Pandas:
Risk and Returns Over Time

FinTech

Lesson 3.3

Class Objectives

By the end of this unit, you will be able to:

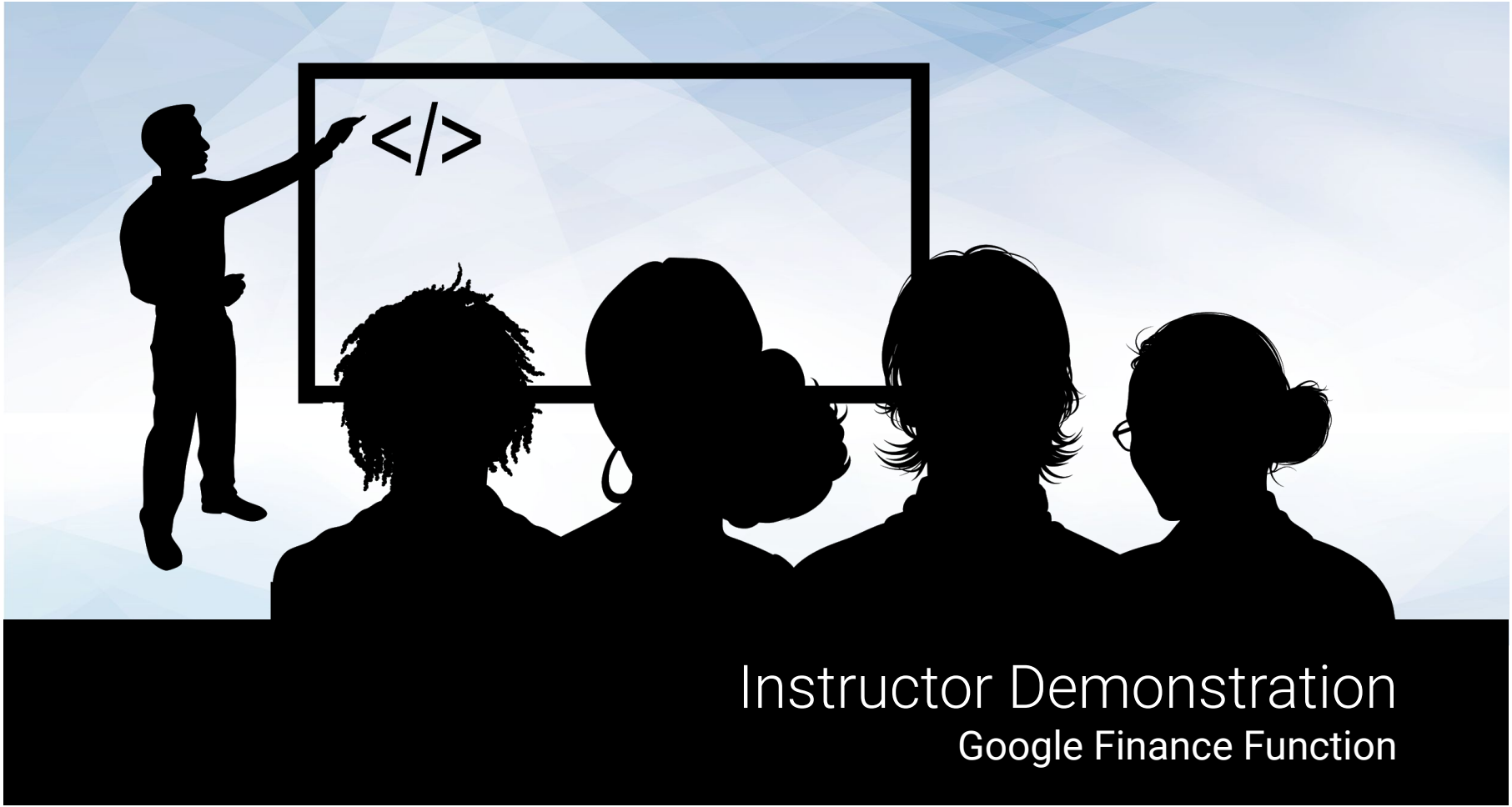
- Group data in a DataFrame to perform calculations on the grouped data.
- Manipulate datetime data in different formats: single variables, DataFrame columns, and series.
- Identify the calculations that can be done with datetime data & declare and use a DateTimeIndex.
- Calculate mean, median, and standard deviation using Pandas & apply standard deviation to risk analysis use cases.
- Determine risk by identifying how stocks deviate from the mean.
- Describe Sharpe ratios and calculate them using Pandas DataFrames.

