

# Assignment 5 Page 1

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1. Legalization of Marijuana. The 2010 General Social Survey asked 1,259 U.S. residents if they think Marijuana should be legalized. 48% of the respondents said it should be legal.

a. Is 48% a sample statistic or a population parameter?

**48% is a sample statistic because it describes a characteristic of a sample surveyed of the entire population**

b. Construct a 95% CI for the proportion and interpret.

$$\left( \hat{p} \pm z_{\alpha/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \right)$$
$$\left( 0.48 \pm z_{0.05/2} \sqrt{\frac{0.48(1-0.48)}{1259}} \right)$$

$$(0.48 \pm (1.96 * 0.0141))$$

$$(0.48 \pm 0.0276)$$

$$(0.452, 0.508)$$

**Therefore, we are 95% confident that the proportion of U.S. Residents surveyed lies between 45.2% and 50.8%**

c. A news piece on this survey's findings states "majority of Americans think marijuana should be legalized." Based on your CI, is this news piece statement justified?

**Yes, technically, because we are only 95% confident of the actual proportion understood from the responses. It is equally likely that any proportion from 45.2% - 50.8% voted in favor of legalizing marijuana. 50.8% is over half and therefore the article title is accurate.**

2. Among a simple random sample of 331 American adults who do not have a four-year college degree and are not currently enrolled in school, 48% said they decided not to go to college because they could not afford to go to school. A news article states that only a majority of the Americans that decide not to go to college decide to do so because they cannot afford it and uses the point estimate from the survey as evidence. Conduct a hypothesis test to determine if these data provide strong evidence supporting this statement.

a. What are the hypotheses for evaluating this test?

$$H_0: p = 0.5$$

$$H_a: p < 0.5$$

b. The test statistic is?

$$z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$
$$z = \frac{0.48 - 0.50}{\sqrt{\frac{0.50(1-0.50)}{331}}}$$
$$z = -0.73$$

c. Based on the p-value for this test, what is the conclusion?

$$P\text{-value} = P(z < -0.73)$$

$$\text{Using excel, = Normsdist } (-0.73) \\ = 0.2327$$

d. Would you expect a confidence interval for the proportion of American adults who decide not to go to college because they cannot afford it to include 0.5?

**Yes, 0.48 is close enough to 0.5 that a 95% CI probably includes it.**

e. Calculate a 90% CI for the proportion if Americans who decide to not go to college because they cannot afford it, and interpret the interval.

**The data does not provide sufficient evidence to claim that only a minority of Americans who choose not to go to college do so because they cannot afford it.**

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3. The Stanford University Heart Transplant Study was conducted to determine whether an experimental heart transplant program increased lifespan. Each patient entering the program was officially designated a heart transplant candidate, meaning that he was gravely ill and might benefit from a new heart. Patients were randomly assigned into a treatment and control groups. Patients in the treatment group received a transplant and those in the control group did not. The table below displays how many patients survived and died in each group.

	Control	Treatment
Alive	4	24
Dead	30	45

Explain why we cannot construct a confidence interval or a hypothesis test

**You can't make a normal approximation because the typical assumptions for normal approximation aren't being met**

4. A 30-year study was conducted with nearly 90,000 female participants.8 During a 5-year screening period, each woman was randomized to one of two groups: in the first group, women received regular mammograms to screen for breast cancer, and in the second group, women received regular non-mammogram breast cancer exams. No intervention was made during the following 25 years of the study, and we'll consider death resulting from breast cancer over the full 30-year period. Results from the study are summarized in the table. If mammograms are much more effective than non-mammogram breast cancer exams, then we would expect to see additional deaths from breast cancer in the control group. On the other hand, if mammograms are not as effective as regular breast cancer exams, we would expect to see an increase in breast cancer deaths in the mammogram group.

- a. Is this study an experiment or an observational study?

**This study is an experiment study**

- b. Set up hypotheses to test whether there was a difference in breast cancer deaths in the mammogram and control groups

**$H_0$ : Mamm == Control**

**$H_a$ : Mamm  $\neq$  Control**