

 W1-2-60-1-6

**JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2013/2014**

**YEAR III EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE AND MATHS AND COMPUTER SCIENCE**

**STA 2300/SMA 2330: THEORY OF ESTIMATION**

**DATE: DECEMBER 2013 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS**

**QUESTION ONE (30 MARKS)**

1. Define the following terms
2. A point estimator
3. A point estimate
4. Interval estimator
5. Sufficient statistic [5 marks]
6. The survival time (in years) of a H.I.V. positive person after taking ARV drugs can be modeled by an exponential distribution with parameter .
7. Given a sample taken from this distribution, use method of moments to determine an estimator for the parameter . [5 marks]
8. Investigate consistency of the estimator obtained in (i) above for the parameter . [6 marks]
9. Define cramer-Rao regular density function. [4 marks]
10. Let X1,X2….Xn be i.i.d random sample from a population with p.d.f

  

 Suppose T is an estimator of the parameter  and T has a density;

 g(t) = 

1. Investigate unbiasness of T for the parameter .
2. Find the cramer-Rao lowerbound for the variance of unbiased estimator of the parameter . [5 marks]
3. X~ where u is known. Let x1, x2…. xn be a random sample from x. Find a minimum variance best unbiased estimator of the variance . [5 marks]

**QUESTION TWO (20 MARKS)**

1. Suppose that x1, x2… xn is a random sample for a normal population with known mean and unknown variable . Obtain the maximum likelihood estimator of the parameter . [4 marks]
2. State without proof the cramer-Rao inequality. [3 marks]
3. Let x1 x2…xn be a random sample from a Bernoulli distribution with unknown parameter .

(i) Find the cramer-Rao lower bond of the variance of unbiased estimator of the paremeter

 .

(ii) Find the minimum variance best unbiased estimator of the parameter . [13 marks]

**QUESTION THREE (20 MARKS)**

1. Define the following terms:
2. Prior distribution
3. Posterior distribution
4. Posterior Bayel estimator [5 marks]
5. Let x1, x2….xn be a random sample from a Bernoulli distribution with parameter *p*. The prior distribution of the parameter *p* is uniform on the interval (0,1). Find the posterior Bayel estimator of the variance of this Bernoulli distribution. [15 marks]

**QUESTION FOUR (20 MARKS)**

1. Define the term “Pivotal quantity” [2 marks]
2. The following data are the income per year in million shillings for 30 companies selected within a given city.

14.7 13.0 14.9 12.9 16.0 15.2

15.3 15.1 12.6 14.8 14.9 15.1

15.3 12.4 17.2 16.0 12.5 14.3

15.4 15.1 15.8 15.4 15.5 12.4

12.0 12.5 16.9 14.4 16.3 15.6

 Assuming normality with unknown parameters;

1. Construct a 90% confidence interval for the true population mean.
2. Construct a 99% confidence interval for the true population variance. [16 marks]