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**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF MASTER OF SCIENCE**

**IN APPLIED STATISTICS**

**1ST YEAR 1ST SEMESTER 2015/2016 ACADEMIC YEAR**

**MAIN CAMPUS**

**COURSE CODE: SAS 820**

**COURSE TITLE: NON PARAMETRIC METHODS**

**EXAM VENUE: STREAM: MSc. APPLIED STATISTICS**

DATE: EXAM SESSION:

TIME: 3.00 HOURS

**Instructions:**

1. **Answer ANY 3 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

**QUESTION ONE (20 MARKS)**

1. The following data represent the number of hours that a rechargeable hedge trimmer operates before a recharge is required:

1.5, 2.2, 0.9, 1.3, 2.0, 1.6, 1.8, 1.5, 2.0, 1.2, 1.7.

Use the sign test to test the hypothesis at the 0.05 level of significance that this particular trimmer operates with a median of 1.8 hours before requiring a recharge (6 Marks)

1. Let and be the set of cumulative distribution functions on  having finite moment. Mallows’ distance between F and G in is defined to be

  (8 Marks)

Where the infimum is taken over all pairs of random variables  and having marginal distributions and, respectively. Show that is a distance on.

1. Let  be a sequence of integers satisfying with, and let  be a random sample from a distribution on with where. Let be the th order statistics. Show that



**QUESTION TWO (20 MARKS)**

Show that for a sample of size, if the number of favorable points to an event  is  and its expected number is   where is large, where is the probability of occurrence of the event, then



**QUESTION THREE (20 MARKS)**

 Let  be a random sample of random variables with Lebesgue density,

  ,

 Be the empirical distribution, and

  

 Where  is a sequence of positive constants.

1. Show that is a Lebesque density on.
2. Suppose that is continuously differentiable at , and Show that the mean squared error of as an estimator of equals

 as 

1. Under  and the conditions in (ii), Show that



1. Suppose that is continuous on , and Show that



**QUESTION FOUR (20 MARKS)**

 An L-functional is defined as

  ,

 Where contains all distribution on for which is well defined and is a Borel function on [0, 1]

1. Show that the influence function is



 Where is the degenerated distribution at 

1. Show that and, if is bounded and has a finite second moment, then 
2. Obtain explicit forms of the influence functions for L-functionals in the following cases and discuss which of them are bounded and continuous.
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**QUESTION FIVE (20 MARKS)**

 Calculate the asymptotic relative efficiency of Hodges-Lehmann estimator with respect to the sample mean based on a random sample from when

1. is the cumulative distribution of ;
2. is the cumulative and distribution of the logistic distribution with location parameter and scale parameter 
3. is cumulative distribution of double exponential distribution with location parameter and scale parameter 
4. , where is the cumulative distribution of the distributionwith 