Statistical Reasoning
Hypothesis Tests

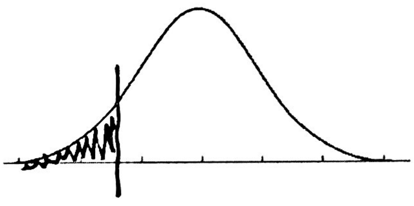
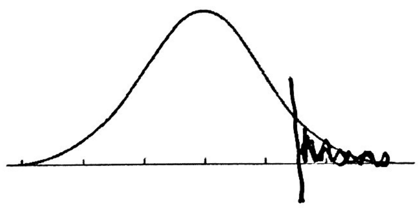
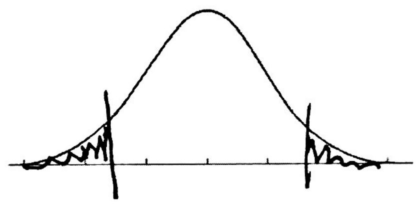
Name: Date: Class:

Hypothesis Tests: Decision Rules and Conclusions

The decision rule, for a hypothesis test, is a statement that tells under what circumstances to reject the null hypothesis. The decision rule depends on 3 factors: the test type, the significance level, and the p-value.

1. The decision rule depends on whether the alternative hypothesis takes the form of a lower-tail test (<), upper-tail test (>), or two-tail test (≠). A hypothesis test might state that the parameter (μ) has decreased (<), increased (>), or changed (≠).

The following figures illustrate the rejection regions defined by the decision rule for upper-, lower- and two-tailed tests with α=0.05. Notice that the rejection regions are in the upper, lower and both tails of the curves, respectively.

Lower-tailed test (<)	Upper-tailed test (>)	Two-tailed test (≠)
Where a "decrease" is hypothesized	Where an "increase" is hypothesized	Where a "change" is hypothesized
		

2. The p-value is also important in determining the decision rule. The p-value, or probability value, is the probability of finding the observed results more extreme than actual value A hypothesis test is be based on the standard normal distribution, so the p-value is the probability found using the standard score (z-score).

3. The third factor is the level of significance (in Step 1 α =0.05) dictates the critical value for which to reject Ho. Typically, significance levels are either .10 (10%), .05 (5%), or .01 (1%). The level of significance is sometimes called the alpha level and often denoted by the Greek symbol "α" ("alpha").

Lower-tailed test (<)	Upper-tailed test (>)	Two-tailed test (≠)
$H_o: \mu = x$ $H_a: \mu < x$	$H_o: \mu = x$ $H_a: \mu > x$	$H_o: \mu = x$ $H_a: \mu \neq x$
In a lower-tailed test the decision rule has investigators reject H_0 if the test statistic is ______ than the critical value.	**In an upper-tailed test the decision rule has investigators reject H_0 if the test statistic is ______ than the critical value**	**In a two-tailed test the decision rule has investigators reject H_0 if the test statistic is extreme, either ______ than an upper critical value or ______ than a lower critical value.**

A. The average grade for a statistics exam was a 75. Use the significance level to create a decision rule for each alternative hypotheses. Use the p-value to conclude if there is enough evidence to **reject the null hypothesis** (or **fail to reject the null hypothesis**).

Lower tail

HYPOTHESES	SIGNIFICANCE LEVEL (α-level)	DECISION RULE	P-VALUE	CONCLUSION
Ho: μ = 75 Ha: μ < 75	α = 0.05	Reject Ho if $p < 0.05$	P-value = 0.0327	Reject Ho
Ho: μ = 75 Ha: μ < 75	α = 0.05	↓	P-value = 0.0501	Fail to Reject Ho

Upper tail

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
Ho: μ = 75 Ha: μ > 75	α = 0.05	Reject Ho if $p < 0.05$	P-value = 0.0718	Fail to Reject Ho
Ho: μ = 75 Ha: μ > 75	α = 0.05	↓	P-value = 0.0230	Reject Ho

Two tail

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
Ho: μ = 75 Ha: μ ≠ 75	α = 0.05	Reject Ho if $p < 0.05$	P-value = 0.0078	Reject Ho
Ho: μ = 75 Ha: μ ≠ 75	α = 0.05	↓	P-value = 0.0318	Reject Ho
Ho: μ = 75 Ha: μ ≠ 75	α = 0.05	↓	P-value = 0.0701	
Ho: μ = 75 Ha: μ ≠ 75	α = 0.05	↓	P-value = 0.1062	

B. The average cell phone plan, for North Cobb students, is said to be $35. You just started paying for your own cell phone plan and think that the true average is much higher. Use a significance level of 10% to find the following information:

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
Ho: μ = $35 Ha: μ > $35	α = 0.10	Reject Ho if $p < 0.10$	P-value = 0.0322	Reject Ho

C. The average hourly wage of 100 randomly sampled North Cobb seniors, is said to be $8.50. Your job is only paying you $7.25 and believe the true mean is much lower. Use a significance level of 1% to find the following information:

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
Ho: μ = 8.50 Ha: μ < 8.50	α = 0.01	Reject Ho if $p < 0.01$	P-value = 0.0086	Reject Ho

D. The daily mean of hot fries sold in North Cobb's vending machines is claimed to be 235. One friend believes the true mean to be much higher and another believes it is actually much lower. Use a significance level of 5% to find the following information:

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
Ho: μ = 235 Ha: μ ≠ 235	α = 0.05	Reject Ho if $p < 0.05$	P-value = 0.9702	Fail to Reject Ho