Track to the Future!

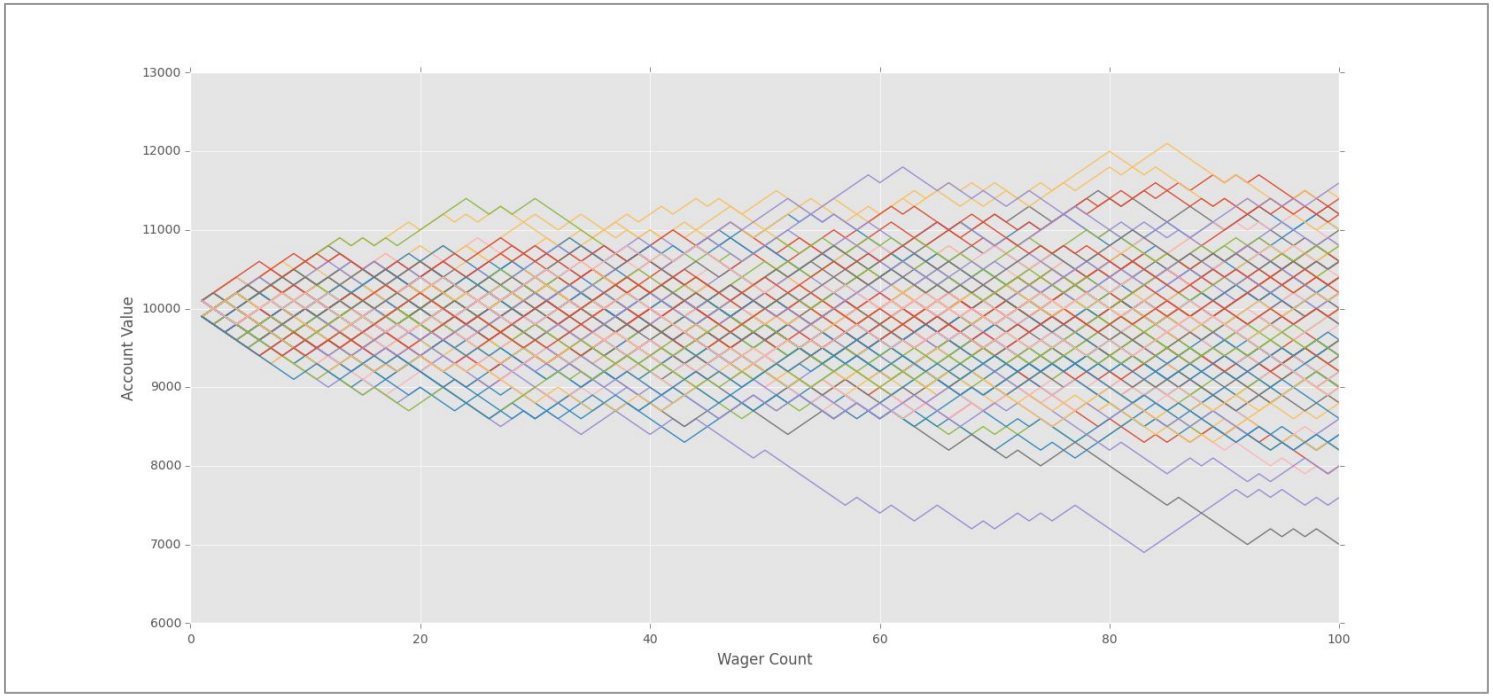
FinTech

Lesson 5.3

Monte Carlo Simulations

Monte Carlo Simulations

Today we will combine what we've learned so far on using APIs to pull in stock data and forecast single stock/portfolio returns using Monte Carlo simulations.

