

STA 111 Practice Problems

1 2020 Election

A recent sample of 1,500 registered voters found that 53.5% are planning on voting for the Democratic party candidate in the upcoming 2020 Presidential election. Does this suggest that a majority of registered voters are planning to vote Democratic?

- 1.1. State H_o and H_a .
- 1.2. Calculate the test statistic.
- 1.3. Find the p -value.
- 1.4. Provide a concise, one-sentence interpretation of your decision in the context of the problem.

2 Body Temperature

You are interested in the claim that the mean body temperature of adults is 98.6°F. You take a sample of 25 individuals and obtain a sample mean of 98.4°F and a sample standard deviation of 0.30°F. Does this data indicate that average body temperature in the population differs from 98.6°F?

- 2.1. State H_o and H_a .
- 2.2. Calculate the test statistic.
- 2.3. Find the p -value.
- 2.4. Provide a concise, one-sentence interpretation of your decision in the context of the problem.

3 Party and Political Affiliation:

The table below contains data from the 2000 General Social Survey. Sex and political party affiliation are cross-classified and you would like to test for independence of sex and party affiliation.

	Political Affiliation			Total
	Democrat	Independent	Republican	
Female	762	327	468	1,557
Male	484	239	477	1,200
Total	1,246	566	945	2,757

- 3.1. What is the expected count of Republican males under the null hypothesis of independence? *Show your work.*
- 3.2. What is the contribution of the Republican male cell to the test statistic? *Show your work.*
- 3.3. What is the distribution of the test statistic?
- 3.4. Suppose $ts = 30.1$. What is your significance probability and statistical decision?

4 Direction of Country

Economist / YouGov surveyed 1,115 U.S. adult citizens between November 3 and November 5, 2019. They asked “Would you say things in this country today are generally headed in the right direction, or are they off on the wrong track?” and also asked the respondent to report their family income. The table below gives a cross-classification of the answers to these two questions. Use the χ^2 test to test the null hypothesis that family income is independent of opinion about the direction of the country.

	Family Income			Total
	<\$50K	\$50 - 100K	\$100K+	
Right Direction	183	156	130	469
Wrong Direction	360	181	105	646
Total	543	337	235	1,115

- 4.1. In a brief paragraph, comment on the relationship in the table above, reporting numerical summaries when appropriate. What is going on here?
- 4.2. State the appropriate null and alternative hypotheses.
- 4.3. Construct the table of expected cell counts assuming the null hypothesis of independence.
- 4.4. Calculate the χ^2 test statistic.
- 4.5. Report the degrees of freedom.
- 4.6. Report your p -value and a conclusion in the context of the problem.
- 4.7. What are possible limitations of this analysis and the χ^2 test of independence in the context of this problem?

5 Die

You are interested in determining if a dice is fair. You roll the dice 1,000 times and record the data below. Are these data consistent with the model of a fair dice?

	1	2	3	4	5	6
Observed	171	161	180	149	177	162

- 5.1. What are your null and alternative hypotheses?
- 5.2. What is the value of your test statistic?
- 5.3. What distribution does your test statistic follow?
- 5.4. What is your significance probability?
- 5.5. Provide a concise, one-sentence conclusion in the context of the problem.

6 College Marijuana Use

In the two-way table below, 445 college students were classified according to their marijuana use (Never, Occasional, Regular) and the parental use of alcohol and psychoactive drugs. Does the data suggest that parental drug use and student drug use are independent? Conduct the appropriate test at $\alpha = 0.05$.

	Student Level of Marijuana Use			Total
	Never	Occasional	Regular	
Neither Parent	141	54	40	235
One Parent	68	44	51	163
Both Parents	17	11	19	47
Total	226	109	110	445

- 6.1. State the appropriate test.
- 6.2. Write out the null and alternative hypotheses.
 - H_o :
 - H_a :
- 6.3. What is the expected count in the “Neither Parent” and “Occasional” cell?

- 6.4. What is the contribution of the “Neither Parent” and “Occasional” cell to the χ^2 test statistic? Write out the appropriate expression.
- 6.5. What are the degrees of freedom?
- 6.6. Suppose $ts = 22.4$. Use the provided χ^2 table to estimate the p -value. State your statistical decision and a conclusion in the context of the problem.

7 TRUE or FALSE

- 7.1. p -values can indicate how incompatible the data are with some specified model.
- 7.2. The p -value is a probability.
- 7.3. A p -value of 0.05 means the null hypothesis has a 5% chance of being true.
- 7.4. Policymakers should base their decisions based only on whether the p -value passes a specific threshold.
- 7.5. A p -value measures the size of an effect.
- 7.6. The p -value is calculated assuming H_A is true.
- 7.7. p -values and related analyses can be reported selectively.
- 7.8. The smaller the p -value, the stronger the evidence against H_o .
- 7.9. The p -value is the probability of obtaining data that is as or more supportive of the alternative hypothesis than the data that we observed, when the null hypothesis is correct.
- 7.10. A nonsignificant difference (p -value > 0.05) means there is no difference between groups.
- 7.11. A p -value > 0.05 means that the probability is greater than 1 in 20 that a difference this large could occur by chance alone.
- 7.12. We reject H_o if the significance probability is less than α .
- 7.13. A p -value < 0.05 means that we have a relationship of practical importance.
- 7.14. Proper inference requires full reporting and transparency.
- 7.15. The smaller the p -value, the greater the statistical incompatibility of the data with the null hypothesis (assuming the underlying assumptions used to calculate the p -value hold).
- 7.16. Smaller p -values imply the presence of larger or more important effects.
- 7.17. A p -value of 0.05 means the null hypothesis has a 5% chance of being false.