Q. 2 Mr. X is an independent consultant who provides consultancy services for subnetwork designing. Janata Bank Bangladesh Limited (JBBL) is searching for a resource person who can provide the consultancy service to increase its network reliability. JBBL needs to manage its branches by their geographic location that they can effectively monitor the network performance. (20)

Mr. X has identified that JBBL could break its network into eight subnetworks based on eight-divisions of Bangladesh. However, each division has its requirements for the hosts. From the analysis, Mr. X has discovered that the Dhaka division requires the maximum number of hosts. Table 1 describes the Union Councils in each division, and for one union council, at least *i* hosts are required for that particular subnetwork.

Table 1: Bangladesh Divisions' data

Division	Number of Districts	Number of Union Councils
Barisal	6	333
Chittagong Division	11	949
Dhaka Division	13	1,248
Khulna Division	10	270
Mymensingh Division	4	350
Rajshahi Division	8	558
Rangpur Division	8	536
Sylhet Division	4	334

Based on the above and the following requirements, design the network as Mr. X will design for the JBBL.

Let the number of union council in each division is ***u***, then
i* = *u* x *your birth month (for example: For Barisal Division ***u*** = 333 and your birth month is April; then ***i*** = 333 x 4 = 1332)

To calculate the subnetwork packages, choose the base network address from Class A if your student id is odd otherwise choose Class B private addresses.

Given

Division	Host requirements (i) $\geq (u \times 8)$
Barisal	$(333 \times 8) = 2664$
Chittagong	$(949 \times 8) = 7592$
Dhaka	$(1248 \times 8) = 9984$
Khulna	$(270 \times 8) = 2160$
Mymensingh	$(350 \times 8) = 2800$
Rajshahi	$(558 \times 8) = 4464$
Rangpur	$(536 \times 8) = 4288$
Sylhet	$(334 \times 8) = 2672$

u = Number of Union councils

birth-month = 8

Now, after rearranging the network name according to the host requirement we can write table like below:

My id is odd, so here I will choose the base network address from class A private address.

Let our base network address is 10.0.0.0/16

Network Name	Host req	N/A	Subnet Mask	F/H	L/H	B/A
Dhaka	9984	10.0.0.0 /18	255.255.192.0	10.0.0.1	10.0.63.254	10.0.63.255
Chittagong	7592	10.0.64.0 /19	255.255.224.0	10.0.64.1	10.0.95.254	10.0.95.255
Rajshahi	4464	10.0.96.0 /19	255.255.224.0	10.0.96.1	10.0.127.254	10.0.127.255
Rangpur	4288	10.0.128.0 /19	255.255.224.0	10.0.128.1	10.0.159.254	10.0.159.255
Mymensingh	2800	10.0.160.0/20	255.255.240.0	10.0.160.1	10.0.175.254	10.0.175.255
Sylhet	2672	10.0.176.0/20	255.255.240.0	10.0.176.1	10.0.191.254	10.0.191.255
Barisal	2664	10.0.192.0/20	255.255.240.0	10.0.192.1	10.0.207.254	10.0.207.255
Khulna	2160	10.0.208.0/20	255.255.240.0	10.0.208.1	10.0.223.254	10.0.223.255

Calculation for Dhaka division has explained here briefly. Rest of the calculation will be followed like this.

As Host req 9984

∴ Host bit will be 14

$= 2^{14} = 16,384$

∴ Network bits 32-14

$= 18$

∴ Subnet mask: 255.255.192.0

[Till 18 bit each bit will be 1]

F/H = 10.10.0.1

B/A = 10.10.63.255

[As After 18 bit rest of the bit will be 1]

L/H = 10.10.63.254

Next Network: 10.10.64.0

Q. 3 a) Suppose IP address of your computer is as your registration ID (***exception for id number 17201100, you will use 17201122***), i.e., 14.20.10.41 where the network mask is based on the following formula (5+5)

Netmask = 16+your birth month; for example, your birth month is April, and the netmask will be 16+4=20. Therefore, the address will be 14.20.10.41/20.

