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Assignment-02

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Section: 04

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Answer to the question no. 1

1 (a)

Given, offset = 200
HLEN = 5
Total length field = 120

We know,
First byte = offset × 8
= 200 × 8
= 1600

Number of first byte = 1600 bytes

Here, header length = (5×4) = 20 bytes

∴ payload size = 120 − 20
= 100

Thats mean here is 100 bytes in this datagram.

∴ Number of last byte = (1600 + 100 − 1)
= 1699 bytes

1 (b)

Given, M=0

M=0 indicates that, this packet is the last packet among all fragments of original packet. There is no more fragment, the fragment is the last one.

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Answer to the question no. 2

2(a)

Given, payload size = 1400 bytes and header = 20 bytes

So, orginal packet size = 1400 + 20 = 1420 bytes

Link AB.:

here, LL1, Maximum Transmission Unit (MTU) = 1500B which is greater than data packet size.

So, here is no fragmentation.

Link BC:

Given, LL2, Maximum Transmission Unit (MTU) = 700B. And our data size 1420B.

So, In this transmission we needed fragmentation.

$\therefore$ Number of fragmentation = $\frac{1420}{700} = 3$

1st Fragmentation:

Flag Field = 1 = 001 ; This is MF and DF Flag not set.

Fragment offset : $(0000\ 0000)_2 = (0)_{10}$

The . fragment offset field is set to zero as this first fragment.

A total length field is 696. The maximum possible 700 bytes packet has not been used, because the fragment offset field in the following fragment must be a multiple of 8 bytes - as the header is 20 bytes,

So, this packet contains 676 bytes of data, with (1420-676) = 744 bytes remaining.

2nd Fragment:

Here, The DF flag not set and MF = 1.

So, Flag Field = 1 = 001

The fragment offset field is set to (744/8) = 93

$\therefore$ Fragment offset : $(0101\ 1101)_2 = (93)_{10}$

A total length field of 696. This packet also contains 676 bytes of data with (744-676) = 68 bytes remaining.

3rd Fragment:

Here DF flag not set and MF = 0

So, Flag Fied = 0 = 000

The fragment offset field is set to (676 + 676) = 1352/ = 169

$\therefore$ Fragment offset : $(1010\ 1001)_2 = (169)_{10}$

A total length field is 68. This packet contains 48 bytes of data.

Link CD :

Given, LL3, Maximum Transmission unit (MTU) = 2048 B which is greater than our packet size.

So, here is no fragmentation.

Link	Total Length	Identification	DF	MF	Fragment offset	Time to Live
AB	1420	45654	0	0	0	255
BC 1st	696		0	1	0	254
BC 2nd	696	45654	0	1	93	254
BC 3rd	68		0	0	169	254
CD	1420	45654	0	0	0	253

2(b)

We know, The fragments are reassembled by the receiving host.

In this whole transmission, only router C needed to fragment reassembled.

Because, transmitted the packet along BC path; LL2 maximum transmission unit (MTU) is 700B, which is lower than our packet size.

On the other side Router A is the sending host. In this router packet is non-fragment type.

And,

Router B and D do not need to reassemble the packet. Because the LL1 maximum transmission unit (MTU) and LL3 maximum transmission unit (MTU) is larger than the packet size. Router B and D receive non-fragment packet.

Answer to the question no. 3

3(a)

Given,
administrator wants to create 512 subnets

so, $2^n = 512$

$n = \log_2(512)$

$n = 9$

default mask = 16

Total subnet mask = 16+9
= 25

In binary notation:

11111111 11111111 11111111 10000000

∴ The subnet mask = 255.255.255.128/25

3(b)

IP address length is 32.

Remaining bits for addressing = 32-25 = 7 bits

∴ Total address = $2^7 = 128$

We know that, 1st and last address can not allocated.

So, The number of address in each subnet is 126.

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3(c)

The first allocatable address in subnet 1:

142.242.0.1 because 142.242.0.0 is reserved.

And,
The last allocatable address in subnet 1:

142.242.0.126 because 142.242.0.127 is allocated for broadcast address.

3(d)

The first allocatable address in subnet 28:

142.242.13.129 because 142.242.13.128 is reserved.

And,
The last allocatable address in subnet 28:

142.242.13.254 because 142.242.13.255 is allocated for broadcast address.

Answer to the question no. 4.

