

2405/303  
STATISTICAL METHODS  
Oct./Nov. 2016  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN APPLIED STATISTICS

MATHEMATICS

3 hours

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Answer booklet;*

*Mathematical tables/Scientific calculator.*

*This paper consists of EIGHT questions.*

*Answer any FIVE questions in the answer booklet provided.*

*ALL questions carry equal marks.*

*Maximum marks for each part of a question are indicated.*

*Candidates should answer all questions in English.*

**This paper consists of 5 printed pages.**

**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**

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Turn over

1.

(a) Table 1 shows time taken by specimen to fail under fatigue test.

Table 1

Time of failure $t$ (hours)	Number of specimen
< 10	1
10 - 19	2
20 - 29	3
30 - 49	9
50 - 99	23
100 - 149	18
150 - 199	11
200 - 299	13
300 - 399	8
400 - 499	5
> 500	7

$$s.d = \sqrt{\frac{\sum f x^2}{N} - \left(\frac{\sum f x}{N}\right)^2}$$

1  
3  
6  
15  
38  
56  
67  
80  
88  
93  
100

$$f.d = \frac{f}{width}$$

$$C.V = \frac{s.d}{\bar{x}}$$

20.08

- (a) Calculate the coefficient of variability for the data in table 1. (10 marks)
- (b) Draw the ogive curve of the data hence determine the median and the quartile deviation. (7 marks)
- (c) Determine the median of the data by calculation and compare with (b). (3 marks)

2.

(a) In a public speaking contest, two judges awarded marks to the competitors as shown in table 2.

Table 2

Competitor	1	2	3	4	5	6	7	8	9	10
Judge A	48	50	55	51	51	47	48	46	52	50
Judge B	18	19	29	22	26	14	22	11	24	17

Use the rank correlation test to determine whether the judges' opinions were consistent. (7 marks)

$$1 - \frac{6d^2}{n(n^2-1)}$$

(b) Postponement of football matches during a season for a 16 team league was found to follow a poisson distribution. The chance of having 3 matches being postponed in a season is 0.0892. Calculate the probability that:

- (i) no matches are postponed during the season;
- (ii) 6 matches are postponed during the season.

$$\frac{e^{-m} m^x}{x!} \cdot np$$

$$\frac{e^{-m} m^3}{3!}$$

(13 marks)

3. (a) The lengths of bolts produced in a certain factory is normally distributed. The lengths of 15.39% of the bolts are more than 12.19 cm, while the lengths of 3.44% of the bolts are less than 9.63 cm.
- $$y = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$
- (i) Calculate the mean length of bolts and the standard deviation. (7 marks)
- (ii) If 75% of bolts have the correct length required, calculate the minimum length required. (4 marks)
- (b) It has been found that 30% of wells in a county have salty water. If a random sample of five wells are selected from the county, calculate the probability that
- (i) exactly **three** are salty;
- (ii) at least **three** are salty;
- (iii) expected number of wells with salty water. (9 marks)

4. The number of hours practised and the corresponding scores made by ten randomly selected cricket players are shown in table 3.

Table 3

Number of practised hours ( $x$ )	0	1	2	4	6	10	11	12	14	15
Scores ( $y$ )	140	150	160	170	185	200	210	220	240	260

- (a) Draw a scatter diagram for the scores. (3 marks)
- (b) Calculate the coefficient of correlation.  $\frac{n\sum xy - \sum x \sum y}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$  (8 marks)
- (c) Determine the least square equation of  $y$  on  $x$  hence draw line on the scatter diagram. (7 marks)
- (d) Determine the scores when  $x = 0$ . (2 marks)

5. (a) The recommended daily wage of a typist in a certain town is Ksh 550. Results compiled from two companies located in the town are shown in table 4.

Table 4

$$\bar{x}_{12} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$$

Company	Number of typist employed	Mean daily wage	Standard deviation
A	50	450	75
B	15	500	50

Determine whether the two companies are abiding to the recommended daily wage of 5% level of significance. (12 marks)

- (b) Explain **four** characteristics of a binomial distribution. (4 marks)
- (c) State **two** advantages and **two** disadvantages of stratified sampling. (4 marks)
6. (a) Explain the following terms as applied in statistics:

- (i) estimator;  
 (ii) point estimation;  
 (iii) interval estimation.

(6 marks)

- (b) The time take to perform a particular task,  $t$  hours, has a probability of density function given by

$$f(t) = \begin{cases} 10ct^2 & 0 \leq t \leq 0.6 \\ 9c(1-t) & 0.6 \leq t \leq 1.0 \\ 0 & \text{otherwise} \end{cases}$$

where  $c$  is a constant.

- (i) Determine the value of  $c$ .  
 (ii) Sketch the graph of this distribution.  
 (iii) Determine the most likely time.  
 (iv) Calculate the median.

(14 marks)

7. (a) Two similar bags, A and B, contain balls. Bag A contains 8 green balls and 5 white balls. Bag B contains 4 green balls and 11 black balls. The bags are arranged such that probability of picking bag B is  $\frac{2}{5}$ . A student is to pick a ball from either bag. If he picks a green ball he is awarded 100/=.

Calculate the probability that:

- (i) the student is awarded 100/=
- (ii) the student is awarded 100/= when she picked the green ball from bag A. (11 marks)
- (b) For the sample data 2, 8, 10, 15, 20, 23, 34, calculate first moment, first moment and second moment about 16, and explain each value. (6 marks)
- (c) State the advantages of a pictograph as a method of statistical presentation. (3 marks)
8. (a) The IQ of fifty students in a college are given in table 5.

Table 5

IQ Score	Frequency
71 - 80	3
81 - 90	6
91 - 100	12
101 - 110	x
111 - 120	8
121 - 130	5
131 - 140	2

$\bar{x} = \frac{\sum fx}{\sum f}$

- (i) Given that the mean of the IQ scores is 103.7, calculate value of x.
- (ii) Calculate the 80<sup>th</sup> percentile and 6<sup>th</sup> decile. (11 marks)
- (b) A random sample of 300 students taking a Physics course at a college was conducted. 170 of the students prefer the Physics final paper be optional. Calculate the 95% confidence interval for the true proportion of Physics students who want the Physics final paper to be optional.

$$P = \bar{x} \pm 1.96 \frac{\sigma}{\sqrt{n}}$$

$$= \frac{170}{300} \pm 1.96 \frac{\sqrt{\frac{170}{300} \left(1 - \frac{170}{300}\right)}}{\sqrt{300}}$$
(9 marks)

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