MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF AGRICULTURE AND NATURAL RESOURCES MANAGEMENT

DEPARTMENT OF AGRIBUSINESS MANAGEMENT

THIRD YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN AGRIBUSINESS MANAGEMENT

KBT 302: QUANTITATIVE TECHNIQUES IN AGRIBUSINESS

Date: 3/12/2016   **Time: 11:00 – 1:00 pm**

INSTRUCTIONS:

Answer ALL questions in section A and ANY TWO questions in section B

Section A: 30 MARKS

QUESTION ONE (COMPULSORY)

a) Given $S_1=\{2, 4, 6\}$, $S_2=\{7,2,6\}$, $S_3=\{4, 2, 6\}$ and $S_4=\{2, 4\}$, find:
   i. $S_4 \cap (S_2 \cap S_1)$ (2 marks)
   ii. $(S_2 \cup S_3) \cap (S_4)$ (2 marks)

b) Given the demand function $Q_d = 60-8P$ and supply function $Q_s = -12+10P$, find P^* and Q^* by elimination of variables. (4 marks)

c) Differentiate between conservative and optimistic approaches to decision making. (2 marks)

d) State five assumptions of linear programming. (5 marks)

e) Given $A = \begin{bmatrix} 2 & -4 \\ 5 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -1 \\ -2 & 4 \\ 3 & -1 \end{bmatrix}$ and $F = \begin{bmatrix} 2 & 1 & -3 \\ 1 & 4 & -1 \\ 0 & -3 & 1 \end{bmatrix}$, find:

   i. The transposed product of A and B (3 marks)
   ii. $\frac{1}{A}$ (2 marks)
   iii. $|C_{32}|$ of F (3 marks)

f) In an agribusiness firm, the number of supervisors working in accounting, marketing and IT departments are 15, 20 and 10, respectively. Every month, one employee is selected at random and taken through a senior management course. Once trained, an employee is ineligible for re-training. Find the probability that the first two employees trained are from the same department (4 marks)

g) Maziwa Ltd makes ten yoghurt brands. In an upcoming children's event, the firm intends to distribute free packages each containing three brands, to promote its products. How many different packages can the firm make? (3 marks)

SECTION B: 40 MARKS

QUESTION TWO (20 MARKS)

Lima Farm Ltd grows maize and barley for the market and is interested in maximizing profits. Assume that only land, labor and capital are required to produce the crops. To produce one ton of maize, 1 acre of land is needed, while one ton of barley requires 0.5 acres of land. Labor requirement for maize is 30 days per ton, while barley requires 10 days of labor per ton. The capital required for maize and barley respectively is Ksh 9,000 and Ksh 10,000 per ton. A ton of maize yields a profit of Ksh 18,000 while barley profit is Ksh 15,000 per ton. The total resources available are: land (20 acres), labor (480 days), and capital (Ksh 360,000)

a) Formulate the linear programming problem. (5 marks)
b) Using the graphical method, determine the optimal level of production (tons) for each crop (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 wheat sales data from Ngano Ltd.

Week	1	2	3	4	5	6	7	8
Sales volume (tons)	17	21	19	23	18	16	20	18

i. Use a 4-week moving average to forecast weekly sales. (4 marks)
ii. Calculate sales forecasts for weeks 2-5 using a smoothing constant of 0.3 (4 marks)

b) The data below was prepared to estimate the relationship between daily sales and number of competitors in the city, for a chain of fast-foods restaurants.

Number of competitors	1	2	3	4	5
Sales (Ksh '000)	3600	3100	2800	2500	2200

    i. Develop the linear squares regression equation for estimating daily sales   (10 marks)
   ii. Use the equation in (i) to estimate restaurant sales in a city with 8 competitors (2 marks)

QUESTION FOUR (20 MARKS)

A grain grower has to make a decision on which crop to grow to maximize revenue. Available resources can only allow production of sorghum revenue. Available resources can only allow production of sorghum or green grams. If rains are good, the farmer on produce 50 tons of sorghum or 30 tons of green grams. However, if rains are moderate, the farm can produce 30 tons of sorghum or 20 tons of green grams. For either crop, the farmer can sell to market A or market B. Each market can buy grains at high price or low price. For sorghum high price is Ksh.35,000 per ton while low price is Ksh.25,000 per ton. For Green grams, high price is Kshs.85,000 per ton and low price Ksh.60,000 per ton.

The probability of receiving good rains is 0.4 while the probability of receiving moderate rainfall is 0.6. The table shows the probabilities of buying at high price for each market

Market	Probability of buying at:	
	High price	Low price
A	0.6	0.4
B	0.3	0.7

Showing your workings where applicable

a)   Construct a decision tree for the above problem   (10 marks)
b)   What is the recommended decision   (8 marks)
c)   What is the expected revenue of the decision   (2 marks)

QUESTION FIVE (20 MARKS)

a) The table below shows the probability distribution of fruit juice production at Matunda farm for the first two quarters of a year

Kiloliters of fruit juice produced	Probability P(x)	
	Quarter1	Quarter2
0	0.05	0.10
5	0.25	0.35
10	0.40	0.40
15	0.30	0.15

  i)   How much juice does the farm expect to produce in the first half of a typical year?

(5 marks)

  ii)   Compare the variability in juice production between the two quarters   (7 marks)

b) In a Country G, the population employed in agriculture in January 2016 is 10 million, while those employed in manufacturing are 5 million people. The probability that a person moves from agriculture to manufacturing is 0.3 while the probability that a person remains in agriculture is 0.7. A person employed in manufacturing has a probability of 0.1 of switching to agriculture, and a 0.9 probability of remaining in manufacturing. Find the number of people working in each sector by January 2018   (8 marks)