



Birzeit University
Faculty of Engineering and Technology
Department of Electrical and Computer Engineering
ENCS3320 – Computer Networks (Term 1241)

Name: **Solution** ID: _____ Section: _____

A company has acquired the IP address block **192.168.88.0/22** from an Internet Service Provider (ISP). The company's network topology is illustrated in the figure below. The network includes a sales department with 156 devices and a management department with 28 devices. Based on this information, answer the following questions:

- 1) Determine whether the address space is public or private.

The address space is **private** (part of Class C private addresses).

- 2) Identify the total number of subnets in the company's network and label each subnet on the figure.

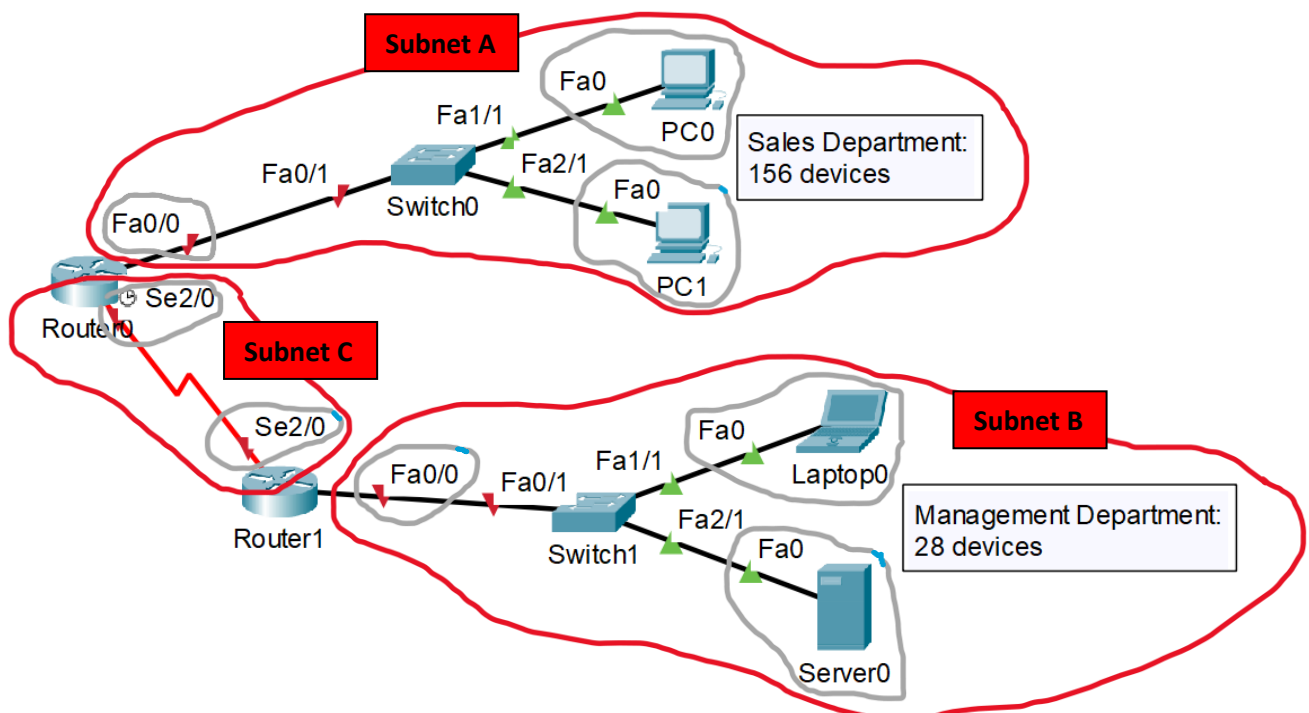
The network includes **3 subnets**, labeled **Subnet A**, **Subnet B**, and **Subnet C** in the figure.

- 3) Identify and circle the interfaces of all hosts and devices that require an IP address.

A total of **4 router interfaces** and **4 end devices** require an IP address, as marked in the figure.

