GENERAL INSTRUCTIONS: Write your name and your TA’s name on the front cover of each of TWO BLUE BOOKS. The exam has 3 parts. Put Part I and Question II.1 in one blue book, and Question II.2 and Part III in a second. The exam is worth 100 points. Point assignments are given in the instructions for each part. Check your calculations on scratch paper but be certain to put all of your answers in the bluebooks.

I. TRUE or FALSE or UNCERTAIN and EXPLAIN: Choose 4 of the following 6 statements, decide whether each is true or false or uncertain, and then explain the reasoning behind your answer in a few sentences; provide any assumptions you may think necessary to draw your conclusion. We will only grade the first 4 that appear in your bluebook. Each question is worth 7 points for a total of 28 points.

1. While retail sales of ready-to-eat breakfast cereals in the Bay Area exhibits an HHI of 1,840, this figure likely overstates the extent of concentration in this market.

UNCERTAIN - If the HHI overstates the extent of concentration then we are saying that the HHI would actually be lower if the market isn’t as concentrated as the HHI suggests. Because the figure includes the whole bay area but consumers will not be willing to travel very far to get, market concentration will be greater if we look at a more local level (i.e. given this argument the HHI is probably understated).

It maybe however, that the market is too narrowly defined, since some consumers may be willing to substitute other breakfast items (oatmeal, granola bars, steak & eggs) for RTE cereal. To find out for sure, we would like to use the SSNIP test: if we raised the price of all RTE cereals, what is the decrease in sales?

2. When firms in an industry act as price takers, their index of scale economies, s, will be less than 1 when the industry reaches in equilibrium.

FALSE: s = AC/MC. When firms act as price takers (i.e. a competitive industry), when s < 1 then AC < MC and firms are making a profit. In equilibrium, however, profits will be zero, since firms enter until profits are zero. Profits are just zero when AC = MC, or when s = 1.

3. It is never profitable to sell a product below its cost of production and below the price charged by competitive firms.

FALSE – We have studied three possibilities where this could be the case.
- First, a product may be a “loss-leaders” – where the firm may be willing to lose money on one product because it makes it up on another.
- Second, learning-by-doing may make a firm decided to overproduce in one period at such a quantity that the price falls below production costs. Although it loses money in the first period, it lowers costs in subsequent periods.
- Third, as in the model of the dominant firm with a competitive fringe, if it’s the dominant firms costs are low enough, its price may be too low for the competitive fringe to produce.

4. A single-product monopolist who controls the quantity and the quality of its product will supply too little of both relative to the social optimum.

UNCERTAIN - A quality setting monopolist will always choose quality so that its marginal private return to doing so equals its marginal private cost. A social planner will want the marginal social return to equal the marginal cost of changing quality. These need not be the same conditions. It depends on how demand changes.
with changes in quality. We may encounter a situation where the private return exceeds the social return, or vice versa. Again, depending on the responsiveness of demand to quality, it can go either way.

Now, for quantity, for a given quality level, the monopolist will always charge above marginal costs (the optimal price for a social planner) and thus hold back quantity. It will thus supply too little quantity relative to the social optimum.

5. An auto manufacturer would never create a slow version of its popular sports car by merely disabling the fifth gear because all of its potential customers would prefer the faster version.

UNCERTAIN – A manufacturer MAY want to disabling fifth gear because, while all customers may prefer a faster version, some may have a higher willingness-to-pay for the fifth gear. Thus, disabling the gear will allow it to price discriminate by pricing 5-gear higher and still sell the 4-gear model to those with a lower willingness-to-pay. However, three other considerations may NOT make it more profitable:

a) The price of the 5-gear needs to be low enough so that the high types get as much utility from buying the 4-gear.

b) Assuming the costs are the same for the 5-gear and the 4-gear, the manufacturers will make less on each 4-gear car. If it loses more than it gains from separating the market, it will not want to price discriminate.

c) Because of a) it may be profitable to only sell to the high types at their reservation price (i.e., only offer a 5-gear model and sell it for the w.t.p. of the high types).

