Soliterrible

Deterministically Unplayable Solitaire

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Abstract

According to reliable sources[5], about 1 in 400 games of Klondike solitaire has no legal moves at the beginning of the game. In this paper, we present a system that increases this to 400 in 400 games.

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1 Introduction

Klondike solitaire is really lame and played by graduate students, and more generally people without friends. Given the fact that these people deserve to be tortured, one may ask what's the best way to go about this. The first and most obvious way is to make sure that they never win their games, but as we will demonstrate, this is too simple and still lets them have fun by actually being able to do something. An optimal solution to this problem presents the illusion that the player is able to do something before quickly crushing their spirit. We posit that the most effective way of going about this is with deterministically unplayable solitaire, where the initial state of the hand and deck present absolutely no valid moves whatsoever. We provide an algorithm which quickly generates a solitaire game meeting these constraints and a reference implementation, Soliterrible, and ask unwitting friends of the author to play it.

2 Previous Work

Limited work has been done on the precise[2] probability[4] of entirely unplayable[3] solitaire game. This work has been largely experimental in nature and focused on deciding the playability of a given deck, as opposed to generating an entirely unplayable deck. This is likely because no reasonable person would want to do this. There has been no known work on generating such a deck, much less applying the algorithm to a playable solitaire application. [1]

3 Generating an unplayable game

We generate this algorithm by distinguishing between 3 mutually exclusive categories of cards

- revealed cards, which are face-up on the board at the beginning of the game
- hidden cards, which the revealed cards are stacked on top of
- the stock which can be accessed by drawing from the deck

As such, based on the rules of Klondike, for a deck to be unplayable, three criteria must be met:

- All aces must be among the hidden cards
- No pair of revealed cards may be stackable on top of each other
- No card in the stock may be stackable on top of a revealed card

As such, the algorithm is as follows:

1. Move all aces into hidden cards
2. Select 7 cards, none of which may be stacked on top of any other
3. Select 24 cards, none of which may be stacked on top of any of the 7 revealed cards
4. Move all other cards to hidden cards[2]

Note that this algorithm is most effective for single-card-draw solitaire. When the player is required to draw 3 cards at a time, one may further torture the player by only selecting 8 cards in step 3 and putting them, in the stock, at positions 3,6,...,24. This makes victory visible, but unreachable. Outside of this variant, the ordering of the cards in each category is irrelevant.

4 Implementation

This algorithm was implemented in place of the shuffling process in an existing solitaire app [1], used with the permission of its original author. The modifications included some minor bug fixes. The source code can be found at https://github.com/sternj/react-native-solitaire. The implementation was in Javascript.

5 Evaluation

A cursory review of the game reveals that the shuffling does meet all of the constraints set out. The author gave this to a number of friends. One of them wrote, "okay i might be very bad at solitaire.... alternatively... its [sic] very well made but are you playing a joke... having a jape". Another wrote: "Are you pranking me... That's three in a row, you

[1] foot 3

[2] However, this fourth step ruins the pattern established by the previous two itemize sections

little butthead… I have a critique of your app smartass… Doesn't rotate well". The author would like to note that the app indeed does not rotate well.

6 Time Complexity

Given that one can remove the aces in constant time and not accounting for the time due to shuffling, constructing an unplayable hand will be linear in the number of cards in the deck and the number of piles on top of which there are revealed cards.

7 Future Work

Given that the goal of this algorithm is to make nerds miserable, additions in future work may include an addition of a "hint" feature that only tells the player to draw another card or reset the deck, potentially fooling them into thinking that their next action may allow a move. An entirely unexplored area is controlling the total number of legal moves deterministically, which could be used to vary the allowable move count while preserving the relative unplayability (and deterministic unwinnability) of the game. The author has also developed an algorithm that guarantees a game's unwinnability by controlling the placement of only 4 cards. The author did not explore these possibilities because he would like to keep his friends rather than torturing them for an unboundedly-large amount of time. [3]

8 Conclusion

This algorithm has succeeded in exclusively generating games of solitaire without any legal moves, though this conclusion section has not succeeded at being good[4].

9 Acknowledgements

The author would like to thank his friends who he sent the app to without explanation for not entirely cutting him out of their lives, along with Stephen Cronin, who graciously let the author use their existing solitaire app to construct this abomination.

References

[1] Stephen Cronin. 2019. cronin4392/react-native-solitaire. https://github.com/cronin4392/react-native-solitaire

[2] Chance Gordon and Matthew Torrence. 2017. Probability of no moves in solitaire. https://math.stackexchange.com/questions/2565763/probability-of-no-moves-in-solitaire

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[4] al pateman and AndyT. 2016. in Klondike-Solitaire, how likely is a deal with no legal moves? https://boardgames.stackexchange.com/questions/32304/in-klondike-solitaire-how-likely-is-a-deal-with-no-legal-moves

[5] u/mushnu. [n.d.]. r/todayilearned - TIL that 1 in 400 solitaire hands are totally unplayable, meaning "no cards can be moved to the foundations even at the start of the game". https://www.reddit.com/r/todayilearned/comments/a7cscn/til_that_1_in_400_solitaire_hands_are_totally/

[3] 1 note

[4] However, this section also generates no games of solitaire with any legal moves, so perhaps it is not so bad