FINAL EXAMINATION ANSWERS

(Covering Lectures 6 - 13)

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The exam consists of 6 questions for a total of 74 points.

This is a closed book exam. No books, notes, neither hard copy nor digital may be consulted during the exam.

You may use a simple (non-graphing calculator).

You have 3 hours to complete the exam.

Good luck!

1. Perfect Competition vs. Monopoly (24 pts. total)
The market for gizmos is characterized by the following market demand:
$Qd = 6000 – 2P$
where P is the price in $ per gizmo and Q is the quantity of gizmos sold per year.
Gizmomaster is the only firm in this market and its cost function is $C(Q) = 100 + 10Q + Q^2$.

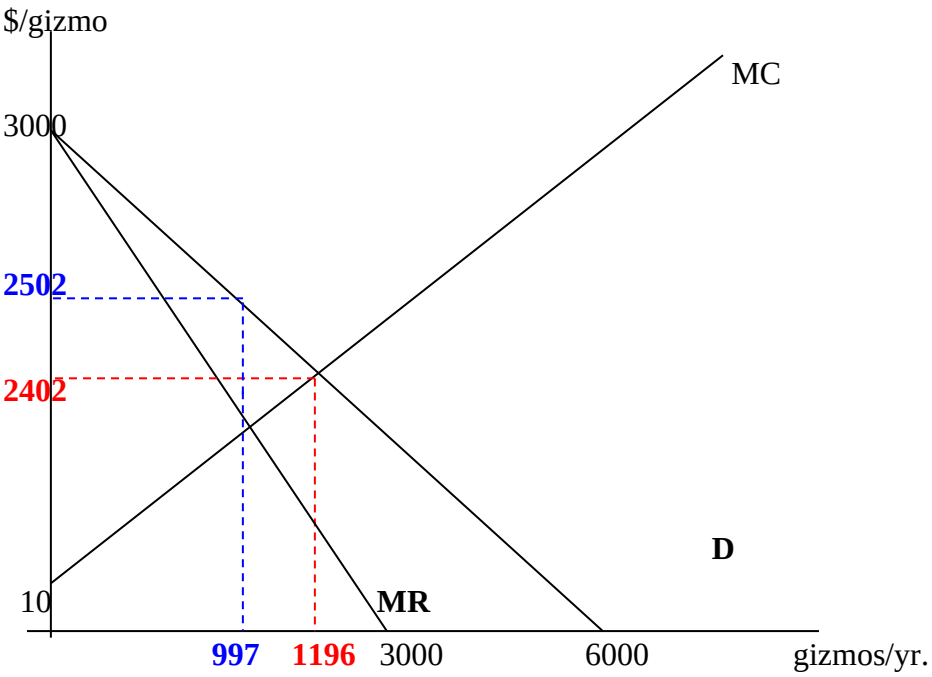
a. (5 pts.) Suppose Gizmomaster *believes* that there is free entry and exit in this market and therefore behaves as though the market were perfectly competitive. What level of output will Gizmomaster choose to produce and what will the market price be?
b. (6 pts.) Now suppose Gizmomaster obtains a patent on its gizmos and therefore has a de facto *monopoly* in this market. What level of output will it now choose to produce and what will the market price be?
c. (3 pts.) Under the monopoly scenario (b above) calculate: Gizmomaster's profit.
d. (4 pts.) Graph the competitive and monopoly market outcomes derived in (a) and (b) above.
e. (4 pts.) Calculate the dead weight loss associated with the monopoly scenario versus the competitive scenario and show the area of DWL on the graph derived in (d) above. (Hint: begin by identifying the area of DWL on the graph.)
f. (2 pts.) All else being equal (i.e. consumer demand and Gizmomaster's costs do not change under the 2 market structures) will the monopoly scenario <u>always</u> result in a certain amount of DWL compared to the competitive scenario?

