

Practice Assignment: Introduction to One-Way ANOVA

- 1) True or False: A one-way ANOVA (analysis of variance) is a statistical test for comparing and making inferences about means associated with two or more groups.

Answer: True

- 2) True or False: The alternative hypothesis in an ANOVA will state that all of the group means are different from one another.

Answer: False; the alternative hypothesis states that at least two of the group means are different.

Questions 3–5

In previous in-class activities, we explored data from a study comparing college students who identified as either Morning Larks, Night Owls, or Neither.

Suppose we wanted to answer the research question, “Is there a difference between the mean number of alcoholic drinks consumed by those who identified as Morning Larks, Night Owls, or Neither?”

- 3) Explain why a one-way ANOVA might be considered to address this research question.

Answer: A one-way ANOVA should be considered because we are interested in comparing the means of three groups.

- 4) Which of the following would be the correct null hypothesis for this situation?

a) $H_0: \mu_1 = \mu_2$

b) $H_0: \mu_1 = \mu_2 = \mu_3$

c) $H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$

d) $H_0: \mu_1 \neq \mu_2 \neq \mu_3$

Answer: b

- 5) Which of the following would be the correct alternative hypothesis for this situation?

- a) $H_A: \mu_1 \neq \mu_2 \neq \mu_3$
- b) H_A : All three of the group means are different.
- c) H_A : The group means are different.
- d) H_A : At least two of the group means are different.

Answer: d

- 6) A researcher is interested in conducting a one-way ANOVA to determine whether there is a difference in systolic blood pressure for individuals randomly assigned to use one of four different blood pressure medications. That is, she would like to compare the mean systolic blood pressures for the four groups. Write the appropriate null and alternative hypotheses for this situation.

Answer:

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$$

H_A : At least two of the group means are different.

- 7) Conducting a one-way ANOVA involves considering the variation among group means and the grand mean. Which of the following best describes the **grand mean**?
- a) The sum of the variation *between* each of the group means and the grand mean
 - b) The sum of the variation *within* each of the groups
 - c) The mean of all data values from all groups
 - d) The average of the *within* group variation and the *between* group variation

Answer: c

- 8) Conducting a one-way ANOVA involves considering a number of statistics, including the error sum of squares. Which of the following best describes the **error sum of squares**?
- a) The sum of the variation *between* each of the group means and the grand mean
 - b) The sum of the variation *within* each of the groups
 - c) The mean of all data values from all groups
 - d) The average of the *within* group variation and the *between* group variation

Answer: b

- 9) Conducting a one-way ANOVA involves considering a number of statistics, including the group sum of squares. Which of the following best describes the **group sum of squares**?
- a) The sum of the variation *between* each of the group means and the grand mean
 - b) The sum of the variation *within* each of the groups
 - c) The sum of the group means divided by the number of groups
 - d) The average of the *within* group variation and the *between* group variation

Answer: a

- 10) True or False: If the *between* group variation is significantly greater than the *within* group variation, this would lead to convincing evidence that at least one of the means is different.

Answer: True

- 11) Write a paragraph describing when we might *fail to reject* the null hypothesis in a one-way ANOVA. What might we see in boxplots or dotplots of these data? Use the phrases “within group variation” and “between group variation” in your response.

Answers will vary.

Sample answer. The null hypothesis in a one-way ANOVA states that each of the population means are equal to one another. We would fail to reject this null hypothesis if the within group variation was significantly larger, relative to the between group variation. That is, if we viewed boxplots or dotplots of the grouped data, we would see significant overlap in the distributions compared to the variation between the group means and the grand mean.

