

2001 Mid-Term Exam—Answer Sheet

Below you will find the answers to the mid-terms as well as a listing of some common mistakes that students made in trying to answer the questions.

Problem #1. True, False, Uncertain

1a) (Note: Problem 1a is not covered anymore) UNCERTAIN. This is a dynamic demand equation (note the presence of $\ln(Q_{t-1})$ on the right.) The SR price elasticity is $-.643$, so that demand is price inelastic in the short run. The LR price elasticity is $-.643/(1 - .646) = -1.82$, so the demand is price elastic in the long run.

Common Mistakes:

- Many students did not differentiate between SR and LR own-price elasticities. The SR elasticity can be read directly from the given equation while the LR elasticity can be calculated as indicated above.
- Another common mistake was not defining, or incorrectly defining, the SR and LR elasticities as either elastic or inelastic. Elasticities are elastic when $(|E| > 1)$ and inelastic when $(|E| < 1)$.
- Some students discussed elasticities (such as income) other than (own) price elasticities, and some students mis-identified price elasticity as 0.231 0.646 rather than as -0.643 (SR).

1b) TRUE. The machines represent a variable cost, as more machines will be acquired as the firm's output increases and there is an active resale market for selling machines if the firm's output declines. The tariff raises the market value of the machines, and therefore raises variable (economic) costs.

Common Mistakes:

- The common mistake here was thinking that the machines would ALWAYS be a fixed cost for the biotech company. Some people said that while they were probably fixed in the short run, in the long run all costs are variable so the tariff should be factored in. In addition, even in the short run, the tariff raises the market value of the machines, which implies higher opportunity costs, raising the firm's User Cost of Capital, which is a component of variable costs. The machines would not be sunk costs because there is an active resale market and the higher market value means that the firm could receive a higher return than before if it chose to sell. Finally, as the question said, the firm could buy more if output increased (or sell them if output decreased), implying that it would be a variable cost.

1c) FALSE. The \$ 20 fee is charged for each snowmobile to be produced: it is a variable cost of production and is not a sunk cost.

Common Mistakes:

- The most common mistake was not realizing that the \$20 fine per snowmobile was a variable cost rather than a sunk cost. Sunk costs are unrecoverable and should not influence future economic decisions. However, the \$20 fine varies with output and does affect future decisions. If the manufacturer does not produce snowmobiles, the \$20 cost is avoided. Alternatively, the manufacturer could increase the price of the snowmobiles to try to recoup all or part of the \$20 cost.

1d) TRUE. If you suspect that your product will exhibit positive network externalities, you want to set price and quantity to reflect that an additional unit sold now will add to installed base in the future, which will increase future revenue. This means that current MR does not reflect all marginal revenue, and that “current MR = current MC” will result in too low an output value. For example, in a two period example, the firm should operate in period 1 such that

$$MR_1 = MC_1 - \frac{\partial R_2}{\partial Q_1}$$

so that for current values only, we have that $MR_1 < MC_1$ is optimal when there is a positive network externality.

Common Mistakes:

- Most people answered this question correctly. Those that did not thought that price should be higher or that you should wait after the product launch to decrease price. For network externalities, you price where marginal cost equals the marginal revenue plus the future benefit (revenue) from production today. Thus, you want to decrease price at the launch to increase quantity demanded via the bandwagon effect, and reap higher revenues in the future. You need to consider the effect of future revenues when pricing today which is why you should lower the price at launch.

Problem #2.

(a) The market equilibrium requires $20,000 - 1,000 p = 1,000 p$, which gives $p = \$10.0$. At this price, supply is 10,000 loaves.
 Price elasticity of demand equals $-b \cdot p / Q = -1,000 \cdot 10 / 10,000 = -1$. Price elasticity of demand equals $d \cdot p / Q = 1,000 \cdot 10 / 10,000 = 1$.

Common Mistakes:

- Most students correctly answered this question. A few students forgot to compute the demand and supply elasticities. Some other students forgot that the demand elasticity was negative (an increase in price results in a reduction in demand), while the supply elasticity is positive (an increase in price results in an increase in production).

(b) With the price band, the new price is at the price ceiling \$2.00. At this price, supply is 2,000 loaves. Note (for further calculation) that the willingness to pay of the marginal consumer who is still able to buy bread is determined by $20,000 - 1,000p = 2,000$. This implies that that person's willingness to pay is \$18.00. The deadweight loss is now simply $(18-2)*(10,000-2,000)/2 = 64,000$, with \$32,000 lost from previous consumer surplus and \$ 32,000 lost from previous producer surplus. In addition, producer's lose $2,000 * (10 - 2) = \$16,000$ in surplus on the 2,000 units sold (at \$2 instead of \$10), so the total loss of producers is $\$32,000 + \$16,000 = \$48,000$.

