

**CS 300**  
**Data Structures**  
**Homework 5**

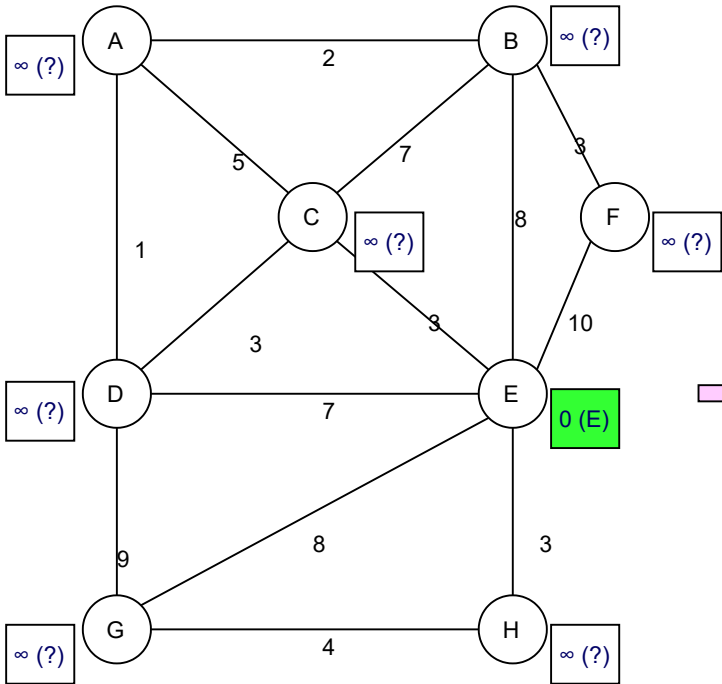
Assigned: Dec 22, 2021, Due: Dec 31, 2021 at  
11:55pm

Rebah Özkoç  
29207

**Question 1 (20 points)**  
Trace the operation of Dijkstra's weighted shortest path algorithm for the following graph.  
Use vertex E as your start vertex.

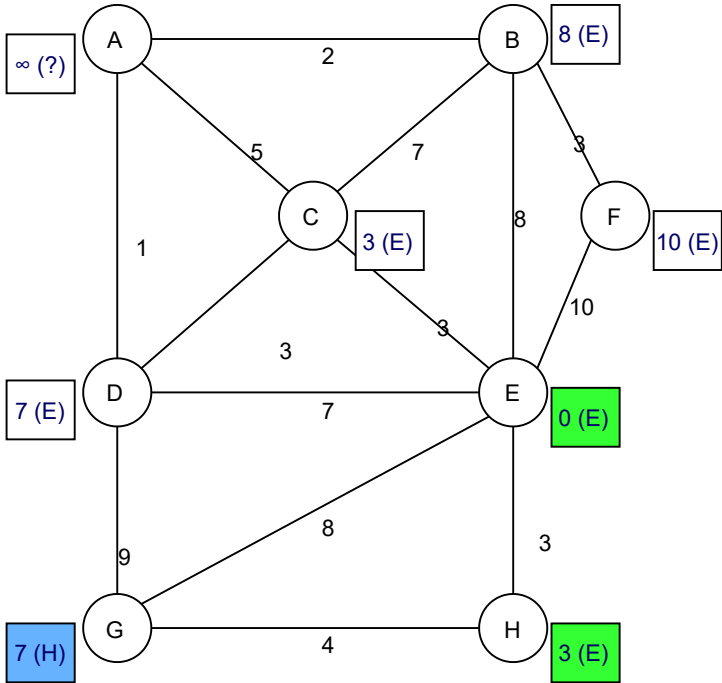
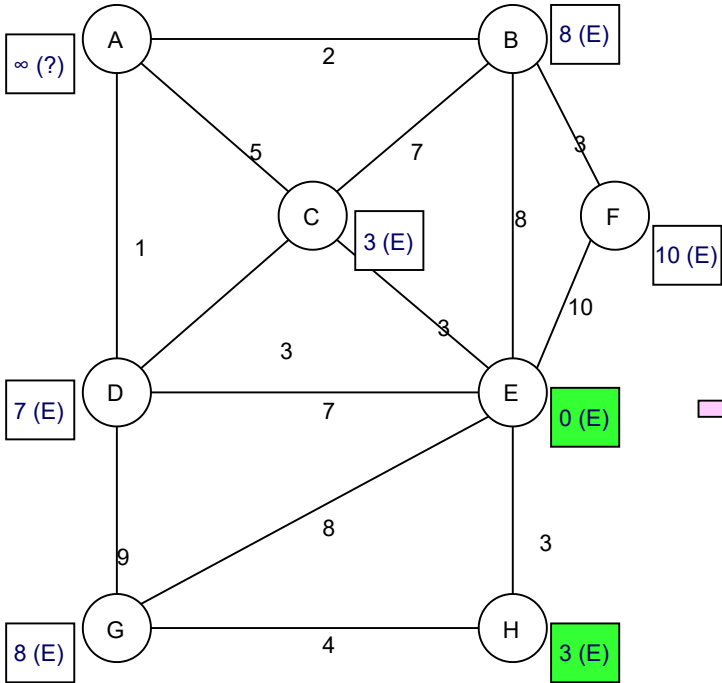
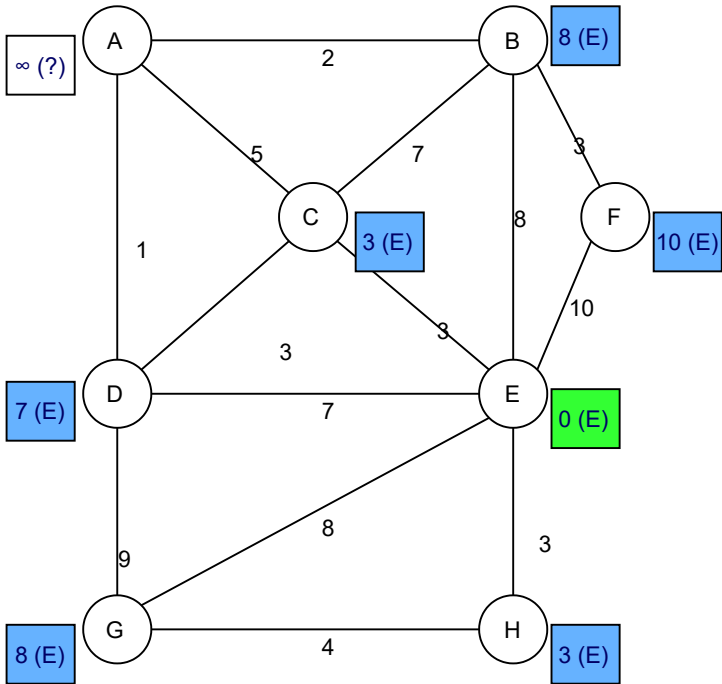
X (Y)

