

Course Outline: Quant Finance with Python (8 Weeks)

Topic 1: Python and Financial Market Data

Notebook 1: Getting Started with Python

- Review of time series, data splits, and data sampling.

Notebook 2: Financial Markets Overview

- Introduction to financial markets and instruments.
 - Stocks
 - ETF's (exchange traded funds)
 - Bonds
 - Options & derivatives
- Risk and return basics.
- **Homework:** Complete assigned Jupyter notebooks covering basic Python techniques of the data science boot camp used in the Quant Finance course.

Topic 2: Using `yfinance` and Basic Stock Analysis

Notebook 3: Fetching Stock Data with `yfinance`

- Installing and using the `yfinance` library.
- Fetching historical stock data: Open, High, Low, Close, Volume.
- Exploring downloaded data with `pandas`.
- Exploring downloaded data through data visualization.

Notebook 4: Basic Stock Analysis and Data Visualization

- Plotting stock prices over time using `Matplotlib`.
- Calculating daily returns and simple statistics.
- **Homework:** Use `yfinance` to fetch and analyze historical data for a stock of your choice. Submit basic analysis on a stock or market index fund with a trade decision based on your basic analysis.

Topic 3: Portfolio Basics

Notebook 5: Introduction to Portfolios

- Combining multiple assets into a portfolio.
- Calculating portfolio returns and variance.
- Introduction to correlation and covariance.

Notebook 6: Portfolio Diversification

- Benefits of diversification.
- Plotting efficient frontiers.
- **Homework:** Use `yfinance` to fetch data for five assets, analyze historical returns, risk, correlations, and construct a portfolio.

Topic 4: Stock Options, Probabilistic Methods, and Simulating Stock Movements

Notebook 7: Introduction to Probabilistic Methods in Finance

- Introduction to Monte-Carlo simulations.
- Understanding stock price distributions.
- Simulating stock price paths using random walks.
- Introduction Geometric Brownian Motion (GBM) and stock price simulations.

Notebook 8: Stock Options, simulating Stock Movements in Python, and Option Pricing

- Introduction to options: calls, puts, and payoff diagrams.
- Implementing the Black-Scholes Model to price a stock option.
- Implementing Monte Carlo simulation future to predict stock price distributions.
- Visualizing multiple simulated price paths.
- Implied volatility of an option.
- **Homework:** Use Monte Carlo simulations to model stock price movements, estimate the probability of a stock landing in a specific price range over a trading period, and model stock option value.

Topic 5: Risk and Performance Analysis

Notebook 9: Measuring Risk

- Portfolio Volatility.
- Portfolio Value at Risk.

Notebook 10: Strategy Performance Metrics

- Calculating cumulative returns, annualized returns, and Sharpe ratio of a portfolio.
- **Homework:** Fetch data for a portfolio, analyze its risk metrics, and propose an adjustment to reduce risk.

Topic 6: Market Making and Delta Hedging

Notebook 11: Introduction to Market Making

- Understanding the role of market makers in financial markets.
- Bid-ask spreads and liquidity provision.
- Analyzing a market-making strategy in Python.

Notebook 12: Delta Hedging

- Introduction to the concept of delta and its role in options trading and market making.
- Using simulation to calculate delta for a given option.
- Implementing a delta hedging strategy to manage risk.
- **Homework #6:** Simulate a market-making strategy combined with delta hedging for a stock option using Python and analyze the strategy's performance.

Topic 7: Analyzing Securities and Exchange Commission Data

Notebook 13: Introduction to SEC Filings

- Overview of the SEC and its role in financial markets.

- Accessing SEC filings.
- Key SEC filings: 10-K, 10-Q, 8-K, and proxy statements.

Notebook 14: Analyzing Financial Data from SEC Filings

- Extracting and processing financial data from filings.
- Analysis of Management Discussion & Analysis (MD&A) sections.
- **Homework:** Analyze data from SEC 10-Q filings for five companies of your choice. Provide insights into the company's financial performance and risks. Create a portfolio based upon your findings.