Lecture 1

CS 218 – Algorithms.

Wed + Fri 11–12:30

Profile

Students CS 2nd yr

Instructor : Mrinal Kumar

TAs Roshan, Rajendra, Kushagra
Ashish, Nilesh, Shivam

Web page:

https://mrinalkr.bitbucket.io

Contact: Email.

Subject: CS218 – ~~~

Office hours.

Wed — 12:30 - 1:30

TA OH — updated soon.

Lectures.

- Online

Announcements.

— Moodle + MS Teams.

Discussion — Moodle + Teams.

Grades

Midsem 1 — Inst. sch. — 30%.

Midsem 2 — March 25 — 25%.

Final — Inst. Sch — 40%.

95%.

Class Participation — 5%.

↳ In class discussions (useful).

↳ Attending lectures

↳ Problem set discussions
↳ In class / Moodle / Teams.

Exams: - Inst. regulations.

Problem sets:
- 5/6 PS
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Note: I might not be reachable in the week leading to any of the exams.

Honor code

References
- Algorithms Design - Kleinberg - Tardos
- Cormen et al CLRS

What is this course about?

- Basic Techniques for Algorithm Design for computational Problems

- Includes things like
  - Divide and Conquer
  - Greedy
  - Dynamic Programming
  - Max flow min cut

- Advanced Data Structures

- Computational Intractability
  - Inherently hard computational problems.
    - P vs NP question
      - Go back and Google

- Coping Strategies.
  - Approximation Algorithms.
  - Parameterized Algorithms

Analysis: - Good vs Bad

Fast vs Slow

Efficient vs inefficient.

- Prove correctness of algorithms.
- Bound the running time

Math based — Theorems / Lemmas /. -

Background

- DSA
- Discrete Math
- Math courses →

- Writing formal proofs
- Induction / Logic / algebra / number theory / Linear algebra

DSA - Directly related

- Asymptotic analysis

O, o, Ω, ω, Θ ..

- Data Structures

  Stack / Queue / Priority Q / Heaps !

- Basic Algorithms

  - Ls sorting - Insertion / Merge / Quick
  - Graph search - BFS / DFS / shortest Path Dijkstras
  - String Matching

Algorithms: well defined recipe for solving computational problems.

Ex: 1) Shortest path from point A to pt B on some map.

2) Allocating slots to courses in CSE@iitb.

3) Cheapest tour

4) Multiply large integers.

5) Factor a given natural number.

6) Check if a given natural number is prime.

Why study Algorithm Design ?

① Algo + DS – crucially used in anything serious in CS

1) Networks – graph algo

2) Cryptography / Security – factoring /

3) Graphics – geometric algorithms.

4) Databases – Data Structures

5) Computational Biology – Dynamic Prog. based algo

2) Technical Innovations rely on new and clever algorithms

3) Computational lens on various natural phenomenon outside CS.

- Quantum computation
- Evolution.
- Economics.

4) Exciting / Challenging.

- Lots of resources on the internet. ✓

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Next:

1) Problem - Asym Notation
   ~~Eff~~. Recurrence

2) Divide and Conquer Paradigm.