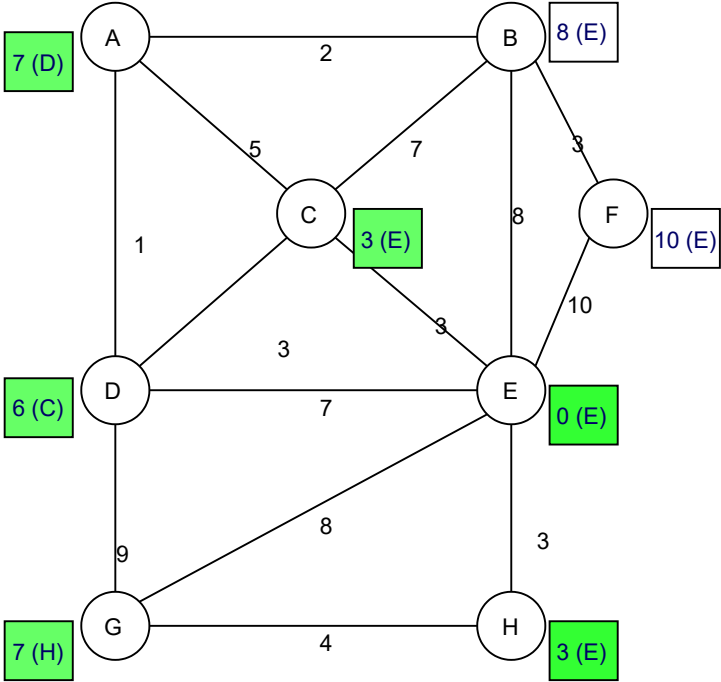
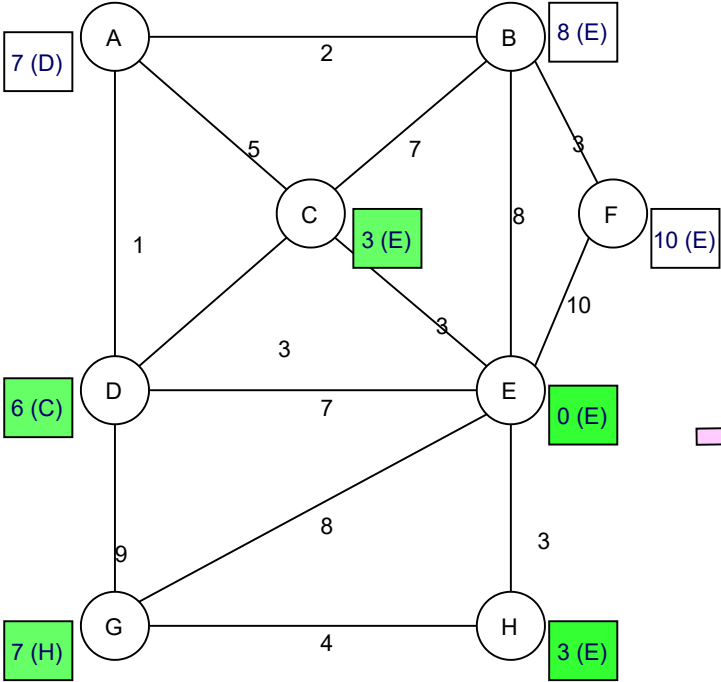
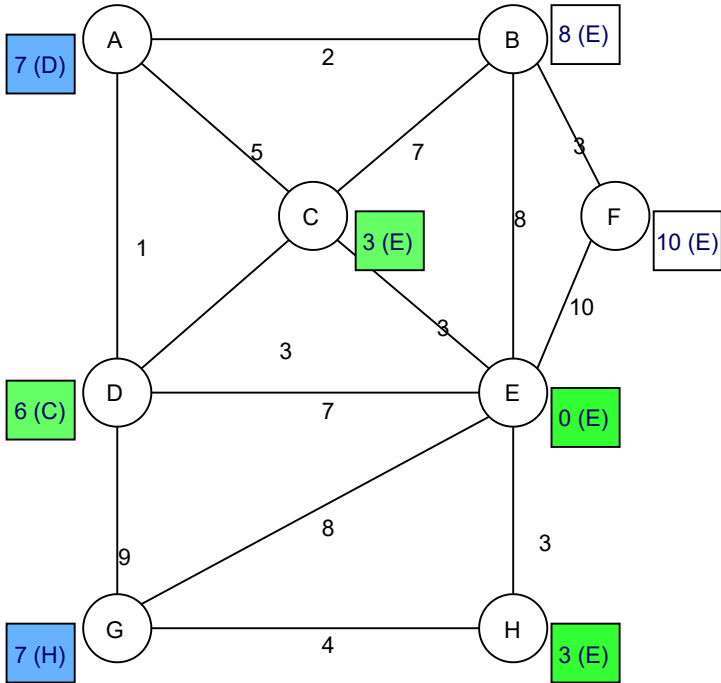
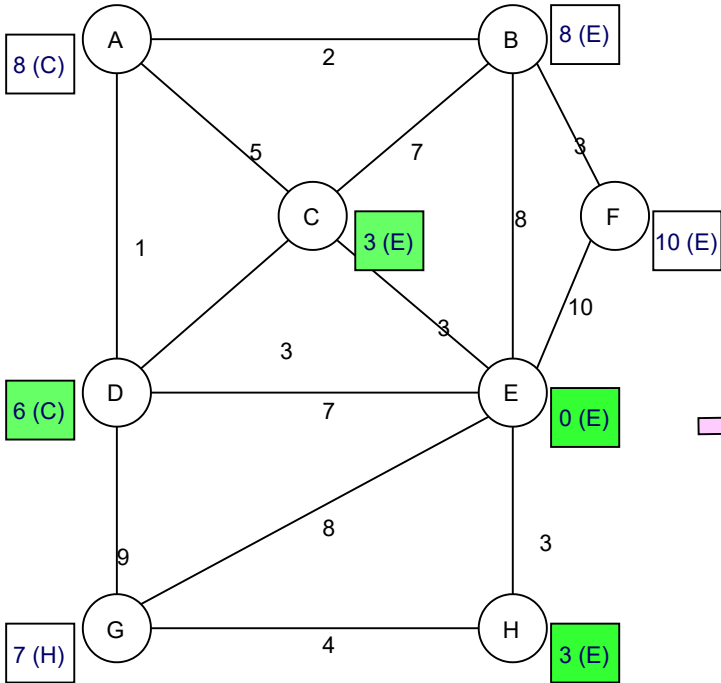
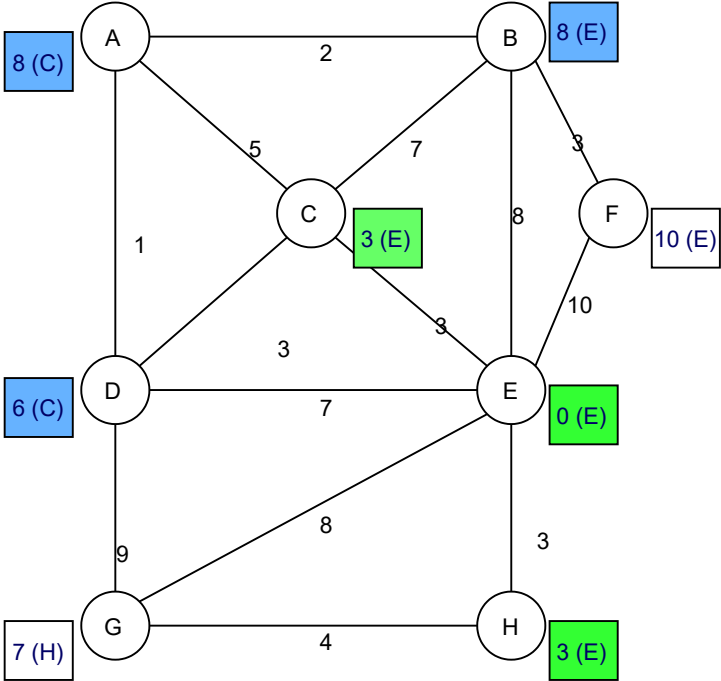
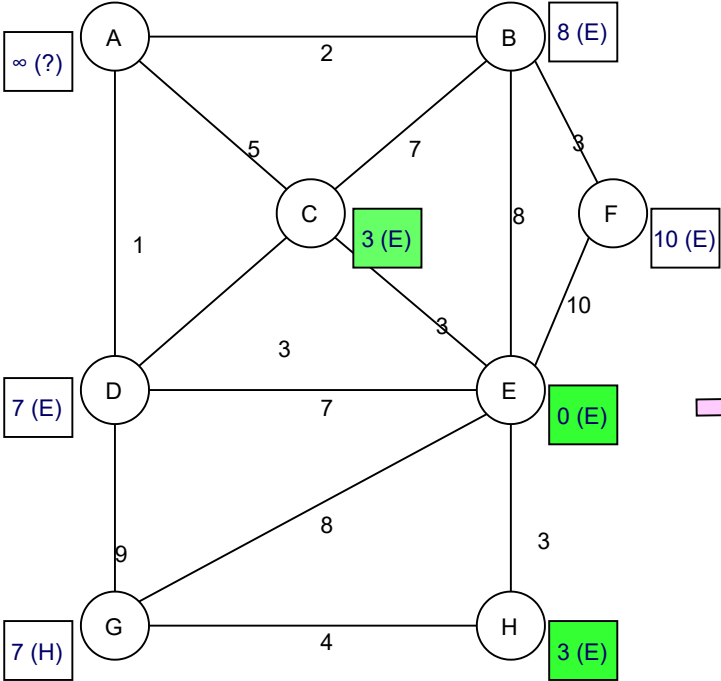
Currently processing node

