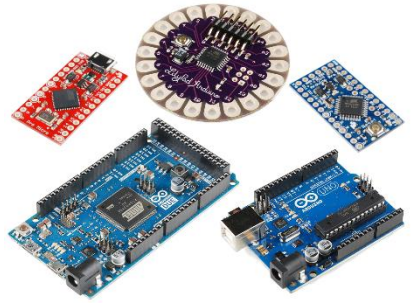
CSN-102: Data Structures

Instructor: Prof. Rahul Thakur

Assistant Professor, Computer Science and Engineering, IIT Roorkee

Instructor Biography



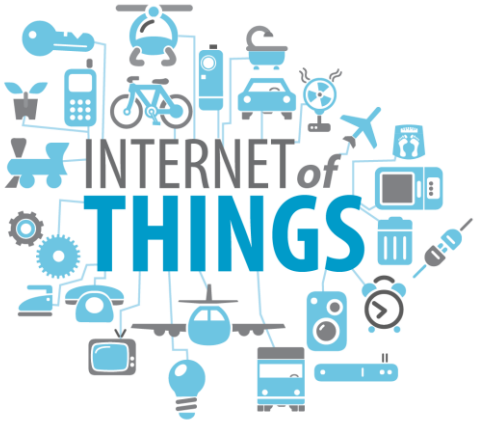
- **Name: Prof. Rahul Thakur**

  Assistant Professor, CSE, IIT Roorkee

  - Assistant Professor, **BITS Pilani Goa Campus**
  - Ph.D., **IIT Madras**
  - M.S., **IIT Madras**

- **Teaching Interest:** Computer Networks and Wireless Communication

- **Research Interest:** Cellular and Wireless Networks, Home Automation, Vehicular Networks, Internet of Things, Artificial Intelligence….

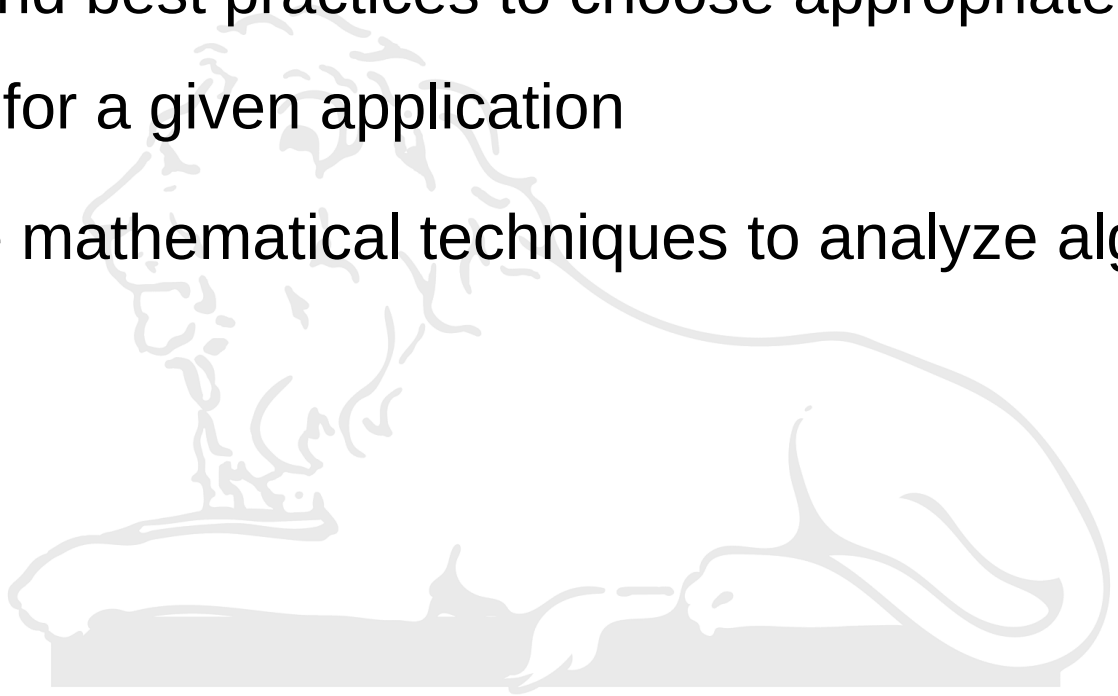


Course Information & Prerequisites

- Course Information
  - Course Title: **Data Structures**
  - Course Code: **CSN-102**
  - Office: **S-131**
  - Email and VOIP: **rahulfcs@iitr.ac.in, +91-1332-285644**
- Prerequisites
  - Basics of Algorithm Design
  - Successful completion of CSN-103 course
  - Mathematics for Computer Science
  - Intermediate programming skills
- Only CS+EC+Minor students can enroll
    - 207 Student Registrations
    - Teaching Assistants: 3

