KENYA METHODIST UNIVERSITY

END OF 1ST TRIMESTER 2009 EXAMINATIONS

FACULTY	:	ARTS AND SCIENCES
DEPARTMENT	:	COMPUTER INFORMATION SYSTEMS
UNIT CODE	:	MATH 331
UNIT TITLE	:	OPERATIONS RESEARCH I
TIME	:	2 HOURS

Instructions:

- *Answer question ONE (compulsory) and any other TWO questions.*

Question 1

a) Define the following terms:

i) Feasible solution

ii) Slack variable

iii) Surplus variable (3 mks)

b) State three main properties of a general linear programming problem. (3 mks)

c) A firm produces two products A and B using two machines 1 and 2. One unit of product A requires 2 hours on machine 1 and 2 hours on machine 2. One unit of product B requires 3 hours on machine 1 and 1 hour on machine 2. Machine 1 is available for 12 hours per day while machine 2 is available for 8 hours per day. If the profits are Ksh.600 per unit of product A and Ksh.800 per unit of product B.

i) Form a linear optimization model. (5 mks)

ii) Use graphical model to solve the linear programming model in (i) above. (5 mks)

d) Obtain the dual of the following primal linear programme.

Minimize $x_0 = 30x_1 + 40x_2 + 12x_3 + 8x_4 - 3x_5$

Subject to: $3x_1 + x_2 + x_3 - x_5 \geq 20$

$x_1 + 3x_2 + x_3 + x_4 \geq 10$

$x_i \geq 0,\ I = 1, 2, 3, 4, 5$ (5 mks)

Question 2 (20 marks)

A company has 1000 tonnes of ore x, 2000 tonnes of ore y and 500 tonnes of z. products A, B and C are to be produced from these ores. For one tone of each of these produces the ore requirements are listed below:

	X	Y	Z	Profit (Ksh) per tone
A	5	10	10	100
B	5	8	5	200
C	10	5	0	50
Max available resources	1000	2000	500	

i) Applying the simplex algorithm, calculate how many tones of each of the products A, B and C should the company produce so as to maximize its profits.

ii) Evaluate this profit.

Question 3 (20 mks)

a) Consider the linear programming functions given below:
maximize z = 2x1 + x2 ≤10

subject to: $x_1 + 5x_2 \leq 10$
$x_1+3x_2 \leq 6$
$2x_1 + 2x_2 \leq 8$
$x_1, x_2 = \geq 0$

Find:

i) The solutions that maximize z using simplex method.

ii) The equivalent dual function

b) Apply the M-technique to find the solution to the following linear program.
Minimize $z = 4x_1 + x_2$
Subject to: $3x_1 + x_2 = 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + 2x_2 \leq 4$
$x_1 \geq 0, x_2 \geq o$

Question 4 (20 marks)

a) State and explain briefly three main basic elements of a mathematical model in operations research. (3 mks)

b) Apply the cutting plane method to solve the following intergar linear programme.

Maximize z =7x1 +10x2

Subject to $-x_1 + 3x_2 \leq 6$
$7x_1 + x_2 \leq 35$
$x_1, x2 \geq 0$ and integer (17 mks)