Midterm Exam: Econ 375 (White) February 25, 2003

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Please, answer all questions on this test form. As usual, show your work and write the answer in the boxes that are provided.

Question 1: Assume there are two firms lobbying congress to subsidize their industry. Let h_1 and h_2 be the number of hours the two industries spend on lobbying. The costs of lobbying are $w_1(h_1)= h_1^2$ for firm 1 and $w_2(h_2)=2h_2^2$ for firm 2. The value of the subsidy is $800(h_1+h_2)$ to each of the firms. Prove that there exists an equilibrium in strictly dominant strategies. In this equilibrium

Firm 1 will spend $h_1=$	hours lobbying

Firm 2 will spend $h_2=$	hours lobbying

10 points

<u>Question 2:</u> Mary and Joe are bidding for two objects A and B. Their valuations are

	Object A	Object B	Getting both A and B
Mary	60	80	140
Joe	40	60	160

As you can see, getting both objects A and B gives Joe an additional benefit. Both Mary and John must separately bid for objects A and B. The person who makes the higher bid receives the object. If the bids are the same, the winner of the object is determined by coin toss. Assume Mary and Joe are restricted to bids that are integers. Determine a Nash equilibrium. In this Nash Equilibrium

10 points

Mary will bid	for A and	for B

Joe will bid	for A and	for B

<u>Question 3:</u> Joe, Mary and Paul want to purchase a painting. Their valuations for the painting are as follows:

Joe: 1,400 Dollars;
Mary: 800 Dollars;
Paul: 1,200 Dollars.

Joe, Mary and Paul know each other's valuations.

Assume that each of the three is supposed to put a bid in a sealed envelope (a bid consists of any positive number). After the envelopes are opened, the person with the highest bid wins and pays the price of the second highest bid. If the two highest bids are identical, then one of the two highest bidders is selected to be the winner (each person's change of being selected is 0.5). In this case, the winner pays the price that he/she bid. Determine an equilibrium in weakly dominant strategies. In this equilibrium,

___________ will win and pay	$	for the painting

10 points

Question 4: Three people bargain how to split a pie of size 1. The game proceeds as follows: First person 3 makes and offer to 1 and 2. If both of them accept then the game ends. Otherwise, the game continues to the second round, where person 2 makes an offer to 1 and 3. If this offer is accepted by both 1 and 3, then the game ends. Otherwise, the game continues to the third round, where 1 makes an offer to 1 and 3. If this offer is rejected then the game ends and everyone's payoff is 0. All parties use the same discount factor δ. Then in a subgame perfect equilibrium with weakly dominant strategies the three people will receive the following shares:

Person 1:	Person 2:	Person 3:

15 points

Question 5: Two Candidates A and B compete in the primary for the presidential elections. For simplicity, assume that there are just 3 states with primaries instead of 50. The first primary is in New Hampshire, the second one Illinois, and the last one is in California. The candidate who wins at least two of the primaries will be nominated to run in the November elections. Assume that if candidate A uses m_A million Dollars and candidate B uses m_B million Dollars in their campaign in one of the states, then the probability of winning the state is $\frac{m_A}{m_A + m_B}$ for candidate A and $\frac{m_B}{m_A + m_B}$ for candidate B. The payoff of being nominated for the November elections is 1. The candidate who is not nominated gets a payoff of zero. The loss of spending m_A or m_B Dollars in a primary is $-0.05m_A$ and $-0.05m_B$ (the total loss for a candidate is the total amount of money spent in three primaries). In each subgame, the expected payoffs are therefore determined as follows. Assume New Hampshire and Illinois primaries have already taken place. If one candidate has already won two of the primaries, then this candidate has won the nomination and gets a payoff $1\text{-}0.05(m_1+m_2+m_3)$, where m_i is the total amount of money spent in the primary i. The other candidate's payoff is $-0.05(m'_1+m'_2+m'_3)$, because he lost the race. However, there is still the California primary and candidates must choose their spending m_3 and m'_3, respectively. Now assume that each of the two candidates has won one of the primaries. Then the race is determined by the outcome of the California primary. The payoffs are therefore $p\text{-}0.05(m_1+m_2+m_3)$, and $p'\text{-}0.05(m'_1+m'_2+m'_3)$, where p and p' are the probabilities of winning California.
Now consider the subgame where one of the candidates has already won New Hampshire. Let p_I be the candidate's probability of winning Illinois. Then with probability p_I we will be in the subgame where one candidate on both of the first two primaries. With probability $1\text{-}\ p_I$ we are in the subgame where each candidate won one of the primaries.
Please, answer the following questions:

(a) (Very easy) Assume that candidate A has already won New Hampshire and Illinois. Then

5 points

Candidate A will spend m_A= in California

Candidate B will spend m_B= in California

(b) Now assume that candidate A and B each won one of the two first states. Then

Candidate A will spend m_A= in California

Candidate B will spend m_B= in California

10 points

(c) Now assume that candidate A has won New Hampshire. Then

Candidate A's probability of winning Illinois is

Candidate A will spend m_B= in Illinois

Candidate B will spend m_B= in Illinois

This result implies the following for the real world: *10 points*

Question 6: Joe and Paul are assigned to be roommates. Joe likes to smoke and hates loud music, whereas Paul hates smoke and likes to listen to music at the highest possible volume. Let *s* denote the amount of time that Joe smokes, and let *h* denote the amount of time that Paul listens to noisy music. Then their payoffs are given by

Joe: $40s-s^2-200h$

Paul: $10h-h^2-50s$

(a) In the Nash equilibrium of the one shot game,

Joe chooses s=	Paul chooses h=

10 points

(b) You can check that the solution in (a) is not efficient. In particular, both of them would be better off if the don't smoke or don't listen to loud music, i.e., s=h=0. Now consider the repeated game that extends over time periods t=0,1,2,… where each person discounts the period utility by a factor δ, where δ is close to 1. Then the smallest value of δ that can support s=h=0 in a subgame perfect equilibrium is given by

δ=

10 points

<u>Question 7:</u> The government wishes to implement voluntary compliance by industry to achive environmental goals. Mark owns a logging company that currently has access to 100 square miles of forests. Mark's profit from cutting x square miles of the forest is given by $170x - x^2$. However, under the new government policy Mark must first announce whether or not he is willing to participate in the voluntary compliance program. If he participates, he promises to cut at most 40% of the forest and set aside the remainder as a nature preserve. Alternatively, if Mark refuses to participate in the voluntary compliance program, then the government will regulate Mark's logging. In particular, the government will send inspectors to check that Mark does not cut more than 40% of the forest. The government's cost of the inspection is 1,000. Mark must be reimburse the government for the costs of inspection in addition to a fee of 100. Note, that unless the government sends inspectors, the government cannot verify the actual amount of logging. Describe a subgame perfect equilibrium of this game.

10 points