**Econ 103 – Quiz 5**

Name: ____________________

**Instructions:** This is closed-book, closed-notes quiz. Please write your answers in the blanks provided. Each question is worth one point but no partial credit will be awarded. Non-programmable calculators are permitted.

1. True or false: a Type I error is when you fail to reject a null that is false

   1. **false**

2. Steve wants to test the null hypothesis that freshman students weigh on average 170 pounds against the two-sided alternative. Write down the null hypothesis and alternative hypothesis, where $\mu$ is the true average weight in the population.

   2. $H_0: \mu = 170$, $H_A: \mu \neq 170$

3. Following on from the previous question, to test this hypothesis Steve gathered data on 9 students. We assume that the weights collected come from a normal distribution: $X_1 ... X_9 \sim iidN(\mu, \sigma^2)$. He calculates the sample mean weight, $\bar{X}$. We assume that he knows the variance $\sigma^2$. Write down an expression for an appropriate test statistic if he wants to test the null hypothesis $\mu = \mu_0$.

   3. $T_n = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{9}}$

4. Suppose you are testing $\mu = \mu_0$ when $X_1, ... X_n \sim N(\mu, \sigma^2)$. Which of the following will be our rejection criterion if we are testing against the two sided alternative hypothesis $\mu \neq \mu_0$ with a significance level of $\alpha$?

   1. $\left| \frac{\bar{X}_n - \mu_0}{\sigma/\sqrt{n}} \right| >$ qnorm$(1 - \alpha/2)$.
   2. $\frac{\bar{X}_n - \mu_0}{\sigma/\sqrt{n}} >$ qnorm$(\alpha)$.
   3. $\frac{\bar{X}_n - \mu_0}{\sigma/\sqrt{n}} <$ qnorm$(1 - \alpha)$.
   4. $\frac{\bar{X}_n - \mu_0}{\sigma/\sqrt{n}} >$ qnorm$(\alpha/2)$.

   4. 1

5. Which of the following is true about $p$ values?

   a. The $p$ value gives the probability that the null hypothesis is true.

   b. The $p$ value is the probability under the null hypothesis of observing a test statistic at least as aberrant as the one actually obtained.

   c. The $p$ value gives us reliable results in the sense that, if we could repeat the experiment a great number of times, we would obtain a significant results on $100p\%$ of those occasions.

   d. The $p$ value can be used to disprove the null hypothesis.

   5. **b.**

6. Suppose that we observe a sample proportion of $\widehat{p} = 0.6$ with a sample size of 100 and want to test $H_0: p = 0.5$ against the one-sided alternative that $p < 0.5$ at the 5% significance level. Calculate the value of the test statistic, fully imposing the null (i.e. using the value of $p$ from our null hypothesis wherever possible)?

   6. $SE(p) = \sqrt{\frac{p(1-p)}{n}}, T_n = (0.6 - 0.5)/(5/100) = 2$

7. Following on from the previous question, should we reject the null hypothesis?

7. ______________________ **no** ______________________

8. Kevin and Sara poll a random sample of 100 Penn Undergraduates to find out the proportion who prefer Coke to Pepsi. Unbeknownst to them, the true proportion is exactly 65%. Using the *exact same* dataset, both Kevin and Sara carry out two-sided hypothesis tests of the null hypothesis $H_0 : p = 0.5$. Whereas Sara uses a 5% significance level for her test, Kevin uses a 1% significance level. Whose test has more power?
A. Kevin's Test B. Sara's Test C. Both have Equal Power D. Not Enough Information to Determine

8. ______________________ **Sara's Test** ______________________