOR gates?

2022/2/25

QUESTION 1B - (10 marks)

(a) Draw the linear feedback shift register for the divisor X^3+X^2+1 (5 marks)

- ① 最高次数为3 \Rightarrow 有三个寄存器
② 除 X^3 外, X^2+1



(b) Calculate the CRC for the bitstring 1111 given the divisor X^3+X^2+1 (3 marks)

① 1101 / $\begin{array}{r} 1011 \\ 1111 \ 000 \\ \underline{1101} \\ 1000 \\ \underline{1101} \\ 1010 \\ \underline{1101} \\ 111 \end{array}$ 最高次 X^3 加三个零

② X^3+X^2+1 / $\begin{array}{r} X^3+X^2+1 \\ X^6+X^5+X^4+X^3 \\ \underline{X^6+X^5+X^3} \\ X^4 \\ X^4+X^3+X \\ \underline{X^3+X} \\ X^3+X^2+1 \\ \underline{X^2+X+1} \end{array}$ 最高次为3, 余数取 111

有1就抄下 111 CRC: 1111 111 3分

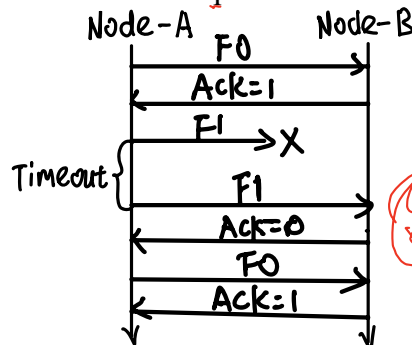
(c) The divisor $X^{16}+1$ has how many registers?

(2 marks)

16

QUESTION 2B - (5 Marks)

Assume that Node-A has three (3) packets for Node-B and both nodes use Stop-and-Wait. Show the sequence of transmissions between the two nodes, and show what happens when the second packet is lost. (3 marks)



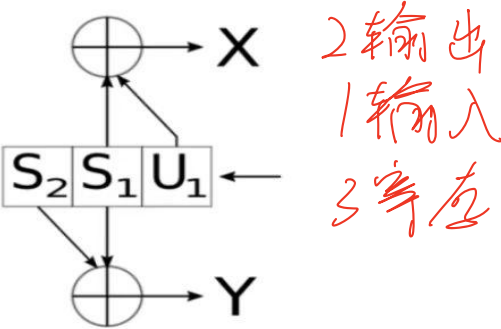
Assume there ten devices on a channel and they are using CSMA. Their contention window size is four. What is the probability of a collision? (2 marks)

probability of collision = $1 - (1-p)^n$
 $= 1 - (0.8)^{10}$
 $= 0.893$

$p = \frac{1}{4CW+1}$
 $= \frac{1}{5} = 0.2$

QUESTION 3B - (10 Marks)

Consider the following encoder, and answer the questions below.



(i) Assume the registers are initially zero. What is the output (XY) for the following bitstring: (2 mark)

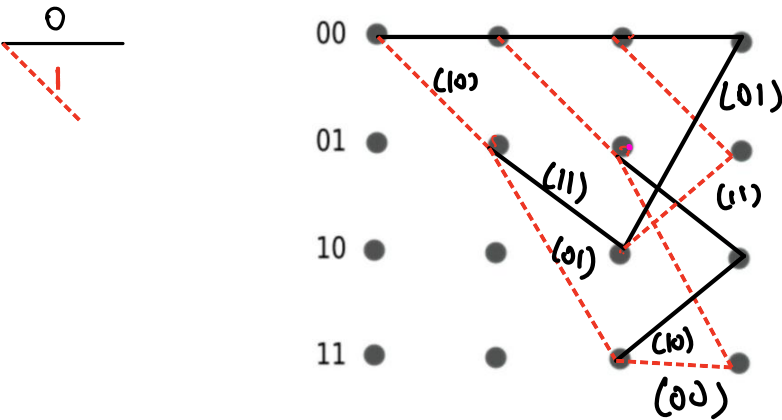
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(ii) Complete the following tables for the encoder on previous page. (4 mark)

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

(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) Identify the time periods in which the connection is in the slow-start phase. (2 Marks)

