

**Question 2, Micro – 30 points**

a) Payoff Matrix (7 points):

Without loss of generality, we normalize the utility of getting nothing to 0. Using the assumption that utility only depends on ice cream, payoffs are symmetric across the pure strategies of the other player. This yields the following payoff matrix:

		Dick	
		Up	Down
Jane	Up	$a_j, 0$	$0, a_d$
	Down	$0, a_d$	$a_j, 0$

Full credit will also be given for extensive form representations.

Equilibrium (8 points): This game satisfies all of the conditions of Nash's existence theorem, so we know there must be an equilibrium. We look for one in mixed strategies.

In a mixed strategy equilibrium players must be indifferent across their strategies. Let  $p$  be the probability that Dick hides upstairs. For Jane to be indifferent between looking upstairs and downstairs the following equation must hold:

$$\begin{aligned} a_j \cdot p + (1 - p) \cdot 0 &= p \cdot 0 + (1 - p) \cdot a_j \\ \implies p &= 1/2 \end{aligned}$$

The same calculation can be done for Dick. Assuming that  $a_j, a_d \neq 0$  the only equilibrium has each player following the strategies (Up, Down) with probability  $(1/2, 1/2)$ .

b) Dominant strategies (5 points):

Neither player has a dominant strategy. If one driver swerves then the other driver doesn't want to swerve. If one driver doesn't swerve then the other wants to swerve.

Pure strategy equilibria (5 points):

This game has two pure strategy equilibria: (S, DS) and (DS, S) where the first entry is driver A's strategy and the second is Driver B's strategy.

Mixed strategy equilibria (5 points):

This game has one mixed strategy equilibrium. To compute it follow the same logic as above. Let  $p$  be the probability that driver B swerves.

$$\begin{aligned} 2 \cdot p + (1 - p) \cdot 2 &= p \cdot 6 + (1 - p) \cdot 0 \\ \implies p &= 1/3 \end{aligned}$$

The game is symmetric across players so the same equation holds for driver B. The equilibrium has each player swerving with  $1/3$  probability and not swerving with probability  $2/3$ .