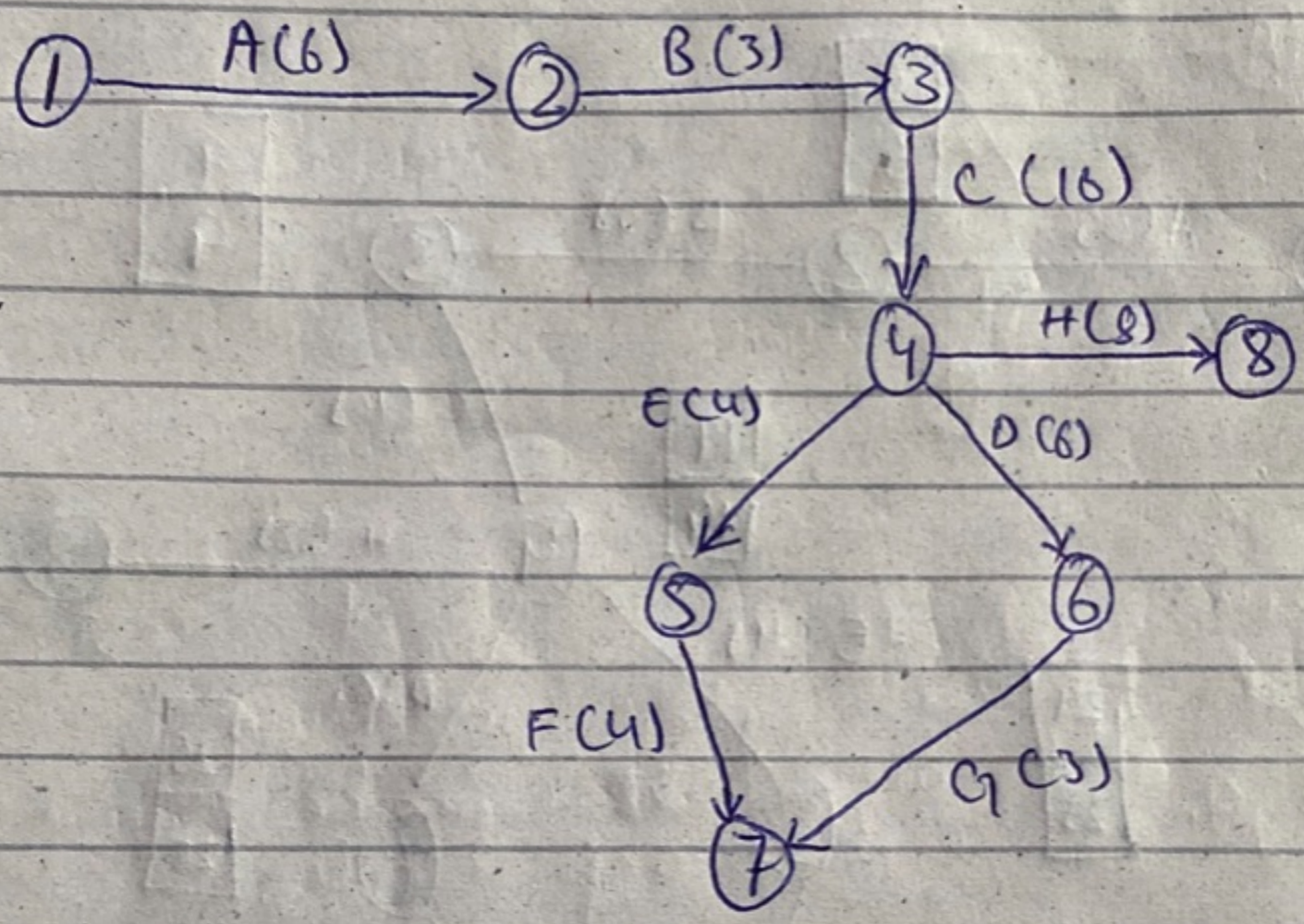
M. Zakria Salem Roll no. 14459

Q2 (a) Construct the project network.



