B.Sc. Engg. / HD EEE 5th Semester — 25 February 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

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

CSE 4575: 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) How are data structures classified? Describe them in brief. 10

   b) Write the algorithm to delete any specified element from an array. 5

   c) What is the prerequisite of binary search? What are the best, average and worst case time complexities of binary search? Search for "8" among the following values using binary search and tabulate the values of low, mid and high. 10

   1, 4, 5, 9, 8, 16, 22, 32, 35, 54

2. a) Write down the following functions for a doubly linked list : 15

   i. Inserting an element after a specified element

   ii. Deleting a specified element

   The specified element will be mentioned by the user. Be sure to consider all possibilities of user input.

   b) Place the following complexities in ascending order: 2

   O(n!), O(logn), O(n), $O(n^2)$, O(nlogn), $O(2^n)$

   c) What will be the time complexity of the following code fragment: 2

```
for(i=0; i<m ; i++){
      for(j=0;j<(n*n);j++)
      {
            printf("%d",i*j);
      }
}
```

   d) What is a proper binary tree? What are the properties of a proper binary tree? 6

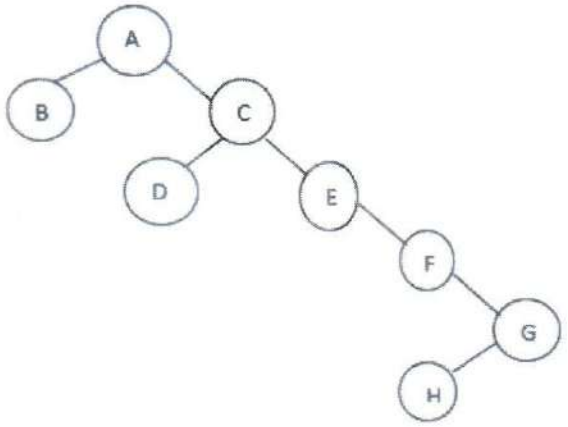
3. a) Write down the algorithm for insertion sort. For the following array, simulate how the insertion sort will work in each iteration of the outer loop. 15

5	2	1	3	19	18	2	4	8	15

   b) Distinguish between array and linked list. 5

   c) What is your preferred data structure to store *any* tree? Why? 5

4. a) Write down the algorithm of preorder, postorder and inorder traversal of a binary tree. For the given tree below, write down the output of the three mentioned traversals.



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b) How can you modify the code for bubble sort so that the best case time complexity becomes O(n)? How does it improve the time complexity? Write the code in order to demonstrate the modification. 7

c) What is the best way to store a complete binary tree and why? Draw a complete binary tree and illustrate the organization of the elements in your chosen data structure (based on the first part of the question). How can you access the children and parent from a given node? 6