UNIVERSITY EXAMINATIONS
NJORO CAMPUS
SECOND SEMESTER 2011/2012

THIRD YEAR EXAMINATION FOR THE AWARD BACHELOR OF SCIENCE IN AGRICULTURE AND BACHELOR OF SCIENCE IN FOOD TECHNOLOGY

AGRO 391 AGRICULTURAL EXPERIMENTATION

STREAM: BSc. AGRIC, BSc. FOOD TECHNOLOGY   TIME: 3 HRS

DAY:_____   DATE :_____

INSTRUCTIONS:
Answer all the questions

SECTION A

Q1.)   The SAS output given below was obtained from an experiment conducted on the strength of the fabric. The data obtained was analyzed as CRD and RCBD.

```
The SAS System          14:50 Friday, February 2, 2001  61
                            The GLM Procedure
                        Class Level Information
                    Class         Levels   Values
                    treat            4      a b c d

                       Number of observations   16
            The SAS System          14:50 Friday, February 2, 2001  62
                            The GLM Procedure

Dependent Variable: streng
                          Sum of
Source              DF      Squares     Mean Square    F Value    Pr > F
Model                3    0.52011875     0.17337292      8.53     0.0026
Error               12    0.24377500     0.02031458
Corrected Total     15    0.76389375


                R-Square     Coeff Var      Root MSE    streng Mean
                0.680878     5.937172      0.142529      2.400625

Source              DF    Type III SS    Mean Square    F Value    Pr > F
treat                3    0.52011875     0.17337292      8.53     0.0026

                          The GLM Procedure
                        t Tests (LSD) for streng
  NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error
rate.
                        Alpha                        0.05
                        Error Degrees of Freedom       12
                        Error Mean Square        0.020315
                        Critical Value of t       2.17881
                        Least Significant Difference   0.2196


        Means with the same letter are not significantly different.
                t Grouping        Mean      N    treat
                        A        2.6800      4    b

                        B        2.4175      4    c
                        B
                C       B        2.3150      4    d
```

```
                         C
                         C           2.1900      4    a

                           The GLM Procedure
                         Class Level Information
                      Class         Levels    Values
                      rep              4      1 2 3 4
                      treat            4      a b c d


                         Number of observations    16
                 The SAS System         14:50 Friday, February 2, 2001   65
                             The GLM Procedure

Dependent Variable: streng
                                      Sum of
Source                    DF        Squares     Mean Square    F Value    Pr > F
Model                      6      0.64673750     0.10778958      8.28     0.0030
Error                      9      0.11715625     0.01301736
Corrected Total           15      0.76389375


                   R-Square      Coeff Var      Root MSE     streng Mean
                   0.846633      4.752664       0.114094      2.400625


Source                    DF     Type III SS    Mean Square    F Value    Pr > F
rep                        3      0.12661875     0.04220625      3.24     0.0744
treat                      3      0.52011875     0.17337292     13.32     0.0012


                 The SAS System          14:50 Friday, February 2, 2001   66
                             The GLM Procedure
                           t Tests (LSD) for streng
   NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error
rate.
                         Alpha                         0.05
                         Error Degrees of Freedom         9
                         Error Mean Square         0.013017
                         Critical Value of t        2.26216
                         Least Significant Difference   0.1825
              Means with the same letter are not significantly different.


                     t Grouping         Mean     N    treat

                              A        2.68000    4    b
                              B        2.41750    4    c
                              B
                      C       B        2.31500    4    d
                      C
                      C                2.19000    4    a
```

a.)   Give a an executable **SAS procedures** that produced the above output   **(5 Marks)**
b.)   With the aid of formula, show how the figures were derived.   **(6 marks)**
c.)   Explain the results   **(4 Marks)**
d.)   Give the experimental layouts that fits the two analyses   **(2 marks)**
e.)   In each case, give statistical equation   **(1 mark)**

Q. 2.   (a) The ANOVA table given below is from an experiment conducted to detect
        effects of eight levels of pain with treatment of two types of codeine and two
        acupuncture. Partial results obtained are presented in the table below.

Source of variation	Df	Sum of Squares	Mean Square	F-value	P<F
Pain				55.30	0.0001
Codein				159.79	0.0001
Acupuncture				233.68	0.0001
Codein x Acupuncture				3.11	0.0923
Error					
Corrected Total	31	11.63875			

The root mean square for this experiment is 0.120268 and CV of 10.40152.

i)   Complete the anova table below, calculate R^2 grand mean, and interpret the results.   **(8 Marks)**
ii) Give statistical equation for the above data   **(1 Mark)**
iii) Give a SAS program that would be suitable for analysis of the above data.
                                                                          (2 marks)

Q3) A researcher conducts an experiment to examine the relationship between the weight gain of chicken whose diets had been supplemented by different amounts of amino acid lysine and amount of lysine ingested. Since the percentage of lysine is known, and amount of food consumed can be monitored, the amount of lysine eaten can be determined. A random sample of twelve 2-week-old chicken was selected for the study. Each was caged separately and was allowed to eat at will from feed composed of a base supplemented with lysine. The sample data summarizing weight gains and amount of lysine eaten over the test period are given below (y represents weight gain in g, and x represents the amount of lysine ingested in g).

