ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2021-2022**

DURATION: 3 HOURS **FULL MARKS: 150**

CSE 4839: Internetworking Protocols

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

Answer **all 6 (six)** 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) Suppose you are designing a large-scale network with multiple Autonomous Systems (AS) and routers, and you need to implement a robust BGP routing policy to ensure efficient and reliable communication between different AS. Discuss in detail the BGP route selection process, including the role of various attributes and policies. Provide real-world examples to illustrate your points. — 10 (CO2) (PO2)

   b) Suppose you are a network engineer responsible for configuring BGP between two routers that connect two Autonomous Systems (AS). You need to troubleshoot a BGP peering issue between the two routers, where **router 1** is not receiving any BGP updates from the **router 2**.
   Using the appropriate BGP messages, explain how you would diagnose and resolve the issue. Specifically, describe the sequence of BGP messages exchanged between the two routers during the establishment of the BGP peering session, and identify the possible causes of the problem with the help of the BGP messages. — 10 (CO2) (PO2)

   c) Each router inside an AS has its intra-domain routing table (RIP, OSPF, etc.) for forwarding packets inside its own AS. Why does the speaker router not share this routing information with neighbor AS? How does the I-BGP help in this regard? — 5 (CO2) (PO2)

2. a) Suppose you are a network engineer responsible for designing and implementing a multicast network that spans multiple sites and supports both one-to-many and many-to-many applications.
   Using the appropriate reverse path mechanisms and protocols, describe how you would configure the multicast routing to ensure efficient and reliable delivery of multicast traffic across the network. Specifically, differentiate between Reverse Path Forwarding (RPF), Reverse Path Broadcasting (RPB), and Reverse Path Multicasting (RPM), and their usage in different parts of the network. — 10 (CO2) (PO2)

b)

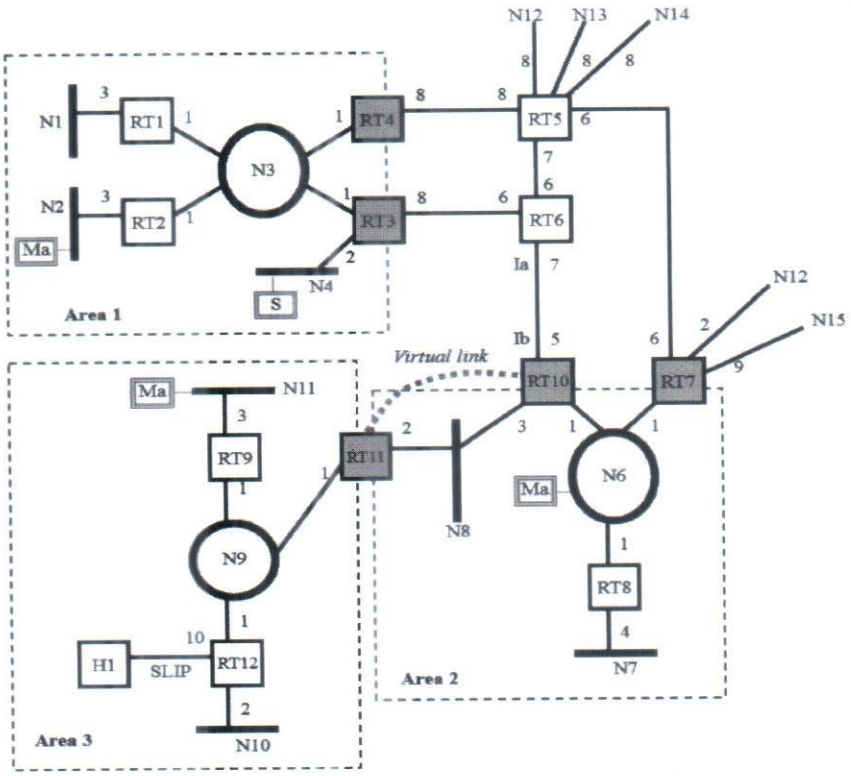

Figure 1: MOSPF with Areas for Question 2.a)

In the network depicted in **Figure *1***, Multicast OSPF (MOSPF) is used as the routing protocol. The source of the multicast message, labeled as **S**, is located in Area 1 and it is being sent to a multicast group with members present in all three areas, as indicated in **Figure *1***.

i. Describe the steps involved in the distribution of a multicast message from source S in Area 1 to members of a multicast group present in all three areas.
ii. Illustrate the MOSPF trees for the Source, Backbone, and Destination areas.
iii. Explain how the router's multicast routing tables are updated based on the MOSPF trees. Write down the updated table.

3.

Table 1: ARP Cache Table for Question 3.a)

State	*Queue*	*Attempt*	*Time-out*	*Protocol Addr.*	*Hardware Addr.*
R	3		80	188.11.8.71	E34573242ACA
P	2	1		129.34.4.8	
P	12	3		16.1.7.82	
R	18		60	180.14.15.2	457342ACAE32
F					
P	5	5		201.11.56.7	
F					

a) An ARP package of a host computer encounter the following events.

- The ARP output module receives an IP datagram (from the IP layer) with the following information in the Header.

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

- Twenty seconds later, the ARP output module receives an IP datagram (from the IP layer) with the following information in the Header.

(CO
(PO

45 00 00 C8 00 64 00 00 20 06 00 00 7C 4E 03 02 13 01 07 6E

- Fifteen seconds later, the ARP input module receives an ARP packet with target protocol (IP) address 188.11.8.71 and physical address ACAE32457342.