Now do the following:

i. Find the broadcast address of the network

ii. The address range of the network

Q.3

3(a)

Netmask
= 16+8
= 24

Given

ip-address : 19.10.10.23/24

∴ Subnet mask = 255.255.255.0

• Network address : 19.10.10.0

[by doing bitwise AND operation between ip address & subnet mask]

(i) The broadcast address will be: 19.10.10.255

(ii) The address range will be

19.10.10.0 → 19.10.10.255

b) In data transmission, it is necessary to check the data at the receiving end that it has any error or not. Suppose we want to send your registration id (14201041), and it is breaking into two parts A=1420; B=1041. Now we will convert it into binary based on the following rules: (10)

The number between 0 to 4 will be binary 1

The number between 5 to 9 will be binary 0

Therefore, A and B will be A=1111; B= 1111

However, now you have to send the data and do the process that at the receiving side we can detect if there is any error or not.

Or

3(b)

My registration id is 19101003. By breaking it into two parts we can find that:

A = 1910 → 1011

B = 1003 → 1111

As given that
For 0→4 binary will be 1
For 5→9 " " " 0

Now if I want to send the ~~data~~ data '10111111' to receiver ~~and~~ in such a way that at the receiving side we can detect if there is any error or not, I need to do UDP checksum process. So ~~the whole process following~~ the calculation of checksum process for the sender & receiver side is given below:

~~For sender side~~

Data unit that need to be transmitted:

10111111

After breaking it into parts we will get

1011	1111

For sender side

Carry 1 1 0

```
  1 0 1 1
  1 1 1 1
-------------
  1 0 1 0
        1  → carry
-------------
  1 0 1 1
```

1's compliment : 0100

∴ Checksum value is 0100

Now sender will append this checksum value before the main data unit and send that to the receiver

So, we will send the below data

0100 1011 1111

For receiver side

Now receiver will receive that data including checksum value. After that he/she will again sum all the data blocks and checksum and chek the result. If the result is all 1's then receiver will accept

the ~~sent~~ data otherwise will reject that and thus receiver can be able to detect error while receiving data.

For the given data block ~~we will~~ let assume sender's data block has been received without error ~~at~~ at the receiver side. We can find that by ~~calculating~~ checking that checksum value like below:

```
carry  1 1 1
       0 1 0 0
       1 0 1 1
       1 1 1 1
     ---------
       1 1 1 0
             1  → carry
     ---------
       1 1 1 1
```

As we can find all 1's in the answer so, this means that receiver has received error free data from sender and so it will be accepted.

Or

Q. 4 You are appointed as the network designer of the University of Asia Pacific. From your experience, you have identified that for better performance of the network, it should break in small LANs based on functionality. Therefore, you have planned to set the individual LAN for each department, and it is described in Table 1. To calculate each department's subnetwork address packages, choose the base network address from your registration id's first six numbers (considering your id is 14201010) for the first three octets as like 14.20.10, and for the last octet, choose 0 with the subnet mask 23, i.e., 14.20.10.0/23.

Table 1: Requirements of each LAN

Department	Number of Hosts
CSE	100
CSE	150
CE	130
Architecture	70
Pharmacy	32
Admin	15

Q(4) (OR)

After calculating rearranging the data according to the host req we can get the table like below by doing VLSM calculation:

According to the ~~requir~~ given rules, base address will be: 19.10.10.0/24

Network Name	Host req	N/A	Subnet Mask	F/H	L/H	B/A
CSE	250	19.10.10.0/24	255.255.255.0	19.10.10.1	19.10.10.254	19.10.10.255
CE	130	19.10.11.0/24	255.255.255.0	19.10.11.1	19.10.11.254	19.10.11.255
Architecture	70	19.10.12.0/25	255.255.255.128	19.10.12.1	19.10.12.126	19.10.12.127
Pharmacy	32	19.10.12.128/26	255.255.255.192	19.10.12.129	19.10.12.190	19.10.12.191
Admin	15	19.10.12.192/27	255.255.255.224	19.10.12.193	19.10.12.222	19.10.12.223

For CSE network the calculation process is explained below:

Given:

Host req: 250

∴ Host bit : 8

∴ Network bit : 32-8
= 24

∴ Subnet Mask: 255.255.255.0
[∵ till 24 bit all will be 1]

∴ N/A = ~~000~~ 19.10.10.0

∴ F/A = 19.10.10.1

∴ B/A = 19.10.10.255 [∵ after 24 all ~~000~~ will be 11]

∴ L/H = 19.10.10.254 [subtracting 1 from B/A]

Next ~~network~~ network address: 19.10.11.0

~~Rest of the network~~

For rest of the network we'll follow the above mentioned process sequentially.

