

UNIVERSITY OF DUBLIN
TRINITY COLLEGE

FACULTY OF ARTS, HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

Senior Freshman
BESS, TSM, PPES

QUANTITATIVE METHODS
FOUNDATION SCHOLARSHIP EXAMINATION
SAMPLE PAPER
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<p>Exam Instructions: Please answer all questions. Each question carries equal weight.</p>
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Materials Permitted for this Examination:

Standard calculator

**You may not start this examination until you are instructed to do so by the
Invigilator.**

Q1. Economic Applications of Cramer's Rule

- (a) Explain what Cramer's rule is and how it is important for the analysis of economic models. Use the Cramer's rule to find the solution for the following system of equations:

$$7x_1 - x_2 - x_3 = 0$$

$$10x_1 - 2x_2 + x_3 = 8$$

$$6x_1 + 3x_2 - 2x_3 = 7$$

- (b) Consider the National-Income model:

$$Y = C + I_0 + G_0$$

$$C = a + b(Y - T)$$

$$T = d + tY$$

where $a > 0$, $0 < b < 1$, $d > 0$, $0 < t < 1$ and Y is output, C is consumption, I_0 is investment, G_0 is government consumption, T are taxes and t is income tax rate.

- (i) Identify the endogenous and exogenous variables and explain their meaning. Write the system in matrix form and solve it using Cramer's rule.
- (ii) Derive and discuss the impact of a government spending stimulus package on the equilibrium levels of Y , C and T .
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Q2. Implicit-Function Theorem

(a) Discuss the usefulness of the Implicit-Function theorem for comparative-static analysis. Describe which are the conditions that ensure the existence of an implicit function at a point $(y_0, x_{10}, \dots, x_{m0})$.

(b) For each of the following equations $F(y, x) = 0$, is an implicit function $y = f(x)$ defined around the point $(y = 3, x = 1)$?

(a) $x^3 - 2x^2y + 3xy^2 - 22 = 0$

(b) $2x^2 + 4xy - y^4 + 67 = 0$

If your answer is affirmative, find $\frac{dy}{dx}$ by the implicit-function rule and evaluate it at the said given point.

(c) Consider the following national-income model without taxes:

$$Y - C(Y) - I(i) - G_0 = 0 \quad (0 < C' < 1; I' < 0)$$

$$kY + L(i) - M_{s0} = 0 \quad (k = \text{positive constant}; L' < 0)$$

Analyse the comparative statics of the model when money supply changes and subsequently when government expenditure changes. Discuss your results.

Q3. Utility Maximisation and Consumer Demand. Given the utility function $U = U(x, y) = (x + 2)(y + 1)$ and the following budget constraint $xP_x + yP_y = B$ with $P_x = 4$, $P_y = 6$ and $B = 130$.

- (a) Write the Lagrangian function for the above utility maximisation problem. Derive the first order conditions. Derive the expression for the Lagrange multiplier and discuss its meaning in the context of this problem.
 - (b) Using the first order conditions in part (a) derive the marginal rate of substitution between goods x and y and describe its meaning. Plot the indifference curves and the budget constraint. Discuss what happens when P_x falls.
 - (c) Derive the second order conditions and interpret the sign of the bordered Hessian. Discuss your results.
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