FRIDAY: 1 December 2017.   **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question.

SECTION A

QUESTION ONE
(a)   Define the following terms as used in inventory management:

    (i)   Lead time.   (1 mark)

    (ii)   Economic Order Quantity (EOQ).   (1 mark)

    (iii)   Buffer stock.   (1 mark)

    (iv)   Re-order level.   (1 mark)

    (v)   Re-order quantity.   (1 mark)

(b)   State FOUR assumptions of game theory.   (4 marks)

(c)   Given the matrices

$$A = \begin{pmatrix} 2 & 3 \\ 2 & 4 \end{pmatrix}, \quad B = \begin{pmatrix} -6 & -4 \\ 4 & 0 \end{pmatrix} \text{ and } C = \begin{pmatrix} -2 \\ 2 \end{pmatrix}$$

    Compute:

    (i) $A + \frac{1}{2}B$.   (2 marks)

    (ii) $\bar{A}B$.   (2 marks)

    (iii) AB^{T}.   (1 mark)

    (iv) AC.   (1 mark)

(d)   Highlight FIVE applications of linear programming.   (5 marks)

(Total: 20 marks)

SECTION B

QUESTION TWO
(a)   The management of County Beverages is planning to stock soft drinks from Brazil. The procurement manager has developed the following information regarding the product:

Annual usage	-	5,400 units
Cost of the product	-	Sh.365 per crate
Ordering cost	-	Sh.55 per crate
Carrying cost	-	28% per year of the inventory held

Required:
Determine:

(i)   The optimal number of units per order.   (4 marks)

(ii)   The optimal number of orders per year.   (3 marks)

(iii)   The annual total inventory cost.   (3 marks)

(b)   The following information was prepared by the accountant of ABC Ltd.:

1.   Costs and selling price   **Sh.**
        • Fixed costs   2,000
        • Variable costs   0.50 per unit
        • Selling price   1 per unit

2.   The company has a single customer who buys the product in batches as indicated:

		Units
Batch 1	-	2,000
Batch 2	-	4,000
Batch 3	-	6,000
Batch 4	-	8,000
Batch 5	-	10,000

Required:
Prepare the break-even chart.   (7 marks)

(c)   The fixed cost per month of a cost centre is Sh.25,000 and variable cost per unit is Sh.30.

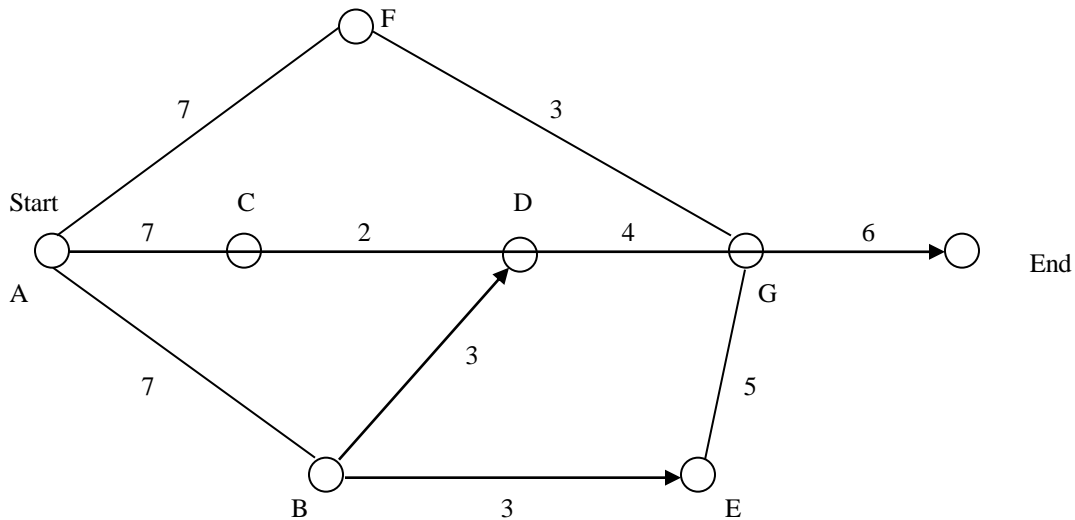Using linear equation, determine the total cost, if units produced in the cost centre in a specific month are 3,000.
                                                                                        (3 marks)
                                                                          (Total: 20 marks)

QUESTION THREE
(a)   The project manager of a local university has availed to you the following network for a building project:

Required:
(i)   List the possible paths through the network, indicating the length of path delays in each case.   (3 marks)

(ii)   Calculate the total float for each activity.   (4 marks)

(b)   Explain FOUR limitations of moving averages.   (4 marks)

(c) Beauty Poa Ltd. manufactures hair products in three distinct sections labelled as P1, P2 and P3. Each of the sections is known to contribute 40%, 35% and 25% respectively of the total output of the company.

