Graduate Microeconomics I
Problem Set 9

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1. Consider the following interaction (sequential game) between a parent and a child. The parent first has to decide whether:

   - to give (G) her child a twinckie,
   - or not (!G),

   and then the child in turn responds in one of three possible ways:

   - hold his breath until he dies (HB),
   - cry for half an hour (C),
   - or do nothing (N).

   The parent does not want to give the child a twinckie because it is less than healthy; however, he also does not like crying and he certainly does not want the child to asphyxiate himself. The parent's utility over this possible outcomes are as follows:

   - give and child holds breath: -100,
   - give and child cries: -3,
   - give and child does nothing: -1,
   - not give and child holds breath: -100,
   - not give and child cries: -2,
   - not give and child does nothing: 10.

   The child loves twinkies, loses energy from crying, and has no wish to kill himself. His utility levels over the possible outcomes are as follows:

- receive and hold breath: $-\infty$,
- receive and cry: 3,
- receive and do nothing: 5,
- not receive and hold breath: $-\infty$,
- not receive and cry: -1,
- not receive and do nothing: 0.

(a) Write out the extensive form (game tree) for this.

(b) Write out the normal form game, being careful to include every strategy on the child's part and remembering that a strategy lists the player's moves for every possible state.

(c) Find the Nash equilibrium or equilibria.

(d) Find the subgame perfect equilibrium for this game.

(e) Compare the results of (c) and (d) and explain.

2. Consider the following simultaneous move-game

		Player 2		
		Left	Middle	Right
Player 1	Top	4,7	1,5	3,6
	Down	2,1	3,1	5,5

(a) Determine all Nash equilibria of this game.

(b) Suppose the game is played sequentially. Under version 1, player 1 starts and chooses either Top or Down, and then player 2 chooses between Left, Middle and Right; payoffs are specified in the table above. Alternatively, under version 2, player 2 starts and chooses an action from her set of alternatives (already mentioned) and then player 1 chooses between T and D. Imagine there is a social planner that only cares about the sum of the individual payoffs and has to choose between the two alternative sequential-move games. Given the equilibria in pure strategies, what is the optimal order of moves?