ECON 331 Sample Midterm Exam

Spring 1998

Selected Answers and Hints:

1. Given the matrix

$$A = \begin{bmatrix} 1 & 0 & 4 & 3 & 3 \\ 0 & 1 & 0 & 6 & 9 \\ 0 & 0 & 1 & -1 & 2 \\ 0 & 0 & 2 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

The determinant:

$$|A| = 3$$

2. Consider the following two market model

$$Q_1^d = 20 - P_1 + 2P_2 \qquad Q_1^s = 2P_1 - 2$$
$$Q_2^d = 18 - 2P_2 + 3P_1 \qquad Q_2^s = 2 + 4P_2$$

   (a) HINT: Look at the signs of the cross partials $\partial Q_i / \partial P_j$

   (b) Use Cramer's rule to find the inverse demand functions

$$P_1 = P_1(Q_1, Q_2) \qquad P_2 = P_2(Q_1, Q_2).$$

   Solution

$$\begin{bmatrix} P_1 \\ P_2 \end{bmatrix} = \begin{bmatrix} \frac{1}{2}Q_1 + \frac{1}{2}Q_2 - 19 \\ \frac{3}{4}Q_1 + \frac{1}{4}Q_2 - \frac{39}{2} \end{bmatrix}$$

3. Consider the following:

   (a) Let $q = f(L)$ be the short run production function where L represents labour, the only input. use calculus to show that when $MP_L > AP_L$, AP_L is rising and $MP_L < AP_L$, AP_L is falling. **HINT: See Chapter 7**

   (b) When $MP_L = AP_L$, AP_L is assumed to be at a maximum and not a minimum. What assumption about the second derivative of $f(L)$ ensures this result? What is the economic expression for this result? **HINT: Look at a graph of MP and AP and read the explanation regarding their shapes.**

4. To produce one unit good one (x_1) you need 0.4 units of x_1 and 0.2 units of x_2. To produce one unit of good two (x_2), you need 0.6 units of x_1 and 0.1 units of x_2. The final market demands for both goods are 100 each. **USE MATRIX INVERSION to find the correct amounts of $\mathbf{x}_1$ and $\mathbf{x}_2$**

$$x = (I - A)^{-1} d$$
$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 2.142\,9 & 1.428\,6 \\ 0.476\,19 & 1.428\,6 \end{bmatrix} \begin{bmatrix} 100 \\ 100 \end{bmatrix}$$
$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 357.15 \\ 190.48 \end{bmatrix}$$

5. Consider a closed economy where equilibrium in the goods market is characterized by

$$I(Y, i) + G_0 = S(Y, i) + T(Y)$$

and in the money market

$$L(Y, i) = M_0^S$$

   (a) What are the normally assumed signs of the partial derivatives of I, S, T, and L with respect to Y and i?

   (b) In particular, what do we often assume about the partial derivative $\partial I / \partial Y$? Do any of the partial deriatives have restrictions on the range of values they may take on?

   (c) In equilibrium this system implicitly defines Y and i as functions of G_0 and M_0^s. Write down the Jacobian of this system. Find the sign of the Jacobian. (assume: $\partial I / \partial Y - \partial S / \partial Y - T' < 0$)

   (d) Find an expression for $\partial Y / \partial M_0^s$ and $\partial i / \partial M_0^s$. What are their signs?

HINT: SEE CHAPTER 8