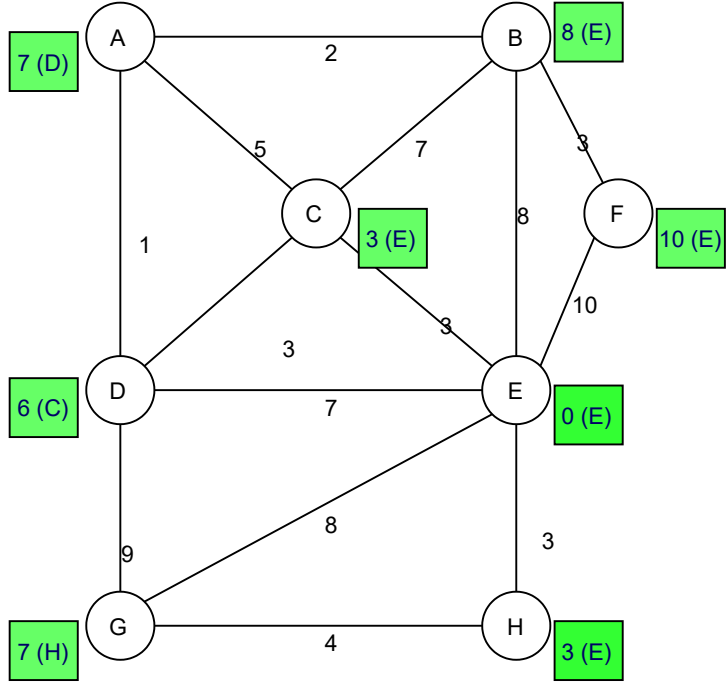
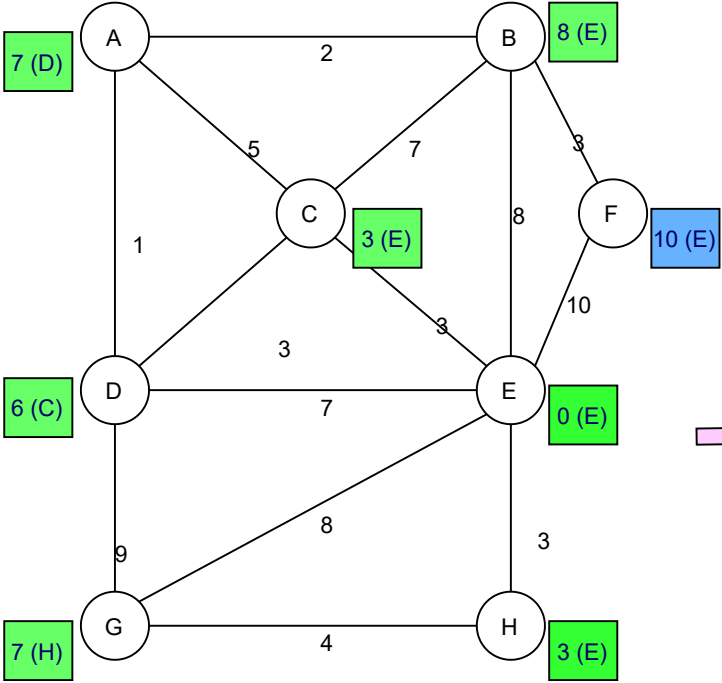
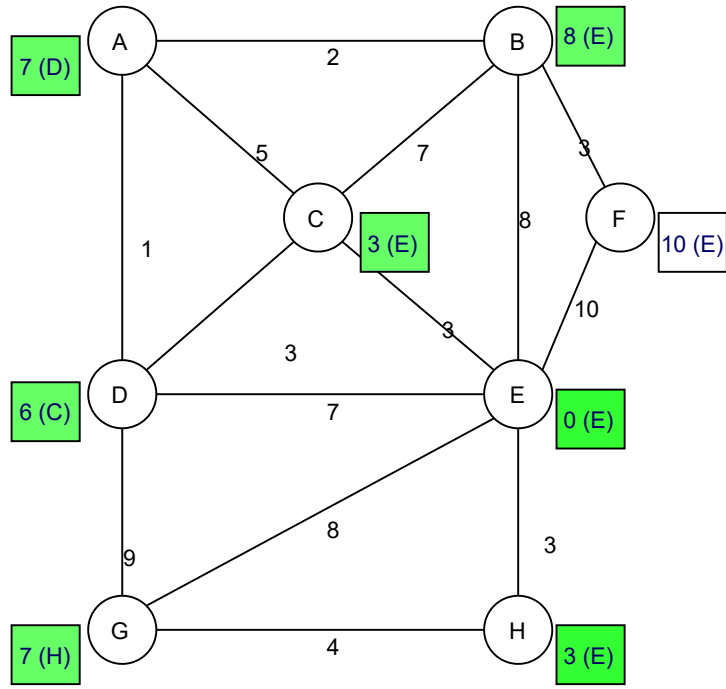
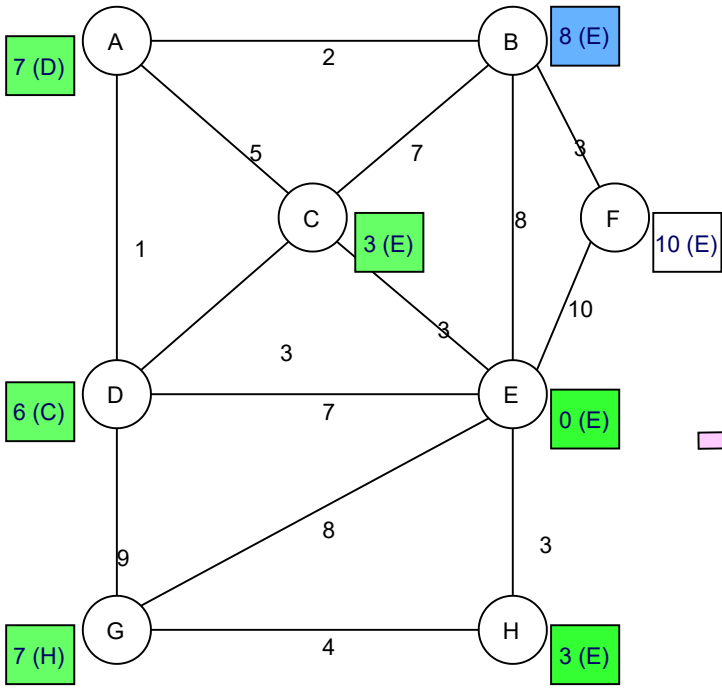


X (Y)

Known node, dist is X, previous node is Y

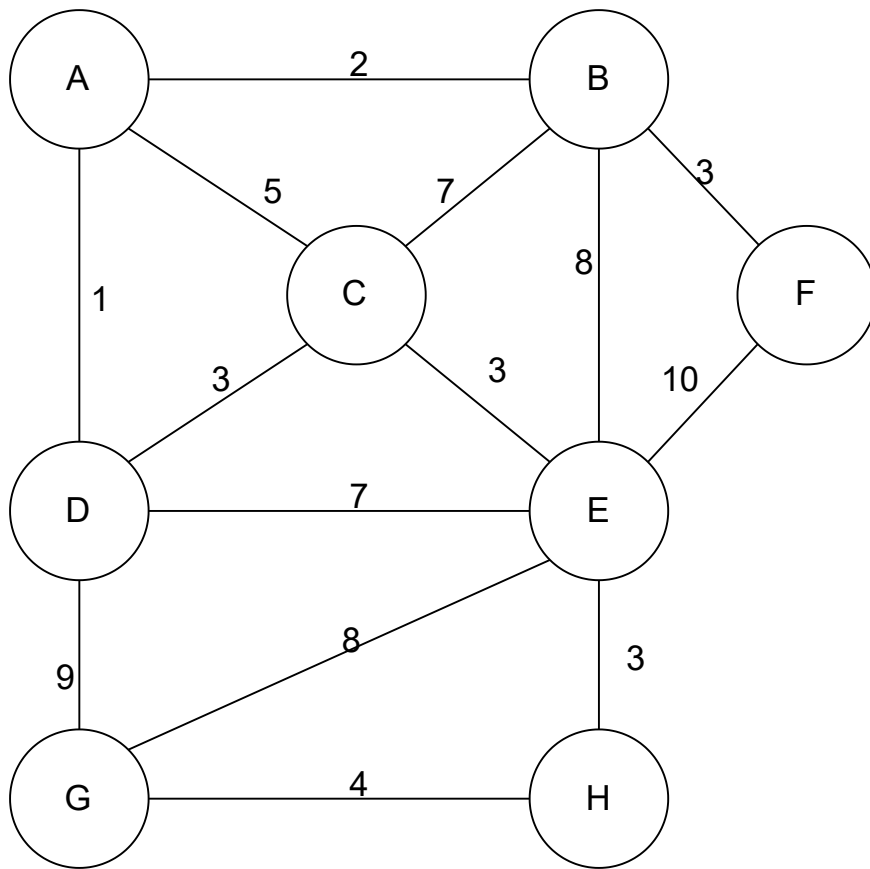




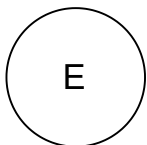


**Question 2 (20 points)**

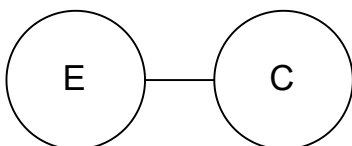
Trace the operation of Prim's minimum spanning tree algorithm for the graph in Figure 1. Use vertex E as your start vertex.



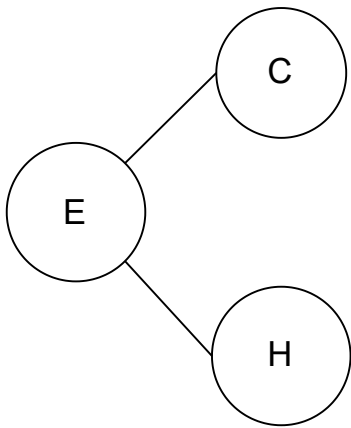
1. Start with vertex E



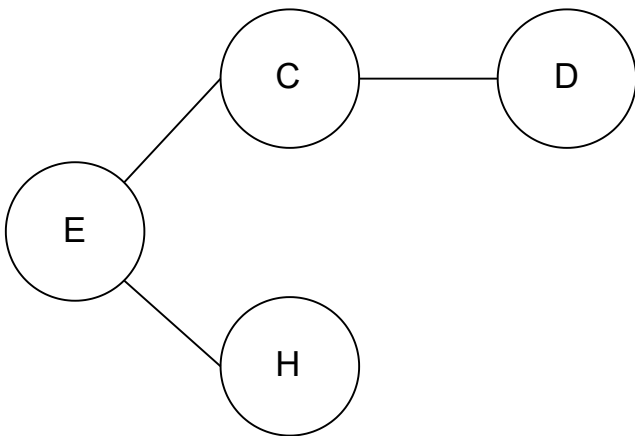
2. Add the edge with weight 3 to graph which connects to E to C



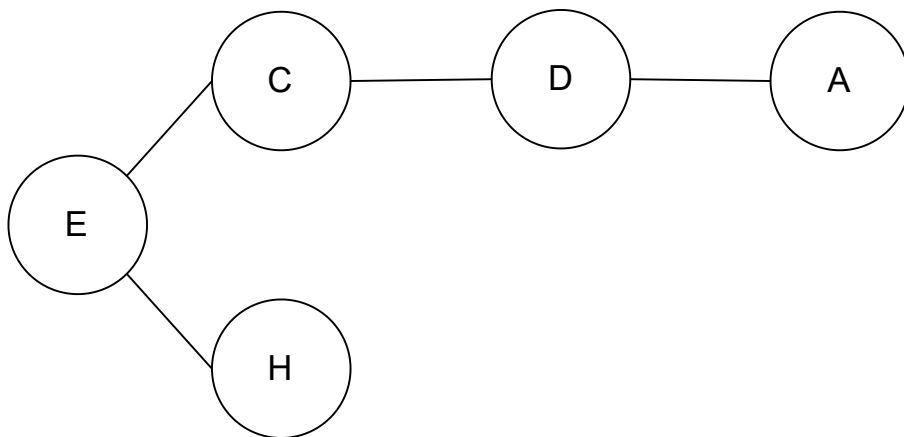
3. Add the edge with weight 3 to graph which connects E to H



