Psy 232
Single-Factor Between-Subjects ANOVA

(1) Consider an experiment comparing the effects of three kinds of reinforcement on the performance of children given a series of simple reasoning problems. The independent variable of reinforcement consists of the following three conditions: praise for correct responses; criticism for mistakes; and silence regardless of whether the child answered the problem correctly. Five children are randomly assigned to each of the treatment conditions. The measure of performance is the number of correct responses given during the course of testing. Calculate the ANOVA and state your conclusion.

$\Sigma X^2 = 688$
$G = \Sigma T = 96$
$N = 15$
$K = 3$

	Praise	Criticism	Silence
	7	9	2
	8	4	7
	6	6	5
	10	9	3
	7	8	5
$\Sigma X = T =$	38	36	22
$\Sigma X^2 =$	298	278	112
SS = (on back)	9.2	18.8	15.2
M =	7.6	7.2	4.4
$n_1 =$	5	5	5

$SS_T = \Sigma X^2 - \frac{G^2}{N} = 688 - \frac{(96)^2}{15} = 688 - 614.4 = \boxed{73.6}$

$SS_{B/TW} = \frac{\Sigma T^2}{n} - \frac{G^2}{N} = \frac{(38)^2}{5} + \frac{(36)^2}{5} + \frac{(22)^2}{5} - \frac{(96)^2}{15} = \boxed{30.4}$

$288.8 + 259.2 + 968 - 614.4$

$SS_{W/IN} = \Sigma SS_{\text{each treatment}} = 9.2 + 18.8 + 15.2 = \boxed{43.2}$

$df_T = N - 1 = 14$
$df_{B/TW} = K - 1 = 2$
$df_{W/IN} = N - K = 12$

$MS_{B/TW} = 30.4/2 = 15.2$
$MS_{W/IN} = 43.2/12 = 3.6$

$F = \frac{15.2}{3.6} = \boxed{4.22}$ Reject H_0

$F_{crit}(2,12) = 3.88$

(2) A researcher investigated the number of viral infections people contracted as a function of the amount of stress they experienced during a six-month period. She obtained the following data:

$\Sigma X^2 = 349$
$G = 67$
$N = 16$
$n = 4$
$k = 4$

	Negligible	Minimal	Moderate	Severe
	2	4	6	5
	1	3	5	7
	4	2	7	8
	1	3	5	4
$\Sigma X = T =$	8	12	23	24
$\Sigma X^2 =$	22	38	135	154
SS =	6	2	2.75	10
	$m_1 = 2$	$m_2 = 3$	$m_3 = 5.75$	$m_4 = 6$

Diff Sig. Diff Sig. 3.69

$SS_1 = \Sigma X^2 - \frac{(\Sigma X)^2}{n} = 22 - \frac{(8)^2}{4} = 6$

$SS_2 = 38 - \frac{(12)^2}{4} = 2$

$SS_3 = 135 - \frac{(23)^2}{4} = 2.75$

$SS_4 = 154 - \frac{(24)^2}{4} = 10$

a) What are the null and alternative hypotheses?

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$
$H_1:$ not all μs are equal

b) Calculate the F-ratio.

$SS_T = \Sigma X^2 - \frac{G^2}{N} = 349 - \frac{(67)^2}{16} = 349 - 280.56 = \boxed{68.44}$ $df_T = 16 - 1 = \boxed{15}$

$SS_{B/TW} = \Sigma \frac{T^2}{n} - \frac{G^2}{N} = \frac{8^2}{4} + \frac{12^2}{4} + \frac{23^2}{4} + \frac{24^2}{4} - 280.56 = \boxed{47.69}$ $df_{B/TW} = K - 1 = \boxed{3}$ $MS_{B/TW} = 47.69/3 = \boxed{15.9}$

$= 16 + 36 + 132.25 + 144 - 280.56$

$SS_{W/IN} = \Sigma SS_{\text{each treat}} = 6 + 2 + 2.75 + 10 = \boxed{20.75}$ $df_{W/IN} = N - K = 16 - 4 = \boxed{12}$ $MS_{W/IN} = 20.75/12 = \boxed{1.73}$

$F = 15.9/1.73 = 9.19$ $F_{crit .05}(3,12) = 3.49$

c) Are the results significant at alpha = .05?

Yes Reject H_0

$\eta^2 = \frac{SS_{B/TW}}{SS_{Total}} = \frac{47.69}{68.44} = .697 \rightarrow .70$ a lot of predictability

(3) A researcher investigated the effect of volume of background noise on participants' error rates while performing a boring task. He tested three groups of randomly selected students and obtained the following error dta and sums of squares:

	Low Volume	Moderate Volume	High Volume
m	61.5	65.5	48.25
n	4	5	7

$N = 16$
$K = 3$

Conduct the ANOVA and fill in the summary table below. ~~Please use the back of the sheet for calculations~~.

Source	*SS*	*df*	*MS*	*F*
Between	652.16	2 (K-1)	326.08	6.92*
Within	612.75	13 (N-K)	47.13	
Total	1264.9	15 (N-1)		

$F_{crit .05} = 3.8$

Reject H_0

*$p < .05$

$\eta^2 = \frac{SS_{B/TW}}{SS_{Total}} = .52$ (52%)