ISE 2211 • Exam VII • 24 April 2020 NAME SOLUTION

You know what to do.

Bias Current (mA)	Total Harmonic Distortion (% THD)			Totals	Averages
	Q_1	Q_2	Q_3		
5.0	0.12	0.15	0.10	0.37	0.1233
10.0	0.080	0.067	0.10	0.247	0.0823
15.0	0.072	0.051	0.083	0.206	0.06867
				0.823	0.09144

$$\sum_{i=1}^{a}\sum_{j=1}^{n} y_{ij}^2 = 0.082463$$

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.

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	f_0
Treatments	0.004856	2	0.002428	6.204
Error	0.002348	6	0.0003913	-
Total	0.007204	8	-	-

$$SS_T = 0.082463 - \frac{0.823^2}{9} = 0.007204 \quad (+1)$$

$$d.o.f. = 3\cdot 3 - 1 = 8 \quad (+1)$$

$$SS_{Tr} = \frac{0.37^2 + 0.247^2 + 0.206^2}{3} - \frac{0.823^2}{9} = 0.004856 \quad (+1)$$

$$d.o.f. = 3 - 1 = 2 \quad (+1)$$

$$SS_E = SS_T - SS_{Tr}$$

$$= 0.007204 - 0.004856$$

$$= 0.002348 \quad (+1)$$

$$d.o.f. = 3(3-1) = 6 \quad (+1)$$

$$MS_{Tr} = \frac{0.004856}{2} = 0.002428$$

$$MS_E = \frac{0.002348}{6} = 0.0003913 \quad \} (+1)$$

$$f_0 = \frac{.002428}{0.0003913} = 6.204 \quad (+1)$$

$$f_{crit.} = f_{.05,\ 3-1,\ 3(3-1)} = 5.14 \text{ (table)} \quad (+1)$$

$f_0 > f_{crit.}$, reject H_0 (+2)

Use Fisher's Least Significant Difference to determine which, if any, pairs of bias currents significantly affect total harmonic distortion $\alpha = 0.05$.

$$t_{.025,\,3(3-1)}^{\,b} = 2.447$$ (+1) (table)

$$LSD = 2.447\sqrt{\frac{2 \cdot 0.0003913}{3}}$$

$$= 0.03952$$ (+1)

5.0 vs. 10.0 : $|.1233 - .0823| = 0.041 > LSD$

10.0 vs. 15.0 : $|.0823 - .06867| = 0.01363 < LSD$

5.0 vs. 15.0 : $|.1233 - .06867| = 0.05463 > LSD$

(pairs listed) (+1)

(differences) (+1)

(+1)

all bias current pairs show significance except 10.0 vs. 15.0 mA (+1)