

**Statistical Reasoning
Hypothesis Tests**

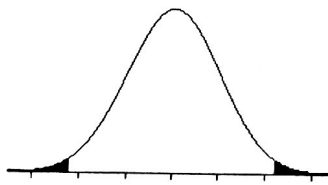
Name: _____ Date: _____ Class: _____

Hypothesis Tests: Decision Rules and Conclusions Practice

1. A significance test looks for evidence to reject the NULL hypothesis and in favor of the alternative hypothesis.
2. The p-value is the calculated probability that we would see a sample outcome as extreme (or more extreme) if the actual observed outcome of the NULL hypothesis was true.
3. Sometimes, before we do a significance test, we determine just how much evidence against H_0 that we will insist on. The decisive P-value is called the significant level and is represented by the Greek letter α .
4. If $H_0: p = 0.5$ and $H_a: p > 0.5$, then the significance test will be right-tailed. (right/left/two)
5. If $H_0: p = 0.5$ and $H_a: p \neq 0.5$, then the significance test will be two-tailed. (right/left/two)
6. If $H_0: p = 0.5$ and $H_a: p < 0.5$, then the significance test will be left-tailed. (right/left/two)
7. For each of the following situations, determine if we have no evidence, some evidence, moderate evidence, or strong evidence against H_0 .

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
$H_0: \mu = 0.5$ $H_a: \mu > 0.5$	$\alpha = 0.05$	Reject H_0 if $p < 0.05$	P-value = 0.0325	Reject H_0
$H_0: \mu = 0.5$ $H_a: \mu > 0.5$	$\alpha = 0.01$	Reject H_0 if $p < 0.01$	P-value = 0.0325	Fail to Reject H_0
$H_0: \mu = 0.5$ $H_a: \mu > 0.5$	$\alpha = 0.01$	Reject H_0 if $p < 0.01$	P-value = 0.00325	Reject H_0

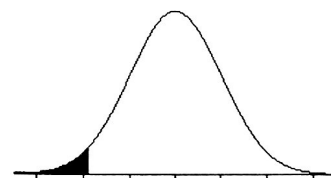
8. For each of the following, $p = 0.5$, $n = 100$. For all graphs, the P-value is the same. Which graph corresponds to each set of hypotheses?



$H_a: \dots \mathbf{C} \dots$



$H_a: \dots \mathbf{A} \dots$



$H_a: \dots \mathbf{B} \dots$

- a. $H_0: \mu = 0.5, H_a: \mu > 0.5$ b. $H_0: \mu = 0.5, H_a: \mu < 0.5$ c. $H_0: \mu = 0.5, H_a: \mu \neq 0.5$

9. The claim being tested in a significance test is the NULL hypothesis. (null/alternative)

10. Hypotheses for significance tests must always be expressed in terms of the parameter (parameter - μ / statistic - \bar{x})

11. Which of these could NOT be possible hypotheses for a significance test?

a. $H_0: \mu = 0.5$
 $H_a: \mu > 0.5$

b. $H_0: \mu < 0.5$
 $H_a: \mu \geq 0.5$

c. $H_0: \mu = 0.5$
 $H_a: \mu > 0.5$

d. $H_0: \mu = 0.5$
 $H_a: \mu > 0.5$

12. Which of these could be possible hypotheses for a significance test?

a. $H_0: \mu > 0.3$
 $H_a: \mu < 0.3$

b. $H_0: \mu = 0.3$
 $H_a: \mu \neq 0.3$

c. $H_0: \mu = 0.3$
 $H_a: \mu > 0.3$

d. $H_0: \mu \neq 0.3$
 $H_a: \mu = 0.3$

For #14 – 17, write the null and alternative hypotheses for each problem.

13. According to M&M/Mars Company, 20% of all Plain M&M's produced are orange. You buy or large 56 oz bag of Plain M&M's and find that it contains 355 orange M&M's out of a total of 1,8 M&Ms. Do we have evidence that the company is lying about the proportion of orange M&M's?

$H_0: P_{orange} = 20\%$ $H_a: P_{orange} \neq 20\%$

14. You've been using the Random Digit Table all year, but one day you decide to check out its randomness. You count the number of times the digit "9" occurs in the last four rows of the table and find that there only 12 "9"s in the last 160 digits. You suspect that the table is flawed by having fewer "9"s than it should and decide to do a significance test.

