# FINAL EXAM  VERSION B

**INSTRUCTIONS:**  This exam is closed-book, closed-notes.  Simple calculators are permitted, but graphing calculators or calculators with alphabetical keyboards are NOT permitted.  Mobile phones or other wireless devices are NOT permitted.  Points will be subtracted for illegible writing or incorrect rounding.  Point values for each question are noted in brackets.  Maximum total points are 200.

**I.  Multiple choice:**  Circle the one best answer to each question.  [1 pts each:  23 pts total]

(1) In *short-run* competitive equilibrium,
a.   price equals marginal cost.
b.   price equals average cost.
c.   average cost equals marginal cost.
d.   all of the above.

(2) Suppose consumers now buy 10 million gallons of ice cream at a price of $5 per gallon.  If the price of ice cream falls to $3 per gallon, and nothing else affecting demand changes, the increase in consumer surplus is
a.   exactly $20 million.
b.   less than $20 million.
c.   more than $20 million.
d.   Cannot be determined from information given.

(3) The "Structure-Conduct-Performance" paradigm is simplistic because it assumes that
a.   structure does not depend on conduct.
b.   conduct does not depend on structure.
c.   performance does not depend on structure.
d.   performance does not depend on conduct.

(4) In the United States, "every contract, combination ... or conspiracy, in restraint of trade" is illegal under the
a.   Sherman Act Section 1.
b.   Sherman Act Section 2.
c.   Clayton Act.
d.   Federal Trade Commission Act.

(5) Under U.S. law, price-fixing is illegal
a.   if significant deadweight loss can be shown.
b.   if price is raised significantly above marginal cost.
c.   *per se*, except in industries Congress has exempted.
d.   if total market quantity is reduced significantly below the competitive quantity.

(6) In private antitrust suits against price-fixing, injured parties can collect damages
a.   multiplied by two.
b.   multiplied by three.
c.   multiplied by five.
d.   multiplied by ten.

(7) Which hypothesis claims that higher industry concentration *not* associated with a loss of social welfare?
a.   collusion hypothesis.
b.   differential efficiency hypothesis.
c.   Both of the above.
d.   None of the above.

(8) One model says that an incumbent firm can deter entry by a second firm if it threatens to cut prices and to force both firms to make a loss.  This model has been criticized because
a.   cutting prices would actually increase profit.
b.   the incumbent firm's threat is not credible.
c.   the entrant firm will incur sunk costs and stay in the market regardless of the price.
d.   cutting prices would increase total quantity demanded, which would only encourage the entrant.

(9) Suppose a bicycle manufacturer merged with a bicycle tire maker.  This would be an example of a
a.   horizontal merger.
b.   vertical merger.
c.   conglomerate merger for product extension.
d.   conglomerate merger for market extension.
e.   pure conglomerate merger.

(10) According to the DOJ-FTC *Non-Horizontal Merger Guidelines*, a conglomerate merger for market extension or product extension may be challenged if the acquired firm's market is highly concentrated and the merger
a.  increases concentration further.
b.  eliminates potential competition.
c.  raises the probability of collusion across firms.
d.  raises costs of the acquired firm.
e.  any of the above.

(11) The view that vertical mergers may be a problem, because less-simple models, analyzed using game theory, show that they can sometimes both be profitable and decrease welfare, is called the
a.  Traditional or Harvard School view.
b.  Chicago School view.
c.  Post-Chicago view.
d.  Supply-side view.

(12) Which practice did the courts hold to be *per se* illegal from the *Dr. Miles* case in 1911 until *Leegin v. PSKS Inc.* in 2007?
a.  territorial restraints.
b.  exclusive dealing.
c.  vertical mergers.
d.  resale price maintenance.

(13) According to the Areeda-Turner (1975) rule, a firm should be presumed to be engaging in predatory pricing if its price is less than its
a.  average total cost.
b.  marginal cost
c.  average variable cost.
d.  average fixed cost.

(14) According to the "essential facilities" doctrine, a company is guilty of monopolization if one can show all of the following, *except*
a.  denial of use of facility to the competitor.
b.  control of the facility by a monopolist.
c.  a difference in price between the monopolist and the competitor.
d.  the competitor's inability to duplicate the facility.
e.  the feasibility of providing the facility to the competitor.

(15) The principle that the government may regulate any industry "affected with a public interest" was established by the Supreme Court in the case of
a.  Nebbia v. New York.
b.  Smyth v. Ames.
c.  Munn v. Illinois.
d.  Standard Oil v. United States.

(16) Suppose regulators must choose between regulatory outcomes A and B.  If they choose A, one million people will gain $1 each.  If they choose B, one hundred people will gain $10,000 each.  According to economic theories of regulation, free-rider problems in political organization lead to the prediction that
a.  regulators will choose outcome A.
b.  regulators will choose outcome B.
c.  either outcome is equally likely because the total gains are equal.
d.  Cannot be determined from information given.

