Vavuniya Campus of the University of Jaffna

First Examination in Information and Communication Technology - 2015

Second Semester - January/February 2017

ICT1213 Data Structures

Answer Five Questions Only

Time Allowed : **Three hours**

1. (a) Briefly describe the *linear* and *non-linear* data structures with suitable examples. [20%]

   (b) Write a method in Java to find whether the given matrix is *lower Triangular matrix* or not. [20%]

   (c) Write an algorithm for *insertion sort* to sort an array of elements in *descending order.* [20%]

   (d) Describe the *merge sort* strategy. [20%]

   (e) Trace the *merge sort* strategy using the following unsorted list:

   [17, 9, 22, 31, 7, 12, 10, 21, 13, 29, 18, 20, 11, 14] [20%]

2. (a) Explain how the *binary search* technique is used to find an element. [15%]

(b) Write a *generic method* in Java to implement the *linear search* technique. [20%]

(c) Compare and contrast the *linear Search* and *binary Search* algorithms when they apply to do searching for the numbers 45 and 54 in the given list: (3, 8, 12, 34, 54, 84, 91, 110). [20%]

(d) Write a *recursive method* in Java to find an element in an integer list. State which data structure is used for the recursion and clearly explain why it is selected. [30%]

(e) State the general approach to solving the *Towers of Hanoi puzzle*. Explain how it relates to the recursion. [15%]

3. (a) Briefly describe the *stack* data structure and its basic operations. [20%]

(b) List three applications of stack data structure. [15%]

(c) Write an algorithm to convert infix expression to postfix expression using a stack. [20%]

(d) Write an algorithm to evaluate a postfix expression using a stack. [15%]

(e) Evaluate the following expression by showing every status of stack in tabular form.

i. 5 4 6 + * 4 9 3 / + *

ii. 7 5 2 + * 4 1 1 + / - [30%]

4. (a) Briefly describe the *queue* data structure. [20%]

(b) List three applications of queue data structure. [15%]

(c) Write a procedure to *add an element* into the *linear queue* using *linked list* representation. [20%]

(d) Write algorithms to do *insertion* operation and to do *deletion* operation for a *circular queue*, using *array*. [30%]

(e) Briefly describe how an *array data structure* is used to represent the *priority queue*. [15%]

5. (a) Briefly describe the *linked list* data structure. [20%]

(b) Write procedures for the following tasks:

i. To search a particular data in a *singly linked list.* [20%]

ii. To insert a new node (element) at the end of the *circular linked list.* [20%]

iii. To traverse (display) the *doubly linked list* in a reverse order (from last node to first node). [20%]

(c) Describe how the *linked list data structure* is used to represent the *stack.* [20%]

6. (a) Define each of the following terms related to the tree data structure with examples:

i. Binary Tree

ii. Heap [20%]

(b) Explain how you delete the maximum element from the heap given below.

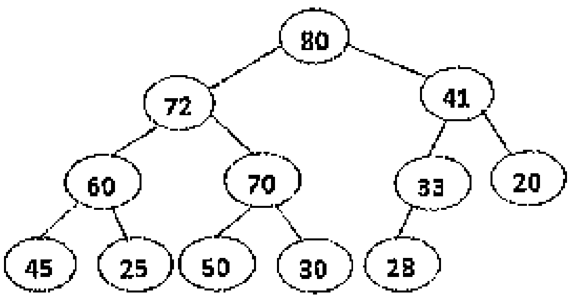

Figure 1: Heap [15%]

(c) Define the *Binary Search Tree (BST)* in your own words. [15%]

(d) The list below contains a set of values:

[63, 80, 27, 51, 33, 13, 26, 58, 70, 57, 92, 60, 82]

i. Build a BST when the values are inserted in the given order. [15%]

ii. Find *in-order, pre-order* and *post-order* traversal on the tree obtained in part d(i). [15%]

iii. Illustrate how you search 60 is available or not in the BST built in part d(i). [10%]

iv. Illustrate how you delete a node 51 from the BST obtained in part d(iii). [10%]