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CMSC 471
Artificial Intelligence
Summer 2021
Quiz 5
Due: As long as it is 17-AUG-2021 anywhere on Earth (AOE)
https://time.is/Anywhere_on_Earth
20 Points
6 questions
5 pages

1. Nash equilibrium is an action configuration where players have no incentive to deviate (or change their minds) if asked in a(n)] _____ fashion. 1
Circle one:

- unilateral
- bilateral
- best response

2. Find the Nash equilibrium for the game below. 1

		Incumbent: Share	Incumbent: Compete
Entrant	Enter	5, 5	-1,1
	Don't	0,10	0,10

(5,5) is cell with all best responses, Incumbent will always choose share as it is dominant strategy. Entrant will not change answer from Enter as it is best choice. At (5,5), no player can do strictly better by deviating.

4. Consider the game below:

			P2 L (q)	P2 R ($1-q$)
P1	p	U	2, 1	0, 0
	$1-p$	D	0, 0	1, 2

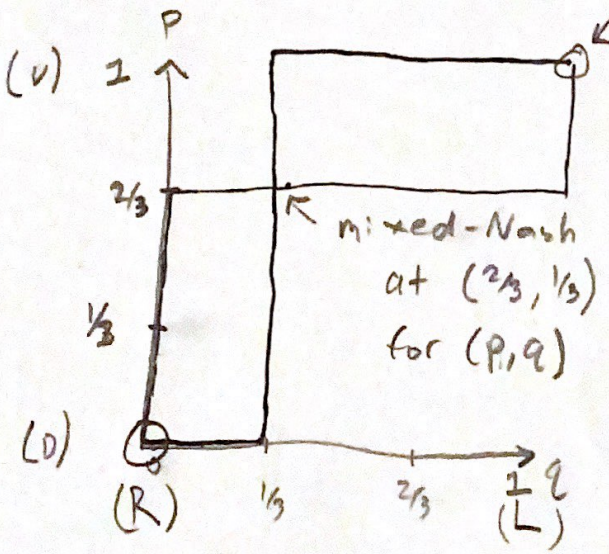
a) Find the mixed-strategy Nash equilibrium. 3

$(1 \cdot p) + (0 \cdot (1-p)) = (0 \cdot p) + (2 \cdot (1-p)) \Rightarrow p = 2 - 2p \Rightarrow p = \frac{2}{3}$

$(2 \cdot q) + (0 \cdot (1-q)) = (0 \cdot q) + (1 \cdot (1-q)) \Rightarrow 2q = 1 - q \Rightarrow q = \frac{1}{3}$

$\left(p = \frac{2}{3}, q = \frac{1}{3}\right)$

b) Draw the Better Reply graph and indicate the pure Nash equilibrium/equilibria. 2



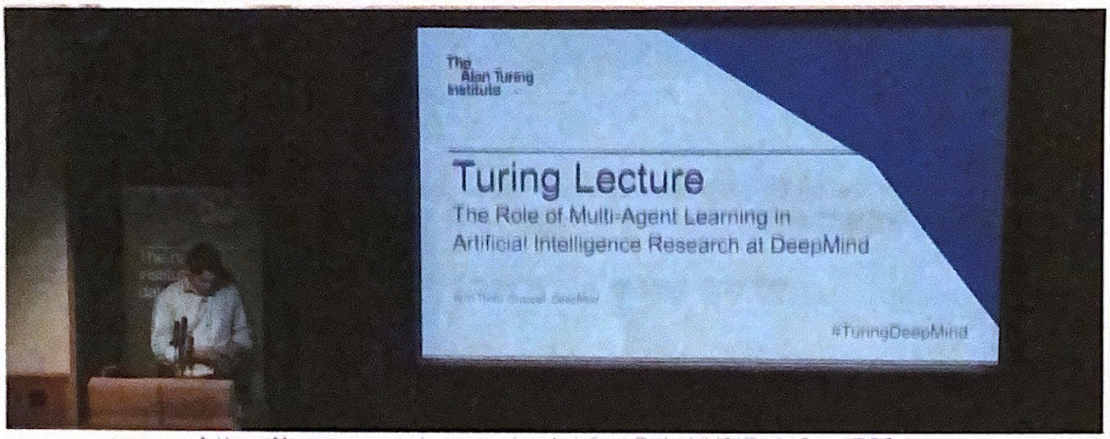
pure Nash equilibrium still at (1, 1) for (p, q), or at (0, 0).. depending on optimization goal.

3. Our classroom needs a better webcam. A webcam benefits everyone and I am soliciting donations from the class. There are N students, and each student possesses a token. A webcam costs K tokens. K is greater than 2, but less than N. Now, the action of each student is to either donate a token or avoid me. Find the Nash equilibrium/equilibria. Please provide a reasoning. 4

The Nash equilibrium would result in all players avoiding you, and zero tokens being given. Since each player (student) can choose to donate, and each students optimal choice is to keep their token, the problem would equalize at every student keeping their tokens,

"Socially undesirable Nash Equilibrium."

5. Watch this video on *Multiagent Learning* (first half + last slide) for the following questions:

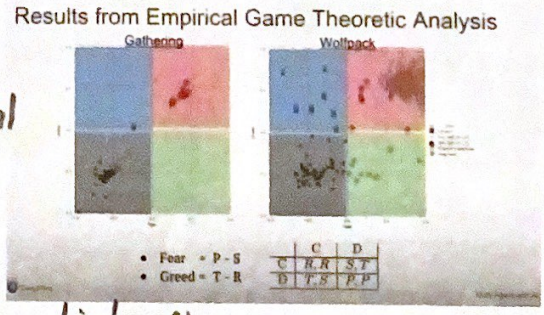


https://www.youtube.com/watch?v=CvL-KV3IBcM&t=1736s

a) Briefly describe the difference between fear and greed, as presented in this talk as game-theoretic terms. 2

Greed is the exploitation of a cooperator over mutual cooperation. Fear is when mutual defection is preferred over being exploited. Greed can drive fear, both greed and fear drive defection.

b) Briefly comment on the finding summarized by the graph below: 2



These findings analyzed whether simple games that were run corresponded to traditional game theory views of social dilemma. The results showed that yes, these simple games did show results similar to traditional game theory examples like the prisoners dillema, stag hunt, and chicken.

6. There are two regions of interest to be covered. One region is a high-valued region with a value of 10 points. The other region has a value to 2 points. We plan on deploying two vehicles to cover these regions. We set up a game where the vehicles are the players. The actions available to each vehicle are: 1) cover the high-valued region, 2) cover the low-valued regions, and 3) cover neither.

a) What is the Nash equilibrium if the utility of a vehicle is defined as follows:
- A vehicle's utility is the value of the region it is covers, divided by the number of vehicles covering that region
- Covering neither region yields 0 points to a vehicle in utility. 2.5

(5,5) would be the Nash Equilibrium both vehicles would choose the optimal column choice, and end when they wouldn't deviate from their choice. No player can do strictly better by deviating.

	10 ↓	2	0
10 →	5,5	10,2	10,0
2	2,10	1,1	2,0
0	0,10	0,2	0,0

b) What is the Nash equilibrium if the utility of a vehicle is defined as follows:
- A vehicle gets 0 points for a region if another vehicle is covering that region
- A vehicle's utility is the value of the region it is covers, provided it is the only one
- Covering neither region yields 0 points to a vehicle in utility. 2.5

The Nash equilibrium would be (2,10) and (10,2), at these points, no player can do strictly better by deviating.

	10	2	0
10	0,0	10,2	10,0
2	2,10	0,0	2,0
0	0,10	0,2	0,0

END