



COMSATS University Islamabad

Department of Computer Science

Terminal Examination SPRING-2024

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Course Title: CSC339 Data Comm. & Computer Networks
Dated: 4th June 2024

Maximum Marks: 50
Time Allowed: 3 Hours

Note: All questions are self-explanatory and require no further explanations during exam time.

- Make sure that you have signed the attendance sheet before leaving the examination room.
- Return the question paper along with the answer sheet.
- Attempt all questions.

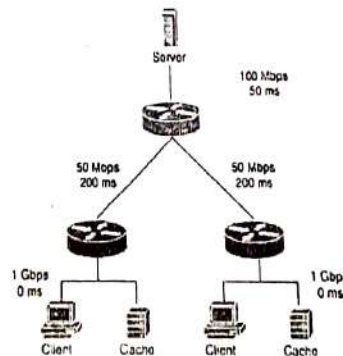
Name: _____

Reg no: _____

CLO-01 (8 Marks) Summarize the fundamental concept of Computer Networks

Question 1:

- [3 points] Suppose two hosts, A, and B, are separated by 20,000 kilometers, and are connected by a direct link of $R = 2$ Mbps. Suppose the propagation speed over the link is 2.5×10^8 meters/sec. Consider sending a file of 800,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time?
- [3 points] What is the end-to-end delay from; when a packet is transmitted by the server to, when it is received by the client? In this case, we assume there are no caches, there's no queuing delay at the routers, and the packet processing delays at routers and nodes are all 0. $b = 20000$



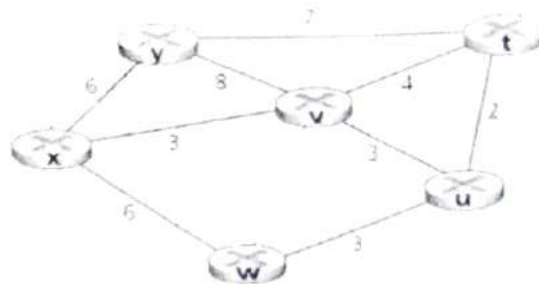
- [2 points] Briefly describe why the actual bandwidth on your cable access network connection on, e.g., a Saturday evening, could be significantly lower than what has been advertised by the provider (Comcast, Charter, etc.)? Would you see the same with a DSL-based provider?

CLO-02 (9 Marks) Apply the concept of computer networks to solve its related problems.

Question 2:

- [4 points] Consider the following network. With the indicated link costs, use Dijkstra's shortest path algorithm to compute the shortest path from x to all network nodes. Show how the algorithm works by computing routes and put the results in the table.

cable access networks often experience significant variations from advertised speeds during peak usage due to shared bandwidth, network congestion, and equipment limitations. While DSL-based providers may offer more stable speeds, they can also be influenced by distance from the service point and line quality, leading to variations in actual performance.



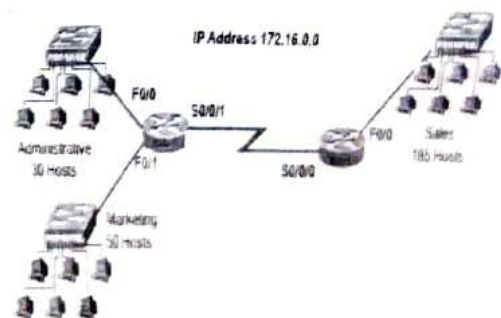
- b. [2 points] Suppose we have a communication channel with a bandwidth of 2 MHz and a signal-to-noise ratio (SNR) of 50. What would be the maximum achievable bit rate and the appropriate signal level for this channel?
- c. [3 points] Suppose a process in Host C has a UDP socket with port number 6789. Suppose both Host A and Host B each send a UDP segment to Host C with destination port number 6789. Will both segments be directed to the same socket at Host C? If so, how will the process at Host C know that these two segments originated from two different hosts?

CLO-03 (17 Marks) Analyze various protocols, algorithms and their functions in a network.

Question 3:

- a. [8 points] Based on the information in the graphic shown, design a classfull network addressing scheme that will supply the minimum number of hosts per subnet, and allow enough extra subnets and hosts for 25% growth in all areas. Circle each subnet on the graphic and answer the questions below.

- Address class: _____
- Custom subnet mask: _____
- Minimum number of subnets needed: _____
- Extra subnets required for 25% growth: _____
- Total number of subnets needed: _____
- Number of host addresses in the largest subnet group: _____
- Number of addresses needed for 25% growth in the largest subnet: _____
- Total number of addresses needed for the largest subnet: _____



- b. [3 points] Suppose a receiver using the CRC generator polynomial $x^3 + x + 1$ receives the sequence of bits 010010101101. Were they received correctly? If so, what was the transmitted message? If not, can you find out how many bit errors occurred? Show your work.
- c. [4 points] Suppose we define a different kind of graph where we have weights on the vertices and not the edges. Does the shortest path problem make sense for this kind of

graph? If so, give a precise and formal description of the problem. If not, explain why not. Note we are not asking for an algorithm, just what the problem is or that it makes no sense.

CLO-04 (16 Marks)

Comprehend the fundamentals of wireless and mobile networks along with the security issues.

Question 4:

- a. [3 points] What are the differences between message confidentiality and message integrity? Can you have confidentiality without integrity? Can you have integrity without confidentiality? Justify your answer. Moreover, what are the principle objectives of cryptography to secure the message.
- b. [5 points] If a periodic signal is decomposed into five sine waves with frequencies of 100, 300, 500, 700, and 900 Hz, what is its bandwidth? Draw the spectrum, assuming all components have a maximum amplitude of 5V.
- c. [3 points] In a wireless network using the RTS/CTS mechanism, if the RTS frame size is 20 bytes and the CTS frame size is 14 bytes, what is the total overhead introduced by the RTS/CTS handshake for each data transmission?
- d. [3 points] Suppose you're designing a new wireless communication protocol for IoT devices operating in a crowded urban environment. Would implementing a handshake mechanism like the RTS (Request to Send) and CTS (Clear to Send) frames in IEEE 802.11 networks be beneficial? Explain the potential advantages and disadvantages of incorporating such a mechanism into your protocol design.
- e. [2 points] Differentiate between:
 - a. Soft handoff vs. Hard handoff
 - b. Visited vs. home networks.