

# CS 300

## DATA STRUCTURES

### Homework 5 Solutions

Question 1 [20 points])

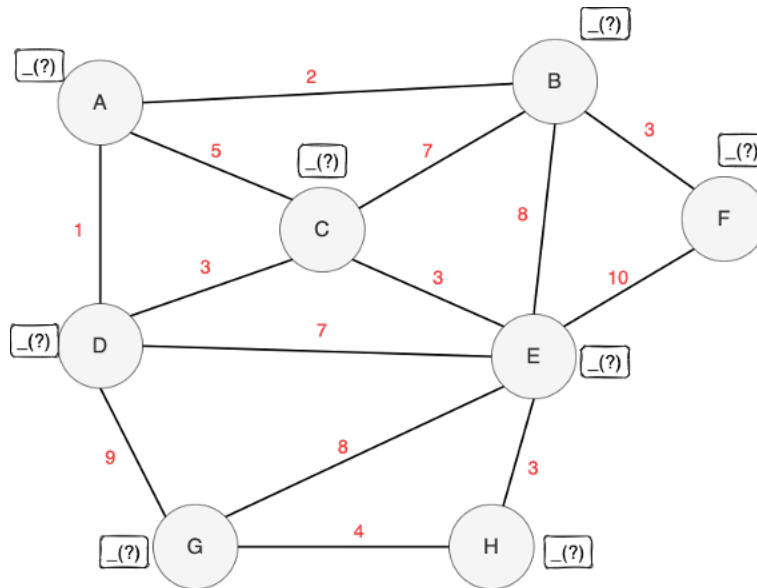


Figure 1: Dijkstra step 1

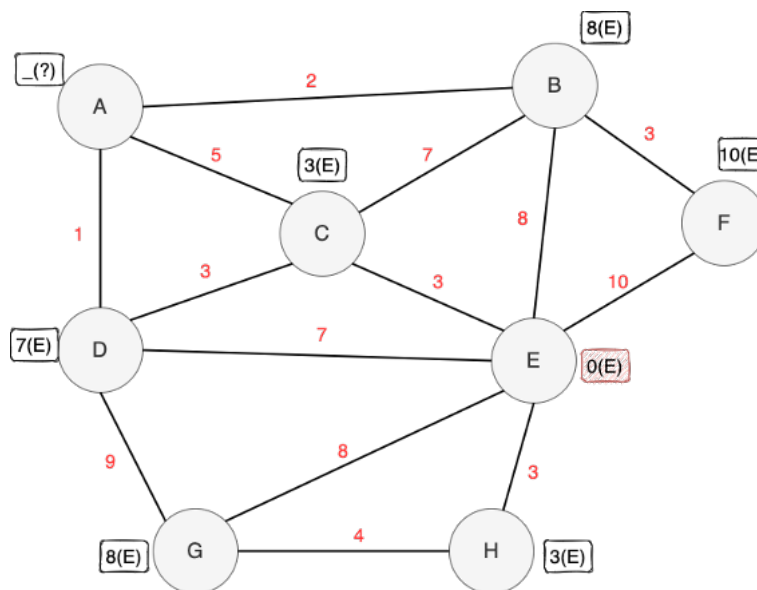


Figure 2: Dijkstra step 2

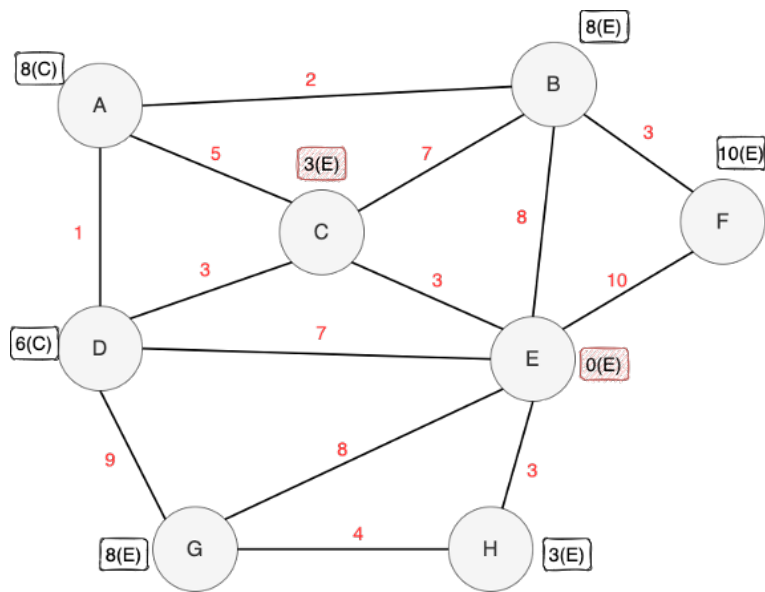


Figure 3: Dijkstra step 3

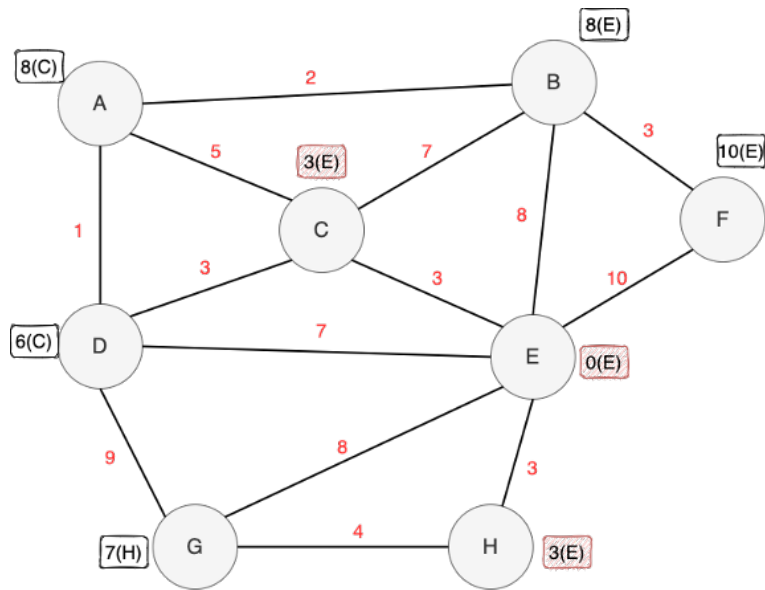


Figure 4: Dijkstra step 4

