Sloan School of Management   15.010/ 15.011
Massachusetts Institute of Technology   Economic Analysis for Business Decisions

2003 Final Exam Answers: Prepared for Grading Purposes

1.a) True. Economies of scale means that average cost is decreasing. Average cost decreases if and only if marginal cost is below average cost.

1.b) False (or uncertain). There are different ways to make essentially the same argument.
- With an up-front outlay of $3,000, you lose the investment returns on the capital that you would spend over time when renting.
- The user cost of capital also includes an opportunity cost of capital.
- The net present value of three times $1,000 is less than $3,000.
The only condition under which it would be true is if your opportunity cost of capital (or your discount rate) is zero.

1.c) False. This is a two-part tariff problem. Since attendees have identical demand for chili-dogs, the way to maximize total profits (across all chili-dogs stands and Mike) is to set p = MC and then charge an entry fee equal to consumer surplus at that price. If Mike requires the chili-dog stands to charge a higher price, then, he will make them better off but at the expense of his own profits. Mike should definitely reject the deal.

2. Wahai

The supply curve of local apples is infinitely elastic at p=10 up to Q=200,000 and then becomes infinitely inelastic. The supply of global apples is infinitely elastic at p=50. This gives the following combined supply curve
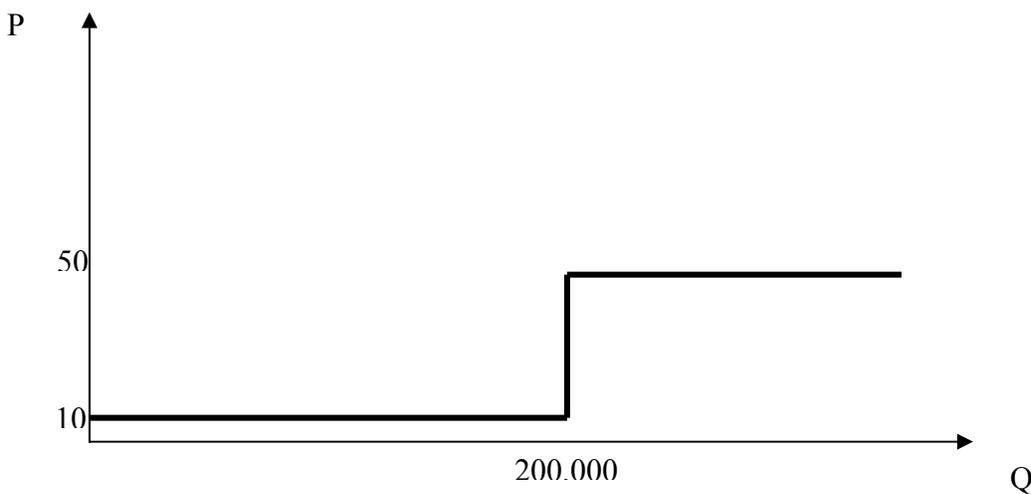
The demand curve of local apples is simply linear according to Q=240-p. The demand curve for global apples is infinitely elastic at p=50. The local demand at p=50 is Q=190,000. This gives the following combined demand curve

P

50

190.000

Q
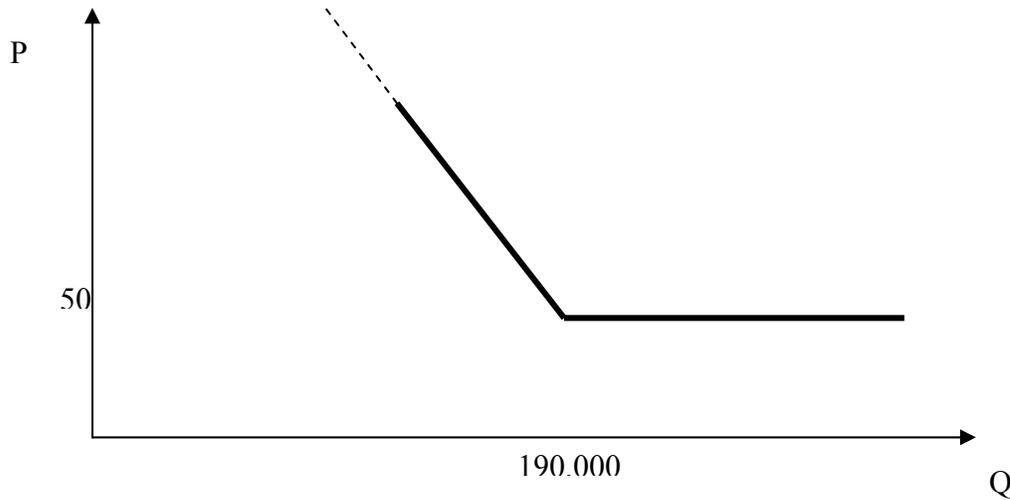
The combined supply-demand diagram is thus

