

Computer Networks  
Spring 2020  
Midterm I  
2/21/2020  
Time Limit: 75 minutes

Name: Solution

Computing ID \_\_\_\_\_

This exam contains 10 pages (including this cover page) and 24 questions.

*-0.5 for each  
wrong multiple select  
each question is worth  
2 points*

**Instructions:**

1. You have **75 minutes** to complete the examination. As a courtesy to your classmates, we ask that you not leave during the last fifteen minutes.
2. Feel use a calculator on this exam. If you don't have a calculator, you can use your phone on airplane mode. Remember you are on your honor.
3. Write your answers in this booklet. **please try to avoid writing on the backs of pages.**
4. There are 3 categories of questions: [C Questions] these are the easiest questions, [B Questions] these are more challenging questions and [A Questions] these question require the most thought and time. Answering A questions correctly demonstrates mastery of the material.
5. Please sign the below Honor Code statement.

I have neither given nor received aid on this exam (2 points).

Signature: \_\_\_\_\_

## 1 Physical Layer

- (2 points) [B] Assuming information is encoded using a BFSK encoding scheme and is transmitted at a baud rate of 5000. What is the speed of the transmission in bps?
  - 128 kbps
  - 40 kbps
  - 51.2 kbps
  - 2500 bps
  - 5000 bps
  - none of the above
- (2 points) [A] Which of the following represent the bit stream encoded by the Manchester encoded signal. (802.3 IEEE Manchester encoding: the XOR between the clock and the signal.)

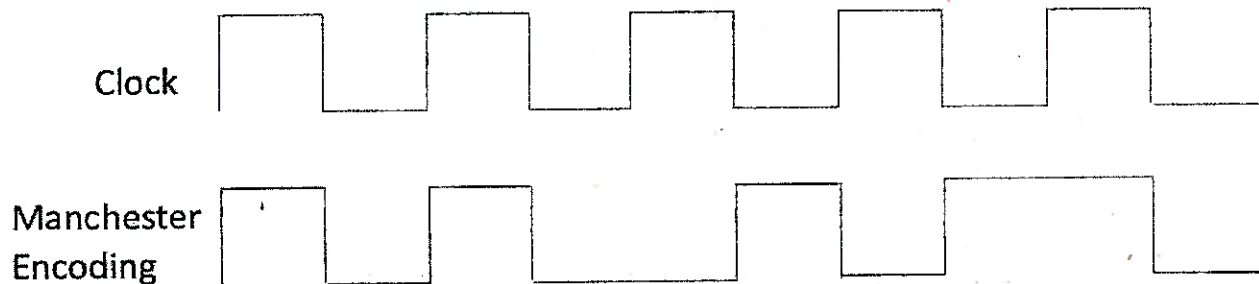


Figure 1: Manchester Encoded Signal and Clock

- 1010010110
  - 0101101001
  - 11001
  - 00110
  - 01011
  - 11011
- ## 2 Link Layer
- (2 points) [C] Consider the following packet 000100110010001111, If the last bit represents the parity bit, which of the following is true?
    - Assuming Even parity the packet has been corrupted.
    - Assuming Even parity the packet has not been corrupted.
    - None of the above.

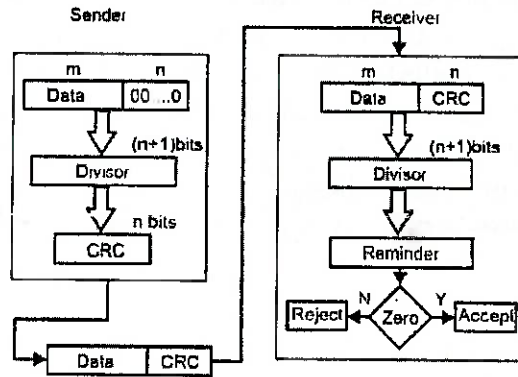


Figure 2: CRC flow

4. <sup>2</sup> (4 points) [B] Refer to figure 2 for an overview of CRC. Assuming that we have a generator function of 101 and packet value of 110101. What is the value of the CRC code for the packet?

- A. 001
- B. 000
- C. 010
- D. 11
- E. 01
- F. 00



5. (2 points) [A] Given the following generator 1011 and packet 1010101001 which of the following corrupted packets will be incorrectly marked as uncorrupted. Select all that apply if none apply leave blank

- 1010101011
- 1111101011
- 1011010111
- 1010110110
- 1010111001

*all marked corrupted*

6. (2 points) [C] Which of the following are disadvantages of the slotted aloha protocol. Select all that apply if none apply leave blank

- Wasted Time slots
- Requires Clock Synchronization
- Single Node can transmit continuously on empty channel
- Decentralized

7. (4 points) [B] The Ethernet Collision detection algorithm uses binary exponential back-off by randomly selecting the number of time slots to wait from the set  $\{0, 1, 2, \dots, 2^m - 1\}$  where  $m$  is the number of collisions detected so far. Assuming that we are transmitting on 1 Mbps (1000000 bits per second) Ethernet, with a max frame size of 512 bits. What is the maximum amount of time we would have to wait before we could re-transmit given that there have been 8 previous collisions.

