Meet Pandas

FinTech

Lesson 3.2

Class Objectives

By the end of today's class, you will be able to:

- Describe the benefits of Pandas over spreadsheets to manipulate data for financial use cases.
- Explain what a DataFrame is and how it differs from a series.
- Create DataFrames from CSV files and use basic commands to manipulate them.
- Clean data using built-in commands of DataFrames.
- Manipulate data using DataFrame indexes.
- Describe the underlying theory and calculations of returns using Pandas.
- Create basic data visualizations with Pandas' built-in plotting functions.

Hello Pandas!

What is Pandas?

Pandas is one of the most powerful libraries in Python.

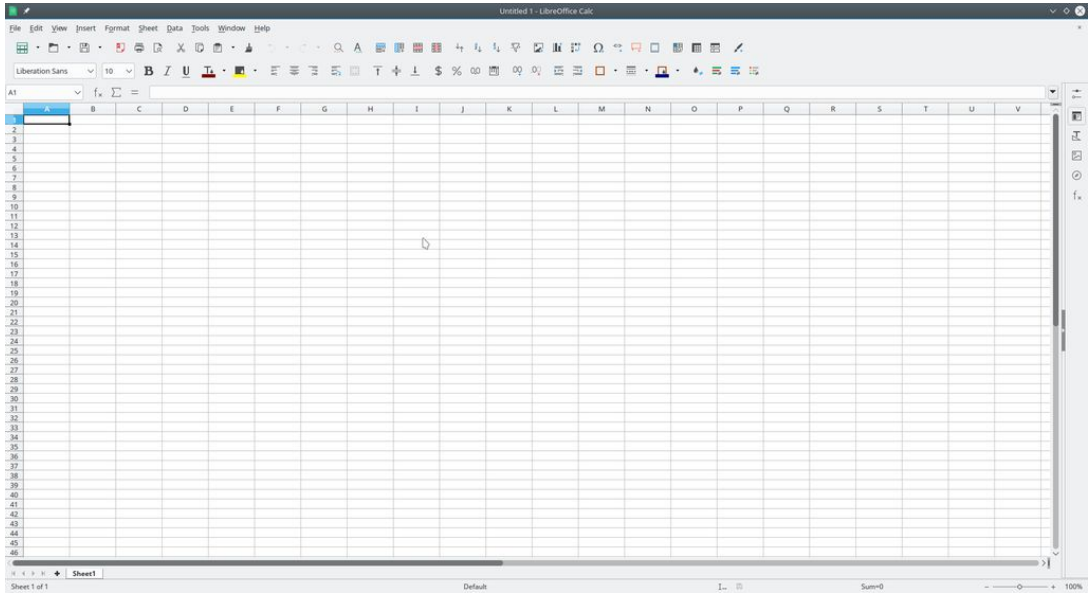
It was created by Wes McKinney to offer a flexible, high-performance tool for conducting quantitative analyses of financial data.

Why Pandas?

Spreadsheets Are AWESOME.

The Rise of Spreadsheets

Since they first appeared in 1969, spreadsheets have transformed finance and quants analysis.

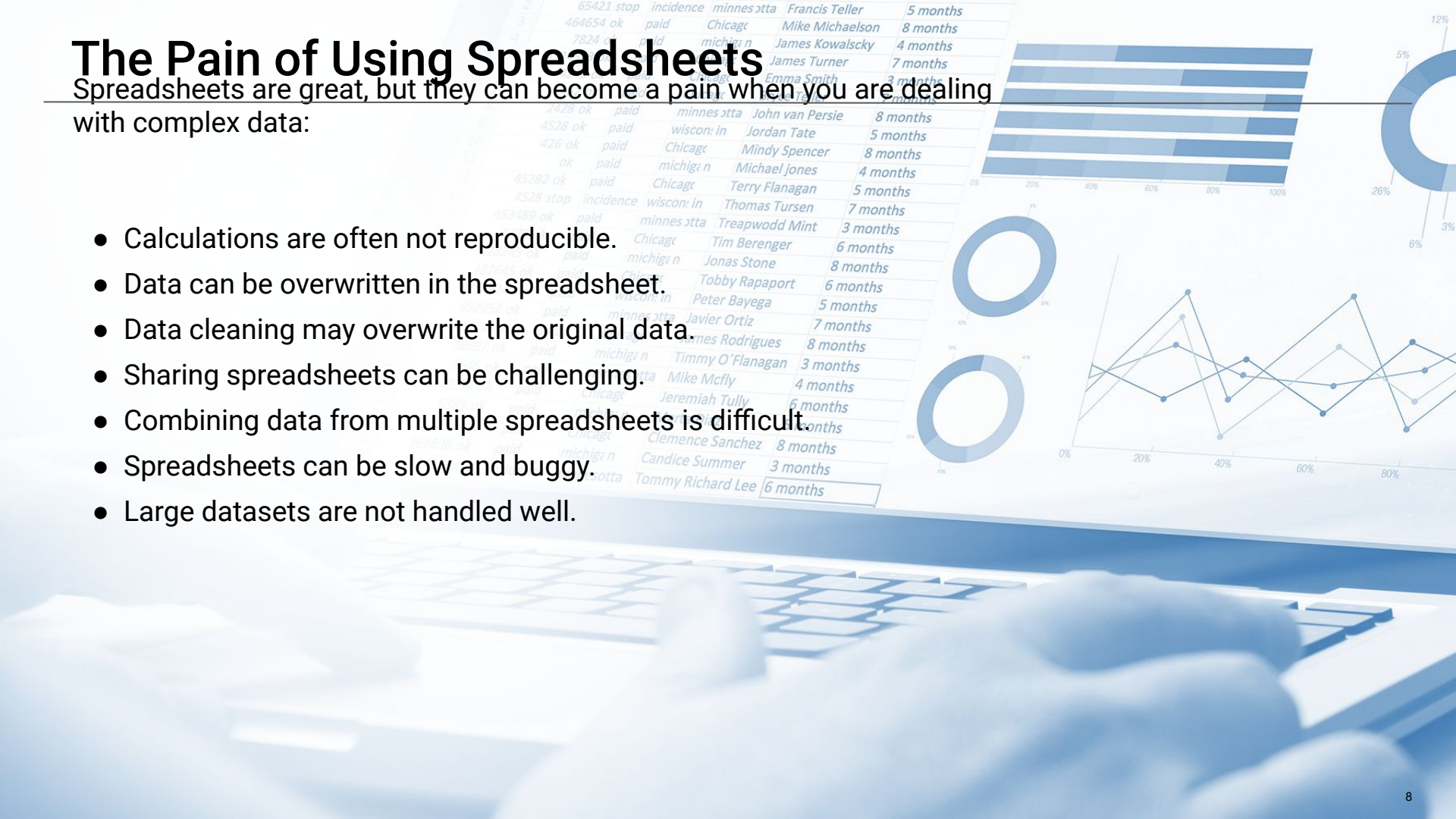


The Pain of Using Spreadsheets

Have you ever felt like this?

