Addis Ababa University
School of Natural and Computational Science

Department of Computational Data Science
(MSc Program)

Introduction to Computational Science and
Basics of Computer Programming
(CDSC 601)

By: Mekonnen Assefa - GSR/5041/13

Instructor

Addisu G. Semie, PhD - Asst. Prof

Simulating the Rolling of Two Dice

Using Monte Carlo Method

Let's do the math

Suppose that we are interested in knowing what the chances are of obtaining two as the sum from rolling a dice twice (assuming a fair dice, of course).

1. to do it the hard way

2. estimating the chance for this event (i.e., obtaining two as the sum from rolling a fair dice twice) is to rely on theoretical probability theory

If you do that .....

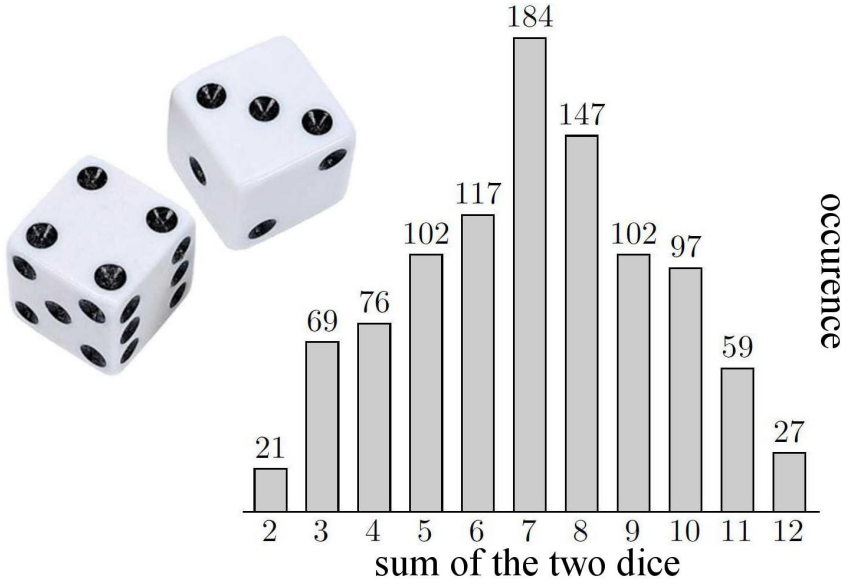
To obtain a sum of two from rolling a fair dice twice necessarily means you obtain one in each roll. The probability of obtaining one from rolling the dice once is 1/6 (0.167). The probability of obtaining one from another rolling of the same dice is also 1/6. Because each roll of the dice is independent of another, according to probability theory, the joint probability of obtaining one from both rolls is the product of two—that is, 0.167 × 0.167 fi 0.028. In other words, the chances of obtaining the sum of two from rolling a fair dice twice should be slightly less than 3 out of 100, a not very likely event.

To obtain Seven as the sum from rolling the dice twice, you have to consider multiple events (6+1, 5+2, 4+3, 3+4, 2+5, 1+6) that will sum up to be seven. Because each of these six events has the probability of 0.028 to occur, the probability of obtaining the sum of seven from rolling a dice twice is 6 × 0.028 = 0.168.

3. Empirical Approach

Monte Carlo simulation (MCS) in which the outcomes of rolling a dice twice are simulated, rather than actually rolling a dice twice. This can be done using a computer program 1

Instead of relying on actually rolling a dice tens of thousands of times, or on probability theory, we can also take an empirical approach to obtain the answer to the question without actually rolling a dice.



The Monte Carlo

The project I am going to do uses the Monte Carlo Simulation, named after the famous Monte Carlo Casino in Monaco.

The basic idea is to show how random events — in this case, rolling dice — can, if done enough times, produce a statistical pattern.

The Monte Carlo Method is based on principles of probability and statistics Monte Carlo relates to or involves "the use of random sampling techniques and often the use of computer simulation to obtain approximate solutions to mathematical or physical problems especially in terms of a range of values each of which has a calculated probability of being the solution."

A Fortran 90 Code Solution

Click here for the Fortran Code

Click here for the Python Plot

KEYTAKEAWAYS

A Monte Carlo simulation is a model used to predict the probability of different outcomes when the intervention of random variables is present.

Monte Carlo simulations help to explain the impact of risk and uncertainty in prediction and forecasting models.

A variety of fields utilize Monte Carlo simulations, including finance, engineering, supply chain, and science.

The basis of a Monte Carlo simulation involves assigning multiple values to an uncertain variable to achieve multiple results and then to average the results to obtain an estimate.

Monte Carlo simulations assume perfectly efficient markets

Thank You

Mekonnen Assefa