Introduction to Probability with Applications to Computational Finance

Prepared by User

December 2, 2024

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.

% Slide: Practical Example

“section–Practical Example: Simulating Stock Returns”

“begin–frame”[fragile]–Practical Example: Simulating Stock Returns”

“textbf–Simulating Stock Returns Using R”

“begin–verbatim”

```
# 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