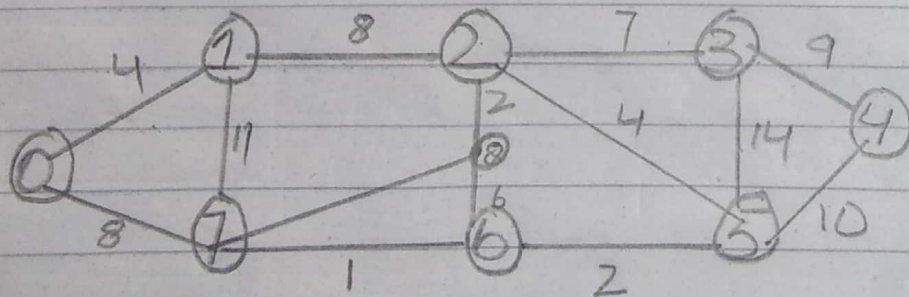


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Program B.S
Subject Operations Research

SECTION B Wednesday

∴ QUESTION * No * 4 ∴

For the following graph, find the minimum spanning tree using Kruskal's algorithm.



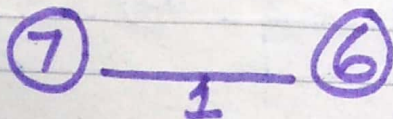
The graph contains 9 vertices and 14 edges so, the minimum spanning tree formed

will be having $(9-1) = 8$ edges

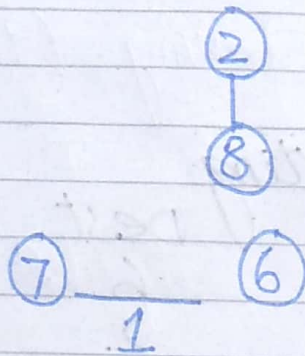
weight	src	dest
1	7	6
2	8	2
2	6	5
4	0	1
4	2	5
6	8	6
7	2	3
7	7	8
8	0	7
8	1	2
9	3	4
10	5	4
11	1	7
14	3	5

Now pick all edges one by one from sorted list of edges

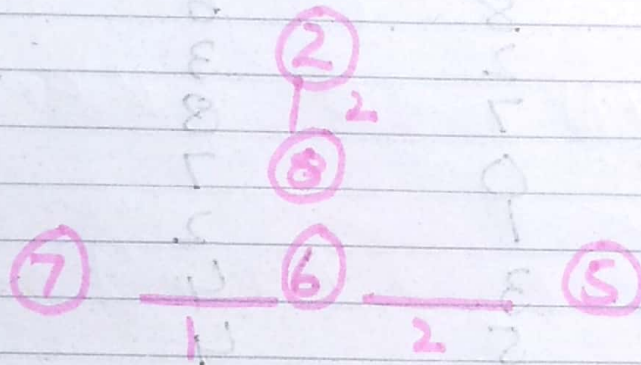
1 Pick edge 7-6 : No cycle is formed include it.



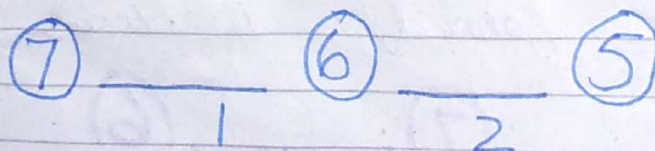
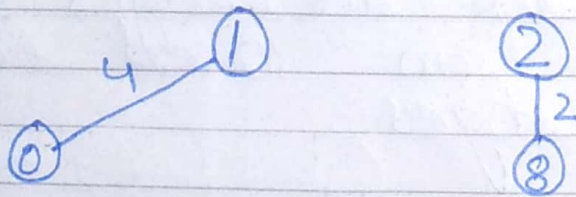
2 Pick edge 8-2 : No cycle is formed include it.



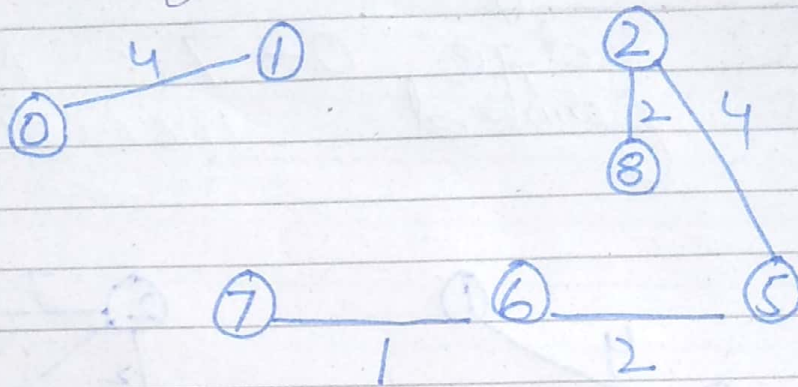
3 Pick edge 6-5: No cycle is formed include it.



