Evil Games

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What kind of games can become “evil”?

- Each instance of a game is a randomly selected answer from a finite set of possible solutions
- On each turn, the player guesses a solution to the game
- Game provides feedback on correctness of proposed solution
- Game continues until player has correctly guessed solution
Examples of games:

Hangman
Examples of games:

Wheel of Fortune
Examples of games:

Safecracking Puzzle
Examples of games:

Mastermind

<table>
<thead>
<tr>
<th>#</th>
<th>Guess</th>
<th># Color</th>
<th># Order</th>
<th># Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image" alt=".colors" /></td>
<td>3</td>
<td>0</td>
<td>44, 63% reduction</td>
</tr>
<tr>
<td>2</td>
<td><img src="image" alt=".colors" /></td>
<td>3</td>
<td>0</td>
<td>13, 70% reduction</td>
</tr>
</tbody>
</table>
How to play an evil version of a game

- The game never generates a random solution at the beginning of the game
- Instead, maintain a set of valid candidate solutions
- After each guess by the player, give feedback that removes the fewest number of candidates from the set of viable solutions
- The player wins once there is only 1 valid solution remaining!
Mastermind

- K slots
- C colored balls

- Each slot can hold one of the colored balls
- Single player game where the goal is to correctly guess the assignment of balls to each slot.
- After each guess, the game returns a hint containing the following information:
  - The number of balls which are the correct color
  - The number of balls which are the correct color and in the correct slot
Mastermind

- **K** slots
- **C** colored balls
- Each slot can hold one of the colored balls

**Guess:**

**Solution:**

Hint says: **2 Correct Colors, 1 Correct Order**
Evil Mastermind

- $K$ slots
- $C$ colored balls
- Each slot can hold one of the colored balls

- Maintain a set of all possible solutions that are consistent with given hints.
  - Always provide the hint that maximizes the number of remaining candidates
  - Player wins when their guess is the only remaining candidate

- Number of initial arrangements:
  $$\prod_{i=0}^{K-1} (C - i)$$