- A. 130 ms  
 B. 256 ms  
 C. 1 us  
 D. 512 ms

# of seconds per frame  $\frac{512}{1,000,000} \times 2^8 - 1$



8. (2 points) [A] Suppose you have three active nodes (A,B,C) which are competing for access to a channel using slotted ALOHA. Assume that each node has a finite number of packets to send and that each node attempts to send with probability 0.5. What is the probability that node A succeeds for the first time in slot 4?

- A. 0.08  
 B. 0.06  
 C. 0.125  
 D. 0.33  
 E. none of the above

The sequence of events

$$F \times F \times F \times S \rightarrow \frac{1}{8} \times \frac{1}{8} \times \frac{1}{8} \times \frac{1}{8} = \underline{0.0837}$$

$$\text{prob of fail} = 1 - S$$

$$= 1 - p(1-p)^{N-1}$$

$$= 1 - \frac{1}{2} \left(1 - \frac{1}{2}\right)^2$$

$$= \frac{1}{8}$$

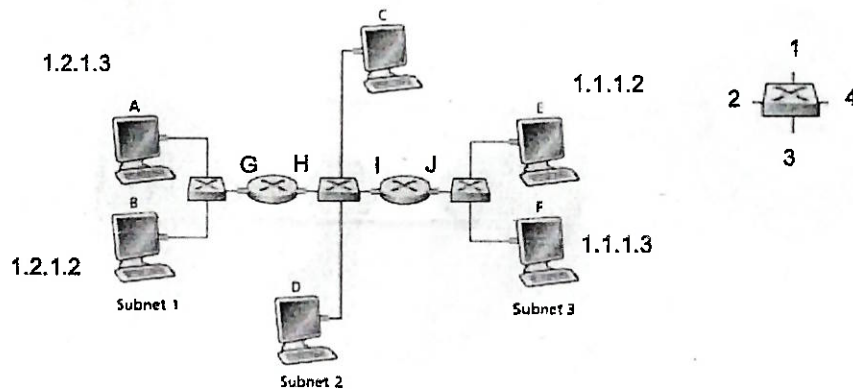


Figure 3: Network Topology

9. (2 points) [C] Consider the topology shown in figure 3. MAC-addresses are shown in letters A-J. Assume that the switch on Subnet 1 is a self learning switch. Interfaces are always numbered based on their orientation as shown in the switch on the top right side of figure 3. When the machine at 1.2.1.3 sends a packet to the machine 1.2.1.2 what gets added to the switches table.
- A. 1.2.1.3 on interface 1
  - B. 1.2.1.2 on interface 3
  - C. A on interface 1
  - D. B on interface 2
  - E. none of the above
10. (2 points) [B] If the machine at 1.2.1.2 sends a packet to the machine at 1.1.1.2. What MAC-address will the receiver see as the sending address? Select all that apply if none apply leave blank
- A
  - E
  - G
  - I
  - J
11. (2 points) [B] The Machine at IP 1.2.1.2 sends a packet to machine at IP 1.1.1.3, which of the following are valid entries in subnet 2's switch Select all that apply if none apply leave blank
- A on interface 2
  - F on interface 4
  - H on interface 2
  - I on interface 4
  - none of the above

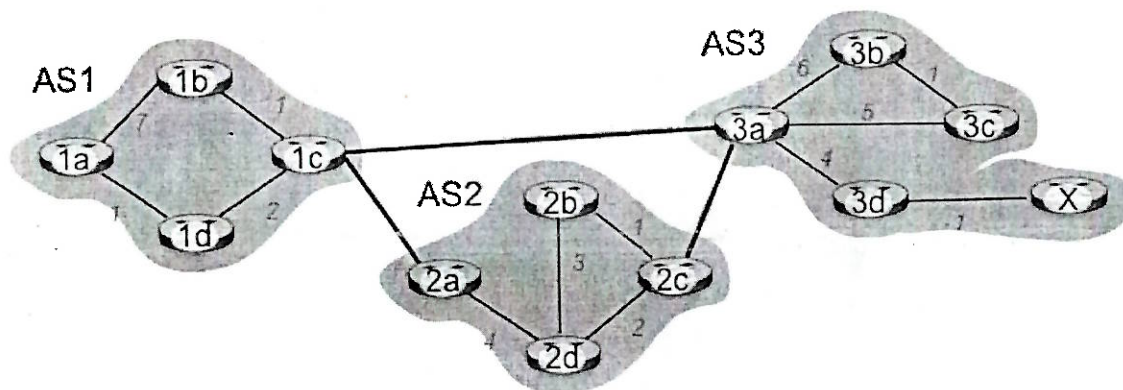


Figure 4: Example Autonomous System Topology with Weights

### 3 Network Layer

12. (2 points) [C] What is the first distance vector sent by router 1a.

