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**University Examinations 2015/2016**

FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF

BACHELOR OF SCIENCE INFORMATION TECHNOLOGY

**SMS 3151/SSA3120: PROBABILITY AND STATISTICS I**

**DATE: AUGUST 2016 TIME: 2 HOURS**

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

**QUESTION ONE (30 MARKS)**

1. Define the following
2. Random variable (2 marks)
3. Probability density function *(p.d.f)* (2 marks)
4. Cumulative distribution function *(c.d.f)*  (2 marks)
5. Consider tossing a coin three time. Let X denote either 0 or 1 according to whether a head or a tail occurs on the first toss, and Y the number of heads which occur.
6. Obtain the sample space (1mark)
7. List the outcomes for the random variable X and Y respectively (4 marks)
8. Compute the probability density function for X and Y (3 marks)
9. Plot the cumulative distribution function for X and Y (2 marks)
10. Compute the Expected value and the variance for X and Y. (6 marks)
11. Let X be a random variable, show that  (4 marks)
12. A food processing company claims that at most 10% of the jars of instant coffee made by it contain less coffee than that claimed on the label. To test this claim, 16 jars of coffee are randomly selected and the contents are weighed. The claim is accepted if fewer than 3 of the jars contain less coffee than that claimed on the label. Find the probability that the claim will be accepted when the actual percentage of jars containing less coffee than that claimed on the label is 5%. (4 marks)

**QUESTION TWO (20 MARKS)**

1. Let  be a random variable with function



1. Verify that this function is a probability density function of x (3 marks)
2. Find  and  (4 marks)
3. If K is a constant,  and  are random variables with probability density function  Show that

 (3 marks)

1. Given the function



Compute the 1st and 3rd quartiles (5 marks)

1. Consider the function. Find the mode of  (5 marks)

**QUESTION THREE (20 MARKS)**

1. Briefly discuss the properties of the following distributions
2. Bernoulli distributions (2 marks)
3. Binomial distribution (3 marks)
4. Poisson distribution (2 marks)
5. Derive the mean and variance for the distributions named in (a) above (13 marks)

**QUESTION FOUR (20 MARKS)**

1. Define the following
2. Central moments (3 marks)
3. Moment generating function (mgf) (3 marks)
4. Let  be a random variable with density function 

Find the moment generating function for x, hence fid the mean and variance for x (7 marks)

1. If the probability of hitting a target is 10% and 10 shots are fired independently. What is the probability that the target will be hit at least once? (5 marks)
2. A family has 4 children, what is the probability that at least one of the children is a boy.

(2 marks)

**QUESTION FIVE (20 MARKS)**

1. If  is the probability density function for hyper geometric distribution, show that

 (10 marks)

1. If  is poisson random variable with parameter , show that

 (5 marks)

1. If  is Geometric random variable verity that 

Where  and is the probability of success. (5 marks)