



MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS 2018/2019 ACADEMIC YEAR FIRST YEAR SECOND SEMESTER

SCHOOL OF SCIENCE AND INFORMATION SCIENCES BACHELOR OF SCIENCE & EDUCATION

**COURSE CODE: STA 1204/1207/1208
COURSE TITLE: PROBABILITY & STATISTICS II**

DATE: 25/04/2019

TIME: 2:30 PM – 4:30 PM

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **Two** questions.
2. Show all the workings clearly
3. Do not write on the question paper
4. All Examination Rules Apply.

Question One (30 Marks)

a) Let X be a random variable with pdf given by $f(x) = \begin{cases} k\sqrt{x} & 0 \leq x \leq 9 \\ 0 & \text{elsewhere} \end{cases}$. Find

the

(i) value of a constant k **(2 Marks)**

(ii) cumulative distribution function $F(x)$ **(1 Mark)**

(iii) $P(X \leq 4)$ **(3 Marks)**

(iv) variance of X **(3 Marks)**

b) The pdf of a random variable X is given by $f(x) = \begin{cases} \frac{x}{15} & x = 1, 2, 3, 4, 5 \\ 0 & \text{elsewhere} \end{cases}$

Find the

i) $P(1 \leq X < 4)$ **(3 Marks)**

ii) the third moment of X about the origin **(2 Marks)**

c) If the probability that a person will believe a rumor about the transgressions of a certain politician is 0.4. Find the probability that

i) The fourth person to hear this rumour is the second person to believe it. **(3 Marks)**

ii) Let X be the number of people who fail to believe the rumour before we get the second person who believes it. Find the mean and variance of X . **(2 Marks)**

d) The probability of launching a missile successfully is 0.8. Test launches are conducted until three successful launches are achieved. Find the probability that exactly six launches will be required **(4 Marks)**

e) The mgf of a random variable X is given by $m(t) = e^{2t + \frac{25}{2}t^2}$.

i) what is the pdf of X **(3 Marks)**

ii) Find $P(X < 0)$ and $P(X > 2)$ **(4 Marks)**

Question Two (20 Marks)

a) At a certain airport, 80% of the flights arrive on time. A sample of 10 flights is studied. Let X be the number of flights that arrive on time. Find

i) $P(X = 10)$ ii) $P(X = 8)$ iii) $P(X \geq 8)$ **(8 Marks)**

b) If the number of bacterial colonies on a petri dish follows a poisson distribution with average number 1.5 per cm^2 , find the probability that

(i) In $1.5 cm^2$ there are no bacterial colonies **(2 Marks)**

(ii) in $2cm^2$ there will be no bacterial colonies **(3 Marks)**

(iii) in $1.5cm^2$ there will be less than 3 bacterial colonies **(5 Marks)**

(iv) In $4 cm^2$ there are six bacterial colonies. **(2 Marks)**

Question Three (20 Marks)

a) The probability that a computer running on a certain operating system crashes on any given day is 0.2. Let X be the number of days on which the computer is working before crashing for the first time. Find

i) $P(X = 5)$ ii) $P(X > 2)$ iii) the mean and variance of X

(6 Marks)

b) The random variable X has pdf given by $f(x) = \begin{cases} \frac{1}{32}(x+4) & -4 \leq x \leq 4 \\ 0 & elsewhere \end{cases}$

i) Find the mean and variance of X **(3 Marks)**

ii) Find q such that $P(X \leq q) = \frac{1}{4}$ **(5 Marks)**

c) There are 15 restaurant in a certain town, four of them have health violations. A health inspector chooses 6 restaurants at random to visit. What is the probability that

- i) two of the restaurants with health code violations will be visited **(3 Marks)**
- ii) more than two of the restaurants with health violations will be visited **(3 Marks)**

Question Four (20 Marks)

a) If $X \sim N(4,9)$. Find

- i) $P(1 < X < 7)$ ii) $P(|X| < 6)$ **(6 Marks)**

b) The standard deviation of a certain group of 800 high school students' grades was 10% and the mean grade was 80%. Assuming that the distribution is normal,

- i) Find the number of students who scored more than 70% **(3 Marks)**
- ii) How many grades were above 90% **(3 Marks)**
- iii) What was the highest grade of the lowest 100 high school students **(3 Marks)**

c) Let the random variable X denote the waiting time (in minutes) for the next train. Under the assumption that a man arrives at the train station at random, X is distributed uniformly on the interval $(0, 15)$.

- i) Find the probability that he waits for at least 10 minutes for the train. **(3 Marks)**
- ii) Find the mean and variance of the waiting time. **(2 Marks)**

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