



ZIMBABWE EZEKIEL GUTI UNIVERSITY
FACULTY OF BUSINESS, ECONOMICS AND ACCOUNTING
DEPARTMENT OF BUSINESS ADMINISTRATION AND MANAGEMENT

EXAMINATION PAPER

COURSE CODE : CBM122
COURSE TITLE : QUANTITATIVE ANALYSIS FOR BUSINESS
SPECIAL REQUIREMENTS : Statistical Tables
Formulae Sheets
Graph Paper
DURATION : 3 Hours
LEVEL : 1.2
DATE : 17 FEB 2022

INSTRUCTIONS TO CANDIDATES:

1. No cell phones are allowed in the examination venue.
2. Answer any **FOUR (4)** questions.
3. The number of marks for each question or part question is shown in brackets []
4. Use of non-programmable calculators is allowed.
5. Show all your workings in order to gain full marks.
6. Begin each answer on a new page.
7. **DO NOT OPEN THIS PAPER UNTIL THE INVIGILATOR INSTRUCTS YOU.**

QUESTION ONE

- a. Sampling methods are widely used for the collection of statistical data in industry and business. Explain the following methods illustrating your answers with practical examples:
- Systematic sampling [5 marks]
 - Quota sampling [5 marks]
- b. An analysis of access time to a computer disc system was made during the running of a particular computer program, which utilized disc file handling facilities. The results of the 120 access times were as follows:

Access time in milliseconds	Frequency
30 – 34	17
35 – 39	24
40 – 44	19
45 – 59	28
50 – 54	19
55 – 59	13

- Determine the mean access time for this program. [5 marks]
- Determine the standard deviation of the access time for this program [5 marks]
- Interpret for your supervisor, who is not familiar with grouped data, what the results of parts (i) and (ii) mean. [5 marks]

QUESTION TWO

An accountant has derived the following data on the weekly output of standard size boxes from a factory.

Week	Output (x) in thousands	Total cost (y) in \$000
1	20	60
2	2	25
3	4	26
4	23	66
5	18	49
6	14	48
7	10	35

8	8	18
9	13	40
10	8	33

- a) Plot a scatter diagram of the data. [4 marks]
- b) Which weekly outputs, if any, appear to be different from the rest of the data? [2 marks]
- c) Find the least squares regression of total cost on output, and plot the line on the graph. [5 marks]
- d) Comment on the coefficients of the regression equation. [4 marks]
- e) Calculate the coefficient of correlation and coefficient of determination and interpret the results. [10 marks]

QUESTION THREE

- a) A finance director estimates that his company will have to spend \$250000 on new machinery in two years from now. Two alternative methods of providing the money are being considered, both assuming an annual rate of interest of 10%.
 - i. A single sum of money, \$A, to be set aside and invested now, with interest compounded every six months. How much should this single sum be? [5 marks]
 - ii. \$B to be put into a reserve fund every six months, starting now. If interest is compounded every six months, what should \$B be in order that the \$250000 will be available in two years from now? [6 marks]
- b) Company records show that the weekly distance travelled by their salesmen is approximately normally distributed with mean 800 miles and standard deviation 90 miles. The sales manager considers that salesmen who travel less than 600 miles in one week are performing poorly.
 - i. If the company employs 300 salesmen, how many would be expected to perform poorly in a particular week? [6 marks]
 - ii. The sales manager wishes to identify the number of miles travelled in one week, above, which only 2% of salesmen are expected to exceed. What weekly mileage is this? [8 marks]

QUESTION FOUR

- a) The annual turnover rate of the 200-count bottle of Aspirin follows the normal distribution with a mean of 6.0 and a standard deviation of 0.50. (This indicates that the stock of Aspirin turns over on the pharmacy shelves an average of 6 times per year.) It is suspected that the mean turnover has changed and is not 6.0. Use the 5% significance level.
 - i. State the null hypothesis and the alternate hypothesis. [2 marks]
 - ii. What is the probability of a Type I error? [1 mark]
 - iii. Give the formula for the test statistic [2 marks]

v. A random sample of 64 bottles of the 200-count size Aspirin showed a mean turnover rate of 5.84. Shall we reject the hypothesis that the population mean is 6.0? Interpret the result. **[8 marks]**

b) A manufacturer sets up the following sampling scheme for accepting or rejecting large crates of identical items of raw material received. He takes a random sample of 15 items from the crate. If he finds more than three defective items in the sample, he rejects the crate; otherwise he accepts it. It is known that approximately 10% of these type of items received are defective.

