KENYA METHODIST UNIVERSITY

END OF FIRST TRIMESTER 2008 EXAMINATIONS

FACULTY	**:**	**SCIENCE AND SOCIAL STUDIES**
DEPARTMENT	**:**	**COMPUTER AND INFORMATION SCIENCE**
COURSE CODE	**:**	**MATH 431**
COURSE TITLE	**:**	**TEST OF HYPOTHESIS**
TIME	**:**	**3 HOURS**

Instructions:

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

Question 1

a) Explain the meaning of the following.
(i) A statistical hypothesis.
(ii) The power functions of a test.
(iii) Unbiasedness of a test δ for testing $H_0 : \theta \varepsilon \Omega_0$ against $H_0 : \theta \varepsilon \Omega_1$.
(iv) Uniformly most powerful test. (8 mks)

b) State the Neyman – Pearson fundamental remma. (3 mks)

c) Let $x_1, x_2, \ldots, x_n$ be a random sample from the Bernoulli distribution.
$f(x,\theta) = \theta^x (1-\theta 0)^{1-x}, \; x = 0,1, \; 0 < \theta < 1$
Show that the Bernoulli distribution has a monotone likelihood ratio in the statistics
$T = \sum x$ (4 mks)

d) The gain in mass of rats receiving their protein from raw peanuts and roasted peanuts is believed to be normally distributed with means μ_1 *and* μ_2 respectively and with same population variance σ^2. The two distributions are independent. The following data is on the gain of mass in grams from ten rats fed on raw peanuts (x) and roasted peanuts (y).

x	62	56	61	58	60	44	56	60	56	65
y	53	51	62	55	59	56	61	54	47	57

Test at a level of significant 5% whether the roasting had only effect as far as gain in mass is concerned. (9 mks)

e) A sample survey showed that 627 of 800 people interviewed preferred to live in medium sized towns. Using $\alpha = 0.01$, test the hypothesis that the true percentage of people preferring to live in medium-sized towns is 0.75. (6 mks)

Question 2

a) Let $x_1, x_2, \ldots, x_n$ form a random sample from the normal population with mean μ and variance σ_0^2 where σ_0^2 is known. Obtain a UMP test α for testing $H_0 : \mu = \mu_0$ against $H_1 = \mu < \mu_0$. (10 mks)

b) When asked if they believed a woman would be elected president in the next 20 years, 22 of 40 randomly selected men said yes and an independent survey, 33 0f 48 randomly selected women said yes. Let P_1 and P_2 denote proportions of all men and women, respectively, that believe a woman will be elected president in the next 20 years. Test $H_0 : p_1 = p_2$ against $H_1 : p_1 < p_2$ at the 0.1 significant level. (10 mks)

Question 3

a) Let $x_1, x_2, \ldots, x_n$ denote a random sample from a normal population with mean μ and variance σ^2 for testing $H_0 : \sigma^2 = \sigma_0^2$ against $H_1 : \sigma^2 > \sigma_0^2$ show that likelihood ration test is equivalent to the Chi square. (10 mks)

b) The following are independent samples from two normal populations.

Sample I	10	6	16	17	13	12	8	15	9	14	
Sample II	7	13	22	15	12	14	18	8	21	23	10 17

Test at level of significance 5%, whether the variances are significantly different. (10 mks)

Question 4

A breeder of thorough bred horses wishes to model the relationship between the gestation period and the life span of a horse. The breeder believes that the two variables may follow a linear trend. The information is given below:-

Horse	1	2	3	4	5	6	7
Gestation period, x	416	279	298	307	356	403	265
Life span, y	24	25.5	20	21.5	22	23.5	21

(i) Fit the model $y = \alpha + \beta x$. (7 mks)

(ii) Do the data provide sufficient evidence to support the breeder's hypothesis? That is, $H_0 : \beta = 0$ against $H_1 : \beta \neq 0$. Use $\alpha = 0.05$. (7 mks)

(iii) Find a 90% confidence interval for β. (6 mks)