



(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR
THIRD YEAR FIRST SEMESTER
MAIN EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: STA312

COURSE TITLE: EXPERIMENTAL DESIGN I

DATE: 21/07/21

TIME: 2 PM -4 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

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QUESTION ONE

- i) Discuss the three principles of experimentation (9mks)
- ii) (i) .The data in the table below gives the number of hours of pain relief provided by 4 different types of headache tablets administered to 24 people. The 24 experimental units were randomly divided into 4 groups and each group was treated with a different brand/type. Do the different drug types give significantly different hours of pain relief? (10 mks)

Brands

	1	2	3	4
	12.2	4.9	8.0	4.6
	9.5	10.6	12.1	6.1
	11.6	7.0	5.7	5.0
	13.0	8.3	8.6	3.8
	10.1	5.5	7.2	8.2
	9.6	11.7	12.4	7.7
y_{io}	66.0	48.0	54.0	36.0
\bar{y}_{io}	11.0	8.0	9.0	6.0

$$y_{oo}=204$$

(ii).Using Fisher's Least Significance Difference (With equal number of observations/treatments as seen in the table above) show the means that are not significant at $\alpha=0.05$ (5mks)

iii) Define the following words as used in designs of experiments:

- i) Experimental Error (2mks)
- ii) Treatment (2mks)
- iii) Standard Latin Square (2mks)

QUESTION TWO

- a) Four groups of students were subjected to different teaching techniques and tested at the end of a specified period of time. The table below gives the performance in percentages. Are the teaching techniques significantly different judging from the performance of the students at $\alpha=0.05$? (10 mks)

Teaching techniques

	1	2	3	4
	65	75	59	94
	87	69	78	89
	73	83	67	80
	79	81	62	88
	81	72	83	
	69	79	76	
		90		
n_i	6	7	6	4
y_{io}	454	549	425	351
\bar{y}_{io}	75.67	78.43	70.83	87.75

$$N = 23$$

$$N = \sum_{i=1}^a n_i$$

$$y_{oo} = 1779$$

$$\bar{y}_{oo} = \frac{1779}{23} = 77.34$$

- ii) Using Fisher's Least Significance Difference (With unequal number of observations/treatments as seen in the table above) show the means that are not significant at $\alpha=0.05$ (10 mks)

QUESTION THREE

- Advantages of Completely Randomized Design (CRD) (5mks)
- Discuss the steps of designing an experiment (8mks)
- Advantages of Randomized Block Design RBD (4mks)
- Differentiate between Type I error and Type II error. (3mks)

QUESTION FOUR

- List advantages of Replication (3mks)
- The table below show the interaction of 3 bean varieties and 4 fertilizer types.

Yield of beans with 3 observations/cell

Fertilisers	Varieties of beans		
	V ₁	V ₂	V ₃
t ₁	64	72	74
	66	81	51
	70	64	65
t ₂	55	57	47
	63	43	58
	68	52	67
t ₃	59	66	58
	68	71	39
	65	59	42
t ₄	58	57	53
	41	61	59
	46	53	38

$r = 4, c = 3, n = 3$

$N = rcn = 4 \times 3 \times 3 = 36$

Test the hypotheses that

- i) The average yield of the beans is the same when different fertilizers are used.
- ii) There is no difference in the average yield for the different varieties of the beans.
- iii) There is no interaction between fertilizers and varieties. (17mks)

QUESTION FIVE

- a) A study on the physical strength measured in kilograms on 7 subjects before and after a specified training period gave the following results:

Table 5: Pre test and post test study measures

Subject	Measures		
	Pre test	Post test	d
1	100	115	15
2	110	125	15
3	90	105	15
4	110	130	20
5	125	140	15
6	130	140	10
7	105	125	20
			110

Question: Was the training effective? Was there an improvement? (10mks)

- b) If we considered the 5.a) above as an experiment at two (2) levels pre and post with 7 blocks which are our subjects, we make up an RBD.
Our data would appear as shown in table 6 below.

Table 6: RBD presentation for the data in Table 5

Subjects	Measures		
	Pre test	Post test	y_{io}
1	100	115	215
2	110	125	235
3	90	105	195
4	110	130	240
5	125	140	265
6	130	140	270
7	105	125	230
y_{oj}	770	880	$y_{oo} = 1650$

Test whether the training has made a significant difference in the physical strength measurements at $\alpha=0.05$ (10mks)