**Question:-**

**You have been appointed as the network administrator for a university campus. The university needs a well-structured network to accommodate different departments and facilities. The requirements for the network are as follows: • Administration Department: Requires 60 devices. • Computer Science Department: Requires 200 devices. • Library: Requires 100 devices. • Student Housing: Requires 300 devices. The university has been assigned the IP address range 172.16.0.0/22.**

Ans:-

Given requirements-

Administration Department: 60 devices.

Computer Science Department: 200 devices.

Library: 100 devices.

Student Housing: 300 devices.

Total devices: 660

Every department needs two more devices one is for network and one Is for broadcast.

So total devices needed are 668.

**1.Subnet Creation: • Divide the given IP address range (172.16.0.0/22) into subnets that will accommodate the required number of devices for each department and facility. • Ensure each subnet has enough addresses for the specified number of devices.**

IP address range (172.16.0.0/22) gives 1024 total IP Addresses (172.16.0.0 to 172.16.3.255).

The subnet size is calculated based on power of 2. We take the nearest power of 2 from the devices.

Now calculate address according to the descending order of required devices so that we left with minimum wastage. So we will calculate for Student housing first than computer science department and so on.

**For Student Housing-**

Required: 300 devices

Additional devices: 2

Total devices: 302 (or 302 address are required)

Nearest power of 2: 512 (2^9)

Subnet mask: 255.255.254.0

Subnet: 172.16.0.0/23

Address range: 172.16.0.0 to 172.16.1.255

So this address range has enough addresses for specified number of devices.

**For computer science department-**

Required: 200 devices

Additional devices: 2

Total devices: 202 (or 202 address are required)

Nearest power of 2: 256 (2^8)

Subnet mask: 255.255.255.0

Subnet: 172.16.2.0/24

Address range: 172.16.2.0 to 172.16.2.255

So this address range has enough addresses for specified number of devices as this has total 256 IP addresses.

**For Library-**

Required: 100 devices

Additional devices: 2

Total devices: 102 (or 102 address are required)

Nearest power of 2: 128 (2^7)

Subnet mask: 255.255.255.128

Subnet: 172.16.3.0/25

Address range: 172.16.3.0 to 172.16.3.127

So this address range has enough addresses for specified number of devices as this has total 128 IP addresses.

**For Administrative department-**

Required: 60 devices

Additional devices: 2

Total devices: 62 (or 62 address are required)

Nearest power of 2: 64 (2^6)

Subnet mask: 255.255.255.192

Subnet: 172.16.3.128/26

Address range: 172.16.3.128 to 172.16.3.190

So this address range has enough addresses for specified number of devices as this has total 64 IP addresses.

**2. Calculate Subnet Mask and CIDR: • Determine the subnet mask and CIDR notation for each created subnet.**

**Student housing-**

Subnet mask: 255.255.254.0

CIDR: 172.16.0.0/23

**Computer science department-**

Subnet mask: 255.255.255.0

CIDR: 172.16.2.0/24

**Library-**

Subnet mask: 255.255.255.128

CIDR: 172.16.3.0/25

**Student housing-**

Subnet mask: 255.255.255.192

CIDR: 172.16.3.128/26

**3. Hosts Calculation: • Calculate the total number of addresses and the number of usable host addresses for each subnet.**

Total address= 2^number of host bits

Usable address= Total address-2

**Student Housing-**

Total Host address= 512

Usable Host address = 512-2= 510

**Computer science department-**

Total Host address= 256

Usable Host address = 256-2= 254

**Library-**

Total Host address= 128

Usable Host address = 128-2= 126

**Student Housing-**

Total Host address= 64

Usable Host address = 64-2= 62

**4. Network Address and Broadcast Address: • Identify the network address and broadcast address for each subnet.**

**Student Housing-**

Network address: 172.16.0.0

Broadcast address: 172.16.1.25

**Computer science department:**

Network address: 172.16.2.0

Broadcast address: 172.16.2.255

**Library-**

Network address: 172.16.3.0

Broadcast address: 172.16.3.127

**Student Housing-**

Network address: 172.16.3.128

Broadcast address: 172.16.3.191