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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2022-2023**

DURATION: 1 HOUR 30 MINUTES **FULL MARKS: 75**

CSE 4585: Computer Networks

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

Answer **all 3 (three)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

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1. a) Describe the services provided by the network layer at the source computer. How do the services change at a router and the destination computer? Use necessary diagrams to justify your answer — 9 (CO1) (PO1)

   b) An organization is granted the block 130.56.0.0/16. The administrator wants to create 1024 subnets. — 6 (CO2) (PO1)

      i. Find the subnet mask.
      ii. Find the number of addresses in each subnet.
      iii. Find the first address, the last address, and the broadcast address in the first subnet.
      iv. Find the first address, the last address, and the broadcast address in the last subnet (subnet 1024).

   c) An ISP is granted a block of addresses starting with 150.80.0.0/16. The ISP wants to distribute these blocks to 2600 customers as follows: — 10 (CO2) (PO1)

      i. The first group has 200 medium-size businesses; each needs approximately 128 addresses.
      ii. The second group has 400 small businesses; each needs approximately 16 addresses.
      iii. The third group has 2000 households; each needs 4 addresses.

      Design the subblocks and give the slash notation for each subblock. Find out how many addresses are still available after these allocations.

2. a) What is the difference between routing and forwarding? Do the routers in both datagram networks and virtual-circuit (vc) networks use forwarding tables? If so, how do the forwarding tables for both classes of networks differ? Consider pros and cons of virtual-circuit and datagram networks. — 8 (CO1) (PO1)

      i. Suppose that routers were subjected to conditions that might cause them to fail fairly often. Would this argue in favor of a VC or datagram architecture? Why?
      ii. Suppose that a source node and a destination require that a fixed amount of capacity always be available at all routers on the path between the source and destination node, for the exclusive use of traffic flowing between this source and destination node. Would this argue in favor of a virtual-circuit or datagram architecture? Why?
      iii. Suppose that the links and routers in the network never fail and the routing paths used between all source/destination pairs remain constant. In this scenario, does a VC or datagram architecture have more control traffic overhead? Why?

b) What are the primary motivations for summarization (route aggregation)? What might be a potential problem of summarization if the subnets are not geographically close to each other? What is the solution to the problem? Your answer should include network diagrams using classless addressing. 9 (CO2) (PO1)

c) An IPv4 datagram has arrived with the following information in the header (in hexadecimal) 8 (CO2) (PO1)

45 00 00 54 00 03 00 00 20 06 00 00 7C 4E 03 02 B4 0E 0F 02

i. Are there any options?
ii. How many additional routers can the packet travel to?
iii. What is the identification number of the packet?
iv. What is the size of the data?

3. a) Both IPv4 and IPv6 assume that packets may have different priorities or precedences. Explain how each protocol handles this issue. In IPv6, the mandatory base header contains no fields related to fragmentation. Briefly explain how fragmentation of packets is implemented in IPv6. 8 (CO2) (PO1)

b) Assume a host with an Ethernet address $(F5{-}00{-}00{-}00{-}00{-}E2)_{16}$ has joined the network. What would be its global unicast address if the global unicast prefix of the organization is 3A00:1111:0000 and the subnet identifier is ABCD? 5 (CO2) (PO1)

c) In distance vector routing, a node advertises its distance vector to its neighbors only. A distance vector is a list of all nodes that the node knows about. Each neighbor updates its routing table and sends the new distance vector to its neighbors. 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 are shared with its neighbors. How does the scenario change if we use the link state algorithm instead of the distance vector algorithm? With the aid of an example scenario, explain the 'counting to infinity' problem of distance vector routing protocols along with the possible solutions to overcome the problem. 12 (CO3) (PO1)

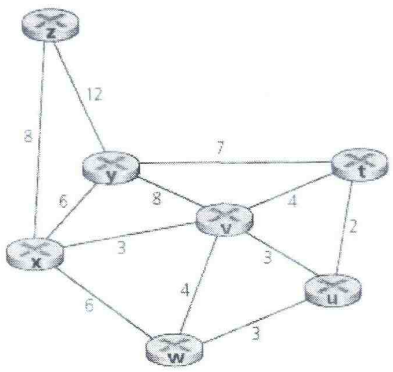

Figure 1: Network for Question 3.c)