STAT 201 Chapter 9.4

Two Types of Errors

Errors Associated with Testing

- **Type I Error** occurs when H_o is rejected but in reality H_o is true

- **Type II Error** occurs when H_o is not rejected but in reality H_o is false

		Truth	
		H_0	H_a
Decision	H_0	Correct Decision	Type II Error
	H_a	Type I Error	Correct Decision

Controlling Error

- We can control the probability of Type I Error by our choice of the level of significance/confidence

- P(Type I Error) = significance level = 1-confidence level

- Though we can't control the probability of Type II Error directly, when we decrease the probability of Type I Error the probability of Type II Error increases

Controlling Error

- To increase Type I error: decrease confidence

- To decrease Type I error: increase confidence

- To increase Type II error: decrease Type I error
  → increase confidence

- To decrease Type II error: increase Type I error
  → decrease confidence

Example 1

- You are planning to hold a party for our STAT 201 class, and you are interested to know at 95% confidence level, whether less than 60% of students will attend.

- $H_o: p \geq 0.6$ and $H_a: p < 0.6$

- **Type I error**: Your decision is to accept H_a but in reality H_0 is true, which means you believe less than 60% of students will attend, but in reality in that party night, more student will come. There might not be enough refreshments or chairs to serve.

Example 1

- You are planning to hold a party for our STAT 201 class, and you are interested to know at 95% confidence level, whether less than 60% of students will attend.

- $H_o: p \geq 0.6$ and $H_a: p < 0.6$

- **Type II error**: Your decision is to accept H_0 but in reality H_a is true, which means you believe more than 60% of students will attend, but in reality in that party night, a little student will show up. You would waste money on preparing large among of refreshments.

Example 1

- Type I error will course the awful experience of all party participants
- Type II error will course the waste of resource
- Both are bad, and you want to avoid.
- **In statistics, we usually control the probability of type I error to be fixed, e.g. 0.05, then try to minimize the probability that type II error happens.**