**Stats 300** **Spring 2024**

# Examples of Hypothesis Testing

## Claims involving hypothesis tests for population proportions:

* I make 57% of my free throws.

* The California legislature's approval rate is less than 14%.

* The fraction of adult females who are college graduates is greater than the fraction of adult males who are college graduates.

## Claims involving hypothesis tests for population means:

* The average height of CRC students is more than 65 inches.

* American adults watch an average of 5.6 movies per year at movie theaters.

* Home basketball teams score more points on average than road basketball teams.

* Women and men score the same, on average, on a driving test.

* The average weight of Jack Russell Terriers is greater than the average weight of Dachshunds.

**Things to watch for:**
* Is it a qualitative variable (proportion) or a quantitative variable (mean)?
* Does the claim say that things are equal or not equal? … OR …
* Does the claim address in which direction things may not be equal, that is, less or greater, or simply equal vs. not equal?
* Is there a single population of items?
* Are there two populations that can be paired up in a natural way? (Look for two samples of the same size, although these can not always be paired up.)
* Are there two populations that can not be paired up? (A giveaway here is that you have 2 different sample sizes.)

**Hypotheses:**
The **null hypothesis**, labelled $H_0$, always says

Some parameter equals some number.

OR

Two things are equal.

OR

There is no difference between 2 things.

OR something with similar wording.

The **alternative hypothesis**, labelled $H_a$ or $H_1$ in various books, always says

There is a difference between 2 things.

OR

Two things are not equal.

OR

One thing is greater than another.

OR something with similar wording.

**Your job (the *p*-value approach):**
* Choose a significance level, $\alpha$
* Calculate a test-statistic, usually $z$ or $t$, but later, $\chi^2$.
* Calculate an associated $p$-value. The $p$-value is the probability, assuming the null hypothesis is correct, of getting results as extreme as your sample, or more so.
* If $p$ is small, you might suspect that the null hypothesis is wrong, since something happened (your sample was extreme) that was very unlikely. This is evidence against the null hypothesis.
* If $p$ is large, you have no evidence against the null hypothesis.

**Your conclusion:**
If $p < \alpha$, you reject the null hypothesis, and accept the alternative hypothesis.
If $p > \alpha$, you do not reject the null hypothesis. (You fail to reject the null hypothesis, and fail to accept the alternative hypothesis.) You don't have enough evidence to accept the alternative hypothesis.
***Write these 2 facts on your cheat sheet. No excuses!***

**Finally:** NEVER *accept* THE NULL HYPOTHESIS. Reject $H_0$, or fail to reject $H_0$. Don't go to math jail.