MACHAKOS UNIVERSITY

University Examinations for 2018/2019 Academic Year

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF AGRICULTURAL EDUCATION AND EXTENSION

SECOND YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN AGRIBUSINESS MANAGEMENT

KBT302/AGB 302: QUANTITATIVE TECHNIQUES IN AGRIBUSINESS

DATE: 22/7/2019   **TIME: 2.00-4.00 PM**

INSTRUCTIONS;

i.   **Answer Question ONE and ANY other Two Questions**

ii.   Clearly show all your workings.

QUESTION ONE

a) Given the demand function $Q_d = 15-2P$ and supply function $Q_s = -6+5P$, find the equilibrium
    quantity and price   (2 marks)

b) Given $S_1=\{0, 1,7\}$, $S_2=\{7,2,5\}$, $S_3= \{1, 0, 3\}$ and $S_4= \{2,7,3,1\}$, find:

    i) $S_2 \cap S_3$ (2 marks)
    ii) $(S_1 \cup S_3) \cap (S_4)$ (2 marks)

c) Given $A = \begin{bmatrix} 6 & -8 \\ 10 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 & 3 \\ -1 & 4 & -1 \\ 0 & -3 & 1 \end{bmatrix}$, find:

    i. $3(A^T)^{-1}$ (3 marks)

    ii. $|B|$ (3 marks)

d) Yummy Ltd makes 10 different snack brands. In an upcoming sports event, the firm intends
    to distribute free packages each containing four brands, to promote its products. What is the
    maximum number of people the firm can reach if each person gets only one unique package?

                                                                                                              (3 marks)

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e) The table below shows the probability distribution of milk sales at Maziwa Limited. Calculate the expected sales in the first half of a typical year   (5 marks)

Sales in Thousands of Shillings (x)		100	350	650	800
Probability [P(x)]	Quarter 1	0.04	0.40	0.36	0.20
	Quarter 2	0.18	0.22	0.37	0.23

f) An agribusiness investor constructed the following payoff table for investment in broiler production. The figures are profits in millions of Kenya Shillings.

Decision alternative	States of Nature	
	Weak demand (s1)	Strong demand (s2)
Small scale production (d1)	15.8	18.0
Medium scale production (d2)	11.3	31.5
Large scale production (d3)	-20.3	45.0

Justifying your answer, advise the investor on the best decision using:
i.   The conservative approach (2 marks)
ii. The minimax regret approach (3 marks)

QUESTION TWO (20 MARKS)

Farm Ltd grows rice and wheat for the market and is interested in maximizing profits. The firm uses only land, labor and capital to produce the crops. One acre of rice requires, 60 days of labor, while an acre of wheat requires 40 days of labor. Capital requirements per acre are Ksh 36,000 for rice and Ksh 14,400 for wheat. An acre of rice yields a profit of Ksh 60,000 while barley has a profit of Ksh 50,000 per acre. The firm has a total of 150 acres of land, 6,600 days labor, and capital amounting to Ksh 3,600,000.

a)   Formulate the linear programming problem   (5 marks)
b)   Using the graphical method, find the optimal solution   (9 marks)
c)   What is the total maximum profit?   (3 marks)
d)   Calculate the levels of inputs required   (3 marks)

QUESTION THREE (20 MARKS)

a) The following table shows activities for a student research project.

Activity	A	B	C	D	E	F	G	H
Duration (days)	5	8	4	5	10	4	9	5
Predecessor	-	A	B	B	C,D	C	E,F	G

    i. Draw the project network using the activity on node approach (5 marks)

    ii. Determine the critical path, showing the total project duration (5 marks)

b) Mutiso Farm produces potatoes and cabbages. In 2017, the farm earned Ksh 560,000 profit from 5 acres of potatoes and 3 acres of cabbages. In 2018, the farm invested in 6 acres of potatoes and 2 acres of cabbages, earning a profit of Ksh 600,000. Using Cramer's rule:

    i. Compute the returns per acre of crop. (8 marks)

    ii. Establish whether the farm will be better off in 2019 by investing in 2.5 acres of potatoes and 5.5 acres of cabbages (2 marks)

QUESTION FOUR (20 MARKS)

a) The data below was extracted from records of Biashara Ltd.

Production costs (Ksh '000)	5	10	25	30	35
Output (tons)	2	2.3	2.5	2.8	3.1

    i. Develop a linear squares regression equation for expressing the relationship between output and production costs (8 marks)

    ii. Use the equation in (i) above to predict output if the firm spends KSh 52,000 in the production process (2 marks)

b) The following table shows wheat sales data from Ngano Ltd.

Month	1	2	3	4	5	6	7	8
Sales volume (tons)	34	42	38	46	36	32	40	36

i. Use a 4-week moving average to forecast monthly sales (5 marks)

ii. Calculate sales forecasts for weeks 2-5 using a smoothing constant of 0.2 (5 marks)

QUESTION FIVE (20 MARKS)

a) In June 2016, Pesa bank limited had 200 employees working in Kwale County and 250 employees working in Meru County. The probability that employees move from Kwale to Meru each year is 0.3 while the probability of moving from Meru to Kwale each year is 0.1. Estimate the number of employees working in each county in June 2018 (10 marks)

b) A milk producer has to make a decision on the marketing channel to use so as to maximize revenue from sale of 1000 litres of milk. The producer can sell to a farmers' cooperative or to a milk processing company, at high or low price. For farmer cooperative, high price is Ksh 45 per litre, and low price Ksh 40 per litre. For the milk processing company, the prices are Ksh 43 and 39 per litre, respectively. The table below shows the probabilities of buying at the different prices for each channel.

Channel	Probability of buying at:	
	High price	Low price
Farmers' Cooperative	0.2	0.8
Milk processing company	0.8	0.2

Showing all your workings where applicable:

i. Construct a decision tree for the above problem (5 marks)

ii. What is the recommended decision? (5 marks)