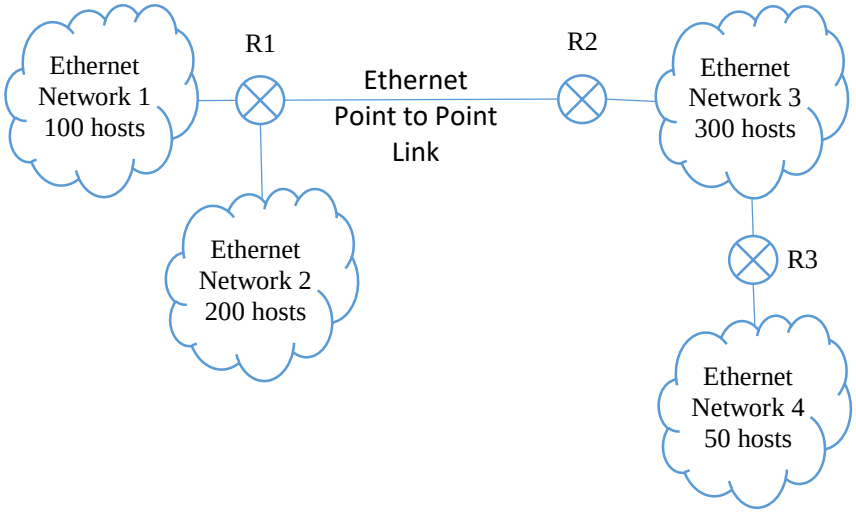
IS 504 – Homework #4

Due: May 17, 2020 Thursday – 23:30

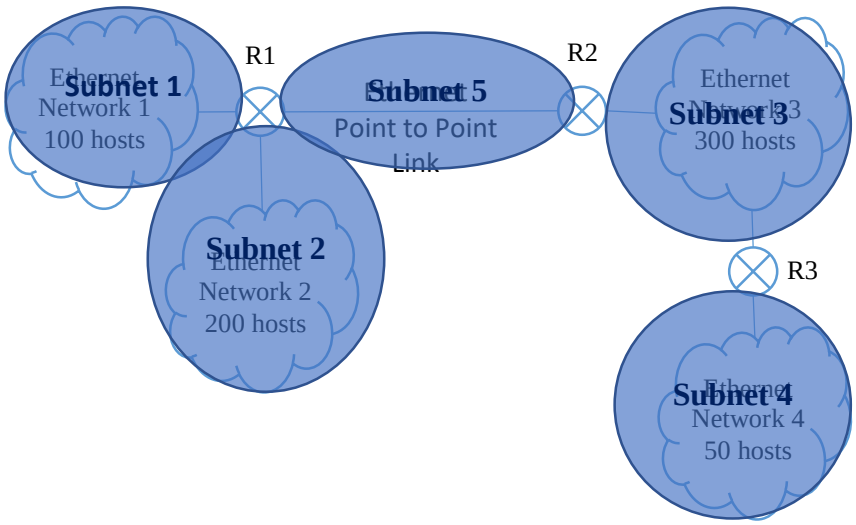
- Late submissions will be accepted by May 25, 2020, 23:30 with 5% per day penalty.
- This is an individual assignment. You have to adhere to the academic integrity principles.

Questions

1. Consider the following network that consists of five subnets interconnected by three routers. The number of hosts in each subnet is indicated in the figure. Suppose addresses will be assigned to the devices in these subnets from IP address block 144.122.0.0/22.
    a. (10 pts) Identify the subnets in this network.
    b. (20 pts) Assign network addresses to these subnets in the form a.b.c.d/m such that each subnet has enough number of IP addresses.



a)

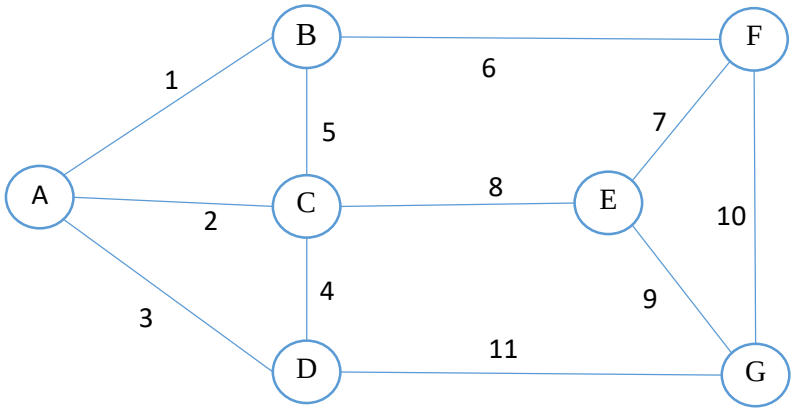


b) 144.122.0.0/22 = (binary) 1001 0000.0111 0000.0000 00|00.0000 0000

therefore addresses will have the prefix: 1001 0000.0111 0000.0000 00|**.**** ****

