UBC
Commerce/ FRE 295
MIDTERM EXAM ANSWERS
October 26, 2009

NAME:_____

STUDENT NUMBER _____

SECTION: _____

PROFESSOR'S NAME: _____

Instructions: This exam will be marked out of 100. You will have **1 hr. and 45 minutes** to do the exam. There are two parts to this exam. The first part is true-false questions. Answer all of these questions. Part II consists of longer questions. **You must choose 4 out of 5 of the longer questions in Part II**.

This midterm has 16 pages. Check now to make sure you have all pages and make sure your name, section, and student number are provided above.

This is a closed-book exam. You may not use books or notes. You may use a non-graphing, non-programmable calculator.

GRADES

True/False _____ / 40

Long Answers:

1. _____ / 15 (answer 4 out of 5)
2. _____ / 15
3. _____ / 15
4. _____ / 15
5. _____ / 15

TOTAL _____/100

PART I

TRUE-FALSE QUESTIONS

Mark <u>each question</u> as true or false, by putting an "X" in the appropriate box.
There is one mark for each true-false question.

1. In a perfectly competitive market for gasoline, determine which of the following statements are true and which are false.

True	False	
■	□	Assuming the supply of gasoline slopes upward, an increase in the price of electricity-based public transportation is likely to cause the price of gasoline to rise.
□	■	If the demand for gasoline were linear, technological progress in gasoline production that shifts the market supply curve to the right is very likely to lead to higher industry-wide revenues.
□	■	If gasoline is a normal good it follows that the supply curve would tend to shift in (left) during a recession.
■	□	Suppose demand is linear and downward sloping and supply is perfectly elastic (flat). If demand were to make a parallel shift to the right, then demand would be less elastic at the new equilibrium point than at the old equilibrium point.

2. The company BC Bread has the production function q=KL, where K represents equipment and L represents labour (employees). The price of labour is $w and the rental rate on equipment is $ r.

True	False	
□	■	BC Bread's production function has constant returns to scale.
□	■	BC Bread's production exhibits a diminishing marginal product of labour.
□	■	If the firm lays off workers it will increase the average product of labour.
□	■	BC Bread has a U-shaped long run average cost curve.

3. Determine if the following statements about government intervention in a competitive market are true or false.

True False

■ □ If demand is perfectly elastic and the government imposes a per-unit tax, the price consumers pay will not be affected.

□ ■ Consumers will tend to bear more of the incidence of a per unit tax (i.e. pass-through of the tax to consumers will be greater) if the good being taxed has close substitutes that are untaxed.

■ □ Government subsidies can cause over-production relative to the level of output that maximises total surplus.

■ □ An effective price ceiling increases consumer surplus for those who are able to purchase the good without additional search or waiting costs.

4. Determine whether the following statements about pricing with monopoly power are true or false.

True False

□ ■ If a monopoly firm switches from standard monopoly pricing (MR = MC with a single or "uniform" price) to perfect price discrimination, the gain in the monopolist's producer surplus equals the loss in consumer surplus.

■ □ If a monopoly firm facing many consumers with different demand functions can charge different entrance fees to each of them as a part of its two-part tariff scheme, then it would maximize its profits by charging the same usage fee P = MC to all of them.

■ □ If a monopoly firm faces two groups of consumers with very different demand functions, then the firm might maximize profits by selling only to the group with the higher demand.

□ ■ A monopoly firm that uses quantity discounts would reduce its profit because, in effect, it offers lower prices than necessary to high volume customers.

5. Determine if the following statements about monopoly are true or false.

True False

□ ■ A monopolist facing a downward sloping linear demand curve maximizes its profits by producing on the inelastic portion of the demand curve.

■ □ If a monopoly firm has the cost function given by C(Q) = 200 + 4Q, then it must be a natural monopoly.

■ □ If a profit-maximizing monopoly produces where the elasticity of demand is -1, then marginal cost must be zero at that point.

□ ■ If a monopoly's profit-maximizing price is $3 and the price elasticity of demand E_d at this level is -3, then the marginal cost of production at that level of production must also be equal to $3.

