Data Structures and Algorithms (ESO207)

Semester I, 2023-24

31st July 2023

Course Logistics

- Instructor:
  Raghunath Tewari
  Room No. 514 RM Building
  email: *rtewari@cse.iitk.ac.in*
- Lecture coordinates: MWF 10 – 11am, L18
- Lab: There will not be any proctored labs in this course. We will only have lab assignments.
- Course Textbook: *Introduction to Algorithms*, by Cormen, Leiserson, Rivest and Stein.
- Course Webpage: moodle.cse.iitk.ac.in

Course Syllabus

1. Random-access-machine model, concept of problem size, and asymptotic behaviour of time/space complexity.
2. Estimation of time/space complexity by smooth function and order notations.
3. A simple example of worst-case time/space complexity analysis.
4. Elementary data-structures: arrays, lists, queues, stacks and their applications. Suggested examples: evaluation of an arithmetic expression (stacks), breadth-first-search of a tree (queues).
5. Efficient data structures for sets with the following group of operations: (i) insert, delete, membership, (ii) insert, delete, minimum, (iii) union, intersection, difference, (iv) disjoint-set union, find.
6. Definition of graphs, paths, trees, cycles. Data structures for graphs: adjacency lists, adjacency matrix.
7. Binary search algorithm, binary trees, binary-search-tree data-structure.
8. Balanced binary-search-tree: Red-Black trees.
9. Hashing for insert, search, delete.

10. Heaps data structure,
11. Sorting algorithms, including the average case analysis of quick-sort.
12. Greedy paradigm. (i) as an exact solution, (ii) as a heuristic.
13. Divide and conquer paradigm.
14. Dynamic-programming paradigm.
15. Graph algorithms: Depth First Search, Breadth First Search, Minimum Spanning Tree.
16. Median computation
17. Additional topics, based on the time and the interest, may be selected from the following list: Single-source shortest path computation, topological sorting of a partially ordered set, convex-hull computation, string matching algorithms, distributed algorithms.

Testing and Grading

Your grades will be based on homework assignments (theoretical and programming), quizzes, a mid semester exam and a final exam. The following table gives a guideline for evaluating your final grade.

Course Component	**Weightage**
Attendance	10%
Programming Assignments	10%
Theoretical Assignments	10%
Quizzes	20%
Mid Semester Exam	15%
Final Exam	35%

Other Important Information

- Attendance policy for this course is as follows. You are permitted to miss a maximum of 2 lectures during the course without any penalty and without any genuine reason. If you miss between 3 and 7 lectures, you will be awarded 5 out of 10 in attendance. If you miss 8 or more lectures, you will be awarded 0 out of 10 in attendance. If you miss more than 2 lectures, then you must show a valid proof of absence (such as medical certificate, travel tickets, etc). Whether your reason is genuine or not is solely upon the discretion of the instructor. Therefore it is strongly encouraged that you attend all lectures.
- The attendance record for each month will be uploaded on moodle.
- There will be three programming and three theoretical assignments in this course. For each assignment you will be given about 10 days to complete it. You are required to upload your submissions on moodle. Late submissions are strongly discouraged and will be penalised.
- There will be around 2 quizzes in this course.

- There will be NO makeup quizzes/exams unless under extreme circumstances, which is solely upon the discretion of the instructor.
- Plagiarism in any form such as cheating, copying, lending your work to others, etc., is very strongly discouraged and will be heavily penalised.
- Clarity and legibility of your solutions are as important as the solution itself.
- All course information will be conveyed via the course mailing list. Please make sure you check your email regularly.