STATISTICS 642 - EXAM I - February 26, 2020 - SOLUTIONS

Problem I. (44 points) Provide the details for each of the following items:

1. Type of Randomization:

- Randomized Complete Block Design with Greenhouses designated as the blocks, and a Split Plot Treatment Assignment

2. Type of Treatment Structure:

- 4×3 crossed factorial structure with Variety crossed with Stimulant

3. Identify each of the factors as being Fixed or Random:

- Greenhouses-2 random levels, Growth Stimulant - 3 fixed levels; Rose Variety - 4 fixed levels

4. Describe the experimental units:

- EU for Variety is a Bench; EU for Stimulant is a Region on a Bench

5. Describe the measurement units:

- MU is a Rose plant

6. Identify any covariates:

- Height of Rose Plant prior to applying the stimulant

Problem II. (36 points)

1. Separate the Caffeine levels into groups of levels such that all members of the group are not significantly different from any other member of the group with respect to their average Adenine concentration. The researcher wants an experimentwise error rate of at most $\alpha = 0.05$ in reaching your conclusions?

- Using the Tukey-Kramer HSD adjusted p-values on page 10 with $\alpha_{PC} = .05$, we obtain:

  $G_1 = \{0\}; \;\; G_2 = \{5, 10\}; \;\; G_3 = \{15\}; \;\; G_4 = \{20\}; \;\; G_5 = \{25\}$

2. Which ones, if any, of the trends in the average Adenine concentration as a function of Caffeine level are significant? The researcher wants an experimentwise error rate of at most $\alpha = 0.05$ in reaching your conclusions?

- Because the 5 contrasts evaluating the trends are mutually orthogonal, use $\alpha_{PC} = 1 - (1 - .05)^{1/5} = .0102$ in selecting contrasts which are significant trends: Using the p-values on Page 11 in the SAS output, the significant trends are Linear, Quadratic, and Cubic.

3. $\alpha = .01; \;\; \gamma_o = .9; \;\; D = 1.4; \;\; \sigma_e^2 \approx .4; \;\; t = 6, r = 8 \;\Rightarrow\; \nu_1 = t - 1 = 5, \nu_2 = t(r-1) = 42;$

- $\lambda^{(5)} = \frac{rD^2}{2\sigma_e^2} = \frac{(8)(1.4)^2}{2(.4)} = 19.6 \;\; \phi = \sqrt{\lambda/t} = \sqrt{19.6/6} = 1.8$

- From Table IX in Tables for Exams with $\nu_1 = 5, \;\; \alpha = .01$, we have $\gamma(\lambda) = \gamma(19.6) \approx 0.75 < 0.9$. Therefore the researcher's goal of 90% power has not been obtained. Using R, $\gamma(19.6) = 1 - pf(qf(.99, 5, 42), 5, 42, 19.6) = 0.7502025$

Problem III. (20 points) CIRLCE (A, B, C, D, or E) corresponding to the **BEST** answer.

1. - D 2. - A - detects increasing trend 3. - D - provides the most EUs in each block
4. - B 5. - E - need to know the constraint on the $\tau's$

EXAM 1 SCORES n = 98

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Min =  41, Q(.25) =  65, Q(.5) = 78 , Mean = 74, Q(.75) =  83, Max =  97
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