

Name

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BS (SE) — 4

Section 'A'

Paper

Operation Research

Date

23-06-20

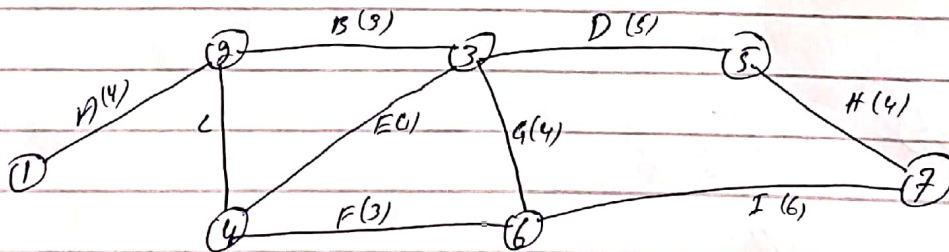
## Question # 1

The given table shows the details of Project.

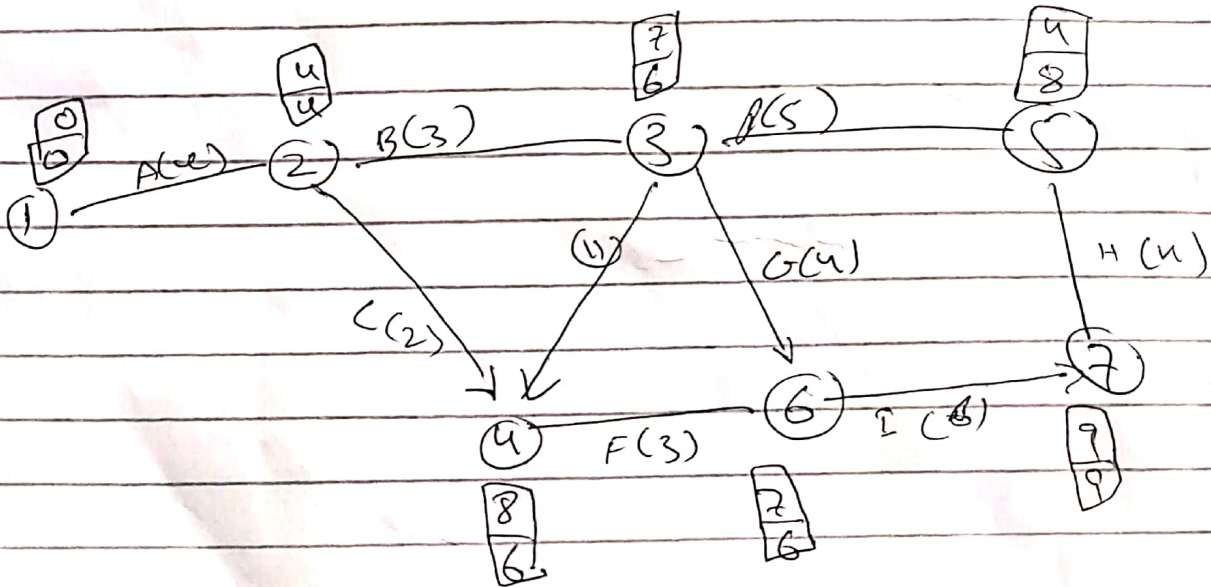
Activity	Predecessors	Time
A	—	4
B	A	3
C	A	2
D	B	5
E	B, C	1
F	C	3
G	E, F	4
H	D, E	4
I	H, G	6

Answer

(a) Calculate the cpm network.