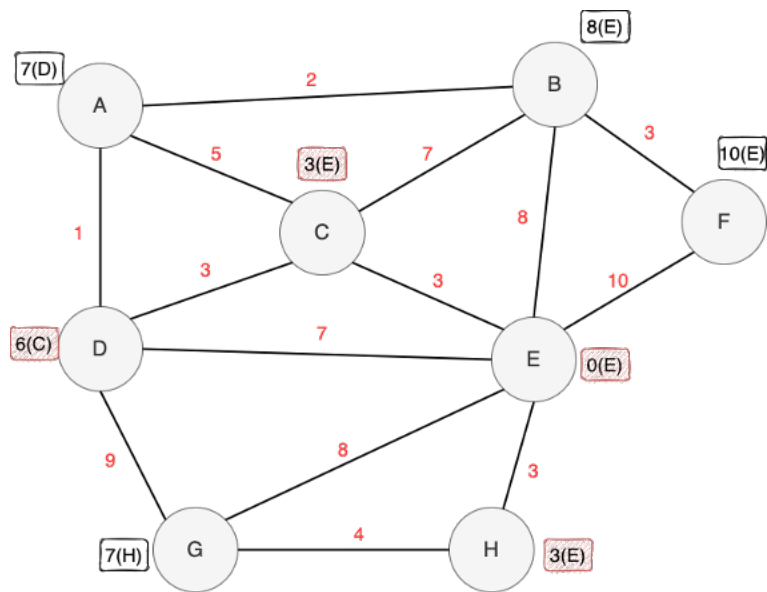


Figure 5: Dijkstra step 5

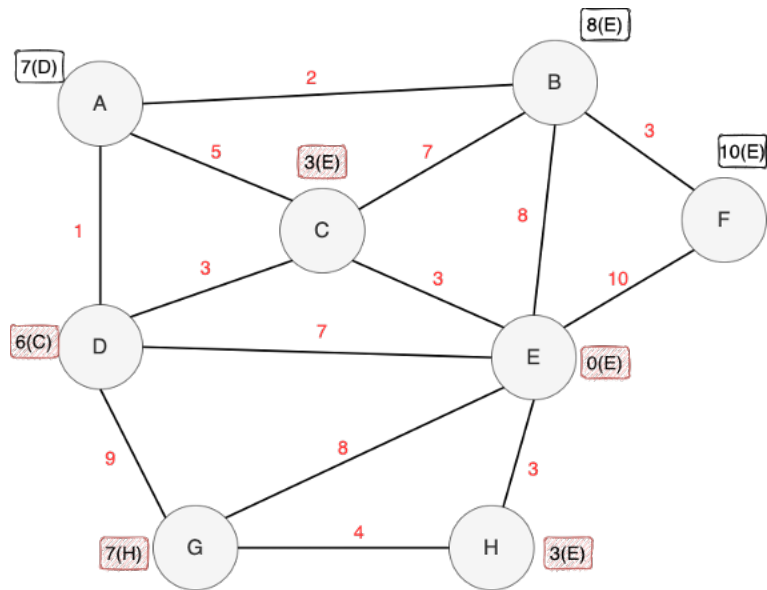


Figure 6: Dijkstra step 6

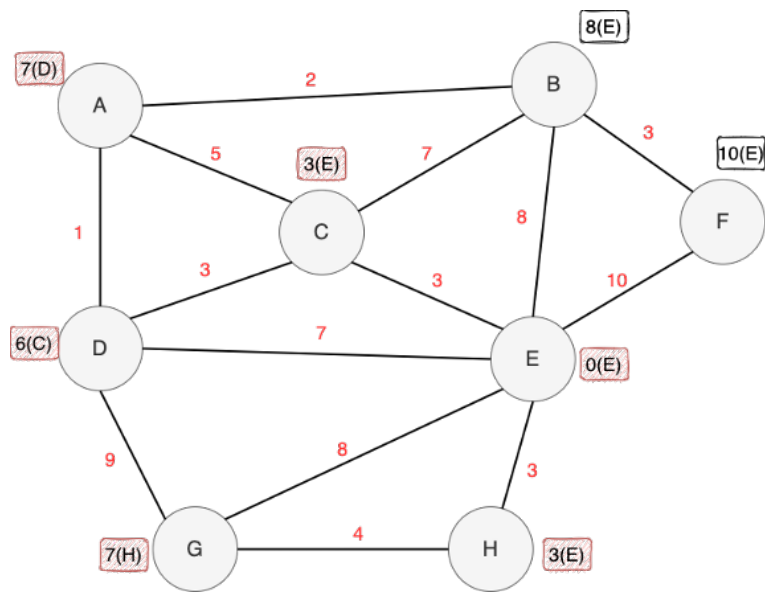


Figure 7: Dijkstra step 7

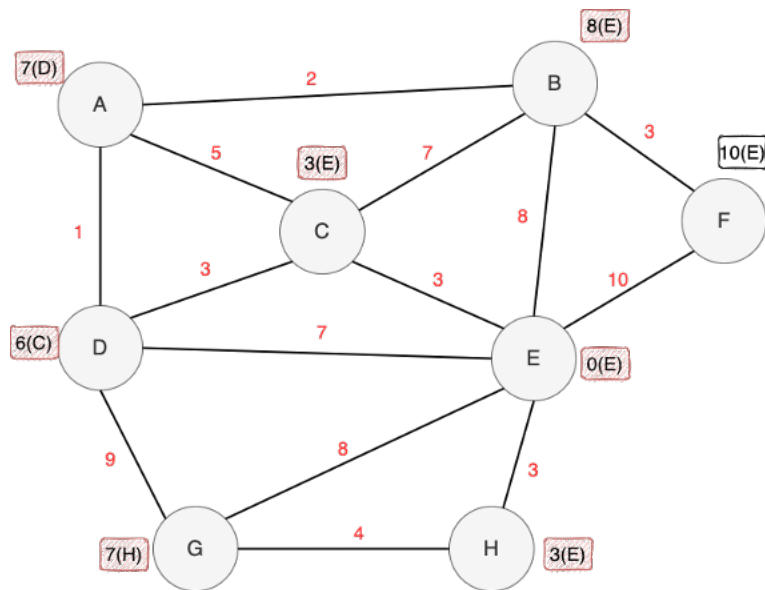


Figure 8: Dijkstra step 8

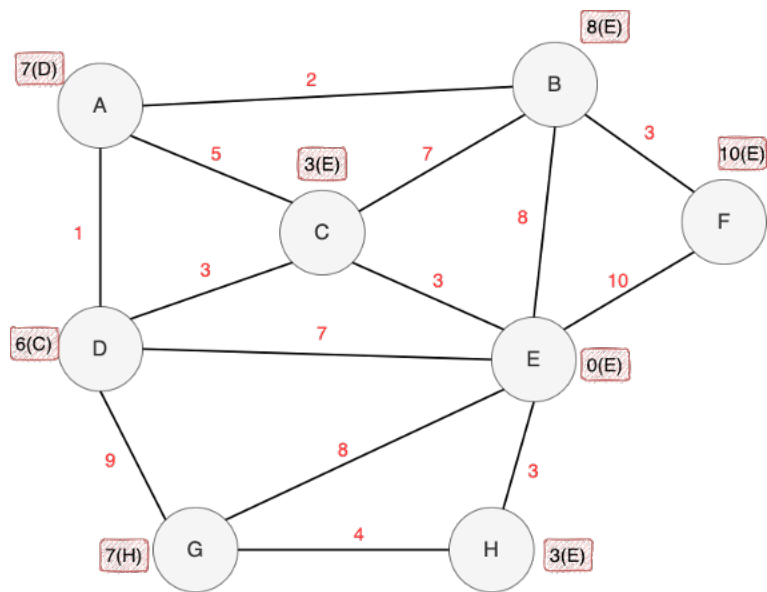


Figure 9: Dijkstra step 9

Question 2 [20 points])

