Economics 11 Caltech Spring 2010

Mid term

This page left blank

Following the Honor code, you should find 90 minutes and to do this test, by yourself and without using any notes. Paper and pen should be all you need. Turn it in Class Tuesday May 3. Each quiz is worth 52pts (out of 200 possible pts)

EXAMS IN PENCIL WILL NOT BE REGRADED.
I Definitions (use words not equations)

3 lines or less

1.A. 2pt Please define: Pareto equilibrium

*An allocation such that no one can be made better off without making someone worse off*

1.B. 2pt Please define: the indifference set of a consumer

*The set of consumption bundle that give the same utility (as the current consumption bundle)*

1.C. 2pt Please explain: What is an inferior good?

*It is a good such that the share of the budget devoted to that good falls as income goes up*

*Partial credit for a good such that consumption falls as income goes up*

1.D. 2pt Please explain: Why are firms under perfect competition the most efficient?

*Because they produce where AC=MC and thus average cost of production are minimized*
Word/Graph problems

2.a. 4pts: Please explain each question in a few sentences.

A firm is in a competitive market. The CEO adopts a new technology that doubles the speeds of all the machines in the plant. What does that do in terms of output? Why? Is it likely to hire more workers? Why?

2.a.1 Output should go up because if the CEO has adopted the new technology it must reduce its costs.

2.a.2 The new technology is increasing the marginal product of workers (because their machines are going twice as fast) thus the old equilibrium \( W = pF' \) no longer holds and the only way to restore equilibrium is to hire more workers.

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

2.b. 4pts True or False: Please explain each question in a few sentences.

How does a profit-maximizing firm decide how much to produce if it takes all prices as given? Why does the same firm shut down if the price falls below the minimum average variable cost of production?

2b.1 A firm that takes the output price as given sets price equal to marginal cost. A firm that takes input prices sets the marginal value product of an input equal to the cost of that input.

2b.2 If price fall below the minimum average variable cost, then there is no way the firm can make a profit, because whatever quantity it chooses it looses money

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
2.c. 4pts Please explain each question in a few sentences.

Tom drops by. He has just been to the market and bought 2 boxes of pears and 1 box of bananas. The cost of pears is $3 a box and that of bananas is $1 a box. What must be true for him to have made the ‘right’ choice from the economist’s perspective? What is Tom likely to do if the price of bananas increases to $2? You may want to draw a graph to illustrate your point.

2.c.1. Tom’s choice makes sense if he likes pears much better than bananas because their price is higher.

2.c.2. If the price of bananas increases he should consume fewer of them. (If he is indifferent at 2,1 when prices are 2,1; he must reduce banana consumption when prices are 2,2)

2.d. 4pts Please explain each question in a few sentences.

What should happen to the demand for beef when consumers become more worried about mad cow disease? In the short run will the price of beef go up or down? What are the consequences for the amount of cattle-hides brought on the market? Does the price of hides go up or down? Why?

2.d.1 The demand for beef will fall and thus price of beef will fall.
2.d.2 Fewer cattle will be brought to market. Beef and hides are complements so fewer hides being available but the demand not changing implies the price of hides will go up.
Technical problem

3. Edgeworth box 14 pts
Assume that Ms Crusoe and Mr Friday are in two person, two good, exchange economy. Ms. Crusoe’s utility function over rice and shrimp is given by \( U_c (R, S) = R^{0.6}S^{0.4} \). Mr Friday has a utility that is \( U_c(R, S) = R^{0.5}S^{0.5} \).
Denote the price of rice as \( p_R \), the price of shrimp as \( p_s \), the income of Ms Crusoe as \( I_c \) and that of Mr Friday \( I_f \).