During production, faults have been found on the products and it has been ascertained that the sections contribute the following percentage of faulty products:

P1   2%   (0.02)
P2   3%   (0.03)
P3   4%   (0.04)

The production manager has asked you to help him determine the probability that a faulty unit came from section:

(i)   P1.   (3 marks)

(ii)   P2.   (3 marks)

(iii) P3.   (3 marks)
(Total: 20 marks)

SECTION C

QUESTION FOUR
(a) Consider the following linear programming problems:

Maximise $Z = 4x_1 + 3x_2$

Subject to $4x_1 + 3x_2 \leq 24$

$x_1 \leq 45$

$x_2 \leq 6$

$x_1, \quad x_2 \geq 0$

Required:
Use the graphical method to solve the problem for an optimal solution.   (11 marks)

(b) Discuss how knowledge of quantitative techniques can be applied in supply chain management.   (4 marks)

(c) "Procurement managers have much to learn from game theory provided they use it to clarify their thinking".

In light of the above statement, describe FIVE useful principals that procurement managers can use to improve negotiations.   (5 marks)
(Total: 20 marks)
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KISM AND KASNEB

CERTIFIED PROCUREMENT AND SUPPLY PROFESSIONAL (CPSP)

PART II

QUANTITATIVE TECHNIQUES

FRIDAY: 27 May 2016.   **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question.

SECTION A

QUESTION ONE

(a)   Describe the term "bias" in the context of quantitative techniques, citing some examples of how it could arise. (4 marks)

(b)   Distinguish between the types of nodes found in decision trees.   (4 marks)

(c)   Impulse Security has a security system comprising four electronic devices (W, X, Y and Z) which operate independently. Each device has a probability of failure of 0.1. The four electronic devices are arranged so that the whole system operates properly if at least one of W or X and at least one of Y or Z functions properly.

  Required:
  The probability that the whole system functions properly.   (4 marks)

(d)   A particular item of stock has an initial inventory of 600. A particular production line requires the items to be drawn continuously from stores at a steady rate of 200 per day. As soon as stock-out is reached, a batch of 600 items is moved in overnight from another source to replenish the inventory.

  Required:
  Sketch the inventory graph for a period of 9 days.   (4 marks)

(e)   The following data relates to visitors (in hundreds) to a hotel in Mombasa over a period of three years:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Year 1	57	85	97	73
Year 2	64	96	107	89
Year 3	76	102	115	95

  Required:
  Comment on:

  (i)   The cycle.   (2 marks)

  (ii)   The trend.   (2 marks)

  (Total: 20 marks)

SECTION B

QUESTION TWO

(a)   A firm procures three products A, B and C which pass through three processes X, Y and Z. The profit contribution of product A, B and C are Ksh.5, Ksh.9 and Ksh.12 respectively. The table below shows the amount of time in hours that each unit of a product spends in each process:

	Process		
	X	Y	Z
A	2	3	5
B	3	1	2
C	4	2	1

The maximum time available in processes X, Y and Z is 150 hours, 200 hours and 180 hours respectively.

Required:

(i)   Formulate a linear programming problem. (4 marks)

(ii)   Highlight <u>THREE</u> components of a time series. (3 marks)

(b)   The marginal revenue (MR) function of a firm is given as:
$$MR = 200 + 10q$$

While the average cost (AC) function is given as $AC = 100 + 6q$, where q = quantity of output.

Determine the following:

(i)   Profit function. (3 marks)

(ii)   Level of output that will maximise profit. (2 marks)

(iii)   Maximum profit. (2 marks)

(c)   The following data relates to the period ending 30 June 2015.

Advertising expenses (Ksh. million)	39	65	62	90	82	75	25	98	36	78
Sales (Ksh million)	47	53	58	86	62	68	60	91	51	84

Required:

(i)   Determine the regression of Y on X.

(ii)   Determine the Karl Pearson correlation coefficient. Interpret your result. (6 marks)

(Total: 20 marks)

QUESTION THREE

(a)   A factory manufactures X laptops per day. The total daily costs in Kenya shillings incurred is $10x^2 + 1400x + 1000$. If the laptop is sold for Ksh.$(3000 – 10x)$ each, find the number of laptops that would maximise daily profit. (5 marks)

(b)   In a certain county there exists three major suppliers of items needed by business people. A recent market survey conducted by an independent contractor shows that 30% of the businesses prefer supplier A, 25% prefer supplier B, 15% both A and B, 5% prefer both B and C, 4% prefer both A and C and 1% prefer all the three.