6. When two duopolists compete by setting price of their undifferentiated products, the industry will result in the Bertrand paradox.

UNCERTAIN: When the products are undifferentiated, all consumers view the products as perfect substitutes. When the duopolists have the same marginal costs, each will attempt to undercut the others price until P = MC.

There are two possible exceptions.
- First, when the firms have different costs, say MC\(_1\) > MC\(_2\). Then, when the firms compete on price, firm 2 will be able to price just below MC\(_1\) which, with no fixed costs, will give it a profit of q(MC\(_1\))\(\times\)(MC\(_1\) – MC\(_2\)).
- A second exception may be two firms with fixed physical locations that compete on price. The products they sell may be undifferentiated but the firms will not price down to marginal costs. This, however, is stretching the definition of undifferentiated, since consumer are actually choosing both the good and how far they have to travel—which effectively makes it a differentiated good. (See the Fall 2001 Final Exam, II.1.a).

II. MULTI-PART QUESTIONS: Answer all of the four parts of both of the following two questions. The point assignment for each subpart is given in [square brackets]. Together, the two are worth 48 points.

1. 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 given by: MC(q\(_f\)) = 80 + 10q\(_f\). Neither type of firm incurs fixed costs.


   We find the supply of a fringe firm from MC:
   \[ P = 80 + 10q_f \leftrightarrow \]
   \[ q_f = s(p) = 8 - p / 10 \]

   Thus,
\[ S(p) = N * s(p) = 10(8 - p / 10) = 80 - p \]

b) [4] Draw a large price-quantity diagram and insert industry demand and competitive fringe supply curves, carefully and completely labeling all points and lines.

c) [6] On a second diagram, draw in the residual demand of the dominant firm and clearly label it, and then add the dominant firm’s corresponding marginal revenue into this second diagram.
d) [6] Draw two marginal cost curves for the dominant firm in your second diagram that result in the following outcomes:

i) \( MC_1 \): The dominant firm chooses the same price and quantity as a monopolist

ii) \( MC_2 \): The fringe produces a positive amount.

NOTE: It was not sufficient to have only drawn the correct Marginal Costs curves. As is the case for the T/F, we are more interested in your reasoning than if you can simply recall a way a graph was drawn. For the \( MC_1 \), you need to show, either graphically or by explaining, that the dominant firm produces the same and prices the same as a monopolist. For \( MC_2 \), you need to show that when the dominant firm sets marginal revenue equal to marginal costs, it picks a price such that the competitive fringe produces, ideally labeling that quantity on your graph.

\( MC_1 \): Marginal costs intersect the marginal revenue curve to the right of the discontinuity in marginal revenue. Thus, the marginal revenue curve that the dominant firm faces is the same that the monopolist faces and will produce the same amount and price at the monopoly price.

\( MC_2 \): Here, it is important to indicate that the fringe is producing a positive amount. The marginal cost curve should intersect the marginal revenue curve to the left of the discontinuity in MR. The dominant firm will produce \( q_d \) at a price that the competitive fringe is willing to produce. Specifically, this is \( q_f \) above.

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2. Consider a Hotelling town served by two firms, one located at the far left end (firm L at \( z = 0 \)) and another at the far right end (firm R at \( z = 1 \)) of the one-mile town. As usual, \( M \) potential customers are evenly distributed along the mile interval, each one places a value of \( V \) on the homogeneous good sold by the firms, and incurs a per-mile transportation charge of \( t \). The prices charged by firms L and R, respectively, are \( p_L \) and \( p_R \). For simplicity, assume that all costs are sunk and that the entire market will be served.

a) [4] Draw a diagram illustrating the Hotelling town being sure to label all points and lines. Indicate the “effective” or “delivered” prices for both firms (as seen by the various customers located along the line) and give the algebraic expressions for those prices.

For any given consumer, an “effective” price for a good is the sum of both the purchase price and the costs associated with travel to the store in order to obtain the good. The farther away the store, the higher the effective price of the good.

