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B.S(SE) Sec "B"

Operation Research.

(1)

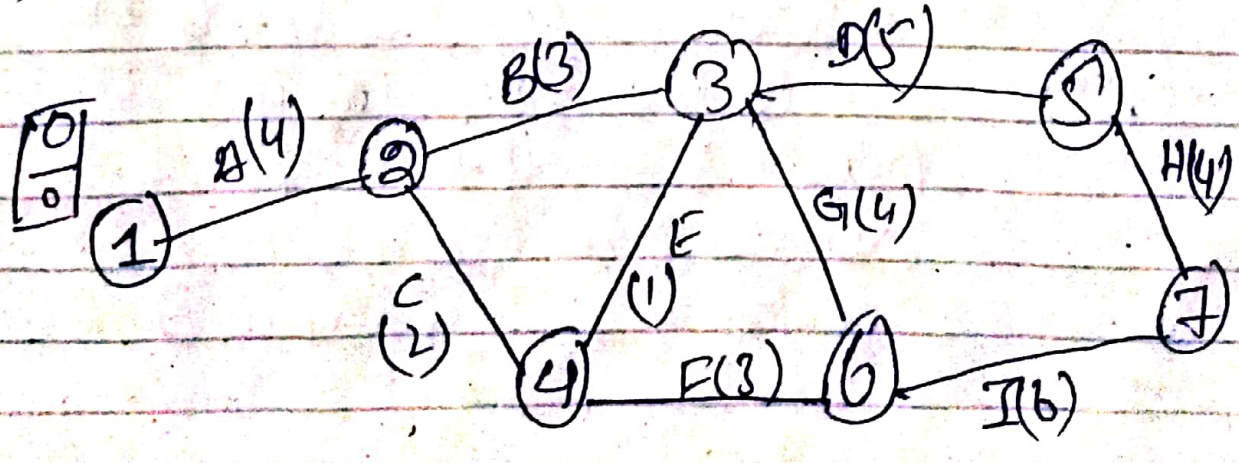
Q 1: The given table shows the detail of a project.

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:

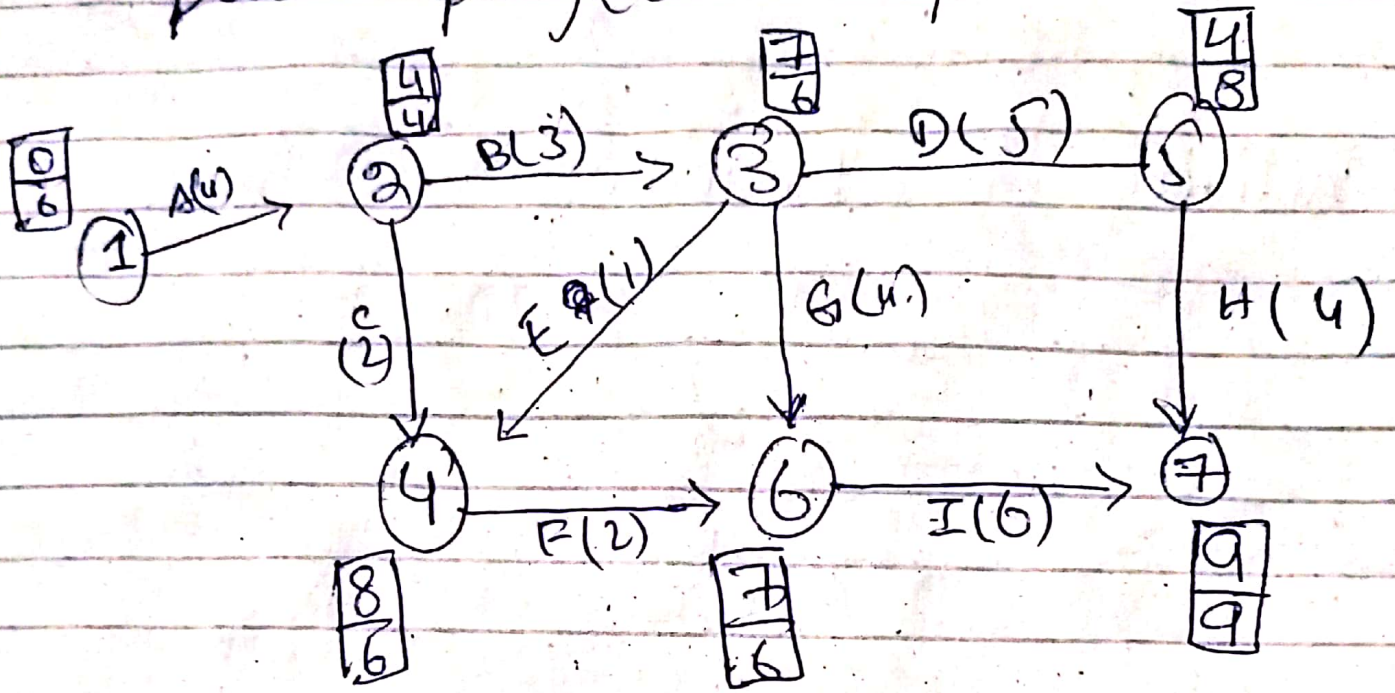
Solution:

(a) Calculate the CPM network.



(2)

(b) Determine the critical and path project completion time.



We know that,

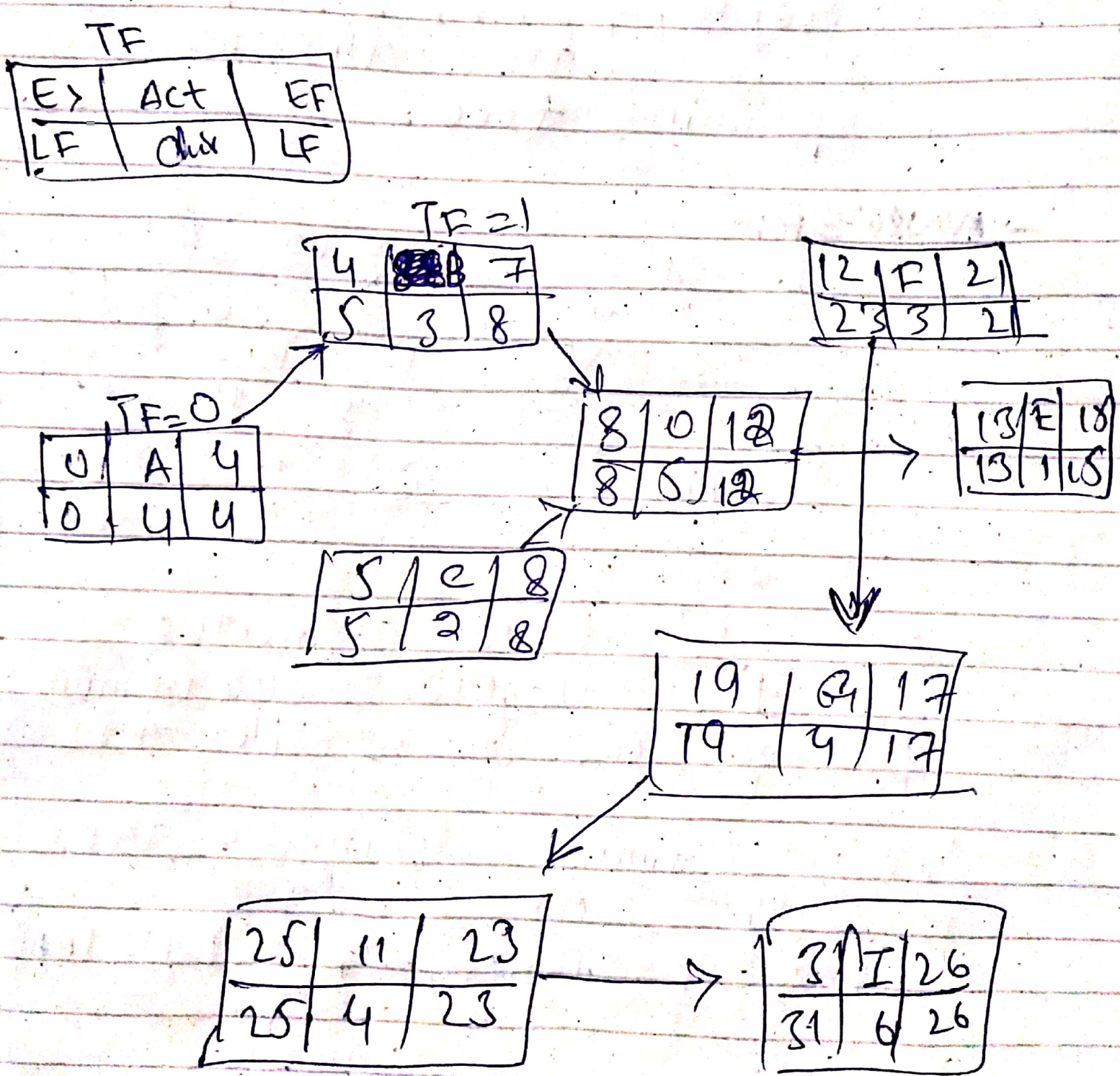
$$ES_j = Max(ES_i + D_{ij})$$

For Node 1 = $ES_1 = 0$.

Node 2 = 0+4 = 4.
Node 3 = 4+3 = 7.
Node 4 = 3+1 = 4
Node 5 = 3+5 = 8.
Node 6 = 3+4 = 7
Node 7 = 5+4 = 9.

(3)

: Q 1: (C)