Consumers who can still buy bread gain $(10-2)*2,000 = \$16,000$. The dead weight loss of \$32,000 plus this gain of \$16,000 means that overall, consumers lose 16,000.

Common Mistakes:

- Many students did not recognize that the price after the band would be \$2. Even at this price, demand is greater than supply. Hence, if the price were below \$2, suppliers would increase price to better meet demand. Some students also thought that the price band meant that suppliers could not produce below \$1. Most students correctly computed DWL. However, many students divided the DWL evenly between the change in CS and PS. This is not a tax and so the pass through formula does not apply. Some students forgot that the area bound by \$2 and \$10 for the 2000 loaves of bread sold moved from producer surplus to consumer surplus.

(c) With the new supply curve, the unrestricted outcome is a price of \$2.00 and a quantity of 18,000. Since \$2.00 falls within the price band, the band has no effect. There is no deadweight loss. Suppliers and consumers get exactly the same surplus with or without the price band policy.

Common Mistakes:

- As in b), some students did not recognize that the equilibrium price would be \$2. Many students did not recognize that the deadweight loss should be computed for the new technology with a price band relative to the new technology without a price band. It does not make sense to compute the deadweight loss of a technology relative to the absence of a technology. The two scenarios represent different markets. Given that the band does not modify the equilibrium, one could immediately answer that there was no DWL and no change in CS/PS.

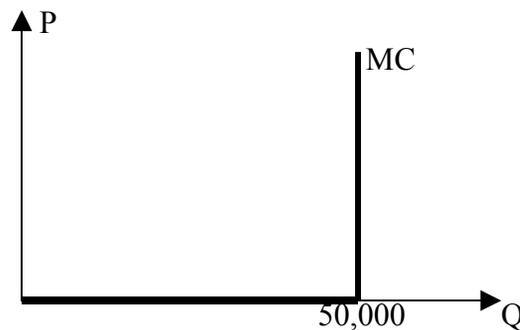
(d) The total worth to society of bread is $10*10,000/2 + (20-10)*10,000/2 = 100,000$ under the parameters as described in (a). Total worth of bread under (b) is $2*18,000/2 + (20-2)*18,000/2 = 180,000$. So the invention is worth 80,000.

Common Mistakes:

- For this question, many students did not recognize that the value to Freedonia would be the change in total surplus under the two scenarios. The new technology increases the value to society consisting of both the producer surplus and the consumer surplus. Many students incorrectly used change in DWL (question specifically says “absent any gov’t intervention”) or change in suppliers’ revenues (does not include supply curve or change in consumer surplus) to calculate the value of technology.

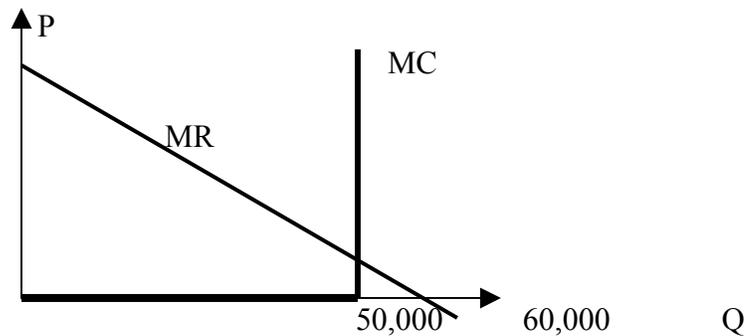
Problem #3.

(a) The total cost is \$500,000 independent of the number of seats sold (up to capacity 50,000). The marginal cost is therefore \$0 up to capacity and infinite thereafter. The inverse demand is $P=100 - 1.25 Q$, which gives marginal revenue $MR=100-2.5 Q$. The optimal solution can thus be found by setting $MR=MC=0$, which gives $Q=100/2.5=40$. So we want to sell 40,000 tickets, which requires us to set a price of $P=100- 40*1.25= \$50$. Profit is then $50*40,000-500,000=1,500,000$.

Common Mistakes:

- Failure to recognize this as a monopolist problem, and therefore assuming $Q_s = 50,000$ and determining equilibrium price from and profit from that, or setting price = MC.
- Improper calculation of marginal cost. Many confused marginal cost with average cost, and set $MC=\$10$ ($=\$500,000 / 50,000$ seats). Some thought the marginal cost was \$500,000.