The Pain of Using Spreadsheets

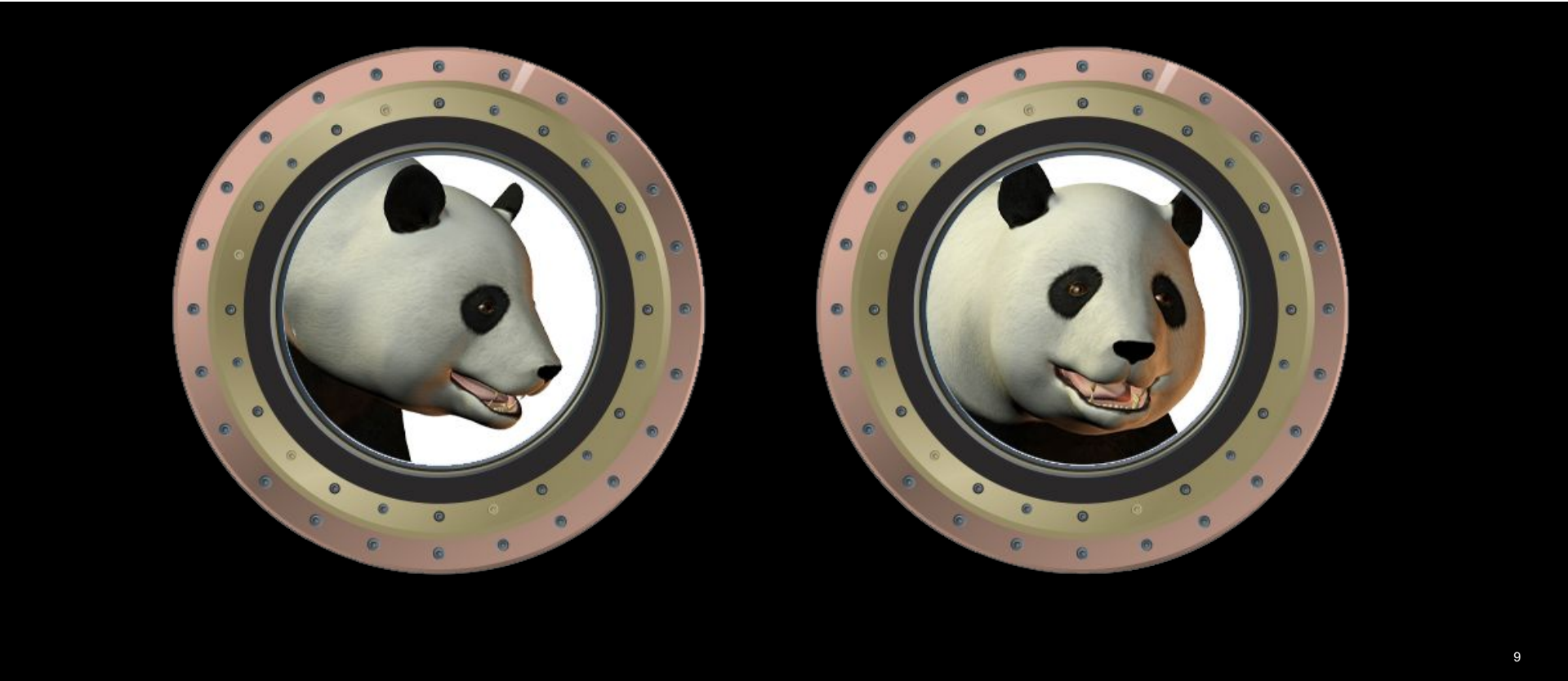
Spreadsheets are great, but they can become a pain when you are dealing with complex data:



- Calculations are often not reproducible.
- Data can be overwritten in the spreadsheet.
- Data cleaning may overwrite the original data.
- Sharing spreadsheets can be challenging.
- Combining data from multiple spreadsheets is difficult.
- Spreadsheets can be slow and buggy.
- Large datasets are not handled well.

Pandas to the Rescue

Fortunately, we have Pandas to help us manage data on Python.



The Origins of Pandas

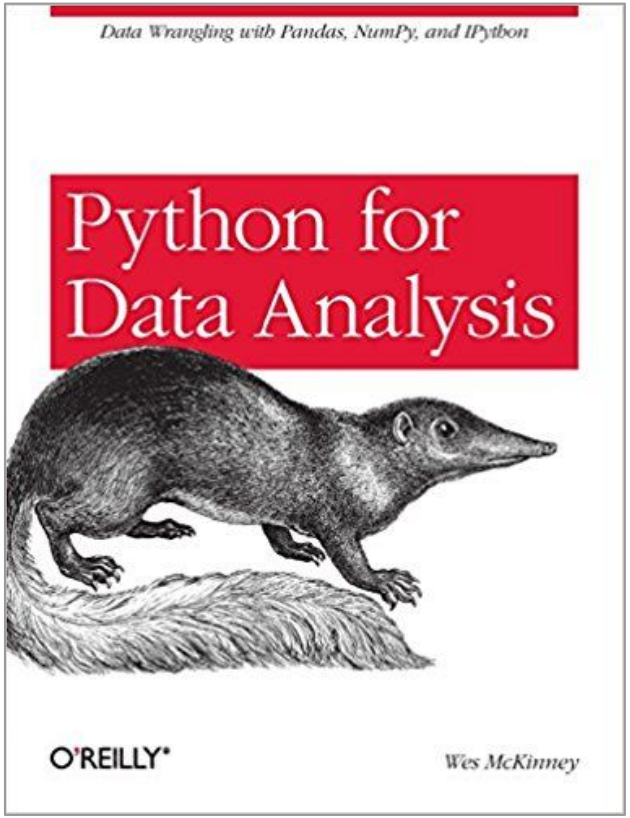
- Pandas is one of the most powerful open source libraries in Python for analyzing and manipulating data.
- The library was born on 2008 at AQR Capital when Wes McKinney was looking for a high-performing, flexible tool to perform quantitative analysis on financial data.
- Etymology: The name “Pandas” originates from “panel data structures.”

