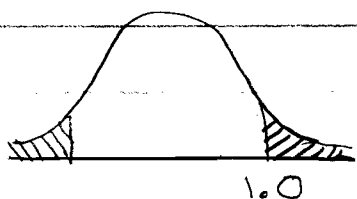


Homework 3 Tues

1. $H_0: \mu_0 = 1000$ $H_a: \mu_0 \neq 1000$ 2-tailed test

$\sigma = 200$ $n = 100$ $\bar{x} = 980$ $\alpha = .01$

$$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{980 - 1000}{200/\sqrt{100}} = \frac{-20}{200/10} = \frac{-20}{20} = -1$$



since the normal curve is symmetric $P(z \text{ more extreme than } -1 \text{ (ie } z < -1)) = P(z > 1)$

$$p\text{-value} : 0.5 - 0.3413 = 0.1587$$

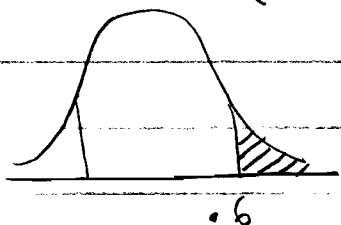
$$2 \text{ sided null} \Rightarrow p\text{-value} = 2(.1587) = 0.3174$$

$p\text{-value} > \alpha \therefore$ cannot reject H_0

2. $H_0: \mu_0 = 50$ $H_a: \mu_0 > 50$ one tailed

$\sigma = 5$ $n = 9$ $\bar{x} = 51$ $\alpha = .03$

$$z = \frac{51 - 50}{5/\sqrt{9}} = \frac{1}{5/3} = \frac{3}{5} = .6$$



$$p\text{-value} : 0.5 - .2257 = .2743$$

$p\text{-value} > \alpha$

\rightarrow do not reject H_0

3. $H_0: \mu_0 = 15$ $H_a: \mu_0 > 15 \rightarrow$ one tailed

$\sigma = 2$ $n = 25$ $\bar{x} = 14.3$ $\alpha = 0.10$

$$z = \frac{14.3 - 15}{2/\sqrt{25}} = \frac{-0.7}{2/5} = -1.75$$



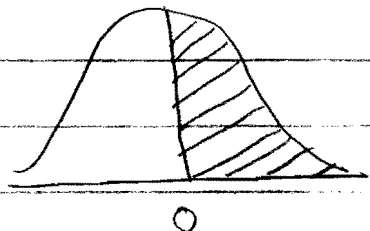
$$p\text{-value} = 0.5 - .4599 = 0.0401$$

$p\text{-value} < \alpha \Rightarrow$ reject H_0

D. $H_0: \mu_0 = 100$ $H_a: \mu_0 \neq 100 \rightarrow 2 \text{ sided}$

$\sigma = 10$ $n = 100$ $\bar{x} = 100$ $\alpha = 0.05$

$$z = \frac{100 - 100}{10/\sqrt{100}} = 0$$



p value: $.50 - 0 = .50$

$2(.50) = 1.0$

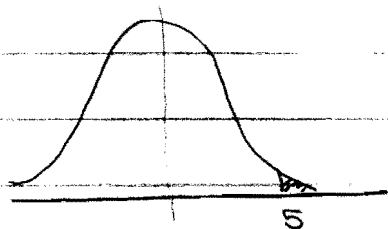
(always!)

p-value $> \alpha$, cannot reject H_0

E. $H_0: \mu_0 = 70$ $H_a: \mu_0 > 70 \rightarrow \text{one tailed}$

$\sigma = 20$ $n = 100$ $\bar{x} = 80$ $\alpha = 0.01$

$$z = \frac{80 - 70}{20/\sqrt{100}} = \frac{10}{20/10} = \frac{10}{2} = 5$$



'off the chart!'

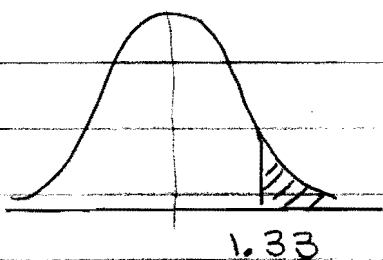
\Rightarrow p-value $< .0001$

and p-value $< \alpha$
reject H_0

F. $H_0: \mu_0 = 50$ $H_a: \mu_0 < 50$ one tailed

$\sigma = 15$ $n = 100$ $\bar{x} = 48$ $\alpha = 0.05$

$$z = \frac{48 - 50}{15/\sqrt{100}} = \frac{-2}{15/10} = -1.333$$



p value: $0.5 - .4082$

$= 0.0918$

p-value $> \alpha$

do not reject

Part III $n = 50$ $\sigma = 8$ $\bar{x} = 33$ $H_a: \mu_0 = 36$ $H_0: \mu_0 < 36$ one tailed

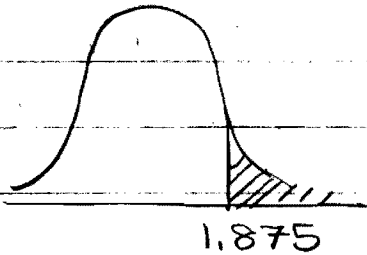
$$a. z = \frac{33 - 36}{8/\sqrt{50}} = \frac{-3}{8/7.07} = \frac{-3}{1.131} = -2.65$$

table value = 0.4961

~~off the chart~~ \rightarrow p-value $< \frac{0.0001}{2}$
 $= 0.00005$

 \rightarrow reject H_0 b. $n = 25$ $\bar{x} = 33$ $\sigma = 8$

$$z = \frac{33 - 36}{8/\sqrt{25}} = \frac{-3}{8/5} = -1.875$$

table value ≈ 0.4696

$$p \text{ value} = 0.5 - 0.4696 = 0.0304$$

p value $< \alpha = 0.05$ \rightarrow reject H_0 at the 0.05 levelc. $n = 100$ $\bar{x} = 33$ $\sigma = 8$

