

EPSY 712—STATISTICAL INFERENCE
EXAM 2
FALL 2020

Name: _____

DUE: Wednesday, December 9, 2020, Noon Eastern

Please write directly on the exam, unless otherwise instructed. Each item is worth 1 point unless otherwise specified. The entire exam is worth 30 points, although there are 35 points available.

As a reminder, this is to be done **independently**. **DO NOT DISCUSS, TALK WITH, OR SHARE YOUR WORK WITH ANYONE** (except Dr. Christy Coleman), **EVEN IF HE/SHE IS NOT IN THIS CLASS** or is a tutor. If you have a question or are having difficulty with something, please talk with Dr. Christy Coleman. You are **NOT** to use or look at previous exams from EPSY 712.

Items #1-7: Choose the alternative that best completes the sentence or answers the question.

- _____ 1. In ANOVA, the term “factor” refers to
- A. a dependent variable
 - B. an independent variable
 - C. a treatment mean
 - D. error
- _____ 2. Within a single one-way between subjects ANOVA, the critical value of q changes from comparison to comparison in the
- a. Tukey’s HSD post hoc test
 - b. Student Newman-Keuls post hoc test
 - c. Scheffe test
- _____ 3. In multiple regression in order to maximize the prediction of the criterion variable (Y), we should select predictor variables (X s) that have _____ correlations with Y but have _____ correlations with each other.
- A. low, high
 - B. low, low
 - C. high, low
 - D. high high
- _____ 4. Which of the following is a design requirement of a between subjects factorial ANOVA?
- A. There are two or more independent variables.
 - B. Participants are assigned to every level of both independent variables.
 - C. A covariate is measured prior to implementation of the intervention.
 - D. There is one independent variable and participants are assigned to only one group.

- _____ 5. A planned orthogonal comparison was conducted with the three levels of the independent variable. The first comparison had the following weights:

Year	Freshman	Junior	Senior
Weight	-2	+1	+1

Which set of weights is orthogonal to the first comparison?

	Freshman	Junior	Senior
A.	-1	0	+1
B.	-1	+1	0
C.	0	-1	+1
D.	0	0	+1

- _____ 6. A researcher reported the statistical results of a one-way between subjects ANOVA as $F(2, 12) = 2.63, p > .05$. What statistical decision was made?
- A. reject H_0
 B. fail to reject H_0
- _____ 7. For an ANCOVA, the researcher reported the covariate as $F(1, 48), 56.29, p < .001$, partial $\eta^2 = .54$. What statistical decision regarding the covariate was made?
- A. reject H_0
 B. fail to reject H_0

Items #8-11: For each item, indicate if the statement is True (T) or False (F).

- _____ 8. The repeated measures design includes some risk of carry-over effects, such as fatigue.
- _____ 9. Post hoc tests would not be needed if the null hypothesis is rejected in a one-way between subjects ANOVA comparing two groups.
- _____ 10. An ANOVA may be used to answer the following research question: Are there differences in political affiliation (democrat, republican, independent) among different grade levels (freshman, sophomore, junior senior)?
- _____ 11. A multiple regression may be used to answer the following research question: Among college sophomores, is there a relationship between college cumulative GPA and high school GPA, SAT-verbal, and SAT-quantitative?

Items # 12-16: Use the following to answer the items.

A counseling psychologist is interested in investigating differences in depression among individuals who have had Covid-19. More specifically, she wants to know if there are differences in depression two months after a positive Covid-19 test among adults, ages 40 to 50, who were asymptomatic, had mild symptoms, or had severe symptoms.

Research Question: Among adults ages 40 to 50 who tested positive for Covid-19 two months earlier, are there differences in depression scores among those who were asymptomatic, had mild symptoms, or had severe symptoms?

Use an alpha of .05. The SPSS output is as follows:

Oneway

Descriptives

depression

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
asymptomatic	46	8.26	2.453	.362	7.53	8.99	2	15
mild symptoms	67	9.15	2.388	.292	8.57	9.73	3	14
severe symptoms	55	12.05	2.697	.364	11.33	12.78	7	19
Total	168	9.86	2.953	.228	9.41	10.31	2	19

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
depression	Based on Mean	.455	2	165	.635
	Based on Median	.480	2	165	.620
	Based on Median and with adjusted df	.480	2	159.698	.620
	Based on trimmed mean	.438	2	165	.646

ANOVA

depression

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	416.358	2	208.179	33.022	.000
Within Groups	1040.213	165	6.304		
Total	1456.571	167			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: depression