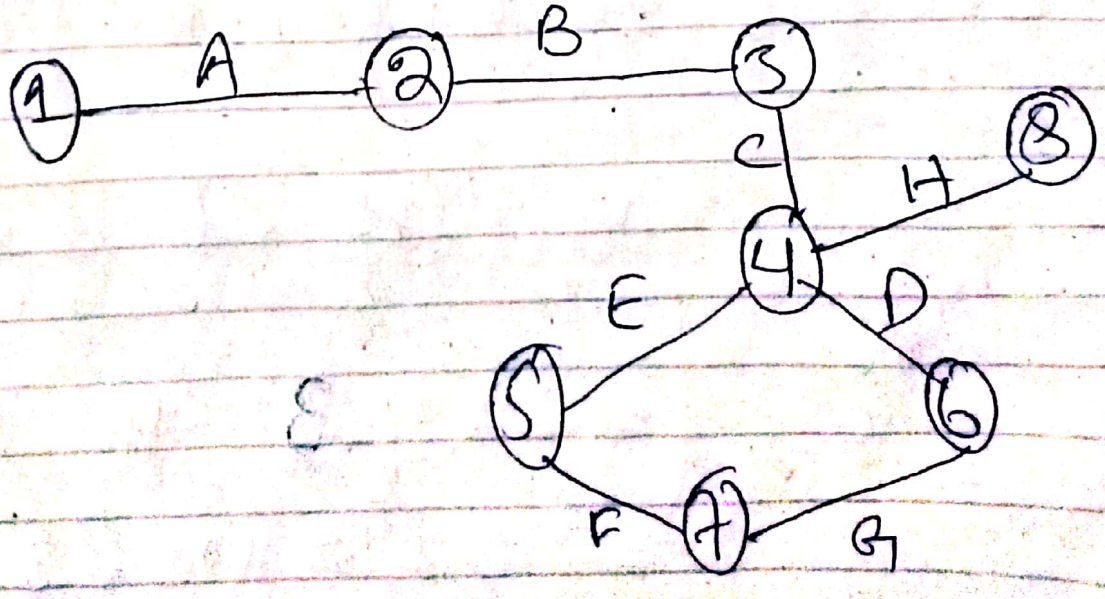

TF
E> | Act | EF
LF | Act | LF
TF=1
4 | B | 7
5 | 3 | 8
TF=0
0 | A | 4
0 | 4 | 4
12 | F | 2
23 | 3 | 2
8 | 0 | 12
8 | 5 | 12
13 | E | 18
13 | 1 | 15
5 | e | 8
5 | 2 | 8
19 | G | 17
19 | 4 | 17
25 | 11 | 23
25 | 4 | 23
31 | I | 26
31 | 6 | 26

:Q2: The given table shows the details of a project.

