Task 1

Current users = 100

Projected increase in next 5 years = 50% = $\frac{50}{\text{of }100} = \frac{50}{100} \times 100 = 50$

∴ Total users after 5 years = 100 + 50 = 150
  (old) (new)

Available network segments to choose from :-

(i) 10.1.0.0/25

⟶⟶ In this network segment we have 25 bits in Network ID (i.e., NID) and as IP address is of 32 bits (IP v4) we have only 7 bits remaining for Host ID (HID)

> And maximum number of IP adds. with 7 bits is $2^7 = 128$.

> But our requirement is of 150 users.

> Therefore, this network segment 10.1.0.0/25 is not fit for our use case.

> 10.1.0.00000000,
  ‾‾‾‾‾‾‾‾ ‾‾‾‾‾‾‾‾
  NID   HID
  (25 bits) (7 bits)

> Here, Maximum IP addresses
  = $2^7 = 128$.

But Maximum Host = $2^7 - 2 = 126$

here, we subtracted '2' because 1st IP is used as NID and last IP is used as Broadcast ID, So it can't be assigned to any host. //

(ii) 10.1.0.0/24

→ But here in this network segment (10.1.0.0/24) we have 24 bits in NID and 8 bits are available for HID.

→ 10.1.0.00000000
  ‾‾‾‾‾‾‾‾‾ ‾‾‾‾‾‾‾‾
  NID (24 bit) HID (8 bit)

∴ Maximum IP addresses = $2^8 = 256$ possible

Maximum Host possible = $2^8 - 2 = 254$.
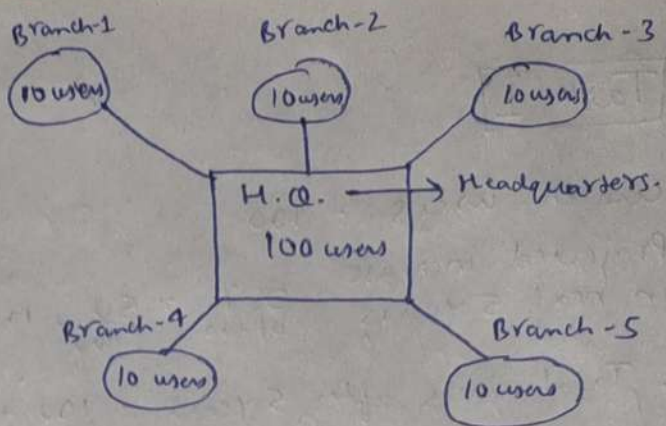
→ Hence this network segment is perfect to use. //

Ans→ we would choose → 10.1.0.0/24 network segment.

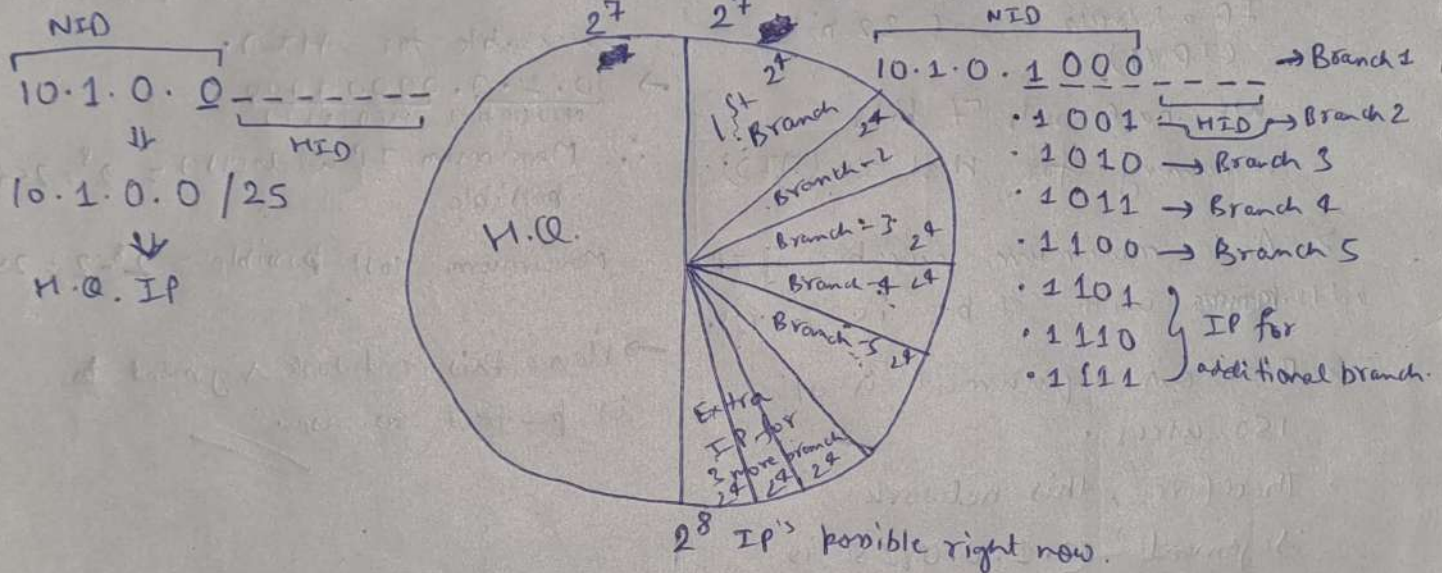| Task 2	here, HQ = Headquarters.

