

Name : Zamin shah

ID : 15277

Dept : BS (S.E)

Section : "B"

Assignmet : Operation Research

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Instructor : Mr : Safiullah Jan.

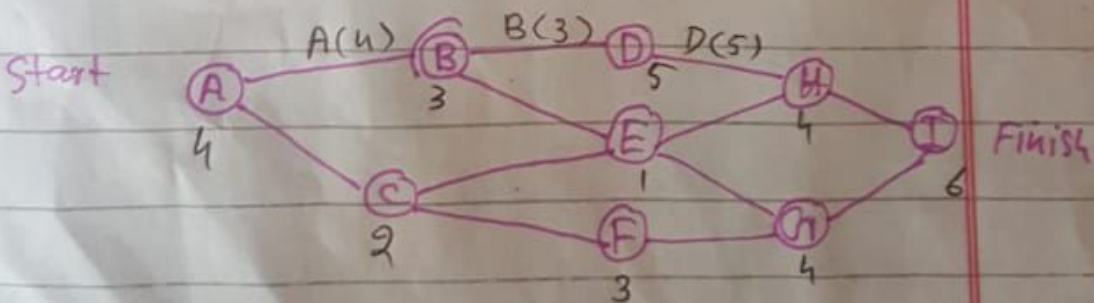
Question # 01.

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

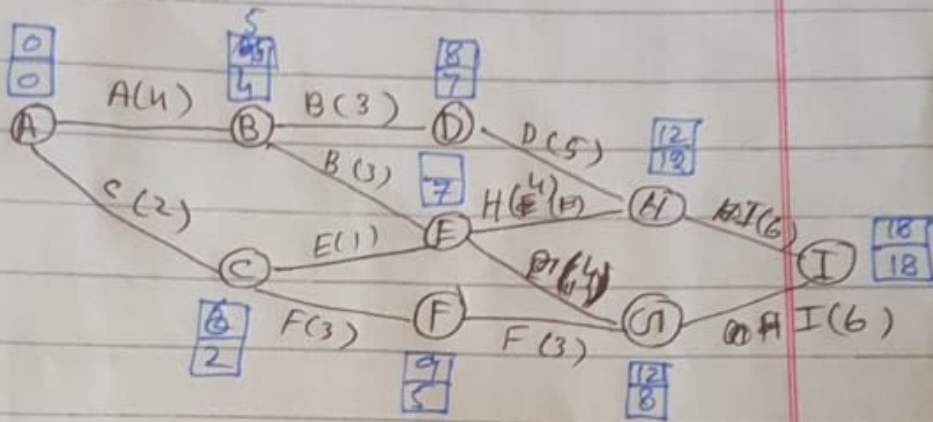
Solution :-

a) Calculate The cpm Network.



b) Determine the critical path and projected completion time

critical path:-



completion time

$$4 + 3 + 1 + 4 + 6 = 18$$

c) total float and Free floats for non-critical activities.

