McPeak
PAI 723
Exam 2 Fall 2014

Name: _Key_

All numbered questions are worth 2 points each, sub questions worth an equal share of these 2 points.

1) Complete the following table.

Output	Fixed Cost	Total Cost	Variable Cost	Marginal Cost	Average Cost	Average Variable Cost
0	10	10	0	NA	NA	NA
1	10	25	15	15	25	15
2	10	39	29	14	19.5	14.5
3	10	54	44	15	18	14.7
4	10	71	61	17	17.8	15.3
5	10	90	80	19	18	16
6	10	114	104	24	19	17.3
7	10	144	134	30	20.6	20.4
8	10	182	172	38	22.8	21.5

a) Is this a short run or long run information on cost? Why?

This is short run information on costs. Fixed cost is greater than zero which indicates we are in the short run.

b) If the price of the good produced is currently 17, what level of output meets the profit maximizing condition?

$P = 17 = mc(q)$ when $q = 4$. at $q = 4$, $P = 17 > AVC$
$= 15.3$

~ or ~

$mc = P = 17$ at $q = 4$. $\pi(q=4) = 17 \cdot 4 - 71 = 68 - 71 = -3$

$\pi(q=0) = -10$

c) Draw a figure illustrating the average cost, the average variable cost, and the marginal cost curves based on the information in this table.
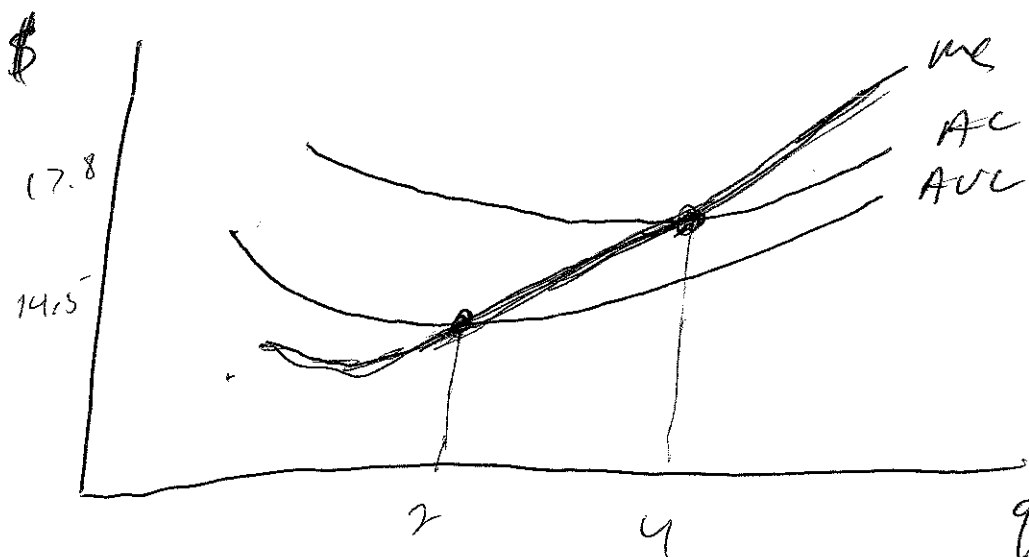
2) Production and cost functions. (2 points)

a. $Q=f(L, \overline{K})$ is the production function. Define the marginal product of labor and the average product of labor for this production function.

$$MP_L = \frac{\Delta Q}{\Delta L} \qquad AP_L = \frac{Q}{L}$$

b. Explain why this production function will exhibit diminishing marginal product as L increases.

Capital is being held fixed at $\overline{K}$, the fixed input leads to diminishy marginal product.

c. If the cost of the input of labor L is $5 per unit, calculate the cost of producing each level of output, and the marginal cost for changing the output level.

Input level L	Output level Q	Cost of producing Q	Change in Q	Change in cost	Marginal Cost
0	0	0	NA	NA	NA
1	10	5	10	5	5/10 = .5
2	22	10	12	5	5/12 = .42
3	33	15	11	5	5/11 = .45
4	43	20	10	5	5/10 = .5
5	52	25	9	5	5/9 = .6
6	60	30	8	5	5/8 = .63
7	67	35	7	5	5/7 = .71
8	73	40	6	5	5/6 = .83
9	78	45	5	5	5/5 = 1

3) Circle the correct answer.

