2002 Final Exam Answers: Prepared for TA Grading Purposes

1. True, False, Uncertain

(1a) UNCERTAIN. The average cost in Pittsfield is lower, but the relevant cost for deciding where to shift the new order is the MARGINAL cost. The MC might be higher or lower in Pittsfield than in North Adams; the question doesn't give any way to tell.

(1b) FALSE: Alex has a comparative advantage in drying dishes (10/8 > 8/7). The optimal solution has Alex drying dishes as much as possible and Benjamin washing dishes as much as possible. In particular, if Benjamin washes dishes all the time and Alex washes dishes for 10 minutes and dries dishes the other 50 minutes, then the total number of dishes washed and dried is 500 versus only 480 per hour when Alex washes dishes all the time and Benjamin dries dishes all the time.

(1c) TRUE Consider a competitor that sells comparable mattresses—a homogenous product. If it raises its price above the local mattress store, the competitor would lose all of the market. This usually leads to a Bertrand equilibrium where price falls to marginal cost. However, with the low-price guarantee, if the competitor sets a price lower than the local mattress store, it will *still* lose the entire market as the local mattress store has promised to offer a 5% discount to such deals. The competitors have little incentive to cut price, and higher prices can be sustained.

2.

(2a) A dominant strategy is an action that is (weakly) optimal (namely, produces the highest payoff), no matter what actions your opponents undertake. Neither player has a dominant action.

(2b) A Nash equilibrium is a set of actions, one for each player, such that each player's action is optimal for that player, given what the other players' actions are. The unique Nash equilibrium in this game is (Down, Right) with payoffs (1,8).

		B		
		Left	Middle	Right
	Up	**10**, 1	3, -10	0, **3**
A	Middle	6, 10	4, **12**	-4, 11
	Down	-5, 0	**8**, 5	**1**, **8**

(2c) If A could commit to an action, it would commit to Middle. In that case, B would also respond with Middle, leading to payoffs (4,12) which is more than A gets in the Nash equilibrium. Since this also increases B's payoffs, B would let A go first.

3.

(3a) The User Cost of Capital for each type of tractor is as follows:

UCC for 1-year use of new tractor = (120,000 – 85,000) + 10%*120,000 = 47,000
UCC for 1-year use of 1-year-old tractor = (85,000 – 45,000) + 10%*85,000 = 48,500
UCC for 1-year use of 2-year-old tractor = (45,000 – 0) + 10%*45,000 = 49,500

(3b) Since variable cost is the same for all types of tractors, and there is no cost of reselling, each year Old McAdams should use whatever tractor has the lowest UCC. Hence, the best plan is to purchase a new tractor at the start of each year and sell it at the end of each year.

(3c) Now we must compute the user cost for tractors including the broker's fee, and holding tractors for more than one year, where interest is 0:

UCC for 1-year use of new tractor = (120,000 – 85,000) + 10,000 = 45,000
UCC for 1-year use of 1-year-old tractor = (85,000 – 45,000) + 10,000 = 55,000
UCC for 1-year use of 2-year-old tractor = (45,000 – 0) = 45,000   (tractor is junked)

For more than one year

UCC for 2-year use of new tractor = (120,000 – 45,000) + 10,000 = 85,000 or 42,500 per year
UCC for 2-year use of 1 year-old tractor = (85,000 – 0) = $85,000 or 42,500 per year
UCC for 3-year use of new tractor = (120,000 – 0) = $120,000 or 40,000 per year

So, the lowest cost option to purchase a new tractor at the beginning of the three year period and hold/use it for all three years, at a cost of $40,000 per year.

4. Big D

The problems states that Demand is P = 10 – 2Q, and AC = MC = $2 for all quantities, implying zero fixed costs.

(4a) Perfect competition implies: P = MC = $2
        Q = 5 - P/2 = 5 - 1 = 4 per person or 40,000 total.
                Consumer Surplus for individual: 0.5*(10-2)(4)=$16, or $160,000 total CS.
                Producer Surplus: $0

(4b) Big D imposes a two-part tariff: set fee=Consumer Surplus for each individual
                                set ticket price=MC to maximize available surplus:
        This implies a Fee = $16, P=$2
        Profits=Producer Surplus=16*10,000=$160,000
        Total surplus is the same as in (4a)—no deadweight loss results when a monopolist
        perfectly price discriminates, though surplus now goes to Big D instead of consumers.

