KABARAK UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF SCIENCE, ECONOMICS AND MATHEMATICS

COURSE CODE: **ECON 315**

COURSE TITLE: **OPERATION RESEACH I**

STREAM: **Y3S1**

DAY: **FRIDAY**

TIME: **8.30-10.30 A.M.**

DATE: **19/12/2008**

INSTRUCTIONS:

Answer question **ONE** and any other **TWO**

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

a) What do you understand by the following terms?

i) Artificial Variable **(2 marks)**
ii) Degeneracy **(2 marks)**
iii) Sensitivity Analysis **(2 marks)**
iv) Infeasibility **(2marks)**

b) Solve the following linear programming problem using graphical method and interpret the results

$$\textit{Maximize} \quad Z = 3x_1 + 5x_2$$
$$\textit{Subject to} \quad 2x_1 + x_2 \geq 7$$
$$x_1 + x_2 \geq 6$$
$$x_1 + 3x_2 \geq 9$$
$$x_1, x_2 \geq 0$$

(7 marks)

c) i) State Maximin-Minimax principle as applied in Theory of Games **(4 marks)**
ii) What is a Saddle point **(3 marks)**

MG Auto has three plants in Nakuru, Nairobi and Mombasa and two major distribution centers in Kisumu and Eldoret. The capacities of the three plants during the next quarter are 1000, 1500 and 1200 cars. The quarterly demands at the two distribution centers are 2300 and 1400 cars.

The trucking company in charge of transporting the cars charges 8 cents per mile per car. The transportation cost per car on different routes rounded to the closest dollar is calculated as

	Kisumu	Eldoret
Nakuru	$80	$215
Nairobi	$100	$108
Mombasa	$102	$68

Formulate LP Model **(8marks)**

QUESTION TWO (20 MARKS)

a) Determine the optimum strategies and the value of the 2 by 5 game whose pay-off table is given below

Strategies for Y

		y_1	y_2	y_3	y_4	y_5
	x_1	3	6	-3	0	-1
Strategies for X	x_2	2	3	-1	2	4

(**12 marks)**

b) Consider the following primal problem

$$\begin{aligned} &\textit{Maximize} && 30x_1 + 40x_2 \\ &\textit{Subject to} && 6x_1 + 12x_2 \le 120 \\ & && 8x_1 + 5x_2 \ge 60 \\ & && 3x_1 + 4x_2 = 50 \\ & && x_1, x_2 \ge 0 \end{aligned}$$

Obtain the dual of this primal (**8 marks**)

QUESTION THREE (20 MARKS)

a) A company employs service engineers based at various locations throughout the country to service and repair their equipment installed in customer's premises. Four requests for service have been received and the company finds that four engineers are available. The distances each of the engineers from various customers is given in the following table and the company wishes to assign engineer to customer to minimize the total distance to be traveled

		Customers			
		W	X	Y	Z
	Christine	25	18	23	14
	Irene	38	15	53	23
Service engineers	Kirui	15	17	41	30
	Damaris	26	28	36	29

(**10marks**)

b) Investigate the feasibility of the following LPP using simplex method

$$\begin{aligned} &\textit{Maximize} && Z = 10x_1 + 20x_2 \\ &\textit{Subject to} && x_1 + x_2 \le 5 \\ & && x_1 + x_2 \ge 20 \\ & && x_1, x_2 \ge 0 \end{aligned}$$

(**10 marks)**

QUESTION FOUR (20 MARKS)

Given the data for the following transportation problem, determine

		Destination				
		1	2	3	4	Supply
Origin	1	30	50	25	20	**1200**
	2	40	30	35	60	**1500**
	3	25	75	40	50	**2400**
	4	60	15	50	30	**1000**
	Demand	**800**	**1900**	**2000**	**1400**	

i) initial solution using North West Corner Method **(5 marks)**

ii) Proceed to solve for the optimal solution using stepping stone algorithm **(15 marks)**

QUESTION FIVE (20 MARKS)

Solve the following linear programming problem using simplex method

$$\begin{aligned} &\textit{Minimize} && Z = 5x_1 + 6x_2 \\ &\textit{Subject to} && x_1 + x_2 \geq 10 \\ & && 2x_1 + 4x_2 \geq 24 \\ & && x_1, x_2 \geq 0 \end{aligned}$$

(20 marks)