

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**

**Department of Computer Science and Engineering (CSE)**

**SEMESTER FINAL EXAMINATION**

**WINTER SEMESTER, 2018-2019**

**DURATION: 3 Hours**

**FULL MARKS: 150**

**CSE 4511: Computer Networks**

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

1. a) What is the slot time in CSMA/CD? Explain how the slot time is related to the maximum network length. Explain why a minimum frame size is required for Ethernet. 3+6+4
- b) An Ethernet MAC sublayer receives 3040 bytes of data from the upper layer. Can the data be encapsulated in one frame? If not, how many frames need to be sent? What is the size of the data in each frame? 4
- c) Write short notes on any two of the followings: 4×2
  - i. Bluetooth
  - ii. Go-Back-N ARQ
  - iii. Network Allocation Vector (NAV)
2. a) Derive the maximum achievable throughput of a pure ALOHA network. Derive the formula to determine the average transfer delay of a pure ALOHA network. 4+7
- b) What do you mean by vulnerable time? "The vulnerable time in ALOHA depends on the frame transmission time, whereas it depends on the propagation delay in CSMA" - Justify the statement in your own word. 2+7
- c) In CSMA/CA, contention window (CW) changes according to the binary exponential back-off strategy. The initial value of the contention window ( $CW_{min}$ ) is 64. If a station requires 4 transmission attempts to successfully transmit a frame, what would be the back-off counter value for those transmission attempts? 5
3. a) Name three ICMPv4 query message and three error-reporting messages. Depict the encapsulation process of ICMPv4 error messages. Under what circumstances no ICMPv4 error messages is generated? 3+3+3
- b) Find the class and default mask of the following IPv4 address. Mention the number of possible IP addresses in each IP class. 3 × 2
  - i. 11000001.00000010.11111110.00000000
  - ii. 25.23.12.25
  - iii. 172.32.25.14
- c) A University is granted the address block 18.15.40.0/24, which contains 256 addresses. The university has six departments and needs to divide the addresses into six sub blocks of 128, 64, 32, 16, 8, and 8 addresses. Design the sub blocks and give the slash notation for each sub block that are assigned to different departments. With the aid of a diagram, show the configuration of the University network and answer the following questions: 10
  - i. What are the valid subnets?
  - ii. What are the broadcast addresses for each subnet?
  - iii. What are the valid hosts in each subnet?

4. a) Both IPv4 and IPv6 assume that packet may have different priorities or precedence. Explain how each protocol handles this issue. 6
- b) In an IPv4 datagram, the M-bit is 0, the value of HLEN is 5, the value of total length is 200, and the fragment offset value is 200. What is the number of the first byte and number of the last byte in this datagram? Is this the last fragment, the first fragment, or a middle fragment? 6
- c) Mention the benefit of dropping the checksum field from IPv6 header. Does it introduce any potential danger of forwarding erroneous packets by IPv6? Explain. 6
- d) Briefly explain the major functionalities of Address Resolution Protocol (ARP) of TCP/IP protocol suite? 7
5. a) ~~Write short notes on any two of the followings:~~ 2 × 4  
~~i. Longest Mask Matching ii. Address Aggregation iii. Counting to Infinity (C2I)~~
- b) How does link state routing differ from distance vector routing? Consider the network given in Figure 1. With the indicated link costs, use Dijkstra's shortest-path algorithm used in link state routing to compute the shortest path from X to all network nodes. Prepare the routing table for node X. 4+6

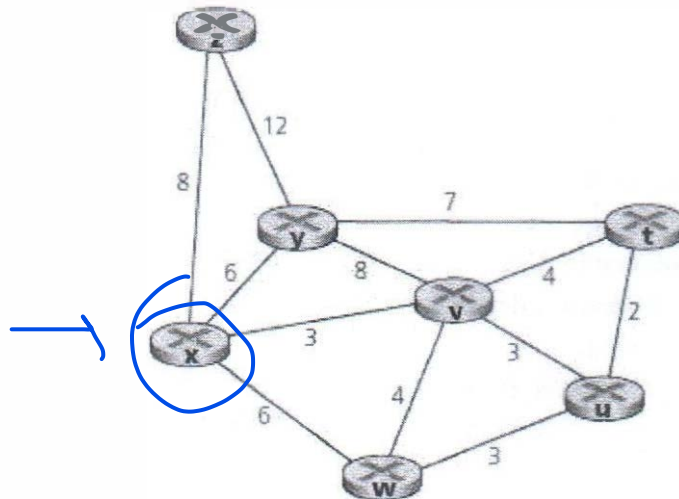


Figure 1: Network for Question 5.b)

- c) What is the C2I (counting to infinity) problem of distance-vector routing? Mention some of the methods to eliminate the problem. 5+2
6. a) A TCP client opens a connection using an initial sequence number (ISN) of 14,534. The TCP server opens the connection with an ISN of 21,732. 4+4
- Show the three TCP segments during the **three-way handshaking** connection establishment.
  - Show the contents of the segments during the connection termination using **four-way handshaking with half-close**.
- (Use timeline in y-axis for each side to show the **states** and the relative duration of the client and the server.)
- b) Briefly explain the acknowledgement and retransmission policy of TCP error control mechanism. 6+6
- c) Name different control flags in a TCP segment. Mention the minimum and maximum size of a TCP segment header. 3+2

7. a) How does congestion control differ from flow control in TCP? Suppose you have a TCP source, which starts transmission from segment number 15 with initial value of slow start threshold (*ssth*) 65000. The size of the receiver window (*rwnd*) is always larger than the congestion window (*cwnd*). Draw the timing diagram (time axes toward the bottom of the page for both the source and destination) for the transmission of segments at least up to 25. The diagram should include slow start, congestion avoidance, and one packet loss identified by triple duplicate acknowledgment and one by time out. 3+10
- b) Briefly explain the significance of Persistence timer and TIME-WAIT timer in TCP? A host sends five packets and receives three acknowledgments. The time is shown as hour:minute:seconds. 6+6
- Segment 1 was sent at 0:0:00.
  - Segment 2 was sent at 0:0:05.
  - ACK for segments 1 and 2 received at 0:0:07.
  - Segment 3 was sent at 0:0:20.
  - Segment 4 was sent at 0:0:22.
  - Segment 5 was sent at 0:0:27.
  - ACK for segments 3 and 4 received at 0:0:45.
  - ACK for segment 5 received at 0:0:65.

Calculate the values of  $RTT_M$ ,  $RTT_S$ ,  $RTT_D$ , and  $RTO$  of the retransmission timer of TCP. Given that the original  $RTO$  is 6 seconds.

8. a) Mention the major security goals of a computer network. How does symmetric key cryptography differ from asymmetric key cryptography? 2+4
- b) How do the classical ciphers differ from the modern ciphers? Encrypt the message "successful" using the Playfair cipher using the key "Crypto". 4+4
- c) Organizations with strict security often enforce password policies in order to make password management more secure. What could such policies be? Give examples. Discuss in what ways strict password policies may actually make password management less secure. 6
- d) Write a short note on any one of the followings: 5
- Replay Attack
  - Reflection Attack