OPTION PRICING MODELS AND THEIR ACCURACY

Timeline

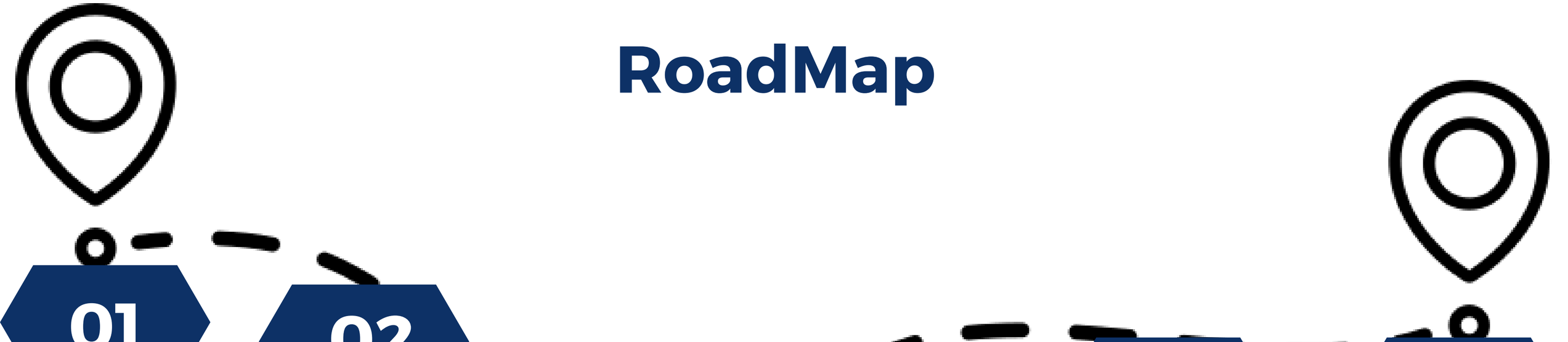
Check Point 1

25th June 2024

Final Report Submission

Around 30th July 2024

RoadMap



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WHAT ARE OPTIONS AND HOW TO PRICE THEM?

CHECKPOINT 1:

The term option refers to a financial instrument that is based on the value of underlying securities, such as stocks, indexes, and exchange traded funds(ETFs). An options contract offers the buyer the opportunity to buy or sell—depending on the type of contract they hold—the underlying asset.

Watch this quick introduction:

https://www.youtube.com/watch?v=CRhGikRHSu8

Read about options here:

https://www.investopedia.com/terms/o/option.asp

Watch a video on options pricing:

https://www.youtube.com/watch?v=MiybnilIvx0

Read more about options pricing here:

https://www.investopedia.com/articles/optioninvestor/09/buying-options.asp

Learn about options profitability here:

https://www.investopedia.com/articles/active-trading/091714/basics-options-profitability.asp

THE BINOMIAL MODEL

CHECKPOINT 2:

The binomial model for option pricing, introduced by John Cox, Stephen Ross, and Mark Rubinstein in 1979, is a widely used method in financial mathematics. This model provides a straightforward, discrete-time framework for valuing options by simulating different paths the underlying asset's price can take, allowing for the incorporation of various factors such as volatility, strike price, and time to expiration.

Watch this video:

https://www.youtube.com/watch?v=eA5AtTx3rRI

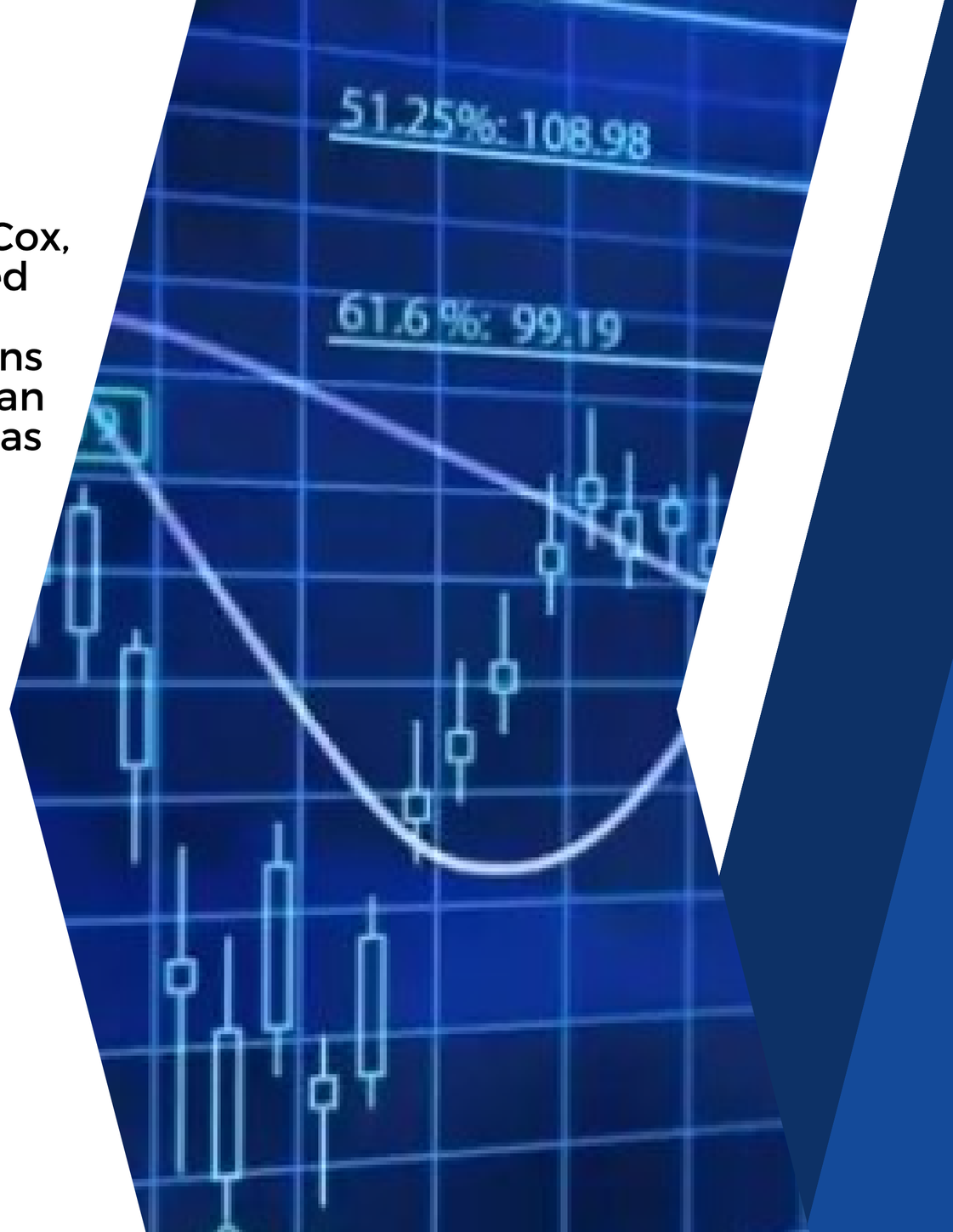
Read about the model here:

https://www.investopedia.com/terms/b/binomialoptionpricing.asp

An example done by hand:

https://www.youtube.com/watch?v=7hL_4J5VjRw

Would recommend going through more examples as well as trying to implement it yourself



THE BLACK-SCHOLES MODEL

CHECKPOINT 3:

The Black-Scholes model, introduced by Fischer Black and Myron Scholes in 1973, is a cornerstone of modern financial theory. This might be the most famous model, providing a mathematical framework for pricing European-style options based on factors like the underlying asset's price, strike price, time to expiration, risk-free interest rate, and volatility.

Watch this short introduction:

https://www.youtube.com/watch?v=pr-u4LCFYEY

Read about the model here:

https://www.investopedia.com/terms/b/blackscholes.asp

Look at a small example:

https://www.sciencedirect.com/topics/economics-econometrics-and-finance/black-scholes-model

Would recommend going through a few more examples to get a thorough understanding of how the model works

THE MONTE-CARLO SIMULATIONS

CHECKPOINT 4:

Monte Carlo simulations for option pricing are a powerful tool in financial mathematics, leveraging computational algorithms to estimate the value of options by simulating the random paths of the underlying asset's price. This method, renowned for its flexibility and applicability to complex derivatives, provides a robust framework for incorporating various factors like volatility, strike price, and time to expiration into the pricing process.

Read this post:

https://medium.com/swlh/option-pricing-using-monte-carlo-simulations-41d9e4ad95f6

Simulating Monte-Carlo on Excel:

https://www.youtube.com/watch?v=r67_YRtYcR8

Simulating Monte-Carlo on Python:

https://www.youtube.com/watch?v=A663NOHPRHE

Monte Carlo simulations can also be used for risk management, portfolio optimization, and forecasting financial market behavior. They are versatile tools applicable in various fields, including engineering, physics, and project management, to model uncertainty and optimize decision-making.

BACKTESTING THE MODELS IN DIFFERENT MARKETS

CHECKPOINT 5:

A backtest is the application of trading strategy rules to a set of historical pricing data.
That is, if we define a set of mechanisms for entry and exit into a portfolio of assets, and apply those rules to historical pricing data of those assets, we can attempt to understand the performance of this "trading strategy" that might have been attained in the past.

Here are some useful links:

https://towardsdatascience.com/backtest-your-trading-strategy-with-only-3-lines-of-python-3859b4a4ab44

https://www.youtube.com/watch?v=zHnvYdsVH7I&t=135s

https://www.quantstart.com/articles/Should-You-Build-Your-Own-Backtester/

CHECKING THE ACCURACY OF THESE MODELS

CHECKPOINT 6:

The Black-Scholes model continues to be the standard option pricing model discussed in virtually all corporate finance and investments texts. A recent article in the hyperlinked journal below discussed how sensitive the calculated option value is to roundoffs made during the calculations and to how the normal probability is calculated.

https://www.jstor.org/stable/41948351?seq=1

reading material is from page number 432 to 436

THANK YOU