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Name:

The Ohio State University
Department of Economics
Econ 5001--Prof. James Peck
Fall 2015
Final Exam

Directions: Neatly write your name at the top of this page. Answer all questions and show all work.

1. (25 points) The matrix given below is the stage game of an infinitely repeated game. Each player's payoff is his/her average payoff across all the periods.

		player 2	
		L	R
player 1	T	2, 2	0, 8
	B	8, 0	1, 1

Find a subgame perfect Nash equilibrium in which each player receives an average payoff of 3. Specify the strategy profile completely, not just the "equilibrium path."

2. (25 points) Consider the following version of the Battle of the Sexes game, in which player 2 is one of two types, each of which occurs with probability one half. Player 1 always wants to meet up with player 2. If player 2 is type M (for "meet"), she receives a positive payoff when she meets up with player 1, and the payoff matrix is given by

		player 2, type M	
		wrestling	ballet
player 1	wrestling	2, 1	0, 0
	ballet	0, 0	1, 2

If player 2 is type A (for "avoid"), she receives a positive payoff when she does not meet up with player 1, and the payoff matrix is given by

		player 2, type A	
		wrestling	ballet
player 1	wrestling	2, 0	0, 2
	ballet	0, 1	1, 0

Player 1 does not observe player 2's type, but player 2 observes her own type before deciding whether to go to the wrestling match or the ballet.

- (a) (15 points) Convert this game of incomplete information into Bayesian normal form by constructing the relevant matrix.
- (b) (10 points) Find all Bayesian Nash equilibria of this game.

3. (25 points) For the following Stackelberg game, the market price depends on the outputs of the two firms (q_1 and q_2) and on nature. In the high demand state (H), the inverse demand function is

$$p^H = 1200 - 2q_1 - 2q_2$$

and in the low demand state (L), the inverse demand function is

$$p^L = 600 - 2q_1 - 2q_2.$$

Each state occurs with probability $\frac{1}{2}$ and the firms have zero costs. First, firm 1 chooses its output, without observing the state of demand. Next, nature chooses the demand state. Then firm 2 observes firm 1's output and the state of demand. As a function of q_1 and the level of demand, firm 2 chooses its quantity. Thus, firm 2 has two types, H and L , and firm 1 only has one type. Each firm's payoff is its expected profit.

Find the pure-strategy subgame perfect Nash equilibrium of this Bayesian game. Remember that firm 2's strategy is a function and not just a quantity.

4. (25 points) In the following Bayesian extensive form game between a doctor (player 1) and a patient (player 2), nature moves first and lets the doctor know whether a lab test is warranted or not. The probability that the lab test is warranted is $\frac{1}{3}$ and the probability that the test is not warranted is $\frac{2}{3}$. Then the doctor decides whether to recommend the test or not. If the doctor recommends the test, the patient, who observes the doctor's recommendation but not whether the test is warranted, decides whether to say yes or no to the test. Here is the game tree.

(a) (12 points) Find all of the pooling perfect Bayesian equilibria (PBE) of this game. A pooling equilibrium is one in which player 1's strategy is either DR, DR' or R, R' . Remember to specify beliefs as well as a strategy profile. (Use the notation that q is player 2's belief that the test is warranted, conditional on reaching her information set.)

(b) (13 points) Find all of the separating perfect Bayesian equilibria (PBE) of this game. A separating equilibrium is one in which player 1's strategy is either DR, R' or R, DR' . Remember to specify beliefs as well as a strategy profile. (Use the notation that q is player 2's belief that the test is warranted, conditional on reaching her information set.)