Statement	The statement is (circle the correct answer)	
A Stackelberg oligopoly model has a quantity setting leader.	**True**	False
Producer surplus is calculated as the area below the price line and above the supply curve.	**True**	False
In a perfectly competitive market the firm is a price taker.	**True**	False
If where price = MC(q), price is less than average fixed cost, the firm should shut down and produce q=0 in the short run.	True	**False**
Marginal cost = cost of the input / marginal product.	**True**	False
The monopolist will supply a greater quantity than would be the case in a perfectly competitive market all else held constant.	True	**False**
According to the last dollar rule, the marginal products of capital and labor should be equal.	True	**False**
The expansion path traces out input bundles that are defined as the minimum cost way of producing a given level of output.	**True**	False

4) You are given the following information on the relationship between inputs and production level at various points.

Points	Labor	Capital	Output
A	14	6	60
B	28	12	140
C	56	24	280
D	112	48	560
E	224	96	1000

a. Illustrate these points using isoquants.
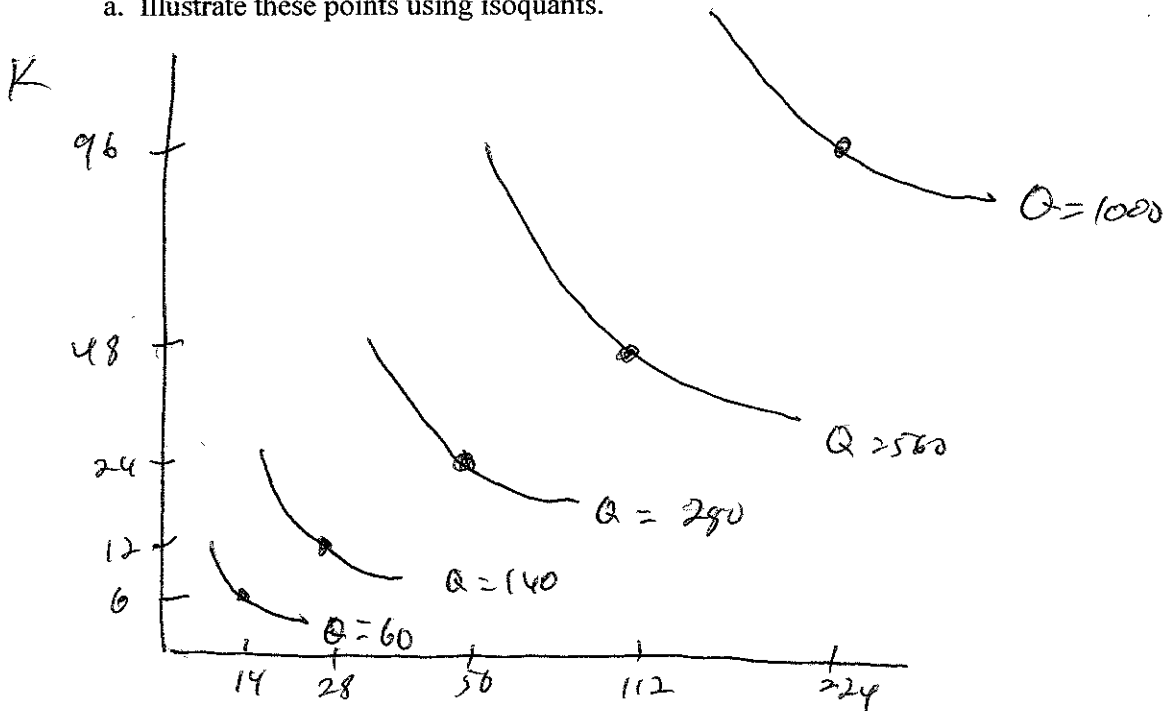
b. Contrast the returns to scale implied by movement between the points. (circle the correct answer)

From A to B I have (increasing, constant, decreasing) returns to scale.
From B to C I have (increasing, constant, decreasing) returns to scale.
From C to D I have (increasing, constant, decreasing) returns to scale.
From D to E I have (increasing, constant, decreasing) returns to scale.