(4c) Big D can distinguish locals from tourists, so treat them as separate markets. To maximize available surplus, the ticket price is set to MC = $2

> Locals purchase 2 tickets at P=MC=2, so $CS_L = 0.5*(10-2)*2 = \$8$
> ⇔ Fee= $8
> Tourists: Same as (4b)
> Profits=8*2000 + 16*8000 = $144,000

(4d)   Willingness to pay to pretend to be a local: $CS_T-CS_L=\$8$

5. U2

(5a)
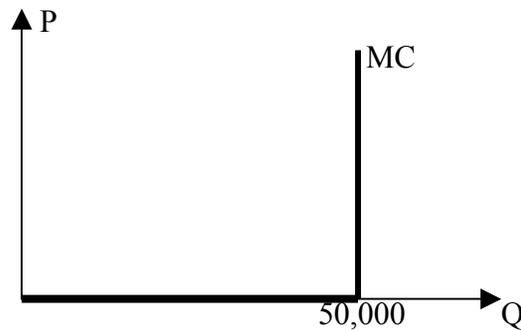
The total cost is $500,000 independent of the number of seats sold (up to capacity 50,000). The marginal cost is therefore $0 up to capacity and infinite thereafter. The inverse demand is P=150-1.25 Q, which gives marginal revenue MR = 150- 2.5 Q. If we set MR = 0, we get Q=150/2.5 = 60, so that without taking the capacity constraint into account, we would sell 60,000 seats. This is beyond the stated capacity of Gillete 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.
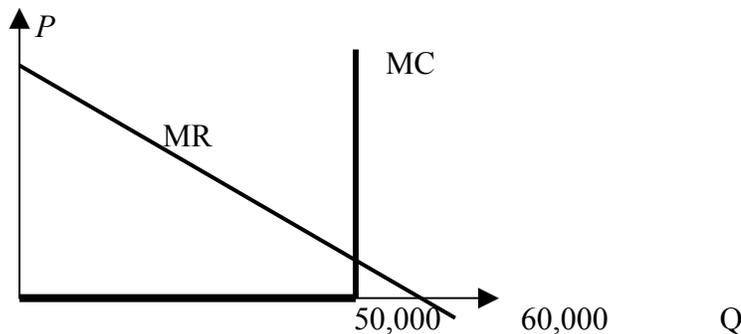
(5b) Given that, as we calculated at the end of part (5a), the MR at 50,000 seats is 25 < 30, we would never want to rent extra seats at that price. The results would therefore be the same as those we obtained in part (5a).

6. Expect Stars to be more likely than Normals to accept *another* offer, as they are likely to do a Great job in another interview. Thus, the pool of those who accept the offer of 150K will have more Normals than Stars, and so their expected productivity will be less than 150K. This is an example of *adverse selection*.

7.   This problem is similar to a firm maximizing profits with revenues of w and rising costs, in this case the disutility of effort.
We are given: $P = \$20$ Sales: $Q = 10 + 2e$ Utility: $U = w - e^2/2$

(7a) $w = 200$:
$U = 200 - e^2/2$
Utility is decreasing in effort, so utility is maximized at e=0, or:
$$\frac{\partial U}{\partial e} = -2e$$
$$= 0 => e^* = 0$$
Sales $= 10 + 2e = 10 + 2*0 = 10$. Profits per employee $= P*Q - w = 20*10 - 200 = \$0$.

(7b) $w = -200 + 20Q$:
$U = -200 + 20Q - e^2/2 = -200 + 20(10 + 2e) - e^2/2 = 40e - e^2/2$
Maximizing utility with respect to effort:
$$\frac{\partial U}{\partial e} = 40 - e$$
$$= 0 => e^* = 40$$
Sales $= 10 + 2e = 10 + 2*40 = 90$
Note that effort and sales increase with 'higher powered' incentives.