Required:

(i)   Draw a Venn diagram to represent the above survey results. (4 marks)

(ii)   Establish the percentage of business people who prefer none of the suppliers. (1 mark)

(iii)   Establish the percentage of business people who prefer at least 2 suppliers. (1 mark)

(c)   Solve the following simultaneous equations:
$$3x – 2y – z = 2$$
$$– 4x + y – z = 3$$
$$2x + z = 1$$
(9 marks)

(Total: 20 marks)

SECTION C

QUESTION FOUR

(a)   Your company is planning a take-over of a small Nairobi chain of stores whose main competitors are co-operatives. As part of the preliminary work, you have been asked to investigate the relationship between turnover, number of stores and regions. Data for nine regions on the number of stores and turnover (in millions of Kenya shillings) of multiples and co-operatives in 2005 is given below:

Multiples

Region:	A	B	C	D	E	F	G	G	I
Stores (X):	952	253	360	484	593	639	498	371	416
Turnover (Y):	3657	819	1250	1302	1861	1635	1452	717	1179

Co-operatives

Region:	A	B	C	D	E	F	G	G	I
Stores (X):	379	322	210	366	575	451	498	257	550
Turnover (Y):	260	236	194	308	445	427	286	130	335

The least squares regression of turnover on stores have been calculated as follows:

$$Y = -508.50 + 4.04x \qquad\qquad r = 0.95 \text{ (multiples)}$$
$$Y = 22.73 + 0.67x \qquad\qquad r = 0.83 \text{ (co-operatives)}$$

Required:
(i)   On the same graph, plot scatter diagrams of Y against X, including the regression lines. Interpret your results.

(5marks)

(ii)   For a region with 500 stores of each type, predict the turnover for multiples and co-operatives. Comment on the likely accuracy of predictions. (3 marks)

(iii)   Use an appropriate method to compare turnover per store between multiples and co-operatives.   (2 marks)

(b)   A company is considering whether to launch a new product. The success of the idea depends on the ability of a competitor to introduce a competing product (estimated at 60%) and the relationship of the competitor's price to the firm's price.

If company's price is	Table A Profits in Sh. '000' If competitors' price is			
	Low	Medium	High	Profit if no competitor
Low	30	42	45	50
Medium	34	45	49	70
High	10	30	53	90

The company must set its price first because its product will be on the market earlier so that the competitor will be able to react to price. Estimates of the probability of a competitor's price are as shown in Table B.

If company's price is	Table B Competitors' price is expected to be		
	Low	Medium	High
Low	0.8	0.15	0.05
Medium	0.20	0.70	0.10
High	0.05	0.35	0.60

Required:
(i)   Draw a decision tree to analyse the problem.   (7 marks)

(ii)   Recommend the best decision for the company.   (3 marks)

(c)   Your company requires two types of tables for its canteens. A maximum sum of Sh.24,000 is available for this purpose. A type X table costs Sh.40 and seats four people. A type Y table costs Sh.30 and seats two people. Seating for at least 1,800 people is required. There must be at least as many type Y tables as type X because the tables are to be used for a variety of functions in the canteens. The company wishes to buy the smallest total number of tables to meet its requirements.

Required:
(i)   State the company's objective function.   (1 mark)

(ii)   State all the constraints (equations).   (3 marks)

(iii)   Draw a graph of these constraints, clearly showing the feasible region.   (4 marks)

(iv)   Recommend the number of each type of table the company should buy, justifying your answer.   (2 marks)

(d)   (i)   Discuss THREE users of quantitative techniques.   (6 marks)

(ii)   Using examples, describe two levels of measurements in quantitative techniques.   (4 marks)

(Total: 40 marks)

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CERTIFIED PROCUREMENT AND SUPPLY PROFESSIONAL (CPSP)

PART II

QUANTITATIVE TECHNIQUES

FRIDAY: 25 May 2018.   Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question.

SECTION A

QUESTION ONE

(a)   Inventory control is concerned with minimising the total cost of inventory.

        Explain the THREE cost factors in inventory control decision making process.   (6 marks)

(b)   Explain the meaning of the following terms as used in quantitative techniques:

        (i)   Positive correlation.   (2 marks)

        (ii)   Negative correlation.   (2 marks)

        (iii)   Uncorrelated correlation.   (2 marks)

        (iv)   Maximax.   (2 marks)

        (v)   Maximin.   (2 marks)

(c)   Highlight TWO limitations of quantitative techniques.   (4 marks)
                                                                                          (Total: 20 marks)

SECTION B

QUESTION TWO

(a)   During a census that was carried out by the government to determine household size and need for school feeding
        programmes in a certain county, the following data was obtained:

Size of household	1	2	3	4	5	6	7 or more
Probability	26.7%	33.6%	15.8%	13.4%	6.3%	2.4%	1.5%

Required:
Compute the following:

        (i)   The mean.   (3 marks)

        (ii)   The variance.   (5 marks)

        (iii)   The standard deviation.   (2 marks)

(b)   Linear regression is an analysis that assesses whether one or more predictor variables explain the dependent variable.

