## **Take-Home Assignment 02**

- 1) List and briefly describe the important duties of the Network Layer of the OSI Model.
  - **Logical Addressing** Assigns IP addresses to devices, helping identify them uniquely across networks.
  - **Routing** Chooses the best path for data to travel from source to destination using routers.
  - **Packet Forwarding** Transfers data packets from one network to another based on their IP addresses.
  - **Fragmentation and Reassembly** Breaks large data packets into smaller ones if needed and reassembles them at the destination.
  - **Error Handling** Helps detect routing errors and controls congestion in the network.
- 2) The IP protocol identifies each computer connected to the network by its corresponding address.
  - a) What is the length of an IPv4 address in bits? The length of an IPv4 address is 32 bits.
  - b) How many octets are there in an IPv4 address, and how many bits are there in an octet?

    An IPv4 address has 4 octets, and each octet is 8 bits long.
  - c) Briefly explain how to write an IPv4 address using decimal numbers and how the decimal numbers can be separated. An IPv4 address is written in decimal format by converting each 8-bit (octet) binary value into a number (0–255). The four decimal numbers are separated by dots (periods).

**Example:** 192.168.1.1

3) Briefly explain how in each of the IPv4 classes, the 32 bits of the address are divided into the network portion and the host portion by default.

Class	<b>Network Bits</b>	<b>Host Bits</b>	<b>Address Range (1st Octet)</b>
A	8 bits	24 bits	1 to 126
В	16 bits	16 bits	128 to 191
C	24 bits	8 bits	192 to 223

4) With the aid of a suitable example for each class, briefly explain how to identify a given IPv4 address.

## Class A

• Example: 10.0.0.1

• First octet: 10 (between 1–126)  $\rightarrow$  Class A

Network portion: 10Host portion: 0.0.1

## Class B

• Example: 172.16.5.4

• First octet: 172 (between 128–191)  $\rightarrow$  Class B

• Network portion: 172.16

• Host portion: 5.4

## Class C

• Example: 192.168.1.1

• First octet: 192 (between 192–223)  $\rightarrow$  Class C

• Network portion: 192.168.1

• Host portion: 1

5) Write the first 5 and last 5 first octet values of A class IP address in binary numbers. 6) Briefly explain how many network IDs and host addresses can be created for each of the first 3 classes.

**Class A range**: 1 – 126

- First 5 octet values in binary:
  - $\circ$  1  $\rightarrow$  00000001
  - $\circ$  2  $\rightarrow$  00000010
  - $\circ$  3  $\rightarrow$  00000011
  - $_{\circ}$  4  $\rightarrow$  00000100
  - $\circ$  5  $\rightarrow$  00000101
- Last 5 octet values in binary:
  - $\circ$  122  $\rightarrow$  01111010
  - $\circ$  123  $\rightarrow$  01111011
  - $\circ$  124  $\rightarrow$  01111100
  - $\circ$  125  $\rightarrow$  01111101
  - $0.0126 \rightarrow 011111110$
- 6) Briefly explain how many network IDs and host addresses can be created for each of the first 3 classes.

Class	Network IDs	<b>Hosts per Network</b>
A	126 (1–126)	16,777,214 (2 <sup>24</sup> - 2)
В	16,384 (128.0 – 191.255)	$65,534 (2^{16} - 2)$
C	2,097,152 (192.0.0 – 223.255.255)	$254(2^8-2)$