Given Ip address = 198.15.128.0

Current mask = 255.255.255.0

For 25 hosts, number of address needed = 25+2 = 27

Bits needed for 27 address = 2^5 = 32 possible address

Bits needed for 10 subnet = 2^4 = 16 possible subnets

∴ Final subnet mask = 255.255.255.224

Here, $\underbrace{\text{Network part}}_{\text{23 bit}}$, $\underbrace{\text{Subnet part}}_{\text{4 bit}}$, $\underbrace{\text{Host part}}_{\text{5 bit}}$

List the address on host 1 on subnet 0, 1, 2, 3, 10 below:

subnet 0, host 1 : 198.15.128.1

subnet 1, host 1 : 198.15.128.33

subnet 2, host 1 : 198.15.128.65

subnet 3, host 1 : 198.15.128.97

subnet 10, host 1 : 198.15.129.65

Answer to the question no. 5

Given,

Starting address 155.100.0.0/16

For first group:

Each customer needs 256 address. Total customer = 80

now, $256 = 2^8$

so, 8 bits are needed each host.

$\therefore$ prefix length $= 32 - 8 = 24$

The address of first customer 1:

155.100.0.0/24 to 155.100.0.255/24

The address of last customer 80:

155.100.79.0/24 to 155.100.79.255/24

For second group:

Each customer needs 16 address. Total customer 400.

now, $16 = 2^4$

so, 4 bits are needed each host.

$\therefore$ prefix length $= 32 - 4 = 28$

The address of first customer 1:

155.100.80.0/28 to 155.100.80.15/28

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The last customer (400) address :

155.100.104.240/28 to 155.100.104.255/28

For third group :

Each customer needs 4 address. Total customer = 2000

now, $4 = 2^2$

So, 2 bits are needed each host

$\therefore$ prefix length = 30

The address of first customer 1 :

155.100.105.0/30 to 155.100.105.3/30

The address of last customer 2000 :

155.100.136.60/30 to 155.100.136.63/30

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Design the subbbcks below:

ISP

First Group:

Address Length:

155.100.0.0 to 155.100.79.255

customer 1 : 155.100.0.0/24

⋮

customer 80 : 155.100.79.0/24

Second Group:

Address Length:

155.100.80.0 to 155.100.104.255

customer 1 : 155.100.80.0/28

⋮

customer 400 : 155.100.104.240/28

Third Group:

Address Length:

155.100.105.0 to 155.100.136.36

customer 1 : 155.100.105.0/30

⋮

customer 2000 : 155.100.136.60/30

Total number of available address $= 2^{16} = 65,536$

Total number of allocated address $= (80 \times 256) + (400 \times 16) + (2000 \times 4)$

$= 20480 + 6400 + 8000$

$= 34,880$

$\therefore$ Available address after allocation $= (65,536 - 34,880)$

$= 30,656$

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Answer to the question no. 6

6(a)

From the given router table:

we can move A to B with the cost 1; Then we can move B to E with the cost 1.

So, total cost = 1+1 = 2

And, Taken path = A→B→E.

6(b)

From the given router table:

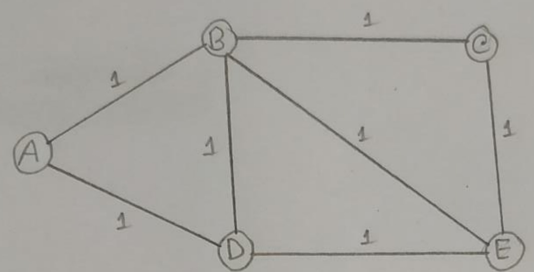
we can move C to B with the cost 1; Then we can move B to D with the cost 1.

So, total cost = 1+1 = 2

And, Taken path = C → B → D.

6(c)

From these given tables, possible network diagram below:



This diagram is similar to given table.

i.e. in routing A; we can move to C with the cost 2 and next hop B and in this design same as our given network table.

So, this is the possible diagram.

