# UNIVERSITY OF FORT HARE

AGB 321

SUPPLEMENTARY EXAMINATIONS

JANUARY 2019

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Time: 3Hours

Subject: Applied Agricultural Biometry

Mark: 100

**This paper consists of 5 pages including the cover page**


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## INSTRUCTIONS

- Answer ALL questions
- Statistical Tables will be provided.

# AGB 321

**Question 1**

a) Define a contrast. [2]

b) In an experiment to examine the responses of maize to nitrogen fertilizer applications, six treatments were used in 4 blocks. The treatments were:

T1: $N_0P_0K_0$ T2: $N_0P_{60}K_{30}$ T3: $N_{30}P_{60}K_{30}$

T4: $N_{60}P_{60}K_{30}$ T5: $N_{90}P_{60}K_{30}$ T6: $N_{120}P_{60}K_{30}$

| | Blocks | | | | |
|---|---|---|---|---|---|
| Treatment | 1 | 2 | 3 | 4 | Total |
| T1 | 0.42 | 0.22 | 0.31 | 0.33 | 1.28 |
| T2 | 0.46 | 0.42 | 0.58 | 0.55 | 2.01 |
| T3 | 0.60 | 0.86 | 0.83 | 0.89 | 3.18 |
| T4 | 2.63 | 2.39 | 1.68 | 2.22 | 8.96 |
| T5 | 2.81 | 2.83 | 1.95 | 2.81 | 10.40 |
| T6 | 3.39 | 2.50 | 2.50 | 2.10 | 10.49 |

The following ANOVA table was obtained from the analysis.

| S.V | d.f | S.S | M.S | F |
|---|---|---|---|---|
| Blocks | 3 | 0.53 | 0.18 | |
| Treatments | 5 | 23.60 | 4.72 | 46.07 |
| Error | 15 | 1.54 | 0.10 | |
| Total | 23 | 25.67 | | |

$F_{5,15,0.05} = 2.90$

Prior to the conduct of the experiment, it was decided that the following differences would be examined.

I. Between the two 'no nitrogen ' treatments

II. Effect of application of nitrogen

III. Between low levels of nitrogen and high levels of nitrogen

IV. Between the two low levels of nitrogen

V. Between the two high levels of nitrogen

Set the hypothesis for each contrast [10]

Compute the table of linear contrast, showing the Sum of Squares contrasts and the corresponding F-values. [15]

Comment on your results. [3]

c) Using the data in 1b above, separate the means using DMRT. Interpret your results. [10]

..... **[40mks]**

**Question 2**

An agronomist set up an experiment to examine the effects of different row spacings on Soybeans yield. The yield was recorded in kg/ha.Data obtained are displayed below.

| | Row spacing(in) | | | | | |
|---|---|---|---|---|---|---|
| Block | 20 | 25 | 30 | 35 | 40 | Total |
| 1 | 336 | 311 | 330 | 284 | 314 | 1575 |
| 2 | 371 | 345 | 295 | 299 | 283 | 1593 |
| 3 | 341 | 305 | 292 | 316 | 289 | 1543 |
| 4 | 346 | 327 | 307 | 323 | 286 | 1589 |
| 5 | 354 | 307 | 307 | 281 | 296 | 1545 |
| 6 | 361 | 303 | 279 | 269 | 334 | 1546 |
| Totals | 2190 | 1898 | 1810 | 1772 | 1802 | 9391 |

The ANOVA table for the above data is:

| S.V | d.f | S.S | M.S | F |
|---|---|---|---|---|
| Blocks | 5 | 540.97 | | |
| Spacings | 4 | 12566.13 | 3141.53 | 8.50 |
| Error | 20 | 7391.87 | 369.59 | |
| Total | 29 | 20498.97 | | |

Since t=5,a polynomial of up to order 4 is possible. Using the table of coefficients for orthogonal polynomials.

Obtain the coefficients for the linear, quadratic, cubic and quartic from the statistical table.

a) Construct a table of contrasts, showing the Sum of Squares and corresponding F-values. [12]
b) State the relationship that is being tested. [5]
c) State the hypothesis. [3]
d) Write the appropriate model. [3]
e) Comment on your results. [2]

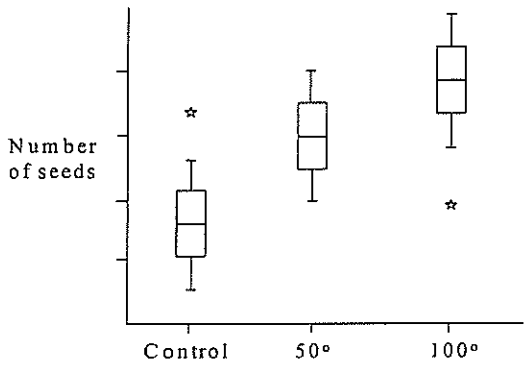
..... **[25mks]**

**Question 3**

An experiment was set up to examine the germination of *Acacia* seeds in response to heat. There were 3 treatments (no heat = control, mild heat = 50°C, extreme heat = 100°C) and 10 replicate seed boxes (each with 100 seeds) for each treatment. The data are the number of seeds germinating in each seed box. The results are presented below:

ANOVA:

| Source of variation | df | MS | *F*-ratio | *P* |
|---|---|---|---|---|
| Between treatments | 2 | 246.4 | 5.78 | 0.009 |
| Residual | 27 | 42.6 | | |



a) The data were not transformed - why? [4]

b) What null hypothesis was being tested by the ANOVA *F*-ratio test? [4]

c) What conclusion(s) can be drawn from the ANOVA? [6]

d) If the ANOVA *F*-ratio test was significant, how would you find out which temperatures were different from which others? [6]

..... **[20mks]**

**Question 4**

a) Define a Type II error in hypothesis testing, and state the statistical relationships between Type II error and the power of a statistical test. [5]

b)

Interpret the outputs below stating the assumptions of ANOVA that are being tested

Tests for Normality

| Hormone | Test | --Statistic--- | | -----p Value------ | |
|---|---|---|---|---|---|
| Buddy: | Shapiro-Wilk | W | 0.946017 | Pr < W | 0.6913 |
| Control: | Shapiro-Wilk | W | 0.943252 | Pr < W | 0.6743 |
| Growfast: | Shapiro-Wilk | W | 0.975665 | Pr < W | 0.8762 |
| Shoot: | Shapiro-Wilk | W | 0.972411 | Pr < W | 0.8563 |

Levene's Test for Homogeneity of Bruise Variance
ANOVA of Squared Deviations from Group Means

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| Hormone | 3 | 44262.3 | 14754.1 | 0.46 | 0.7149 |
| Error | 12 | 384307 | 32025.6 | | |

Suggest solutions to the problems observed. [10]

..... **[15mks]**