file=io-w08-mid.tex

Last Name (Please PRINT): ....

First Name (PRINT): ....

Your UM I.D. Number: ....

INSTRUCTIONS (please read!)

1. Please make sure that you have 8 pages, including this page. Complaints about missing pages will not be accepted.
2. Please answer all the questions. You are not allowed to use any course material. Calculators are permitted.
3. Maximum Time Allowed: 1 hour and 20 minutes (1:10–2:30).
4. Your grade depends on the arguments you develop for supporting your answers. Each answer must be justified by using a logical argument consisting of a model/graph. An answer with no justification will not be given any credit.
5. You must provide all the derivations leading you to a numerical solution.
6. When you draw a graph, make sure that you label the axes with the appropriate notation.
7. Maximum Score: 100 Points
8. Budget your time. If you cannot answer a certain question, skip to the next one.
9. Please always bear in mind that "somebody" has to read and understand your handwriting. Please make sure that your ink is "visible" and that your sentences are properly organized and fit into the designated blank space. If you think that your handwriting is poor, please print each word!
10. **Good Luck !**

Instructor's use only

Problem #	1	2	3	4	5	6	Total
Maximum	30	20	10	20	10	10	100
Points							

(1) In Ben Barber there are two suppliers of distilled water, labeled firm A and firm B. Distilled water is considered to be a homogenous good. Let p denote the price per gallon, q_A quantity sold by firm A, and q_B the quantity sold by firm B. Firm A and firm B bear a production cost of $c_A = c_B = \$2$ per one gallon of water. Ann Barber's inverse demand function for distilled water is given by

$$p = 12 - \frac{1}{3}Q = 12 - \frac{q_A + q_B}{3},$$

where $Q = q_A + q_B$ denotes the aggregate industry supply of distilled water in Ben Barber. Solve the following problems:

(1a) [10 points] Suppose the firms compete in quantities (production levels). Compute each firm's quantity best response function, and conclude how much each firm produces in a Cournot-Nash equilibrium.

(1b) [5 points] Compute the price and the profit of each firm in a Cournot-Nash equilibrium.

(1c) [10 points] Compute the quantity produced by each firm in a sequential (Stackelberg) game in which firm A sets its output level before firm B.

(1d) [5 points] Compute the price and the profit of each firm in a Stackelberg equilibrium.

(2) Consider firm A and firm B described in Problem #1 (the market for water in Ben Barber). Suppose now that the firms compete in prices, p_A and p_B instead of quantities.

(2a) [10 points] Write down each firm's price best response function, and solve for the price each firm sets in a Bertrand-Nash equilibrium.

(2b) [5 points] Compute the quantity produced and the profit of each firm in a Bertrand-Nash equilibrium.

(2c) [5 points] Suppose now that firms set their prices in sequence. In stage I, firm A sets p_A. In stage II, after observing p_A, firm B sets p_B. Write down the firms' price *strategies* in a subgame-perfect equilibrium (SPE).

(3) [10 points] The demand function for concert tickets to be played by the Ann Arbor symphony orchestra varies between nonstudents (N) and students (S). Formally, the two demand functions of the two consumer groups are given by

$$q_N = 240(p_N)^{-2} \quad \text{and} \quad q_S = 540(p_S)^{-3}.$$

Assume that the orchestra's total cost function is $C(Q) = 2Q$ where $Q = q_N + q_S$ is to total number of tickets sold. Compute the concert ticket prices set by this monopoly orchestra, and the resulting ticket sales, assuming that the orchestra can price discriminate between the two consumer groups.

(4) A brewery is allowed to sell beer in two domestic markets called market 1 and market 2. Since both markets are located nearby each other, the brewery cannot price discriminate, and therefore must set a uniform price p in both markets.

The inverse demand function in market 1 is $p_1 = 60 - q_1$. The demand in market 2 is $p_2 = 50 - q_2$, where q_1 and q_2 are quantity demanded in each market (measured in cans), and the price is measured in cents. The cost of producing each can of beer is $c = 30¢$. Solve the following problems:

(4a) [10 points] Compute the monopoly's profit-maximizing uniform price, the quantity of beer sold in markets 1 and 2, and total profit.

(4b) [10 points] Suppose now the brewery is allowed to sell beer to a nearby town (call it market 3) located just across the border. The inverse demand function in this town is $p_3 = 40 - q_3$. Due to the proximity of the three markets, the brewery cannot price discriminate and must set again a uniform price of p in all three markets. Compute the profit-maximizing price, the quantity sold in each market, and total profit.

(5) [10 points] Firms A and B can choose to adopt a new technology (N) or to adhere to their old technology (O). Formally, firms' action sets are: $t_A \in \{N, O\}$ and $t_B \in \{N, O\}$. The table below exhibits the profit made by each firm under different technology choices.

		Firm B	
		NEW TECHNOLOGY (N)	OLD TECHNOLOGY (O)
Firm A	NEW	200 0	0 200
	OLD	50 100	100 50

Write down the best-response functions of firms A and B, $t_A = R_A(t_B)$ and $t_B = R_B(t_A)$, and conclude which outcome(s) is a Nash equilibrium.

(6) [10 points] Discuss whether it is illegal to price discriminate according to the U.S. Law. Explain which section of the law deals with price discrimination, and how this section should be interpreted.

THE END