

TIMES

THROWBACK BUSINESS MATH II

© 2017

(Includes Moti-et al Management Math Addenda)



TIMES TRAINING CENTRE

Redefining Quality

ACKNOWLEDGEMENT

We gratefully acknowledge permission to use past KASNEB (CPA / KATC / ATD) examination questions.

We would also like to extend our sincere gratitude and deep appreciation to Moti S. Oyando for his time and expertise which were integral in developing this revision handbook.

Moti has studied management science in both postgraduate and undergraduate levels, in addition to being a certified accountant. To his credit also is over 13 years experience in tutoring Business Mathematics Statistics (KATC / ATC / ATD) and Quantitative Techniques / analysis (CPA).

Lastly but not least we recognize the effort of patient typesetters / IT department at Times Training Centre

NOTE TO THE READER

This handbook is a sequel to:

**TIMES
THROWBACK BUSINESS MATH I**

Separate manual for suggested approaches, broken down into:

PART ONE, PART TWO, PART THREE & PART FOUR

To follow this handbook is:

**TIMES
THROWBACK MANAGEMENT MATH**

With current technology, things might seem a bit hazy but, basically, without the express permission of Times Training Centre:

- Photocopying our hard copies is a breach of copyright
- Scanning, rip casting or conversion of our soft copies into different file formats, uploading them on Facebook or emailing them to your friends is a breach of copyright

Once done with your hard / soft copy, you can of course keep it in your home library – it is from these home libraries that exemplary students – lecturers – authors – leaders are made.

Wishing you a thorough and enterprising read!

CORE CONTENTS IN SUMMARY

PART ONE: Sample ATD mathematical assignments (2016/ 2017 class)

- 1.0. Equations
- 2.0. Equations / matrices, set theory & probability

PART TWO: Sample ATD statistical assignments (2016 / 2017 class)

- 3.0. Commercial mathematics
- 4.0. Elementary statistics
- 5.0. Descriptive statistics and index numbers

PART THREE: sample ATD block releases (Earlier classes 2005 - 2013)

- 6.0. Equations / matrices
- 7.0. Commercial mathematics
- 8.0. Set theory and probability
- 9.0. Elementary / descriptive statistics
- 10.0. Block release mock
- 11.0. Exam technique

PART FOUR: Addenda (2014 / 2015 class)

Addendum 1:

CPA Mathematical skills / techniques block release

Addendum 1

CPA probability block release

Addendum 3

CPA Game / L.P. block release revision question



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

ASSIGNMENT ON EQUATIONS – ATD 11

AUGUST 2016 SERIES

TIME ALLOWED: 3 HOURS

QUESTION ONE

(a) Citing an example in each case, differentiate between a ‘function’ and an ‘equation’. (2 marks)

(b) A steel manufacturing company produces steel rolls through a series of steps that involve employees in each production line. The production process which is determined by two variables namely, the number of employees (E) and the number of production lines (L), is given as follows:

$$P = (600) E^{1/2} L^{1/2} \quad \text{where } P = \text{Production level in quantity.}$$

The current production level in the company is undertaken by 36 employees engaged in 9 production lines.

Required:

(i) The current production level of steel rolls. (2 marks)

(ii) The expected production level of steel rolls when the inputs are doubled. (2 marks)

(c) Silala Bakery Ltd has fixed costs of Sh.450,000 for production of cakes. The variable cost of production of each cake is Sh.60. the selling price of a cake is Sh.90.

Required:

(i) Revenue function. (1 mark)

(ii) Total cost function. (2 marks)

(d) The demand for oranges in a local market is 400 units when the unit price is Sh.10 and 480 units when the unit price is Sh.8.

Required:

(i) A linear demand function for oranges. (3 marks)

(ii) The unit price of oranges when demand is 160 units. (1 mark)

(e) Faida Limited deals in the production of a product named ‘Nguvu’. The total cost and demand functions of ‘Nguvu’ are given by:

$$TC (\text{Sh.}'000') = 1,064 + 5q + 0.04q^2$$

And

$$P = 157 - 3q$$

Where: TC = Total cost of production.

q = Output level of ‘Nguvu’

p = Unit price of ‘Nguvu’ in shillings.

Required:

(i) The profit equation. (4 marks)

(ii) Determine the break even point. (3 marks)

(Total: 20 marks)

QUESTION TWO

(a) Outline three uses of functions in business. (6 marks)

(a) A hawker sells exercise books and pencils in an urban centre. Each exercise book sells at Sh.20 and a pencil sells at Sh.15. during the month of October 2014, the hawker's sales were Sh.3,450. Customers bought 5 times as many books as pencils.

Required:

The number of exercise books and pencils sold by the hawker in the month of October 2014. (4 marks)

(b) The Cost Accountant of Amazuri Limited has provided the following statements of costs, profit and selling price per unit of a certain product:

	Sh.
Direct materials	25
Direct labour	3
Variable overheads	2
Fixed overheads	5
Profit	<u>15</u>
Selling price	<u>50</u>

The company is currently operating at an activity level of 500,000 units per annum.

Required:

(i) The break-even number of units. (5 marks)

(ii) Suppose the direct materials cost increases by 5 per cent, determine the additional number of units the company would need to produce in order to maintain its current level of profit. (5 marks)

(Total: 20 marks)

QUESTION THREE

(a) XYZ Limited intends to invest in a particular project whose maximum duration is 9 months. The estimated total profit of the project is given by the function:

$$\Pi = 31.5t - 3t^2 - 60$$

Where: Π is the estimated total profit of the project in thousands of shillings.

t is the duration of the project in months.

Required:

(i) A graph to represent the above estimated total profit function. (6 marks)

(ii) The break-even duration of the project. (4 marks)

(iii) The initial cost of the project. (2 marks)

(iv) Using the graph obtained in (i) above, estimate the optimal duration of the project. (2 marks)

(b) A company produces three products; X, Y and Z which are processed through three departments namely; P, Q and R. The table below shows the labour hours required to produce one unit of each product in each of the departments.

Department	Labour hours per unit		
	Product X	Product Y	Product Z
P	30	30	20
Q	30	20	0
R	10	30	10

The monthly labour-hour capacities for the three departments are 13,000, 8,500 and 6,000 hours for departments P, Q and R respectively.

Required:

Using the elimination method, determine the optimal combination of the products that could be produced each month. (6 marks)

(Total: 20 marks)

QUESTION FOUR

(a) The total manufacturing cost function of Mangwe Ltd. Is quadratic in nature and passes through the following points:

Quantity produced in units (q)	0	10	20
Total manufacturing cost (c)	25	105	385

Required:

- (i) The total manufacturing cost function. (9 marks)
(ii) The total manufacturing cost incurred in producing 40 units of the product. (1 mark)

(b) Optimal Product Limited deals in the production of a product named 'Daima'.

The average revenue and average cost functions of 'Daima' are given by:

$$AR = 40 - 10x$$

$$AC = 16 - 2x + x^2 + \frac{10}{x}$$

Where: AR = Average revenue function (Sh.'million')

AC = Average cost function (Sh.'million')

x = Number of units of 'Daima' sold.

Required:

- (i) The total profit function. (4 marks)
(ii) The maximum profit. (6 marks)

(Total: 20 marks)

QUESTION FIVE

- (a) (i) Differentiate between biased error and unbiased error. (4 marks)
(ii) Joe Mwamba has been contracted by Ujenzi Limited to supply 20,000 units of product 'Zee' at a unit price of Sh.600. the unit associated with product 'Zee' are estimated as follows:

	Sh.	%
Direct labour	200	± 5
Direct material	60	± 5
Variable overheads	80	±10
Fixed overheads	100	-

Required:

Absolute error in the estimated profit of Joe Mamba. (6 marks)

(b) A trader estimates that sales for the coming year from four of his outlet stores will be Sh.950,000, Sh.1,200,000, Sh.1,500,000 and Sh.900,000 respectively. The trader's sales estimates are correct to ± Sh.10,000. The associated costs of production are also uncertain and are estimated as follows:

	Sh.	Error (%)
Salaries and wages	1,250,000	± 5
Materials	1,400,000	± 10
Fixed expenses	600,000	± 2

Required:

- (i) The maximum possible profit. (5 marks)
(ii) The minimum possible profit. (5 marks)

(Total: 20 marks)



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS ASSIGNMENT ON EQUATIONS /MATRICES, SETS AND PROBABLILITY – ATD 11

SEPTEMBER 2016 SERIES

TIME ALLOWED: 3 HOURS

QUESTION ONE

- (a) Define the following terms as used in probability theory:
- (i) Mutually exclusive events. (1 mark)
 - (ii) Complementary events. (1 mark)
 - (iii) Equally likely events. (1 mark)
- (b) Explain the term ‘venn diagram’ as used in set theory. (2 marks)
- (c) Roka College of Accountancy offers three main business courses namely; Finance, Accounting and Economics. A total of 180 students enrolled for the courses.

The enrollments are as follows:

- Finance is taken by 88 students.
- Accounting is taken by 77 students.
- Finance and Accounting are taken by 30 students.
- Finance and Economics are taken by 33 students.
- Accounting and Economics are taken by 25 students.
- All the three business courses are taken by 20 students.

Required:

- (i) A venn diagram to represent the above information. (3 marks)
 - (ii) Number of students taking at least two of the business courses. (2 marks)
 - (iii) Number of students taking one business course only. (2 marks)
 - (iv) Number of students taking Economics. (2 marks)
- (d) Swere Manufacturing Ltd produces two types of oil products; A and B. The following information relates to the two products:

Product	Labour (hours per unit)	Cost per labour hour (shillings)
A	2	10
B	3	20

Labour hours are limited to 72 hours per week and total expenditure on labour is limited to Sh.420 per week.

Required:

Using matrix algebra, determine the number of units of A and B that should be produced per week.

(6 marks)

(Total: 20 marks)

QUESTION TWO

- (a) Explain the following terms as used in set theory.
- (i) Universal set. (2 marks)
 - (ii) Null set. (2 marks)
 - (iii) Subset. (2 marks)
 - (iv) Disjoint sets. (2 marks)
- (b) Quality Pumps Ltd. deals in the production of water pumps. The Quality Assurance Manager of the company has established that the probability of obtaining a defective water pump from a certain production line is 0.1. The Quality Assurance Manager randomly selects three water pumps from the production line.