- 4) Assign an IP address to each subnet. Ensure that the allocation minimizes the amount of address space used while leaving the largest possible contiguous block(s) of unused address space available for future subnet expansion. For each subnet, specify the following details:

- A) The IP address in CIDR notation.
 B) The subnet mask.
 C) The broadcast IP address.
 D) The starting address (first usable host IP address)
 E) The ending address (last usable host IP address)



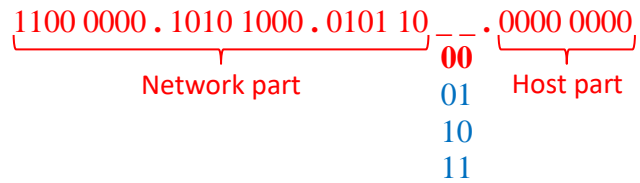
1100 0000 . 1010 1000 . 0101 10 __ . ____ . ____ . ____
0 0 . ____ . ____ . ____ . ____
0 1 . 0 0 0 . ____ . ____ . ____ . ____
0 1 . 0 0 1 0 . 0 0 . ____ . ____

(Subnet **A** – 8 bits for host part)
 (Subnet **B** – 5 bits for host part)
 (Subnet **C** – 2 bits for host part)

A) Subnet A (Sales Department):

This subnet requires **159 IP addresses** (156 devices + 3 for network, broadcast, and gateway). Using **8 bits** for hosts ($2^8 = 256$), the subnet requires /24.

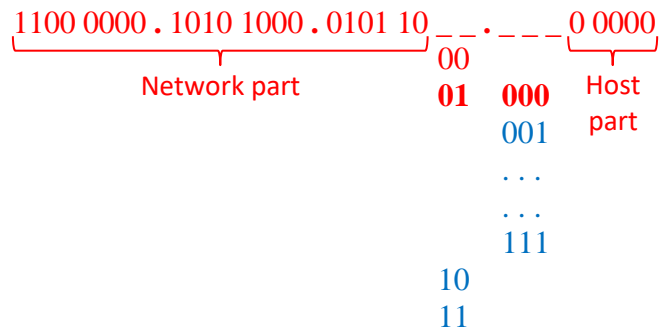
- 1) IP Address (CIDR): 192.168.88.0/24
- 2) Subnet Mask: 255.255.255.0
- 3) Broadcast Address: 192.168.88.255
- 4) First usable host IP address: 192.168.88.1
- 5) Last usable host IP address: 192.168.88.254



B) Subnet B (Management Department):

This subnet requires **31 IP addresses** (28 devices + 3 for network, broadcast, and gateway). Using **5 bits** for hosts ($2^5 = 32$), the subnet requires /27.

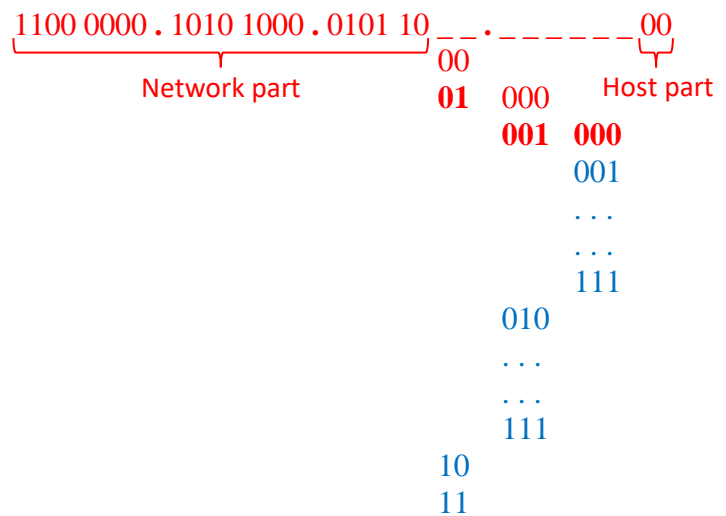
- 1) IP Address (CIDR): 192.168.89.0/27
- 2) Subnet Mask: 255.255.255.224
- 3) Broadcast Address: 192.168.89.31
- 4) First usable host IP address: 192.168.89.1
- 5) Last usable host IP address: 192.168.89.30



C) Subnet C:

This subnet requires **4 IP addresses** (2 interfaces + 2 for network and broadcast). Using **2 bits** for hosts ($2^2 = 4$), the subnet requires /30.

- 1) IP Address (CIDR): 192.168.89.32/30
- 2) Subnet Mask: 255.255.255.252
- 3) Broadcast Address: 192.168.89.35
- 4) First usable host IP address: 192.168.89.33
- 5) Last usable host IP address: 192.168.89.34



Note: The unused IP address blocks, highlighted in blue, represent contiguous blocks of free address space available for future subnetting.

GOOD LUCK