

## COSC-223 Spring 2019 Midterm 2 Topics

**This is a fairly complete list of topics we've covered in class since the first midterm. You (hopefully) have a lot more detail written in your notes than what appears on this page, and you are responsible for all of the course material up to this point. The second midterm is not cumulative in the sense that the focus will be on material that we've covered since the first midterm, but is cumulative in the sense that the material builds on itself.**

- Discrete Time Markov Chains
  - Definitions: what is a DTMC? Markovian and stationary properties
  - How to set up a DTMC
  - Transition probability matrix, limiting probabilities
  - Limiting distribution vs. stationary distribution
  - Setting up and solving stationary equations
- Continuous Random Variables
  - Definition: continuous RV
  - Definition: probability density function, cumulative distribution function
  - Examples of discrete distributions: Uniform( $a,b$ ), Exponential( $\lambda$ ), Pareto( $\alpha$ )
  - Memoryless property of the exponential distribution
  - Expectation and variance of continuous RVs
  - Independence, conditioning, joint pdf, marginal pdf
  - Inverse transform method to generate continuous RVs for simulation
- Queueing Theory
  - System parameters: service order/scheduling policy, arrival rate, interarrival time, service requirement/job size, service rate, mean service time
  - Important performance metrics: response time, queueing time, number in system, number in queue, utilization, throughput
  - Little's Law
  - Failure rate function, increasing failure rate, decreasing failure rate
  - Heavy-tailed distribution properties
  - Kendall notation for describing queues
  - Analyzing an M/M/1 queue: mean number in system, mean response time
- Continuous Time Markov Chains
  - Definition, two ways of viewing a CTMC
  - Relationship between Exponential distribution and Geometric distribution
  - Solving CTMCs: transformation to a DTMC
  - Setting up and solving balance equations to solve a CTMC