HARAMAYA UNIVERSITY

COLLEGE OF COMPUTING AND INFORMATICS

Department of Computer Science

Data Structures and Algorithms (CoSc 2092)

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3 Credit Hrs.	5 ECTS	Lecture Hrs.: 2	Lab Hrs.: 3	Tutorial Hrs. 2	Year II	Sem II	Compulsory

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Prerequisite*: CoSc 1012 Computer Programming & MATH 2051-Discrete Mathematics and Combinatorics*

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Course Description

This course focuses on the study of data structures, algorithms and program efficiency. Topics include: analysis of time and space requirements of algorithms; program efficiency improving techniques, abstract data types such as linked lists, stacks, queues, trees (traversal, implementations); simple searching algorithms (linear search, binary search, ...), simple sorting algorithms (bubble sort, insertion sort, selection sort, ...), advanced sorting algorithms (merge sort, quick sort, heap sort ...)

Course Objectives

- ✓ To introduce the most common data structures like stack, queue, linked list
- ✓ To give alternate methods of data organization and representation
- ✓ To enable students, use the concepts related to Data Structures and Algorithms to solve real world problems
- ✓ To practice Recursion, Sorting, and searching on the different data structures
- ✓ To implement the data structures with a chosen programming language

Chapter 1. Introduction to Data Structures and Algorithms [4hr]

- ✓ Introduction to Data Structures and Abstract data Types
- ✓ Algorithms
- ✓ Algorithm analysis concepts [Complexity analysis]
- ✓ Asymptotic Analysis

Chapter 2: Simple Sorting and Searching Algorithms [4hr]

- ✓ Sorting Algorithms **[**Insertion, Selection, Bubble, Pointer]
- ✓ Searching Algorithms [Linear Search (Sequential search), Binary Search]

Chapter 3: Linked Lists [4hr]

- ✓ Review on Pointer and Dynamic Memory allocation
- ✓ Linked List and Its Implementation [Singly, Doubly, Circular]

Chapter 4: Stacks [4hr]

- ✓ Properties of Stack
- ✓ Implementations of Stack [Array, Linked List]
- ✓ Application of Stack [Evaluation of Algebraic Expression, Infix and Post fix (RPN) conversion, Function calls]

Chapter 5: Queue [4hr]

- ✓ Properties of Queue
- ✓ Implementations of Queue [Array, Linked List, Double Ended Queue
- ✓ Priority Queue and Its Application

Chapter 6: Trees [4hr]

- ✓ Binary Tree and Binary Search Trees
- ✓ Basic Tree Operations [Traversing in a Binary tree]
- ✓ General Trees and Their Implementations

Chapter 7: Graphs [4hr]

- ✓ Introduction
- ✓ Directed vs Undirected graph
- ✓ Traversing Graph

Chapter 8: Advanced Sorting and Searching algorithms [4hr]

- ✓ Advanced Sorting [Shell, Quick, Heap, Merge,
- ✓ Advanced Searching [Hashing]

Teaching - Learning methods

Two contact hours of lectures, three hours of lab and two hours of tutorials per week. Students do home assignments.

Assessment method

> Quizzes 20%
> Assignments 10%
> Project 20%
> Final Exam 50%
> Total 100%

Reference Books

1. Robert Lafore, "Data Structures and Algorithms in JAVA, 2nd Ed.", Sams Publishing
2. Jean Paul Tremblay, Paul G. Soreson, "An Introduction to Data Structures with Applications", Mc. Graw Hill Computer Science Series.
3. E. Horowitz, S. Sahni and Dinesh Mehta. Fundamentals of data structures in C++, W.H Freeman and Company (1995)
4. Sanjay Pahuja, A practical approach to data structures and algorithms, new age international publishers, 2008.