

## MATH 4530/5530- Project 1

### Problem 1:

If you roll a fair cubical die, the probability of getting a six is  $1/6$  (theoretically). We want to verify it by simulation. Follow the following steps:

Write a function named `count_a_six`. Use `n` for argument. This function should:

- i. Roll a six-sided die for  $1:n$  times.
- ii. In each roll, it should count the number of sixes.
- iii. Find the probability of getting a six and store for all rolls.
- iv. It should return a plot of those probabilities' vs the number of rolls.
- v. Apply your function for  $n = 100000$ .

### Problem 2

Consider the following drawcard game with a well-shuffled deck of cards. If you a red card, you win nothing. If you get a spade, you win \$5. For any club, you win \$10 plus an extra \$20 for the ace of clubs. Find the expected winning in this game. You should answer this question by simulation. Follow the following steps.

Write a function `Ace_Clubs_Wins` that will:

- i. Create a deck of 52 cards.
- ii. Draw one card randomly.
- iii. If you draw a red card, your win is 0, if your draw is a spade, you win is 5, if your draw is a club but not an ace of clubs, you win 10, if your draw is an ace of clubs, you win 30.
- iv. Your function should return the amount of money you could win in one game.
- v. Simulate this game 100000 times and find the average amount of money that you win.

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### Problem 3

In a game of die, a player rolls two dice. If the sum of the dice is either a 2, 3, or 12, the player loses; if the sum is either a 7 or an 11, the player wins. If the outcome is anything else, the player continues to roll the dice until she rolls either the initial outcome or a 7. If the 7 comes first, the player loses, whereas if the initial outcome reoccurs before the 7 appears, the player wins.

- a. Write a function `Roll_Two_Dice` that returns the result of one game (TRUE or FALSE). That is: True if you win, and FALSE if you lose.
- b. Simulate this game  $N = 100000$  times, and find proportion of win. This is the probability of win in this game.

### Problem 4

In a coin flip game, you flip a fair coin until the difference between the number of heads and number of tails is 4. You are paid \$30 at the end, but you have to pay \$2 for each flip of the coins. It means if you flipped the coin more than 15 times, you will lose some dollars. If you end up flipping less than 15 times, you will win some dollars.

- a. Write a function that will return the amount that you will earn in 1 game.
- b. Simulate this game  $N=100000$  times, and find the average of the amount that you could win in this game.