

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

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

WINTER SEMESTER, 2017-2018

FULL MARKS: 150

DURATION: 3 Hours

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.

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1. a) Explain why a minimum frame size is required for Ethernet. For example, standard (10Base) Ethernet impose a minimum frame size constraint of 64 bytes. Now suppose that the distance between two ends of an Ethernet LAN is d . Derive a formula to find the minimum frame size needed for an Ethernet packet. 6+3
 - b) A sender sends a series of packets to the same destination using *Go-Back-N ARQ*. If the header of the frame allows 4 bit sequence number that starts with 0, what is the sequence number after sending 100 packets? If the sender uses 'Stop-and-Wait ARQ' protocol for flow control then what should be the sequence number after sending 100 packets. 6
 - c) Write short notes on any two of the followings: 2×5
 - i. Cheapernet
 - ii. Fast Ethernet
 - iii. Vulnerable Time

 2. a) What is the significance of D (Duration) field in an IEEE 802.11 frame? What is the significance of contention window(CW) in CSMA/CA? 4+4
 - b) Can RTS-CTS hand-shaking completely eliminate the hidden station problem? If YES, then justify how the RTS-CTS hand-shaking avoids the collision from hidden nodes. If NO, then draw a frame exchange scenario where a collision occurs due to hidden nodes. 7
 - c) Consider a system of four LANs (L_1 to L_4) interconnected by five bridges (B_1 to B_5). The bridges connect the LANs as follows: 10
 - i. B_1 connects L_1 and L_2
 - ii. B_2 connects L_1 and L_3
 - iii. B_3 connects L_1 , L_3 and L_4
 - iv. B_4 connects L_3 and L_4
 - v. B_5 connects L_1 , L_2 , and L_4

Assume B_1 as the root bridge. Show the forwarding and the blocking ports after applying the spanning tree algorithm.

 3. a) Name three ICMPv4 query message and three error-reporting messages. What is the purpose of including the IP header and the first 8 bytes of datagram data in the error reporting ICMPv4 messages? 4+4
 - b) What is the main role of Address Resolution Protocol (ARP) in the network layer of TCP/IP protocol suite? Briefly explain how ARP is used to create subnetting effect. 3+5

- c) Which fields of the IPv4 header are mutable, that means change from router to router? 2+2+5
Name the fields in IPv4 header those are necessary to handle the fragmentation of packets.
In IPv6, mandatory base header contains no fields related to fragmentation. Briefly explain how fragmentations of packets are implemented in IPv6.

4. a) What is the difference between routing and forwarding? What is the advantage of net specific routing over host specific routing? 2+3

- b) An ISP is granted a block of addresses starting with 130.15.0.0/16. The ISP wants to distribute these blocks to 320 customers as follows: 12

- The first group has 64 customers; each needs 256 addresses
- The second group has 128 customers; each needs 128 addresses
- The third group has 128 customers; each needs 64 addresses

Design the sub blocks and show the address allocation and distribution by the ISP. Find out how many addresses are still available after these allocations.

- c) What is IP address space depletion? Briefly explain different measures to handle IP address depletion 2+6

5. a) Briefly explain the working principle of link state routing. Consider the network shown in Figure 1, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance vector/table entries at node V that is shared with its neighbors. How does the scenario change if we use link state algorithm instead of distance-vector algorithm? 7+6

