



MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2014/2015

FOURTH YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF BUSINESS ADMINISTRATION WITH INFORMATION TECHNOLOGY

MAIN CAMPUS

SUPPLEMENTARY

AEC 409: OPERATIONS ANALYSIS I

Date: 15th November, 2015

Time: 11.00 - 1.00 pm

INSTRUCTIONS:

- Answer question ONE and any other TWO questions.
- Question ONE carries 30 marks.
- The rest of the questions carry 20 marks each



Q1. a) Describe the three characteristics of linear programs. [3 Marks]

b) Identify three general formulations of linear programs. [3 Marks]

c) Nyamakima growers are leading horticultural company in Republic of Kuleturu. They produce two products rose cabbages and avocados for export. The production plant has three production department cutting, mixing, and packaging. The equipment in each can be used for 8 hours a day; thus they regard 8 hours as the capacity in each department. The process of production can be summarized as follows: Cabbages are first cut, then packaged. Each tonne of this product uses up $\frac{1}{2}$ hour of the cutting capacity and $\frac{1}{2}$ hour of the packing capacity. Avocados are first mixed, then packaged. Each tonne of this product uses up 1 hr of the mixing capacity and $\frac{2}{3}$ hour of the packaging capacity. Finally, cabbages and avocados can be sold at prices Ksh.8,000 and Ksh.6,000 per tonne respectively but after deducting the variable costs incurred, they yield on a net basis of Ksh.4,000 and Ksh.3,000 per tonne. This can also be considered as profits per tonne. The problem for the firm is what output combination should the firm choose in order to maximize the total profits.

i) Set up the linear programme problem. [6 Marks]

ii) Find the solution for the extreme points using a graph. [10 Marks]

iii) Suppose now the management realised that there some capacity that is under-utilized. Transform the linear program problem in (i) to capture this problem using slack variables. [8marks]

iv) Solve for optimal extreme points of the problems using a simplex tableau method. [8 Marks]

Q2. Given the following dual program.

$$\text{Primal: Maximize } \pi = 3x_1 + 4x_2 + 3x_3$$

$$\text{Subject to } \begin{bmatrix} 1 & 1 & 3 \\ 2 & 4 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \leq \begin{bmatrix} 12 \\ 42 \end{bmatrix}$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

$$\text{Dual: Maximize } \pi^* = 12y_1 + 42y_2$$

$$\text{Subject to } \begin{bmatrix} 1 & 2 \\ 1 & 4 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} \geq \begin{bmatrix} 3 \\ 4 \\ 3 \end{bmatrix}$$

$$\text{and } y_1, y_2 \geq 0$$

- i) Use a graph to solve the dual problem and obtaining the optimal points. Solve for the primal problem through the dual problem. [7 Marks]
- ii) State the two duality theorems. [4 marks]
- iii) From (ii) above and the primal and dual problem prove that when $x_i > 0$ then $s_i = 0$ and when $x_i = 0$ then $s_i > 0$. [9 Marks]

- Q3. a) Define the Yakov Ben-Haim info-gap decision theory and identify its three models. [4 Marks]
- b) Characterize the info-gap model of uncertainty. [4 Marks]
- c) Using the example of worker with uncertain, explain the absolute error model and fractional error model of his choices. [6 Marks]
- d) Suppose now we introduce the resource allocation problem. Show graphically how uncertainty is solved with robustness and opportuneness. [6 Marks]

- Q4. a) Describe the concept of stochastic process. Using examples. [9 Marks]
- b) Explain the following:
- i) Multiple random variables [4 Mark]
 - ii) Random variable x [3Mark]
 - iii) Mean, Variance and Moments of the probability distribution. [4 Mark]

d) Discuss the following terms:

- i) Markov chains that have more than two states. [5 Marks]
- ii) Markov chains with absorbing states. [5 Marks]

Q5. a) Assume that a unit of output can be produced by either of the following