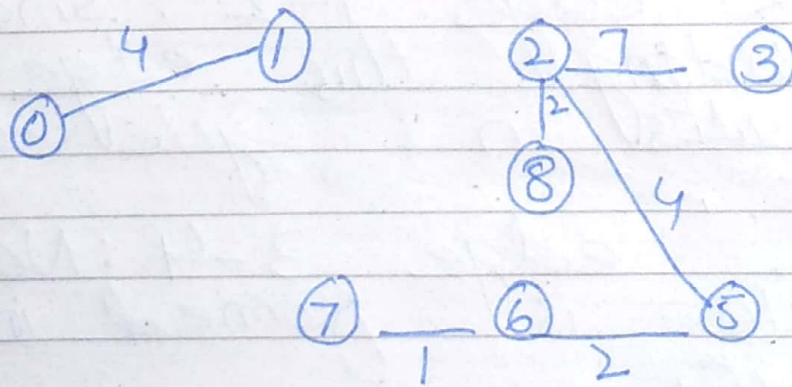
4 Pick edge 0-1: No cycle is formed include it.



5 Pick edge 2-5 : No cycle is formed include it



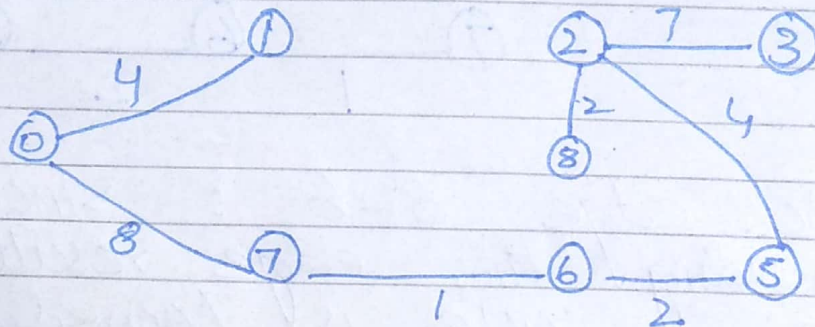
6 Pick edge 8-6 : Since including this edge results in cycle is formed include it.



7 Pick edge 2-3 : No cycle is formed include it.

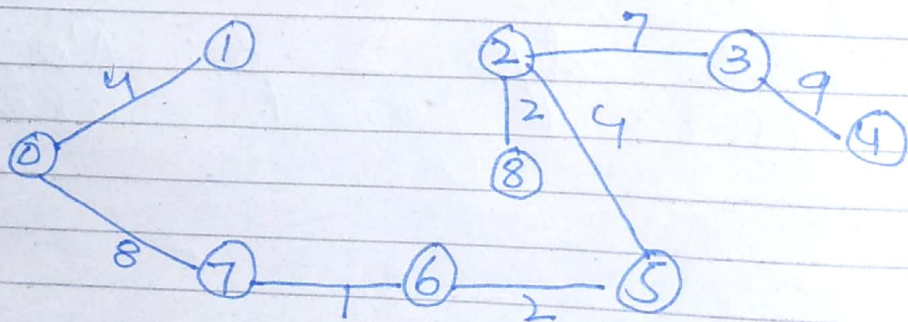
8 Pick edge 7-8 : Since including this edge results in cycle, discard it.