Why Pandas is Great

- Pandas provides many advantages over spreadsheets due to its data structures and built-in functions for analysis.
- Python + Pandas = the perfect combination for small experiments or for implementing large-scale production systems to analyze data and make smarter decisions.
- High-performance data structures:
  - Series (1D labelled vectors)
  - DataFrame
    (2D structures similar to spreadsheets)
  - Panel
    (Collection of DataFrames as 3D labelled arrays)
- Built-in time series functionality, which is a must for financial and quants analysis.

Resources for Learning More About Pandas

- Official website: pandas.pydata.org
- Pandas on GitHub: github.com/pydata/pandas
- *Python for Data Analysis* by Wes McKinney



Python for Data Analysis
by Wes McKinney
(O'Reilly Media, 2017)

There is life beyond Excel to analyze data. Let’s find the path!

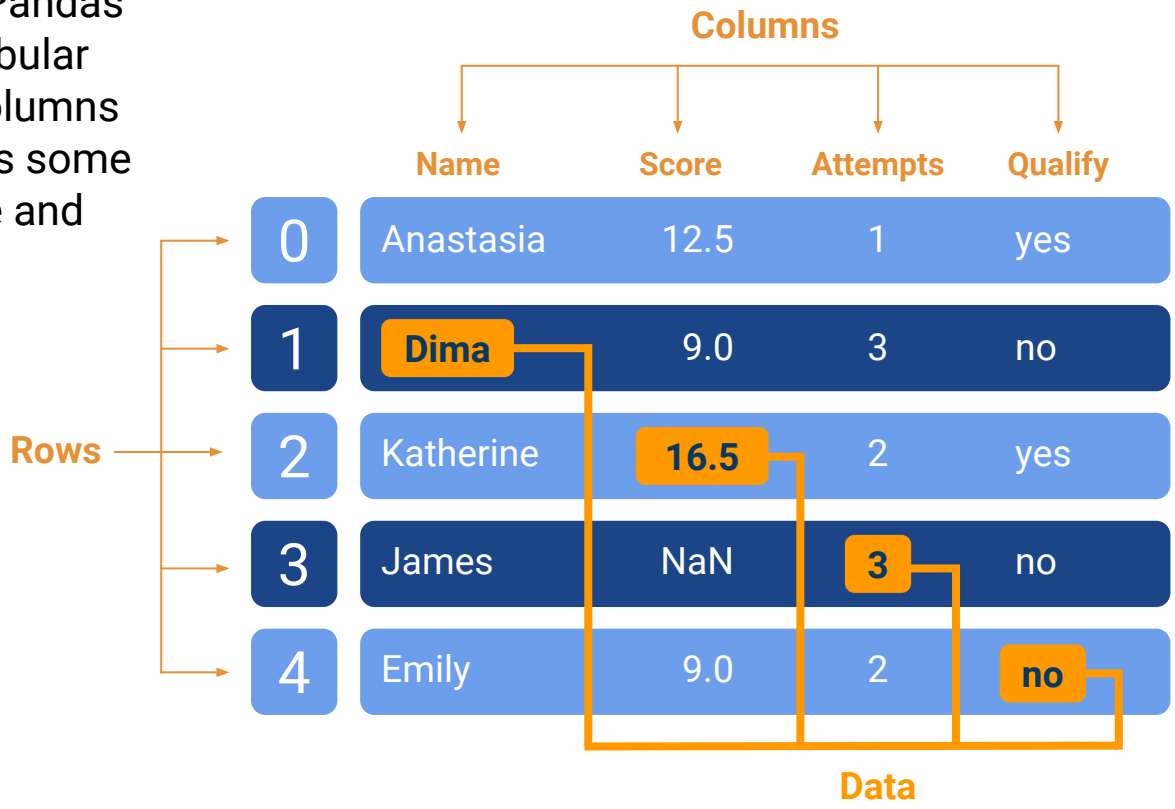
The Pandas DataFrame

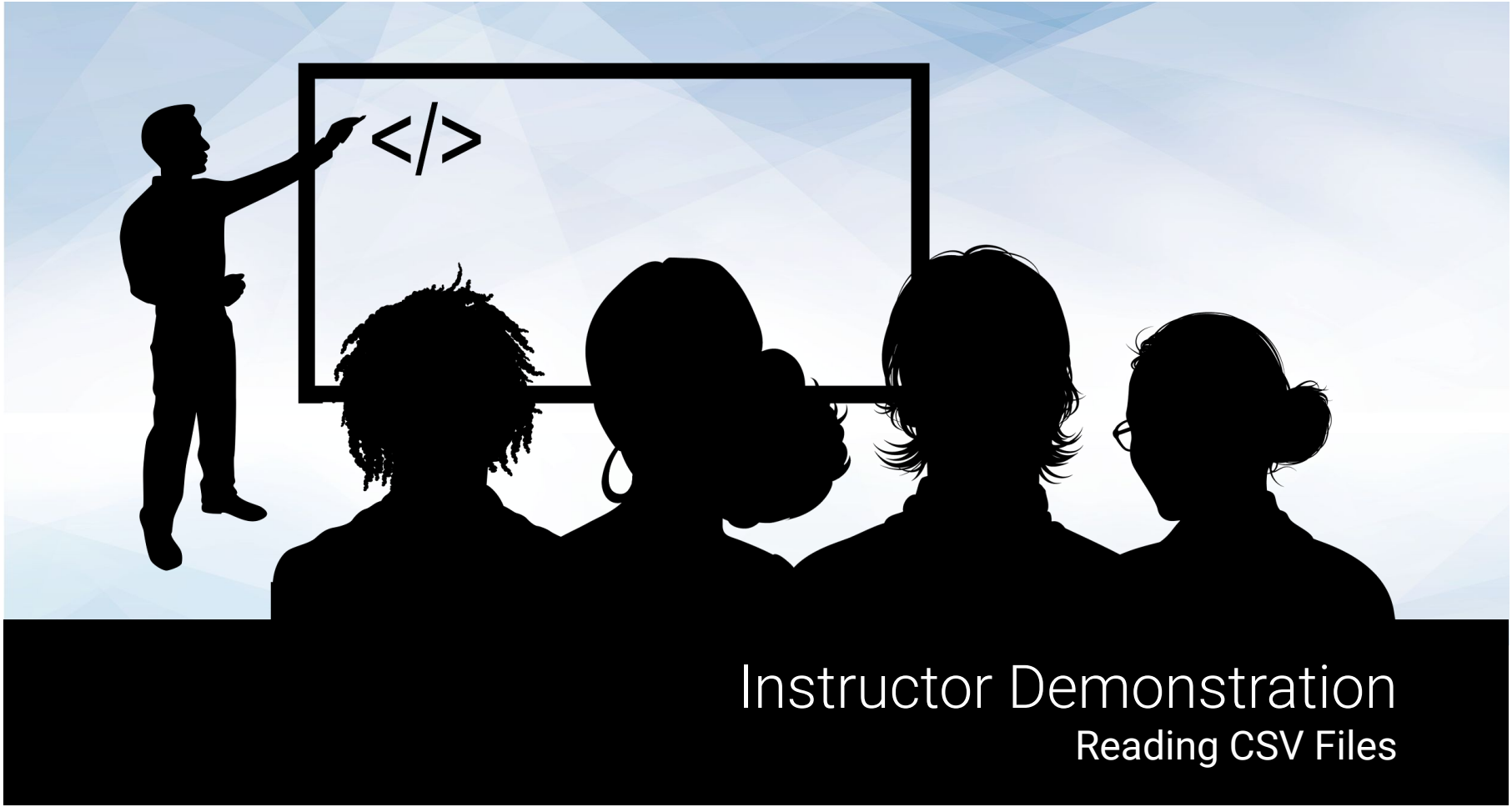
What is a Pandas DataFrame?

