Exam 3 Review

#1 (a) First, compute $\hat{\sigma} = \sqrt{\frac{SS}{N-1}} = \sqrt{\frac{50}{5-1}} = 3.536$

Then 95% CI =

$$\bar{X} \pm t^*_{df} \cdot SE$$

$$= \bar{X} \pm 2.776 \cdot \frac{\hat{\sigma}}{\sqrt{N}}$$

$$= 74 \pm 2.776 \cdot \frac{3.536}{\sqrt{5}}$$

$$= 74 \pm 4.39 = (69.61, 78.39)$$

(b) $d = \frac{\bar{X} - \mu}{\hat{\sigma}} = \frac{74-70}{3.536} = 1.13$

(c) Define $H_0: \mu = 70$ Assume H_0 is true

$H_1: \mu > 70$.

Then $t = \frac{\bar{X} - \mu}{\hat{\sigma}/\sqrt{N}} = \frac{74-70}{3.536/\sqrt{5}} = 2.53$

Report: $t(4) = 2.53$, $p < 0.05$ (but $p > 0.025$)

Reject H_0.

Conclude: pop. mean of tmt group sig. larger than mean for general population

#2

(a) $\hat{\sigma} = \sqrt{\frac{SS}{N-1}} = \sqrt{\frac{9600}{25-1}} = 20$

$$95\%\ CI = \bar{X} \pm t^*_{df} \cdot SE$$

$$= \bar{X} \pm 2.064 \cdot \frac{\hat{\sigma}}{\sqrt{N}}$$

$$= 51 \pm 2.064 \cdot \frac{20}{\sqrt{25}}$$

$$= 51 \pm 8.26 = (42.74,\ 59.26).$$

(b) $d = \frac{\bar{X} - \mu}{\hat{\sigma}} = \frac{51-45}{20} = 0.30.$

(c) Define $H_0: \mu = 45$
$H_1: \mu \neq 45$. Assume H_0 is true.

Then $t = \frac{\bar{X} - \mu}{\hat{\sigma}/\sqrt{N}} = \frac{51-45}{20/\sqrt{25}} = 1.5$

Report: $t(24) = 1.50$, $p < 0.20$ (but $p > 0.10$).

Fail to reject H_0.

Conclude: pop mean for students in program <u>not</u> sig. different from general population.

#3

(a) $\hat{\sigma}_p = \sqrt{\dfrac{SS_1 + SS_2}{df_1 + df_2}} = \sqrt{\dfrac{580 + 608}{11 + 11}} = 7.348$

$$95\%\ CI = \bar{X} \pm t^*_{df} \cdot SE = (\bar{X}_1 - \bar{X}_2) \pm 2.074 \cdot \hat{\sigma}_p \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}$$

$$= (17 - 24) \pm 2.074 \cdot 7.348 \sqrt{\frac{1}{12} + \frac{1}{12}}$$

$$= -7 \pm 6.22 = (-13.22, -0.78)$$

(b) $d = \dfrac{\bar{X}_1 - \bar{X}_2}{\hat{\sigma}_p} = \dfrac{17 - 24}{7.348} = -0.95$

(c) Define μ_1 = pop mean score for children with no siblings
μ_2 = " " " " " " older sibling

$H_0: \mu_1 = \mu_2$ Assume H_0 is true.
$H_1: \mu_1 < \mu_2$

Then $t = \dfrac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_p \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}} = \dfrac{(17 - 24) - 0}{7.348 \sqrt{\frac{1}{12} + \frac{1}{12}}} = -2.33$

Report: $t(22) = -2.33$, $p < 0.025$ (but $p > 0.01$).

Reject H_0.

Conclude: pop mean social skills for children with no siblings is sig reduced compared to those w/ older siblings.

#4

Tmt 1

X_i	$X_i - \bar{X}$	$(X_i - \bar{X})^2$
5	2	4
1	-2	4
2	-1	1
3	0	0
4	1	1

$\bar{X}_1 = 3$ $\quad SS_1 = 10$

Tmt 2

X_i	$X_i - \bar{X}$	$(X_i - \bar{X})^2$
6	-6	36
10	-2	4
14	2	4
12	0	0
18	6	36

$\bar{X}_2 = 12$ $\quad SS_2 = 80$

So $$\hat{\sigma}_p = \sqrt{\frac{SS_1 + SS_2}{df_1 + df_2}} = \sqrt{\frac{10+80}{4+4}} = 3.354$$

(a) 95% CI: $$(\bar{X}_1 - \bar{X}_2) \pm t^*_{df} \cdot \hat{\sigma}_p \cdot \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}$$

$$= (3 - 12) \pm 2.306 \cdot 3.354 \sqrt{\frac{1}{5} + \frac{1}{5}}$$

$$= -9 \pm 4.89 = (-13.89, -4.11)$$

b) $$d = \frac{\bar{X}_1 - \bar{X}_2}{\hat{\sigma}_p} = \frac{3-12}{3.354} = -2.68$$

c) μ_1 = pop mean for Tmt 1
μ_2 = pop mean for Tmt 2

$H_0: \mu_1 = \mu_2$
$H_1: \mu_1 \neq \mu_2$ $\rightarrow$ $$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_p \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}}$$

Assume H_0 true

$$= \frac{(3-12) - 0}{3.354\sqrt{\frac{1}{5} + \frac{1}{5}}} = -4.24$$

Report: $t(8) = -4.24$, $p < 0.01$

Reject H_0.

Conclude: there is a sig difference between the pop means of Tmt 1 and Tmt 2.

#5

(a) μ_1 = pop mean for Trmt 1
μ_2 = " " " Trmt 2
μ_3 = " " " Trmt 3

$H_0: \mu_1 = \mu_2 = \mu_3$

H_1: not all μ_i are equal.

(b) $F(2,12) = 7.50$, $p = 0.008$

(c) $$\eta^2 = \frac{SS_{between}}{SS_{total}} = \frac{30}{30+24} = 0.56.$$

→ 56% of variability in dependent variable is explained by the Treatment group.

(d) Reject H_0 since $p < 0.05$ (data is rare if H_0 is true!

Thus, conclude that there is a significant difference among the treatment groups.