Slot Simulator

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1 Overview

This project will explore the mathematical models behind slot machines. Modern slot machines are governed by complicated mathematical models that determine the odds of winning. Given a mathematical configuration, it is valuable to be able to predict what the odds of winning are. Specifically, I am most interested in answering the following question: If I play out every possible reel stop on a given machine exactly once, how many times will each magnitude of pay occur?

A slot machine may have the following features:

1. A set of symbols, S.

2. A set of reels, R. Each reel in R is a tuple of arbitrary length containing elements from S. A reel may contain any number of each symbol. At any given time, only a portion of each reel is visible. The set of all possible visible combinations is V. $V_0, V_1, ..., V_n$ represent the visible results of every possible reel stop. $V_{current}$ is evaluated following a spin to determine if the player won.

3. A set of paylines, L.

4. A function, P. The result of $P(V_i)$ is the prize associated with V_i. In the simplest case, a prize will be awarded if a sequence of symbols occurs along a payline. Figure 1 shows the visible portion of five slot reels. The slot machine has two paylines. Four a's have stopped along $payline_2$, from left to right. Generally, the symbols along $payline_2$ would constitute a winning combination, though this is dependent on the contents of P. A *scatter pay* is an example of a more complicated scenario. A three-way scatter pay occurs when a designated symbol is visible anywhere on any three reels. If P defines s as a three-way scatter symbol then Figure 2 illustrates a scatter pay. Though the three s's don't appear along a payline or in sequence from left to right, they represent a win.
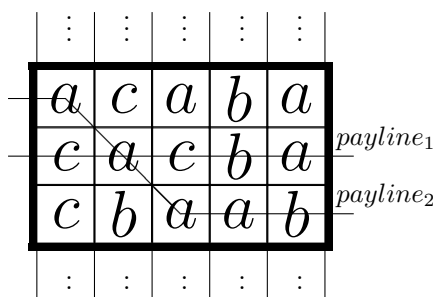

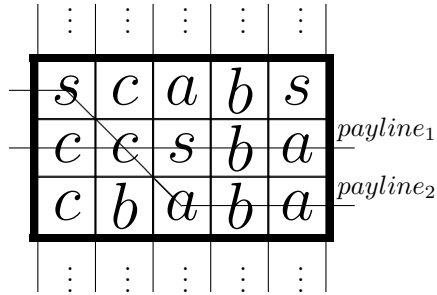Figure 1: A set of five reels demonstrating a standard line pay

Figure 2: A set of reels demonstrating a scatter pay

Several machine properties determine the complexity of the machine's mathematical model. The size of the reels and number of entries in the paytable have an affect. In addition, special symbol properties, such as the concept of a wild symbol or multiplier, make things more complex. Finally, the concept of a bonus game may be introduced. A bonus game is an arbitrary game of chance that is triggered by en element of V. Not necessarily resembling the underlying slot machine, the intention of a bonus game is to add variation and excitement to a machine's gameplay.

In summary, given a machine, the simulator will exercise every possible reel stop, evaluate the game state for wins and tabulate win statistics.

2 Functionality

2.1 Core Functionality

This is the essential functionality of project.

I. The system will be able to simulate a five reel slot machine.

II. There will be default contents for the reels.

III. The system will be able to take a paytable as input.

IV. The system will be able to give back the number of times each win in the paytable was hit after every possible game was played.

2.2 Extended Functionality

This is extra functionality that I intend to add to the core.

A. The system should be able to take input that determines the contents of its reels.

B. The system should be able to support arbitrary bonus game evaluation additions.

C. The system may support wild symbols.

2.3 Optional Functionality

This is extra functionality that I might add to the core if time allows.

1. The system may support multiple pay lines.

2. The system may support multiplier symbols.

3. The system may support scatter symbols.

2.4 High Risk Functionality

This is functionality that I expect to be difficult or do not know how to do.

i. The system may support wild symbols that do arbitrary things. For example, a wild symbol may make an entire column wild. A special symbol may act as a wild for a subset of the symbols available.

ii. The system may graphically display its state.

3 Schedule

Release	Date	Targeted Features	Actual Features
Baseline	14 October	I-IV	
Release 2	21 October	A-C	
Release 3	28 October	1-3	
Final	4 November	i-ii	