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Chuck-a-Luck

In the Chuck-a-Luck game, a player chooses a number between 1 and 6, and then 3 dice are thrown. If their number appears on one, two, or three of the dice, they win one, two, or three times their original stake, respectively, plus their original stake back. Otherwise, they lose their original stake.

Using the binomial distribution, we can easily calculate the expected loss in this game on a unit ($1) stake. The probability of none of the dice landing the player's guess is:

$$\binom{3}{0}(1/6)^0(5/6)^3 = \frac{125}{216}$$

The probability of 1 of the dice landing the player's guess is:

$$\binom{3}{1}(1/6)^1(5/6)^2 = \frac{25}{72}$$

In a similar fashion, the probabilities for the dice landing 2 or 3 of the player's guesses are $\frac{5}{72}$ and $\frac{1}{216}$, respectively.

Combining these probabilities, the expected result of playing the game on a unit stake is:

$$\frac{25}{72}(1) + \frac{5}{72}(2) + \frac{1}{216}(3) + \frac{125}{216}(-1) = -0.08$$

Thus, the player can expect to lose about 8 cents on a unit stake in Chuck-a-Luck.