

Monte-Carlo Simulation



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Day 3: Session

23-June-2023



WHAT IS SIMULATION

Simulation is normally used to assess the current, or predict the future, performance of a business process. The concept is designed to help practitioners and business owners discover new ways to improve their business processes through the use of mathematical, statistical and other analytical methods.

- "A large number of scenarios and outcomes ... are impossible to comprehend and evaluate without the help of a computer simulation model (Harrington and Tumay, 2000)."
- "We all are probably living in simulation" – Elon Musk



Monte Carlo SIMULATION

Monte Carlo simulations are used in a diverse range of applications

- the assessment of traffic flow on highways
 - the development of models for the evolution of stars
 - attempts to predict risk factors in the stock market
 - applications in integrated circuit design
 - quantum mechanics and communications engineering
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- **to assess the risk and uncertainties in Financial/ Stochastic Models.**
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- The analysis is based on the use of random numbers and probability statistics to investigate the likelihood of particular outcomes.
 - Monte Carlo simulation is named after the city in Monaco, where the primary attractions are casinos that have games of chance. Gambling games, like roulette, dice, and slot machines, exhibit random behaviour.



Risk Analysis Var and CVar

LET'S DIVE IN



VAR vs CVAR

VAR

Value at risk

CVAR

Conditional value at risk

Most Commonly calculated at 95|99|99.9 Percent



VAR vs CVAR

if $\text{VAR}(95) = 3\%$

$$5 = 100 - 95$$

5% chance to lose 3%
or more on a given day





VAR vs CVAR

if $\text{CVAR}(95) = 4.5\%$

$$5 = 100 - 95$$

In the worst
5% of returns



Your average
loss will be 4.5%





VAR vs CVAR

CVAR gives us an
average expected loss

VAR gives us a **range**
of potential losses

Less Accurate and Lower
Approximation of Risk

NPV – Net Present Value-

<https://corporatefinanceinstitute.com/resources/knowledge/valuation/npv-formula/>

Steps to create Monte-Carlo Simulation

Steps to perform Monte-Carlo Simulation:

1. Determine all input components of the process and how they relate to each other.
2. Determine the parameters of the distributions.
3. Take out the sample from each of the distributions and integrate the results based on point 1.
4. Simulate the process as many times as required.

How to build a Monte-Carlo Simulator in VBA:

Example Problem Statement: A mean of demand for a product sale is 500 with a standard deviation of 50. The following costs are given as:

Administrative Cost: 400000 USD

Advertising Cost: 600000 USD

Labor Cost: 450 USD / Unit

Parts Cost: 1000 USD / Unit

The selling price is given as 3500 USD / Unit

The probability of loss needs to be determined along with Value at Risk (VaR) and Conditional Value at Risk (CVaR).distribution