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NPTEL (https://swayam.gov.in/explorer?ncCode=NPTEL) » Design and analysis of algorithms (course)

Announcements (announcements) **About the Course (https://swayam.gov.in/nd1_noc20_cs27/preview)**

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Unit 9 - Week 3 Quiz

Week 3 Quiz

The due date for submitting this assignment has passed. **Due on 2020-02-19, 23:59 IST.**
As per our records you have not submitted this assignment.

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.

No, the answer is incorrect.
Score: 0
Feedback:
A minimal connected graph on n vertices is a tree, with n-1 edges. If each of the four components is a tree and we join them with edges to form a single component, we would have to add 3 edges. The resulting graph would be a tree with 29 edges on 30 vertices. Hence, the four components originally had 26 edges. This is the same, regardless of how the graph is decomposed

Accepted Answers:
26

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

For each u in V, we wish to compute a corresponding list in(u) = [v_1,v_2,…,$v_{k'}$] such that (v_i,u) in E for each i in {1,2,…,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 in(u), u in V, from the lists out(u), u in V?

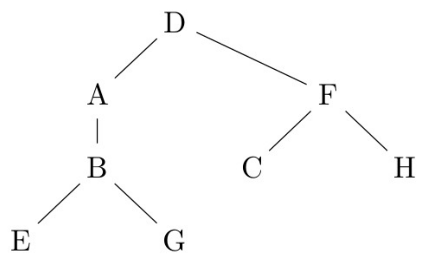
- O(m)

Week 3 Programming Assignment
Week 4 : Weighted graphs
Week 4 Quiz
Week 4 Programming Assignment
Week 5: Data Structures: Union-Find and Heaps
Week 5 : Divide and Conqure
Week 5 Quiz
Week 6: Data Structures: Search Trees
Week 6: Greedy Algorithms
Week 6 Quiz
Week 6 Programming Assignment
Week 7: Dynamic Programming
Week 7 Quiz
Week 7 Programming Assignment
Week 8: Linear Programming and Network Flows
Week 8: Intractability
Week 8 Quiz
Text Transcripts

- O(n + m)
- O(n^2)
- O(n^2 + m)

No, the answer is incorrect.
Score: 0
Feedback:
We can do it in O(n+m) as follows. Initialize in(u) to empty for each u in V (time O(n)). For each v in V, scar out(v) and for each j in out(v), add v to in(j) (time O(m) across all V).
Accepted Answers:
O(n + m)

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?

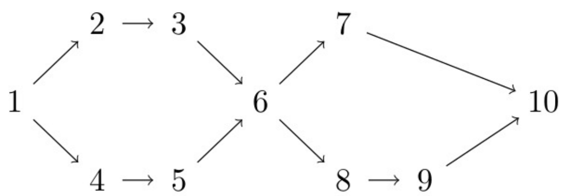
- (D,E)
- (D,H)
- (A,G)
- (A,C)

No, the answer is incorrect.
Score: 0
Feedback:
In an undirected graph, all non-tree edges of a DFS tree must be along a path from an ancestor to a descendant. (A,C) is an edge across different paths and hence not possible.
Accepted Answers:
(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?



- 18
- 16
- 6
- 2

No, the answer is incorrect.
Score: 0
Feedback:

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Any topological sort is of the form 1, followed by a topological ordering of {2,3,4,5}, followed by 6, followed by a topological ordering {7,8,9}.

Nodes {2,3,4,5} have (4 choose 2) = 6 topological orderings of which only one, 2-3-4-5 has 3 before 4. All other orderings have 4 before 3: 2-4-3-5, 2-4-5-3, 4-2-3-5, 4-2-5-3, 4-5-2-3..

Nodes {7,8.9} have 3 topological orderings, 7-8-9, 8-7-9, 8-9-7, of which two have 8 before 7 and one has 8 after 7.

There are 6 × 3 = 18 total topological orderings of which 1 × 2 = 2 violates both conditions, so 16 satisfy one condition or both.

Accepted Answers:
16

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***

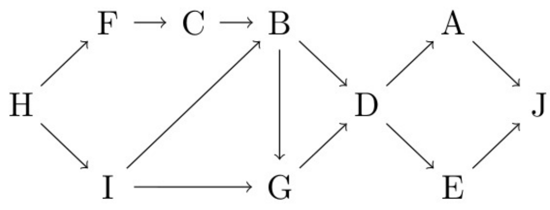
- A must happen before J
- B must happen before D
- B must happen before G
- C must happen before B
- D must happen before A
- D must happen before E
- E must happen before J
- F must happen before C
- G must happen before D
- H must happen before F
- H must happen before I
- I must happen before B
-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

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

- 9
- 8
- 7
- 6

No, the answer is incorrect.
Score: 0

Feedback:
Here is the corresponding dag, whose longest path, for instance H-F-C-B-G-D-A-J, has length 8.



Accepted Answers:
8