(b) Find expected duration and variance.

$$\text{Mean} = t_o + 4t_m + t_p \qquad \text{Variance} = \left(\frac{t_p - t_o}{6}\right)^2$$

Activity	T_o	T_m	T_p	Mean	Variance
A	4	5	12	$\frac{4+4(5)+12}{6} = 6$	$\left(\frac{12-4}{6}\right)^2 = 1.77$
B	2	3	4	$\frac{2+3(4)+4}{6} = 3$	$\left(\frac{4-2}{6}\right)^2 = 0.11$
C	6	8	22	$\frac{6+4(8)+22}{6} = 10$	$\left(\frac{22-6}{6}\right)^2 = 7.11$
D	4	6	8	$\frac{4+4(6)+8}{6} = 6$	$\left(\frac{8-4}{6}\right)^2 = 0.44$
E	3	4	5	$\frac{3+4(4)+5}{6} = 4$	$\left(\frac{5-3}{6}\right)^2 = 0.11$
F	2	4	6	$\frac{2+4(4)+6}{6} = 4$	$\left(\frac{6-2}{6}\right)^2 = 0.44$
G	2	3	4	$\frac{2+3(4)+4}{6} = 3$	$\left(\frac{4-2}{6}\right)^2 = 0.11$
H	5	7	15	$\frac{5+4(7)+15}{6} = 8$	$\left(\frac{15-5}{6}\right) = 2.77$

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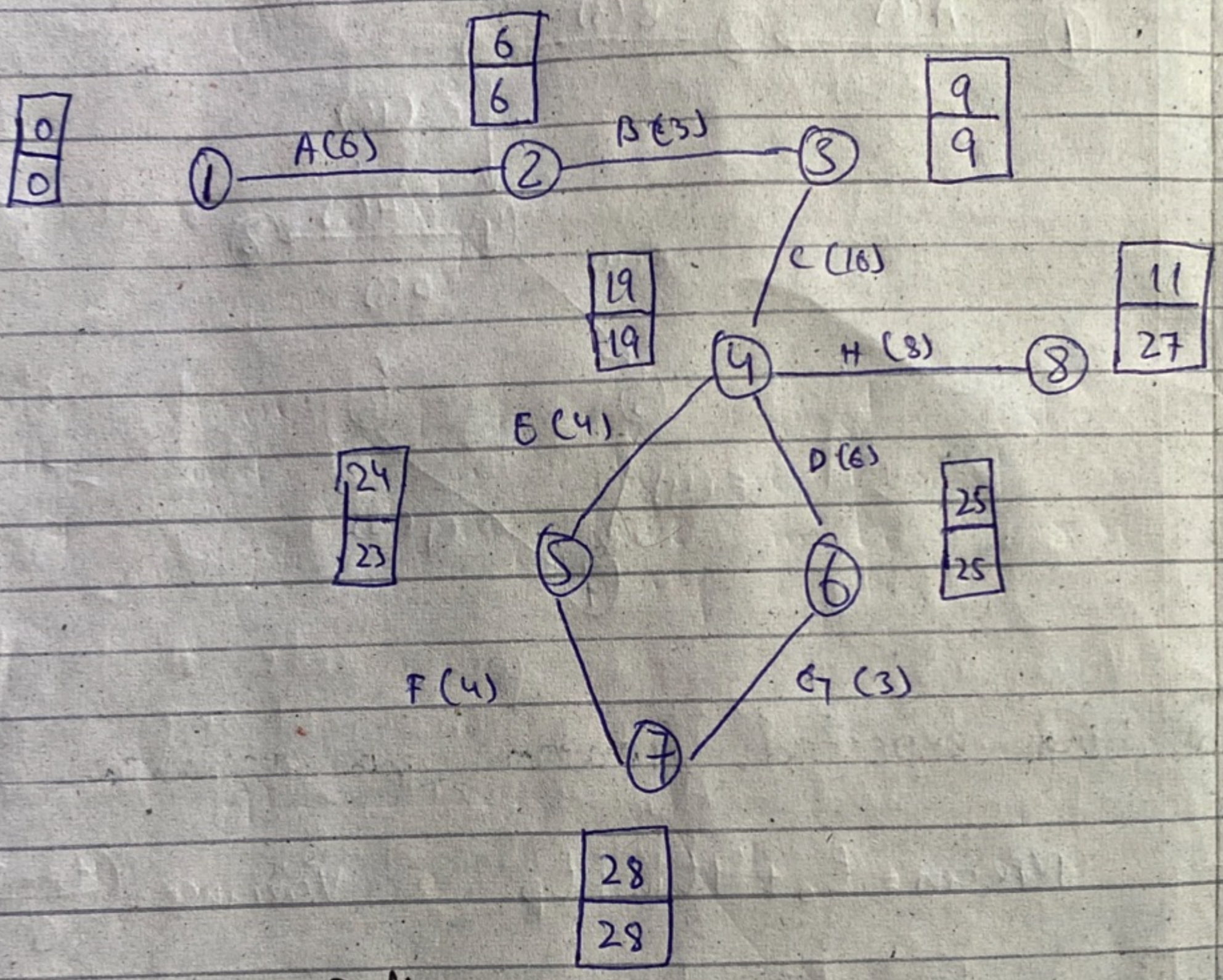
(c) Find the critical path and expected project completion time.



