Q. 1 Imagine you're a network engineering responsible for managing a company's Network infrastructure. Your company heavily relies on real-time video conferencing for ~~computing~~ communication between remote offices. Recently, some employees have complained about poor video quality and frequent disconnects during their conference calls. Upon investigation, you discover that the network traffic is ~~called~~ experiencing congestion during peak hours, causing delays and packet loss. You realize that the current transport layer protocol being used, TCP (Transmission Control Protocol), might not be the best choice for real time applicants like video conferencing due to ~~this~~ its congestion control mechanisms. Can you suggest better option with suitable justification.

→ To address the issue of poor video quality and frequent disconnets during video conferencing, UDP (User Datagram Protocol) would be a better transport layer protocol compared to TCP.

As it have:-

i) Low Latency
ii) No Congestion Control
iii) No Retranmission
iv) Efficient Bandwidth Usage

Switching to UDP - based communication will significantly enhance the quality of real-time video conferencing.

Q.2 Consider the following routing table at an IP router. For each IP address in Group - I identify the correct choice of the next hop from Group - II using the entries from the routing table below.

Network No.	Net Mask	Next hop
128.96.170.0	255.255.254.0	Interface 0
128.96.168.0	255.255.254.0	Interface 1
128.96.166.0	255.255.254.0	R2
128.96.164.0	255.255.254.0	R3
0.0.0.0	Default	R4

List - I

A. 128.96.171.92

B. 128.96.167.151

C. 128.96.163.151

D. 128.96.165.121

List - II

1. Interface 0
2. Interface 1
3. R2
4. R3
5. R4

Soln Checking network ID of A.

128.96.171.92 = 10000000 . 11000000 . 10101011 . 1011100

AND

255.255.254.0 = 11111111 . 11111111 . 11111110 . 00000000

= 10000000 . 11000000 . 10101010 . 00000000

↓

128 . 96 . 170 . 0

Network id :- 128.96.170.0 → Interface 0

Checking network ID of B

128.96.167.151 → 10000000. 11000000. 10100111. 10010111
And
255.255.254.0 → 11111111. 11111111. 11111110. 00000000

10000000. 11000000. 10100110. 00000000
128 . 96 . 166 . 0

Network ID → 128.96.166.0 → R_2

Checking network Id of C

128.96.163.101 → 1000 0000. 11000000. 10100011. 01100101
And
255.255.254.0 → 11111111. 11111111. 11111110. 00000000
10000000. 11000000. 1010010. 00000000
128 . 96 . 162 . 0

Network ID → 128. 96. 162. 0 → Not matched

Checking network ID of D
128 . 96. 165. 121 → 1000 0000. 11000000. 10100101. 01111001
And 255. 255. 254. 0 → 11111111. 11111111. 11111110. 00000000
10000000. 11000000. 10100100. 00000000
128. 96 . 164. 0

Network ID → 128.96.164.0 → R_3

Answer. A-(i) , B-(iii) , D → (iv)

Q.3. An Instagram Service Provider (ISP) has the following chunk of CIDR-based IP address available with it : 245.248.128.0/20. The ISP wants to give half of this chunk of addresses to Organization A, and a quarter to Organization B, while retaining the remaning with itself. Which of the following is a valid allocation of addresses to A and B?

a) 245.248.136.0/21 and 245.248.128.0/22

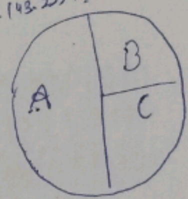
b) 245.248.128.0/21 and 245.248.128.0/22

c) 245.248.132.0/22 and 245.248.132.0/21

d) 245.248.136.0/24 and 245.248.132.0/21

Solu^n ~~Step 1 :- Total IP addressing 245.248.128.0/20~~ is 4096

A
254.248.136.0/21
to
254.248.143.255/21



Solu^n

Since Half of 4096 post address must be given Organisation A, we can set the 12^{th} bit to 1 include that bit into the network path of Organisation A. So the Valid allocation of address to A is
254.248.136.0/21.

The 12^{th} bit is set to 0, but we need only half of the 2048 address. the 13^{th} bit is set can be set to be 0 addresses to B is 245.248.128.0/22

Hence, the correct answer is 245.248.136.0/21 and 245.248.128.0/22

Q.4 Consider three machines M, N and P with IP addresses 100.10.5.2, 100.10.5.5 and 100.10.5.6 respectively. The subnet mask is set to 255.255.255.252 for all the three machines. Which one of the following is true?

A) M, N, P all belong to same subnet.

B) Only M and N belong to the same subnet

C) Only N and P belong to the same subnet.

D) M, N and P belong to three different subnets

Soln Doing bitwise AND between Subnet mask and given IP addressing one by one

for M: 100.10.5.2 Bitwise AND.

