

THE OPEN UNIVERSITY OF TANZANIA
FACULTY OF SCIENCE, TECHNOLOGY AND ENVIRONMENTAL
STUDIES

Assignment 1

OMT 352: Test of Hypothesis and Theory of Estimation

YEAR 2008/09

Instructions:The assignment covers Course material formerly called OMT 314: Theory of Estimation.

- **Do all four questions**
- **Remember to write your Registration number and Full Address**
- **Please write legibly and in an organized manner.**
- **The assignment should be submitted by 12th Dec 2008**

- Q1. (a) Explain briefly the meaning of
- (i) an unbiased statistic
 - ii) a consistent statistic

(b) Find the likelihood function for a random sample of size n drawn from the following populations:

- (i) Normal (μ, σ^2) (ii) Binomial (n, p)

(c) Let X_1, X_2, \dots, X_n be random sample from a distribution with probability density function:

$$f(x, \theta) = \frac{1}{\theta} \exp (-x/\theta); 0 < x < \infty, 0 < \theta < \infty$$

Find the maximum likelihood estimator of θ .

- Q2. (a) State three characteristics of a good estimator of a population parameter with a given probability distribution.
- (b) Briefly describe how you would use the Method of Moments to estimate the mean of a probability distribution.
- (c) Let (x_1, x_2, \dots, x_n) be a random sample from the p.d.f :

$$f(x, \theta) = \begin{cases} \theta \exp(-\theta x), & 0 < x < \infty, \theta > 0 \\ 0, & \text{elsewhere} \end{cases}$$

Estimate θ using Method of moments.

- Q3. (a) Define (i) a sufficient statistic (ii) a complete statistic
 (b) State the factorization theorem on sufficiency
 (c) If x_1, x_2, \dots, x_n is a random sample from the distribution
 $f(x, \theta) = \theta x^{\theta-1}, 0 < x < 1$.
 show that $Y = x_1 x_2 \dots x_n$ is a sufficient statistic for θ .
- Q4. (a) Explain briefly giving examples the meaning of
 (i) a statistic
 (ii) a population parameter
 (b) Suppose X and Y are independent random variables with the same unknown means μ . Both X and Y have variances of 36. Let $T = aX + bY$ be an estimator for μ .
 (i) Show that T is an unbiased estimator of μ if $a + b = 1$.
 (ii) If $a = \frac{1}{3}$ and $b = \frac{2}{3}$, what is the variance of T ?
 (iii) What choice of a and b minimizes the variance of T subject to the requirement that T is an unbiased estimate of μ ?

Assignment 2

OMT 352: Test of Hypothesis and Theory of Estimation

YEAR 2008/09

Instructions: The assignment covers course material formerly called OMT 315: Test of Hypothesis

- **Do all four questions.**
- **Remember to write your Registration number and Full Address.**
- **Please write legibly and in an organized manner.**
- **The assignment should be submitted by 27th March 2009**

OMT 315 Test of Hypothesis

Q1. (a) In Statistical test of Hypothesis explain the meaning of:

- (i) Power of test
- (ii) Critical Region

(b) The manufacturer of electric light tube knows from past experience that the average life of a tube is 2000 hours, with standard deviation of 150 hours. A sample of 100 tubes has an average life of 1960 hours. It is required to test whether the sample came from a normal population with mean 2000 hours. State

- i) Your null and alternative hypothesis,
- (ii) Describe the type I and type II errors in this problem
- (iii) Test the hypothesis at significance level of 5%

Q2. (a) Explain briefly the meaning of:

- (i) point estimation of a population parameter
- (ii) Interval estimation of a population parameter
- (iii) Confidence coefficient

(b) 1000 apples are taken from a large consignment and 150 of them are found to be bad, estimate the percentage of bad apples in the consignment and assign limits within which the percentage lies. (use $\alpha = 0.05$)

Q3. (a) In statistical Test of hypothesis explain the meaning of:

- (i) The null hypothesis
- (ii) A simple hypothesis

(b) The demand of a particular spare part in a factory was found to vary day by day. In a sample study the following information was obtained:

Day	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat
No of parts demanded	1124	1125	1110	1120	1126	1115

Test the hypothesis that the number of parts demanded does not depend on the day of the week.

Q4. (a) Distinguish between a one tailed test and a two tailed test.

(b) In a Bernoulli distribution with parameter p , $H_0 : p = \frac{1}{2}$ against $H_1 : p = \frac{2}{3}$ is rejected if more than 3 heads are obtained out of 5 throws of a coin. Find the probabilities of Type I and Type II errors.