

2405/303  
STATISTICAL METHODS  
Oct./Nov. 2017  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN APPLIED STATISTICS

STATISTICAL METHODS

3 hours

#### INSTRUCTIONS TO CANDIDATES

*You should have the following for this examination:*

*Answer booklet;*

*Scientific calculator/Mathematical tables.*

*This paper consists of EIGHT questions.*

*Answer FIVE questions.*

*All questions carry equal marks.*

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

*Candidates should answer the 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.**



1. (a) Explain the following measures of dispersion:

- (i) quartile deviation;
- (ii) range; - Difference between the highest and the lowest
- (iii) mean deviation.  $\frac{\sum d}{n}$

(6 marks)

(b) Table 1 shows data of annual profits earned by various companies.

Table 1

Profits (Ksh. '000)	Number of companies
100 - 110	18
110 - 120	54
120 - 130	189
130 - 140	184
140 - 150	326
150 - 160	198
160 - 170	21
170 - 180	8

Calculate Karl Pearson's coefficient of skewness and comment on the results.

(14 marks)

2. (a) (i) Define correlation as used in statistics.

(ii) Explain three importance of correlation.

(7 marks)

(b) Table 2 shows fertilizer usage and the productivity realized in tonnes.

Table 2

Fertilizers usage (tonnes)	18	20	28	26	34	38	40	44	50	52
Productivity (tonnes)	70	76	88	96	100	110	140	162	174	180

Calculate the product moment correlation coefficient between the usage of fertilizers and productivity hence comment on the results.

(11 marks)

(c) State two disadvantages of median as a measure of central tendency.

(2 marks)



3. (a) Explain **four** sampling techniques used in data collection. (8 marks)
- (b) The data in table 3 indicates the marks obtained by 130 students in a certain examination, with an arithmetic mean of 57.8.

Table 3

Marks	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Number of students	5	8	x	19	28	y	15	13	11

Calculate the:

- (i) values of x and y;  
 (ii) standard deviation;  
 (iii) median.

(12 marks)

4. (a) Table 4 shows the output and the cost data in thousands for company XYZ Ltd.

Table 4

Output (Units) in '000'	Costs Kshs. '000'
20	160
16	138
26	168
24	160
20	150
18	146
28	180

- (i) Using the least squares method, determine the equation of regression line of cost on the outputs.
- (ii) Estimate the cost if 32,000 units are produced.

(12 marks)

- (b) In a sample of 1000 students who sat for a test, the mean was 14 marks and standard deviation was 2.5 marks. Assuming the distribution to be normal, calculate the number of students who scored:

- (i) between 12 and 15;  
 (ii) above 18;  
 (iii) below 8.

(8 marks)



5. (a) Outline **four** demerits of mean deviation as a measure of dispersion. (4 marks)
- (b) Watches manufactured by a certain factory contain 3% defectives. If 10 watches are selected at random, determine the probability of getting:
- (i) 3 defectives;
  - (ii) at most 2 defectives;
  - (iii) 8 non-defectives.

(8 marks)

- (c) Table 5 shows the marks obtained by students in statistics and accounts tests.

Table 5

Statistics	15	10	8	12	16	20	7	9	13
Accounts	8	19	12	16	15	11	14	6	9

Calculate the Spearman's rank correlation coefficient and comment on the result.

(8 marks)

6. (a) Outline the central limit theorem. (5 marks)
- (b) The average weekly overtime earnings from a sample of workers from a particular service industry are indicated in table 6.

Table 6

Average weekly overtime earnings	0-100	100-200	200-300	300-400	400-500
Number of workers	10	29	17	12	3

Determine the:

- (i) mean;
- (ii) standard deviation;
- (iii) sample size required to estimate the average weekly overtime earnings to be within  $\pm$  Ksh. 5 with 95% confidence interval.

(15 marks)

7. (a) Explain the following terms as used in statistical inferences:
- (i) test of hypothesis;
  - (ii) type I error;
  - (iii) type II error;
  - (iv) level of significance.

(8 marks)



- (b) A lorry manufacturer claims that the average annual maintenance cost for his vehicles is Kshs. 50,000. The maintenance department of one of their customers believes it to be higher. A sample of six lorries were randomly selected from their large fleet. From this sample, the mean annual maintenance cost was found to be Kshs. 55,500, with a standard deviation of Kshs. 7,500. Test the manufacturer's claim at 5% significant level. (7 marks)
- (c) In a certain manufacturing firm, the probability of a machine producing a defective item is 4%. If 120 items were tested for their qualities, calculate the probability of a machine producing:
- at most two defective items;
  - at least three defective items;
  - exactly four defective items.

(5 marks)

8. (a) Distinguish between point and interval estimates. (4 marks)

- (b) Explain the following terms as used in statistical inference:

- null hypothesis;
- standard error of mean.

(4 marks)

- (c) (i) A dispute exists between workers on two production lines. The workers on production line A claim that they are paid less than those of production line B. The company investigates the claim by examining the pay of 70 workers from each production line. The results are indicated in table 7.

Table 7

Sample Statistics	Production line	
	A (Kshs.)	B (Kshs.)
Accounts		
Mean	39,300	39,450
Standard deviation	600	750

Test the claim at 5% significance level.

- (ii) Outline four advantages of arithmetic mean.

(12 marks)

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