Welcome/Refresher

Returns Over Time

Returns over time require investment close prices, i.e., stock data. Stock close prices can be acquired from Google Sheets via the Google Finance function.

Returns over time can be calculated using the `pct_change()` function.



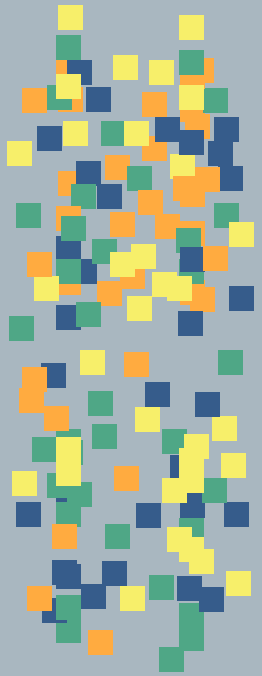
Instructor Demonstration

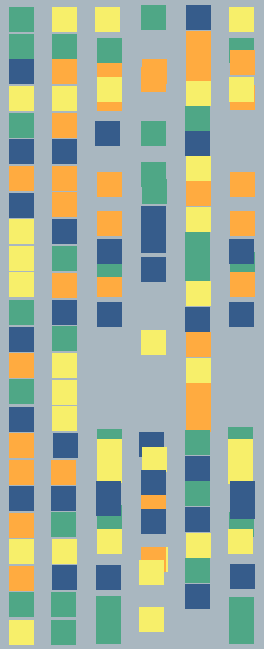
Google Finance Function

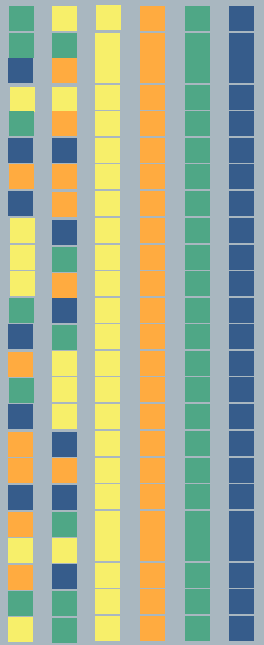
Sorting

Sorting

Data is not always organized in the best way for analysis. Sometimes, data needs to be cleaned and sorted.