(17) The *rate base* for a regulated public utility is
a.  the monthly service fee for its lowest-price customers.
b.  the number of customers it serves.
c.  the minimum usage price it may charge.
d.  the value of its plant and equipment.

(18) Assume that in some wholesale electricity market, all producers get paid the same equilibrium price, and that no firm has the ability to manipulate the final price.  Then each firm's optimal bid is
a.  greater than its true marginal cost.
b.  less than its true marginal cost.
c.  equal to its true marginal cost.
d.  zero.

(19) The 1982 consent decree (or "Modification of Final Judgment") in the case of U.S. v. AT&T allowed the seven regional companies to
a.  sell telephone equipment.
b.  offer local phone service.
c.  offer long-distance service.
d.  All of the above.

(20) Regulation prevented *exit* from unprofitable markets in
a.  railroads.
b.  trucking.
c.  both industries.
d.  neither industry.

(21) Which industry became *less* profitable after deregulation?
a.  Railroads.
b.  Trucking.
c.  Both industries.
d.  Neither industry.

(22) Airline regulation of fares and entry had the indirect effect of increasing
a.   the total number of passengers flying.
b.   load factors.
c.   the quality of food and other amenities.
d.   the frequency of flights.

(23) After airline deregulation, fares *rose* for
a.   long-haul routes (more than 1000 miles).
b.   short-haul routes (less than 500 miles).
c.   all routes.
d.   no routes.

**II.  Problems:**  Insert your answer to each question below in the box provided.  Use the margins and graphs for scratch work—only the answers in the boxes will be graded.  Work carefully—partial credit is not normally given for questions in this section.
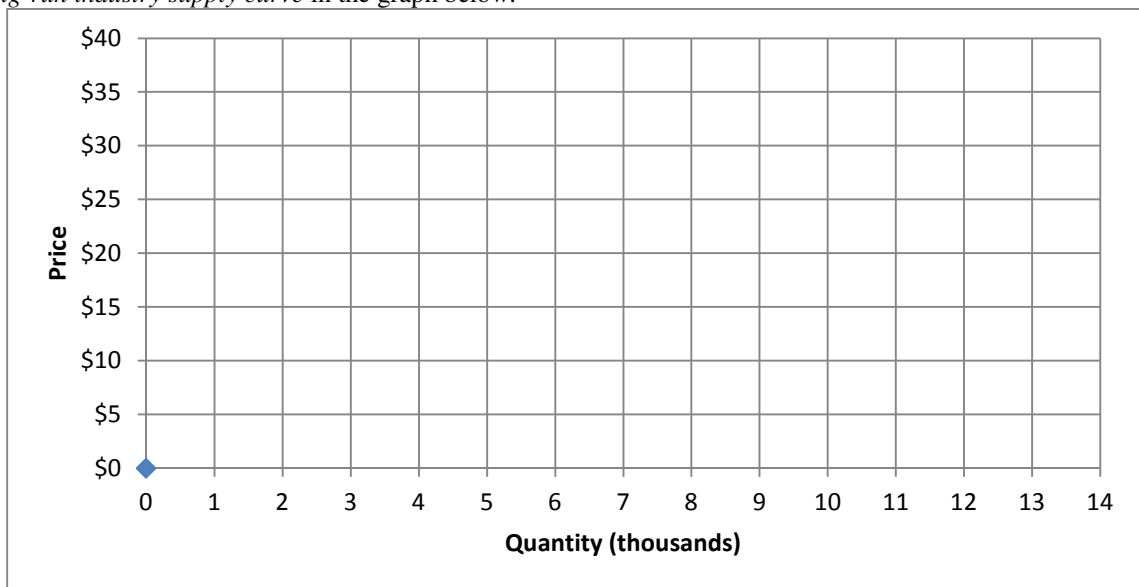
(1) [Long-run cost and supply: 8 pts]  Suppose a firm faces a (long-run) total cost function given by
$TC(q) = q^3 - 100 q^2 + 2520 q$ .  Find the following, showing your work and circling your final answers.

a. Find the firm's marginal cost function MC(q).

b. Find the firm's average cost function AC(q).

c. Compute the firm's breakeven price (that is, minimum average cost).

d. Suppose all firms in this industry have the same costs, and these costs are not affected by other firms in the same industry or by total industry output.  Further assume the industry enjoys free entry and exit.  Draw and label the *long-run industry supply curve* in the graph below.