        Explain FIVE assumptions that underlie the linear regression model.   (10 marks)
                                                                                          (Total: 20 marks)

QUESTION THREE

(a)   The manager of Tegemeo Distributors has found out that the best forecast is obtained by using 50% of actual sales of the preceding month, 30% and 20% for the other months respectively. If actual sales in 2017 were as follows:

January	February	March	April	May	June
800	900	1,000	800	700	800

Required:

(i)   Determine the sales for July using the weighted moving average.   (2 marks)

(ii)   Determine sales for July using a 3 month simple average.   (5 marks)

(b)   The following information was extracted from ABC Ltd. on an ongoing contract negotiation:

Activity	Immediate predecessor	Duration (months)
A	None	2
B	A	4
C	A	2
D	B	2
E	B, C	4
F	A, E	6
G	D	4
H	D, E, F	2
I	G, H	6
J	H, F	6
K	H, I, J	4

Required:

(i)   Construct a precedence diagram to analyse the project.   (9 marks)

(ii)   Determine the project duration.   (2 marks)

(iii)   Show the critical path of the project.   (2 marks)

(Total: 20 marks)

SECTION C

QUESTION FOUR

(a)   Two companies A and B are competing for the same market and each firm must choose a high price (Sh.200 per bottle) or a low price (Sh.100 per bottle). Here are the rules of the game:

-    At a price of Sh.200, 5,000 bottles can be sold for total revenue of Sh.1,000,000.
-    At a price of Sh.100, Sh.10,000 bottles can be sold for total revenue of Sh.1,000,000.
-    If both companies charge the same price they split the sales evenly between them.
-    If one company charges a higher price, the company with the lower price sells the whole amount and the company with the higher price sells nothing.
-    Payoffs are the profits (revenue less fixed costs of Sh.5,000).

Required:

(i)   Draw the play-off table.   (4 marks)

(ii)   Determine solution of the game.   (3 marks)

(b) (i) Explain the following terms as used in linear programming:

        (i) Function. (2 marks)

        (ii) Variable. (2 marks)

(c) Solve the following equation using quadratic function method:

$$2x^2 - x - 1 = 0$$ (4 marks)

(d) In a survey of 500 students of a college, it was found out that 49% liked watching English premier League (EPL), 53% liked watching Spanish La Liga and 62% liked watching French League 1. It was also found out that 27% liked watching both EPL and Spanish La Liga, 29% liked watching both French League 1 and Spanish La Liga and 28% liked watching both EPL and French League 1 while 5% liked watching none of these games.

Required:

(i) Represent the above information in a Venn diagram. (5 marks)

(ii) Determine how many students like watching all the 3 games. (2 marks)

(iii) Compute the ratio of number of students who like watching EPL only to those who like watching Spanish La Liga only. (2 marks)

(iv) Compute the number of students who like watching only one of the three given leagues. (2 marks)

(v) Determine the number of students who like watching at least two of the given leagues. (2 marks)

(e) The following information was extracted from the Term III report form of 10 students in a class:

Marks

English	56	75	45	71	62	64	58	80	76	61
Mathematics	66	70	40	60	65	56	59	77	67	63

Required:
Calculate Rank Correlation on the data. (12 marks)

(Total: 40 marks)

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KISM AND KASNEB

CERTIFIED PROCUREMENT AND SUPPLY PROFESSIONAL (CPSP)

PART II

QUANTITATIVE TECHNIQUES

PILOT PAPER

September 2015.   Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

SECTION A

QUESTION ONE

(a)   Write short notes on the following:

      (i)   Binomial probability distribution.   (3 marks)

      (ii)   Poison probability distribution.   (3 marks)

      (iii)   Normal probability distribution.   (3 marks)

(b)   Explain any THREE objectives of economic order quantity (EOQ).   (6 marks)

(c)   ABC manufactures supplies up to 100 units of a product at a price of Sh.10 per unit. The cost of producing the product is composed of a fixed cost of Sh.1,000 and a variable cost of Sh.8 per unit.

Required:

      (i)   Break-even point in units.   (3 marks)

      (ii)   Profit when 900 units are produced and sold.   (2 marks)

                                                               (Total: 20 marks)

SECTION B

QUESTION TWO

(a)   Top Saucer Ltd. produces cups and saucers. The production requires machine and labour hours as follows:

	Cups	Saucers
Machine hours	4	3
Labour hours	2	2

The available machine and labour hours are 80,000 and 70,000 respectively.

Required:
Determine the number of cups and saucers that can be produced by Top Saucer Ltd.   (5 marks)

(b)   A company estimated its marginal revenue function to be $20 - 2q$ while the marginal cost function is $4q - 10$. Its fixed costs are Sh.30. q represents quantity of the product produced and sold:

Determine:

      (i)   Total revenue function.   (3 marks)

      (ii)   Total cost function.   (3 marks)

      (iii)   The profit function.   (3 marks)

      (iv)   (3 marks)

      (v)   Break-even point.   (3 marks)

                                                                (Total: 20 marks)

QUESTION THREE

(a) Baraka Ltd is preparing to implement a new project to solve storage problems being experienced by its supply chain management department. The table below is a summary of activities required to complete the project and corresponding duration.