For the consumer located at any given \( z \), we have the following effective prices:

When buying from Firm L: \( EP_L = p_L + tz \)
When buying from Firm R: \( EP_R = p_R + t(1-z) \)

The diagram is as follows:
b) [8] Derive the location of the “marginal consumer”:
\[ z = \frac{(p_R - p_L + t)}{2t} \] (assuming V is large enough relative to prices that everyone in town makes a purchase). Then use this location to write down Firm L’s profit and show that its profit-maximizing price (given the price of Firm R) is: 
\[ p_L = \frac{1}{2}(p_R + t) \]

The marginal consumer is located at \( z \) in the above graph. This consumer, given prices and per-unit transportation costs, is indifferent between a purchase from Firm L and Firm R. The consumer’s effective price (or alternatively, remaining consumer surplus) is the same regardless of the store visited.

Algebraically:
\[ p_L + tZ = p_R + t(1 - Z) \]
\[ 2tZ = p_R - p_L + t \]
\[ Z = \frac{(p_R - p_L + t)}{2t} \]

Firm L’s profit is equal to its total revenues minus its total costs. Total revenues equal price \( p_L \) times quantity \( MZ \), the number of people in town multiplied by the percentage served by Firm L. Recall that our total costs are assumed to be zero. Profits are therefore:

\[ \pi_L = p_L M[(p_R - p_L + t) / 2t] \]
\[ = \frac{1}{2}t \left[ p_R M - 2p_L M + p_L M t \right] \]

To find the profit-maximizing \( p_L \), take the derivative of \( \pi_L \) with respect to \( p_L \) and set equal to zero:

\[ \frac{d\pi_L}{dp_L} = \frac{1}{2}t \left[ p_R M - 2p_L M + M t \right] = 0 \]

Solve \( p_L \) in terms of \( p_R \) (Firm L’s best response function):

\[ \frac{1}{2}t \left[ p_R M - 2p_L M + M t \right] = 0 \]
\[ 2p_L M = p_R M + M t \]
\[ p_L = \frac{1}{2} (p_R + t) \]

c) [8] Solve for the equilibrium prices charged by the two firms and explain how and why they vary with transportation cost \( t \).
Because Firm L and Firm R each have the same cost structure, we know that Firm R’s best response function is just like Firm L’s (with $p_L$ and $p_R$ interchanged).

$$p_L = \frac{1}{2} (p_R + t)$$
$$p_R = \frac{1}{2} (p_L + t)$$

To find equilibrium prices, solve for the intersection of these two best response functions. Substituting one into the other yields:

$$p_L = \frac{1}{2} (\frac{1}{2} (p_L + t) + t)$$

$$\Rightarrow p_L = \frac{1}{4} p_L + \frac{1}{4} t + \frac{1}{2} t$$

$$\Rightarrow \frac{3}{4} p_L = \frac{3}{4} t$$

$$\Rightarrow p_L = t$$

$$\Rightarrow p_R = \frac{1}{2} (p_L + t) = t$$

\[p_L = p_R = t.\] 
\[dp_R/dt = dp_L/dt = 1\]

The greater the value of $t$, the more the consumer is willing to pay a high price to avoid being far away from a favorite location. A high $t$ value indicates that the firms need not worry about charging a high price because consumers would prefer to pay that price rather than buy a low-price alternative that is located far away. In other words, the larger the $t$, the less the price competition and thus the greater the prices charged by each of the individual firms. [see section 5.4.2 for the same example but with positive marginal costs]

d) [8] Suppose now that firms L and R merge to form a monopoly with two locations. Compute the prices that will now be charged by the monopolist and compare to the pre-merger prices. Do they rise or fall? Explain why.

Let’s assume that these firms did not relocate after the merge (you could have also provided a graph showing a move and derived correct prices as a result of that specific move). Again, the cost structure in each of the two plants is identical, and thus identical prices are charged and the marginal consumer is located at $z = \frac{1}{2}$.