5) You know that the demand curve is defined by the following function: P=100-5*Q.

    a. Use the bisection rule to define the marginal revenue curve

$$MR = 100 - 10Q$$

    b. If total cost is defined by 10*Q, then you know MC is 10 for all possible levels of Q. What is the value of Average Cost? Explain.

$$AC = \frac{TC}{Q} \quad \text{if} \quad TC = 10 \cdot Q, \quad AC = \frac{10 \cdot Q}{Q} = 10$$

    c. At what Q do marginal cost and marginal revenue cross?

$$100 - 10Q = 10 \qquad 90 = 10Q \qquad Q = 9$$

    d. What is the selling price for a monopolist?

$$P = 100 - 5(9) = 100 - 45 = 55$$

    e. Why is the firm not better off setting Q=0 and shutting down rather than producing at the Q you noted in (c)? Explain your reasoning briefly

$$P = 55 > AC = 10$$

$$\_\text{or}$$

$$\Pi(q = 9) = 9 \cdot 55 - 9 \cdot 10 = 405$$

$$\Pi(q = 0) = 0$$

6) Continue with the demand curve from (5) and the MC=10 supply curve. Assume the market for this commodity was to become a perfectly competitive market for some reason.

    a. What are the market price and amount of quantity in the market if all firms in the competitive market had identical cost structures to the monopoly firm (MC=10) and the demand curve was unchanged?

$$100 - 5Q = 10 \qquad 90 = 5Q \qquad Q = 18$$

$$P = 100 - 5(18) = \quad 100 - 90 = 10$$

$$(10, \; 18)$$

    b. Show the competitive case in comparison to the monopoly case on a single graph.
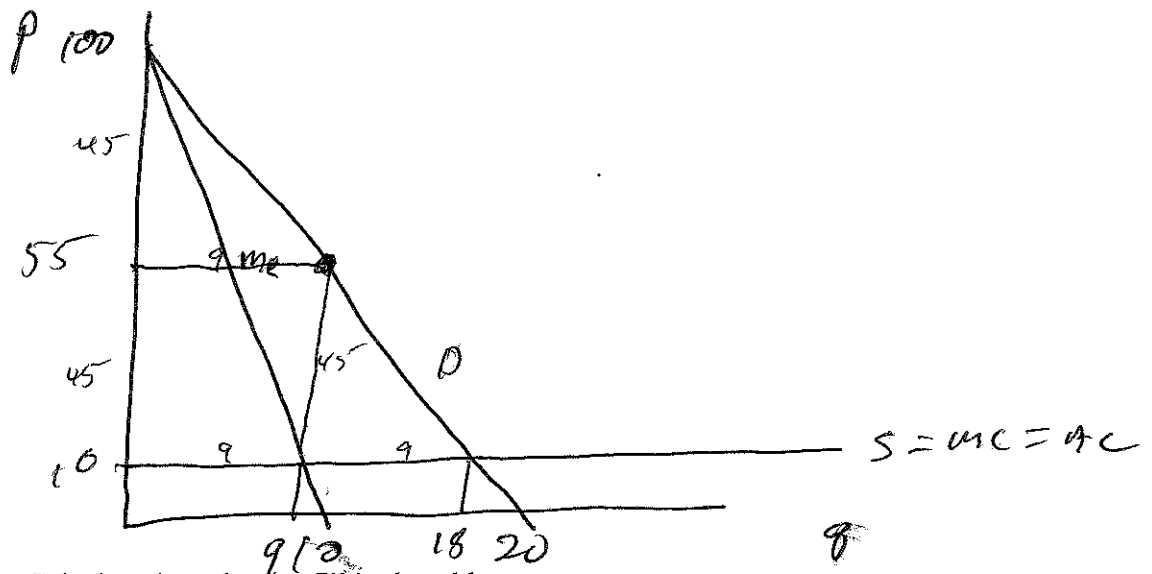

    c. Calculate the values to fill in the table.

|	Monopoly	Perfect Competition
Consumer Surplus	$\frac{1}{2}(100 - 55)9 = 202.5$	810
Producer Surplus	$45 \times 9 = 405$	0
Deadweight Loss	$\frac{1}{2} \cdot 45 \cdot 9 = 202.5$	0
Total Social Welfare	607.5	810

7) Production.

a) Q=f(L, $\overline{K}$) is the production function with L as labor and K as a fixed level of capital. Draw this production function from the side view and illustrate areas that are: technologically infeasible, technologically efficient, and technologically inefficient.