> Total users = 150
> Divisional H.Q. = 100 users.
> Each branch = 10 users
> Total no. of branch = 5 branch

→ To find → Assign IP addresses to each of the six office from the chosen network segment 10.1.0.0/24, also find how many additional branches could be supported with the remaining IP addresses.

Soln:- We would solve the problem using VLSM technique :-

Our Network segment → 10.1.0.0/24

We have 8 bits in HID (Host ID) So,

$$\text{NID} \quad 2^7 \quad 2^7 \quad \text{NID}$$

```
NID
10.1.0.0 --------
  ‖        HID
10.1.0.0/25
  ↓
H.Q. IP
```


2^8 IP's possible right now.

```
              NID
10.1.0.1 0 0 0 ----- → Branch 1
  .1 0 0 1 ← HID → Branch 2
  .1 0 1 0 → Branch 3
  .1 0 1 1 → Branch 4
  .1 1 0 0 → Branch 5
  .1 1 0 1 ⎫
  .1 1 1 0 ⎬ IP for
  .1 1 1 1 ⎭ additional branch.
```

Step 1 :- 2^8 possible IP addresses.

Step 2 :- After fixing one bit for subnet, 2^8 IP address space is divided into two separate sub-networks, each having 2^7 possible IP's. And, we will assign one 2^7 IP space network to H.Q.

Step 3 :- Now, we have to create IP's for 5 other offices for which we will have to divide the rest of 2^7 ~~IP's~~ remaining IP addresses.

step 4 :- Requirement :- 5 subnetworks
Remaining :- 7 bits in HID

So, for 5 subnetworks we need to borrow minimum of 3 bits from HID.

step 5:- So, after doing that we will get 5 branches, in addition we would get extra IP space for similar 3 more branches.

Step 6 :– IP distribution is given as :–

H.Q. IP → 10.1.0.0/25 ; DBA = 10.1.0.127

↗ Network Segment 1

Branch-1 Ip → 10.1.0.128/28 ; DBA = 10.1.0.143

Branch-2 IP → 10.1.0.144/28 ; DBA = 10.1.0.159

Branch-3 IP → 10.1.0.160/28 ; DBA = 10.1.0.175

Branch-4 IP → 10.1.0.176/28 ; DBA = 10.1.0.191

Branch-5 IP → 10.1.0.192/28 ; DBA = 10.1.0.207

IP/network	Host/netw...
128	126
16	14
16	14
16	14
16	14
16	14

Additionally '3' more branches could be supported with following Network segment IP addresses.

	Network Segment	DBA	IP/network	Host
New – Branch – 6 =	10.1.0.208/28	; 10.1.0.223	16	14
New – Branch – 7 =	10.1.0.224/28	; 10.1.0.239	16	14
New – Branch – 8 =	10.1.0.240/28	; 10.1.0.255	16	14

Here, HQ = Headquarters and DBA = Direct Broadcast Address.

