

SOC Week2 Report

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Contents

1	Reading1: Two Player Games	2
2	Reading2: Sequential and Simultaneous Move Games	2
3	Reading3: Normal Form Game Representation	3
4	Week2 Tasks	3

1 Reading1: Two Player Games

- When it comes to discussing 2 player games there are some **crucial terminologies**, namely player(agent and the opponent), starting state (S_0), actions(s) [the set of possible actions at state s], player(s) [the player whose turn it is at state s], successor(s, a) [next state in case action a was taken at state s by player(s)], isEnd(s) [checking if state s is the terminal state] and utility(s) agent's utility once the action is taken at state s].
- **Constant sum games** are games in which the total utility of both the players remains constant throughout the game's course. A subset of this type of games is Zero sum constant games where the sum of the utilities of both players is always zero. The key characteristic of this type of games is that objectives of both players are opposite in the sense that one's profit is another's loss.
- **Strategy of a player**: It is the action a player must stake in case it is in any of the states of the game. Types of strategies include **deterministic Strategies** (action of a player at a specific state is fixed and predetermined), **randomized Strategies** (choose different strategies in different probability distributions) and **probabilistic strategies** (follow a strategy that innately uses probabilistic distribution between actions).

Max player is the player who tries to maximise the utility and the min player is a utility minimiser.

- **Backward Induction**: It is a method to find the sequence of optimal sequence of moves by starting at the end of the decision tree and reasoning our way up.

2 Reading2: Sequential and Simultaneous Move Games

→ Enhancements on the Backward Induction

- Depth Limited Search: This algorithm explores as far as possible along each branch before backtracking back to the first node of difference.
 - Breadth First Search: This algorithm explores all nodes present at the current depth and then moves to the next depth level.
 - α, β pruning: It is a technique used in game theory to reduce the number of nodes evaluated in the minimax algorithm search tree. It aims to eliminate branches that are deemed irrelevant to the final result.
- Simultaneous Move Games: Games in which both players might make moves at the same time. For eg: basketball.
 - Equilibrium is a situation wherein no player gains any utility if one player out of the two adopts any other alternate strategy while the other player sticks to their strategy.

3 Reading3: Normal Form Game Representation

- **Dominated Strategies:** Dominated strategies always perform worse relative to some other alternative strategy (of the other player).
 - Strictly dominated strategy is one which always delivers worse than other alternative strategies.
 - Weakly dominated strategy is a strategy that delivers an equal or worse outcome than an alternative strategy.
- **Dominant Strategies:** Dominant strategies always perform better relative to some other alternative strategy (of the other player).
 - .Strictly dominant strategy is one which always delivers better than other alternative strategies. Weakly dominant strategy is a strategy that delivers an equal or better outcome than an alternative strategy.
- **Equilibrium** is a situation wherein a player has best move despite of what the other player does. Pure Strategy Nash Equilibrium (PSNE) is a strategy profile from which unilateral deviations (other players' actions are fixed and only one player moves) are not beneficial. **A PSNE might not always exist.**
 - When both the players have strictly dominant (SDS) or weakly dominant strategies (WDS), the strategy profile of their SDS/WDS is called strictly/weakly dominant strategy equilibrium (SDSE/WDSE).

4 Week2 Tasks

Link to the code: [Week2Tasks](#)