Activity	Predecessor	Optimistic time (O)	M	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

(a) Solution:

(a) Construct the project networkes.



(b) Find the expected duration & variance for each activity.

Activity	Predecessor	O	M	P	expected duration	Variance
A	-	4	5	12	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	2.76

* mean $te_1 = \frac{to + 4tm + tp}{6}$

$= \frac{4 + 4(5) + 12}{6}$

$= \frac{4+20+12}{6}$

$= \frac{36}{6} = 6$

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

$= \frac{2+12+4}{6} = 3.$

(6)

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

$$= \frac{6+32+22}{6} \rightarrow 10$$

$$te_4 = \frac{4+4(6)48}{6}$$

$$= \frac{4+24+8=6}{6}$$

7

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

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

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

$$= \frac{2+16+6}{6} = 4$$

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

$$= \frac{2+12+4=3.}{6}$$

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

$$= \frac{5+28+15=8.}{6}$$

★ Variance (β^2) :-

$$\beta^2 = \left(\frac{tp-to}{6}\right)^2$$

★ $\beta_1^2 = \left(\frac{12-4}{6}\right)^2 = \left(\frac{8}{6}\right)^2 = (1.33)^2 = 1.77.$

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$\Rightarrow \delta_2^2 = \left(\frac{4-3}{6}\right)^2 = \left(\frac{1}{6}\right)^2 = 0.11$

$\Rightarrow \delta_3^2 = \left(\frac{12-6}{6}\right)^2 = \left(\frac{16}{6}\right)^2 = 7.09.$

$\Rightarrow \delta_4^2 = \left(\frac{8-4}{6}\right)^2 = \left(\frac{4}{6}\right)^2 = 0.44$

$\Rightarrow \delta_5^2 = \left(\frac{5-3}{6}\right)^2 = \left(\frac{2}{6}\right)^2 = 0.11$

$\Rightarrow \delta_6^2 = \left(\frac{6-2}{6}\right)^2 = \left(\frac{4}{6}\right)^2 = 0.44$

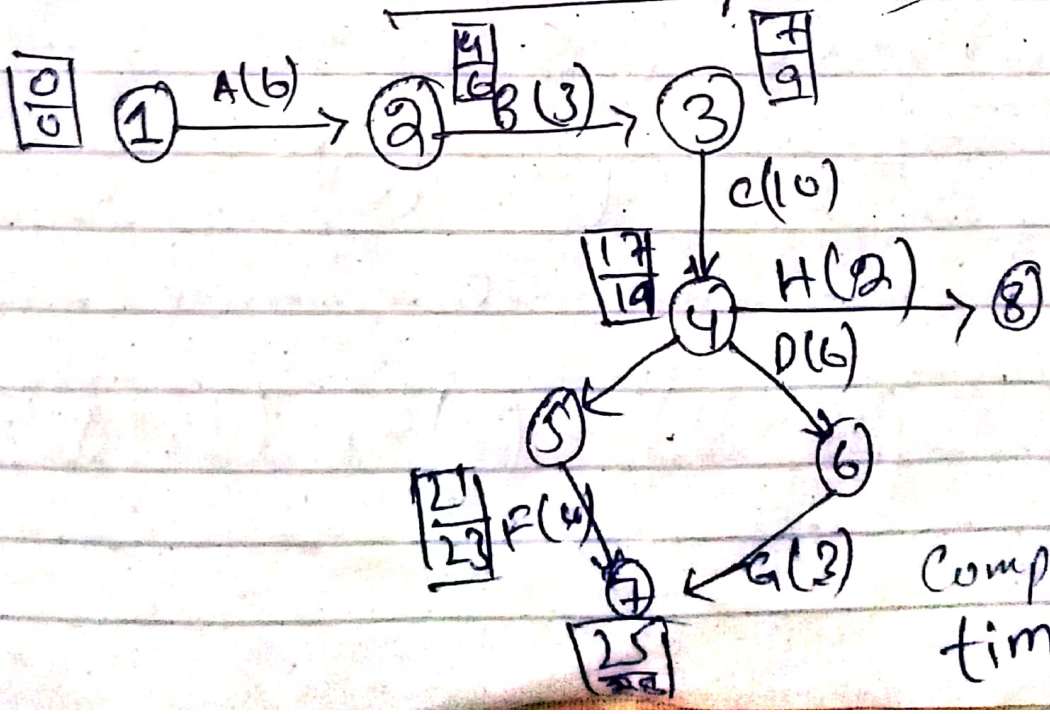
$\Rightarrow \delta_7^2 = \left(\frac{4-3}{6}\right)^2 = \left(\frac{1}{6}\right)^2 = 0.11$