(2) [Monopoly, profit maximization: 14 pts]  Suppose a monopolist has total cost function given by
$TC(Q) = Q + (Q^2/200)$.  This monopolist faces a demand curve given by  $P = 19 – (Q/100)$.  Circle your final
answers.

a. Find the monopolist's marginal cost function.
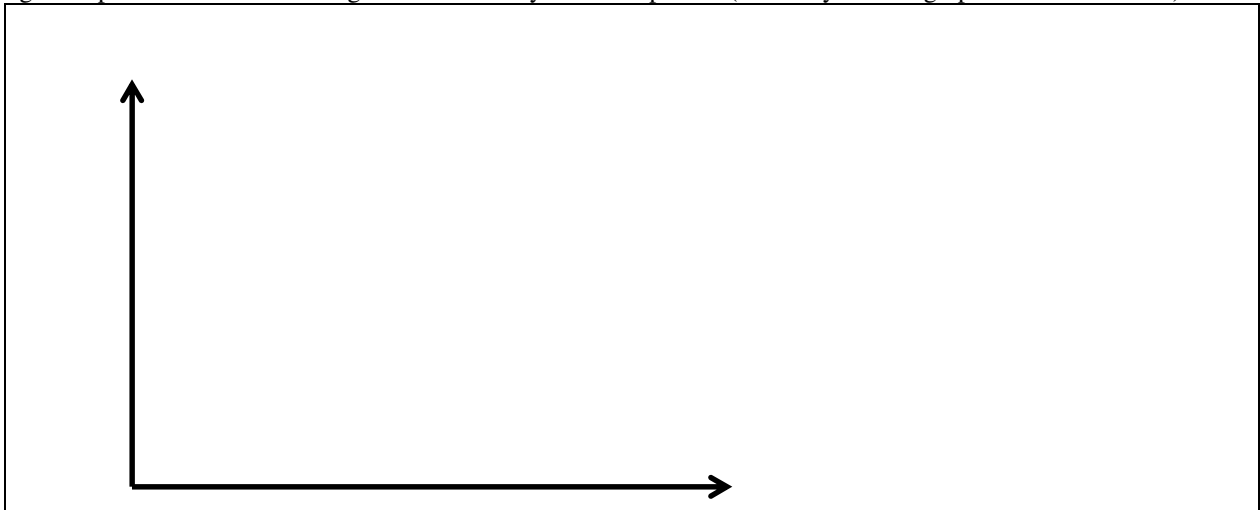
b. Find the monopolist's average cost function.

c. Find the monopolist's marginal revenue function.

d. Compute the monopolist's profit-maximizing level of output Q*.

e. Compute the monopolist's profit-maximizing price P*.

f. Compute the monopolist's profit.

g. Compute the social deadweight loss caused by the monopolist.  (You may use the graph for scratch work.)

(3) [Cournot duopoly: 6 pts]  Suppose the market for vitamins is served by only two firms.  Suppose the two behave as a *symmetric Cournot duopoly*, each firm setting its own quantity while taking the other firm's quantity as given. Let $q_1$ = firm #1's quantity and $q_2$ = firm #2's quantity, so that total market quantity $Q = q_1 + q_2$ .  The market demand curve is  $P = 20 - (Q/100)$.  Each firm has constant marginal and average cost equal to $2.  Circle your final answers.  Use the space at the bottom of the next page for scratch work.
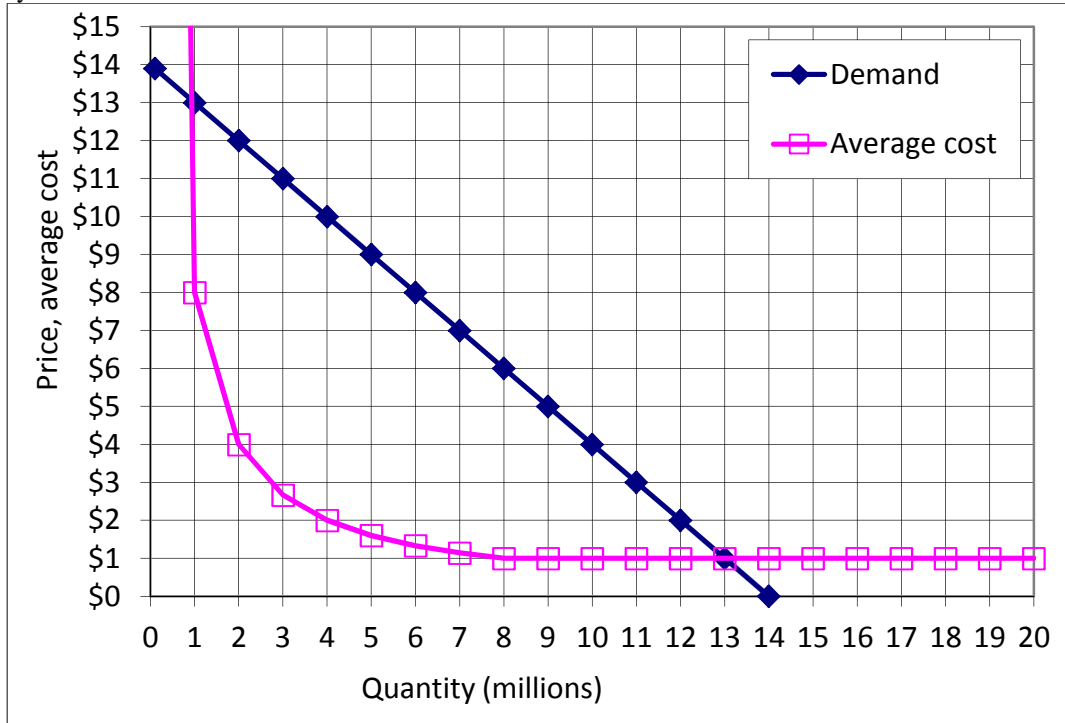
    a.   Find an expression for firm #1's reaction function (or best reply function), showing how much firm #1 will produce for any given level of quantity set by the other firm:  $q_1{}^* = f(q_2)$.  [Hint:  Set $MR_1 = MC$ and solve for $q_1$ as a function of $q_2$ .]