① RTT0 ~ RTT4

② RTT5 ~ RTT9

③ RTT17 ~ RTT21

已超时 timeout

(ii) At which RTT(s) did the sender experience congestion? (2 Marks)

RTT5 and RTT17

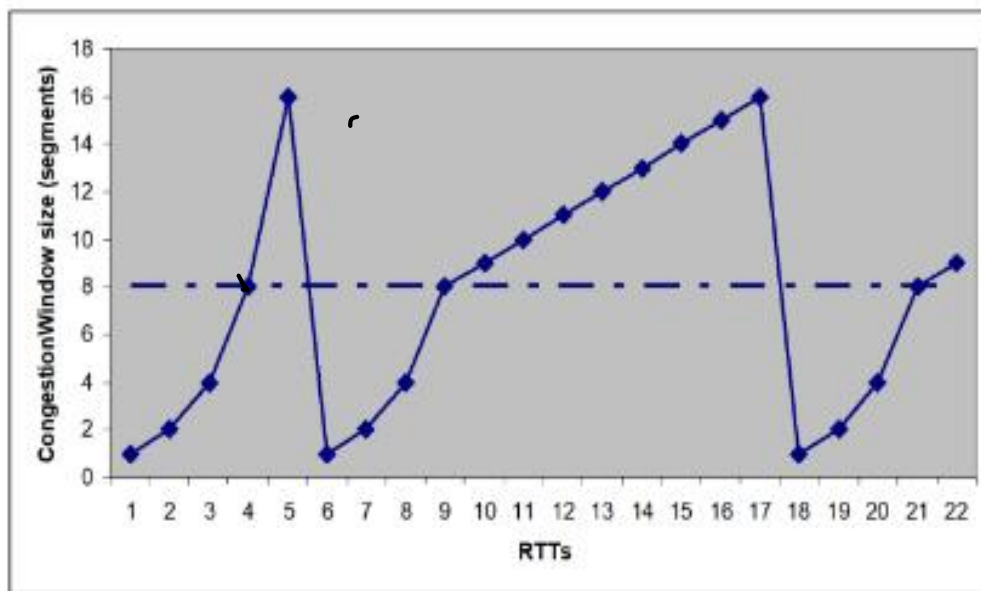


Figure 1B

QUESTION 5B - (6 marks)

Consider Figure 2B below. Answer the questions below:

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

thresh = 21

第5题

$$\frac{(1+2+4+8+16+32) \times 1024 \times 8}{100 \times 10^{-3} \times 5}$$

5个5

(ii)What is the throughput between RTT=1 (cwnd=1) and RTT=6 (cwnd=32). Assume each RTT is 100 ms and the packet size is 1024 bytes. (4 mark)

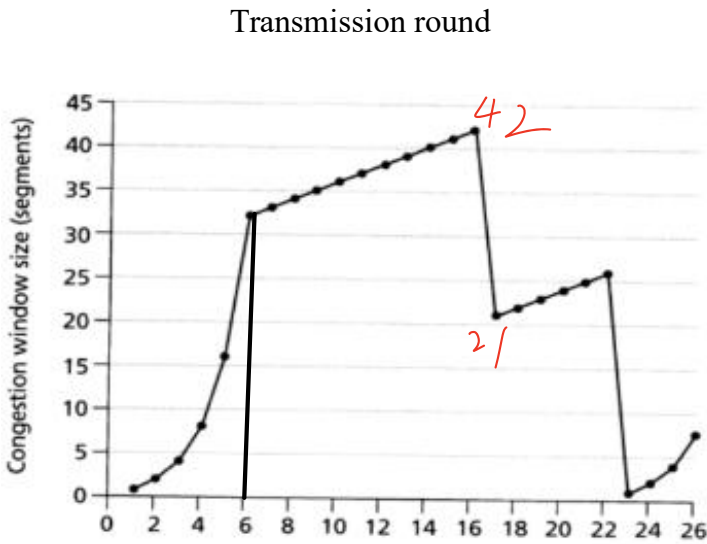
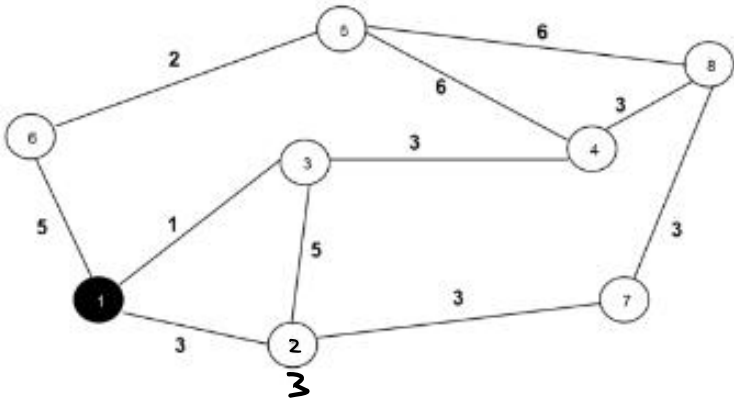


