Nathan Donaldson
ECE 3530

Homework 9

1. a) $n=30 \quad \overline{X}=800 \quad s=45 \quad v=29$

$1-\alpha = .90 \quad \alpha = .1$

$t_{\alpha/2} = t_{.05} = 1.699$

$\overline{x} - t_{\alpha/2}\frac{s}{\sqrt{n}} < \mu < \overline{x} + t_{\alpha/2}\frac{s}{\sqrt{n}}$

$786.04129069 < \mu < 813.95870938$

b)

$1-\alpha = .99 \quad \alpha = .01$

$t_{\alpha/2} = t_{.005} = 2.756$

wider

$800 - 22.64 < \overline{X} < 800 + 22.64$

$777.36 < \overline{X} < 822.64$

c)

$1-\alpha = .95 \quad \alpha = .05$

$t_{\alpha/2} = t_{.05} = 1.699$

$800 - 1.699\frac{45}{\sqrt{30}} < \mu$

$786.04129 < \mu$

d)

$\sigma = 45 \qquad n = 30 \quad \bar{X} = 800$

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

$1 - \alpha = .90 \qquad \alpha = .1$

$z_{\alpha/2} = z_{.05} = -1.645$

$$1.645\left(\frac{45}{\sqrt{30}}\right) + 800 < \bar{X} < -1.645\left(\frac{45}{\sqrt{30}}\right) + 800$$

$$813.515 > \bar{X} > 786.485$$

2.

$\sigma = 28 \qquad n = 49 \quad \bar{X} = 360$

a) $H_0 = \mu = 352, \quad H_1 = \mu > 352$

b) $\alpha = 0.01 \qquad v = 48$

$z_{0.99} = 2.33$

$$\bar{X} < 352 + 2.33\left(\frac{28}{\sqrt{49}}\right)$$

$$\bar{X} < 361.32$$

Rejected if $\bar{X}$ > greater end

Critical Region: $360 > 361.32$ X

Not rejected

c)

$\alpha = .001 \qquad z_{.999} = 3.08$

$\bar{X} > 352 + 3.08\left(\frac{28}{\sqrt{49}}\right)$

$\bar{X} \geq 364.32$ X

Not rejected

d) $P\left(z < \frac{361.32 - 368}{\left(\frac{28}{\sqrt{49}}\right)}\right) = P(z < -1.67)$

$= 0.0475$

3.

$\mu = 50 \qquad n = 9 \quad \bar{X} = 45.4 \quad S = 5 \quad v = 8$

a) $H_0: \mu = 50 \quad H_1: \mu \neq 50$

b) $\alpha = .01$

$t_{.005} = 3.355 \qquad T = \frac{\bar{X} - \mu}{S/\sqrt{n}}$

$\mu + 3.355\left(\frac{5}{\sqrt{n}}\right) > \bar{X} > \mu - 3.355\left(\frac{5}{\sqrt{n}}\right)$

$55.6 > 45.4 > 44.408$

. not rejected.

4.

$1\mu,\ 1.1\mu,\ 1.4\mu,\ 1.4\mu,\ 1.5\mu,\ 1.5\mu,$
$1.5\mu,\ 1.7\mu,\ 2.4\mu$

a)

$n=9$ $\quad \bar{X} = \frac{1}{9}(1\mu+1.1\mu+1.4\mu+1.4\mu+1.5\mu+1.5\mu$
$v=8$ $\quad +1.5\mu+1.7\mu+2.4\mu)$

$= 1.5\mu$

$$s^2 = \frac{1}{8}\Big((1\mu-1.5\mu)^2+(1.1\mu-1.5\mu)^2+(1.4\mu-1.5\mu)^2$$
$$+(1.4\mu-1.5\mu)^2+(1.5\mu-1.5\mu)^2+(1.5\mu-1.5\mu)^2$$
$$+(1.5\mu-1.5\mu)^2+(1.7\mu-1.5\mu)^2$$
$$+(2.4\mu-1.5\mu)^2\Big)$$

$$= 2.5^{-13}+1.6^{-13}+1^{-14}+1^{-14}+0+0+0$$
$$+4^{-14}+8.1^{-13}$$

$= 16p$

$s = \sqrt{16p} = .4\mu$

$\alpha = 99.5$

$t_{.005} = 3.355$

$$\left(-\infty,\ \bar{X}+3.355\left(\frac{s}{\sqrt{n}}\right)\right)$$

$(-\infty,\ 1.9473\mu)$

b)

$\mu_0 = 1.8\mu$, yes it falls within $(-\infty, 1.942)$

c) μ_0 is too close to $\bar{X}$ to conclude with 95.5% confidence that the new μ is less than μ_0.

5.

50k, 52k, 54k, 54.5k, 54.5k, 54.5k, 55.5k, 57k, 58.5k

$\mu = 54k$ $\quad H_0 = 54k$, $H_1 \neq 54k$

$\alpha = .01$

$\bar{X} = \frac{1}{9}(50k + 52k + 54k + (54.5k \cdot 3) + 55.5k + 57k + 58.5k$

$= 54.5k$

$s^2 = \frac{1}{8}\left[(50k-54.5k)^2 + (52k-54.5k)^2 + (54k-54.5k)^2 + (55.5k-54.5k)^2 + (57k-54.5k)^2 + (58.5k-54.5k)^2\right.$

$= 20.25M + 6.25M + 250k + 1M + 6.25M + 16M$

$= 6.25M$

$s = \sqrt{6.25M} = 2500$

$t_{0.005} = 3.355$

$$54k + \left(3.25\left(\frac{2500}{3}\right)\right) > \bar{x} > 54k - \left(3.25\left(\frac{2500}{3}\right)\right)$$

$$56{,}708 > \bar{x} > 51{,}292$$

Accepted