SCHOOL OF ENGINEERING AND TECHNOLOGY

FINAL EXAMINATION FOR THE BSc (HONS) INFORMATION TECHNOLOGY; BSc (HONS) INFORMATION TECHNOLOGY (COMPUTER NETWORKING AND SECURITY); BSc (HONS) COMPUTER SCIENCE; BACHELOR OF SOFTWARE ENGINEERING (HONS).

ACADEMIC SESSION   **: SEPTEMBER 2024 SEMESTER**

SUBJECT   **: NET2201 COMPUTER NETWORKS**

EXAMINATION   **: JANUARY 2025**

TIME ALLOWED   **: 2 HOURS + 10 MINUTES READING TIME**

INSTRUCTIONS TO CANDIDATES

This question booklet contains two sections.

Section A: Answer the **compulsory** questions.
Section B: Answer **two** questions out of three questions.

All answers must be written in the answer booklets provided using blue or black INK.

IMPORTANT NOTES TO CANDIDATES

Materials Allowed

Standard Items :   Pen, Pencil, Eraser or Correction Fluid, Ruler
Special Items   :   Non Programmable Calculators

It is your responsibility to ensure that you do **NOT** have in your possession any unauthorised notes or any other means that would improperly help you in your work. If you have any unauthorised materials with you, hand it to the invigilator BEFORE reading any further.

DO NOT REMOVE THIS QUESTION PAPER FROM THE EXAMINATION HALL

[This paper contains **FOUR** questions printed on **FOUR** pages, including cover page]

> **Section A**
> *Compulsory Section*

Question 1 [Typical Time Required: 1 Hour]   (Total: 50 marks)

(a) A network diagram is shown in Figure 1. Use the distance-vector algorithm to compute the shortest path from Node A to the rest of the nodes of the network. The link cost is indicated on each link. Assume each node initially knows the costs to each of its neighbors. Show the distance table entries at Node A.   **(15 Marks)**
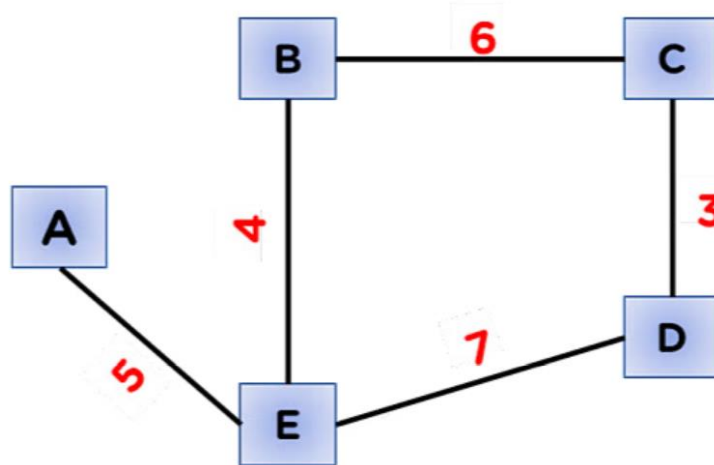

Figure 1. The Network Diagram for Q#1 (a)

(a) Discuss the concept of web caching and explain how it improves network performance.
(5 Marks)

(b) Differentiate between Packet Switched and Circuit Switched Networks in terms of the following: resource reservation, performance efficiency, and complexity.
(9 Marks)

(c) Consider two hosts X and Y connected by a single direct link of rate 10^6 bits/sec. The distance between the two hosts is 10,000 km and the propagation speed along the link is 2 x 10^8 m/sec. Host X sends a file of 50,000 bytes as one large message to host Y continuously. Find the transmission and propagation delays in milliseconds.
(5 Marks)

(d) Do you agree with the following statements? Please justify your response by explaining your reasoning for either agreeing or disagreeing with the statement.
(4*4 = 16 Marks)

   (i)   Stop-and-wait protocol must have sufficient buffer size to store packets at sender and receiver.
   (ii)   Processing delay is the longest among the four types of nodal delays.
   (iii)   The primary function of the Network Layer is to establish, maintain, and terminate connections between hosts.
   (iv)   The Transport Layer guarantees data delivery by establishing dedicated circuit connections between sender and receiver, similar to how traditional telephone systems operate.

Section B
Answer any TWO questions from this section.

Question 2 [Typical Time Required: 30 Mints]   (Total: 25 marks)

(a) Explain the characteristics and advantages of peer-to-peer (P2P) network architecture.   **(5 Marks)**

(b) Explain the concept of Medium Access Control (MAC), list the different types of MAC protocols, and differentiate between Carrier Sense Multiple Access (CSMA) and Carrier Sense Multiple Access with Collision Detection (CSMA/CD).
(10 marks)

(c) Differentiate between persistent and non-persistent HTTP connections, focusing on their connection behavior, advantages, and disadvantages. Provide examples as well.   **(10 marks)**

Question 3 [Typical Time Required: 30 Mints]   (Total: 25 marks)

(a) A file of size **F** = 50 Gbits is shared among **N** = 150 peers. The server has an upload speed of **us** = 80 Mbps, while each peer has a download rate of **di** = 10 Mbps and an upload speed of **ui** = 900 Kbps.

   (i)   Calculate the estimated distribution time in a client-server architecture.
(6 Marks)
   (ii)   Calculate the estimated distribution time in a peer-to-peer architecture.
(7 Marks)

(b) Determine if the following statements are true or false: **(3*4 = 12 Marks)**

   (i)   The size of the TCP rwnd never changes throughout the duration of the connection.
   (ii)   Suppose Host A is sending Host B a large file over a TCP connection. The number of unacknowledged bytes that A sends cannot exceed the size of the receiver buffer.
   (iii)   Suppose Host A sends Host B a large file over a TCP connection. If the sequence number for a segment of this connection is m, then the sequence number for the subsequent segment will necessarily be m+1.
   (iv)   TCP Tahoe uses fast recovery after packet loss.

Question 4 [Typical Time Required: 30 Mints]   **(Total: 25 marks)**

(a) Consider the following: **(15 Marks)**

Generator (G) = 11011
Data to be sent (D) = 110100110
Number of CRC Bits (r) = 4

Tasks
   (i)   Calculate the CRC R that needs to be appended to the data.
   (ii)   Form the transmitted codeword (c) by appending R to D.
   (iii)   At the receiver, verify the received codeword by performing the CRC check.
           Use the received codeword $C' = 110100110R$
;
(b) Explain the concept of Network Address Translation (NAT) and discuss its
       advantages and potential drawbacks in network management.   **(5 Marks)**
(c) Explain how a host acquires an IP address through the Dynamic Host
       Configuration Protocol (DHCP).   **(5 Marks)**

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