

# KASNEB

CPA PART II SECTION 4

CIFA PART II SECTION 4

CCP PART II SECTION 4

QUANTITATIVE ANALYSIS

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.

## QUESTION ONE

- (a) Highlight any four assumptions of Markov Analysis. (4 marks)
- (b) The research industry in your country has three market research firms namely X, Y and Z which provide research services. The following data has been collected in relation to the flow of clients among the three firms:

	Number of clients	Market share	Flow of Clients						Number of clients	Market share
			Gains from			Losses to				
	31.12.2013		X	Y	Z	X	Y	Z	31.12.2014	
X	408	0.177	-	24	40	-	30	18	424	0.184
Y	832	0.361	30	-	10	24	-	14	834	0.362
Z	1062	0.461	18	14	-	40	10	-	1044	0.454

### Required:

- (i) Convert the above data into a matrix of transition probabilities. (4 marks)
- (ii) Estimate each firm's market share for 2015. (4 marks)
- (c) A firm has a linear demand function for its product. When the price of the product is Sh. 220, the quantity demanded is 40 units. When the price increases to Sh. 240 the quantity demanded becomes 30 units. In addition, the firm's marginal cost function is given by:
- $$MC = 40q - 2q^2 + 2$$
- Fixed cost = Sh. 5million
- where q = quantity demanded, MC = marginal cost (in Sh. million)

### Required:

- (i) The level of output that maximises profits. (3 marks)
- (ii) The maximum profit. (1mark)
- (iii) The price of the product at the maximum profit. (1mark)
- (iv) The price elasticity of demand when the profit is at the maximum (interpret your result). (3 marks)

(Total: 20 marks)

## QUESTION TWO

- (a) The City Theatre has four auditoriums namely C1, C2, C3 and C4. Each auditorium performs a different play at any given time. The performances start at different times to avoid long queues that would occur if all the auditoriums were to start performance at the same time. The theatre has a single ticket booth and a cashier who can maintain an average service rate of 280 patrons per hour. Arrivals are poisson distributed at an average of 210 patrons per hour. The services are assumed to follow an exponential distribution.

**Required:**

- (i) The average number of patrons waiting in line to purchase the tickets. (2 marks)
- (ii) The average time spent waiting in line to get to the ticket window. (2 marks)
- (iii) The average time a patron spends in the system. (2 marks)
- (iv) The percentage of time the cashier is busy. (2 marks)
- (v) The probability that there are more than two people in the system. (2 marks)
- (b) A marketing firm employs part-time marketers. The hours worked and the earnings of ten such marketers are as shown below:

Marketer	1	2	3	4	5	6	7	8	9	10
Hours worked (x)	20	30	48	39	28	14	60	50	62	43
Earnings (Sh. "000") (y)	5.5	7.4	11.0	9.3	7.2	4.3	13.5	12.0	14.0	10.0

**Required:**

- (i) The least squares regression function relating the hours worked and earnings. Interpret your results. (6 marks)
- (ii) The Spearman's rank correlation coefficient. Comment on your result. (4 marks)
- (Total: 20 marks)**

**QUESTION THREE**

- (a) Lanex Company specialises in the production of an industrial dye. The firm manufactures two types of dyes; light and dark. The selling price and the unit variable costs for the dyes are shown below:

Production	Selling price (Sh.) per litre	Unit variable cost (Sh.) per litre
Light	13.00	9.00
Dark	16.00	10.00

Each litre of light dye requires 6 minutes of skilled labour and each litre of dark dye requires 12 minutes of skilled labour.

In a given day, there are 400 man hours of skilled labour available. There are also 100 grammes of an important blending chemical available each day, where each litre of light dye requires 0.05 grammes of the blending chemical and each litre of dark dye requires 0.02 grammes of the chemical.

The processing capacity at the plant is limited to 3,000 litres of dye per day.

