

Modeling Multi-agent Scenarios

Homework #1

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A. Sidewalk shuffle

I imagine you have a very narrow staircase which can hold only two people side by side, like the one in Masdar 1A.

Myself and Dr. Jacob meet on two ends of the staircase, standing in the middle. Then we can choose to both step to left or right and be able to pass easily, or one of us steps left or right, while the other one mirror his movements and step in the other direction. This way if we continue, we will bump into each other.

Dr. Jacob \ Myself	Left	Right
Left	1,1	0,0
Right	0,0	1,1

1. This is a team-game – in fact, it's a perfect or pure coordination game
2. No information is available to the players. Although it could be that we know that we both are from cultures driving on the right. Then the probability of both of us moving to the right increases and actually makes coordination easier and since we do not have to step out of our comfort zone, we can put a higher payoff on it.

	Left	Right
Left	1,1	0,0
Right	0,0	2,2

However, if I was from a culture driving on the left, for example, then I would prefer stepping towards the left, whereas Dr. Jacob would prefer stepping to the right, the our best choices would collide.

	Left	Right
Left	2,1	0,0
Right	0,0	1,2

3. If this game was played repeatedly, since in the original setup the game is entirely symmetric, we would expect to encounter a 50-50% division between left-left and right-right coordination. However, if there is a first-mover, achieving a payoff of 1 is always possible. With simultaneous steps, however, payoff of 1 and avoiding collision is only expected to happen in 2 out of 4 simulations, so 50% of the time.
4. In the original setup, if it is played simultaneously, the random is choice is the expected action of the players. If it is played in a turn-by-turn basis, then pure coordination, i.e. responding left to the left and right to the right is the expected behavior. If background information on direction

preference exists and the corresponding payoffs are higher, then this will be the expected outcome. Personally, I would choose on direction and stick to it in the original setup of the game, when its played simultaneously, as no information about the choice of the other player is available hence it is impossible to decide on my payoff and this would essentially be equivalent to a pseudorandom choice.

B. Sidewalk shuffle pro

I imagine the same situation but now my leg is hurting and I really have to hold the handrail on the right side. On the other hand, Dr. Jacob prefers the left side of the staircase to the right, where the AC is blowing from above.

Myself and Dr. Jacob still meet on two ends of the staircase, standing in the middle. Then we can choose to both step to left or right and be able to pass easily, or one of us steps left or right, while the other one mirror his movements and step in the other direction. This way if we continue, we will bump into each other. However, I would really prefer to stay on the right, as I can hardly stand on my leg. Dr. Jacob prefers the left side (on his direction, so he would bump into me), because of the AC not blowing directly on top of his head. Likewise we define the payoffs in the following way: I would really like to stay on the right, so I get 4 for that and 1 for the left, as my leg really hurts. Dr. Jacob gets 3 for left and 2 for right, as he can still pass in both situations, easier than me with my hurting leg without handrail. If we bump into each other, we still get 0,0.

Dr. Jacob \ Myself	Left	Right
Left	1,3	0,0
Right	0,0	2,4

1. This is mainly team-game, with some competitive elements – conflicting interest. It is also a constant sum game.
2. Dr. Jacob sees my injured leg and I know that he prefers the non-AC side.
3. If this game was played repeatedly, we would expect to see me choosing to stay on the right 80% of the time and going left 20% of the time. Dr. Jacob, on the other hand would stay on the left 60% of the time and step to the right 40% of the time. This will result in avoiding each other 20+20=40% of the time and bumping into each other 60%. This is the rational expectation, however, human beings will tend to lock in into one of the solutions, maybe with myself staying on the right and Dr. Jacob also stepping to the right version, with Dr. Jacob scarifying a little bit from himself and choosing to endure the AC for the staircase passage. Achieving passage next to each other is not necessarily a rational expectation, as we will see in the next point.
4. Again, this is highly dependent, whether we play the game simultaneously or not, but if we suppose we don't, the rational expectation from the players is to bump into each other. Since Dr. Jacob has a higher payoff for continuing on the left and I have a higher payoff for continuing on the right, bumping into each other on the right side of the staircase (as from my point of view) is the expected outcome. If the game is played in turns, then the same reasoning presented at game A. applies.