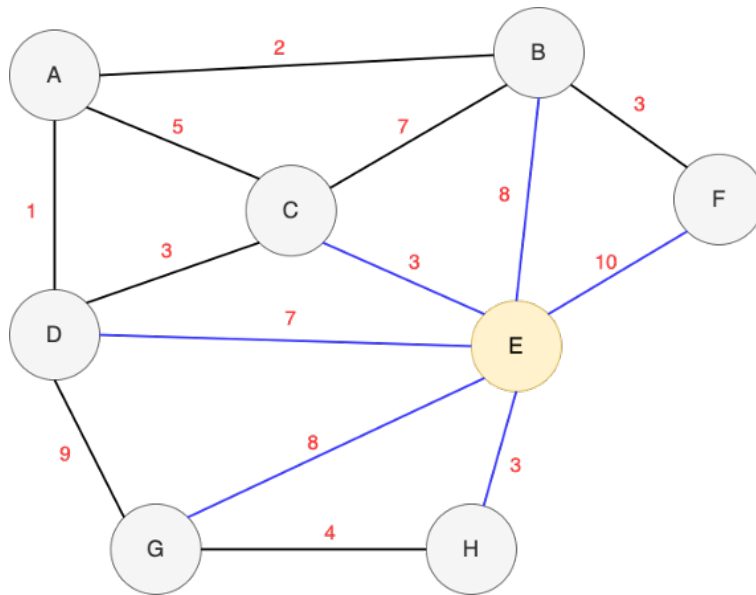


Figure 10: Prim's step 1

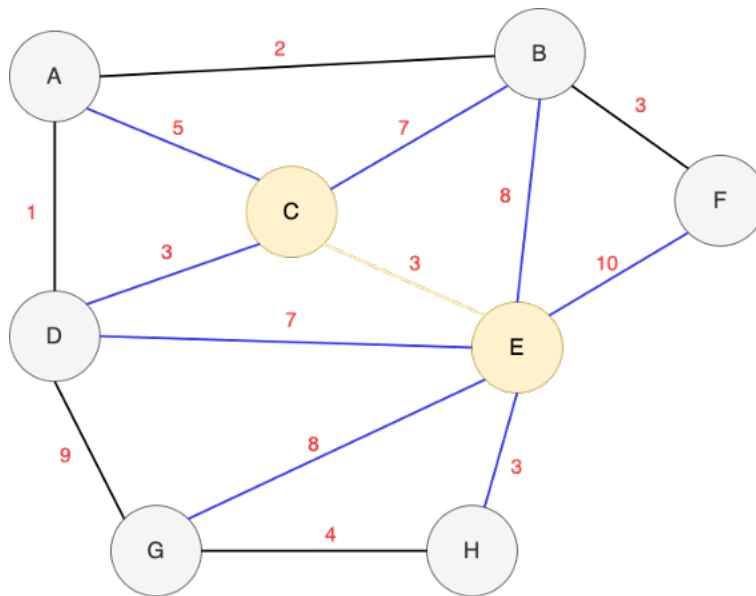


Figure 11: Prim's step 2

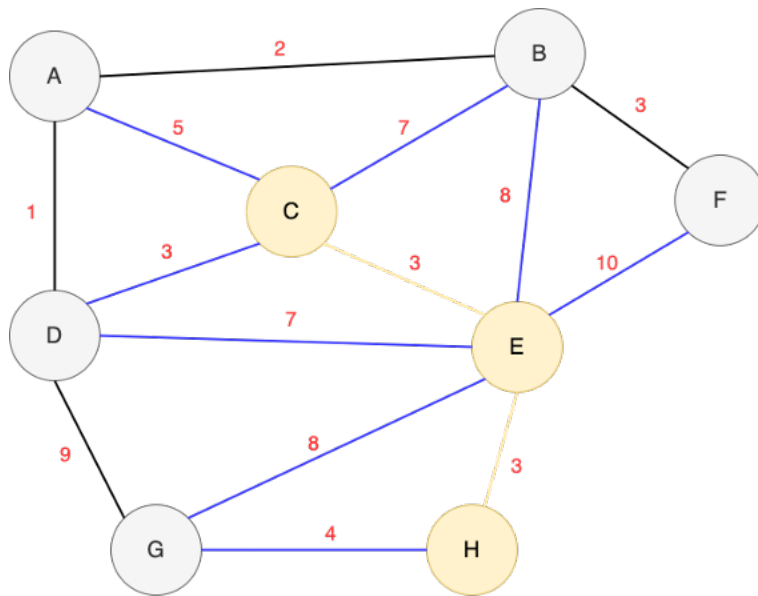


Figure 12: Prim's step 3

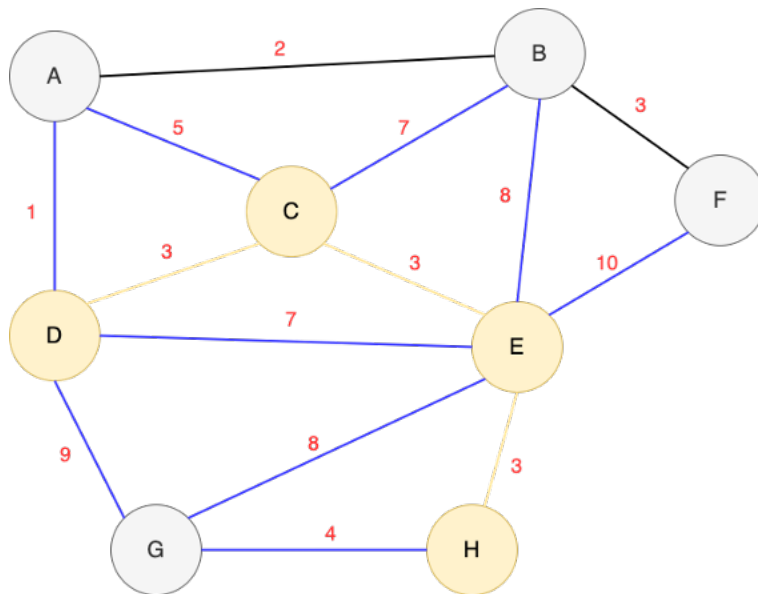


Figure 13: Prim's step 4

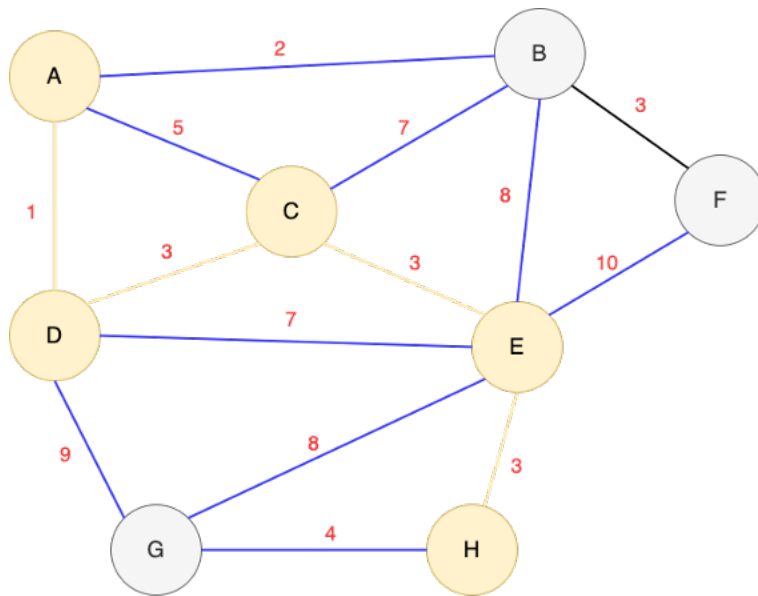