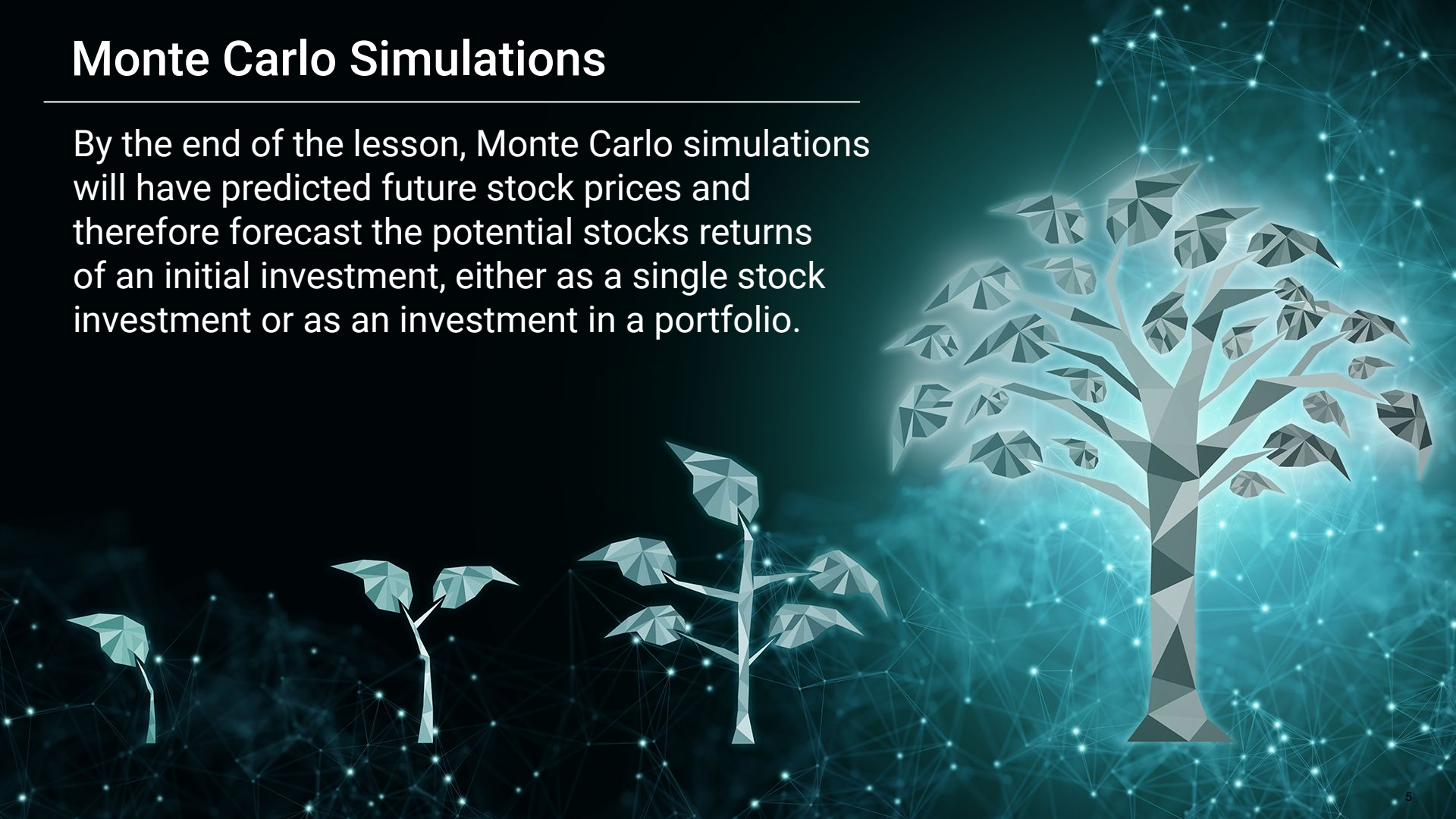


Monte Carlo Simulations

Simulations will require a switch from historical analysis to predicting the future.

Monte Carlo Simulations

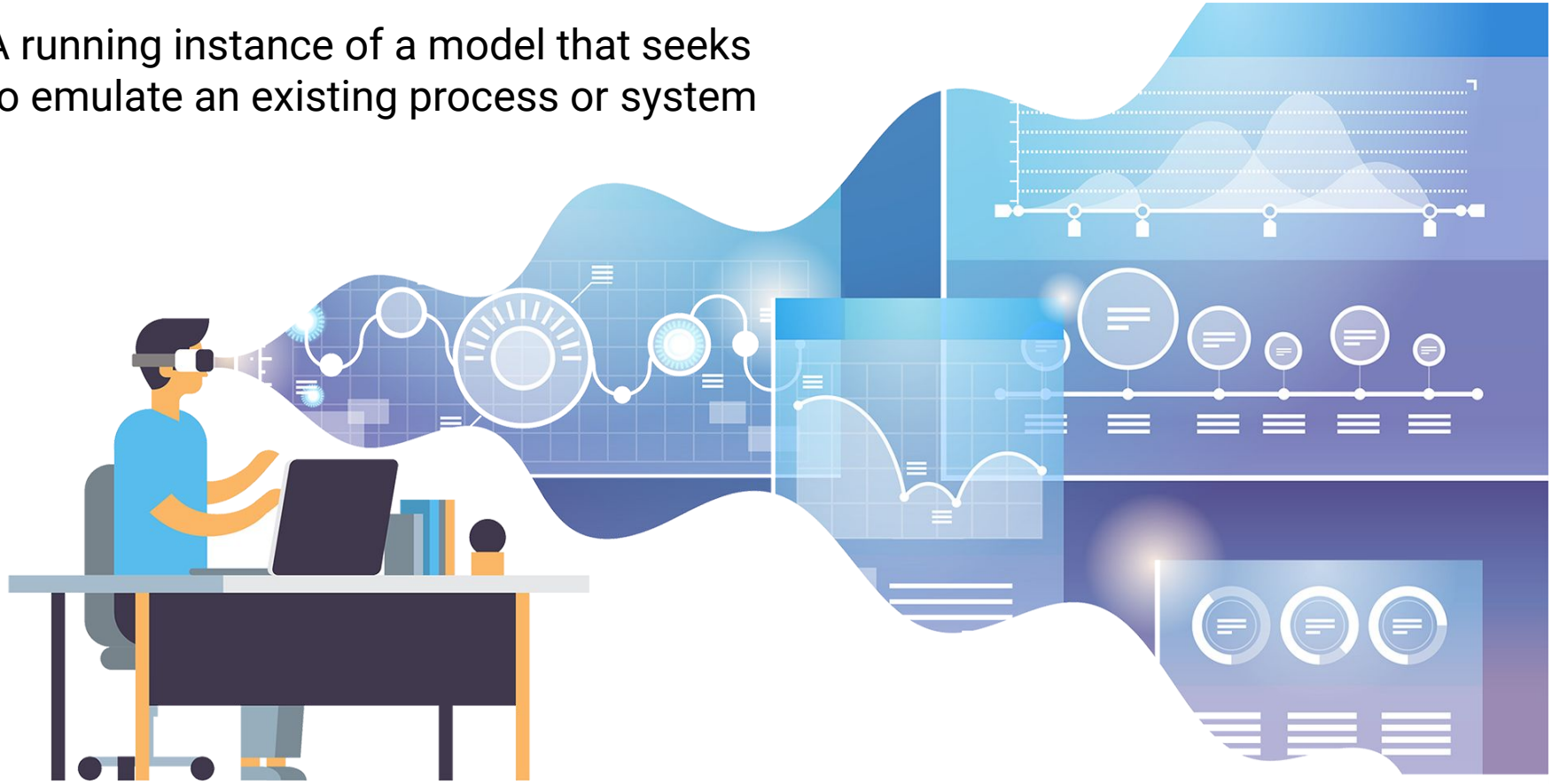
By the end of the lesson, Monte Carlo simulations will have predicted future stock prices and therefore forecast the potential stocks returns of an initial investment, either as a single stock investment or as an investment in a portfolio.



Simulations

What are simulations?