Activity	Preceeding activity	Time
A	-	6
B	-	7
C	A, B	8
D	A	9
E	A	3
F	D, E	4
G	D	7
H	G	6
I	G	11
J	I	12
K	H	10

Required:
Draw the network diagram and show the critical path for the project. (10 marks)

(b) Kanywaji, a top beer manufacturer uses barley as a key raw material to produce beer. The quantity utilised in each of the last nine months are listed below:

Month	Quantity utilised
January	353
February	387
March	342
April	374
May	396
June	409
July	399
August	412
September	408

Required:
Using the method of least squares:

(a) Formulate a linear regression model. (7 marks)

(b) Use the model to predict the raw material required for the month of October. (3 marks)

(Total: 20 marks)

SECTION C

QUESTION FOUR

Mjukuu Ltd has been in existence for the last 15 years. In those 15 years, 8 managers have been fired from their position on the grounds that they are not able to make decisions under uncertainty and risk. The Chief Executive Officer (C.E.O) also felt that the managers are not able to forecast the sales volumes of the organisation and interpret the results to the organisation. The C.E.O heard that you are undertaking CPSP course and he has come to you for assistance.

From the table below provided by the C.E.O you are required to advice him on the best purchase decision.

NB: All amounts are in Kenya shillings.

PAY OFF TABLE

	States of nature	
Purchase decision	Good economic conditions	Poor economic conditions
Apartment building	50,000	30,000
Office building	100,000	– 40,000
Warehouse	30,000	10,000

$\alpha = 0.4$

Required:

(a)   Advice the C.E.O on the best option by use of:

    (i)   Maximax.   (2 marks)

    (ii)   Maximin.   (2 marks)

    (iii)   Minimax\regret.   (4 marks)

    (iv)   Hurwicz criteria.   (4 marks)

    (v)   Laplace criteria.   (4 marks)

(b)   Explain the following forecasting methods to the C.E.O and how they can be of use in the organisation:

    (i)   Moving averages.   (2 marks)

    (ii)   Ordinary least squares.   (2 marks)

    (iii)   Exponential smoothing.   (2 marks)

(c)   Describe to the C.E.O the application of the following in an organisation:

    (i)   Scatter diagrams.   (3 marks)

    (ii)   Measures of correlation.   (3 marks)

    (iii)   Simple linear regression.   (3 marks)

    (iv)   Coefficient of determinants.   (3 marks)

(d)   Highlight any three assumptions of linear programming.   (6 marks)

(Total: 40 marks)

KISM AND KASNEB

CERTIFIED PROCUREMENT AND SUPPLY PROFESSIONAL (CPSP)

PART II

QUANTITATIVE TECHNIQUES

FRIDAY: 26 May 2017.   **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

SECTION A

QUESTION ONE

(a)   Define the following terms as used in Quantitative Techniques:

      (i)   Set theory.   (1 mark)

      (ii)   Equilibrium state.   (1 mark)

      (iii)   Feasible solution.   (1 mark)

      (iv)   Assignment problem.   (1 mark)

(b)   Highlight FOUR assumptions of linear programming.   (2 marks)

(c)   Describe the differences between a fixed-quantity and a fixed-period inventory system.   (4 marks)

(d)   Explain the purpose of venn diagrams.   (2 marks)

(e)   Let A = $\begin{bmatrix} 3 & -4 \\ 6 & 9 \end{bmatrix}$ B = $\begin{bmatrix} 0 & 4 \\ 3 & -2 \end{bmatrix}$

Required:

      (i) $3A - B$.   (2 marks)

      (ii) A^{-1}.   (2 marks)

      (iii) AB^T.   (2 marks)

      (iv) B^2 (2 marks)
(Total: 20 marks)

SECTION B

QUESTION TWO

(a)   Wanjenzi Ltd. is a construction company that builds residential houses for sale. In a new site in Kitengela they intend to undertake a project of 10 activities.

The time estimate in weeks and the preceeding activities are as shown below:

Activity	Preceding Activity	Time (weeks)
	A	
	A	
	A	
	C	
	D	
H	B,D,E	
	H	3
	F,G,I	4

Required:

(i)   Draw a network diagram for the project.   (10 marks)

(ii)   Determine the critical path and project duration.   (2 marks)

(b)   Explain the following terms as used in network analysis:

(a)   Activity.   (2 marks)

(b)   Event.   (2 marks)

(c)   Dummy activity.   (2 marks)

(d)   Float.   (2 marks)

(Total: 20 marks)

QUESTION THREE

(a)   The Production Manager of Utamu Bottlers has provided you with demand for pineapples that are used to make juice syrup in each of the last 5 months as shown below:

Month	1		3	4	5
Demand (000's)	13	17	19	23	24

The production manager is unsure about month 6 and has approached you for help.

Required:

(i)   Use a two month moving average to generate forecast demand in month 6   (5 marks)

(ii)   Apply exponential smoothing with a smoothing constant of 0.9 to generate a forecast for demand in month 6   (5 marks)

(iii)   Justify which of the TWO forecasts you would prefer.   (3 marks)

(b)   State SEVEN differences between PERT and CPM.   (7 marks)

(Total: 20 marks)

SECTION C

QUESTION FOUR

(a)   Decision-making is a process of identifying problems and opportunities, and choosing the best options among alternative courses of action.