Tukey HSD

(I) Covid-19 Status	(J) Covid-19 Status	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
asymptomatic	mild symptoms	-.888	.481	.157	-2.03	.25
	severe symptoms	-3.794*	.502	.000	-4.98	-2.61
mild symptoms	asymptomatic	.888	.481	.157	-.25	2.03
	severe symptoms	-2.905*	.457	.000	-3.99	-1.82
severe symptoms	asymptomatic	3.794*	.502	.000	2.61	4.98
	mild symptoms	2.905*	.457	.000	1.82	3.99

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

depression

Tukey HSD^{a,b}

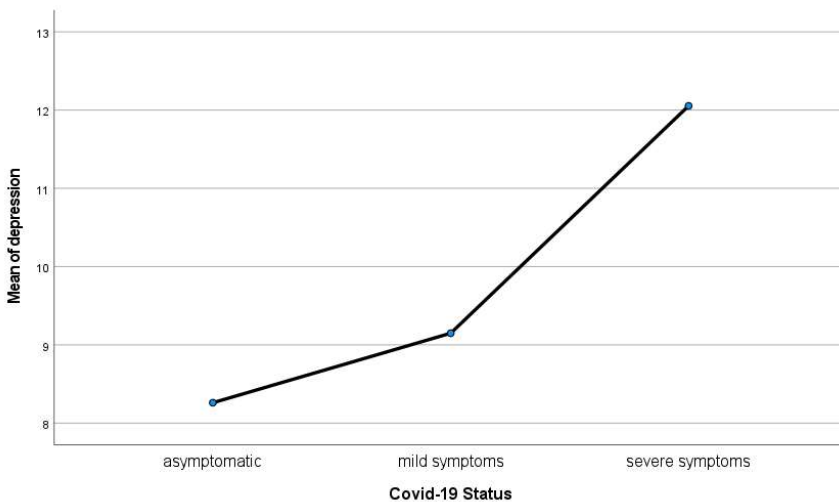
Covid-19 Status	N	Subset for alpha = 0.05	
		1	2
asymptomatic	46	8.26	
mild symptoms	67	9.15	
severe symptoms	55		12.05
Sig.		.157	1.000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 54.698.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Means Plots



The assumptions of independence and normality have been examined and met.

12. Test the assumption of homogeneity of variance. (3 points)

a) State your statistical hypotheses for testing the assumption of homogeneity of variance.

H_0 :

H_1 :

b) Using Levene's test, make a decision. Was the assumption met?

13. Write the statistical hypotheses for this study's research question. Be sure to use the variable's labels. (2 points)

H_0 :

H_1 :

14. Calculate strength of association (effect size) by hand and interpret this value. (2 points)

Calculation:

Interpretation:

15. Write the F in journal form:

16. Post hoc tests (3 points)

a) Which post hoc test was conducted? Be specific.

b) Which Covid-19 status groups scored differently on depression? Give direction of the difference (e.g., which status had higher depression). Only state those that are significantly different.

Items # 17-19: Use the following to answer the items.

A sample of 15 high anxiety students participated in a study to examine the effectiveness of a new anxiety reduction technique. Prior to learning the new technique, each student's anxiety was assessed (pretest). Their anxiety was assessed immediately after learning the new technique (posttest) and again the next day (follow-up).

Research Question: Are there differences in anxiety at pretest, posttest, and follow-up?

Use an alpha of .05. The SPSS output is as follows:

General Linear Model
Within-Subjects Factors

Measure: MEASURE_1

TimeOfTest	Dependent Variable
1	Pretest
2	Posttest
3	FollowUp

Descriptive Statistics

	Mean	Std. Deviation	N
Pretest	12.40	2.293	15
Posttest	12.33	1.877	15
FollowUp	13.07	2.120	15

Multivariate Tests^a

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
TimeOfTest	Pillai's Trace	.349	3.485 ^b	2.000	13.000	.061	.349
	Wilks' Lambda	.651	3.485 ^b	2.000	13.000	.061	.349
	Hotelling's Trace	.536	3.485 ^b	2.000	13.000	.061	.349
	Roy's Largest Root	.536	3.485 ^b	2.000	13.000	.061	.349

a. Design: Intercept

Within Subjects Design: TimeOfTest

b. Exact statistic

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser	Epsilon ^b Huynh-Feldt	Lower-bound
TimeOfTest	.919	1.101	2	.577	.925	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept

