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Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Specialised in Computer Systems and Network Engineering

Final Examination
Year 1, Semester 2 (2022)

IE1020 – Network Fundamentals

Duration: 2 Hours

November 2022

Instructions to Candidates:

- This paper has 4 questions.
- Answer all questions in the booklet given.
- The total mark for the paper is 100.
- This paper contains 4 pages, including the cover page.
- Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.

Question 1 — 25 Marks

a. The Data-link layer is the second layer from the bottom in the OSI (Open System Interconnection) network architecture model. It is further divided into two sub-layers.

   i. Name the two sub-layers in the data link layer (2 marks)

   ii. Explain the functions performed by each sub-layer (4 marks)

b. Use a diagram and explain the steps used by a switch to learn MAC Addresses (5 Marks)

c. The process that converts data into signals for transferring over a medium is called modulation. This process can be digital or analog.

   i. Name three Analog Modulation techniques (3 Marks)

   ii. Explain each of the above techniques using diagrams (6 Marks)

d. What is Pulse Code Modulation (PCM)? (2 Marks)

   i. Use a diagram and explain the steps used in Pulse Code Modulation (PCM). (3 Marks)

Question 2 — 30 Marks

a. Migration from IPv4 to IPv6 is required due to the depletion of IP addresses in IPv4.

   i. State three IPv4 to IPv6 migration techniques. (3 marks)

   ii. Write down the IPv6 address "ab50:0000:0000:000b:0089:1234:0002:4500" in the compressed form. (2 marks)

b. Assume that you are a newly appointed Network Engineer for Xiteb (PVT) Limited, a high-tech networking solutions development company. The company has been contracted to implement a networking project from Lanka Hospital, to interconnect the main hospital which is located in Colombo with four sub hospitals which are located in Galle, Kandy, Jaffna and Anuradhapura.

The Lanka hospital needs to manage all these five networks as separate Local Area Networks and interconnect them to transfer patients' medical reports and other relevant information.

You have been assigned to design an IP addressing scheme for the network to interconnect the main hospital with the four sub-hospitals, adhering to the following requirements.

Office	**No. of hosts required**
Main Hospital	120
Kandy branch	12
Galle branch	30
Anuradhapura branch	32
Jaffna branch	14

Assume that the organisation is using the network 192.168.10.0/24.

i. Build the IP addressing plan for the network and write down the following details for each subnet.

Branch	Network address of the subnet with the prefix	Subnet mask	Broadcast address	First usable IP address	Last usable IP address

Copy the given table to your answer booklet to provide answers. (15 Marks)

ii. Draw a logical network topology diagram for the scenario based on the addressing plan built in question i. (10 Marks)

Question 3 — 30 Marks

a. State the main functions performed by the Network Layer in the ISO/OSI Reference Model? (3 Marks)

b. Compare and contrast Interior Gateway Protocols (IGP) and Exterior Gateway Protocols (EGP). (4 Marks)

c. Consider sending 5000 Byte Segment into an Ethernet link.

i. Using a diagram clearly illustrate the fragmentation process within the Network Layer. (4 Marks)

ii. What are the offset values for each fragment (2 Marks)

iii. What flags need to be set for each fragment (2 Marks)

d. Draw a time sequence diagram to illustrate the TCP Connection Establishment, 1 Byte data request and 1 Byte data response, and TCP Connection Termination.

Your diagram should clearly show all TCP messages, Sequence numbers (SN), Acknowledgement numbers (ACK), and respective TCP states. You may assume any suitable number as your Initial Sequence number (ISN). Further, you may assume that the MTU is 1500 bytes. (15 Marks)

Question 4 — 15 Marks

a. Compare and contrast Traditional Networks and Converged networks? (2 Marks)

b. Name three services offered by the Application layer (3 Marks)

c. Briefly explain two functionalities of the Presentation Layer. (4 Marks)

d. Explain the process of data Encapsulation and Decapsulation in ISO/OSI layered architecture. (6 Marks)