MATH 124 Spring 2005

Lecture: 23 A
Date: May 17, 2005

Skills you should acquire from this lecture:

- Problem solving skills related to two sample problems for difference between two means. Confidence intervals and Hypothesis testing
- Problems 7.109, 7.117, 7.107, 7.110(a,b,c)

problems related to difference between two means

7.109, 7.117, 7.107, 7.110a, b, c

Problem 7.109

Let μ_1 = mean amino acid uptake of nitrate labelled medium

μ_2 = mean amino acid uptake of control medium

$H_0: \mu_1 - \mu_2 \geq 0$ (ie amino acids uptake same or higher for nitrate)

$H_A: \mu_1 - \mu_2 < 0$ (ie amino acid uptake lower for nitrates)

test statistic $t = \dfrac{7880 - 8112}{\sqrt{\dfrac{1115^2}{30} + \dfrac{1250^2}{30}}} = -0.759$ (3dp)

with $df = \min(30-1, 30-1) = 29$

Since H_A is $\mu_1 - \mu_2 < 0$ Pvalue $= P(T < -0.759)$

by symmetry of t distribution $P(T < -0.759) = P(T > 0.759)$

so $.683 < .759 < .854$

$\Rightarrow$ $.25 > P(T > .759) > .20$

Since Pvalue is large cannot reject H_0. There is no evidence to show that nitrates decrease amino acid uptake.

Problem 7.117

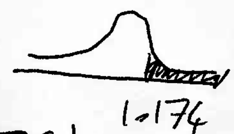
Let μ_1 = mean cholesterol level of ~~plate~~ dogs
μ_2 = mean cholesterol level of clinic dogs

(a) $H_0: \mu_1 - \mu_2 \leq 0$ (i.e. pets have same or lower cholesterol than clinic dogs)

$H_A: \mu_1 - \mu_2 > 0$ (i.e. pets have higher cholesterol)

test statistic $t = \dfrac{193-174}{\sqrt{\dfrac{68^2}{26} + \dfrac{44^2}{23}}} = 1.174$ (3dp)

with $df = \min(26-1, 23-1) = 22$



Since H_A is $\mu_1 - \mu_2 > 0$ Pvalue $= P(T > 1.174)$

$1.061 < 1.174 < 1.321$

$\Rightarrow .15 > P(T > 1.174) > .10$

so since Pvalue is large cannot reject null hypothesis.
So there is no evidence that pets have higher cholesterol levels than clinic dogs.

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

$193 - 174 \pm 2.074 \sqrt{\dfrac{68^2}{26} + \dfrac{44^2}{23}} \Rightarrow 19 \pm 2.074(16.1870)$

$\Rightarrow 19 \pm 33.572$

$\Rightarrow (-14.572, 52.572)$

(c) A 95% CI for μ_2 is

$$174 \pm (2.074)\left(\frac{44}{\sqrt{23}}\right)$$

$\Rightarrow 174 \pm 19.028$

$\Rightarrow (154.972,\ 193.028)$

(d) The primary assumptions are that the two groups of dogs are independent. Also each type of dog should be a SRS from population of all dogs (this is clearly where the chief threat lies). The final assumption is that each is a sample from a normally distributed population (this is the assumption most likely violated).

Problem 7.107

Let μ_1 = mean "commitment to adult animals" for evacuaters

μ_2 = " " " " non-evacuaters

Test $H_0: \mu_1 - \mu_2 = 0$ (ie no difference)

vs $H_A: \mu_1 - \mu_2 \neq 0$ (difference in commitment)

test statistic $t = \dfrac{7.95 - 6.26}{\sqrt{\frac{3.62^2}{116} + \frac{3.56^2}{125}}} = 3.650$

with $df = \min(116-1,\ 125-1) = 115 \Rightarrow$ use $df = 100$ line

$3.390 < 3.650$

Since H_A is $\mu_1 - \mu_2 \neq 0$

Pvalue $= 2P(T > |3.650|)$

$\Rightarrow .0005 > P(T > 3.650)$

$\Rightarrow .001 > 2P(T > 3.650)$

so since pvalue $< .001$ this means we can reject the null hypothesis. So conclude that there is a difference in "commitment to adult animals" between the groups.

Problem 7.110 a, b, c

Let μ_1 = mean number of pins for students
μ_2 = mean number of pins for workers

(a) $H_0: \mu_1 - \mu_2 \geq 0$ (ie students were better)

$H_A: \mu_1 - \mu_2 < 0$ (ie students worse)

test statistic $t = \dfrac{35.12 - 37.32}{\sqrt{\dfrac{4.31^2}{750} + \dfrac{3.83^2}{412}}} = -8.954$ (3dp)

with $df = \min(750-1, 412-1) = 411$ so use $df = 100$ line

-8.954

since H_A is $\mu_1 - \mu_2 < 0$ Pvalue $= P(T < -8.954)$

by symmetry of t distribution $P(T < -8.954) = P(T > 8.954)$

$3.390 < 8.954$

$.0005 > P(T > 8.954)$

$\Rightarrow$ Pvalue $< .0005$

$\Rightarrow$ reject H_0. Therefore experienced workers could complete more pins on average than students.

(b) Because we have large sized samples CLT applies which tells us that $\bar{x}$ has approximately normal distribution

(c) "an experienced worker" = sample of size 1

so CI is

$$37.32 \pm 1.96 \frac{3.83}{\sqrt{1}}$$

$$\Rightarrow 37.32 \pm 7.507$$

$$\Rightarrow (29.813, 44.827)$$