$Q = f(\overline{K}, L)$ technologically infeasible   tech eff $Q = f(\overline{K}, L)$

(tech. efficient)

technologically inefficient

L
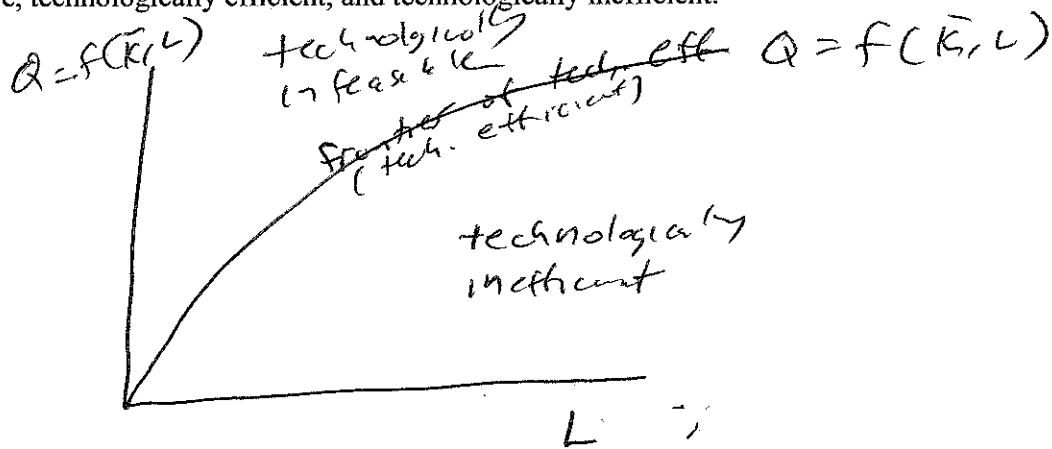
b) Q=f(L,K) is the production function with both labor and capital variable. Draw an isoquant for the quantity Q_1 and illustrate areas that are: technologically infeasible for producing Q_1, technologically efficient for producing Q_1, and technologically inefficient for producing Q_1.

K

technologically inefficient for producing Q_1

technologically infeasible for Q_1

Q_1

L
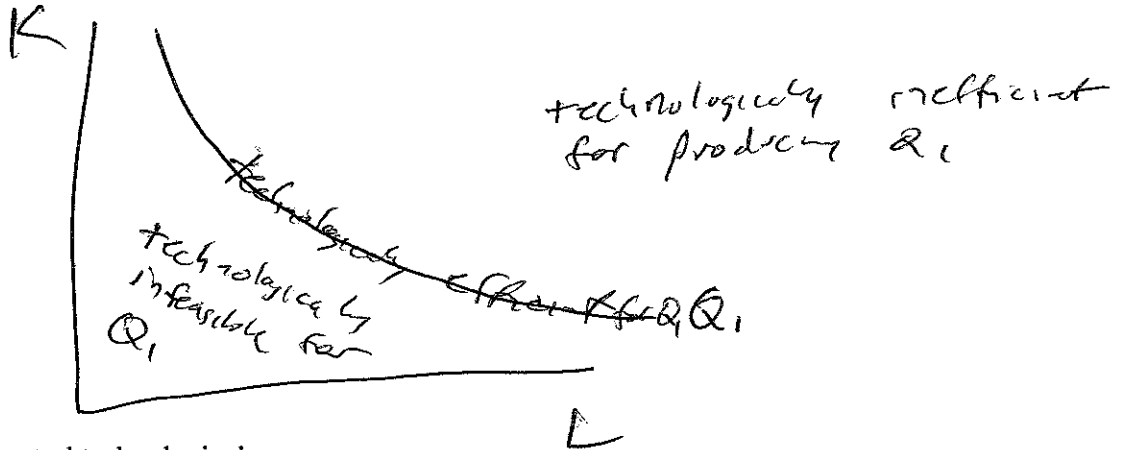
c) Describe neutral technological progress.

