TUTORIAL-6

Q1] what do you mean by minimum spanning tree? what are application of MST?

By] A minum spanning tree is a subset of the edges of a connected, edge weighted Undirected graph that connects all the vertices together, without any cycles and with the minimum possible total edge weight.

No. of edges must be → n-1.

Applications:-

1. Designing local Area Networks.
2. It also use in making transportation networks, water supply networks etc.

Q2] Please analyse the time and space complexity of Prim, Kruskal, Dijkstra & Bellman ford Algo.

By] Kruskal Algo :-

TC → O(E log V)

SP → O(log(E))

Prim's Algo

TC → $O((V+E)\log V)$

SP → $O(V+E)$

Dijkstra's Algorithm

TC → $O(V^2)$

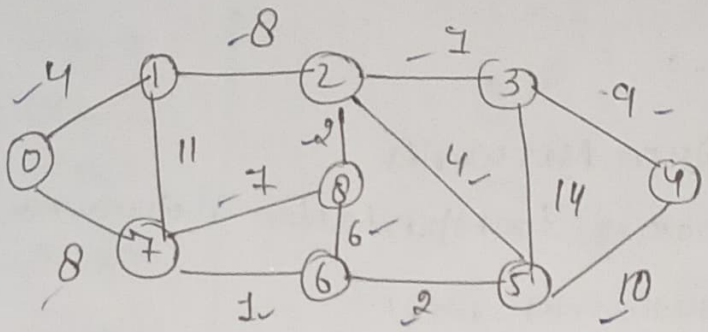
SP → $O(V^2)$

Bellmanford

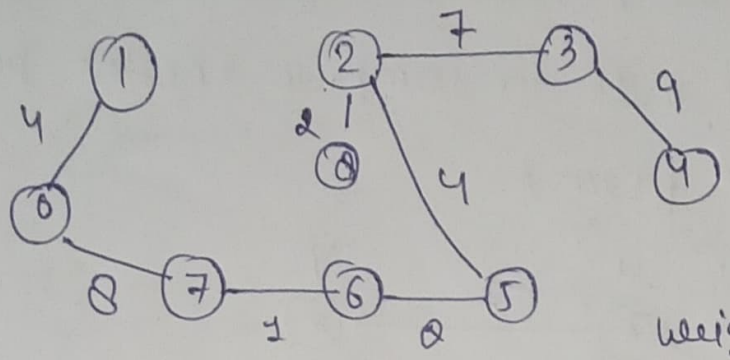
TC → $O(V \cdot E)$

SP → $O(N+E)$

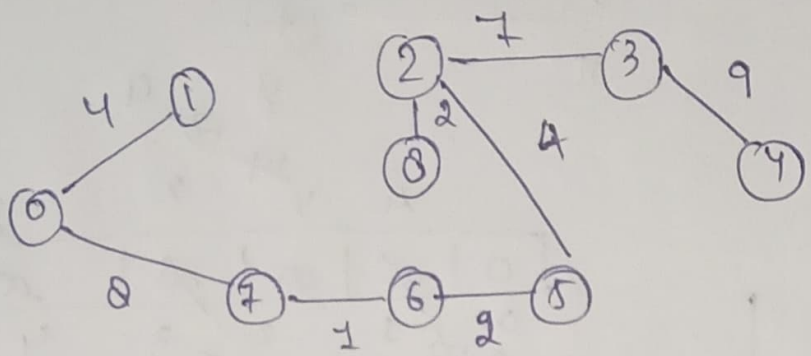
Q.1 Apply Kruskal & Prism algo on graph.



wt	u , v
1	6 , 7
2	2 , 8
2	5 , 6
4	0 , 1
4	2 , 5
6	6 , 8
7	2 , 3
7	7 , 8
8	0 , 7
8	1 , 2
9	3 , 4
10	4 , 5
11	1 , 7
14	3 , 5



