

7. Write all your answers in the Examination answer booklet provided

QUESTION ONE

a) Research was done to determine the effects of sales (in units) and advertisement expenditure (Dollars) would have on the profit (Dollars). On analysis using Multiple Regression, the output was recorded as below:

$$Y = 11.515 + 0.173 X_1 - 0.2857X_2$$

$$n = 155; R^2 = 0.67$$

Where Y = Profit; X_1 = Sales X_2 = Advertisement expenditure

Required:

- i. Interpret the reported values for constant, coefficients and R^2 **(3 Marks)**
- ii. Are the signs for estimate what you expected to be? Explain **(2 Marks)**
- iii. Determine the profit if the total sales are 12 units and the advertisement expenditure are 200 dollars

(2 Marks)

b) Distinguish between the following terms as used in statistics

i) Parameter and Statistic **(2**

Marks)

ii) Descriptive and Inferential Statistics **(2**

Marks)

iii) Estimate and Estimator **(2**

Marks)

c) Fishers' method of constructing weighted index numbers is considered an ideal method. Discuss

(2 Marks)

d) In a simple queue system, the arrival rate for a particular week follows poisson distribution. The manager wanted to optimize the operations and has recorded the following probability distribution

Arrivals (x)	2	5	6	3	4	7	1
Probability, P(x)	0.	0.1	0.0	0.15	0.2	0.2	0.1
	2		5				

Required:

- i. Verify that the above distribution is a probability distribution. **(2 Marks)**
- ii. Find the probability that arrivals took prime number **(2 Marks)**
- iii. Calculate the standard deviation of the distribution **(3 Marks)**

e) A local college wants to compare the mean GPA for players on four of its sports teams: Basketball, baseball, hockey and Football. A random sample of players was taken from each team and their GPA recorded. Assuming the contingency table obtained was as follows:

Source of Variation	Sum of Squares	Degree of Freedom	Mean Squares	F-Statistics
Between groups	0.2215	---b----	---d---	----f---
Within Groups	--a--	----c---	----e---	
Total	8.00095	19		

- i. Fill in the missing values **(3 Marks)**
- ii. Assuming the populations are normally distributed and have equal variances. At 5% level of significance, test the hypothesis that there is no difference between the GPA means for the team **(5 Marks)**

QUESTION TWO

- a) The following data represent sales revenue (in millions) and advertising expenditure (in millions) for a company over 6 years:

Year	Sales Revenue	Advertising Expenditure
1	120	10
2	130	12
3	150	15
4	170	18
5	160	17
6	180	20

Required:

- i. Determine the regression equation of Y on X. Interpret values **(6 Marks)**
 - ii. Estimate sales revenue when advertising expenditure is Kshs. 14 million. **(2 Marks)**
 - iii. Calculate and interpret the coefficient of determination. **(4 Marks)**
- b) Explain why Measures of dispersion is important in decision analysis. **(3 Marks)**

QUESTION THREE

- a) A researcher selected a random sample of 100 managers to test a new training method. The average score after training was 72 with a standard deviation of 10. Test at 5% level of significance whether the average score is significantly different from 70.

(10 Marks)

- b) Given the following formulated Linear programming Model which involves an organises which produces three products

Objective Function, $Z = 4X_1 + 6X_2 + 3X_3$ (Maximization)

Subject to; $X_1 + 3X_2 + X_3 \leq 23$

$X_1 + 5X_2 \leq 19$

$X_1 + 7X_2 + 2X_3 \leq 12$

And $X_1, X_2, X_3 \geq 0$ (Non-Negativity Condition)

Obtain a dual programme (5 Marks)

QUESTION FOUR

- a) The marks obtained in a business statistics test are:
35, 40, 50, 45, 60, 55, 70, 75, 65, 85

Calculate the Coefficient of Variation and interpret the results
(6 Marks)

- b) In a survey of 500 people, 110 preferred product A, 100 preferred product B, 70 preferred product C, 170 preferred product D and 50 preferred product E.