$$\text{Total float} = \boxed{LF_j - ES_i - D_{ij}}$$

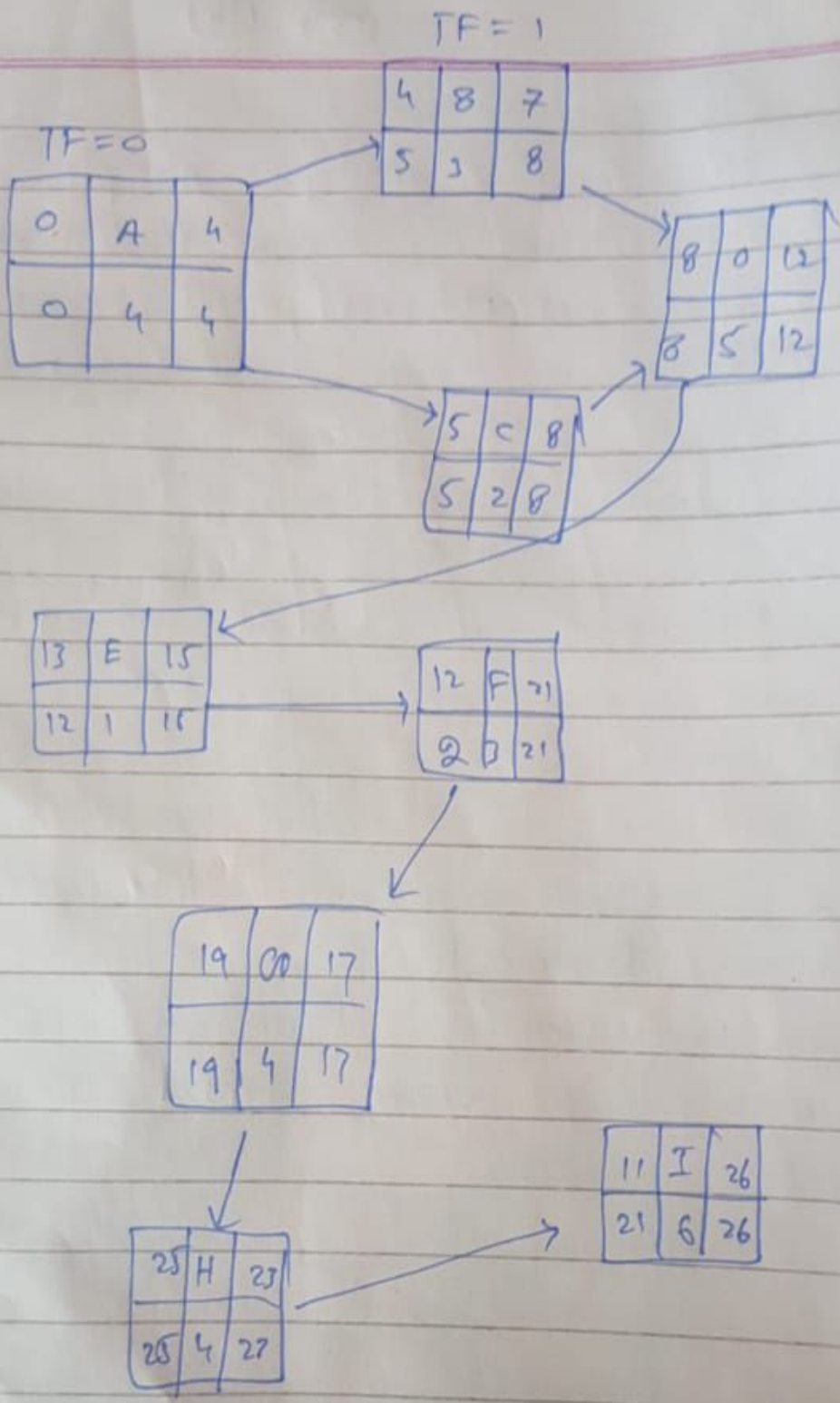
$$= \cancel{L} - \cancel{E} - \cancel{D} = \dots$$

Total float = TF

TF = LF - EF "Finish float"

TF = LS - ES "start float"

TF		
ES	A=1	EF
LF	du	LF

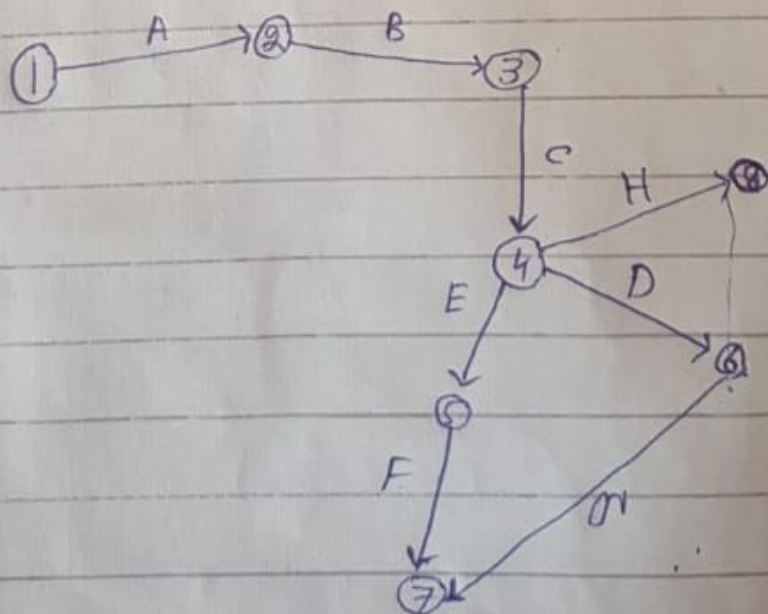


Question # 2.

Activity	Predecessor	optimistic Time (o)	Mostly Lik 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.



b)

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Activity	Predecessor	O	M	P	Mean 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	e	5	7	15	8	2.76

by formula.

$$(\text{mean}) te_1 = \frac{t_o + 4t_m + t_p}{6}$$

$$= \frac{4 + 4(5) + 12}{6} = \frac{4 + 20 + 12}{6} = 6.$$

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

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

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

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

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

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

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

Variance ( $\sigma^2$ ):-

by formula.