Answer:
a. If Gizmomaster believes this is a perfectly competitive market, it will act as a price taker, i.e. its MR(Q) will be equal to the market price P.
We can derive P from the demand function by expressing demand as inverse demand:
$Q = 6000 – 2P$
$P = 3000 – ½ Q$
Gizmomaster then maximizes profits by setting its $MC(Q) = P$
Given $C(Q) = 100 + Q^2 + 10Q$ → **$MC(Q) = 2Q + 10$**
Thus, Gizmomaster maximizes profits (or thinks it is maximizing profits) by setting:
$2Q + 10 = 3000 – ½ Q$
$2.5Q = 2990$
Qc = 2990/2.5 = **1196 gizmos/yr.**
Derive P* by substituting Q* into the demand function:
Pc = 3000 – ½ (1196) **= $2402**

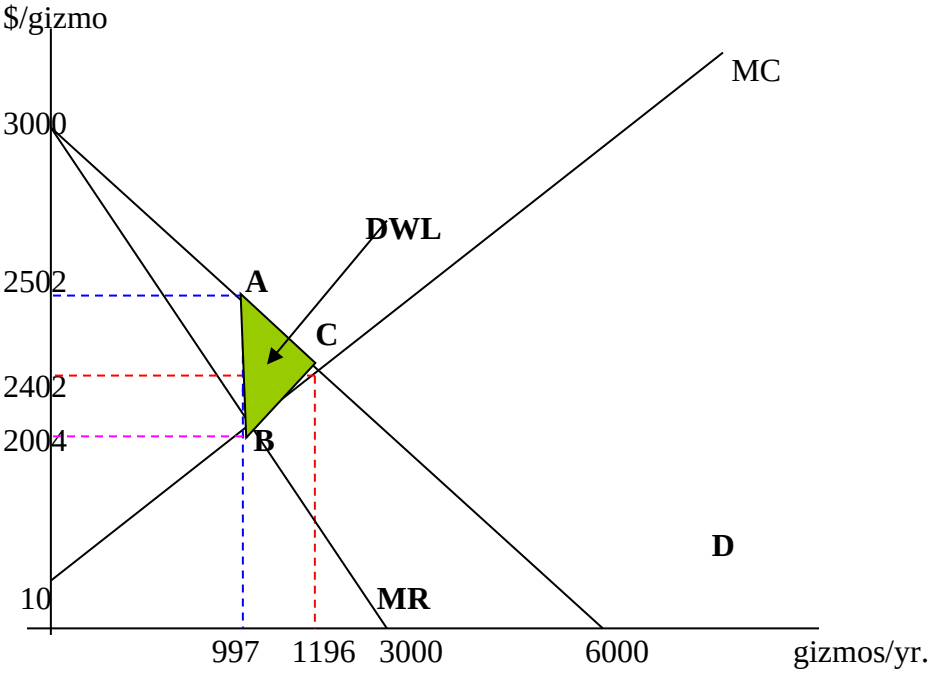
b. If Gizmomaster understands that it has the monopoly of this market, it realizes that it faces a downward-sloping demand curve and it maximizes profits by setting MR(Q) = MC(Q).
MR(Q) is the first derivative of total revenue with respect to Q, dTR(Q)/dQ.
$TR(Q) = P*Q = (3000 – ½ Q) * Q = 3000Q – ½ Q^2$.
Thus, MR(Q) = dTR(Q)/dQ = 3000 – Q
So, the profit-maximizing monopolist will set:
3000 - Q = 2Q + 10
3Q = 2990

Qm = 2990/3 = **997gizmos/yr.**
The monopolist's profit-maximizing price Pm is derived by substituting the profit-maximizing quantity Qm into the inverse demand function (or the direct demand function):
Pm = 3000 – ½ (997) = **$2502/gizmo**
Note: as expected, the monopoly price is greater and the monopoly quantity smaller than the competitive ones.

c. Profits under (b): PmQm – C(Qm)
$2502 (997) – [100 + $(997)^2$ + 10(997)]
$2,494,494 - $1,004,079 = **$1,490,415/yr.**
Alternative way of calculating profit: [ATC(Qm) – Pm] * Qm
Profit-maximizing level of output = Qm = 997 gizmos/yr.
Profit-maximizing price = $2502/gizmo
Average cost = C(Q) /Q = (100 + Q^2 + 10Q)/Q.
Therefore, the average cost per gizmo at the profit-maximizing level of output = C(997)/997 = [100 + 997^2 + 10(997)]/997 = $1007.10
Therefore, Gizmomaster's profit will be ($2502 - $1007.10) * 997 = **$1,490,415/yr.**
d.



e. The dead weight loss is the triangle ABC. Its height AB is given by the difference between the monopolist's profit-maximizing price and the marginal cost (at the profit-maximizing output chosen by the monopolist). Its base BC is given by the difference between the monopolist's profit-maximizing quantity and the quantity that would be sold in a competitive market.