i. Calculate the proportion of crates that will be rejected **[5 marks]**

ii. Calculate the mean and variance of the number of defectives in the same sample of 15 items. **[5 marks]**

QUESTION FIVE

a) A furniture factory manufactures two types of coffee table A and B. Each table goes through two distinct costing stages, assembly and finishing. The maximum capacity for assembly is 195 hours and for finishing, 165 hours. Each A table requires 4 hours assembly and 3 hours finishing, while a B table requires 1 hour for assembly and 2 hours for finishing. Calculate the number of A and B tables to be produced to ensure that the maximum capacity available is utilized. **[10 marks]**

b) Your firm has recently started to give economic advice to your clients. Acting as a consultant you have estimated the demand curve of a client's firm to be:

$$P = 200 - 8x, \text{ where } x \text{ is output.}$$

Investigation of the client firm's cost profile shows that total cost is given by:

$$TC = \frac{1}{3}x^3 - 14x^2 + 211x + 10$$

- i. Using the methods of differentiation, find the turning points of the firm's profit curve and say whether these point(s) are maxima or minima. **[8 marks]**
- ii. Calculate the maximum profit. **[3 marks]**
- iii. Find the equations of marginal cost and marginal-revenue. **[4 marks]**

THE END

STATISTICAL FORMULAS

MEASURES OF CENTRAL TENDENCY

Ungrouped data

$$\text{Population mean, } \mu = \frac{\sum x}{N}$$

$$\text{Sample mean, } \bar{x} = \frac{\sum x}{n}$$

$$\text{Median, } M_e = \frac{n+1}{2}$$

Grouped data

$$\text{Population mean, } \mu = \frac{\sum fx}{N}$$

$$\text{Sample mean, } \bar{x} = \frac{\sum fx}{n}$$

$$\text{Median, } M_e = L_m + \frac{\left(\frac{n}{2} - F\right)C}{f_m}$$

$$\text{Mode, } M_o = L_m + \frac{(d_1)C}{d_1 + d_2}$$

MEASURES OF DISPERSION

Ungrouped data

$$\text{Population average deviation, } AD = \frac{\sum |x - \mu|}{N}$$

$$\text{Sample average deviation, } AD = \frac{\sum |x - \bar{x}|}{n}$$

$$\text{Population variance } = \sigma^2 = \frac{1}{N} (\sum x^2 - \frac{1}{N} (\sum x)^2)$$

$$\text{Sample variance } = s^2 = \frac{1}{n-1} (\sum x^2 - \frac{1}{n} (\sum x)^2)$$

$$\text{Population standard deviation, } \sigma = \sqrt{\frac{1}{N} (\sum x^2 - \frac{1}{N} (\sum x)^2)}$$

$$\text{Sample standard deviation, } s = \sqrt{\frac{1}{n-1} (\sum x^2 - \frac{1}{n} (\sum x)^2)}$$

Grouped data

Range = maximum value - minimum value

$$\text{Percentile, } P_k = L_p + \frac{\left(\frac{kn}{100} - F\right)C}{f_p}$$

$$\text{Decile, } D_k = L_d + \frac{\left(\frac{kn}{10} - F\right)C}{f_d}$$

$$\text{Lower quartile, } Q_1 = L_q + \frac{\left(\frac{n}{4} - F\right)C}{f_q}$$

$$\text{Upper quartile } Q_3 = L_q + \frac{\left(\frac{3n}{4} - F\right)C}{f_q}$$