9 Pick edge 0-7 : No cycle is formed include it.



10 Pick edge 1-2 : Since including this edge results in cycle, discard it.

11 Pick edge 3-4 : No cycle is formed include it.



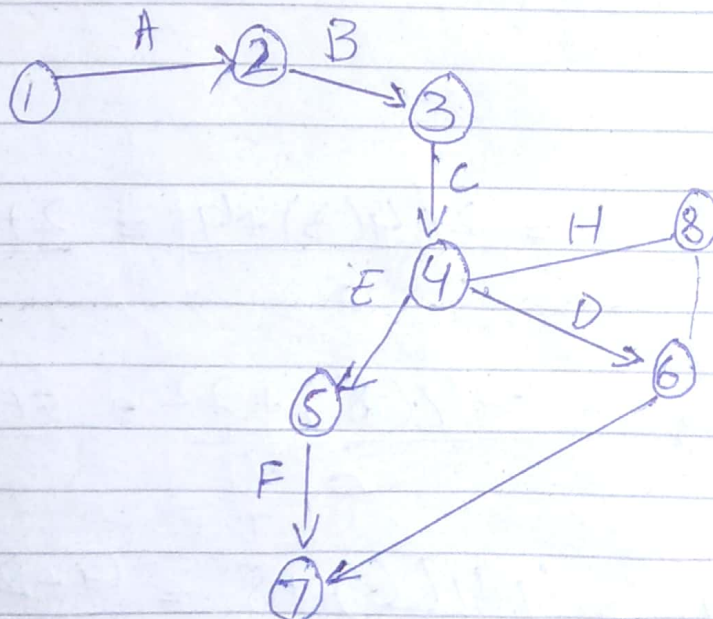
Since the number of edge included equals $(V-1)$ the algorithm stops here.

QUESTION * NO# 2

Activity	Predecessor	Optimistic Time (O)	Mostly likely time (M)	Pessimistic Time (P)
A	-	4	5	12
B	A	2	3	4
C	B	6	8	22
D	C	4	6	8
E	C	3	4	5
F	E	2	4	6
G	D, F	2	3	4
H	C	5	7	15

Solution :-

a) Construct the project Network.



Activity	Predecessor	O	M	P	most expected duration	Variance
A	-	4	5	10	6	1.77
B	A	2	3	4	3	0.11
C	B	6	8	22	10	7.09
D	C	4	6	8	6	0.44
E	C	3	4	5	4	0.11
F	E	2	4	6	4	0.44
G	D, F	2	3	4	3	0.11
H	C	5	7	15	8	7.76

By formula :-

$$\begin{aligned}
 (\text{mean}) \quad te &= \frac{t_o + 4t_m + t_p}{6} \\
 &= \frac{4 + 4(5) + 10}{6} = \frac{4 + 20 + 10}{6} = 6
 \end{aligned}$$

$$te_2 = \frac{2 + 4(3) + 4}{6} = \frac{2 + 12 + 4}{6} = 3$$

$$te_3 = \frac{6 + 4(8) + 22}{6} = \frac{6 + 32 + 22}{6} = 10$$

$$te_4 = \frac{4 + 4(6) + 8}{6} = \frac{4 + 24 + 8}{6} = 6$$

$$te_5 = \frac{3 + 4(4) + 5}{6} = \frac{3 + 16 + 5}{6} = 4$$

$$te_6 = \frac{2 + 4(4) + 6}{6} = \frac{2 + 16 + 6}{6} = 4$$

$$te_7 = \frac{2 + 4(3) + 4}{6} = \frac{2 + 12 + 4}{6} = 3$$

$$te_8 = \frac{5 + 4(7) + 15}{6} = \frac{5 + 28 + 15}{6} = 8$$

variance (σ^2)

By formula:-

$$\sigma^2 = \left(\frac{te_p - te_o}{6} \right)^2$$

$$\sigma_1^2 = \left(\frac{12 - 4}{6} \right)^2 = \left(\frac{8}{6} \right)^2$$

$$= (1.33)^2$$

$$= 1.77$$

$$\sigma_2^2 = \left(\frac{4 - 2}{6} \right)^2 = \left(\frac{2}{6} \right)^2$$

$$= 0.11$$

$$\sigma_3^2 = \left(\frac{22 - 6}{6} \right)^2 = \left(\frac{16}{6} \right)^2 = 7.09$$

$$\sigma_4^2 = \left(\frac{8-4}{6}\right)^2 = \left(\frac{4}{6}\right)^2 = 0.44$$

$$\sigma_5^2 = \left(\frac{5-3}{6}\right)^2 = \left(\frac{2}{6}\right)^2 = 0.11$$

