MATH 442

CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

FOURTH YEAR EXAMINATION FOR THE AWARD OF DEGREE
OF BACHELOR OF SCIENCE (ECONOMICS AND STATISTICS) AND
BACHELOR OF EDUCATION (SCIENCE)

MATH 442: DESIGN OF EXPERIMENT I

STREAMS: BSC (ECON & STATS) & BED (SCI)   **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 06/12/2017   **11.30 A.M. – 4.30 P.M.**

INSTRUCTIONS:
- **Answer question ONE and any other TWO questions**
- **Use of calculators and statistical tables is allowed**
- **Do not write anything on the question paper**

QUESTION I (30 MARKS)

(a)   Experimental error and sampling error are both sources of variability in field and

laboratory experiments. Define each of the errors and describe their possible sources.

[5 marks]

(b)   (i)   Discuss possible advantages of using split design plot and give a skeleton of

ANOVA table for split-plot design.   [9 marks]

(ii)   State three possible situations where split plot design would be appropriate.

[3 marks]

(c)   Discuss the essential components of the design of an experiment.   [6 marks]

(d)   Discuss three data transformation methods and state when each in most appropriate.

[6 marks]

QUESTION 2 (20 MARKS)

A researcher designed an experiment to study the growth of a particular strain of bacteria at four different temperatures and the results are given below.

Temperature	T_1	T_2	T_3	T_4
	74.8	89.0	96.6	102.2
	78.4	99.8	109.2	112.5
	78.1	94.6	98.6	105.9

(a)   Carry out the analysis of variance and interpret the results.   [12 marks]

(b)   Perform mean separation procedures using least significant difference (LSD) on the analyzed data at $\alpha = 0.05$, and make your comment.   [8 marks]

QUESTION 3 (20 MARKS)

A certain company had five salesmen A, B, C, D and E, each of whom was sent for a week into four different county, M, N, O and P. The coded sales per week are shown below:

Salesmen/county	M	N	O	P
A	22	8	8	10
B	12	8	6	12
C	16	12	8	22
D	28	54	16	36
E	14	8	18	28

(a)   Write down the statistical model.   [3 marks]

(b)   Carry out the analysis of variance and interpret the results.   [17 marks]

QUESTION 4 (20 MARKS)

An experiment was set up in a 5 x 5 Latin Square Design (LSD) with the blocking being due to operators and type of materials (values in the parenthesis indicate the response value for a given treatment)

	Materials				
Operators	A[24]	B[17]	C[18]	D[26]	E[22]
	B[20]	C[24]	D[38]	E[31]	A[30]
	C[19]	D[30]	E[26]	A[26]	B[20]
	D[24]	E[27]	A[27]	B[23]	C[29]
	E[24]	A[36]	B[21]	C[22]	D[31]

(a) Compare randomized complete block design and Latin square design and state a situation where it is most appropriate. [2 marks]

(b) Carry out an analysis of variance and interpret the result. [18 marks]

QUESTION 5 (20 MARKS)

(a) An experiment with two levels for the animal treatment (factor A) and three levels for the type of feed (factor B) and replicate three times was laid out in RCBD. Generate a plot layout and write down a skeleton of ANOVA table. [12 marks]

(b) Discuss the assumptions of analysis of variance. [8 marks]