Final Exam

1. Complete the sentence with the correct word or phrase.

2. Fill in blanks in a source table with the correct formuli for df, MS, and F.

3. Identify the graphic form and nature of the source table for each design.

4. Identify the most appropriate design from a description of a research study.

5. Fill in blanks in a source table with the actual numerical values for df, MS, and F, given the Sums of Squares.

6. Interpret the results on printouts for all designs.

Designs

One-way ANOVA

Planned and post hoc comparisons

Two-way ANOVA

Three-way ANOVA

Simple linear regression

Multiple linear regression

Randomized blocks

Repeated measures

Nested

Split plot

Analysis of covariance (ANCOVA)

Canonical correlation

Discriminant Analysis

Multivariate Analysis of Variance (MANOVA)

1. Complete the sentence with the correct word or phrase.

The factors to consider in determining the number of blocks in a randomized block design are

2. Fill in blanks in a source table with the correct formuli for df, MS, and F.

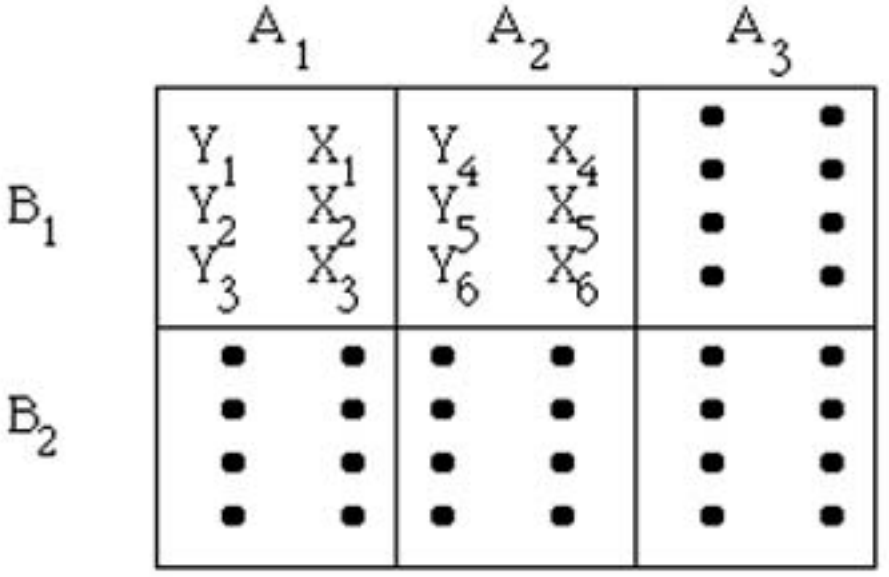
Two-way ANOVA

Source	SS	df	MS	F
A (fixed				
B (random)				
AxB				
Within				
Total				

Randomized blocks (n=1)

Source	SS	df	MS	F	R^2
blocks					
treatments					
blocks x treatments					
Total					

3. Identify the graphic form and source table for each design.



		A_1	A_2	A_3	A_4	A_5
B_1	Subject 1 Subject 2	Y_1 Y_2	Y_1 Y_2	Y_1 Y_2	Y_1 Y_2	Y_1 Y_2
B_2	Subject 3 Subject 4	• •	• •	• •	• •	• •

A_1		A_2	
Class 1	Class 2	Class 3	Class 4
Y_1 Y_2 Y_3	Y_4 Y_5 Y_6	• • • •	• • • •

Source table: A x B design

Source	df

Source table: Split plot design

Source	df

Source table: Nested design (B nested within A)

Source	df

Review of Designs

Treatments

Blocks	A_1	A_2	A_3	A_4
Block 1				
Block 2				
Block 3				
Block 4				
Block 5				
Block 6				

Source	df	F
A	j-1	$\frac{A}{A \times block}$
blocks	k-1	
A x blocks	(j-1) (k-1)	

Randomized Blocks Design (n=1)

Treatments or Times

Subjects	A_1	A_2	A_3	A_4
S_1				
S_2				
S_3				
S_4				
S_5				
S_6				

Source	df	F
A	j-1	$\frac{A}{A \times subject}$
Subjects	n-1	
A x subjects	(j-1)(n-1)	

Repeated Measures Design

		Source	df	F
A_1 Method 1	Class 1	A	J-1	A / B within A
	Class 2	B within A	J(K-1)	B within A / within B
A_2 Method 2	Class 3	within B	JK(n-1)	
	Class 4			

Nested Design

blocks or subjects

		A_1	A_2	A_3	A_4
(Plot 1) B_1	block				
	block				
	block				
(Plot 2) B_2	block				
	block				
	block				

Split Plot Design

Source	df	F
between blocks (nested)		
B	K-1	B / blocks within B
blocks within B	K(n-1)	
within blocks (crossed)		
A	J-1	A / A x blocks within B
AxB	(J- WK- 1)	AxB / A x blocks within B
A x blocks within B	K(n-1 1)(J-1)	

4. **Identify the most appropriate design from a description of a research study.**

   1. **A researcher wants to test the effectiveness of the "new math" vs. the "old math." Six 4th grade classes are provided for study. Three are using the new math and three are using the old math.**

   2. **A researcher wants to test the effects of hours of training (10 and 20) and type of media (film, slides) on achievement. The researcher, however, first blocks on IQ then randomly assigns blocks to the two types of media. The researcher's primary interest is in finding out if differences exist between number of hours of training.**

   3. **A researcher gives four tests of math achievement at a single time, each measuring a different facet of math achievement, at the end of a year long instructional program. Half the subjects in the instructional program were given tutorial assistance and half were not. The researcher wants to know if the tutorial assistance made a difference in math achievement.**