$H_0: \dots\dots\dots H_a: \dots\dots\dots$

15. The White House press secretary comments that the president currently has a 72% favorable job approval rating. A pollster challenges this claim as being too high. His polling service has just conducted a random survey of 1000 people (calling both landline and cell phone numbers) and 660 people gave the president a favorable job approval rating. Do we have reason to doubt the press secretary?

$H_0: p = 72\%$ $H_a: p < 72\%$

16. A 2009 nationwide random survey of 1500 adults asked the open-ended question, "What do you think is the most important problem facing this country today?" Sixty-nine percent responded with some form of economic problems (such as economy in general, unemployment/jobs, etc). Do these data provide good evidence that more than 2/3 of all adults believe that economic problems is the most important problem facing this country today?

$H_0: p = 2/3$ $H_a: p > 2/3$

17. The college bookstore tells prospective students that the average cost of its textbooks is \$52. A group of your friends who graduate last year, laughed at that figure and assured you they believed the true mean cost was much higher. Use a critical value of 5% to find the following information:

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
$H_0: \mu = 52$ $H_a: \mu > 52$	$\alpha = 0.05$	Reject H_0 if $p < 0.05$	P-value = 0.9512	Fail to Reject H_0

18. A certain chemical pollutant in the Genesee River has been constant for several years with

representatives whose companies discharge liquids into the river is now claiming that they have lowered the average with improved filtration devices. Use a 10% level of significance to find the following information:

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
$H_0: \mu = 31 \text{ ppm}$ $H_a: \mu < 31 \text{ ppm}$	$\alpha = 0.1$	Reject H_0 if $p < 0.1$	P-value = 0.0512	Reject H_0

19. A manufacturer, who produces skateboard ball bearings, states that their mean diameter is 0.50 cm with a standard deviation of .04 centimeters. Ball bearings with diameters that are too small or too large cause malfunctions. In order to test a batch, a simple random sample of 125 ball bearings were measured. Use a 5% level of significance to test the claimed. Assume that a mean diameter of 0.51 centimeters. Perform a hypothesis test and state your decision.

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
$H_0: \mu = 0.50 \text{ cm}$ $H_a: \mu \neq 0.50 \text{ cm}$	$\alpha = 0.05$	Reject H_0 if $p < 0.025$	P-value = 0.04812	Fail to Reject H_0

20. The mean yield of corn in the United States is about 120 bushels per acre. A survey of a SRS of 50 farmers selected from the population of all commercial corn growers this year gave a sample mean yield of slightly higher than the claim. Is there evidence at the 1% level of significance that the true population mean is more than 120 bushels/acre?

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
$H_0: \mu = 120 \text{ bushels}$ $H_a: \mu > 120 \text{ bushels}$	$\alpha = 0.01$	Reject H_0 if $p < 0.01$	P-value = 0.0085	Reject H_0

21. If a die is fair, then the number 5 should occur 1/6 (16.7%) of the time. You have a die that you suspect is loaded so that the number 5 lands face up more often than expected. You roll the die 200 times and get 45 5's. Do we have evidence that the die is unfair (i.e. loaded) at a 5% level of significance?

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
$H_0: p = 1/6$ $H_a: p > 1/6$	$\alpha = 0.05$	Reject H_0 if $p < 0.05$	P-value = 0.09812	Fail to Reject H_0

22. McDonald's Szechuan sauce is a discontinued condiment, but McDonald's executives agree to bring back the sauce if there is enough public interest. In a survey's results, McDonalds claimed that they found that only 31% of the people who participated in a blind taste test gave favorable reviews. You believe that the data is inaccurate and that the true percentage is much higher? Is there enough evidence that more people want the Szechuan sauce returned to the menu? Use a 5% level of significance.

HYPOTHESES	SIGNIFICANCE LEVEL	DECISION RULE	P-VALUE	CONCLUSION
$H_0: p = 31\%$ $H_a: p > 31\%$	$\alpha = 0.05$	Reject H_0 if $p < 0.05$	P-value = 0.9456	Fail to Reject H_0