Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science and Engineering
2nd 1st Year 1st Semester B.Sc. (Engg.) Examination-2013
Course No-CSE200 Course Title: Data Structures

Full Marks:70 Time:4 hours

N.B. i) Answer **SIX** questions, taking any **THREE** from each section.
ii) All questions are of **equal** values.
iii) Use separate answer script for each section.

Section A

1. a) Why is machine independent time complexity required? 2.67
   b) What is the average case and worst case complexity analysis in computation? 3
   c) Define the rate of growth as *Big-O* and *theta* notation. Illustrate them graphically. 4
   d) Suppose, $f(n)=5n^2-3n$. Find the order of magnitude of the complexity function $f(n)$ in Big-O notation where n is the size of input data. 2

2. a) What types of structure can a string be stored? 1.67
   b) The complexity of a brute-force pattern matching algorithm is $O(n^2)$. How can we improve a pattern matching algorithm, which may take $O(n)$ complexity. 5
   c) Write an *edit distance* algorithm to find the number of operations needed to convert one string into another. 5

3. a) What will be the postfix expression of the given infix expression: 4
   (A+B)*C-(D*E)/F
   b) "The inorder traversal of a binary search tree produces a sorted list"- prove the statement by building a binary search tree with following characters: C R I C K E T. 3.67
   c) Write recursive traversing algorithm against a binary search tree for preorder, inorder and postorder traversal. 4

4. a) Define a recursive function with necessary properties. Illustrate the calling procedure of recursive function to find a factorial of 5. 1.67 +2
   b) Write a *quick-sort* algorithm using recursion. 6
   c) Illustrate the procedure to insert a node into a *priority queue* with a figure. 2

Section B

5. a) Suppose, the base of an array is *200*, size of a cell is *4* words, the array is started with *0* index. Now, find the address of element for *1965*. 2.67
   b) Write and illustrate an algorithm for insertion sort with example. 4+2
   c) Compare the order of complexity of different sorting algorithms 2
   d) What is basic restriction on data to perform binary search? 1

6. a) Write an algorithm to traverse a linked list. 2.67
   b) Illustrate how a node can be inserted at the beginning, after a given node or at the end of a linked list with appropriate figures. 6
   c) Draw appropriate figures of the following terms: 3
   Circular Linked List, Header Linked List, Two-Way List

7. a) Prove that the complexity of bubble sort algorithm is $O(n^2)$. 2.67
   b) Suppose the following eight numbers are inserted in order into an empty binary search tree *T*: 2+1
   50, 33, 44, 22, 77, 35, 60, 40
   Draw the tree *T*. Now, what will you do to delete the node *50*?
   c) Describe the process to build a *max-heap* with the following list of numbers: 4
   44, 30, 50, 22, 60, 55, 77, 55
   d) Suppose the six weights *4, 15, 25, 5, 8, 16* are given. Draw a 2-tree *T* with the given weights so that we can find a minimum weighted path length. 2

8. a) What is minimum spanning tree (MST)? 1+
   Apply Prim's algorithm in *Figure 1* to find the MST (). 3.67
   b) Apply Dijstra's algorithm in *Figure 2* where *a* is the source and *z* is the destination. 4
   c) Explain bipartite graphs. 3

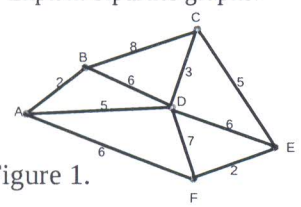

Figure 1.

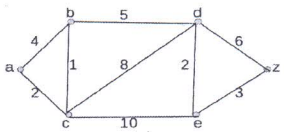

Figure 2.