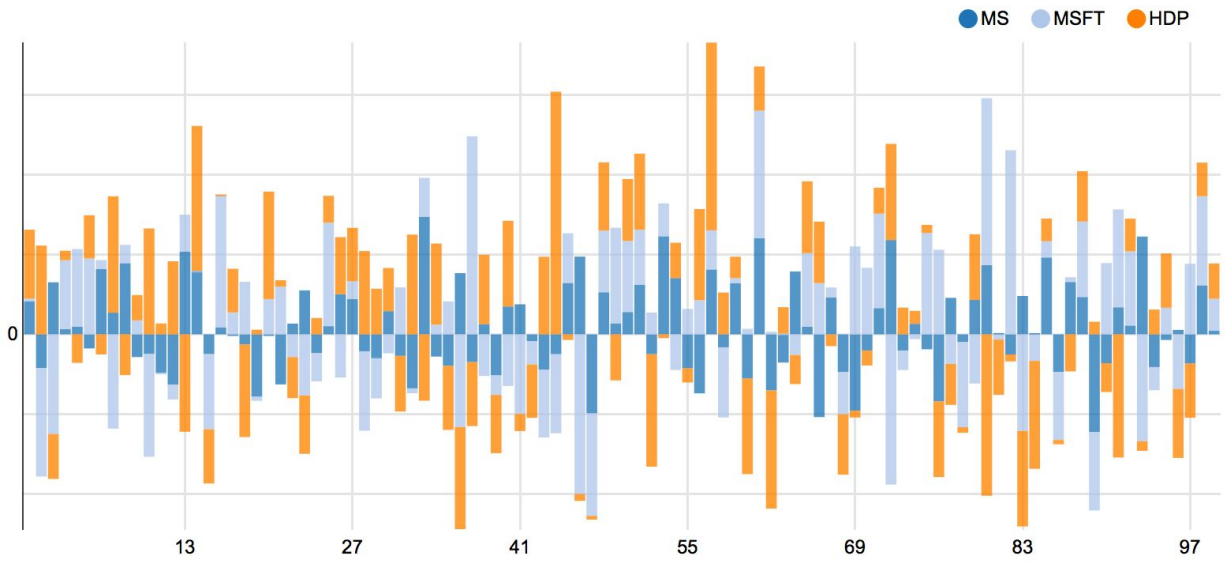
A running instance of a model that seeks to emulate an existing process or system



What are Monte Carlo simulations?

Simulations that use probability and variables to predict the future potential outcomes of a randomly occurring process

Daily Value At Risk (1 Simulation for 100 future days)



VaR Percentiles

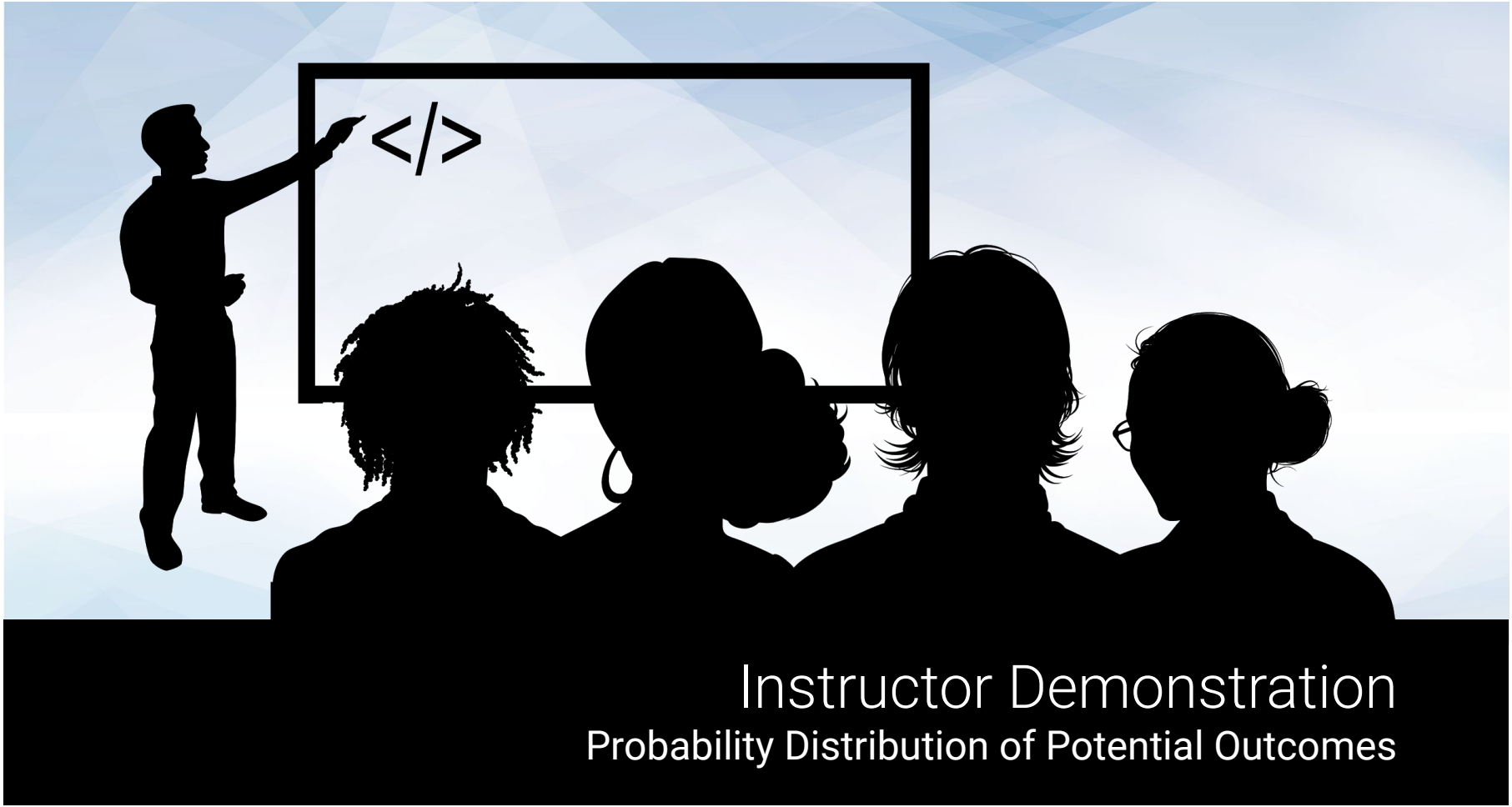
percentile	outcome
-1.87%	worst
0.25%	typical
2.15%	best

Why use Monte Carlo simulations?