Chick	y	x	Chick	y	x
1	14.7	0.09	7	17.2	0.11
2	17.8	0.14	8	18.7	0.19
3	19.6	0.18	9	20.2	0.23
4	18.4	0.15	10	16.0	0.13
5	20.5	0.16	11	17.8	0.17
6	21.1	0.23	12	19.4	0.21

```
        The SAS System              07:31 Wednesday, March 7, 2001    1

                              The REG Procedure
                               Model: MODEL1
                          Dependent Variable: wtgain
                             Analysis of Variance
```

```
                                      Sum of          Mean
      Source                 DF     Squares        Square   F Value   Pr > F
      Model                   1    28.35785       28.35785    26.52   0.0004
      Error                  10    10.69215        1.06921
      Corrected Total        11    39.05000


                        Root MSE              1.03403   R-Square    0.7262
                        Dependent Mean       18.45000   Adj R-Sq    0.6988
                        Coeff Var             5.60449



                              Parameter Estimates
                              Parameter      Standard
      Variable    DF      Estimate        Error    t Value   Pr > |t|
      Intercept    1     12.50853       1.19168      10.50    <.0001
      diet         1     35.82799       6.95694       5.15    0.0004

      The SAS System        07:31 Wednesday, March 7, 2001    2
                              The REG Procedure
                                Model: MODEL1
                          Dependent Variable: wtgain

                              Output Statistics

                             Dep Var    Predicted
                    Obs       wtgain        Value     Residual
                      1      14.7000      15.7330      -1.0330
                      2      17.8000      17.5244       0.2756
                      3      19.6000      18.9576       0.6424
                      4      18.4000      17.8827       0.5173
                      5      20.5000      18.2410       2.2590
                      6      21.1000      20.7490       0.3510
                      7      17.2000      16.4496       0.7504
                      8      18.7000      19.3158      -0.6158
                      9      20.2000      20.7490      -0.5490
                     10      16.0000      17.1662      -1.1662
                     11      17.8000      18.5993      -0.7993
                     12      19.4000      20.0324      -0.6324
                    Sum of Residuals                        0
                    Sum of Squared Residuals          10.69215
                    Predicted Residual SS (PRESS)      14.89513
```

(i)   Give an executable SAS program that was used to produce the above
        output.   **(4 Marks)**
(ii)   Give the statistical hypothesis of this experiment   **(2 marks)**
(iii)   Explain the results in the output and conclusion   **(8 marks)**

Q4.) The data provide in was obtained from field experiment conducted on winter
      triticale. Examine the data presented in the table and figures critically.
a.)   From the data, give a mathematical model that may have been used to analyze the
      above data and critique.   **(2 Marks)**
b.)   Write a SAS program that was used to analyze the data that produced the above
      results.   **(5 marks)**
c.)   Give an **ABSTRACT** of about 300-350 words   **(10 Marks)**

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Table 4. Mean squares and F values for grain yield and yield components of winter triticale grown at three Iowa locations in three growing seasons.

			Yield component									
			Grain yield		Fall tillers m^{-2}		Spikes m^{-2}		Kernels spike^{-1}		1000-kernel weight	
Source of variation	d.f.	Random or fixed	MS	F value	MS	F value	MS	F value	MS	F Value	MS	F value
			Mg ha^{-1}								g	
Year (Y)	2	R	68.91	4.99	865698	1.70	146919	1.37	507.5	8.15	940.26	9.14**
Location (L)	2	F	21.26	1.47	16020	0.04	156858	1.39	701.1	11.76**	356.19	3.87
Y × L	3	R	14.43	15.96***	469754	2.26	112943	15.38***	59.9	1.78	91.88	8.86**
Block within Y × L	24	R	0.32	2.85***	24079	0.89	3620	1.62**	24.5	1.29	7.25	2.13**
Planting date (P)	3	F	3.15	6.29*	10610478	51.50***	50771	13.59**	81.2	2.64	1.59	0.08
Y × P	6	R	0.55	0.81	1391666	1.21	3948	0.68	31.9	1.14	20.49	3.09
L × P	6	F	0.77	1.11	30993	0.17	4718	0.79	47.3	1.67	5.24	0.77
Y × L × P	8	R	0.71	6.22***	200780	7.42***	6053	2.70**	28.5	1.50	6.85	2.01*
Error	145		0.11		27075		2241		18.9		3.41	