6. George is trying to pick a cell phone plan. He is concerned about two attributes: voice minutes and text messages. George has smooth, standard-shaped, convex downward sloping indifference curves over these two attributes and will consume positive amounts of both attributes.

True False

■ □ If the price of text messages decreases, George will necessarily be better off.

□ ■ If George's utility from plan A is 10 and from plan B is 20, George would necessarily be willing to pay twice as much for plan B as for plan A.

■ □ The greater the number of text messages George has, the more text messages he could give up to get an additional voice minute and maintain the same utility.

□ ■ Doubling the price of text messages and voice minutes will have no effect on George's budget constraint.

7. Green Acres produces corn in a perfectly competitive industry with an upward sloping marginal cost of production and positive fixed costs. The corn industry consists of a large number of farms which have the same cost structure as Green Acres.

True False

■ □ In the long run competitive equilibrium, the price of corn is equal to both the marginal cost of production and the average total cost of production for Green Acres.

□ ■ If new farmers start entering the industry because short run industry profits are positive, then Green Acres will increase its production in order to maintain its market share.

■ □ If the market demand for corn shifts up and to the right, then in the short run (before entry by new farmers), the average total cost of production for Green Acres will increase.

□ ■ Suppose the corn industry is currently in a long run competitive equilibrium. If all farmers are now required to pay an additional $10 tax per unit of production, then Green Acres will produce more corn as the industry adjusts to a new long run competitive equilibrium.

8. Which of the following statements about the organization of the firm are correct?

True False

■ □ The separation of ownership and control in large modern corporations often leads to agency problems.

□ ■ Corporations that go bankrupt earn insufficient profit and are therefore part of the non-profit sector.

■ □ If managerial compensation is structured as an increasing function of the firm's revenue we might expect the firm's output to exceed the profit-maximizing level.

□ ■ Profit maximization requires MR = MC except under perfect competition where the rule P = MC applies instead.

9. Joanne prefers consumption bundle A to consumption bundle B and she prefers consumption bundle B to consumption bundle C.

True False

■ □ By transitivity Joanne must prefer A to C.

□ ■ By non-satiation (more is preferred to less) Joanne must prefer A to C.

□ ■ Bundle A must be more expensive than Bundle C.

□ ■ Bundle A cannot include any pair of goods that are perfect complements.

10. Potter Enterprises produces magic wands and wizard's robes. Wands and robes are produced by magical methods so the cost of production is zero. There are three potential customers. Their willingness to pay for robes and wands is shown by the following table. (Each customer would buy at most one robe and one wand.)

	Robes	Wands
Consumer A	70	20
Consumer B	50	40
Consumer C	30	90

True False

■ □ Potter Enterprises can earn higher profit by selling robes and wands as bundles rather than by stand-alone monopoly pricing.

□ ■ Bundling generates higher profit than first degree price discrimination would in this case.

■ □ This example illustrates negatively correlated willingness to pay for robes and wands by these three customers.

■ □ The maximum profit that can be earned under bundling exceeds 250.

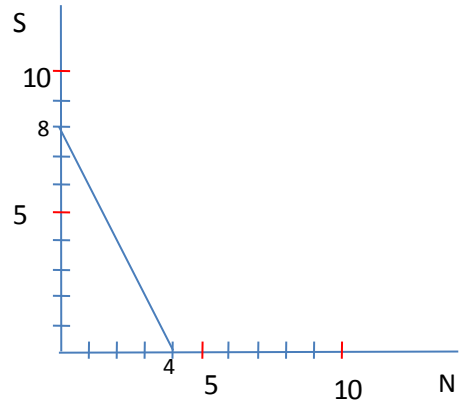
Part II
LONGER ANSWER QUESTIONS

Answer only 4 of these 5 questions. Please show your working and answer the question within the space provided.

Question 1

Jenny is at a hockey game, trying to decide how many nachos (N) and sodas (S) she should purchase.

a) Jenny has an available budget of $16, the price of a basket of nachos (P_N) is $4, the price of soda ($P_S$) is $2. On a graph with nachos on the horizontal axis and soda on the vertical axis draw the budget line. What is the algebraic form of this budget line? **(5 pts)**



To derive this budget line we note that $P_N N + P_S S = 16$. Rearranging yields $S = 16/P_S - (P_N/P_S)N$ or $S = 8 - 2N$.

