

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2022-2023

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 with corresponding COs and POs in parentheses.

1. Consider a large outdoor music festival is taking place in a sprawling park. Thousands of attendees are spread out across the park grounds, moving from stage to stage to enjoy different performances. Due to the vast area and the temporary nature of the events, traditional infrastructure-based networking solutions are impractical. Instead, attendees rely on their smartphones and other mobile devices to stay connected to the Internet and share their experiences with friends and social media followers.
  - a) "Due to the vast area and the temporary nature of the events, traditional infrastructure-based networking solutions are impractical." - Justify the statement in the context of described music festival. 10  
(CO2)  
(PO2)
  - b) In the context of the described scenario, which MANET routing protocol among AODV, DSR, or DSDV would you consider the most suitable choice, and why? Additionally, what factors lead you to conclude that the other two protocols are less appropriate? 5 + 5  
(CO2)  
(PO2)
  - c) Describe the impact of clustering in MANET routing and its impact on scalability. 5  
(CO1)  
(PO1)
  
2. Consider a MANET consisting of 12 nodes is deployed in a disaster recovery operation. Each node represents a mobile device carried by a rescue team member. The nodes are spread across a rugged terrain with intermittent connectivity due to obstacles and varying signal strengths. The objective is to establish efficient communication among the nodes to coordinate search and rescue efforts.
  - a) Evaluate the suitability of the OLSR protocol for this disaster recovery operation. Discuss how OLSR addresses challenges such as intermittent connectivity, rugged terrain, and varying signal strengths. Additionally, analyze the protocol's effectiveness in maintaining communication reliability and facilitating coordination among the rescue team members in such challenging conditions. 3 + 4  
(CO2)  
(PO2)
  - b) Assuming any initial topology, generate the routing table for any single node in the described scenario using the OLSR protocol. Provide any necessary values or information for the calculation. 10  
(CO2)  
(PO2)
  - c) Describe the concept of Multipoint Relays (MPRs) in the OLSR protocol and how they are used to optimize flooding in the network. 2 + 3  
(CO1)  
(PO1)
  
3.
  - a) Explain how SDN can be adapted to optimize network performance and resource management in Big Data environments. Discuss architectural considerations and specific SDN applications for handling large volumes of data traffic. 5 + 5  
(CO5)  
(PO1)
  - b) How can the integration of SDN in cloud computing infrastructures enhance network agility, scalability, and service delivery of the cloud platform? Explain using examples of specific cloud services. Draw a diagram illustrating the SDN-integrated cloud architecture. 7 + 3  
(CO2)  
(PO2)
  - c) Explain the role of the Data Plane and the Control Plane in the SDN architecture. 5  
(CO1)  
(PO1)

4. You have been assigned to design an SDN architecture for a global financial institution with offices in major cities around the world. The network consists of thousands of switches, routers, and other network devices, serving diverse applications and services used by employees, customers, and partners. It supports critical financial transactions, real-time market data feeds, and secure communication between trading desks, clients, and partner institutions. The goal is to improve network agility, scalability, and manageability while minimizing costs and ensuring high availability and performance, meeting stringent security and compliance requirements.
- a) Given the size and complexity of the network, how would you determine the optimal number of controllers for the SDN deployment? Justify your answer considering the factors such as network size, traffic pattern, geographic dispersion, and application requirement. 10 (CO4) (PO2)
  - b) Where would you recommend placing the controllers within the network topology? Identify specific locations, such as data centers, regional hubs, or strategic points of presence (PoPs), and explain the justification behind each placement decision, taking into account network latency, bandwidth requirements, and redundancy. 10 (CO4) (PO2)
  - c) Discuss the advantages and disadvantages of using a centralized controller architecture in SDN compared to a distributed controller architecture. 5 (CO5) (PO1)
5. Considering the scenario in Question 4, answer the following questions:
- a) Suppose, you want to implement the network solution for the scenario using the Network Function Virtualization (NFV) approach. How would you separate the functionalities as Virtualized Network Functions (VNFs) to adapt in NFV architecture? Explain with a diagram. 10 (CO3) (PO2)
  - b) Can SDN and NFV be implemented together in the given scenario? If yes, how would you distinguish and allocate the respective modules and functions for SDN and NFV? What key factors would you consider in separating their roles and responsibilities? 5 + 5 (CO2) (PO2)
  - c) Explain the role of NFV Orchestrator (NFVO) in the NFV Management and Orchestration (NFV MANO) architecture. 5 (CO5) (PO1)
6. Some Internet service providers (ISPs) are deploying proprietary Content Delivery Network (CDN) cache nodes in their networks to improve delivery of video and other high-bandwidth services to their customers. Cache nodes typically run on dedicated appliances running on custom or industry standard server platforms. Both CDN cache nodes and CDN control nodes can potentially be virtualized.
- a) Using a virtualization architecture, describe how virtualization of CDN cache nodes and CDN control nodes enhances the delivery of high-bandwidth services to customers. 10 (CO5) (PO1)
  - b) What challenges might ISPs encounter when virtualizing CDN cache nodes and control nodes, and how can these challenges be addressed? 4 + 3 (CO5) (PO1)
  - c) Discuss the potential security challenges with the NFV deployment in this scenario. 8 (CO1) (PO1)