Not only is this marginal consumer indifferent between buying from Store L or Store R, but this consumer is charged such a high price that she is just indifferent between buying and not buying the good; consumer surplus after the purchase is made will be zero. Since both stores are a 1/2 mile away, her effective price is $p + t/2$.

The monopolist sets this equal to her reservation price in order to determine the best price to charge:

$$V = p + t/2$$

$$\Rightarrow p = V - t/2 \text{ (which is the same in both stores)}$$

The monopoly price is larger than the competitive price when $V - t/2 > t$, or $V/t > 3/2$.

Note that earlier in the problem, we assumed $V$ was large enough so that everyone in town makes a purchase; when that is assumed, we need not worry about the above condition.

The price must have risen. The monopolist doesn’t need to worry about undercutting from competing firms. In fact, given that the monopolist supplies the entire town, the monopoly price is at its highest (any price higher than $p = V - t/2$ will result in the middle consumers declining to purchase the good).
III. **INDUSTRY STUDIES:** Choose just one of the three industries—BEER or STEEL or BREAKFAST CEREALS—and then answer all of the questions below for the chosen industry. This section has a total of 24 points.

1. [8] Describe the extent of scale economies in the industry, and give one cause for:
   a) increasing returns to scale.
   b) decreasing returns to scale.

2. [6] Give one example of likely scope economy that occurs in the production of products in this industry, and identify the source of that scope economy.

3. [10] Briefly describe the pattern of concentration over time in this industry in the U.S. Be certain to identify the significant events and economic forces underlying the major changes in concentration that have occurred.

**BEER (80% of the class choose this industry)**

1. Some sources of scale economies in beer production are dimensional economies, fixed cost/lumpiness, multi-plant production and advertising. 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 costs measured in terms of dollars per barrel falls with scale of production. Fixed costs or lumpiness refers to the fact that the cost of beer making and canning/bottling facilities tend not to vary much with output – a very low marginal cost is incurred once the facilities are in place. If fixed costs are high, this translates into a negatively-sloped average cost curve as output increases. Multi-plant production allows reallocation of production to low-MC plants (assuming MC curves slope upwards) once economies of scale for a given plant are exhausted (the point of MES is reached and additional production in that particular plant increases AC). National advertising realizes significant savings (measured according to the ability to deliver advertising messages per population) over regional or local advertising. Multi-plant economies of scale, especially those associated with national advertising, tend to explain why a firm with three to four plants has significant cost advantages over a firm with only one or two plants.

Increasing returns to scale imply that as all inputs are increased proportionally, the output increases by more than this proportion; thus as output increases, average costs fall. An example of IRTS might be dimensional economies of scale (discussed above). Another is the specialization of labor and machinery - as production in a given plant increases, tasks become more specialized, increasing efficiency and thus lowering per-unit costs.

A cause for decreasing returns to scale may be transportation costs. If it were not a concern, we would expect to find each of the major beer producers operating a single, gigantic, centrally located beer-producing plant, shipping all of its product from that one location. But of course, that’s not what we see. Plants have MES of up to 4.5 million barrels, and a typical large company might operate four plants throughout the US. It must have been more costly to produce in a single 18-million-barrel-producing plant and transport to a larger portion of the US than to operate four 4.5-million-barrel-producing plants at different locations (even if the fixed costs of four smaller plants are higher than that for one larger plant).

2. Economies of scope are realized when it is cheaper to produce a set of goods in one multi-product plant than it is to produce in two or more specialized plants. It is easy to see the scope economies for the case of beer. For instance, regular and light beers are produced in essentially the same manner, and share many of the
same inputs, too. Because the fixed costs of plants and machinery are so high, it is probably much cheaper to produce both types of beer in a single plant than it is to produce each type in its own plant.

Economies of scope may also be realized in advertising. Budweiser and Bud Light are both of the same brand, and advertising for one of the two most likely reminds the consumer of all Budweiser products. It is probably more costly to get an equivalent advertising “bang” when the two products are Budweiser and, say, “Light Suds” – two products perceived by consumers to be entirely different brands. Thus an advertising dollar is better spent when a firm produces a number of beer types than when a firm produces only a single type of product.