Critical Path:

1. $A \rightarrow B \rightarrow C \rightarrow E \rightarrow F = 6+3+10+4+4 = 27$
2. $A \rightarrow B \rightarrow C \rightarrow H = 6+3+10+8 = 27$
3. $A \rightarrow B \rightarrow C \rightarrow D \rightarrow G = 6+3+10+6+3 = 28$

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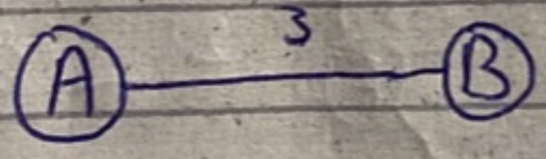
Qs For the following graph, find minimum spanning tree using Prim's algorithm. Start with vertex A.

Step 1: Remove all loops and Parallel edges.

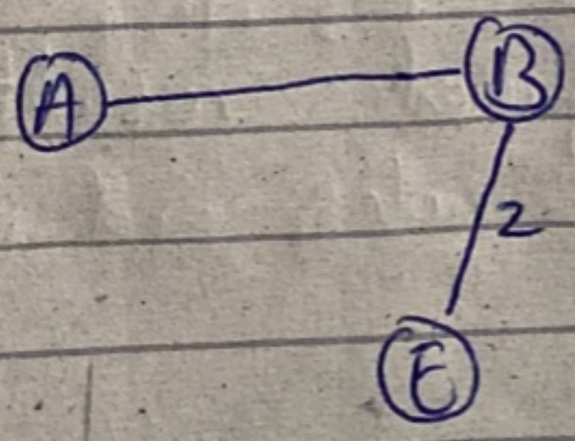
Step 2: Choose node 'A' as arbitrary node.

Step 3: Check outgoing edges of each vertex, and then select the one with less cost.

1. Now, as we have given node 'A' to start from. So there are three outgoing edges from node 'A', we will select the less cost one which is A-B.