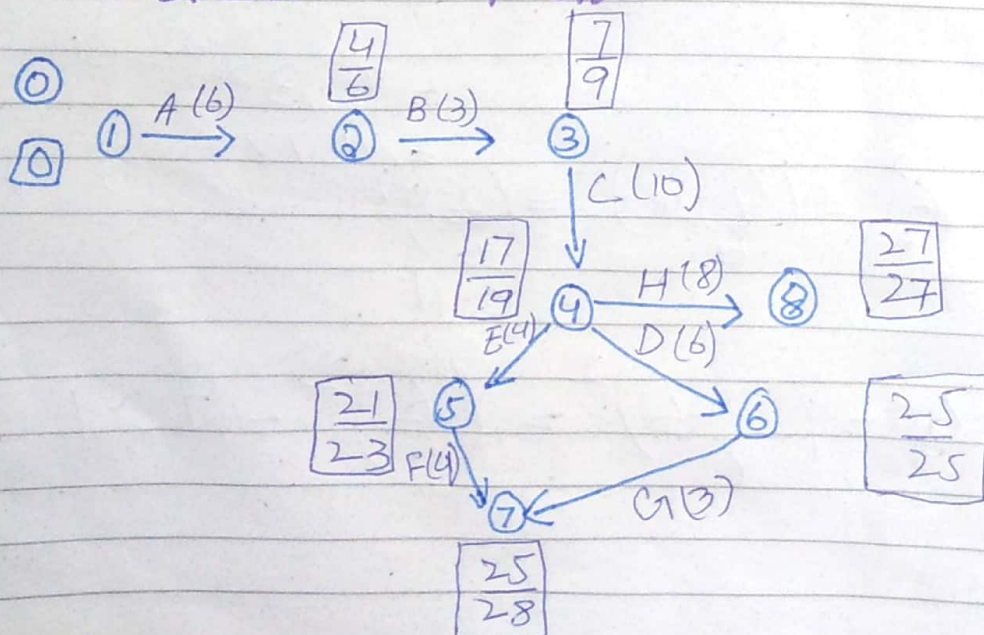
$$\sigma_6^2 = \left(\frac{6-2}{6}\right)^2 = \left(\frac{4}{6}\right)^2 = 0.44$$

$$\sigma_7^2 = \left(\frac{4-2}{6}\right)^2 = \left(\frac{2}{6}\right)^2 = 0.11$$

$$\sigma_8^2 = \left(\frac{15-5}{6}\right)^2 = \left(\frac{10}{6}\right)^2 = 2.76$$

(C) Find the critical path and expected project completion time

Critical Path



Q ≠ NO 3

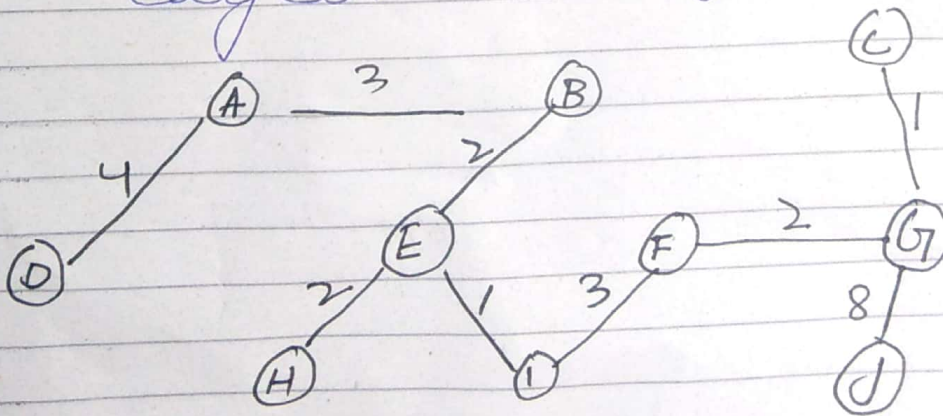
Answer :-

In Prim's Algorithm the idea is simple to create a spanning tree with all sides connected by minimum weight. Also there should be no cycles.

Step (i) =

1) Choose an arbitrary start vertex

2) keep including connected edges.



Q No 5:

Write a detailed note on how this course (Operation Research) will help you in your professional life?

Answer:

Reasons to consider a career in Operation Research.

1. You have to opportunity to solve real-world problems:-

These problem matter to organization and have an impact. In areas such as healthcare, public policy, resource management, and disaster relief, you can truly change people's lives for better.

2. You can use your analytical skill and your creativity.

Whether your background is math, software engineering, computer science, or an industry such as health-care manufacturing, finance, government, there is a job in OR for you.

3. You have mobility across industries and careers.

You can apply your core skills to almost any industry pharmaceutical, law enforcement, even entertainment so you're far more recession-proof than if focused on one cyclical industry.

4. You don't have to subscribe to a dominant worldview.

Operation Research has no single mode of professional practice so you never have to get bored or pigeonholed into a specific technique or problem solving approach that never change.

5. You become a better strategist

The O.R. discipline looking at problems, creating models and setting up analysis that point better option and result - helps you make personal and professional decisions.

6. You become an essential link b/w technology or organizational department and management.

As an O.R. professional you often act as interpreter b/w technical staff - operations, operation management, computer programmers, software engineers, etc. helping to abstract real world need into software or models.

7. You can make a great living.

There are three average starting salary for an O.R. professional in 60,000 to 70,000 and its easy to move.