Required:

- (i) A probability tree of all the possible outcomes. (4 marks)
- (ii) The probability that the third water pump selected will be the second defective water pump to be selected by the Quality Assurance Manager. (2 marks)
- (c) A Certified Securities and Investment Analyst has made the following predictions relating to the share price of XYZ Ltd. for the month of November 2015:
- The probability that the share price will increase by 20 per cent given a rise in the Gross National Product is 0.6.
 - The probability that the share price will increase by 20 per cent given a constant Gross National Product is 0.5.
 - The probability that the share price will increase by 20 per cent given a fall in the Gross National Product is 0.4.

An economist has predicted the following;

- The probability of a rise in the Gross National Product is 0.3
- The probability of a constant Gross National Product is 0.3
- The probability of a fall in the Gross National Product is 0.4

Required:

- i) The probability that the share price will increase by 20 per cent. (3 marks)
- ii) The probability of a rise or fall in the Gross National Product, given that the share price will increase by 20 per cent. (3 marks)

(Total: 20 marks)

QUESTION THREE

- (a) An entertainment club sells tickets based on sitting arrangement. The tickets are sold at Sh.70 for the Executive section, Sh.60 for the Main section and Sh.50 for the Balcony section. The number of tickets sold for the Executive, Main and Balcony sections and the relevant day of the week were as follows for a certain week.

	Executive	Main	Balcony
Thursday	1,500	1,250	600
Friday	1,300	1,300	520
Saturday	1,600	1,750	800

Required:

- (i) A row matrix showing the ticket price by sitting arrangement. (1 mark)
- (ii) A rectangular matrix showing the number of tickets sold in each section on the relevant days of the week. (1 mark)
- (iii) The total sales made on the relevant days of the week. (2 marks)
- (b) A bookshop vendor sold 5 statistics books and 6 cost accounting books for Sh.24,400 to Tezo College of Accountancy. The vendor sold 7 statistics books and 9 cost accounting books for Sh.35,600 to Taireni Institute of Technology.

Required:

- (i) Form simultaneous equations to represent the above problem. (1 mark)
- (ii) Use matrix algebra to compute the price of a statistics book and the price of a cost accounting book. (4 marks)
- (c) A mobile telephone service provider is undertaking a promotion in which 40% of the scratch cards reveal a prize. A customer has in possession three of the promotional scratch cards.

Required:

- (i) A tree diagram to represent the customers' probability space. (3 marks)
- (ii) The probability of receiving one prize. (2 marks)
- (iii) The probability of receiving no prize. (2 marks)
- (iv) The probability of receiving two prizes. (2 marks)
- (v) The probability of winning a prize. (2 marks)

(Total: 20 marks)

QUESTION FOUR

- (a) A company manufactures tennis rackets. The total cost of manufacturing x (in thousands) rackets is given by the function $c = 3x^2 + 720x + 640$, where c is in thousands of shillings. The revenue (in thousands of shillings) is given by the equation: $R = 1000x - 12x^2 : 0 \leq x < 25$

Required:

- i) The profit equation. (1 mark)
 - ii) The break-even number of rackets. (2 marks)
 - iii) Draw the graph of the profit equation (use $x = 0, 2, 4, 6, 8, 10, 12, 14, 16, 18$). (3 marks)
 - iv) Use the graph in (iii) above to identify the number of rackets required to have a maximum profit. (2 marks)
 - v) What is the maximum profit? (prove it mathematically) (3 marks)
- (b) Kasablanka Restaurant stocks the following favourite drinks; Novida, Alvaro and Picana. The following data relates to units sold in its three departments.

Department	Novida	Alvaro	Picana
Hotel	60	50	10
Bar	40	60	80
Outside catering	100	120	90

The selling price and the cost price of each product is as follows;

Product	Cost price	selling price
Novida	50	60
Alvaro	45	60
Picana	30	50

Required:

Using matrix algebra, determine;

- i) The profit matrix (1 mark)
 - ii) Total profit per product (2 marks)
 - iii) Total profit per department (2 marks)
 - iv) Which product should be stocked in plenty per department? Give good reasons. (1 mark)
- (c) The demand and supply functions for products A and B are given as follows

Product	Demand	Supply
A	$P_A = 1500 - 4Q_A - 3Q_B$	$P_A = 400 + 3Q_A + Q_B$
B	$P_B = 700 - Q_A - 2Q_B$	$P_B = 200 + Q_A + Q_B$

Where;

P_A = Price of product A in shillings

P_B = Price of product B in shillings

Q_A = Quantity demanded of product A in units

Q_B = Quantity demanded of product B in units

Required;

Using matrix algebra, determine the equilibrium prices and quantities of products A and B. (3 marks)

(Total: 20 marks)

QUESTION FIVE

(a) In a particular government office, employees Solomon, Jennifer, Wambua and Beryl have a diploma, with Solomon and Beryl also having a degree. Solomon, Moses, Wambua, Toby, Miriam and Kosher are members of ICPAK with Toby and Miriam having a diploma.

Required:

Identifying set A as those employees with diploma, set C as members of ICPAK and set D as having a degree;

i) Draw a Venn diagram representing sets A, C and D, together with their known elements. (1 mark)

ii) What special relationship exists between sets A and D? (1 mark)

iii) Specify the elements of the following sets and for each set, state in words what information is being conveyed: $A \cap C$; $D \cup C$ and $D \cap C$. (1 mark)

iv) What would be a suitable universal set for this situation? (1 mark)

(b) In a survey of 150 families, the number that read the recent issues of a certain monthly magazine were found to be: September only 23; September but not August 28; September and July 13; September 51; July 53; July and August 13; none of the three months 29; with the help of set theory, find

(i) How many read August issue. (3 marks)

(ii) How many read two consecutive issues. (2 marks)

(iii) How many read the September and August issues but not the July issues. (2 marks)

(c) The results for ATC Level I students from a population of 3370 who sat for an exam recently were as follows.

- 420 students failed all the three subjects
- 2000 students passed Business Math, 1700 passed Law and 1900 passed PM
- 1150 students passed PM and Law
- 1200 passed Law and Business Math
- 1250 students passed PM or Business Math but not Law
- 1650 students passed at least two subjects

Required:

i) Venn diagram to represent the above information. (3 marks)

ii) Number of students who passed all units. (1 mark)

iii) Number of students who passed utmost two subjects. (1 mark)

(d) A survey was conducted of families in Mega town. The families were classified to whether or not they regularly watched documentary programmes and soap operas. The survey revealed that 40% of the families watched documentary programmes, 30% watched both documentary programmes and soap operas and 60% watched either documentary programmes or soap operas.

Required:

(i) The percentage that watched soap operas. (2 marks)

(ii) The percentage that watched soap operas given that they watched documentary programmes. (2 marks)

(Total: 20 marks)



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

Commercial and Financial Arithmetic Assignment (JAN /FEB 2017)

Time Allowed: 3 hours

Question 1

- (a) Mary owns a piece of land currently valued at sh.200,000. She intends to dispose of the piece of land and use the proceeds to purchase a pick up currently valued at sh.1 million. The value of the piece of land appreciates at a fixed rate of sh.50,000 per annum while the value of the pick up depreciates at the rate of 20 per cent per annum, on a straight line basis.

Required:

The number of years it would take for the value of the piece of land to be equal to the value of the pick up.

(6 marks)

- * (b) Faulu University College employed an accounting lecturer on 1 January 2017. The annual salary of the lecturer in the year 2016 was sh.1,440,000. On 1 January 2017, the annual salary of the lecturer was increased by 7%. The lecturer is entitled to the following tax reliefs per annum.

Personal relief sh.13,944

Other reliefs sh.48,000

Income tax deduction (PAYE) was calculated according to the following schedule.

Monthly taxable income (sh.)	Rate of tax (%)
1 – 10,164	10
10,165 – 19,740	15
19,741 – 29,316	20
29,317 – 38,892	25
Excess over 38,892	30

Required:

The percentage increase in the lecturer's net monthly salary for the year 2017.

(14 marks)

(Total: 20 marks)

Question 2

- (a) Scolastica intends to purchase a posho mill costing sh.344,960 in the year 2017. She would like to invest a certain sum of money in Faidika Bank on 1 January 2015, such that at 31 December 2015, the sum of money will amount to sh.308,000 and at 31 December 2016, the amount will be enough to purchase the posho mill.

Required:

- (i) The amount of money that Scolastica should invest in Faidika Bank if compounding is done annually. (4 marks)
- (ii) The amount of money that Scolastica should invest in Faidika Bank if compounding is done quarterly. (5 marks)

- * (b) Shujaa Ltd, a manufacturing company, pays its casual employees using the piece rate and hourly rate methods.

For the piece rate method, an employee is paid sh.10 per unit produced, as long as he produces a minimum of 250 units in a day. Production of any extra unit above 250 units is paid at the rate of sh.20 per unit, up to a maximum of 20 units.

For the hourly rate method, an employee is paid sh.250 per hour, as long as he works for a minimum of 8 hours in a day. Any extra hour worked above 8 hours is paid at the rate of sh.400 per hour, up to a maximum of 2 hours in a day.

Juma Bidii and Tumaini Kazungu, casual employees of Shujaa Ltd, are paid using the piece rate and hourly rate methods respectively. The working days of the company are from Monday to Friday every week. The wages are paid at the end of the month and are subject to income tax deduction calculated according to the following schedule:

Monthly taxable pay (sh.)	Rate of tax (%)
1 – 10,164	10
10,165 – 19,740	15
19,741 – 29,316	20
29,317 – 38,892	25
Excess over 38,892	30

Personal relief is sh.1,162 per month.

Required:

- a) The net pay for Juma Bidii for the month of July 2016, given that he produced 300 units per day. (Assume a 4-week month). (6 marks)
- b) The net pay for Tumaini Kazungu for the month of July 2016, given that he worked for 10 hours per day. (Assume a 4-week month). (5 marks)

Question 3

* (a) A green grocer bought four bunches of bananas at a total cost of sh.800. Each bunch had a total of 56 bananas. He later sold 168 bananas at a profit of 40% on cost per banana. The remainder of the bananas were sold at a profit of 12% on cost per banana.

Required:

- (i) The selling price per banana when he made a profit of 40% on cost. (2 marks)
 - (ii) The selling price per banana when he made a profit of 12% on cost (2 marks)
 - (iii) The total amount of profit that the green grocer made from the sale of all the bananas. (2 marks)
- (b) Joseph Opiyo took a mortgage of sh.3.6 million to purchase a house. The loan capital excluding interest is to be repaid in equal monthly instalments over a period of 15 years (180 months). An interest of 1.25% is charged on the monthly outstanding balance of the loan capital per month. The monthly instalment of the loan capital and the interest charged are paid at the end of each month.