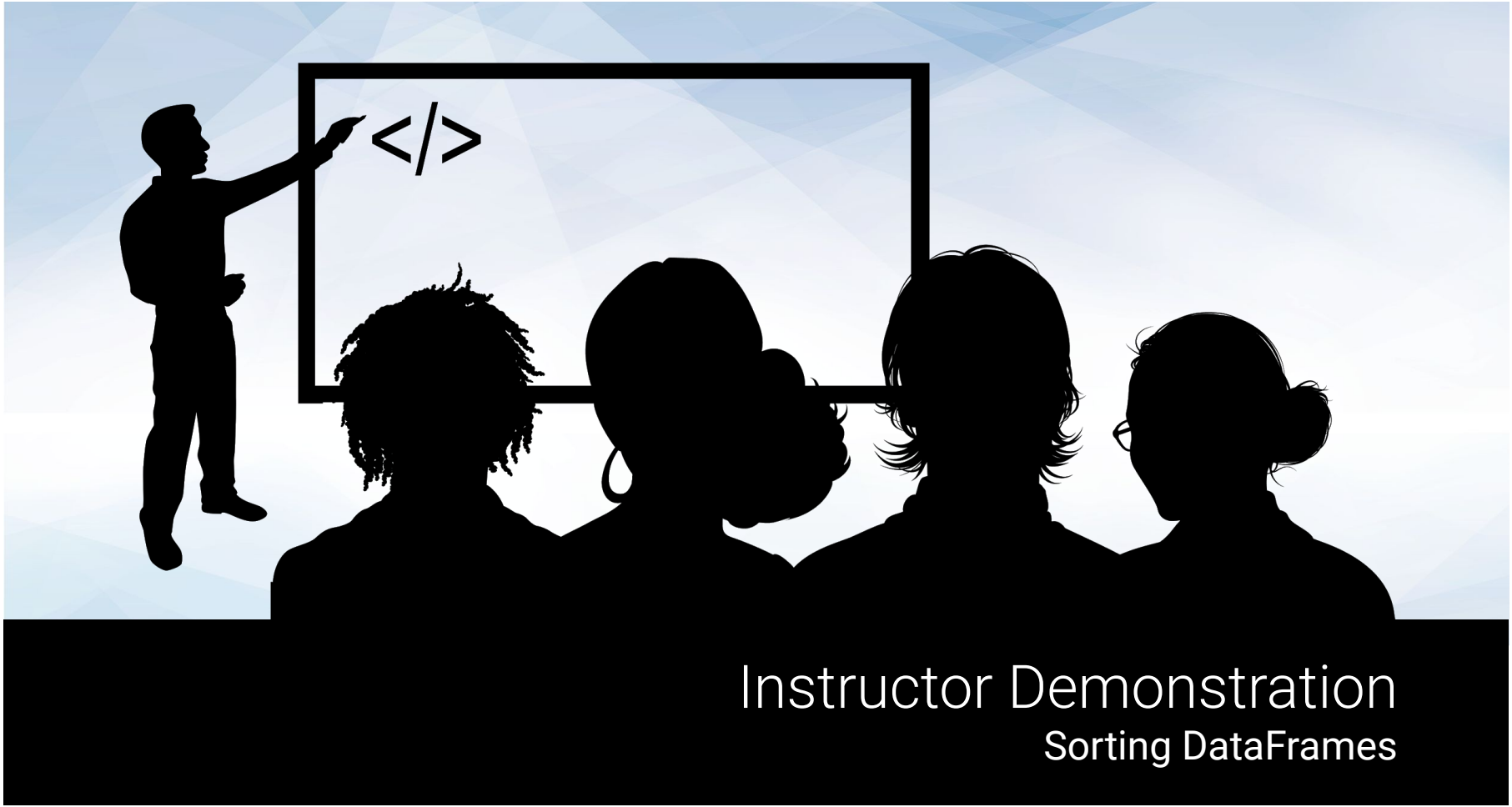
Sorting

The `sort_values` function in Pandas can be used to sort a DataFrame. Sorting data helps improve visual representation of data.

Data can be sorted in either ascending or descending order.

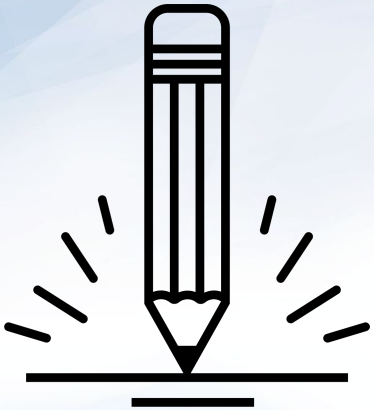
```
sort_values(ascending=True)
```

Consider dates: would you rather see dates sorted or randomly listed?



Instructor Demonstration

Sorting DataFrames



Activity: Out of Sorts

In this activity, you will extract data for a single ticker from Google Sheets via the in-built Google Finance function and calculate daily returns for the year 2019. The data will then be sorted in descending order to identify the top 5 performing days for returns.

(Instructions sent via Slack.)

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.

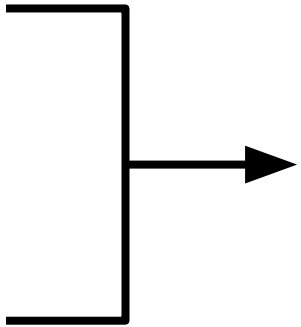
Grouping

Grouping

A key component of data analysis is grouping data. **Grouping** allows for similar data to be aggregated or manipulated as groups.

