



Vavuniya Campus of the University of Jaffna
First Examination in Information and Communication
Technology - 2016

Second Semester - November/December 2017

ICT1213 Data Structures

Answer Five Questions Only

Time Allowed : Three hours

1. (a) Define each of the following terms with regards to Data Structures:
 - i. Data Structure
 - ii. Abstract Data Type
 - iii. Algorithm
 - iv. Program

[20%]
- (b) Give two sample data structure for each of the following:
 - i. Linear data structure.
 - ii. Non-Linear data structure.

[10%]
- (c) State the difference between a ragged array and a regular 2D array in Java.

[20%]
- (d) Briefly describe the difference between iterative and recursive programming techniques.

[20%]
- (e) Write a recursive method in Java to compute the n^{th} factorial.

[30%]

2. (a) State the major difference between the *linear search technique* and the *binary search technique*.

(b) Write a linear search algorithm to search for a key in a given one-dimensional array.

(c) Write a recursive method in Java to implement the binary search algorithm.

(d) Apply the binary search technique to search for the key 28 in the given list.

(25, 35, 16, 12, 67, 28, 10, 56, 45, 38, 49, 52)

(e) State one advantage and one disadvantage of binary search approach compare with linear search approach.

3. (a) Write a method in Java to implement the bubble sort algorithm.

(b) Sort the given list of elements using the selection sort technique (Show the status of the array after each iteration)

(65, 33, 45, 12, 5, 48, 27, 38, 15, 50)

(c) Briefly describe the strategy used in merge sort technique.

(d) Apply the merge sort technique on the set of elements given below:

(56, 42, 27, 19, 59, 68, 25, 13, 60, 72)

4. (a) Explain how the data is stored and accessed in a stack.

(b) List down the stack operations and describe the functionality of each of them.

(c) Write a method in Java to reverse a given phrase using a stack and its operations.

(d) You are given an empty stack S, which can hold 5 integer values. Draw a sequence of stack frames showing the progress of each of the following segments of a code. (Start with an empty stack)

[This question is continued on the next page]

- i. push('2');
- ii. push('5');
- iii. pop();
- iv. peck();
- v. push('10');
- vi. pop();
- vii. push('15');
- viii. pop();
- ix. pop();

[40%]

5. (a) Briefly describe the queue data structure and its operations. [25%]
- (b) State three real world situations to apply queue data structure. [15%]
- (c) Write a method in Java to insert and delete an element in an array linear queue. [20%]
- (d) State one drawback of linear queue and state a solution to overcome it. Modify your method written in part (c) to represent your solution. [20%]
- (e) Write a method in Java to find the minimum element in a sequence using queue operations. [20%]
6. (a) Briefly describe the differences between the array data structure and linked list data structure. [20%]
- (b) Consider the following Linked List.



Perform the following sequence of operations on the above Linked List and show the status of the Linked List as diagram after each operation. (First Node Index = 0)

[30%]

[This question is continued on the next page]

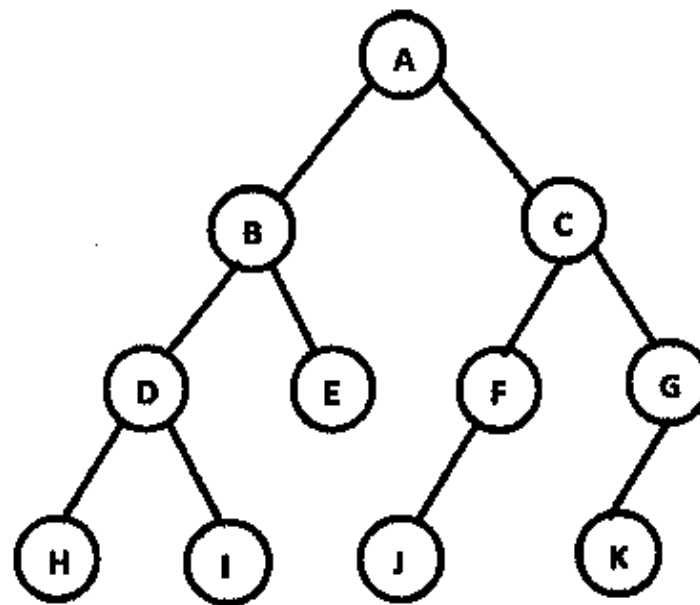
- i. add(2, 175);
- ii. add(4, 165);
- iii. remove(3);
- iv. remove(3);
- v. add(4, 250);
- vi. add(0, 180);

(c) Draw the tree structure for each of the following tree types with empty nodes.

- i. Strictly Binary Tree
- ii. Complete Binary Tree
- iii. Balanced Binary Tree

[20%]

(d) Consider the following binary tree and write down the order of elements for each of the traversal given below:



- i. In-Order Traversal
- ii. Pre-Order Traversal
- iii. Post-Order Traversal

[30%]