



Air University
Final Examination: Fall 2024

Student ID : 231340

Section II : Subjective
(To be solved on Answer Books only)

Subject: Computer Networks
Class: BS-CYS
Section(s): A&B
Course Code: CS - 360

Time Allowed: 03 Hours
Max Marks: 100 Marks
FM's Name: Azhar Ghafoor
FM's Signature:

INSTRUCTIONS

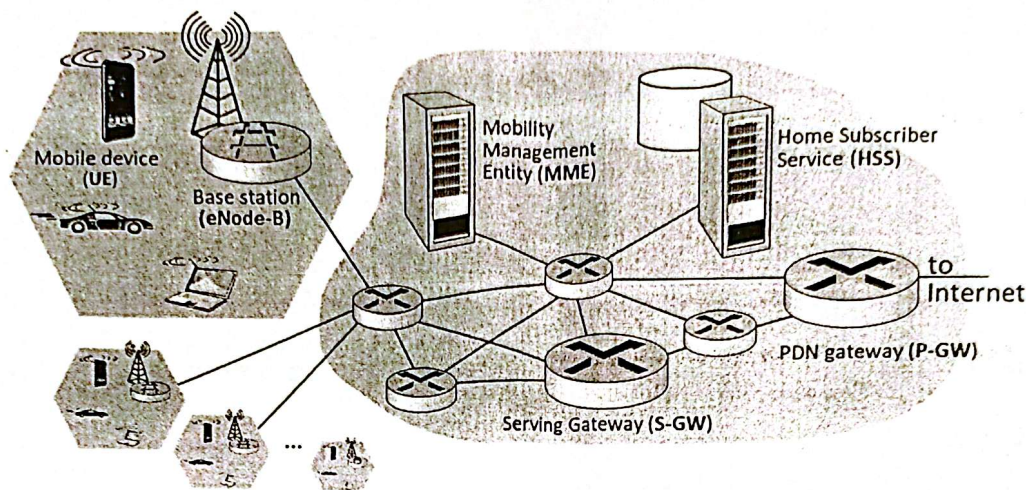
- Attempt responses on the answer book only.
- Nothing is to be written on the question paper.
- Rough work or writing on question paper will be considered as use of unfair means.
- Tables / calculators are allowed / not allowed.
- Questions will not be entertained during exam hours. Understanding the questions is part of the exam.

Q1: Imagine a university campus with multiple lecture halls, each equipped with its own Wi-Fi access point (AP). During a busy hour, hundreds of students in each hall simultaneously attempt to upload their assignments to a central server using the Wi-Fi network. This surge in network activity causes significant congestion and potential collisions in data transmission. (15 Marks) (CLO-2)

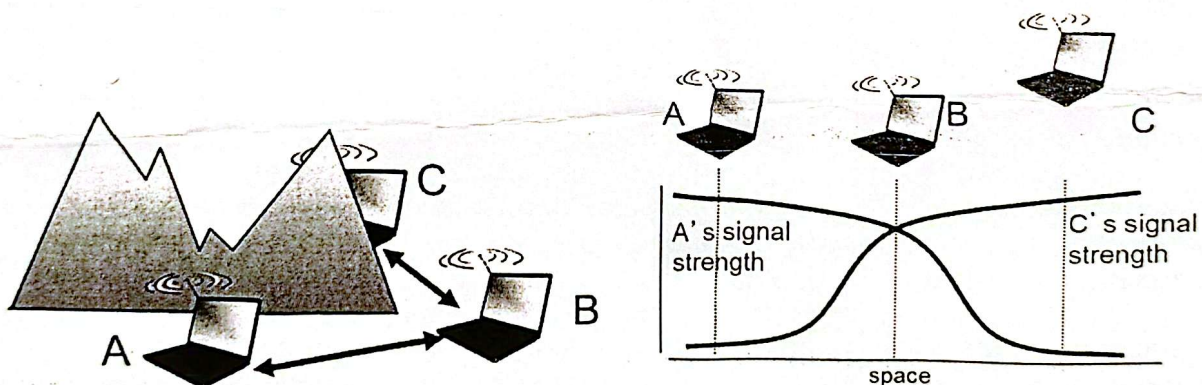
Given this scenario:

