Psychology 610	Midterm I
Prof. Moore	Fall 2005

SHOW YOUR WORK!

ID # _____Answer Key_______________________

(Do not put your name on this exam.)

1. While reviewing an article submitted for publication in the *Journal of Experimental Psychology,* Professor Anita Lyphe likes to make sure the statistics reported in the results sections are correct. In the paper she is reading currently, the authors report:

"The overall effect of goal type on performance was not significant, $F(2,21) = 3.22$, $p > .05$ ($M_{intrinsic} = 6.50$, SD = 0.53; $M_{extrinsic} = 2.50$, SD = 0.53; $M_{both} = 6.00$, SD = 5.90). However, post-hoc tests using the Fisher-Hayter method revealed that participants in the intrinsic goal group performed significantly better than those in the extrinsic group, $p < .05$. None of the other groups significantly differed from each other."

A. (30 points) Help Prof. Lyphe by filling out as much as you can of the summary source table below given the information above (assume equal n in each group, and show your work):

Source	df	SS	MS	F
Mean	1	600	600	50.81
A	2	76	38	3.22
S/A	21	248	11.81	
"Real Total"	24	924		

[T]= 600
[A]= 676

2. In her response to the authors, Prof. Lyphe makes a number of comments. Please respond to each comment below by either performing a requested calculation, writing a response, or both.

   A. (20 points) The author's choice of post-hoc methods is not appropriate. The authors should choose a different method, redo the calculations, and explain why the new method is appropriate whereas the other was not.

Fisher-Hayter is not appropriate because it is a step-down method and the overall F was non-significant. Tukey would be appropriate because it is a simultaneous method and has the highest power for all pair-wise comparisons.

$d_T = 3.58\sqrt{\frac{11.81}{8}} = 4.35$

	ext	int	both
ext	-	4.0	3.5
int	-	-	.5

No pairs are significantly different using Tukey test.

   B. (10 points) It appears as if an assumption of ANOVA may have been violated. Please include in the limitations section a discussion of the following: What assumption may have been violated? Is violating this assumption generally serious or not? What effect does it have on your ANOVA?

-Homogeneity of Variance
-More serious than normality, less serious than independence
-It makes your $MS_{S/A}$ an inappropriate error term
-In long run, tends to increase probability of type I errors

C. (10 points) I'm concerned that your study did not have enough statistical power. Please discuss in the limitations section what you could do differently to increase the power of this experiment.

-increase alpha
-increase n
-strengthen manipulation
-improve statistical control

D. Professor Lynn E. Yer is interested in the relationship between amount of payment for doing charity work and personal satisfaction. Prof. Yer hypothesizes that doing charity work for free will lead to a feeling of great satisfaction, being underpaid for the work will lead to lower satisfaction, while being paid a fair amount will lead to more satisfaction, but being overpaid will lead to lower satisfaction. She runs an experiment with 6 groups given different payments or no payment for helping at a fundraiser an then measures personal satisfaction on a scale from 1-19, high numbers indicating greater satisfaction. The data are given here:

Pay	\$0	\$5	\$10	\$15	\$20	\$25
Mean	18	13.5	14.5	15.5	15.0	14.0

$MS_{S/A} = 2.944$; $n = 4$ $MS_A = 10.167$

A. (15 points) Please test Prof. Yer's hypothesis.

H_O: $\Psi = 0$ H_A: $\Psi \neq 0$

C_{cubic}: -5 7 4 -4 -7 5

$\Psi = -34.5$

$$SS_\Psi = \frac{4(34.5)^2}{180} = 26.45$$

$$F = \frac{26.45}{2.944} = 8.98$$

$F_{table\ \alpha = .05}(1,18) = 4.41$

There is a significant cubic trend in the direction of Prof Yer's hypothesis.

B. (10 points) Another researcher, Prof. Q. Byck, believes that there may be another unspecified trend that explains some of the variance in the above data. Conduct a test to show whether there is a significant amount of variance remaining after Prof. Yer's hypothesis is tested.

$SS_A = 50.835\ (10.167 \times 5)$

$SS_{Res} = 50.835 - 26.45 = 24.385$

$MS_{Res} = \dfrac{24.385}{1}$ or $\dfrac{24.385}{4} = 6.096$

$F = 8.28$ or $F = 2.07$

$F^*(1,18) = 4.41$ or	$F^*(4,18) = 2.93$
significant variance remaining	no significant variance remaining

C. (5 points) There are two different ways to compute the test in B. Explain the difference between the two methods.

1. use df= a-1-1
   tests whether there is significant variance remaining if spread evenly over all remaining trends.

2. use df=1
   tests whether there is significant variance remaining if all variance was accounted for by 1 trend.

D. (15 points) Prof. Lyphe is also reviewing this paper for JEP. In her response she asks whether the pattern of data might not be better explained by the hypothesis that volunteer work, where one is paid no money, is more satisfying than work in which one gets paid any money at all. Test her hypothesis.

c: 5 -1 -1 -1 -1 -1

Ψ= 17.5 H_o: Ψ=0 H_A: $\Psi \neq 0$

$$SS_\Psi = \frac{n\Psi^2}{\sum cj^2} = \frac{4(1.75)^2}{30} = 40.833$$

df=1

$$F = \frac{40.8333}{2.944} = 13.87$$

$F^*(1,18)$= 4.41 Reject H_o

Volunteer work is more satisfying than paid work.

E. (10 points) Whose hypothesis accounts for the most variance, Prof. Yer's (part A) or Prof. Lyphe's (part D)?

Lyphe: $\frac{40.833}{50.835}$ x100 = 80.32% of variance accounted for

Yer: $\frac{26.450}{50.835}$ x100 = 52.03% of variance accounted for

Prof. Lyphe's hypothesis accounts for more variance.

4. (10 points) Describe what the sampling distribution of the mean is, and why it is an important concept of ANOVA.

Distribution of sample means created by calculating the mean of repeated random samples of the same size taken from a population.

In ANOVA if Ho is true, then group means are different means from the same population and they make up a small sampling distribution of means. We can use the variance of this small sampling distribution to estimate population variance. This is the numerator of the F ratio. If Ho is false, then this estimate of σ^2 will be bloated by the treatment effect.

5. Here is a 95 % confidence interval:

$2.04 \le \mu_1 - \mu_2 \le 4.84$

A. (5 points) Write an interpretation of the confidence interval.

There is a 95% chance that the interval 2.04 to 4.84 contains the population parameter $\mu_1 - \mu_2$.

B. (5 points) Given this confidence interval, what must $\overline{Y}_1 - \overline{Y}_2$ have been in this experiment?

$\frac{2.02 + 4.84}{2} = 3.44$ Or right in the middle of the interval

C. (5 points) If the H_O for this experiment was $\mu_1 - \mu_2 = 0$, then what was probability that the researcher committed a type II error?

0, because we didn't retain H_O, so we couldn't have retained a false H_O.