100.10.5.2 → 01100100.00001010.00000101.00000010

255.255.255.252 → 11111111.11111111.11111111.11111100

01100100.00001010.00000101.00000000 (100.10.5.0)

for N: 100.10.5.5 Bitwise AND

100.10.5.5 → 01100100.00001010.00000101.00000101

255.255.255.252 → 11111111.11111111.11111111.11111100

01100100.00001010.00000101.00000100 (100.10.5.4)

for P: 100.10.5.6 → 01100100.00001010.00000101.00000110

255.255.255.252 → 11111111.11111111.11111111.11111100

01100100.00001010.00000101.00000100 (100.10.5.4)

Answer:- Only N and P belong to the same subnet

Q5. In the network ...
the last IP address of the network ...
a host is ____

Solu^n Given IP address 200.10.11.144/27

To find out the class address in a block, we have to set (32-n) no. of right most bits to 1.

n=27

32 - n = 32-27 = 5

Starting -> 200.20.11.10010000

Ending -> 200.20.11.10011111

∴ CIDR addressing range is ~~200.20.11.10010000~~

200.20.11.128/27 – 200.20.11.159/27

The value of the last octet of the last host in this network is 200.20.11.158.

Q.6 You have interface on a router with the IP address of 192.168.192.10/29. What is the broadcast address the host will use on this LAN?

IP address - 192.168.192.10 -> 11000000. 10101000. 11000000. 00001010

Subnet -/29 - -> 11111111. 11111111. 11111111. 11111000

11000000. 10101000. 11000000. 00001000

(192.168.152.8)

For the IP address 192.168.152.10/29 the subnet range is 152.168.192.8 - 192.168.192.15

The broadcast address is the last address in the range

Broadcast address : 192.168.192.15

Q.7. Your Company has been using the network of 193.56.7.0/24. You want to put each of the 6 floors in your building on a different subnet. What is the range of the last available subnet after doing Subnetting?

6 floor = 6 subnets, we need to borrow 3 bits, as := 2^3 = 8>6

Hence, now Network Bits will be 24+3 = 27. Hence subnetting CIDR is: /27

Subnet Mask /27 = 255.255.255.224

Therefore, Subnetwork Block size = 256-224 = 32

Last subnet range will be 193.56.7.224 _ 193.56.7.255

Q.8. One employee came to you and he was saying that the internet was not working on his system, but other employees could work on the internet. You went to his system and check its IP configuration and you saw 172.29.97.127/26 was configured there. What will be your first step to solve this problem?

first of all ip needs to change as it is Broadcast IP address

Containig ip address = 172.29.97.127/26.

CIDR = /26.

Subnet mask = 255.255.255.192

net block size = 256-192 = 64

Hence Subnets are designed as below.

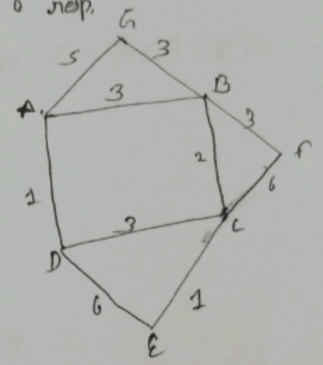
Nw address	1st host	Last host	Broadcast address
172.29.97.0	172.29.97.1	172.29.97.62	172.29.97.63
172.29.97.64	172.29.97.65	172.29.97.126	172.25.97.127
172.29.97.128	172.29.97.125	172.29.97.190	172.29.97.191
172.29.97.192	172.29.97.193	172.29.97.254	172.29.57.255

So, network address is 172.29.97.64.
and broadcast ip 172.29.97.127.

Q.9 Consider the subnet given in the below ... routing algorithm is used.
The following vectors have just come in to router C

From B: (3,0,6,5,3,8,3)
from D: (1,5,3,0,8,6,3)
from E:- (4,3,1,1,0,4,6)
from F: (3,8,3,6,4,0,9)

he measured delays to B, D, E, F are 2,3,1 and 6 resp.
What is C's new routing table?



A.) (5,2,0,2,5,5,5)
B.) (4,4,0,3,1,6,5)
C.) (5,4,0,3,5,6,6)
D) (4,2,0,2,1,5,5)

Soln.
Given that the distance metric (delay) from C to B is 2
C to D is 3
C to E is 1
C to F is 6

So the distance vector at C if going via B is = Distance from C to B + Distance from B to other routers

- Going via B gives (2+3, 2+0, 2+6, 2+5, 2+3, 2+8, 2+3) = (5, 2, 8, 7, 5, 10, 5)
- Going via D gives (3+1, 3+5, 3+3, 3+0, 3+8, 3+6, 3+3) = (4, 8, 6, 3, 11, 9, 6)
- Going via E gives (1+4, 1+3, 1+1, 1+1, 1+0, 1+4, 1+6) = (5, 4, 2, 2, 1, 5, 7)
- Going via F gives (6+3, 6+8, 6+3, 6+6, 6+4, 6+0, 6+9) = (9, 14, 9, 12, 10, 6, 15)

So taking minimum for each destination except C from the above calculations.
we get (4,2,0,2,1,5,5)

Option D is correct

Q.10 TCP is a connection oriented protocol, Show the connection establishment process in T.C.P. In the connection termination phase, suppose the FIN segment from the client-side contains data ranging from sequence no. 100 to 200, So will the ACK no. from the server start from 201 or 202?

