Assignment 7: One-way ANOVA

Use the following data to determine if there is a difference among three personality types in terms of exercise frequency.

Neuroticism Participants	Exercise Frequency Per Week		Extraversion Participants	Exercise Frequency Per Week		Openness Participants	Exercise Frequency Per Week
1	3		6	1		11	3
2	6		7	2		12	3
3	5		8	5		13	3
4	5		9	1		14	4
5	6		10	1		15	3

SPSS Instructions

- On the bottom left, click Variable View.
- Enter 'Person' in the first cell and enter 'ExeFre' in the cell below it.
- On the bottom left, click Data View.
- In the Person column, enter '1' for the first 5 cells, '2' for the next 5 cells, '3' for the next 5 cells.
- In the ExeFre column, enter the exercise frequency data. (1=Neuroticism, 2=Extraversion, 3=Openness.)
- Click Analyze, General Linear Model, Univariate
- Move ExeFre into the Dependent Variable window, and Person into the Fixed Factor(s) window.
- Click Post Hoc on the right. Move Person into the "Post Hoc Tests for" window. Check LSD, click Continue. Click Options, check "Estimates of effect size" and click Continue. Click OK.
- Save the Data file and Output file separately. Use informative file names.

SPSS Data

	Person	ExeFre
1	1.00	3.00
2	1.00	6.00
3	1.00	5.00
4	1.00	5.00
5	1.00	6.00
6	2.00	1.00
7	2.00	2.00
8	2.00	5.00
9	2.00	1.00
10	2.00	1.00
11	3.00	3.00
12	3.00	3.00
13	3.00	3.00
14	3.00	4.00
15	3.00	3.00

SPSS Output

Tests of Between-Subjects Effects

Dependent Variable: ExeFre

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	22.800[a]	2	11.400	7.277	.009	.548
Intercept	173.400	1	173.400	110.681	.000	.902
Person	22.800	2	11.400	7.277	.009	.548
Error	18.800	12	1.567			
Total	215.000	15				
Corrected Total	41.600	14				

a. R Squared = .548 (Adjusted R Squared = .473)

Multiple Comparisons

Dependent Variable: ExeFre

LSD

(I) Person	(J) Person	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
1.00	2.00	3.0000*	.79162	.003	1.2752	4.7248
	3.00	1.8000*	.79162	.042	.0752	3.5248
2.00	1.00	-3.0000*	.79162	.003	-4.7248	-1.2752
	3.00	-1.2000	.79162	.155	-2.9248	.5248
3.00	1.00	-1.8000*	.79162	.042	-3.5248	-.0752
	2.00	1.2000	.79162	.155	-.5248	2.9248

Based on observed means.

The error term is Mean Square(Error) = 1.567.

*. The mean difference is significant at the .05 level.

Written Answers

Show all work.

(1) Provide the notation for the null and research hypotheses, and a written statement for the former.
(2) Calculate F by hand, provide a summary table, provide the result in APA format, and write a conclusion. Use α .01.

(3) Use eta-squared to provide the effect size and a write a conclusion.
(4) Use Protected t (Fisher's LSD) to determine if there is a difference between Neuroticism and Openness, and between Extraversion and Openness. Provide the results in APA format and write a conclusion. Use α .05.

1.)
H_0: $\mu_{1=}\ \mu_{2=}\ \mu_3$
H_1: $\mu_{1\neq}\ \mu_{2\neq}\ \mu_3$

Null hypothesis: There is no statistically significant difference among the population means of personality types in terms of exercise frequency.

2.)

$$\overline{X}_{neut} = 3+6+5+5+6/5 = 5$$
$$\overline{X}_{Ext} = 1+2+5+1+1/5 = 2$$
$$\overline{X}_{Ope} = 3+3+3+4+3/5 = 3.2$$
$$\overline{X}_{gm} = 3+6+5+5+6+1+2+5+1+1+3+3+3+4+3/15 = 3.4$$

$$SS_{total} = \sum X^2 - \frac{(\sum X)^2}{N}$$

$$\sum X^2 = 3^2+6^2+5^2+6^2+1^2+2^2+5^2+1^2+1^2+3^2+3^2+3^2+4^2+3^2 = 215$$

$$(\sum X^2) = (3+6+5+5+6+1+2+5+1+1+3+3+3+4+3)^2 = 2601$$

$$SS_{total} = \sum X^2 - \frac{(\sum X)^2}{N} \quad SS_{total} = 215 - \frac{2601}{15} = 41.6$$

$$SS_{group} = n\sum(\overline{X}_{group} - \overline{X}_{gm})^2 = 5[(5-3.4)^2+(2-3.4)^2+(3.2-3.4)^2] = 22.8$$

$$SS_{error} = SS_{total} - SS_{group} = 41.6 - 22.8 = 18.8$$

Source	df	SS	MS	F
Group	2	22.8	11.4	7.26
Error	12	18.8	1.57	
Total	14	41.6		

F_{cv} for 2 and 12 df using α.01=6.93. The test statistic of 7.26>6.93, therefore reject H_0

Result in APA format: $F(2,12)=7.26$, $p=.009$

Conclusion: There is a statistically significant difference among the population means of personality types in terms of exercise frequency, such that Neuroticism types exercise more frequently than Extraversion types.

3.)

$$\eta^2 = \frac{SS_{group}}{SS_{total}} \qquad \frac{22.8}{41.6} = .55$$

Conclusion: About 55% of the variability in exercise frequency can be attributed to personality type.

4.)

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{MS_{error}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Neuroticism vs. Openness:

$$t = \frac{5 - 3.2}{\sqrt{1.57\left(\frac{1}{5} + \frac{1}{5}\right)}} = \boxed{2.27}$$

Extraversion vs. Openness:

$$t = \frac{2 - 3.2}{\sqrt{1.57\left(\frac{1}{5} + \frac{1}{5}\right)}} = \boxed{-1.52}$$

t_{cv} using error df (12 df) for $\alpha.05 = \pm 2.179$. → The test statistic 2.7 is significant but -1.52 is not.

Results in APA format:
Neuroticism vs. Openness: $t(12)=2.27$, $p=.042$
Extraversion vs. Openness: $t(12)=-1.52$, $p=.155$

Conclusion: Neuroticism types exercise significantly more frequently than Openness types, but exercise frequency is not significantly different between Extraversion and Openness types.