Required:

- a) Prepare a schedule of the loan repayments for the first six months showing the monthly loan capital outstanding balance, the monthly interest charged and the total loan repayment. (9 marks)
- b) Assuming that the interest charged per month follows an arithmetic progression; determine the common difference of the arithmetic sequence. (2 marks)
- c) Calculate the total interest paid over the 15-year period. (3 marks)

(Total: 20 marks)

Question 4

* (a) Jecinta bought 1,200 oranges from a retail market in Mombasa at a price of sh.70 for every 40 oranges. The oranges were packed into 3 boxes, namely A, B and C, each containing a total of 400 oranges. She transports the oranges to Nairobi and incurred transportation cost of sh.125 per box. On reaching Nairobi, she found out that 14 oranges, 8 oranges and 5 oranges from boxes A, B and C respectively were spoilt and were therefore thrown away.

She later gave out 35 oranges to her family and friends. The remaining oranges were sold at a price of sh.5.50 per orange.

Required:

The profit that Jecinta made from the whole transaction. (5 marks)

- * (b) The following schedule shows the electricity rates charged by Mwangaza Power Ltd to the residents of Mali Mingi City.

Fixed monthly charge	Sh.150
Number of units	Cost per unit (sh.)
First 200	4.50
Next 300	6.00
Above 500	7.00

A value added tax (VAT) of 16% is charged on any extra units above 200 units.

Required:

- a) The electricity bill to be paid by a household whose consumption is 570 units. (5 marks)
- b) The number of units consumed by a household whose electricity bill amounts to sh.825 (4 marks)
- (c) Wajenzi Construction Ltd purchased a power generator on 1 January 2011 at a cost of sh.325,000. The generator is expected to have a useful of 10 years and a scrap value of sh.75,000. The company intends to use the reducing balance method to depreciate the power generator.

Required:

Calculate the annual depreciation rate. (6 marks)

(Total: 20 marks)

Question 5

- (a) Pesa Creditors Ltd offers credit to small-scale traders to buy vehicles to enhance their businesses. Mr. Raka, a small-scale trader wishes to buy a vehicle for transporting his wares. The terms of sales for the vehicle are sh.2,950,000 cash or sh.1,000,000 deposit and sh.130,000 per month for 18 months. Mr. Raka prefers the hire purchase terms. He has agreed that the vehicle can be seized by Pesa Creditors Ltd without any compensation whatsoever if he falls two months in arrears.

Required:

- i) The hire purchase cost of the vehicle (2 marks)
- ii) The compound interest at which sh.2,950,000 can be invested for 18 months to yield the hire purchase cost of the vehicle. (2 marks)
- iii) The saving that Mr. Raka would make if he bought the vehicle for cash. (2 marks)
- (b) After 12 months of operation, the vehicle breaks down and Mr. Raka is unable to meet the hire purchase conditions for the 13th and the 14th months. In the 15th month, the vehicle is seized by Pesa Creditors Ltd and auctioned for sh.90,000.

Required:

- i) The total amount of money that Mr. Raka will have paid for the vehicle. (2 marks)
- ii) The total amount of money above cash price that Pesa Creditors Ltd will make from the sale transactions if they pay the auctioneers 5% commission. (2 marks)
- (c) The table below shows the amounts to which a certain initial sum of money invested, (x), grows for the periods and rates shown.

Year	10% p.a. Sh.	11% p.a. Sh.	12% p.a. Sh.	14 % p.a. Sh.
1	137,500	138,750	140,000	142,500
2	151,250	154,013	156,800	162,450
3	166,375	170,954	175,616	185,193
4	-	-	-	-

Required:

- The initial sum of money (x). (1 mark)
- Complete the table for the fourth year (4 marks)
- The sum of money which when invested for 4 years at 11% per annum compound interest, amounts to sh.258,072. (2 marks)
- The rate of compound interest being paid if a sum of sh.185,000 invested for 3 years amounts to Sh.266,936. (3 marks)

The sum of money which when invested for 4 years at a compound interest rate of 11% p.a. yields an interest of sh.106,205 (3 marks)

(Total: 20 marks)

* - Commercial /Arithmetic



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

Data Presentation and Collection Assignment (FEB / MARCH 2017)

Time Allowed: 3 hours

Question 1

(a) Statistical data may be collected by sample inquiry or census inquiry.

Required:

- i) Distinguish between sample inquiry and census inquiry (2 marks)
- ii) Give reasons why sample inquiry is more frequently used than census inquiry in the collection of statistical data. (2 marks)
- (b) Explain the difference between a multiple bar chart and a component bar chart. (2 marks)
- (c) The table below shows sources of revenue and amount of revenue made in three years by a banking institution.

Source of revenue	Revenue (sh.'million')		
	2014	2015	2016
Government securities	143.0	125.0	156.0
Mortgage loans	15.0	29.0	54.0
Personal loans	33.0	60.0	108.0
Commissions	175.0	180.0	190.0
Equity	84.0	106.0	132.0

Required:

- i) Construct a percentage component bar chart to represent the above data. (7 marks)
- ii) The revenue received from personal loans as a percentage of total revenue, in the year 2016. (1 mark)
- (d) The data below show the number of households in Semeni Village using electricity over the past five years.

Year	Number of household
2012	6
2013	9
2014	12
2015	15
2016	18

Required:

- a) Represent the above data using a pictogram. (2 marks)
- b) Use a pie chart to represent the above data. (3 marks)
- c) Determine the specific functional relationship represented by the data above. (1 mark)

(Total: 20 marks)

Question 2

- (a) Explain the difference between primary and secondary data. (4 marks)
- (b) What are the major factors when deciding between a census and a sample? (3 marks)
- (c) List the main methods of collecting primary data. (3 marks)

- (d) A United Nations agency wishes to estimate the average income per household for families living in Nairobi by taking a sample of 5000 households. Describe a procedure that could be followed to ensure that the sample is representative. (6 marks)
- (e) Highlight four advantages of tabulating statistical data. (4 marks)

(Total: 20 marks)

Question 3

- a) State four reasons why presenting data in graphical form is more superior to diagrammatical presentation. (4 marks)
- b) The following are export and import values of an African country for 1 year.

Month	Exports Sh.'million'	Imports Sh.'million'
January	29	118
February	28	87
March	24	106
April	23	74
May	19	68
June	21	45
July	20	58
August	23	45
September	24	36
October	25	30
November	18	20
December	20	15

Required:

- i) A Lorenz curve to compare the imports and exports. (13 marks)
- ii) Explain whether trade is balanced in this African country. (3 marks)

(Total: 20 marks)

Question 4

- a) Differentiate between the following types of sampling techniques:
- i) Cluster sampling and simple random sampling (2 marks)
 - ii) Stratified random sampling and systematic random sampling (2 marks)
- b) List two advantages of the multi-stage sampling technique (2 marks)
- c) A population consists of provinces which are divided into districts. The districts are further divided into divisions and the divisions are divided into wards. Describe how you would select a simple random sample from the above population using the multi-stage sampling technique. (4 marks)
- d) Identify and briefly explain three characteristics of an ideal estimator. (6 marks)
- e) Briefly explain how an ogive can be used to determine the median of a distribution. (4 marks)

(Total: 20 marks)

Question 5

- (a) The data below relate to the electricity consumption (in kilowatt hours) of 48 households for the month of April 2017.

151	159	161	162	161	163	164	167	171	172	177	182
157	161	143	146	165	144	165	148	172	180	182	192
159	162	164	143	147	168	178	171	178	183	192	195
162	153	152	167	159	169	172	180	186	188	193	140

Required:

- a) A stem-and-leaf display of the data above. (3 marks)
- b) State two advantages and two disadvantages of presenting data using a stem-and-leaf display. (2 marks)

- (b) Identify the following variables as either nominal, ordinal, interval or ratio scale;
- (i) The population of a town (1 mark)
 - (ii) The country of origin (1 mark)
 - (iii) The weight of a student (1 mark)
 - (iv) The temperature in a given day (1 mark)
 - (v) The performance of a contestant in a beauty contest (1 mark)
 - (vi) The gender of a person (1 mark)
 - (vii) The time spent by a student in class (1 mark)
- (c) Outline four properties of a histogram. (4 marks)
- (d) Explain the application of the following methods of representing statistical data.
- (i) Z-Chart (2 marks)
 - (ii) Semi-logarithmic graph. (2 marks)

(Total: 20 marks)



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

Descriptive Statistics and Index Numbers Assignment (March / April 2017)

Time Allowed: 3 hours

Question 1

- a) State two advantages and two disadvantages of the mode as a measure of central tendency. (4 marks)
- b) The following table shows the distribution of the ages of residents of Town X, obtained from a recently conducted census:

Age (years)	Number of residents
Less than 5	390
5 – under 15	910
15 – under 30	1,220
30 – under 45	990
45 – under 65	1,300
65 – under 75	500
75 and above	280

Required:

- i) Percentage ‘less than’ ogive curve for the above data and the inter-quartile range. (8 marks)
- ii) The mean age of the residents (3 marks)
- iii) The standard deviation. Comment on your result. (5 marks)

(Total: 20 marks)

Question 2

- (a) The table below shows the food, housing and overall indices of a certain economy over the nine-year period.

Index	Year								
	2008	2009	2010	2011	2012	2013	2014	2015	2016
Overall	89.6	91.7	93.5	94.1	94.2	94.9	97.0	100.0	103.3
Food	89.9	92.5	94.1	94.3	93.4	94.1	96.1	100.0	104.8
Housing	83.5	85.4	87.6	89.8	92.3	94.2	97.6	100.0	103.1

Required:

- a) Giving a reason, identify the year chosen as the base in the computation of the above indices. (3 marks)
- b) Recompute the above indices, using year 2012 as the base. (9 marks)
- c) Explain the significance of the choice of base year, from the consumers’ point of view. (4 marks)
- (b) Highlight four methods of measuring dispersion. (4 marks)

(Total: 20 marks)

Question 3

David bakes and supplies various types of cakes to Faida Supermarket on a weekly basis. The table given below shows the sales made from the year 2014 to the year 2016 and the price per cake (in shillings).

Type of cake	2014		2015		2016	
	Quantity	Price (sh.)	Quantity	Price (sh.)	Quantity	Price (sh.)
Marble cake	96	100	99	95	120	110
Chocolate cake	88	70	80	85	105	85
Fruit cake	110	125	105	105	98	138

Required:

- a) A Paasche’s price index for the years 2015 and 2016 using year 2014 as the base year. (8 marks)
- b) Fisher’s ideal price index for years 2015 and 2016 using year 2014 as the base year. (8 marks)
- c) Differentiate between Paasche’s price index and Laspeyres price index (4 marks)

(Total: 20 marks)

Question 4

- a) Distinguish between a histogram and a frequency polygon. (2 marks)
- b) The data below show the profit realized by 40 medium size companies for the year 2010.

