Statistics for Computing

Revision Class 13A

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Revision for Inference Procedures

- Definitions
- Computing Confidence Intervals
- Performing Hypothesis Testing
  - by comparing test statistics to critical values
  - by considering the p-value
  - by using the confidence interval.

Inference : Definitions (1)

- Samples
  - Sample and Population
  - Sampling error
- Sampling Distributions
  - Central Limit Theorem
  - Standard Error

Inference : Definitions (2)

- Underlying theory of hypothesis testing
  - The p-value
- Hypothesis tests
  - Null hypothesis
  - Alternative hypothesis
- Decisions
  - Test Statistics
  - Acceptance Region
  - Critical Regions (Rejection Region)

Inference : Definitions (3)

- Types of Error
  - Type I error (Significance)
  - Type II error (Power)
- Important Skills
  - Using Murdoch-Barnes table 7 to compute Quantiles / Critical Values.
  - Using Murdoch-Barnes table 3 to compute p-Values.

Inference : Structure of a Hypothesis Test (1)

- Formally write out the null and Alternative Hypothesis.
  - Denote the null as H_0 and the alternative as H_1.
  - Use the parameter values (i.e. μ and π), not the sample estimates.
  - Remember to provide a brief description of each hypothesis.

Inference : Structure of a Hypothesis Test (2)

- Compute the Test Statistic (TS)
  - You will need to compute the value for Standard Error (See back of exam paper).
  - The general structure is

$$\frac{\text{observed value} - \text{null value}}{\text{Standard Error}}$$

  - The p-value is computed as $P(Z \geq |TS|)$ (from Murdoch Barnes 3). N.B. p-value is for large samples only.

Inference : Structure of a Hypothesis Test (3)

- Determine the Critical Value
  - You will need to know the sample size (n), the significance (α) , and the number of tails (k).
  - In this module, $\alpha = 0.05$ and $k = 2$ always.
  - Depending on the sample size the degrees of freedom is $\nu = n - 1$ 9 when $n \leq 30$ or $\nu = \infty$ when $n > 30$

Inference : Structure of a Hypothesis Test (4)

- Making a decision (Critical Value) : Is the absolute value of the Test Statistic greater than the Critical Value?
  - If $|TS| > CV$ We reject the null hypothesis.
  - If $|TS| \leq CV$ We fail to reject the null hypothesis.

Inference : Structure of a Hypothesis Test (4)

- Making a decision (p-value) :
  Is the p-value less than than the critical threshold α/k.?
  - If p-value $< \alpha/k$: We reject the null hypothesis.
  - If p-value $\geq \alpha/k$: We fail to reject the null hypothesis.

Inference : Confidence Intervals

Basic Structure

$$\text{Observed value} \pm [\text{Quantile} \times \text{Standard Error}]$$

Inference : Paired values

- Know how to compute case-wise differences.
- Know how to compute the mean of the case-wise differences (see formulae).
- Know how to compute the standard deviation of the casewise differences (see formulae).