Midterm Examination  
October 18, 2001

Please answer each question in the space provided. You may consult one page of notes. I understand that the honor code applies: I will not lie, cheat, or steal to gain an academic advantage, or tolerate those who do.

(Name and Signature)

1. (30 points) It’s been several years since the hugely successful launch of Xamoff, an over-the-counter medicine that reduces exam-related anxiety. Industry reports estimate sales last year at 20 million doses at a price of $12 each. The product was developed by Professor Simon Bartov of NYU, who licensed pharmaceuticals giant Melco to produce it. You have learned, however, that because the product was developed at NYU, the University has the right to license one additional vendor. They have offered the license to you for $2 per dose. Further research suggests that you would be able to produce for $5/dose. The question is whether your costs are low enough to withstand the competition that may arise with Melco. You are worried, in particular, that the royalty to NYU may give you higher costs than Melco, whose cost structure is kept closely guarded.

(a) Market research suggests that the elasticity of demand for Xamoff is between –2 and –3. Use each of these numbers to estimate Melco’s marginal cost.
(b) Suppose competition between you and Melco drives the price down to the marginal cost of the high-cost producer. Would you make money at this price?
(c) What do you tell NYU?

2. (40 points) A distant family relation is thinking of starting a pizza restaurant in the Village and would like your advice. He says that people in this business are making thousands of dollars a week and wonders whether he could do the same. You consult a friend in the restaurant business, who tells you that pizza is thought by consumers to be a homogeneous product. She also tells you that the demand for pizza is

\[ Q = 84 - 2p, \]

and the cost function for a restaurant (they’re all the same) is

\[ C(q) = 25 + 2q + q^2. \]
Price is measured in dollars per pizza. Quantities are measured in thousands of pizzas per week. The capital “Q” in demand is a reminder that this is the demand curve for the whole industry.

(a) Does pizza-making have a fixed cost?
(b) Draw the average and marginal cost AC curves, showing their most important qualitative features. Show that the minimum of the average cost curve is at \( q = 5 \). (If you can’t show this, please assume it for the rest of the problem.) What are average and marginal cost at this level of output? [Reminder: If \( y = ax^n \), then \( \frac{dy}{dx} = nax^{n-1} \).]
(c) What is the supply curve for a single restaurant?
(d) Given the cost structure and demand, how many restaurants will operate in this market in the long run?

Suppose that, in the short run, there are 10 restaurants operating.

(e) What is the market supply curve?
(f) What is the equilibrium price of pizza? At this price, do the existing restaurants make money?
(g) What would you tell your relative?

3. (30 points) HAL Corp has been rethinking its executive education efforts. It has been running an extensive educational program at a conference center north of New York City, spending 500k annually to pay off a conference center, 150k for its educational director, and 200k for an educational staff that teaches a wide range of courses. The program has brought some clear benefits to IBM: employees gain critical skills and value HAL’s investment in them; and the organization spreads common values and builds personal connections across divisions.

Despite these benefits, HAL is considering two alternative approaches. Plan A is to outsource education to the NYU Stern School. In this case, it would retain the center and its director, who would oversee the relationship with Stern, but pay Stern 180k to replace its educational staff. It has been assured access to the best Stern faculty, which HAL thinks are of higher quality than its own dedicated staff. Plan B is to drop its education program altogether, leasing its center for 200k/year and leaving its employees to enroll in degree programs at universities in the area. It estimates that its existing tuition reimbursement program would lead to additional costs of 350k a year.

Your mission is to outline the costs and benefits to HAL of Plans A and B.

(a) What are the annual costs and benefits, financial and otherwise, of moving from the current situation to Plan B?
(b) What are the costs and benefits, financial and otherwise, of moving from the current situation to Plan A? What are the main advantages and disadvantages of outsourcing course delivery to Stern?
Suggested Answers

1. Xamoff knockoff.
   (a) One version of the elasticity formula is \( p \left(1+\frac{1}{\varepsilon}\right) = MC \). With \( \varepsilon = -2 \), \( MC = 6 \).
   With \( \varepsilon = -3 \), \( MC = 8 \). The uncertainty about the elasticity thus translates into uncertainty about Melco’s costs.
   (b) Your MC is 7: 5 for production, 2 for NYU. If the elasticity is –2, you’re in trouble: Melco could price below your cost and still make money.
   (c) You need to get NYU to budge. One approach might be to get them to accept $1, which would allow you to match Melco’s cost in the worst-case scenario. A more complex deal would be to tie the royalty to the market price: if the price falls to $6, the royalty falls to $1.

2. Pizza: an analysis of a competitive industry.
   (a) Yes: \( C(0) = 25 \).
   (b) \( MC(q) = \frac{dC}{dq} = 2 + 2q \). (This is a derivative.) MC is increasing (it’s a straight line). AC is U-shaped (the U is a little flatter on the right side than the left, but that’s a fine point). The min is where \( AC = MC \) (this is a general result): \( q = 5 \).
   The marginal and average costs at \( q = 5 \) are both 12.
   (c) The supply curve for a single restaurant is given by the MC curve: \( p = MC = 2 + 2q \). Or we’d typically say: \( q = \frac{p}{2} – 1 \).
   (d) In the long run, firms will produce at the minimum of AC and therefore produce \( q = 5 \) and sell at price \( p = 12 \). At \( p = 12 \), demand is \( Q = 84 – 2p = 60 \), which leaves room for \( 60/5 = 12 \) restaurants.
   (e) With 10 restaurants, we get 10q at each price: \( Q = 10q = 10(\frac{p}{2}-1) = 5p – 10 \).
   (f) Set supply equal to demand: \( p = 94/7 = 13.43 \). At this price, each restaurant supplies \( q = \frac{p}{2} – 1 = 5.71 \). (Remember, units are thousands per week.) At this quantity, \( AC = 12.09 \) and profits are \( 5.71(13.43-12.09) = 7.65 \) thousand dollars per week.
   (g) Advice: this is currently a profitable business and there’s room for 2 more. After your relative enters, profits will drop. (You could compute the profit by redoing (e) with 11 restaurants.) And if another restaurant appears, profits will disappear altogether.

3. HAL.
   (a) Financial analysis: Plan B saves 200k. Why? Cost of the current situation: conference center (200k opportunity cost), director (150k), and staff (200k), 550k total. Cost of Plan B: 350k. Thus you save 200k. Other factors: You’ve lost the “culture building” aspects of in-house programs. HAL’s leadership will have to decide how much value to place on them.
   (b) Plan A would save 20k and produce higher quality. A classic case of the advantages of outsourcing. HAL gets a more attractive price/quality combination, the results of Stern’s expertise in this area. HAL loses, however, some of the direct control over the process and possibly some information from teaching itself (what its employees are concerned about, etc). The holdup problem and strategic
leverage don’t seem relevant: there are few specific assets (even an investment by Stern in HAL cases wouldn’t cost much) and Stern is but one of several local providers.

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