

➤ Q\_0: You have an IP address and a mask: 27.25.38.154 /28.

Q\_0a: Write down all possible subnets of this network in the following format with all numbers in dotted-decimal:

32-28=4. Subnet is 11111111. 11111111. 11111111.11110000 → 255.255.255.240

$2^4 = 16$  so each subnet contains 16 hosts

- 0) 27.25.38.0 --- 27.25.38.15 --- 255.255.255.240
- 1) 27.25.38.16 --- 27.25.38.31 --- 255.255.255.240
- 2) 27.25.38.32 --- 27.25.38.47 --- 255.255.255.240
- 3) 27.25.38.48 --- 27.25.38.63 --- 255.255.255.240
- 4) 27.25.38.64 --- 27.25.38.79 --- 255.255.255.240
- 5) 27.25.38.80 --- 27.25.38.95 --- 255.255.255.240
- 6) 27.25.38.96 --- 27.25.38.111 --- 255.255.255.240
- 7) 27.25.38.112 --- 27.25.38.127 --- 255.255.255.240
- 8) 27.25.38.128 --- 27.25.38.143 --- 255.255.255.240
- 9) 27.25.38.144 --- 27.25.38.159 --- 255.255.255.240
- 10) 27.25.38.160 --- 27.25.38.175 --- 255.255.255.240
- 11) 27.25.38.176 --- 27.25.38.191 --- 255.255.255.240
- 12) 27.25.38.192 --- 27.25.38.207 --- 255.255.255.240
- 13) 27.25.38.208 --- 27.25.38.223 --- 255.255.255.240
- 14) 27.25.38.224 --- 27.25.38.239 --- 255.255.255.240
- 15) 27.25.38.240 --- 27.25.38.255 --- 255.255.255.240

Q\_0b: to which subnet belongs given IP address? (Write a number “n” from the list above)

Answer: 9

Since 27.25.38.154 is between 27.25.38.144-27.25.38.159, it must be in 9's subnet;

Other way is looking to result of bitwise--> IP address(27.25.28.144) AND subnet address(255.255.255.240) which is 27.25.28.144. Since we know that each subnet has 16 host, by dividing 144 to 16 we get 9's subnet;

➤ Q\_1: Your brother is the head of Helios Petroleum. They are moving to a new building and he asked you to help him out with the new LAN for them. They need 2 subnets with 100 available IP addresses inside each (part “a”) subnet AND 6 subnets with 16 available IP addresses inside each (part “b”) subnet. Will you help him?

$$2^6 = 64 \quad 2^7 = 128 \quad 2^4 = 16 \quad 2^5 = 32$$

We need to choose closed number with mind that 2 host will not be available. So for “a” it is 128 and for “b” it is 32 because  $16-2=14$  is smaller than required 16 available IP addresses.

a) 150.20.35.0

Subnet is equal to 11111111.11111111.11111111.10000000 which is 255.255.255.128

Each subnet contains 128 hosts

0) 150.20.35.0 --- 150.20.35.127 --- 255.255.255.128

1) 150.20.35.128 --- 150.20.35.255 --- 255.255.255.128

#### b) 70.11.23.0

Subnet is equal to 11111111.11111111.11111111.11100000 which is 255.255.255.224

Each subnet contains 32 hosts

0) 70.11.23.0 --- 70.11.23.31 --- 255.255.255.224

1) 70.11.23.32 --- 70.11.23.63 --- 255.255.255.224

1) 70.11.23.64 --- 70.11.23.95 --- 255.255.255.224

1) 70.11.23.96 --- 70.11.23.127 --- 255.255.255.224

1) 70.11.23.128 --- 70.11.23.159 --- 255.255.255.224

1) 70.11.23.160 --- 70.11.23.191 --- 255.255.255.224

➤ Q\_2: You are given an IP address 90.121.34.55/22. Give us network, broadcast addresses and subnet mask for it

$32 - 22 = 10$ ; So subnet is 11111111. 11111111. 11111100.00000000 which is 255.255.252.0

90.121.34.55 in bits  $\rightarrow$  01011010.01111001.00100010.00110111

By making last 10 bits of IP address equal to zero we find network:

01011010.01111001.00100000.00000000  $\rightarrow$  90.121.32.0

By making last 10 bits of IP address equal to one we find broadcast:

01011010.01111001.00100011.11111111  $\rightarrow$  90.121.35.255

Network: 90.121.32.0 || Broadcast: 90.121.35.255 || Subnet Mask: 255.255.252.0

➤ Q\_3: Pick any IP you like, following these rules: • First octet must not exceed 223; • All octets must be bigger than 102; • Difference between octets must be bigger than 22; • Third and Fourth octets must be even; Your mask is /21. As you chose your IP, give me network, broadcast addresses and subnet mask for it. (Do not forget to provide CALCULATIONS). If you break one of the rules above, you will get zero. Be, careful.

