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Monte Carlo Simulations Documentation

The Monte Carlo simulation program includes two different simulations. The programs are using the pokemon theme. There is a deck of 60 and the player hand has seven cards. The types of cards are trainer, pokemon, and energy.

The first monte carlo simulation wants to find the probability of having AT LEAST one pokemon in your hand when drawing the card. The program tests the probability of having the pokemon in your hand on the first draw when there is 1 pokemon in the deck all the way up to 60(deck size). The program tests this case 1,000,000 times for each amount of pokemon in the deck. This is to get the most accurate results. There is an included excel spreadsheet of a graph and table of results.

```
Number of Pokemon in deck 1 Percentage of True: 11.6753%
Number of Pokemon in deck 2 Percentage of True: 22.1768%
Number of Pokemon in deck 3 Percentage of True: 31.5161%
Number of Pokemon in deck 4 Percentage of True: 39.9226%
Number of Pokemon in deck 5 Percentage of True: 47.4933%
Number of Pokemon in deck 6 Percentage of True: 54.126%
Number of Pokemon in deck 7 Percentage of True: 60.1131%
Number of Pokemon in deck 8 Percentage of True: 65.3516%
Number of Pokemon in deck 9 Percentage of True: 70.0841%
Number of Pokemon in deck 10 Percentage of True: 74.1006%
Number of Pokemon in deck 11 Percentage of True: 77.7625%
Number of Pokemon in deck 12 Percentage of True: 80.9218%
Number of Pokemon in deck 13 Percentage of True: 83.6941%
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Number of Pokemon in deck 47 Percentage of True: 99.9999%
Number of Pokemon in deck 48 Percentage of True: 99.9998%
Number of Pokemon in deck 49 Percentage of True: 100.0%
Number of Pokemon in deck 50 Percentage of True: 100.0%
Number of Pokemon in deck 51 Percentage of True: 100.0%
Number of Pokemon in deck 52 Percentage of True: 100.0%
Number of Pokemon in deck 53 Percentage of True: 100.0%
Number of Pokemon in deck 54 Percentage of True: 100.0%
Number of Pokemon in deck 55 Percentage of True: 100.0%
Number of Pokemon in deck 56 Percentage of True: 100.0%
Number of Pokemon in deck 57 Percentage of True: 100.0%
Number of Pokemon in deck 58 Percentage of True: 100.0%
Number of Pokemon in deck 59 Percentage of True: 100.0%
Number of Pokemon in deck 60 Percentage of True: 100.0%
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The second Monte Carlo simulation is testing conditional probability. We still have a deck of 60 cards, but we have 15 pokemon in the deck. Other than the hand and deck, we have a prize pile of 6 cards. We want to know the probability of having a pokemon in our hand similar to the first simulation, but we also want to know the probability of a rare candy trainer card being in the prize pile if there is a pokemon in hand. For this case, we have 15 pokemon, 1 rare candy, and the rest energy cards. We want to test this probability by having 1 rare candy on deck all the way up to 4. The amount of pokemon stays the same for each. This is testing conditional probability.

$$P(A \mid B)$$

The program tests each case 1,000,000 times to get the most accurate results. The program gets the percentage of A which is the probability of a pokemon being in the deck. The second thing it calculates is the probability of A and B happening where B is the probability of having a rare candy in the prize pile. The program then divides both results giving us the conditional probability.

```
The probability of getting a pokemon in hand is: 88.3134%
The probability of getting a rare candy in prize pile is: 8.8876%
The conditional probability is: 8.8876%
The probability of getting a pokemon in hand is: 88.287%
The probability of getting a rare candy in prize pile is: 16.9986%
The conditional probability is: 16.9986%
The probability of getting a pokemon in hand is: 88.2377%
The probability of getting a rare candy in prize pile is: 24.3929%
The conditional probability is: 24.3929%
The probability of getting a pokemon in hand is: 88.2898%
The probability of getting a rare candy in prize pile is: 31.1428%
The conditional probability is: 31.1428%
```