Economics 121 SUGGESTED SOLUTIONS FOR MIDTERM EXAM

I. <u>TRUE or FALSE or UNCERTAIN and EXPLAIN</u>: For each of the following 4 statements, decide whether each is true or false or uncertain, and then explain the reasoning behind your answer in a few sentences; if appropriate, provide a diagram. Each question is worth 7 points for a total of 28 points.

1. The two-product cost function $C(q_1, q_2) = 100 + q_1 + q_2 + q_1q_2$ exhibits falling ray average cost when two units of q_2 are produced for each unit of q_1 .

FALSE

If we let a bundle (q) be one unit of q_1 and two units of q_2 , then: RAC(q) = C(q, 2q) / q = (100 + q + 2q + q*2q) / q = 100/q + 3 + 2q To see if RAC(q) is falling, we can check the derivative: dRAC(q)/dq = -100 / q² + 2 RAC(q) is falling when the derivative is less than zero, i.e. when $-100 / q^2 + 2 < 0 \iff 100 / q^2 > 2 \iff q^2 < 50$ So, RAC falls until the square-root of 50, but then it rises.

2. In an industry composed of two equal-sized firms, if a new firm enters at the same time that the two incumbent firms merge, the change in the HHI will indicate that the industry is more concentrated.

TRUE

Before the merger, there are 2 firms of equal size, so HHI is equal to ½which is the minimum HHI possible with 2 firms. After the merger and entry, there are again two firms. So, the only way that the HHI will not indicate that the industry is more concentrated is if the two firms after merger/entry are of equal size (which seems unlikely).

3. An airline may find it profitable to offer an "express service" that allows a passenger paying an additional \$100 per ticket to go through separate security check-in lines even though those lines are no different than existing ones.

TRUE

Because express service saves time, all would prefer it, though some would value it less than \$100. This partitions consumers into two groups based on willingness to pay for this benefit. If zero marginal cost of service, then profit increases. This is just like the Paris Metro example.

4. In the Hotelling model with one store located in the middle of Main Street, a monopolist's price does not change as consumers' transportation cost increases.

UNCERTAIN

This depends on the initial level of the transportation cost. If the initial transportation cost was high enough such that initially the monopolist served less then the entire market, then an increase in the transportation cost will have no effect on price because price is (v+c)/2 and doesn't depend on t. If the

initial transportation cost was low enough such that the monopolist initially serves the entire market, then the monopolist is charging a price of P = v - t/2. An increase in the transportation cost will cause the monopolist to either keep full coverage by dropping price or to drop the price to (v+c)/2. Either way, the monopolists price will change when the monopolist is initially serving the entire market.

II. <u>MULTI-PART QUESTIONS</u>: Answer <u>all parts</u> of the following two questions. The point assignment for each subpart is given in [square brackets]. In total there are 46 points.

- 1. MonoAir is the only U.S. airline providing service from city A to city B and the reverse direction. It does not serve any other route. MonoAir's marginal cost of a passenger between the two cities is 10. Assume that demand for air travel between A and B by domestic travelers is given by the (inverse) demand curve: $P_d(q_d) = 70 - q_d$. There are also foreign travelers who originate in cities outside the U.S. who wish to travel between these two cities. Their (inverse) derived demand for A-B service is given by: $P_f(q_f) = 110 - q_f$.
 - a) [3] Suppose that MonoAir cannot distinguish domestic and foreign travelers so that it must charge them the same fare on its route. Find and expression for aggregate demand that MonoAir faces for A-B service and graph it.

Here is the graph of aggregate demand:



b) [8] Find the profit-maximizing fare charged by MonoAir for A-B service.

To find the profit-maximizing price for MonoAir, we need to find marginal revenue.

