Lecture 20
Examples
Announcements

- Homework 4
  - due Friday 5:59PM, 1 point bonus for turning in on Thursday
Step 1: Select Two Hypotheses

- A test chooses between two views of how data were generated: *Null hypothesis* proposes that data were generated at random; *Alternative hypothesis* proposes some effect other than chance.

Step 2: Choose a Test Statistic

- A value that can be computed from the data.

Step 3: Compute What The Null Hypothesis Predicts

- Compute the distribution of the test statistic: what the test statistic might be if the null hypothesis were true.

Step 4: Compare the Prediction to the Observed Data
Conclusions From a Test

Hypothesis test

Can't reject the null hypothesis (inconclusive, don't know)

Reject the null hypothesis (accept the alternative)
Definition of $P$-value

The $P$-value is the chance,

- under the null hypothesis,
- that the test statistic
- is equal to the value that was observed in the data or
- is even further in the direction of the alternative.
<table>
<thead>
<tr>
<th></th>
<th>Null is true</th>
<th>Alternative is true</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test rejects the null</td>
<td>✗</td>
<td>✅</td>
</tr>
<tr>
<td>Test doesn’t reject the null</td>
<td>✓</td>
<td>?</td>
</tr>
</tbody>
</table>
The cutoff for the P-value is an error probability.

If:

- your **cutoff is 5%**
- and the **null hypothesis happens to be true**
- (but you don’t know that)

Then there is about a **5% chance** that your test will reject the null hypothesis anyway.
Assess this:

“Statistical significance is an objective, unambiguous, universally accepted standard of scientific proof.

— Letter to *Nature*, 1994
What month were you born in?

Jan-March
April-June
July-Sept
Oct-Dec
Deflategate
Deflategate
Tom Brady Then
Afterwards

Tom Brady on Deflategate: 'I've just moved on, man'

Adam Kurkjian Sunday, October 09, 2016

Boston Globe, Sunday 10/9/16