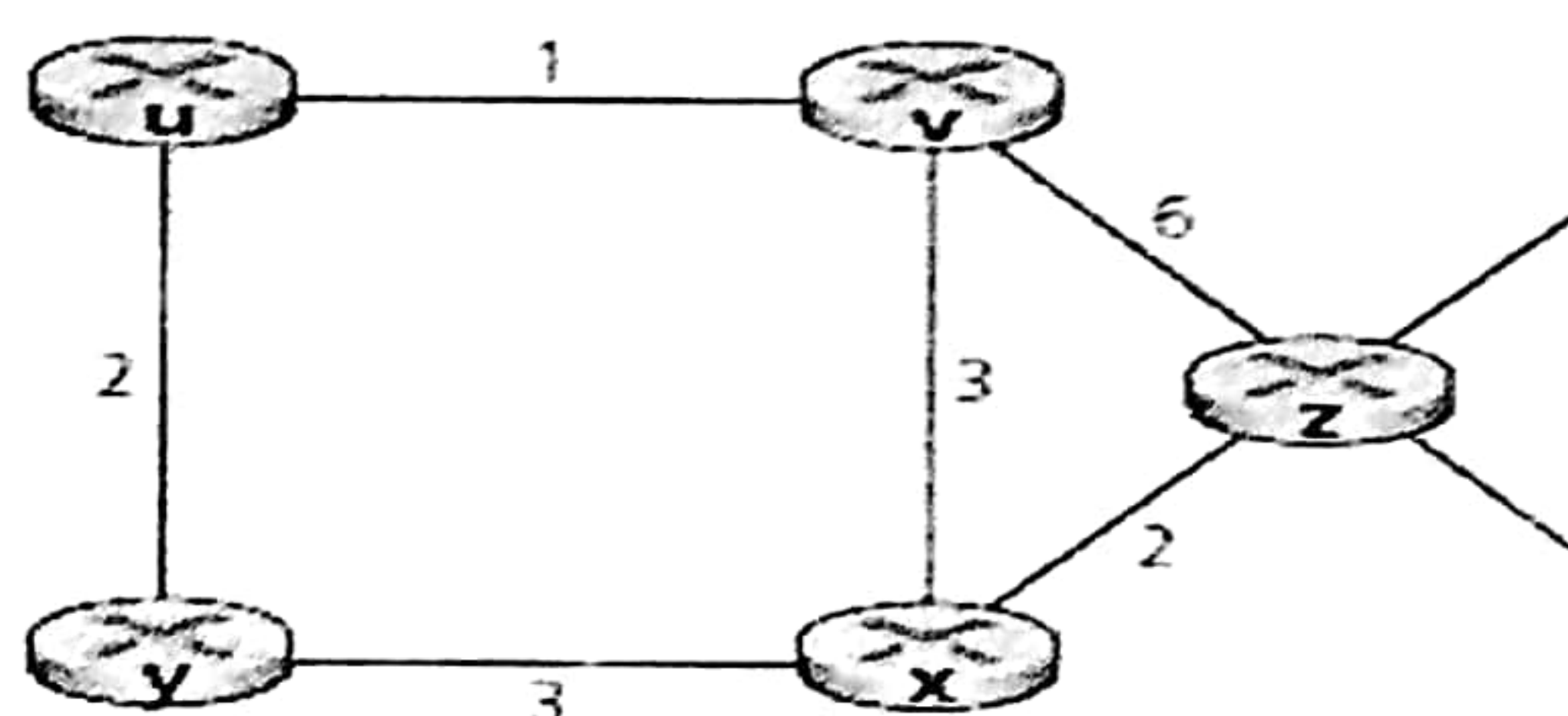


Figure 1: Network for Question 5.a)

- b) With necessary diagrams explain the C2I (counting to infinity) problem of distance-vector routing protocols. Mention some of the methods to eliminate the C2I (counting to infinity) problem of distance-vector routing. 9+3

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+6

- i. Show the three TCP segments during the **three-way handshaking** connection establishment.

- ii. 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) Name different flags used in a TCP segment. Briefly explain the significant role of Persistence timer and TIME-WAIT timer in TCP. 3+7

- c) What is **SYN flooding attack**? Mention some strategies to alleviate the effect of a SYN flooding attack. 5

7. a) A TCP source sends segments of equal size, and maintains the sequence number for each segment (i.e., the TCP protocol is segment-oriented instead of byte-oriented). Assume that the sequence number of the first data segment is 35. The size of the receiver window ($rwnd$) is always larger than the congestion window ($cwnd$). For the first data segment, assume that the value of the $cwnd$ is 1, and the value of the slow start threshold ($ssth$) is 65000.

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You are asked to draw a timing diagram, where y-axis shows the time, and two parallel lines in the y-axis represent the events (sending and receiving of data and ACK segments, $cwnd$ values, etc.) at the source and destination TCP.

Assume that the source always tries to send as many data segments as it is allowed to.

Draw the diagram considering the followings:

- The successful transmission of segments from sequence number 35 to 55.
 - Segment 42 is lost, and the source identifies this by triple duplicate acknowledgments.
 - Segment 49 is lost (assume subsequent segments are also lost), and the source identifies this by a timeout.
 - At the left side of the source TCP timeline, show the value of $cwnd$ and $ssth$, whenever they are updated.
 - Identify the slow start, congestion avoidance, congestion detection region in the source TCP timeline.
- b) The UDP protocol does not provide any of the important services of the transport layer, namely reliability, flow control, and congestion control. Explain why we still use UDP, and what applications are suitable for UDP.

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8. a) From a service perspective, how does symmetric key cryptography differ from asymmetric key cryptography? Can you 'decrypt' a hash of a message to get the original message? Explain your answer.

4+4

- b) Briefly explain the cryptographic strength of the Vigenere cipher over the Caesar cipher. Using the Playfair cipher encrypt the word "committee" using the key 'thief'.

4+4

- c) Suppose Alice wants to communicate with Bob using symmetric key cryptography using a session key K_S . The trusted third party (TTP) is a server that shares a unique secret symmetric key with each registered user. For Alice and Bob, denote these keys by K_{A-TTP} and K_{B-TTP} . Design and explain a scheme that uses the TTP to distribute K_S to Alice and Bob. Your scheme should use at least three messages to distribute the session key: a message from Alice to the TTP; a message from the TTP to Alice; and finally a message from Alice to Bob. Your scheme should provide mutual authentication and should avoid the reflection attack as well as replay attack.

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