The budget line can be expressed as $16 = 4N + 2S$ or $8 = 2N + S$ or $S = 8 - 2N$. Any of these forms is okay for 2 pts.

b) Jenny's marginal utility of a can of soda is 1/S and her marginal utility of a basket of nachos is 1/N. If she currently has 2 baskets of nachos and 4 sodas, what is her marginal rate of substitution (MRS). Interpret the MRS in words. **(5 pts)**

With S on the vertical axis, $MRS = -MU_N/MR_S = -(1/N)/(1/S) = -S/N$. With N=2 and S=4, her MRS is -2, meaning she would be willing to give up two sodas to get an additional basket of nachos.

c) Given the prices, Jenny's budget, and her preferences, how many sodas and nachos will she purchase? **(5 pts)**

Setting MRS=MRT yields: $-S/N = -4/2 \Rightarrow N=S/2$.
Substituting this back into the budget constraint, $S = 8 - 2(S/2)$
$\Rightarrow S = 4$ and $N = S/2 = 2$ baskets.

Question 2:

We Make Bikes Inc. (WMB) has the following production function for bicycles: $q=K^{0.5}L^{0.5}$, where q stands for the number of bicycles produced in one day, K is the amount of machine hours and L is the amount of labour hours. Input prices (the rental rate on machine time and the wage rate) are fixed.

a. Find algebraic expressions for the marginal product of labour (MP_L) and for the average product of labour (AP_L). Now, assume that WMB hires machines for 4 hours a day. Does the production function exhibit diminishing marginal returns to labour? **(6 pts)**

$MP_L(K,L)=dq/dL=0.5K^{0.5}/L^{0.5}$, $APL(K,L)=q/L=K^{0.5}/L^{0.5}$
$MPL(4,L)=dq/dL=0.5(40.5)/L0.5 =1/L0.5$, $dMPL/dL= - 0.25/L^{1.5}<0$. This implies that the marginal product of labour falls as labour rises, or that the production function exhibits decreasing marginal returns to labour.

b. Show that the production function exhibits constant returns to scale. **(5 pts)**

A production function has constant returns to scale if increasing inputs by some percentage causes output to increase by the same percentage. For example, doubling inputs would double output. In this case we can substitute 2K and 2L instead of L and K into the production function to get:

$q(2K, 2L)=(2K)^{0.5}(2L)^{0.5}=(2)^{0.5+0.5}(K)^{0.5}(L)^{0.5}=2K^{0.5}L^{0.5}$, which equals 2q. Thus doubling the inputs generates twice as much output, which implies constant returns to scale.

c. Explain what constant returns to scale implies about the relationship between long run marginal (MC) and long run average cost (AC), given that input prices are fixed. **(4 pts)**

With constant returns to scale and fixed input prices the AC is flat (or remains constant), which implies that AC=MC for every quantity produced.

Question 3

Suppose a number of identical firms produce handmade bicycle frames in a perfectly competitive market. Total long run monthly costs for a typical firm are given by $C(q) = 20q^2 + 10q + 2000$, where q = number of frames produced/month. Market demand for the frames is given by Q = 2,000 - 3P, where Q = quantity demanded/month and P = market price.

(a) Derive algebraic expressions for the firm's long run average cost and long run marginal cost. **(4 pts)**

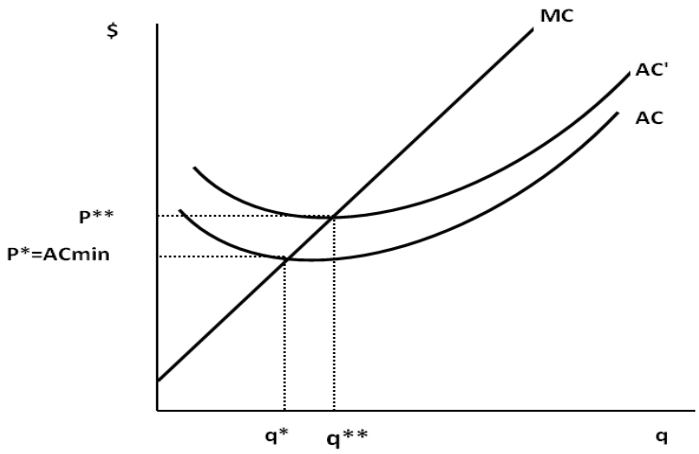
MC = dC/dq = 40q + 10.
AC = C/q = 20q + 10 + 2000/q.

