(Knowledge for Development)

KIBABII UNIVERSITY COLLEGE

A CONSTITUENT COLLEGE OFMASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATIONS

2014/2015 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION

COURSE CODE: STA 342

COURSE TITLE: TESTS OF HYPOTHESES

DATE: 29/4/15 **TIME:** 8.00AM -10.00PM

INSTRUCTIONS TO CANDIDATES

Answer Question One in and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MKS)

a) Define the following terms:
   i) Random variable (2mks)
   ii) Sample (2mks)

b) The heights of maize and bean seedlings at a local farm are known to be normally distributed with δ_{maize}=0. 5cm and δ_{beans}= 0.8cm. A random sample of 25 maize seedlings had a mean height of 4.8cm and a random sample of 30 bean seedlings had a mean height of 4.5cm. Is there any evidence that the mean height of maize seedlings is greater than that of bean seedlings at $\alpha = 5\%$? (6mks)

c) The average length of a random sample of 20 rolls of wire 2031m with a standard deviation of 47m. Test at α =1% whether the mean is greater or less than 2000m (5mks)

d) What is a critical region? (1mk)

e) In Mandera county deaths due to a rear skin disease used to occur at the rate of 8 per month. Residents petitioned for construction of more health facilities but public health officers believed that the number of deaths could be reduced simply by doing health awareness campaigns. In the month that followed the health awareness campaigns there were 5 deaths reported.
   i) Does this give significant evidence that the public health officers were right? Use $\alpha = 5\%$ level (6mks)
   ii) At what value of C would H_0 be rejected? (3mks)

f) A machine produces metal sheets of thickness T which is normally distributed with a mean of 0.58cm and a standard deviation of 0.015cm. After servicing the machine a random sample of 50 sheets from the next batch was taken to see if the mean thickness T had changed. The mean thickness was found to be 0.577cm with the same standard deviation. Test at 1% significance level whether or not there was evidence that the mean thickness of the sheets had changed. (5mks)

QUESTION TWO (20 MKS)

State and prove Neyman-Pearson lemma (20mks)

QUESTION THREE (20 MKS)

a) State two applications of the chi-square test (2mks)

b) Random samples drawn from Kibabii University and Maseno University have the following data relating to the heights of male students

	Kibabii University	Maseno University
Mean height	167.42	167.25
Standard deviation	2.58	2.50
Sample size	1000	1200

Establish at $\alpha = 5\%$ whether the difference between the
   i) Means is significant (8mks)
   ii) Standard deviations is significant (6mks)

c) What do you understand by the following terms:
   i) Type I error (2mks)
   ii) Type II error (2mks)

QUESTION FOUR (20 MKS)

a)Suppose X~N (μ, δ^2); where μ and δ^2 are unknown. Use the likelihood ratio test to test

H_0: $\mu = \mu_0$, $0< \delta^2<\infty$ against
H_1: $\mu > \mu_0$, $0< \delta^2<\infty$ where,
$\Omega = \{(\mu, \delta^2): \mu_0< \mu <\infty; 0< \delta^2<\infty\}$
$\omega = \{(\mu, \delta^2): \mu = \mu_0; 0< \delta^2<\infty\}$ (11mks)

d) At a certain military training college recruits are weighed when they join the college. The weights of the recruits are normally distributed with mean 70kg and standard deviation 7.5kg. A random sample of 90 recruits was weighed and their mean weight was 71.6kg. Assuming that the standard deviation has not changed test at α = 5% whether there is sufficient evidence that the mean weight of the new entry is more than 70kg. (9mks)

QUESTION FIVE (20 MKS)

a) A group of public health officers at the Namanga border set out to establish the effectiveness of a new yellow fever vaccine among individuals visiting Tanzania from Kenya. The following data was obtained on antibody strength for six individuals injected with the vaccine: 1.3, 3.1, 2.6, 2.5, 2.0, 1.1 . Use this data to
   i) Test the hypothesis that the mean antibody strength for individuals vaccinated with the drug is greater than 1.8 at α = 0.05 (9mks)
   ii) Estimate μ, the population mean antibody strength for individuals vaccinated with the new drug at 95% confidence interval (9mks)

b) State two properties of the likelihood ratio test (2mks)