Part 1: True/False Questions (4 points each):

Instructions: Circle the appropriate answer.

1. True/False As the confidence level increases, the margin of error for a confidence interval decreases.

2. True/False A large $P$-value provides evidence that $H_0$ is not true.

3. True/False If other factors are kept fixed, then increasing the $\alpha$ level decreases the chance of a Type I error.

4. True/False A result that is statistically significant is always important in practice.

5. True/False A $P$-value is computed under the assumption that $H_0$ is true.

6. True/False If we fail to reject $H_0$, then we can conclude that $H_0$ is true.

Part 2: Other Questions:

Instructions: SHOW YOUR WORK to receive credit.

Problem 7: (16 points) In a certain area of the country, only about 30% of the wells that are drilled find adequate water at a depth of 100 feet or less. A man claims to be able to find water by “dowsing,” and he hires out his services. You check with 80 of his customers and find that 27 have wells less than 100 feet deep. Is this evidence that “dowsing” works? Test an appropriate hypothesis at the 0.05 level. Be sure to show all steps and state your conclusion clearly.
Problem 8: (14 points) A Villanova student decides to estimate the proportion of Villanova undergraduates that consider themselves Catholic by interviewing a random sample of students. If he wants his 95% confidence interval to have a margin of error no larger than 5%, how many students must he interview?

Problem 9: (18 points) A company is willing to renew its contract with a local radio station only if the station can prove that more than 20% of the city’s residents have heard the advertisement and are familiar with the company. The radio station plans to conduct a random phone survey of 400 people.

Part a: What are the null and alternative hypotheses?

Part b: The station plans to conduct the test using $\alpha = 0.10$, but the company wants to use $\alpha = 0.05$. Why is this?

Part c: The company and the radio station agree to use $\alpha = 0.05$, but the company proposes that the station call 600 people rather than just 400. How will this change the chance of a Type II error?
Problem 10: (12 points) Women have heights that are normally distributed with mean 65 inches and standard deviation 4 inches, while men have heights that are normally distributed with mean 70 inches and standard deviation 4 inches. Suppose that one woman and one man are selected at random. What is the distribution of the difference between the man’s height and the woman’s height?

Problem 11: (16 points) An artist experimenting with using clay to create pottery has found that about 40% of pieces break. She hopes that a new, more expensive clay will fix the problem. She plans to make 3 test pieces with the new clay, and she will decide to use the new clay if none of the 3 pieces breaks.

Part a: Suppose that the new clay is no better than the old. What is the probability that she erroneously chooses to use the new clay? (Hint: Use the binomial model).

Part b: If the new clay can reduce breakage to only 10%, what is the probability that her test will correctly lead her to use the new clay?