Subnet	**# of addresses needed**	**# of bits needed for host part**	**Mask**	**Prefix**
Subnet 3	300 hosts + 2 router + 2 reserved = 304	9 $2^9>304>2^8$	/23	1001 0000.0111 0000.0000 00|0*.**** **** 144.122.0.0/23
Subnet 2	200 hosts + 1 router + 2 reserved = 203	8 $2^8>203>2^7$	/24	1001 0000.0111 0000.0000 00|10.**** **** 144.122.2.0/24
Subnet 1	100 hosts + 1 router + 2 reserved = 103	7 $2^7>103>2^6$	/25	1001 0000.0111 0000.0000 00|11. 0*** **** 144.122.3.0/25
Subnet 4	50 hosts + 1 router + 2 reserved = 53	6 $2^6>53>2^5$	/26	1001 0000.0111 0000.0000 00|11. 10** **** 144.122.3.128/26
Subnet 5	2 router + 2 reserved = 4	2 $2^2=4$	/30	1001 0000.0111 0000.0000 00|11. 1100 00** 144.122.3.192/30

2. Consider the following network,
   a. (20 pts) Use Dijkstra's algorithm to compute the shortest path from node "A" to all other network nodes.
   b. (10 pts) Give the forwarding table in node "A" and indicate <destination, cost, next hop> for each destination.

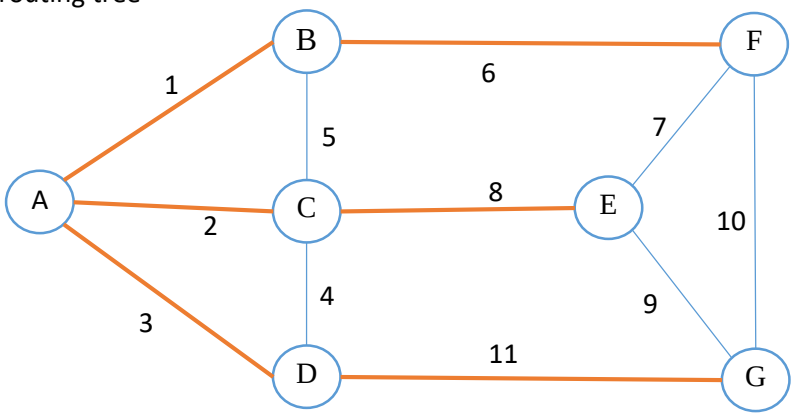


a)

Step	N'	D(B),p(B)	D(C),p(C)	D(D),p(D)	D(E),p(E)	D(F),p(F)	D(G),p(G)
0	A	1,A	2,A	3,A	∞,-	∞,-	∞,-
1	AB		2,A	3,A	∞,-	7,B	∞,-
2	ABC			3,A	10,C	7,B	∞,-
3	ABCD				10,C	7,B	14,D
4	ABCDF				10,C		14,D
5	ABCDFE						14,D
6	ABCDFEG						

b)

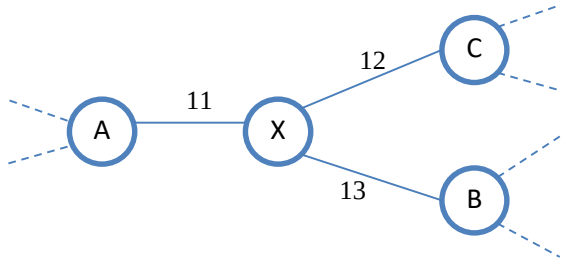
routing tree



Routing table:

destination	cost	Next hop
A	0	-
B	1	B
C	2	C
D	3	D
E	10	C
F	7	B
G	14	D

3. A fragment of a network is shown below. Suppose router X has just joined the network and received the following distance vectors from its neighbors (suppose these vectors were received at the same time instant and X computed its first distance vector just after it received all these vectors). The costs of the links between router X and its neighbors are shown in the figure.



The distance vectors received by node X just after it joined the network:

From A	
Destination	Cost
A	0
B	32
C	41
D	90
E	50
F	80

From B	
Destination	Cost
A	32
B	0
C	50
D	70
E	18
F	62

From C	
Destination	Cost
A	41
B	50
C	0
D	49
E	65
F	39

a. (10 pts) Compute X's distance vector by using these received distance vectors.

From\To	A	B	C	D	E	F
A	0	32	41	90	50	80
B	32	0	50	70	18	62
C	41	50	0	49	65	39
X	min { 0+11, 32+13, 41+12 } = **11** **via A**	min { 32+11, 0+13, 50+12, } = **13** **via B**	min { 41+11, 50+13, 0+12, } = **12** **via C**	min { 90+11, 70+13, 49+12, } = **61** **via C**	min { 50+11, 18+13, 65+12, } = **31** **via B**	min { 80+11, 62+13, 39+12, } = **51** **via C**

b. (10 pts) Suppose poisoned reverse is not used. What is the first distance vector sent to each neighbor after receiving these vectors?

Destination	Cost
X	0
A	11
B	13
C	12
D	61
E	31
F	51

c. Suppose poisoned reverse is used.

i. (10 pts) What is the first distance vector sent to each neighbor after receiving these vectors?

to A	
Destination	Cost
X	0
A	∞
B	13
C	12
D	61
E	31
F	51

to B	
Destination	Cost
X	0
A	11
B	∞
C	12
D	61
E	∞
F	51

to C	
Destination	Cost
X	0
A	11
B	13
C	∞
D	∞
E	31
F	∞

ii. (10 pts) Does A's distance vector change after processing the first distance received from X? Justify your answer.

Yes.

For example,

- **previously, the cost of the best path to B was 32**
- **now A knows that it can reach B via X and the cost of the path is:**

  13 (distance reported by X) + 11 (the cost of the link between X and A) = 24

- **So, For destination B, A will switch to the path via X upon receiving X's distance vector.**