Profit 'sh.million'				
24.4	25.4	25.9	20.8	23.5
25.0	22.6	22.3	24.1	21.4
23.5	22.9	23.8	24.7	21.7
22.9	23.5	21.4	24.4	26.0
22.3	27.7	28.4	23.0	28.1
28.7	29.0	22.6	27.5	29.6
28.0	25.1	22.0	22.7	28.6
29.5	24.4	21.4	22.9	29.5

Required:

- i) Using the inclusive form of grouping, prepare a frequency distribution table, with equal classes, for the data above, beginning with the class 20.0 – 20.9 (4 marks)
- ii) Construct a histogram and a frequency polygon to represent the data above. (6 marks)
- iii) Using the histogram constructed in b (ii) above, estimate the modal profit realized by the companies (2 marks)
- iv) Calculate the quartile deviation and interpret your result. (6 marks)

(Total: 20 marks)**Question 5**

- (a) The table below shows the distribution of advertising costs incurred by 1,000 companies in the month of April 2017.

Cost of advertising (sh.'000')	Number of companies (cumulative)
100 – 120	17
120 – 140	70
140 – 160	269
160 – 180	463
180 – 200	790
200 – 220	998
220 – 240	1,000

Required:

- a) The median cost of advertising. (3 marks)
- b) The mean absolute deviation. (3 marks)
- c) The coefficient of skewness. Comment on your result. (3 marks)
- (b) Janet bakes and sells different types of cakes in the city centre. The table below shows the quantity of sales made in years 2016 and 2017 and the unit price for each type of cake.

Type of cake	2016		2017	
	Quantity	Price (sh.)	Quantity	Price (sh.)
O	100	100	120	140
P	140	120	160	160
Q	180	80	140	100
R	160	140	180	160

Required:

Using year 2016 as the base year, calculate;

- a) Laspeyre's quantity index (2 marks)
- b) Paasche's quantity index (2 marks)
- c) Fisher's ideal quantity index (2 marks)
- (c) From the data below (in Sh.'000'), compute the interpercentile range. (2 marks)
- 42, 63, 59, 42, 39, 78

(d) Using appropriate diagrams define the following distributions.

(i) Leptokurtic

(1 mark)

(ii) Mesokurtic.

(1 mark)

(iii)Platykurtic.

(1 mark)

(Total: 20 marks)



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

EQUATIONS/FUNCTIONS, MATRICES AND CALCULUS ELEMENTS BLOCK RELEASE

Question 1 (May 2005 Qn.1a, b)

James stocks and sells cabbages, oranges and mangoes in his grocery at Nairobi City Market. On Monday last week, he sold 55 cabbages, 100 oranges and 95 mangoes making a total sale of sh.1,625. On Tuesday, he sold 60 cabbages, 120 oranges and 80 mangoes making a total sale of sh.1,580. On Wednesday, he sold 75 cabbages, 150 oranges and 120 mangoes making a total sale of sh.2,175. He buys these items from a distributor at sh.3, sh.2 and sh.6 for a cabbage, an orange and a mango respectively.

Required:

- Three simultaneous equations connecting the number of units sold and total sales. (3 marks)
- The selling price for each item using matrix algebra (9 marks)

Question 2 (August 2009 Qn.1b)

A market consists of three commodities; A, B and C. The demand and supply functions of the three commodities are as follows;

$$\begin{aligned} QD_A &= 4,500 - 2P_A + 3P_B - 7P_C & QS_A &= -500 + 4P_A \\ QD_B &= 4,000 + 2P_A - P_B - 3P_C & QS_B &= -2500 + 5P_B \\ QD_C &= 3,000 - P_A + 2P_B - 8P_C & QS_C &= -600 + 2P_C \end{aligned}$$

Where

- QD_A = Quantity demanded of commodity A in units
- QD_B = Quantity demanded of commodity B in units
- QD_C = Quantity demanded of commodity C in units
- QS_A = Quantity supplied of commodity A in units
- QS_B = Quantity supplied of commodity B in units
- QS_C = Quantity supplied of commodity C in units
- P_A = Unit price of commodity A in shillings
- P_B = Unit price of commodity B in shillings
- P_C = Unit price of commodity C in shillings

Required:

Determine the equilibrium prices and quantities of commodities A, B and C.

Question 3 (May 2007 Qn.1a)

An electronics dealer bought 'x' number of radios at a total cost of sh.144,000. Five of the radios were damaged during transportation and written off. The dealer later sold each of the remaining radios at sh.1,600 above the cost price per radio. The dealer realized a total profit of sh.16,000 from the whole transaction.

Required:

- The number of radios (x) that the electronics dealer bought. (8 marks)
- The selling price per radio. (2 marks)
- The total revenue realized by the electronics dealer. (1 mark)

Question 4 (June 2004 Qn.1a:QA)

Beta Glassworks Ltd manufactures bottles for the beverage industry. The company specializes in producing bottles of three different capacities: 0.2 litre, 0.3 litre and 0.5 litre. The three types of bottles are made by two machines A and B. The number of hours required for each type of bottle on each machine is as shown below;

	Type of bottle		
	0.2 litre	0.3 litre	0.5 litre
Machine A	0.45	0.75	0.60
Machine B	0.30	0.15	0.75

Machine A has 3,825 hours available and machine B has 2,025 hours available. The management has decided that 1,500 bottles of 0.2 litre must be produced.

Required:

Determine how many bottles of 0.3 litre and 0.5 litre should be produced in addition to the 1,500 bottles of 0.2 litre. (6 marks)

Question 5 (November 2009 Qn.2c)

A salesman earns a fixed monthly basic salary and a commission that is directly proportional to the number of units sold in the month. During the months of August 2010 and September 2010, the salesman's total earnings were sh.60,000 and sh.70,000 respectively.

The number of units sold by the salesman in the months of August 2010 and September 2010 were 100 units and 250 units respectively. In the month of October 2010, the salesman sold a total of 400 units.

Required:

The salesman's total earnings in the month of October 2010. (4 marks)

Question 6 (matrices)

A company makes 4 products i.e. A, B, C and D. Each product is made from raw material J, K and L. One unit of A uses 2 units of J, 3 of K and 5 of L. One unit of B uses 2 units, 1 unit and 3 units of J, K and L respectively. One unit of C uses 3 of J, 1 of K and 6 of L. one unit of D uses, 1, 1 and 6 units of J, K and L respectively. The unit cost of raw material is sh.2, sh.5 and sh.3 for J, K and L respectively. Selling prices for A, B, C and D are sh.75, sh.50, sh.50 and sh.70 respectively.

Required:

- Matrix W, a 4 by 3; showing raw material requirement for each product
- Raw material cost per product in form of matrix K
- Profit per product using matrices

Question 7 (functions/equations and calculus elements)

KK Ltd has the following summary in relation to prices and units.

Price	Units
400	10,000
500	8,000

The total cost function has been derived as $TC = 99.34 + 16.35X$

Required:

- Total revenue function
- Profit function
- Break-even units
- Profit maximizing units



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

COMMERCIAL MATHEMATICS BLOCK RELEASE

General observation from the Department of Management science

- ✓ Always read to **understand** the question before **solving** it
- ✓ Avoid calculation **errors** by using your calculator **always** and **properly**.
- ✓ It is a human being who reads your solutions, so **arrange** your solution in a systematic way to make his work easier.
- ✓ When tackling any paper, plan to do **ALL** the questions as required including all **theories**.
- ✓ Always start with the **easiest** questions and use the **minimum** time in such questions but **cautiously**.
- ✓ Always keep **referring back** to the required to ensure you are answering what is required.

Question

- (a) Martin Kimani has four children: Ken, Nyambura, Leah and Maina. All of them are in boarding secondary schools. Martin Kimani normally gives his children pocket money in the ratio of 5:4:4:3 for Ken, Nyambura, Leah and Maina respectively. At the beginning of the final school term for the year 2014, Martin Kimani decided to use 5% of his net salary after tax on his children's pocket money. However, because Nyambura was going for a school trip, she was given an additional amount equal to 50% of her normal pocket money. The additional money Nyambura received was Sh.500.

Required:

- (i) The amount received by each child at the beginning of the final school term.
- (ii) The net salary of Martin Kimani.
- (iii) Martin Kimani's gross salary before he pays income tax at the rates shown below;

Monthly taxable pay	Rate of tax
Shillings	% in each shillings
First 9680	10%
Next 9120	15%
Next 9120	20%
Next 9120	25%
Over 37040	30%

- (b) A salesman earns a commission of 3% on the sale of chairs and a commission of 4% on the sale of tables. The selling prices of a chair and a table are Sh.6,000 and Sh.15,000 respectively. During the month of April 2014, the number of chairs the salesman sold were 10 units more than the number of tables he sold. He received a total commission of Sh.21,300.

Required:

- (i) The number of chairs and tables the salesman sold in the month of April 2014.
- (ii) The commission he received on the sale of chairs.
- (iii) The commission he received on the sale of tables.

- (c) A Kenyan businessman imported a 500 gold rings from Tanzania at a cost of TSh.76,275 per ring. He incurred insurance charges of KSh.375,000. He also incurred custom duty of 25 percent in Kenyan Shillings.
1KSh. = TSh.13.5 ± 10%

Required:

- (i) The maximum total cost incurred by the businessman in Kenya Shillings.
- (ii) The maximum selling price per gold ring if the businessman intends to earn a profit markup of 30 per cent.

(d) An entrepreneur bought a washing machine on hire purchase. The cash price of the machine was Sh.800,000. An initial deposit of 20% of the cash price was paid. A flat interest rate of 15% was charged on the outstanding balance for the period of repayment. The balance plus the interest were payable in 36 equal monthly instalments. A customer who purchases the machine on cash basis receives a 10% discount on the cash price.

Required:

The amount of money saved if the machine is bought on cash basis.

(e) Rosemary borrowed a certain amount of money for two years. The rate of simple interest for the first year was 9.75%. During the second year, the rate increased to 11%. At the end of the period, Rosemary realized that she earned Sh.937.50 more in the second year than in the first year.

Required:

(i) The amount of money Rosemary had borrowed.

(ii) The rate of compound interest that would have earned Rosemary the same total interest during the two years.