Technological innovation that increases Q for a given level of inputs K and L in such a way that MP_L and MP_K are increased by the same proportion (MRTS is unchanged).

8) Assume the rental rate of capital is 2 and the wage rate is 3.
   a. Draw an isocost curve for a total cost level of 120.

$$K \overset{60}{}$$

$$c = 120$$

$$40$$

$$L$$
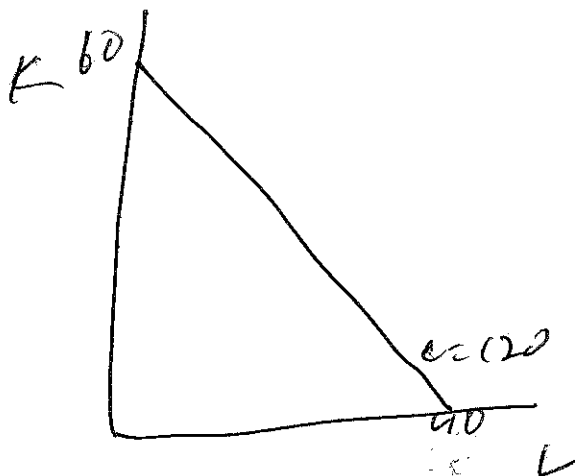
b. If the marginal product of labor is 6, what is the marginal product of capital at an economically efficient point? Why?

$$\frac{MP_L}{w} = \frac{MP_{K}}{r} \quad , \quad \frac{6}{3} = \frac{MP_{K}}{2} \Rightarrow MP_K = 4$$

c. What are two formulas for the slope of the isocost you drew in part a?

$$\text{Slope of the isocost} = \frac{\Delta K}{\Delta L} \, , \, -\frac{w}{r}$$

9) Circle the correct answer

Condition A	Condition B	What type of condition is B for establishing A?
MC is above AVC at q	AVC is upward sloping at q	N, NS S, NN **(N,S)**
Price taking behavior by buyers and sellers	The market is perfectly competitive	N, NS **(S, NN)** N,S
The market is perfectly competitive	Price taking behavior by buyers and sellers	**(N, NS)** S, NN N,S
The quantity q' is produced in an economically efficient way	Profit is maximized at quantity q'	N, NS **(S, NN)** N,S
A quantity is the profit maximizing quantity	The quantity is produced in a technologically efficient way.	**(N, NS)** S, NN N,S
The last dollar rule is satisfied at a bundle	MRS=MRT at a bundle	N, NS S, NN **(N,S)**
Output doubles when inputs double	The firm is experiencing constant returns to scale	N, NS S, NN **(N,S)**
The point defined by the input bundle (K,L) satisfies w*L+r*K=C	The point defined by the input bundle (K,L) lies on the expansion path	N, NS **(S, NN)** N,S

N,NS : Necessary, not sufficient

S, NN: Sufficient, not necessary

N, S: Necessary and sufficient.

10) Complete the following table.

Quantity of Output	Total Cost	Average Cost	Marginal Cost
0	0	------------	----------
1	3	3	3
2	7	3.5	4
3	12	4	5
4	18	4.5	6
5	26	5.2	8
6	36 36	6	10
7	50	7.1	14
8	66	8.3	16

b. If the market price for the output produced is 10 and the market structure is perfectly competitive, what level of output is the profit maximizing level of output? Why?

$$P = 10 = MC(q) \text{ where } q = 6. \qquad P > AC (q=6) = 6.$$

$$-or-$$

$$P = MC(q) = 10 \text{ when } q = 6$$

$$\pi(q=6) = 6 \cdot 10 - 36 = 60 - 36 = 24$$

$$\pi(q=0) = 0$$

c. Explain the concept of producer surplus based on your answer above.

If I look at the MC curve, P=10 is above the mc curve up to q=6. The first unit costs me 3 to make, I get 10 for it. The second unit costs me 4 to make, I get 10 for it. Add the difference up between P and MC for each unit produced when P ≥ MC and you get Producer surplus (profit in this LR setting)