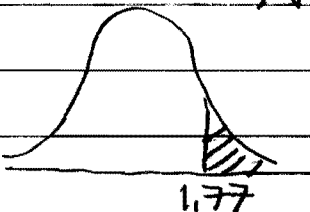
$$z = \frac{33 - 36}{8/\sqrt{100}} = \frac{-3}{8/10} = -3.75$$

 \rightarrow p value < 0.0001 \rightarrow reject H_0 d. $\sigma = 5$ $n = 50$ $\bar{x} = 33$

$$z = \frac{33 - 36}{5/\sqrt{50}} = \frac{-3}{5/7.07} = -4.24$$

p-value < 0.0001 reject H_0 e. $\sigma = 12$ $n = 50$ $\bar{x} = 33$

$$z = \frac{33 - 36}{12/\sqrt{50}} = \frac{-3}{12/7.07} = -1.768 \sim -1.77$$



$$p \text{ value} = 0.5 - 0.4616 = 0.0384$$

p value < 0.05 so reject H_0 at 0.05

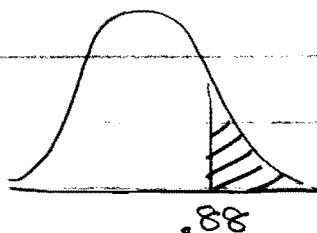
5. $\bar{x} = 30$ $n = 50$ $\sigma = 8$

$$z = \frac{30 - 36}{8/\sqrt{50}} = \frac{-6}{8/7.07} = -5.33$$

$\rightarrow p \text{ value} < 0.0001$ & H_0 rejected

6. $\bar{x} = 35$ $n = 50$ $\sigma = 8$

$$z = \frac{35 - 36}{8/\sqrt{50}} = \frac{-1}{8/7.07} = -0.883$$



$$p\text{-value} = 0.5 - 0.3106 \approx 0.1894$$

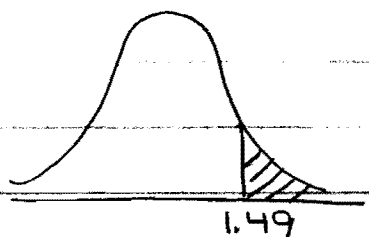
cannot reject H_0 .

Part III

a. $n = 20$ $\bar{x} = 23$ $s = 9$ $\alpha = 0.05$

$H_0: \mu_0 = 20$ $H_a: \mu_0 > 20$

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{23 - 20}{9/\sqrt{20}} = \frac{3}{9/4.47} = 1.49$$



$$df = n - 1 = 19$$

table gives $t_{.05} = 1.729$

$$t_{.10} = 1.328$$

$t < t_{.05} \rightarrow$ do not reject H_0

b. $n = 10$ $\bar{x} = 23$ $s = 9$ $df = 9$ $t_{.05} = 1.833$

$$t = \frac{23 - 20}{9/\sqrt{10}} = \frac{3}{9/3.16} = 1.05$$

$t < t_{.05}$ so do not reject

c. $n = 50$ $\bar{x} = 23$ $s = 9$ $df = 49$ (ok. to use 50)

$$t = \frac{23 - 20}{9/\sqrt{50}} = \frac{3}{9/7.071} = \frac{3}{1.27} = 2.357$$

$t_{.05} = 1.676 < t \rightarrow$ can reject H_0

c. $s = 5$ $n = 20$ $\bar{x} = 23$ $df = 19$ $\alpha = 0.05$ $t_{.05} = 1.729$

$$t = \frac{23 - 20}{5/\sqrt{20}} = \frac{3}{5/4.47} = 2.68$$

$t > t_{.05} \rightarrow \text{reject } H_0$

d. $s = 20$ $n = 20$ $\bar{x} = 23$

$$t = \frac{23 - 20}{20/\sqrt{20}} = \frac{3}{20/4.47} = 0.67$$

$t < t_{.05} \rightarrow \text{do not reject } H_0$

e. $\bar{x} = 21$ $s = 9$ $n = 20$ $df = 19$ $\alpha = 0.05$ $t_{.05} = 1.729$

$$t = \frac{21 - 20}{9/\sqrt{20}} = \frac{1}{9/4.47} = 0.4969$$

$t < t_{.05}$, do not reject H_0

f. $\bar{x} = 26$ $s = 9$ $n = 20$

$$t = \frac{26 - 20}{9/\sqrt{20}} = \frac{6}{9/4.47} = 2.98$$

$t > t_{.05}$ so we can reject H_0

Part IV

$H_0: \mu_0 = 15$ $H_a: \mu_0 \neq 15$

$\bar{x} = 15.5$ $s = 8.2627$ $n = 12$

$$t = \frac{15.5 - 15}{8.2627/\sqrt{12}} = \frac{0.5}{2.385} = 0.2096$$

$df = 11$ $\alpha = 0.05$ $t_{.05} = 1.796$

$t < t_{.05} \rightarrow \text{Do not reject } H_0$