Namal College, Mianwali

Module Title: Data Structures and Algorithms-I
Offered to: 3rd Year – BSc (CS)
Instructor: Dr. Malik Jahan Khan
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Office Hrs: Anytime, anywhere
Semester: Fall 2017-18

Module Description

*Data Structures are the building block of computer software. This course is a **linked module** and this document covers the contents of the first semester only.*

Objectives

- *Enhancement of problem solving and programming skills*
- *Command on implementation of data structures*
- *Sound knowledge of abstract data types (trees, hash tables etc.)*

Course Learning Outcomes

- *Ability to:*
  - *demonstrate the usage of fundamental data structures using a programming language*
  - *choose and apply appropriate data structures for real life problems*
  - *design and implement different operations of abstract data types and relate them other CS subject areas like operating systems, databases, artificial intelligence, computer networks etc.*
  - *analyze the computation cost of different operations and optimize them*

Text Book

- *M. T. Goodrich, R. Tamassia: "Data Structures and Algorithms in Java", 4th Edition, John Wiley and Sons.*
- *M. A. Wiess: "Data Structures and Problem Solving using Java", 4th Edition, Pearson.*
- *Class Handouts and Selected Readings*

Assessment Tools

Assessments for the whole year (*to be counted towards final grade*)

- *Two Projects in semester-1 (25% + 25% weight)*
- *Final Exam towards end of semester-2 (50% weight)*

General Policies

- *Additional to disciplinary policies of the department / college, **plagiarism** will be strictly dealt with. Cheating any assignment or exam from anyone else may lead to severe penalty of grade. Violation of rules / involvement in plagiarism may easily lead you to an **"F"** in the module or expulsion from the course.*
- *Evaluation will be based on all class discussions, handouts, recommended readings, slides, home works, labs and revision sessions etc.*
- *Your active participation is highly encouraged.*
- *Attendance in lectures and labs is mandatory. In case of attendance below 85%, you may be dropped from the module without warning. You may see your attendance over LMS.*

Tentative Schedule

Wk. No.	*Content*
1	Introduction to the module, Quick recap of Java, Recursion, Introduction to data structures, Introduction to algorithms, Analysis of algorithms (Big-O). *Lab-1: Address Book Implementation* *HW-1: Recursion*
3	Arrays, Linked lists, Generic implementations of arrays and linked lists. *Lab-2: Implementation of Array Operations* *HW-2: Implementation of "Dynamic" Array*
3	Stacks, Queues, Array based implementation of stacks and queues, Linked lists based Implementation of stacks and queues. *Lab-3: Implementation of Linked List Operations* *HW-3: Implementation of Stack and Queue using Array as well as Linked List*
4	Circular queues, Doubly linked lists. *Lab-4: Implementation of Circular queues and DLL through enhancing Lab-3* *HW-4: Simulator of Production Queue of Donuts*
5	Trees, Binary trees, Binary search, BST, Tree traversal techniques. *Lab-5: Implementation of Binary Search Tree* *HW-5: BST Traversal Operations*
6	Priority queues, Heaps. *Lab-6: Implementation of MinHeap* *HW-6: Simulator of Priority Queue of OS Processes*
7-8	Need of Balancing, AVL Trees, B-trees, B+-trees *Lab-7: Implementation of AVL Trees* *Lab-8: Implementation of B+-Trees* *HW-7: Simulator of Search Engine* Coursework (Part-1)
9-10	Hashing, Hash function, Separate chaining, Open addressing, Rehashing. *Lab-9: Implementation of Linear & Quadratic Probing* *Lab-10: Analysis of Algorithmic Efficiency of Balanced Trees & Hashing* *HW-8: Simulator of Dictionary*
11	Skip lists *Lab-11: Implementation of Skip List* *HW-9: Exploring DB Applications of Skip List and Comparative Analysis with Hashing and Balanced Trees*
12	Insertion sort, Selection sort, Bubble sort, Heap sort. *Lab-12: Implementation of Sorting Algorithms* *HW-10: Analysis of Execution Time of Different Algorithms on Large Data*
13	Coursework (Part-2) Recap and left-over content (Lab Slots / Additional Tutorial Slots)!!!
14	CW viva