$\Rightarrow \delta_8^2 = \left(\frac{15-5}{6}\right)^2 = \left(\frac{10}{6}\right)^2 = 2.76.$

(9)

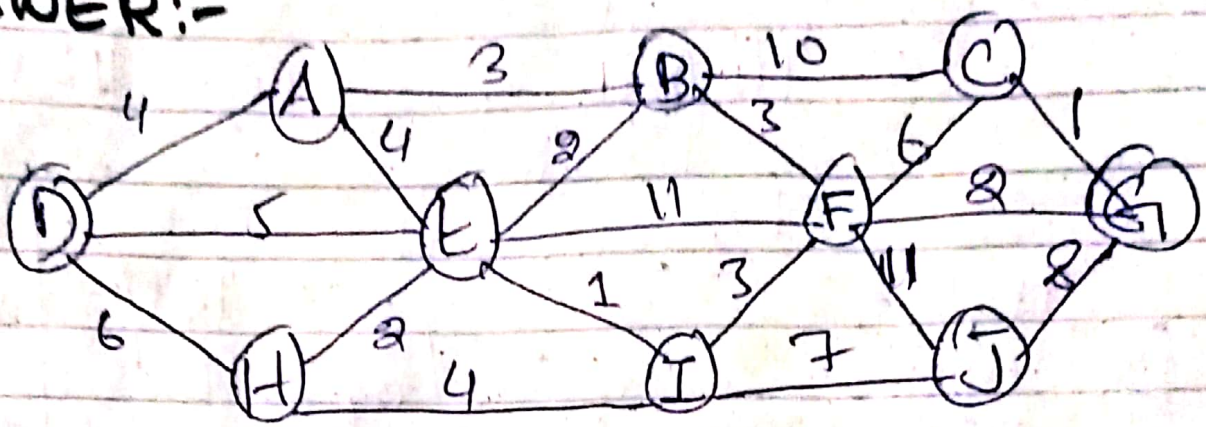
(c) Find the critical path & expected project, completion time.

Critical path :



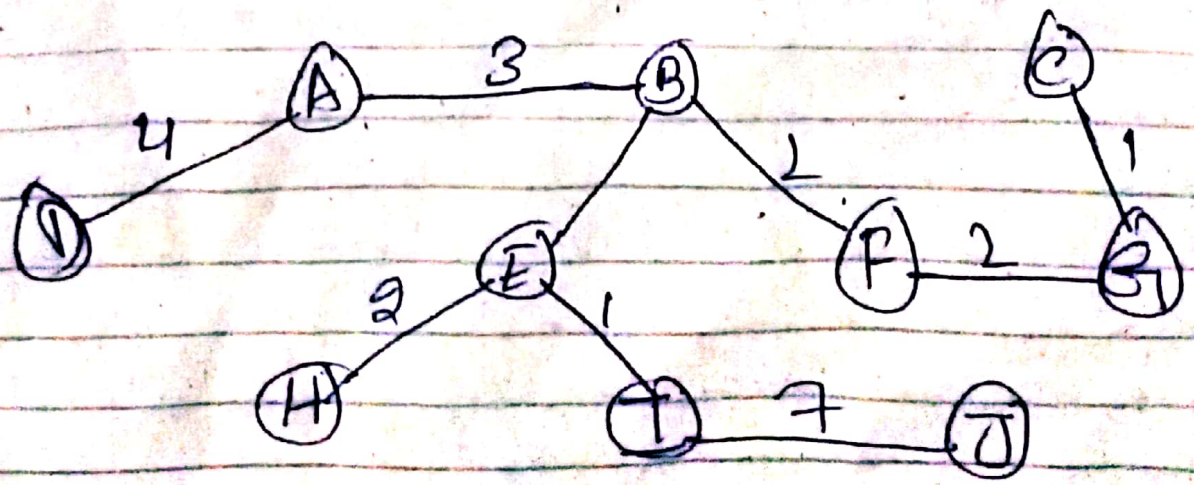
:Q3: For the following graph ..... to the Minimum Spanning tree.