2. Now we will again select the lowest cost edge, which is B-E



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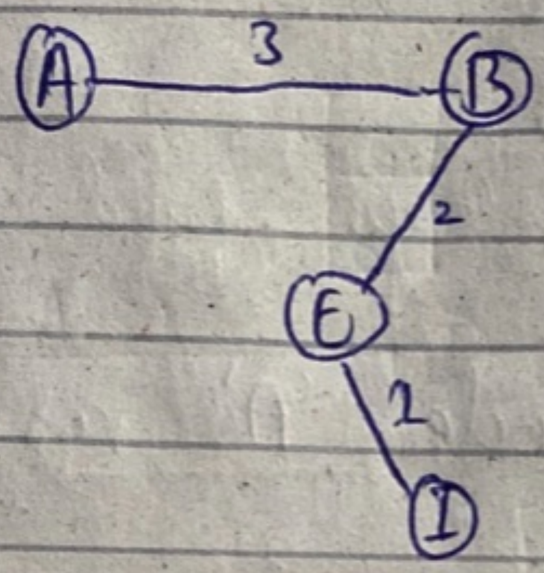
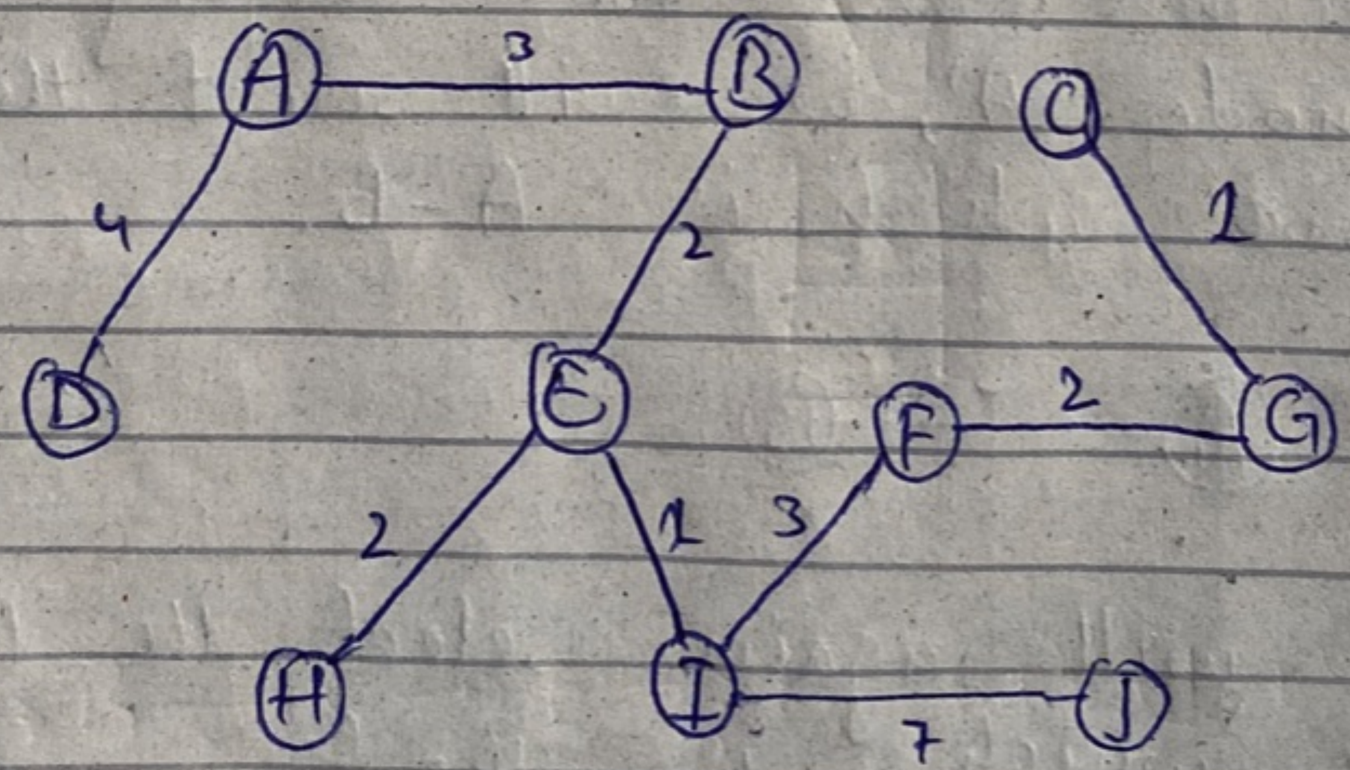
3. Again withe the same procedure. Select the lowest cost edge. E - I



4. Now again select the lowest cost edge and go on with the lowest cost edge. And we have to make sure that we dont make any cycle.



