After completing this material, you should be able to:

- conduct a test of hypothesis about p using the appropriate format.

- state when it is valid to use this procedure.

- define Type I and Type II errors in terms of the problem.

- discuss the consequences of these errors.

What is a hypothesis test?

Steps in a Hypothesis Test

Step 1: State the hypotheses to be tested.

Step 2: Set the significance level for the test.

Step 3: Calculate the test statistic and p-value based upon the sample collected.

Step 4: Make a decision and interpret the results.

Notation Alert!!

Null hypothesis:

Alternative hypothesis:

Significance level:

Formula Alert!!

This formula will be given on the formula sheet.
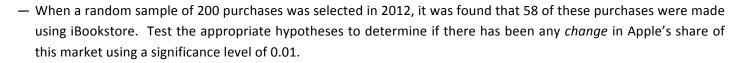
Example 1: According to a 2014 report, 38% of all US teenagers (ages 13 – 17) report regularly using Snapchat. A social scientist believes this percentage has likely increased. To investigate the claim, a simple random sample of teenagers is taken from the United States Postal Service's database of addresses. Any selected household that contained a teenager who was willing to participate in the survey was included in the sample. The sample resulted in 1,066 teenagers of which 438 reported regularly using Snapchat. Use the sample to test the analyst's conjecture at a significance level of 0.10.

What variable was recorded? Is this variable categorical or quantitative?

Step 1	

Step 2	

Step 3	

Step 4	

In order for the inference to be valid, what assumptions must be satisfied?

Example 2: In 2013, 18% of all Kentucky adults were uninsured. With the passing of the Affordable Healthcare Act, one believes that this percentage should decrease. To test this theory, a random sample of 700 KY adults is taken from driver's license records. It is found that 109 are uninsured. Use this sample to test the appropriate claim using a significance level of 0.05.

What type of sample was taken? Would you feel comfortable generalizing the results of this survey to the entire population of US adults?

Example 3: In 2011, Apple claimed that its online bookstore iBookstore had captured a 22% share of the US e-book market. To determine if there has been any fluctuation in the market, an analyst plans to take a random sample of 200 recent e-book purchases and determine the number of these purchases which were from iBookstore.

  — Assuming there has been no change since 2011, determine if the assumptions satisfied for a hypothesis test to be conducted.

— When a random sample of 200 purchases was selected in 2012, it was found that 58 of these purchases were made using iBookstore. Test the appropriate hypotheses to determine if there has been any *change* in Apple's share of this market using a significance level of 0.01.

Example 4: In 2005, the CDC reported that 6.5% of parents of children (aged 0 – 17) have chosen to not vaccinate their child against one or more common childhood illnesses. In the past few years speculation has been raised that vaccinations could be linked to autism in children. Although this theory has been debunked by the CDC, a researcher has speculated that more parents are now choosing to not vaccinate their children. To test this conjecture, a random sample of 600 parents of children of vaccination age across the United States is selected and 54 of parents have children they have chosen not to vaccinate. Does the sample provide convincing evidence for the claim made by the researcher? Test the appropriate hypotheses using a significance level of 0.05.

Suppose the sample size were increased to 1500 individuals (but with the same sample proportion as used above). What would the new test statistic be? Would the probability associated with this new test statistic be larger, smaller, or unchanged from what was found in part b? **Explain**.

New test statistic:

Probability (circle one):   Larger   Smaller   Unchanged

Explanation:

Errors in Hypothesis Tests   Textbook pages: 543 – 550

In a hypothesis test, the decision is made from sample data, but a conclusion is made about a population parameter.

So, what's the problem??

Even with lots of evidence, the data can still lead to the wrong decision. When we perform a hypothesis test, we can make mistakes in one of two ways:

So, if errors are possible, why do we even bother with a hypothesis test?

What effect does the significance level have on the errors?

Example: A drug manufacturer is developing an alternative to Prilosec for treating acid reflux. Suppose the published risk of headache when taking Prilosec is 3.8%. In a clinical trial of 1204 patients with acid reflux, 66 reported experiencing a headache after taking a daily dose of the drug.

- Identify the who, what, and why for this scenario.

- The drug manufacturer wants to know if the risk of headache with the new drug differs from that of Prilosec. What hypotheses should they test to see if there is evidence to support this conjecture?

- Using these hypotheses above, describe a Type I and Type II error. Also discuss the consequence of committing each of these errors from the company's perspective. From these consequences, what significance level do you feel should be set?

- Now that a significance level has been chosen based on the consequences of the error, use the sample information given at the beginning of the problem to complete the hypothesis test.