جامعة القاهرة

Dept. of Electronics and Electrical
Communication Engineering
Faculty of Engineering – Cairo University

Fourth Year
Academic Year 2011/2012

ELC403A - Computer Networks
Sheet 3

Problem 1 *(Domain Name Server)*

Hierarchical naming reduces the size of the name server tables. This exercise explores that reduction. Imagine there are 10^9 names in the Internet. Propose decomposition into domains and subdomains. How many entries will be in each name server? Next, propose a three level decomposition: Domains, Subdomains, and Sub-subdomains. How many entries in each name server? What happens as the number of levels in the hierarchy increases?

Problem 2 *(Domain Name Server)*

Consider the following network setup:

- Internet Lab at EE Dept. of the Faculty of Engineering/Cairo University (EEN) is connected to:
- Network facilities at the Faculty of Engineering/Cairo University (FOECU) which is connected to:
- Internet Service Provider for Egyptian universities (EUN) which is connected to:
- Internet Access provider in U.S.A. (UUNET) which is connected to:
- Internet service provider in state of Washington (WSN) which is connected to:
- Network facilities at Microsoft Corporation in Seattle, Washington (MSN) which is connected to:
- Research Lab dealing with Microsoft Office Products (MOPN) in Microsoft Corporation.

a) Propose a layout for DNS's that would be needed in order for a student at EE Dept. to access a file at MOPN.

b) Explain the steps that are followed in order to deduce the IP address of the server at MOPN starting from a PC at EEN.

c) Once the name is resolved into an IP address it will be cached for future use. However this information has a time to live after which it is deleted. State two reasons why we do that.

Problem 3 *(IP Addressing)*

If you have the following facts:

- Number of schools in Egypt is 30000
- Number of Governorates in Egypt is 30
- Number of ministries in Egypt is 20

- Number of domains in Egypt is 10
- Number of international bodies in the world is 250

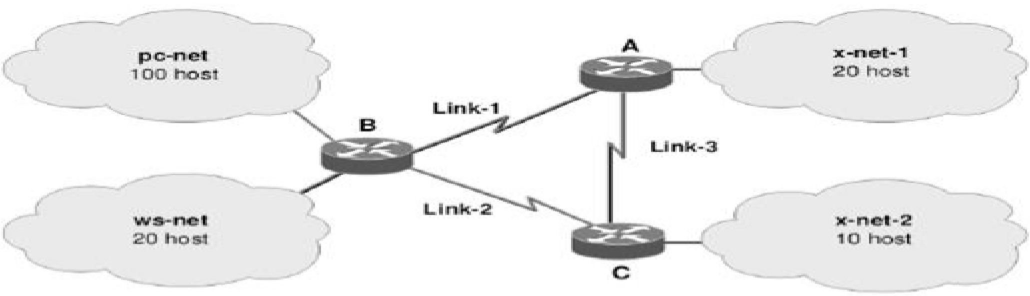
Propose an IP addressing scheme for the Ministry of Education that allows each school to be connected to the Internet. Your proposal should include the total number of the set of IP addresses, an example of the address range for each set, the network mask associated with each set and the utilization factor in each of the following cases:

a) Using class B without subnetting
b) Using class B with subnetting
c) Using CIDR

Problem 4 *(VLSM)*

For the shown network topology, it is required to assign IP addresses for all PCs in pc-net, ws-net, x-net 1 and x-net 2. Propose an addressing scheme for them considering the following two cases:

a) Without using VLSM.
b) Using VLSM.