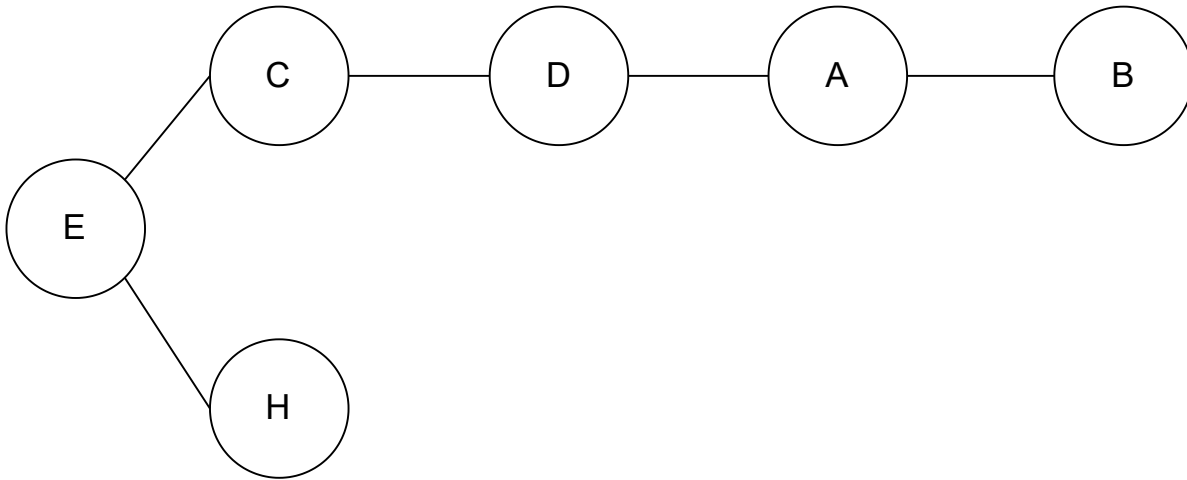
4. Add the edge with weight 3 to graph which connects C to D



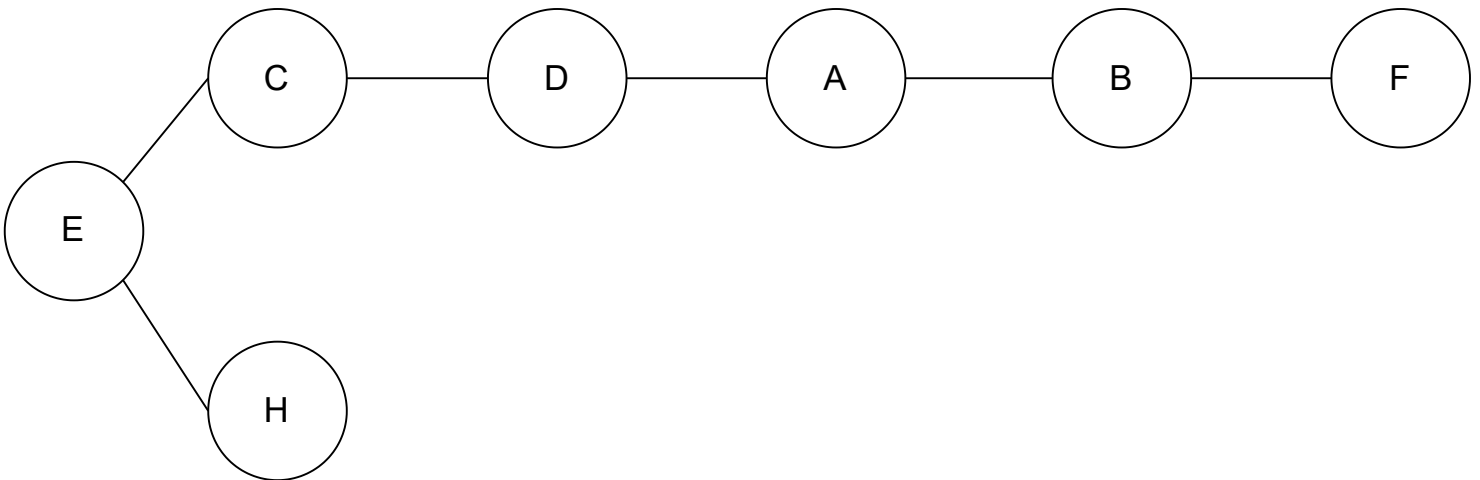
5. Add the edge with weight 1 to graph which connects D to A



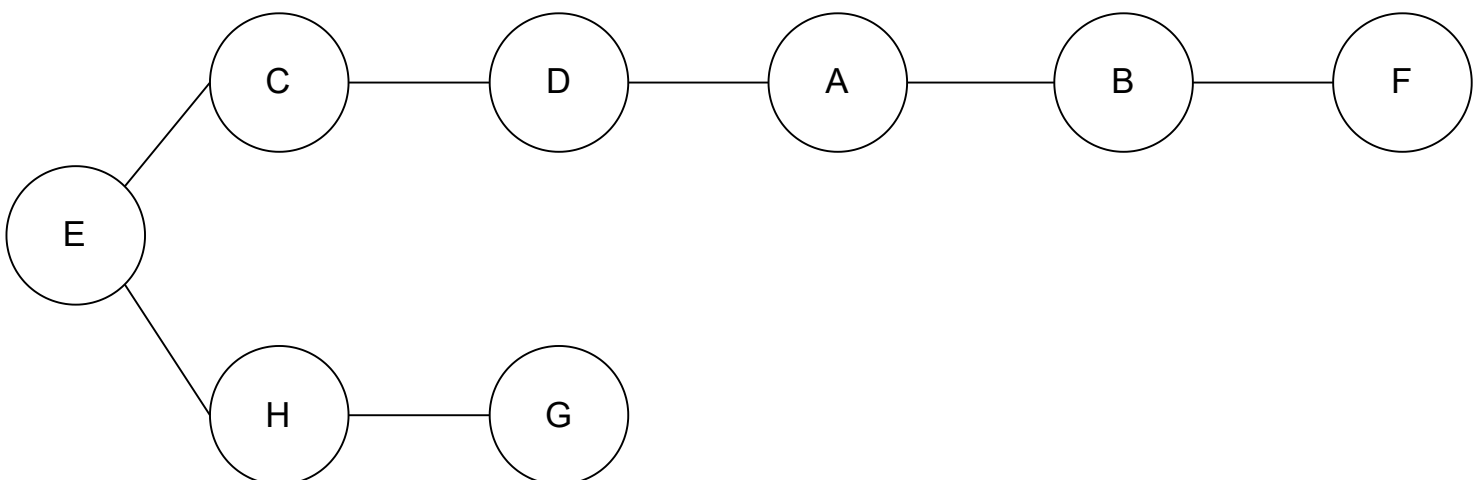
6. Add the edge with weight 2 to graph which connects A to B



7. Add the edge with weight 3 to graph which connects B to F



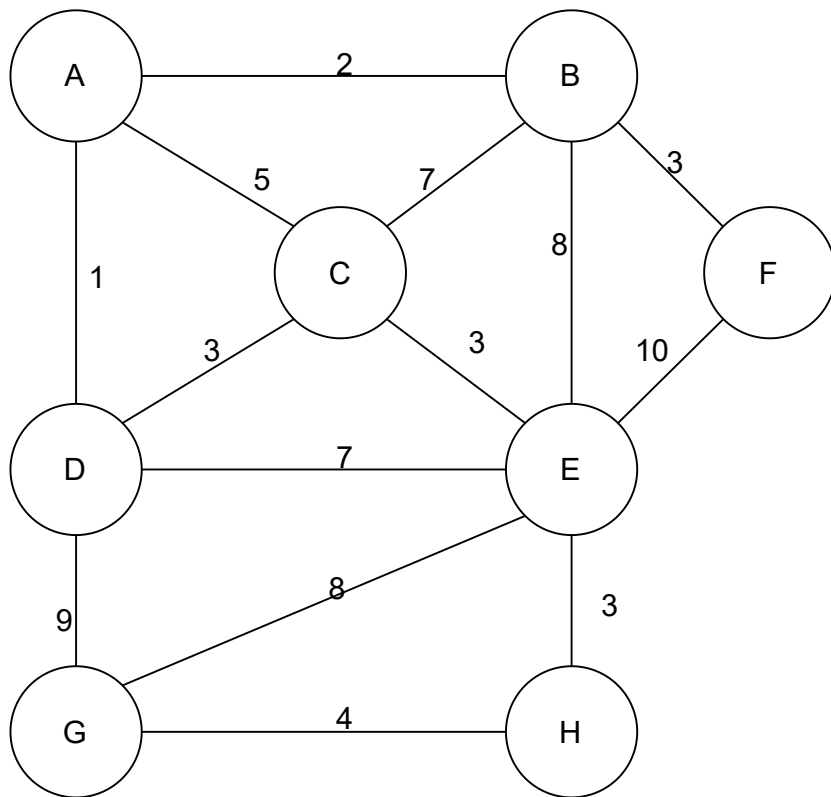
8. Add the edge with weight 4 to graph which connects H to G



