Econ 301
Intermediate Microeconomics
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Problem set 11
(due Thursday, May, 8th before class)

Problem 1 (Oligopolistic Industry)
Below you can find market shares of major beer producers in the USA in 2000.

Bud Light	36.8%
Coors Light	19.1%
Miller Lite	18.5%
Natural Light	9.2%
Busch Light	6.1%
Michelob Light	3.3%
Keystone Light	2.6%
Millwaukee's Best Light	2.3%
Old Milwaukee Light	0.8%
Miller Genuine Draft Light	0.7%

The total light beer sales in 2000 amounted to 87 million barrels.

a) Find the concentration ratio (a "big four" index) for the beer industry in the USA.

b) Is such industry perfectly competitive or oligopolistic (concentrated)? Why?

c) What in your opinion would be a reaction of the Trade Commission to a merger proposal by Bud Light and Coors Light? Why?

Problem 2 (Aircraft industry)
The jet aircraft industry is dominated by two major competitors: Airbus (A - based in Europe) and Boeing (B - based in the USA). Both companies have similar technology allowing each firm to produce a jet at a cost of \$20 (in mln). Accordingly, their costs functions are given by

$$\begin{aligned} TC(y_A) &= 20y_A \\ TC(y_B) &= 20y_B \end{aligned}$$

In order to simplify our analysis, we assume no fixed costs. The inverse demand for jets by major airlines is estimated to be

$$p(y) = 200 - y$$

a) Find analytically profit function $\pi_B(y_B)$ for Boeing, given that the production of Airbus amounts to $y_A = 100$ jets. In a graph with y_B on the horizontal axis and π on the vertical one, plot the profit function.

b) Is the production $y_B = 100$ jets Boeing's best response to $y_A = 100$? Why or why not? Find the optimal level of production, given Airbus produces $y^A = 100$, $y_A = 50$, and $y_A = 0$? Mark the three points in space (y_A, y_B).

c) Find analytically the best response function for Boeing $R_B(y_A)$ and plot it in the graph from point b) .

d) Find analytically the best response function for Airbus, $R_A(y_B)$ and add it to your graph from point b)

e) Find analytically the market price of an aircraft, the level of individual and aggregate production in a Cournot-Nash equilibrium. Also find the level of profit of each individual firm. Show the equilibrium in your graph from b.

f) What is the deadweight loss (DWL) associated with oligopolistic trading by the two firms?

g) Suppose the two firms A and B form a cartel. What is the aggregate level of production, and profit per firm given collusion? Does collusion benefit the two producers?

h) Find a deadweight loss (DWL) given collusion, and compare it to the one from f) . Which loss is greater, why?

i) Is the considered cartel sustainable if the interactions, as described above, are only in the short run? Why? How about if the market interactions are repeated? Why?

Problem 3 (Accounting & Audit services in the USA)

There are $N > 2$ auditing firms in the USA (N is a parameter). "Production" y^i of a firm i is measured in auditors' hours and a cost function is given by

$$TC\left(y^i\right) = 10y^i$$

You can think of \$10 as an hourly wage paid to an auditor. Again we assume no fixed cost. The inverse demand for auditing in the USA is

$$p\left(y\right) = 1000 - y$$

where y is an aggregate supply.

a) Find the level of aggregate production and market price in two extreme cases: monopoly ($N = 1$) and perfect competition (Hint: recall that in the case of perfect competition the secret of happiness is $p = MC$.)

b) Plot the inverse demand function and mark the two points located on it - one for competitive interactions and one for monopoly.

c) Find analytically the level of production y^i supplied by each auditing firm and aggregate y number of hours, market price for one hour, p, the level of profit and the deadweight loss in the industry, all in the Cournot - Nash equilibrium. Find all variables as functions of N.

d) Find the values of aggregate production y and p for $N = 2,\ 5$ and 10. Mark the corresponding values on the graph from b)

e) In the graph with N on the horizontal axis and p on the vertical one, plot the equilibrium price. What can you say about the price limit, as N goes to infinity?

f) In the graph with N on the horizontal axis and y on the vertical one plot the equilibrium aggregate production. What can you say about the limit of aggregate production, as N goes to infinity?

g) In the graph with N on horizontal and DWL on vertical one plot the equilibrium DWL. What can you say about the limit of aggregate production, as N goes to infinity?

Problem 4 (Externality)

a) Give four examples of market interactions with externalities: two positive and two negative ones.

b) In each of your examples is the outcome Pareto efficient or not? Why or why not.(you can answer this question assuming that market is not regulated)

c) In each case explain how possibly we could change incentives of the agents so that they are closer to socially optimal outcome?

Problem 5 (Positive externality)

In this problem we study market interactions with positive externalities. We consider a plant that manufactures dynamite d and a nearby farm producing tomatoes t. The cost of production of dynamite is

$$TC_d\left(d, x\right) = \frac{1}{2}d^2 + \left(x - 2\right)^2$$

where d is the amount of dynamite produced and x is the intensity of use of a nitrogen in the production process. The side product associated with use of the nitrogen is ammonia - a fertilizer that is released to the air. Such fertilizer promotes growth of tomatoes making the production on the farm cheaper. In particular the higher the intensity x the lower the farmers cost

$$TC_t\left(t, x\right) = \frac{1}{2}t^2 + 2t - xt$$

The prices of tomatoes and dynamite are $p_d = p_t = \$1$

a) Is the market interaction associated with a positive or negative externality?

b) Find the level of production of dynamite d and intensity x that maximizes the profit of the dynamite manufacturer. What is the maximal level of profit?

c) What is the marginal benefit (negative of marginal cost) from using x in optimum. Give one number and show it on the graph with x is on the horizontal axis. Explain why this is a reasonable number.

d) Given the intensity x from a) find the optimal level of production of tomatoes t, and the profit of the farmer.

e) Find the joint profit of the dynamite manufacturer and the farmer.

f) Find the Pareto efficient level of production of d, t and use of nitrogen x. Compare these values to the ones obtained in points b and d.

g) Is the marginal benefit from using x in f positive, zero, or negative? Why?

h) Economists say that the positive externality is associated with too little activity, compared to the efficient outcome. Are your findings in this problem confirming this statement?