Example:

Dec. 14/09
Review Session

p. 421-422, #2

Do male nurses earn more than female nurses, on average?

Test using $\alpha = 0.05$

→ H_0, H_1, etc.

→ One group or comparing 2 groups?

$n_1 \geq 30$
AND
$n_2 \geq 30$ → z

→ t

K

Female	Male
$\bar{X}_2 = 23750$	$\bar{X}_1 = 23800$
$S_2 = 250$	$S_1 = 300$
$n_2 = 20$	$n_1 = 16$

Use $t = \dfrac{\bar{X}_1 - \bar{X}_2}{\sqrt{\dfrac{S_1^2}{n_1} + \dfrac{S_2^2}{n_2}}}$

$H_0: \mu_1 = \mu_2$ (H_0: ALWAYS $=$).

$H_1: \mu_1 > \mu_2$ (claim)

$$t = \frac{23800 - 23750}{\sqrt{\dfrac{300^2}{16} + \dfrac{250^2}{20}}} = \boxed{0.53}$$

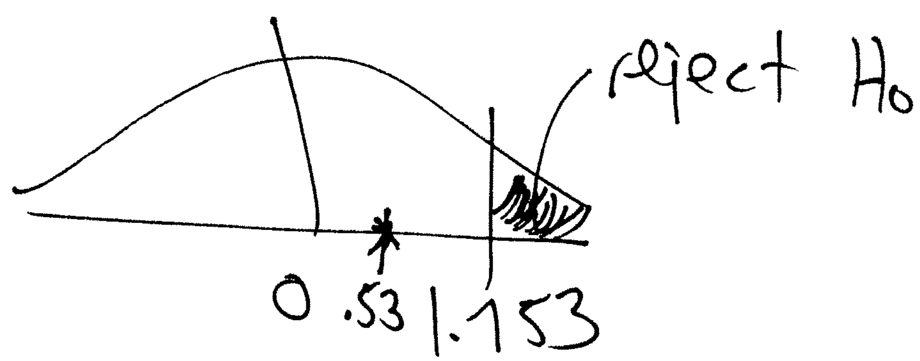
$\alpha = 0.05 = P(\text{Type I error})$ $H_1: \mu_1 > \mu_2$

Reject H_0 if $t > t_{.05}$,

using smaller$(n_1 - 1, n_2 - 1)$ d.f.

$n_1 - 1 = 15$
$n_2 - 1 = 19$ → 15 d.f.

$$\boxed{t_{.05} = 1.753}$$



Since $0.53 < 1.753$, don't reject H_0.

Males don't earn more than females.

Find 90% C.I. for $(\mu_1 - \mu_2)$:

$$(\bar{X}_1 - \bar{X}_2) \pm t_{\alpha/2} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

~~α~~ 90% CI: $\alpha = 1 - .9 = .1$,

$\alpha/2 = .05$,

$t_{.05} = 1.753$

using 15 d.f.

$$(23800 - 23750) \pm 1.753 \sqrt{\frac{300^2}{16} + \frac{250^2}{20}}$$

$= (\quad , \quad)$

$\boxed{\text{P. 432, \#7}}$

Student	1	2	3	4	5	6
Errors Before	12	9	0	5	4	3
Errors After	9	6	1	3	2	3
B − A	3	3	−1	2	2	0

Has the number of errors been reduced by grammar program?

2 groups $\Rightarrow$ Paired data.

(groups dependent)

$H_0: \mu_D = 0$

$H_1: \mu_D > 0$ (bef. − after > 0)

$$t = \frac{\bar{D}}{S_D/\sqrt{n_D}} = \frac{1.5}{1.2/\sqrt{6}} = 3.06$$

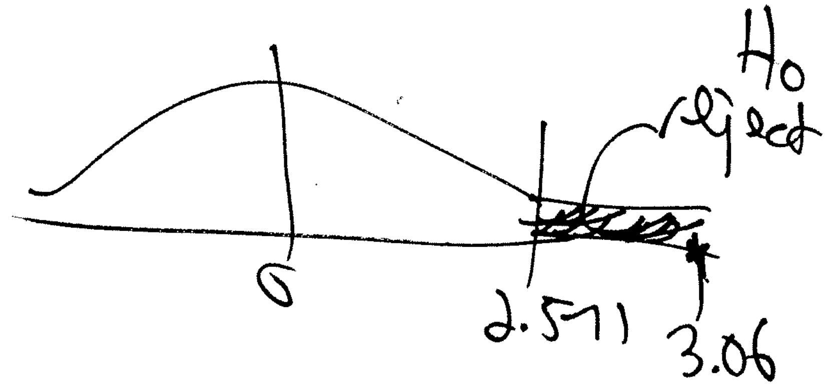
(say)

$n_D = 6$, $\bar{D} = 1.5$, $S_D = 1.2$

$\underline{\alpha = 0.025}$: Reject H_0 if $t > t_{.025}$,

using $(n_D - 1) = 5$ d.f.