(f) A businessman purchased a grinding machine at a cost of Sh.700,000. Its estimated useful life is 10,000 hours of running time with an estimated residual value of Sh.40,000. The estimated hours of running time of the machine for each year are as follows:

Year	Running time (hours)
1	3,500
2	2,000
3	3,000
4	<u>1,500</u>
	<u>10,000</u>

Required:

Using the machine-hour method of depreciation, calculate the annual depreciation amount and the net book value of the machine as at the end of each year.



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

PROBABILITY AND SETS BLOCK RELEASE

Question 1 (August 2009 Qn.4)

- a) Explain the following as used in set theory;
- Union of sets (2 marks)
 - Intersection of sets (2 marks)
 - Complement of a set (2 marks)
- b) A survey of 117 households was carried out at Rongai town to find out the number of households that watched Television channels; A, B and C respectively. The results of the survey were as follows;
- 42 of the households watched channel A
 - 52 of the households watched channel B
 - 51 of the households watched channel C
 - 11 of the households watched both channels A and C
 - 17 of the households watched both channels B and C
 - 5 of the households watched all the three channels

Required:

- Present the above information in a Venn diagram. (4 marks)
 - The number of households which watched only one channel. (2 marks)
 - The number of households which watched none of the three channels. (2 marks)
- c) Excel Ltd recently released a new product in the market. In order to generate sales, the company ran a television commercial on the product. In a bid to determine the effectiveness of the television commercial, the company conducted a market survey of 800 individuals. The results of the survey are as summarized below;

	Individual recalls viewing the television commercial	Individual does not recall reviewing the television commercial	Total
Individual had purchased the product	160	80	240
Individual had not purchased the product	<u>240</u>	<u>320</u>	<u>560</u>
Total	<u>400</u>	<u>400</u>	<u>800</u>

Required:

Suppose event A represents an individual recalling viewing the television commercial and event B represents as individual having purchased the product.

- Determine, $P(A \text{ or } B)$ (2 marks)
- Explain whether A and B are mutually exclusive events. Justify your answer. (2 marks)
- Determine the probability that an individual selected at random recalls viewing the television commercial, given that the individual had purchased the product. (2 marks)

Question 2 (May 2008 Qn.7b)

The information provided below relate to the probabilities of occurrence of two events; X and Y.

$$P(X) = \frac{4}{7}$$

$$P(Y) = \frac{2}{5}$$

$$P(X \text{ and } Y) = \frac{11}{35}$$

Required:

A contingency table for the probabilities.

(4 marks)

Question 3 (May 2006 Qn.7)

- a) Define the term 'sample space' as used in probability. (2 marks)
- b) Ujuzi Consultants Ltd is located at the city centre. Out of the total number of employees, 70% are university graduates. Out of the total number of university graduates employed by the company, 15% are in the accounts department. Of the employees who are not university graduates, 75% are in the accounts department.

Required:

- i) The probability that an employee selected at random is in the accounts department. (3 marks)
- ii) The probability that an employee selected at random is neither in the accounts department nor a university graduate. (4 marks)
- c) A manufacturing company uses three machines in its production process namely; machine A, machine B and machine C. The daily production of the machines A, B and C are 6,000 units, 5,000 units and 9,000 units respectively.

Past experience shows that the percentage of defective output produced by machines A, B and C are 1.5%, 1.8% and 3% respectively. An item is drawn at random from the daily production run and is found to be defective.

Required:

- i) The probability that the defective item was from machine A. (5 marks)
- ii) The probability that the defective item was from machine B. (3 marks)
- iii) The probability that the defective item was from machine C. (3 marks)



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

ELEMENTARY / DESCRIPTIVE STATISTICS BLOCK RELEASE

Question one

- (a) (i) Define harmonic mean. (1 mark)
- (ii) From the following set of speeds compute the harmonic average:
78 km/h 83 km/h 61 km/h 69 km/h 49 km/h (2 marks)

- (b) The growth rate of enrollment of students at a certain institution for the last five years are give below:

Year	2001	20002	2003	2004	2005
Growth rate (%)	12	100	24	32	36

Required:

- (i) Calculate the geometric mean of the growth rates and interpret your answer. (3 marks)
- (ii) If the student population in the year 2000 was 3,216, use the geometric mean to compute the student population in the year 2005. (2 marks)
- (c) The geometric mean of 10 observations on a certain variable was calculated as 162. It was later discovered that one of the observations was wrongly recorded as 129 while in fact it was 219. Calculate the correct geometric mean of the observation. (3 marks)
- (d) Explain the difference between arithmetic mean and weighted average. (3 marks)
- (e) Briefly explain what constitutes a good measure of central tendency (be sure to compare and contrast the three basics measures). (6 marks)

(Total: 20 marks)

Question two

- (a) A company operates ten factories and the number of accidents in each of the factories are shown below:

Factory:	A	B	C	D	E	F	G	H	I	J
Accidents:	17	9	10	4	12	21	25	8	6	3

Required:

- (i) Prepare histogram and a frequency polygon on the same graph using six intervals over the rage of 0 accidents to 30 accidents. (5 marks)
- (ii) Use the histogram to comment on
- Mode
 - Skewness
 - Kurtosis (5 marks)
- (iii) Construct a percentage ogive and use it to estimate the quartile coefficient of dispersion. (5 marks)
- (iv) Compute the coefficient of variation from the data above. (5 marks)

(Total: 20 marks)

Question three

- (a) State two advantages and two disadvantages of each of the following methods of data collection:

- (i) Direct observation. (4 marks)
- (ii) Postal questionnaire. (4 marks)

(b) The table below show the distribution of monthly salaries of employees of Industrial Complex Limited:

Monthly salary Sh. "000"	Number of employees
Below 10	100
10 - < 20	60
20 - < 30	50
30 - < 40	30
40 - < 50	25
50 - < 60	20
60 - < 80	10
Above 80	<u>5</u>
	<u>300</u>

Required:

- (i) The median monthly salary of the employees. (3 marks)
- (ii) The quartile deviation. (4 marks)
- (iii) The percentage of employees whose salary is between Sh. 15,000 and Sh. 75,000. (3 marks)
- (iv) The 85th percentile. (2 marks)

(Total: 20 marks)

Question four

(a) Explain the types of sampling techniques you would use to obtain the following measures of location and dispersion.

- (i) The mean
- (ii) Median
- (iii) Semi-interquartile range. (6 marks)

(b) Table below shows waists of children.

Size (cm)	Number of children
38 – 41	4
42 – 45	20
46 – 49	30
50 – 53	70
54 – 57	52
58 – 61	16
62 - 65	3

Required:

- (i) Without using any graphical representation (i.e. formulae) compute averages (mean, mode and median) (6 marks)
- (ii) Coefficient of variation and coefficient skewness. (6 marks)
- (c) What is the disadvantage of standard deviation as a measure of dispersion? (2 marks)

(Total: 20 marks)

Question five

(a) Citing relevant examples, briefly explain the difference between discrete data and continuous data. (4 marks)

(b) From the discrete data below in (kg)

78, 16, 33, 42, 33, 58

Compute:

- (i) Quartile of deviation. (2 marks)
- (ii) Coefficient of variation. (2 marks)

(c) Distinguish between the following set of terms:

- Frequency distribution and relative frequency distribution. (2 marks)

(d) The data below show the monthly consumption of product “Q” in units for 30 households in Kilindini.

20	40	30	10	50	70	90	210	130	150	180	170
140	100	120	160	70	60	190	220	110	230	220	
240	20	50	30	40	30	20					

Required:

A frequency distribution of the above data using a class interval of 50 in the following groupings:

(i) Inclusive form. (3 marks)

(ii) Exclusive form. (3 marks)

(e) Briefly explain what a relative frequency histogram is and how it can be used in statistical analysis. (4 marks)

(Total: 20 marks)



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

BLOCK RELEASE MOCK

May, 2017

Instructions

- ✓ Answer ALL questions.
- ✓ Marks will be lost for disorganized work
- ✓ Time allowed is 3 hours

Question one (Probability and sets)

- a) Distinguish between the following sets of terms as used in probability;
- i) Theoretical probability and empirical probability (2 marks)
 - ii) Addition rule and multiplication rule (2 marks)
- b) A news analyst has to make a choice on which national and foreign newspapers to read each morning. The national newspapers consist of Daily News, The Informer and Business Today whereas the foreign newspapers are The Time and The Newsweek. To decide on which national newspaper to read, the news analyst throws a die each morning. If the score is 1, 3 or 5, he reads Daily News, if the score is 2 or 4, he reads The Informer and if the score is 6, he reads Business Today.

For foreign newspapers, the news analyst reads either The Time or The Newsweek but never reads both at the same time. The probability of reading either of the two foreign newspapers depends on the national newspaper selected by the news analyst. The probabilities of reading The Time are as follows;

- If the news analyst reads Daily News, the probability that he will read The Time is 0.75
- If the news analyst reads The Informer, the probability that he will read The Time 0.5
- If the news analyst reads Business Today, the probability that he will read The Time is 0.25

Required:

Determine the probability that the news analyst will read;

- i) Daily News newspaper (2 marks)
 - ii) The Informer newspaper in two consecutive days (2 marks)
 - iii) The Informer and The Newsweek newspapers (2 marks)
 - iv) The Time newspaper (2 marks)
 - v) Neither Daily News nor The Time newspapers (2 marks)
- c) Faidika College offers three courses namely; Accounting, Information Technology and statistics. The marketing department of the college conducted a survey on 500 students to determine the number of students enrolled for each of the three courses. The results of the survey were as follows.
- 329 students were enrolled for Accounting.
 - 186 students were enrolled for Information Technology.
 - 295 students were enrolled for Statistics.
 - 83 students were enrolled for Accounting and Information technology
 - 217 students were enrolled for Accounting and Statistics.
 - 63 students were enrolled for statistics and Information technology.

