Economics 2740
Department of Economics
University of Guelph

Hypothesis Testing

Hypothesis Testing

- In math class – prove theorems *conclusively*

- In the real world – *Uncertainty*

- Make decisions based on the best available evidence

- Hypothesis – when can we safely draw conclusions?

e.g. John Doe accused of murder in Texas & you're on the jury

The Truth / *Jury Decision*	Innocent H_o	Guilty H_a
Innocent (*Fail to reject H_o*)	Correct Decision (√)	• *Murderer Walks* • *Simplest example of a* **Type II** *error*
Guilty (*Reject H_o*)	• *The innocent is executed* • *Simplest example of a* **Type I** *error*	Correct Decision (√)

- Now, the most important question to ask here is *which mistake is worse?*

- Well, the Liberal Democracy Answers: Convicting Innocent Man

- **"Burden of Proof"** lies on the prosecution to show

- *"Guilty Beyond __Reasonable__ Doubt!*

Now, let's translate this into statistics

1)   Our _Null Hypothesis_ (H_0) is John is Innocent

2)   Our _Alternative Hypothesis_ (H_A, H_1) is that John is Guilty

3)   2 Possible Errors:

a) <u>Type I error</u>

    Reject H_0 when H_0 is true

    (Execute John when innocent)

b) <u>Type II error</u>

    Fail to reject H_0 when H_0 is false

    (Free John when Guilty)

4) <u>Significance Level or size (α)</u>

  α = Probability of a Type I Error

  = Probability of executing an innocent man

5) <u>Probability of Type II Error (ß)</u>

  ß = Probability of a Type II Error

  = Probability of setting the murderer free!

6) <u>No Free Lunch</u>

  For any given amount of evidence (data):

  i) decreasing α implies increasing ß

  ii) decreasing ß implies increasing α

7) <u>Type I Error considered Worse</u>

- choose α in advance to be small (i.e. α = 0.05, or α = 0.01)

- In the criminal trial: α = *"Beyond a reasonable doubt"*

- Rejecting H_0 means concluding with confidence in favor of H_A

8) <u>Can't Control Type II error:</u>

     Fail to Reject H_0 : Cannot say that H_0 True

     We just can't say H_0 false

   e.g. John might be guilty

       but inconclusive evidence

       so police had to let him go!