KENYA METHODIST UNIVERSITY

END OF FIRST TRIMESTER 2008 EXAMINATIONS
SCHOOL BASED

FACULTY	**:**	**SCIENCE AND SOCIAL STUDIES**
DEPARTMENT	**:**	**COMPUTER AND INFORMATION SCIENCE**
COURSE CODE	**:**	**MATH 134**
COURSE TITLE	**:**	**INFERENTIAL STATISTICS**
TIME	**:**	**2 HOURS**

Instructions:

- *Answer question **ONE** (compulsory) and any other **TWO** questions.*

Question 1

a) Explain the following terms as used in statistics.
(i) Statistic.
(ii)Type I error.
(iii) Sampling distribution.
(iv) P-value. (8 mks)

b) The following sample of IQ measurements of students selected from a population that is normally distributed

91	80	99	110	95	106	78	121	106	100
97	82	100	83	115	104	114	118	96	101
79	101	79	130	94	101				

Calculate
(i) Standard error. (3 mks)
(ii) 96% confidence interval for the population mean. (5 mks)

c) The marks obtained by students in form four mathematics examination are approximately normally distributed, with mean 68% and standard deviation 3%. If a random sample of ten students is selected, calculate the probability that the mean mark, $\bar{x}$ is
(i) More that 69% (3 mks)
(ii) Between 67% and 69% (3 mks)

d) Jade believes that there is no difference in proportion of degrees for both male and female graduates. A random sample of 200 universities degrees earned in 2005 gave the following breakdown.

	Degree		
Gender	Bachelor	Master	Ph.D
Males	100	30	12
Females	40	10	8

Test whether her claim is correct at 95% confidence. (8 mks)

Question 2

a) Explain four differences between correlation and regression analysis. (8 mks)

b) The data below gives the values for marks scored by students on admission (x) and the increase in marks expressed as a percentage of admission marks (y).

x	112	111	107	119	92	80	81	84	118	106	103	94
y	63	66	72	52	75	118	120	114	42	72	90	91

(i) Fit the least squares regression line , $y = a+bx$ to the data. (6 mks)

(ii) Test whether x contributes information for the prediction of y using the fitted line at $\alpha = 0.05$. (6 mks)

Question 3

A sociologist studying Nairobi City ethnic groups wants to determine if there is a difference in income for immigrants from four different countries during their first year in the city. She obtained the data from a random sample of immigrants from these countries (incomes in thousands of dollars).

Country 1	12.7	9.2	10.9	8.9	16.4
Country 2	8.3	17.2	19.1	10.3	
Country 3	20.3	16.6	22.7	25.2	19.9
Country 4	17.2	8.8	14.7	21.3	19.8

Test the claim that there is no difference in the earnings of immigrants from the four different countries. Use $\alpha = 0.05$ (20 mks)

Question 4

a) Explain three advantages and three disadvantages of non-parametric methods. (6 mks)

b) Independent random samples of three different brands of magnetron tubes were subjected to stress testing the number of hours each operated without repair was recorded. Experience has shown that the distributions of life length for manufactured products are often non-normal and thus not proper use of an ANOVA F-test.

Brand A	36	48	5	67	53
Brand B	49	33	60	2	55
Brand C	7	31	140	59	42

Use the Kruskal-Wallis H-test to determine whether evidence exists to conclude that the brands of tube differ in length of life under stress at 10% level of significance. (14 mks)

FORMULAE

1. **Regression Analysis**

$$y = a + bx$$

Where

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - \left(\sum x\right)^2}$$

$$a = \frac{\sum y - b\sum x}{n}$$

Test statistics for $H_0 : b = 0$

$$t = \frac{b}{s / \sqrt{\sum x^2 - \frac{\left(\sum x\right)^2}{n}},} \qquad s^2 = \frac{\sum y^2 - b\sum xy}{n-2}$$

2. $A = (1-\alpha)100\%$ **CI for mean**

$$\mu = \bar{x} \pm t_{\alpha/2, n-1} \frac{s}{\sqrt{n}}$$

3. **Chi-square test**

$$x^2 = \sum (O-E)^2 / E \text{ where } E = \frac{r_i c_j}{n}$$

4. **ANOVA**

$$S^2{}_B = \frac{n_1\left(\bar{x}_1 - \bar{x}\right)^2 + n_2\left(\bar{x}_2 - \bar{x}\right)^2 \ldots + n_x\left(\bar{x}_x - \bar{x}\right)2}{k-1}$$

$$S^2{}_w = \frac{n_1 s_1{}^2 + n_2 s_2{}^2 + \ldots + n_k s_k{}^2}{n-k}$$

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2 + \ldots + n_k s_k{}^2}{n}$$

$$F = \frac{S_B{}^2}{S_W{}^2}$$

5. **Kruskal-Wallis test.**

$$H = \frac{12}{n(n+1)} \sum {T_i{}^2}/{n_i} - 3(n+1)$$