DATA 8

Spring 2020

Lecture 21

Examples

Announcements

Testing Hypotheses

How to do a hypothesis test

- **Before computing anything:** figure out the viewpoint the question wants to test, and formulate:
  - **Null hypothesis**: Completely specified chance model under which you can simulate data
  - **Alternative hypothesis**: Viewpoint from the question
  - **Test statistic**: to help you choose one viewpoint
- Compute the value of the test statistic in your data
- Simulate the test statistic under the null many times
- Compare the results

Definition of the *P*-value

The *P*-value is the chance,

- if the null hypothesis is true,
- 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.

(Demo)

P-Values and Error Probabilities

Can the Conclusion be Wrong?

Yes.

	Null is true	Alternative is true
Test favors the null	✓	✗
Test favors the alternative	✗	✓

An Error Probability

- The cutoff for the *P*-value is an error probability.
- If:
  - your **cutoff is 5%**
  - and the **null hypothesis happens to be true**
- then there is about a **5% chance** that **your test will reject the null hypothesis**.

P-value cutoff vs P-value

- P-value cutoff
  - Does not depend on observed data or simulation
  - Decide on it before seeing the results
  - Conventional values at 5% and 1%
  - Probability of hypothesis testing making an error
- P-value
  - Depends on the observed data and simulation
  - Probability under the null hypothesis that the test statistic is the observed value or further towards the alternative

Example: Benford's Law

(Demo)

Post-lecture feedback

Please fill out this very short anonymous feedback form for today's lecture.