Chapter 14 Large Sample Hypothesis Testing Part II

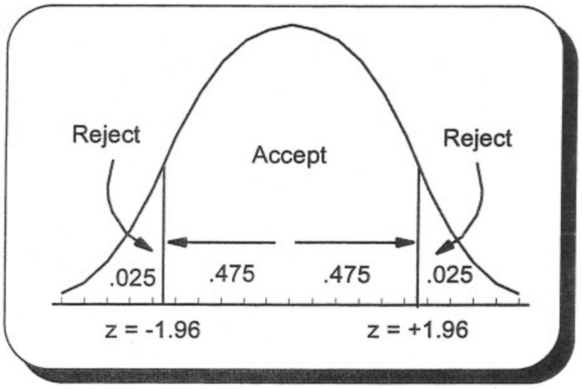
I. **Two-tail testing of two sample means from independent populations**
   A. Variables are independent when the occurrence of one variable does not affect the value of the other variable.
   B. Linda is interested in whether the average customer purchase is different at two of her stores.
      1. A sample of 50 from store #1 had a mean of $7.50 and a standard deviation of $1.00.
      2. A sample of 32 from store #2 had a mean of $7.40 and a standard deviation of $.80.
   C. The 5-step approach to hypothesis testing
      1. State the null and alternate hypothesis.
         a. This is a two-tail problem because the claim involves any difference in average purchase.
         b. $H_o : \mu_1 = \mu_2$ and $H_1 : \mu_1 \neq \mu_2$
      2. Since the claim is marketing oriented, the test will be at the .05 level of significance.
      3. Determine the relevant test statistics.
         a. $\bar{x}$ is the relevant test statistic.
         b. $$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Note: If the difference between the two sample means is large relative to their average standard errors, z for the test will be larger than the critical value of z and the null hypothesis will be rejected.

      4. Determine the decision rule using a graph of the critical values.

The critical value of z for $\alpha \div 2 = .05 \div 2 = .025$ is $\pm$ 1.96. If z from the test statistic is beyond $\pm$ 1.96 the null hypothesis will be rejected.

Note: This would be a one-tail problem if Linda wanted to know whether one store had a larger average purchase than the other store.



      5. Apply the decision rule.

Store # 1	$n_1 = 50$	$\bar{x}_1 = \$7.50$	$s_1 = \$1.00$
Store # 2	$n_2 = 32$	$\bar{x}_2 = \$7.40$	$s_2 = \$.80$

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{7.50 - 7.40}{\sqrt{\frac{(1.00)^2}{50} + \frac{(.80)^2}{32}}} = \frac{.10}{\sqrt{.02 + .02}} = \frac{.10}{.2} = .50$$

Accept H_0 because .50 < 1.96. Sales are the same at the .05 level of significance.

II. **Hypothesis testing using p-values**
   A. The p-value approach to hypothesis testing compares the probability associated with the test statistic's tail or tails (p) with the level of significance. P measures the significance of the test data.
      1. If the p-value is smaller than the level of significance, the probability of a test statistic this extreme is unlikely (less than the level of significance), and the null hypothesis is rejected.
      2. A small p-value (a tail of .003) means substantial difference and H_o is rejected.
      3. A large p-value (a tail of .30) means little difference and H_o is easily accepted.
   B. For example, a p-value analysis of the one-tail and two-tail problems on page 85, where z for the test statistic was 2.50 and the level of significance was .01, would be done as follows.

One-tail Problem

$z = 2.50 \rightarrow .4938 \rightarrow (.5000 - .4938) = .0062$

Reject H_0 because p of .0062 < .01.

Two-tail Problem

$z = 2.50 \rightarrow .4938 \rightarrow (.5000 - .4938) = .0062$

Because this is a two-tail problem, $\alpha/2 = .01/2 = .005$.

Accept H_0 because p of .0062 > .005.