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 4411: Data Communication and Networking

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.

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1. John and Tom are communicating using a noisy channel. The protocol being used ensures re-sending of packets in case of failures. However, they observed that communication gets delayed when there are many packets to be sent. Tom identified that this is because if one of the packets gets dropped, all the current packets are resent.

   Now, answer the following questions:

   a) Identify the protocol used in the scenario and suggest an alternative that solves the problem identified by Tom. With necessary diagrams and examples, demonstrate the working procedure of the new approach by sending at least 10 packets. — 16 (CO3) (PO3)

   b) Discuss the required sizes of the send and receive windows of the new approach with proper justification. — 7 (CO1) (PO1)

   c) Discuss the usefulness of piggybacking in the case of above communication by John and Tom. — 7 (CO1) (PO1)

2. Jerry and Simon want to communicate with each other using TCP as the transport layer protocol. There is a server that helps in facilitating the connection. They are aware of the header flags required for connection establishment, connection termination, and data transfer.

   a) Explain the use of `SYN`, `PSH`, `ACK`, and `FIN` flags with proper examples. You can assume appropriate sequence and acknowledgement numbers. — 8 (CO1) (PO1)

   b) Why is the UDP still necessary given its unreliability? Provide a real-life scenario where this protocol is used. — 6 (CO1) (PO1)

   c) Identify the differences between the TCP and the UDP headers and provide an explanation for the differences. — 6 (CO1) (PO1)

3. a) A person is using a lightweight device for accessing a website. Suggest the suitable type of DNS resolution that should be applied for the given scenario. — 7 (CO1) (PO1)

   b) A client sends an HTTP request for a document to a server and the server sends the reply. After that, the client sends some information to the server. Identify and briefly describe the methods of HTTP used in this scenario. — 9 (CO1) (PO1)

   c) Write short notes on generic, country, and inverse domains. — 4 (CO1) (PO1)

4. a) You are the manager of an ISP company. Your ISP is granted a block of addresses starting with 155.55.0.0/16. The ISP wants to efficiently distribute these blocks to 352 customers as follows:

- The first group has 32 customers; each needs 256 addresses
- The second group has 64 customers; each needs 128 addresses
- The third group has 256 customers; each needs 64 addresses

Now, answer the following questions:

i. Design the sub-blocks and show the address allocation and distribution by the ISP. You can ignore the network and broadcast addresses. Find out how many addresses are still available after these allocations. — 12 (CO2) (PO2)

ii. Consider that, two customers from the first group need 510 addresses each. What changes can be incorporated to make this possible? — 7 (CO1) (PO1)

b) What is the main benefit of using Network Address Translation (NAT)? — 6 (CO1) (PO1)

c) Abbreviate the following IPv6 address with proper rules:
ABEC:0780:0000:0000:0000:C0EE:0000:AEEA. — 5 (CO1) (PO1)

5. a) What are the propagation time and the transmission time for a 3.5 kB message (an e-mail) if the network bandwidth is 0.5 Gbps? Assume that the distance between the sender and the receiver is 15,000 km and light travels at 2.5×10^8 m/s. — 6 (CO1) (PO1)

b) A clock has only minute hand and hour hand. Comment on the sampling rate for the clock using the concept of Nyquist Theorem. — 7 (CO1) (PO1)

c) Compare the constellation diagrams of 4-QAM and 8-QAM. — 5 (CO1) (PO1)

d) You are using an optical fiber cable with wavelengths ranging from 900nm to 1000nm. Each communication requires 10nm of wavelength. How many communications can be accommodated? Discuss the required multiplexing technique. — 7 (CO1) (PO1)

6. Renly and Rob want to communicate with each other. As suggested by Rob, they are using a technique where all the physical resources are dedicated for them during their communication.

a) Identify the switching technique they are using. Discuss the feasibility of using this approach if the network is scaled up. — 7 (CO2) (PO2)

b) Renly wants to use a technique where allocation of resources are done on demand. Discuss the merits and demerits of this approach. Suggest an alternative approach where both Rob and Renly's ideas can be incorporated together. — 6 + 4 (CO1) (PO1)

c) Using the idea of Hamming Distance, find out the size of the codeword if the dataword is of 2 bits and the objective is to detect one or two errors. — 8 (CO1) (PO1)