Applying Statistical Methods in Roulette to Maximize Winnings using Reinforcement Learning

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March 7, 2025

1 Introduction

After reading a book on combining reinforcement learning & finance, I was inspired to work on a fin-tech project that combined my passion of writing code and learning about finance. Introduced to the idea of roulette by a friend, I wanted to explore using some of the statistical methods I learnt, such as bayesian updating and probabilistic matching when it comes to maximizing the reward from rolling a dice or tossing a coin, and implement it for a simple roulette game.

For this project, I wanted to combine everything I've learnt, by building a front-end application usinf JavaFX, working on the backend using Java, performing statistical analysis using R, and working on the graphing of the results of experiments with Python and coming out with conclusions after using different hypothesis testing methods.

2 Understanding the Roulette Game

Roulette is a casino game where you place bets on numbers and colors, and a spinning wheel determines the winner. The game is explained in further detailed in the following subsections below.

2.1 The Wheel & Numbers

The wheel has numbers 1 to 36, and 0 and 00. The numbers are red or black, except for 0 and 00, which are green.

2.2 Buying Chips

The player can buy special roulette chips, in stacks of 20 from the dealer. Each player gets their own color of chips. Each chip is worth $1, and these chips can be used only at the roulette table.

2.3 Placing Bets

You place chips on numbers or groups of numbers. You can bet on a single number, two numbers, a color (red or black), or whether the number will be odd or even. The dealer spins the ball in the opposite direction of the wheel.

2.4 Winning & Payouts

If the ball lands on your number or bet, you win based on the type of bet:

- **Single Numbers:** 35 times your bet
- **Two Numbers:** 17 times your bet
- **Three Numbers:** 11 times your bet
- **Four Numbers:** 8 times your bet
- **Five Numbers:** 6 times your bet
- **Six Numbers:** 5 times your bet
- **Columns (12 Numbers):** 2 times your bet
- **Dozens (1-12, 13-24 or 25-36):** 2 times your bet
- **Odd/Even, Red/Black, or 1-18/19-36:** 1 times your bet

2.5 End of Round

The dealer announces "No more Bets", and the ball lands on a number. The dealer places a marker on the winning number and pays the winners. No one can touch their chips until the dealer removes the marker.