**Chapter 12: Two Factor ANOVA or Two-Way ANOVA**

1. A student notices that the phrase “cold and lonely” is quite common and wonders why people talk about being “cold and lonely” rather than “hot and lonely.” Is it possible that people actually feel lonely when they are physically cold? To test this possibility, she recruits 120 participants and randomly assigns half of them to hold a hot cup of coffee and the other half to hold a cold cup of iced coffee. She wants to know if men and women react differently to this manipulation and so half of the participants in each of the temperature conditions are men and half are women. While holding the cup, all participants complete the UCLA loneliness scale which is scored such that higher numbers indicate greater loneliness. She plans to analyze the data using a two-factor ANOVA. When entering the data into SPSS, how many columns will she need?

A. 1

B. 2

\*C. 3

D. 4

Learning Objective: 12-9: Use SPSS to perform a two-factor ANOVA and create a graph of the main effects and interaction.

Cognitive Domain: Knowledge

Answer Location: Data File

2. For the study described in question #1, how many *F* ratios will she need to compute for this study?

A. 1

B. 2

\*C. 3

D. 4

Learning Objective: 12-9: Explain when to use a two-factor analysis of variance (ANOVA).

Cognitive Domain: Application

Answer Location: Logic of the Two-Way ANOVA

3. For the study described in question #1, the null hypothesis for the interaction states that the effect of temperature on loneliness scores \_\_\_\_\_\_\_\_\_\_\_\_.

\*A. is the same for males and females

B. is greater for males than for females

C. is greater for females than for males

D. is different for females than for males

Learning Objective: 12-3: Write null and research hypotheses for the main effects and interaction *F* tests.

Cognitive Domain: Application.

Answer Location: Example of a Two-Way ANOVA

4. Review the study from question #1 and identify the degrees of freedom and the critical value of *F* for the interaction between gender and temperature. Set α at .05.

A. The critical value of *F* with 1 and 116 degrees of freedom is 6.86.

B. The critical value of *F* with 1 and 120 degrees of freedom is 6.86.

C. The critical value of *F* with 1 and 120 degrees of freedom is 3.92.

\*D. The critical value of *F* with 1 and 116 degrees of freedom is 3.92.

Learning Objective: 12-6: Define the critical region for each *F* test.

Cognitive Domain: Application

Answer Location: Example of a Two-Way ANOVA

5. Review the SPSS output from the study from question #1. Which of the following best describes the main effect of temperature?

\*A. People who held the cold packs reported more loneliness than people who held the warm packs.

B. People who held the cold packs reported less loneliness than people who held the warm packs.

C. Men who held the cold packs reported more loneliness than women who held the warm packs.

D. Women who held the warm packs reported less loneliness than men who held the warm packs.

E. The main effect of temperature was not significant.

Learning Objective: 12-7: Determine whether you should reject each null hypothesis; 12-12: Interpret the SPSS output for a two-factor ANOVA.

Cognitive Domain: Application

Answer Location: Example of a Two-Way ANOVA

6. Simple effects analyses are needed when:

A. one of the main effects is significant.

B. both main effects are significant.

\*C. the interaction is significant.

D. you fail to reject the null and have two IVs.

Learning Objective: 12-10: Use SPSS to compute simple effect analyses.

Cognitive Domain: Knowledge

Answer Location: Example of a Two-Way ANOVA

7. Review the SPSS output from the study from question #1. Which of the following statements best describes the interaction?

\*A. Men did not report more loneliness while holding the cold packs while women did report significantly more loneliness while holding the cold packs.

B. Both men and women reported more loneliness while holding the cold packs than the warm packs.

C. Women reported more loneliness when holding the cold packs and mean reported more loneliness when holding the warm packs.

D. Women were lonelier than men and people were lonelier when holding the cold packs than the warm packs.

E. The interaction was not significant.

Learning Objective: 12-7: Determine whether you should reject each null hypothesis; 12-12: Interpret the SPSS output for a two-factor ANOVA.

Cognitive Domain: Application

Answer Location: Example of a Two-Way ANOVA; Data File

8. Review the SPSS output from the study from question #1. Which of the following means would you graph for the main effect of gender?

A. 2.5433 and 2.1083

\*B. 2.2208 and 2.4308

C. 2.7683 and 2.0933

D. 2.3183, 2.1233, 2.7683, and 2.0933

E. 2.5433, 2.1083, 2.2208, and 2.4308

Learning Objective: 12-4: Identify which means are compared when computing each main effect and interaction *F* tests.

Cognitive Domain: Application

Answer Location: Example of a Two-Way ANOVA; Output File

9. Review the SPSS output from the study from question #1. Compute the effect size (*d*) for the simple effect for women.

A. .42

B. .83

C. .65

\*D. .96

Learning Objective: 12-8: Compute effect sizes for each main effect and the interaction, and describe each as small, medium, or large

Cognitive Domain: Application

Answer Location: Example of a Two-Way ANOVA

10. Review the SPSS output from the study from question #1.

A. *F*(1, 120) = 4.15, *p* = .04, MSE = 1.73, *ηp*2 = .03

B. *F*(1, 116) = 4.15, *p* = .04, MSE = 1.73, *ηp*2 = .03

\*C. *F*(1, 116) = 4.15, *p* = .04, , MSE = .42, *ηp*2 = .03

D. *F*(1, 120) = 4.15, *p* = .04, MSE = .42, *ηp*2 = .03

Learning Objective: 12-11: Summarize the results of the ANOVA using American Psychological Association (APA) style.

Cognitive Domain: Application

Answer Location: Example of a Two-Way ANOVA