**Elementary Statistics**

Name _____

Justify all answers by showing your work or by providing a coherent explanation. Please circle your answers

1. In some mining operations, a byproduct of the processing is mildly radioactive. Of prime concern is the possibility that release of these byproducts into the environment may contaminate the freshwater supply. There are strict regulations for the maximum allowable radioactivity in supplies of drinking water, namely an average of 5 picocuries per liter (pCi/L) or less. However, it is well known that even safe water has occasional hot spots that eventually get diluted, so samples of water are assumed safe unless there is evidence to the contrary. A random sample of 25 specimens of water from a city's water supply gave a mean of 5.39 pCi/L and a standard deviation of 0.87 pCi/L. The appropriate null and alternative hypotheses are:

    a. $H_0 : \mu = 5.39$ vs $H_a : \mu = 5.39$
    b. $H_0 : \mu = 5.39$ vs $H_a : \mu < 5.00$
    c. $H_0 : \mu = 5.$ vs $H_a : \mu = 5.39$
    d. $H_0 : \mu = 5$ vs $H_a : \mu < 5$
    e. $H_0 : \mu = 5$ vs $H_a : \mu > 5$

2. Resting pulse rate is an important measure of the fitness of a person's cardiovascular system with a lower rate indicative of greater fitness. The mean pulse rate for all adult males is approximately 72 beats per minute. A random sample of 25 male students currently enrolled in the School of Agriculture was selected and the mean pulse resting pulse rate was found to be 80 beats per minute with a standard deviation of 20 beats per minute. The experimenter wishes to test if the students are less fit, on average, than the general population. What is the minimum level of significance that would assure that the experimenter's claim is accepted?

    a. 1%   **b.** 2%   **c.** 5%   **d.** 10%   **e.** Not listed

3. A newspaper claims that the time of travel from downtown to the University via the Interstate bus has an average of $\mu = 27$ minutes. A student who normally takes this bus service believes that μ is greater than 27 minutes. A sample of six ride-times taken to test the hypothesis of interest gave $\bar{x} = 27.5$ minutes and the standard deviation $s = 243$ minutes. What is the minimum level of significance that would assure that the student's claim is accepted?

    a. 1%   **b.** 2%   **c.** 5%   **d.** 10%   **e.** Not listed

4. A large supermarket chain will increase its stock of bakery products if more than 20% of its customers are purchasers of bakery products. A random sample of 100 customers found 28% purchased bakery items. What is the minimum level of significance that would assure an increase of the chain's stock?

    a. 1%   **b.** 2%   **c.** 5%   **d.** 10%   **e.** Not listed
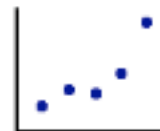
5. Consider the scatterplots on the right:
    Order the correlations associated with the first, second, and third scatterplots, respectively by size.
    (eg. $r_1 < r_2 < r_3$)
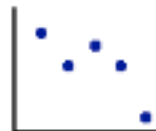
r_1 r_2 r_3

6. The time taken by a biological cell to divide is 30 minutes. The population standard deviation is 3.5 minutes. A sample of 16 cells placed in red light was observed to divide in an average time of 31.6 minutes. Did exposure to red light change the dividing time of the cells? Use $\alpha = 0.05$.

7. The label on a can of pineapple slices states the mean carbohydrate content per serving is over 50 grams. A random sample of 25 servings has a mean carbohydrate content of 52.3 grams with a standard deviation of $s = 4$ grams. Is the company correct in its claim?   Use $\alpha = 0.05$.

6. In a sample of 1200 college freshmen, the mean IQ is 112. If the mean IQ of the general population is 100 with a standard deviation of 15, can you reject the hypothesis that the mean IQ of college freshmen is no higher than that for the general population?   Use $\alpha = 0.05$.

9. From his experience a farmer knows that the mean yield of corn per acre on his farm is 150 bushels. When a new seed introduced on the market was tried on 16 randomly picked experimental 1-acre plots, the mean yield was 158 bushels. Suppose the yield per acre can be assumed to be normally distributed with a standard deviation of yield of 20 bushels. Is the new seed significantly better? Use $\alpha = 0.05$.

10. A drug company claims that more than 80 percent of the people given a vaccine will develop immunity to a disease. Of 160 randomly picked people who were given the vaccine, 140 developed immunity. On the basis of this evidence, is the claim of the drug company valid? Use $\alpha = 0.03$.