

## **BST 140.651 Final Exam**

Notes:

- 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.
- There are three pages containing 8 questions.
- Good luck!

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signature and **printed name**

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4. In a random sample of 100 subjects with low back pain, 27 reported an improvement in symptoms after exercise therapy. Give and interpret an interval estimate for the true proportion of subjects who respond to exercise therapy. (Show some work.)

5. Let  $X$  be binomial with success probability  $p_1$  and  $n_1$  trials and  $Y$  be an independent binomial with success probability  $p_2$  and  $n_2$  trials. Let  $\hat{p}_1 = X/n_1$  and  $\hat{p}_2 = Y/n_2$  be the associated sample proportions. Suppose that it is known that

$$Z = \frac{\hat{p}_1 - \hat{p}_2 - (p_1 - p_2)}{\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}}$$

is standard normally distributed for large  $n_1$  and  $n_2$ . Use this fact to derive a 95% confidence interval for  $p_1 - p_2$ . (Do not just give an answer, show some steps.)

6. Consider the setting from problem 4. Suppose that in a second sample of 100 subjects with lower back pain who received no treatment, 10 reported an improvement in symptoms. Using your answer to question 5, answer the question of whether or not the treatment appear to be effective?

7. You need to calculate the probability that a *standard normal* is larger than 2.20, but have nothing available other than a regular coin. Describe how you could estimate this probability using only your coin. (Do not actually carry out the experiment, just describe how you would do it.)
8. Suppose that 18 obese subjects were randomized, 9 each, to a new diet pill and a placebo. Subjects' body mass indices (BMIs) were measured at a baseline and again after having received the treatment or placebo for four weeks. The average difference from follow-up to the baseline (followup - baseline) was  $-3 \text{ kg/m}^2$  for the treated group and  $1 \text{ kg/m}^2$  for the placebo group. The corresponding standard deviations of the differences was  $1.5 \text{ kg/m}^2$  for the treatment group and  $1.8 \text{ kg/m}^2$  for the placebo group. Does the change in BMI over the two year period appear to differ between the treated and placebo groups? (Show some work and interpret your results.) Assume normality and a common variance.