



**RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES**

**B.Sc. (General) Degree in Information & Communication Technology
First Year Semester II Examination – April/May 2015**

ICT 1305 – Data Structures

Time allowed: Three Hours

Instructions to candidates

- This is a closed book examination.
 - There are **THREE (3) pages** in the question paper.
 - Question paper consists of **SIX (6) questions**.
 - **Answer any FIVE (5) questions**
 - All questions carry equal marks.
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Q1.

- 1) Linked Lists can be used as a base for other Data Structures. Give 3 examples and discuss advantages and disadvantages of using Linked Lists over Arrays. **(5 marks)**
- 2) Suggest a suitable Data Structure(s) to store data related to a known number of students who follows unknown number of courses. The suggested should provide provisions to store course data which they have registered for. Justify your answer. **(4 marks)**
- 3) Write a C/C++ code segment to implement the above mentioned structure. **(5 marks)**
A student may have, an Index number, Name, NIC number, List of courses they follow
- 4) Give two uses of Data Structures and Algorithms **(2 marks)**
- 5) Illustrate how to insert an item into a sorted linked list **(4 marks)**

Total Marks: 20

Q2.

- 1) Write down two direct applications of stack. (2 marks)
- 2) Evaluate the given postfix expression using stacks. Write down step by step. (4 marks)
 $512+-293/+*2^4+$
- 3) Rewrite the following expression in postfix notation using a stack. Illustrate step by step (4 marks)
 $a*b+c(d*e-f)/g$
- 4) Write down the pseudo code for placing N number of queens in NxN chess board without attacking each other (4 marks)
- 5) Implement push and pop methods for a linked list based stack in C/C++ (6 marks)

Total Marks: 20

Q3.

- 1) "Queue is an FIFO structure" Is the statement true? Justify your answer using a suitable example. (3 marks)
- 2) Suppose there is a queue of patients who has an integer appointment number. Write down C/C++ methods to enqueue and dequeue for a dynamic queue. (6 marks)
- 3) Illustrate insertion of the given elements into the queue given below. Indicate the front and rear after each insertion (6 marks)

32,10,13,04



FRONT = 4

REAR = 6

- 4) What is a Priority Queue? Explain by defining the heap property in Priority Queues (3 marks)
- 5) Write the formulas to obtain the left child and the right child of i^{th} node of a priority queue? (2 marks)

Total Marks: 20

Q4.

- 1) What are the advantages of using Binary Search Tree instead of Binary Tree? (2 marks)
- 2) Illustrate the insertion of the given list of items into a Binary Search Tree.
List: 12,18,32,06,19,10,11
 (6 marks)
- 3) Output the items in the tree in part (2) using In Order, Pre Order and Post Order traversal methods (3 marks)
- 4) Illustrate how to delete 35 and then 18 from the above tree in part (2) (5 marks)
- 5) Explain the Full Binary tree and Complete Binary Tree using suitable diagrams (4 marks)

Total Marks: 20

Q5.

- 1) What is an AVL Tree and how does it differ from a Binary Search Tree? **(2 marks)**
- 2) What are the 4 cases in rebalancing an AVL Tree? State whether each of them require single or double rotation. **(6 marks)**
- 3) Define the Balance Factor of a given node using the Heights of the left and the right sub trees. **(2 marks)**
- 4) Illustrate a Double rotation operation of an AVL Tree using a suitable Diagram **(4 marks)**
- 5) Insert the following list into an AVL Tree. After inserting each of the items check for the Balance Factor. If the tree is imbalance, illustrate how to rebalance the tree by rotating.

List : 22,13,37,5, 28,35,40,50

(6 marks)

Total Marks: 20

Q6.

- 1) What are the two conditions that the output of a sorting algorithm should satisfy? **(4 marks)**
- 2) What is the idea of the selection sort? How does it differ from insertion sort? **(4 marks)**
- 3) Illustrate step by step how to run the merge sort on the following list. **(4 marks)**
41,32,12,19,28,47,08,17
- 4) What is the Binary Search algorithm? Explain using a suitable example. **(4 marks)**
- 5) Write down the algorithm to search an element in an array using binary search **(4 marks)**

Total Marks: 20

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