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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
SECOND YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
BUSINESS INFORMATION TECHNOLOGY
Date: 13th December, 2022
Time: 2.30 – 4.30pn

KMA 2213: MATHEMATICAL STATISTICS

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 Marks)

a) Suppose that X and Y have a joint distribution function

$$f(x,y)=\begin{cases} k(x^2+2y), & 0<x<1, 1<y<3 \\ 0, & elsewhere \end{cases}$$

i. Find the value of k (3 Marks)

ii. Find $P(X>0.5, 1.5<Y<2.4)$ (3 Marks)

iii. Marginal distribution function of X (3 Marks)

b) Three varieties of cowpeas were grown in plots arranged in a completely randomized design. The dry matter yields are given in the table below.

Sample	Variety		
	A	B	C
1	2	8	11
2	4	7	10
3	3	9	12

Test whether there's a significant difference among the varieties at $\alpha = 0.05$ level. (6 Marks)

c) Given a bivariate function

$$f(x,y)=\begin{cases}\frac{1}{36}, & x=1,2,3,4,5,6;\ y=1,2,3,4,5,6\\ 0, & \textit{elsewhere}\end{cases}$$

Find;

i. $F(4,5)$ (4 Marks)

ii. $F(-1,3)$ (2 Marks)

d) Briefly describe the three kinds of variation that may occur in an experiment with the use of relevant examples. (4 Marks)

e) A coin was tossed 575 times with 275 heads occurring. Can we say the coin is fair at 1% level of significance? (5 Marks)

QUESTION TWO (20 MARKS)

a) The joint probability mass function between X and Y is given by;

$$f(x,y)=\begin{cases}a(x+3y+1), & x=1,3;\ y=0,1,2\\ 0, & \textit{elsewhere}\end{cases}$$

i. Find the value of a (3 Marks)

ii. Find the marginal probability mass functions for X and Y (5 Marks)

iii. $\text{var}(XY)$ (5 Marks)

iv. $E(X)$ (2 Marks)

b) In a certain clinic in Mwihiko, a random sample was taken and revealed that in a certain month the number of births were 48 females and 52 male babies. Do these data confirm the hypothesis that males and females are born in equal numbers at 5% level of significance? (5 Marks)

QUESTION THREE (20 MARKS)

a) Suppose that the joint probability distribution function of X and Y is

$$f(x,y)=\begin{cases}\frac{1}{45}(x+y), & x=0,1,2;\quad y=0,1,2,3,4\\ 0, & \textit{elsewhere}\end{cases}$$

Find $E(X+Y)$ (6 Marks)

b) The joint probability distribution function of X and Y is given by

$$f(x,y)=\begin{cases}6xy(2-x-y), & 0\le x\le 1;0\le y\le 1\\ 0, & \textit{elsewhere}\end{cases}$$

Find;

i. $\text{cov}(XY)$ (10 Marks)

ii. Correlation between X and Y hence explain the result (4 Marks)

QUESTION FOUR (20 MARKS)

a) The marks obtained in both the the mock examination and KCSE by a random sample of 15 students are as follows;

Student	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mock	29	27	51	71	42	82	40	79	65	80	63	87	53	56	60
KSCE	35	30	60	73	60	88	45	75	68	77	69	88	47	67	70

Did students perform better in KSCE than in mocks $\alpha = 0.05$? Use sign test (7 Marks)

b) Distinguish non-parametric tests from parametric tests. (8 Marks)

c) A joint probability distribution function of x and y is given by

$$f(x,y) = \begin{cases} 6x^2 y, & 0 \le x \le 1, \quad 0 \le y \le 1 \\ 0, & elsewhere \end{cases}$$

Compute $p(X + Y \ge 1)$ (5 Marks)

QUESTION FIVE (20 MARKS)

a) An experiment was installed to test 4 types of fertilizer effects on cabbage production. There were 3 replicates of each fertilizer and the experiment was installed in a randomized complete block design. The yields (in '000' Kgs) are given in the table below.

Treatment (fertilizer)	Blocks		
	I	II	III
1	3.5	3.8	3.7
2	3.9	4.2	4.4
3	4.0	4.4	4.8
4	4.3	4.2	4.9

Test at $\alpha = 0.05$ level of significance whether there's a significant difference among

i. Different types of fertilizer (8 Marks)

ii. Blocks (6 Marks)

b) Differentiate the completely randomized design from the randomized block design. (6 Marks)