Q.4 IT department of the University of Asia Pacific (UAP) plans to increase the network performance and divide the whole network into smaller subnetworks for better management. The IT department identified that UAP requires seven subnetworks, namely CSE, CE, EEE, Phy, Eng, Law, and Admin. Table 1 describes the host requirements for each subnetwork. (20)

Table 1: Host requirements

Department	Number of Hosts requirements
CSE	60 *n*
CE	11 *n*
EEE	13 *n*
Phy	51 *n*
Eng	40 *n*
Law	84 *n*
Admin	12 *n*

As a network engineer, your job is to design the UAP network with each subnetwork's network address, subnet mask, usable host range, and broadcast addresses from the above requirements. **You have to keep in mind that with each subnetwork multiply your birth month to get the actual host numbers.**

To calculate the subnetwork packages, choose the base network address from Class A private address if your student id is odd otherwise choose Class B private address.

Q(4)

Given:

Department	Host req
CSE	60×8 = 480
CE	11×8 = 88
EEE	13×8 = 104
Physics	51×8 = 408
English	40×8 = 320
Law	84×8 = 672
Admin	12×8 = 96

As n=8 for my birth month

Now after rearranging the table's data according to their host requirement the VLSM calculation is given below:

Let assume our base address is 10.0.0.0/16

Dep Name	Host req	~~Subnet~~ N/A	~~Host~~ Subnet Mask	F/H	L/H	B/A
Law	672	10.0.0.0 /22	255.255. 252.0	10.0.0.1	10.0.3.254	10.0.3. 255
CSE	480	10.0.4. 0/23	255.255. 254.0	10.0.4.1	10.0.5.254	10.0.5. 255
Physics	408	10.0.6. 0/23	255.255. 254.0	10.0.6.1	10.0.7.254	10.0.7.255
English	320	10.0.8. 0/23	255.255. 254.0	10.0.8.1	10.0.9.254	10.0.9. 255
~~Admin~~ EEE	104	10.0.10. 0/24	255. 255.255. 0	10.0.10.1	10.0.10.254	10.0.10. 255
Admin	96	10.0.11. 0/25	255.255. 255.128	10.0.11.1	10.0.11.126	10.0.11.127
CE	88	10.0.11. 128/25	255.255. 255.128	10.0.11. 129	10.0.11. 254	10.0.11.255

is

For Law department the calculation is explained below

Given Host req: 672

∴ Host bit → 10

∴ Network bit → 32 - 10

= 22

∴ Subnet Mask: 255.255.252.0

[As All 22 bit will be all 1's]

As, N/A = 10.0.0.0

∴ F/H = 10.0.0.1

∴ B/A = 10.0.3.255

[As After 22 bit all will be 1]

∴ L/H = 10.0.3.254 [By substracting 1 from B/A]

Next network: 10.0.4.0

rest of the network calculation has been done by following the above mentioned way.

OR

a) Consider a subnet with the prefix 128.119.40.128/26. Give an example of one IP address (of the form **xxx.xxx.xxx.xxx**) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 128.119.40.64/26. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form **a.b.c.d/x**) for the four subnets?

