Effect Size & Power **Math 121 - Workshop**

A statistical study is **powerful** if the sample size is large enough so that random error probably won't cause a Type II error. That is, it will probably be able to recognize that a real effect is statistically significant.

Steps to Determine if a Study is Powerful Enough

1. Choose an **effect size** that you'd like to be able to detect.
2. Guess a plausible standard deviation (for quantitative data only).
3. Calculate the margin of error based on your standard deviation and sample size.

If the margin of error exceeds the effect size, then your study is not powerful enough.

1. A large farm wants to test a new fertilizer to see if it increases corn yields by at least 40 lbs. per plot. Currently plots produce 1215 lbs. of corn on average with a standard deviation of 94 lbs. per plot.

   If we did an experiment where we randomly assigned $N_1 = 20$ plots to get the new fertilizer and $N_2 = 20$ plots to not get the new fertilizer, would that be a powerful enough study to detect a 40 lbs. per plot improvement? Estimate the margin of error for the difference in yields:

   $$t^* \sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}.$$

   Would a statistical analysis with that margin of error be able to recognize a 40 lbs. improvement as statistically significant?

2. A doctor thinks that taking the herbal supplement Garcinia Cambogia will increase the percent of overweight people who can lose 10% of their body weight and keep the weight off for a full year. A 2005 study in the *American Journal of Clinical Nutrition* found that only 20% of overweight people are able to lose that much weight and keep it off for a full year.

   Suppose this doctors thinks that G. Cambogia could increase the percent of patients who can lose weight and keep it off for a full year from 20% to 40%. Would a randomized experiment with 30 patients in each group be powerful enough to detect this? What about a study with 40 patients in each group?