UNIVERSITY OF WISCONSIN
Economics 101 – Spring 2007
Professor Brown

Problem set 11 answers

1.

a. If Bill plays Windows, Linus gets 5 playing Windows and 2 playing Linux, so Windows is his best response. Similarly, if Bill plays Linux, Linus gets 1 playing Windows and 4 playing Linux, so Linux is his best response.

If Linus plays Windows, Windows is Bill's best response, while if Linus plays Linux, Linux is Bill's best response.

The game's matrix, augmented with markings denoting best responses is drawn below:

		Bill	
		Windows	Linux
Linus	Windows	$\underline{5}$, $\underline{7}$	1, -2
	Linux	2, 3	$\underline{4}$, $\underline{4}$

That 5 is underlined, for example, denotes that playing that strategy (Windows) is a best response when Bill plays Windows.

A Nash equilibrium is a strategy profile such that each player is playing a best response to the other; from the matrix, this is clearly true for {Windows, Windows} and {Linux, Linux}, so we have two Nash equilibria (notation: {X,Y} means "player one plays X and player two plays Y").

b. Applying the logic of a, we have

		Driver 2	
		Straight	Swerve
Driver 1	Straight	-1, -1	$\underline{2}$, $\underline{1}$
	Swerve	$\underline{1}$, $\underline{2}$	0, 0

so there are two Nash equilibria, {Swerve, Straight}, and {Straight, Swerve}

2.The payoff matrix, augmented with best response markers, is as follows:

Sal Monella's

Road Kill Cafe

	Clean up	Don't clean up
Clean up	\$5000, \$5000	\$12000, \$3000
Don't clean up	\$3000, \$12000	\$7000, \$7000

This is a prisoner's dilemma because both players have a dominant strategy, and the outcome obtained from each playing her dominant strategy is worse for each than that they would get if they agreed upon each playing their dominated strategy. The Nash equilibrium is {Clean up, Clean up}.

3. The only Nash equilibrium of this game is for everyone to play 0. To see, consider a hypothetical set of integers that has at least one person playing something over zero. For a set of strategies to be a Nash equilibrium, each person must be doing as well as he can, given what everyone else is doing. If at least one person is playing above zero, then the highest bid is above zero. The guy playing the highest number cannot possibly be playing a best response, as he could change his bid to 90% of the second-highest bid. In doing so, he would win at least a share of the prize, while he loses the contest for sure by playing the highest bid. Since this guy can increase his payoff by switching strategies, he cannot be playing a best response, and so any set of bids containing a bid greater than zero cannot be a Nash equilibrium.

To see that everyone playing 0 *is* a Nash equilibrium, everyone would win the contest and thus a share of the prize money, whereas switching to any other number would ensure that player of winning nothing, as he would now be playing the highest integer, and it is not possible for the highest integer to win.

Were this contest actually held and I personally were entering, I would probably guess 810; Nash equilibrium is not always a great predictor when people play complicated games one time. Were this game played repeatedly amongst the same group of people, play would surely converge to everyone playing 0; sometimes players need to learn how to play a game before a prediction of Nash equilibrium can have bite.

4. Note that the numbers themselves do not matter for the correctness of this answer, but they must be ordered as follows:

Male 2

Male 1

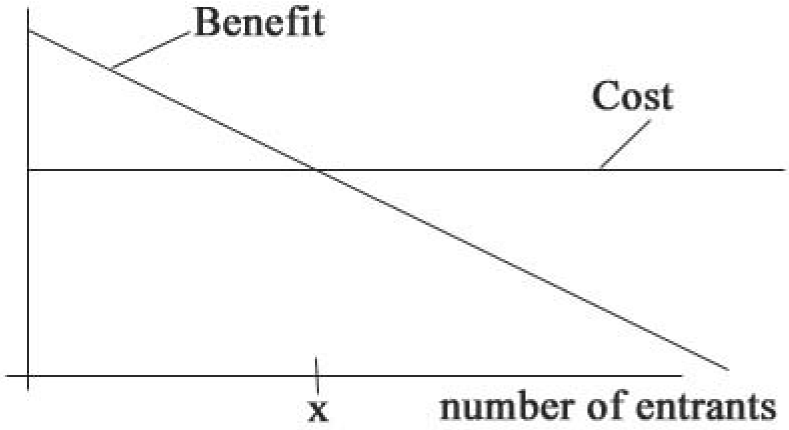
	Hawk	Dove
Hawk	-5, -5	10, 0
Dove	0, 10	3, 3

where I have already drawn in lines marking the best responses. From this, it is clear that we have two Nash equilibria, {Dove, Hawk}, and {Hawk, Dove}.

5. Let's make the unrealistic assumption that everyone solicited to play the sweepstakes is exactly identical. If this is true, then I claim in any Nash equilibrium each person must be indifferent between entering and not entering the sweepstakes. If not, if, say, everyone prefers entering to not entering, then we cannot be in a Nash equilibrium, as the people who haven't yet entered could profitably switch and enter the sweepstakes.

Now, the cost of entering the sweepstakes shouldn't depend on how many people have already entered... the cost is postage and the time cost of filling out the stupid form, this won't change as more or fewer people enter. However, the benefit of entering certainly changes as more people enter. For example, if you are the only person entering, you'll surely win a lot of money, but if you are one of ten million, you will almost surely win nothing. Thus I claim that the benefit to entering is decreasing in the number of people who have already entered, that is as in the following figure.

People are indifferent between entering and not when benefit equals cost, i.e. at point x. The idea is, then, that some people enter and some don't. If all people are identical, any Nash equilibrium would have the property that x people enter the sweepstakes. More realistically, people differ somewhat in, say, how much they value their time, and perhaps those who value their time the least enter, while those who value their time more do not.



6. Suppose all three firms did locate at the center of the beach. Then each firm gets 1/3 of all the customers. Now suppose that Alice is considering whether or not she can relocate to increase her profits. If she moves, say, 10 feet to the right, she will get all customers to her right, about half of all customers, and perhaps one or two customers located between her and the stands of Bob and Carl. Thus surely she'll get more than 1/3 of customers, as she was when she was located at the center. Thus she is better off, and so if Bob and Carl are located in the center, it cannot be Alice's best response to also locate in the center.