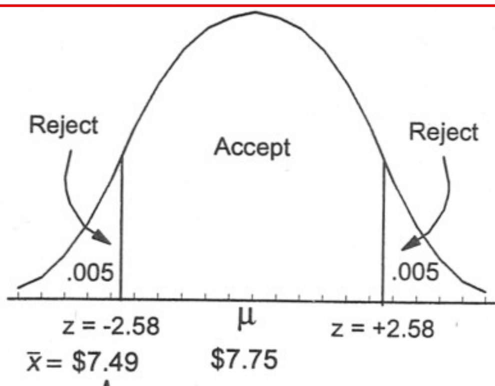
III. Analyzing type II error (β)

A. Type II error is the probability of accepting a false null hypothesis.

B. Linda's two-tailed study concerning any change in the average purchase price from last year's $7.75 (see page 85) will be analyzed. First we will calculate the lower critical value, an accept/reject point for this null hypothesis.

$$\alpha \div 2 = .01 \div 2 = .005$$
$$.50 - .005 = .495 \rightarrow z = \pm 2.58$$

$$\mu - z(\sigma_{\bar{x}})$$
$$\$7.75 - 2.58(\$.10)$$
$$\$7.75 - \$.258 = \$7.49$$



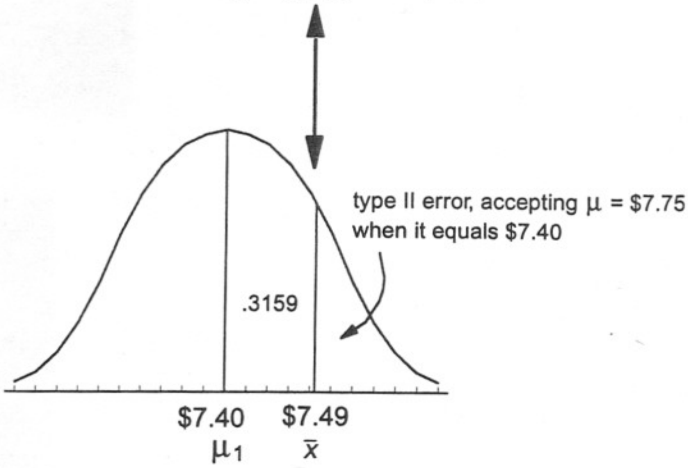
1. Here, type II error exists everywhere except for $\mu = \$7.75$.
2. This means the amount of type II error varies depending upon the value of the true population mean.
3. We will calculate the probability of type II error for a population mean (μ_1) of $7.40.

$$Z = \frac{\bar{x} - \mu_1}{\frac{\sigma}{\sqrt{n}}}$$

$$Z = \frac{\$7.49 - \$7.40}{\frac{\$.70}{\sqrt{49}}} = \frac{\$.09}{\$.10} = .90 \rightarrow .3159$$

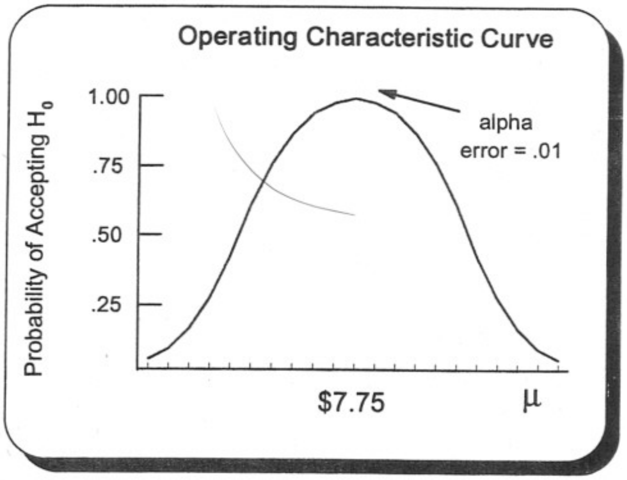
type II error is .50 − .3159 = .1841

When the mean is $7.40, Linda's decision rule has a type II error of 18.41%.



C. **Operating characteristic curves**

1. The operating characteristic curve graphs the probability of type II error. It depicts all possible type II errors given some acceptable level of type I error. It measures accepting no change when there has been change.
2. As the true population mean in the above example drops, accepting a false null hypothesis becomes less likely as the right tail area of the second graph becomes smaller. Eventually the true population mean is so small that accepting a false null hypothesis is almost impossible.
3. As the true mean approaches $7.75, the area to the right gets larger. It reaches a peak of 98+ percent just before $7.75. Type II error does not exist for $\mu = \$7.75$ because the null hypothesis is not false.
4. At a point just beyond $7.75, beta error is still 98+ percent and it drops toward zero as the true population mean increases.



D. **Power curves**

1. A power curve graphs the probability of not making a type II error. It measures:
   a. how often you correctly reject a false null hypothesis
   b. how often you accept a correct research hypothesis
2. It is the complement of type II error or 1 - type II error.
3. The power curve shows accepting a change in quality, consumer attitude, and voter preference when there has been changes in these areas.
4. Lowering type II error comes at the expense of increasing type I error and vice versa.