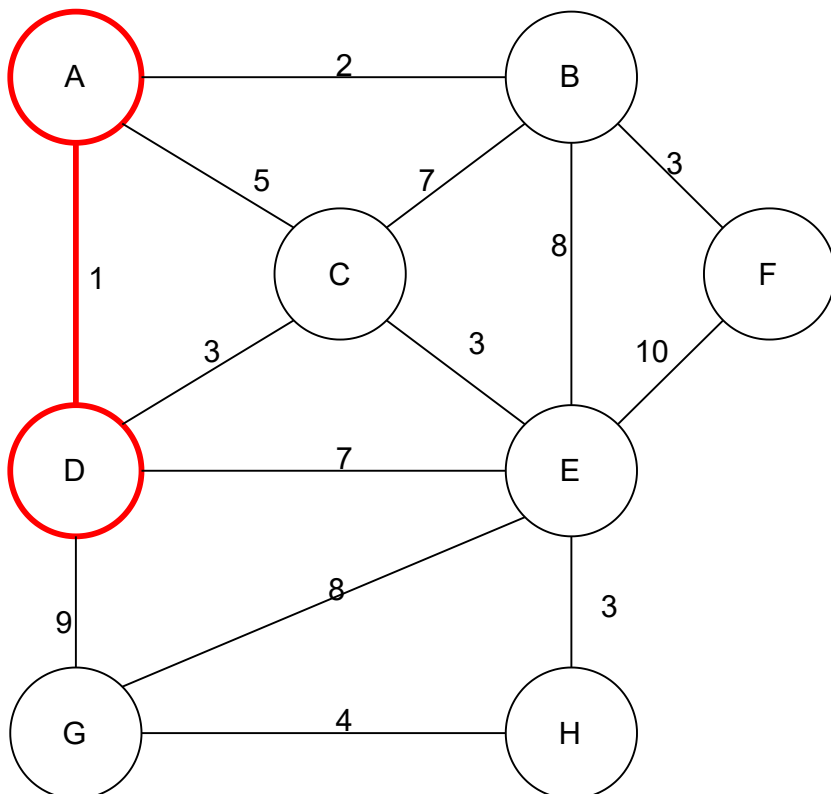
10. All vertices ended. Stop the algorithm

**Question 3 (20 points)**

Trace the operation of Kruskal's minimum spanning tree algorithm for the graph in Figure 1

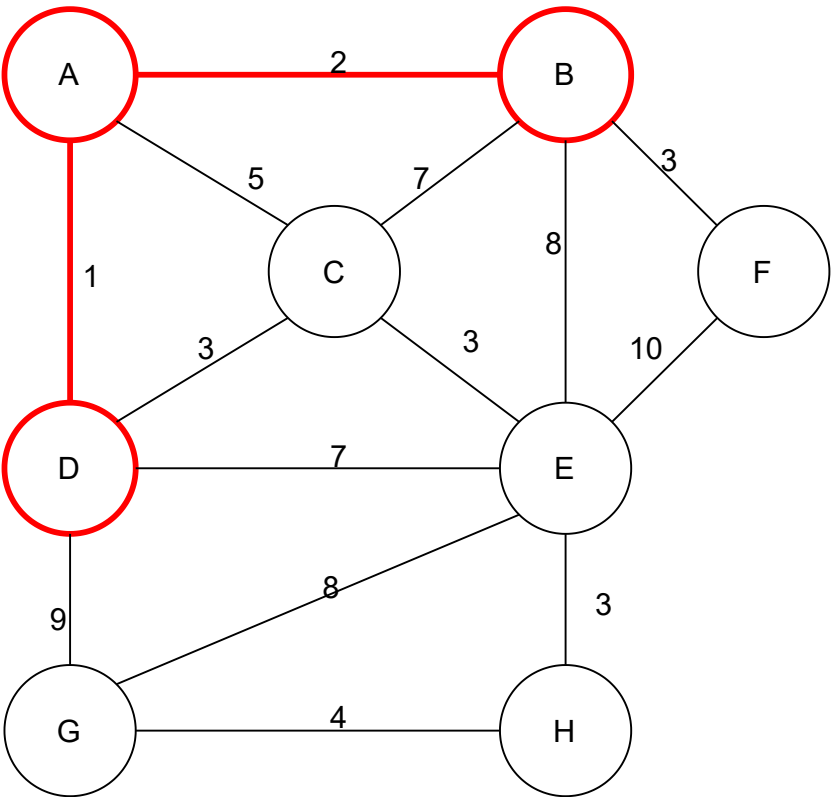


1. Select the edge with the minimum weight.

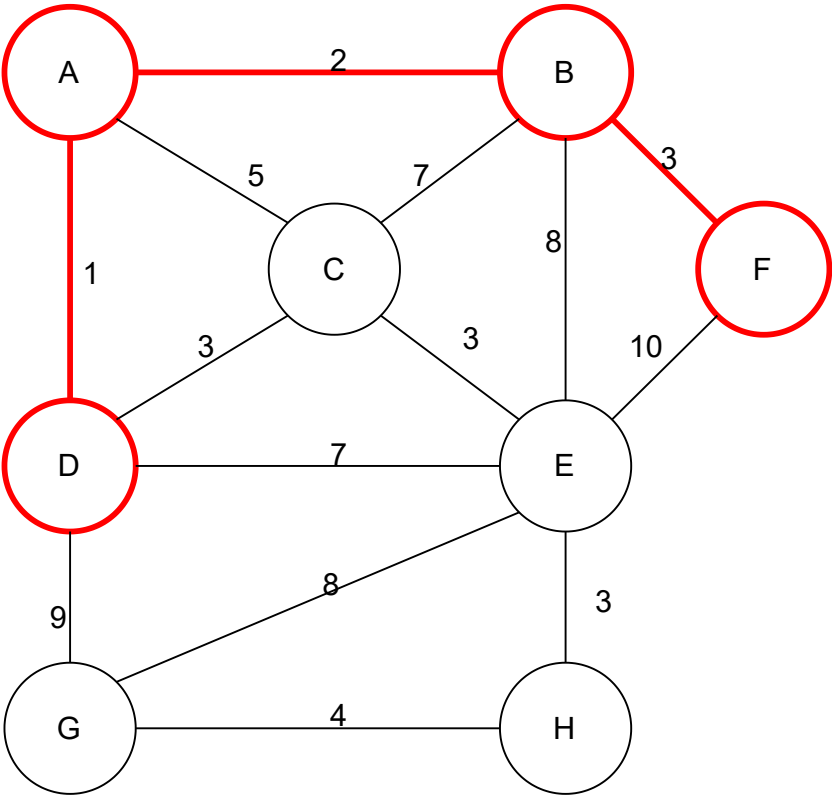




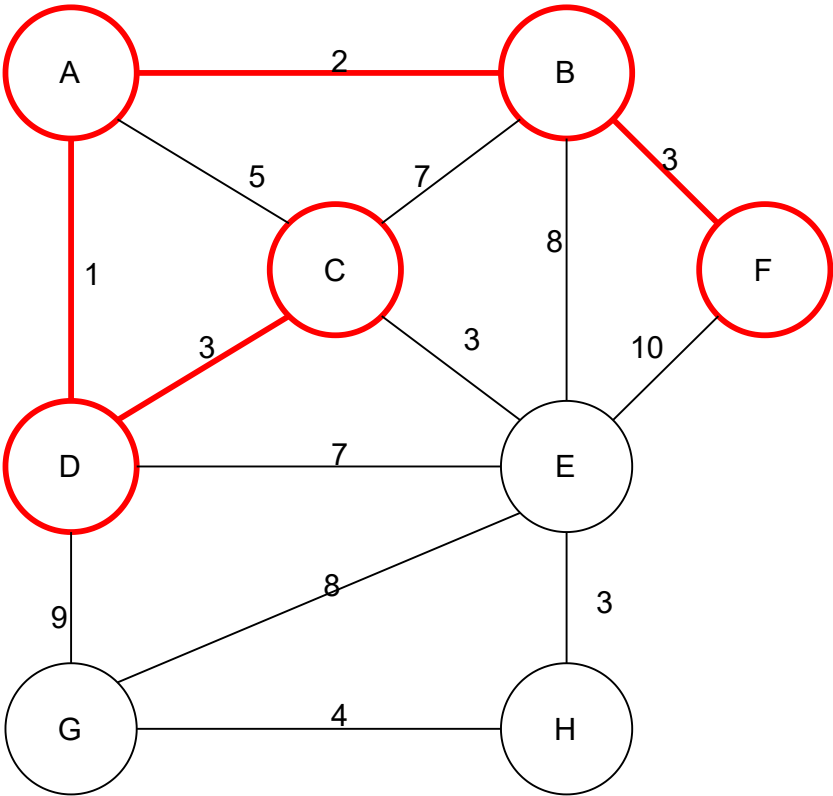
2. Select the edge with the minimum weight which does not cause a cycle.