Q 1 Part B



We know the

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

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 =  $3 + 4 = 7$

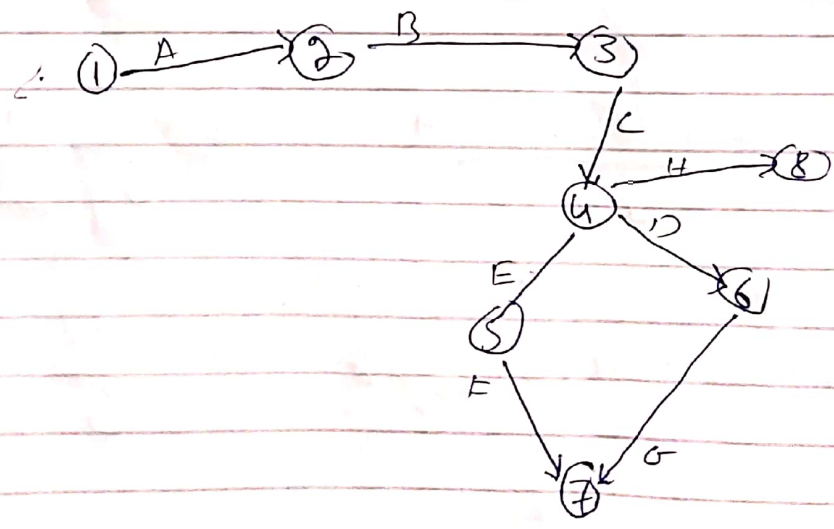
Node 7 =  $5 + 4 = 9$

Q 2: ~~Activity~~ predecessor

Q 2:

Activity	predecessory	optimistic Time (O)	mostlly Time	passmitic Time
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	3	3	4
H	C	5	7	15

Q 2 a) Construct the project Network,





psr (B)

Activity	Predecessor	O	M	P	mean expected mean deviation	Variance
A	-	4	5	12	6	1.77
B	A	2	3	4	3	0.11
C	B	6	8	22	10	2.09
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

by formulae.

$$(mean) t_{e1} = \frac{t_o + 4t_m + t_p}{6}$$

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

$$t_{e2} = \frac{2 + 4(3) + 4}{6} = \frac{2 + 12 + 4}{6} = 3$$

$$t_{e3} = \frac{6 + 4(8) + 22}{6} = \frac{6 + 32 + 22}{6} = 10$$

$$t_{e5} = \frac{3 + 4(4) + 5}{6} = \frac{3 + 16 + 5}{6} = 4$$

$$t_{e6} = \frac{2 + 4(4)}{6} = \frac{2 + 16 + 6}{6} = 4$$

$$t_{R7} = \frac{2 + 4(3) + 4}{6} = \frac{2 + 12 + 4}{6} = 3$$

$$t_{R8} = \frac{5 + 4(7) + 15}{6} = \frac{5 + 28 + 15}{6} = 8$$

Variance  $(6)^2$ :

$$\text{Formula } \sigma^2 = \left( \frac{t_p - t_o}{6} \right)^2$$

$$\Rightarrow \sigma_1^2 = \left( \frac{12 - 4}{6} \right)^2 = \left( \frac{8}{6} \right)^2 = 1.77$$

$$\Rightarrow \sigma_2^2 = \left( \frac{4 - 2}{6} \right)^2 = \left( \frac{2}{6} \right)^2 = 0.11$$

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

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

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

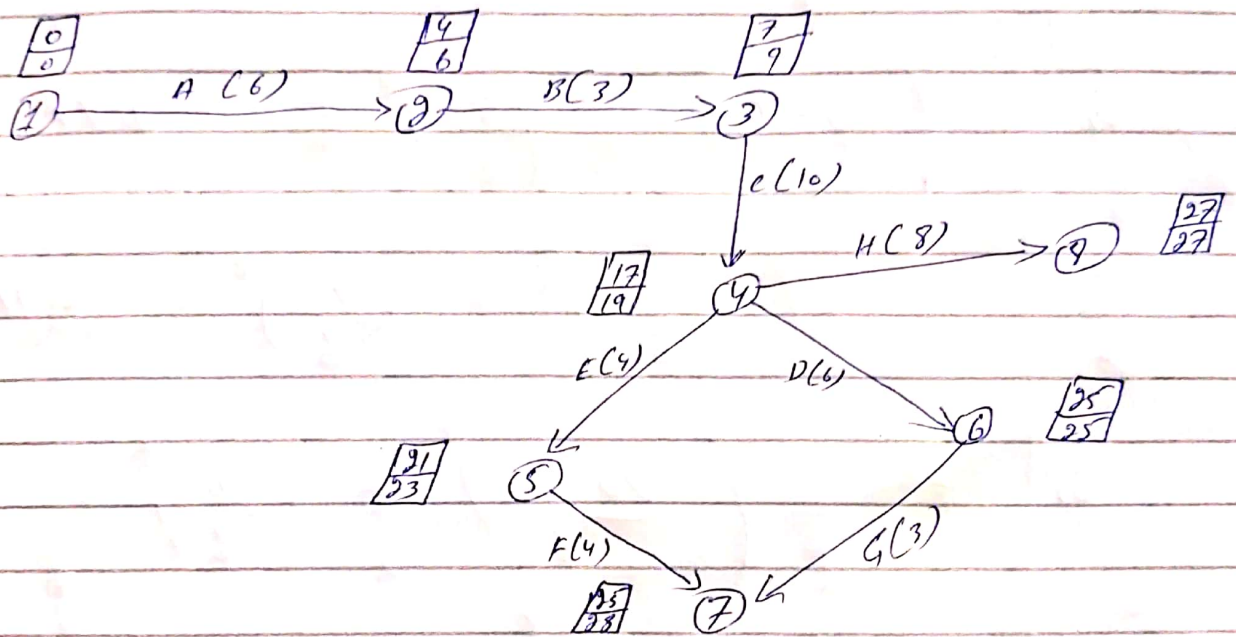
$$\Rightarrow \sigma_6^2 = \left( \frac{6 - 2}{6} \right)^2 = \left( \frac{4}{6} \right)^2 = 0.44$$

