Summary Notes for Week 3: Alternate Solution Concepts

Iterated elimination of strictly dominated strategies

Strictly dominated strategies can be removed from a game matrix entirely because choosing the strictly dominated strategy always gives a worse outcome than choosing another strategy.
In the first step, at most one dominated strategy is removed from the strategy space of each of the players since no rational player would ever play these strategies. This results in a new, smaller game. Some strategies—that were not dominated before—may be dominated in the smaller game. The first step is repeated, creating a new even smaller game, and so on. The process stops when no dominated strategy is found for any player.

	L	C	R
U	3, 1	0, 1	0, 0
M	1, 1	1, 1	5, 0
D	0, 1	4, 1	0, 0

1. For player 1, R is strictly dominated by L / C => remove R.

	L	C
U	3, 1	0, 1
M	1, 1	1, 1
D	0, 1	4, 1

2. Neither U or D strictly dominates M. However, a mixed strategy of choosing either U or D with a probability of 0.5 strictly dominates M. If player 2 plays L, the payoff for a mixed strategy of U or D is (3+0)/2 = 1.5, which is more than 1 for choosing M. If player 2 plays C, the payoff for a mixed strategy of U or D is (4+0)/2 = 2, which is more than 1 for choosing M. Hence, M is strictly dominated by a mixed strategy that selects U or D with equal probability. => remove M.

	L	C
U	$3, 1$	$0, 1$
D	$0, 1$	$4, 1$

3. Player 2 is indifferent to playing L or C, so there is no more strict domination.

If a strategy is dominance solvable, it will result in a Nash equilibrium.

<u>Iterated elimination of weakly dominated strategies</u>

Another version involves eliminating both strictly and weakly dominated strategies. If, at the end of the process, there is a single strategy for each player, this strategy set is also a Nash equilibrium. However, unlike the first process, elimination of weakly dominated strategies may eliminate some Nash equilibria. As a result, the Nash equilibrium found by eliminating weakly dominated strategies may not be the only Nash equilibrium. (In some games, if we remove weakly dominated strategies in a different order, we may end up with a different Nash equilibrium.)

<u>Maximin & Minimax Strategies</u>

Player i's maximin strategy is a strategy that maximizes i's worst-case payoff, in the situation where all the other players happen to play the strategies which cause the greatest harm to i. The maximin strategy is adopted by a conservative agent maximizing their worst-case payoff, or a paranoid agent worried that others are out to get him.

Player i's minimax strategy against player -i in a 2-player game is a strategy that minimizes player -i's best-case payoff.

The minimax strategy is adopted by an agent to punish the other agent as much as possible, or in a zero-sum two-player game, to maximize his own payoffs because by minimizing the other player's payoff, he maximizes his own payoff (since it's zero-sum).

In zero-sum games, the Nash equilibrium, maximizing your own gain, and minimizing your opponent’s gain coincides.