4. **A researcher wants to study the effects of a participatory management program in hospital settings on the attitudes of nurses. She convinces one hospital to use the program for six months and, then, finds a similar hospital which is not using the program to use as a "control." She completes the study and is just about to analyze the data when a colleague working in the "control" hospital informs her that a large number of the nurses at that hospital have had experience with a participatory management plan in the past.**

5. **A researcher measures "attitude toward teaching" of thirty-two recently trained teachers at three different intervals: at graduation, six months after graduation, and one year after graduation. The researcher hypothesizes that attitudes will become more negative over time.**

6. **A researcher wants to find out why some students complete their Ph.D. degrees and others do not. He gets from university records the names and transcripts of one hundred students who completed their degrees in the last five years and one hundred who did not. He then gets from the transcripts their (a) GRE scores, (b) undergraduate GPA, (c) amount of financial aid received, if any, and (d) occupation of father and/or mother, scaled 5 (professional) to 1 (unemployed).**

7. **A researcher wants to study the long term effects of exercise on heart rate. He devises a "heavy" and "light" exercise program. He realizes before the study begins, however, that body weight varies tremendously for the subjects in each of his treatments and that body weight is highly correlated with heart rate. He would like to eliminate the possibility that no significant differences will be found simply due to this variable, especially in light of the fact that he expects only small between groups differences.**

8. **A researcher wants to study the achievement level of undergraduates under four conditions: high stress, low motivation; high stress, high motivation; low stress, low motivation; low stress, high motivation. She gives a pretest and a posttest to each of the four groups.**

9. **What if the above researcher had a well reasoned hypothesis that high stress, high motivation was significantly different than low stress, low motivation and that high stress, low motivation was significantly different than low stress, high motivation, and this was all the researcher hypothesized prior to the experiment.**

5. Fill in blanks in a source table with the actual numerical values.

Source	SS	df	MS	F	p
A	100	2			
B	56	4			
AxB	18				
Within					
Total	200	44			

Randomized Blocks

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE
RESIDUAL ERROR	4.83333	6	.80556
sLK	4.50000	2	2.25000
TRT	12.16667	3	4.22222
(MODEL)	17.16667	5	3.43333
(TOTAL)	22.00000	11	2.00000

R-SQUARED = .78030

ADJUSTED R-SQUARED = .59722

How many blocks are there?

How much of the variance is explained by blocks?

Is TRT significant?

Repeated Measures

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE
RESIDUAL	3.83333	6	.63889
SUB	8.91667	3	2.97222
TRT	31.50000	2	15.75000
(MODEL)	40.41667	5	8.08333
(TOTAL)	44.25000	11	4.02273

R-SQUARED = .91337

ADJUSTED R-SQUARED = .84118

How many levels of TRT are there?

How many subjects within a single level of TRT?

What does "R-Squared" mean?

NESTED DESIGN

SOURCE OF VARIATION	SUM OF SQUARES	DF	M S	F	p
WITHIN CELLS	580.66667	12	48.38		
CHURCH W RELIC (ERROR 1)	420.16667	3	140.05	2.89	.07
(MODEL)	420.16667	3	140.05		
(TOTAL)	1000.83333	15	66.72		

R-SQUARED = .41982
ADJUSTED R-SQUARED = .27477

ERROR 1	420.16667	3	140.05		
RELIC	423.44444	2	211.72	1.51	.35
(MODEL)	423.44444	2	211.72		
(TOTAL)	843.61111	5	168.72		

R-SQUARED = .50194
ADJUSTED R-SQUARED =.16990

How many levels of religion?

How many churches within religion?

SPLIT-PLOT REPEATED MEASURES

SOURCE OF VARIATION	SUM OF SQUARES	DF	M S	F	p
ERROR 1 Subjects within B	.22222	4	.22222		
B (blocks)	21.11111	1	5.27778	.04	.84
(MODEL)	.22222	1	.22222		
(TOTAL)	21.33333	5	4.26667		

R-SQUARED = .01042
ADJUSTED R-SQUARED = 0

ERROR 2 A x Subjects within B	18.88889	8	2.36111		
A (blocks)	44.33333	2	22.16667	9.38	.00
A by B	3.44444	2	1.72222	.72	.51
(MODEL)	47.77778	4	11.94444		
(TOTAL)	66.66667	12	5.55556		

R-SQUARED = .71667
ADJUSTED R-SQUARED =.57500

How many plots?

How many subjects (or blocks) within a single level of B?

Analysis of Covariance

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
COVARIATES	169.191	1	169.191	27.348	.003
X	169.191	1	169.191	27.348	.003
MAIN EFFECTS	15.876	1	15.876	2.566	.170
A	15.876	1	15.876	2.566	.170
EXPLAINED	185.067	2	92.532	14.857	.008
RESIDUAL (ERROR)	30.333	5	6.18		
(TOTAL)	216.000	7	30.857		

How many covariates?

How many subjects?

Test of Homogeneity of Group Regressions

	VARIABLE ENTERED	REMOVED	F TO ENTER OR REMOVE	SIGNIFICANCE	MULTIPLE R
1	X	Covariate X	21.86875	.003	.88504
2	Z1	Groups A	2.56621	.170	.92563
3	Z2	Interaction A by X	.84256	.411	.93395

Was the homogeneity of group regressions assumption met?

What is the significance of Y regressed on X?

Discriminant Function

Function	Eigen Value	Percent of Variance	Cumulative Percent	Canonical Correlation	Wilks	Chi Square
1	13.19180	100.00	100.00	.96412	.07	45.09

Standardized Canonical Discriminant Function Coefficients

	Func 1
X_1	-.60190
X_2	.71972

Unstandardized Canonical Discriminant Function Coefficients

	Func 1
X_1	-.911764
X_2	1.07637
Constant	-.93437

What is the equation for predicting group membership?
Which variable is most predictive of group membership?