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


Course outline

How does an NPTEL online course work?

 Week 1 :
Introduction

 Week 1 :
Analysis of algorithms

Week 1 Quiz

 Week 2 :
Searching and sorting

Week 2 Quiz

 Week 2
Programming Assignment

Week 3 : Graphs

Week 3 Quiz

Week 3 Quiz

The due date for submitting this assignment has passed.

Due on 2021-09-15, 23:59 IST.

Score: 10/10=100%

Assignment submitted on 2021-09-15, 16:05 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) A connected undirected graph G has 1225 edges. What can we say about n , the number of vertices in G ? **2 points**

- ☐ $51 \leq n \leq 1225$
☐ $50 \leq n \leq 1225$
☐ $51 \leq n \leq 1226$
☒ $50 \leq n \leq 1226$

Yes, the answer is correct.

Score: 2

Feedback:

A tree with 1226 vertices has 1225 edges. A complete graph with 50 vertices has 1225 edges.

Accepted Answers:

 $50 \leq n \leq 1226$

 2) An airline serves 1000 cities and runs 5500 direct flights each day between these cities. Which of the following is a good data structure to represent the collection of flights? **2 points**

- ☐ A 1000×1000 array A , where $A[i][j] = 1$ if there is a direct flight from city i to city j and 0 otherwise.

Quiz: Week 3 Quiz
(assessment? name=123)

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 Conquer

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

- ☐ A stack containing values (i, j) for each pair of cities i, j for which there is a direct flight from city i to city j .
- ☐ A queue containing values (i, j) for each pair of cities i, j for which there is a direct flight from city i to city j .
- ☒ A list containing values (i, j) for each pair of cities i, j for which there is a direct flight from city i to city j .

Yes, the answer is correct.

Score: 2

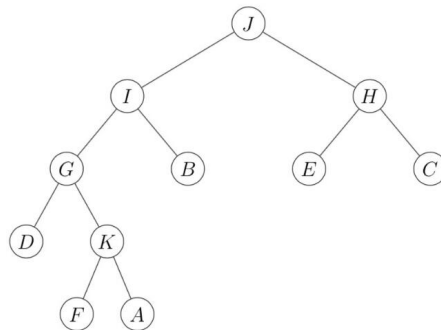
Feedback:

The array will have 1,000,000 entries, while a list will have 11,000 elements. Even allowing for an overhead for pointers etc, the list will be more space-efficient. There is no benefit to using a stack or queue.

Accepted Answers:

A list containing values (i, j) for each pair of cities i, j for which there is a direct flight from city i to city j .

- 3) Suppose we obtain the following BFS tree rooted at node J for an undirected graph with vertices $\{A, B, C, D, E, F, G, H, I, J, K\}$. **2 points**



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

- ☐ (C,G)
- ☐ (B,K)
- ☒ (B,F)
- ☐ (A,D)

Yes, the answer is correct.

Score: 2

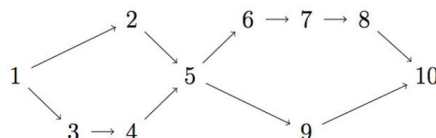
Feedback:

In an undirected graph, all nontree edges must be at the same level or between adjacent levels. (B,F) is an edge across two levels.

Accepted Answers:

(B,F)

- 4) We are interested in topological orderings of the following DAG which satisfy the constraint that whenever 9 appears after 8, 2 must appear after 4. How many such orderings are there? **2 points**



Week 8: Linear Programming and Network Flows

Week 8: Intractability

Week 8 Quiz

Text Transcripts

Books

Download Videos

- ☐ 12
☒ 10
☐ 9
☐ 8

Yes, the answer is correct.

Score: 2

Feedback:

There are two blocks in parallel, $\{2\} \parallel \{3,4\}$ and $\{6,7,8\} \parallel \{9\}$ that can be reordered. There are 4 ways of ordering the right block, of which only one, 6-7-8-9 has 9 after 8. There are 3 ways of ordering the left block, of which only one, 3-4-2, has 2 after 4. So there are $3 \times 3 = 9$ unconstrained topological orders, plus one that meets the constraint.

Accepted Answers:

10

5) Applying for permits to put up a factory is an 11 step process. Some steps depend on **2 points** others, as described below.

- Step 1 must be completed before steps 3 and 4 start.
- Step 2 must be completed before steps 3, 6 and 7 start.
- Step 3 must be completed before step 7 starts.
- Step 4 must be completed before step 5 starts.
- Step 5 must be completed before step 7 starts.
- Step 7 must be completed before steps 8 and 9 start.
- Step 9 must be completed before steps 10 and 11 start.

Each step takes a week to complete. What is the minimum number of weeks required to get all the permits in place?

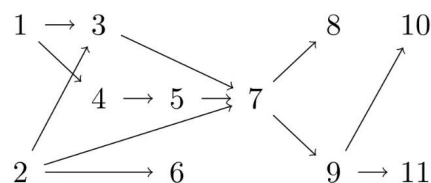
- ☐ 4
☒ 6
☐ 8
☐ 9

Yes, the answer is correct.

Score: 2

Feedback:

The constraints describe the following dag.



A typical longest path is $1 \rightarrow 4 \rightarrow 5 \rightarrow 7 \rightarrow 9 \rightarrow 10$ which requires 6 weeks.

Accepted Answers:

6