TCP connection establishment:

SYN = Client sends SEQ = x.
SYN - ACK: Server responds with SEQ = Y, ACK = $x+1$
ACK: Client sends ACK = $y+1$.

TCP connections termination:

FIN = one side sends FIN.
ACK:- receiver acknowledgment FIN.
FIN:- Other side sends FIN.
ACK:- initial sender acknowledge FIN

Clients FIN includes data ranging from SEQ 100 to 200.
Since FIN consumes 1 sequences.
ACK = 200+1 = 201.

Q.11 An IP diagram of size 1000 bytes arrives at a router. The router has to forward this packet on a link whose MTU (maximum transmission unit) is 100 bytes. Assume that the size of the IP header is 20 bytes. The numbers of fragments that the IP ~~address~~ datagram will be divided in to for transmission is.

IP datagram size = 1000 bytes
IP header size = 20 bytes
MTU = 100 bytes
Size of data in one fragement = 100 - 20 = 80 bytes
Size of data = IP datagram - IP header = 1000 - 20 = 980

Number of fragments = $\frac{980}{80}$ = 13 (approx)

Q.12 An IP router with a Maximum Transmission Unit (MTU) of [illegible] received an IP packet of size 4404 bytes with an IP header of length 20 bytes. The values of the relevant fields in the header of the third IP fragment generated by the router for this packet are.

Total data to be sent $= 4404 - 20 = 4384$

no. of fragment $= \frac{4384}{1480} = 3$

first fragment:- $\boxed{1480 \mid 20}$

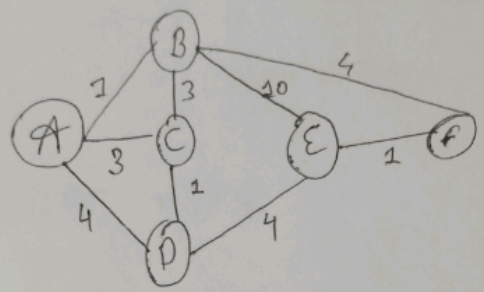
Offset $= 0$, $M.F = 1$

Second $=$ $\boxed{1480 \mid 20}$ offset $= \frac{1480}{8} = 185$, $M.F = 1$

Third $=$ $\boxed{1424 \mid 20}$ offset $= \frac{2960}{8} = 370$. $MF = 0$

IP datagram count: both data and header so $1424 + 20 = 1424$ MF of third datagram is 0 and offset of third datagram is 370.

Q.13 Consider the Network below.



(a) Show the Operation of Dijkstra's (Link State) algorithm for computing the least ~~cost~~ path from F (the right most node in the figure below) to all destinations that ~~is~~ are the result of the algorithm's computation.

(b) Show the distance table that would be computed by the distance vector algorithm in B. (Note: You do not have to run the ~~dest~~ distance vector algorithm; you should be able to compute the table by inspection).

1. Initialization.

$f = 0$ Consider direct

$B = 4$

$E = 1$

$D = \infty$

$C = \infty$

$A = \infty$

Step 2 F moved to E

$f = 0$

$E = 1$

$A = \infty$

$B = 4+1 = 5$

$C = \infty$

$D = 4+1 = 5$ (min)

Visited (F, E)

Step 3 E moved to D

$f = 0$

$E = 1$

$A = 5+4 = 9$

$C = 6$

$B = 5$ (min)

Step 4: D. moved to B

A = 6
C = 6 (No change)

Step5:- FEDBAC Visited

B) Distance Table from B

Distance	Cost Via A	Cost Via C	Cost Via E
A	1	BCA (3+3) = 6	(BFEDA) 9+4 = 13
B	0	3	(EFB) 1+4 = 5
C	(BAC) 3+1 = 4	3	(BFEDC) 4+1+4+1 = 10
D	(BAD) 1+4 = 5	BCDE 1+3+4 = 8	(BFED) 4+1+4 = 9
E	(BADE) 1+4+4 = 9	BCDE 1+3+4 = 8	BFE 4+1 = 5
F	(BADEF) 1+4+4+1 = 10	BCDEF = 3+1+4+ = 9	BF 4

Q.14 Assume that source S and Destination D are connected through two intermediate routers labeled R. Determine how many times each packet has to visit the network layer and the data link during a transmission from S to D

Solun

At intermediate Router R the packet will not go beyond the network layer. Hence network layer will only be visited layer will only be visited onceat both routes.