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

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

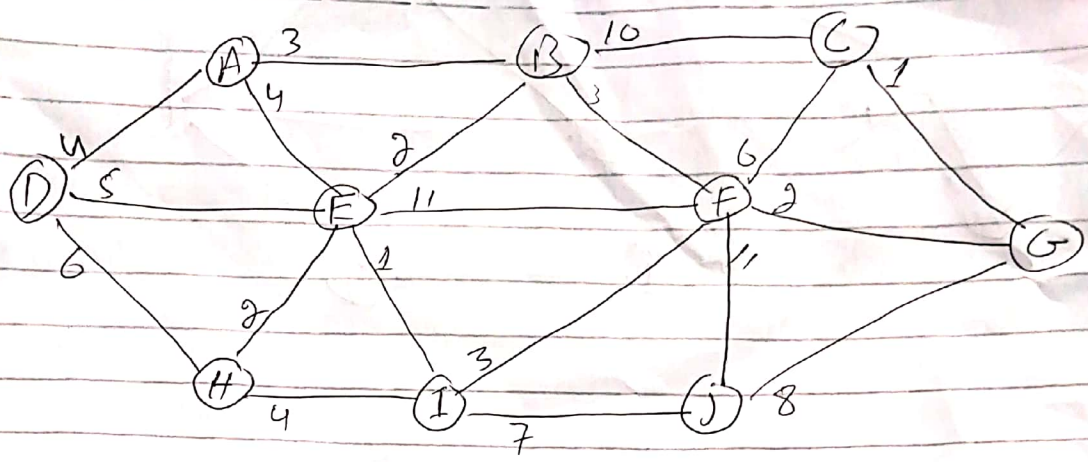
Part 8C)

