ISE 2211 • Exam VII • 30 July 2020 NAME SOLUTION

R Setting	Gain (V/V)			Totals	Averages
	Sample 1	Sample 2	Sample 3		
4	7.8	8.1	7.9	23.80	7.933
3	5.2	6.0	4.3	15.50	5.167
2	4.4	6.9	3.8	15.10	5.033
1	2	1.7	0.8	4.500	1.500
				58.90	4.908

+1 +1

$$\sum_{i=1}^{a}\sum_{j=1}^{n} y_{ij}^2 = 359.3$$

$N = an = 4 \cdot 3 = 12$

This is actual data from one of Joe Tritschler's audio engineering experiments. Use Analysis of Variance (ANOVA) to test the null hypothesis that the treatment means are equal at the $\alpha = 0.05$ level of significance. Fill in the ANOVA table.

+1 everything on table

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	f_0
Treatments	62.55	3	20.85	21.80
Error	7.65	8	0.9563	-
Total	70.20	11	-	-

$SS_T = 359.3 - \frac{58.90^2}{12} = 70.20$ +1

$d.o.f.(T) = 4 \cdot 3 - 1 = 11$ +1

$SS_{Tr} = \frac{23.80^2 + 15.50^2 + 15.10^2 + 4.500^2}{3} - \frac{58.90^2}{12} = 62.55$ +1

$d.o.f.(Tr) = 4 - 1 = 3$ +1

$SS_E = 70.20 - 62.55 = 7.65$ +1

$d.o.f.(E) = 4(3-1) = 8$ +1

$MS_{Tr} = \frac{62.55}{3} = 20.85$

$MS_E = \frac{7.65}{8} = 0.9563$ } +1

$f_0 = \frac{20.85}{0.9563} = 21.80$ +1

$f_{critical} = f_{.05,3,8} = 4.07$ +1

$f_0 \gg f_{critical} \therefore$ reject H_0 +1

Use Fisher's Least Significant Difference to determine which, if any, pairs of resistance settings significantly affect attenuation at $\alpha = 0.05$.

$$LSD = t_{.025,8} \sqrt{\frac{2 \cdot 0.9563}{3}} = 2.306 \quad (+1)$$

$$= 1.841 \quad (+1)$$

4 vs. 3 : $|7.933 - 5.167| = 2.766$

3 vs. 2 : $|5.167 - 5.033| = 0.1340$

2 vs. 1 : $|5.033 - 1.500| = 3.533$

(+1) $<$ LSD

4 vs. 2 : $|7.933 - 5.033| = 2.900$

3 vs. 1 : $|5.167 - 1.500| = 3.667$

4 vs. 1 : $|7.933 - 1.500| = 6.433$

(+1) (+1)

all pairs show significance except 3 vs. 2

(+1)