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MAIN EXAMINATION

JANUARY – APRIL 2022

FACULTY OF ARTS AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

REGULAR PROGRAMME

ECN 317: MATHEMATICS FOR ECONOMISTS II

Date: APRIL 2022	Duration: 2 Hours
INSTRUCTIONS: Answer Question ONE and any TWO Questions	

Q1.

a) A company can produce two products, A and B. The profit per unit of A produced is 6 dollars while the profits per B produced are 8 dollars. To produce a unit of A, the company requires 30 labour hours and 20 labour hours for B. The machine hours required are 5 and 10 hours for A and B, respectively. The total availability is 150 and 200 hours for machine and labour processes, respectively.

   i) Formulate this problem as a linear programming problem. **(3 Marks)**

   ii) What should be the optimal production of products A and B. Use the simplex method to solve. **(6 Marks)**

   iii) Formulate the dual problem of the primal problem **(4 Marks)**

b) Determine whether the following functions are linearly dependent. **(4 Marks)**

$$y_1 = 3x_1^2 + 2x_2^2$$

$$y_2 = 5x_1 + 1$$

c) Highlight the Kuhn-Tucker necessary conditions for a minimum and a maximum.

(5 Marks)

d) The supply and demand function of cabbage is given as:

$Qdt = 125 - 2P_t$

$Qst = -50 + 1.5P_{t-1}$

Required:

i) Determine the equilibrium price. **(2 Marks)**

ii) Find the general and particular solution. **(4 Marks)**

iii) Is the price stable? **(2 Marks)**

Q2.

a) Solve the following three simultaneous equations using the gauss Jordan elimination method. **(10 Marks)**

$$X - Z = 4$$
$$2Y - Z = 6$$
$$X + Y = 10$$

b) Differentiate between a homogeneous and a non-homogeneous difference equation. **(4 Marks)**

c) Solve the following difference equations.

i) $Y_{t+1} = 0.2Y_t + 4$ **(3 Marks)**

ii) $Y_{t+1} = 1.2Y_t, Y_0 = 5$ **(3 Marks)**

Q3.

a) With the aid of relevant examples, differentiate between the first-order linear differential function and the second-order third-degree differential function. **(4 Marks)**

b) Determine if the following function is concave or convex.

$Z = 2x - y - x^2 + 2xy - y^2$ **(4 Marks)**

c) Solve the following maximization problem and show all the necessary Kuhn-Tucker conditions. **(12 Marks)**

$$Max\ u = xy$$
$$st.$$
$$x + y \leq 100$$
$$x \leq 40$$
$$x, y \geq 0$$

Q4.

a) Determine if the following functions are positive definite or negative definite using the Hessian determinants.

i) $Z=2XY-X^2+5Y^2$ **(3 Marks)**

ii) $Z=200-2x^2-y^2-3w-xy-e^{x+y+w}$ **(4 Marks)**

b) Given demand and supply for the cobweb model as follows,

$Q_{dt}=22-3P_1 Q_{st}=-2+P_{t-1}$

Where,

Q_{dt} is the quantity demanded and Q_{st} is the quantity supplied.

i) Find the inter-temporal equilibrium prices. **(3 Marks)**

ii) Determine whether the equilibrium is stable. **(4 Marks)**

c) Solve for Y in the following differential equations.

i) $\frac{dy}{dt}=\frac{t}{y}$ **(3 Marks)**

ii) $\frac{dy}{dt}+2ty=t$ **(3 Marks)**

Q5.

a) Determine if a Cobb-Douglas production function given as $Q=AK^{\beta}L^{\alpha}$ is concave or convex given that β+α≤1. **(5 Marks)**

b) Integrate the following functions:

i) $\int (x+3)(x+1)^{\frac{1}{2}}dx$ **(5 Marks)**

ii) $\int x^3.(Lnx^2)dx$ **(5 Marks)**

iii) $\int 6x^2(x^3+2)^{99}dx$ **(5 Marks)**

END