Critical Path





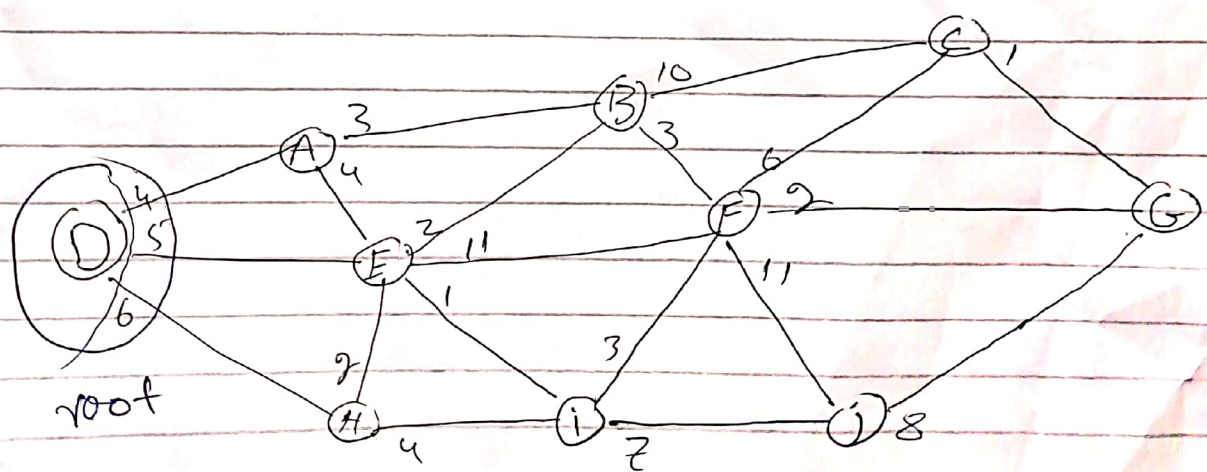
### Question 32



Step 1:-

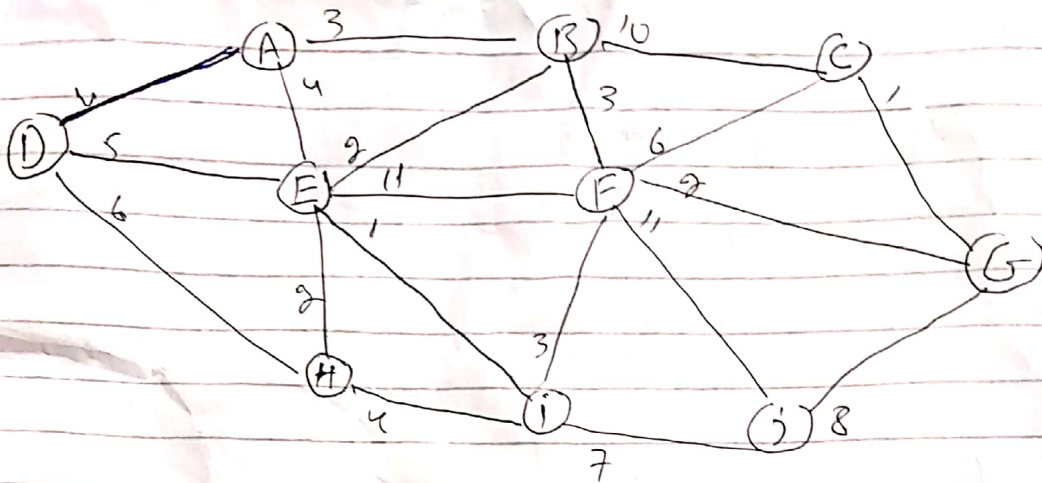
Removing all loops and parallel edges.

Step 2:- choosing arbitrary node as root node.