Example aggregations that can be done on groups are adding, summing, determining min and max, etc.

Category	Sales
a	1
a	2
b	10
b	9



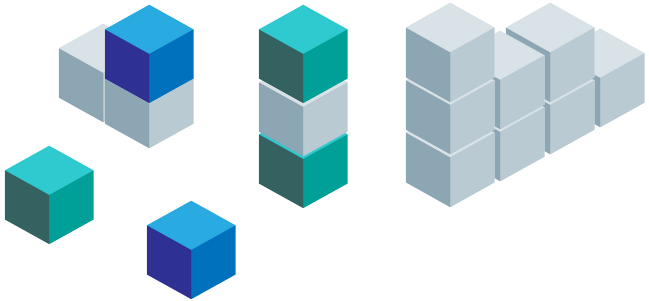
Category	Sales
a	3
b	19

Grouping

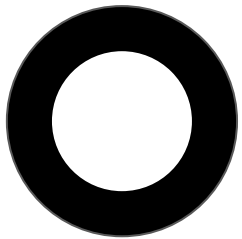
Behind the scenes, the Pandas `groupby` function does the following:

Splits the data into groups based on certain criteria.

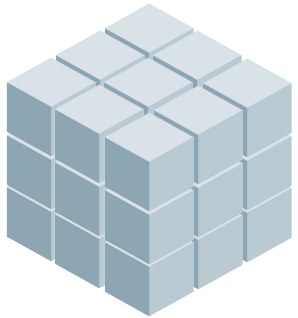
Applies a function to each group independently.



