

# COT 4930 Randomized Algorithms

**Credits:** 3 credits

**Textbook, Title, Author and Year:** There is no required textbook. The lectures will follow the book: Probability and Computing: Randomized Algorithms and Probabilistic Analysis. By Michael Mitzenmacher and Eli Upfal.

**Reference Materials:** Randomized Algorithms. By Rajeev Motwani and Prabhakar Raghavan, The probability method. By Noga Alon and Joel H. Spencer

## Specific Course Information

- a. **Catalog Description:** Probability, randomness, statistics have been playing an important role in computer science, ranging from purely theoretical studies (e.g. complexity theory) to highly practical applications (e.g. secure communication, page ranking, network routing, etc.) Research in the related fields has been extremely active since the past three decades. This course will introduce several basic techniques in the design and analysis of randomized algorithms. With each technique, we will demonstrate various applications to see how it can be applied. We will see how and why randomness can be so powerful that bypasses some barriers of deterministic algorithms. Also, we will see its limitations.
- b. **Prerequisites:** COT 4400 Design and Analysis of Algorithms

## Specific Goals for the Course:

To learn the power of randomness in computer science, and how to design and analyze randomized algorithms.

## Brief List of Topics to be Covered:

- Introduction: The Power of Randomness in Computer Science
- Background of (Discrete) Probability: Random Variables, Expectations
- Chernoff Bounds and Applications
- Balls, Bins, and Random Graphs
- The Probabilistic Methods
- Markov Chains and Random Walks
- Entropy, Randomness and Information
- Other Selected Topics (E.G. Monte Carlo Methods, Martingale, Derandomization, Martingale)