

**THE INSTITUTE OF CHARTERED  
ACCOUNTANTS (GHANA)**



**MAY 2010 EXAMINATIONS  
(PROFESSIONAL)**

**PART 2**

**QUANTITATIVE TOOLS IN BUSINESS  
(Paper 2.1)**

**Attempt five (5) Questions in ALL**

**TIME ALLOWED:**

Reading & Planning	-	15 Minutes
Working	-	3 Hours

**NOTE:** *Formulae and statistical table are attached to the question paper.*

## QUESTION 1

The table below refers to taxes paid by a sample of 1000 people in a suburb of Kumasi in various income groups last year.

Annual Gross Income (GH¢)	Number of people	Total Tax Paid (GH¢)
Less than 6000	60	6,000
6000 and less than 8000	260	20,000
8000 and less than 10000	310	66,000
10000 and less than 14000	220	70,000
14000 and less than 20000	120	74,000
20000 and less than 32000	20	68,000
32000 and above	10	100,000

### Required:

- a)
  - (i) Use appropriate formulas to calculate all the **three (3)** measures of central tendency of the gross annual income. (9 marks)
  - (ii) Use your answers in (i) to comment on the distribution of the gross annual incomes of the people of this suburb. (2 marks)
- b) Calculate the coefficient of variation of the distribution of gross annual incomes of the people of this suburb. (4 marks)
- c) Construct a Lorentz curve that will show the inequality or otherwise of the distribution of taxes paid by the people in this suburb. (5 marks)

(Total: 20 marks)

## QUESTION 2

- a) State any two basic decisions faced by a manager with stock-control responsibility. (2 marks)
- b) State and explain **four (4)** costs involved in stock-control. (6 marks)
- c) A local firm has responsibility for producing and supplying pens to all schools in its catchment area. Over the past couple of years, annual demand for these pens has been 1550 packets per year. The local firm can produce at an annual rate of 7750 packets of pens.

The setup cost per production run is GH¢3,000 and the inventory holding cost per packet per year is GH¢360. There are 310 working days in a year for the local firm.

**Calculate:**

- (i) The optimal production lot size. (2 marks)
- (ii) The maximum inventory. (2 marks)
- (iii) The number of production runs. (2 marks)
- (iv) The production run time (2 marks)
- (v) The time between production runs (2 marks)
- (vi) The annual inventory cost (2 marks)

**(Total: 20 marks)**

**QUESTION 3**

Detergent Ltd manufactures two types of detergents: Doclean and Maclean. Each detergent passes through a two-stage production process namely Stage I and Stage II. Each detergent also requires the following ingredients notably Mix A and Mix B.

For one litre of Doclean, Stages I and II take thirty minutes each of labour to produce. For one litre of Maclean, Stage I takes forty-eight minutes of labour and Stage II takes seventy-five minutes of labour to produce.

To produce a litre of Doclean, five litres of Mix A and ten litres of Mix B are required. Similarly, to produce a litre of Maclean, twenty litres of Mix A and thirty litres of Mix B are needed.

Only eight hours of labour are available in Stage I but at least ten hours must be used in Stage II. Only 180 litres of Mix A are available and for inventory purposes not less than 240 litres of Mix B must be used.

The contribution to profit of Doclean is GH¢25 per litre and GH¢18 per litre for Maclean.

**Required:**

- a) Formulate the linear programming problem in terms of determining the profit-maximizing combination of the two detergents. (4 marks)
- b) Graphically determine the optimal production-mix of the two detergents. (8 marks)
- c) Identify the binding and non-binding constraints. (2 marks)
- d) (i) Undertake sensitivity analysis on the labour in Stage I constraints and, (3 marks)
- (ii) Evaluate the management information that this generates. (3 marks)

**(Total: 20 marks)**

## QUESTION 4

a) A dealer in imported cars of three models, with extra enhancements, has the following Retail Price Matrix, M and Dealer Invoice Price Matrix, N:

Retail price (GH¢)

	Basic car	Aircondition	AM/FM Radio	
Model A	10,900	650	250	] = M,
Model B	13,800	720	380	
Model C	16,500	870	540	

Dealer Invoice Price (GH¢)

	Basic car	Aircondition	AM/FM Radio	
Model A	9,400	520	210	] = N
Model B	12,000	650	320	
Model C	14,200	720	460	

The markup matrix, P is given by

$$P = M - N$$

Suppose the value of the currency has had a decline so the Dealer Invoice price is to have an across-the-board 20% increase, next year. In order to stay competitive, the dealer increases the retail price by 10%.

