

1. DSA-1

L-T-P-C: 3-0-1-4

*Data Structures and Algorithms-1 Course Description:*

A course for introducing fundamental data structures and algorithm analysis.

*Course Objective:*

At the end of this class, we expect the students to be able to do

- i) Explain clearly which algorithm and data structures are suited for solving which type of problems and justify their efficiency.
- ii) Implement and use the algorithms and data structures in C or Similar language.

*Prerequisites:*

1. Intro to C programming
2. Overview of Computers

*Note: The course number and name might vary based on the semester/year.*

*Syllabus:*

**Refresher**

1. Review of C programming Language (LUC chapter 1 to 13)
  - a. Basic data types
  - b. Operators and expressions
  - c. Control statements
  - d. Functions and Pointers
  - e. Recursion

**Main Topics**

1. Introduction (DSAC chapter 1)
2. Algorithm Analysis (DSAC chapter 2)
  - a. Math background
  - b. Introduction to running time analysis
  - c. Asymptotic Notation
3. Lists, Stacks and Queues (DSAC chapter 3)
  - a. Abstract Data Types (ADT)
  - b. List ADT
  - c. Stack ADT
  - d. Queue ADT
4. Trees (DSAC chapter 4)
  - a. Binary Tree
  - b. The search tree ADT – Binary Search Tree
  - c. AVL Trees
  - d. Splay Trees
  - e. B Trees
5. Hashing (DSAC chapter 5)
  - a. Hash Functions
  - b. Collision detection/resolution
    - i. Separate chaining
    - ii. Open addressing
6. Priority Queues (DSAC chapter 6)

- a. Binary Heap
- b. Implementation and Applications
- 7. Sorting (DSAC chapter 7)
  - a. Insertion sort
  - b. Shell sort
  - c. Heap sort
  - d. Merge sort
  - e. Quick sort

**Extended Topics**

- 1. The Disjoint Set ADT (DSAC chapter 8)
  - a. Equivalence Relations
  - b. Smart Union Algorithms
- 2. Graph Algorithms (DSAC chapter 9)

*Note: We will receive constant feedback from the students. Based on the feedback, if we decide on increasing the pace of the course, only then we will cover extended topics.*

*Teaching Plan:*

*TBD*

*Tentative Teaching Timeline :*

*TBD*

*Assessment:*

*TBD*

*Text Book:*

- *Data Structures and Algorithm Analysis in C. Second Edition. - Mark Allen Weiss (DSAC)*

*References:*

- *Algorithms Illuminated Part1: Basics. - Tim Roughgarden*
- *Data Structures using C - Reema Thareja*
- *Let us C – Yashwant Kanetkar (LUC)*

*Course Webpage*

*TBD*