

CSE523: Randomized Algorithms

Credits: 4

Discipline: CSE

UG/ PG/ UG+PG: UG+PG

Pre-requisites

- Analysis and Design of Algorithms – CSE222
- Discrete Mathematics – CSE121
- Probability & Statistics – MTH201

Anti-requisites

- None

Post Condition (on student capability after successfully completing the course):

(list 3-4, the postconditions should reflect different levels of learning)

- The student can analyse events of probability occurring in algorithmic problems.
- The student can analyse an algorithm with respect to a given input distribution.
- The student is able to design a randomized algorithm with provable bounds.
- The student understands different random processes occurring in problems.

Brief Description

Randomisation and probability plays a huge role in today's algorithms, especially in two situations: the data itself has errors, or is too large and complex. This course studies algorithms which, by design, may not be correct 100% of the time, or run within the stipulated resource always, but definitely do so in an overwhelmingly large number of cases. The course will be split into three main logical sections - tools from probability theory, algorithms which are probabilistic and analysis of deterministic algorithms for different input distributions.

Week	Topics Covered	Nature of assignments / labs and (expected hours of work)
1	Review of probability, expectation	Homework (4 hours)
2	Conditional events, random variables	Homework (4 hours)
3	Probabilistic inequalities, applications	Homework (4 hours)
4	Concentration bounds	Homework (4 hours)
5	Bernoulli trials	Homework (4 hours)
6	Probabilistic method	Homework (4 hours)
7	Random graphs & randomized	Homework (4 hours)

	algorithms	
8	Random walk	Homework (4 hours)
9	Markov Chain	Homework (4 hours)
10	Sampling	Homework (4 hours)
11	Derandomization	Homework (4 hours)
12	Entropy & Mutual Information	Homework (4 hours)
13	Topics of interest	Homework (4 hours)

Tutorials/Labs

- None

Evaluation

- Homework – 15%
- Quizzes – 15%
- Mid-sem exam – 30%
- Final exam – 40%

Texts/Other Resources

- Probability and computing : randomized algorithms and probabilistic analysis by Mitzenmacher, Michael; Upfal, Eli (Cambridge University Press, 2005)
- Reference book: Randomized algorithms by Motwani, Rajeev; Raghavan, Prabhakar (Cambridge University Press, 1995)