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

$$\begin{aligned} \sigma_1^2 &= \left( \frac{12 - 4}{6} \right)^2 = \left( \frac{8}{6} \right)^2 \\ &= (1.33)^2 \end{aligned}$$

$$\begin{aligned} \sigma_2^2 &= \left( \frac{4 - 2}{6} \right)^2 = \left( \frac{2}{6} \right)^2 \\ &= 1.77 \end{aligned}$$

$$= 0.11$$

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

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

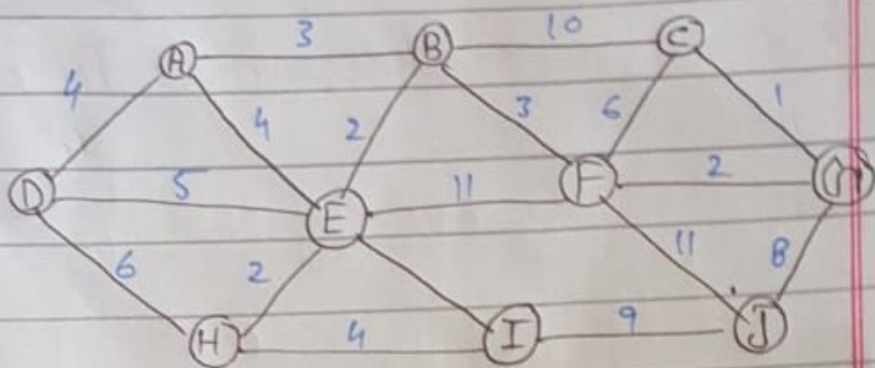
$$\sigma_5^2 = \left( \frac{5 - 3}{6} \right)^2 = \left( \frac{2}{6} \right)^2 = 0.11$$

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

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

Question # 03.

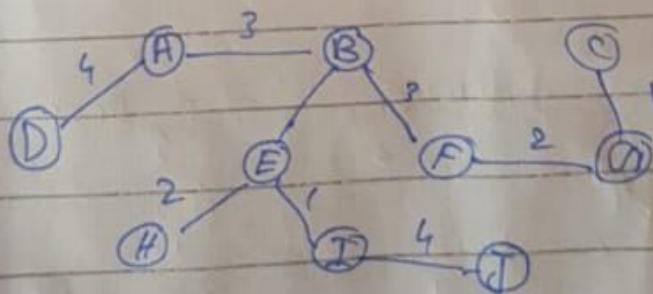
ANSWER # 03.



NOW we have connected all the vertices our minimum spanning tree looks like this.

The minimum spanning tree is list of edges.

(CA, CF, FB, BE, EI, IJ  
EH, BA, AD)

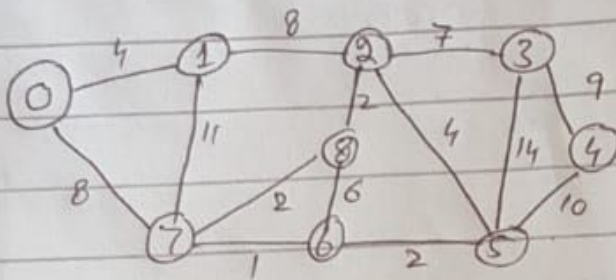


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### Question # 04.

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



Ans # 04.

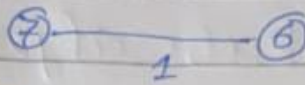
↳ The graph contains 9 vertices and 14 edges, the minimum spanning tree formed will be having  $(9-1) = 8$  edges.

After sorting :-

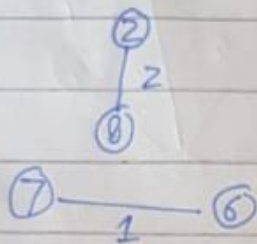
weight	src	Dest
1	7	6
2	8	2
3	<del>8</del> 6	5
4	0	1
5	2	5
6	8	6
7	2	3
8	7	8
9	0	7
10	1	2
11	3	4
12	<del>5</del>	
13	5	4
14	3	2

Now pick all edges one by one.

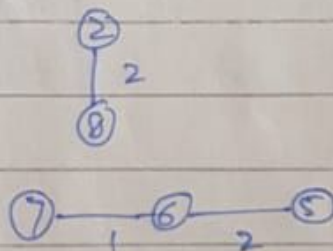
1) Pick edge 7-6 : No cycle is formed.



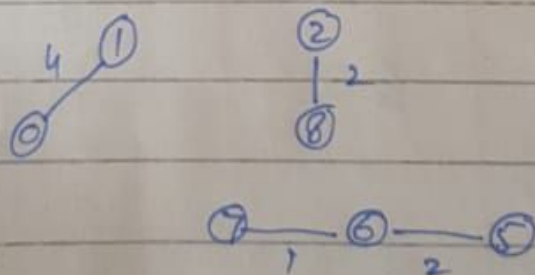
2) Pick edges (8-2) No cycle is formed.



