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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2016/2017 ACADEMIC YEAR
FIRST YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(MATHEMATICS)

Date: 9th August, 2016.
Time: 11.00am – 1.00pm

KMA 106 – PROBABILITY AND STATISTICS 1

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Differentiate the following;

i) Statistic and Parameter

ii) Sample and population

iii) Null and alternative hypothesis

(6 Marks)

b) State the central limit theorem.

(3 Marks)

c) A continuous random variable X has the probability density function

$$f(x)=\begin{cases} c(1-x)^2, & 0<x<1 \\ 0, & \text{elsewhere} \end{cases}$$

i) Find the value of constant c

(3 Marks)

ii) Find the mean and variance of X

(4 Marks)

d) A shelf life in days for bottles of a certain prescribed medicine is a random variable having the density function

$$f(x)=\begin{cases} \dfrac{20000}{(x+100)^3}, & x>0 \\ 0, & \text{otherwise} \end{cases}$$

Find the probability that a bottle of tis medicine will have a shelf life of;

i) At least 200 days

(4 Marks)

ii) Anywhere from 80 to 120 days

(4 Marks)

e) Suppose we would like to determine if the typical amount spent per customer for dinner at a new restaurant in town is more than Shs. 2000. A sample of 49 customers over a three-week period was randomly selected and the average amount spent was Shs. 2260. Assume that the standard deviation is known to be Shs. 250. Using a 0.05 level of significance, would we conclude the typical amount spent per customer is more than Shs. 2000?

(6 Marks)

QUESTION TWO (20 MARKS)

a) KPMG Corporation gives each of its employees an aptitude test. The scores on the test are normally distributed with a mean of 75 and a standard deviation of 15. A simple random sample of 25 is taken from a population of 500.

i) What is the probability that the average aptitude test score in the sample will be between 70.14 and 82.14?

(5 Marks)

ii) What is the probability that the average aptitude test score in the sample will be equal to or greater than 82.68?

(4 Marks)

iii) Find a value, C, such that P($\overline{X}$ ≥ C) = .015.

(3 Marks)

b) Suppose that the lifetime X of a fuse (in 100 hours units) is exponentially distributed with $P(x>10)=0.7$. Find;

i) Rate parameter

(5 Marks)

ii) Mean and standard deviation of X

(3 Marks)

QUESTION THREE (20 MARKS)

a) Consider a continuous random variable X with p.d.f

$$f(x)=\begin{cases} kx^2, & 0\le x\le 1 \\ 0, & elsewhere \end{cases}$$

i) Determine the constant k

(3 Marks)

ii) Find a and b such that;

a) $\Pr(X\le a)=\Pr(X>a)$

(5 Marks)

b) $\Pr(X>b)=0.05$

(3 Marks)

b) The amount of growth, in a 15-day period, for a population of sunflower plants was found to follow a normal distribution with mean 3.18 cm and standard deviation 0.53 cm. What percentage of plants grow

i) 4cm or more?

(4 Marks)

ii) Between 2.5 and 3.5 cm?

(5 Marks)

QUESTION FOUR (20 MARKS)

a) Let X be an exponential random variable given by p.d.f

$$f(x)=\begin{cases}\lambda e^{-\lambda x}, & 0<x<\infty \\ 0, & \textit{elsewhere}\end{cases}$$

If $\Pr(X \le 2)=\Pr(X>2)$, find $E[X]$ and $Var(X)$

(10 Marks)

b) Let X be continuous random variable uniformly distributed over the interval (a,b). Show that the mean and variance of X is;

$$E[X]=\frac{b+a}{2},\ \text{var}(X)=\frac{(b-a)^2}{12}$$

(10 Marks)

QUESTION FIVE (20 MARKS)

a) A continuous random variable Y is uniformly distributed over the interval $[-2,7]$

i) Write down fully the probability density function of Y

(3 Marks)

ii) Find the mean and variance of Y

(6 Marks)

b) A new soft drink is being market tested. It is estimated that 60% of consumers will like the new drink. A sample of 96 taste-tested the new drink.

i) Determine the standard error of the proportion

(3 Marks)

ii) What is the probability that equal to or more than 70.4% of consumers will indicate they like the drink?

(4 Marks)

iii) What is the probability that equal to or more than 30% of consumers will indicate they do ***not*** like the drink?

(4 Marks)