- a) *How does the IEEE 802.11 standard manage multiple access in such a dense environment? (5 marks)*
- b) *What specific mechanisms, like RTS/CTS (Request to Send/Clear to Send), might be used to avoid collisions? Explain how these mechanisms reduce interference from hidden terminals in this context. (5 marks)*
- c) *If the wireless link experiences high signal attenuation due to distance or obstacles within the halls, what additional features of the IEEE 802.11 standard could help maintain a stable connection? (5 marks)*

Q2: Explain the Elements of 4G LTE architecture in detail with real world examples (10 Marks) (CLO-2)



Q3: In a wireless network, three devices—Device A, Device B, and Device C—are located in a challenging environment with obstacles and varying signal strengths. Refer to the attached diagrams showing the physical arrangement of the devices and their signal strength patterns. (10 Marks) (CLO-3)



Analyze the given scenario in detail and answer the following:

- Describe the nature of the communication challenges faced by the devices in the given arrangement. Consider interference, connectivity, and any limitations observed from the diagrams (4 marks)
- Evaluate how the positioning of these devices and the signal attenuation depicted in the diagrams affect the overall network performance. Provide a detailed explanation of the issues that could arise and the potential impact on data transmission reliability. (6 marks)

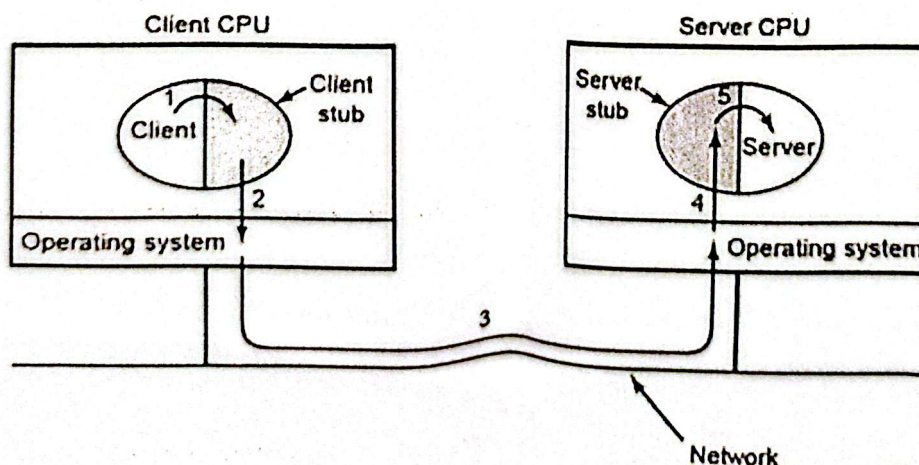
Q4: A device in Network A (192.168.2.30/24) sends a packet to a destination in Network D (192.168.5.6/24). The packet must traverse multiple networks (Network A, Network B, Network C, and Network D) through routers acting as gateways. Each router uses its routing table to determine the next hop based on the destination IP address. If a routing table lacks an entry for the destination network, the router either uses a default route or drops the packet. Misconfigurations, such as an incorrect default gateway, can disrupt packet delivery. Using this information, analyze the situation and create a visual representation of the network. (20 Marks) (CLO-3)

- Trace the journey of the packet from Network A to Network D. Identify the gateways involved and explain how the next-hop addresses are determined. (5 Marks)
- What happens if the router in Network C lacks a route to Network D? How could a default route resolve this? (5 Marks)
- If the device in Network A has an incorrect default gateway, describe the impact on packet delivery and how to fix the issue. (5 Marks)
- Create a figure illustrating the network topology, labeling all network IP ranges, gateway addresses, and next-hop details. (5 Marks)

Q5: Efficient bandwidth allocation is crucial for maintaining optimal network performance, especially under congestion. Your task is to analyze and propose solutions for balancing network demands between real-time and non-real-time applications. (20 Marks) (CLO-2)

- Analyze the trade-offs involved in implementing Quality of Service (QoS) policies to prioritize bandwidth allocation. (4 Marks)
- Imagine a network where real-time video calls are delayed due to bandwidth saturation caused by bulk file transfers. Propose a solution to dynamically regulate the sending rate and bandwidth allocation to prevent congestion. Justify your approach with specific examples. (4 Marks)
- Create two graphs to illustrate: (8 Marks)
 - The relationship between goodput and delay as data load increases in a network.
 - The impact of bandwidth allocation on delay for different application types (real-time vs. non-real time).
- Explain how the trends in these graphs can guide network engineers to optimize congestion control. (4 Marks)

