



Vavuniya Campus of the University of Jaffna

First Examination in Information and Communication

Technology - 2014

Second Semester - February/March 2016

ICT1213 Data Structures

Answer Five Questions Only

Time Allowed : Three hours

1. (a) Briefly describe the *dynamic* and the *static* data structures with suitable example. [20%]
- (b) Write a method in Java to verify whether a given 5x5 matrix is *diagonal*. [25%]
- (c) Briefly describe *tail recursion* with the aid of a suitable example. [20%]
- (d) Consider the following method implemented in Java:

```
public int rMethod(int [] Array,int index){  
    if(index==Array.length)  
        return 0;  
    else  
        return Array[index]+ rMethod(Array,index+1);  
}
```

- i. State the purpose of the above method. [20%]
- ii. Explain how the above method will be called into the main method with the array: `int [] A = { 2,3,6,1,4 }` [15%]

2. (a) Sort the following unsorted numbers using the *selection sort* strategy:

23, 78, 45, 8, 32, 56

- (b) Write an algorithm for *insertion sort* to sort an array of elements, in an ascending order.

- (c) Trace the above algorithm written in part(b) using the following unsorted list:

5, 2, 4, 6, 1, 3

- (d) Differentiate *linear search* and *binary search*.

3. (a) Briefly explain the *stack* data structure and its basic operations.

- (b) Define a strategy using a single *stack* to check whether the parentheses of a given mathematical expression are nested correctly.

- (c) Write an algorithm using a *stack* to covert infix expression into postfix expression which do not have any parentheses.

- (d) Trace the above algorithm written in part(c) with the following mathematical expression:

$A + B * C / D - E$

- (e) Evaluate the following postfix expressions using single *stack*:

$5\ 7\ 8\ * +$

4. (a) Briefly discuss the importance of array based representation of *linear queue*.

- (b) Give three applications of *queue* data structure.

- (c) Write an algorithm for inserting an element into a *circular queue*, using array.

- (d) State what is *priority queue*.

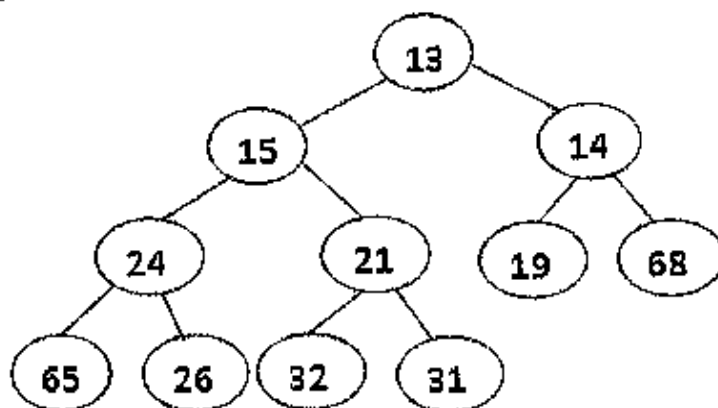
- (e) Define a strategy to check whether the given word is a palindrome or not using both a *single stack* and a *single queue*.

5. (a) State what is meant by *circular linked list*. [15%]
 (b) Write a procedure to insert a new element as the first node in a circular linked list. [25%]
 (c) Discuss the linked list representation of *stack*. [20%]
 (d) Write a procedure to remove the top element from the *stack* in a linked list representation. [20%]
 (e) Write a procedure to add an element into the *queue* using linked list representation. [20%]

6. (a) State what is *node* in a *Tree* data structure. [15%]
 (b) List down the properties of *Binary Tree*. [15%]
 (c) Consider the following mathematical expression:

$$((4 + 8) * (6 - 5)) / ((3 - 2) * (2 + 2))$$

- i. Draw a binary tree to represent the above expression. [15%]
 ii. Show pre-order, in-order, and post-order traversal in the tree obtained in c(i). [15%]
 (d) Explain how you will delete the minimum element from the *min heap* given below:



min heap

- (e) Build a *Binary Search Tree (BST)* using the elements in the list *L* are inserted from left to right.

$$L = [25, 15, 10, 50, 22, 35, 18, 12, 4, 24, 70, 44, 66, 31, 90]$$