# Introduction to Probability and R

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# Table of contents i

# Preface

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*"What I hear, I forget; What I see, I remember; What I do, I understand"*

*— Confucius, 551-479 BC*

# What are these lecture notes about?

These lecture notes support the course **An Introduction to Probability - with Applications to Computational Finance using R**. The course introduces essential probability concepts that every finance practitioner must understand.

Key highlights: - Hands-on learning approach. - Leverages **R** for simulations and visualizations. - Connects theory with real-world applications.

# Key Learning Objectives

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

# Building Intuition through Simulation

- Probability concepts gain value when connected to real or conceptual experiments:
  - Stock price changes.
  - Portfolio value fluctuations.
  - Credit risk evaluations.
- Simulations allow us to:
  - Construct and manipulate random phenomena.
  - Model financial risks and explore future scenarios.

# Example: Simulating Stock Returns in R (Code)

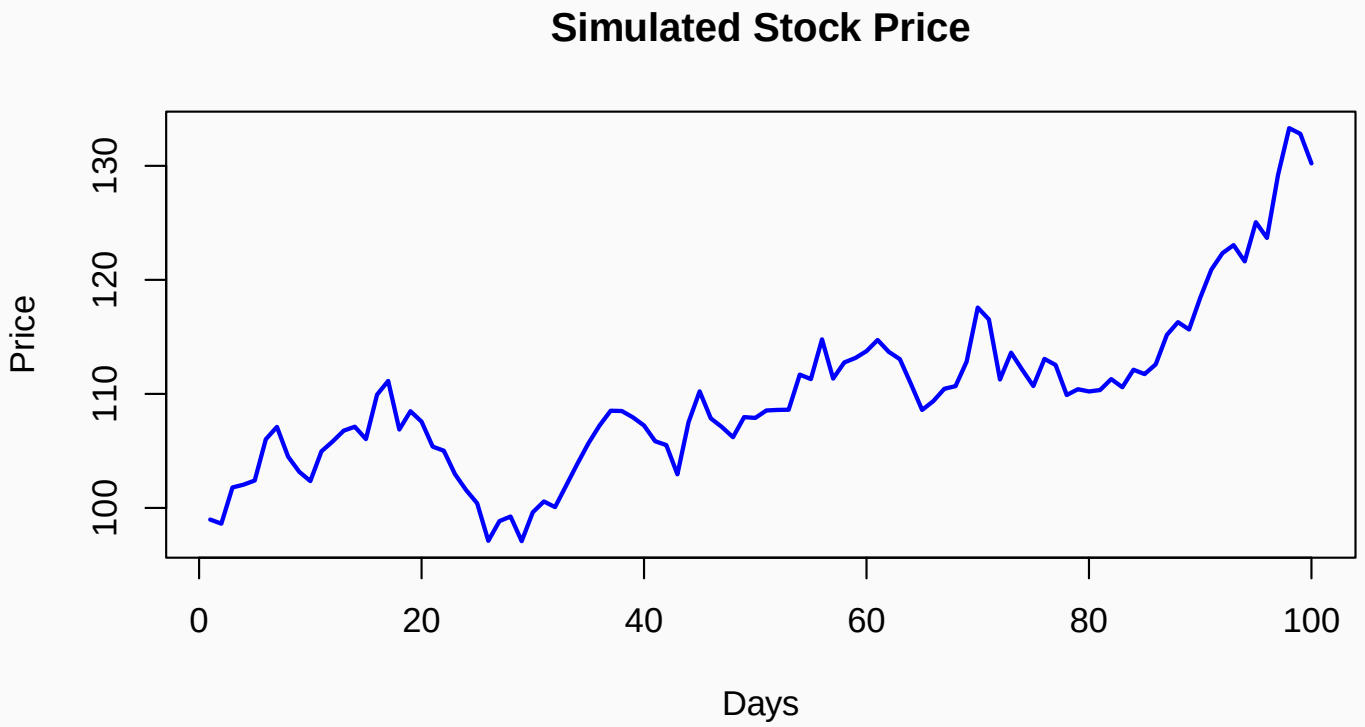
```r
set.seed(123)  # Ensure reproducibility
n <- 100       # Number of days
daily_returns <- rnorm(n, mean = 0.001, sd = 0.02)

price <- cumprod(1 + daily_returns) * 100  # Starting price

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

# Example: Simulating Stock Returns in R (Visualization)

```
# Ensure the plot is scaled properly
plot(price, type = "l", col = "blue", lwd = 2,
     main = "Simulated Stock Price",
     xlab = "Days", ylab = "Price")
```




- **Highlights**:
  - Influence of randomness on stock prices.

# Using R and RStudio

## Installing R

1. Download from CRAN.
2. Choose your operating system (Windows, Mac, Linux).
3. Install precompiled binaries (easiest method).

## Installing RStudio

1. Download RStudio Desktop (free) from RStudio website.
2. Ensure R is installed first.

# Large Language Models (LLMs) for Learning

- LLMs like ChatGPT can assist with:
  - Clarifying concepts.
  - Generating examples.
  - Debugging R code.
  - Creating practice exercises.

# Acknowledgments

# Acknowledgments

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# References

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