    b.   Compute total market quantity $Q^*$ and the equilibrium price $P^*$.

    c.   Compute the social deadweight loss from Cournot duopoly.

Price

Quantity

(4) [Entry barriers and contestable markets: 26 pts]  The graph below shows a market where the incumbent firm now produces ten million units of output and charges a price of $4.  The average cost curve applies both to the incumbent and to any other firm that tries to enter this market.



a. What is minimum average cost?

$

b. What is the minimum efficient scale?

million

c. Assume MC=AC and compute the incumbent's Lerner index (or "price-cost margin").  [Hint:  By definition, the Lerner index = (P-MC)/P.]

First, suppose a second firm enters the market and produces four million units of output.  Assume the *Bain-Sylos postulate*:  the incumbent firm keeps its output level fixed at ten million and lets the market price fall.

d. What is the new market price?

$

e. What is the entrant's average cost?

$

f. Does the entrant make a profit or a loss?

g. How much?

$           million

Alternatively, suppose a second firm enters the market and offers a price of $3.  Do not assume the Bain-Sylos postulate.  Instead assume the market is *contestable* and the incumbent firm keeps its price fixed at $4.

h. What is the entrant's quantity?

million

i. What is the entrant's average cost?

$

j. Does the entrant make a profit or a loss?

k. How much?

$           million

l. What price *should* the incumbent set to prevent entry?

$

m. Compute the incumbent's Lerner index (or "price-cost margin") assuming it sets price as in part (l).

(5) [HHI and merger guidelines: 12 pts]  Shares in U.S. beer market in 2012 were as follows.[1]

| | |
|---|---|
| Anheuser-Busch InBev | 39% |
| MillerCoors | 26% |
| Grupo Modelo (maker of Corona) | 7% |
| Heineken USA | 6% |
| Others | 22% |

    a. Compute the value of the Hirschman-Herfindahl index.  Assume
       that "Others" are too small to affect the HHI.
    b. Under the 2010 DOJ-FTC *Horizontal Merger Guidelines*, would
       this industry be classified as "unconcentrated," "moderately
       concentrated," or "highly concentrated"?

In 2012 Anheuser-Busch InBev proposed to buy Grupo Modelo.
    c. Compute the postmerger value of the Hirschman-Herfindahl
       index.
    d. Under the DOJ-FTC *Horizontal Merger Guidelines*, would this
       industry now be classified as "unconcentrated," "moderately
       concentrated," or "highly concentrated"?
    e. On the basis of these HHI calculations alone, would the
       government conclude that this merger
         (i) is "presumed to be likely to enhance market power," or
         (ii) "raises significant competitive concerns," or
         (iii) is "unlikely to have adverse competitive effects," according
       to the 2010 *Guidelines?*
    f. Why or why not?

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(6) [Vertical integration with fixed proportions: 26 pts]  Suppose an upstream monopoly firm produces a proprietary sauce that is used by a downstream industry to make pizzas.  The upstream firm has constant marginal cost (equal to average cost) of $MC_S = \$1$.  Each pizza requires exactly one unit of sauce and \$3 of other inputs in fixed proportion.  Therefore the downstream industry has constant marginal cost (equal to average cost) of \$3 plus the price of sauce, $P_S$, which set by the upstream monopolist.  The key assumptions are

| | | |
|---|---|---|
| Marginal and average cost of sauce: | $MC_S$ | $= AC_S = \$1.$ |
| Marginal and average cost of pizzas: | $MC_P$ | $= AC_P = \$3 + P_S$ |
| Demand for pizzas: | $P_P$ | $= 8 - (Q/500).$ |

a. [2 pts] Find the equation for the marginal revenue curve for pizzas.  [Hint:  If demand is linear, marginal revenue has the same vertical intercept, but twice the slope, as the demand curve.]

$MR_P =$

Now compare market outcomes under two scenarios:  (i) upstream market is monopolized and downstream market is competitive, and (ii) upstream and downstream are served by a vertically-integrated monopoly.

