MATH 160A   Introduction to Applied Statistics   Fall 2007   Exam #3

Instructions: Do your work and record your results on separate paper. You can work on the problems in any order. Clearly number your work for each problem.. You do not need to write answers on the question sheet.

   This exam is a tool to help me (and you) assess how well you are learning the course material. As such, you should report enough written detail for me to understand how you are thinking about each problem. If you use your calculator, write down enough details of the arithmetic to make clear what calculation you are doing.   (100 points total)

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1. Green M&M's make up about 15% of all M&M s that are manufactured. You will randomly select 8 M&M's from a package.

   (a) What is the probability of getting exactly 2 green M&M's?   (6 points)

   (b) What is the probability of getting 4 or more green M&M's?   (6 points)

2. Find the normal distribution that approximates the binomial distribution $B(200, 0.55)$. Sketch a plot of this normal distribution. Include the values of the center and the inflection points on the horizontal axis of your plot.   (10 points)

3. You are planning a study that will involve a SRS of 75 UPS students. You want to know what to expect for the proportion of women in the sample you draw. The proportion of women among all students at UPS is 0.62.

   (a) Explain why it is reasonable to use a normal approximation for the sample proportion distribution in this situation.   (4 points)

   (b) Determine the specific normal distribution that can be used to approximate the sample proportion distribution.   (6 points)

   (c) Use your normal distribution from (b) to determine the probability of getting a sample proportion greater than or equal to 0.70.   (6 points)

4. Given a population distribution with mean μ and standard deviation σ, you can look at simple random samples (all of the same size) and record the distribution of sample means $\bar{x}$. Fill in the blanks for each of the following.

   (a) If _____, then the sample mean distribution is the normal distribution _____.

   (b) If _____, then the sample mean distribution is approximately the normal distribution _____.

   Note the length of each blank doesn't mean anything. Don't try to fill in the blanks on this sheet since there may not be enough room.   (5 points each)

5. You calculate a 95% confidence interval for a population mean from a set of sample data. You then calculate a 90% confidence interval using the same set of data. Would the 90% confidence interval be narrower than, the same as, or wider than the 95% confidence interval *or* would the comparison between the two depend on the sample data? Explain your reasoning in reaching a conclusion.   (8 points)

6. Microsoft is interested in knowing the proportion of people in the U.S. who are aware that the lastest version of the *Halo* game series has been released. Microsoft plans to hire a polling company to conduct a sample survey that will return a 95% confidence interval for the proportion of people in the US who are aware of the latest release. Due to a computer glitch, 40 different Microsoft managers independently take on the same task. Each contacts a different polling company so 40 different sample surveys are conducted. Would you expect all of the 40 confidence intervals that get reported to contain the true value of the proportion? Explain your reasoning in reaching a conclusion.   (8 points)

7. You are interested in the mean weight of males in the U.S. with ages from 20 to 29 years. The distribution of weights for all males is approximately normal and has a standard deviation of 40 pounds. (Note: It is unrealistic to think we would know this value without knowing the mean of the distribution.) You measure weights for a SRS of 120 males and compute a sample mean of $\bar{x} = 168$ pounds. Determine the 90% confidence interval for the mean weight of all U.S. males in the age group 20-29.   (12 points)

8. The Survey of Study Habits and Attitudes (SSHA) is a psychological test that measures the motivation, attitude toward school, and study habits of students. Scores range from 0 to 200. The mean score for U.S. college students is about 115, and the standard deviation is about 30. A teacher who suspects that older students have better attitudes toward school gives the SSHA to 25 students who are at least 30 years of age. Their mean score is $\bar{x} = 132.3$. The teacher sets up the hypotheses

$$H_0 : \mu = 115$$
$$H_a : \mu > 115$$

   (a) Explain why a one-side alternative hypothesis is reasonable to use in this situation.   (4 points)

   (b) Carry out a significance test using the significance level $\alpha = 0.05$.   (8 points)

   (c) In the language of the real-world situation, state a conclusion based on your significance test results.   (4 points)

9. A standard short-term memory test involves showing each subject a list of words for a brief time and then counting the number of words the subject can correctly recall. A researcher is studying the question of whether current college students are worse at short-term memorization than college students were 30 years ago. Data from 30 years ago shows the mean number of words correctly recalled by college students was 6.21. Let μ be the mean number of words correctly recalled by current college students. The researcher forms the hypotheses

$$H_0 : \mu = 6.21$$
$$H_a : \mu < 6.21$$

The researcher administers the word recall test to $10,000$ current college students. Using the sample mean for this data, the researcher calculates a P-value of 0.00023. The researcher also computes a 99% confidence interval of $[6.19, 6.22]$. The researcher summarizes these results, by writing "There is a significant difference between the two groups, but this difference is not important." Explain why this summary is consistent with the results and does not contradict itself.   (8 points)