But the data link will be visited twice Hence network layer will be visited 4 times and the data link layer will be visited 6 times 1+2(a+R)+2 (a+R)+1=6

Q.15 In a RSA cryptosystem a particular A uses two prime numbers p=13 and q=17 to generate her public and private keys. If the public key of A is 35. Then the private key A is

Given p=13, Q=11

Using RSA algorithm to calculate private key.

$\phi(n)=(13-1)\times(17-1)=192$

Now,

$(e\times d) \bmod \phi(n)=1$

$(e\times 35) \bmod 192=1$

$e=11$

private key of A = 11

Q.16 Consider a network with five nodes

The network ~~with five Nodes~~ uses a Distance Vector Routing protocol. Once the routes have stabilized, the distance vectors at different nodes are as following.

N1: (0,1,7,8,4)

N2: (1,0,6,7,3)

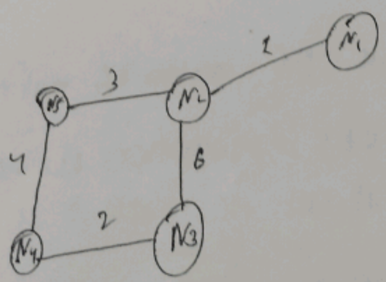
N3: (7,6,0,2,6)

N4: (8,7,2,0,4)

N5: (4,3,6,4,0)

Each distance vector is the distance of the best known path at that instance to nodes, N_1 to N_5, where the distance to itself is 0. Also, all links are symmetric and the cost is identical in both direction. In each round, all nodes exchange their distance vectors with their respective neighbours. Then all nodes update their distance vectors. In between two rounds, any change in cost of a link will cause the two incident nodes to change only that entry in their distance vectors.

The cost of link N2-N3 reduces to 2 (in both directions). After the next round of update what will be the new distance vector at node, N3?



Solu^n

In the next round: every node will send and receive distance vectors to and receive - distance vectors to own neighbours and update its distance vector.

N3 will recieve (1,0,2,7,3) from N_2 and it will update

Q18. You have an interface on a router with the ... will use on this LAN?

distance to N_1 and N_5 as 2 and 5 respectively.
So answer will be (3, 2, 0, 2, 5)

Q17. Suppose a Network with IP Address 192.16.0.0 is divided into 2 subnets, find number of hosts per subnet. Also for the first subnet, find-

1. Subnet Address
2. First Host ID
3. Last Host ID
4. Broadcast Address

Solu^n

- Given IP Address belongs to class C
- So, 24 bits are reversed for the Net ID
- The given network is divided into 2 subnet
- So, 1 bit is borrowed from the host ID part for the subnet ID,
- Then, Number of bits remaining for the Host ID = 7
- Thus, Number of hosts per subnet $= 2^7 = 128$

- Subnet Address = first IP address = 192.16.0.00000000 = 192.16.0.0
- First host ID = 192.16.0.00000001 = 192.16.0.1
- Last host ID = 192.16.0.01111110 = 192.16.0.126
- Broadcast Address = Last IP address = 192.16.0.01111111 = 192.16.0.127

14/17

Q18. You have an interface on a router with the [illegible]
What is broadcast address the hosts will use on this LAN?

IP address : 192.168.192.10/29

Subnet mask : /29 which corresponds to 255.255.255.248

Number of IP address in subnet mask :-

A /29 subnet provides $2^{32-29} = 2^3 = 8$ IP address

The Network address :-

The subnet starts at the nearest multiple of 8 in the 4th Octet that does not exceed 10 (the host part of the IP address)

The network address is 192.168.192.8.

BroadCast address:-

192.168.192.8 + 7 = 192.168.192.15

Q.19 An IPv4 packet has arrived with the first 8 bits as shown 01000010. The receiver discards the packet. Why?

The first 8 bits are 01000010.
The first 4 bits ~~are~~ indicates the version which is IPV4 (0100)
Now the next four bits indicates Header length (bit decimal value × 4)
which is $2 \times 4 = 8$

Which is not possible since the minimum header length for IPv4 is 20 bytes

Hence, Reciever will reject the packet.

Minimum header size of IPV4 = 20
Maximum " " " " = 60
Header length field is 4
(Maximum possible value of (1111) = 15

Scalling factor = $\frac{60}{15} = 4$ is integer

Q.20 In an IPv4 packets, the value of HLEN is 1000 in binary
How many bytes of Options are being carried by this packet

$$HLEN = 1000 = (8)_{10}$$

Header Length is scaled by a factor of 4. So actual header size = $8 \times 4 = 32$ bytes out of which 20 byte are necessary and remaning

$32 - 20 = 12$ bytes are for options.