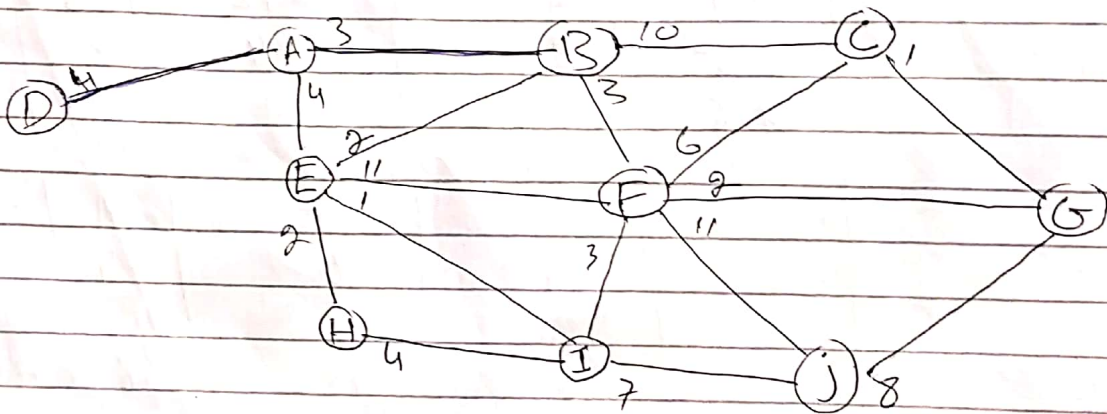


Step 3 find the tree



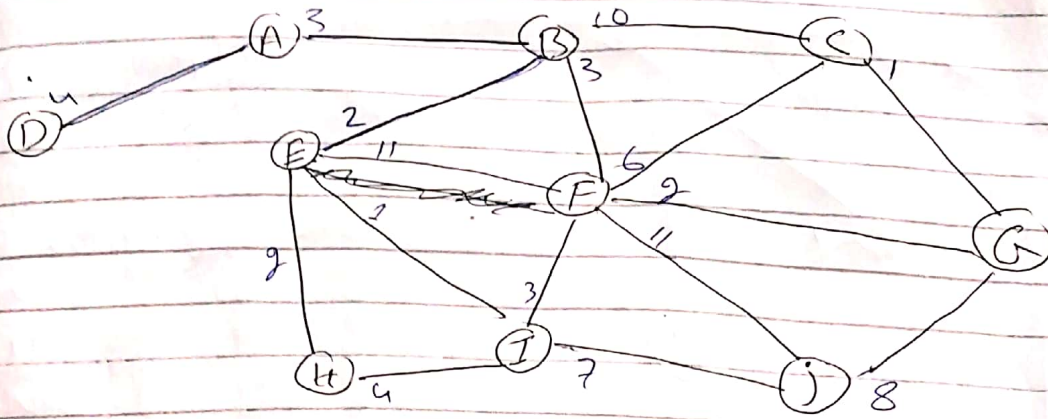


Now the tree D-A is treated as one node and we are checking for all edges.



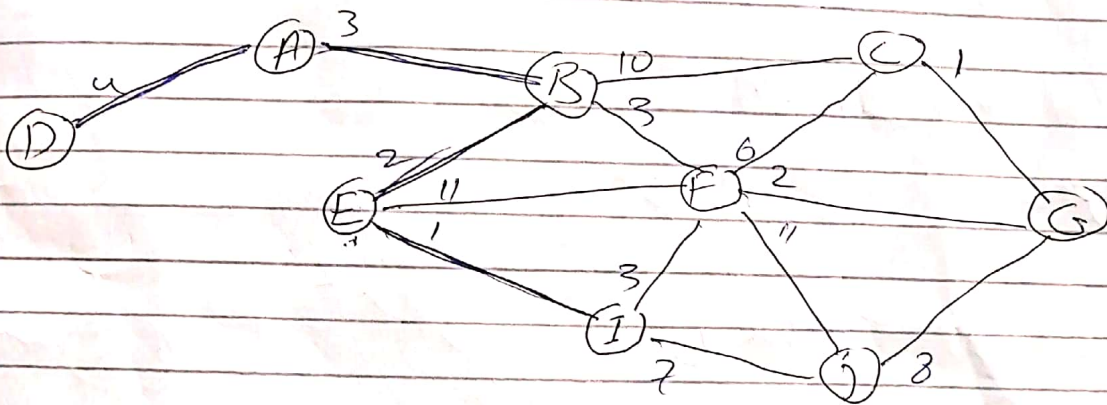
after adding node B

D-A-B tree is formed  
 Now we will again  
 traverse it as a node  
 and will check the  
 edge again



