Names: _____

AP Stats Assignment 11.1 Hypothesis Testing:

1. What is the Null Hypothesis? What does it have to contain?

2. What is the Alternative Hypothesis? What does it have to contain?

3. What is a P-value? Explain

4. What is a significance level? Explain:

5. What does a significance level of 5% mean in context?

6. How is conditional probability used in stating the Null and Alternative Hypothesis?

7. State the NULL and Hypothesis for each of the following. Indicate whether if it will be "ONE" or "TWO" Tail. Write the hypothesis both in notation and in context:
   a) To test whether if the use of A.I. will increase productivity in company operations, every employee was given a mobile phone with access to a A.I. database. Employee productivity was measured in a scale from 1 to 15, with one being inefficient and 15 being at maximum efficiency. Before A.I. was introduced, the average efficiency for the company of 1200 employees was ranked at 10.4. A random sample of 45 employees were given the mobile phones with access to A.I. and their mean efficiencies was recorded after 6 months.

   b) Phentermine is a weight loss medication, where users begin to lose 5% of their weight after two months of use. Scientists want to test this claim by giving it to a random sample of 50 middle aged woman with a BMI of between 19 to 25. The average weight loss percentage of the sample were tallied after 2 months.

c) A tutoring company claims that students will increase their average mark by at least 15% after two months of tutoring. A random of 120 students that attended the tutoring center were selected. The percentage difference in mark were recorded.

d) Anabolic steroids are often used by athletes to increase muscle mass. One type of anabolic steroid claims to increase more than 7kg of muscles after 20 weeks of use for male athletes weighing between 150 to 170 lbs before use.

8. 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. 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? [$\alpha = 0.01, 0.05,$ or 0.10] Please explain

   e. Based on your choice in part "d', if the mean income 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?

9. 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: "$Ho: \mu = 8,\ \ Ha: \mu < 8$". Please explain your answer:

10. 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.