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ISE 2211 • Exam VII • 6 December 2019 NAME SOLUTION

Here is some data. I'll spare you the engineering rationale so you can get right to work.

Remanence (T)	Current (mA)						Totals	Averages
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6		
1.3	234	305	243	292	276	287	1637	273
1.6	231	230	272	292	273	274	1572	262
2.0	339	285	274	340	298	236	1772	295
2.4	297	352	341	290	248	373	1901	317
2.8	391	393	428	363	381	467	2423	404
							9305	310

Use Analysis of Variance (ANOVA) to test the null hypothesis that the treatment means are equal at the $\alpha = 0.01$ level of significance. Fill in the ANOVA table.

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	f_0
Treatments	76510	4	19128	14.44
Error	33124	25	1325	-
Total	109634	29	-	-

$\sum_{i=1}^{a}\sum_{j=1}^{n} y_{ij}^2 = 2995735$ (You're welcome!) (+1)

(table filled in) (+1)

$SS_T = 2995735 - \frac{9305^2}{5 \cdot 6} = 109634$ (+1)

d.o.f. $= 5 \cdot 6 - 1 = 29$ (+1)

$SS_{Treatments} = \frac{1637^2 + 1572^2 + 1772^2 + 1901^2 + 2423^2}{6} - \frac{9305^2}{5 \cdot 6}$

$= 76510$ (+1)

d.o.f. $= 5 - 1 = 4$ (+1)

$SS_E = 109634 - 76510$

$= 33124$ (+1)

d.o.f. $= 5(6-1) = 25$ (+1)

$MS_{Treatments} = \frac{76510}{4} = 19128$

$MS_E = \frac{33124}{25} = 1325$ (+1)

$f_0 = \frac{19128}{1325} = 14.44$ (+1)

$f_{critical} = f_{.01,4,25} = 4.18$ (+1)

$f_0 > f_{critical}$; so reject H_0 (+1)

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Write a 99% confidence interval on output current at the 2.4-tesla level of remanence.

$\bar{y}_{5\cdot} = 317$ mA (+1)

$t_{\alpha/2,\, 9(n-1)} = t_{.005,\, 25} = 2.787$ (+1)

$317 \pm 2.787 \sqrt{\frac{1325}{6}}$

$275.6 < \mu_5 < 358.4$ (mA)

(+2) (+1)

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Use Fisher's Least Significant Difference to determine which, if any, pairs of remanences show significant difference at $\alpha = 0.01$.

$$LSD = 2.787\sqrt{\frac{2 \cdot 1325}{6}} = 58.57$$

+1

1.3 vs 1.6 :	$\lvert 273 - 262 \rvert$	=	11	$\not>$	LSD
1.6 vs 2.0 :	$\lvert 262 - 295 \rvert$	=	33	$\not>$	LSD
2.0 vs. 2.4 :	$\lvert 295 - 317 \rvert$	=	22	$\not>$	LSD
2.4 vs. 2.8 :	$\lvert 317 - 404 \rvert$	=	87	$>$	LSD
1.3 vs. 2.0 :	$\lvert 273 - 295 \rvert$	=	22	$\not>$	LSD
1.6 vs. 2.4 :	$\lvert 262 - 317 \rvert$	=	55	$\not>$	LSD
2.0 vs. 2.8 :	$\lvert 295 - 404 \rvert$	=	109	$>$	LSD
1.3 vs. 2.4 :	$\lvert 273 - 317 \rvert$	=	44	$\not>$	LSD
1.6 vs. 2.8 :	$\lvert 262 - 404 \rvert$	=	142	$>$	LSD
1.3 vs. 2.8 :	$\lvert 273 - 404 \rvert$	=	131	$>$	LSD

+1 all ~~ten~~ pairs

+1 ~~ten~~ differences (no double jeopardy)

+1 Comparisons to LSD

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2.4 vs. 2.8, 2.0 vs. 2.8, 1.6 vs. 2.8, and 1.3 vs. 2.8 Show significance

+1