Problem 5 *(Routing Tables)*

A router has the table shown below:

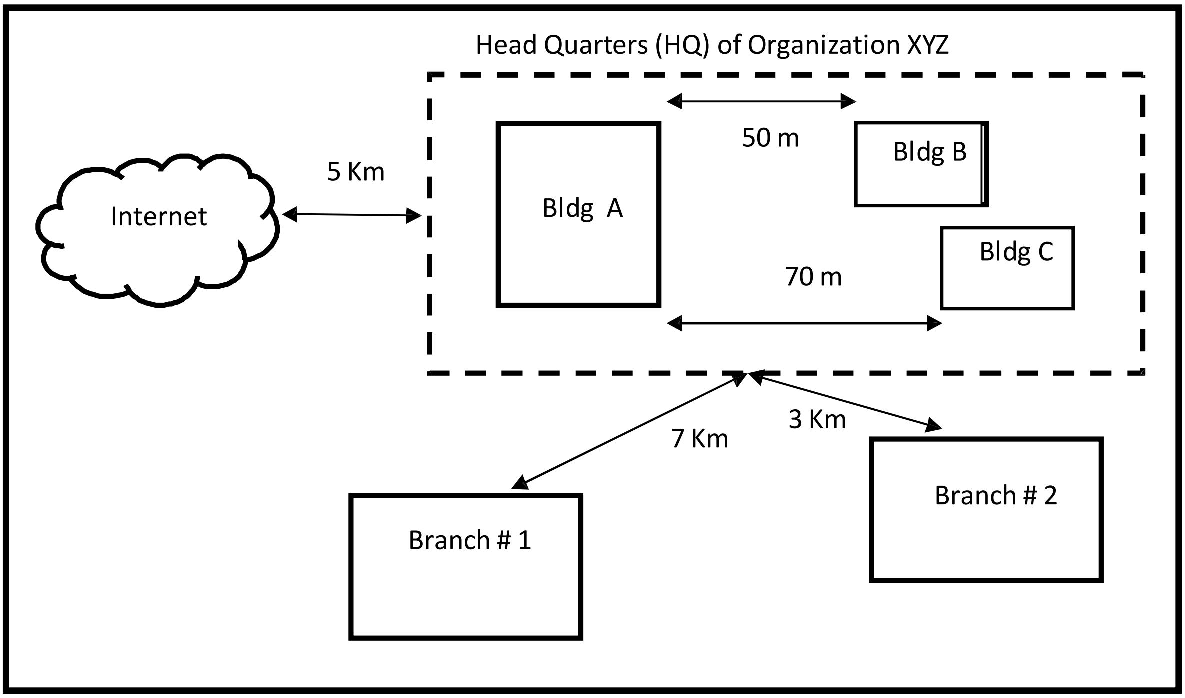
SubnetNumber	SubnetMask	NextHop
128.96.39.0	255.255.255.128	Interface 0
128.96.39.128	255.255.255.128	Interface 1
128.96.40.0	255.255.255.128	R2
192.4.153.0	255.255.255.192	R3
⟨Default⟩		R4

What does the router do with IP packets with the following destination addresses:

(a) 128.96.39.10
(b) 128.96.40.12
(c) 128.96.40.151
(d) 192.4.153.17
(e) 192.4.153.90

Problem 6 *(IP Addressing)*

-For the shown topology, suppose that organization XYZ has the following layout:



Further, assume that: Bldg A has 100 PCs, Bldg B has 50 PCs, Bldg C has 30 PCs, Branch #1 has 60 PCs, and Branch #2 has 40 PCs.

You are asked to design a computer network for organization XYZ that achieves the following connectivity requirements:

1- All PCs in each Bldg, and all PCs in each Branch are interconnected together.
2- Bldgs A, B and C are interconnected together.
3- The THREE sites: HQ, Branch #1 and Branch #2 are interconnected together.
4- The company is connected to the Internet via a link from the HQ.

