Assignment No. 5

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CSCI 6704: Advance Topics in Networks

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Exercise 1 : VSLM Problem 1

Given a class C network address 201.45.68.0 and the following subnet requirements:

1. Subnet A: must support 14 hosts
2. Subnet B: must support 28 hosts
3. Subnet C: must support 2 hosts
4. Subnet D: must support 10 hosts
5. Subnet E: must support 45 hosts

Draw the topology of the internetwork showing the main gateway router at the exit point of the internetwork, routers at the exit point of each subnet, and each of these routers connecting to the main gateway router (similar to the examples from the lectures). The above requirement does not include router interfaces, or the extra networks created by router interconnections (that is, you have to add them and account for them).

Design the subnetting scheme using VLSM. You need to account for all the extra addresses required by the routers. Show all steps. In the final solution table, indicate the subnet number, host ranges, broadcast address and mask for each subnet. Also indicate the total number and ranges of free addresses.

Answer

Below figure is responsible for showing the internetwork with an IP address of **201.45.68.0**

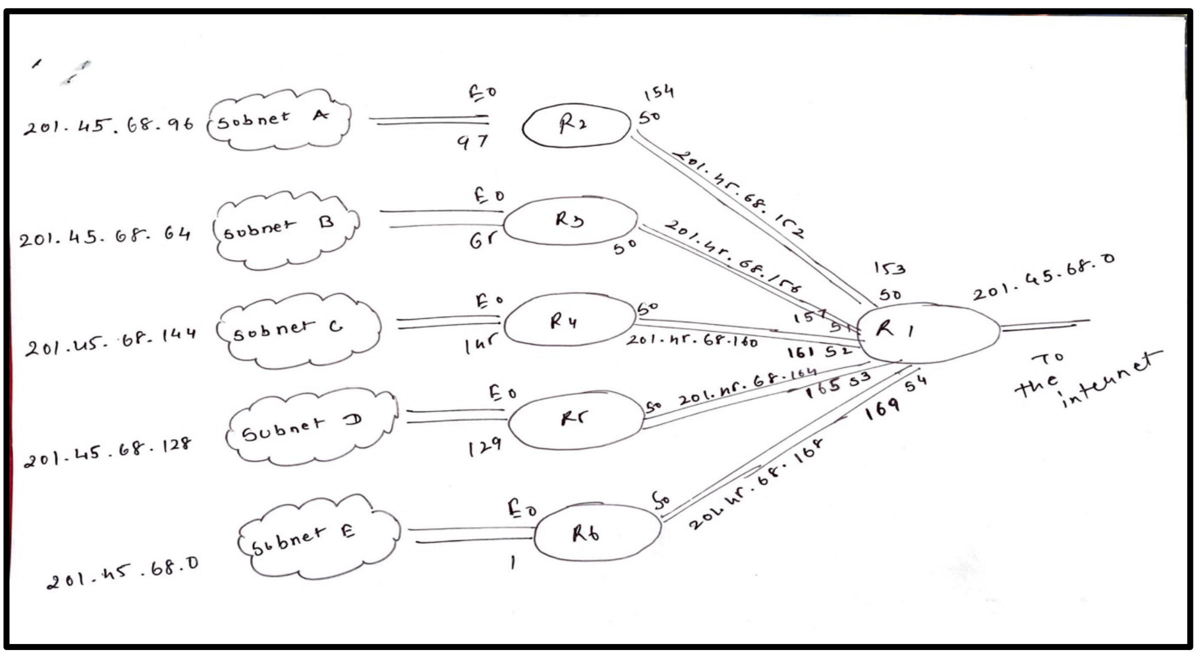


Figure 1:Internetwork with IP address 201.45.68.0

We will determine the total number of addresses needed by each subnet.

1 will be added to the host for subnet interface address and 2 will be added for subnet and broadcast address.

Table 1: Total addresses calculation

Subnet	Addresses required in total
Subnet A	14 hosts + 1 + 2 = 17
Subnet B	28 hosts + 1 + 2 = 31
Subnet C	2 hosts + 1 + 2 = 5
Subnet D	10 hosts + 1 + 2 = 13
Subnet E	45 hosts + 1 + 2 = 10
R1 & R2	2 + 2 = 4
R1 & R3	2 + 2 = 4
R1 & R4	2 + 2 = 4
R1 & R5	2 + 2 = 4
R1 & R6	2 + 2 = 4
Total	134

Now we will add host bits and subnet bits for each subnet. The allocation of Subnet ID and Host ID is shown below. We will consider 1 as Subnet Id and 0 as Host Id.

