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

MID SEMESTER EXAMINATION   SUMMER SEMESTER, 2018-19
DURATION: 1 Hour 30 Minutes   **FULL MARKS: 75**

CSE 4277: Data Structures and Algorithms

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

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1. a) What do you understand by data structure? Explain the criteria to select the data structure for an application.   6

   b) What are the main categories of data structures? Explain their hierarchical classification with appropriate diagram.   7

   c) Write short notes on the following data structures mentioning their uses: 12
      i.   Stack
      ii. Queue
      iii. Graph
      iv. Tree

2. a) What do you understand by Abstract Data Types (ADT)? Explain ADT with Linear List, Matrix and Tree.   8

   b) Describe how an application program interacts with the data stored in the memory in Abstract Data Type Model. Use figure if necessary.   10

   c) Suppose a dataset S contains n elements.   7
      i. Compare the running time T_1 of the linear search algorithm with the running time T_2 of the binary search algorithm when the value of n is 10,000 and 1,000,000
      ii. Discuss searching for a given item in dataset S when S is stored in a linked list.

3. a) Consider the following algebraic expression: 12
$$(2x + y)(a - 7b)^3$$
   Using a vertical arrow (↑) for exponentiation and an asterisk (*) for multiplication, represent the expression by a tree. Traverse the tree in Infix, Prefix and Postfix order.

   b) Explain the advantages and disadvantages of using Array and Linked list.   6

   c) An employee personnel record may contain the following data items: Social Security Number, Name, Address, Age, Salary, and Dependencies.   7
   However, Name may be a group item with the subitems Last, First and MI (middle initial). Also, Address may be a group item with the subitems Street address and Area address, where Area itself may be a group item having subitems City, State and ZIP code number. Draw the hierarchical representation of an employee instance.

4. a) Write down the pseudo code for binary search and then represent the same pseudo code in a flowchart.   8

   b) What do you understand by asymptotic notation? Define the following with necessary figures.   9
      i.   Omega Notation (Ω)
      ii. Big O Notation (O)
      iii. Theta Notation (Θ)

   c) Write down the pseudo codes to perform following operation on a linked list.   8
      i. Insert an element
      ii. Delete an element