From the answers above, we have all the points we need to calculate the DWL except for the point B, which is the monopolist's marginal cost at quantity Q = 997, i.e. MC(997). Since MC(Q) = 2Q + 10, MC(997) = 2 (997) + 10 = 2004. Therefore, point B = $2004.
Thus, **DWL =** [($2502 – $2004) * (1196-997)]/2 = $498 * 199 = $99,102/2 **= $49,551**

f. All else being equal, the monopoly outcome will **always** result in a welfare loss compared to the competitive outcome. See Mankiw, chapter 15, pp. 323-326.

2. Monopolistic Competition (4 pts.)
Provide an example of a particularly successful good or service produced in a monopolistically competitive market. Describe its competitive and monopolistic aspects.
Answer: Many possible answers.

3. Cooperative Oligopoly (6 pts.)

A well-functioning cartel requires a high degree of collaboration among cartel members.
a. (2 pts.) List 2 factors that facilitate collaboration among cartel members.

Even though cartels are very profitable, they are often unstable, with members either cheating (producing more than the cartel-allotted level of output) or leaving the cartel altogether.
b. (4 pts.) Why is the incentive to cheat *greater* for cartel members with *lower costs* than for other cartel members? You may use a graph to illustrate your answer (but you don't have to.)

Answer:
a. Factors include: few firms in industry, relatively inelastic demand, relatively homogenous product, existence of a trade association, low expectation of severe punishment.

b. The *lower* the cartel member's *costs*, the *higher* the *profitability* from cheating. Therefore, a cartel member with lower costs than the others will have a greater incentive to cheat.

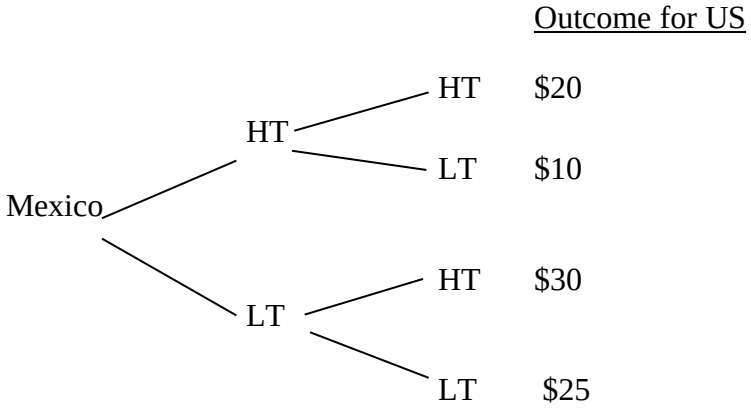
4. Non-Cooperative Oligopoly (12 pts total) Consider trade relations between the United States and Mexico. Assume that the trade representatives of the two countries believe the payoffs to alternative trade policies are as follows[1]:

		United States	
		Low tariffs	High Tariffs
Mexico	Low tariffs	(25,25)	(30,10)
	High Tariffs	(10,30)	(20,20)

Figures in parentheses show annual payoffs in $ billions. The first figure refers to the US and the second to Mexico. We assume both firms know the payoff matrix.

a. (6 pts.) Assume that the US and Mexico must choose their tariff strategies at the same time (i.e. this is a Cournot game). What strategies will the US and Mexico choose? Show the extensive representation of the game used to derive your answer.
b. (2 pts.) Is your answer to (a) above a Nash equilibrium and if so, why?
c. (4 pts.) Under the North American Free Trade Agreement (NAFTA), the United States and Mexico agreed to reduce trade barriers and reduce tariffs simultaneously. How does NAFTA affect the outcome derived in (a) above?

Answer:
a. Extensive Form Representation of the Game from US's Perspective:



As shown in the representation of the game above, if Mexico imposes high tariffs, then the US is better off with high tariffs, because it gets $20 billion with high tariffs and only $10 billion with low tariffs; if Mexico imposes low tariffs, then the US is better off with high tariffs,

[1] The symmetric payoffs are somewhat unrealistic since the US economy and flows of imports and exports are so much larger than Mexico's.

because it gets $30 billion with high tariffs and only $25 billion with low tariffs. Thus, the US has a *dominant strategy* of high tariffs.

