

## Quiz #5

### answers

**Problem 1** Consider the game below:

		Stringer	
		L	R
Avon	T	4,8	0,0
	B	8,20	X,Y

a. If  $(B, R)$  is the Nash equilibrium of this game, what must be true of  $X$  and  $Y$ ? Your answer should be two inequalities, one for  $X$  and one for  $Y$ .

It must be that  $X \geq 0$  and  $Y \geq 20$ .

b. If this game is played sequentially, with Avon moving first and  $(B, R)$  is the subgame perfect equilibrium outcome, what must be true of  $X$  and  $Y$ ? Your answer should be two inequalities, one for  $X$  and one for  $Y$ .

It must be that  $X \geq 4$  while  $Y \geq 20$ .

**Problem 2** Two guys suffering from testosterone poisoning drive toward each other in the middle of a road. As they approach the impact point, each has the option of continuing to drive down the middle of the road or to swerve. Both believe that if only one driver swerves, that driver loses face (payoff=0) and the other guy gains in self-esteem (payoff=2). If neither swerves, they are maimed or killed (payoff=-10). If both swerve, no harm is done to either (payoff=1).

Show the payoff matrix for the two drivers engaged in this game of chicken, and determine the Nash equilibria for this game

The payoff matrix is below. The Nash equilibria are 'Straight, Swerve' and 'Swerve, Straight'.

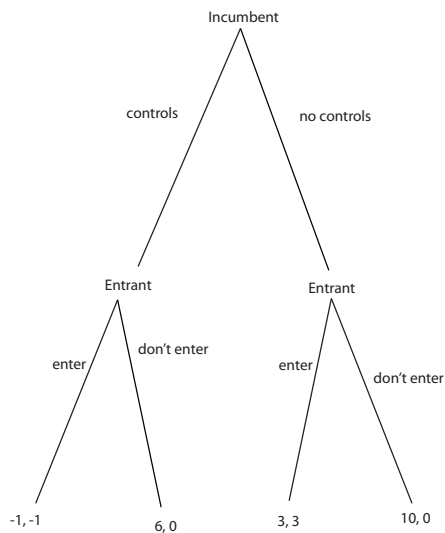
		Guy 2	
		Straight	Swerve
Guy 1	Straight	-10,-10	2,0
	Swerve	0,2	1,1

**Problem 3** An incumbent monopoly is currently earning a profit of \$10M. A second firm is considering entering the market; if it does so, both firms will earn profit of \$3M. The incumbent firm is considering urging the government to require all firms in the industry to install pollution control devices, which will lower profit by \$4M.

a. Suppose the incumbent firm chooses between ‘pollution controls’ and ‘no controls’ and the entrant chooses between ‘enter’ and ‘don’t enter’, and that their decisions are made simultaneously. What are the Nash equilibria of this game?

The above game has one Nash equilibrium, at ‘no controls, enter’.

b. Now suppose the incumbent firm moves first, and then, upon observing whether pollution controls are in place or not, the entrant chooses between ‘enter’ and ‘don’t enter’. What is the subgame perfect Nash equilibrium of this game?



**Problem 4** Firm 1 and Firm 2, are Cournot competitors. The market demand curve is  $p = 120 - q_1 - q_2$ . Firm 1 has a constant marginal cost of \$20, while Firm 2's is \$10.

a. What are the Cournot equilibrium quantities? What is the equilibrium price?

The Cournot equilibrium is  $q_1^C = 30$ ,  $q_2^C = 40$ . The equilibrium price is \$50.

b. How much profit does each firm make in the Cournot equilibrium?

Firm 1 makes a profit of \$900. Firm 2, \$1,600.