Figure 14: Prim's step 5

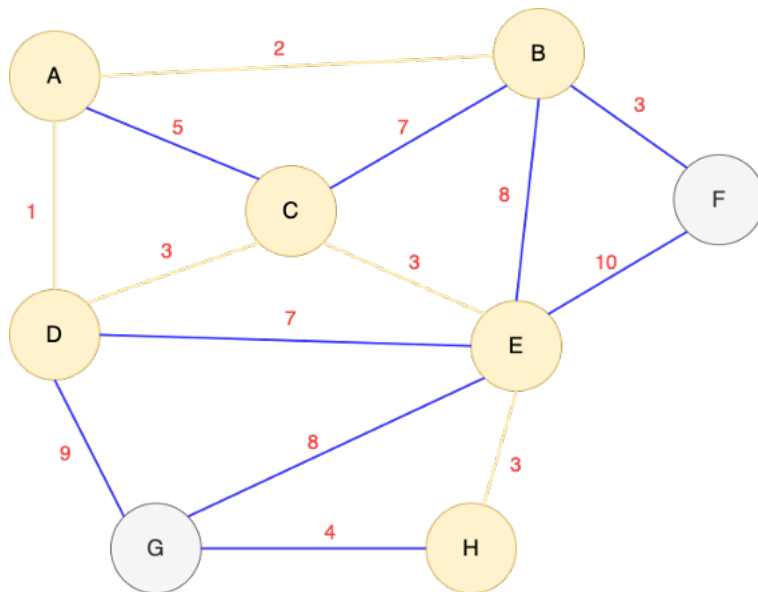


Figure 15: Prim's step 6



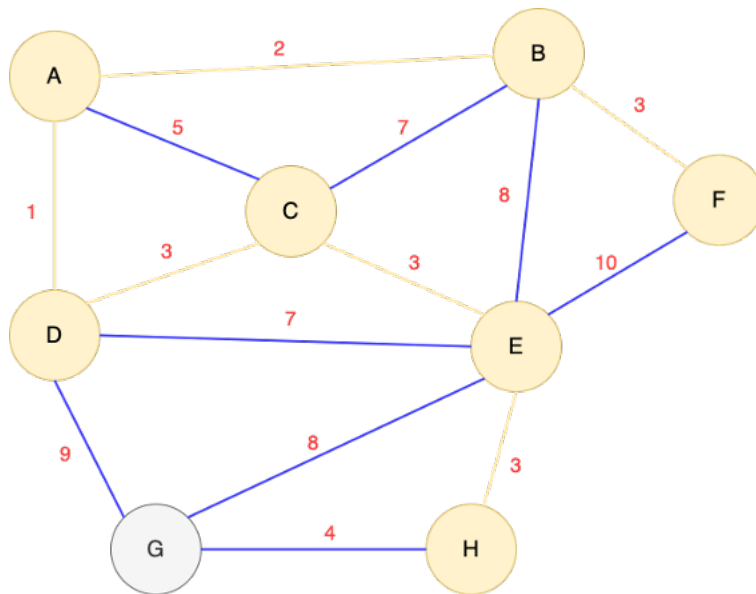


Figure 16: Prim's step 7

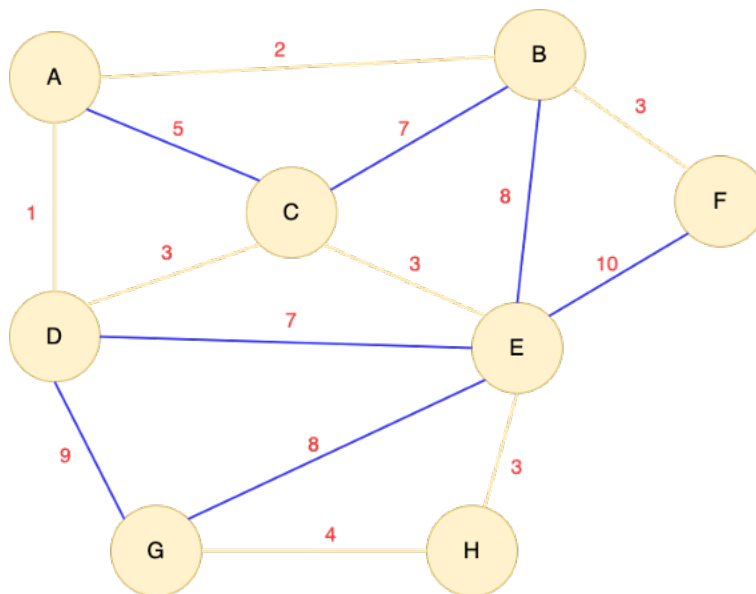


Figure 17: Prim's step 8

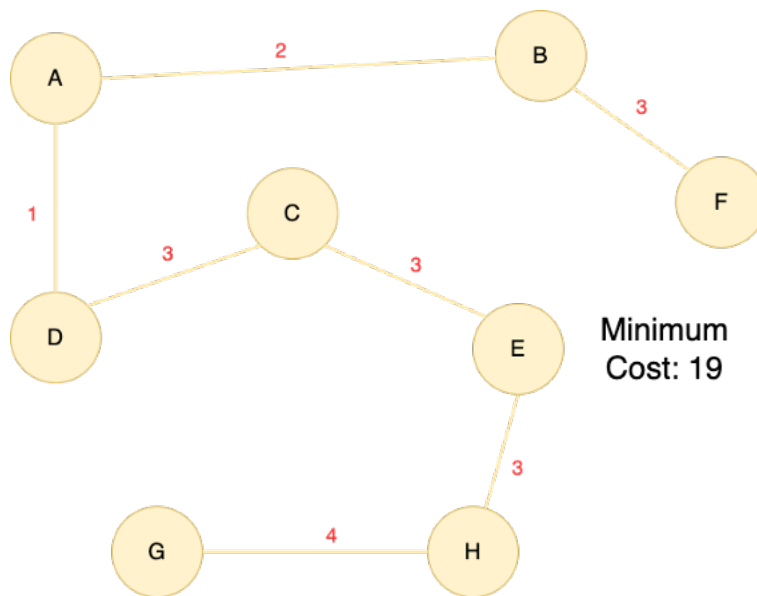


Figure 18: Prim's Final

Question 3 [20 points])

