There are multiple steps to a Monte-Carlo simulation.

(1) handom Vaniable Generation

O These variables represent the uncertain elements of the model.

- The chaice of probability distribution obepends on the nature of the clata.

Common clistributions are Caussian, log-normal, uniform le binomial distribution

For our case, and for most financial models, the gaussian, normal distribution is used.

here => 4= mean or = variance

 $f(x|A,T^2) = \frac{1}{\sqrt{2\pi}\sigma^2} e^{-\frac{(n-4)^2}{2\sigma^2}}$

Now, random samples from this distribution can be generated from algorithms like the Box-Muller transporm.

1) Box Muller Transform

The Box-Muller transform takes two independent random numbers from a uniform distribution and transforms them into two independent normally distributed random variables. This is particularly useful because computers are typically good at generating random numbers in a uniform distribution, which can then be transformed into a normal distribution.

for 2 independent random variables

= U, & Uz

Viniformly distributed in interval (0,1)

the transform converts these 2 independent standard normally clistributed random variables Zo&Zi

WHY IT WORKS

because it ejectively maps the uniform distribution a circular distribution a then projects points from this circle onto the x by axes, which results

in a normal distribution due to the properties of sine & cosine functions in a circle.

2) Repeated Sampling

The monte carlo simulation relies heavily on the law of large Nos.

LAW OF LARGENDS =

Ang of the results obtained from a large no of trials is much more likely to be closer to the expected value, and tends closer with increasing no of results.

Therations of Law iteration uses a new set of random variables, with accuracy increasing with no. of iterations.

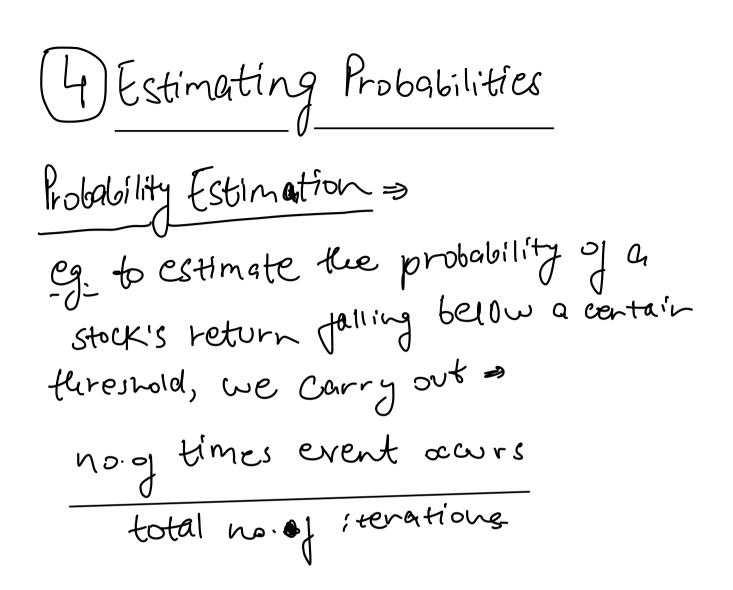
Now in each run, a specific outcome is calculated on the basis of the model being simulated.

3) Aggregation & Analysis

After running the Simulations, results are aggregated to make a statisti-Cal distribution.

Mean => X = 1 Enoi

 $S.d \Rightarrow \delta = \sqrt{\frac{\sum_{i=1}^{N} (0i - \sum_{j=1}^{N} 1)^{2}}{N-1}}$



5) Application in Portfolio Optimization

OFuture Value Estimation =>

Juture Stock = Currently X (1+h)

value = Lualue I x (1+h)

Sportfolio 7

analysis

return of Example Wiki

portfolio = 2:5

where or Wi= weights Ri- assets returns

Other Calculations for the portfolio Can be carried out on the basis of the result obtained above.