It is a special data structure in Pandas that is designed to work with tabular data (data that has rows and columns like a spreadsheet) and provides some useful functions to help analyze and manipulate tabular data.

A Pandas DataFrame can be created in several ways, such as:

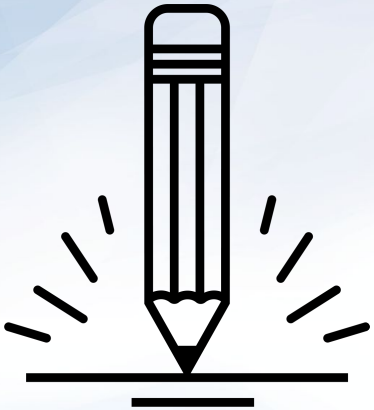
- using a Python dictionary
- using a list of lists, or
- reading data from an external file like CSV or JSON.





Instructor Demonstration

Reading CSV Files



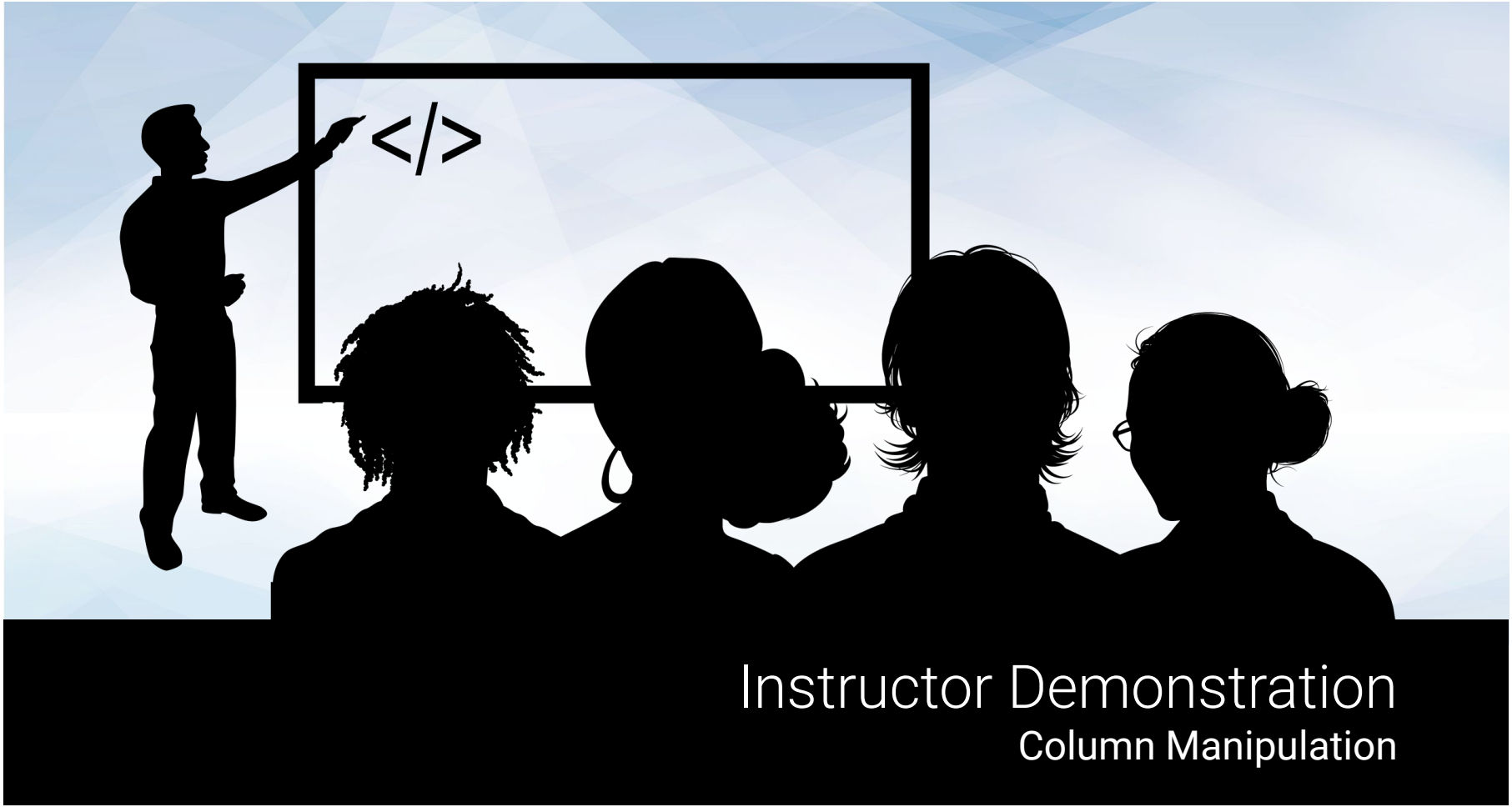
Activity: Reading Stock Data from a CSV File

In this activity, you will get hands-on experience reading CSV files into Pandas. You will use the `read_csv` function, sample data with the `head` function, and create DataFrames with specified column names.