Within Subjects Design: TimeOfTest

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TimeOfTest	Sphericity Assumed	4.933	2	2.467	2.684	.086	.161
	Greenhouse-Geisser	4.933	1.850	2.667	2.684	.091	.161
	Huynh-Feldt	4.933	2.000	2.467	2.684	.086	.161
	Lower-bound	4.933	1.000	4.933	2.684	.124	.161
Error(TimeOfTest)	Sphericity Assumed	25.733	28	.919			
	Greenhouse-Geisser	25.733	25.898	.994			
	Huynh-Feldt	25.733	28.000	.919			
	Lower-bound	25.733	14.000	1.838			

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	TimeOfTest	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
TimeOfTest	Linear	3.333	1	3.333	4.000	.065	.222
	Quadratic	1.600	1	1.600	1.592	.228	.102
Error(TimeOfTest)	Linear	11.667	14	.833			
	Quadratic	14.067	14	1.005			

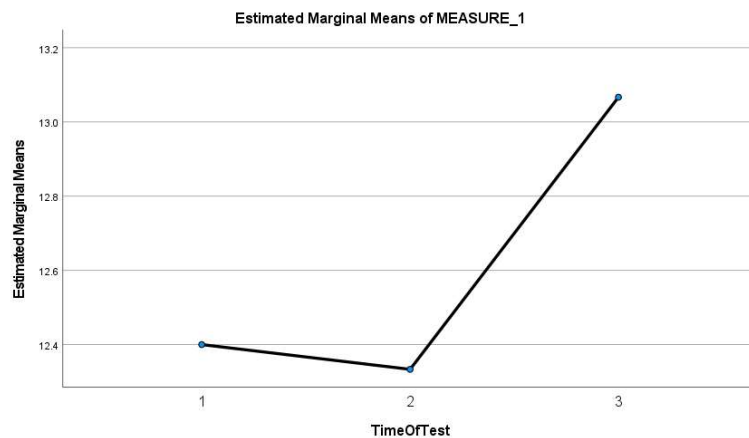
Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	7144.200	1	7144.200	624.597	.000	.978
Error	160.133	14	11.438			

Profile Plots



17. Write the hypotheses in statistical form. Be sure to use the variable's labels. (2 points)

H_0 :

H_1 :

____ 18. What is the decision regarding the null hypothesis?

- A. reject H_0
- B. fail to reject H_0
- C. cannot be determined with the information given

19. Write the F in journal form.

Items #20-23: Use the following factorial ANOVA (between subjects) summary table.

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>sig</i>	<i>partial η^2</i>
Gender	26.55	1	26.55	3.77	.054	.02
Treatment	8.74	2	4.37	.62	.539	.01
Gender * Treatment	5.62	2	2.81	.40	.672	.01
Within (error)	1141.65	162	7.05			
Total	1187.62	167				

____ 20. How many individuals participated?

____ 21. How many levels of treatment were tested?

____ 22. What statistical decision was made regarding the interaction?

- A. reject H_0
- B. fail to reject H_0

23. Write the F statistic in journal form for Gender.

Items #24-28: For each study description or research question, choose the appropriate statistic to use. There are more responses than items. (1 point each)

A. z-test	G. Factorial ANOVA—between subjects only
B. t-test for single samples	H. Factorial ANOVA—within subjects only
C. t-test for independent measures	I. Factorial ANOVA—mixed design
D. t-test for related measures	J. ANCOVA
E. One-way independent measures ANOVA	K. Pearson Correlation
F. One-way repeated measures ANOVA	L. Multiple regression

_____ 24. Are there differences in the work value of having job security among freshmen, sophomore, juniors, and seniors?

_____ 25. A psychologist tested the effect of a group encounter session on individuals' self-esteem. The Rosenberg Self-Esteem Scale was administered to 25 individuals just before they participated in the encounter session and again just after. Scores on this scale range from 10 to 40 with lower values indicated higher self-esteem.

_____ 26. Is there a relationship between job satisfaction and work pressure?

_____ 27. A psychologist was interested in the effect that anxiety has the ability of students to learn new material. He was also interested in whether the effect of anxiety depends on the difficulty of the new material. An experiment was conducted in which there were three levels of anxiety (low, medium, high) and three levels of difficulty (low, medium, high) for the material to be learned. Out of the pool of volunteers, 30 low-anxiety, 30 medium-anxiety, and 30 high-anxiety participants were selected and then randomly assigned to one of the three difficulty levels. Each participants was given 30 minutes to learn the new material. Each was then tested to determine the amount of material learned and a score was given for the number correct.

_____ 28. Do students at ISU, IU, and Purdue differ on GRE quantitative scores, after controlling for socioeconomic status?

I completed this exam entirely on my own, **without assistance from anyone** except Dr. Christy Coleman, **and without use of previous exams.**

Signature

Date

Congratulations! This is the end of Exam 2 for EPSY 712.