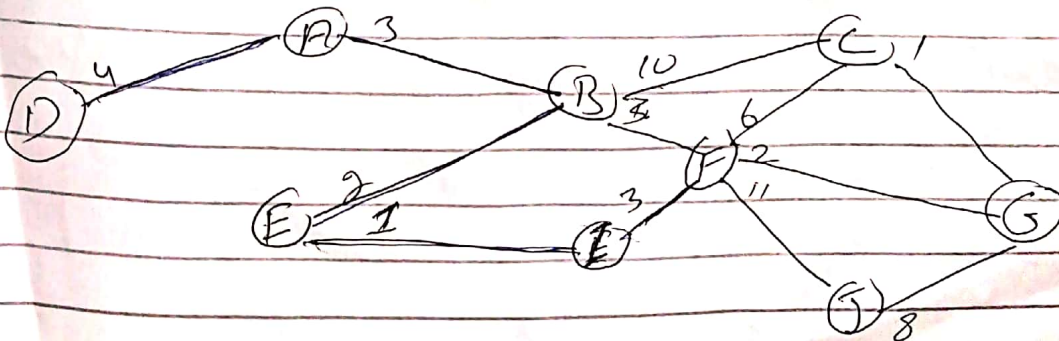
after adding ~~D~~ node E

D-4-A-3-F-2



after adding I-1

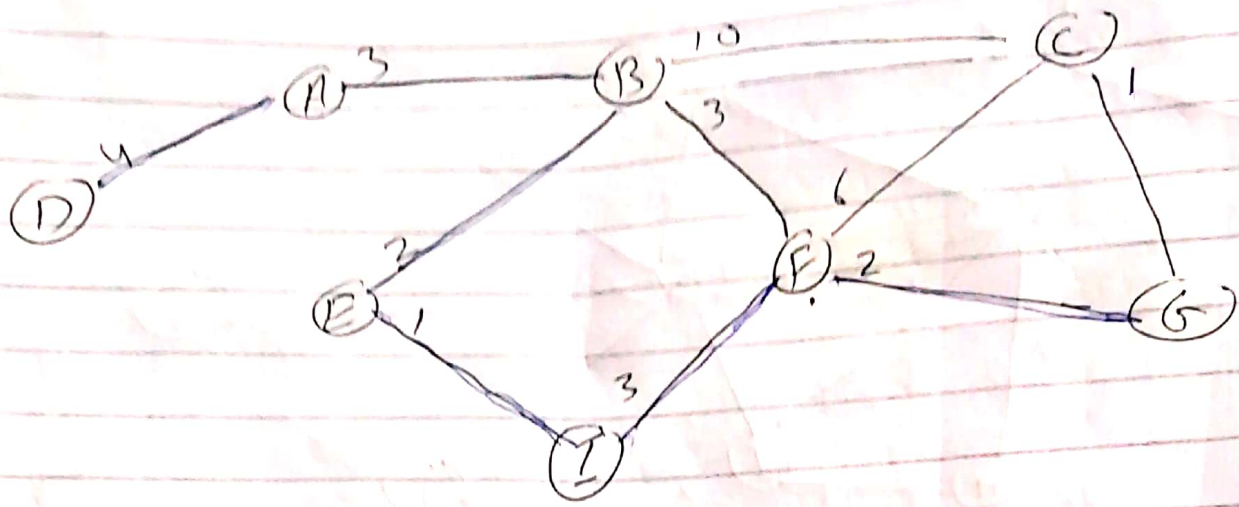
D-4-A-3-E-2-I-1



after adding F-3

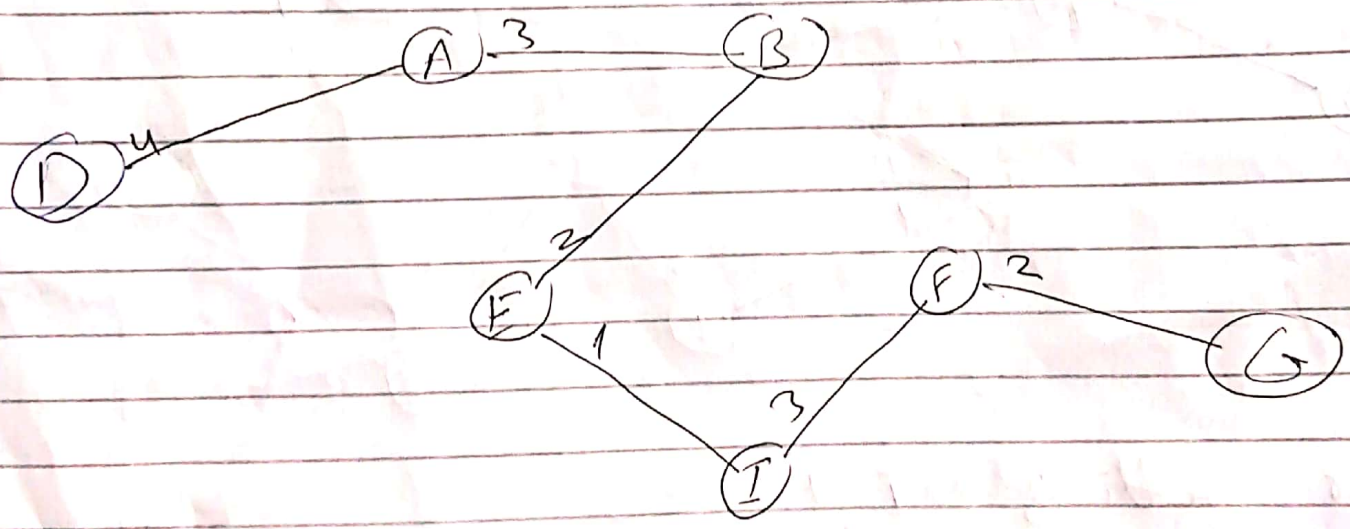
D-4-A-3-E-2-I-1-F-3





after adding G node

D-4-A-3-E-2-I-1-F-3-G-2



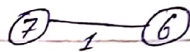
minimum spanning tree:  
 $= 4 + 3 + 2 + 1 + 3 + 2$



