(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2016/2017 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: STA 205

COURSE TITLE: INTRODUCTION TO STATISTICS AND PROBABILITY

DATE: 25/09/17 TIME: 8 AM -10 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) 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. (4marks)

c) 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)

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

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

f) 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 marks).

(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 marks).

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. $P(X > 1)$ (3marks)

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			
Probability	80,000	90,000	105,000	110,000
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? (6 marks)

QUESTION TWO (20 MARKS)

a. Define the following terms (2 marks)

(i) Hypothesis testing

(ii) Estimation

b. 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)

c. Two independent samples of 7 and 6 gave the following values;

Sample A	9	11	13	15	9	12	15
Sample B	11	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)

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

e. 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)

QUESTION THREE (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)

d) Khetia 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)

QUESTION FOUR (20 MARKS)

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_0: 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 χ^2 *statistics* (3marks)

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

b) State and explain the use of Chi-square test (3 marks)

c) Explain the term degrees of freedom (2 marks)

QUESTION FIVE (20 MARKS)

a) Define the following terms as used in statistical inference

i. Confidence interval

ii. Estimator

iii. Parameter

iv. Statistic

v. Random variable (5marks)

b) Find the following probabilities using the normal tables (3 Marks)

i) $P(Z > 1.26)$

ii) $P(Z > 0.25)$

iii) $P(Z < -1.96)$

c) In an investigation to estimate the mean weight in Kg of 15 year old children in a particular region, a random sample of 100 children is selected. Previous study indicate that the variance of weights of such children is 3.0 Kg. Suppose the sample mean weight is 38.4 Kg, estimate the population mean weight of all 15 years old children in the region assuming that these weights are normally distributed. Use $\alpha = 5\%$. (5 marks)

d) A random sample of 11 bags were selected from a machine packaging wheat flour in bags marked 1 kg. The actual weight of each flour in kgs were 1.017, 1.051, 1.078, 0.997, 1.033, 0.996, 1.059, 1.082, 1.014, 1.072 and 0.998. . Construct a 95% C.I for the mean weight of flour in bags marked 1 kg assuming the weights are normally distributed.

(7 marks)

Normal distribution

Cumulative distribution function $\Phi(z)$

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.00	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.10	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.20	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.30	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.40	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.50	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.60	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.70	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.80	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.90	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.00	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.10	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.20	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.30	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.40	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.50	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.60	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.70	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.80	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.90	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.00	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.10	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.20	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.30	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.40	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.50	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.60	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.70	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.80	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.90	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.00	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.10	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.20	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.30	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.40	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.50	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.60	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.70	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.80	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.90	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000