Understand that valid statistical conclusions are based on randomly selected, representative samples of the population. That is to say, if the sample is not representative of the population, then all bets are off.

Understand the caveats that statistical conclusions are based on the sample data and the level of significance. That is to say, if we were to use a different sample and/or a different level of significance, then we might arrive at a different conclusion regarding the hypotheses.

Be able to apply ***one sampl***e hypothesis testing procedures to both large sample (n >= 30) and small sample (n < 30).

- State the Claim
- State the Null Hypothesis
- State the Alternate Hypothesis
- Type of Test, Number of Tails, Degrees of Freedom
- Determine Critical Value
- Calculate Test Value
- Conclusion Regarding the Null Hypothesis
- Conclusion Regarding the Alternate Hypothesis
- Conclusion Regarding the Claim

For any problems dealing with hypothesis testing: you must be able to correctly

- state both the null hypothesis and the alternate hypothesis;
- determine the appropriate critical value(s);
- calculate the pertinent test statistic;
- decide whether to “Reject the Null” or to “Fail to Reject the Null”;
- draw a proper conclusion about the problem specifics based on your decision regarding the null hypothesis.

Remember “Reject the Null” is a strong conclusion.
In general, “Fail to Reject the Null” is at its best, a suggestion that there is *insufficient evidence to warrant rejecting* $H_0$, or equivalently, *insufficient evidence to warrant accepting* $H_1$.

One- Sample Hypothesis Testing examples of conclusions in cases where we failed to reject the null hypothesis:

- if $H_1$: $\mu \neq \mu_0$, then an appropriate statement would be "insufficient evidence to say $\mu \neq \mu_0$".
- if $H_1$: $\mu < \mu_0$, then an appropriate statement would be "insufficient evidence to say $\mu < \mu_0$".
- if $H_1$: $\mu > \mu_0$, then an appropriate statement would be "insufficient evidence to say $\mu > \mu_0$".

Be mindful that hypotheses are assumptions about population parameters and that conclusions are not facts but only suppositions with some associated degree of confidence. We can never know whether the null hypothesis is true or false and therefore we risk encountering either a Type I or a Type II Error regardless of how carefully we conducted the experiment and how diligently we collected the data

Define *Type I Error, Type II Error, Power of the Test*.
Describe the effect of changing the *Level of Significance* has on both the *Probability of Type I & Type II Errors*.
Explain the difference between *Statistical Significance* and *Practical Significance*.
Know the definition and application of *p-values*.
Be able to calculate p-values for large sample size hypothesis testing (n >= 30).

For the test, you will be given the sample size, mean, and standard deviation as needed;
you will not be required to calculate these sample statistics.
In addition, you will need access to the Standard Normal Distribution Z Table; either via your textbook, a copy of a Z Table, Excel, your calculator, a web link, etc., or a terrific memory.
You must have your own calculators, notes, and tables, no sharing!
Cell phones use is NOT permitted during the test and must be out of sight.

Practice Review Problems: (Use $\alpha$ = 5% for all problems. It is not necessary to calculate any p-values.)

- Homework #7 One Sample Hypothesis Testing
- Example Problems and Questions from Previous Exams (see page 2).

**One Sample Hypothesis Testing**

The specified amount of the active ingredient for an over-the-counter analgesic is 485 milligrams. An assay of 36 randomly sampled tablets averaged 487.4 milligrams, with a sample standard deviation of 6.7 milligrams. Based on the sample data, does the over-the-counter drug meet specifications?

The package label for 3/4 inch nylon rope states that the average breaking strength exceeds 5000 pounds. A safety expert used a sample of 100 different pieces of rope and calculated the average breaking strength to be 5045 pounds with a sample standard deviation of 245 pounds. What can you conclude about the manufacturer's statement regarding the average breaking strength, does the sample data provide strong statistical evidence that the average breaking strength exceeds 5000 pounds?

The brightness of an LCD screen is in some aspects determined by illumination current. The design for a certain level of brightness specifies an average current of 300 milliamps. Twenty sample circuits were measured and the average current was 318 milliamps with a sample standard deviation of 42 milliamps. Note: If the average illumination current is either too low or too high, the LCD brightness will be adversely affected. Based on the sample average illumination current, does the circuit meet specifications for average current of 300 milliamps?

The average tensile strength for a safety break-away link is specified to be less than 2400 pounds. A safety expert used a sample of 25 different links and calculated the average break-away strength to be 2385 pounds with a sample standard deviation of 40 pounds. What can you conclude about the manufacturer's statement regarding the average break-away strength, does the sample data provide strong statistical evidence that the average break-away strength is less than 2400?

**Questions**

1. Define
    - Type I Error
    - Type II Error

2. Type I and Type II Errors:
    - T / F Increasing the Level of Significance increases the probability of a Type I Error.
    - T / F Decreasing the Level of Significance increases the probability of a Type II Error.
    - T / F *Rejecting the Null Hypothesis* is logically equivalent to *Accepting the Alternate Hypothesis*.
    - T / F *Failing to Reject the Null Hypothesis* may lead to Type Two Errors.
    - T / F Figures never lie, but liars sometimes figure.

3. Practical Significance versus Statistical Significance
    - T / F For large sample sizes, small departures from the hypothesized value $\mu_0$, will probably be detected, even though the difference is of little or no practical difference.
    - T / F For large sample sizes, small departures from the hypothesized value $\mu_0$, will probably not be detected, unless we use a level of significance $\alpha <= 1\%$.
    - T / F Practical differences can only be detected for sample size $n < 30$, if the p-value is less than 1%.
    - T / F Practical differences can only be detected for sample size $n < 30$, if the p-value is greater than 5%.
    - T / F To insure discriminating between practically significant and statistically significant differences, we should use sample size $n > 30$.
    - T / F To insure discriminating between practically significant and statistically significant differences, we should use a level of significance $\alpha <= 1\%$.