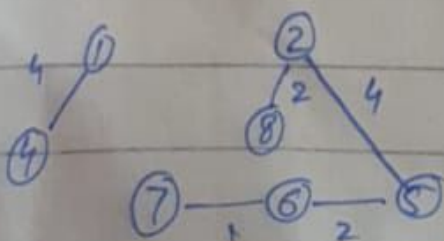
3) Pick edge 6-5 No cycle is formed.



4) Pick edge 0-1 No cycle is formed.

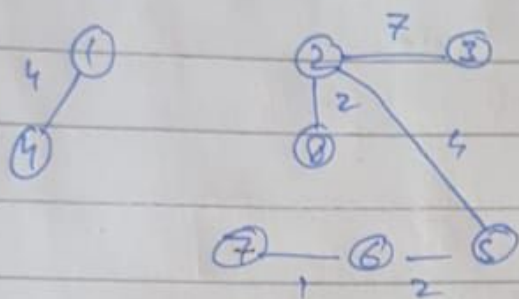


5) Pick edge 2-5 No cycle is formed.



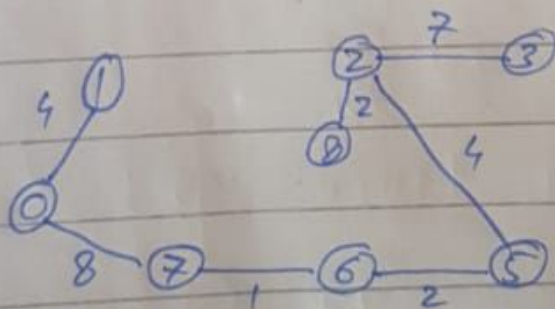
6) Pick edge 8-6 since including this edge results in cycle.

7) Pick edge 2-3 No cycle is formed.



8) Pick edge 7-8 since including this edge results in cycle.

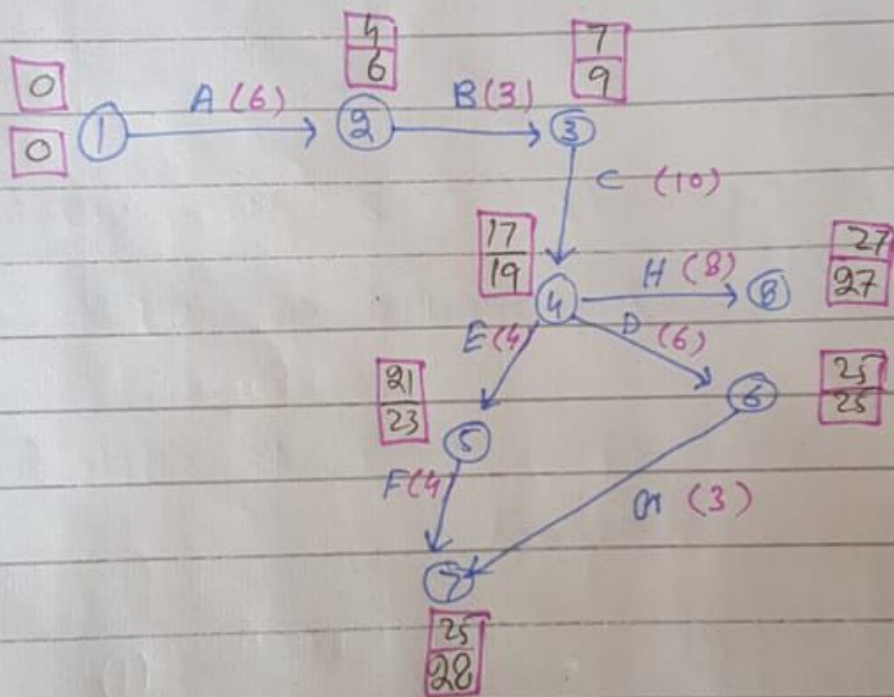
Pick edge 0-7 No cycle is formed.



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

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

critical path.



Completion time as:

$$= 27$$

## Question # 05

Write detail note on course (Operational research) with help of Professional life.

## ANSWER # 05.

## Mean of Operational Research :-

An analytical method of problem - solving and decision-making that is useful in the management of organizations. In operation research, problems are broken down into basic components and then solved in defined steps by mathematical analysis.

## Operational Research in real life (Professional) :-

- Scientific study of operations for making better decisions.
- The process of observation and testing method.
- Situation, problems statement, model construction, Validation, experimentation, candidate solutions.

(15)

(14)

- operation Research is a quantitative approach to decision making.
- Development of solution techniques.
- operation Research techniques applied on many industries.
- applied on mathematics, engineering, physics, Petro-chemical airlines,
- business area and management area also used operation Research.
- Now it has become an area of active academic and industrial Research.
- operational Research used in mostly every field in life.

Ended thank you.