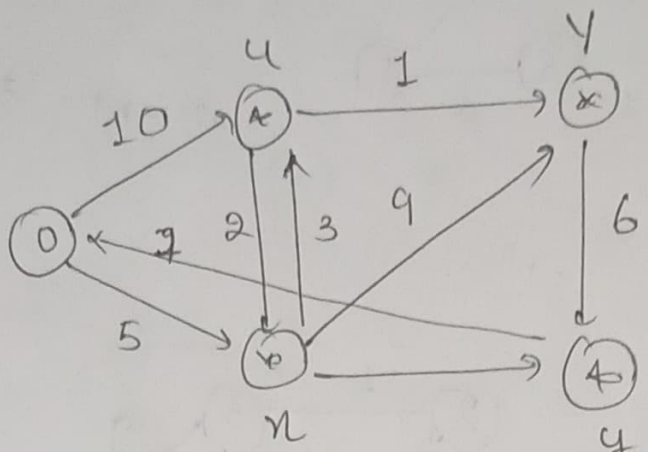
Prim's



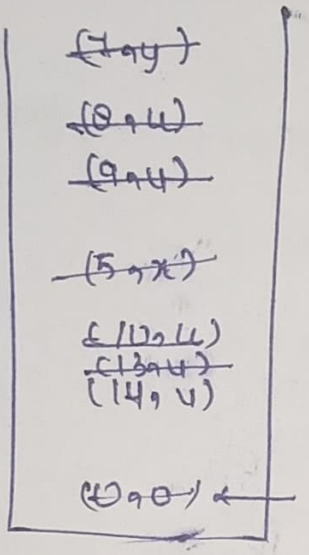
weight = 4+8+1+2+2+4+7+9

= 36

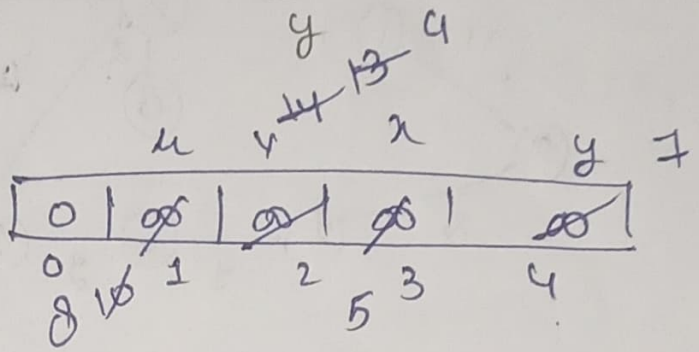
Q1 Apply Dijkstra & Bellman algorithm on graph given on right side to compute shortest path to all nodes from x.

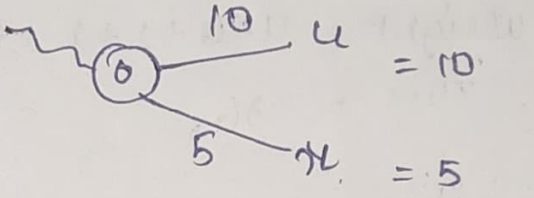


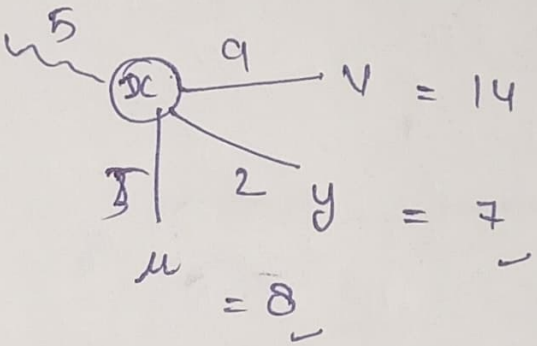
Dijkstra

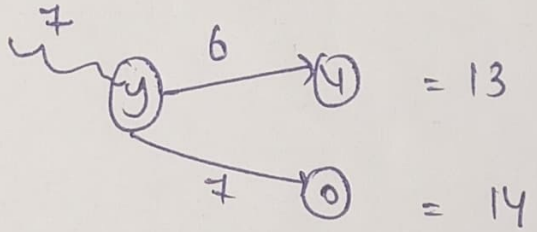


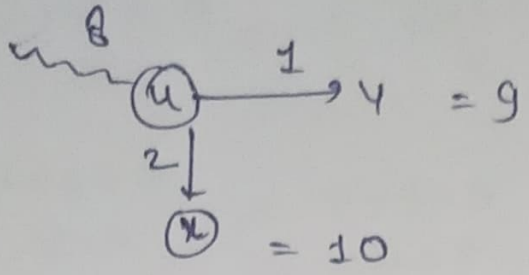
Priority Queue
(min heap)
(dist, node)

