Math 121 **Test #3** **Fall 2011**

1. (12 pts) Last month some people at Roanoke College conducted a poll[1] of 600 Virginians about their religious beliefs. Among their findings was that 94% of Virginians believe in God, 87% believe in heaven, and 80% believe in life after death. Also, 48% believe that their pets will join them in heaven. That is slightly less than half of the sample. Can we conclude that less than 50% of all Virginians believe that their pets will join them in heaven? Test this hypothesis at the 10% significance level.

2. (10 pts) Using the statistics of the previous problem,

   (a) (8 pts) Find a 95% confidence interval for the proportion of Virginians who believe that their pets will join them in heaven.

   (b) (2 pts) What is the margin of error in your estimate in part (a)?

3. (14 pts) Many young people are in debt, including many college graduates who need to pay off their student loans. If a person's debt exceeds the value of his possessions, then his net worth is less than \$0. Suppose that we take a survey of 25 young people (younger than 35) and find that their average net worth is \$3600, with a standard deviation of \$9500. Can we conclude that the average net worth of all young people is greater than \$0?

   (a) (2 pts) To test this hypothesis, should we use a z test or a t test? Explain. Include all relevant facts in your explanation.

   (b) (12 pts) Test the hypothesis at the 5% level of significance that the average net worth of young people is greater than \$0.

4. (14 pts) A report[2] recently published in the Journal of the American Medical Association states that women who consume three to six alcoholic beverages per week have a 15% greater risk of developing breast cancer than do women who do not consume alcohol. Inspired by these numbers, suppose we do our own study involving 1000 women who do not consume alcohol and 1000 women who consume three to six drinks per week. Years later, when the women are in their 50s, we find 24 cases of breast cancer in the first group and 40 cases in the second group. Test the hypothesis at the 5% level of significance that the incidence of breast cancer is higher among women who consume three to six drinks per week than it is among women who do not consume alcohol.

[1] http://www2.timesdispatch.com/news/2011/oct/24/tdmet01-god-important-to-virginians-poll-finds-ar-1404862/

[2] http://www.nlm.nih.gov/medlineplus/news/fullstory_118204.html

5. (9 pts) Find the following probabilities concerning t.

   (a) (3 pts) $P(t < 1.4)$ with 2 degrees of freedom.

   (b) (3 pts) $P(t < 1.4)$ with 10 degrees of freedom.

   (c) (3 pts) $P(-1 < t < 1)$ with 30 degrees of freedom.

6. (12 pts) In each of the following situations, tell whether there is only one sample, two dependent (paired) samples, or two independent samples.

   (a) (3 pts) Each spouse in 30 husband-wife pairs is asked his or her political affiliation.

   (b) (3 pts) Jim uses a rifle to take 50 shots at a target. The distances of his shots from the bull's eye are measured. Joe, using the same rifle, takes 50 shots at a similar target. The distances of his shots from the bull's eye are measured.

   (c) (3 pts) To test the calibration of thermometers, two thermometers are placed outdoors side by side. Each hour for 24 hours, technicians record the readings of both thermometers.

   (d) (3 pts) A coin is tossed 100 times, resulting in 45 heads and 55 tails.

7. (5 pts) Suppose that we conduct an opinion survey of 25 males and 40 females. We find that 12 of the males respond "yes" and that 26 of the females respond "yes" to the question. What is the pooled estimate for the overall proportion of people (males and females combined) who would respond "yes?"

8. (10 pts) Suppose that we gather data on the president's approval rating. Let p be the proportion of voters who approve of the president's performance. We compute a 95% confidence interval for p and get the interval $(0.34, 0.54)$.

   (a) (5 pts) What is the margin of error?

   (b) (5 pts) If we increased the confidence level to 99%, would the margin of error increase or would it decrease?

9. (14 pts) Suppose that we want to compare the health benefits or risks of living in two different parts of a city, where one part is near an industrial park and the other part is from from it. We take a random sample from each of the two areas. In the area near the industrial park, we study 60 residents and find that they visit the doctor an average of 6.4 times a year, with a standard deviation of 1.6 visits. In the area far from the industrial park, we study 40 residents and find that they visit the doctor an average of 5.2 times a year, with a standard deviation of 1.2 visits. Test the hypothesis at the 1% level of significance that people living near the industrial park visit the doctor more often than those living far from the industrial park.