Q6: Carefully analyze the given figure and answer the following (10 Marks) (CLO-3)

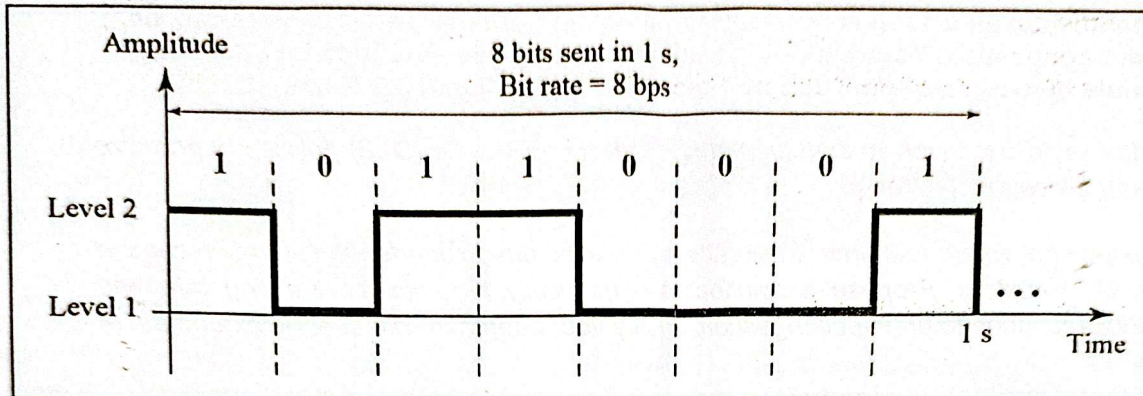


- What does the figure represent? Explain the concept it is illustrating. (2 Marks)

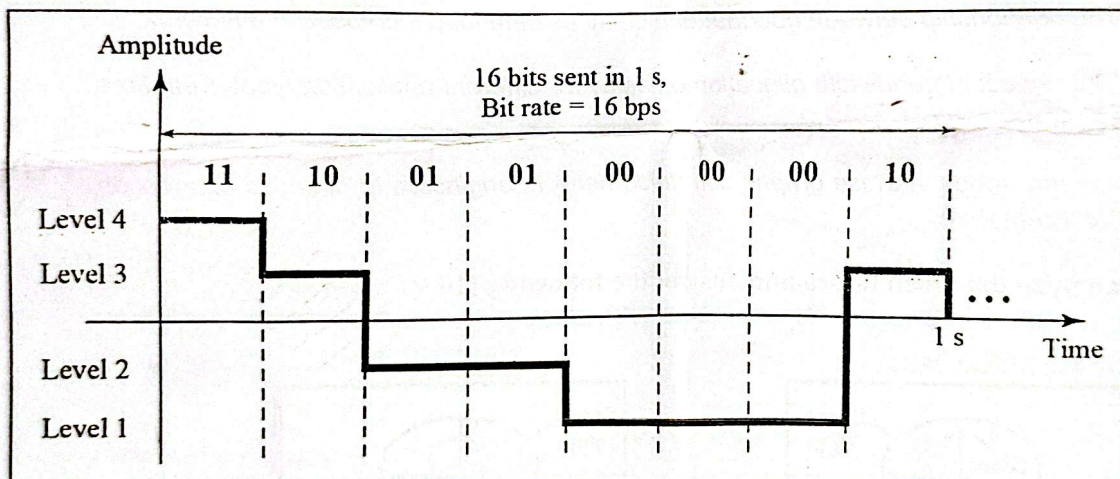
b) Describe how the process works step by step, highlighting the roles of each component. (4 Marks)

c) Create a detailed implementation figure of your own to represent how the process works in a real-world scenario. Include all necessary components and clearly label them. (4 Marks)

Q7: Carefully analyze the given figure and answer the following (15 Marks) (CLO-3)



a. A digital signal with two levels



b. A digital signal with four levels

a) A digital signal has eight levels. How many bits are needed per level? (6 Marks)

b) Discuss how increasing signal levels impacts the bit rate and signal complexity. (4 Marks)

c) Highlight the advantages and challenges of using higher signal levels in communication systems. (5 Marks)

Good Luck