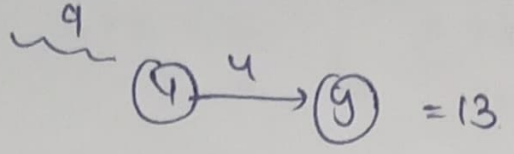


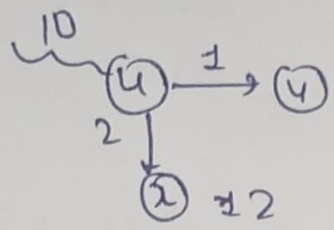


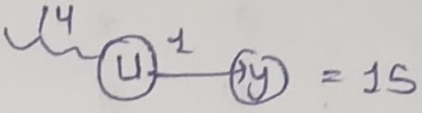


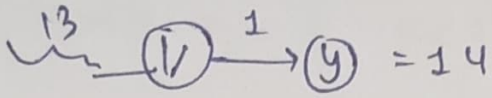












So

$0 \to 0 = 0$

$0 \to u \Rightarrow 8$

$0 \to v = 9$

$0 \to x = 5$

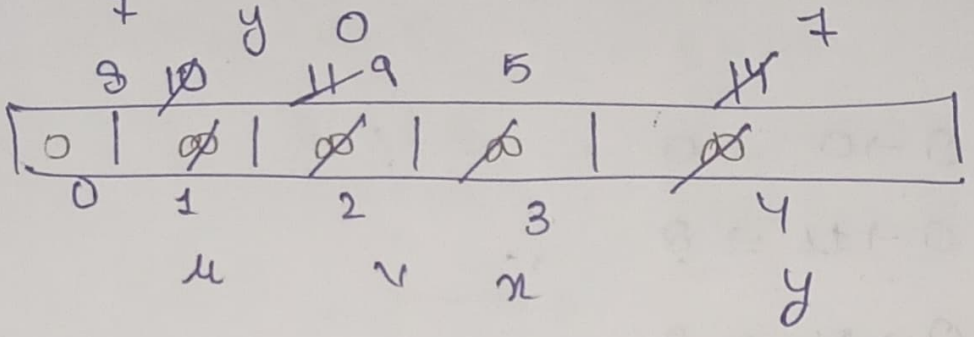
$0 \to y = 7$

Shortest distance

Ans.

Bellman ford

wt	source (u)	des. (v)
10	0	u
5	⓪	x
1	u	y
2	u	x
3	x	u
9	x	y
2	x	y
6	y	v
4	v	y
7	y	0



=1

$0+10<\infty$, $0+5<\infty$, $10+1<\infty$

$10<\infty$ $5<\infty$ $11<\infty$

$10+2<5$, $5+3<10$, $5+9<\infty$

$12<5$ $8<10$ $14<14$

dec2 $5+2<14$, $7+6<11$, $11+4<7$

$7<14$ $13<11$ $15<7$

$7+7<0$

$14<0$

=2

$0+10<8$, $0+5<5$, $8+1<11$,
$10<8$ $5<5$ $9<11$

$8+2<5$, $5+3<8$, $5+9<7$
$10<5$ $8<8$ $14<7$

$5+2<7$, $7+6<9$, $9+4<7$
$7<4$ $13<9$ $13<7$

$7+7<0$
$14<0$

=3 $0+10<8$, $0+5<5$, $8+1<9$
$10<8$ $5<5$ $9<9$

$8+2<5$, $5+3<8$ $5+9<7$
$10<5$ $8<8$ $14<7$

$5+2<7$, $7+6<9$ $9+4<7$
$7<7$ $13<9$ $13<7$

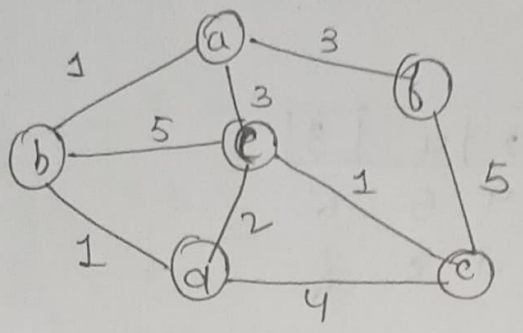
$7+7<0$
$14<0$

=4 it will be same.