(7c)   The employee will work for the subscription company if the utility there is greater than the utility achieved at the alternative: $U_{alternative} = 200 - 0 = 200$
With the franchise fee, Utility is given by: $U_{Acme} = -F + 200 + 40e - e^2/2$
Maximizing utility with respect to effort will yield e=40 as found in 7b. So,

$U_{Acme} = -F + 200 + 40^2 - 40^2/2 = -F + 1000$

From this we can see that the maximum franchise fee to attract the employee would be $800 (or $799 to be sure):

The employee will work for Acme if:
          $U_{Acme} \geq U_{alternative} \Leftrightarrow -F + 1000 \geq 200 \Leftrightarrow -F \geq 800 \Leftrightarrow F \leq 800$

8. Accounet

(8a) The competitive market for TCGs plus the 0 conversion means that ACGs can be bought or sold for 2.00. Therefore, the optimal transfer price is 2.00.

Production: Solve MC = 2.00 for each of the facilities:

Facility 1: (NJ) MC = 2 implies $Q_1 = 6$

Facility 2: (NY) MC = 2 implies $Q_2 = 11$

Facility 3: (CT) MC = 2 implies $Q_3 = 9$

(Total production is 26)

Distribution: Solve NMR = 2 for each distribution division:

Distributor 1: (US) NMR $= 20 - Q - 3 = 17 - Q$, so NMR = 2 implies $Q_{US} = 15$

Distributor 2: (EU) NMR $= 16 - Q - 4 = 12 - Q$, so NMR = 2 implies $Q_{US} = 10$

Distributor 1: (JP) NMR $= 12 - Q - 5 = 7 - Q$, so NMR = 2 implies $Q_{US} = 5$

(Total distribution is 30)

So 30 – 26 = 4 million ACGs are converted from TCGs.

(8b) To acquire an ACG, you buy a TCG for 1.30 and convert it for .70, so the buying price is 2.00. To dispose of an ACG, you convert it to a TCG for .20 and sell it for 1.30, so the selling price is 1.10. Note, if we set the transfer price to the buying price of 2.00, we get the same solution as above, which involves "buying" ACGs by converting from TCGs.

Therefore the optimal transfer price is 2.00, the production and distribution quantities are the same as in (8a), and 4 million ACGs are converted from TCGs.

(8c) Since the government order of 36 million is larger than the previous distribution demand of 30, we have that for optimal production, the same transfer price 2.00 is set. We have the same production levels in each production facility as in (8b), and now 36 – 26 = 10 million ACGs are converted from TCGs.

9. All prices are in $ per pound, all quantities are in million pounds, all profits are in million dollars.

(9 a i) In this case, the effective MC of Stop&Go is 2 (in $ per pound), while the MR = 10-2Q. So the optimal quantity is 4, so that the optimal price is 6.

(9 a ii) In general, Stop&Go solves Pd = 10-2Q and we are given that Q = 10 – Pm. Thus, the optimal market price is Pm = 5 + 0.5 Pd.

(9 a iii) Dagen's revenue is thus Pd * Q = (10 - 2Q) Q. (Note that we have to express revenue as a function of quantity to derive the marginal revenue.) Its marginal revenue is MR = 10 - 4Q. Given that it has MC=0, it will optimally choose a price such that Q = 2.5. This implies that Pd = 5, and Pm = 7.5. Profits are 12.5 for Dagen and 6.25 for Stop&Go, for a total profit of $18.75 million.

(9b) The merged firm has a MR = 10-2Q and zero MC, so it will choose price such that Q = 5. This means Pm = 5. The total profit is now $25 million. The reason is that in (9a) the firms suffer from double marginalization: each firm restricts output to drive up its profits, but does not take into account how that affects the other. With the merger these effects are internalized.

(9c) In this case, Stop&Go's revenue is half of before and its marginal revenue is thus MR = 5-Q. Since its MC = 0, it follows that it will set Pm to obtain Q = 5, or Pm = 5. The result is the same as (9b), with a profit of 12.5 to each firm, for a total joint profit of 25. The revenue sharing agreement also maximizes joint profits and eliminates the double marginalization problems here.

(d) You get a suboptimal solution since you solve α MR = MC, where $\alpha < 1$. That is, there are insufficient revenue incentives to achieve overall profit maximization with MR = MC. Note, when MC = 0, you can divide by α, with α MR = MC = 0 giving the same incentives as MR = 0.