(i) First suppose the upstream market (sauce) is monopolized but the downstream market (pizzas) is perfectly competitive.

b. [2 pts] Find the equation for the derived demand curve for sauce.  [Hint:  Since the market for pizzas is perfectly competitive, you may assume that $MC_P = P_P$.]

$P_S =$

c. [2 pts] Find the equation for the marginal revenue curve for sauce.  [Hint:  For linear demand curves, marginal revenue has the same vertical intercept, but twice the slope, as the demand curve.]

$MR_S =$

Now compute the quantity of sauce (and thus pizzas) sold  Q,  the price of sauce  $P_S$,  the upstream sauce monopolist's profit, the price of pizzas  $P_P$,  and the downstream pizza firms' total profit.  Insert your answers in column (i) in the **Table of Results** on the next page.

[Problem continues on next page.]

(ii) Second, assume the upstream and downstream industries are served by a vertically-integrated monopoly.  The marginal cost of pizzas for the vertically-integrated monopoly is therefore  MC = $1 + $3.

Now compute the quantity of pizzas, the price of pizzas $P_P$, and the integrated monopolist's profit.  Insert your answers in column (ii) of the Table of Results below.

| Table of results<br>[18 pts] | (i) Upstream market monopolized, downstream market competitive | (ii) Vertically integrated monopoly |
|---|---|---|
| Q = quantity of sauce (and pizzas) | | |
| $P_S$ = price of sauce | $ | |
| Profit of upstream firm | $ | |
| $P_P$ = price of pizzas | $ | $ |
| Profits of downstream firms | $ | |
| Total upstream + downstream profits | $ | $ |

(iii) Third, consider the policy implications.

  d. [2 pts]  Suppose initially that the upstream market (sauce) is monopolized and the downstream market (pizzas) is competitive.  Then suppose the upstream firm proposed to merge with a downstream firm.  Should the government try to block the merger?  Why or why not?

(7) [Monopoly price discrimination: 4 pts]  Suppose the elasticity of demand for basketball tickets by students is **-7**,  and the elasticity of demand for basketball tickets by the general public is **–1.5** .  Suppose the basketball arena has a marginal cost of  **$ 3** per person.
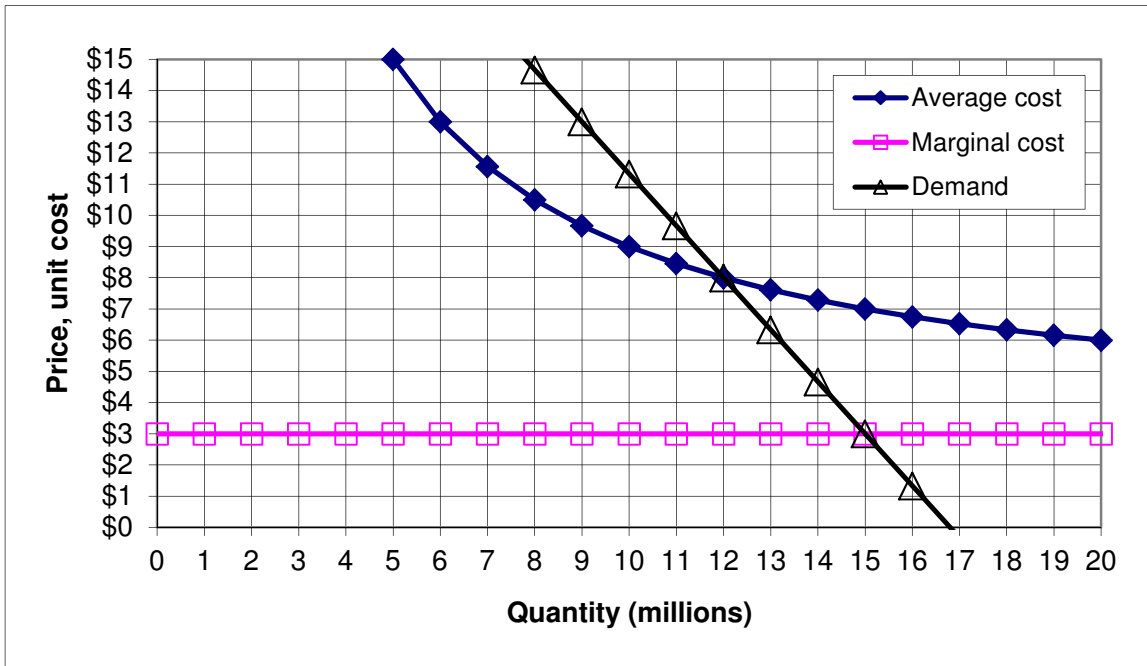
  a. Compute the profit-maximizing price for tickets sold to students.                    $

  b. Compute the profit-maximizing price for tickets sold to the general public.          $

(8) [Pricing with economies of scale: 20 pts]  The following graph shows average cost, marginal cost, and market demand for a firm subject to price regulation.



