Homework Three

1. Suppose that routing information is exchanged using link state routing protocol and the shortest paths are computed using Dijkstra's algorithm. Find the shortest path from A to all other nodes in the network. Show the steps in your computation. Please use the table format in the class slides.

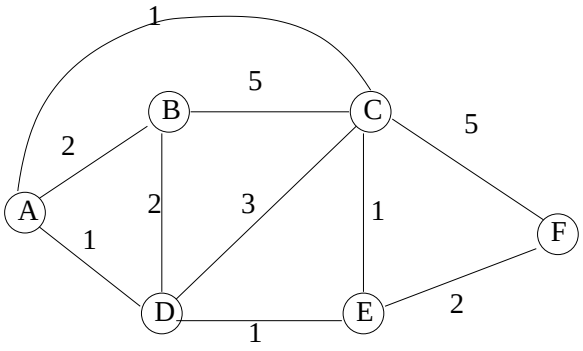

Figure 1:

Step	N	D(B), p(B)	D(C), p(C)	D(D), p(D)	D(E), p(E)	D(F), p(F)
0						
1						
2						
3						
4						
5						

2. Consider a network with 6 nodes, A, B, C, D, E, and F. C has three neighbors, B, D, and E. Distance vector routing is used, and the following vectors have just come to router C: from B: (5,0,8,12,6,2); from D: (16,12,6,0,9,10), and from E: (7,6,3,9,0,4). (The numbers in the vectors should be interpreted as, for example, E has a path of length 7 to A, a path of length 6 to B, etc.) The measured delays to B, D, and E, are 6,3, and 5, respectively. What is C's new routing table? Give both the outgoing line to use and the expected delay.

   Distance table:

	B	D	E
A			
B			
D			
E			
F			

   Routing table:

	Dist., Next hop
A	
B	
D	
E	
F	

3. A large number of consecutive IP addresses are available starting at 198.16.0.0. Suppose four organizations, A, B, C, and D, request 4096, 2048, 4096, and 8192 IP addresses, respectively, and in that order. For each of these, give the first IP address assigned, the last IP address assigned, and the mask in w.x.y.z/s notation. (Hint: recall that a 2^i address block must start with an address with the lowest i bits being 0.)

4. A router just received the following new IP addresses: 57.6.96.0/21, 57.6.104.0/21, 57.6.112.0/21, and 57.6.120.0/21. If all of them use the same outgoing line, can they be aggregated? If so, to what? If not, why not?

5. A router has the following (CIDR) entries in its routing table:

   Address/mask Next hop
   135.46.56.0/22 Interface 0
   135.46.60.0/22 Interface 1
   192.53.40.0/23 Router 1
   default Router 2

   For each of the following addresses, what will the router do if a packet with that address arrives?

(a) 135.46.63.10

(b) 135.46.57.14

(c) 135.46.52.2

(d) 192.53.40.7

(e) 192.53.56.7

6. Suppose TCP is used over a lossy link that loses one segment during the 4_{th}, 8_{th}, 12_{th}, 16_{th} RTT. Assume that there is no variance of RTT. Show how congestion window varies over time by filling in the following table. Assume that (1) initially the congestion window is 1 segment and threshold is 32 segments (2) fast retransmission and fast recovery algorithm are NOT used (3) receiver's window is always larger than the congestion window (4) when received ACK, sender will send data immediately (5) if the congestion window reaches the threshold during an RTT, it won't further increase during that RTT (6) while computing threshold round it up to the nearest integer (for example 2.5 is rounded 3) and (7) the numbers shown in the table for RTT_i are the values of the congestion window and threshold immediately after the i_{th} RTT.

RTT #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
$congwin$	1	2																
$threshold$	32	32																

7. Consider the RSA algorithm. If $p = 5$, $q = 11$, and $d = 27$, find e and encrypt $1, 2, 3, 4, 5$ (5 numbers).