POLI 30 Review Session Answers

1. The average American spends 42 hours a year waiting in traffic. If this mean statistic was based on a survey of 1000 Americans with a standard deviation of 10 hours, what is the margin of error?

Formula: Margin of error for a mean

Answer: 0.632 hours

Interpretation: We can be 95% sure that the true value is within 0.632 hours of the sample mean. (Or we can be 95% sure that the true value is within 0.632 hours of 42.)

2. A 2010 PEW Research Center poll surveyed 1000 Americans and found that only 15% of people could accurately estimate the inflation rate. What is the 95% confidence interval?

Formula: Confidence interval for a proportion

Answer (0.13, 0.17) or (13%, 17%)

Interpretation: We can be 95% sure that the true percentage of Americans that could answer correctly is between 13% and 17%.

3. The poll also collected information on whether the Americans they surveyed had taken an economics class in college. They want to now if Americans that took economics know more about inflation. Is the difference significant? Can we state with 95% confidence that Americans who take economics classes are more likely to answer the question correctly?

	Correct	Incorrect	
Took economics	100	200	300
Didn't take economics	50	650	700

Null hypothesis: There is no difference between the proportion of people with an economics class who answered correctly and the proportion of people without an economics class who answered correctly. ($p_{economics\ class} - p_{no\ economics\ class} = 0$)
Formula: Confidence interval for the difference of proportions

Answer: (0.2, 0.32) or (20%, 32%)

Interpretation: We can be 95% sure that the true difference in knowledge of inflation between people with and without an economics class is between 20% and 32%. This number does not cross zero, so I can also reject my null hypothesis and conclude that there is a significant difference between people with and without economics experience.

4. I'm interested in the relationship between campaign spending and vote share. I hypothesize that candidates who spend more during their campaigns are more likely to win votes. To test this hypothesis, I run a regression where the dependent variable is vote share (% of total vote) and the independent variable is campaign spending (in million of $). The output provides me with a

regression coefficient for campaign spending and the intercept. It also provides me with the confidence intervals for both variables.

What is the null hypothesis for the significance of the regression coefficient for campaign spending? The intercept is equal to 0 (a=0).

Answer: Coefficient = 12.8 and Confidence Interval=(-13, 28.6)

Interpretation: If campaign spending was 0, a candidate would win 12.8% of the vote. However, because the confidence interval crosses 0, I fail to reject the null hypothesis. I cannot conclude that the null hypothesis is different from 0.

What is the null hypothesis for the significance of the regression coefficient for the intercept? The regression coefficient for campaign spending is equal to 0 (b=0).

Answer: Coefficient = 0.03 and Confidence Interval=(0.0285, 0.0315)

Interpretation. A one million dollar increase in campaign spending, leads to a 0.03% increase in a candidate's vote share. Because the confidence interval does not cross 0, I can reject the null hypothesis. There is a significant and positive relationship between campaign spending and vote share.

5. Opensecrets.com surveyed 5000 Americans and found that only 0.5% of Americans donates more than $200 to a federal candidate, political action committee or party. What is the margin of error for the percentage of Americans who donate to political campaigns?

Formula: Margin of error for a proportion

Answer: 0.002 (or 0.2%)

Interpretation: We can be 95% sure that the true value is within 0.2% of the sample proportion. (Or we can be 95% certain that the true value is within 0.2% of 0.5%).

6. In 2017, the US Census Bureau concluded that mean credit card debt for people living in Alabama was $6000. The mean credit card debt for people living in California was $9000. They surveyed 450 Alabamians, with a standard deviation of $1600. They surveyed 700 Californians with a standard deviation of $2200. Is the difference between Alabama and California significant? Can we state with 95% confidence that Californians hold more debt?

Null hypothesis: There is no difference in credit card debt between Alabamians and Californians

Formula: Confidence interval for a difference in means

Answer: (2775.47, 3224.53)

Interpretation: We can be 95% sure that the true difference in the credit card debt between Californians and Alabamians is between $2275.47 and $3224.53. Because this confidence interval does not cross 0, I can also reject the null. There is a significant difference between Californians and Alabamians.

7. I collect data on students who participate in political protests on college campuses. I hypothesize that protest participation depends on academic major. The table below shows the number of students who protested and didn't protest in each major. Is protest participation independent of academic major?

	Political Science	Sociology	Biology	Computer Science	Total
Protested	10	15	5	0	30
Did Not Protest	5	5	30	30	70
Total	15	20	35	30	100

Null hypothesis: Protest participation is independent of academic major. There is no relationship between academic major and protest participation.

Type of test: Chi Square

Formula: Chi Square formula

Calculate Expected Counts:

	Political Science	Sociology	Biology	Computer Science	Total
Protested	(30*15)/100 = 4.5	(30*20)/100 = 6	(30*35)/100 = 10.5	(30*30)/100 = 9	30
Did Not Protest	(70*15)/100 = 10.5	(70*20)/100 = 14	(70*35)/100 = 24.5	(70*30)/100 = 21	70
Total	15	20	35	30	100

(observed - expected)^2/expected

	Political Science	Sociology	Biology	Computer Science	Total
Protested	(10.5-4.5)^2/4.5 = 8	(15-6)^2/6 = 13.5	(5-10.5)^2/10.5 = 2.88	(0-9)^2/9 = 9	30
Did Not Protest	(5-10.5)^2/10.5 = 2.88	(5-14)^2/14 = 5.79	(30-24.5)^2/24.5 = 1.23	(30-21)^2/21 = 3.86	70
Total	15	20	35	30	100

Add up: 8+13.5+2.88+9+2.88+5.79+1.23+3.86 = 47.14

Degrees of Freedom: (rows-1)*(columns-1) → (2-1)*(4-1) → 1*3 = 3
Threshold: 7.81 → 47.14 > 7.81, therefore we reject the null hypothesis.

Interpretation: We are 95% confident that there is a relationship between academic major and protest participation. Protest participation does not vary between academic majors.