Name of the Program: B.Sc. in Computer Science and Engineering	06 September 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)

Semester Final Examination	Winter Semester: 2020-2021
Course Number : CSE 4511 / CSE 4585 Course Title : Computer Networks	Full Marks: 75 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) Give the comparison between IPv4 options and IPv6 extension headers. An IPv4 datagram has arrived with the following information in the header(in hexadecimal) — 5+6 (CO2) (PO1,PO2)

   43 00 00 54 00 03 40 00 20 06 00 00 7C 4E 03 02 B4 0E 0F 02

   i. Is the packet corrupted?
   ii. Are there any options?
   iii. Is the packet fragmented?
   iv. How many more routers can the packet travel to?

   b) Both *IPv4* and *IPv6* assume that packet may have different priorities or precedence. Explain how each protocol handles this issue. — 6 (CO2) (PO1,PO2)

   c) Briefly explain the host autoconfiguration feature of *IPv6* addressing. An organization is assigned the block 2000:1456:2474/48. What is the *IPv6* address of an interface in the i_{th} subnet (**where i:= Last digit of your student ID**) if the IEEE physical address of the computer is **(F5-A'Student ID')$_{16}$**. For Example, The student having the ID 180041250 should consider the physical address as $(F5\text{-}A1\text{-}80\text{-}04\text{-}12\text{-}50)_{16}$ — 8 (CO2) (PO1,PO2)

2. a) With the aid of necessary diagrams briefly explain the working principal of Link State Routing Protocols. How does link state routing differ from path vector routing? — 7+4 (CO3) (PO1,PO2)

   b) What is the purpose of including the IP header and the first 8 bytes of datagram data in the error reporting ICMPv4 messages? Name different components of ARP package. — 4+3 (CO2) (PO1,PO2)

   c) Mention the possible ways to solve the counting to infinity (C2I) problem of distance vector routing. Does path vector routing use the same solutions to solve the looping problem? Explain. — 7 (CO3) (PO1,PO2)

3. a) With the help of state transition diagram briefly explain the half-close termination of TCP. A TCP client opens a connection using an initial sequence number (ISN) of **N** (**where N:= Last 4 digits of your student ID**). The TCP server opens the connection with an ISN of M (**where M:=N+1000**).Show the Time-line diagram for connection establishment. (Use timeline in y-axis for each side to show the **states** and the **relative duration** of the client and the server.) — 9 (CO2) (PO1, PO2)

   b) How does SCTP differ from TCP and UDP as a transport layer protocol? What are the significant changes of a SCTP packet over a TCP segment? — 6 (CO2)

c) Briefly explain the significances of TIME-WAIT timer. A host sends five packets and receives three acknowledgments. The time is shown as hour:minute:seconds. (PO1, PO2) 10 (CO2) (PO1, PO2)

i. Segment 1 was sent at 0:0:00.
ii. Segment 2 was sent at 0:0:05.
iii. ACK for segments 1 and 2 received at 0:0:07.
iv. Segment 3 was sent at 0:0:20.
v. Segment 4 was sent at 0:0:22.
vi. Segment 5 was sent at 0:0:27.
vii. ACK for segments 3 and 4 received at 0:0:45.
viii. ACK for segment 5 received at 0:0:65.

Calculate the values of RTT_M, RTT_S, RTT_D, and RTO of the retransmission timer of TCP. Given that the original RTO is **N** seconds.

(The value of N should can be calculated from your student ID using the following formula. **N:= (Last three digits of student ID mod 10)+2** For Example, The student having the ID 180041250 should calculate the value of N as follows:

N:=(250 mod 10)+2
⇨ N:=0+2
⇨ N:=2)

OR

a) An SCTP client opens an association using an initial tag of 2200, an initial TSN of 11111, and a window size of 30000. The server responds with an initial tag of 1100, an initial TSN of 250, and a window size of 15000. Show the time-line diagram of the association establishment. Ignore the value of the cookie but mention the significances of using cookie. 6 (CO2) (PO1, PO2)

b) Mention the significances of using verification tag in SCTP general header. Name some features and services of SCTP those are not applicable for TCP and UDP. 6 (CO2) (PO1, PO2)

c) A TCP source sends segments of equal size, and maintains the sequence number for each segment (i.e., the TCP protocol is segment-oriented instead of byte-oriented). Assume that the sequence number of the first data segment is N (where **N:= Last three digits of your student ID**). The size of the receiver window (*rwnd*) is always larger than the congestion window (*cwnd*). For the first data segment, assume that the value of the *cwnd* is 1, and the value of the slow start threshold (*ssth*) is 65000. 13 (CO2) (PO1, PO2)

You are asked to draw a timing diagram, where the y-axis shows the time, and two parallel lines in the y-axis represent the events (sending and receiving of data and ACK segments, *cwnd* values, etc.) at the source and destination TCP.

Assume that the source always tries to send as many data segments as it is allowed to.

Draw the diagram considering the followings:

- The successful transmission of at least 20 segments.
- Seventh (7_{th}) Segment is lost, and the source identifies this by triple du acknowledgments.
- Fourteenth (14_{th}) Segment is lost (assume subsequent segments are also lost), source identifies this by a timeout.
- At the left side of the source TCP timeline, show the value of *cwnd* an whenever they are updated.
- Identify the slow start, congestion avoidance, congestion detection region source TCP timeline.