Required:

- (i) Illustrate the above information in a venn diagram. (4 marks)
- (ii) The probability that a student is enrolled for all the three courses. (1 mark)
- (iii) The probability that a student is enrolled for Accounting or Statistics but is not enrolled for Information Technology. (1 mark)

(Total: 20 marks)

Question two (Elementary and descriptive statistics)

- a) Outline two advantages and two disadvantages of the mean as a measure of central tendency. (2 marks)
- b) The monthly mean wage of casual employees in a certain manufacturing company is sh.16,200. If the monthly mean wage of female casual employees is sh.16,740 and the monthly mean wage of male casual employees is sh.15,750, calculate the proportion of the total casual employees who are female. (2 marks)
- d) The salaries paid to the employees of two companies, S and L are distributed as follows;

Range of income Sh.'000'	Number of employees	
	Company S	Company L (cumulative)
4 - < 6	5	15
6 - < 8	7	45
8 - < 10	7	73
10 - < 12	18	97
12 - < 14	23	114
14 - < 16	14	118
16 - < 18	10	130
18 - < 20	16	132
20 - < 22	4	134

Required:

- (i) The mean and the standard deviation of salaries of company S employees (2 marks)
- (ii) The mean and the standard deviation of salaries of company L employees (2 marks)
- (iii) Combined mean and combined standard deviation of company S and L (2 marks)
- (iv) The coefficients of variation for the salaries of the two companies (1 mark)
- (v) Which company has a better distribution of salaries? Give reasons. (1 mark)
- (vi) A Lorenz curve to represent the income and the employees of the companies on the same graph. (8 marks)

(Total: 20 marks)**Question three (Equations and matrices)**

- a) Mr. S. Mwijo, a sole trader has observed the following market behaviour for product X:
- At a price of Sh. 400, 20 units were sold while at reduced price of Sh. 100 the sales increased to 50 units.
 - A total of 15 units were supplied at a price of Sh. 230 while at an increased price of Sh. 255 the supply of product X increased by 25 units.

It has also been determined that the firm's total cost of producing q units is estimated as:

$$TC = 75q + 5,000$$

NB: Assume that the firm's supply and demand curves are linear.

Required:

- The market equilibrium price and quantity. (3 marks)
 - The break-even number of units and the corresponding price. (3 marks)
 - The number of units that should be sold to maximize profit and the corresponding profit. (3 marks)
- b) XYZ Ltd. produces three products, Celon, Celdox and Doxin using three types of ingredients; I_1 , I_2 and I_3 . The table below shows the number of kilogrammes of the ingredients required to produce one unit of each product.

Ingredient (Kilogrammes)

Product	I_1	I_2	I_3
Celon	5	3	2
Celdox	2	1	3
Doxin	1	5	2

The daily supply of the ingredients is 580 kilogrammes, 400 kilogrammes and 420 kilogrammes of ingredients I_1 , I_2 , I_3 respectively.

Required:

Determine the optimal daily product mix of the company. (5 marks)

- c) ABC Ltd., a manufacturing company, produces four products X_1 , X_2 , X_3 and X_4 . Each product is made from three raw materials P, Q and R. One unit of X_1 requires 20 units of P, 20 units of Q and 40 units of R; one unit of X_2 requires 50 units of P and 30 units of R; one unit of X_3 requires 40 units of P, 30 units of Q and 20 units of R; one unit of X_4 requires 40 units of P, 20 units of Q and 20 units of R.

The raw materials are purchased in lots of 10 units and the cost for each lot is P sh.2; Q sh.3 and R sh.6. The other direct production costs per unit are X_1 , sh.4, X_2 , sh.2, X_3 , sh.3 and X_4 , sh.5.

The product selling prices per unit are X_1 , sh.40, X_2 , sh.40, X_3 , sh.36 and X_4 , sh.32.

The monthly demands for each product are X_1 , 4000 units, X_2 , 5000 units, X_3 , 6000 units and X_4 , 2000 units.

Required:

Using the above information, develop appropriate matrices to determine;

- i) The raw material cost per unit of product. (2 marks)
 - ii) Total monthly contribution for the company. (2 marks)
- d) Differentiate between a “mistake” and an “error” as used in business statistics. (2 marks)

(Total: 20 marks)

Question four (Commercial mathematics and index numbers)

- (a) Ann bought a posho mill on hire purchase terms. The cash price of the posho mill is sh.420,000. The hire purchase terms comprise a deposit of 30% of the cash price and equal monthly instalments of the balance and interest payable. Simple interest is charged on the principal balance at the rate of 10% p.a. A cash discount of 7.5% of the outstanding balance is offered if the outstanding balance is repaid as a lump sum before the final installment. However, lump sum payment of the outstanding balance is only accepted at least six months after purchase. Defaulting an installment would attract a penalty of 10% of the outstanding balance plus interest. The penalty plus the defaulted installment must be paid together with the following month's installment. Defaulting the instalments for three consecutive months would lead to repossession of the posho mill by the vendor.

Required:

- i) The total interest to be charged if Ann pays for the posho mill in 24 months (2 marks)
 - ii) The equal monthly instalments if Ann pays for the posho mill in 24 months (2 marks)
 - iii) The cash savings if Ann clears the outstanding balance as a lump sum payment after six months. (3 marks)
 - iv) The total amount Ann paid for the posho mill if she defaulted the tenth and the twentieth instalments. (3 marks)
- (b) A casual employee in a manufacturing company in Nairobi is paid sh.150 per hour for normal working hours between Monday and Saturday. The normal working hours from Monday to Friday start at 8.00 a.m. and end at 5.00 p.m. which includes a one hour lunch break. The lunch break is not regarded as a normal working hour. On Saturday, the normal working hours start at 9.00 a.m. and end at 1.00 p.m. For any work done outside the normal working hours, the employee is paid at 1.5 times the normal rate per hour. If he works on Sunday, the hourly rate is twice the normal rate.

The wages are paid at the end of the week and are subject to a 10% tax deduction.

Required:

- a) The net pay for the employee for a normal working week with no overtime. (2 marks)
- b) The net pay in a week if the employee worked 2 hours overtime each day from Monday to Friday. (2 marks)
- c) In a certain week, the casual employee was paid a net wage of sh.10,192.50. If he had worked 3 hours on Sunday during that week, determine the total number of hours he worked that week. (2 marks)

(c) The values of the consumer price index (CPI) for the years 2013 to 2017 were as shown below;

Year	Consumer price index
2013	130.7
2014	136.2
2015	140.3
2016	144.5
2017	148.2

Required:

Determine the purchasing power of the shilling for each of the five years. (2 marks)

(d) Differentiate between “mark-up” and “margin”. (2 marks)

(Total: 20 marks)

Question five (Mix)

a) Maryx ltd manufactures motor vehicle bearings. The cost accountant of the company has estimated the following costs for the second quarter of year 2014;

- Cost of raw materials Sh.32,000 ± 6%
- Cost of labour Sh.18,000 ± 2%
- Other variable expenses Sh.10,000 ± 4%
- Fixed costs Sh.10,000,000

The sales level is estimated to be 216,000 units at a selling price of sh. 1,200 per unit. The sales level and selling price are subject to error margins of 2% and 4% respectively.

Required:

(i) Maximum possible profit for the second quarter of year 2017. (2 marks)

(ii) Minimum possible profit for the second quarter of year 2017. (2 marks)

b) Given the following matrices: $A = \begin{bmatrix} 1 & -2 \\ 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 5 \\ -3 & 6 \end{bmatrix}$

Required:

(i) Show that $AB \neq BA$ (2 marks)

(ii) Show that $AA^{-1} = A^{-1}A = I$ (2 marks)

c) Explain the following terms as used in set theory:

(i) Complement of a set. (1 mark)

(ii) Union of sets. (1 mark)

(iii) Intersection of sets. (1 mark)

d) Distinguish between probability sampling and non-probability sampling. (2 marks)

e) Rehema Samson went out for shopping. She spent $\frac{1}{2}$ of the money on clothes, $\frac{1}{4}$ of the remaining money on toys for children and $\frac{2}{3}$ of the remaining money on food. She remained with a balance of sh.4,500 after the shopping.

Required:

The amount of money Rehema Samson had before she went out for shopping. (2 marks)

f) Explain two factors that might necessitate the shifting of the base of an index number. (2 marks)

g) An investment analyst collects data on shares and notes whether or not dividends were paid and whether or not the shares increased in price over a certain period.

- Of all the 112 shares that paid dividends, 78 shares had not increased in price.
- Of all the 127 shares that had no price increase, 49 shares did not pay dividends.
- The total number of shares analysed were 246.

Required:

Represent this data on a contingency table. (2 marks)

(h) Differentiate between descriptive statistics and inferential statistics. (1 mark)

(Total: 20 marks)



TIMES TRAINING CENTRE

Redefining Quality

ATD LEVEL II – BUSINESS MATHEMATICS AND STATISTICS

EXAMINATION TECHNIQUE

A. GENERALLY

To pass a paper, you must have read/revised thoroughly, convince the examiner you have the knowledge and do it within the time allowed.

B. SPECIFICALLY

On the examination day, the student should ensure to convince the examiner within the time allowed;

1. Read the questions carefully, do just what the examiner asks and keep returning to the question to ensure no deviation.
2. For computational problems, pay more attention to the first parts of the question (say a, b) since they not only form the basis of the rest of the question but also attract more marks.
3. Don't ignore any theoretical question, for there's always a related concept that can earn you half the marks and remember half is better than none (you ignore you will get zero). Put the points logically and number them where possible.
4. Don't panic but welcome 'nerves'/little shiver, especially for first timers.

To avoid panic:

- Allocate your time appropriately based on marks allocated.
- Concentrate on maximizing marks rather than the thought of whether you are passing or failing.
- Don't be over confident even if all questions look familiar, this will negatively affect judgment. Allow a little shiver since it helps increase your concentration.
- Answer the question you feel most comfortable with first and attempt the most difficult nevertheless (it could be difficult all over and attempts may have high rewards).



TIMES TRAINING CENTRE

Redefining Quality

CPA – QUANTITATIVE ANALYSIS

RELEASE 1 – MATHEMATICAL SKILLS / TECHNIQUES

Question 1

- a) A VCT centre is charged with providing medicare and counseling services to AIDS infected, HIV positive, and HIV/AIDS affected persons. The center has capacity to serve a maximum of 500 such patients per month with sh.150,000 available for medicare and sh.100,000 for counseling. AIDS infected patients require an average of sh.500 for medicare and sh.200 for counseling per month; HIV positive patients require an average of sh.300 for medicare and sh.100 for counseling; and HIV/AIDS affected persons require an average of sh.200 medicare and sh.300 for counseling.

Required:

Determine the number of patients of each type that the centre can serve per month.

- b) The following system of equations represents the intersector demand and final demand of sectors in a given economy;

$$X_1 = 0.3X_1 + 0.3X_2 + 0.2X_3 + d_1$$

$$X_2 = 0.1X_1 + 0.2X_2 + 0.3X_3 + d_2$$

$$X_3 = 0.2X_1 + 0.1X_2 + 0.4X_3 + d_3$$

Where: X_1 , X_2 and X_3 are outputs of sectors 1, 2 and 3 respectively and d_1 , d_2 and d_3 are the final demand of output from sectors 1, 2 and 3 respectively.