First, suppose the regulator uses marginal-cost pricing.

a. What price would be set?

$ _____

b. Does the firm experience economic profit, loss, or neither?

_____

c. How much?

$ _____ million

d. Compute the social deadweight loss from this policy.

$ _____ million

Second, suppose the regulator uses average-cost pricing.

e. What price would be set?

$ _____

f. Does the firm experience economic profit, loss, or neither?

_____

g. How much?

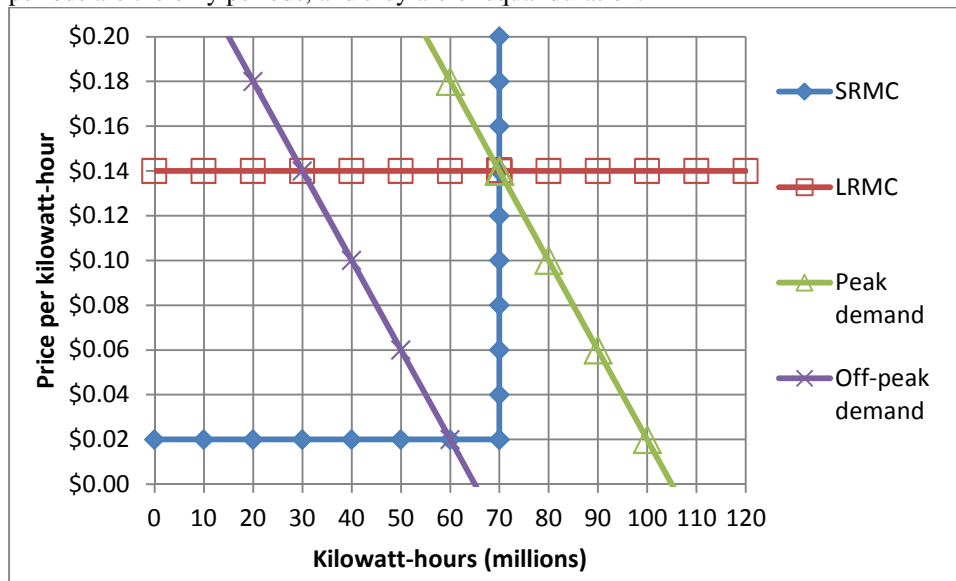$ _____ million

h. Compute the social deadweight loss from this policy.

$ _____ million

Third, suppose the regulator uses a two-part tariff to maximize social welfare (efficiency) while permitting the firm to break even.

i. What per-unit price would be set?

$ _____

j. What per-customer fixed charge (or "entry fee") would be set?  Assume the firm has  4  million customers with identical individual demands.

$ _____

(9) [Peak-load pricing: 22 pts]  Suppose cost and demand for electricity are given by the following graph.  Costs are shown as short-run marginal cost (SRMC) and long-run marginal cost (LRMC) curves.  LRMC includes the cost of building new capacity.  Demands are shown as peak demand and off-peak demand.  Assume for simplicity that peak and off-peak periods are the only periods, and they are of equal duration.



a. Explain in words why SRMC bends up vertically at 70 million kilowatt hours.

First, suppose efficient peak-load pricing is used.

b. Find the price of electricity during the peak period.

$ _____ per kWh

c. Find the quantity of electricity demanded during the peak period.

_____ million kWh

d. Find the price of electricity during the off-peak period

$ _____ per kWh

e. Find the quantity of electricity demanded during the off-peak period.

_____ million kWh

Now suppose instead a uniform price of  **$ 0.10**  per kilowatt-hour is used in both peak and off-peak periods.

f. Find the quantity of electricity demanded during the peak period.

_____ million kWh

g. Find the quantity of electricity demanded during the off-peak period.

_____ million kWh

h. Would generation capacity have to *increase, decrease*, or *stay the same* to accommodate uniform pricing?

i. By how much?

_____ million kWh

j. In the graph above, shade the areas representing social deadweight loss from uniform pricing.

k. Compute the social deadweight loss from uniform pricing.

$ _____ million

(10) [Multiproduct cost functions: 12 pts] Tasty Bakery makes two products: cakes and pies.  Let $Q_C$ denote the quantity of cakes, and let $Q_P$ denote the quantity of pies.  The total cost $C(Q_C,Q_P)$ of producing the products at various levels of output are given by the following table.