-:ANSWER:-



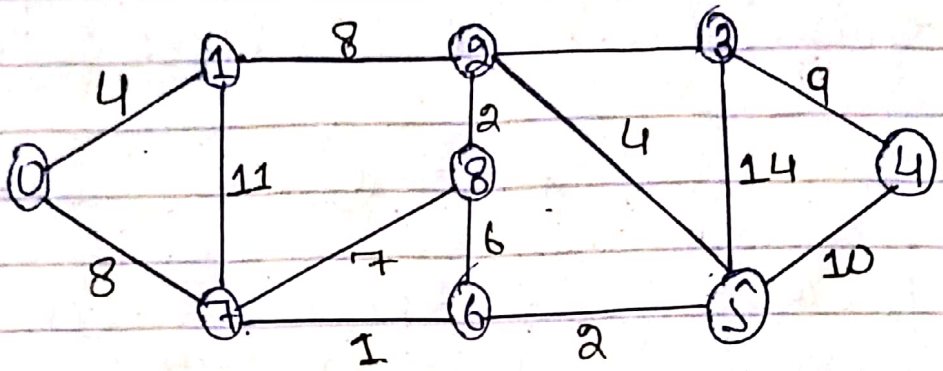
★ Now we have connected all the vertices our mimum spanning tree looks like this.

★ The minimum spanning tree is list of edges (CG, GF, FB, BE, EI, IJ, EH, BA, AD)



:Q4: For the following, find the minimum spanning tree using Kruskal's algorithm.

:Solution:



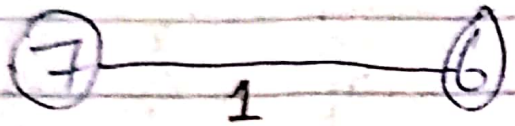
★ The graph contains 9 vertices and 14 edges. So, the minimum spanning tree formed will be having (9-1) = 8 edges.

-: After Sorting:-

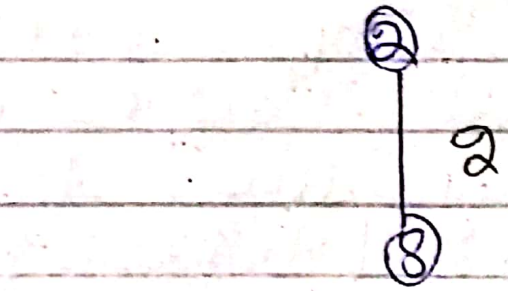
Weight	Src	Dest
1	7	6
2	8	2
2	6	5
4	0	1
4	2	5
6	8	6
7	2	3
7	7	8
8	0	7
8	1	2
9	3	4
10	5	4
11	1	7
14	3	5

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

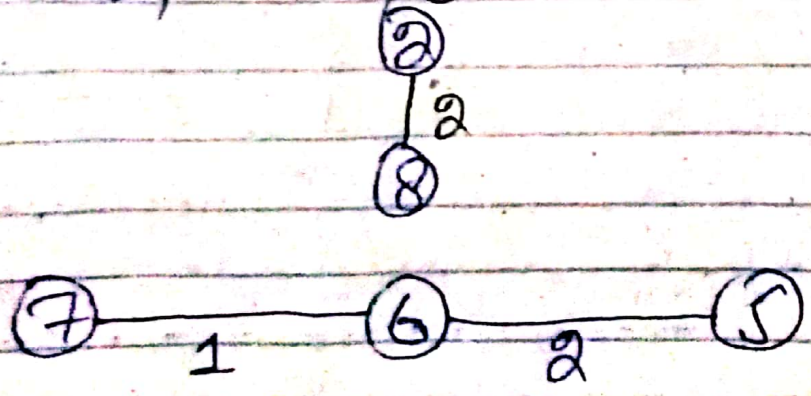
1. Pick edge 7-6: No cycle is formed, in-clude it.



