Homework #10 Solutions

7.34, 7.35, 7.70, 7.74

Problem 7.34

Let μ = this patients mean phosphate level

(a) First find sample mean $\bar{X}$ and sample sd s

$$\Sigma x = 32.2 \qquad \Sigma x^2 = 175.02$$

$$\bar{X} = \frac{32.2}{6} = 5.3667 \text{ (4dp)} \qquad s = \sqrt{\frac{175.02 - 6(5.3667)^2}{5}}$$

$$= 0.6653 \text{ (4dp)}$$

$$SE(\bar{X}) = \frac{s}{\sqrt{n}} = \frac{0.6653}{\sqrt{6}} = 0.2716 \text{ (4dp)}$$

(b) A 90% CI for μ is

comes from table df=5

$$5.3667 \pm \cancel{t}(2.015)\left(\frac{0.6653}{\sqrt{6}}\right)$$

$$\Rightarrow 5.3667 \pm 0.5473$$

$$\Rightarrow (4.8194, 5.9140)$$

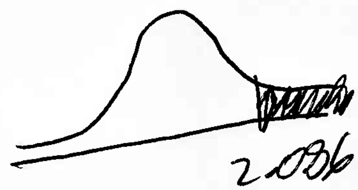
Problem 7.35

$$\left.\begin{array}{l} H_0:\ \mu \leq 4.8 \quad \text{mean is less than or equal to 4.8} \\ H_A:\ \mu > 4.8 \quad \text{mean above 4.8} \end{array}\right\} \text{Null and allternative}$$

Finding the test statistic

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{5.3667 - 4.8}{0.6653/\sqrt{6}} = 2.086$$

$df = n - 1 = 6 - 1 = 5$



since $H_A: \mu > 4.8$ the Pvalue $= P(T > 2.086)$

From t-table $df = 5$ line

$$2.015 < 2.086 < 2.571$$

$$\Rightarrow .05 > P(T > 2.086) > .025$$

So p-value is between .025 and .05 which means we have some evidence against the null hypothesis. Therefore conclude that this patient does indeed have elevated phosphate levels.

Problem 7.70

(a) Let $\mu_1 =$ birth weight for positive cocaine/crack babies
$\mu_2 =$ birth weight for other babies

$H_0: \mu_1 - \mu_2 \geq 0$ (ie crack babies weigh same or more)
$H_A: \mu_1 - \mu_2 < 0$ (ie crack babies weigh less)

Find test statistic

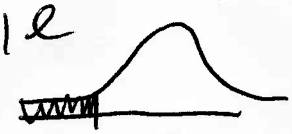
$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{2733 - 3118}{\sqrt{\frac{599^2}{134} + \frac{672^2}{5974}}} = -7.337$$

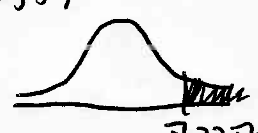
Also $df = \min(n_1 - 1, n_2 - 1) = \min(133, 5973) = 133$
since the alternative is $\mu_1 - \mu_2 < 0$ the pvalue

is Pvalue $= P(T < -7.337)$

because the t-distribution is symmetric

ie

$P(T < -7.337) = P(T > 7.337)$ 

$\equiv$ 

well df=133 is not in table. Instead use df=100

$3.390 < 7.337$
$\Rightarrow .0005 > P(T > 7.337) \Rightarrow$ Pvalue $< .0005$
so reject Ho and accept HA.
crack babies have lower mean birth weight.

(b) A 95% CI for $\mu_1 - \mu_2$ is given by

$$2733 - 3118 \pm 1.984 \sqrt{\frac{599^2}{134} + \frac{672^2}{5974}}$$

from df=100 line

$$\Rightarrow -385 \pm (1.984)(52.4710)$$

$$\Rightarrow -385 \pm 104.1026$$

$$\Rightarrow (-489.1026, -280.8974)$$

(c) We don't really know if the data is from a SRS (and whether the two samples are independent) or not. More specifically there could be other factors besides maternal drug use that could confound with drug use and explain the differences in birth weight.

Problem 7.74

(a) Let μ_1 = mean hemoglobin level for breast fed babies
μ_2 = mean hemoglobin level for formula fed babies

$H_0: \mu_1 - \mu_2 \leq 0$ (ie breast fed babies ~~have~~ same or lower hemoglobin levels)

$H_A: \mu_1 - \mu_2 > 0$ (ie hemoglobin levels are higher for breast fed babies)

the test statistic is

$$t = \frac{13.3 - 12.4}{\sqrt{\frac{1.7^2}{23} + \frac{1.8^2}{19}}} = 1.654$$

$$df = \min(23-1, 19-1) = 18$$

Since H_A is $\mu_1 - \mu_2 > 0$ then

$$\text{Pvalue} = P(T > 1.654)$$

$$1.330 < 1.654 < 1.734$$

$$\Rightarrow .1 > P(T > 1.654) > .05$$

ie $.05 < \text{Pvalue} < .1$

So there is not sufficient evidence to reject H_0.

Therefore can not conclude breast fed babies have higher hemoglobin.

(b) A 95% CI for $\mu_1 - \mu_2$ is given by

$$13.3 - 12.9 \pm 2.101\sqrt{\frac{1.7^2}{23} + \frac{1.8^2}{19}}$$

$$\Rightarrow 0.9 \pm (2.101)(0.5105)$$

$$\Rightarrow 0.9 \pm 1.0726$$

$$\Rightarrow (-0.1726, 1.9726)$$

(c) In general we assume that

1. The two groups are independent from each other
2. Data in each group is from a SRS
3. Each group is sample from normally distributed population.

The last of these assumption is the least important. The larger the sample sizes the more the central limit theorem (CLT) helps by giving approximate normality.