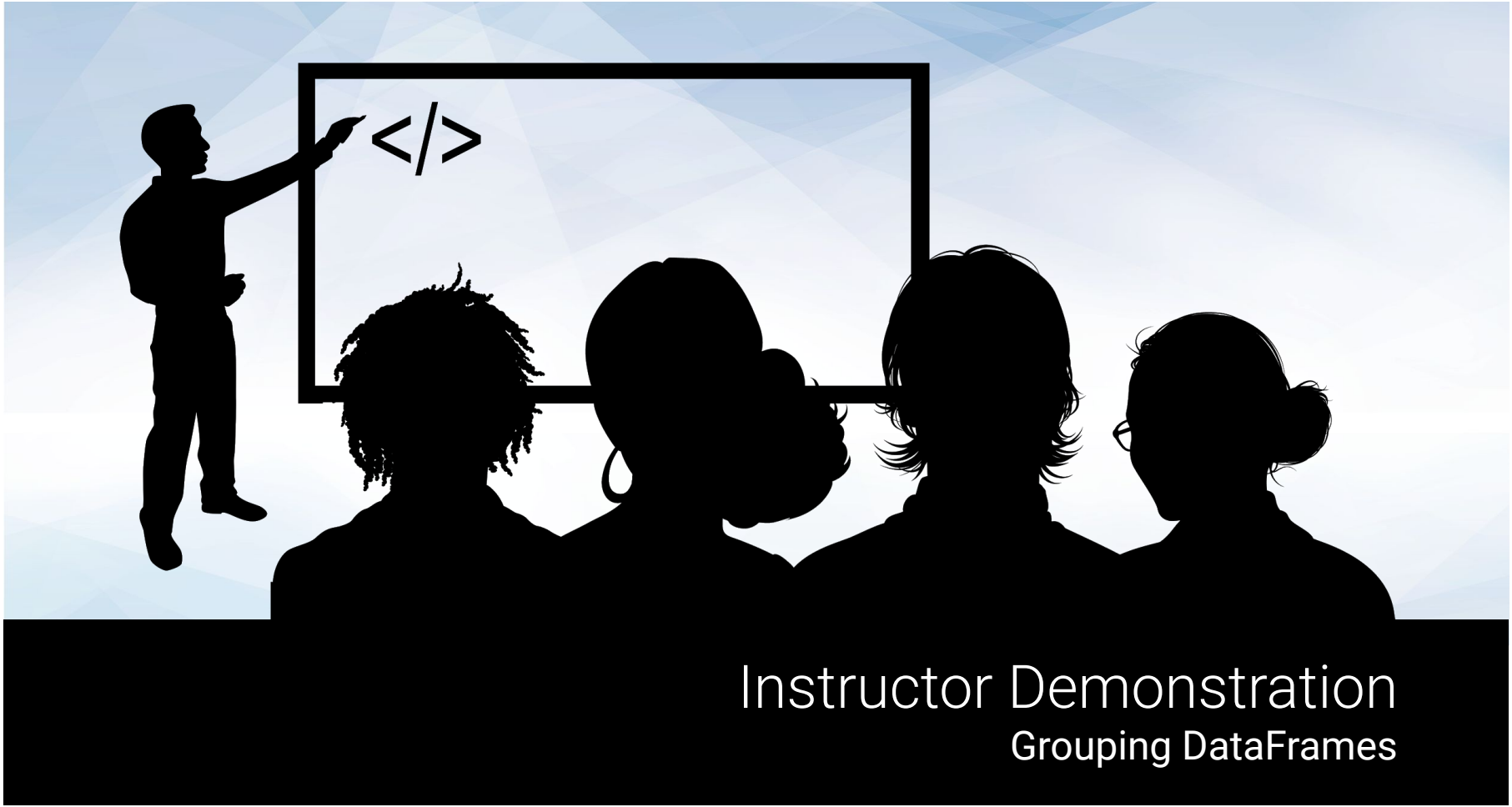
Splitting Data



Applying a Function

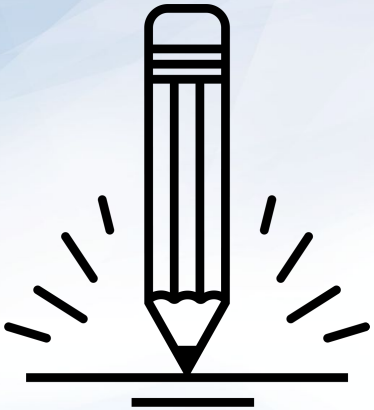


Combining Results



Instructor Demonstration

Grouping DataFrames



Activity: Group Dynamics

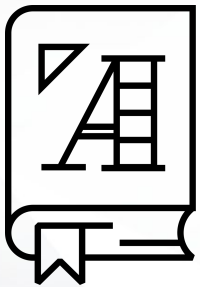
In this activity, you will work with historical cryptocurrency data. You will load in cryptocurrency data, group data by each crypto, and then perform aggregations to analyze price trends. You will then plot the results.

(Instructions sent via Slack.)

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.

