Exam II will cover Sections 3.1, 3.2, 3.3, 3.4, 3.6, 4.1, 4.2 and 4.3. Although the exam is not exceedingly difficult, it is not an easy exam and you would be wise to prepare accordingly. The following is an outline of concepts from each of these sections with a short description of what you will be expected to know from each section.

- Section 3.1 Random Variables
  - Know what a random variable is and how to distinguish between a discrete random variable and a continuous random variable.
- Section 3.2 Probability Distributions for Discrete r.v.
  - Be able to determine if a given definition of $p(x)$ is in fact a probability mass function.
  - Be able to use a pmf to calculate the probability of a discrete random variable taking on certain values (e.g. $P(X = 6)$, $P(X \geq 5)$ etc.)
  - Be able to use a cdf (cumulative distribution function) to calculate the probablities of a discrete random variable taking on certain values.
  - Given a pmf for a discrete random variable X, be able to construct the associated cumulative distribution function.
  - Given a cumulative distribution function for a discrete random variable X, be able to construct the associated pdf.
- Section 3.3 Expected Values
  - Given a discrete random variable and an associated probability mass function, be able to calculate the expected value the disrete random variable, $E[X]$.
  - Be able to calculate the expected value of any function of the discrete r.v., $E[h(X)]$.
  - Know how to calculate the variance of the the discrete r.v., $V[X]$
- Section 3.4 The Binomial Probability Distribution
  - Be able to recognize a discrete random variable that has a binomial distribution.
  - Given $X \sim Bin(n, p)$ be able to use the **formula or tables** to calculate probabilities for values of X. (e.g. $P(X = 6)$, $P(X \geq 5)$)
  - Be able to find the expected value and variance of $X \sim Bin(n, p)$.
- Section 3.6 The Poisson Probability Distribution
  - Be able to recognize a discrete random variable that has a Poisson distribution. (e.g. a binomial distribution with large n and small p, and $np = \lambda$)
  - Given X (with a Poisson distribution) be able to use the **formula or tables** to calculate probabilities for values of X. (e.g. $P(X = 6)$, $P(X \leq 3)$)
  - Be able to find the expected value and variance of X (where X has a Poisson distribution).

- Section 4.1 Probability Density Functions
  - Know the definition and properties of the pdf for a continuous random variable.
  - Given a pdf, $f(x)$, for a continuous random variable, x, be able to calculate $P(a \leq X \leq b)$.
- Section 4.2 Cumulative Distribution Functions and Expected values
  - Given a pdf, $f(x)$, be able to calculate the associated cdf , $F(x)$, and given the cdf, be able to calculate the associated pdf.
  - Given a pdf, $f(x)$, be able to calculate percentiles of X.
  - Be able to calculate the expected value of any function of a continuous r.v., $E\left[h(X)\right]$.
  - Given a pdf, $f(x)$, be able to calculate the expected value and variance of the continuous random variable X.
- Section 4.3 The Normal Distribution
  - Be familiar with the properties of a normal distribution and a standard normal distribution.
  - Be able to use the cdf (z-distribution table) to calculate probabilities for a standard normal distribution and for a normal distribution.
  - Be able to use the cdf (z-distribution table) to calculate percentiles for a standard normal distribution and for a normal distribution.
- Given a random variable X (continuous or discrete) be familiar with the relations (infact you may have to prove either of these relations):

$$E[aX + b] = aE[X] + b$$

and

$$V[aX + b] = a^2V[X]$$

for any constants a and b.