P

Demand

50

Supply

10

190K　200K

Q
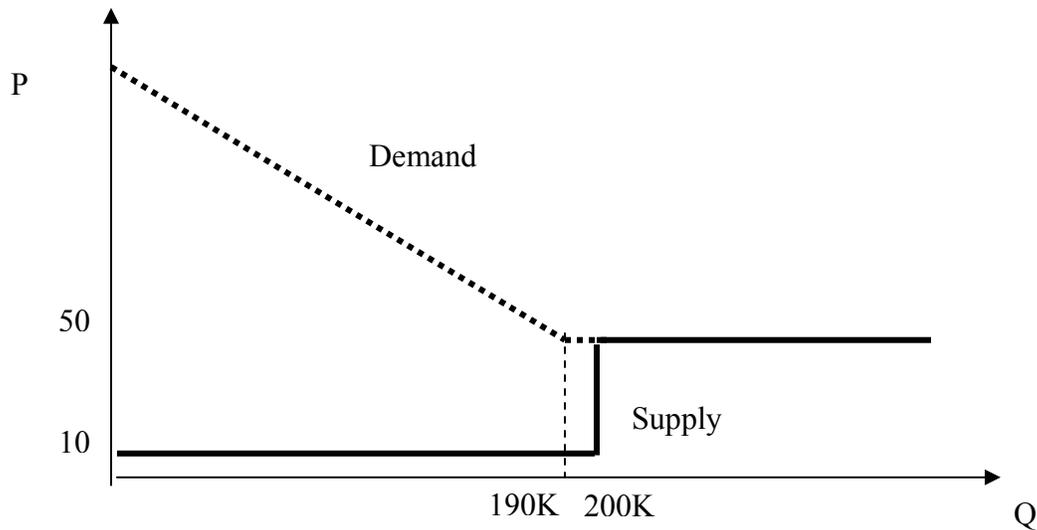
We have that for the local demand Q=240-50 = 190. So 190,000 apples get consumed locally while 10,000 apples get exported.

2b) With transportation costs of 10 cents, the supply of apples after 200,000 will be infinitely elastic at 60 cents. The demand will be infinitely elastic at 40 cents. The combined curves given by:
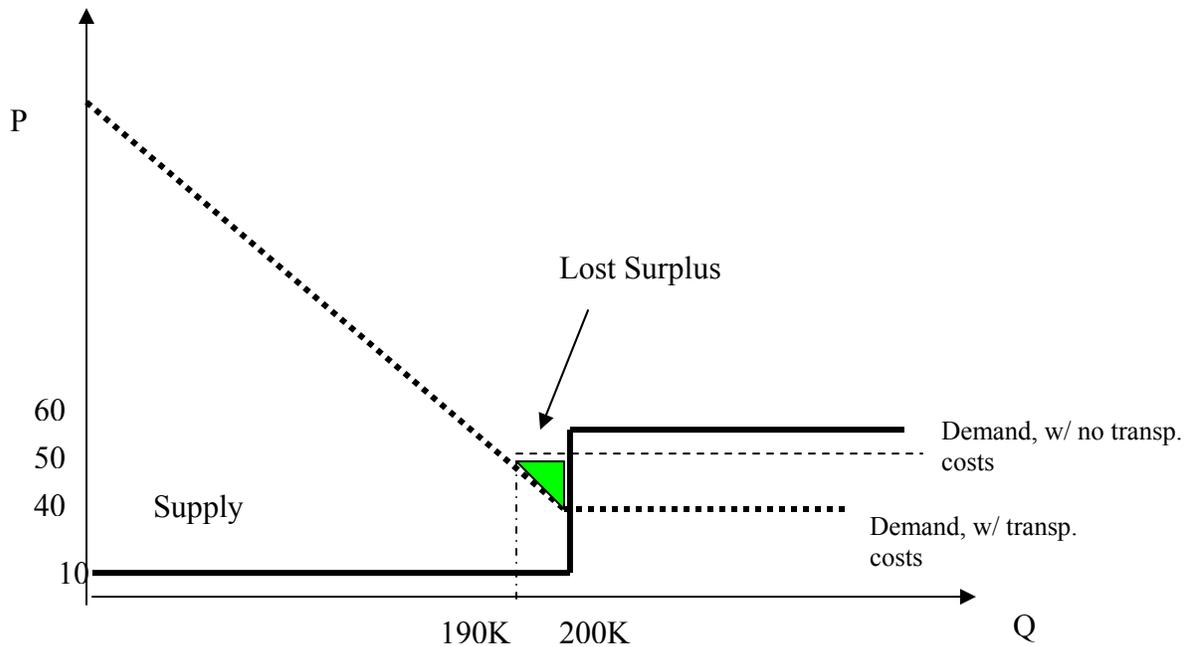
So the equilibrium is Q=200,000 and p=40. There are no imports or exports.
The loss in surplus is due to the 10,000 apples that are no longer exported (the shaded triangle above), with a cost of 10 cents times 10,000 apples divided by 2, or $500.