Table 2: Allocation of Subnet ID and Host ID bits

Subnet Name	Addresses Required	Host ID bits	Subnet ID bits	Host and Subnet bits
Subnet A	17	2^5 = 32 i.e., 5 bits	8 – 5 = 3 bits	201.45.68.11100000
Subnet B	31	2^5 = 32 i.e., 5 bits	8 – 5 = 3 bits	201.45.68.11100000
Subnet C	5	2^3 = 8 i.e., 3 bits	8 – 3 = 5 bits	201.45.68.11111000
Subnet D	13	2^4 = 16 i.e., 4 bits	8 – 4 = 4 bits	201.45.68.11110000
Subnet E	48	2^6 = 64 i.e., 6 bits	8 – 6 = 2 bits	201.45.68.11000000
R1 & R2	4	2^2 = 4 i.e., 2 bits	8 – 2 = 6 bits	201.45.68.11111100
R1 & R3	4	2^2 = 4 i.e., 2 bits	8 – 2 = 6 bits	201.45.68.11111100
R1 & R4	4	2^2 = 4 i.e., 2 bits	8 – 2 = 6 bits	201.45.68.11111100
R1 & R5	4	2^2 = 4 i.e., 2 bits	8 – 2 = 6 bits	201.45.68.11111100
R1 & R6	4	2^2 = 4 i.e., 2 bits	8 – 2 = 6 bits	201.45.68.11111100

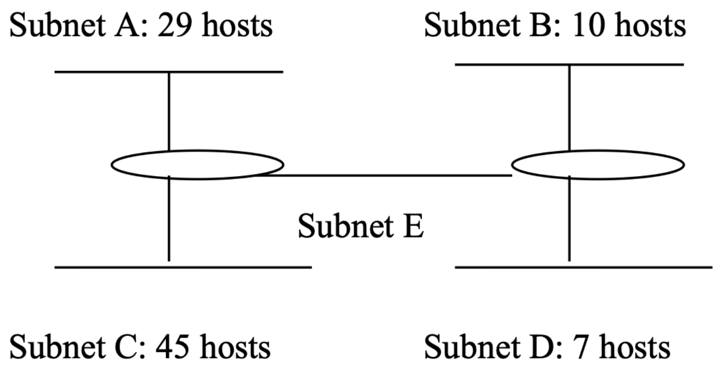
Finally, we will create a table that contains subnet number, broadcast address, host range, and mask for each subnet

Table 3: Final Solution Table

Subnet Name	Subnet Assign	Subnet Address	Host Range	Broadcast Address	Mask
Subnet A	01100000	201.45.68.96	201.45.68.97 – 201.45.68.126	201.45.68.127	/27
Subnet B	01000000	201.45.68.64	201.45.68.65 – 201.45.68.94	201.45.68.95	/27
Subnet C	10010000	201.45.68.144	201.45.68.145 – 201.45.68.150	201.45.68.151	/29
Subnet D	10000000	201.45.68.128	201.45.68.129 – 201.45.68.142	201.45.68.143	/28
Subnet E	00000000	201.45.68.0	201.45.68.1 – 201.45.68.62	201.45.68.63	/26
R1 & R2	10011000	201.45.68.152	201.45.68.153 – 201.45.68.154	201.45.68.155	/30
R1 & R3	10011100	201.45.68.156	201.45.68.157 – 201.45.68.158	201.45.68.159	/30
R1 & R4	10100000	201.45.68.160	201.45.68.161 – 201.45.68.162	201.45.68.163	/30
R1 & R5	10100100	201.45.68.164	201.45.68.165 – 201.45.68.166	201.45.68.167	/30
R1 & R6	10101000	201.45.68.168	201.45.68.169 – 201.45.68.170	201.45.68.171	/30

Exercise 2 : VSLM Problem 2

Repeat the VLSM design problem for the following scenario:



The class C address allocated to the network is 209.78.32.0. The router interfaces must also be assigned with addresses – these are not included in the number of hosts given.

Answer

- Here we are given class C address allocated an IP address of 209.78.32.0.
- Subnet A and Subnet C are connected to a router named as R1 and similarly, Subnet B and Subnet D are connected to router named as R2.
- This two named router R1 and R2 forms a subnet named as Subnet E.

To determine whether our requirement falls under a Class C network, first we have to determine the total number of addresses needed by each subnet.

1 will be added to the host for subnet interface address and 2 will be added for subnet and broadcast address.

Table 4: Total addresses calculation

Subnet	Addresses required in total
Subnet A	29 hosts + 1 + 2 = 32
Subnet B	10 hosts + 1 + 2 = 13
Subnet C	45 hosts + 1 + 2 = 48
Subnet D	7 hosts + 1 + 2 = 10
R1 & R2	2 + 2 = 4
Total	107

As calculated, there are total **107** subnets, hence we can create subnet as total subnets are less the 256.

Now we will add host bits and subnet bits for each subnet. The allocation of Subnet ID and Host ID is shown below. We will consider 1 as Subnet Id and 0 as Host Id.

