BST 140.652 Midterm Exam
Notes:

- You may use your one 8.5 by 11 formula sheet.
- Please use only the basic mathematical functions on your calculator.
- Show your work on all questions. Simple "yes" or "no" answers will be graded as if blank.
- Please be neat and write legibly. Use the back of the pages if necessary.
- Good luck!

_____
signature

_____
printed name

1. A clinical trial is conducted where a antacid treatment is given to 100 patients with heartburn while a placebo is given to another 100 with heartburn. Of the treated, 73 reported an improvement in symptoms. Of the controls 63 reported an improvement. Perform a hypothesis test that the treatment is effective. State your hypotheses defining any notation that you use and report a P-value. Interpret your results.

2. Refer to the previous problem. Give and interpret confidence intervals for the relative risk and odds ratio.

3. A friend gives you a coin that is slightly bent and claims that the probability of a head is $.6$. You would like to test this hypothesis. You flip it 5 times and obtain 4 heads. Perform the relevant hypothesis test, stating your hypotheses (defining any notation that you use), report a P-value and interpret your results.

4. Refer to the previous problem. Suppose that in 200 flips of the coin there are 123 heads. Test the hypothesis using this new sample and report and interpret a P-value.

5. Let $X_1, \ldots, X_{N_1}$ be iid random variables from a population with mean μ_1. Let $\bar{X}$ and S_x be the sample mean and standard deviation, respectively. Use the delta method to obtain a confidence interval for $\log(\mu_1^2)$.

6. Refer to the previous problem. Let $Y_1, \ldots, Y_{N_2}$ be iid random variables froma population with mean μ_2. Let $\bar{Y}$ and S_y be the associated sample mean and standard deviations. Using your answer from the previous question, obtain a confidence interval for $\log(\mu_2^2/\mu_1^2)$. (If you do not have an answer for the previous problem define notation for the parts that you are missing.)

7. Researchers would like to test whether or not the mean systolic blood pressure in a particular obese population is greater than 135 mmHg. She conjectures that it may be as high as 138 mmHg. This population is known to have a standard deviation of SBP of 5 mmHg. She intends to take a sample of 100 subjects. What is the probability that she rejects her hypothesis if her conjecture is correct and she uses a $.05$ type I error rate?

$H_0: \mu = 135$
$H_a: \mu > 135$

μ = Pop. mean BP $\quad z_{.95} = 1.96$

$$P\left(\frac{\bar{x} - 135}{.5} \geq 1.96 \mid \mu = 138\right) = P(\text{Reject } H_0 \mid \mu = 138)$$

$$= P\left(\frac{\bar{x} - 138}{.5} + \frac{138 - 135}{.5} \geq 1.96 \mid \mu = 138\right)$$

$$= P(z \geq 1.96 - 6)$$

$$= P(z \geq -4.04) \approx 1$$

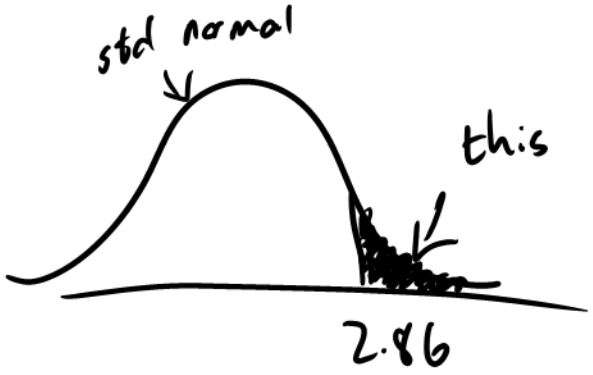
8. Refer to the previous problem. After collecting data (100 subjects), the mean was $137mmHg$ with a standard deviation of $7mmHg$. Perform and interpret the relevant test. State your hypotheses defining any notation that you use. Report a P-value.

$H_0: \mu = 135$
$H_a: \mu > 135$

μ = Pop. mean BP

$$T.S. = \frac{137 - 135}{7/\sqrt{100}} = 2.86$$

Reject H_0 under $\alpha = .05$ error rate

Pvale = 

= (look it up)

Intrpret:

At the 5% - level type I error rate there is evidence to sugest that the Mean SBP is higher than 135 mm/Hg.

The pvalue is (fill in).