Names: _____

AP Stats Assignment 11.2 Type I and TYPE II Errors

1. What is a TYPE I error? When does it occur?

2. What is a TYPE II error? When does it occur?

3. What is the probability of a TYPE I error? Explain

4. What is the probability of a TYPE II error? Explain:

5. In order for a TYPE I error to exist, the Null Hypothesis must be TRUE or FALSE? Explain

6. What is POWER? Define it:

7. In order to find POWER, the Null Hypothesis must be TRUE or FALSE? Explain:

8. When finding POWER, do you use the significance level or the sample statistics for calculating it? Explain:

9. For each of the following scenarios,
   i) state the NULL and Alternative Hypothesis.
   ii) Indicate what a TYPE I and TYPE II errors are and also state the consequences of each error.
   iii) Also indicate which error is more serious.
   iv) Use your results from iii to determine whether if the significance level should be at 1%, 5%, or 10%. Justify your answer

   a) Retail stores in Metrotown will decrease their spending on security if the average cost of merchandise stolen each month is less than $500. From a cost perspective, some executives believe it is cheaper to let goods be stolen than commit to salary. A test will be taken to justify cutting security costs.

   b) The Burnaby municipality uses the average household size to determine the population one of its zones. Ie: Population = Number of Households x Average Household size. If the average household size is 4 or more, the city will inject $2.5 billion into the zone to build infrastructure.

   c) The Burnaby school district is planning to cancel the FLEX block if less than 5% of students are failing one of their academic courses. A sample of students will be taken to determine if FLEX blocks are needed.

   d) The ministry of transportation suggests investing $1 billion into training truck drivers in the province. Currently, there is an average of 5 reported truck driver related accidents on BC roads. The ministry believes there is more. A test will be performed if there are more accidents than reported.

10. You, an entrepreneur is planning on opening a restaurant at a location. From research, you know that the mean income of those living in that neighborhood must be over $85,000 to support type of upscale restaurant you wish to open. Taking a SRS of 50 people living near the location, you will use this data to determine if you should open your restaurant at this location. Given that $\sigma = \$5000$.
    a. State the appropriate null and alternative hypothesis. Define your parameters

    b. Describe the two types of errors that you might make. Identify which is a Type I error and which is a type II error.

    c. Indicate the consequences of each error. Which of these two types of error is more serious? Please explain

    d. If you had to choose one of the "standard" significance levels for your significance test, which value of α which you choose? [$\alpha = 0.01, 0.05, \text{ or } 0.10$] Please explain

    e. Based on your choice in part "d', if the mean income of residents in the area is $87,000, how likely are you to open a restaurant in that area ?

    f. What is the value of β ? What does it mean?

11. The Burnaby municipality uses the average household size to determine the population one of its zones. Ie: Population = Number of Households x Average Household size. If the average household size is 4 or more, the city will inject $2.5 billion into the zone to build infrastructure. A random sample of 300 household were selected and got an average of 3.5 with a standard devation 1.2. Perform a hypothesis test of 5%.
    a. State the appropriate null and alternative hypothesis. Define your parameters

    b. Find the P value and interpret the results

    c. Suppose the average household size was truly only 3.4. What is the probability of rejecting the NULL Hypothesis?

    d. What is the value of POWER?

12. The Burnaby school district is planning to continue the FLEX block if 5% or more of students are failing one of their academic courses. A random sample of 100 students will be taken in the district and 4% were failing at least one academic course.

a) State the appropriate null and alternative hypothesis. Define your parameters

b) Find the P value and interpret the results

c) Suppose the true percentage of students in the school district that were failing at least one academic course was only 3%, what is the probability of failing to reject the NULL Hypothesis?

d) What is the value of POWER?

13. Hospital administrators want to improve paramedic response times to within 8 minutes, so they started looking at the "***proportion***" of calls where paramedics arrived within 8minutes. Last year, paramedics arrived on the scene of an accident 75% of the time within 8 minutes. The city manager wants to determine whether they have done significantly better this year:
    a. State the appropriate null and alternative hypothesis for the hospital admins to test

    b. Describe a Type I and Type II error in this context

    c. Explain the consequences of each type of error

    d. Which is more serious? Type I error or Type II error. Justify your answer:

    e. Suppose you were in a life threatening injury from an accident and you need medical assistance as quickly as possible. Which of the two significance tests would you before useful to you? The one in part "a" of this question, or the following significance test: "$Ho: \mu = 8, \quad Ha: \mu < 8$". Please explain your answer:

14. A company that manufactures chairs claims that the mean breaking strength of the chairs they make is 300pounds. From years of production, they have seen that $\sigma = 15lbs$. One of the chairs collapsed beneath a 220 pound person several days ago. You wonder if the manufacturer is overstating the breaking strength of their chairs.
    a. State the Null and Alternative hypothesis in words and symbol (1point)

    b. Describe a Type 1error and a Type 2 error in this situation. Which is more serious?

    c. There are 30 chairs from this company. You decide to determine the breaking strength of each chair and then to find the mean of those values. What values of $\bar{x}$ would cause you to reject H_0 at the 5% significance level?

    d. If the truth is that $\mu = 290 pounds$, find the probability that you will make a type II error

    e. Explain two ways that you could improve the "power" of this test.