Answer to the question no. 6 (2nd)

6(a)

Derive the initial routing table for all the routers below:

t routers:

Dv in t
$D_t(t)=0$
$D_t(u)=2$
$D_t(v)=4$
$D_t(w)=\infty$
$D_t(x)=\infty$
$D_t(Y)=7$
$D_t(z)=\infty$

u routers:

Dv in u
$D_u(u)=0$
$D_u(t)=2$
$D_u(v)=3$
$D_u(w)=3$
$D_u(x)=\infty$
$D_u(y)=\infty$
$D_u(z)=\infty$

v routers:

Dv in v
$D_v(t)=4$
$D_v(u)=3$
$D_v(v)=0$
$D_v(w)=4$
$D_v(x)=3$
$D_v(y)=8$
$D_v(z)=\infty$

w routers:

Dv in w
$D_w(t)=\infty$
$D_w(u)=3$
$D_w(v)=4$
$D_w(w)=0$
$D_w(x)=6$
$D_w(y)=\infty$
$D_w(z)=\infty$

x routers:

Dv in x
$D_x(t)=\infty$
$D_x(u)=\infty$
$D_x(w)=6$
$D_x(v)=3$
$D_x(x)=0$
$D_x(y)=6$
$D_x(z)=8$

Y routers:

Dv in Y
$D_y(t)=7$
$D_y(u)=\infty$
$D_y(v)=8$
$D_y(w)=\infty$
$D_y(x)=6$
$D_y(y)=0$
$D_y(z)=12$

z routers:

Dv in z
$D_z(t)=\infty$
$D_z(u)=\infty$
$D_z(v)=\infty$
$D_z(w)=\infty$
$D_z(x)=8$
$D_z(y)=12$
$D_z(z)=0$

6(b)

Given, in the next time slot, router t receives route u, v and y.

Dv in t	Dv in u	Dv in v	Dv in y
$D_t(t)=0$	$D_u(t)=0$	$D_v(t)=4$	$D_y(t)=7$
$D_t(u)=2$	$D_u(u)=2$	$D_v(u)=3$	$D_y(u)=\infty$
$D_t(v)=4$	$D_u(v)=3$	$D_v(v)=0$	$D_y(v)=4$
$D_t(w)=\infty$	$D_u(w)=3$	$D_v(w)=4$	$D_y(w)=\infty$
$D_t(x)=\infty$	$D_u(y)=\infty$	$D_v(x)=3$	$D_y(x)=6$
$D_t(y)=7$	$D_u(x)=\infty$	$D_v(y)=8$	$D_y(y)=0$
$D_t(z)=\infty$	$D_u(z)=\infty$	$D_v(z)=\infty$	$D_y(z)=12$

now compute t router:

$D_t(u) = \min(c_{d,u} + D_u(u);\ c_{t,v} + D_v(u),\ c_{t,y} + D_y(u))$
$= \min(2, 7, 10) = 2$

$D_t(v) = \min(c_{t,u} + D_u(v);\ c_{t,v} + D_v(v),\ c_{t,y} + D_y(v))$
$= \min(5, 4, 11) = 4$

$D_t(w) = \min(c_{t,u} + D_u(w),\ c_{t,v} + D_v(w);\ c_{t,y} + D_y(w))$
$= \min(5, 8, \infty)$
$= 5$

$D_t(x) = \min(c_{t,u} + D_u(x),\ c_{t,v} + D_v(x),\ c_{t,y} + D_y(x))$
$= \min(\infty, 7, 13)$
$= 7$

$$D_t(Y) = \min(C_{t,u} + D_u(Y),\ C_{t,v} + D_v(Y),\ C_{t,y} + D_y(Y))$$
$$= \min(\infty, 12, 7) = 7$$

$$D_t(Z) = \min(C_{t,u} + D_u(Z),\ C_{t,v} + D_v(Z),\ C_{t,y} + D_y(Z))$$
$$= \min(\infty, \infty, 19) = 19$$

$\therefore$ t's new router table :

D_v in t
$D_t(t) = 0$
$D_t(u) = 2$
$D_t(v) = 4$
$D_t(w) = 5$
$D_t(x) = 7$
$D_t(y) = 7$
$D_t(z) = 19$

6(c)

Given. in next time slot, router u receives route t, v, and w.

