Chapter 8

Hypotheses Tests

8.1 Hypotheses and Test Procedures

8.2 z-Tests for Hypotheses about a Population Mean

8.3 The One-Sample t-Test

8.4 Tests Concerning a Population Proportion

Stat 3115, Spring 2024   279

279

Hypotheses Tests

A **test procedure** is specified by

(i) a **test statistic** on which the decision (reject or do not reject the null hypothesis H_0) is based

(ii) a **rejection region**, the set of all test statistic values for which H_0 will be rejected.

A **type I error** is rejecting H_0 when it is true

A **type II error** is not rejecting H_0 when it is false

Stat 3115, Spring 2024   280

280

Hypotheses Tests

The **P-value** is the probability, calculated assuming that the null hypothesis is true, of obtaining a value of the test statistic at least as contradictory to H_0 as the value calculated from the available sample data. We reject H_0 if the P-value is less than or equal to α.

Stat 3115, Spring 2024   281

281

Example

A farmer sells eggs from two populations, both normally distributed with (in gram) $\mu_0=50$, $\sigma_0=10$, $\mu_1=54$, $\sigma_1=11$. Let n=100.

(a) Give a test statistic and a rejection rule with barrier c.

(b) If the sample mean is 52, what is the P-value? Can we reject H_0 with $\alpha=0.05$? Can we reject H_0 with $\alpha=0.01$?

(c) If $\alpha=0.05$, find c and β.

(d) If $\alpha=0.01$, find c and β.

(e) If $\beta=0.1$, find c and α.

(f) If $\alpha=\beta$, find c.

Stat 3115, Spring 2024   282

282

Example

A certain type of automobile is known to sustain no visible damage 25% of the time in a 10-mph crash. The car producer claims that this proportion is increased using a new technology.

Design a test with n=20 independent crashes and find the corresponding type I and type II errors.

Stat 3115, Spring 2024   283

283