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

**SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE**

**IN ACTUARIAL SCIENCE**

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

**REGULAR**

**COURSE CODE: SAS 103**

**COURSE TITLE: INTRODUCTION TO PROBABILITY THEORY**

**EXAM VENUE: STREAM: BSC. ACTUARIAL SCIENCE**

DATE: EXAM SESSION:

TIME: 2.00 HOURS

**Instructions:**

1. **Answer Question ONE and ANY other two 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 (30 MARKS)**

1. A normal distribution has a mean . Compute the standard deviation for this distribution if 20% of the area lies to the right of under its curve . (6marks)
2. In a survey, 15% of the participants said that they had never bought lottery tickets or a premium bond. 73% had bought lottery tickets and 49% had bought premium bonds. Find the probability that a person chosen at random from those taking part in the survey,
3. Had bought lottery tickets or premium bonds,
4. Had bought lottery tickets and premium bonds
5. Had bought lottery tickets only (6marks)
6. When a car owner needs her car serviced she phones one of the three garages A,B or C. Of her phone calls to them, 30% are to A, 10% are to B and 60% are to C. The percentage of occasions when the garage phoned can take the car in on the day of phoning are 20%, 6%, and 9% for A, B and C respectively.
7. Find the probability that the garage phoned will not be able to take the car in on the day of phoning.
8. Given that the car owner phones a garage and the garage can take her car in on that day, find the probability that she phoned garage B. (6marks)
9. A discrete random variable has and the following probability distribution

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | 1 | 2 | 3 | 4 | 5 |
| P(X=x) | 0.3 | a | 0.1 | b | 0.2 |

1. Determine the values of and .
2. Determine variance of . (6marks)
3. Determine whether or not the following is a probability density function

(6marks)

**QUESTION TWO (20 MARKS)**

1. A continuous random variable has a pdf given by

Determine

1. The value of
2. The mean and variance of . (10 marks)
3. The random variable X has probability mass function

Work out

1. The mode of the distribution
2. The median of the distribution (10 marks)

**QUESTION THREE (20 MARKS)**

1. For the events and , , , . Find,
3. (10marks)
4. The number of surface flaws in plastic panel used in the interior of automobiles has a Poisson distribution with a mean of 0.05 flaws per square foot of plastic panel. Assume each automobile interior contains 8 square feet of plastic panel. Find the probability that:
5. There are no surface flaws in an auto’s interior.
6. In 10 cars sold to a rental company none of the 10 cars has any surface flaw.
7. In 50 cars sold to a rental company at most two cars have any surface flaw. (10marks)

**QUESTION FOUR (20 MARKS)**

1. During a survey, it was noted that about 4% of the respondent were allergic to some generic drug that cures malaria. Use the Poisson approximation to binomial to solve the following problems. Among 200 respondents in the survey find the probability that:
2. Exactly 6 were allergic to the drug.
3. At least 4 were allergic to the drug (7marks)
4. A random variable takes the integer value with probability p(x) defined by

Find the value of hence the cumulative distribution function of X . (7marks)

1. A factory makes its products using three machines. Machine A, B and C produce 50%, 30% and 20% of products respectively. It has been noticed that 4%, 2% and 4% of products from A, B and C respectively is defective. What is the probability that:
2. A randomly selected product is defective?
3. If a randomly selected product was found to be defective, it was made by machine A. (6marks)

**QUESTION FIVE (20 MARKS)**

1. The probability of a successful optical alignment in the assembly of an optical data storage product is 0.8. Assume that the trials are independent. What is the probability that:
2. The first successful alignment requires four trials.
3. The first successful alignment requires at most four trials. ( 6 marks)
4. In a certain African village, 80% of the villagers are known to have a particular eye disorder. Twelve people are waiting to see the nurse. Find
5. The most likely number to have the disorder
6. The probability that fewer than half have the eye disorder. (6 marks)
7. A continuous random variable X has a probability density function given by

Observations on X indicate that the mean is 1. Determine the values of and hence the variance of (8marks)