(Instructions sent via Slack.)

Suggested Time:
10 Minutes

Time’s Up! Let’s Review.



Instructor Demonstration

Column Manipulation

Data Cleaning

Data Cleaning at a Glance

Data cleaning is the process of getting your data ready to be used.

It consists of three parts:

01

Data exploration

02

Data quality checks

03

Data cleaning strategies

Data cleaning helps avoid data quality issues that may compromise the integrity, or "health," of a dataset. The goal of data cleaning is to keep the “plumbing” of data pipelines clean and in working condition, so that analytics can run smoothly.

Determining Data Quality

Most data quality rules are influenced by general coding etiquette.

Use correct data types and minimize use of nulls.

Numerical fields should only contain digits, not string characters.

Datasets should not contain duplicate rows.

Define a standard format for managing dates.

Why does data become dirty?

Common Reasons for Having Dirty Data

01

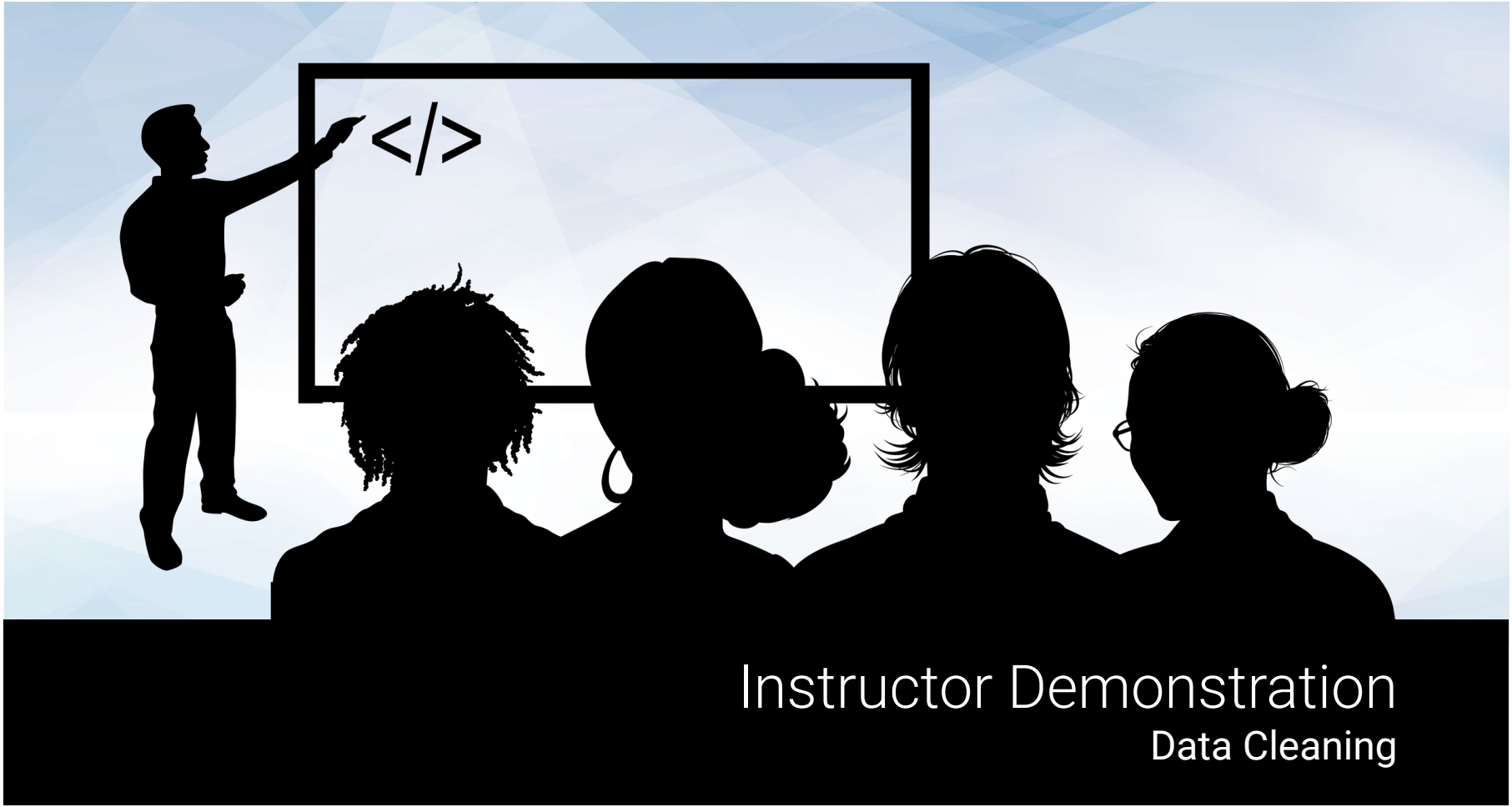
Typos
If gone unchecked, typos can corrupt data values. There is little that can be done to get rid of typos, as it is often difficult to identify them.

02

Human Error
Humans can copy and manipulate data incorrectly. For instance, someone might copy and paste data into the wrong Excel file. Or a Python function can incorrectly compute a data value.

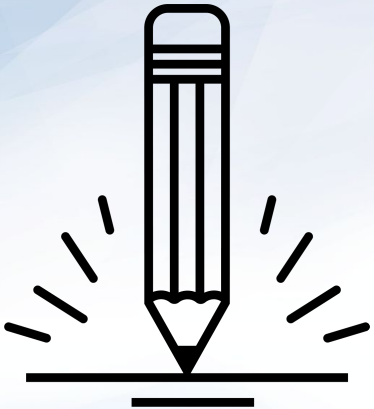
03

Poor Data Management
Data is poorly managed when it is not cleaned or stored in an effective way. Industry standards and business rules should be consistently implemented to ensure data integrity.