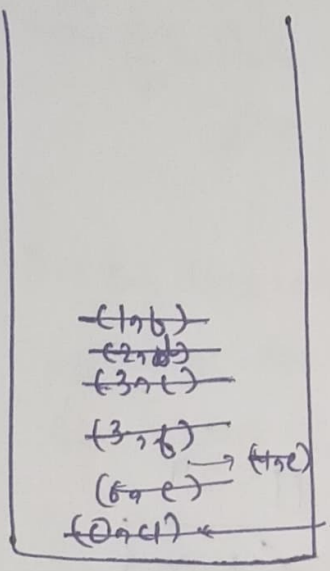
2 $0-0 \rightarrow 0$
$0-u \rightarrow 8$
$0-w \rightarrow 9$
$0-s \rightarrow 5$
$0-y \rightarrow 7$ 2

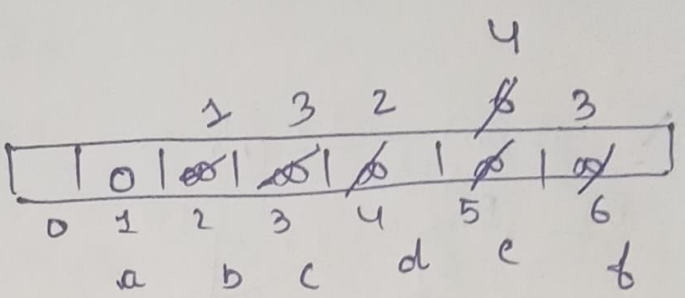
Q4) Given a directed weighted graph. what will be the effect of if we increase weight by 10 or multiply by 10.

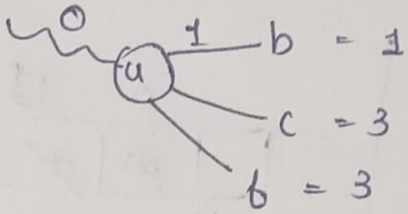
Ans)

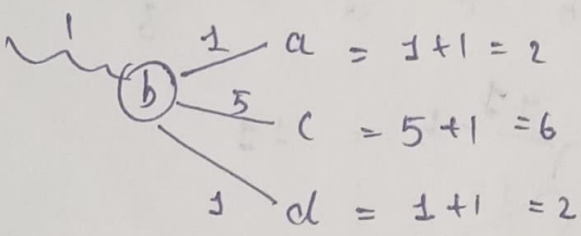


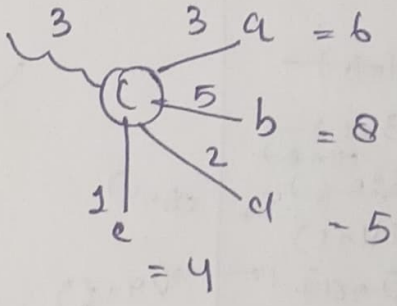
Ans)

