Math 155, Fall 2016
Test #2 Learning Objectives

Section 4.2 – Basic Concepts of Probability

- Be familiar with terminology introduced in this section – "event," "simple event," "sample space," "complement"
- Be familiar with, and be able to answer questions about/solve problems involving, the three main approaches to probability.
    - Relative Frequency (also known as "empirical" probability – based on observations, calculate the relative frequency of an event (e.g. if a baseball player gets a hit 25 times in 80 attempts, then his probability of getting a hit is estimated as 25/80=5/16, or 0.3125)
    - Classical – assume all simple events have equally likely outcomes; calculate probability as number of ways an event can occur divided by the total number of simple events (e.g. if we roll a fair 6-sided die, there is a 4/6 probability of rolling a number 3 or greater)
    - Subjective – estimate based on available knowledge or evidence (e.g. 40% change of rain tomorrow, based on current conditions)
- Know the complement rule for probabilities: $P(\bar{A}) = 1 - P(A)$
- Know the probability of an impossible event is 0, and the probability of a certain event is 1
- Interpret events as "unlikely" or "unusual" based on their probability of occurring . (Rule of thumb, as stated on page 141 of the text: "unlikely" means a small probability, usually 0.05 or less; "unusual" means an extreme result which almost never occurs, usually less than 0.001.)
- NOTE: I feel that the textbook is not completely consistent in its usage of the terms "unlikely" and "unusual," and that this can cause unnecessary confusion. I won't try to emphasize the distinction between these two words on the test. If there is a question in which I want you to interpret an "extreme" event as one whose probability is less than 0.001, I will describe it as "extreme" rather than "unusual." I'll try to stick to "unlikely" for describing non-extreme events with probability 0.05 or less, as described on p. 141.)

Chapter 5 – Discrete Probability Distributions (covered: all *except* section 5.5)

- Be familiar with all definitions and notation introduced in the chapter
- Know that a "random variable" is a variable whose value is determined by the outcome of some procedure of experiment
- Know what is meant by "discrete random variable" as opposed to "continuous random variable;" understand the distinction between these (this is essentially the same as the distinction between "discrete" and "continuous" defined in Section 1-3)
- Know the requirements for a probability distribution (there is a numerical random variable; each probability is between 0 and 1; the sum of all probabilities of all possible values of x is 1).
- Know how to read or write a probability distribution in table form or graph (histogram) form
- Use a probability distribution to find probabilities of events
- Be able to find the expected value, variance, and standard deviation of a discrete random variable

- Be able to identify "unlikely" (probability 0.05 or less) and/or "extreme" (probability less than 0.001) events based on a probability distribution

- Know the criteria for a random variable to be defined as a "binomial" random variable – fixed number of trials; independent trials; each trial has exactly two outcomes (success/failure); the probability of success is constant for all trials
- Know the terminology and notation for binomial random variables – in particular, n=number of trials, p=probability of success on each trial, q=probability of failure on each trial; x = number of observed successes; P(x)=probability of observing exactly x success among n trials
- Know how to read a binomial probability table to find probabilities of events
- Know how to use the binomial probability formula to find the probability of a specific number of successes

- Know the notation for binomial random variable parameters: μ = expected value; σ^2 = variance; σ = standard deviation
- Know the formula for each of these parameters of a binomial random variable:
$$\mu = np, \sigma^2 = npq, \sigma = \sqrt{npq}$$
- Interpret values of a binomial random variable to be "unusually high" or "unusually low" based on the "range rule of thumb" from Chapter 3: values above $\mu + 2\sigma$ are generally considered "unusually high," while values above $\mu - 2\sigma$ are generally considered "unusually low."

Chapter 6 – Normal Probability Distributions (covered on test: 6-2, 6-3)

- Be familiar with the uniform distribution – what it is, how to read or draw one, and how to interpret one to find the probability of an event
- Understand the correspondence between area "under" a probability distribution curve and the probability of an event
- For the standard normal distribution (with $\mu = 0, \sigma = 1$)
  - Understand how to read and interpret probabilities from the standard normal table
  - Be able to find probabilities of events using the standard normal table
  - Be able to find the area of a shaded region of the standard normal distribution using the standard normal table
  - Given a probability, α, be able to find the "critical value" z_α, the value of the standard normal variable z for which $P(z > z_\alpha)$ is equal to α.
- For a non-standard normal distribution, be able to convert values into z-scores in order to use the standard normal table to find probabilities of events