

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

WARNING

1. **PLAGIARISM OR HIRING OF GHOST WRITER(S) FOR SOLVING THE ASSIGNMENT(S) WILL DEBAR THE STUDENT FROM AWARD OF DEGREE/CERTIFICATE, IF FOUND AT ANY STAGE.**
2. **SUBMITTING ASSIGNMENTS BORROWED OR STOLEN FROM OTHER(S) AS ONE'S OWN WILL BE PENALIZED AS DEFINED IN "AIOU PLAGIARISM POLICY".**

Course: Data Structure (3408)

Level: B.S (CS)

Semester: Spring, 2014

Total Marks: 100

Pass Marks: 40

ASSIGNMENT No. 1

Note: All questions carry equal marks.

- Q.1 a) Differentiate between data type and data structure. Discuss different types of data structure.
b) What types of operations could be performed on data structures?
- Q.2 Define the following terms with proper examples.
1. Array 2. Traversing Array 3. Stacks 4. Binary Tree
- Q.3 Identify the worst-case scenario for merge-sorting n integers. Explain your answer with an example of $n = 8$ distinct integers. The worst-case example should use the maximum possible number of operations, e.g., comparisons and swapping, among all problem instances having 8 elements.
- Q.4 a) How to find middle element of linked list in one pass?
b) What is difference between Singly Linked List and Doubly Linked List data structure?
- Q.5 A sorting algorithm is called stable if it maintains the relative positions of two records with equal keys. For example, if a record X appears before a record Y (with equal keys), a sorting algorithm is stable if X remains before Y after sorting. Identify the stable sorting algorithms from the following list: insertion-sort, heap-sort, merge-sort quick-sort (deterministic). If some of these algorithms are not stable, explain why with small examples.

ASSIGNMENT No. 2

Total Marks: 100

Pass Marks: 40

Note: All questions carry equal marks.

- Q.1 Implement radix-sort and bucket-sort. Define a C++ class named sorting which supports the following functions: input (), bucket sort(), output(). The input should be taken from a set of integers/ fractions stored in a single-column text file. The output should be a set of sorted integers/fractions stored in a single-column text file in a single column. Assume that each integer is at most 5 digits long.
- Q.2 a) Why stacks are called “LIFO” structures? Explain.
b) Discuss an array representation of stacks. Also describe the different operations performed on a stack.
- Q.3 Explain how the selection algorithm can be used in the pivot selection of the deterministic quick sort algorithm such that running time of quick sort becomes $O(n \log n)$ even in the worst case?
- Q.4 a) Draw a graph using the following paths.
P1 = (2,1)
P2 = (3,4)
P3 = (1,5), (5,4), (3,2)
P4 = (1,5), (1,3), (1,4)
P5 = (2,3), (3,4), (2,5)
b) Give and explain each step with graph example for the trace of depth first search graph.
- Q.5 Explain how the bucket sort algorithm can be slightly modified to an $O(n)$ average-case time?

3408 Data Structure

Credit Hours: 4 (4+0)

Recommended Book:

Introduction to Data Structure with Application by Paul Trembley Sorenson

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

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, Operation Perform on Queue (Inserting and Removing Nodes), De-queues, Priority queues

Unit No. 5 Linked Lists

Linked Lists Concept, Representation of Linked Lists in Memory, Traversing & Searching a Lined 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), Basic Operation (Insertion Deletion)

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.