3. DSL

(a) DSL will offer 10Mbps service to both and charge $100 to businesses and $40 to families.

(b) Given zero marginal cost, compare revenues: 100*$100 when attracting only businesses vs. 200*$40 when attracting both. $10,000 > $8000, so DSL should charge $100. DSL loses $4,000 in family revenues. Consumer surplus is zero with perfect price discrimination and does not change with the regulation.

(b) DSL can focus on 10 Mbps service or offer both 10 Mbps and 2 Mbps. Part (b) shows that focusing on 10 Mbps yields revenues of $10,000. The option that remains is slower service geared toward families and faster service geared toward businesses. That is, extract all surplus from the low-value group and price high-speed service so that businesses will choose it over the slower service. DSL can charge $20 for 2Mbps service. Each business could choose this $20-2Mbps package and receive a surplus of $10 (=$30-$20). To ensure that businesses take the faster service, it will be priced at $90 (=$100-10) or slightly less. This provides revenues of: 100*$90 + 100*$20 = 9000 + 2000 = $11,000. $11,000>$10,000 so DSL should offer the two services.

If the NCC forbids any slowdown, DSL will charge $100 as found in (b) with TS=$10,000. Without the regulation, TS=$12,000 (PS=$11,000, CS=$10*100=$1000). Forbidding DSL from slowing down its service would lead to a $2000 reduction in total surplus.

4. Xemico

a) Producer 1's revenue is $12 q1-q1(q1+q2)$, so his marginal revenue is $12-2q1-q2$. Setting marginal cost equal to marginal revenue, his optimal choice is $q1=(12-q2)/2$. By symmetry, Producer 2's reaction curve is $q2=(12-q1)/2$. Combining these gives $q1=q2=4$ tons, for a price of 4 million petesas.

b) By the above, the profit for each firm is 16. Consumer surplus is $8*8/2 = 32$. So, total surplus is 64 million petesas. If the market were competitive, then profits would be zero and consumer surplus would be $12*12/2 = 72$ million petesas. So the surplus would grow by 8 million petesas .

5. Harry met Sally

a) Harry's utility function is 0.5 (h + s - h*s) - 0.5 h^2. It follows that Harry's reaction curve is 0.5(1-s) - h = 0 or 2h=1-s. Analogously, we get 2s=1-h for Sally. Combining these gives h = s = 1/3. Payoffs are 0.5((1/3)+(1/3)+(1/9)) - 0.5*(1/3) = 2/9 for each.

b) Sally will now incorporate Harry's reaction function giving her utility function as: 0.5 (0.5*(1-s) + s – 0.5*(1-s)*s) – 0.5 s^2. Taking the derivative and setting it equal to zero yields the optimal effort for Sally is zero. Harry will put in 0.5(1-0) = 0.5 hours. They will then split the project outcome of 0.5 at an effort cost of zero to Sally and 1/8 to Harry. Payoffs then are 1/4 for Sally and 1/4 - 1/8 = 1/8 for Harry.

6. Transfer pricing
a) NMR = 1100-900 = 200. Since NMR is fixed, we know immediately that the optimal transfer price equals $200. Setting NMR=MC gives Q=20.
b) By the above argument, the optimal transfer price is again $200. Since we need NMR=MC1=MC2, we get immediately that Q1=20 (as in part a) and Q2=19.
c) Since the outside market for engines always has higher revenue (250>200), all engines will be sold on the outside market and the company will produce no lawn mowers. We will accept two answers--optimal transfer price equal to the outside market ($250) or equal to NMR ($200). If the transfer price is set at $250 there will be no internal demand and all engines are sold on the outside market. If the transfer price is set at $200 there is no internal supply and, again, all engines are sold on the outside market. Production quantities can be found again by setting MR (=250) = MC1 = MC2. This gives Q1=25 and Q2=24.

