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Final Exam: Economics 101 – June 11, 2003

READ THE INSTRUCTIONS: You have three hours. Do all 5 questions; each has equal weight. Please be sure to number each problem by number and part, especially if you choose to do them out of order. You will get credit *only if you provide a clear explanation of your answer and how you got it*. Write only in the blue book using pen; cross out any scratch work. Put the answers to questions 1,2 in the first bluebook; questions 3,4 in the second bluebook and question 5 in the third bluebook. Calculators are not allowed. Good luck.

1. Normal Form Games

In each of the following games

- i) Find all of the pure strategy Nash equilibria.
- ii) For games (a) and (b) only, determine whether or not there is a mixed strategy Nash equilibrium (in addition to the pure equilibria which are also considered mixed), and if so, what it is.
- iii) Which of these equilibria are Pareto efficient?
- iv) Do any of the pure strategy equilibria involve playing weakly or strictly dominated strategies?
- v) Sketch the socially feasible set.
- vi) Find a pure strategy that minimizes the payoff the other player can get (this is called the minmax payoff).
- vii) Sketch the corresponding socially feasible individually rational set.

a)

	L	R
U	0,0	2,2
D	4,1	0,0

b)

	L	R
U	17,16	1,20
D	11,0	12,11

c)

	L	C	R
U	13,6	1,7	3,0
M	15,0	11,5	3,0
D	1,1	1,1	1,0

2. Repeated Games

	A	B
A	4,4	1,6
B	5,1	2,2

Suppose that this stage game is repeated between two infinitely lived players with discount factor equal to δ . Propose a strategy and a discount factor δ such that the Nash equilibrium outcome of the game is for both players to play AA. Are these strategies

subgame perfect? What does the Folk Theorem tell us about this game?

3. Long Run versus Short Run

A thuggish dictator (player 2) must decide whether to threaten a gentle democracy (player 1). If there is no threat, both countries get 0. If there is a threat takes place, the gentle democracy must decide whether to appease the dictator giving the dictator a payoff of 10 at a cost to the gentle democracy of 10 (that is, player 1 gets -10 in this case), or whether to call his bluff and go to war. A war yields a payoff of -20 to both countries.

- Find the extensive and normal form of this game.
- What pure strategy Nash equilibria are there in the stage game; which are subgame perfect?
- What is the Stackelberg equilibrium of the stage game in which 1 moves first?
- Suppose that this stage game is repeated: player 1 is infinitely lived with discount factor equal to δ and there is a sequence of short-lived player 2's. Propose a strategy and a discount factor δ such that in equilibrium players end up playing the Stackelberg equilibrium.

e) What difference would reputation make in the repeated case?

4. Bayes Law

A variety of experiments show that if you tell the truth, a lie detector will show that you are lying about 10% of the time. In one government agency it is asserted that 20% of employees are deceptive and that when they are all given lie detector tests, 20% of employees are found by the lie detector to be deceptive. Assume that this data is correct.

1. What is the probability that if you lie, a lie detector will show that you are lying?
2. Suppose that if you are a practiced spy, the probability that you are caught in a lie by a lie detector is $\frac{1}{2}$ the probability for a deceptive government employee.
3. Suppose that 1 in a thousand FBI agents are spies, and all FBI agents are given a lie detector test and asked if they are a spy. (You should assume that they all deny it.) What is the probability an FBI agent who fails the lie detector test is a spy? What is the probability that an FBI agent who passes the lie detector test is a spy?

5. Cournot with Uncertain Cost

Consider a Cournot Duopoly with demand $p = 17 - x$. There are two possible levels of marginal cost: low and equal to 1 or high and equal to 3. There is a 70% chance both firms are high cost, a 10% chance they are both low cost, a 10% chance firm 1 is high cost and firm 2 low cost, and a 10% chance firm 1 is low cost and firm 2 high cost. Assuming that each firm knows its own marginal cost and these probabilities, what are the equilibrium strategies of the two firms in the Bayesian Nash equilibrium of the Cournot Game? Please note that you must use conditional probabilities to correctly solve this problem. Compare industry output with the case in which both firms know their rivals (and their own) cost before they choose their level of output?