

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

**MID SEMESTER EXAMINATION****WINTER SEMESTER, 2011-2012****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.

1.
  - a) What is Abstract Data Type (ADT)? 4
  - b) What are the major operations in Data Structure? Briefly Explain. 5
  - c) Suppose, an array A[-15 ... 64] is stored in a memory whose starting address is 459. 5 x 2  
 Assume that the word size for each element is 2 bytes. Then obtain the following:
    - i. How many numbers of elements are there in the array A?
    - ii. How much memory is required to store the entire array?
    - iii. What is the location for A[50]?
    - iv. What is the location of the 10<sup>th</sup> element?
    - v. Which element is located at 589?
  - d) Suppose a *InsetArray* algorithm only checks the last elements for vacancy. While ( $i \leq \text{Location}$ ) it needs to push down all the trailing elements from that location. But an array can be empty from any  $i$ th position ( $L \leq i \leq U$ ); in that case the number of push down can be reduced instead of pushing down the entire trailing part of the array. Write an algorithm *InserArray* when the last element is at the  $i$ th location ( $i \leq U$ ). 6
2.
  - a) Explain the Dynamic representation of Linked List in memory. 6
  - b) Given two sorted list  $L1$  and  $L2$ , write an algorithm to find  $L1 \cup L2$ . 6
  - c) What advantages do the circular linked lists have over ordinary linked list? 6
  - d) Write an algorithm which accepts a stack as input and reverses the element of the stack using one additional queue. 7
3.
  - a) Convert the given expression into a postfix expression: 10  

$$P = ((A + ((B^{\wedge} C) - D)) * (E - (A / C)))$$

- b) The celebrated Fibonacci sequence (denoted as  $F_0, F_1, F_2, F_3, \dots, F_n$ ) is as: 6  
 1, 1, 2, 3, 5, 8, 13, ...  
 The above sequence can be defined using recursion as follow:  
 If  $n = 0$  or  $n = 1$  then  $F_n = 1$   
 Else  $F_n = F_{n-1} + F_{n-2}$   
 Show how recursive implementation of this Fibonacci sequence can be done using stack.
- c) When is a recursive procedure and function called *well-defined*? 4
- d) What are the possible difficulties one might face implementing priority queue using an array and multi-queue implementation. 5

4. a) Prove that the maximum and minimum levels that are possible for a binary tree with  $n$  nodes are 6

$$l_{\max} = n - 1$$

$$l_{\min} = \lceil \log_2(n+1) - 1 \rceil$$

- b) Suppose the inorder and postorder of a binary tree are as follows: 5  
 Inorder: D B H E A I F J C G  
 Postorder: D H E B I J F G C A  
 Construct the Binary Tree.
- c) Let the following data are given: 12  
 34, 20, 40, 12, 50, 45, 67, 45  
 Sort these data in ascending order using heap tree without storing the output into another array. Show the required steps.
- d) What is the disadvantage of Huffman coding? 2