AP Statistics
Mr. Murphy
10.2 Single Sample Hypothesis Tests for a Population Proportion

HW Pg. 600 # 10.25, 10.27, 10.34, 10.40, 10.41

Goal: 1. Conduct a test of significance for a population proportion.

This section introduces the specifics of **Hypothesis Testing**.

Single Sample z Test for p

Null Hypothesis: $H_0 : p = \text{hypothesized value}$

Test Statistic:
$$z = \frac{\hat{p} - \text{hypothesized value}}{\sqrt{\frac{(\text{hypothesized value})(1 - \text{hypothesized value})}{n}}}$$

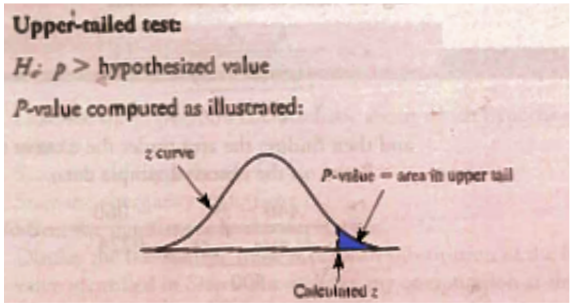
Alternate Hypothesis:	***P* – value:**
$H_a : p > \text{hypothesized value}$	Area under z curve to right of calculated z
$H_a : p < \text{hypothesized value}$	Area under z curve to left of calculated z
$H_a : p \neq \text{hypothesized value}$	(1) 2(area to right of z) if z is positive, or (2) 2(area to left of z) if z is negative

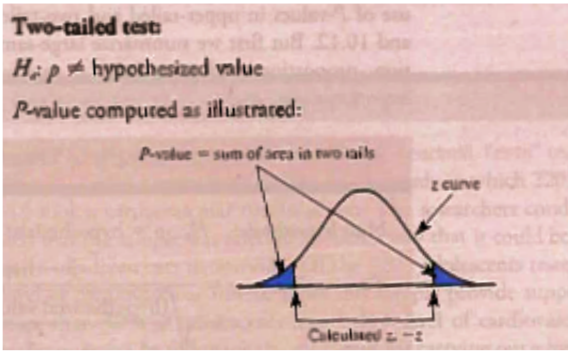
Assumptions:

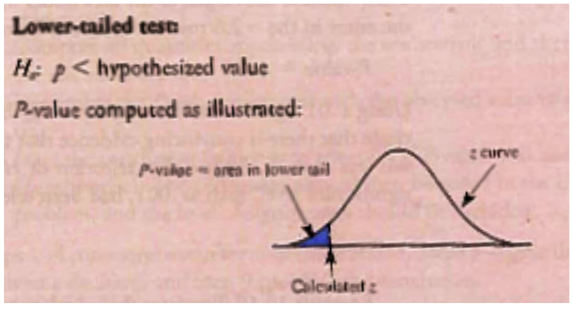
1. The sample proportion is from a **random sample** or **sample represents population**.

2. $np \geq 10$ and $n(1-p) \geq 10$ (for Normality)

3. The sample size is no more than 10% of the population size (SSSRTP).







STEPS IN HYPOTHESIS TESTING

1. Define the population characteristic (i.e. parameter) about which hypotheses are to be tested.

2. State the null hypothesis H_0.

3. State the alternative hypothesis H_a.

4. State the significance level α for the test.

5. Check all assumptions.

6. State the name of the test.

7. State **df** if applicable (not applicable in proportion land).

8. Display the test statistic to be used without any computation at this point.

9. Compute the value of the test statistic, showing specific numbers used.

10. Calculate the *P* – value.

11. Sketch a picture of the situation.

12. State the conclusion in two sentences -

    A. Summarize in theory discussing H_0.

    B. Summarize in context discussing H_a.

These 12 steps will be given to you throughout Chapter 10.
You must have these steps memorized by Chapter 11.

Ex1 The article “Credit Cards and College Students: Who Pays, Who Benefits?” described a study of credit card payment practices of college students. According to the authors of the article, the credit card industry asserts that at most 50% of college students carry a balance from month to month. However, the authors of the article report that, in a random sample of 310 college students, 217 carried a balance each month. Does this sample provide sufficient evidence to reject the industry claim? We will answer this question by carrying out a hypothesis test using a 0.05 significance level.

Ex2 Owners of a very large lake recently stocked the lake with bass and proudly proclaimed that 80% of the bass caught in the lake meet the required 15-inch minimum length (smaller fish must be thrown back). At the lake, 10 fishermen caught 51 bass, of which they were allowed to keep 27.

(a) Do the fishermen have evidence to show that the lake's proportion of bass that meet the required 15-inch minimum length is different from the owners' claim?
(b) Find a 95% confidence interval for the proportion of bass that meet the required 15-inch minimum length.
(c) Use your confidence interval to justify your decision in part (a).

Checkpoint
Multiple Choice

Questions #1-3: A major videocassette rental chain is considering opening a new store in an area that currently does not have any such stores. The chain will open if there is evidence that more than 5,000 of the 20,000 households in the area are equipped with videocassette recorders (VCRs). It conducts a telephone poll of 300 randomly selected households in the area and finds that 96 have VCRs.

1. State the test of interest to the rental chain:

(a) $H_0: \ p = 0.32$, $H_a: \ p > 0.32$

(b) $H_0: \ \mu = 5000$, $H_a: \ \mu > 5000$

(c) $H_0: \ p = 5000$, $H_a: \ p > 5000$

(d) $H_0: \ p = 0.25$, $H_a: \ p > 0.25$

(e) $H_0: \ \mu = 0.25$, $H_a: \ \mu > 0.25$

2. The P-value associated with the test statistic in this problem is approximately equal to

(a) 0.0026
(b) 0.0013
(c) 0.0051
(d) 0.1000
(e) 0.0125

3. The decision on the hypothesis test using a 3% level of significance is

(a) no decision should be made
(b) to reject H_0
(c) to fail to reject H_0
(d) to accept H_0
(e) to accept H_a

4. A *P*-value tells you:

(a) The probability that your results are statistically significant.
(b) The probability that your sample mean is equal to the population mean.
(c) The probability that you'd get results as extreme as you did, from random variation alone.
(d) The significance level.
(e) Whether to use a binomial, normal, or geometric distribution.

Free Response

The Public Policy Institute of California reported that 71% of people nationwide prefer to live in a single-family home. To determine whether the preferences of Californians are consistent with this nationwide figure, a random sample of 2002 Californians were interviewed. Of those, 1682 said they consider a single-family home the ideal. Can we reasonably conclude that the proportion of Californians who prefer a single-family home is different from the national figure? We will answer this question by carrying out a hypothesis test with $\alpha = 0.01$.