PLSC 724 - EXAMINATION 1

October 14, 2009
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Name: Key

(40) 1. A corn breeding company is developing a drought-resistant hybrid for western North Dakota. The company claims that the drought-resistant hybrid yields 35% more than the check hybrid under drought conditions. Based on data from 20 observations, write the null and alternative hypotheses to be tested and determine if the mean yield of the check hybrid plus 35% yields less than the drought resistant hybrid using a confidence interval. The check hybrid yielded 65 bushels per acre with a variance of 64. The drought resistant hybrid yielded 95 bushels per acre with a variance of 49. All hypotheses in this problem should be tested at the 95% level of confidence.

$\bar{Y}_{Drought} = 95$ bu/Ac $\quad \bar{Y}_{Check} = 65$ bu/Ac

$\sigma^2_{Drought} = 49 \quad \sigma^2_{Check} = 64$

$n_{Drought} = 20 \quad n_{Check} = 20$

$H_0: \mu_{Check} + 35\% \geq \mu_{Drought}$

$H_A: \mu_{Check} + 35\% < \mu_{Drought}$

$\mu_{Check} + 35\% - \mu_{Drought} = 0$

1. Folded F-test $\frac{\text{Larger } \sigma^2}{\text{Smaller } \sigma^2} = \frac{64}{49} = \boxed{1.306} \quad F_{\frac{.05}{2}; 19,19} = \boxed{2.51}$

$F_{calc} < F_{Table}$ ∴ fail to reject $H_0: \sigma^2_{Drought} = \sigma^2_{Check}$

2) Calculate $S_{\bar{Y}_1 - \bar{Y}_2} = \sqrt{\frac{2S_p^2}{n}}$

$S_p^2 = \frac{64 + 49}{2} = \boxed{56.5}$

∴ $S_{\bar{Y}_1 - \bar{Y}_2} = \sqrt{\frac{2(56.5)}{20}} = \boxed{2.377}$

3) Construct Confidence Interval

$CI = [\bar{Y}_{Check} + (\bar{Y}_{Check} * .35) - \bar{Y}_{Drought}] \pm t_{38 df; \frac{.05}{2}} \cdot S_{\bar{Y}_1 - \bar{Y}_2}$

df for $t = (n_{dmight} - 1) + (n_{check} - 1)$

$= (20-1) + (20-1)$

$\boxed{= 38}$

$\therefore\ t_{38\,df;\,\frac{.05}{2}} = \boxed{1.686}$

$H_A : \mu_{check} + 35\% < \mu_{Dmight}$

One-tail test and lower limit $= -\infty$ since there is a "<" sign in H_A if it is written as the question states

$\therefore\ CI = [65 + (65 * 0.35) - 95] + (1.686 * 2.377)$

$\boxed{= -3.243}$

$$\boxed{-\infty \le [(\mu_{check} + 35\%) - \mu_{Dmight}] \le -3.243}$$

Interval does not include zero

$\therefore$ Reject $H_0: \mu_{check} + 35\% \ge \mu_{Dmight}$

2. From a completely random design with no sampling, an investigator reported the following treatment means.

Treatment	A	B	C	D
$\bar{Y} = \bar{Y}_{i.}$	160	200	280	360
$Y_{i.}$ = (×4 reps)	640	800	1120	1440

$Y_{..} = 4{,}000$

Each mean is based on four observations.

$s^2_{\bar{Y}_1-\bar{Y}_2} = 40$

Using the information above:

(20) a. Construct the analysis of variance table including sources of variation, degree of freedom, sums of squares, mean squares, and all valid F-tests.

(5) b. Test the null hypothesis of no differences between the treatment means at the 95 and 99% levels of confidence.

(10) c. Regardless of the results of the F-test, calculate an LSD to compare the means of treatments at the 95% level of confidence. Indicate using lowercase letters which means are significantly different.

$$s^2_{\bar{Y}_1-\bar{Y}_2} = \frac{2\,\text{Error MS}}{r} \equiv 40 = \frac{2(\text{Error MS})}{4} \Rightarrow \frac{160}{2} = \text{Error MS}$$

$$\boxed{\therefore \text{Error MS} = 80}$$

$$\text{Trt SS} = \left(\frac{640^2}{4} + \frac{800^2}{4} + \frac{1120^2}{4} + \frac{1440^2}{4}\right) - \frac{4{,}000^2}{4 \times 4}$$

$= 94{,}400$

SOV	df	SS	MS	F
Trt	3	94,400	31,466.67	393**
Error	12	960	80	
Total	15			

$F_{.05;3,12} = 3.41$

$F_{.01;3,12} = 6.93$

$$LSD = t_{\frac{.05}{2};\,12df}\sqrt{\frac{2\,\text{Error MS}}{r}}$$

$$2.179\sqrt{\frac{2(80)}{4}}$$

$$= 13.78$$

$$\cong 14$$

Trt	mean	
A	160	a
B	200	b
C	280	c
D	360	d

(25) 3. From the following analysis of variance table, compute the standard error appropriate for use when calculating the T_α for Tukey's Procedure.

Sources of variation	Degrees of freedom	Sum of square	MS
Treatments	6	840	
Experimental Error	21	210	10
Sampling Error	56	1050	
Total	83		

$(rt-1)-(t-1)=21$

$(7r-1)-6=21$

$7r=28$

$r=4$

$rts-1=83$

$(7)(4)s=84$

$s=3$

$$S_{\bar{Y}}=\sqrt{\frac{\text{Error MS}}{r\cdot s}}$$

$$=\sqrt{\frac{10}{4*3}}$$

$$\boxed{=0.913}$$

"Upon my honor, I have neither given nor received aid in writing this exam."

Signed____________________________________