This is a symmetric game, thus the game has the same outcome from Mexico's perspective. Thus, Mexico also has a *dominant strategy* of high tariffs.
Therefore, **both the US and Mexico will chose a strategy of high tariffs and the outcome will be $20 billion for each country**.

b. A Nash equilibrium is a situation in which economic actors interacting with one another each choose their best strategy given the strategies others have chosen. The Nash equilibrium in this case is for each country to have high tariffs.

c. The NAFTA agreement represents cooperation between the two countries under which each country reduces tariffs and both are better off as a result since: if each chose low tariffs their individual outcomes increase from $20 billion each derived in (a) above to $25 billion each. Thus, **the NAFTA agreement solves the prisoner's dilemma type outcome associated with this scenario.**

5. Strategic Firm Behavior: Monopoly and Price Discrimination (10 pts. total)
Hawaii Airlines is the sole provider of non-stop airline service on the Honolulu – Chicago route. It estimates that the total demand for the route is $Q = 500 - P$.
The costs of running each flight on this route is $41,000 + $100 per passenger.
Where P= ticket price/passenger and Q = number of passengers/flight

Unfortunately, given these demand and cost functions, Hawaii Airlines' CFO concludes correctly that the profit maximizing quantity (200 passengers/flight) and price ($300/passenger) result in a loss for Hawaii Airlines of $1000 on each of the Honolulu – Chicago flights. (No need to do any calculations.)

To address the problem of losses on the Honolulu-Chicago route, Hawaii Airlines hires an economic consultant to evaluate what it can do to make the route profitable. The consultant analyzes the market for air travel over the route and finds that there are two types of travelers flying from Chicago to Honolulu: business travelers (b) and tourist (t) travelers. The consultant estimates that these two types of travelers have different demand functions estimates as follows:
$Qb = 260 - 0.4Pb$
$Qt = 240 - 0.6Pt$
The cost of travel does *not* vary depending on whether business or tourists are on the flight. The consultant suggests price discriminating between the two types of travelers.

a. (6 pts.) With price discrimination, what price does Hawaii Airlines charge business versus tourist travelers and how many of each will be on its flights?
b. (4 pts.) Calculate total profit per flight with price discrimination. Does the route become profitable?

Answer:

a. Hawaii Airlines will maximize profits by choosing Qb and Qt and Pb and Pt to maximize profits separately for business and tourist travelers.
We begin by rewriting each of the demand functions in inverse demand form:
Pb = 650 – 2.5Qb
Pt = 400 – 1.67 Qt

Thus, MRb = dTR(Qb)/dQb = d/dQb(P*Qb) = d/dQb[(650 – 2.5Qb)*Qb] = d/dQ[650Qb - $2.5Qb^2$] = 650 – 5Qb
Note: MRb has the same algebraic form as the linear demand Pb with twice the slope.
Thus, we can simply derive MRt = 400 – 3.34Qt
Now we have the functional forms for MR(Qb) and MR(Qt)

To maximize profits Hawaii Airlines will choose Qb and Qt such that:
MRb = MC or 650 – 5Qb = 100
-5Qb = -550
Qb = 110 passengers/flight

MRt = MC or 400 – 3.34Qt = 100
-3.34Qt = -300
Qt = 90 (89.82 rounded) **passengers/flight**

Substitute the profit maximizing quantity into the respective inverse demand equations to find the profit maximizing prices:
Pb = 650 -2.5(110) = **$375/passenger**
Pt = 400 – 1.67 (90) = **$250/passenger**