Task 3

Solution →
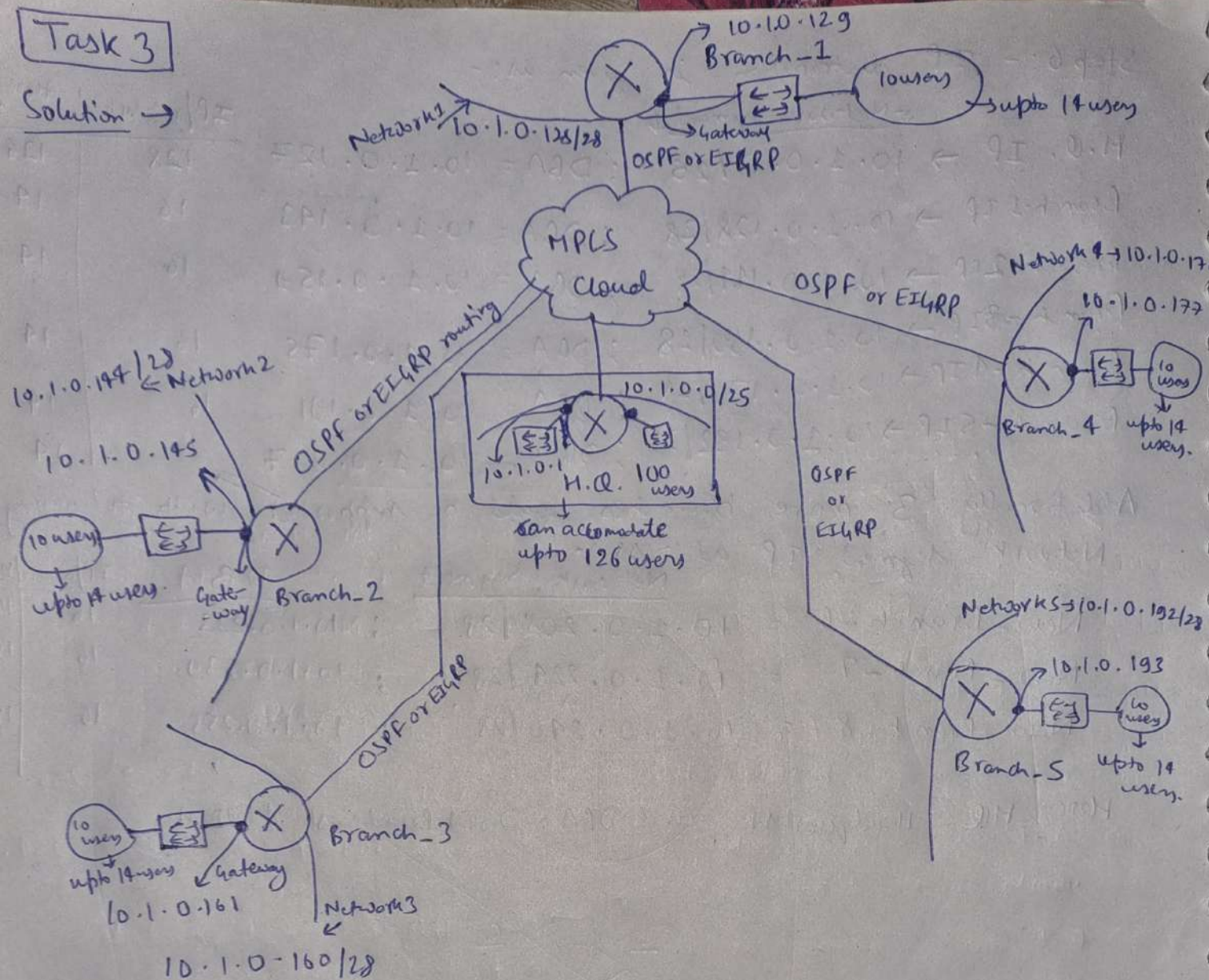
Office	Network address / Inter IP segment	DBA	No. of Hosts	Default Gateway.
H.Q.	10.1.0.0 /25	10.1.0.127	126	10.1.0.1
Branch_1	10.1.0.128 /28	10.1.0.143	14	10.1.0.129
Branch_2	10.1.0.144 /28	10.1.0.159	14	10.1.0.145
Branch_3	10.1.0.160 /28	10.1.0.175	14	10.1.0.161
Branch_4	10.1.0.176 /28	10.1.0.191	14	10.1.0.177
Branch_5	10.1.0.192 /28	10.1.0.207	14	10.1.0.193