Exam 2 PS 217, Spring 2002

1. Drs. Dewey, Stink, & Howe were interested in memory for various odors. They conducted a study in which 6 participants were exposed to 10 common food odors (orange, onion, etc.) and 10 common non-food odors (motor oil, skunk, etc.) to see if people are better at identifying one type of odorant or the other. The 20 odors were presented in a random fashion, so that both classes of odors occurred equally often at the beginning of the list, at the end of the list, etc. (Thus, this randomization is a strategy that serves the same function as counterbalancing.) The dependent variable is the number of odors of each class correctly identified by each participant. The data are seen below. Analyze the data and fully interpret the results of this study. [15 pts]

	Food Odors	Non-Food Odors	P
	7	4	11
	8	6	14
	6	4	10
	9	7	16
	7	5	12
	5	3	8
ΣX (T)	42	29	71
ΣX^2	304	151	454
SS	10	10.8	20.8

H_0: $\mu_{Food} = \mu_{Non\text{-}Food}$ H_1: $\mu_{Food} \neq \mu_{Non\text{-}Food}$

Source	SS	df	MS	F
Treatment	14.1	1	14.1	176.25
Within Groups	20.8	10		
Subjects	20.4	5		
Error	0.4	5	0.08	
Total	34.9	11		

$F_{Crit}(1,5) = 6.61$

Decision: Reject H_0, because $F_{Obt} \geq F_{Crit}$.

Conclusion: People remember food odors significantly better than non-food odors. [Note that no post hoc test was needed, because there were only two groups.]

2. In most prisons there are a variety of treatment and rehabilitation programs, such as substance abuse and psychological and spiritual counseling, as well as academic and vocational education programs. An interesting question is whether corrections officers of various races are more likely to oppose such inmate programs and take a punitive attitude toward doing time (Jackson & Ammen, 1996). Using the following data, test the hypothesis that there are differences on a punitive attitude scale among White, African-American, and Hispanic corrections officers. (Higher scores on the scale indicate a greater punitive attitude.) [15 pts]

	White	African-American	Hispanic
Mean	27.90	21.77	25.58
Variance	9.55	11.49	9.18
n	30	30	30

H_0: $□_W = □_{AA} = □_H$ H_1: Not H_0

Source	SS	df	MS	F
Treatment	567	2	283.5	28.2
Error	876.4	87	10.07	
Total	1443.4	89		

Hartley's F_{Max}: $F_{Max} = 11.49 / 9.18 = 1.25$ and $F_{Max\ Crit} = 2.4$, so there appears to be no evidence for lack of homogeneity of variance.

Decision: Because Hartley's F_{Max} wasn't significant, use □ = .05, so $F_{Crit}(2,87) = 3.10$. Reject H_0, because $F_{Obt} \geq F_{Crit}$.

Conclusion: HSD = $3.38\sqrt{\frac{10.07}{30}} = 1.96$

	White	African-American	Hispanic
White	-		
African-American	6.13	-	
Hispanic	2.32	3.81	-

Thus, the White corrections officers take a more punitive attitude than African-American and Hispanic corrections officers. Hispanic corrections officers take a more punitive attitude than African-American corrections officers. Note, of course, that race cannot be manipulated, so you couldn't claim that the race "caused" the more punitive attitudes.

3. Suppose that you were interested in computing an ANOVA on 3 sets of data from 30 different people, for which summary statistics are shown below. [5 pts]

	Group 1	Group 2	Group 3
Mean	15	20	40
Variance	10	20	60
n	10	10	10

a. What parameter the MS_{Error} is intended to estimate? **$□^2$**

b. What the MS_{Error} would be in the ANOVA computed on the data? **30 [the mean group variance]**

c. [Careful!] What F_{Crit} would you use to evaluate the F_{Obt}? **$F_{Max} = 6$, and $F_{Max\ Crit} = 5.34$, so you would be concerned that there was heterogeneity of variance, and you would use □ = .01 for testing your H_0. $F_{Crit}(2,27) = 5.49$.**

4. Not only are repeated measures designs more powerful than independent groups designs, they are also more efficient ("more bang for the buck"). Give a specific example to illustrate the efficiency of a repeated measures design compared to an independent groups design. [3 pts]

You might simply note that in the very first problem on the exam, 6 participants generated all 12 pieces of data. However, to get exactly the same amount of data in an independent groups design would have required 12 participants.

5. People like Jacob Cohen suggest that we should conduct experiments with power of at least .80. What are they saying about the level of Type II error that they are willing to tolerate? [2 pts]

Because power and Type II error are complementary, if power = .80, then Type II error = .20.

6. As you might recall from the last lab, we talked about research on the auditory localization abilities of bats. Suppose that Dr. Belfry was interested in conducting a similar study, looking at bats' abilities to avoid wires of varying thickness as they traverse a maze. The DV is the number of times that the bat touches the wires. (Thus, higher numbers indicate an inability to detect the wire.) Complete the source table below and fully interpret the results. [15 pts]

ANOVA Table for Wire Thickness

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
Subject	12	37.026	3.085				
Category for Wire Thickness	2	135.436	67.718	102.232	<.0001	204.465	1.000
Category for Wire Thickness * Subject	24	15.897	.662				

Means Table for Wire Thickness
Effect: Category for Wire Thickness

	Count	Mean	Std. Dev.	Std. Err.
Thin Wire	13	4.923	1.553	.431
Medium Wire	13	3.077	1.256	.348
Thick Wire	13	.385	.650	.180

Decision: Because $p \leq .05$, reject H_0.

Conclusion: $HSD = 3.53\sqrt{\frac{.662}{13}} = .80$

Thus, the bats touch the thin wire significantly more often than the medium or thick wires. They also touch the medium wire significantly more often than the thick wire.

You should also note a problem with the counterbalancing in this study. With only 3 levels, complete counterbalancing should have been used. Thus, Dr. Belfry would need to run in multiple of 6 bats. Thirteen bats would be one too many!