Required:

- i) The input-output matrix for the above economy
ii) The equilibrium levels of output for the three sectors, given that d_1 , d_2 and d_3 are sh.50 million, sh.30 million and sh.60 million respectively.
- c) ABC Ltd., a manufacturing company, produces four products X_1 , X_2 , X_3 and X_4 . Each product is made from three raw materials P, Q and R. One unit of X_1 requires 20 units of P, 20 units of Q and 40 units of R; one unit of X_2 requires 50 units of P and 30 units of R; one unit of X_3 requires 40 units of P, 30 units of Q and 20 units of R; one unit of X_4 requires 40 units of P, 20 units of Q and 20 units of R.

The raw materials are purchased in lots of 10 units and the cost for each lot is P sh.2; Q sh.3 and R sh.6. The other direct production costs per unit are X_1 , sh.4, X_2 , sh.2, X_3 , sh.3 and X_4 , sh.5.

The product selling prices per unit are X_1 , sh.40, X_2 , sh.40, X_3 , sh.36 and X_4 , sh.32.

The monthly demands for each product are X_1 , 4000 units, X_2 , 5000 units, X_3 , 6000 units and X_4 , 2000 units.

Required:

Using the above information, develop appropriate matrices to determine;

- i) The raw material cost per unit of product.
ii) Total monthly contribution for the company.

Question 2

- a) Ridership on a small region airline has been declining, approximately, at a linear rate. In 2005 the number of passengers was 245,000; in 2010 the number was 215,000. if n equals the number of passengers using the airline per year and t equals time measured in years ($t = 0$ for 2005):

Required:

- i) Determine the linear estimating function $n = f(t)$
 - ii) Interpret the meaning of the slope.
 - iii) What is the number of riders expected to equal in the year 2015.
 - iv) It is estimated that the airline will go out of business if ridership falls below 180,000. According to your function in part (i), when will this happen?
- b) A firm finds that the marginal revenue is given by the expression $20 - 2q$ while the marginal cost is given by the expression $4q - 10$. Its fixed costs are sh.30, q represents quantities of output produced and sold.

Required:

Determine the following;

- i) Total revenue, total cost and hence profit function.
- ii) Profit maximizing
 - Output
 - Price
 - The maximum profit
- iii) Average total cost at profit maximizing output.
- iv) Break even point.

Question 3

- a) Halgreen Ltd. manufactures two styles of lawnmowers, the Z-model and the W-model. Halgreen had a study performed concerning price-sales ratios. The study shows that z model Z lawnmowers can be sold per week at a price of (sh.200 - .01z) and that w model W lawnmowers can be sold per week at a price of (sh.300 - .02w).

Fixed costs are sh.40,000 per week. Manufacturing costs are sh.50 per unit for the model Z and sh.80 per unit for model W. If both models are produced, there is an intermix cost of .025wz.

Required:

- i) What is the optimal product mix, the optimal selling prices for each model, and the expected total weekly profit?
- ii) Suppose that manufacturing time for a unit of model W is 1 hour and for a unit of model Z is 1 hour. What would be the optimal production schedule if there were 5,000 man hours available each week for production?
- iii) What would be the (marginal) value of an extra production hour?
- iv) A company is able to sell two products X and Y, which have the demand functions:

$$P_x = 52 - 2x$$

$$P_y = 20 - 3y$$

Its total cost function is:

$$TC = 10 + 3x^2 + 2y^2 + 2xy$$

Required:

- i) Determine the profit maximizing levels of output and prices for X and Y and this profit.
- ii) If product Y were not produced, what would your answer to part (i) be?
Investigate the same if product X were not produced.

Question 4

- a) i) A company is hiring persons to work in its plant. For the job the persons will perform, efficiency experts estimate that the average cost C of performing the task is a function of the number of persons hired x . Specifically,

$$C = f(x) = 0.005x^2 - 0.49$$

Required:

Determine the number of persons who should be hired to minimize the average cost.

ii) Given the demand relationship

$$p = 800 - 75q$$

Required:

Determine the elasticity of demand when demand equals 200.

b) The efficiency of a worker over his 8 hour shift is assumed to vary continuously at a rate (of change of percentage efficiency w.r.t. time t from starting, in hours) of

$$\frac{3}{5}(11 - 4t)$$

If it is known that he commences the shift working at 90% of efficiency, find the efficiency function in terms of t .

How efficient is he;

- i) After 3 hours?
- ii) At the end of the shift?
- iii) At what point is efficiency maximized?
- iv) Sketch the efficiency function.

Question 5

d) Explain the following as used in set theory;

- i) Union of sets
- ii) Intersection of sets
- iii) Complement of a set

e) A survey of 117 households was carried out at Rongai town to find out the number of households that watched Television channels; A, B and C respectively.

The results of the survey were as follows;

- 42 of the households watched channel A
- 52 of the households watched channel B
- 51 of the households watched channel C
- 11 of the households watched both channels A and C
- 17 of the households watched both channels B and C
- 5 of the households watched all the three channels

Required:

- i) Present the above information in a Venn diagram.
- ii) The number of households which watched only one channel.
- iii) The number of households which watched none of the three channels.

f) i) Distinguish between the following as used in counting;

- Tree diagram
- Permutation
- Combination

ii) Times Training has 15 students to be transported to Wasini Island. The students are to be divided into three groups so that three vehicles can be used.

The three vehicles will carry four, five and six students respectively.

Required:

In how many ways can the groups be formed?

Question 6

(a) Mr. Boss has Sh. 100,000 to invest at an interest rate of 10% p.a for 3 years.

Required:

- (i) Determine the amount he will eventually have if interest is compounded monthly.
- (ii) Calculate the amount he will eventually have if interest is compounded daily. (Assume 360 days in a year).
- (iii) How much will he have at the end of the period if interest is compounded hourly?
- (iv) Will the amount at the end of the 3 years differ from that in (iii) above if interest is compounded continuously? If YES/NO, why?

(b) Kwalele Enterprises has provided the following summary in relation to its revenues and costs.

- Fixed cost Sh. 2,000,000 (rounded to nearest 100,000)
- Variable cost Sh. 6,000 (± 500)
- Selling price/unit Sh. 10,000 ($\pm 10\%$)

Required:

The range within which the break-even point will lie.

(c) An analysis of Times Ltd costs for the past 15 years reveals the following;

At the end of each year there is a fixed increment on the previous year's cost.

At the end of the 13th year the annual cost was Sh.324,000.

The cost at the end of the 7th year was three times the annual cost at the end of the 2nd year.

Required:

The total cost incurred by Times Ltd for the past 15 years.

Question 7

Beauty products Ltd. has launched a new mouth wash branded "Aloe" into the market. The product is competing with brands of the company's two competitors; "Fluoride" produced by Cee Ltd. and "Vera" produced by Dee Ltd.

In order to determine the market share of "Aloe", the marketing department of Beauty products Ltd. conducted a market survey in the month of April 2014. The results of the survey were such that:

1. Out of 1,000 consumers who used "Aloe" at the beginning of the month of April, 100 had shifted to "Fluoride" while 100 had shifted to "Vera" at the end of the month
2. Out of 1,000 consumers who used "Fluoride" at the beginning of the month of April, 70 and 30 of them had shifted to "Aloe" and "Vera" respectively at the end of the month.
3. Out of 1,000 consumers who used "Vera" at the beginning of the month of April, 100 and 200 of them had shifted to "Fluoride" and "Aloe" respectively at the end of the month.

The management of Beauty products Ltd. are also considering undertaking a promotional campaign of the "Aloe" brand. The promotional strategies of the company are as follows:

Strategy I: Offer a 50ml packet for every 100 ml packet of "Aloe" purchased. The results of the strategy are expected to be such that:

1. Out of the total consumers using "Aloe" at the beginning of the month, 90% would be repeat consumers, 5% would shift to "Fluoride" and 5% would shift to "Vera" at the end of the month.
2. Out of the total consumers of "Fluoride" at beginning of the month, 90% would be repeat consumers, 7% and 3% would shift to "Aloe" and "Vera" respectively at the end of the month

3. Out of the total consumers of “Vera” at the beginning of the month, 70% would be repeat consumers, 20% and 10% would shift to “Aloe” and “Fluoride” respectively at the end of the month.

Strategy II: Advertise in the television network

The results of the strategy are expected to be such that:

1. Out of the total consumers of “Fluoride” at the beginning of the month, 87% of them would be repeat consumers, 10% of them would shift to “Aloe” and 3% would shift to “Vera” at the end of the month.
2. Out of the total consumers of “Vera” at the beginning of the month, 25% and 10% of them would shift to “Aloe” and “Fluoride” respectively at the end of the month.
3. Out of the total consumers of “Aloe” at the beginning of the month, 8% of them would shift to “Fluoride” and 8% would shift to “Vera” at the end of the month.

The total market for mouth wash is estimated to be worth Sh.200 million each month.

Required

- (a) Assuming that no promotional campaign is undertaken, determine the long-run market share of each of the brands.
- (b) Advise the management of Beauty Products Ltd. on the promotional strategy (if any) that the company should adopt in order to improve its market share in the long-run.

Question 8

(a) Solve for w, x, y and z in the following matrices:

$$\begin{pmatrix} 3x & 3y \\ 32 & 3w \end{pmatrix} = \begin{pmatrix} x & 6 \\ -12 & w \end{pmatrix} + \begin{pmatrix} 4 & x+y \\ z+w & 3 \end{pmatrix} \quad (2 \text{ marks})$$

(b) Differentiate the functions below:

(i) $y = \frac{6x^3}{2x+5}$ (2 marks)

(ii) $y = (4x^3 + 7)^5$ (2 marks)

(c) The marginal profit of a product is known to be in the linear form $y = 100 - 2x$ when x is the output (units). At the break-even point 5 units are produced.

Required:

- (i) The profit function
- (ii) The fixed cost of production.

(d) Find the following integrals:

(i) $\int 20x^4(x^5+7)dx$ (2 marks)

(ii) $\int 3x(x+6)^2dx$ (2 marks)

(e) Find the present value of Kes 10,000 kept for 5 years at 8% discounted continuously. (2 marks)

(f) Distinguish the following as used in calculus:

- (i) Consumer surplus. (2 marks)
- (ii) Producer surplus. (2 marks)



TIMES TRAINING CENTRE

Redefining Quality

CPA – QUANTITATIVE ANALYSIS

PROBABILITY REVISION

Question one (Basic Probability / Statistics)

(a) The table below shows the frequency distribution for the number of minutes per week spent watching TV by residents of Nyali in Mombasa.