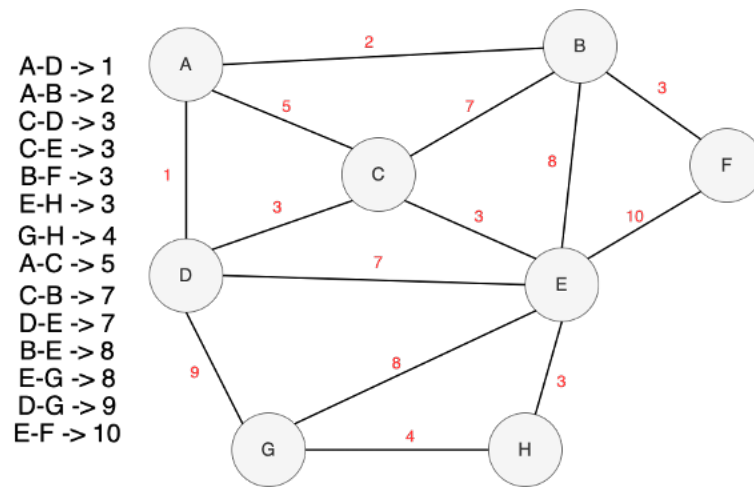


Figure 19: Kruskal step 1

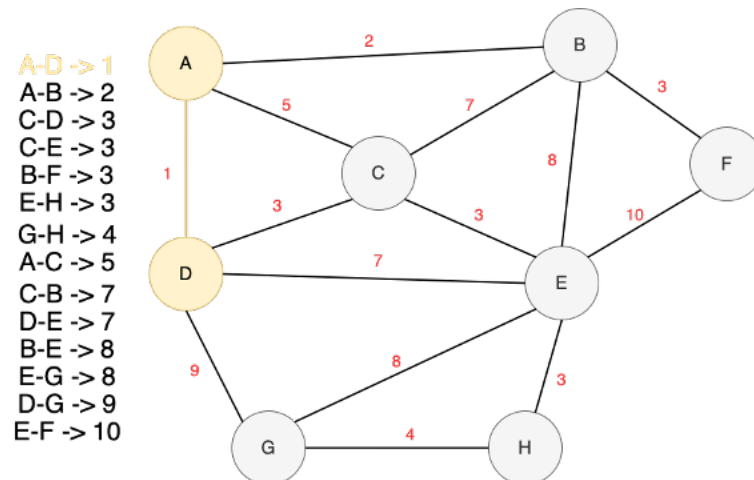


Figure 20: Kruskal step 2

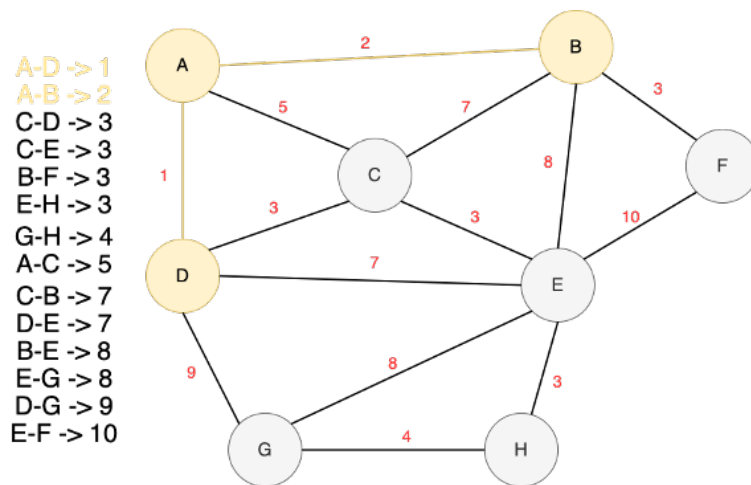


Figure 21: Kruskal step 3

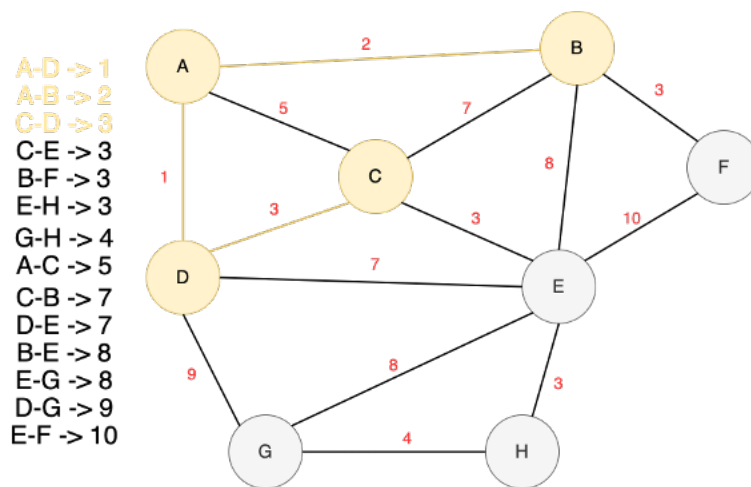


Figure 22: Kruskal step 4

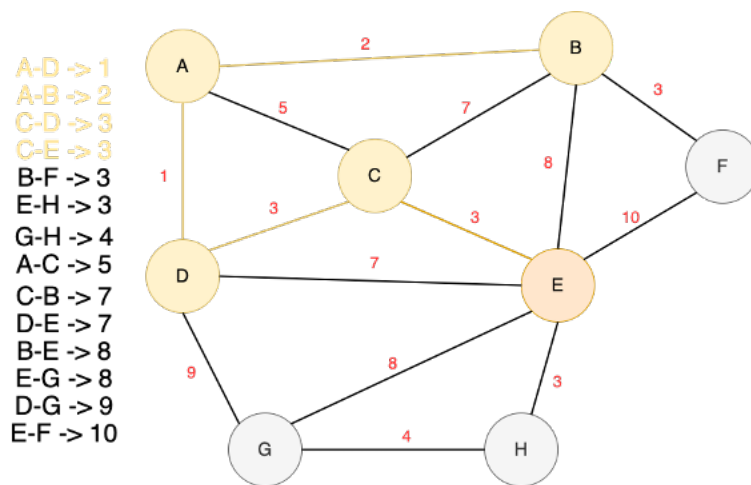


Figure 23: Kruskal step 5

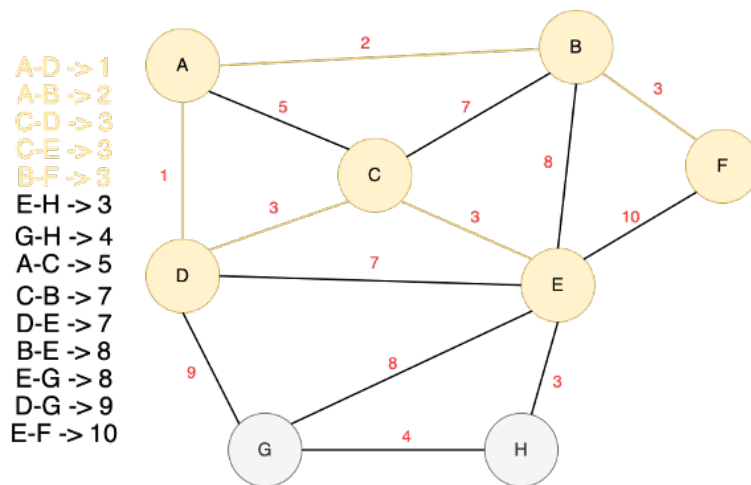


Figure 24: Kruskal step 6