| $C(Q_C,Q_P)$ | | $Q_P$ | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 10 | 20 | 30 | 40 |
| | 0 | $0 | $80 | $197 | $333 | $484 |
| | 10 | $106 | $166 | $274 | $404 | $550 |
| $Q_C$ | 20 | $260 | $312 | $417 | $544 | $688 |
| | 30 | $441 | $486 | $589 | $714 | $856 |
| | 40 | $641 | $681 | $781 | $905 | $1,045 |

a. [2 pts] Does Tasty Bakery enjoy *economies of scope*?  Why or why not?  Give a numerical example.
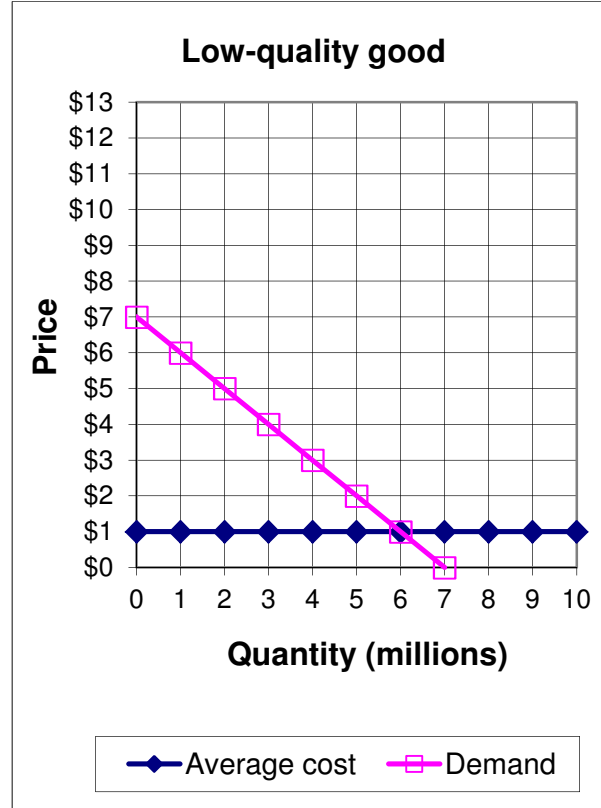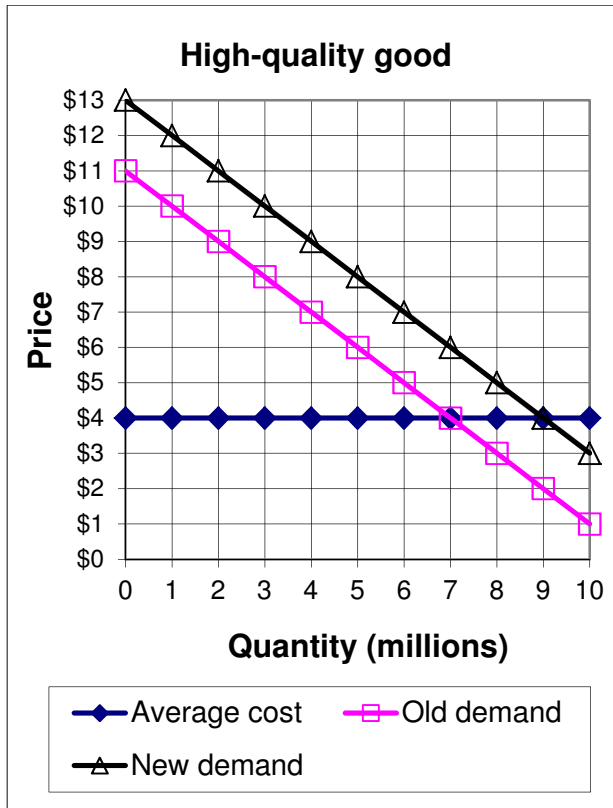
b. [4 pts] Compute the *incremental cost* of cakes, given that the firm will produce 20 pies, and place your answers in the table below.

c. [4 pts] Compute the *average incremental cost* of cakes, given that the firm will produce 20 pies, and place your answers in the table below.  Round answers to the nearest whole dollar.

| $Q_C$ | IC($Q_C$) given $Q_P$=20 | AIC($Q_C$) given $Q_P$=20 |
|---|---|---|
| 10 | $ | $ |
| 20 | $ | $ |
| 30 | $ | $ |
| 40 | $ | $ |

d. [2 pts] Does Tasty Bakery enjoy *product-specific economies of scale* for cakes?  Why or why not?

(11) [Effect of regulation on quality: 14 pts]  The following graphs show demand and supply for low-quality and high-quality versions of the same good.  Assume average cost also equals marginal cost.

**High-quality good**



**Low-quality good**



First, consider the market without regulation.
  a. Find the quantity purchased of the low-quality good.

|  | million |
|---|---|

  b. Assume the demand for the high-quality good is given by "Old demand."
     Find the quantity purchased of the high-quality good.

|  | million |
|---|---|

Suppose a price floor of **$ 8** is imposed on the low-quality good.
  c. Find the new quantity purchased of the low-quality good.

|  | million |
|---|---|

  d. Compute the social deadweight loss in the low-quality market from the
     price floor.

| $ | million |
|---|---|

The low-quality and high-quality goods are substitutes, so demand for the high-quality good shifts right to "New demand."  Suppose the same price floor of **$ 8** is now also imposed on the high quality good.
  e. Find the new quantity purchased of the high-quality good.