Interquartile range = $Q_3 - Q_1$

$$\text{Quartile deviation } = \frac{Q_3 - Q_1}{2}$$

$$\text{Population average deviation, } AD = \frac{\sum f|x - \mu|}{N}$$

$$\text{Sample average deviation, } AD = \frac{\sum f|x - \bar{x}|}{n}$$

$$\text{Population variance, } \sigma^2 = \frac{1}{N} (\sum fx^2 - \frac{1}{N} (\sum fx)^2)$$

$$\text{Sample variance } = s^2 = \frac{1}{n-1} (\sum fx^2 - \frac{1}{n} (\sum fx)^2)$$

$$\text{Population standard deviation, } \sigma = \sqrt{\frac{1}{N} (\sum fx^2 - \frac{1}{N} (\sum fx)^2)}$$

$$\text{Sample standard deviation, } s = \sqrt{\frac{1}{n-1} (\sum fx^2 - \frac{1}{n} (\sum fx)^2)}$$

$$\text{Population coefficient of variation, } CV = \frac{\sigma}{\mu} \times 100\%$$

$$\text{Sample coefficient of variation, } CV = \frac{s}{\bar{x}} \times 100\%$$

SHAPE OF FREQUENCY DISTRIBUTIONS

$$\text{Population skewness, } S_k = \frac{3(\mu - \text{median})}{\sigma} \text{ or } \frac{(\mu - \text{mode})}{s}$$

$$\text{Sample skewness, } S_k = \frac{3(\bar{x} - \text{median})}{s} \text{ or } \frac{(\bar{x} - \text{mode})}{s}$$

$$\text{Population kurtosis } = \frac{\sum f(x - \mu)^4}{\sigma^4}$$

$$\text{Sample kurtosis } = \frac{\sum f(x - \bar{x})^4}{s^4}$$

BASIC PROBABILITY CONCEPTS

i. Classical Method of Assigning Probabilities: $P(E) = \frac{ne}{N}$

ii. Probability by Relative Frequency of Occurrence

$$\frac{\text{Number of Times an Event Occurred}}{\text{Total Number of Opportunities for the Event to Occur}}$$

$$\text{Coefficient of determination, } R^2 = \left(\frac{n \sum XY - \sum X \sum Y}{\sqrt{[n \sum X^2 - (\sum X)^2][n \sum Y^2 - (\sum Y)^2]}} \right)^2$$

TIME SERIES ANALYSIS

Fitted Trend Line: $Y = a + bX$

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

$$a = \bar{Y} - b \bar{X}$$

BUSINESS CALCULATIONS

Quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Differentiation

- i. if $f(x) = x^n$ then $f'(x) = nx^{n-1}$; if $y = x^n$ then, $\frac{dy}{dx} = nx^{n-1}$
- ii. Rule 1: The constant rule. If $h(x) = cf(x)$ then $h'(x) = cf'(x)$ for any constant c .
- iii. Rule 2: The sum rule. If $h(x) = f(x) + g(x)$ then $h'(x) = f'(x) + g'(x)$
- iv. Rule 3: The difference rule. If $h(x) = f(x) - g(x)$ then $h'(x) = f'(x) - g'(x)$
- v. Rule 4: The chain rule. If y is a function of u , which is itself a function of x , then

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

- vi. Rule 5: The product rule. If $y = uv$ then $\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$
- vii. Rule 6: The quotient rule. If $y = \frac{u}{v}$ then $\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$
- viii. Implicit differentiation: $\frac{dy}{dx} = -\frac{f_x}{f_y}$

Simple interest:

$$FV = \text{Principal} \times \text{Rate} \times \text{Time}$$

Compound interest:

$$FV = A(1+i)^n$$

Future Value of an Ordinary Annuity: $FV = R \left[\frac{(1+i)^n - 1}{i} \right]$

Regular deposit: $R = \frac{FVi}{(1+i)^n - 1}$

Present Value of an Ordinary Annuity: $PV = R \left[\frac{1 - (1+i)^{-n}}{i} \right]$

Regular payment: $R = \frac{PVi}{1 - (1+i)^{-n}}$

Remaining Balance: $B = R \left[\frac{1 - (1+i)^{-(n-x)}}{i} \right]$

Net Present Value: $NPV = \sum_{j=0}^n \frac{R_j}{(1+i)^j}$

Internal Rate of Return: $IRR = a + \left[\left(\frac{NPV_a}{NPV_a - NPV_b} \right) (b-a) \right] \%$

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