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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2012-2013**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4303: Data Structures

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 are static and dynamic storage structures? Write one advantage and one disadvantage of each. 6

   b) Explain how one would increase the precision of a floating point number. 5

   c) Calculate the floating point values represented by the following binary values. Each floating point word is 16 bits long where bit 1 represents sign, bits 2-6 represent the exponent, and bits 7-16 represent the mantissa. 3X3

      i. 0000010101000000
      ii. 1000010101000000
      iii. 0001001010011000

   d) "Arrays are direct access data structures". State why they are called so and state one problem that may arise from direct access. 3

   e) Define the term "packed word". 2

2. a) Draw a diagram to show how recursive lists can be used to store the following list of strings: 5

      ("cat", "hat", "bat", "ball", "tall", "mall", "bog", "dog", "hog")

   b) Compare array-based lists and linked lists regarding: 6

      i. Type of storage structure,
      ii. Element access method,
      iii. Insertion and deletion operation costs.

   c) With a sequential list of length n, show that if all $(n+1)$ possible locations for an insertion are equally likely, then the expected number of elements that must be moved for an insertion into a sequentially allocated list is $n/2$. 8

   d) Given a choice between an array list and a linked list, state and briefly justify which type of list you would use to store the following items in a program: 6X1

      i. A list of 5 integers.
      ii. A list of customers waiting in line at a store.
      iii. A list of people in an elevator.
      iv. A list of students in your class.
      v. A grocery list.
      vi. Scorecard for a team in a cricket match.

3. a) Draw a table to show how a stack is used to convert the following infix equation into Polish notation: 8

      $$(a + b) \div (c \times (d - e)).$$

      Your table must show the contents of the stack, input string and output string at each step.

b) Describe the steps to evaluate a Polish postfix expression. You may write it in pseudocode or describe the steps in short sentences. 5

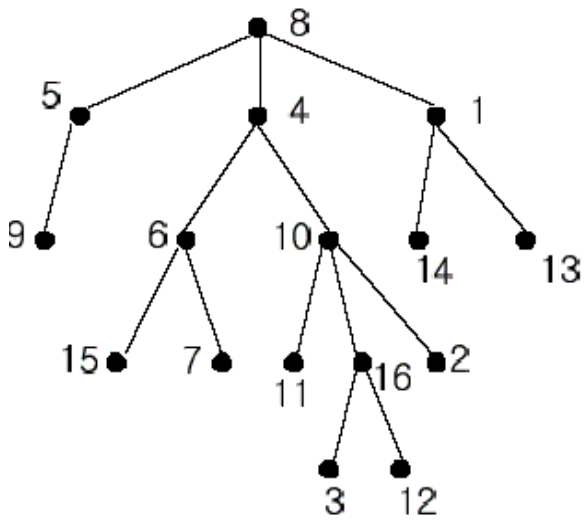
c) What is meant by overflow and underflow in stacks/queues? Explain a simple step that one can take to prevent these errors when writing a code for a stack/queue. 5

d) Given the following enqueue times and dequeue times of elements in a queue, draw diagrams to illustrate the changes that occur throughout the lifetime of the queue. 7

Element	Enqueue Time (s)	Dequeue Time (s)
A	0	6
B	4	10
C	9	14
D	15	17
E	16	20

4. a) Draw a binary search tree given the following series of inputs: 6, 4, 7, 3, 1, 17, 2, 5, 9, 13 4

b) Given the following tree



show the sequence of numbers that would be found by the following traversals:

i. preorder
ii. inorder
iii. postorder
iv. level order

4X2

c) Draw a tree with nodes labeled A, B, C, etc. From your tree show one example of nodes with the following relationships:

i. Father-Son
ii. Brothers
iii. 1st cousins
iv. 1st cousins, once removed
v. 2nd cousins, twice removed

5X1

d) Using diagrams, very briefly explain the implementation of trees using

i. LEFT and RIGHT pointers
ii. FATHER pointers

2X4