They help make sense of the risk of uncertainty in prediction and forecasting models, which are particularly helpful when dabbling in the domain of capital investments and stock price uncertainty

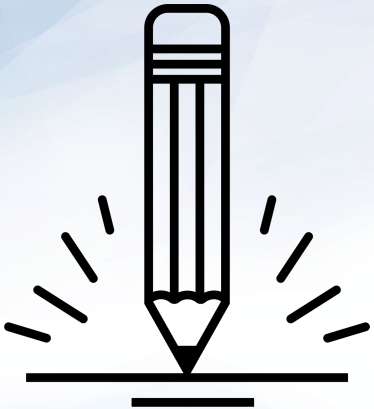
What is an example of a Monte Carlo simulation?

Predicting the number of times a coin will land on either heads or tails when flipped 10 times



Instructor Demonstration

Probability Distribution of Potential Outcomes

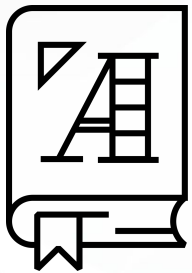


Activity: Free Throw Simulation

Suggested Time:
15 minutes

Time’s Up! Let’s Review.

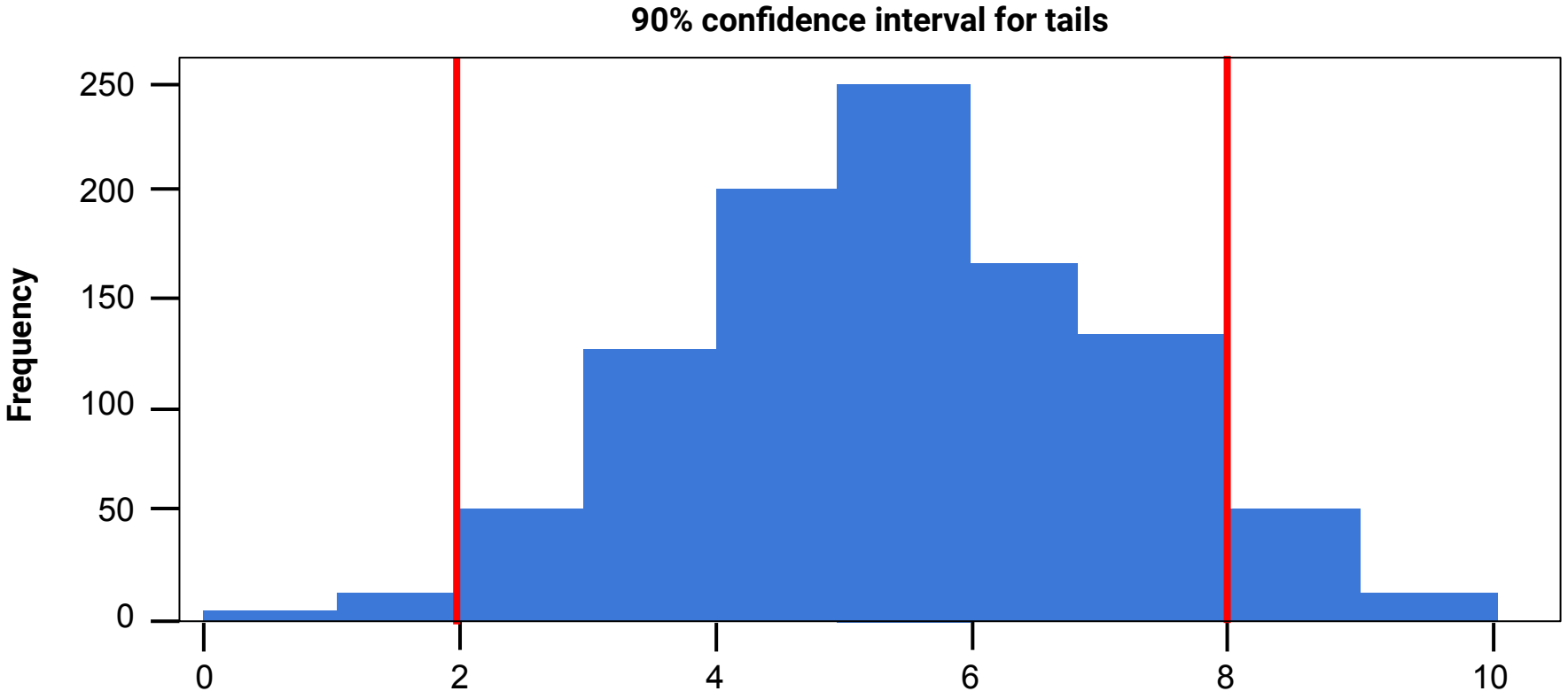
Confidence Intervals



Confidence intervals are a range of values for potential outcomes with a particular probability of that outcome occurring.

Confidence Intervals

Monte Carlo simulations can be evaluated using confidence intervals.