Inverse demand is given by $P_{d+f}(q) = \{110 - q \text{ if } q \le 40 \\ \{90 - \frac{1}{2}q \text{ if } q > 40 \}$ Thus, $MR(q) = \{110 - 2q \text{ if } q \le 40 \\ \{90 - q \text{ if } q > 40 \}$

Setting MR = MC, the portion of MR for $q \le 40$ gives us $110 - 2q = 10 \Rightarrow q = 50$. However, this violates the restriction that $q \le 40$, so there is no intersection of MR and MC on this portion of the demand curve. When q > 40, setting MR = MC gives us $90 - q = 10 \Rightarrow q = 80$. Equilibrium price is $P^* = 90 - \frac{1}{2}q^* = 90 - 40 = 50$.

Now assume that MonoAir forms a joint venture with ForAir, a foreign airline that uses city A as its "gateway," i.e., it runs an international flight into and out of city A. As part of their agreement, ForAir provides MonoAir with a list of its passengers arriving into and departing from A.

c) [7] Find the fare MonoAir will charge the two types of passengers now that it can distinguish between domestic and foreign travelers.

 $MR_{d} = 70 - 2q_{d} = 10 = MC \Rightarrow q_{d} = 30 \Rightarrow P_{d} = 40$ $MR_{f} = 110 - 2q_{f} = 10 = MC \Rightarrow q_{f} = 50 \Rightarrow P_{f} = 60$

d) [4] Calculate the Lerner Index, and then use it to find the price elasticity for each of the two groups.

 $L_{d} = (P_{d} - MC) / P_{d} = (40 - 10) / 40 = 3/4 = 1 / \eta_{d} \Rightarrow h_{d} = 4/3$ $L_{f} = (P_{f} - MC) / P_{f} = (60 - 10) / 60 = 5/6 = 1 / \eta_{f} \Rightarrow h_{f} = 6/5$

e) [6] Drawing on your knowledge of actual conditions for the supply of airline services, give two examples of cost efficiencies that MonoAir and ForAir could realize in providing air service to foreign travelers.

The two airlines could share facilities, thereby eliminating duplication of terminal/gate space, repair and service facilities, and computer reservation systems. They also could gain efficiencies by transporting both types on the same planes (rather than 2 separate fleets) to increase load factors and use larger aircraft (giving lower seat-mile cost).

2. Suppose a dominant firm resides in an industry with (inverse) market demand of P(Q) = 100 − Q. Each of 10 competitive fringe firms has marginal cost of: MC(q_f) = 80 + 10q_f.
a) [3] Show that the supply curve of the competitive fringe is given by: S_f(P) = P − 80.

We find the supply of a fringe firm from MC: $P = 80 + 10q_f \iff q_f = s(p) = 8 - p / 10$ Thus, $S_f(p) = 10 * s(p) = 80 - p$



b) [2] Draw a <u>large</u> diagram with industry demand and competitive fringe supply.

c) [4] On a second diagram, draw in the <u>residual</u> demand of the dominant firm and clearly label *it.*



d) [3] Add the dominant firm's marginal revenue into the second diagram and clearly label it.

See Diagram Above

e) [6] Draw two Marginal Cost Curves in your second diagram that reflect the following conditions:

 MC_1 : The dominant firm chooses the same price and quantity as a monopolist. MC_2 : The fringe produces a positive amount.

See Diagram Above

- III. <u>INDUSTRY STUDIES</u>: Choose <u>either</u> the beer <u>or</u> the steel industry and then answer the two questions below for the chosen industry. Point assignment is given in [square brackets]. This section has a total of 26 points.
- NOTE: We give below answers that we consider are complete, but there are many more detailed points that could be included, and were included by students, that were given additional credit.
- 1. <u>BEER INDUSTRY</u>

Begin with a product and geographic market, e.g., lager beers in Berkeley. In the first part of the test, ask whether a hypothetical monopolist over products in this market would find a SSNIP profitable. To make this operational, consider a 10% increase in all prices in the candidate market and check whether there is a loss of more or less than 5% over the course of one year. If the answer is no, then add either products (e.g. ales, malt liquors, soft drinks) or areas (e.g. Bay Area, Northern California). If yes, then remove products/areas. The second part of the test is to choose the smallest possible market such that a SSNIP is just profitable.