* Significant at $P = 0.05$.
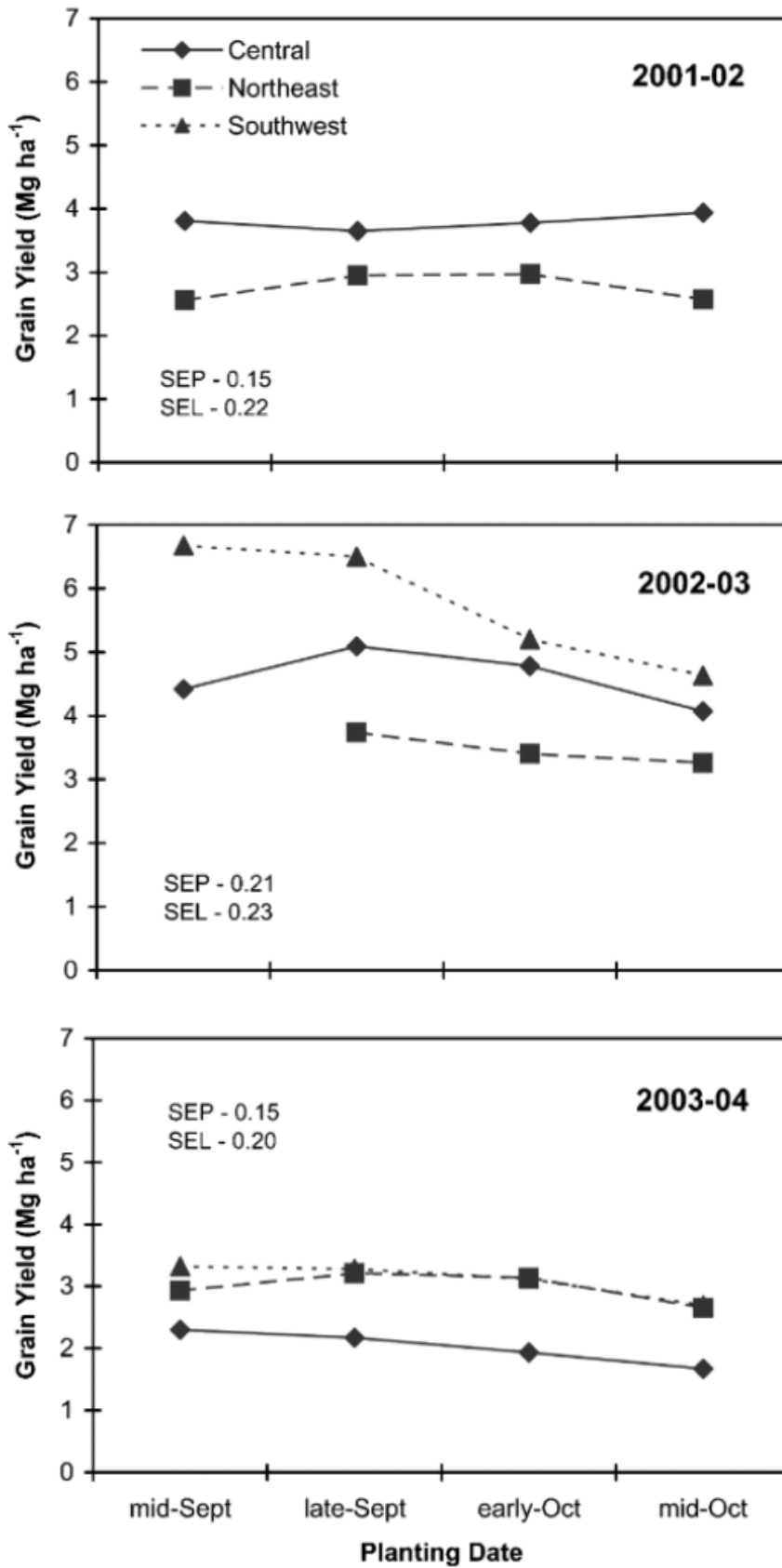** Significant at $P = 0.01$.
*** Significant at $P = 0.001$.

Fig. 1. The effect of planting date on winter triticale grain yield at three Iowa locations in three growing seasons. SEP = standard error for comparison between two planting dates within a location and year; SEL = standard error for comparison between two locations for a planting date within a year.

Q5.) You are required to test 15 loves of bread {Festive (2), supaloaf (3), Elliots (6), Toasti (1), Broadway (4)} for bread crumbs, loaf volume, loaf weight and other qualities from different bakers. All the types of loaves were sampled from Nakuru, Kisumu Eldoret and Nairobi.

(i) Give an experimental layout that would suit your study **(2 Marks)**
(ii) Give the hypothesis of this experiment **(2 marks)**
(iii) Draw the experimental layout that can be used in this research **(4 marks)**
(iv) What is the statistical model for this experiment **(2 marks)**