SM239: Important Concepts

- Descriptive Statistics and Introduction to MATLAB(Chapter 2)
  - General MATLAB stuff
    - reading a dataset into MATLAB: File→Import or cut-and-paste
    - row selection (picking out members of a particular group, for example)
  - Measures of location: mean, median, mode (choice of mean vs. median)
  - Measures of spread: five-number summary, quantiles/percentiles, range, standard deviation
  - Shape: symmetric, skewed right, skewed left
  - Graphical methods
    - for looking at a single variable: histogram, boxplot, smoothed histogram
    - for comparing two or more groups: side-by-side boxplots
    - being able to read shape, location, and spread off the graph

- Probability (Chapter 3)
  - samples space, event, union ($\cup$), intersection ($\cap$), complement ($\bar{\ }$)
  - independent events, mutually exclusive events
  - idea of probability as a long-term relative frequency
  - probability laws – using these to solve problems
  - conditional probability – solving problems using tables
  - screening tests
    - sensitivity, specificity, predictive value positive, predicitive value negative
    - false positives, false negatives
    - solving problems using tables
    - interpreting results – is it a good screening test?

- Discrete Probability Distributions (Chapter 4)
  - Discrete vs. Continuous random variables
  - General concepts for discrete random variables: pmf, cdf, mean, sd, calculating probabilities
  - The binomial distribution: X = the # of successes in n trials

- The negative binomial distribution: X = the # trials required for r successes
- The Poisson distribution: X = the # events in a time period of length t
- The Erlang distribution: X = the waiting time to the rth event
- For each of these distributions:
  - be able to identify which situation we're in and/or know the conditions for model to be appropriate
  - calculating probabilities in MATLAB
  - mean/expected value and variance
  - solving confidence level problems: 'I can be 95% confident...'

- Continuous Probability Distributions (Chapter 5)
  - General concepts for continuous random variables: pdf, cdf, mean, sd, finding probabilities
  - The Normal distribution
    - what does the pdf look like? be able to sketch it! know how the mean (μ) and standard deviation (σ) affect the pdf
    - the rule of thumb (68%, 95%, 99.7%)
    - calculating Normal probabilities
    - solving confidence level problems: 'I can be 95% confident...'
    - using standardization/z-scores to compare between two different groups
    - the standard normal distribution
    - sums and difference of normals
    - normal approximation to the binomial (using continuity correction)

- Estimation (Chapter 6)
  - Exact confidence bounds/intervals for the binomial, negative binomial, Poisson, and Erlang distributions
  - Confidence bounds/intervals for the normal distribution with standard deviation known and unknown
  - Confidence bounds/intervals for the binomial distribution using the normal approximation

- One-sample Hypothesis Testing (Chapter 7)
  - General structure of a hypothesis test: null/alternative distribution, p-value, conclusion
  - One-sample test for the mean of a normal distribution
  - Relationship between hypothesis tests and confidence bounds/intervals
  - One-sample test for a binomial proportion