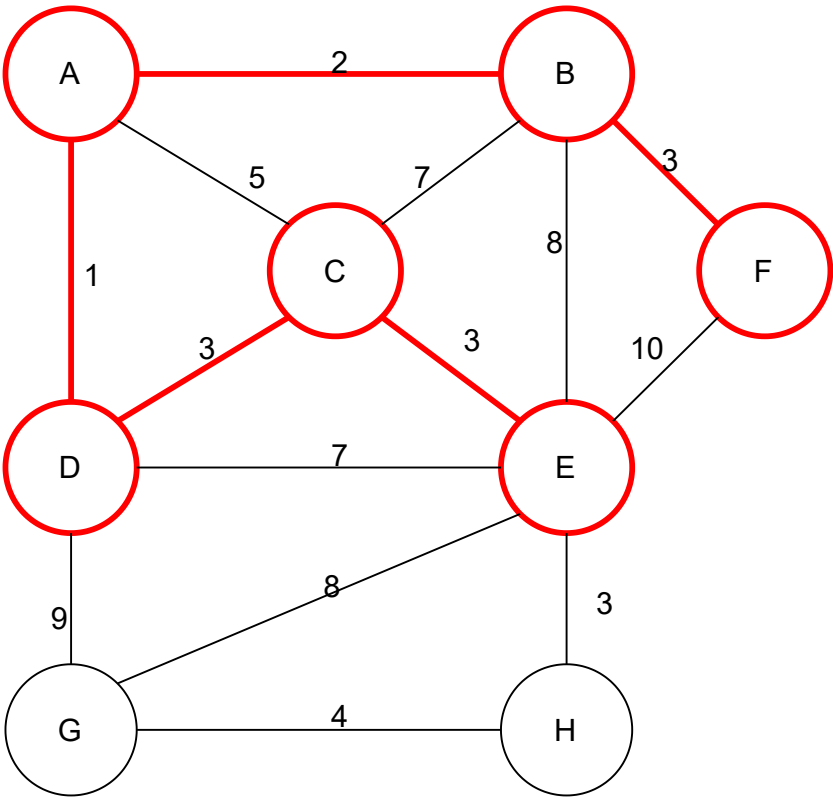
3. Select the edge with the minimum weight which does not cause a cycle.



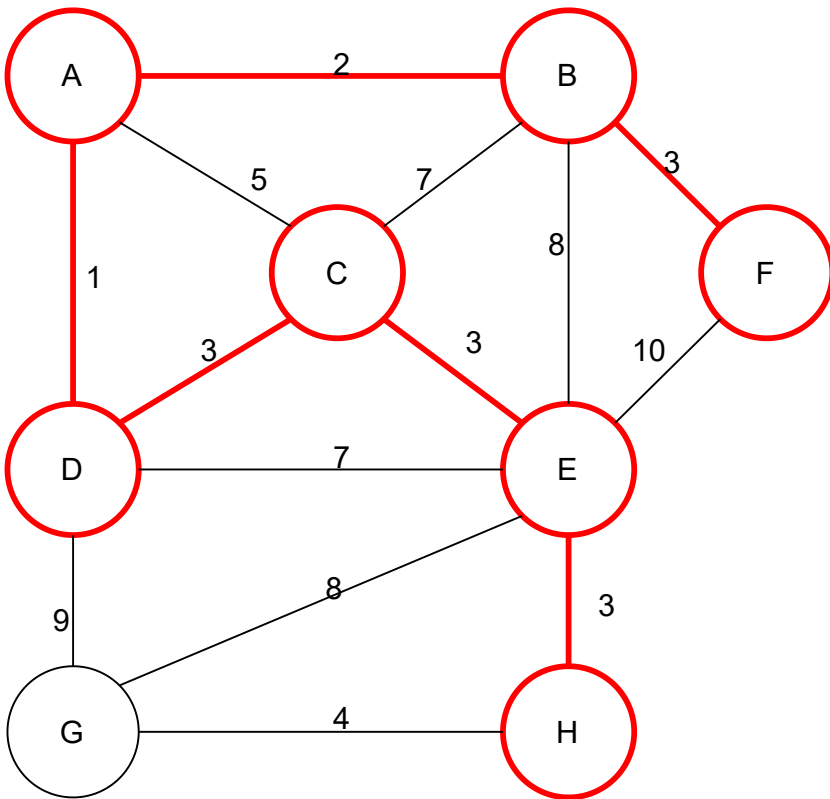
4. Select the edge with the minimum weight which does not cause a cycle.



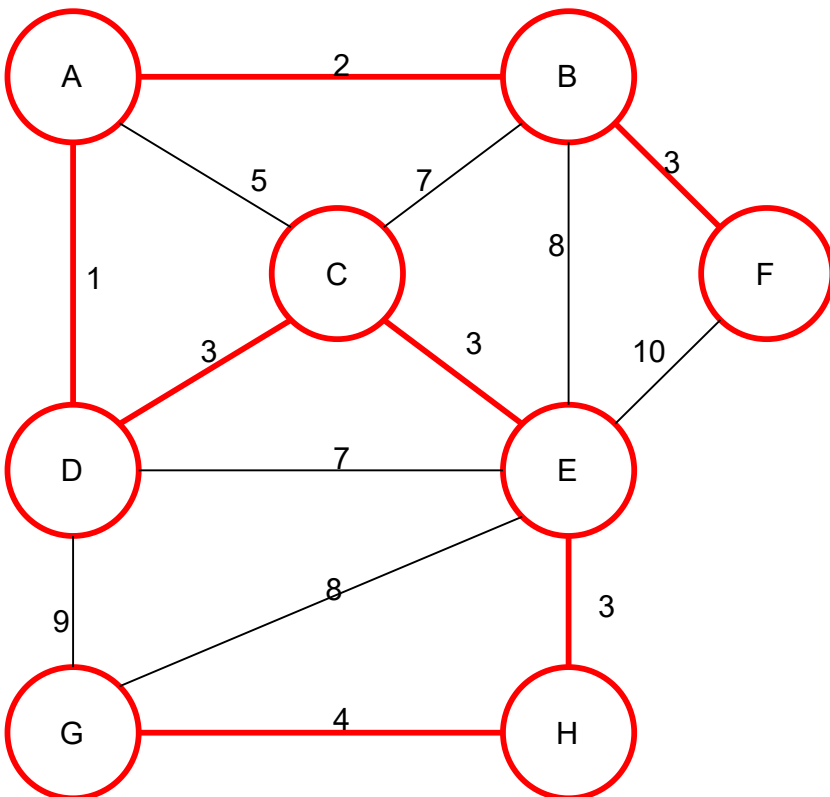
5. Select the edge with the minimum weight which does not cause a cycle.