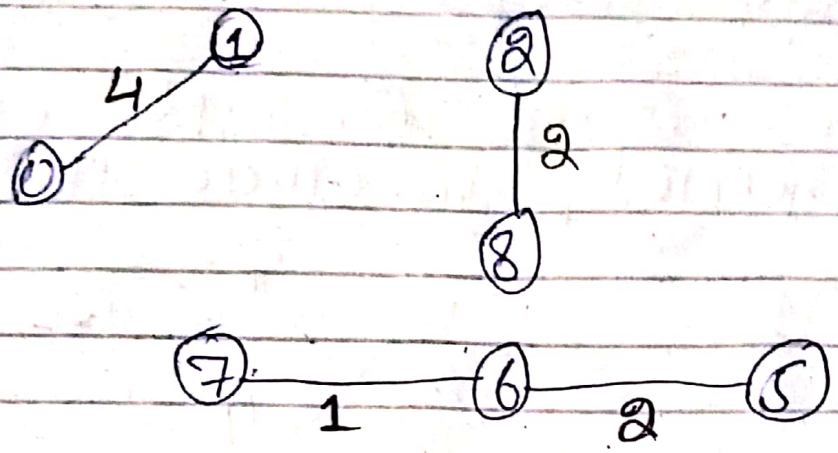
2. Pick edge 8-2: No cycle is formed, in-clude it.



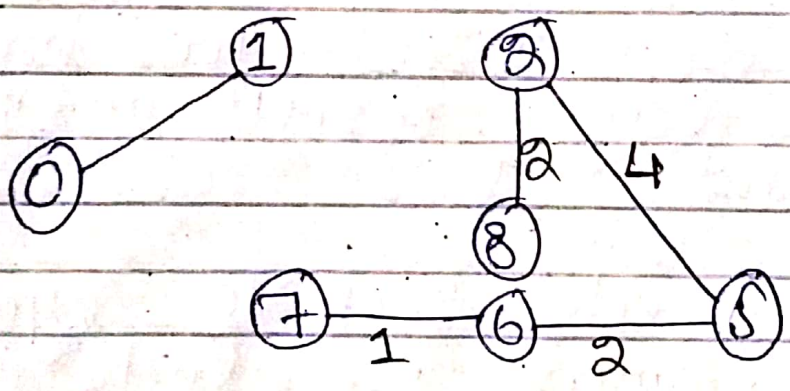
3. Pick edge 6-5: No cycle is formed, in-clude it.



