Name of the Program: B.Sc. in Computer Science and Engineering **14 June 2021**
Semester: Winter 2020-2021 **Time: 2:30 pm – 4:00 pm**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

Mid Semester Examination **Winter Semester: 2020-2021**
Course Number : CSE 4511 **Full Marks: 75**
Course Title : Computer Networks **Time: 1.5 Hours**

There are **3 (three)** questions. Answer all of them. Figures in the right margin indicate marks. The examination is **Online** and **Close Book**. Marks of each question and corresponding **CO** and **PO** are written in the brackets.

Write **Student ID** and **Name** top of the **first page** and write **student ID** and **page no** in every page of the answer script.
Submission pdf of the answer script should be named as **Full_Student_ID<space>Course Code.pdf**

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1. a) By applying the suitable probabilistic model determine the maximum achievable throughput of a pure ALOHA network. Derive the formula to calculate the average transfer delay of a pure ALOHA network. 5+6 (CO1) (PO1)

   b) A random access network uses the Pure ALOHA access protocol. The average input rate to each of the 150 stations is 1 packet per second and the packet is of constant length of 1000 bits. The channel capacity is 1 Mbps. 6 (CO1) (PO1)

      i. If the network is operated at this given throughput, what is the total traffic offered to the network per packet transmission time?

      ii. What is the average rate of retransmission per station?

      iii. What is the average number of retransmissions per successful transmission?

      iv. What is the average transfer delay if the back off strategy is to select an integer from the set {0, 1, 2, • • •, 19} with equal probabilities?

   c) "The vulnerable time in ALOHA depends on the frame transmission time, whereas it depends on the propagation delay in CSMA" -justify the statement in your own words using appropriate diagrams and equations. 8 (CO1) (PO1)

2. a) Demonstrate the looping problem of a transparent bridge with appropriate diagrams. Consider a system of four LANs (L_1 to L_4) interconnected by five bridges (B_1 to B_5). The bridges connect the LANs as follows: 7+4 (CO1) (PO1)

      i. B1 connects L1 and L2
      ii. B2 connects L1 and L3
      iii. B3 connects L1, L3 and L4
      iv. B4 connects L3 and L4
      v. B5 connects L1, L2, and L4

   Assume B_1 as the root bridge. Show the forwarding and the blocking ports after applying the spanning tree algorithm.

b) How does the Distributed Coordination Function (DCF) differ from the Point Coordination Function (PCF) as a MAC sublayer for *IEEE 802.11*? In CSMA/CA, contention window (CW) changes according to the binary exponential back-off strategy. The initial value of the contention window (CW_{min}) is 8. If a station requires 3 transmission attempts to successfully transmit a frame, what would be the back-off counter value for those transmission attempts? 4+3 (CO1) (PO1)

c) Can RTS-CTS hand-shaking completely eliminate the hidden station problem? If YES, then justify how the RTS-CTS hand-shaking avoids the collision from hidden nodes. If NO, then draw a frame exchange scenario where a collision occurs due to hidden nodes. 7 (CO1) (PO1)

3. a) Explain the concept of address aggregation and longest prefix matching for classless IPv4 addressing with appropriate network diagram. 9 (CO2) (PO1, PO2)

b) What is the subnet address and broadcast address of the host 172.16.88.255/20? A router receives a packet on an interface with a destination address of 172.16.46.191/26. What will the router do with the packet? 6 (CO2) (PO1, PO2)

c) Suppose you are working in a reputed ISP. You are given a class B network address 180.18.0.0 and you are asked to create subnets from the given network using the subnet mask 255.255.255.224 (which equivalent is to /27 in CIDR). Now as a network expert answer the following questions: 10 (CO2) (PO1, PO2)

i. How many subnets can be there?
ii. How many hosts per subnet?
iii. What are the valid last eight subnets?
iv. What are the broadcast addresses for the last eight subnets?
v. What are the valid hosts in the last eight subnets?

OR

a) Find the class and default mask of the following IPv4 address. Mention the number of possible IP addresses in each IP class. 6 (CO2) (PO1, PO2)

i. 11000001.00000010.11111110.00000000
ii. 25.23.12.25
iii. 172.32.25.14

b) What is the purpose of NAT? How is NAT related to private IP addresses? 6 (CO2) (PO1, PO2)

c) An ISP is granted a block of addresses starting with 172.15.0.0/16. The ISP wants to distribute these blocks to 2500 customers as follows: 13 (CO2) (PO1, PO2)

i. The first group has 100 medium-size business; each needs 32 addresses
ii. The second group has 400 customers; each needs 16 addresses
iii. The third group has 2000 customers; each needs 8 addresses

Design the sub blocks and show the address allocation and distribution by the ISP. Find out how many addresses are still available after these allocations.