ALLAMA IQBAL OPEN UNIVERSITY, ISLAMABAD
(Department of Computer Science)

Course: Data Structures & Applications (3581)

Level: PGD (CS) Semester: Autumn, 2012
Total Marks: 100 Pass Marks: 40

ASSIGNMENT No. 1
(Units 1–4)

Note: All questions are compulsory and carries equal marks.

Q.1 a) Define data structure. Name and classify different types of data structures. Name operations that can be performed on these data structures.
  b) What is an algorithm? What is time and space analysis of an algorithm? Explain the concept of the best, average & worst case analysis.

Q.2 a) One-dimensional arrays and structures can each be thought of as a group of items. What are the principle differences between them?
  b) How address calculations are performed for the access of an item from an array and structure?

Q.3 a) Define and explain stack. Give representation of a stack in memory.
  b) Write an algorithm for the insertion (push) and deletion (pop) of an element from a stack.

Q.4 a) What are infix, postfix and prefix notations? Write an algorithm for the conversion of infix expression to polish or reverse polish expression.
  b) Convert the following expression from infix to prefix and postfix. Explain each step.
     `A * B + C / D – A`

Q.5 a) Define and explain queue, de-queue and priority queue. Give memory representation of simple queue, de-queue (circular queue) and priority queue.
  b) Write an algorithm for the insertion (QINSERT) and deletion (QDELETE) of an element from a queue.

ASSIGNMENT No. 2
(Units 5–8)

Note: All questions are compulsory and carries equal marks.

Q.1 a) Define and explain linked list. What are its types? Give representation of a linked list in memory.
   b) Write an algorithm to insert an element at the start of the linked list.

Q.2 a) Define and explain tree and its types. Give linked representation of a binary tree in memory.
   b) Write an algorithm for the pre-order, post-order and in-order traversal of binary tree. Illustrate with the help of figures.

Q.3 Give trace of following sort algorithms by using one suitable example for each:
   a) Bubble sort
   b) Selection sort

Q.4 a) Give time complexities of Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Radix sort, Binary search and Sequential search in tabular form.
   b) Give trace of Binary search algorithm by using a suitable example.

Q.5 a) What is a graph and what are its types? Give matrix and adjacency list representation of an example graph in memory?
   b) Give and explain each step with graph example for the trace of depth first search graph traversal algorithm.

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Course Code: 3581 (Old 3425)
Course Title: Data Structures and Applications
Credit Hours: 4 (3 + 1)2 hours lectures and 2 hours per week
Recommended Book: Fundamentals of C++ and Data Structures by Kenneth Lambert, Thomas L. Naps

Reference Books:

1. **Digital fundamentals,** 9E by Thomas L. Floyd Published by Floyd Publisher, 2007. Learning Data Structures Using C++ by Peter Harold, Nadine Basta, 2005.
2. **Data Structure** by Schaum's outline series.
3. **Data Structures** Using C++ by D.S. Malik, 2009.
4. **Introduction** to Data Structure by Trembly.

Course Outlines:

Unit No. 1   Introduction
Basic Terminologies, Introduction to Data Structures, Data Structure (Classification, Types, Operation), Basics of Algorithms, Notation used, Importance of Algorithms for Optimized Application Development, Introduction to Analysis of Algorithms, Algorithm Complexity, Classes of Efficient algorithm (Divide and Conquer, Dynamic, Greedy).

Unit No. 2   Arrays
Arrays (Definition and Examples), Representation of array in Memory Accessing & Traversing Array, inserting & Deleting, Multi Dimensional Arrays & their Representation in memory.

Unit No. 3   Stacks
Stack, Importance of Stack, Array Representation of Stacks, Stack Operations (PUSH and POP operations), Infix, Postfix and Prefix Expressions.

Unit No. 4   Queues
Queue, Representation of Queues, Operations Performed on Queues (Inserting and Removing Nodes), De-queues, Priority queues.

Unit No. 5   Linked Lists
Linked Lists Concepts, Representation of Linked Lists in Memory, Traversing & Searching a Linked List, Insertion & Deletion in Linked List, Types of Linked Lists.

Unit No. 6   **Trees**
Tree, Tree Types (simple, binary, General), Representation of Binary Tree in memory Traversing (Pre order, In order, Post order), Basic Operation (Insertion Deletion), Spanning Trees.

Unit No. 7   **Sorting & Searching**
Bubble Sort, Quick Sort, Insertion Sort, Selection Sorting, Sequential Search, Binary Search.

Unit No. 8   **Graphs**
Graph Theory Terminology, Linked Representation of Graphs, Directed and undirected Graphs Traversal methods.

Unit No. 9   **Files and Data Storage**
Basic Operations on Different Files Organizations, Add, Update and Delete Record, File Organizations, Sequential, Indexed Sequential, Direct (Hashing), merging Files.