Explain the decision-making conditions under certainty, risk and uncertainty.   (10 marks)

(b)   A company that manufactures skin lighting cream makes purchases 5 times a year, represented by X in the table below. Y represents the corresponding quantities of raw materials bought as shown below:

X	0		3	4
Y	2	5	4	6

Required:

(i)   Find the least square regression line $y = ax + b$.   (10 marks)

Estimate the value of y when $x = 10$.   (4 marks)

(c)   During a strategic meeting of a manufacturing firm, the Chief Executive Officer (CEO) kept referring to marginal cost and marginal revenue. The Marketing Manager had no idea what the CEO was talking about. He has approached you to help him understand the terms.

Explain to him the meaning of marginal cost and marginal revenue.   (6 marks)

(d)   EA Computer Mart wants to reduce a large stock of Personal Computers (PCs). It has offered the University of Africa a quantity discount pricing schedule as follows:

Quantity		Price
1	49	USD 1,400
50 -	89	USD 1,100
90 +		USD 900

The university's annual carrying cost for a PC is USD190 while the ordering cost is USD2,500. The annual demand for this particular model is estimated to be 200 units. The university wants to determine if it should take advantage of this discount or order the basic EOQ order size.

Advise the university on whether or not to take advantage of the discount.   (10 marks)
(Total: 40 marks)

CERTIFIED PROCUREMENT AND SUPPLY PROFESSIONAL (CPSP)

PART II

QUANTITATIVE TECHNIQUES

FRIDAY: 24 May 2019.   **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

SECTION A

QUESTION ONE
(a)   Highlight THREE justifications for use of quantitative techniques in supply chain management. (3 marks)

(b)   Outline THREE elements of a basic structure of a linear programming problem. (3 marks)

(c)   Distinguish between the following terms:

     (i)   Unit matrix and zero matrix. (2 marks)

     (ii)   Continuous probability and discrete probability. (2 marks)

     (iii)   Re-order level and re-order quantity. (2 marks)

     (iv)   Activity and event. (2 marks)

     (v)   Standard deviation and variance. (2 marks)

(d)   List FOUR assumptions of game theory. (4 marks)
     (Total: 20 marks)

SECTION B

QUESTION TWO
(a)   A procurement student has 8 free hours that he can spend doing some online jobs. He can earn upto Sh.750 for every time spent doing online surveys and Sh.325 writing essays. His use of the internet is limited by the service provider that allows 10GB of data for 8 hours. Online surveys require 2GB of data for every hour spent online. Essay writing requires 1GB of data per hour.

     Required:
     (i)   Determine the objective function. (3 marks)

     (ii)   Determine the constraints for solving the above function. (7 marks)

(b)   The probability that a visit to a particular car dealer results in either buying a second-hand car or a Japanese car is 55%. Of those coming to the dealer, 25% buy second-hand car and 30% buy Japanese car.

     Required:
     Determine the probability that a visit leads to buying a second-hand Japanese car. (5 marks)

(c)   Solve the following using matrix method:
     $-x + 5y = 4$
     $2x + 5y = 2$

     (5 marks)
     (Total: 20 marks)

QUESTION THREE

(a)   Farm Products Ltd. produces and sells fresh milk. The milk has to be sold within one day otherwise it will get spoilt. The milk is packaged for distribution in crates each carrying 20 packets of milk. Each crate of fresh milk costs Sh.300 to produce and sells for Sh.450. Any milk not sold at the end of the day is given out free of charge to workers. If demand exceeds supply, a special production of fresh milk is made at a cost of Sh.400 per crate. However, the selling price remains unchanged.

The table below shows sales of crates of milk over the last 8 days:

Number of crates sold	Frequency of sales (days)
100	8
200	20
300	32
400	12
500	8

Required:

(i)   Extract the payoff table for information above.   (4 marks)

(ii)   Calculate the optimal number of crates the company should produce under:

   •   The maximax criterion.   (4 marks)

   •   The maximin criterion.   (4 marks)

   •   The expected monetary value (EMV) criterion.   (4 marks)

(b)   (i)   State FOUR principal components of a time series.   (2 marks)

(ii)   Explain the difference between multiplicative model and additive models as used in times series.   (2 marks)

(Total: 20 marks)

SECTION C

QUESTION FOUR

(a)   The monthly electricity bill of a firm over the past 12 months is as follows:

Month	Amount (Sh.)
December	30,660
January	27,190
February	30,570
March	30,640
April	29,730
May	31,530
June	29,720
July	33,070
August	30,010
September	27,550
October	30,130
November	29,940

Required:

Using exponential $\alpha = 0.5$ as the index to smoothing with, forecast the next January electricity bill.   (14 marks)

(b)   The following data refer to a two variable promotional expenses and sales collected in the context of a promotional study:

Promotional Expenses (Sh. 000)	7	10	9	4	11	5	3
Sales (Sh. Millions)	12	14	13	5	15	7	4

Required:

Compute the correlation coefficient and comment on the results.   (6 marks)

(Total: 20 marks)

(c) Given a matrix A, compute the determinant using diagonal method.

