hw3_games_q7_suboptimal_strategies

Question 7: Suboptimal Strategies

0.0/3.0 points (graded)

Player MAX and player MIN are playing a zero-sum game with a finite number of possible moves. MAX calculates the minimax value of the root to be M. You may assume that at every turn, each player has at least 2 possible actions. You may also assume that a different sequence of moves will always lead to a different score (i.e., no two terminal nodes have the same score). Which of the following statements are true?

- [x] Assume MIN is playing sub-optimally at every turn, but MAX does not know this. The outcome of the game could be larger than M (i.e. better for MAX). ✔
- [ ] Assume MIN is playing sub-optimally at every turn. If MAX plays according to the minimax strategy, the outcome of the game could be less than M.

a)
Consider a toy example in which there is only one turn, MAX has two actions, and MIN has two actions. For both of MAX's actions, one terminal node is positive, and the other is negative. M would be one of the negative values, while the actual outcome would be one of the positive values.

b)
If MAX is playing optimally, the minimax value is only a lower bound on the outcome of the game. If MIN plays suboptimally, that can only improve MAX's options each turn and thus improve the outcome for MAX.

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problem

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For this question, assume that MIN is playing randomly (with a uniform distribution) at every turn, and MAX knows this.

- [ ] There exists a policy for MAX such that MAX can guarantee a better outcome than M.
- [x] There exists a policy for MAX such that MAX's expected outcome is better than M. ✔
- [ ] To maximize his or her expected outcome, MAX should play according to the minimax strategy (i.e. the strategy that assumes MIN is playing optimally).

a)
MIN could randomly choose the optimal action at every turn, which would result in an outcome of M if max plays according to the minimax policy, or possibly less if max plays according to a different policy.

b)
The policy found using Expectimax will have a higher expected outcome than M.

c)
Expectimax gives MAX a higher expected outcome than the minimax strategy.

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problem

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- [x] Assume MIN is playing sub-optimally at every turn. MAX following the minimax policy will guarantee a better outcome than M. ✔

- [x] Assume MIN is playing sub-optimally at every turn, and MAX knows exactly how MIN will play. There exists a policy for MAX to guarantee a better outcome than M. ✔

a)
MIN playing sub-optimally every turn will only improve MAX's choices each turn, because the minimax policy assumes that MIN will choose the worst possible move from MAX's perspective. Thus, at each step, MAX is guaranteed to have a value better than the minimax value.

b)
As stated above, the minimax policy will guarantee MAX a better outcome than M.

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