

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2018-2019

DURATION: 3 Hours

FULL MARKS: 150

CSE 4277: Data Structures and Algorithms

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (eight)** questions. Answer any **6 (six)** of them.

Figures in the right margin indicate marks.

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|-------|--|----|
| 1. a) | What do you understand by an algorithm? What are the main methods of representing algorithms? Explain them with examples. | 7 |
| b) | Classify Non-Primitive data structures based on linearity. | 6 |
| c) | Write short note on the following data structures mentioning their applications: | 12 |
| | i. DAG | |
| | ii. Topological Sort | |
| | iii. Spanning Tree | |
| | iv. Adjacency Matrix | |
| 2. a) | What are the main operations in data structure? Answer them with real examples. | 8 |
| b) | Explain the mechanism how an application program uses ADT(Abstract Data Model) model for storing and retrieving data. | 8 |
| c) | Discuss whether a stack or a queue is the appropriate structure for determining the order in which elements are processed in each of the following situations. | 9 |
| | i. Batch computer programs are submitted to the computer center. | |
| | ii. Program A calls subprogram B which calls subprogram C, and so on. | |
| | iii. Employees have a contract which calls for a seniority system for hiring and firing. | |
| 3. a) | Write the algorithm to find the largest number from an unsorted list. You can use any notation for writing the algorithm, i.e. pseudo code, flowchart, NS diagram. | 6 |
| b) | Perform the time complexity analysis of the worst case and average case of binary search. | 12 |
| c) | What do you understand by space time tradeoff? Explain with appropriate examples. | 7 |
| 4. a) | Write down the pseudo code for binary search and then represent the same pseudo code in a flowchart. | 13 |
| b) | What do you understand by asymptotic notation? Define the following with necessary figures. | 12 |
| | i. Omega Notation (Ω) | |
| | ii. Big O Notation (O) | |
| | iii. Theta Notation (Θ) | |
| 5. a) | The daily flights of an airline company appear in the Table 1. CITY lists the cities, and ORIG[K] and DEST[K] denote the cities of origin and destination respectively of the flight NUMBER[K]. Draw the corresponding directed graph of the given data. (The graph is directed because the flight numbers represent flights from one city to another but not returning) | 10 |

Table 1: Airports and Flights

CITY		NUMBER ORIG DEST		
1	Atlanta	1	701	2 3
2	Boston	2	702	3 2
3	Chicago	3	705	5 3
4	Miami	4	708	3 4
5	Philadelphia	5	711	2 5
		6	712	5 2
		7	713	5 1
		8	715	1 4
		9	717	5 4
		10	718	4 5

- b) Consider the following algebraic expression: 8

$$(2x + y)(5x + 35)(a - 7b)^3$$

Using a vertical arrow (\uparrow) for exponentiation and an asterisk (*) for multiplication, represent the expression by a tree. Traverse the tree in Infix, Prefix and Postfix order.

- c) Reconstruct the Binary Tree from the given Inorder and Preorder notation. 7

Inorder Traversal: {4, 2, 1, 7, 5, 8, 3, 6 }

Preorder Traversal: {1, 2, 4, 3, 5, 7, 8, 6 }

6. a) What do you understand by Minimum Spanning Tree? Calculate the minimum spanning tree for the given graph in Figure 1 using Prim's Algorithms. 8

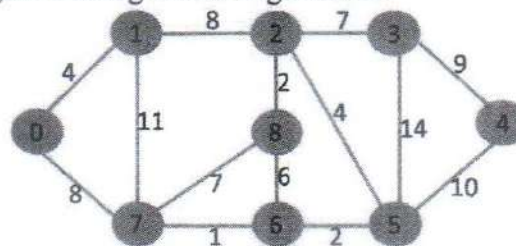


Figure 1

- b) Explain the difference between Kruskal's and Prim's algorithms to find out the minimum spanning tree. 10
- c) Calculate the Adjacency Matrix for the given graph in Figure 1. 7
7. a) Find out the BFS and DFS traversal sequence for the given directed graph given in Figure 2. 13
- Consider length of each of the edge is equal.

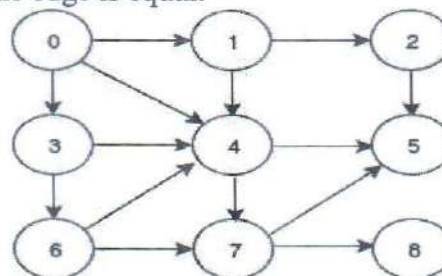


Figure 2: Directed Graph

- b) Define different types of edges that you can find out in DFS with appropriate examples. 12

8. a) Perform topological sort on the given graph in Figure 3

13

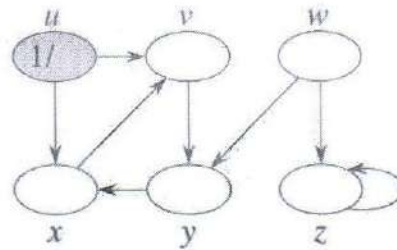


Figure 3: Graph for Topological sort

b) Write down the pseudo codes to perform following operation on a linked list.

- Insert an element
- Delete an element

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