Viewing Time (Hours)	Number of Residents
300 – 399	14
400 – 499	46
500 – 599	58
600 – 699	76
700 – 799	68
800 – 899	62
900 – 999	48
1000 – 1099	22
1100 – 1199	6
Total	400

Required:

- By calculating the appropriate measures of central tendency, measures of variation and measures of normality, comment on the skewness of the distribution. Give reasons for the selected measures.
 - Assuming the distribution approximates a normal distribution, what proportion of the residents;
 - Spend less than 480 hours watching television
 - Spend between 725 and 1025 hours watching television
 - Spend more than 800 hours watching television
- (b) Distinguish between the following sets of terms as used in probability;
- Marginal probability and joint probability
 - Baye's rule and additive rule
- (c) A news analyst has to make a choice on which national and foreign newspapers to read each morning. The national newspapers consist of Daily News, The Informer and Business Today whereas the foreign newspapers are The Time and The Newsweek. To decide on which national newspaper to read, the news analyst throws a die each morning. If the score is 1, 3 or 5, he reads Daily News, if the score is 2 or 4, he reads The Informer and if the score is 6, he reads Business Today.

For foreign newspapers, the news analyst reads either The Time or The Newsweek but never reads both at the same time. The probability of reading either of the two foreign newspapers depends on the national newspaper selected by the news analyst. The probabilities of reading The Time are as follows;

- If the news analyst reads Daily News, the probability that he will read The Time is 0.75
- If the news analyst reads The Informer, the probability that he will read The Time 0.5
- If the news analyst reads Business Today, the probability that he will read The Time is 0.25

Required:

Determine the probability that the news analyst will read;

- Daily News newspaper

- vii) The Informer newspaper in two consecutive days
- viii) The Informer and The Newsweek newspapers
- ix) The Time newspaper
- x) Neither Daily News nor The Time newspapers

(d) i) Distinguish between the following as used in counting;

- Tree diagram
- Permutation
- Combination

ii) Times Training has 15 students to be transported to Wasini Island. The students are to be divided into three groups so that three vehicles can be used.

The three vehicles will carry four, five and six students respectively.

Required:

In how many ways can the groups be formed?

Question two (Discrete and continuous Probability Distributions)

a) The probability of recovering after a particular type of operation is 0.6 and follows a binomial distribution. If over the next one week, 6 patients will undergo this operation;

Required:

- i) Construct a table of probabilities for the binomial distribution
- ii) Find the mean and standard deviation for the distribution

b) An electric utility company has found that the weekly number of occurrences of lightning striking the transformers is a poisson distribution with mean 0.4

Required:

- i) The probability that no transformer will be struck in a week
- ii) The probability that at most two transformers will be struck in a week.
- iii) Repeat (ii) above using normal distribution as an approximation.
- iv) Comment on (iii) above.

c) An energy saving bulb manufacturer, SaveLyt Ltd., claims that the average economic life of bulbs manufactured by the firm is 5,000 hours. The economic lifetime of the energy saving bulbs is also assumed to follow an exponential probability distribution.

Required:

- i) The probability that an energy saving bulb will be replaced within 4,000 hours
- ii) Te probability that an energy saving bulb will have an economic life of more than 10,000 hours
- iii) The probability that an energy saving bulb will have an economic life of between 2,000 and 8,000 hours
- iv) Given that an energy saving bulb would result to a saving of 3 kilowatts of electricity per hour and that it costs sh.900 more compared to a normal light bulb, determine the probability of the minimum economic lifetime that the bulb should have in order to justify its purchase if the cost per kilowatt our of electricity is sh.0.5

- d) After the analysis of accounts receivable, accounts either end up as paid or bad debts. A credit control accountant at Kargo Ltd. has established that in a financial year, 20% of the accounts receivable end up being debts. At the beginning of the current financial year the accountant has a hundred accounts receivable.

Required:

The probability that at most 30 of the accounts receivable will be bad debts

Question three (Probability table and random variable)

- (a) Describe the two laws of probability. (4 marks)

- (b) A manufacturing company uses machine X, Y and Z in its production process. Out of the daily output, 30%, 50% and 20% are produced by machine X, Y and Z respectively. Past experience shows that 10% of the daily output produced by machine X is defective whereas 5% and 4% of the daily output from machines Y and Z respectively are defective. The production manager randomly select an item from the daily total; output.

Required:

A contingency table showing the relative frequencies for machines X, Y and X and their defectives

(10 marks)

- (c) Maanzoni Ltd. has the following profit distribution:

Profit range	Probability
100,000 – 159,000	0.3
160,000 – 249,000	0.5
250,000 and over	0.2

Required:

Assess the degree of risk in the distribution of profits.

(6 marks)

(Total: 20 marks)

Question four (Random variable and further probability distributions)

- (i) For each of the experiment below identify the random variable (x) and the possible values (Be sure to indicate whether the random variable is discrete or continuous)

Experiment:

- (i) Sell of a car
(ii) Operating a restaurant
(iii) Filling a soft drink can with max capacity of 300 ml
(iv) Constructing a new library.
- (ii) What is meant by a probability function and what are its two main properties. (Be sure to use a brief example) (3 marks)
- (iii) Highlight the key differences between hyper-geometric and binomial distribution. (2 marks)
- (iv) Electric fuses produced by Moti-et al electronics are packaged in boxes of 12 units each and an inspector randomly selects 3 of the 12 fuses for testing.

Given that the box contains exactly 5 defective fuses

Required:

- (i) Probability that the inspector will find exactly 1 of the 3 fuses defective. (2 marks)
(ii) Mean distribution. (2 marks)
(iii) Variance and standard deviation of the distribution. (2 marks)
- (v) Phone calls arrive at the rate of 48 per hour at an airline agency reservation desk.

Required:

- (i) Probability of receiving 3 calls in a 5 minute interval of time. (2 marks)
(ii) Probability of the agent taking 3 minutes for personal time without a call interrupting. (3 marks)

(Total: 20 marks)

Question five (Basic probability and probability distributions)

(a) A survey on car dealership in a country in 2014 revealed that 60 per cent of cars were sold in the capital city while the rest were sold in other parts of the country. The probability of a customer buying a Toyota model was 0.6, a Nissan model 0.3 and any other vehicle model 0.1. Wealthier citizens preferred to buy brand new vehicles with a relative frequency of 0.25. In the month of April 2015, a dealer sold one thousand vehicles.

Required:

- (i) Present the above information in form of a tree diagram. (4 marks)
 - (ii) The number of brand new Toyotas or brand new models of other vehicles bought in April 2015. (1 mark)
 - (iii) The number of Nissan vehicles bought that were not new (1 mark)
 - (iv) The number of second hand vehicles bought in other parts of the country. (1 mark)
- (b) Briefly explain the following terms as used in probability theory
- (i) Mutually exclusive events. (2 marks)
 - (ii) Independence. (2 marks)
 - (iii) Joint probability. (2 marks)
 - (iv) Conditional probability. (2 marks)
- (c) The cost accountant of Mjengo Construction Ltd. has established that the total cost of a certain project is normally distributed with a mean of Sh.8,520,000 and standard and standard deviation of Sh.1,700,000. The expected total revenue of the project is Sh. 10,000,000.

Required:

- (i) The probability that the project will be profitable. (2 marks)
- (ii) The probability that the project will not be profitable. (1 mark)
- (iii) The amount of the total revenue that should be earned from the project in order to have a 0.99 change of the company making a profit. (2 marks)

(Total: 20 marks)

Question six (basic probability)

- (a) Define transition probability as used in matrix algebra. (2 marks)
- (b) A local motor vehicle assembly plant has initiated a pilot project to manufacture and sell motor vehicles locally. The plant will manufacture motor vehicles with an engine capacity of 1200cc, 1500cc or 1800cc. The body style of the motor vehicles will be either saloon, station wagon or pick-up with a white, blue or cream body colour.

Required

With the aid of a tree diagram, determine the probability that a motor vehicle picked for purchase by a buyer is a blue saloon with an engine capacity of 1500cc. (4 marks)

- (c) A survey was carried out on the loyalty of employees of Z Ltd. The study was based on whether the employees would accept a job offer by another company which was rated equal to or slightly better than their present position.

The results of the survey were as follows

Loyalty	Length of service			More than 10 years
	Less than one year	1 – 5 years	6 – 10 years	
Would remain	10	30	5	75
Would not remain	25	15	10	30

Required

- (i) The probability that a randomly selected employee has more than 10 years of service and would remain in employment. (2 marks)

(ii) The probability that a randomly selected employee would either have been with the company for less than 1 year or would remain in employment (2 marks)

(d) Mr. Nzulwa is a businessman who normally invests in stocks. He would like to invest in one of the two stocks listed in the stock exchange. His stockbroker has a past record of the price behaviour over the last 100 days. This information is summarized in the table below:

Price (Sh)	Number of days	
	Stock A	Stock B
10 – 15	5	4
15 – 20	19	7
20 – 25	31	13
25 – 30	29	16
30 – 35	10	38
35 – 40	4	15
40 - 50	<u>2</u>	<u>7</u>
	100	100

Required

Mr. Nzulwa would prefer to buy the stock whose price is more stable, which one would you recommend? Why?

(Show all the relevant calculations)

(10 marks)



TIMES TRAINING CENTRE

Redefining Quality

CPA – QUANTITATIVE ANALYSIS

RELEASE – THE LP AND GAME THEORY MODELS

Question one (L.P & Game Theory)

- With aid of a brief example, explain what is mean by a linear programme.
- Outline the steps followed in graphical linear programming.
- With regard to game theory model, when is the simplex technique of linear programming preferred to the graphical approach.
- Briefly state how a game theory scenario can be input into the simplex table.

Question two (Game Model)

- Identify and explain types of decision making environments (6 marks)
- Topcom Kenya International Limited (TKIL) is a telecommunications company situated in Nakuru. Recently the company was faced with a workers strike which necessitated a renegotiation of the workers salaries thorough their union. The management with the help of a consultant, has prepared the pay-off matrix below:

		Pay-off matrix			
		Workers union strategies			
		U₁	U₂	U₃	U₄
Company strategies	C ₁	+2.5	+2.7	+3.5	-0.2
	C ₂	+2.0	+1.1	+0.8	+0.8
	C ₃	+1.4	+1.2	+1.5	+1.3
	C ₄	+3.0	+1.0	+1.9	0

A positive sign represents a wage increase while a negative sign represents decrease

Required

- Advise the management on the best strategies (6 marks)
 - The value of the game. (2 marks)
- (c) Briefly explain the limitations of the use of game theory in decision making (6 marks)

(Total: 20 marks)