So, this is the final result we get from following the rules and steps of Prim's algorithm.

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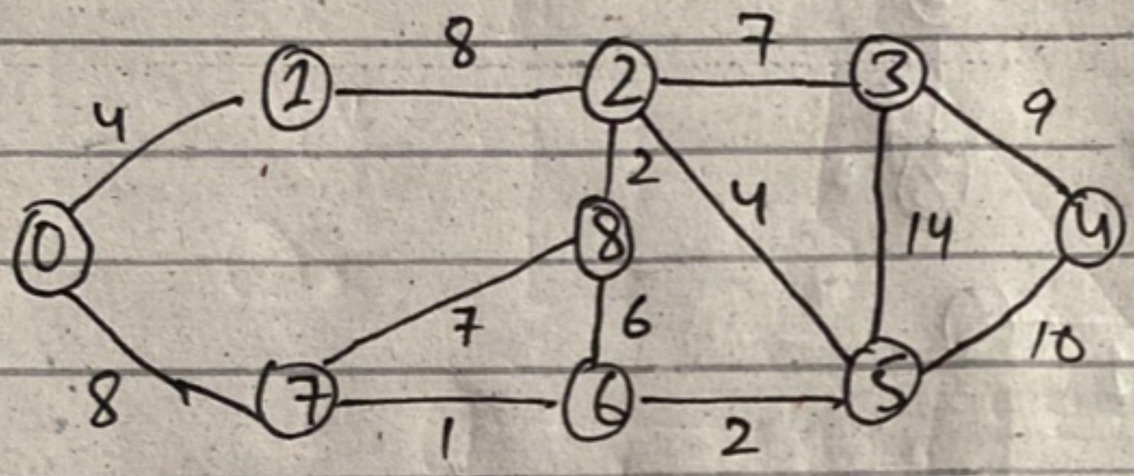
Q4 For the following graph, find the minimum spanning tree using Kruskal's algorithm.



Step 1:- Remove all loops and Parallel Edges.

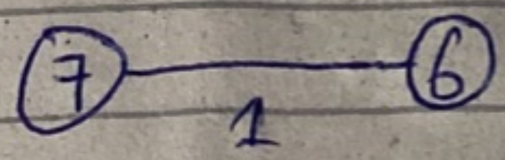
Step 2:- Arrange all edges in their increasing order of weight.

7,6, 2,8, 6,8, 0,1, 2,5, 6,8, 7,8, 2,3, 0,7, 1,2, 3,4, 4,5, 3,5

7,6	2,8	6,8	0,1	2,5	6,8	7,8	2,3	0,7	1,2	3,4	4,5	3,5
1	2	2	4	4	6	7	7	8	8	9	10	14

1. Now we will pick all the edges to sort out the edges one by one.

First we will pick edge 7, 6.