Figure 2B

QUESTION 6B - (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. Fill in the table



below.

Figure 3B (10 marks)

T	2	3	4	5	6	7	8
1	3	1	Inf	Inf	5	Inf	Inf
1,3	3	1	4	Inf	5	Inf	Inf
1,3,2	3	1	4	Inf	5	6	Inf
1,3,2,4	3	1	4	10	5	6	7
1,3,2,4,6	3	1	4	7	5	6	7
1,3,2,4,6,7	3	1	4	7	5	6	7
1,3,2,4,6,7,5	3	1	4	7	5	6	7
1,3,2,4,6,7,5,8	3	1	4	7	5	6	7

(c)Router A using ^{RIP}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

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

Dest	Cost	Next-hop		
Net2	6	A	Net5	3
Net3	4	E	Net6	2
Net4	4	A		
Net5	4	B		
Net6	3	B		

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

Dest	Cost	Next-hop		
Net2	3	E	Net2	2
Net3	2	E	Net3	1
Net4	4	A		
Net5	4	B		
Net6	3	B		

(iii)Why is important to have a fast route convergence? (2 Marks)
fast route convergence ensures reliable network performance
reduces downtime, optimizes resource usage.

(iv)In distance vector routing, a router always send a route update that includes the path to a given destination. True/False? (1 Mark)
False

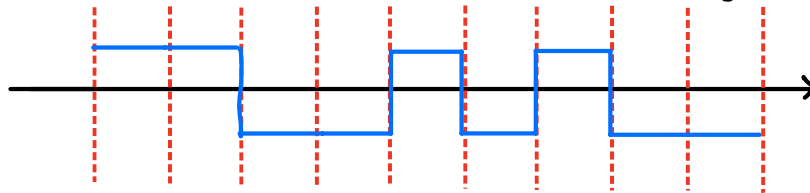
^{neighbour}
(v)A network is using the Dijkstra algorithm. We only need to run the algorithm once from one node only to obtain the routing table for all nodes. True/False? (1 Mark)
False

0 0 | 0 | 1 | 1 | 0

QUESTION 7B - (5 Marks)

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

NRZ-I 反向非归零编码
Rule: 1 (transition), 0 (stay at current signal)



4B/5B

4B/5B 编码

Rule: every 4 bits of data encoded in a 5-bit code

Advantage: Equal number of 0s and 1s

Error Detection

32-QAM 32-正交幅度调制 QAM (Quadrature Amplitude Modulation)

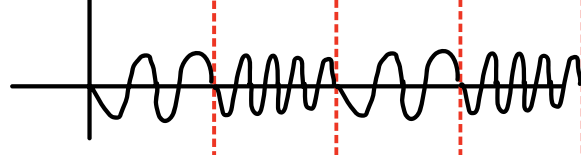
Rule: combines ASK with PSK

changes both amplitude and phase to represent a 0 and 1

FSK 频移键控法

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

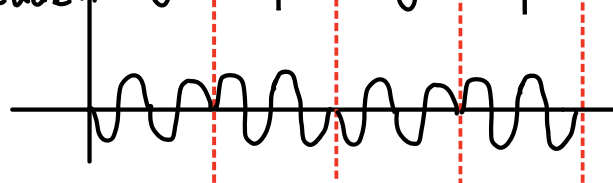
Amplitude 0 1 0 1 Amplitude and phase remain unchanged



PSK 相位幅度调制

Rule: phase of the signal is changed to represent a 1 or 0

Amplitude 0 1 0 1 Amplitude and Frequency remain unchanged



NRZ-L

Rule: 0 (high level), 1 (low level)