



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

MAY – JULY 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER AND LIBRARY SCIENCE

REGULAR PROGRAMME

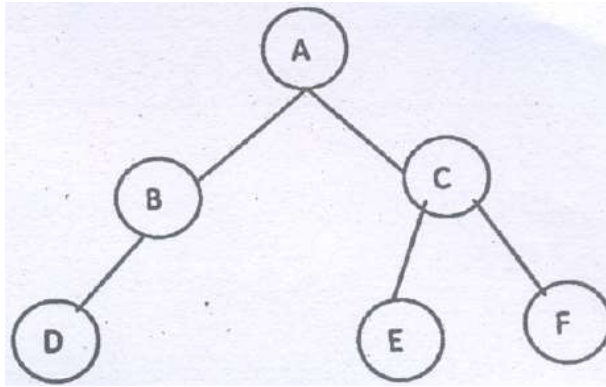
CMT 309: DESIGN AND ANALYSIS OF ALGORITHMS

Date: JULY 2018

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

- Q1. a) What is meant by "Analysis of Algorithms"? Why is it important? **(4 Marks)**
- b) Write an algorithm to find the **greatest number** among a group of numbers. Explain its time and space complexity. **(6 Marks)**
- c) Explain what is meant by Dynamic programming. **(4 Marks)**
- d) Differentiate between **Deterministic** and **Non-deterministic** algorithms **(4 Marks)**
- e) Using appropriate examples, **explain** the below concepts as used in Analysis and Design of Algorithms:
- a) 'P' problems **(2 Marks)**
 - b) 'NP' problems **(2 Marks)**
 - c) Backtracking **(2 Marks)**
- f) Explain binary tree and its properties. Implement an algorithm for binary tree traversal techniques for the following tree: **(6 Marks)**



Q2. a) Differentiate between recursive and Non-recursive algorithms. **(4 Marks)**

b) Explain the Travelling Salesman problem. Give the procedure involved in solving it. **(4 Marks)**

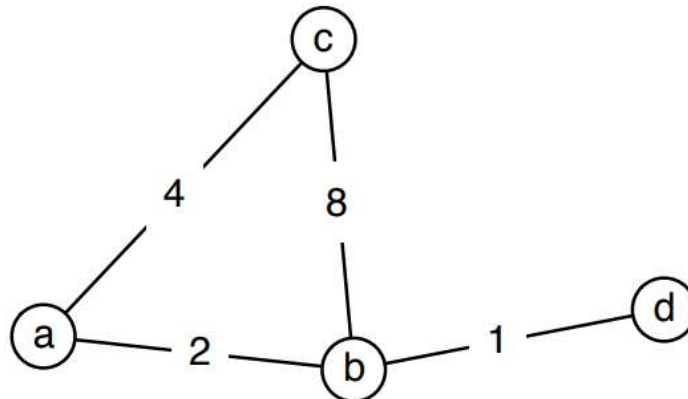
c) Briefly explain the Big oh Notation and its application. **(3 Marks)**

d) Show and explain the **worst case**, **best case** and **average case** for a linear search algorithm **(9 Marks)**

Q3. a) Explain what you understand by the term **Algorithm**. What is the relationship between an algorithm and pseudocode? **(4 Marks)**

b) Briefly explain the steps involved in designing and analysis of an algorithm. **(4 Marks)**

c) Consider the below undirected graph. The number on an edge indicates its weight.



Calculate and show:

a) The Weight of the minimum spanning tree **(3 Marks)**

b) The Weight of maximum weight matching **(3 Marks)**

c) The Length of the shortest path between c and d **(3 Marks)**

d) The Diameter of the graph **(3 Marks)**

Q4. a) Using an appropriate example, differentiate between empirical and theoretical analysis of an algorithm. **(4 Marks)**

- b) List and explain any THREE sorting algorithms you are familiar with. **(6 Marks)**
- c) Write an algorithm for quick sort to sort A, L, G, O, R, I, T, H, M in alphabetical order. **(10 Marks)**
- Q5. a) Differentiate between the knapsack problem and the tower of Hanoi. **(6 Marks)**
- b) State and explain the principle of backtracking. **(4 Marks)**
- c) Explain any THREE characteristics of an algorithm. **(6 Marks)**
- d) Differentiate between **divide-and-conquer** and **greedy** techniques. **(4 Marks)**

END