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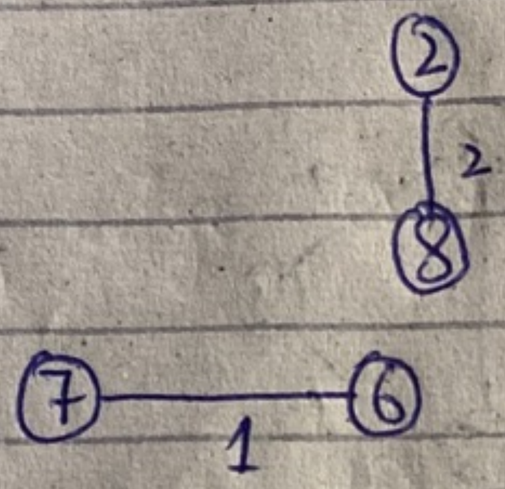
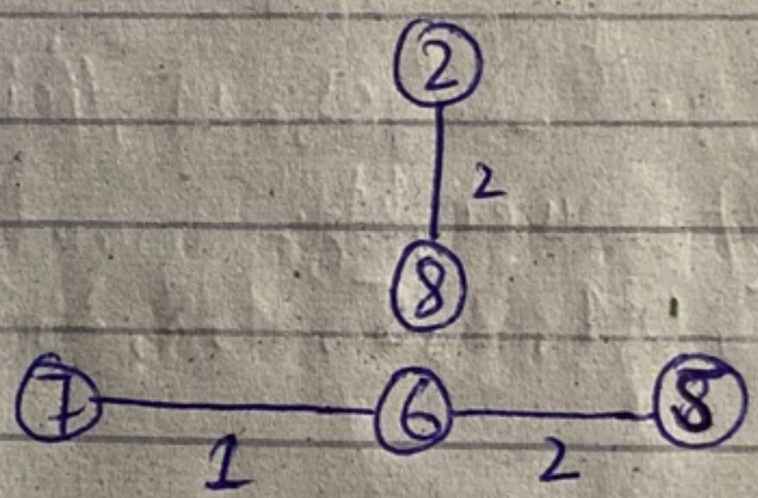
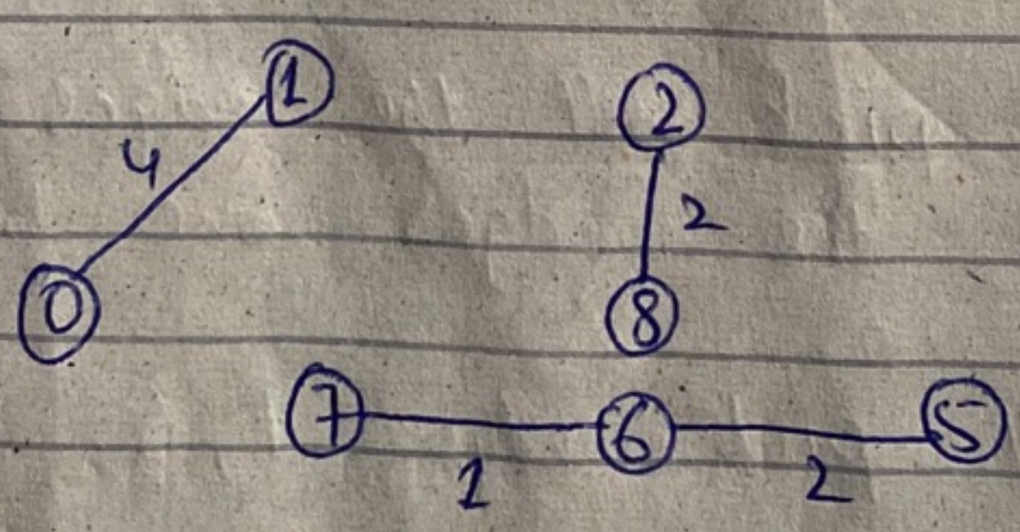
2. Now picking edge 2, 8.