Instructor Demonstration

Data Cleaning



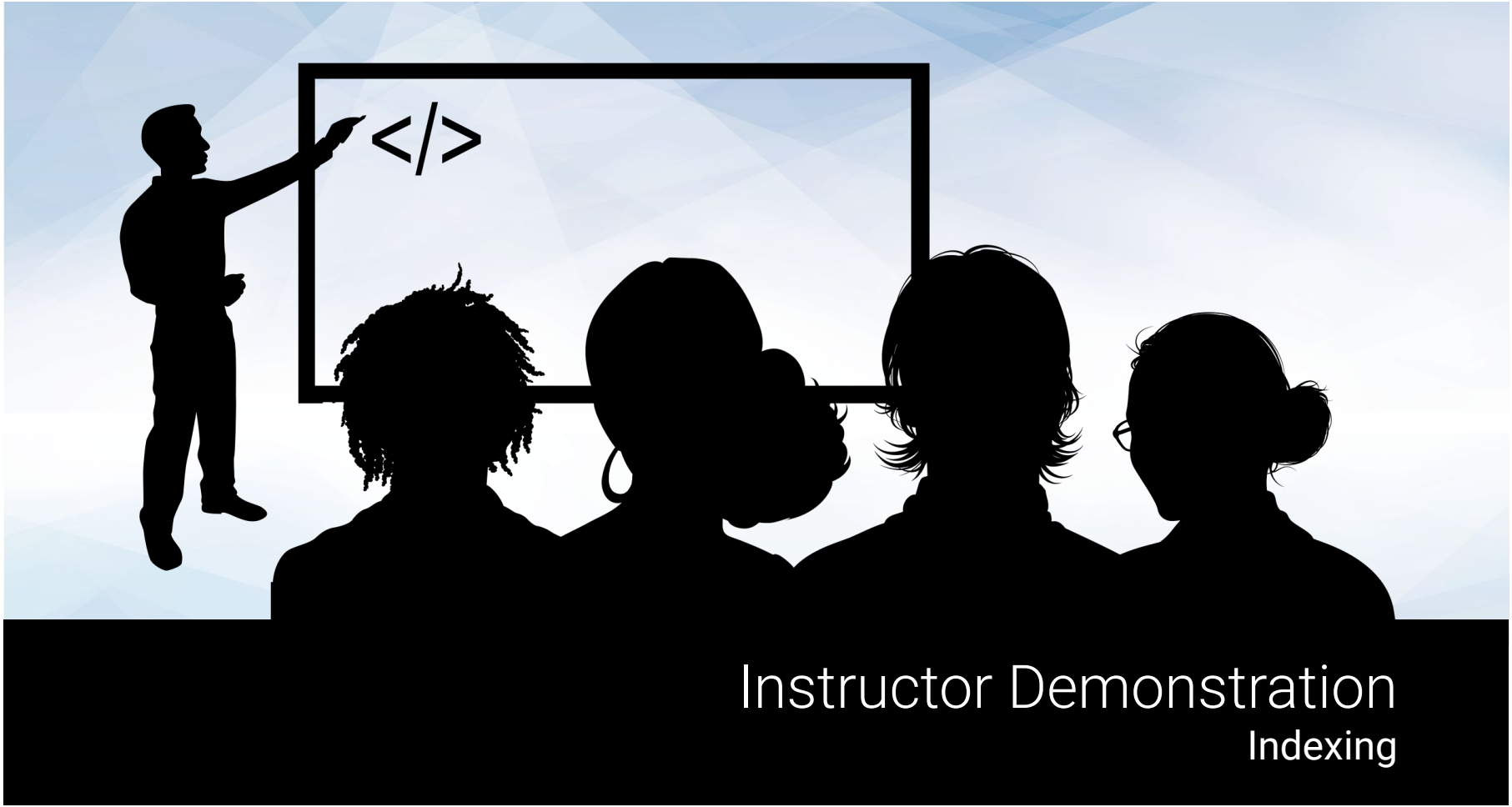
Activity: Spring Cleaning

In this activity, you will perform a series of data quality checks on stock data to ensure the data is ready for analytical use. The objective is to learn how to cleanse data using Pandas native functions (`count`, `value_counts`, `isnull`, `sum`, `mean`, `contains`, and `replace`).

(Instructions sent via Slack.)

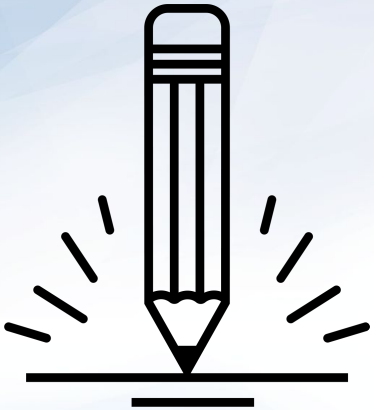
Suggested Time:
15 Minutes

Time’s Up! Let’s Review.