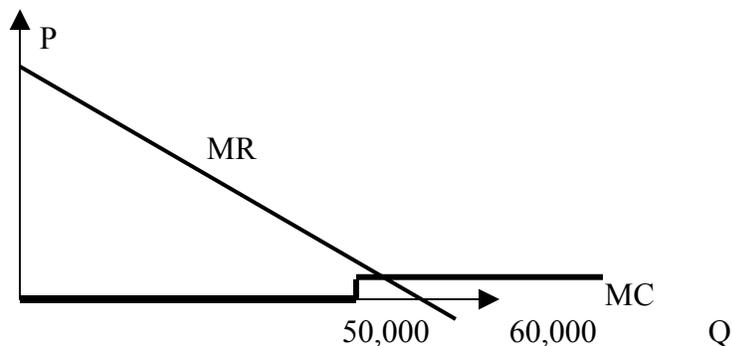
(b) In this case, the inverse demand curve equals $P=150-1.25 Q$, and thus $MR=150-2.5 Q$. If you solve the problem without taking into account the capacity constraint, then the optimal quantity of seats to sell is 60,000. This is beyond the capacity of Foxboro Stadium. This implies that we will set the price such that the quantity sold is exactly 50,000. (Note, from the figure below, that that is indeed the quantity where $MR=MC$.) The price is thus $150-1.25*50 = 87.5$. The profit becomes $50,000*87.5-500,000 = 3,875,000$. Note, for later reference, that $MR=25$ at $Q=50,000$.



Common Mistakes:

- Failure to recognize the capacity limitation after calculating the profit maximizing quantity at 60,000.
- After recognizing the capacity limitation, using \$75 price rather than recalculating the price using the reduced quantity of 50,000.

(c) The MC curve becomes as depicted below. Beyond 50,000 seats, the MC is thus \$10. It follows that we find the optimal quantity by setting $MR=MC=10$. This gives $150-2.5Q=10$ or $Q = 140/2.5 = 56$. To sell these 56,000 seats, we need to set price at $150-1.25 \cdot 56 = 80$. We will pay \$60,000 for the extra seats, so profits become $56,000 \cdot 80 - 500,000 - 60,000 = 3,920,000$.



Common Mistakes:

- Incorrectly assuming that the excess demand calculated in (b) would be the additional seating you would want. This would only be correct if marginal cost of extra seats stayed at zero, but the marginal cost increases to \$10, and therefore need to reassess $MR=MC$ to determine Q.
- Incorrectly assume you can price discriminate such that the price of additional seats would be different that the exiting seats.
- Confused \$10 costs of seats with \$10 price of seats, i.e., assuming that you would collect \$10 for every additional seat added.
- Failed to account for the variable costs (\$10/chair) associated with additional chairs in the profit calculation.

(d) Given that, as we calculated at the end of part b, the MR at 50,000 seats is $25 < 30$, we would never want to rent extra seats at that price. The results would therefore be the same as those we obtained in part b.

Common Mistakes:

- It is difficult to correctly answer this part intuitively if you have not properly considered the rest of the problem.
 - Many students recognized intuitively that if MC rises, quantity would fall, but were unable to see that the quantity of additional seats would actually be zero at $MC=30$.
 - Given that price calculated in (c) is still higher than MC of \$30, add as many seats as possible, incorrectly assuming price remains fixed no matter how many seats you add or assuming demand is infinite.
 - Incorrectly assuming that cost of additional seats rises as you add more and more, thereby recommending the addition of seats until the marginal cost rises to equal the previously calculated price.
 - Add no chairs (right answer) because optimal price was improperly calculated previously at a level below the marginal cost of \$30 (wrong reason).
4. In this question you give a cogent discussion of whether cellular phone calls are substitutes for conventional calls in local areas. The first criterion for defining the market is to ask whether the products in question are substitutable in the eyes of the buyers. On those grounds, the two types of calls are imperfect substitutes. They both fulfill needs for communication. Cellular phone calls provide mobility, convenience and flexibility, but somewhat poorer sound quality and reliability than conventional phone calls, so they are not perfect substitutes. A quantitative way to determine whether the two products are demand substitutes is to check whether the cross price elasticity is positive. Knowledge that cellular phone calls are priced much higher than conventional phone calls stresses the imperfections in their substitutability --- as in the ADM case (with sugar and HFCS), one could argue that consumers who are indifferent between conventional and cellular calls at similar prices would have switched to conventional, so that consumers remaining with higher priced cellular calls do not view them as perfect substitutes for conventional phone calls.

Common Mistakes:

- Failed to identify key market definition criteria.
- Failure to mention demand and supply substitutability as relevant criteria for market definition.
- Incorrectly argued for clear supply substitutability – actually, supply substitutability would be fairly low as telecommunication companies can not easily deploy the technology infrastructure needed to provide cellular service.
- Failure to mention positive cross-price elasticity as an indication of the existence of demand substitutability (two products are substitutes).

- Stated that negative cross-price elasticity as an indication that two products are substitutes – actually, negative cross-price elasticity is an indication that two products are complements.
- Incorrectly identified cellular and conventional phones as complements or perfect substitutes – in fact, cellular and conventional phones are imperfect substitutes as mentioned in the answer key.
- Failed to answer the question regarding price gap between cellular and conventional phones.
- Failure to identify that price differential of the two products, cellular and conventional phones, is important in determining market definition.