3. Now picking edge 6, 5.



4. Now picking edge 0, 1.



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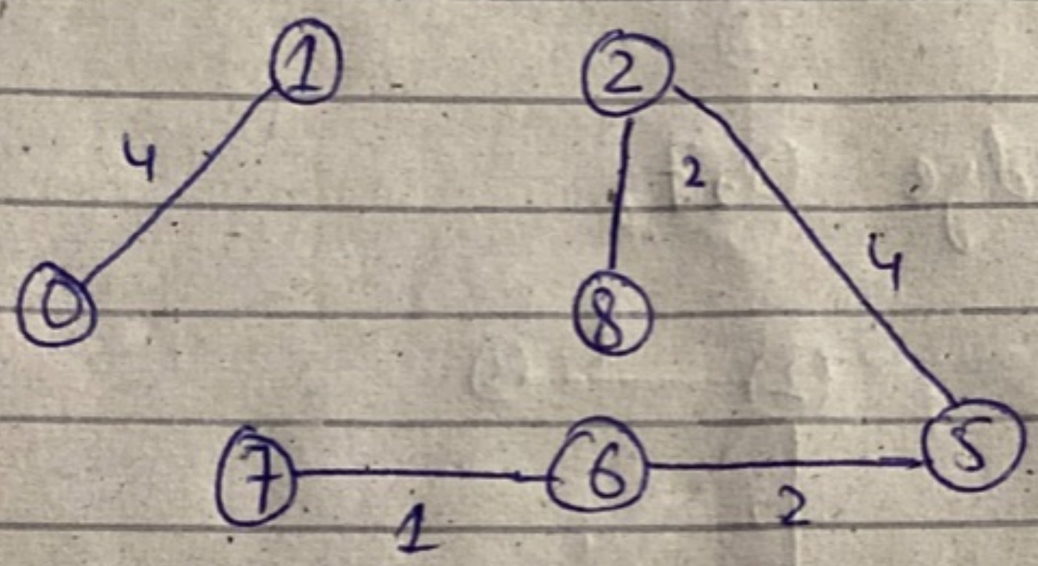
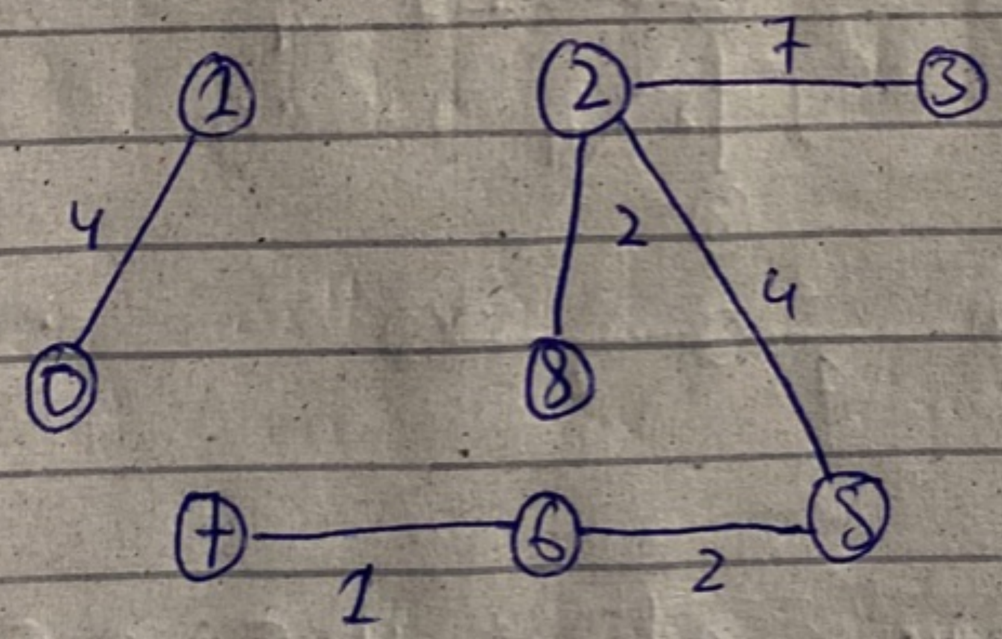
5. Now picking edge 2,5.