Confidence Intervals

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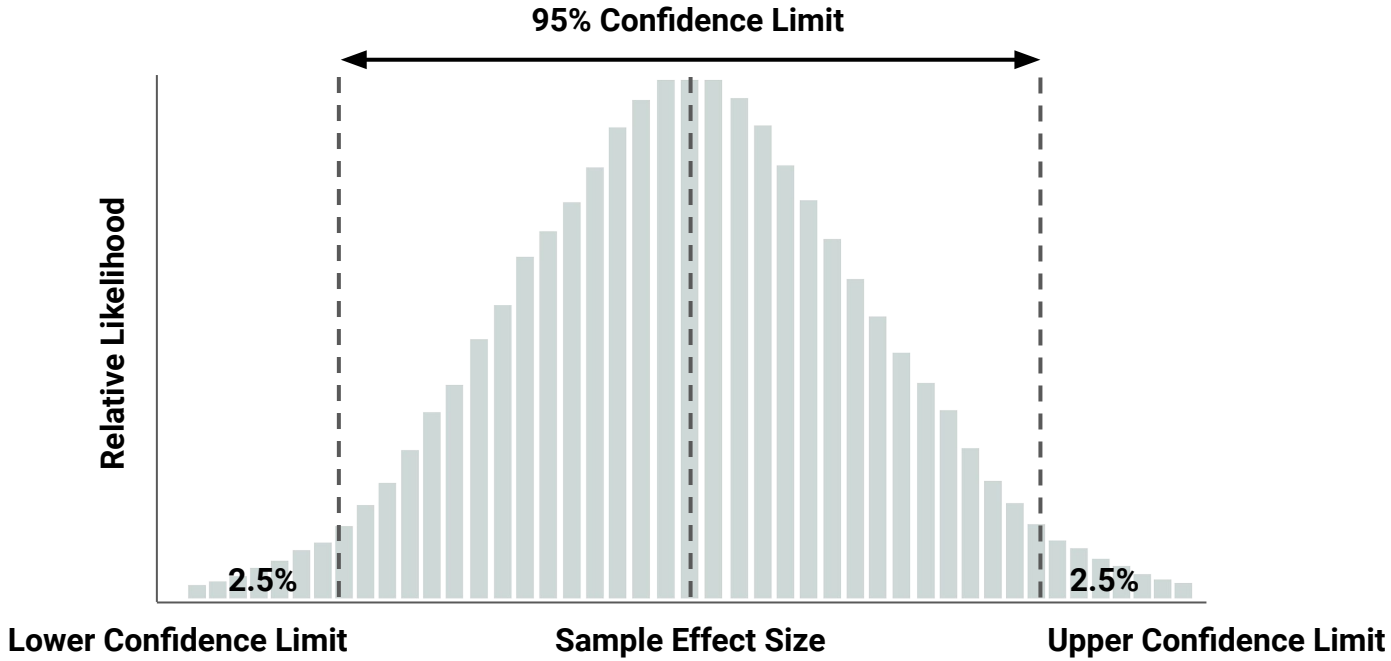
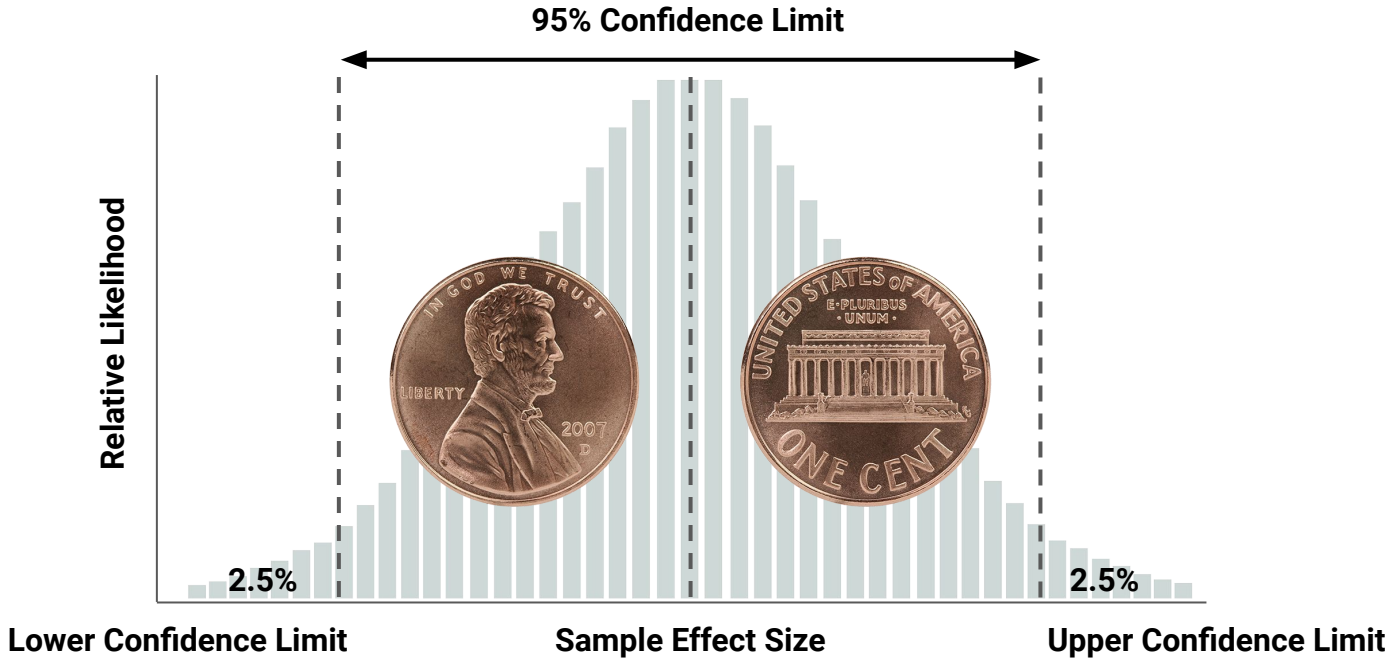