Extent of market in end will depend on beer drinkers ability/willingness to substitute goods outside the market. Consequently, cross-price elasticities are crucial. For example, a zero cross-price elasticity of beer and soft drinks excludes soft drinks from the market. Also, "blind" taste test consistently show that American beer drinkers cannot identify their favorite brand unless they can be reminded by the label, so brand may be a distinguishing feature.

b) [10] Give two sources of scale economies in beer production.

Some sources of scale economies in beer production are dimensional economies, fixed cost/lumpiness, and multi-plant production. Currently, an efficient brewer would build two facilities each with approximately 4 million barrels per year capacity.

Dimensional economies arise from the fact that vats, warehouses, and even beer trucks have the property that the material cost of enclosing them goes up by square while volume (and hence quantity) goes up by the cube. Consequently unit cost measured in terms of dollars per barrel falls with scale of production.

a) [16] Using the SSNIP test for market definition, describe briefly how you would go about defining the economic market that includes lager beer.

Fixed cost or lumpiness refers to the fact that the cost of beer making facilities (e.g., vats) and canning/bottling tend to not vary much with output, giving a very low MC once these facilities are in place. Related is the economies that derive from specialization in the design and use of facilities (e.g., a line fills just certain kind of bottles, than on that fills bottles and cans of all shapes). Multi-plant production allows reallocation of production to low MC plants (assuming rising marginal cost and ignoring transportation expense). Over time major brewers have built several plants and have dispersed them throughout the country. Factors that make this possible while maintaining uniformity of the product include a common brewing formulas and standardized inputs and facilities.

National advertising realizes significant savings (measured according to the ability to deliver advertising messages per population) over regional or local advertising. The latter would include local radio and bill board.

2. <u>STEEL INDUSTRY</u>

a) [16] Describe two prominent trends that have contributed to structural change in the U.S. steel industry over the past 50 years. Be sure to include the sources of structure change.

Trends that have contributed to structural change in the U.S. steel industry over the past 50 years include domestic entry, integrated mills exiting, and foreign imports on the supply side, and slowing growth in steel consumption on the demand side, caused in part with ready availability of substitute materials like plastic, fiberglass and aluminum.

Domestic entry has been mainly mini-mills throughout the country, over-represented in low labor cost areas (e.g. the south) and in areas under-represented by integrated mills. Their entry is mainly due to new technologies (electric furnace, continuous casting).

Integrated mill exit has been from retirement of plants and bankruptcies due to their lack of adoption of innovations (continuous casting) and excess wage rates (Unite Steel Workers union).

Foreign imports have increased due to opening of trade with "new" producing countries (Brazil, Poland) as well as increased production by more traditional suppliers (Germany, Korea). Some of foreign supply is using mini-mills (e.g., Japan).

Over the 30 year period 1965-95, integrated mill production shrunk in half (to 72 million tons per year from 144) while mini mills increased nearly ten fold (4.5 up to 40.5).

b) [10] Compare integrated mills and mini-mills in terms of their technology, products and scale.

The raw inputs for integrated mills are ore, coke, magnesium, and lots of energy. Mini Mills use scrap, directly reduced ore (and sometimes pig iron), and electricity.

The technology of integrated mills is the Basic Oxygen Furnace (BOF) and rolling mills and some continuous casting. Pig iron is produced as an intermediate product of integrated mills. Mini mills use the electric furnace with continuous casting and thin slab casting. Mini mills have substantially greater productivity as measured in terms of man-hours per ton.

Integrated mills produce the full range of steel products including slabs, billets, blooms and coil. These mills also produce high quality steel products such as stainless sheet and coils sold to auto and appliance manufacturers. Traditionally, mini mills produced lower quality steel such as bars, rods, structural and construction materials. Mini mills are increasing their production of finished products. It is also cheaper to build a mini mill: \$200 per ton of steel making capacity as opposed to \$1,200-1,500 for an integrated works.

Efficient scale of an integrated mill is 2 blast furnaces at about 3 - 4 million tons per year. The scale of an efficient mini mill runs 350-750K tons per year, more if it has a thin-slab caster.