Instructor Demonstration

Indexing



Activity: Three-Year Loans

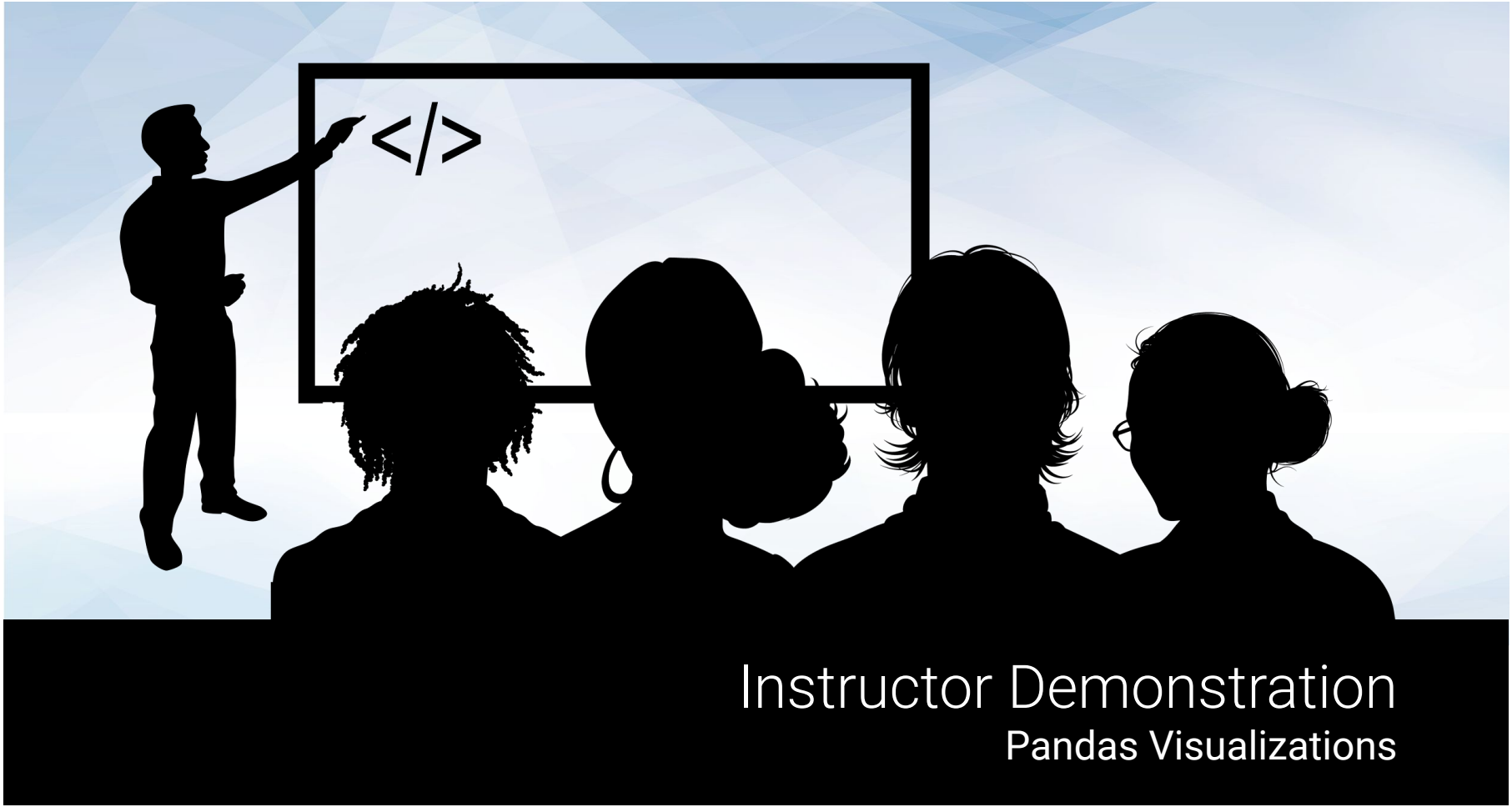
This activity will test your DataFrame indexing skills. You will slice and dice the `loans.csv` data to generate insights about three-year loan customers.

(Instructions sent via Slack.)

Suggested Time:
15 Minutes

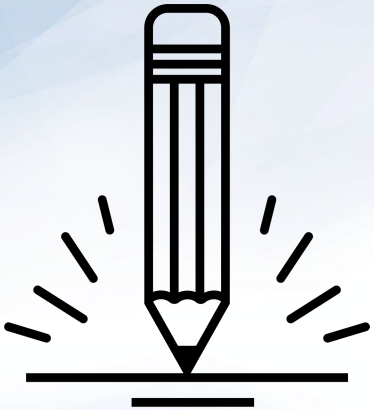
Time’s Up! Let’s Review.


Break



Instructor Demonstration

Pandas Visualizations



Activity: Market Analysis

In this activity, you will use Pandas to create three different charts: a pie chart, bar chart, and scatter plot.

(Instructions sent via Slack.)

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.

Returns

Return on Investment (ROI)

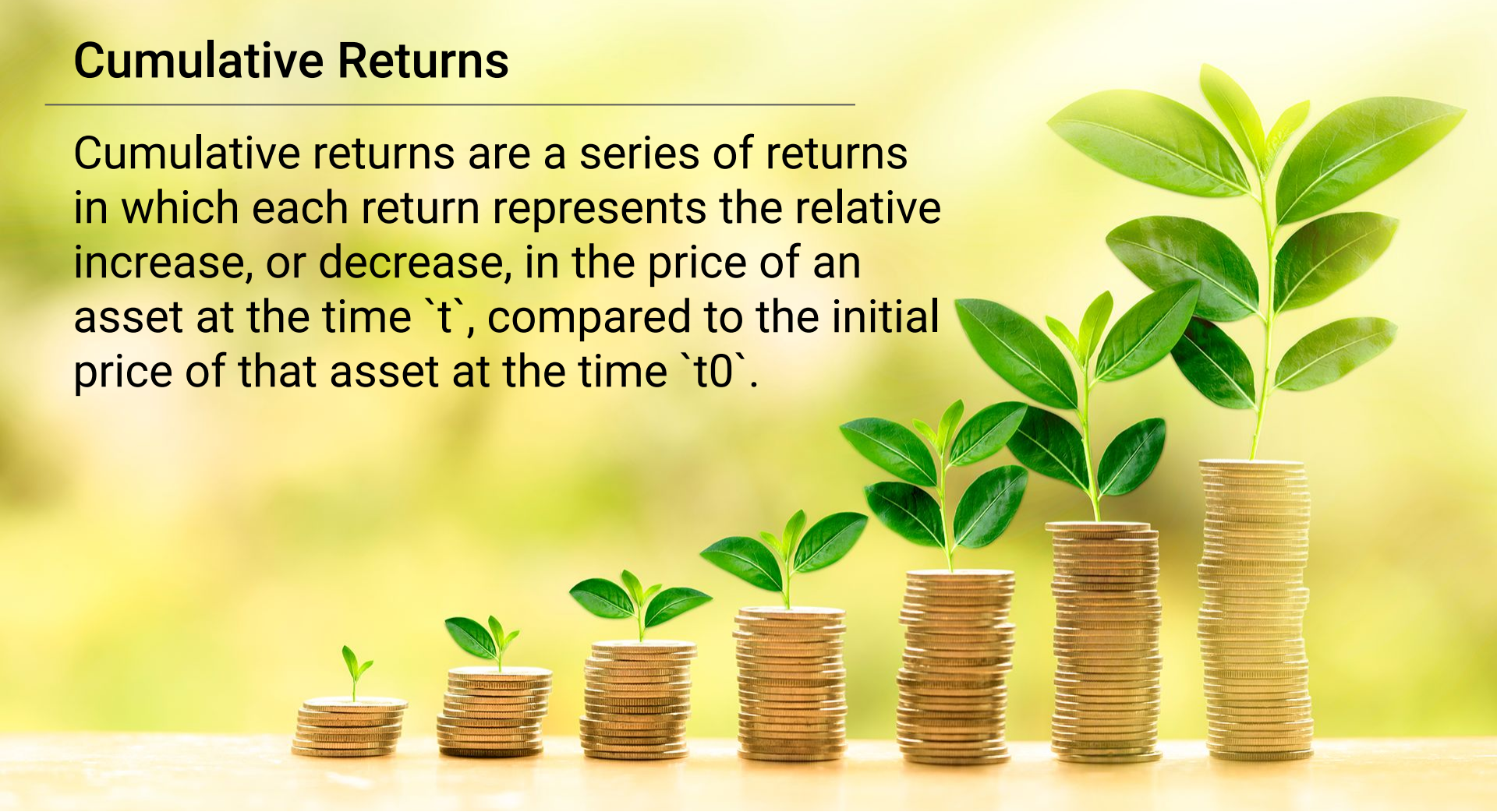
- ROI is a percentage calculation that signifies either a profit or loss relative to the initial cost of an investment.
- ROI calculations can be used to standardize and compare the investment performances of varying asset classes such as equities, bonds, real estate, etc.