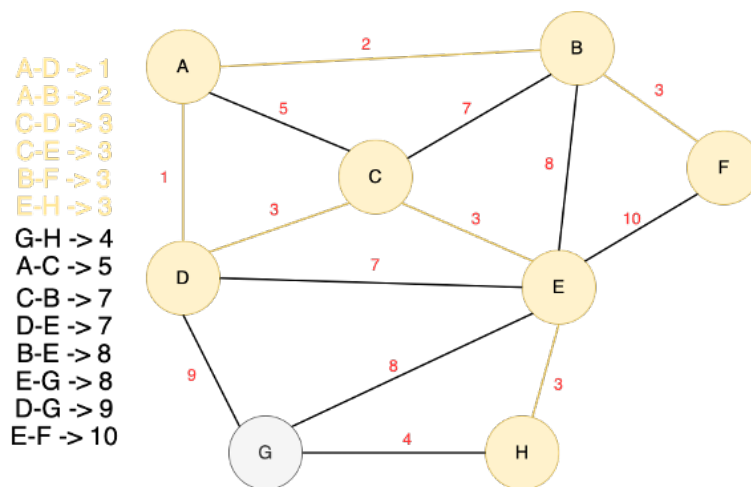


Figure 25: Kruskal step 7

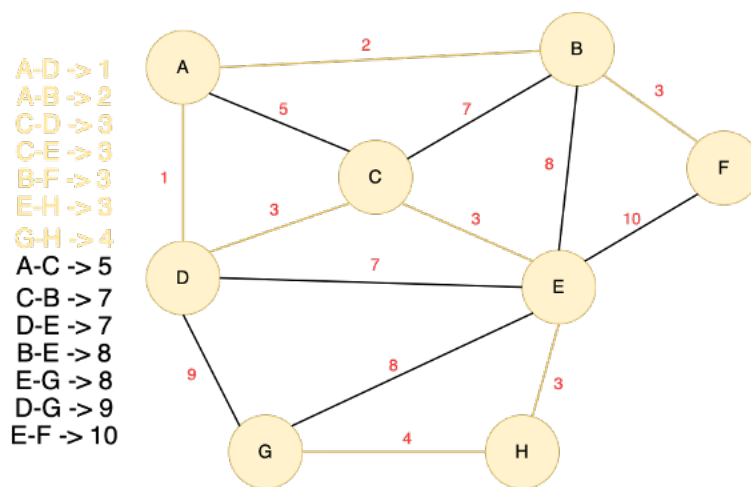


Figure 26: Kruskal step 8

$A-C \rightarrow 5$   
 $C-B \rightarrow 7$   
 $D-E \rightarrow 7$   
 $B-E \rightarrow 8$   
 $E-G \rightarrow 8$   
 $D-G \rightarrow 9$   
 $E-F \rightarrow 10$

are the same union

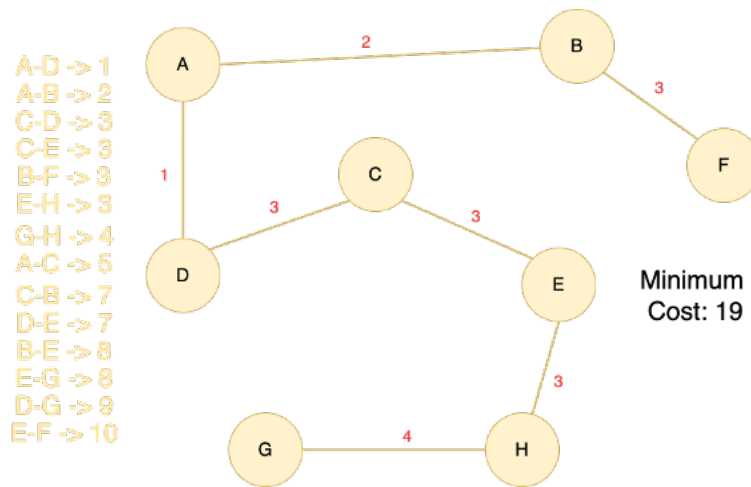


Figure 27: Kruskal step 9

Question 4 [20 points])

We start at vertex G.