4.a 4pt Use the Lagrange method to derive Ms Crusoe’s demand for Rice and Shrimp as a function of prices and income. What is Mr Friday’s demand for Rice and Shrimp as a function of prices and income?

\[
\begin{align*}
L(R, S, \lambda) &= U_c (R, S) = R^{0.6}S^{0.4} + \lambda (I_c - p_R R - p_s S) \\
\frac{\partial L}{\partial R} &= 0.6R^{0.4}S^{0.4} - \lambda p_R = 0 \\
\frac{\partial L}{\partial S} &= 0.4R^{0.6}S^{0.6} - \lambda p_s = 0 \\
\frac{\partial L}{\partial \lambda} &= I_c - p_R R - p_s S = 0
\end{align*}
\]
Ratio of the first two gives \( R = 1.5S \frac{p_s}{p_R} \) or \( S = \frac{R p_R}{1.5 p_s} \). Back into the third \( I_c - p_R(1.5S \frac{p_s}{p_R}) - S p_s = 0 \) \( I_c = 2.5 p_R S \Rightarrow S_c = 0.4I_c/p_s \). But then \( R_c = 0.6 I_c/p_R \).

Because these utilities are cobb-Douglas, \( R_F = 0.5I_F/p_R \), \( S_F = 0.5I_F/p_s \).

4.b 2pt Ms Crusoe nets a 100 ounces of shrimp a day. Mr Friday harvests 70 ounces of rice a day. If the price of rice is 1, what is the income of Ms Crusoe and Mr Friday?

Income of Crusoe = 100\( p_s \) income of Friday = 70

4.c 4 pts if they can trade at a market price as price-takers with \( (p_R=1) \). Using the information above determine the equilibrium price of shrimp. What is the final allocation of Rice and Shrimp?

Total Rice \( = R_F + R_C = 70 = 0.6 I_c/p_R + 0.5 I_F/p_R \)
\( P_R = 1 \) so \( 70 = 0.6 I_c + 0.5 I_F \) But \( I_F = 70 \Rightarrow 35 = R_F = R_c \Rightarrow 0.6 I_c = 35 \Rightarrow I_c = 58.33 \)
\( I_c = 58.33 \) so \( 0.4I_c/p_s = 40 \Rightarrow S_c = 40 \Rightarrow S_F = 60 \)
So \( P_r = 1, P_s = 7/12, R_c = 35, S_c = 40 \) \( R_F = 35, S_F = 60 \)

4.d 4pt If the price of rice becomes 2 what happens to the price of shrimp and the final allocation?
\( P_R = 2 \) so \( 70 = 0.6 I_c/2 + 0.5 I_F/2 \) But \( I_F = 140 \Rightarrow 70 = 0.6 I_c/2 + 0.5 \times 140/2 \Rightarrow 35 = R_F = R_c \)
\( \Rightarrow 0.6 I_c/2 = 35 \)
\( I_c = 70/0.6 = 100p_s \Rightarrow p_s = 70/60 \Rightarrow 7/6 \)
Allocation is the same both prices double.
4. **Competitive 14 pts**

Consider a market where \( D(p) = A-2p \). Assume that each firm in this market has a cost function given by \( 100+q^2/4 \).

5.a **2pt** define a competitive equilibrium for this market (with one firm)

Competitive equilibrium is price equal to marginal cost

5.b **4 pt** If the firm is a price taker, what is the competitive equilibrium?

Marginal cost \( MC(q) = q/2 \)

\[ p^d = A/2 - q/2 \Rightarrow A/2 = Q \Rightarrow P = A/4 \]

5.c **4pt** What happens to equilibrium quantity and prices when there are 2 firms that both take prices as given.

Quantity supplied is twice what a single firm supplies so

Quantity supplied by one firm is \( q_1 = 2p \) (if \( mc(q) = q/2 \)) so quantity supplied by 2 firms is 4p

\[ 4p = q = A/2 - 2p \Rightarrow p = A/6 \Rightarrow q = A/3 \Rightarrow Q = 2A/3 \]

5.d **4pt** Give a formula for the supply curve if all firms have the same cost function and the equilibrium is perfect competition. Be sure to define what conditions are required for perfect competition to hold.

If the equilibrium is perfect competition \( AC = MC \) and \( AC \) min

\[ AC = 100/q + q/4 \text{ min } AC \Rightarrow -100/q^2 + 1/4 = 0 \Rightarrow q^2 = 400 \Rightarrow q = 20 \]

Or

\[ AC = 100/q + q/4 = q/2 \Rightarrow 100/q = q/4 \Rightarrow q^2 = 400 \Rightarrow q = 20 \Rightarrow MC = AC = 10 \]