(b) In the long run competitive equilibrium price must equal average cost. How many frames will each firm produce and what price will it charge? **(5 pts)**

Profit maximization implies that P = MC. Also P = AC in the long run.
It follows that MC = AC.
Therefore, $40q + 10 = 20q + 10 + 2000/q$
$\Rightarrow \quad q^* = 10.$
Long run equilibrium $P^* = MC(q^*) = 40*10+10 = \$410$

(c) Now suppose that market demand for the handmade frames shifts to the right (due to their increased popularity), and as a result the existing firms start making profits in the short run. This short-run profitability attracts new (but identical to existing ones) firms into the market that are identical to the earlier firms. This puts an upward pressure on the rents the firms are paying for their offices. Draw a diagram showing Marginal Cost and Average (Total) Cost Curves for a typical firm. Illustrate how this increase in fixed cost (due to higher rents) would affect the long-run equilibrium price and quantity each firm produces. No numerical calculation is necessary. The diagram does not need to be to scale but show the relationships among the curves. **(6 pts)**

The increase in FC would shift AC curve upwards (but not MC curve). As a result both long-run equilibrium price and quantity each firm produces increase.



Question 4

Answer the following questions about monopolies and pricing strategies with market power.
(a) The demand for a monopolist's product is given by $Q^D = 100 - 2P$. The monopolist's cost function is given by $C(Q) = 10Q + 0.5Q^2$. Demonstrate algebraically that the profit maximizing price, P^*, exceeds marginal cost. **(5 pts)**

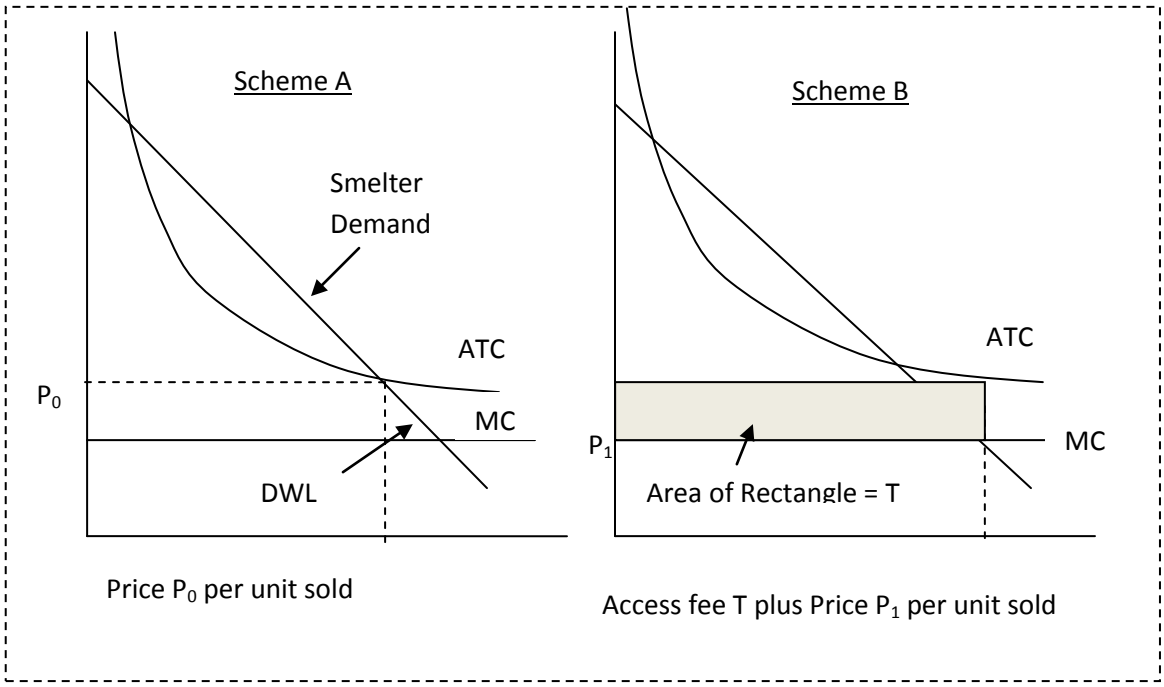
Invert the demand schedule to obtain P = 50 - 0.5Q. The marginal revenue schedule is the same as demand except it has double the slope: MR = 50 – Q. Marginal cost is found