**Required:**

Calculate a markup matrix for next year. (8 marks)

b) A stadium has a total capacity of 10,000 seats. Tickets are in denominations of GH¢4 and GH¢8 and are sold for a very high profit match.

**Required:**

- Formulate a matrix equation if an allocation of GH¢K, in thousands of Ghana cedis, is expected to accrue from match (1). (6 marks)
- Determine how a return of GH¢56,000 will be allocated for the ticket denominations in match (2). (6 marks)

	1	2
Tickets sold	10,000	10,000
Required return (GH¢000)	K	56

[Assume all seats at the stadium are occupied for the two matches]

(Total: 20 marks)

**QUESTION 5**

- a) State any **four (4)** properties of a probability of an event A. (2 marks)
- b) Two fair dice, one red and the other blue are tossed together with a fair coin.

**Required:**

- (i) List the entire sample space of the experiment from the sample space. (4 marks)
  - (ii) Determine the probability of scoring a total of 8 on the dice with a head on the fair coin. (2 marks)
  - (iii) Determine the probability of scoring a total of 8 on the dice. (2 marks)
  - (iv) Determine the probability of scoring an odd number, less than 7 on the dice and a tail on the fair coin. (2 marks)
- c) (i) Briefly explain the following terms:

Mutually exclusive events; Exhaustive events; Independent events. (3 marks)

The table below shows the job status of Accountants who recently graduated from an Institute.

Gender	Employed	Awaiting employment	Total
Male	500	100	600
Female	300	200	500
Total	800	300	1100

**Required:**

Assume an Accountant is picked at random, what is the probability that the person picked is

- (ii) Male and employed. (1 mark)
- (iii) Unemployed given that she is a female. (2 marks)
- (iv) Male unemployed or female employed. (2 marks)

(Total: 20 marks)



## QUESTION 6

- a) State **two (2)** ways of interpreting the coefficient of determination. **(2 marks)**
- b) The data below relates to a sample of profit centres in a large company together with its sales or turnover figures.

Sales (GH¢'000)	Profit (GH¢'000)
748.82	42.13
377.04	24.39
166.93	7.77
140.78	6.32
702.11	38.47
41.54	-0.32
96.85	3.65
109.05	4.31
50.84	-2.69
141.57	6.39
265.28	17.48
91.80	7.21

- (i) Determine the least squares regression equation so that profits can be forecasted from sales. **(5 marks)**
- (ii) Identify and interpret the regression coefficient. **(3 marks)**
- (iii) Estimate the profits when sales figures are:
- (x) GH¢40,000 **(2 marks)**
- (β) GH¢400,000 **(2 marks)**
- (iv) Qualitatively assess the reliability of your estimates in b) (iii) **(1 marks)**
- (v) Quantitatively assess the reliability of your estimates in b) (iii). **(5 marks)**

**(Total: 20 marks)**

## QUESTION 7

- a) Define the term 'expected monetary value' and comment on its usefulness in business decision-making. **(3 marks)**
- b) Just Christ Ltd is considering its strategy for the next 3 years. It has 4 possible courses of action, A, B, C, and D, which are described below:

- b) Just Christ Ltd is considering its strategy for the next 3 years. It has 4 possible courses of action, A, B, C, and D, which are described below:
- A. Expand the business by relocating to a new site. This is estimated to have an 80% chance of success, which will increase the company's profits by GH¢50,000, but a failure will decrease the company's profits by GH¢70,000.
  - B. Take over a small rival company. The probability of successfully taking over the rival company is estimated to be 0.5 and the financial statements of the rival company suggest that there would be a 70% chance of increasing profits by GH¢60,000 and a 30% chance of increasing profits by just GH¢15,000. However, if the takeover attempt fails, profits are estimated to fall by GH¢20,000.
  - C. Make no investments. In this case, it is estimated that there is a 60% chance the profits will remain unchanged, a 25% chance that the profits will increase by GH¢15,000 and a 15% chance that the profits will fall by GH¢2,000.
  - D. Fold up the business. Folding up the business means that the company can gain profits up to GH¢20,000 upon selling its assets.

**Required:**

- i. Draw a decision tree to illustrate Just Christ Ltd's decision-making problem. (6 marks)
- ii. By calculating expected monetary values (EMVs), advise Just Christ Ltd management on the best course of action. (7 marks)
- c) A manufacturing company of bolts and nuts has received an order from a garage to produce standard boxes of bolts and nuts. Assume that the weight of the boxes produced is normally distributed with mean, 95 kg and standard deviation 1.8 kg.

**Calculate**

- (i) Proportion of boxes which contain bolts and nuts weighing less than 92 kg. (2 marks)
- (ii) Proportion of boxes which contain bolts and nuts weighing more than 97 kg. (2 marks)

**(Total: 20 marks)**

## FORMULAE

### PROBABILITY

$A \cup B = A \text{ or } B$

$A \cap B = A \text{ and } B \text{ (overlap)}$

$P(B|A) = \text{probability of } B, \text{ given } A.$

### Rules of Addition

If A and B are mutually exclusive:  $P(A \cup B) = P(A) + P(B)$

If A and B are **not** mutually exclusive:  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

### Rules of Multiplication

If A and B are independent:  $P(A \cap B) = P(A) * P(B)$

If A and B are **not** independent:  $P(A \cap B) = P(A) * P(B|A)$

$E(X) = \Sigma (\text{probability} * \text{payoff})$

### Quadratic Equations

If  $aX^2 + bX + c = 0$  is the general quadratic equation, the two solutions (roots) are given by:

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

### DESCRIPTIVE STATISTICS

Arithmetic Mean

$$\bar{x} = \frac{\sum x}{n} \quad \bar{x} = \frac{\sum fx}{\sum f} \quad (\text{frequency distribution})$$

Standard Deviation

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{N}} \quad SD = \sqrt{\frac{\sum fx^2 - \bar{x}^2}{\sum f}} \quad (\text{frequency distribution})$$

### TIME SERIES

Additive Model

Series = Trend + Seasonal + Random

Multiplicative Model

Series = Trend \* Seasonal \* Random



## LINEAR REGRESSION AND CORRELATION

The linear regression equation of Y on X is given by:

$$Y = a + bX \text{ or } \bar{Y} - \bar{Y} = b(X - \bar{X})$$

where

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

and

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

or solve

$$\begin{aligned}\sum Y &= na + b\sum X \\ \sum XY &= a\sum X + b\sum X^2\end{aligned}$$

Coefficient of correlation

$$r = \frac{\text{Covariance (XY)}}{\sqrt{\text{Var(X)} \cdot \text{Var(Y)}}} = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{\{n\sum X^2 - (\sum X)^2\} \{n\sum Y^2 - (\sum Y)^2\}}}$$

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

Median

$$m = L_m + A \left[ \frac{\frac{n - F_m}{2}}{F_m} \right] \cdot c$$

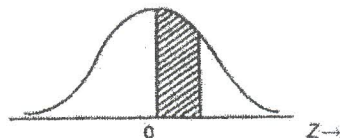
Mode

$$m = L_o + \frac{D_1}{D_1 + D_2}$$

Stocks

$$EOQ = \sqrt{\frac{2 C_o D}{C_n}}$$

This table gives the area under the normal curve between the mean and a point  $Z$  standard deviations above the mean. The corresponding area for deviations below the mean can be found by symmetry.

[illegible]