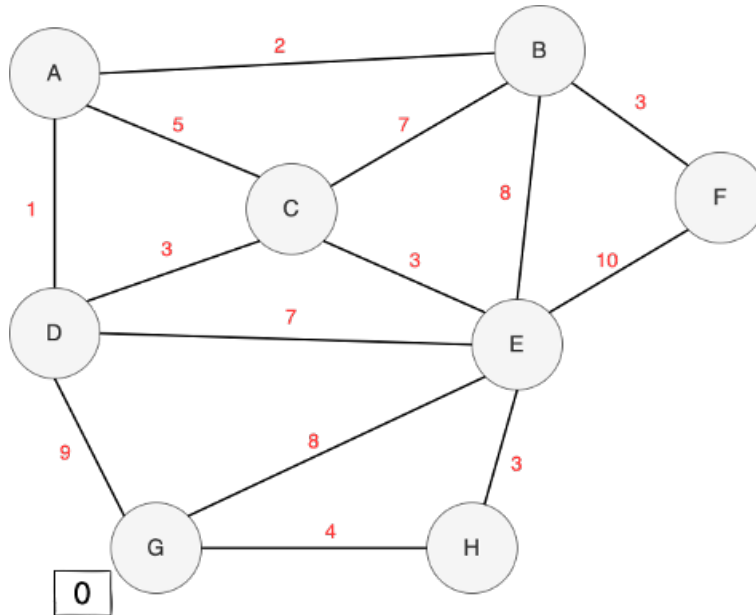


Figure 28: BFS step 0

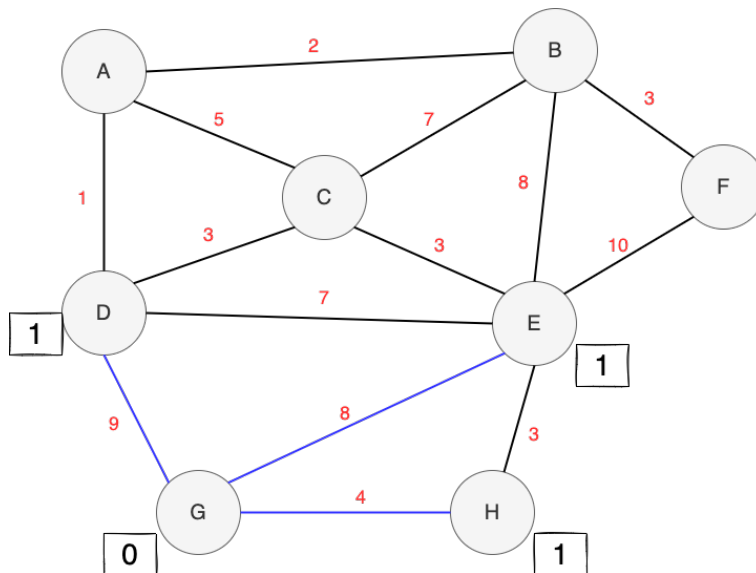


Figure 29: BFS step 1

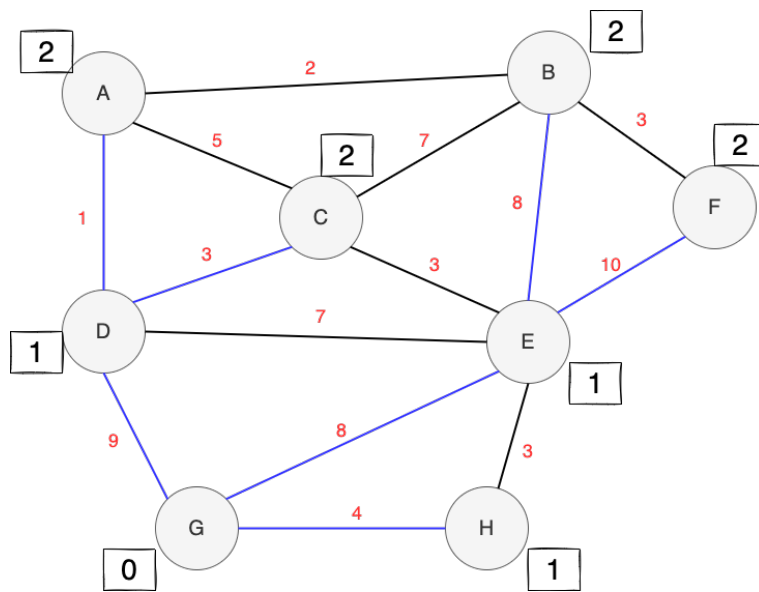


Figure 30: BFS step 2



**Question 5 [20 points])**

One possible solution is below:

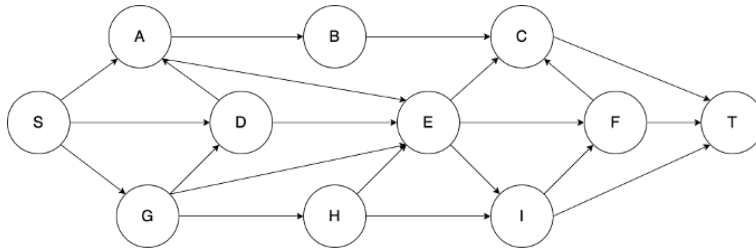


Figure 31: Topological sort step 1

Result: S

Delete: S

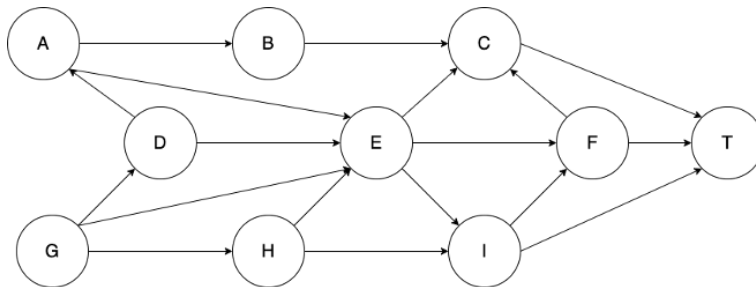


Figure 32: Topological sort step 2

A, D has in-degree 1

G has in-degree 0

Result: S, G

Delete G

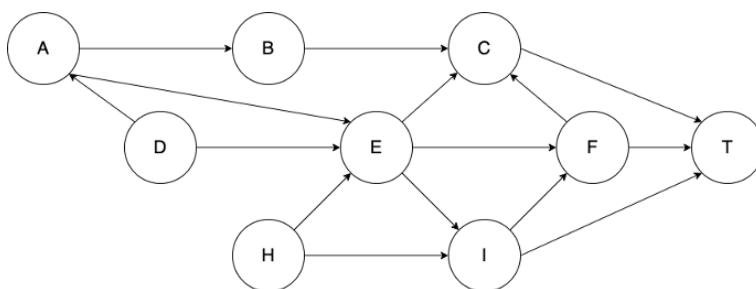


Figure 33: Topological sort step 3

A has in-degree 1

D, H has in degree 0

Result: S, G, D  
Delete D

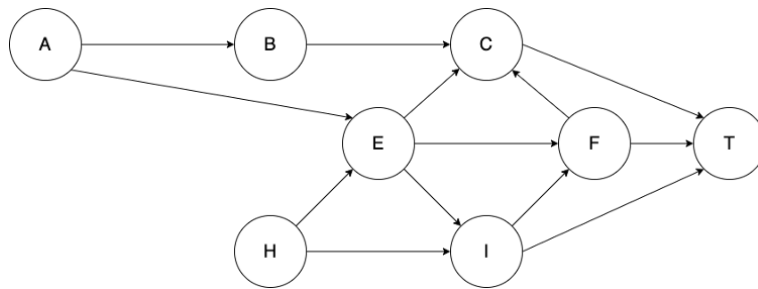


Figure 34: Topological sort step 4

H, A has in degree 0

Result: S, G, D, H  
Delete H

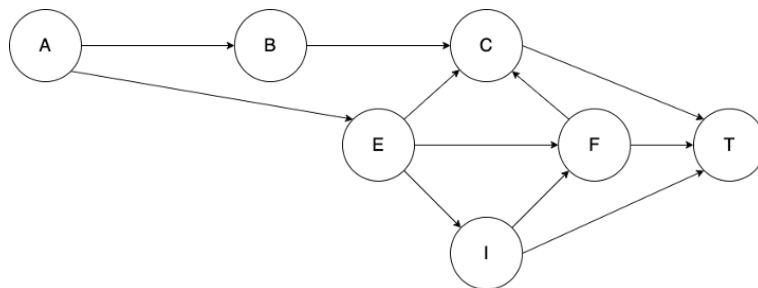


Figure 35: Topological sort step 5

E, I has in-degree 1  
A has in-degree 0

Result: S, G, D, H, A

Delete A

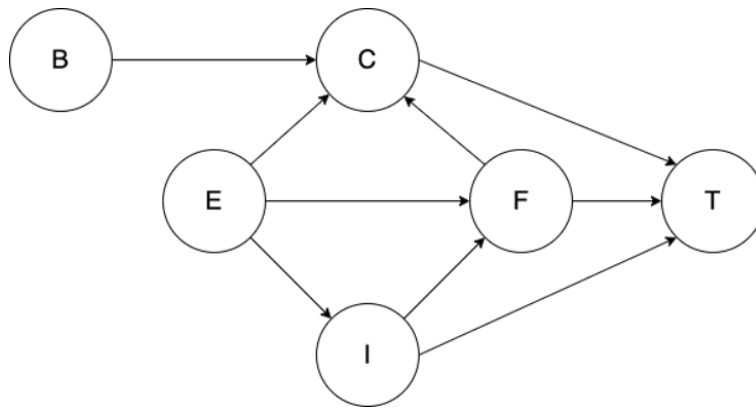


Figure 36: Topological sort step 6

E, I, B has in-degree 0

Result: S, G, D, H, A, E

Delete E

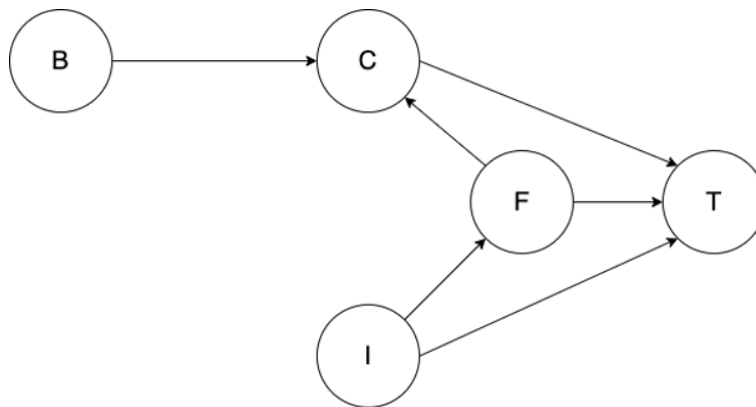


Figure 37: Topological sort step 7

I, B has in-degree 0

Result: S, G, D, H, A, E, I

Delete I

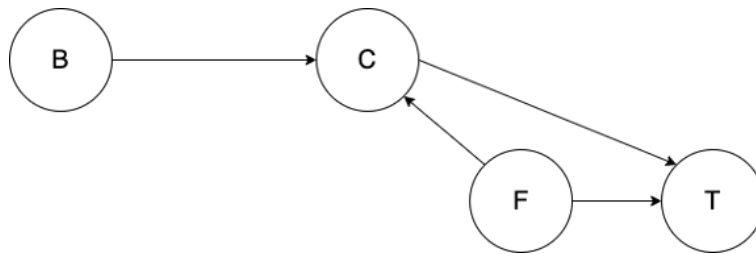


Figure 38: Topological sort step 8

B, F has in-degree 0

Result: S, G, D, H, A, E, I, B

Delete B

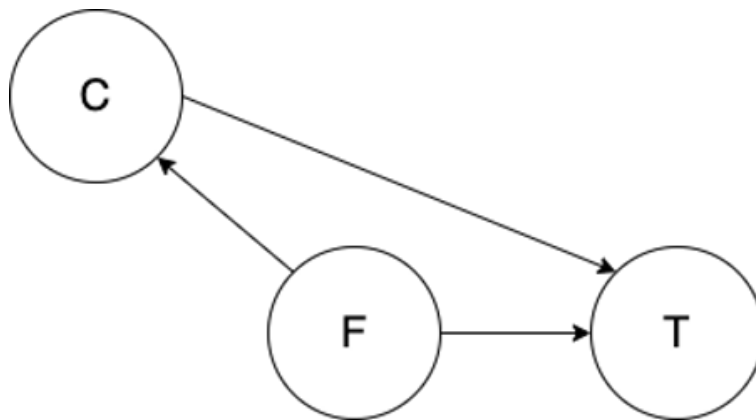


Figure 39: Topological sort step 9

F has in-degree 0

Result: S, G, D, H, A, E, I, B, F

Delete F

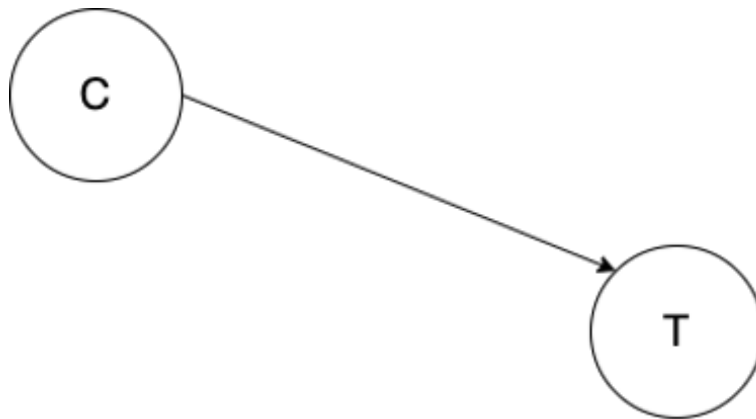


Figure 40: Topological sort step 10

C has in-degree 0

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

Delete C

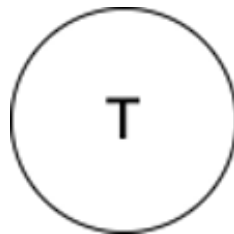


Figure 41: Topological sort step 11

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