7.
(a)
If the settlement is not allowed, this becomes a standard monopoly pricing problem. Q = 8,000,000 – 200P → P = 40,000 – Q/200 → MR = 40,000 – Q/100. Setting MR = MC, we get **Q* = 3,000,000 trucks** and optimal price is P* = **$25,000 per truck**.

GM's profit is 3,000,000 *(25,000-10,000) = **$45,000,000,000**.
Consumer surplus is ½ * 3,000,000 * (40,000 – 25,000) = **$22,500,000,000**.

(b)
There is an inelastic supply of 10M coupons. Demand for coupons depends on the price being charged for trucks, but the problem asks us to assume that GM charges a price of $26,000. Any consumer whose willingness to pay is more than $26,000 will definitely buy a truck and so is willing to pay up to $1000 for the coupon. Similarly, any consumer whose willingness to pay is less than $25,000 will definitely not buy a truck (even given a coupon) and so is willing to pay $0 for a coupon. For those in between, with willingness to pay 25,000 < V < 26,000, they will buy the truck with the coupon but not without the coupon. In particular, if they have a coupon they will get surplus V – 25,000 so that is what they are willing to pay for the coupon. (2.8 million consumers are willing

to pay more than $26,000 for a truck, 3.0 million are willing to pay more than $25,000.)
We therefore get the graph below of demand and supply for coupons. **Coupons trade at price $0.**

Since coupons trade for $0, everyone who purchases a GM truck will have a coupon.
Thus, each consumer pays and GM receives $1000 less than the sticker price.
Consequently, both GM's marginal cost and marginal revenue shift up by the same
amount ($1000) and so cross at the same quantity as before, **Q* = 3M.**

GM's profit is 3,000,000 *(26,000-11,000) = **$45,000,000,000**.
Consumer surplus is ½ * 3,000,000 * (41,000 – 26,000) = **$22,500,000,000**.

Consumers are equally well off with the coupon program as without.

Market for Coupons
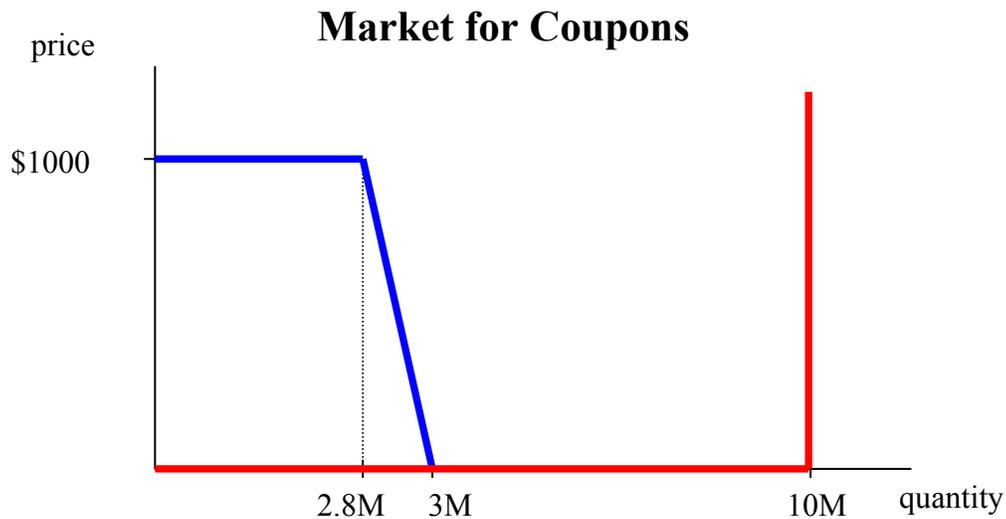
8. Zipcar.

The calculation of the CFO overestimates the profits after the change since it does not
take into account adverse selection and moral hazard:
- Adverse selection: people who want to drive long distances get a better deal, people
who drive short distances get a worse deal; as a consequence you lose some of your
earlier customers who drove short distances and get some new customers who drive long
distances; so the average number of miles driven per hour rented will go up; and
therefore the cost to Zipcar per hour rented goes up
- Moral hazard: since you do not have to pay for distances driven any more, people will
care less about minimizing distances; this also increases the average distance driven per
hour rented and thus the cost to Zipcar per hour rented.