Choice of $\alpha$-level

Recall: $\alpha = P($TYPE I Error$)$
$\beta = P($TYPE II Error$)$

Typical $\alpha$-values are
$.001, .005, .01, .05, .10$

The value of $\beta$ depends on $\alpha$, $n$, and the alternate hypothesis, as well as $S$, the (pooled) std. dev.

Suppose $n$ is fixed - we can't acquire more observations.
IF TYPE I is the worse type of error to make, choose $\alpha$ small. The "price" we pay is that $\beta$ increases.

IF TYPE II is the worse type of error to make, choose $\alpha$ large ($\alpha = .10$). This will make $\beta$ decrease.

IF $n$ is not fixed, we can make both $\alpha$ and $\beta$ decrease by increasing the sample size ($n$).
More data means more information which decreases the probability of making errors.

In fact, if we could obtain data from everyone in a pop., we could eliminate all error, making $\alpha = 0$ and $\beta = 0$.

Ex: Determine an appropriate $\alpha$ level for the following hypothesis test
$H_0$: The person accused of the crime is not guilty

$H_1$: The accused person is guilty.

**TYPE I Error** - Reject $H_0$ when $H_0$ is really true.

The accused person is not guilty but the judge decides he is guilty.

**TYPE II Error** - Fail to reject $H_0$ when $H_0$ is really false

The accused person is guilty.
but the judge decides he is not guilty.

Assess the consequences of a TYPE I error:

1) Innocent person jailed
2) " loses job
3) " no longer pays taxes
4) Waste, money, resources, jailing an innocent person
5) Guilty person still free
6) Justice system credibility is damaged
Assess the consequences of a TYPE II error:
1) Guilty person still free
2) No justice for victim
3) Other criminals may emulate the same crime
4) Cost of continuing investigation

It appears that a TYPE I error is worse in this situation; So chose $\alpha$ small (.01 or less)
When the Assumptions are Violated

If one (or more) assumption is not valid, the result of the hypothesis test will not be valid.

We must use some other procedure. (Nonparametric Tests — Unfortunately no time this semester to discuss nonparametric methods.)
Connection Between Confidence Intervals and Hypothesis Testing

There is a relationship between C.I.'s and hypothesis tests involving a two-sided alternative.

If the hypothesized value of μ (stated in Ho) is inside the $(1-\alpha)100\%$ confidence interval, we would fail to reject Ho, at the specified $\alpha$-level.
IF the hypothesized value of \( \mu \) is not in the \((1-\alpha)100\%\) C.I., we would reject \( H_0 \), at the specified \( \alpha \)-level.

EX: Suppose a 95\% C.I. on \( \mu \) goes from 43.5 to 62.7

IF \( H_0: \mu = 58 \)
\( H_1: \mu \neq 58 \)
\( \alpha = .05 \)
we would fail to reject \( H_0 \)