$$A = \begin{bmatrix} 3 & 1 & 2 \\ -1 & 2 & 4 \\ 3 & -2 & 1 \end{bmatrix}$$

(4 marks)

(d) Lee Enterprises intends to hold a concert in Kasarani Stadium. The management of the company has invited you to examine the viability of the project and has provided you with the following data:

Estimated fixed costs   Sh. 6,000,000
Variable cost   Sh.1,000
Selling price per ticket   Sh.2,000

Required:
(i)   Complete the number of tickets that must be sold to break even.   (3 marks)

(ii) How many tickets must be sold to earn a target profit of Sh.300,000   (5 marks)

(e) List the rules that must be followed when constructing network diagrams.   (8 marks)
(**Total: 20 marks**)

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KISM AND KASNEB

CERTIFIED PROCUREMENT AND SUPPLY PROFESSIONAL (CPSP)

PART II

QUANTITATIVE TECHNIQUES

FRIDAY: 25 November 2016.   **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question.

SECTION A

QUESTION ONE

(a)   Discuss the importance of quantitative techniques in decision making process.   (4 marks)

(b)   Define the following terms:

    (i)   Zero matrix.   (1 mark)

    (ii)   Unit matrix.   (1 mark)

    (iii)   Find the inverse of matrix 'x', given that:

$$x = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

        (3 mark)

(c)   Solve the simultaneous equations below using matrix method:

$$2x + 4y + Z \qquad 8$$
$$3x + 3y + Z \qquad 16$$
$$3x + y + 2Z \qquad 8$$

        (4 marks)

(d)   Explain FOUR reasons for holding inventories.   (4 marks)

(e)   Summarise THREE parameters which are required to determine the optimal number of units of the product to order so as to minimise the total cost associated with purchase, delivery and storage of the product.   (3 marks)

(Total: 20 marks)

SECTION B

QUESTION TWO

(a)   Ordinary least squares (OLS) method is a statistical technique used to determine line of "best fit" for a model.

    List FIVE assumptions of the OLS method.   (5 marks)

(b)   (i)   Define the term "time series".   (1 mark)

    (ii)   Outline the components of a "time series".   (4 marks)

(c)   The following table gives ages of husbands and wives at the time of marriage.

Husbands age in years	23	26	30	42	48	50
Wives age in years	18	20	24	32	36	39

Required:

    (i)   Compute the product moment coefficient of correlation.   (5 marks)

    (ii)   Derive the regression equation of ages of wives on husbands.   (5 marks)

(Total: 20 marks)

QUESTION THREE

(a)   Define the following terms as used in linear programming:

     (i)   Feasible region.   (2 marks)

     (ii)   Optimal solution.   (2 marks)

(b)   State FIVE limitations of linear programming.   (5 marks)

(c)   Consider the following linear programming problem:

Maximise $Z = 4x_1 + 3x_2$

Subject to $4x_1 + 3x_2 \leq 24$

                           $x_1 \leq 45$

                           $x_2 \leq 6$

                           $x_1, x_2 \geq 0$

Required:
Use graphical method to find the optimal solution for the problem.   (11 marks)

(Total: 20 marks)

SECTION C

QUESTION FOUR

(a)   The general manager of Jua Kali Limited has provided you with the following project breakdown of activities, order and duration:

Activity	Order	Duration (days)
A	Can start at the same time as activity B	
B	Can start as the same time as activity A	
C	Cannot commence until activity A is complete	
D	Cannot commence until activity B is complete	
E	Cannot commence until activity C is complete	2
F	Cannot commence until both activity D and E are complete	2

Required:

(i)   Draw the network diagram.   (6 marks)

(ii)   Establish the Earliest Start Time (EST) for the project.   (2 marks)

(iii)   Establish the Latest Finish Time (LFT) for the project.   (2 marks)

(iv)   Identify the critical path for the project.   (2 marks)

(v)   Distinguish between a "node" and an "activity" in a network diagram.   (2 marks)

(vi)   Highlight to the manager, the advantages and disadvantages of using the critical path analysis.   (6 marks)

(b)   Quantitative analysis requires representation of a business problem using a mathematical model. Over time, both qualitative and quantitative factors in a mathematical model have evolved.

The evolution of these qualitative and quantitative aspects in mathematical modeling is now being viewed as emerging trends in quantitative analysis.

Required:
Identify THREE qualitative factors and THREE quantitative factors that can be termed as emerging trends in quantitative analysis.   (6 marks)

(c)   Two friends decide to play a game and the strategies adopted by each player and possible pay-offs are represented in the table below:

		Player B				
		I	II	III	IV	V
	I	-2	0	0	5	3
Player A	II	3	2	1	2	2
	III	-4	-3	0	-2	6
	IV	5	3	4	2	-6

Required:

(i)   Determine the minimax value of the game.   (3 marks)

(ii)   Determine the maximin value of the game.   (3 marks)

(iii)   Giving reasons, explain which strategy player A should adopt.   (3 marks)

(iv)   Giving reasons, explain which strategy player B should adopt.   (3 marks)

(v)   Establish the value of the game.   (2 marks)
                                                                                                            (Total: 40 marks)

FRIDAY: 30 November 2018.   Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

SECTION A

QUESTION ONE

(a)   In business, good inventory management is essential.