- A.  $[1a : 0, 1b : 7, 1d : 1]$
- B.  $[1a : 0, 1b : 4, 1d : 1]$
- C.  $[1a : 0, 1b : \infty, 1d : \infty]$
- D.  $[1a : 0, 1b : 0, 1d : 0]$

13. (2 points) [B] Assuming all distance vectors are in their initial state and that the only messages that are sent are the following:

- $t_0$  1a  $\rightarrow$  1b
- $t_1$  1c  $\rightarrow$  1b
- $t_2$  1d  $\rightarrow$  1a

What is 1b's new distance vector?

- A.  $[1a : 7, 1b : 0, 1c : 1, 1d : 8]$
- B.  $[1a : 7, 1b : 0, 1c : 1, 1d : \infty]$
- C.  $[1a : 7, 1b : 0, 1c : 1, 1d : 3]$
- D.  $[1a : 7, 1b : 0, 1c : 1, 1d : 3]$
- E.  $[1a : 4, 1b : 0, 1c : 1, 1d : 3]$
- F. none of the above

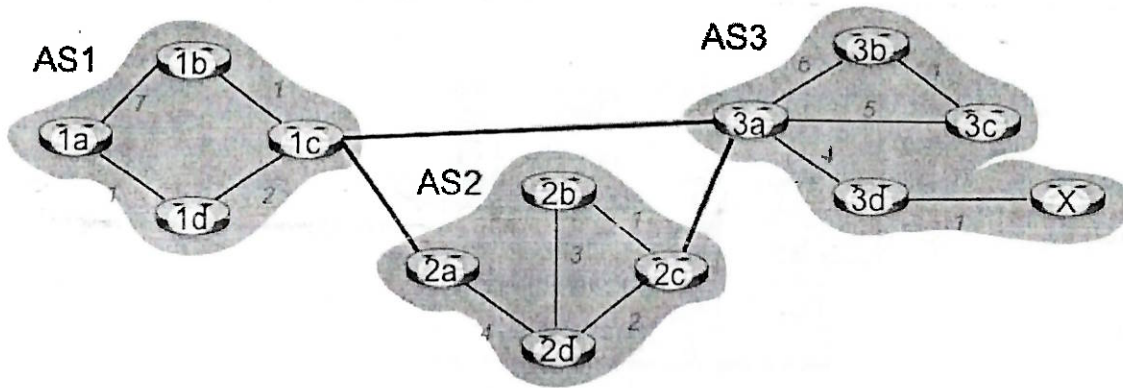


Figure 5: Copy of same diagram above

14. (2 points) [A] Assuming that the distance vector algorithm has converged, what happens if the link cost between 1d and 1c increases to 74. What is/are the appropriate message(s) that need(s) to be sent if the poison reverse strategy is correctly implemented. Select all that apply if none leave blank
- distance vector from 1a to 1d says that 1a's cost to 1c is infinite
  - distance vector from 1c to 1d says that 1c's cost to 1a is infinite
  - distance vector from 1d to 1a says that 1d's cost to 1c is infinite
  - distance vector from 1d to 1c says that 1d's cost to 1a is infinite
15. (2 points) [C] What AS path vector(s) does gateway router 2a receive for the subnet attached to X. Remember that these path vectors are propagated inside of the Autonomous System.
- A. [AS1, AS3, X]
  - B. [AS3, X]
  - C. [AS1, AS3, X], [AS3, X]
  - D. none of the above
16. (2 points) [B] Router 2d has a packet that is destined for the subnet attached to router X. If hot potato routing takes precedence over all other routing policies. What will the next hop router be?
- A. 2a
  - B. 2b
  - C. 2c
  - D. none of the above