The company is committed to supply a leading retailer with 5,000 litres of light dye and 2,500 litres of dark dye each working week (consisting of five days). In addition, there is an agreement with the unions that at least 2,000 litres should be produced each day.

Lanex company's management would like to determine the daily production volume for each of the two dyes that will maximise total contribution.

**Required:**

- (i) A linear programming model of the production problem facing Lanex company. (2 marks)
- (ii) Using the graphical approach, determine the optimum daily production plan and consequent contribution. (8 marks)
- (b) Brightshine Limited based in Nairobi manufactures a detergent. The firm is considering opening a new plant in Nakuru. The opening of a new plant will, however, depend on the demand for the detergent in Nakuru.

Information concerning the demand for the detergent is shown below:

- H - High demand and leads to a profit of Sh.6,000,000 per year.
- M - Moderate demand and leads to a profit of Sh.1,500,000 per year.
- L - Low demand and leads to a loss of Sh.2,500,000 per year.

The chances of having high, moderate and low demand are assessed at 30%, 30% and 40% respectively by the firm's management.

A market research group could be employed to provide information on which market demand would be realised. Past experience with work in the same market with this group shows its information cannot be relied upon to be absolutely accurate.

The market research group classifies its results as either being good prospects (G) or poor prospects (P). The table below gives the extent of reliability of this market research group:

Market survey Result	Actual state of nature		
	H	M	L
G	0.7	0.6	0.2
P	0.3	0.4	0.8

The market research group would charge a fee of Sh.60,000 if it was hired.

**Required:**

- (i) The best course of action on the basis of prior information. (2 marks)
  - (ii) The expected value of perfect information. (2 marks)
  - (iii) Advise Brightshine Limited whether the market research should be conducted. Show your workings using a decision tree. (6 marks)
- (Total: 20 marks)**

**QUESTION FOUR**

(a) Distinguish between the following sets of terms:

- (i) Zero-sum game and non-zero sum game. (2 marks)
- (ii) Pure strategy game and Mixed strategy game. (2 marks)

(b) An engineering firm is tendering for a contract to supply a steel fabrication. The tasks have been analysed as follows:

Activity	Predecessor activity	Time (Days)
A		10
B	-	12
C	A	10
D	A	9
E	A	13
F	A, B	17
G	C	12
H	C, D	14
I	E	13
J	G, H	12
K	H	10
L	H, I	14
M	H, I, F	13

**Required:**

- (i) A network diagram for the project. (8 marks)
  - (ii) The critical path and the expected project duration. (4 marks)
  - (iii) The time schedules for activities F, G and H. (4 marks)
- (Total: 20 marks)**

**QUESTION FIVE**

(a) A machine is composed of three components X, Y and Z. The probability that component X is in good working condition is  $\frac{7}{10}$ . If component X is in good working condition, the probability that component Y is in good working condition is  $\frac{3}{5}$ . If component X is not in good working condition, the probability that component Y is in good working condition is  $\frac{1}{3}$ . If components X and Y are in good working condition, the probability that component C is in good working condition is  $\frac{5}{6}$ , otherwise, it is  $\frac{1}{10}$ .

The machine can only be effective when component Z is in good working condition.

**Required:**

- (i) The probability that the machine is effective. (2 marks)
  - (ii) The probability that only one component Y or Z is in good working condition. (2 marks)
  - (iii) The probability that component Y is in good working condition given that component Z is in good working condition. (2 marks)
- (b) The data below represent the sales made by Pengo Traders for a period of three years:

Year	Sales (Sh. "000,000")			
	1	2	3	4
2012	2.2	5	7.9	3.2
2013	2.9	5.2	8.2	3.8
2014	3.2	5.8	9.1	4.1

**Required:**

- (i) The centred moving average trend values. (4 marks)
  - (ii) The seasonal additive indices. (4 marks)
  - (iii) The deseasonalised time series. (2 marks)
- (c) Highlight the four components of a time series. (4 marks)

**(Total: 20 marks)**

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