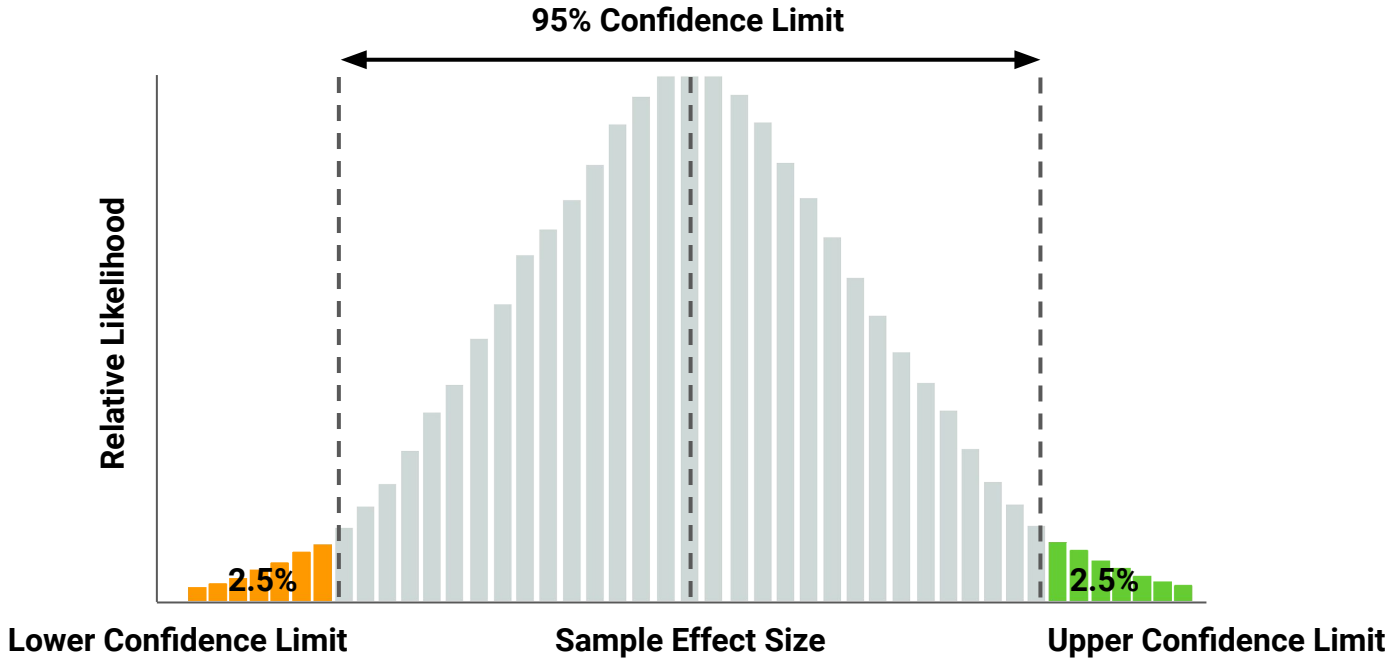
Confidence Intervals

When used with Monte Carlo simulations, confidence intervals can help predict and specify the likelihood of an outcome falling within a specific range.



Confidence Intervals

In order to create a confidence interval, the upper and lower bounds of the confidence interval need to be set as a quantile or percentile range of the frequency distribution.

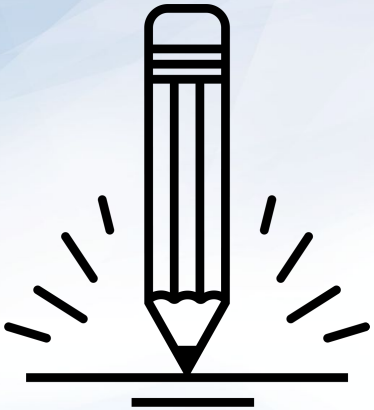


Confidence Intervals

Quantile ranges can be created using the Pandas Quantile function.

```
>>> df = pd.DataFrame(np.array([[1, 1], [2, 10], [3, 100], [4, 100]]),
...                   columns=['a', 'b'])
>>> df.quantile(.1)
a    1.3
b    3.7
Name: 0.1, dtype: float64
>>> df.quantile([.1, .5])
       a     b
0.1  1.3   3.7

 0.5  2.5  55.0
```



Activity: Archery Target Hits

Suggested Time:
20 minutes

Time’s Up! Let’s Review.

Simulation of Stock Price Trajectory

Simulation of Stock Price Trajectory

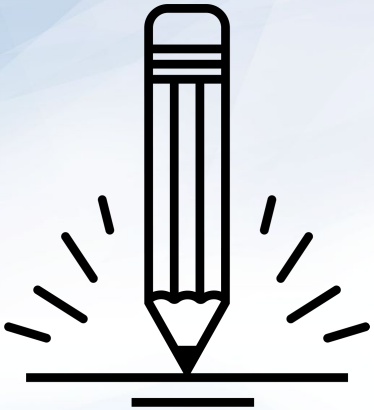
Monte Carlo simulations can be applied to a historical dataset of daily closing stock prices in order to predict probable stock price trajectories.

Plot the Simulated Stock Price Trajectory for AAPL over the Next Year (252 Trading Days)

```
# Use the `plot` function to plot the trajectory of AAPL stock based on a 252 trading day simulation
simulated_price_df.plot()
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x11e06d6a0>
```

The simulated trajectories can then be used to calculate cumulative profits/losses.