Daily Returns

Daily returns are a series of returns calculated over several days, with each daily return representing the relative increase or decrease in investment between days.

Cumulative Returns

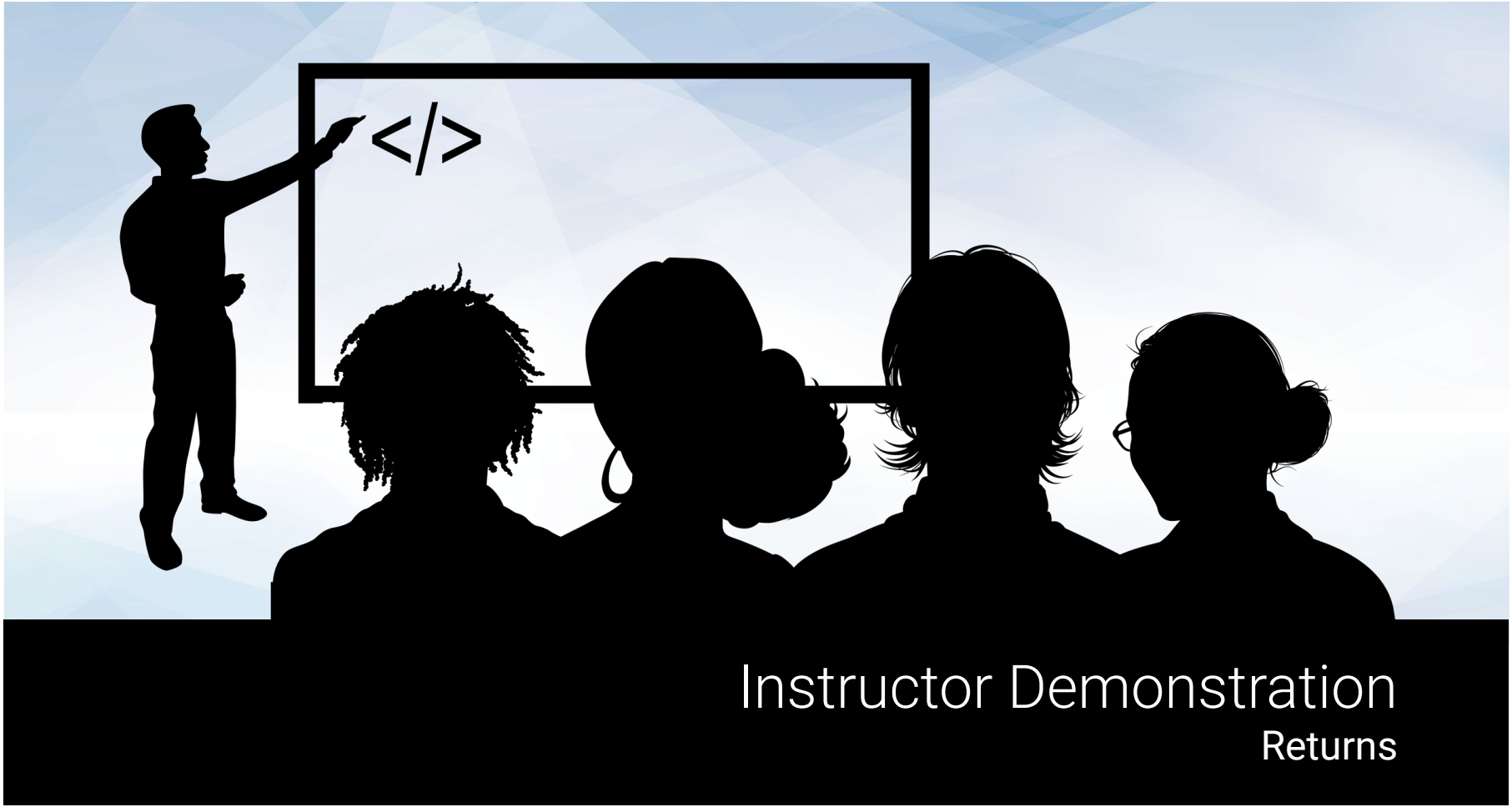
Cumulative returns are a series of returns in which each return represents the relative increase, or decrease, in the price of an asset at the time `t`, compared to the initial price of that asset at the time `t0`.



Calculating ROI using Python

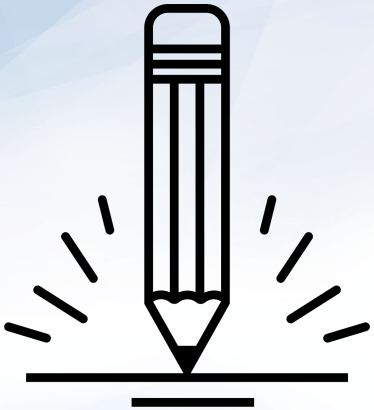
```
# ROI = (Current Value of Investment - Cost of
Investment) / Cost of Investment
initial_investment = 100
current_price = 110


roi = (current_price - initial_investment) /
initial_investment
roi_pct = roi * 100
```



Instructor Demonstration

Returns



Activity:
Returns Over Date Ranges

In this activity, you will analyze historical price data for Shopify and plot the daily returns over the previous 1-, 2-, 3-, and 4-year periods.

(Instructions sent via Slack.)

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.

Questions?


The End