MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

SECOND YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

MAIN CAMPUS

CIT 203: DATA STRUCTURES AND ALGORITHMS

Date: 15th June, 2017   Time: 12.00 – 3.00 pm

INSTRUCTIONS:

- SECTION A: Attempt question ONE which is compulsory (30 marks)
- SECTION B: Attempt any TWO questions (20 marks each)
- Start each question on a new page
- Mobile phones WHETHER ON OR OFF are prohibited in the Examination room
- DO NOT WRITE on the question paper.

Instructions

Attempt QUESTION ONE and ANY OTHER TWO questions

Question 1 (30 marks): Compulsory

    a. Suppose you are to develop an application for a mobile phone book. Suggest the data structure that you will use. What are the factors that will guide you for your choice   [10marks]

    b. Proper choice of a data structure will result and best possible algorithm and ultimately, results in a good program. Explain.   [5 marks]

    c. Given the binary tree below, construct the equivalent array representation showing all the positions.   [5 marks]
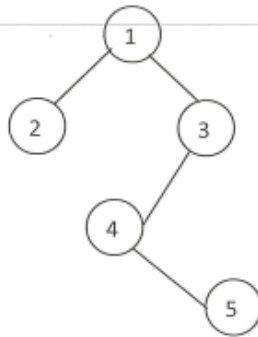
    e. Differentiate between space complexity and space complexity   [4 marks]

    f. Draw a binary Tree for the expression :   [6 marks]
        A * B - (C + D) * (P / Q)
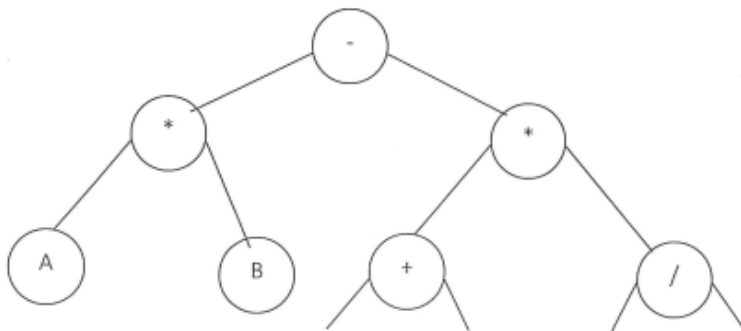
Question 2 (20marks)

a. Using well labeled diagram(s) explain the following concepts of a tree.   [10 marks]

      i.   root

     ii. Size

    iii. Depth

    iv. leaf

     v. path

b. What is an 'algorithm? Outline FIVE desirable characteristics of an algorithm.   [6 marks]

c. Compare the usage of linked lists to arrays as technique of implementing ADTs.   [4marks]

Question 3 (20marks)

a. Outline any FIVE areas in which data structures are applied extensively? [5 marks]

b. Convert the following infix expression into binary tree: (2+y) – (a*b).

Use the tree to perform

i) prefix and

ii) postfix traversal [9marks]

c. Explain three types (measures) of time complexity of an algorithm. [6marks]

Question 4 (20marks)

a.

i) What is a stack? [1 mark]

ii) Define the term sequential search, and explain its performance relative to the element population. [4 marks]
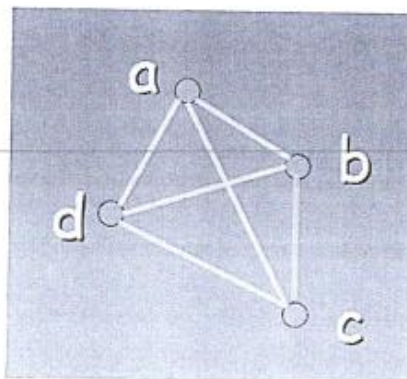
b. You have been contracted to write a program to simulate the inbox of mobile phone.
   i)   Which data structure will you choose?

   ii)   Write a C++ function to insert a new element into the structure in (i) above [10 marks]

c.   Give the adjacency matrix A for the following graph G based on the order:
        a, b, c, d ? [5 marks]

Question 5 (20marks)

a.

i)   What is a heap?   [2marks]

ii)   Map the array below into a heap.   [4marks]

80	60	73	35	40	50	70	30	20	39

(i) Explain how *straight selection sort* works.   [4marks]

   (ii) Perform a selection sort the array below.   [5 marks]

       84, 69, 76, 86, 94, 91

c. Explain five applications of Queue ADT.   [5marks]