3. The beer industry shows a very strong pattern of increasing concentration over time. In the late 1940’s, many small firms whose shipments never crossed more than a few state boundaries characterized the industry. In 1947, there were more than four hundred firms operating a total of 465 plants, the C4 concentration index was 8.8 percent, and Stroh-Schlitz was the industry leader with 5.5% of market share (if we go back to the turn of the century, we find even less concentration and more localized markets). In contrast, in 1996 five firms operate 31 breweries, and the C2 was 67.2 percent. Anheuser-Busch and Miller account for roughly two thirds of the market.

A number of factors explain the increase in concentration. Massive increases in single-plant minimum efficient scales were realized through the construction of new plants and technical changes in production and storage. Improvements in the technology of refrigeration and transportation allowed plants to serve larger market segments. Strong plant scale economies have increased the MES from about 150,000 barrels per year after WWII to about 4.5 million barrels per year now. Efficient-sized firms became very large and produced significant shares of entire market demand – so the market could not support as many firms as it had in the past. Additionally, the high start-up costs associated with building successful companies kept potential entrants away.

Large advertising expenditures and exclusive contracts of the national brands act as barriers to entry. Ads on national TV are less costly (per unit of advertising), partly because fewer contracts and transactions need to be made to get the advertising on the air. And because larger firms are more likely to afford national advertising, their message often effectively drowns out those of smaller competitors. Additionally, the exclusive contracts often arranged - typically for sporting events - make it nearly impossible for a burgeoning firm to make its way into the industry.

The large companies have also used a number of different pricing strategies to increase their market shares. Both horizontal and vertical product differentiation are used widely as both pricing and risk-reducing strategies. A high degree of product proliferation exists, and established brands attempt to fill every niche in order to make it difficult for new firms to enter with unique products. Larger companies also do not need to rely on a single (or a few types of) beer, reducing risk.

Other, less significant characteristics of the industry include mergers, imports and microbrews. Mergers may have contributed to concentration, but only in a minor way; the largest firms became larger primarily through internal growth, while only the less popular and declining brands merged. Imported beer and superpremiums accounted for 1 percent of total sales in 1960, and by 1996 this figure has grown to 8%. Microbreweries have also sprung up over the last decade, but for the time being they remain a minor share of the market.
STEEL (10% of the class choose this industry)

1. Some of the scale economies experienced in the beer industry are applicable to the steel industry as well, specifically the dimensional economies and the economies due to high initial fixed costs. Advertising, however, is not a factor in this industry. IRTS may be realized due to these dimensional economies of scale, as well as the ability to have more specialized labor and machinery with larger plants. Cost savings from continuous casting is also important, as shutting down a plant (even for the night) may be costly.

Decreasing returns to scale may arise as a result of high transportation costs; the value-to-weight ratio of steel is quite low. Scarcity of inputs is another example. An increase in production requires additional iron ore, but the increased demand for ore raises its price. This may in turn increase the AC for a firm.

2. One example of a scope economy would be the mini-mill practice of taking advantage of cost complimentaries by refining the scrap metal in the same place as the actual production of steel. Also, because many different products such as bars, slabs, billets, blooms, rods and metal sheets all share the same initial stage, a firm may find it worthwhile to produce all these items in the same location rather than reserve separate plants for separate products.

3. The steel industry exhibits a pattern of decreasing concentration all along this century. This decline in concentration changed the industry from a virtual monopoly, to a cooperative oligopoly, to competition.

US Steel was formed by a series of mergers between 1898 and 1901 that gave it over 65% of the total country’s steel production capacity. It also had control over much of the available iron ore. In the 1920s, Bethlehem, Republic and National make many acquisitions, and thus the industry converged to a set of regional oligopolies in which US Steel would be the price leader. US Steel discouraged price competition with a delivered price system known as basing-point pricing. Antitrust was a major force in these pricing practices, and in 1948 the FTC halted US Steel’s basing point pricing.

