Pig: Optimal Play

By Hope Schaumburg

How to Play Pig:

Materials: Fair six-sided die

The object of the dice game Pig is to be the player with the highest score at the end of 5 turns. Each player’s turn consists of repeatedly rolling a die. After each roll, the player is faced with two choices: roll again, or hold (decline to roll again).  
• If the player rolls a 1(a skunk), the player scores nothing and it becomes the opponent’s turn.  
• If the player rolls a number other than 1, the number is added to the player’s turn total and the player’s turn continues.  
• If the player holds, the turn total, the sum of the rolls during the turn, is added to the player’s score, and it becomes the opponent’s turn.

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| --- | --- | --- | --- | --- | --- | --- |
| Player | Turn1 | Turn2 | Turn3 | Turn4 | Turn5 | Total |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

What strategy did you use to play the game?

Did it work in your favor?

Questions About Pig and Probability:

1. What is the probability of rolling a 1 or a skunk?
2. If you roll several 6’s in a row, does it affect the probability of you rolling a 1 or skunk on the next turn?
3. Is there an optimal number of rolls at which you should end your turn?
4. Is there an optimal number of points at which you should end your turn?
   1. **Expectation:** a long-term average of the event if you were to observe the event infinitely many times
   * In Pig, the event is the score after rolling a die assuming we have already collected k points

**Method 1:** Let k equal the optimal number points collected at which to end the turn

**Method 2:** In this method, we are finding the expected value of points gained by a turn given you already have collected k points for the turn. Let k equal the optimal number points collected at which to end the turn

Break even when k=\_\_\_\_\_\_\_\_\_\_

**Additional Questions:**

* If you have many competitors who are following the above stopping strategy, how does this affect who wins?
* What if your opponent is far ahead of you in points and you only have one turn remaining?

**Reference**

Dice Game Depot (2018). *Pig dice game rules.* Retrieved from

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