The Primary Goals of the Course

- Introduce linear and non-linear data structures
- Understand best practices to choose appropriate data structure for a given application
- Introduce mathematical techniques to analyze algorithms



Course Plan and Modules

- Introduction to Data Structures and Algorithms (1 Hr)
  - Data structure
  - Algorithms, programs, pseudocode
  - Need of data structures and (efficient) algorithms
- Complexity Analysis (3 Hr)
  - Time and Space complexity of algorithms, Asymptotic analysis, Big O and other notations, Importance of efficient algorithms, Program performance measurement
- Linear Lists (8 Hr)
  - Abstract data types
  - Data Structures: Array, linked list, doubly linked lists, circular lists, skip lists
  - Operations: Insertion, deletion and search
  - Applications of lists: Sorting and searching

Course Plan and Modules

- Stacks and Queues (6 Hr)
  - Introduction to stack and queues
  - Stack operation: PUSH and POP
  - Queue operations: Enqueue and Dequeue
- Hashing (4 Hr)
  - Hashing basics
  - Search efficiency in lists and skip lists, hashing as a search structure
  - Hash table, collision avoidance, linear open addressing, chains,
  - Uses of hash tables in text compression, LZW algorithm
- Trees (8 Hr)
  - Binary trees and their properties, terminology
  - Tree traversal methods and algorithms
  - Heaps: Priority queues, heap implementation, insertion and deletion operations, heapsort, heaps in Huffman coding, bin packing.

Course Plan and Modules

- Search Trees (4 Hr)
  - Binary search trees, search efficiency, insertion and deletion operations
  - Importance of balancing, AVL trees, searching insertion and deletions in AVL trees
  - Red-black trees, comparison with AVL trees, search insert and delete operations
- Multiway Trees (5 Hr)
  - Issues in large dictionaries, m-way search trees, B-tree, search insert and delete operations, height of B-tree, 2-3 trees
- Graphs (6 Hr)
  - Definition, terminology, directed and undirected graphs, connectivity
  - Implementation: Adjacency matrix and linked adjacency chains
  - Graph traversal: Breadth first and depth first, spanning trees

Books

1. Seymour Lipschutz, **"Data Structures",** (Schaum's Outline Series) McGraw Hill Education
2. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C.**,"Introduction to Algorithms",** Prentice-Hall of India
3. Sahni, S., **"Data Structures, Algorithms, and Applications in C++",** WCB/McGraw-Hill
4. Sahni, S., **"Data Structures, Algorithms, and Applications in Java",** WCB/McGraw-Hill
5. Drozdek, A., **"Data Structures and Algorithms in C++",** Vikas Publishing House.

- Additional Books and Reference Material

Evaluation Components and Schedule

- **Evaluative Component**
  - **Mid-Term Exam: 30%**
  - **End-Term Exam: 50%**
  - **Class Work Sessional: 20% → Tutorials\Quizzes**

- **Schedule**
  - **Class (LHC-104)**
    - **Monday: 04:05 – 5:00 PM**
    - **Thursday: 04:05 – 5:00 PM**
    - **Friday: 05:05 – 6:00 PM**
  - **Tutorial**
    - **One session (2hr) alternate week**
    - **Preferably on Saturday/Sunday**
  - **Extra Classes (if necessary)**

Problem with the Schedule?

CHEATING

and

USE OF UNFAIR MEANS

Other Relevant Information

- Mode of Teaching: PPT (Preferred) and Board
- Attendance: Not Compulsory
- Re-Examination: Medical/Exceptional Cases Only
- Resources: Piazza -- Slides, Notes, Assignments, Updates

  piazza.com/iitr.ac.in/spring2020/csn102

Mode of Communication

  - **Email:** rahulfcs@iitr.ac.in (Preferred)
  - **VOIP:** Availability is not guaranteed
  - **Class Representative (CR)**
- First Lecture: 3rd Jan 2020
- Last Lecture: 23rd April 2020
- Number of Lectures: ~ 35-42

Questions?