

Introduction to Probability with Applications to Computational Finance

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What Are These Lecture Notes About?

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- Support the course **An Introduction to Probability - with Applications to Computational Finance using R**.
- Introduce essential probability concepts for finance practitioners.
- Contextualize abstract concepts using computational finance problems.
- Emphasize hands-on learning using R and visualizations.

Key Learning Objectives

- Understand foundational probability concepts.
- Apply probability principles to solve computational finance problems.
- Gain hands-on experience using R for probability and finance applications.
- Develop proficiency in interpreting and visualizing probabilistic data.

Leveraging ChatGPT for Learning

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- Use ChatGPT to clarify concepts, generate examples, debug R code, and create custom exercises.
- Example: *"Explain the concept of a probability distribution with an example."*
- Simulate discussions to test understanding and learn R best practices.
- Always verify outputs and critically evaluate suggestions.

Using Jupyter Notebooks with R

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1. Install Jupyter Notebook using `pip install notebook`.

2. Install R and the IRkernel:

```
install.packages("IRkernel") IRkernel::installspec()
```

3. Start Jupyter Notebook: `jupyter notebook`.

4. Create a new R notebook and install R packages as needed.

Practical Example: Simulating Stock Returns

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Simulating Stock Returns Using R

```
# Simulate daily returns for a stock
set.seed(123)
n <- 100
daily_returns <- rnorm(n, mean = 0.001, sd = 0.02)

# Compute cumulative returns
price <- cumprod(1 + daily_returns) * 100

# Visualize the stock price
plot(price, type = "l", col = "blue", lwd = 2,
      main = "Simulated Stock Price",
      xlab = "Days", ylab = "Price")
```

Visualization Example

example_plot.png