Assuming the expected preferences for products was the same for the different people, determine whether there is significance difference in frequencies of preferences at 90% confidence level

(9 Marks)

FORMULAS

$$\text{Mean} = \frac{\sum X}{n} \quad \text{Mean,} = \frac{\sum FX}{\sum F} \quad \text{Z-Formula} = \frac{\text{Mean - Value}}{\text{standard deviation}}$$

$$\text{Mode} = L + \frac{F_1}{F_1 + F_2} \times i \quad \text{or} \quad \text{Mode} = L + \left(\frac{D_1}{D_1 + D_2} \right) \cdot c$$

$$\text{Median} = L + \frac{i}{F} (m - c) \quad \text{or} \quad \text{Median} = L + \left(\frac{\frac{N}{2} - F_{m-1}}{f_m} \right) \cdot c$$

$$\text{Variance} = \frac{\sum F (X - \text{mean})^2}{\sum F} \quad \text{or} \quad \text{Variance,} \quad S^2 = \frac{\sum fx^2}{\sum f} - \bar{x}^2$$

$$S = \frac{\sqrt{\sum F (x - \text{mean})^2}}{\sum F} \quad \text{or} \quad S = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

$$\text{CV} = \frac{\text{SD}}{\text{Mean}} \times 100 \quad \text{SKp} = 3 \times \frac{(\text{mean} - \text{median})}{\text{Standard deviation}}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \bar{X}_{12} = \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2}$$

$$\delta_{12} = \sqrt{\frac{N_1 \delta_1^2 + N_2 \delta_2^2 + N_1 d_1^2 + N_2 d_2^2}{N_1 + N_2}} \quad \mu = x_1 p(x_1) + x_2 p(x_2) + \dots + x_n p(x_n)$$

$$= \sum_{i=1}^n x_i p(x_i)$$

$$\text{Var}(X) = \sum_{i=1}^n (x_i - \mu)^2 \cdot p(x_i) \quad \bar{x} - z_{\alpha/2} \frac{\delta}{\sqrt{n}} < \mu < \bar{x} + z_{\alpha/2} \frac{\delta}{\sqrt{n}}$$

$$\bar{x} - t_{n-1, \alpha/2} \frac{S}{\sqrt{n}} < \mu < \bar{x} + t_{n-1, \alpha/2} \frac{S}{\sqrt{n}} \quad p(n, x) = \binom{n}{x} p^x q^{n-x}$$

$$\frac{\bar{x} - \mu_0}{\delta / \sqrt{n}} \quad \chi^2 = \sum_{i=1}^6 \frac{(O_i - E_i)^2}{E_i} \quad F = \frac{\text{MSB}}{\text{MSW}}$$

Z =

$$MSB = \frac{SSB}{k-1}$$

$$MSW = \frac{SSW}{n-k}$$

$$SSB = \sum_{j=1}^k \frac{T_j^2}{n_j} - \frac{T^2}{N}$$

$$SSW = \sum_{j=1}^k \sum_{i=1}^{n_j} X_{ij}^2 - \sum_{j=1}^k \frac{T_j^2}{n_j}$$

$$r = \frac{n \sum XY - \sum X \sum Y}{\sqrt{\left[n \sum X^2 - (\sum X)^2 \right] \left[n \sum Y^2 - (\sum Y)^2 \right]}}$$

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

$$r \sqrt{\frac{n-2}{1-r^2}}$$

$$\hat{b} = \frac{n \sum XY - \sum X \sum Y}{n \sum X^2 - (\sum X)^2}$$

$$\hat{a} = \frac{1}{n} (\sum Y - \hat{b} \sum X) = \bar{Y} - \hat{b} \bar{X}$$

$$T = \frac{\bar{x} - \mu_0}{S / \sqrt{n}}$$

$$\text{Variance} = \frac{\sum F (X - \text{mean})^2}{\sum F}$$

or

$$\text{Variance, } S^2 = \frac{\sum fx^2}{\sum f} - \bar{x}^2$$