Data Structures and Algorithms (ESO207)

Semester II, 2020-21

12th January, 2021

Course Logistics

- Instructor:
  Raghunath Tewari
  Room No. 514 RM Building
  email: *rtewari@cse.iitk.ac.in*

- Mode of Instruction: Pre-recorded lectures with weekly discussion hour.

- Discussion Hour: Tue 10:00am – 11:00am

- Course Textbook: *Introduction to Algorithms*, by Cormen, Leiserson, Rivest and Stein.

- Webpage: moodle.cse.iitk.ac.in

- Zoom Link:

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. 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, median computation, 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
Programming Assignments	15%
Theoretical Assignments	15%
Quiz	20%
Mid Semester Exam	15%
Final Exam	35%

Other Information

- Pre recorded lectures will be posted every week on the course webpage.

- In addition to that, we will have a weekly discussion session every Tuesday at 10am.

- All course information will be conveyed via the course mailing list.

- There will be 3 programming and 3 theoretical assignments distributed over the semester. You will be given about 7-10 days to complete each assignment. Late submissions are strongly discouraged and will be penalised.

- There will be around 2 quizzes in this course.

- Plagiarism in any form such as cheating, copying, lending your work to others, etc., is very strongly discouraged and will be heavily penalised.

- There will be NO makeup quizzes/exams unless under extreme circumstances, which is solely upon the discretion of the instructor.

- Clarity and legibility of your solutions are as important as the solution itself.

- It is strongly encouraged that you attend all lectures.