My IP address is : 222.197.172.144/21

$32 - 21 = 11$ ; So subnet mask is 11111111. 11111111. 11111000.00000000 which is 255.255.248.0

222.197.172.144 in bits  $\rightarrow$  11011110. 11000101. 10101100. 10010000

By making last 11 bits of IP address equal to zero we find network:

11011110. 11000101. 10101000. 00000000 → 222.197.168.0

By making last 11 bits of IP address equal to one we find broadcast:

11011110. 11000101. 10101111. 11111111 → 222.197.175.255

Network: 222.197.168.0 || Broadcast: 222.197.175.255 || Subnet Mask: 255.255.248.0

➤ The National Clinic asked you to organize an internal network for them. They want 4 different subnets for 4 different branches. The network you chose is 18.50.73.0 /24 1<sup>st</sup> branch – Hematology, 20 PCs. 2<sup>nd</sup> branch – Cardiology, 61 PCs. 3<sup>rd</sup> branch – Pulmonology, 25 PCs. 4<sup>th</sup> branch – Surgery, 101 PCs.

1<sup>st</sup> branch need 20PC's + one for network + one for broadcasting, thus 22 hosts, closest  $2^5 = 32$

2<sup>nd</sup> branch need 61PC's + 2, thus 63 hosts, closest  $2^6 = 64$

3<sup>rd</sup> branch need 25PC's + 2, thus 27 hosts, closest  $2^5 = 32$

4<sup>th</sup> branch need 101PC's +2, thus 103 hosts, closest  $2^7 = 128$

$32+64+32+128=256=2^8$

Order is 1<sup>st</sup> branch → 3<sup>rd</sup> branch → 2<sup>nd</sup> branch → 4<sup>th</sup> branch, in increasing order

1<sup>st</sup> branch calculation-----

$32-5=27 \rightarrow 18.50.73.0 /27 \rightarrow$  so subnet is 11111111. 11111111. 11111111.11100000  
→255.255.255.224

IP address in bits → 00010010.00110010.01001001.00000000

By making last 5 bits of IP address equal to zero we find network:

00010010.00110010.01001001.00000000→ 18.50.73.0

By making last 5 bits of IP address equal to one we find broadcast:

00010010.00110010.01001001.00011111→ 18.50.73.31

1st usable host ip address is equal to network address + 1

last usable host ip address is equal to broadcast address -1

1 – Hematology – 18.50.73.0 – 18.50.73.1 – 18.50.73.30 – 18.50.73.31 – 255.255.255.224

2<sup>nd</sup> branch calculation-----

$32-5=27 \rightarrow 18.50.73.32/27 \rightarrow$  so subnet is 11111111. 11111111. 11111111.11100000  
→255.255.255.224

IP address in bits → 00010010.00110010.01001001. 00100000

By making last 5 bits of IP address equal to zero we find network:

00010010.00110010.01001001. 00100000 → 18.50.73.32

By making last 5 bits of IP address equal to one we find broadcast:

00010010.00110010.01001001. 00111111 → 18.50.73.63

1st usable host ip address is equal to network address + 1

last usable host ip address is equal to broadcast address -1

3 – Pulmonology – 18.50.73.32 – 18.50.73.33 – 18.50.73.62 – 18.50.73.63 – 255.255.255.224

3<sup>rd</sup> branch calculation-----

32-6=26 → 18.50.73.64/26 → so subnet is 11111111. 11111111. 11111111.11000000  
→ 255.255.255.192

IP address in bits → 00010010.00110010.01001001. 01000000

By making last 6 bits of IP address equal to zero we find network:

00010010.00110010.01001001. 01000000 → 18.50.73.64

By making last 6 bits of IP address equal to one we find broadcast:

00010010.00110010.01001001. 01111111 → 18.50.73.127

1st usable host ip address is equal to network address + 1

last usable host ip address is equal to broadcast address -1

2 – Cardiology – 18.50.73.64 – 18.50.73.65 – 18.50.73.126 – 18.50.73.127 – 255.255.255.192

4<sup>th</sup> branch calculation-----

32-7=25 → 18.50.73.128/25 → so subnet is 11111111. 11111111. 11111111.10000000  
→ 255.255.255.128

IP address in bits → 00010010.00110010.01001001. 10000000

By making last 7 bits of IP address equal to zero we find network:

00010010.00110010.01001001. 10000000 → 18.50.73.128

By making last 7 bits of IP address equal to one we find broadcast:

00010010.00110010.01001001. 11111111 → 18.50.73.255

1st usable host ip address is equal to network address + 1

last usable host ip address is equal to broadcast address -1

4 – Surgery – 18.50.73.128 – 18.50.73.129 – 18.50.73.254 – 18.50.73.255 – 255.255.255.128

Final Answer:

1 – Hematology – 18.50.73.0 – 18.50.73.1 – 18.50.73.30 – 18.50.73.31 – 255.255.255.224

3 – Pulmonology – 18.50.73.32 – 18.50.73.33 – 18.50.73.62 – 18.50.73.63 – 255.255.255.224

2 – Cardiology – 18.50.73.64 – 18.50.73.65 – 18.50.73.126 – 18.50.73.127 – 255.255.255.192

4 – Surgery – 18.50.73.128 – 18.50.73.129 – 18.50.73.254 – 18.50.73.255 – 255.255.255.128