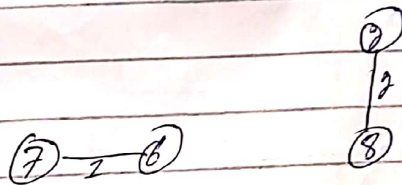
Answer 4

Now pick all edges one by one from sorted list to edges.

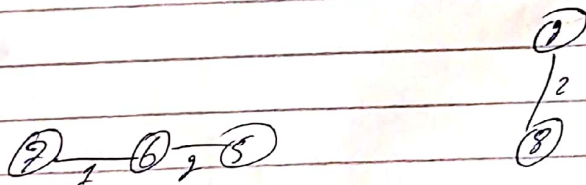
(1) pick edge 7-6:



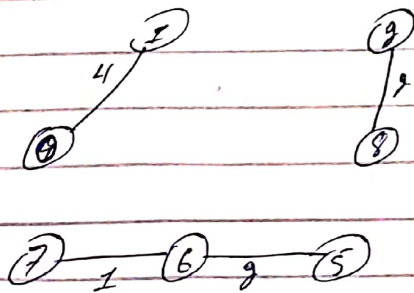
(2) pick edge 8-2:



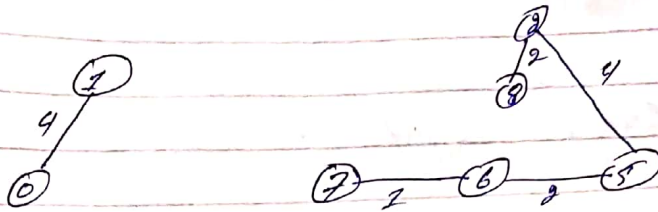
(3) pick edge 0-1:



(4) pick edge 0-1:



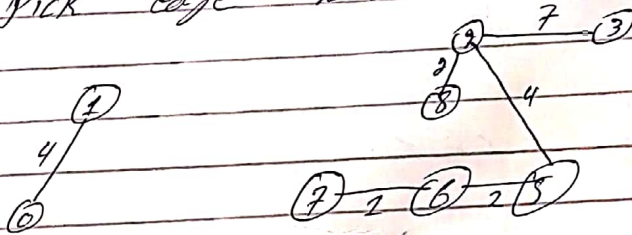
(5) Pick edge 2-5:



(6) Pick edge 8-6:

Since including this edge results in cycle, discard it.

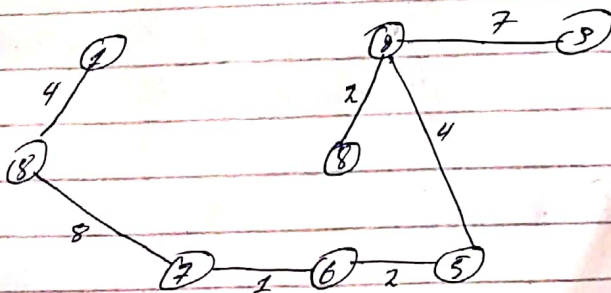
(7) Pick edge 2-3:



(8) Pick edge 7-8:

Since including this edge results in cycle, discard it.

(9) Pick edge 0-7:



(10) Pick edge 7-2:

discard it.



=> Answer (5)

Operation research is an analytical method of problems, 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.

The concept of operation research arose during World War II by military problems. After the war, the techniques used in their operations research were applied to addressing problems in business, the government and society.

Characteristics of Operation research -

- 1 Optimization
- 2 Simulation
- 3 Probability

Applications and Examples:-

- \* Airline Industry (routing and flight plans, crew scheduling, revenue management).
- \* Telecommunications (network routing, queue control).
- \* Manufacturing Industry.
- \* Health care (Hospital management, facility design)



\* Transportation ( traffic control, logistic, network flow).

\* strategic planning.

\* Supply chain management.

\* Logistics and site location.

\* Forecasting.

## Importance of Operation research.

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