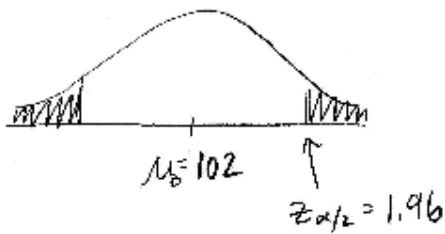


Solutions

- ① Reject H_0 when H_0 is true.
- ② Don't reject H_0 when H_0 is false.
- ③ $P(\text{Type I Error}) = \alpha$, the significance level of the hypothesis test.

④



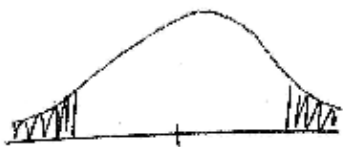
Test is two-tailed
unless otherwise specified.

Non-rejection region
(unshaded)

$$\mu_0 \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$$
$$102 \pm 1.96 \left(\frac{16}{\sqrt{42}} \right)$$

$$97.16 \leq \bar{x} \leq 106.84$$

5



$$\mu_0 = 250 \quad z_{\alpha/2} = 2.576$$

Test is two-tailed
unless otherwise
specified.

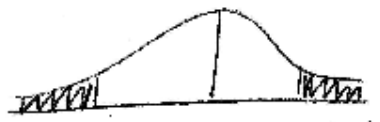
Non-rejection region
(unshaded)

$$\mu_0 \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$$

$$250 \pm 2.576 \left(\frac{2}{\sqrt{40}} \right)$$

$$249.19 \leq \bar{x} \leq 250.81$$

⑥ First, find the non-rejection region:



$$\mu_0 = 300$$

$$\mu_0 \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

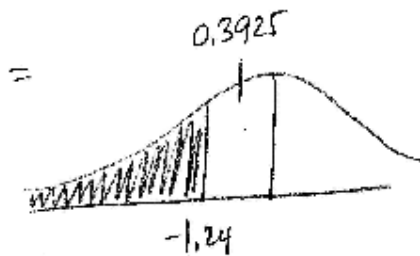
$$300 \pm 1.96 \left(\frac{4.2}{\sqrt{80}} \right)$$

$$299.08 \leq \bar{x} \leq 300.92$$

Now $P(\text{Type II Error} \mid \mu = 301.5)$

$$= P(299.08 \leq \bar{x} \leq 300.92 \mid \mu = 301.5)$$

$$= P(-5.15 \leq z \leq -1.24)$$



$$= 0.5 - 0.3925$$

$$= 0.1075$$

$$z_1 = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

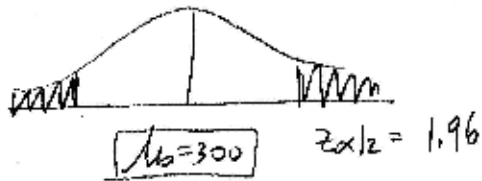
$$= \frac{299.08 - 301.5}{(4.2/\sqrt{80})}$$

$$\approx -5.15$$

$$z_2 = \frac{300.92 - 301.5}{(4.2/\sqrt{80})}$$

$$\approx -1.24$$

⑦ First, find the non-rejection region:



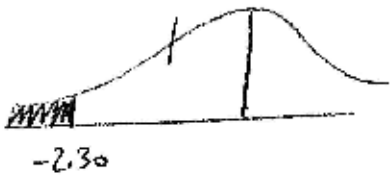
$$\mu_0 \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$$
$$300 \pm 1.96 \left(\frac{4.2}{\sqrt{80}} \right)$$

$$299.08 \leq \bar{x} \leq 300.92$$

Now $P(\text{Type II Error} | \mu = 302)$
 $= P(299.08 \leq \bar{x} \leq 300.92 | \mu = 302)$

$$= P(-6.22 \leq z \leq -2.30)$$

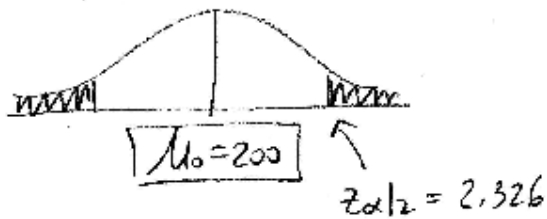
$$= 0.4893$$



$$= 0.5 - 0.4893$$
$$= 0.0107$$

$$z_1 = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$
$$= \frac{299.08 - 302}{(4.2/\sqrt{80})}$$
$$\approx -6.22$$
$$z_2 = \frac{300.92 - 302}{(4.2/\sqrt{80})}$$
$$\approx -2.30$$

⑧ First, find the non-rejection region:

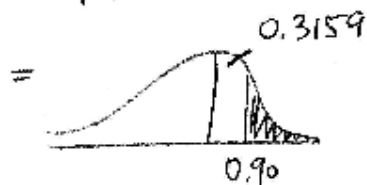


$$\mu_0 \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$$

$$200 \pm 2.326 \left(\frac{2.2}{\sqrt{50}} \right)$$

$$199.28 \leq \bar{x} \leq 200.72$$

$$\begin{aligned} & P(\text{Type II Error} \mid \mu = 199) \\ &= P(199.28 \leq \bar{x} \leq 200.72 \mid \mu = 199) \\ &= P(0.90 \leq z \leq 5.53) \end{aligned}$$



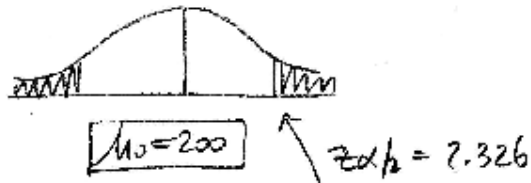
$$= 0.5 - 0.3159$$

$$= 0.1841$$

$$\begin{aligned} z_1 &= \frac{\bar{x} - \mu}{(s/\sqrt{n})} \\ &= \frac{199.28 - 199}{(2.2/\sqrt{50})} \\ &\approx 0.90 \end{aligned}$$

$$\begin{aligned} z_2 &= \frac{200.72 - 199}{(2.2/\sqrt{50})} \\ &\approx 5.53 \end{aligned}$$

⑨ First, find the non-rejection region:



$$\mu_0 \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$$

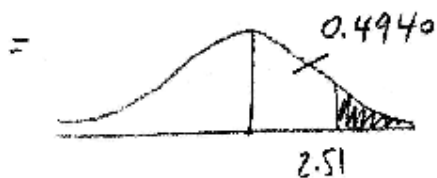
$$200 \pm 2.326 \left(\frac{2.2}{\sqrt{50}} \right)$$

$$199.28 \leq \bar{x} \leq 200.72$$

$P(\text{Type II Error} \mid \mu = 198.5)$

$$= P(199.28 \leq \bar{x} \leq 200.72 \mid \mu = 198.5)$$

$$= P(2.51 \leq z \leq 7.14)$$



$$= 0.5 - 0.4940$$

$$= 0.0060$$

$$z_1 = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$= \frac{199.28 - 198.5}{(2.2/\sqrt{50})}$$

$$\approx 2.51$$

$$z_2 = \frac{200.72 - 198.5}{(2.2/\sqrt{50})}$$

$$\approx 7.14$$

$$(10) \quad P(\text{Reject } H_0 \mid \mu = 198.5)$$

$$= 1 - P(\text{Don't reject } H_0 \mid \mu = 198.5)$$

$$= 1 - P(\text{Type II Error} \mid \mu = 198.5)$$

$$= 1 - 0.0060$$

$$= 0.9940$$