6. Select the edge with the minimum weight which does not cause a cycle.

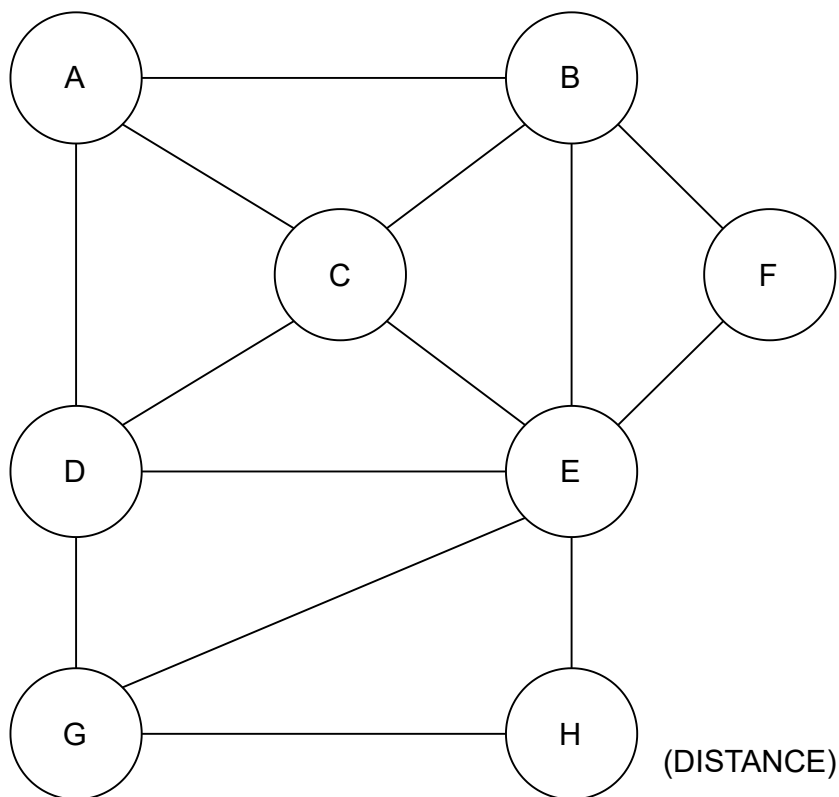


7. Select the edge with the minimum weight which does not cause a cycle

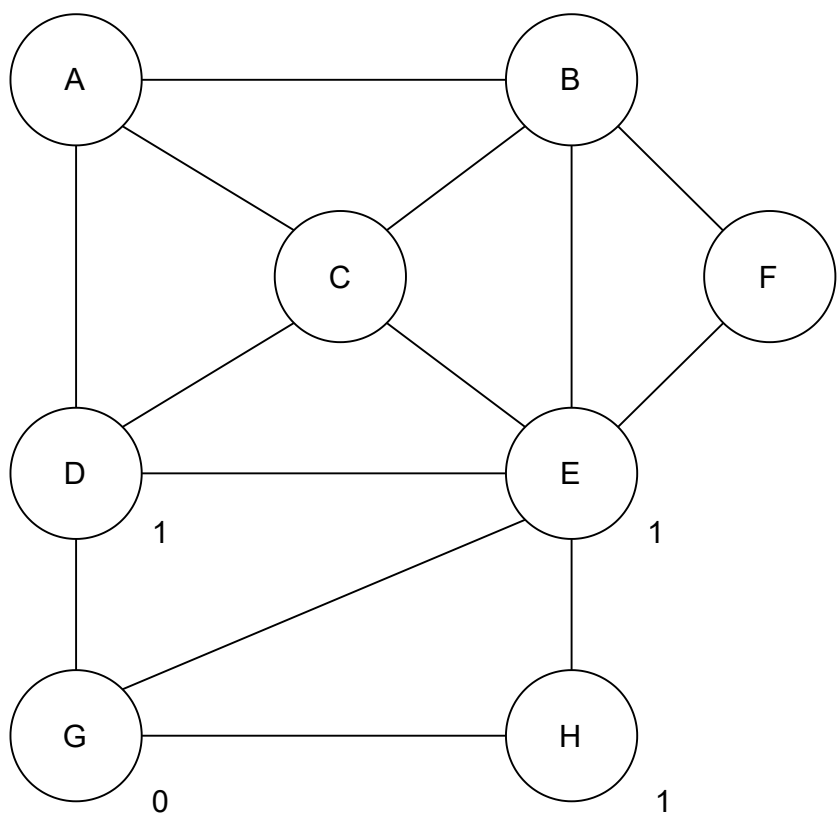


**Question 3 (20 points)**

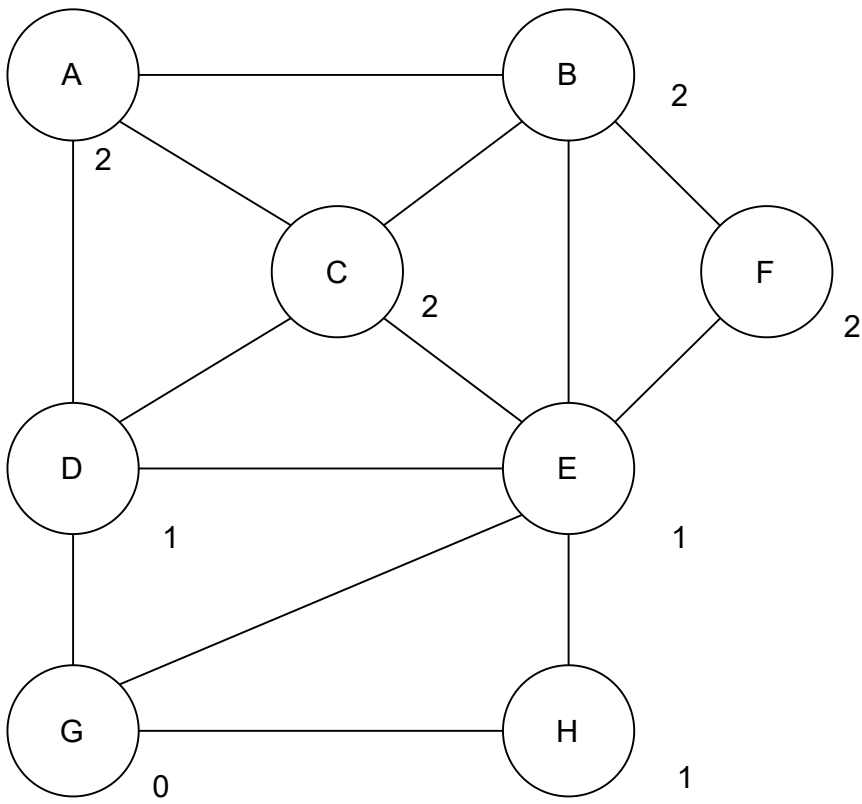
Find shortest unweighted path from G to all other vertices for the graph in Figure 1. Use breadth-first search algorithm in your answer. Do NOT forget to show the trace



1. Select the unvisited neighbouring vertices of G and mark their distance as 1. (D, E, H)



2. Select the unvisited neighbouring vertices and mark their distance as 2. (A, C, F, B)

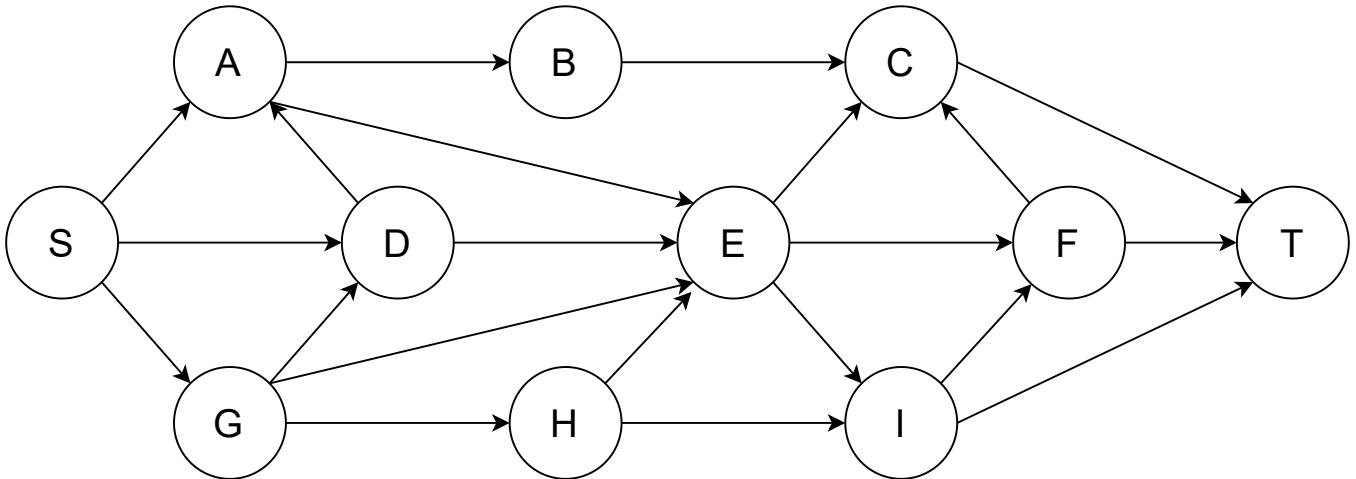


3. All vertices are visited. Algorithm is done.

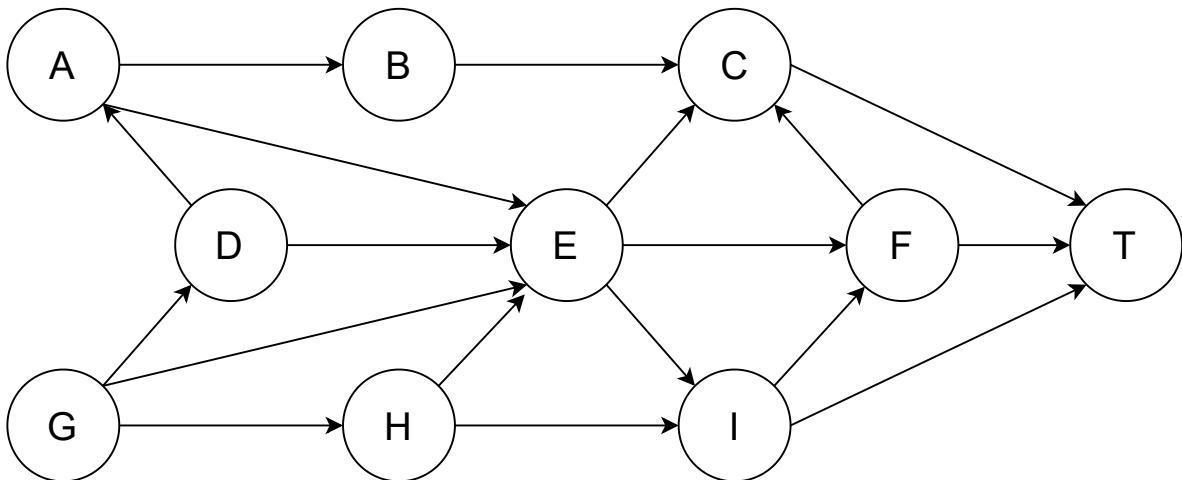
### Question 5 (20 points)

Find a topological ordering of the graph in Figure 2.

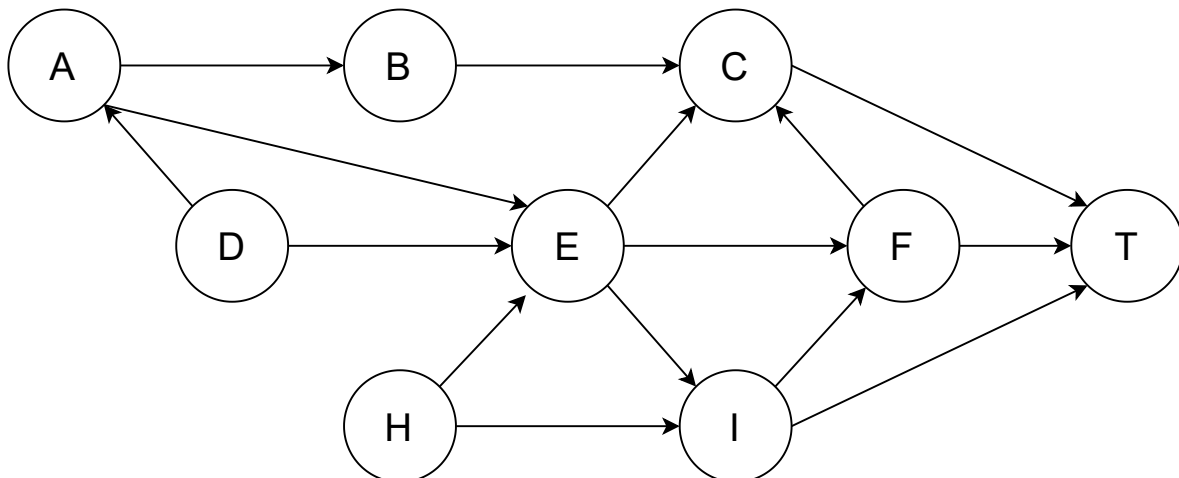
1. Remove S which is in degree 0.



