



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2017/2018

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
ECONOMICS, BACHELOR OF ECONOMICS AND STATISTICS AND BACHELOR OF
ECONOMICS AND FINANCE

EES 300: MATHEMATICS FOR ECONOMIST III

DATE: Friday, 1st December, 2017

TIME: 11.00 a.m. - 1.00 p.m.

INSTRUCTIONS: Answer question **ONE** and any other **TWO** questions.

QUESTION ONE

- a) Explain the meaning of the following terms
- (i) Shadow price versus Slack variable (4 Marks)
 - (ii) Dynamic optimization versus Static optimization (4 Marks)
- b) Given the following system of equations $f_1(x, y) = 2x + 3y$ and $f_2(x, y) = x + 6y$
Show that the Jacobian is equal to the determinant of the coefficient matrix (4 Marks)
- c) Find the derivatives of the following definite integral with respect to x
- (i) $\int_0^1 \frac{2x+3}{5x^2+1} \partial x$
 - (ii) $\int_{-a}^a \frac{x^3 e^{x^2}}{1+x^2} \partial x$ (8 Marks)
- d) For which values of constants a and b is the function $f(x, y) = e^{ax+by^2}$ defined as a concave and a convex (10 Marks)

QUESTION TWO

A fruit grower has 150 acres of land available to raise two crops, A and B. it takes one day to trim an acre of crop A and two days to trim an acre of crop B, and there are 240 days per year available for trimming. It takes 3 day to pick an acre of crop A and 1 day to pick an acre of crop B, and there are 30 days per year available for picking. Each acre of crop A gives a profit of \$140 while each acre of B yields a profit of \$ 236 per acre.

- (a) Using Simplex method, solve for this problem, and find the maximum profit attainable (10 marks)
- (b) Identify the scarce resource and the abundant resource(s) (2 Marks)
- (c) What are the shadow prices for the resource(s) identified? (3 Marks)
- (d) Show the problem associated with availing 65 additional trimming days (3 Marks)
- (e) Based on Q1(c), what is the maximum acreage needed to satisfy the feasibility condition (2 Marks)

QUESTION THREE

Consider the following problem: Max $f(x, y, z) = xyz$ subject to: $x + y \leq 1$ and $x + z \geq 1$

- i) Explain the meaning of complementary slackness condition (4 Marks)
- ii) Derive the Kuhn-tucker conditions, and solve for the problem (16 Marks)

QUESTION FOUR

- a) Solve the following simultaneous equations using Gauss-Jordan method (8 Marks)

$$\begin{aligned} 4x - 2y + 3z &= 19 \\ 3x - 2y - 3z &= -14 \\ x - y + 5z &= 24 \end{aligned}$$

- b) A first order difference equation is given as: $1.5Y_{t+1} + Y_t = 22(0.8)^t$ and $Y(0) = 90$. Find the general solution for this equation (4 Marks)
- c) Solve the function using the exact method

- i) $\frac{dy}{dt} = -\frac{t}{y}$ (4 Marks)

- ii) $6y^2t\partial y + (2y^3 + 4t)\partial t$ (4 Marks)

QUESTION FIVE

- a) Test the existence of functional dependence between the following paired functions: (4 Marks)

$$f_1(x, y, z) = X + 3Y + 20Z^2 \quad \text{and} \quad f_2(x, y, z) = X^2 + 6XY + 15Z + 9Y^2$$

- b) Suppose that in the market for a single commodity, the demand (D) and supply (S) functions for period t are defined below. Use difference equations to study the market equilibrium behavior by answering the following questions

$$D_t = 2700 - 4P_t \quad \text{and}$$

$$S_t = -100 + 5P_{t-1}$$

- i) What is the long run equilibrium price and quantity (4 Marks)
- ii) Find the general solution and illustrate the stability condition of the mark (6 Marks)
- iii) Draw a time series graph for the price following a disturbance of 200 units above equilibrium price (6 Marks)