Show the updated cache table after each event. Also, show the cache table after 100 seconds. (Cache-control module update the entry of cache table after every 40 seconds)

Hardware Type (2 bytes)		Protocol Type (2 bytes)
Hardware Length (1 byte)	Protocol Length (1 byte)	Operation (2 bytes) Request 1, Reply 2
Sender Hardware Address (6 bytes for Ethernet)		
Sender Protocol Address (4 bytes for IPv4)		
Target Hardware Address (6 bytes for Ethernet)		
Sender Protocol Address (4 bytes for IPv4)		

Figure 2: ARP Message Format for Question 3.a)

b) The complex network of a large organization consists of multiple subnets and VLANs, and the DHCP servers are responsible for providing IP addresses and other network configuration parameters to the hosts. For some reasons the hosts are not receiving IP addresses from the DHCP servers.
Explain the DHCP message exchange process, including the types of messages, and the sequence of events that occur during the message exchange process. Then, discuss the possible reasons why the hosts are not receiving IP addresses. — 10 (CO1) (PO1)

c) Explain the importance of Address Resolution Protocol (ARP) in packet transmission. Explain why ARP is in between the IP layer and the Data-link layer. — 3+2 (CO2) (PO1)

4. a) What is the role of the DNS Root Server system in the overall operation of the DNS protocol, and how does it ensure the availability and reliability of the DNS infrastructure? — 10 (CO1) (PO1)

b) What does Domain refer to in the context of DNS (Domain Name System)? On the internet, the domain namespace is divided into three different sections. Differentiate those domain sections with appropriate examples — 10 (CO1) (PO1)

c) How do DNS servers interact with each other to resolve domain names across different zones and domains? — 5 (CO1) (PO1)

5.

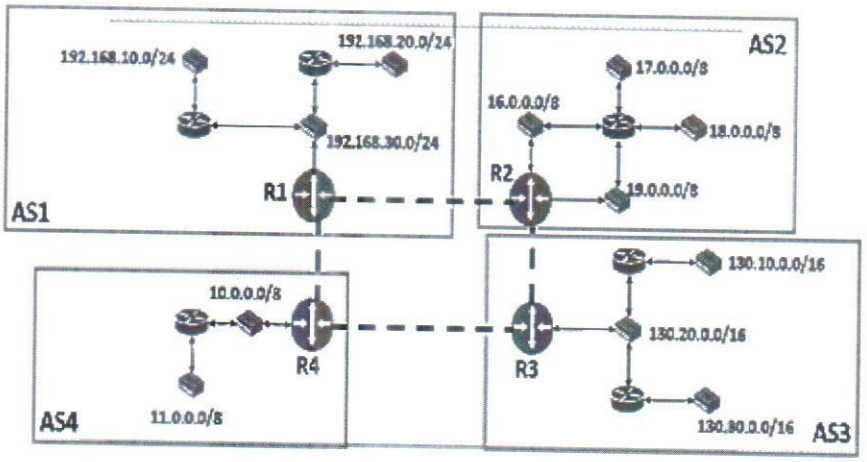

Figure 3: BGP areas with AS for Question 5.a)

a) Formulate and write down the reachability table for the above topology in the figure. Is it possible to decrease the size of the table with the help of aggregation? If possible, show the final table as well. (CO2 (PO2

b) The Core-Based Tree (CBT) protocol is a group-shared protocol that uses a core as the root. As a core, a rendezvous point is selected. The core then forms the tree for the successful transmission. 1 (CO2 (PO1
Explain what criteria are important for selecting the rendezvous router and how the tree is formed in CBT. Discuss how a multicast packet is sent through the rendezvous router in CBT.

c) A diskless client on an Ethernet network 192.168.16.0/24 uses DHCP. The DHCP server is on another Ethernet network 128.32.44.0/24. Draw a figure of the networks with appropriate IP addresses (assume the IP addresses from the given network range) for the client, server, and relay agent. Fill out a DHCP request and reply packet. Explain the role of the relay agent in this scenario. 1 (CO3 (PO2

6. a) What are the specific issues that traditional routing protocols fail to solve in Mobile Ad-Hoc Networks (MANET)? Explain why a separate protocol, specifically designed for MANET networks is necessary, while highlighting the shortcomings of existing protocols. Provide examples to support your answer. 1 (CO2 (PO1

b) Consider a scenario where a group of mobile nodes is moving in a remote location without any pre-existing infrastructure. As a network engineer, you have been tasked to design a routing network for these nodes using the AODV routing protocol. 1 (CO4 (PO3
However, during the implementation, you face several challenges such as nodes frequently moving in and out of the network, link disruptions, and the need to minimize network overhead while ensuring reliable and efficient routing.
In light of these challenges, explain in detail, how you would design a robust and efficient AODV routing network for the mobile nodes. Discuss the key steps you would take to ensure that the network remains stable and can handle the constantly changing conditions of a mobile ad-hoc network. Provide examples to support your answer.

c) Compare and contrast the Destination-Sequenced Distance Vector (DSDV) protocol and the Dynamic Source Routing (DSR) protocol for MANETs. Which protocol would you recommend for a large-scale MANET with high mobility and frequent topology changes? Justify your answer. 5 (CO3) (PO2)