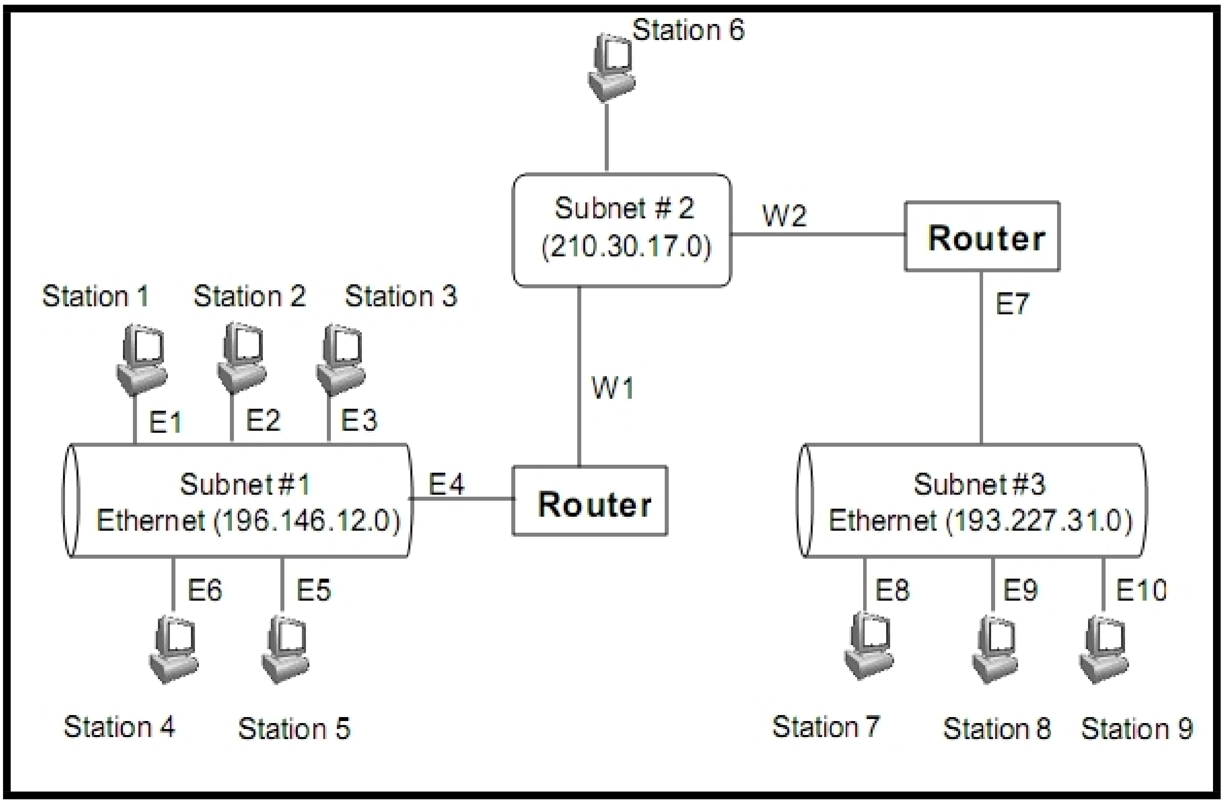
a) Propose a suitable design to achieve the above requirements by specifying the following information:
   i) Type and number of networking devices (hubs, switches and routers) to be used in each building (A, B and C) and in each branch (Branch #1 and Branch #2).
   ii) The connection diagram between the various devices proposed in i) above. (Distinguish between LAN links and WAN links)

   Remark: Assume that a hub or switch can have up to 48 ports in one device, while a router can have multiple ports.

b) If each PC is given a separate IP address, propose the required range of IP's needed to allow communication between them using the IP protocol. In your answer, consider the following THREE cases:
   Class-based addressing – Subnetting addressing – CIDR addressing
   For each case, calculate the efficiency of the proposed IP range.

Problem 7 *(Addressing and Fragmentation)*

For the shown internet:



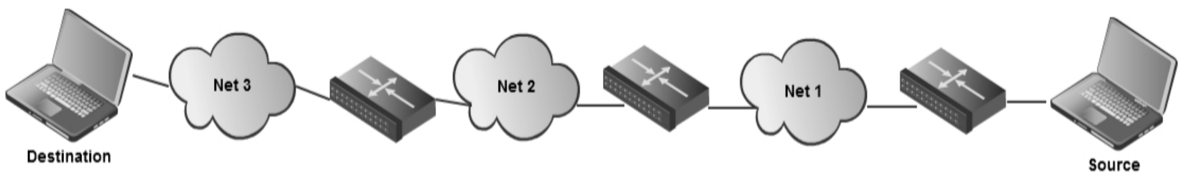
- Propose suitable IP addresses for the various components and subnetwork masks associated with subnetworks #1, #2 and #3.