In 1950 the basic oxygen furnace came out in Austria. However, large US steel makers continued with their traditional practices of integrated mills with blast furnaces and rolling mills, and did not start adopting basic oxygen furnaces until 1963. Although imports were initially nonexistent, they became an important consideration in the US market when the foreign firms adopted these more efficient practices, experienced declines in transportation costs, and found additional iron ore sources. In 1968, voluntary import restraints were introduced.

The high energy costs of the 1970s brought in even more foreign firms. Additionally, a new technology sprouted based on electric furnaces, leading rise to a type of plant known as a minimill. They used these electric furnaces to make steel from scrap, and located in areas with lower labor costs. They didn’t need iron ore, and were able to operate at a much smaller scale than the integrated firms and with lower start-up costs, too - MES was 350,000 – 750,000 tons/year for a minimill versus 7-8 million tons/year for a large plant. Eventually, their collective market share would rise to about one third of total production. Imports held around 20% of the market and US Steel held only around 10%.
BREAKFAST CEREALS (10% of the class choose this industry)

1. The machines used in the production of breakfast cereals are modest in scale. Given their current size, it is not necessarily a good thing to build larger plants, as they would produce too much supply given the demand in the market.

Economies of scale and increasing returns to scale occur in breakfast cereal advertising. In fact, during the mid-1970s, nearly 10% of sales revenues were devoted to ads. The larger the ad contract, the more cost effective, as discounts from buying network insertions and savings from not having to buy multiple local spot messages were experienced. Also, repetition of an advertising message is often necessary when trying to alter consumer behavior.

Decreasing returns to scale may be observed as a result of high transportation costs. A single firm is often builds multiple plants at various locations. For example, in 1978 Kellogg and General Mills each operated five separate plants rather than consolidating all their production into larger, more comprehensive facilities.

2. When a plant has several production lines, multiple products may be produced (or even the same product, one for major label boxes and one for generic) using the same production process and machinery. Multi-line plants also take advantage of economies associated with the costs of overhead and large-scale handling of raw grain. Finally, there may be economies of scope in marketing, as it works to publicize not only the specific breakfast cereal but the brand name as well [see discussion on the beer case].

3. The ready-to-eat (RTE) breakfast cereal industry is considered a tight oligopoly, and has been one for a considerable length of time; the C4 measure increased from 84% to 89% over the course of the forty years from 1937 to 1977. Following WWI, Kellogg behaved in the manner of a price leader in the industry. This could have led to monopolistic pricing, but because of high product differentiation the price leadership factor was not as strong as it could have been. In the 1970s and beyond, it appears that the RTE market leaders maintain their shares primarily through the use of aggressive advertising and marketing techniques aimed at achieving large nationwide sales volumes. The explanation for such a high level of concentration in the industry is probably a complex interaction of these advertising schemes, plant-scale economies and the leading sellers’ practice of product proliferation to the point of covering all niches in the spectrum of product characteristics.

Many aggressive ads and market techniques are used in this industry. Direct price competition is often eschewed for more quasi-price competitive strategies such as in-pack premiums, trade dealings (giving retailers a percentage discount if they agree to promote a product), and couponing.

Some scale and scope economies exist in the physical production and distribution of breakfast cereals, but as discussed in (1) and (2), the role of advertising tends to be much more influential.

Product proliferation is a widely used means by which to prevent entry and maintain market share. It is very difficult for new brands to enter the market with a unique product and obtain a viable share of the market when there are already so many supposedly unique products out there in the first place. The big firms are also the ones more likely to obtain prime shelf positions in supermarkets, and the mere fact of limited shelf space means that many burgeoning products from unknown brands are unlikely to make it to the shelf at all. In 1972
some additional firms were able to get a foothold through the introduction of “natural” cereals, but soon thereafter the large, preexisting companies retaliated with their own variants. Greater variety could be beneficial to consumers if considering the wide array of goods available for purchase, but the new products often cannibalize sales of existing products. Often, the launching of additional products consumes substantial resources (via advertising) and ultimately enhances the market power of the firms.