From (a)	From (b)	From (a)	From (a)
Dv in v	Dv in t	Dv in u	Dv in w
$D_v(t)=4$	$D_t(t)=0$	$D_u(t)=0$	$D_w(t)=\infty$
$D_v(u)=3$	$D_t(u)=2$	$D_u(u)=2$	$D_w(u)=3$
$D_v(v)=0$	$D_t(v)=4$	$D_u(v)=3$	$D_w(v)=4$
$D_v(w)=4$	$D_t(w)=5$	$D_u(w)=3$	$D_w(w)=0$
$D_v(x)=3$	$D_t(x)=7$	$D_u(x)=\infty$	$D_w(x)=6$
$D_v(y)=8$	$D_t(y)=7$	$D_u(y)=\infty$	$D_w(y)=\infty$
$D_v(z)=\infty$	$D_t(z)=19$	$D_u(z)=\infty$	$D_w(z)=\infty$

Now compute u router:

$$D_u(t) = \min(c_{u,t}+D_t(t);\ c_{u,v}+D_v(t),\ c_{u,w}+D_w(t))$$
$$= \min(2,7,\infty) = 2$$

$$D_u(v) = \min(c_{u,t}+D_t(v),\ c_{u,v}+D_v(v),\ c_{u,w}+D_w(v))$$
$$= \min(6,3,7)$$
$$= 3$$

$$D_u(w) = \min(c_{u,t}+D_t(w),\ c_{u,v}+D_v(w),\ c_{u,w}+D_w(w))$$
$$= \min(7,7,3) = 3$$

$$D_u(x) = \min(c_{u,t}+D_t(x),\ c_{u,v}+D_v(x),\ c_{u,w}+D_w(x))$$
$$= \min(9,6,9)$$
$$= 6$$

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$D_u(Y) = \min(C_{u,t} + D_t(Y), C_{u,v} + D_v(Y), C_{c,w} + D_w(Y))$

$= \min(9, 11, \infty)$

$= 9$

$D_u(Z) = \min(C_{u,t} + D_t(z), C_{u,v} + D_v(z), C_{u,w} + D_w(Z))$

$= \min(21, \infty, \infty)$

$= 21$

u's new roteting table :

Dv in u
$D_u(t) = 2$
$D_u(u) = 0$
$D_u(V) = 3$
$D_u(W) = 3$
$D_u(X) = 6$
$D_u(Y) = 9$
$D_u(Z) = 21$

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Answer to the question no. 7

Using the Dijkstra shortest-path algorithm, compute the shortest path below the table:

node	D(t), P(t)	D(v), P(v)	D(w), P(w)	D(x), P(x)	D(y), P(y)	D(z), C(z)
u	2, u	3, u	3, u	∞	∞	∞
ut	2, u	3, u	3, u	∞	9, t	∞
utv	2, u	3, u	3, u	6, v	9, t	∞
utvw	2, u	3, u	3, u	6, v	9, t	∞
utvwx	2, u	3, u	3, u	6, v	9, t	14, x
utvwxy	2, u	3, u	3, u	6, v	9, t	14, x
utvwxyz	2, u	3, u	3, u	6, v	9, t	14, x

shortest path:

node	path	cost
t	ut	2
v	uv	3
w	uw	3
x	uvx	6
y	uty	9
z	uvxz	14

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Answer to the question no. 8

Show the all step below:

Step 1:

The host 10.0.0.3 sends a packet to 142.122.40.180

Source: 10.0.0.3, 4334

Destination: 142.122.40.180, 80

Step 2:

NAT router changes the packet source address from 10.0.0.3, 4334 to 138.76.29.7, 4032

Source: 138.76.29.7, 4032

Destination: 142.122.40.180, 80

Step 3:

Now reply the destination address:

Source: 142.122.40.180, 80

Destination: 138.76.29.7, 4032

Step 4:

Now NAT router send host message

Source: 142.122.40.180, 80

Destination: 10.0.0.3, 4334

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NAT Transmission Table:

WAN side Address	LAN side Address
138.76.29.7, 4032	10.0.0.3, 4334

Answer to the question no. 9

9(a)

As A updates the routing table and declare the new path "Ax" for destination x to B and C.

∴ C learns a new path to reach "CAx".

9(b)

If B announces the new path for destination x to C. It will go through B. So, the new path is "CBAx".

9(c)

There are two way to reach the destination, one is "CBAx" and another one is "CAx".

There is a significant amount of delay for traffic to pass through B in addition to passing through C, A and x.

So, we will choose the shortest path for the forwarding packets. The shortest path is "CAx" and it takes shorter delay will satisfy z better.

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9(d)

There are two path "CBAx" and "CAx". From (c) we know the shortest path "CAx", but C careless of the customer's satisfaction and B charges less per unit traffic to forward for C and A charges more.
In this situation "CBAx" path would C prefer to annouce to z because it will cost less for the same transfer, its does not metter the path is long.