$t_{.025} = 2.571$



Since $3.06 > 2.571$, reject H_0

Number of errors reduced.

Conditional Probability

$$P(A \mid B) = \frac{P(A \text{ and } B)}{P(B)}$$

"given"

("if")

B: what you're 'given'

<u>EX</u>: In a survey, find the probability a respondent answers 'yes', given that they are male.

'yes' A male B

$$P(A \mid B) = \frac{P(A \text{ and } B)}{P(B)}$$

p. 231, #12 :

70% of teenagers have CD player by age 16.

For (random) sample of 20 teenagers, find:

a) P(at least 14 have CD)

b) P(9 have CD)

c) P(more than 17 have CD)

~~Bino~~ Binomial : 4 characteristics.

X = number with CD

$$X \sim \text{bin}(\overset{n}{20}, \overset{p}{0.7})$$

$$P(X) = \frac{n!}{(n-x)!\,x!}\, p^{x} (1-p)^{n-x}$$

at least

(a) $P(X \geq 14)$

$$= P(X = 14 \text{ or } 15 \text{ or } \ldots \text{ or } 20)$$

$$= P(X=14) + P(X=15) + \ldots + P(X=20)$$

$$= \frac{20!}{(20-14)!\,14!} (0.7)^{14} (1-0.7)^{20-14}$$

$$+ \ldots\ldots + \frac{20!}{(20-20)!\,20!} (0.7)^{20} (1-.7)^{20-20}$$

$\Rightarrow$ TOO LONG FOR EXAM QUESTION.

(b) $P(X=9) = \frac{20!}{(20-9)!\,9!}(0.7)^{9}(1-.7)^{20-9}$

$= \frac{20!}{11!\,9!}(0.7)^{9}(0.3)^{11} = \boxed{}$

(c) $P(X>17)$

$= P(X=18 \text{ or } 19 \text{ or } 20)$

$= P(X=18) + P(X=19) + P(X=20)$

(d) P(at most 19 have KD)

$$= P(X \leq 19)$$

$$= P(X=19 \text{ or } X=18 \text{ or } \cdots \text{ or } X=0)$$

$$= P(X=19) + P(X=18) + \cdots + P(X=0)$$

TOO LONG!

Complement Rule: $P(A) = 1 - P(\bar{A})$

$$P(\underbrace{X \leq 19}_{A}) = 1 - P(\underbrace{X > 19}_{\bar{A}})$$

$$= 1 - P(X = 20)$$

(e) $P(\text{at most } 1) = P(X \leq 1)$

$$= P(X=1) + P(X=0)$$

Winter 2006 EXAM (online)

(1) 2 mutual funds.

A : 1st fund makes profit $P(A) = \frac{1}{10}$

Given (2nd doesn't make profit) B, prob. that (1st makes profit) A is 3/5.

Conditional prob..

$$P(A|B) = 3/5.$$

P(1st profit and 2nd doesn't) = P(A and B) = 1/5.

P(2nd makes profit) = ?

$= P(\bar{B}) = 1 - P(B)$

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

$$3/5 = \frac{1/5}{P(B)}$$

$$P(B) = \frac{1/5}{3/5} = \boxed{\frac{1}{3}}$$

$$P(\overline{B}) = 1 - \frac{1}{3} = \boxed{\frac{2}{3}}$$

Example 10-9, p. 470-1

Find regression line
(line of best fit,
least squares regression line)

$n = 6$, $\Sigma x = 345$,

$\Sigma y = 819$, $\Sigma x^2 = 20399$,

$\Sigma xy = 47634$

$y' = a + bx$

<u>NOTE</u>: Formulas for a, b from class don't look same as formulas on p. 470, <u>but they give same answers.</u>

$$b = \frac{SS_{xy}}{SS_{xx}}$$

$$SS_{xy} = \Sigma xy - (\Sigma x)(\Sigma y)/n$$

$$SS_{xx} = \Sigma x^2 - (\Sigma x)^2/n$$

$$SS_{xy} = 47634 - (345)(819)/6$$

$$= \square$$

$$SS_{xx} = 20399 - (345)^2/6$$

$$= \square$$

$$\boxed{b = 0.964} = SS_{xy}/SS_{xx}$$

$$a = \bar{y} - b\bar{x} \quad ; \quad \bar{y} = \frac{819}{6} = \square$$

$$= \bar{y} - 0.964\,\bar{x} \qquad \bar{x} = \frac{345}{6} = \square$$

$$= \boxed{81.048}$$

$$\boxed{y' = 81.048 + 0.964x}$$