

Your Name: _____

The Ohio State University
Department of Economics
Second Midterm Examination

Econ 5001
Spring 2017
Prof. James Peck

Directions: *Answer all questions, show all work, and label all figures.*

1. (25 points) Consider the following Cournot game in which three firms simultaneously choose a non-negative output quantity. Let q_1 denote the quantity chosen by firm 1, q_2 denote the quantity chosen by firm 2, q_3 denote the quantity chosen by firm 3, and Q denote the total quantity, $q_1 + q_2 + q_3$. The market price is given by

$$p = 600 - 2Q.$$

Each firm has a marginal production cost of 40 per unit of output.

(a) (12 points) *What is firm 1's best response to the profile, (q_2, q_3) ? That is, according to the notation used in class, what is firm 1's best response function, $BR_1(q_2, q_3)$?*

(b) (13 points) *Solve for the Nash equilibrium of this game.*

Hint for part (b): Because all firms have the same marginal cost, the NE will be symmetric, with $q_1 = q_2 = q_3 = q^*$ for some q^* . Use your result from part (a) and the condition, $q^* = BR_1(q^*, q^*)$ to solve for q^* .

2. (25 points) In the following game of "Hide and Seek," first player 1 either hides in the treehouse, T, or hides under the bridge in a stream, B. Then player 2 tries to find player 1, but only has time to look in the treehouse, LT, or look under the bridge, LB. Even though player 1 moves first, player 2 does not observe this choice, so we can treat this as a simultaneous move game. Player 1's payoff depends on whether or not he is found, and also on the disutility of hiding under the bridge in the stream, given by the parameter, c . Player 2's payoff only depends on whether or not she finds player 1. The payoff matrix is

		player 2	
		LT	LB
player 1	T	0, 10	10, 0
	B	$10 - c, 0$	$-c, 10$

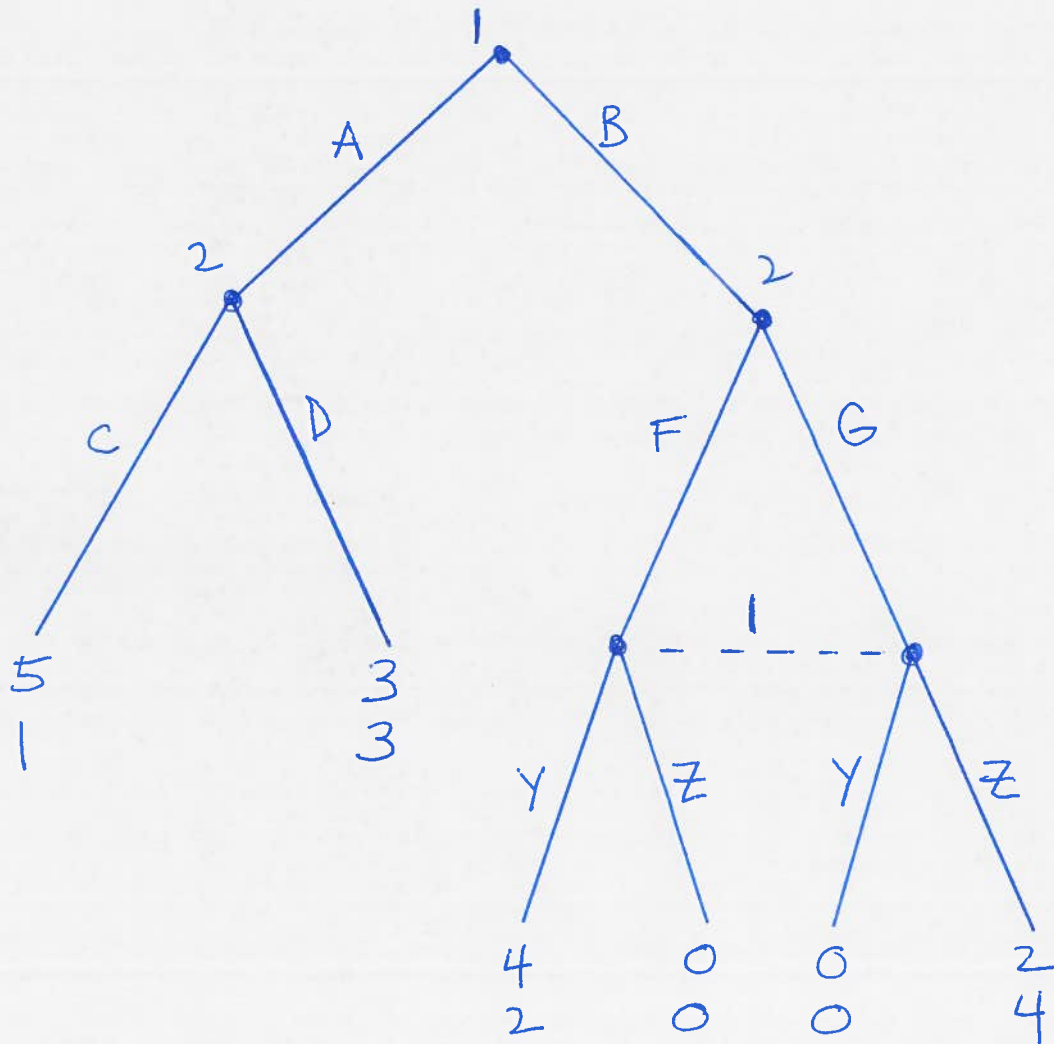
(a) (15 points) Find the mixed strategy Nash equilibrium of this game, keeping in mind that the strategies could depend on the parameter, c .

(b) (10 points) When c goes up, (i) does the probability that player 1 hides under the bridge in the MSNE go up, go down, or stay the same, and (ii) does the probability that player 2 looks under the bridge in the MSNE go up, go down, or stay the same? Briefly explain.

3. (25 points) Consider the following game in extensive form.

(a) (10 points) Find all of the Nash equilibria of this game.

(b) (15 points) Find all of the subgame perfect Nash equilibria of this game.



4. (25 points) Two firms are engaged in a game of sequential price competition. First firm 1 chooses a non-negative price, p_1 . Then firm 2 observes firm 1's price before choosing its own non-negative price, p_2 . Both firms have constant marginal production cost of 200 per unit. The market demand, as a function of the (lowest) price p , is given by

$$D(p) = 1000 - p.$$

If $p_2 \leq p_1$, then firm 2 serves the entire market demand at the price p_2 , and firm 1's sales are zero. If $p_1 < p_2$, then firm 1 serves the entire market demand at the price p_1 , and firm 2's sales are zero. Notice that when both firms choose the same price, firm 2 serves the entire market. Each firm's payoff is the profit that it receives.

Find a subgame perfect Nash equilibrium of this game. Remember that a strategy for firm 2 is a function that specifies p_2 for every non-negative p_1 .