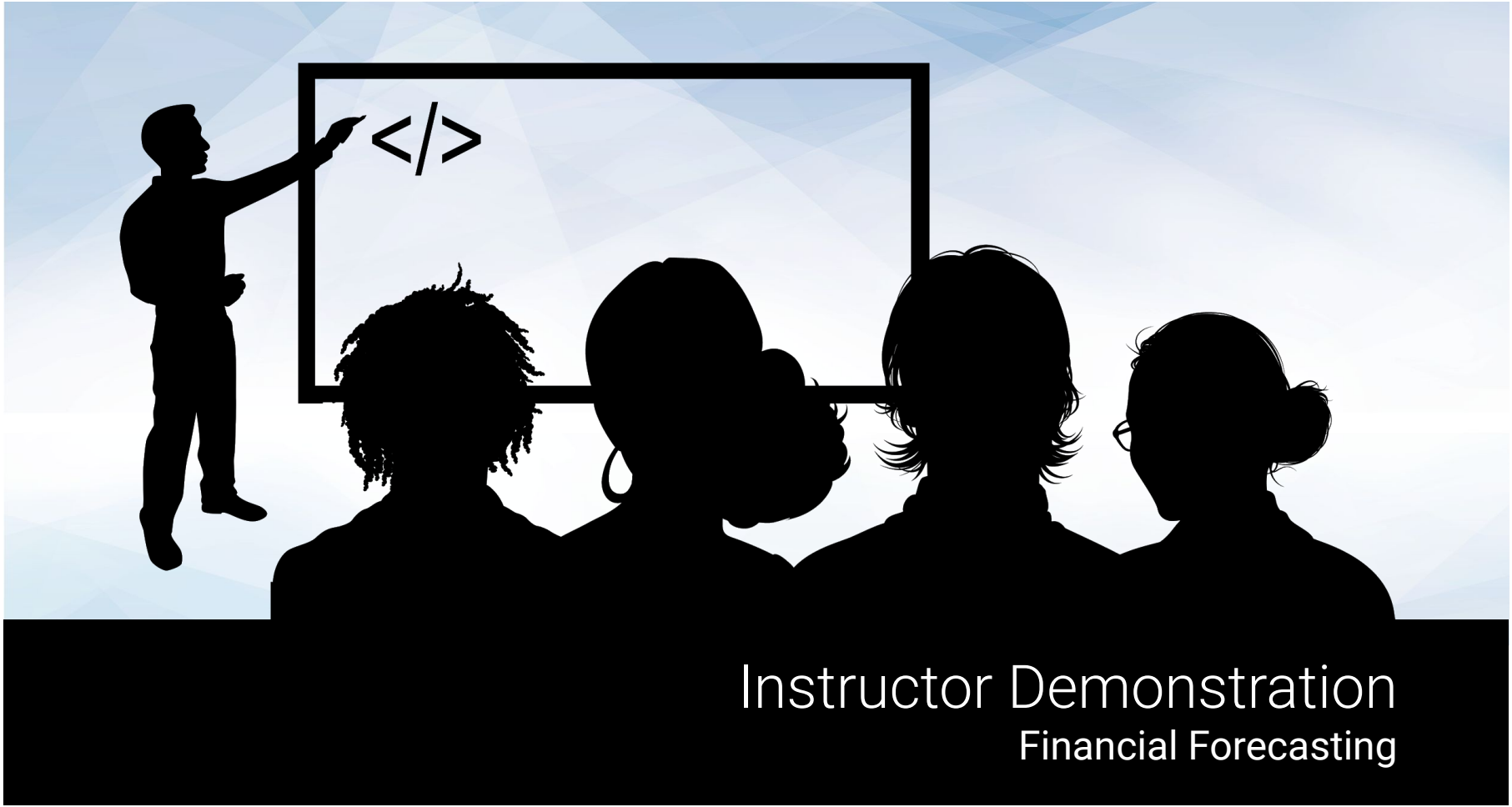
Activity: Financial Forecasting Part 1

Suggested Time:
15 minutes

Time’s Up! Let’s Review.

