STAT 473 – Game Theory
Fall 2021
Problem Set 2

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Due: 10/14/21, 9:30 am

1. [**10 pts**] Consider the game Chicken (Example 4.2.3), modified as follows: there is a probability p (between 0 and 1) such that, when a player Swerves, the move is changed to Drive with probability p.[1] Write the matrix for the modified game, and show how the effect of increasing the value of M (the loss in the case of both players selecting Drive) changes the equilibrium strategies and expected values from the original version.

2. [**10 pts**] Consider the game Location-sensitive Pollution (Example 4.3.9). Since it satisfies the definition of a symmetric game, it must have a symmetric equilibrium strategy. Find such a strategy and prove that when all players play it, they are in Nash equilibrium.

3. [**10 pts**] Find an example of a two-player game that has at least one pure Nash equilibrium, but where it is possible for best-response dynamics to cycle (unlike in a potential game). Argue why your example is correct.

4. [**10 pts**] Find the symmetric Nash equilibrium of the game of Hawks and Doves, as below.

	dove	hawk
dove	(1,1)	(0,3)
hawk	(3,0)	(-4,-4)

Table 1: The payoff matrix for Hawks and Doves

5. [**10 pts**] Consider the following congestion game with four destinations: A, B, C, and D.

- The road between A and B costs 3 for one driver to use and 6 per driver if two drivers use it.
- The road between A and D costs 1 for one driver to use and 5 per driver if two drivers use it.
- The road between B and C costs 1 for one driver to use and 2 per driver if two drivers use it.
- The road between C and D costs 2 for one driver to use and 4 per driver if two drivers use it.

All these roads can be taken in either direction. No roads connect A to C or B to D directly.

Suppose Alice wants to get from A to C and Bob wants to get from B to D. Write this game between Alice and Bob in matrix form and find all the pure Nash equilibria.[2]

[1] This corresponds to the situation from Footloose that we watched in class, where Kevin Bacon's character tries to swerve, but his shoelace randomly gets stuck, so is strategy is switched to drive.

[2] Since this is a potential game, we know at least one such equilibrium exists.