Test 3 Study Guide
Math 160 Section 3

0.1 Chapter 13 - The Binomial Distribution

1. What are the characteristics of the Binomial setting?
2. What kind of random variable has a Binomial distribution?
3. Say $X \sim B(n, p)$, in other words X has the Binomial distribution with parameters n and p.
   (a) What do n and p stand for?
   (b) What is the mean of X? What is the standard deviation of X?
   (c) What is the probability that $X = k$, if $0 \leq k \leq n$?
   (d) What is the command on your calculator that gives the probability that $X \leq k$?
4. What is the binomial coefficient $\binom{n}{k}$? Compute $\binom{6}{3}$ and $\binom{7}{2}$
5. Martha plays poker with 5 friends every week. Martha is good at poker, and each week, she has probability .35 of winning. Let X be the number of times a year Martha wins at poker. (There are 52 weeks in a year.)
   (a) What is the formula giving the probability that Martha wins one-quarter of the poker games in a given year?
   (b) What is the probability that Martha wins one-quarter or fewer of the poker games in a given year?
   (c) On average, how many games a year does Martha win?

0.2 Chapter 3 - The Normal Distribution

1. What is the area under a density curve and above the x-axis?
2. If a density curve is left-skewed, which is larger: the mean or the median?
3. What does the $68 - 95 - 99.7$ Rule for normal distributions say?
4. Suppose $X \sim N(25, 25)$. Draw pictures of the following values as areas under a density curve. Find the values using Table A, and give the z-values used.
   (a) $P(X < 22)$.
   (b) $P(X > 32)$.
   (c) $P(22 \leq X \leq 32)$.
5. Let L be the random variable which is the length of human pregnancies from conception to birth. Then $L \sim N(266, 16)$, where L is given in days. Draw pictures of the following values as areas under a density curve. Use your calculator to find the following values, and write out the commands used.
   (a) The proportion of pregnancies lasting less than 240 days.
   (b) The proportion of pregnancies lasting between 240 and 260 days.
   (c) The lengths of the longest one-fifth of pregnancies.

0.3 Chapter 11 - Sampling Distributions

1. Define the term *parameter*.
2. Define the term *statistic*.
3. What is the difference between $\bar{x}$ and μ?
4. What does the "Law of Large Numbers" say?
5. Explain what the "Sampling Distribution of the Mean" is.
6. Suppose the time between nerve impulses (interspike interval) in humans follows an exponential distribution with mean 0.219 seconds, and standard deviation 0.148 seconds. As part of a test of the effects of nicotine on the nervous system, the times between 101 nerve impulses are recorded from the arms of control subjects. The result are 100 interspike intervals for each subject. These 100 intervals are then averaged, to give an average interspike interval for each subject.
   (a) What is the distribution of the average interspike intervals?
   (b) What is the probability that a given subject has an interspike interval longer than 0.25 seconds?
   (c) Within what range do the interspike intervals of 90% of subjects lie?

0.4 Chapter 14 - Confidence Intervals

1. What is the general definition of a confidence interval at level C for a parameter θ?
2. Which of the following is true about a 99% confidence interval?
   (a) 99% of the possible sample means will be included in this interval.
   (b) 99% of the intervals constructed using this process based on repeated samples from this population will include the population mean.
   (c) 99% of the time the interval will include the sample mean.
   (d) 99% of the time the interval will include the population mean.
   (e) 99% of the possible population means will be included in the interval.
3. Given the same sample size and the same population, which is longer: a 95% confidence interval or a 90% confidence interval?
4. How can we decrease the margin of error of a confidence interval?
5. What are the assumptions (the book calls them "Simple Conditions") we have made so far when calculating confidence intervals?
6. Say we have a population which is normally distributed with $\sigma = 3.75$. We take a simple random sample of 25 individuals from the population, and find $\bar{x} = 10$.
   (a) Find a 92% confidence interval for the population mean.
   (b) How many more individuals must we sample to obtain a 96% confidence interval with the same margin of error?

0.5 Chapter 15 - Tests of Significance

1. What is the result of a test of significance? What does it tell you?
2. In hypothesis testing, what is H_a? What is H_0?
3. Suppose $H_0 : \mu = \mu_0$. Set up a one-sided H_a.
4. What's an α, in the context of significance?
5. True or false: a p-value of 0.05 is stronger evidence against the null hypothesis than a p-value of 0.1.
6. Experiments on learning in animals sometimes measure how long it takes mice to find their way through a maze. The mean time is 18.4 seconds, with standard deviation 2.3 seconds, for one particular maze. A researcher thinks that a loud noise will cause the mice to complete the maze in less time. She measures how long each of 10 mice takes with a noise as stimulus. She assumes that the standard deviation for maze times under these conditions will also be 2.3 seconds, and chooses a significance level of $\alpha = .05$. On average, it takes the 10 mice 19.2 seconds to find their way through the maze.
   (a) What are the null and alternative hypotheses for this test?
   (b) What is the p-value for this test?
   (c) What conclusion can be drawn?
7. Explain, by drawing a suitable diagram, why a significance test that is significant at the 1% level must also be significant at the 5% level.