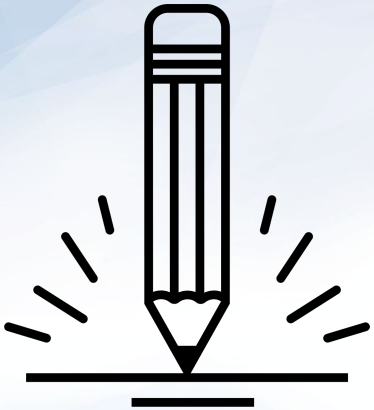

Break

Predicting Probable Outcomes of Stock Price Trajectories



Instructor Demonstration

Financial Forecasting



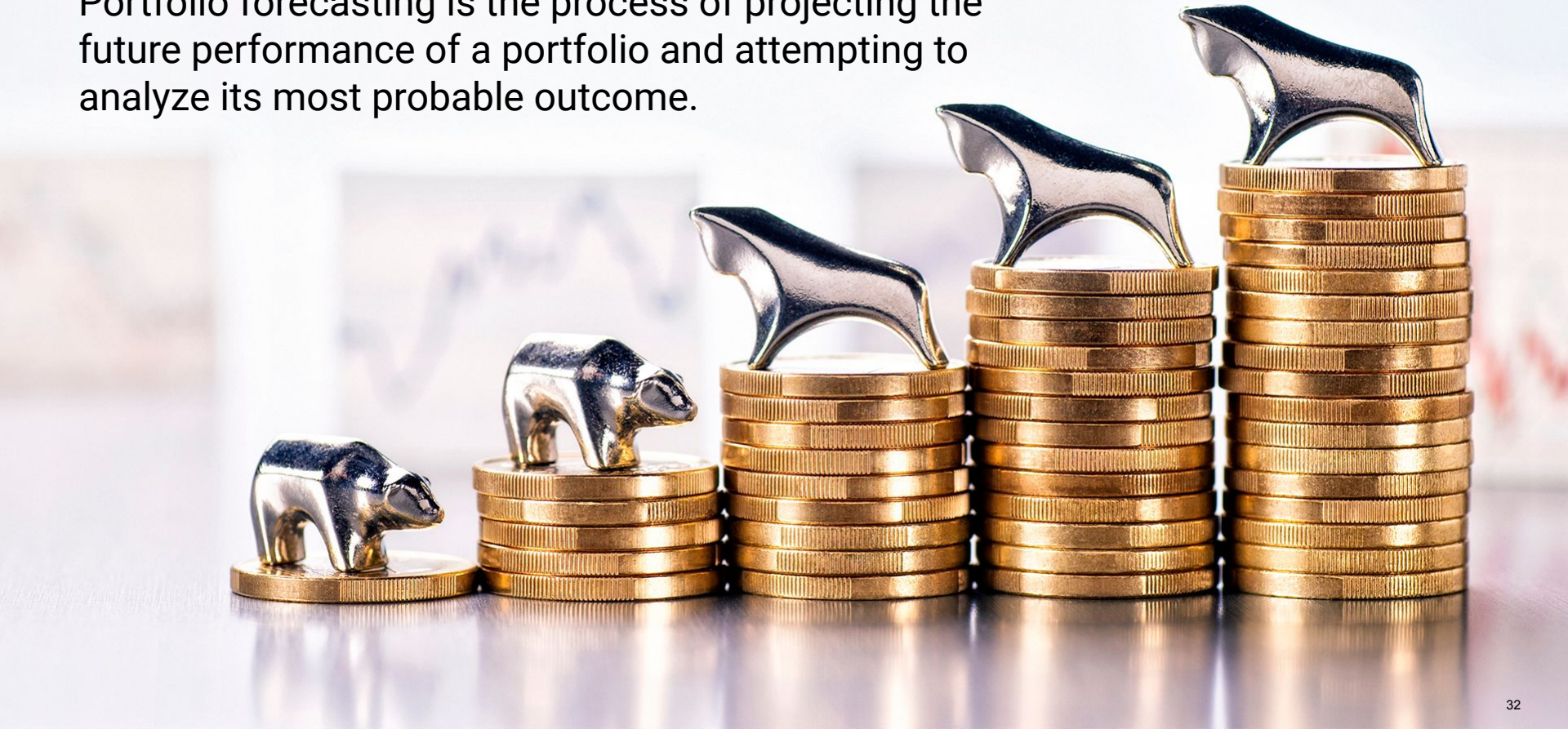
Activity: Financial Forecasting Part 2

Suggested Time:
15 minutes

Portfolio Forecasting using Monte Carlo Simulations

Portfolio forecasting

Portfolio forecasting is the process of projecting the future performance of a portfolio and attempting to analyze its most probable outcome.

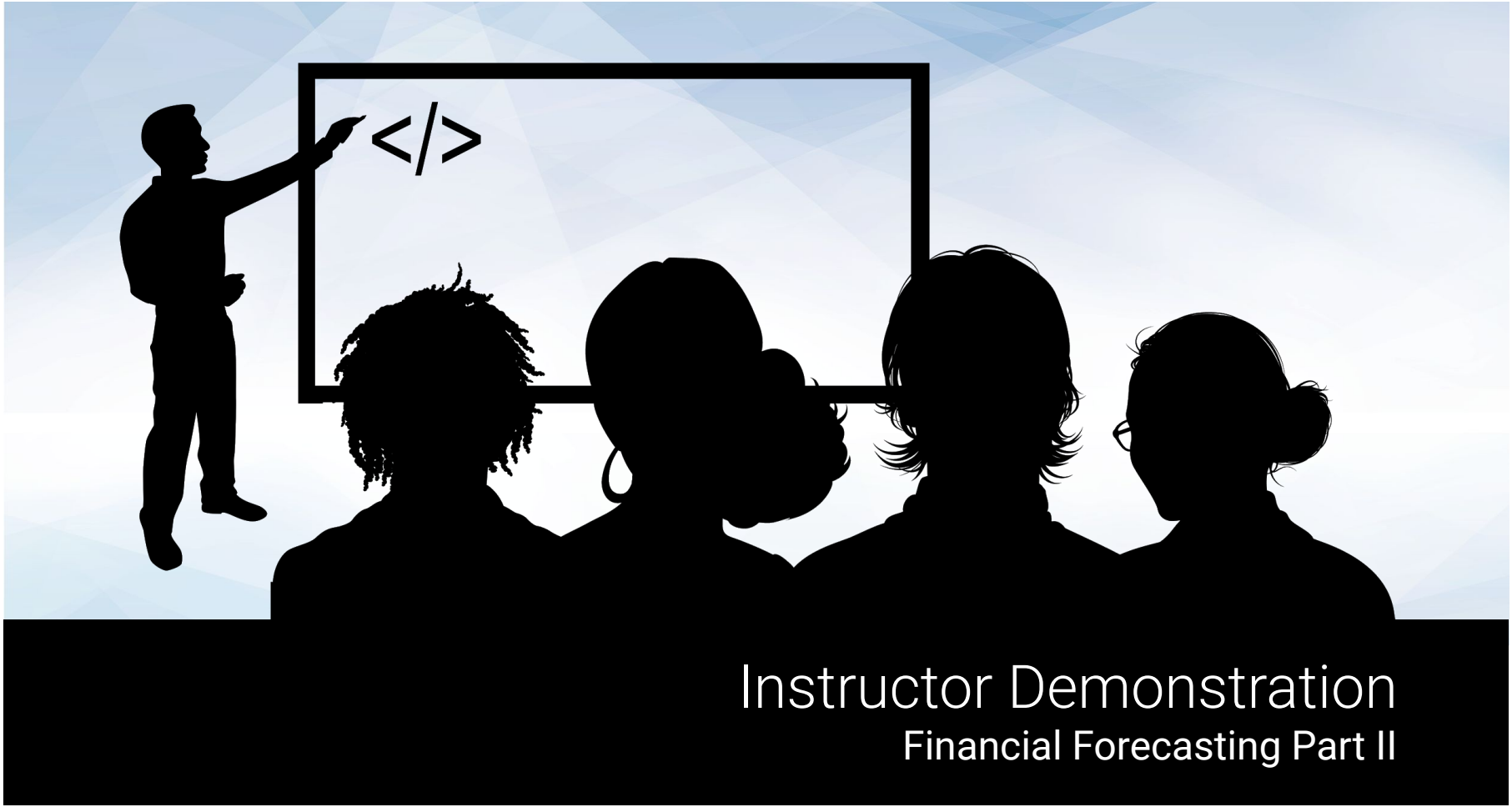


Portfolio forecasting

Portfolio forecasting helps analyze the potential risk and likelihood that a portfolio's performance can deviate from the expected result.

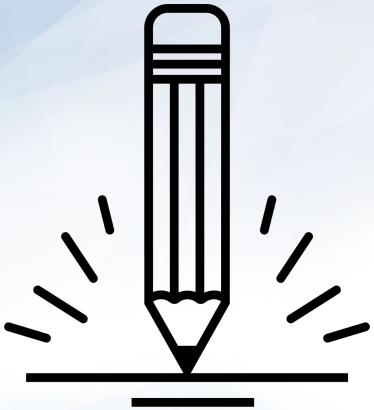
Portfolio forecasting

Typically, portfolio managers, quantitative analysts, retirement planners are the individuals who conduct portfolio forecasting. However, because of FinTech, and APIs like Alpaca and Plaid, soon anyone will be able to complete portfolio forecasting.



Instructor Demonstration

Financial Forecasting Part II



Activity: Financial Forecasting Part 3

Suggested Time:
15 minutes

Questions?