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**University Examinations 2016/2017**

THIRD YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN STATISTICS, BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE, BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE.

**SMS 3306: THEORY OF ESTIMATION**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: -** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. Define the following
2. Loss function (2 marks)
3. Risk function (1 mark)
4. Give a brief explanation of the following properties of an estimator
5. Unbiased (2 marks)
6. Consistent (2 marks)
7. Efficient (2 marks)
8. Sufficient (3 marks)
9. Let $x$ be a binomial random variable with parameter $n$ and $p$, show that the estimator

 is a biased estimator of $p$ unless  (4 marks)

1. Suppose that  are iid poisson where is the unknown parameter. Let the statistic



Verify that T is sufficient estimator for by

1. Showing that the conditional distribution of  does not involve. (5 marks)
2. Using the Neyman factorization theorem (4 marks)
3. Let $x$ be binomial random variable with parameter $n$ and $p$, compute the lower bound for the variance of an unbiased estimator for $p$. (5 marks)

**QUESTION TWO (20 MARKS)**

1. Given that  and are independent ransom variable with their respective p.d.f

 and  where  is unknown. Use the Neyman factorization theorem to determine a sufficient statistic for . (3 marks)

1. Suppose that  are iid  where  and  are both unknown. Compute
2. The maximum likelihood estimator for  and  (6 marks)
3. From factorization criterion, obtain the joint sufficient statistics for and  (4 marks)
4. Let  be a random sample from Bernoulli 
5. Obtain a sufficient statistic for $p$ using fisher factorization theorem (3 marks)
6. Determine the minimal sufficient statistic for $p$ (4 marks)

**QUESTION THREE (20 MARKS)**

1. State and prove the Cramer Rao inequality (10 marks)
2. Let x have a posson distribution with parameter . Obtain UMVUE for  (5 marks)
3. Let x be a single observation from a poisson distribution with p.d.f  let have a prior distribution with p.d.f  given a loss function as . Find the posterior distribution and determine the Bayes estimator for  (5 marks)

**QUESTION FOUR (20 MARKS)**

1. Determine the lower bound for the variance of an unbiased estimator based on sample data $n$ from  distribution. (8 marks)
2. Suppose that a random sample of size n is form a distribution having p.d.f suppose that  has a prior distribution with p.d.f of an exponential distribution.. Determine the Bayes estimator for  assuming the squared error loss . (6 marks)
3. Let  be random sample from gamma distribution with and  unknown. Find the maximum likelihood estimator for both and  (6 marks)

**QUESTION FIVE (20 MARKS)**

Let be iid random variable from  let be  where is known. Compute the bayes estimate for 