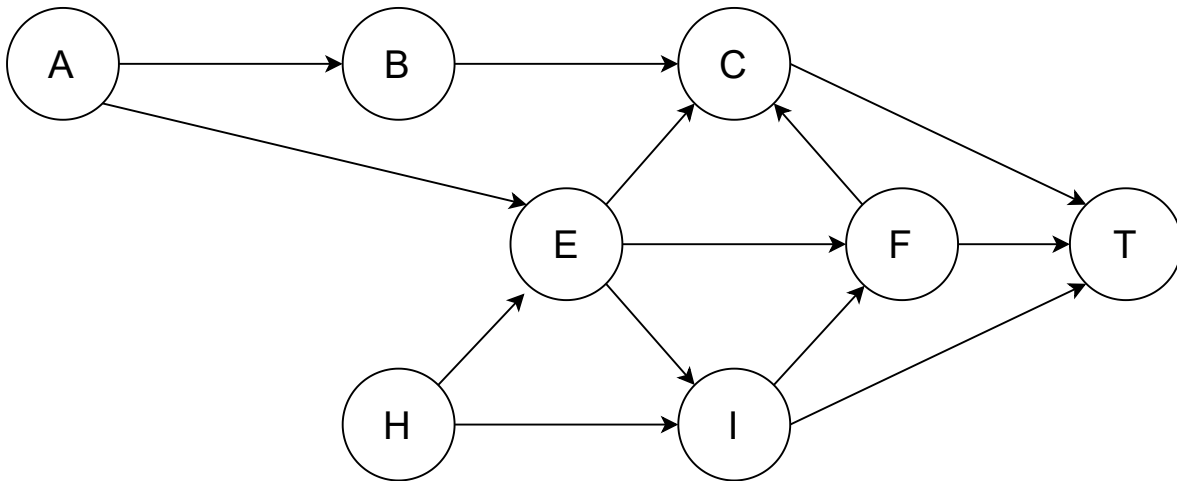
2. Remove G which is in degree 0.



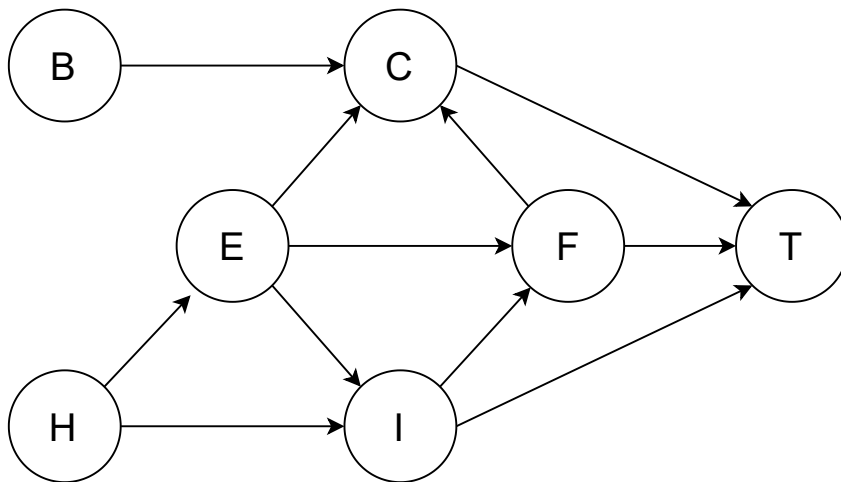
3. Remove D which is in degree 0.



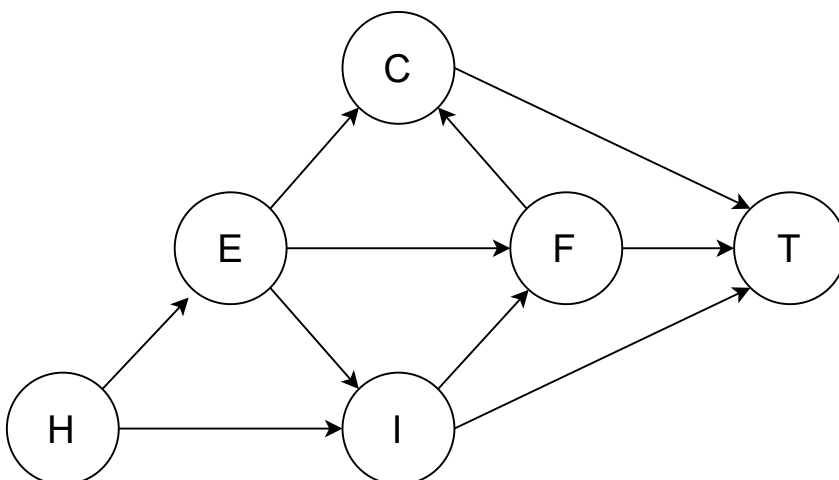
4. Remove A which is in degree 0.



5. Remove B which is in degree 0.

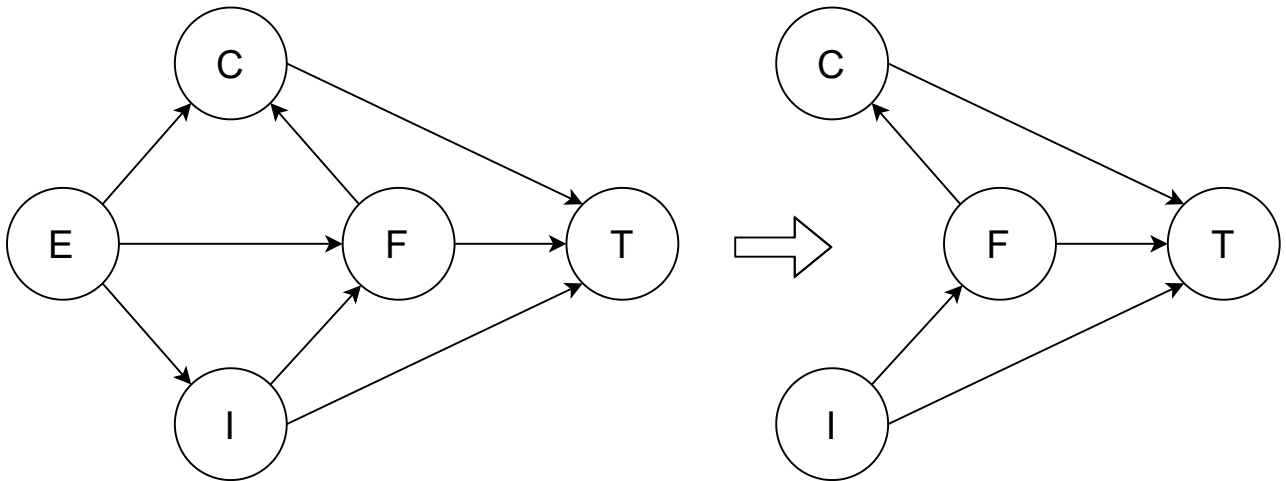


6. Remove H which is in degree 0.



7. Remove E which is in degree 0.

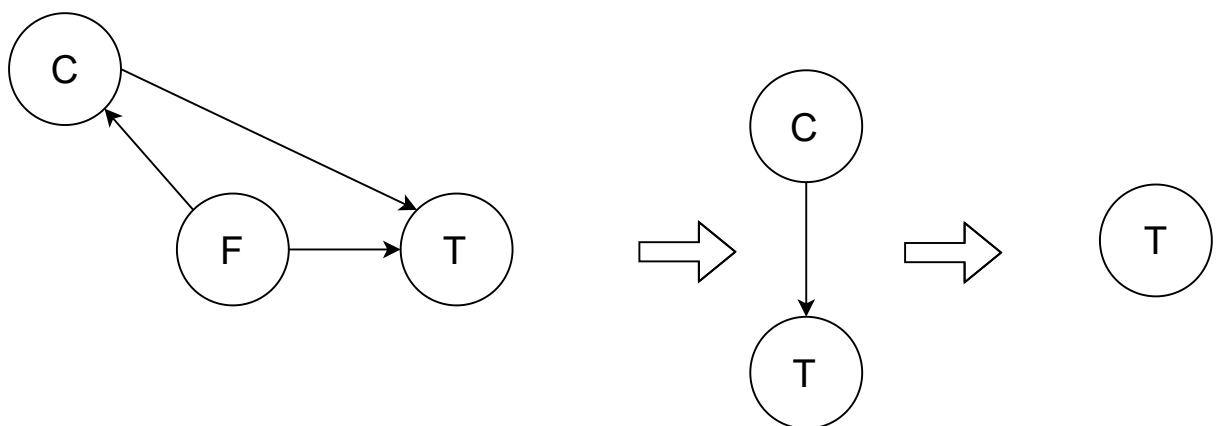
8. Remove I which is in degree 0.



9. Remove F which is in degree 0.

10. Remove C which is in degree 0.

11. Remove T which is in degree 0.



Result: S G D A B H E I F C T