8. You're not part of a fad.

The diverse techniques of O.R. - including mathematical programming, simulation decision analysis are all proven with hundreds of successful case studies.

9. You can have fun at work.

In many professional careers, little of what you create is implemented.

QUESTION ≠ NO E 1

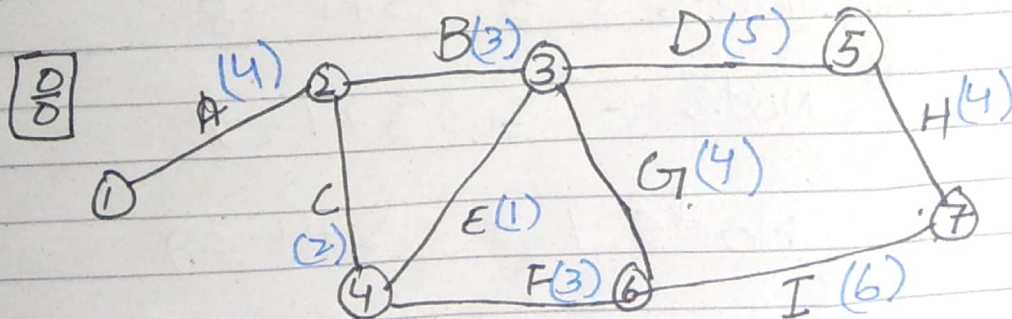
The given table shows the details of a project:

Activity	PREDECESSOR	TIME
A	-	4
B	A	3
C	A	2
D	B	5
E	B, C	1
F	C	3
G	E, F	4
H	D, E	4
I	H, G	6

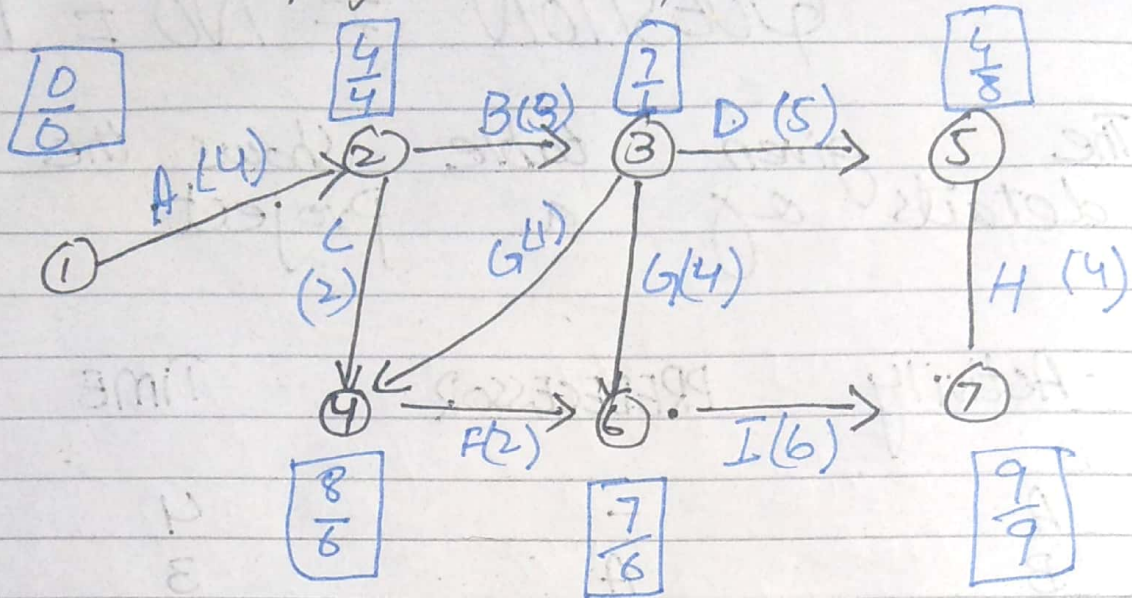
ANSWER

(a)

calculate the CPM Network



b) Determine the critical path and project completion time.



we know that

$$ES_j = \max (ES_i + D_{ij})$$

For Node 1 $\Rightarrow ES_1 = 0$

Node 2 $\Rightarrow 0 + 4 = 4$

Node 3 $\Rightarrow 4 + 3 = 7$

Node 4 $\Rightarrow 3 + 1 = 4$

Node 5 $\Rightarrow 3 + 5 = 8$

Node 6 $\Rightarrow 3 + 4 = 7$

Node 7 $\Rightarrow 5 + 4 = 9$

C₁₁

Total Float = TF

TF = LF - EF

'Finish Float'

TF = LS - ES

Start Float