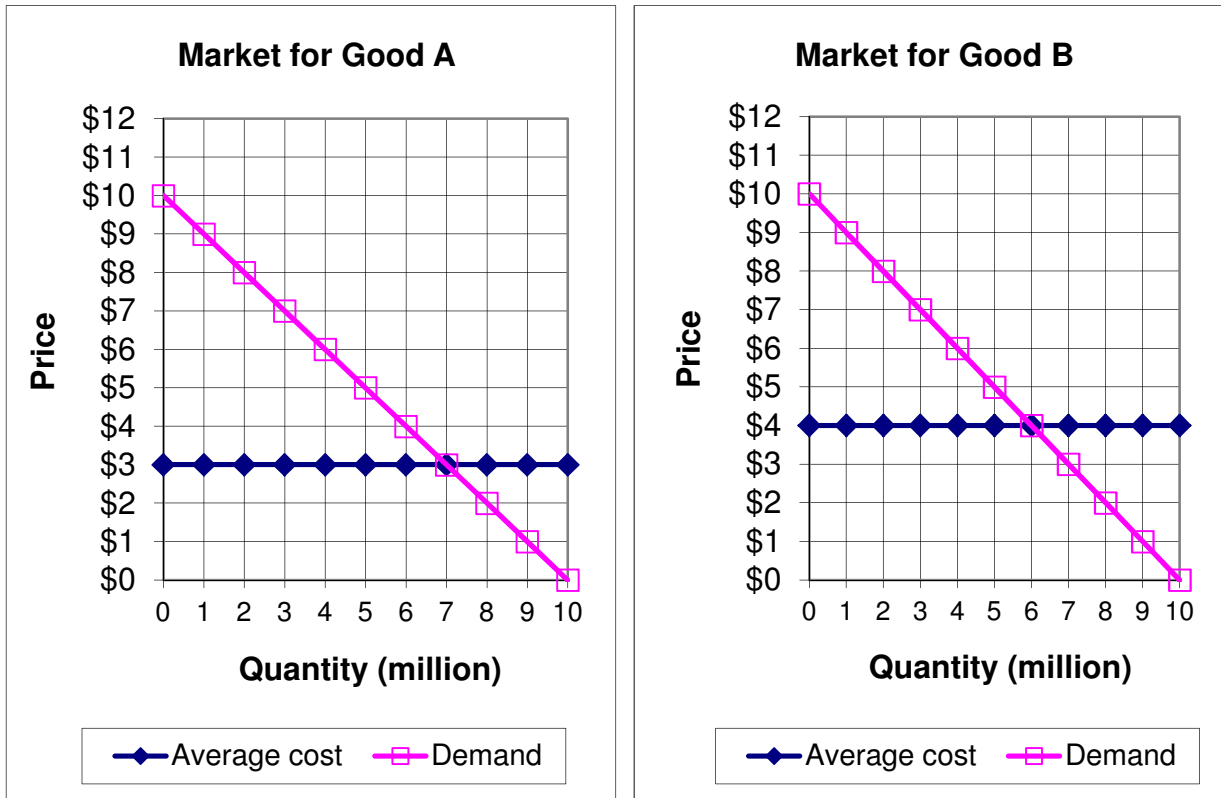|  | million |
|---|---|

  f. Compute the social deadweight loss in the high-quality market from the
     price floor.

| $ | million |
|---|---|

  g. Compute the total cost of regulation—that is, the social deadweight loss in
     the low-quality market plus the social deadweight loss in the high-quality
     market.

| $ | million |
|---|---|

(12) [Maximum prices and exit restrictions: 10 pts]  The following graphs show the demands and average costs for good A and good B.  Assume average cost also equals marginal cost.

### Market for Good A



### Market for Good B



Suppose a regulated firm is required to supply good A at a price of **$ 2**.

a. Compute the social deadweight loss in the market for good A from this pricing policy.

$ _____ million

b. Compute the loss that the firm will experience in the market for good A from this pricing policy.

$ _____ million

Suppose the regulated firm is permitted to recover its loss in the market for good A by raising price above average cost in the market for good B.

c. What is the minimum price in the market for good B that would allow the firm to recover its loss in the market for good A?

$ _____

d. Compute the social deadweight loss in the market for good B from this pricing policy.

$ _____ million

e. Compute the total cost of regulation with cross-subsidization—that is, the social deadweight loss in the market for good A plus the social deadweight loss in the market for good B.

$ _____ million

**III.  Critical thinking**  [3 pts]

Suppose a market is now served by two firms.  The market output quantity is now 10 million units and the market price is $5.

The two firms propose to merge.  It is believed that the merger would give the firms greater market power, causing the price to rise to $7 and the quantity to decrease to 7 million units.  However, the merged firm would enjoy economies of scale, causing the average cost to fall from $4.00 to $3.50.

Would this merger increase social welfare?  Justify your answer.

Please write your answer below.  Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling.

[end of quiz]