ANOVA in class exercise November 2024

Question 1

1. What are the probabilities associated with each of the following F values and degrees of freedom, what decision do you make concerning the null hypothesis, and what type of error do you risk?

			H_0		Error Risked	
F	df	p <	Reject	Don't Reject	Type I	Type II
4.42	3, 25	_____	☐	☐	☐	☐
6.21	8, 40	_____	☐	☐	☐	☐
3.40	2, 28	_____	☐	☐	☐	☐
3.55	4, 10	_____	☐	☐	☐	☐
3.55	4, 120	_____	☐	☐	☐	☐

Question 2

If 2 were subtracted from each dependent variable score in a data set, what would happen to the total, within-groups, and between-groups sums of squares, the F ratio, and the associated probability? Would they increase, decrease, or remain the same?

Statistic	Decrease	Remain the Same	Increase
Total sum of squares	☐	☐	☐
Within-groups sum of squares	☐	☐	☐
Between-groups sum of squares	☐	☐	☐
F ratio	☐	☐	☐
p	☐	☐	☐

Question 3

For the following data, please answer the following questions

Here are the estimated hours spent studying on a typical day of five high school students in each of three types of places:

Place of Residence		
Rural	Suburban	Urban
1	3	2
3	1	1
0	3	0
1	3	4
0	5	3

1) The null hypothesis

2) Computing all means

3) Computing SS_{Total}

4) Computing $SS_{Between}$

5) Computing SS_{Within}

6) Computing $df_{Between}$

7) Computing df_{Within}

8) Computing $MSS_{Between}$

9) Computing MSS_{Within}

10) Computing F ratio

11) Determine the p value

12) Decision regarding the null hypothesis, and type of error committed

13) Computing eta-square

14) Interpreting the meaning of eta-square

ANOVA TABLE

	Sum of Square	Degree of freedom	MSS	F	P	Eta-square
Between	$\sum_{\times N_G}(\overline{X_G} - \overline{X_T})^2$	K – 1	$\frac{SS_{Between}}{df_{between}}$	$\frac{MSS_{Between}}{MSS_{Within}}$		$\frac{SS_{Between}}{SS_{Total}}$
Within	$SS_{Total} - SS_{Between}$	N – K	$\frac{SS_{Within}}{df_{Within}}$			
Total	$\sum(X_i - \overline{X_T})^2$					

Question 4

For the following data, please complete the ANOVA table

Here is some hypothetical data with a small enough N to keep your calculations fairly simple. Imagine a sample of 12 teenagers from three high schools—Washington, Adams, and Jefferson. Here are the school each teenager attends and the number of school days missed during a school year.

School Attended	Number of Days Missed
Washington	6
Washington	5
Washington	7
Adams	5
Adams	4
Adams	6
Adams	5
Jefferson	2
Jefferson	1
Jefferson	3
Jefferson	1
Jefferson	3

ANOVA Table

	Sum of square	df	MSS	F	P	Eta-square
Between						
Within						
Total						

Question 5

For the following data, please complete the ANOVA table

'A dean of students randomly selects 16 students, asking each a series of questions that measure students' "school spirit" on a scale from 1 to 10. Here are the total school spirit scores of these 16 students:

First-Years		Sophomores		Juniors		Seniors	
Name	Score	Name	Score	Name	Score	Name	Score
Alfie	6	Eddie	5	Iggy	4	Mannie	7
Betty	3	Frannie	5	Jackie	3	Nellie	4
Charlie	6	Gigi	2	Kelly	5	Ollie	7
Deedee	5	Hildi	4	Louie	4	Pepe	6

	Sum of square	df	MSS	F	P	Eta-square
Between						
Within						
Total						

Question 6

For the following data, please complete the ANOVA table

A General Social Survey asked 1465 respondents how much they liked rap music. Liking of rap music was measured on a five-point scale ranging from 1 (like it very much) to 5 (dislike it very much). These are the mean rap scores and Ns for type of community in which respondent lives:

Type of Community	Mean	N
Big City	3.773	256
Suburbs	3.909	395
Small City	3.930	572
Village	4.400	55
Country	4.011	187

	Sum of square	df	MSS	F	P	Eta-square
Between						
Within	1,811.96					
Total						