



# 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  
4:30 PM

TIME: 2:30 PM -

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#### 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

$$f(x) = \begin{cases} k\sqrt{x} & 0 < x < 9 \\ 0 & \text{elsewhere} \end{cases}$$

(i) value of a constant  $k$  (2

**Marks)**

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

**Mark)**

(iii)  $P(X < 4)$  (3

**Marks)**

(iv) variance of  $X$  (3

**Marks)**

$$f(x) = \begin{cases} \frac{x}{5} & x = 1, 2, 3, 4, 5 \\ 0 & \text{elsewhere} \end{cases}$$

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

Find the

i)  $P(1 < X < 4)$  (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)  $P(X = 8)$  **(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

$$f(x) = \begin{cases} \frac{1}{2}(x+4) & -4 \leq x \leq 4 \\ 0 & \text{elsewhere} \end{cases}$$

- 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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