Explain FOUR consequences of poor decision making in inventory management.   (8 marks)

(b)   Explain a "saddle point" as used in game theory.   (3 marks)

(c)   Explain THREE disadvantages of moving averages as a forecasting tool.   (6 marks)

(d)   State THREE advantages of using quantitative techniques in business.   (3 marks)
                                                                                        (Total: 20 marks)

SECTION B

QUESTION TWO

(a)   Skydiving Ltd. has been offering skydiving rides to tourists and has given the following information for 2016:

Month	Tourists (millions) x	Ridership (millions) y
	7	1.5
2	2	1.0
	6	1.3
4	4	1.5
5	14	2.5
	15	2.7
7	16	2.4
	12	2.0
	14	2.7
10	20	4.4
11	15	3.4
12	7	1.7

Required:

(i)   Determine the regression relationship in the form $y = a + bx$.   (10 marks)

(ii)   Determine the correlation and the coefficient of determination.   (5 marks)

(b)   A firm has a cost function $TC = Q^2 + 9Q$. Given that in a particular month 10 units were produced, determine the marginal cost of producing the 100th unit of this good.   (5 marks)
                                                                                        (Total: 20 marks)

Required:

(a) Propose FIVE contractual clauses that GG could include into the contract while engaging the suppliers to mitigate the risks of supplier failure. (10 marks)

(b) Describe FIVE circumstances under which a procurement auditor can be held liable for professional negligence. (10 marks)

(c) Explain FIVE reasons why GG should consider keeping a risk register. (10 marks)

(d) Examine FIVE relative merits for using a third party procurement risk management expert. (10 marks)
(Total: 40 marks)

THURSDAY: 28 November 2019.   **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

SECTION A

QUESTION ONE

(a)   The cost function of a firm is given as

$$TC = 72Q - 20Q^2 + 4Q^3$$

Required:
Determine:

(i)   Minimum average cost.   (2 marks)

(ii)   Marginal cost.   (3 marks)

(b)   A firm's sales data over a period is as follows:

Period	Sales	Variable cost	Fixed cost
1	Sh.100,000	Sh.60,000	Sh.20,000

Required:
(i)   Determine break even sales revenue.   (3 marks)

(ii) Compute profit to be earned if sales are Sh.600,000.   (3 marks)

(iii) Determine the sales revenue required for a profit of Sh.110,000.   (2 marks)

(iv) Determine profit if variable cost incurred is Sh.300,000.   (5 marks)

(v)   Define the term "break even point.   (2 marks)
                                                                                 (Total: 20 marks)

SECTION B

QUESTION TWO

(a)   (i)   Discuss the basic assumption of linear programming.   (6 marks)

(ii)   Solve the following linear programming problem by graphical method.

Maximise Z $=$ $3x_1 + 2x_2$
Subject to $2x_1 + 3x_2 \leq 18$ (i)
                          $3x_1 + x_2 \leq 9$ (ii)
                          $x_1 + 5x_2 \leq 10$ (iii)
                          $x_1, x_2 \geq 0$ (iv)

                                                                                       (14 marks)
                                                                                 (Total: 20 marks)

QUESTION THREE

An electrification project in Sao Village has to pass through six tasks. The duration and precedence order of these tasks are given below:

Tasks (Activity)	Predecessor activity	Duration in days
A	-	14
B	A	16
C	A	18
D	B	15
E	C	17
F	D, E	15

Required:

(i) Construct the network diagram for the project. (10 marks)

(ii) Identify the critical path. (2 marks)

(iii) Determine the project duration. (2 marks)

(b) A company with monthly supply of 2000 units to its customers has the monthly holding and set up costs of Sh.50 and Sh.200 respectively.

Required:

(i) Determine the Economic Order Quantity (EOQ). (2 marks)

(ii) Total cost at EOQ. (4 marks)

(Total: 20 marks)

SECTION C

QUESTION FOUR

(a) Explain the following terms as used in decision theory:

(i) Decision making under risk and decision making under uncertainty. (4 marks)

(ii) Two persons game and non zero sum game. (4 marks)

(iii) Pure strategy versus mixed strategy. (4 marks)

(b) The following table shows the amount of loan (Sh.000) per working day given out to a co-operative society over a period of 4 consecutive weeks in the first quarter of 2019:

Amount of loan in Sh.000					
Week	MON	TUE	WED	THUR	FRI
1	11	15	21	32	40
2	32	30	45	49	52
3	44	48	55	62	69
4	61	66	69	73	81

Required:

Compute five-day moving average. (8 marks)

(c) Giving examples, distinguish between:

(i) Continuous probability distribution and discrete probability distribution. (6 marks)

(ii) Correlation and regression. (4 marks)

(d) Highlight FIVE areas where quantitative techniques could be applied in a business. (10 marks)

(Total: 40 marks)

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