6. Now picking edge 6,8. So, we can't pick edge 6,8 because it will make a cycle and we dont want that.

7. Now picking edge 2,3.



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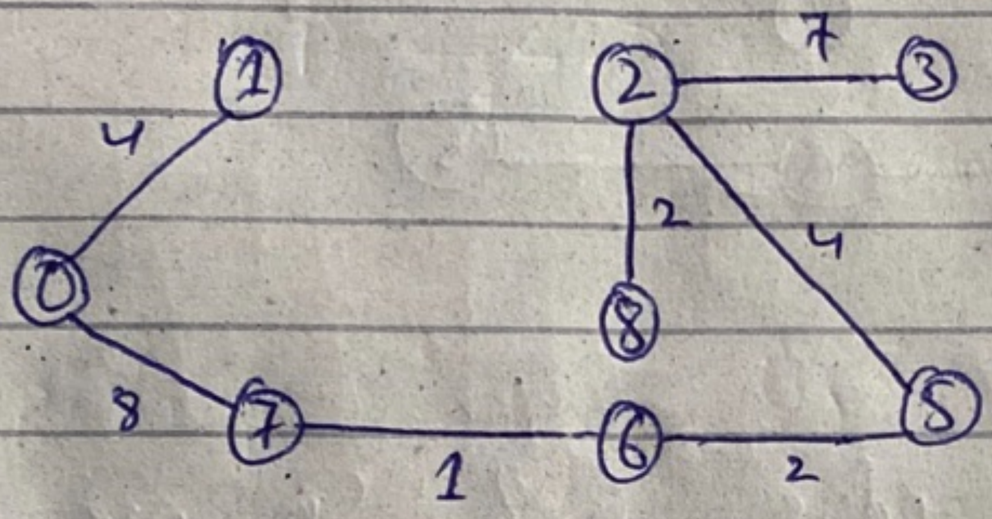
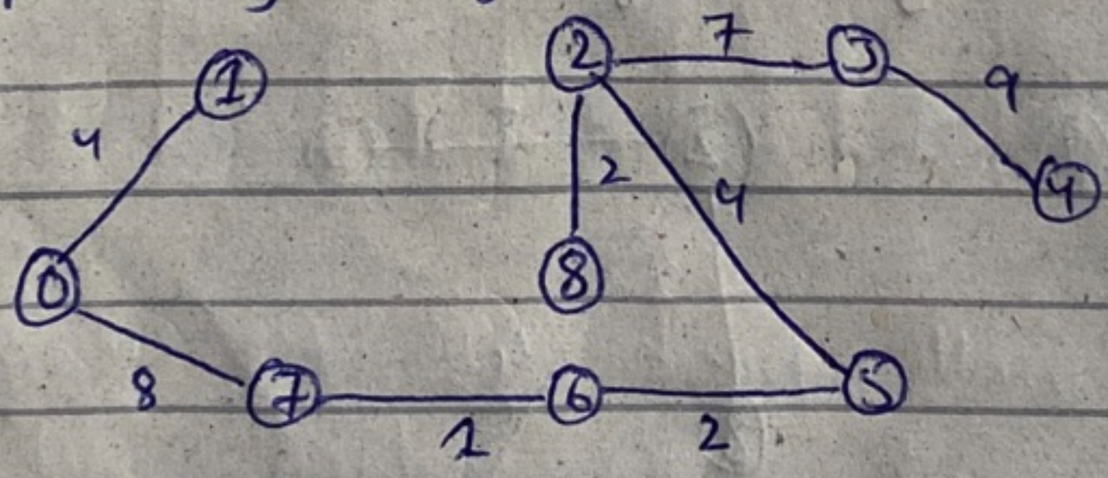
8. Now picking edge 7,8. We cannot pick 7,8 edge; otherwise it will result is cycle.

9. Now picking edge 0,7.



10. Now picking edge 1,2. we can't pick edge 1,2. Since it will result is cycle.

11. Now picking edge 3,4.



12. Now
We will leave edge 4,5, 3,5. We will not pick them because it will result in cycle.

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Q5

Operation research is a quantitative approach that solves problems, using a number of mathematical techniques. It is helpful to use operations research when you are trying to make decisions but the conditions are uncertain, and when differing objectives are in conflict with each other.

Advantages of Operation Research.

These mathematical techniques used in operations research help managers do their jobs more effectively.

Better decision making:
The mathematical models of operations research allow people to analyze a greater number of alternatives and constraints than would usually be possible.