- Explain h*ow station 1 can send a frame to station 4 and then to station 8. Assume that stations have knowledge of only the IP address.

- If subnet #1 uses an Ethernet with maximum transfer unit of 1500 bytes, and subnet #2 uses a leased line with maximum transfer unit 512 bytes, Find the total number of fragments received by station 6 from station 2 if the last one transmits message of 30000 bytes.

Problem 8 *(Fragmentation)*

Consider the following network. The MTU of networks: 1, 2 and 3 are 64535, 1520 and 512 respectively. The source generates a packet with payload length of 40,000 octets.



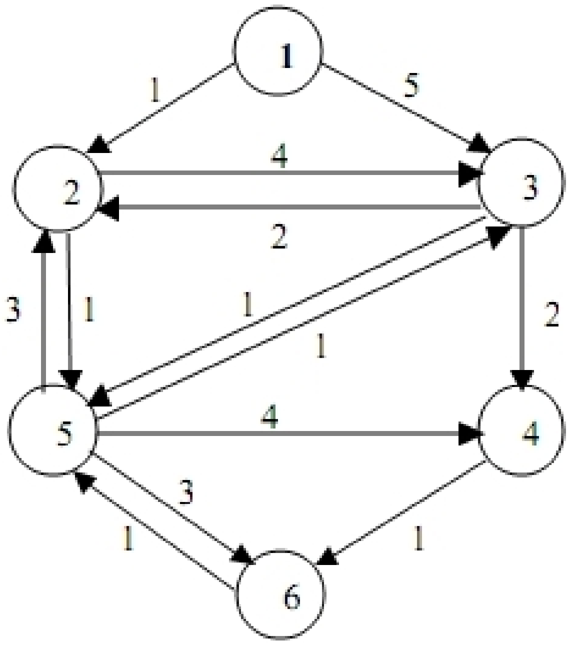
a) Find the total number of fragments received at the destination.

b) The following illustrates IP fragments received by destination. Find the Identification number (ID), Fragment offset (FO), More fragments (MF) and Total length (TL) fields of the original fragment (before being secondly fragmented.) Note that TL field value is equal to IP header length + the carried data length. The IP header length is assumed to be fixed to 20 bytes.

TL = 512	MF = 1	FO = 39000	ID = 10
TL = 512	MF = 1	FO = 39492	ID = 10
TL = 36	MF = 0	FO = 39984	ID = 10

Problem 9 *(Dijkstra Algorithm)*

Find the shortest paths between node 6 and all nodes in the shown network graph using Dijkstra's shortest path algorithm. For each step write down the set of up nodes, set of neighbours and set of remaining nodes. In addition, identify for each of the above nodes the minimum distance to 6, and the corresponding path.



Problem 10 *(IP Addressing)*

An ISP with a class B address is working with a new company to allocate it a portion of address space based on CIDR. The new company needs IP addresses for machines in three divisions of its corporate network: Engineering, Marketing, and Sales. These divisions plan to grow as follows: Engineering has 5 machines as of the start of year 1 and intends to add 1 machine every week; Marketing will never need more than 16 machines; and Sales needs 1 machine for every two clients. As of the start of year 1, the company has no clients, but the sales model indicates that by the start of year 2, the company will have six clients and each week thereafter gets one new client with probability 60%, loses one client with probability 20%, or maintains the same number with probability 20%.

a) What address range would be required to support the company's growth plans for at least seven years if marketing uses all 16 of its addresses and the sales and engineering plans behave as expected?
b) How long would this address assignment last? At the time when the company runs out of address space, how would the addresses be assigned to the three groups?
c) If CIDR addressing were not available for the seven-year plan, what options would the new company have in terms of getting address space?