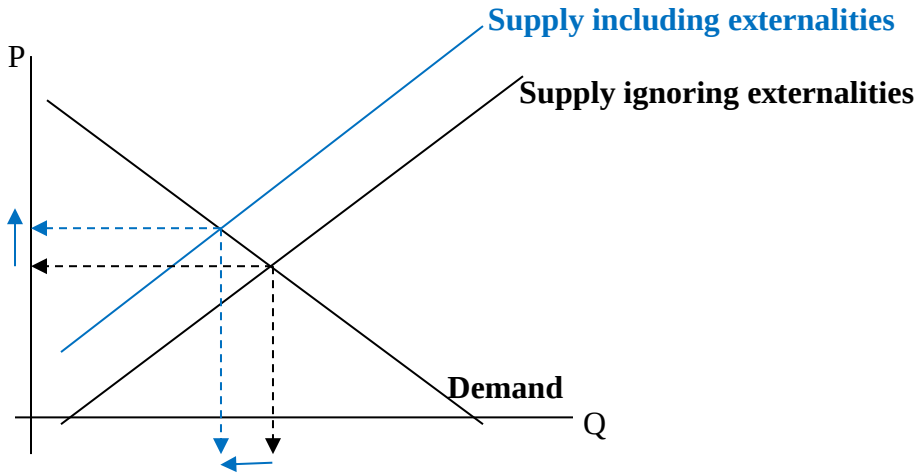
b. Total revenue per flight will be:
$375 * 110 – $250 * 90 = $63,750
Total cost per flight will be:
$41,000 + 200 * 100 = $61,000
Thus, **total profit per flight will be** $63,750 - $61,000 = **$2,750.**
Yes, the route is now profitable.

6. Government Intervention into Market: Negative Externalities (10 pts)
The market for paper products involves production processes which cause a lot of waste products resulting in air and water pollution. These are negative externalities.
a. (4 pts.) What policies can be *imposed on paper producers* so as to *internalize these externalities*?
b. (6 pts.) Draw a graph illustrating what happens to market demand and supply *before and after* the policies in (a) above are imposed on paper production.
Will price of paper and the quantity of paper sold in the market be:
(a) lower (b) higher (c) unclear?

Answer:

a. Policies are mainly of two types:
(1) standards imposed on paper companies to reduce pollution to an acceptable level requiring them to install technology which reduces air and water pollution at their own expense.
(2) fees or taxes imposed on paper producers per unit of emissions.
Both of these measures will cause paper producers to include the cost of meeting the policies either by (1) having to invest in pollution reducing equipment to meet the standards or (2) by having to add the emissions tax/fee associated with emissions from its paper production. Either way, the negative externality will be internalized in the cost of paper.

b. As shown in the graph below, imposition of the policies which internalize the externalities will cause the supply curve to shift inwards. The resulting price will be higher and the quantity sold will be lower.



7. Antitrust: Measures of Industry Concentration (10 pts.)

In the state of Florida, there are four major producers of freshly squeezed orange juice with the following market shares:

Tropicana:	50%
Ocean Spray:	10%
Sunkist:	30%
Florida Gold:	10%

Sunkist makes an attractive merger offer for Ocean Spray arguing that the merger will result in cost efficiencies related to economies of scale and scope.

a. (4 pts.) According to the DOJ Merger Guidelines, will the merger be investigated?

b. (6 pts.) What arguments could the lawyers for Sunkist use to argue that *the individual HHIs for Florida are overstated* for the purposes of evaluating whether the market for orange juice in Florida should be investigated?

Answer:

a. HHI pre-merger**:** $50^2 + 10^2 + 30^2 + 10^2 =$ **3,600**

Thus, the market is classified as highly concentrated because HHI pre-merger is >2500.
HHI post-merger**:** $50^2 + 40^2 + 10^2 =$ **4,200**
The merger will indeed be investigated because the market is classified as highly concentrated and the difference between the pre and post HHIs is >200 points.

b. The HHIs as calculated above define the *product market* strictly as "freshly squeezed orange juice" and the *geographic market* strictly as "Florida". The lawyers could argue that these product and geographical markets are too narrowly defined and thus the market shares calculated in this way are overstated for purposes of applying the Merger Guidelines. With regard to the product market, they could argue that it should include other close substitutes for the product (from the point of view of consumers). For example, in the case of "freshly squeezed orange juice" *close substitutes may include orange juice from concentrate as well as (perhaps) other freshly squeezed juices such as grapefruit juice and other types of fruit juice drinks.*

With regard to the geographic market, they could argue that it should include production by other suppliers of the product in the relevant market that consumers could buy from. Thus, the relevant geographical market could not be just the state of Florida but also *other states that grow oranges (such as California, Georgia and South Carolina)*. If transportation and refrigeration costs are not too high, then *suppliers from neighboring countries (e.g. Mexico and other Central American countries)* may also be included.
Expanding the product and geographic markets would result in smaller market shares for the companies listed above and the corresponding HHIs would be smaller, implying that concentration is less of a concern.