

# Thank you for taking the Week 3 Quiz.

## Week 3 Quiz

Your last recorded submission was on 2024-02-13, 23:51 IST

Due date: 2024-02-14, 23:59 IST.

All questions carry equal weightage. You may submit as many times as you like within the deadline. Your final submission will be graded.

1) An undirected graph  $G$  on 30 vertices has 4 connected components. What is the minimum number of edges in  $G$ ?

2 points

- ☐ 29
- ☒ 25
- ☐ 26
- ☐ Depends on the sizes of the four connected components.

2) Suppose we have a directed graph  $G = (V, E)$  with  $V = \{1, 2, \dots, n\}$  and  $E$  is presented as an adjacency list. For each vertex  $u$  in  $V$ ,  $\text{out}(u)$  is a list  $[v_1, v_2, \dots, v_k]$  such that  $(u, v_i)$  in  $E$  for each  $i$  in  $\{1, 2, \dots, k\}$ .

For each  $u$  in  $V$ , we wish to compute a corresponding list  $\text{in}(u) = [v_1, v_2, \dots, v_k]$  such that  $(v_i, u)$  in  $E$  for each  $i$  in  $\{1, 2, \dots, k\}$ .

Let  $n$  be the number of vertices in  $V$  and  $m$  be the number of edges in  $E$ . How long would it take to construct the lists  $\text{in}(u)$ ,  $u$  in  $V$ , from the lists  $\text{out}(u)$ ,  $u$  in  $V$ ?

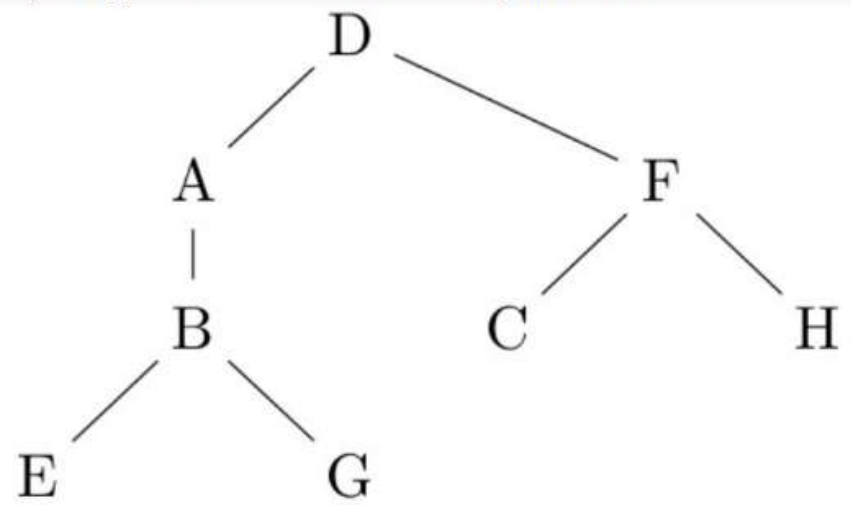
- ☐  $O(m)$
- ☒  $O(n + m)$
- ☐  $O(n^2)$
- ☐  $O(n^2 + m)$

3) Suppose we obtain the following DFS tree rooted at node  $D$  for an undirected graph  $G$  with vertices  $\{A, B, C, D, E, F, G, H\}$ .

2 points

3) Suppose we obtain the following DFS tree rooted at node D for an undirected graph Gr with vertices {A,B,C,D,E,F,G,H}.

2 points



Which of the following **cannot** be an edge in the graph Gr?

- ☐ (D,E)
- ☐ (D,H)
- ☐ (A,G)
- ☒ (A,C)

4) We are interested in topological orderings of the following DAG that satisfy one or both of the following constraints:

2 points

- 4 appears before 3
- 8 appears after 7

How many such orderings are there?

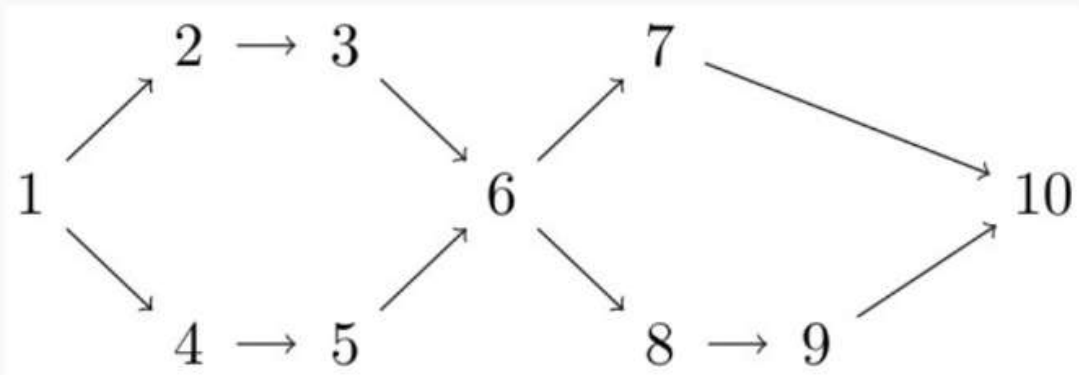


4) We are interested in topological orderings of the following DAG that satisfy one or both of the following constraints:

**2 points**

- 4 appears before 3
- 8 appears after 7

How many such orderings are there?



- ☐ 18
- ☒ 16
- ☐ 6
- ☐ 2

5) Finishing the interiors of a lecture hall consists of several steps, such as laying electrical cables, installing audio-visual equipment, attaching the blackboard, etc. Suppose there are 10 steps, labelled A, B, C, D, E, F, G, H, I, J. Each step takes a day to complete and we have the following dependencies between steps.

**2 points**

- A must happen before J
- B must happen before D
- B must happen before G

5) Finishing the interiors of a lecture hall consists of several steps, such as laying electrical cables, installing audio-visual equipment, attaching the blackboard, etc. Suppose there are 10 steps, labelled A, B, C, D, E, F, G, H, I, J. Each step takes a day to complete and we have the following dependencies between steps. **2 points**

- A must happen before J
- B must happen before D
- B must happen before G
- C must happen before B
- D must happen before A
- D must happen before E
- E must happen before J
- F must happen before C
- G must happen before D
- H must happen before F
- H must happen before I
- I must happen before B
- I must happen before G

What is the minimum number of days required to complete the interiors?

- ☐ 9
- ☐ 8
- ☐ 7
- ☒ 6

You may submit any number of times before the due date. The final submission will be considered for grading.

**Submit Answers**