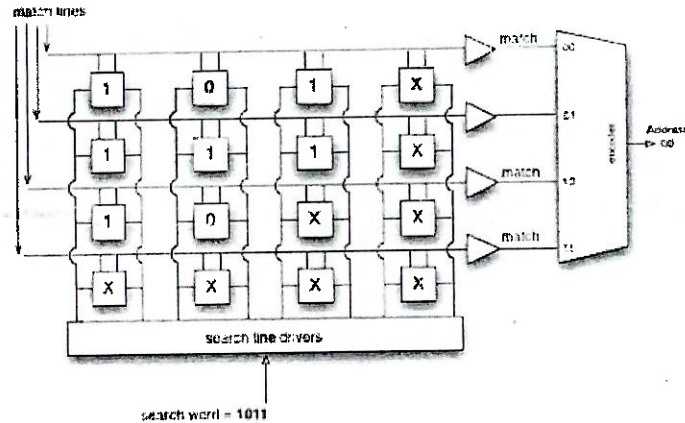


Figure 6: Ternary Content addressable memory

17. (2 points) [C] Which of the following are on the same subnet, given the following subnet mask: 201.23.16.0/23. Select all that apply if none apply select none
- 201.23.16.1
  - 201.23.17.1
  - 201.23.18.1
  - 201.23.22.5
18. (2 points) [C] Which of the following represents the subnet mask corresponding to CIDR notation /24.
- A. 255.254.0.0
  - B. 255.255.254.0
  - C. 255.255.255.0
  - D. 255.255.255.254
19. (2 points) [B] Consider the image of a TCAM shown in figure 6. Which of the following packets would get forwarded on port 01? Select all that apply if none apply select none
- 1010
  - 1000
  - 1001
  - 1011



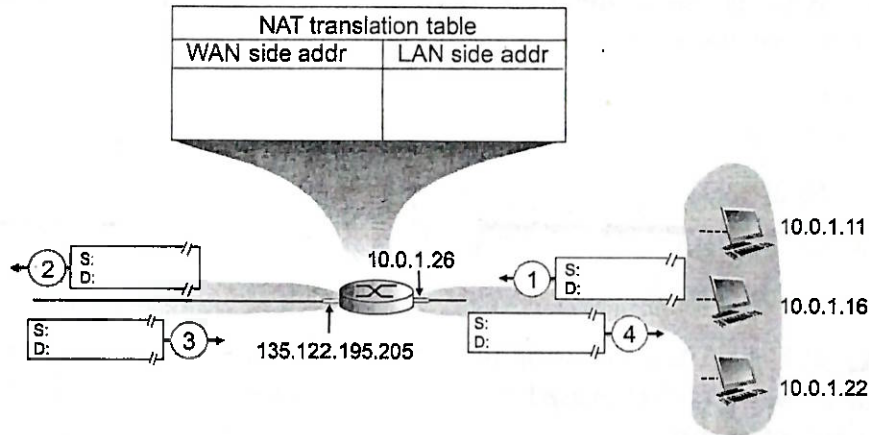


Figure 7: Network address Translation

20. (2 points) [B] Consider Figure 7. If the machine at 10.0.1.16 has an application running on port 45 which sends a packet to 128.18.46.12 on port 80. If the NAT table assigns a port of 3000 to the application running on port 45, what is the value of the source field of the packet on the Step 2?
- A. 10.0.1.16 : 45  
 B. 10.0.1.16 : 3000  
 C. 128.18.46.12 : 45  
 D. 128.18.46.12 : 3000  
 E. none of the above
21. (2 points) [B] Consider Figure 7. After the server at 128.18.46.12 responds what will be source address and port of the packet at step 4?
- A. 10.0.1.16 : 45  
 B. 10.0.1.16 : 3000  
 C. 128.18.46.12 : 45  
 D. 128.18.46.12 : 3000  
 E. none of the above
- Handwritten notes:*  
 135.122.195.205 : 3000  
 128.18.46.12 : 80

22. (2 points) [C] What is the Value of the MAC Address in the Ethernet frame containing the DHCP broadcast message:

- A. 0.0.0.0
- B. ff:ff:ff:ff:ff:ff**
- C. 255.255.255.255
- D. 00:00:00:00:00:00
- E. None of the above.

23. (2 points) [C] Which of the following are associated with "routing within a single network (typically owned and operated by one organization)." **Select all that apply if none apply select none**

- OSPF
- intra-AS routing
- inter-AS routing
- eBGP
- iBGP
- Driven more by performance than by routing policy
- Driven more by routing policy than end-end routing performance

24. (2 points) [B] Suppose a provider network only wants to carry traffic to/from its customer networks (i.e., to provide no transit service), and customer networks only want to carry traffic to/from itself. Suppose C has advertised path Cy to x. To implement this policy, to which of the following networks would network x advertise the path xCy? **Select all that apply if none apply select none**

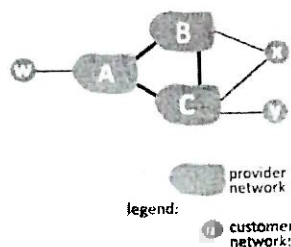


Figure 8: AS Connections

*Don't want to route other people's traffic*

- A. w
- B. C
- C. B
- D. A
- E. None of these networks**