(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2015/2016 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: STA 205

COURSE TITLE: STATISTICS AND PROBABILITY

DATE: 10/5/16   **TIME:** 9 AM -11 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

a) Define the following terms. (4 marks)

    (i)   Exhaustive events

    (ii)   Complimentary events

    (iii) Power set

    (iv) Cardinality of a set

b) Differentiate between axiomatic approach to probability and classical approach to probability (2marks)

c) Prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ (2marks)

d) In a one hour period, the number of gallons of a certain toxic chemical that is produced at a local plant say Y has the following pmf

Y	0	1	2	3
$P_y(Y)$	0.2	0.3	0.3	0.2

    (i) Compute the expected number of gallons produced during a one-hour period (2 mks).

    (ii) The cost (in hundreds of dollars) to produce Y gallons is given by the cost function $C(Y) = 3 + 12Y + 2Y^2$. What is the expected cost in a one hour period? (4 mks).

e) Urn 1 has 2 white and 3 black balls, Urn II has 4 white and 1 black ball and Urn III has 3 white and 4 black balls. An urn is selected at random and a ball drawn at random is found to be white. Find the probability that urn 1 was selected. (3marks)

f) In a hospital 480 female and 520 male babies were born in a week. Do these figures confirm the hypothesis that males and females are born in equal number at 5% significance level (3marks)

g) The random variable X is distributed B (7, 0.2). Find correct to three decimal places

    i. $P(X=3)$

    ii. $P(1 < X \leq 4)$

    iii. $P(X > 1)$ (5marks)

h) A consignment is offered to two firms X and Y for Ksh 100,000. The following table shows the probability at which the firms will be able to sell it at different prices.

	Selling price in Ksh			
	80,000	90,000	105,000	110,000
Probability				
X	0.2	0.3	0.4	0.1
Y	0.25	0.2	0.5	0.05

Which firm X and Y will be more incline towards the offer? (5marks)

QUESTION TWO

a) Define the following terms as used in statistical inference

    i.   Confidence interval

    ii.   Estimator

    iii.   Parameter

    iv.   Statistic

    v.   Random variable   (5marks)

b) A population has unknown mean μ and standard deviation 2.61. If a sample of 900 values has a mean of 3.25 and the population is normal. Find the 98% C.I for the mean. (6marks)

c) For several years a teacher has kept records of how long it takes students to solve a difficult problem in statistics. If 64 randomly selected took an average of 32.5 mean with a variance of 10.89. Construct a 99% C.I for the mean average time it takes a student to solve this problem. (6marks)

d) Find the following probabilities using the normal table

    i. $P(Z > 1.26)$

    ii. $P(Z > 0.25)$

    iii. $P(Z < -1.96)$

STA 205: INTRODUCTION TO PROBABILITY AND DISTRIBUTION

d) Yako traders wishes to test whether its three salesmen A, B, and C tend to make sales of the same size or whether they differ in their selling ability as measured by the average size of their sales. During the last week there have been 14 sale calls; A made 5 calls, B made 4 calls, and C made 5 calls. The following are the weekly sales record of three salesmen.

A(Shs.)	B (Shs.)	C (Shs.)
300	600	700
400	300	300
300	300	400
500	400	600
0	-	500

Perform the analysis of variance and draw your conclusions (8 Marks)

a. Define the following terms (2 marks)

   (i)   Hypothesis testing

   (ii)   Estimation

b. Suppose that $f(x) = \frac{x}{8}$ for $3 < x < 5$. Determine the mean and variance for x (3 marks)

c. A batch of parts contains 100 parts from a local supplier of tubing and 200 parts from a supplier of tubing in the next state. If four parts are selected randomly and without replacement. What is the probability that;

   (i)   Two or more parts in the sample are from the local suppliers (3 marks)

   (ii)   Atleast one part in the sample is from the local supplier (2 marks)

d. A machine produced 20 defective articles in the batch of 400. After overhauling it produced 10 defectives in a batch of 300. Has the machine improved? (4 marks)

e. Two independent samples of 8 and 7 gave the following values;

Sample A	9	11	13	15	9	12	14
Sample B	10	12	10	9	8	10	-

Examine whether the difference between the means of the two samples is significant at 5% level of significance. (6 marks)

QUESTION THREE

a) The table below gives observed frequencies in the nine different length-of-stay and type-of-insurance categories into which the sample has been divided. Prof.Tireito wishes to test the hypothesis at $\alpha = 0.01$

H_O: length of stay and type of insurance are independent

H_1: length of stay depends on type of insurance

Fraction of cost covered by insurance	Days in hospital			Total
	< 5	5-10	>10	
< 25%	40	75	65	180
25-50%	30	45	75	150
>50%	40	100	190	330
Total	110	220	330	660

Find

i. The expected frequencies (10marks)

ii. The value of $\chi^2 statistics$ (3marks)

iii. Whether to reject or accept the null hypothesis (2marks)

b) State and explain the use of Chi-square test

c) Explain the term degrees of freedom

QUESTION FOUR (20 MARKS)

a) State three assumptions made in the determination of F-test.   (3 Marks)

b) Two random sample were drawn from two normal populations and their values were

A	66	67	75	76	82	84	88	90	92	
B	64	66	74	78	82	85	87	92	93	95	97

At 5% level of significance test whether the two populations have the same variance (6 marks)

c) State the reasons for the increase in the use of non-parametric tests in research.   (3 marks)

QUESTION FIVE (20 MARKS)

f. Define the following terms   (2 marks)

   (iii)   Hypothesis testing

   (iv)   Estimation

g. Suppose that $f(x)= \frac{x}{8}$ for $3 < x < 5$. Determine the mean and variance for x (3 marks)

h. A batch of parts contains 100 parts from a local supplier of tubing and 200 parts from a supplier of tubing in the next state. If four parts are selected randomly and without replacement. What is the probability that;

   (iii)   Two or more parts in the sample are from the local suppliers   (3 marks)

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i. A machine produced 20 defective articles in the batch of 400. After overhauling it produced 10 defectives in a batch of 300. Has the machine improved?   (4 marks)

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Examine whether the difference between the means of the two samples is significant at 5% level of significance.   (6 marks)