4. Pick edge 0-1: No cycle is formed, in-clude it.

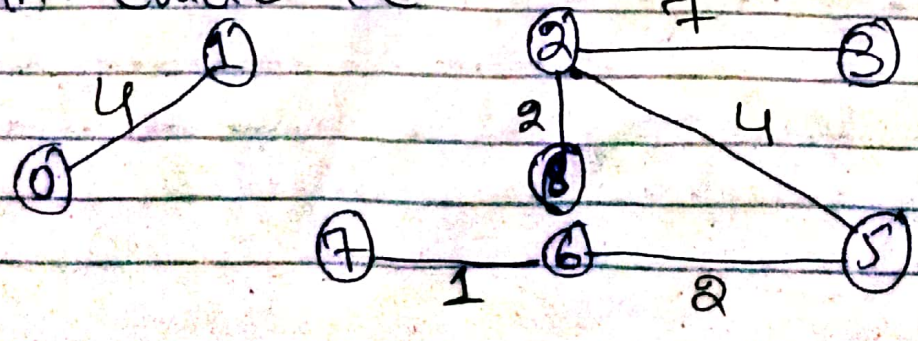


5. Pick edge 2-5: No cycle is formed, in-clude it.



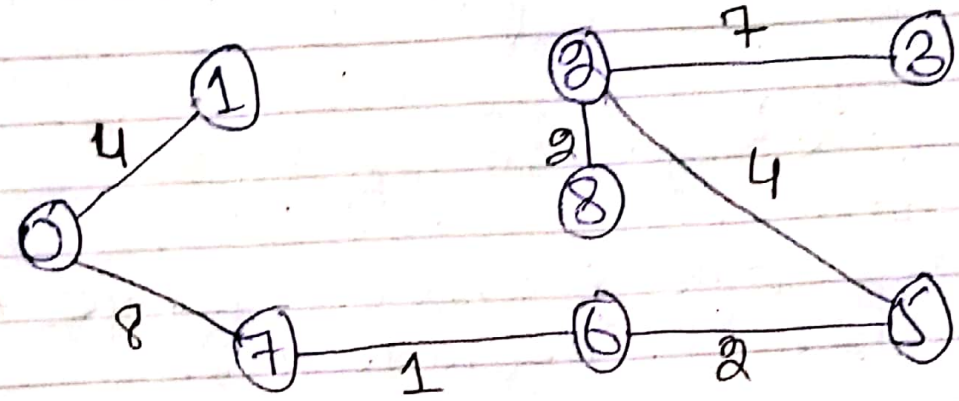
6. Pick edge 8-6: Since including this edge results in cycle, discard it.

7. Pick edge 2-3: No cycle is formed, in-clude it.



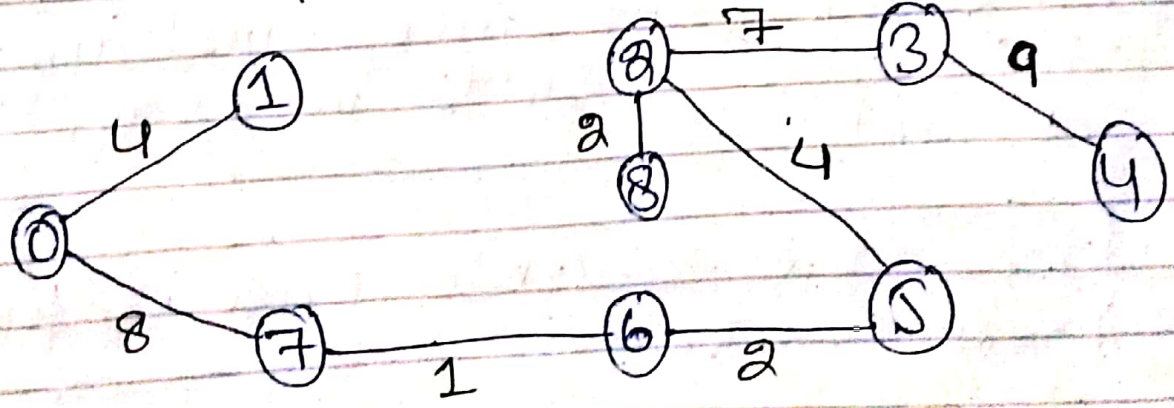
8. Pick edge 7-8: Since including this edge results in cycle, discard it.

9. Pick edge 0-7: No cycle is formed, in-clude it.



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

11. Pick edge 3-4: No cycle is formed, in-clude it.



* Since the number of edges included equals (V-1), the algorithm stops here.

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: Q5:

:ANSWER:

: Operation Research:-

Operations research (OR) is an analytical method of problem-solving and ~~desici~~ decision-making that is useful in the management of organizations.

: Importance of in Daily life:

The field of operations research provides ~~a~~ us a more powerful approach to decision making than ordinary software and data analytics tools. Employing operations research professional can help companies achieve more complete data sets, consider all available options, predict all possible outcomes and estimate risk.

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→ Uses of Operation Research in daily life:-

Operation research can be applied to a variety of use cases, including.

* Scheduling and time management.
* Urban and agricultural planning.
* Enterprise resource planning (ERP) and supply chain management (SCM).
* Inventory management.
* Network optimization and engineering.
* Packet routing optimization.
* Risk Management.

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:Duties:

Operations research analysts typically do the following:

* Identify and solve problems in areas such as business, logistic, healthcare, and other fields.

* Collect and organize information from a variety of sources, such as computer database, sales histories, and customer feedback.

* Examine information to figure out what is relevant to a problem and what methods might be used to analyze it.

* Advise managers and other decisionmakers on the effects of various courses of action to take in order to address a problem.