by differentiating the cost function with respect to Q: MC = 10 + Q. Maximizing profits requires MR = MC ➔ 50 – Q = 10 + Q. Solve this equation to get $Q^* = 20$. Substitute $Q^* = 20$ into the inverse demand schedule to obtain $P^* = 50 - 0.5(20) = 40$. With $Q^* = 20$ we have $MC^* = 50 – 20 = 30$. Therefore, $P^* > MC$.

(b) What is the point elasticity of demand at the profit maximizing price and quantity? Explain why demand must be elastic at the profit maximum. **(5 pts)**.

$E = (dQ/dP)(P/Q) = -2(40)/20 = -4$.
If demand is inelastic the firm can increase revenue and lower cost by raising price and therefore would increase profit. Thus demand cannot be inelastic at the solution. Demand cannot have elasticity of -1 because the firm could raise profit by raising price, keeping revenue constant and lowering costs. Therefore, only if demand is elastic can the firm be maximizing profit.

(c) Your job as a public regulator is to ensure that a monopoly supplier of electricity to a large copper smelter earns zero economic profit. You have two options: (A) require the monopolist to charge the smelter P_0 per unit of electricity sold; and (B) require the monopolist to charge the smelter a fixed access fee T (which is independent of electricity consumption) plus P_1 per unit of electricity sold. Label the left-hand graph below with P_0 to illustrate zero profits for the monopolist. Label the right hand graph below with P_1 and T to illustrate zero profits for the monopolist. Explain whether A or B is the most efficient pricing scheme for society. (5 pts)



Scheme B results in a more efficient scheme for society because there is no deadweight loss (DWL). However Scheme A causes DWL as P > MC in this case.

Question 5

Suppose that Evier and Perrian produce a particular type of mineral water. They are the only firms with access to the necessary mineral springs so no other firms are in the market. Output is measured in cases (12 bottles per case) and is homogeneous. The marginal cost of production is the same for both firms and is constant at $10 per case. Demand for cases is given by (inverse) demand curve $P = 100 - Q$ where $Q = Q_E + Q_P$. (Subscript E and P stand for Evier and Perrian respectively.)
a) In the context of the Cournot oligopoly model, show that the best-response curve for Evier is given by $Q_E = 45 - Q_P/2$. **(5 pts)**

For Evier: $R = PQ_E = (100 - (Q_E + Q_P))Q_E = 100Q_E - Q_E^2 - Q_EQ_P$.
$MR = dR/dQ_E = 100 - 2Q_E - Q_P$. $MC = 10$.
To maximize profit Evier should set $MR = MC$, yielding $100 - 2Q_E - Q_P = 10$.
We can rearrange this equation to obtain $Q_E = (100 - 10)/2 - Q_P/2$ or
$Q_E = 45 - Q_P/2$. This equation shows the profit maximizing or "best" output for Evier for any output level chosen by Perrian.

b) Calculate the Cournot equilibrium quantity and price. **(6 pts)**

The best response curve for Perrian is derived in the same way and can be written as $Q_P = 45 - Q_E/2$. This can be rewritten as $Q_E = 90 - 2Q_P$. The two best response curves are two linear equations in two unknowns that can be solved: $Q_E = 90 - 2Q_P = 45 - Q_P/2$. It follows that $3Q_P/2 = 45$ or $Q_P = 30$. Q_E also equals 30 so $Q = 60$. Price is given by $100 - Q = 40$.

c) Provide a diagram showing the best response functions and the Cournot equilibrium solution. Put Q_E on the vertical axis and Q_P on the horizontal axis. The diagram does not need to be to scale but determine the intercepts. No explanation is necessary. (4 pts)