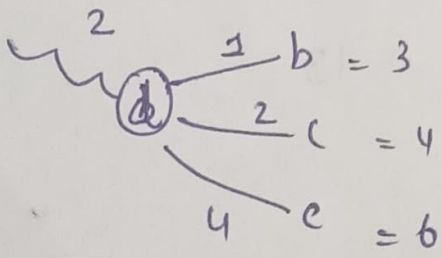


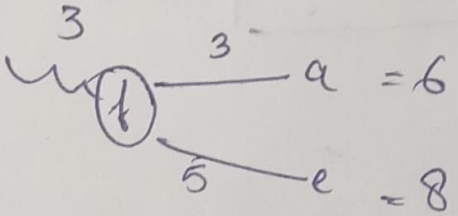


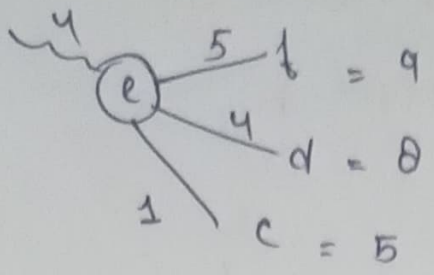


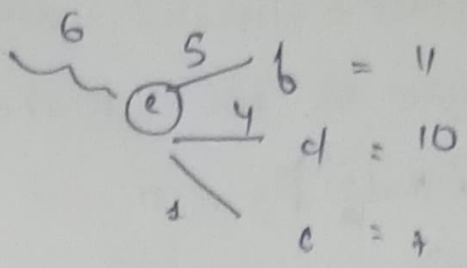






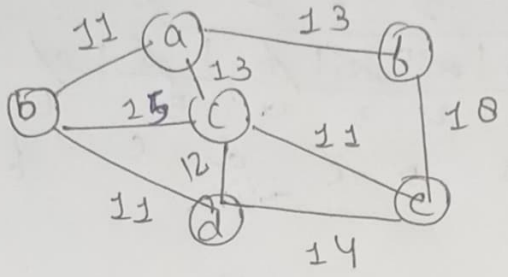


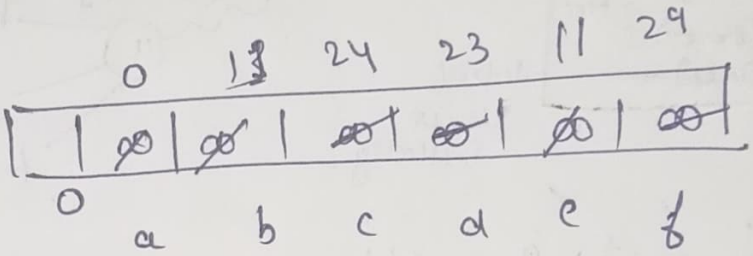




0	0	1	3	2	4	3
0	1	2	3	4	5	6
a	b	c	d	e	f	

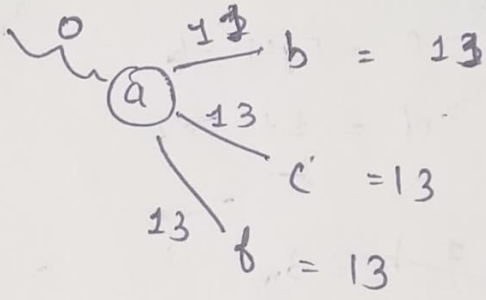
Now if we increase weight by 10.

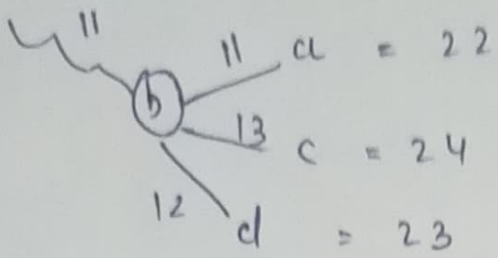


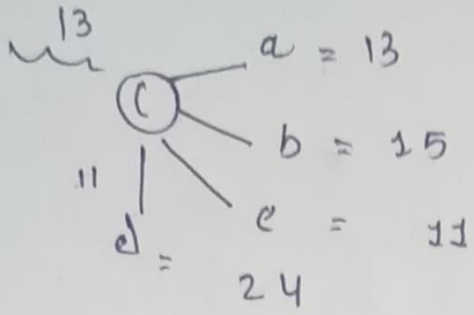


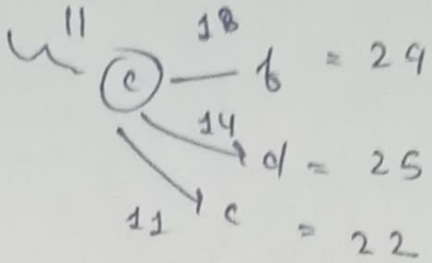
~~(11, b)~~
~~(13, c)~~
~~(11, e)~~
(13, f)
(24, d)
~~(0, a)~~

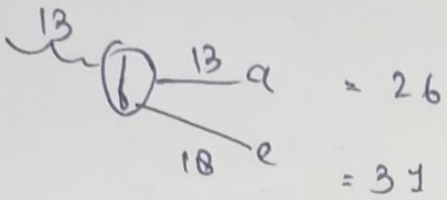
(13, c)
(24, f)











So by this we can conclude that on ~~increasing~~ adding the 10 to all the weights will change the value of shortest path.

But if we multiply by 10 all the weight is multiply by same amount and the ratio maintained will be same.