Given

Network address: 128.119.40.128/26

Subnet Mask: 255.255.255.192

[∴ Network bit: 26
∴ till 26 bit all will be 1]

∴ Network range will be:

128.119.40.128 → 128.119.40.191

[∴ B/A = 128.119.40.191]

Here B/A: 128.119.40.191

So usuable host ip can be from

128.119.40.129 → 128.119.40.190

An example of on ip address than can be assigned to this network is: 128.119.40.130

Now, ~~Isp~~ given that:

ISP owns the block of address of the form: 128.119.40.64/26

So, here our base network address:

128.119.40.64/26

Now from this base network address, ~~for the~~ if we want to create four subnetworks then the ~~address~~ calculation will be like below:

Network serial	~~No~~ N/A	Subnet Mask	F/H	L/H	B/A
1	128.119.40.64/26	255.255.255.192	128.119.40.65	128.119.40.126	128.119.40.127
2	128.119.40.128/26	255.255.255.192	128.119.40.129	128.119.40.190	128.119.40.191
3	128.119.40.192/26	255.255.255.192	128.119.40.193	128.119.40.254	128.119.40.255
4	128.119.41.0/26	255.255.255.192	128.119.41.1	128.119.41.62	128.119.41.63

a) Sonali Bank invites you to design its corporate network to improve network functionality and management capability. Chief Technical Officer (CTO) of Sonali Bank has decided to build the network based on user types and access policy. As a network designer, you propose the following design idea for the network of Sonali Bank, as listed in Table 1. 15

Table 1: Sonali Bank Network

Name	Number of Hosts	Purpose
Branch users	1000	Branch users will use for day to day transactions
Accounts	200	The accounts department will use for their tasks
Corporate	250	Corporate officials will use
Audit	100	The audit team of branch offices will use
Managers	70	Each manager will use for their activities

Complete your proposal by providing the Sonali Bank's details design to choose the base network address from a Class B private IP address block.

After rearranging the data according to their host requirements we can find the table like below by doing vlsm calculation :

Let assume our base address is : 172.16.0.0/16

Network Name	Host req	N/A	Subnet Mask	F/A	L/A	B/A
Branch users	1000	172.16.0.0 /22	255.255.252.0	172.16.0.1	172.16.3.254	172.16.3.255
Corporate	250	172.16.4.0 /24	255.255.255.0	172.16.4.1	172.16.4.254	172.16.4.255
Accounts	200	172.16.5.0 /24	255.255.255.0	172.16.5.1	172.16.5.254	172.16.5.255
Audit	100	172.16.6.0/25	255.255.255.128	172.16.6.1	172.16.6.126	172.16.6.127
Managers	70	172.16.6.128 /26	255.255.255.192	172.16.6.129	172.16.6.190	172.16.6.191

For Branch users, the calculation process has been explained below:

Given:

Host req: 1000

∴ Host bit: 10

∴ Network bit: 32-10
= 22

∴ Subnet Mask: 255.255.252.0 [∵ till 22 bits all will be 1]

∴ N/A = 172.16.0.0

∴ F/A = 172.16.0.1

∴ B/A = 172.16.3.255

[∵ After 22 bits all will be 1]

∴ L/A = 172.16.3.254 [Subtracting 1 from B/A]

∴ Next network address will be: 172.16.4.0

~~So next~~ For the rest of the networks above ~~mentioned process~~ mentioned process will be followed

Q. 3 a) List the subnetwork address, subnet mask, and broadcast address from the following IP addresses: (9)

(i) 162.12.5.6/a

(ii) 10.10.10.10/b

(iii) 192.1468.54.250/c

Here, a = 15 + Your birth month

b = 17 + Your birth month

c= 18 + Your birth month

Q.3

3(a)

Given

$a = 15 + 8$ [$\because$ birth_month = 8]

$= 23$

$b = 17 + 8$

$= 25$

$c = 18 + 8$

$= 26$

(i) ip address: 162.12.5.6/23

Subnet mask: 255.255.254.0

Network address:

162.12.00000101.6

&

255.255.11111110.0

$\Rightarrow$ 162.12.00000100.0

$\therefore$ Network address is 162.12.4.0

Broadcast address is 162.12.5.255

(ii) ip address:

10.10.10.10/25

Subnet Mask: 255.255.255.128

Network address:

10.10.10.00001010

&

255.255.255.10000000

=> 10.10.10.00000000

∴ Network address is 10.10.10.0

Broadcast address:

10.10.10.127

(iii) ip address:

192.146.54.25/26

Subnet Mask: 255.255.255.192

Network address:

192.146.54.00011001

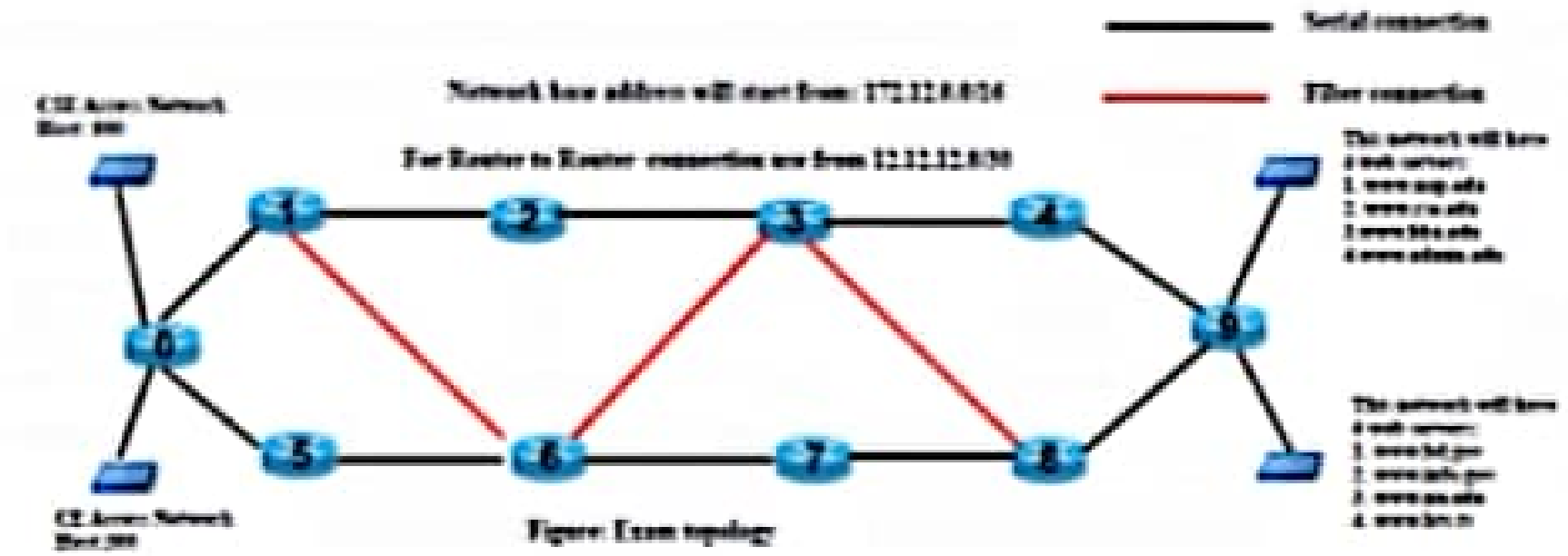
&

255.255.255.11000000

=> 192.146.54.00000000

∴ Network address:
192.146.54.0
Broadcast address: 192.146.54.63

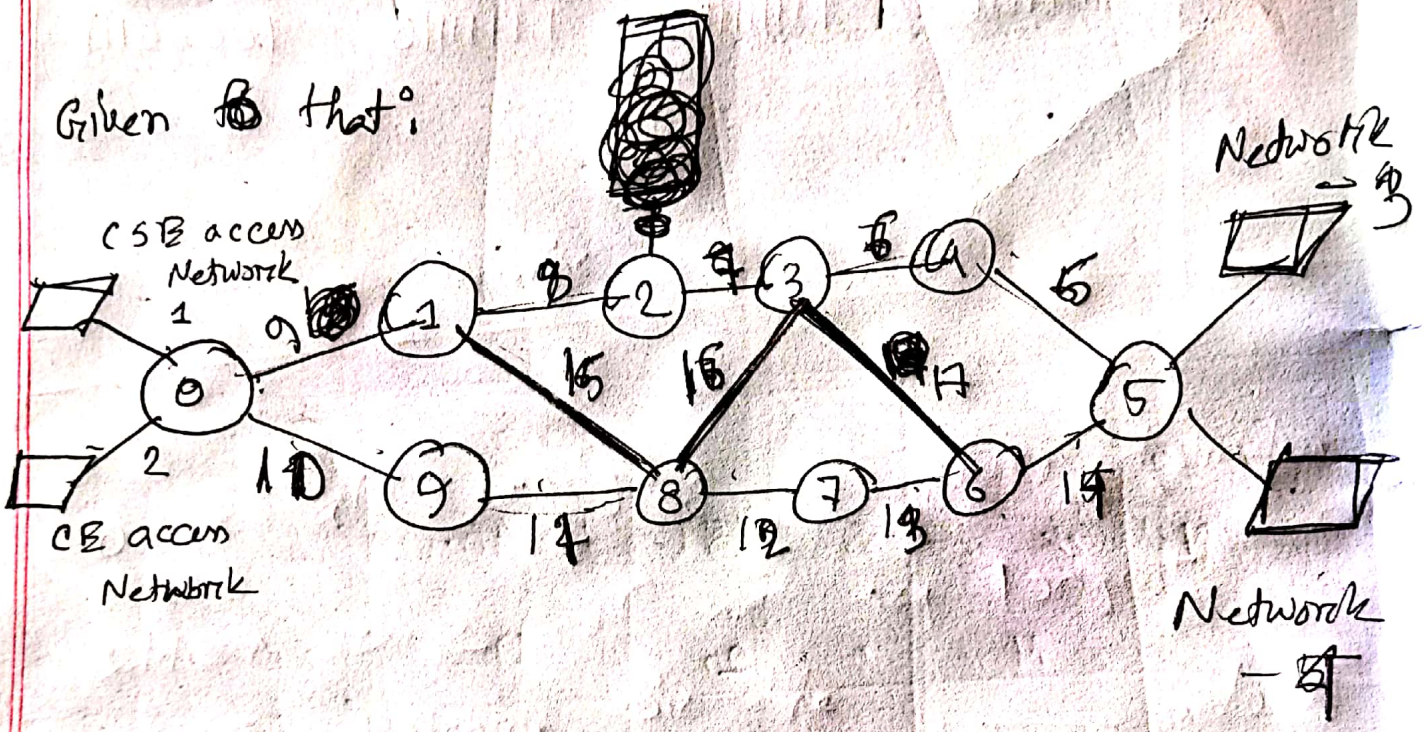
c) Identify how many subnetworks are in the following network topology? (3)



e) Consider a datagram network using 32-bit host addresses. Suppose a router has four links.

(c) Here, from the given figure of ~~topo~~ that network topology, we can find that total We ~~will~~ needed 10 subnetworks like below:

Given that:



So here atleast 17 sub networks will be needed ~~atleast~~, according to the ~~given~~ above network diagram. As we can find 10 routers where total 17 link interface ~~are~~ have ~~found~~ been found.

c) Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

Destination Address Range	Link Interface
11100000 00000000 00000000 00000000 through 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 through 11100000 01000000 11111111 11111111	1
11100000 01000001 00000000 00000000 through 11100001 01111111 11111111 11111111	2
otherwise	3

Illustrate how the forwarding table determines its appropriate link interface for datagrams with destination addresses:

11001000 10010001 01010001 01010101
11100001 01000000 11000011 00111100
11100001 10000000 00010001 01110111

(c) We know that, if we want to determine appropriate link interface for datagrams with destination address in the forwarding table, then we will use longest prefix matching which means if longest prefix match with particular destination address range, then router will choose that link interface for that particular link.

Given that:

Destination Address Range	Link interface
11100000 00000000 00000000 00000000 through 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 through 11100000 01000000 11111111 11111111	1

Destination Address range				Link interface
11100000	00000001	00000000	00000000	
through				2
11100001	00111111	11111111	11111111	
otherwise				3

So after analyzing the given destination address range, if we try longest prefix matching for the ~~given~~ below datagrams with destination address, we can find that

11001000 10010001 01010001 01010101

→ Here the longest prefix match with ~~otherwise~~ 'otherwise' so, Here link interface will be 3

11100001 01000000 11000011 00111100

Here the longest prefix match with above mentioned 3rd range, so here link interface will be 2

11100001 10000000 00010001 01110111

Here the longest prefix match with above mentioned 4ast range, so, here link interface will be 3.