Table 5: Allocation of Subnet ID and Host ID bits

Subnet Name	Addresses Required	Host ID bits	Subnet ID bits	Host and Subnet bits
Subnet A	31	2^5 = 32 i.e., 5 bits	8 – 5 = 3 bits	209.78.32.11100000
Subnet B	12	2^4 = 16 i.e., 4 bits	8 – 4 = 4 bits	209.78.32.11110000
Subnet C	47	2^6 = 64 i.e., 6 bits	8 – 6 = 2 bits	209.78.32.11000000
Subnet D	9	2^4 = 16 i.e., 4 bits	8 – 4 = 4 bits	209.78.32.11110000
R1 & R2	4	2^2 = 4 i.e., 2 bits	8 – 2 = 6 bits	209.78.32.11111100

Finally, we will create a table that contains subnet number, broadcast address, host range, and mask for each subnet

Table 6: Final Solution Table

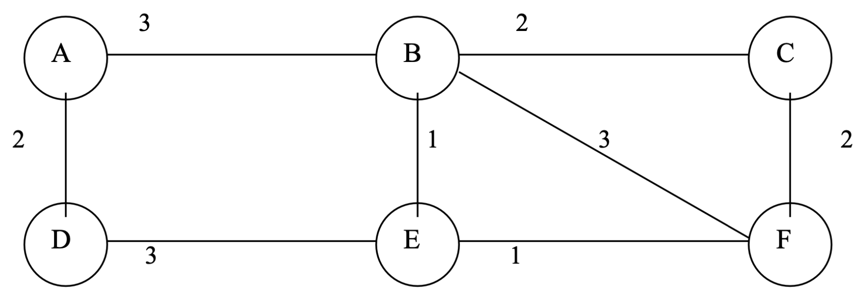
Subnet Name	Subnet Assign	Subnet Address	Host Range	Broadcast Address	Mask
Subnet A	01000000	209.78.32.64	209.78.32.65 – 209.78.32.94	209.78.32.95	/27
Subnet B	01100000	209.78.32.96	209.78.32.97 – 209.78.32.110	209.78.32.111	/28
Subnet C	00000000	209.78.32.0	209.78.32.1 – 209.78.32.62	209.78.32.63	/26
Subnet D	01110000	209.78.32.11	209.78.32.113 – 209.78.32.126	209.78.32.127	/28
R1 & R2	10000000	209.78.32.128	209.78.32.129 – 209.78.32.130	209.78.32.131	/30

Hence, we can say that free addresses range is between **209.78.32.132** and **209.78.32.255**

Exercise 3 : Network Running DV algorithm

The following figure shows a network of routers. Also assume that networks N1, N2, etc. are connected to routers A, B, etc., respectively. The cost of each link is shown and that the cost from each router to its directly connected network is 0. Assume that the network runs the Distance Vector algorithm.

1. (a) Write the DV table in router B after stabilization.
2. (b) Suppose that the link BE fails, write the new DV table in router B after re-stabilization.
3. (c) Suppose that the link EF also fails (in addition to BE), write the new DV table in router B after re-stabilization.
   Note: Write only the final tables – no need to show the intermediate steps.



Answer

1. DV table in router B after stabilization

Table 7: DV table in router B after stabilization

Network	Cost	Next Router
N1	3	A
N2	0	d (direct)
N3	2	C
N4	4	E
N5	1	E
N6	2	E

2. DV Table of B after BE Link Fails

Table 8: DV Table of B after BE Link Fails

Network	Cost	Next Router
N1	3	A
N2	0	d (direct)
N3	2	C
N4	5	A

N5	4	F
N6	3	F

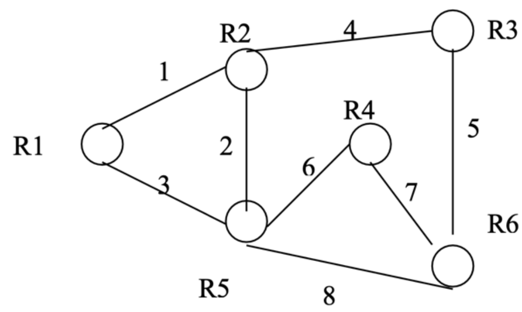
3. DV Table of B after EF Link Fails, In Addition to BE Link

Table 9: DV Table of B after EF Link Fails, In Addition to BE Link

Network	Cost	Next Router
N1	3	A
N2	0	d (direct)
N3	2	C
N4	5	A
N5	8	A
N6	3	F

Exercise 4 : Link State Database

The following figure shows a network of routers running the link state routing algorithm. The numbers on the links represent costs. Assume that R1 is directly connected to a network N1 with a cost of 0, R2 to N2, etc. Write the link state database (topology information database) that will be stored in each router after flooding.



Answer

Link state database (topology information database) that will be stored in each router after flooding.

Table 10: Link State Database

R1		R2		R3		R4		R5		R6	
N1	0	N2	0	N3	0	N4	0	N5	0	N6	0
R2	1	R1	1	R2	4	R5	6	R1	3	R3	5
R5	3	R3	4	R6	5	R6	7	R2	2	R5	8
		R5	2					R4	6	R4	7
								R6	8		