



MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SPECIAL /SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING

ECU 0201: MATHEMATICS V PROBABILITY AND STATISTICS

DATE: 24/3/2021

TIME: 2.00-4.00 PM

INSTRUCTIONS TO CANDIDATES

Answer question ONE and any other TWO questions

QUESTION ONE (30 MARKS)

- a) Define the following terms as used in probability
- i. Probability (1 mark)
 - ii. Event (1 mark)
 - iii. Independent and dependent events (1 mark)
- b) Two marbles are drawn one after the other without replacement from an urn containing 4 Red and 2 Blue marbles.
- Represent the information in a tree diagram (2 marks)
- Find the $Pr(\text{red}); Pr(\text{Blue}), Pr(\text{Red/Blue})$; (4 marks)
- c) Suppose that 120 students took both mathematics and chemistry. 15 failed mathematics and 16 failed chemistry. If the events “failed mathematics” and “failed chemistry” are independent events, find the probability “failed both courses”
- d) A variable x is distributed as shown below

x	-3	1	2	6
P(x)	$\frac{3}{12}$	$\frac{1}{12}$	$\frac{4}{12}$	$\frac{4}{12}$

Calculate

i. $E[X]$ (2 marks)

ii. $E[X^2]$ (2 marks)

iii. $E[X - \mu]^2$ (2 marks)

e) Given that $f(x) = \begin{cases} k(x^2 - x) & 0 < x < 3 \\ 0 & \text{elsewhere} \end{cases}$

calculate the value of k and hence evaluate

i. mean

ii. standard deviation

iii. $pr(1 \leq x \leq 2)$ (8 marks)

QUESTION TWO (20 MARKS)

a) The average marks obtained in a class of 20 students in an examination were as follows

51 43 30 36 42

40 27 31 61 57

74 64 55 42 83

52 50 37 41 71

Determine the mean mark and the median (10 marks)

b) Suppose there are four countries in the land of OZ. At home the men of each wear ties of a special color, Munchkins wear blue, Quadlings red, Gillikins purple, and Winkies yellow.

While visiting the Emerald City, however some men wear green ties. 20% of the

Munchkins, 30% of the Quadlings, 40% of the Gillikins, 50% of the Winkies change their tie color. As a visitor approaches the guardian of the Emerald City assigns prior probability

$$P(M) = \frac{1}{2}, \quad P(Q) = P(G) = P(W) = \frac{1}{6}$$

Use tree diagram to evaluate

i) $Pr(\text{Green})$

ii) $Pr(M/\text{Green})$

ii) $Pr(Q/\text{Green})$

QUESTION THREE (20MARKS)

The table below shows the number of motor vehicle parts produced per hour by a machine on 60 different occasions

65 85 80 83 70 95 85 79 68 74
82 70 92 61 78 85 86 96 73 76
97 74 82 76 82 68 93 63 81 77
78 66 98 77 81 78 86 65 78 64
62 99 87 90 68 73 87 62 84 79
96 81 72 94 62 66 94 70 82 61

- a) Group the data into a frequency distribution table using classes

(60 – 64), (65 – 69)

Hence determine using an assumed mean of 82, the

- i) Mean
- ii) Median
- iii) Standard deviation

QUESTION FOUR (20 MARKS)

- a) The table below gives time taken by certain individuals to travel to work

Time	1-10	11-20	21-30	31-40	41-50
Frequency	8	14	12	9	7

Calculate the Q_1, Q_3, D_3, P_{40} of the data. (10 marks)

- b) i Calculate the median of the data below (5 marks)

marks	0-10	10-20	20-30	30-40	40-50	50-60
	2	18	30	45	35	20

- ii Find the variance and the standard deviation of the following data (5 marks)

No. of order	10-12	13-15	16-18	19-20
Frequency	4	12	20	14

QUESTION FIVE (20 MARKS)

a) A department has four lecture theaters. The probability that any one lecture theater is unoccupied is $\frac{1}{7}$. Find the probability that

i. Any three of the four lecture theaters are unoccupied (2 marks)

ii. All the lecture theaters are occupied (2 marks)

c) A continuous random variable that a probability density function defined by

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

Find

i) the value of the constant k (3 marks)

ii) the mean and the standard deviation (10 marks)

iii) the probability that t lies between 1.5 and 2.5 (3 marks)