MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND SEMESTER EXAMINATION FOR DEGREE IN BACHELOR EDUCATION

SMA 260: PROBABILITY & STATISTICS 1

DATE: SCHOOL BASED **TIME:**

INSTRUCTIONS:

Answer Question ONE which is compulsory and any other TWO Questions Time 2 Hrs

QUESTION ONE (30 MARKS)

(a) By citing examples differentiate between discrete and continuous random variable (4 marks)

(b) The age of University staff members is normally distributed where 31% of the staff is below 45 years and 8% are over 64 years. Determine the mean and the standard deviation of the age distribution. (5 marks)

(c) Given that X is a random variable with *pdf*

$$f(x)=\begin{cases}\dfrac{1}{2\sqrt{x}} & 1<x<4\\ 0 & elsewhere\end{cases}$$

Determine the quartile deviation of the random distribution (4 marks)

(d) Given that $F(x)$ is the CDF of a poison distribution with parameter λ and that $F(2)=2F(1)$. Determine the value of λ (6 marks)

(e) If X is a hyper geometric random variable, show that $E(x)=\left(\frac{A}{N}\right)n$ (6 marks)

(f) Suppose the unit rate of receiving calls at an exchange board is 10 calls per hour. Determine in three hour interval;

i. The expected number of calls and its variance

ii. The probability of receiving exactly 20 calls (5 marks)

QUESTION TWO (20 MARKS)

(a) Suppose X is a random variable with a density function defined as

$$f(x)=\begin{cases}\lambda e^{-\lambda x} & x>0 \quad \lambda>0\\ 0 & , \quad otherwise\end{cases}$$

Determine the mgf_X , $E(x)$ and $Var(x)$ (10 marks)

(b) The *pdf* of a random variable X is given by

$$f(x)=\begin{cases}\frac{1}{3} & ,-1<x<2\\ 0 & otherwise\end{cases}$$

Calculate $E(x^2)$, $E(x^3)$ and μ_3 (10 marks)

QUESTION THREE (20 MARKS)

a) The lifespan of bulbs manufactured by a certain company is normally distributed with $\mu=2040$ hours and $\sigma=60$ hours. This is based on an experiment of 20,000 bulbs. Based on the experiment determine the

i. Number of bulbs with a lifespan of 1,960 to 2,150 hours

ii. Probability that a bulb picked at random would last for at least 2,200 hrs (6 mks)

b) An examination has 10 multiple-choice questions, with 4 choices for each question but only one is correct. To pass a student must answer at least 6 questions correct. If an ill prepared student decided to select the answers randomly determine the probability that the student

i. Got no answer correct

ii. Passed the examination (6 marks)

c) If X is the number heads that show up after tossing a fair coin twice, determine the mgf_x, $E(x)$ and $Var(x)$ (8 marks)

QUESTION FOUR (20 MARKS)

a) Given that 20% of the articles taken from a batch of eight are found to be defective. Calculate the probability of getting three or more defective

(4 marks)

b) A variable X has a hypergeometric distribution with parameters $A=8$ and $B=20$, for what value of n, will $Var(X)$ be maximum (8 marks)

c) The density for X, the lead concentration in gasoline in grams per liter is given by

$$f(x)=\begin{cases} 12.5x-1.25 & ,0.1\le x\le 0.5 \\ 0 & ,Otherwise \end{cases}$$

Determine the

i. Expected value of x

ii. Variability from liter to liter $Var(x)$

iii. Cumulative distribution function of x (8 marks)

QUESTION FIVE (20 MARKS)

a) A container has 120 alarms of which 5 are defective. If 3 of these alarms are randomly selected and delivered to a customer, determine the probability that the customer will get one defective alarm. (4 marks)

b) i) Highlight four properties of a binomial distribution function (4 marks)

ii) If X is a binomial random variable then $Var(x)=npq$ show (12 marks)