Multi-Indexing

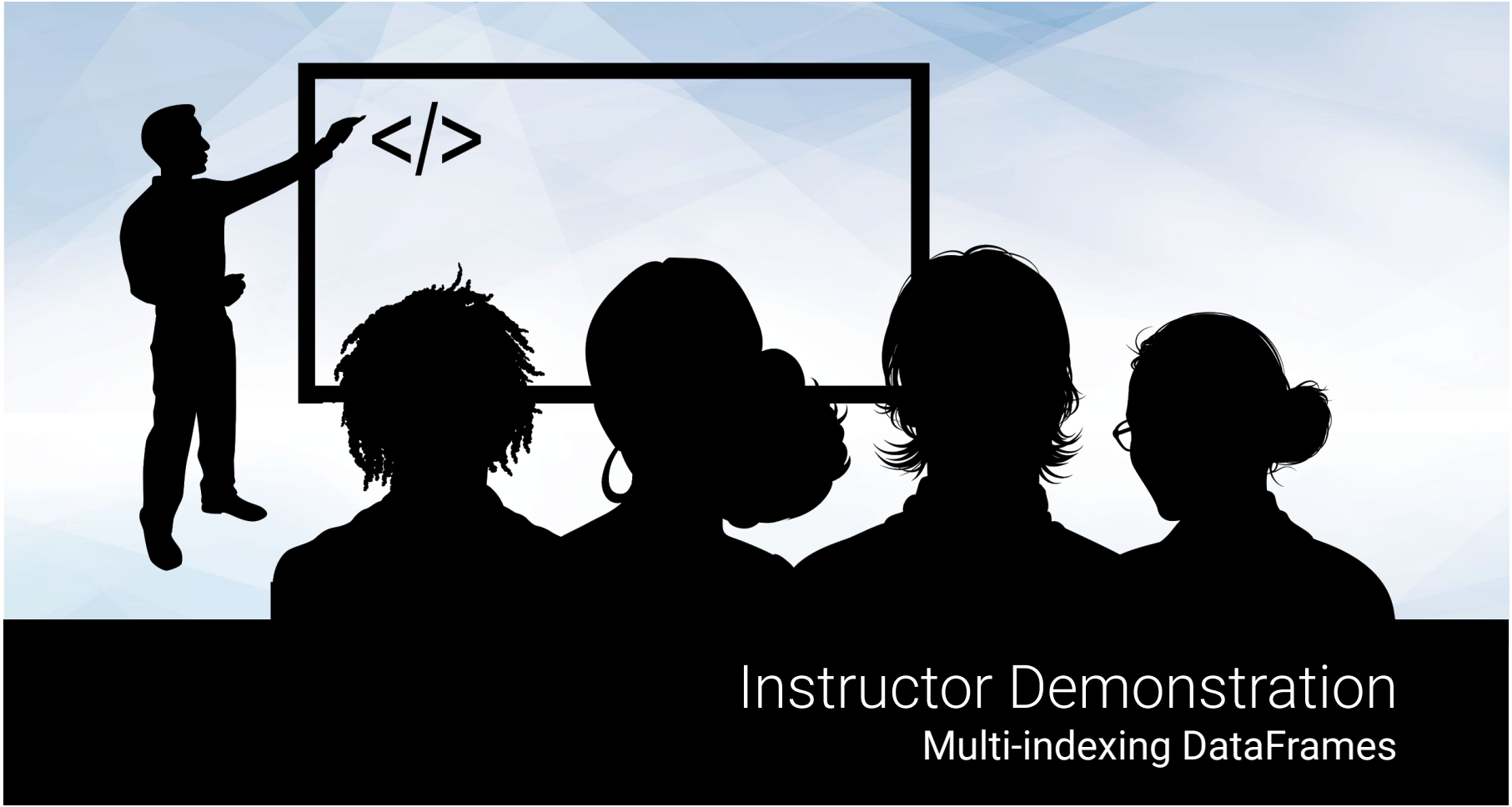


Multi-indexing is the process of creating more than one index for a DataFrame.

Multi-Indexing

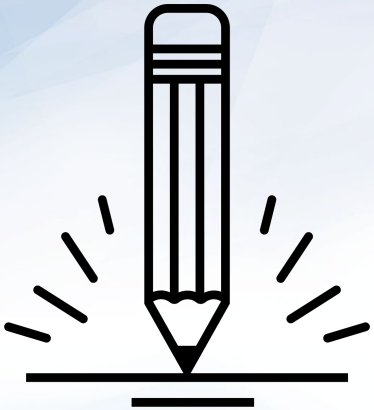
Sometimes, one index is not enough for performing data lookups; more than one index is needed. For example, it is common to use multi-indexing when working with dates. This allows data to be accessed by year, month, and/or day.

	one			two		
	a	b	c	a	b	c
0	-1.401530	0.626666	-0.165782	-0.361173	-1.139887	-0.027251
1	1.201998	-0.665546	-0.554207	0.644199	0.572868	-1.552404
2	-1.201190	-1.428929	1.226697	0.162548	1.481702	0.721526
3	-1.622470	0.541475	-0.482980	-1.970389	1.974586	0.165966



Instructor Demonstration

Multi-indexing DataFrames



Activity: Indexing Fever

In this activity, you will use hierarchical indexes to gain access to historical stock data. You will leverage Google Sheets to extract Google Finance data to perform data segmentation for a single ticker over multiple months in a year.

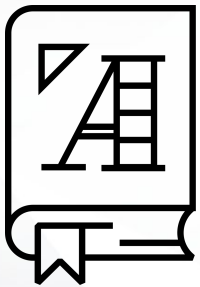
(Instructions sent via Slack.)

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.


Countdown timer
15:00
(with alarm)
Break

Concatenation



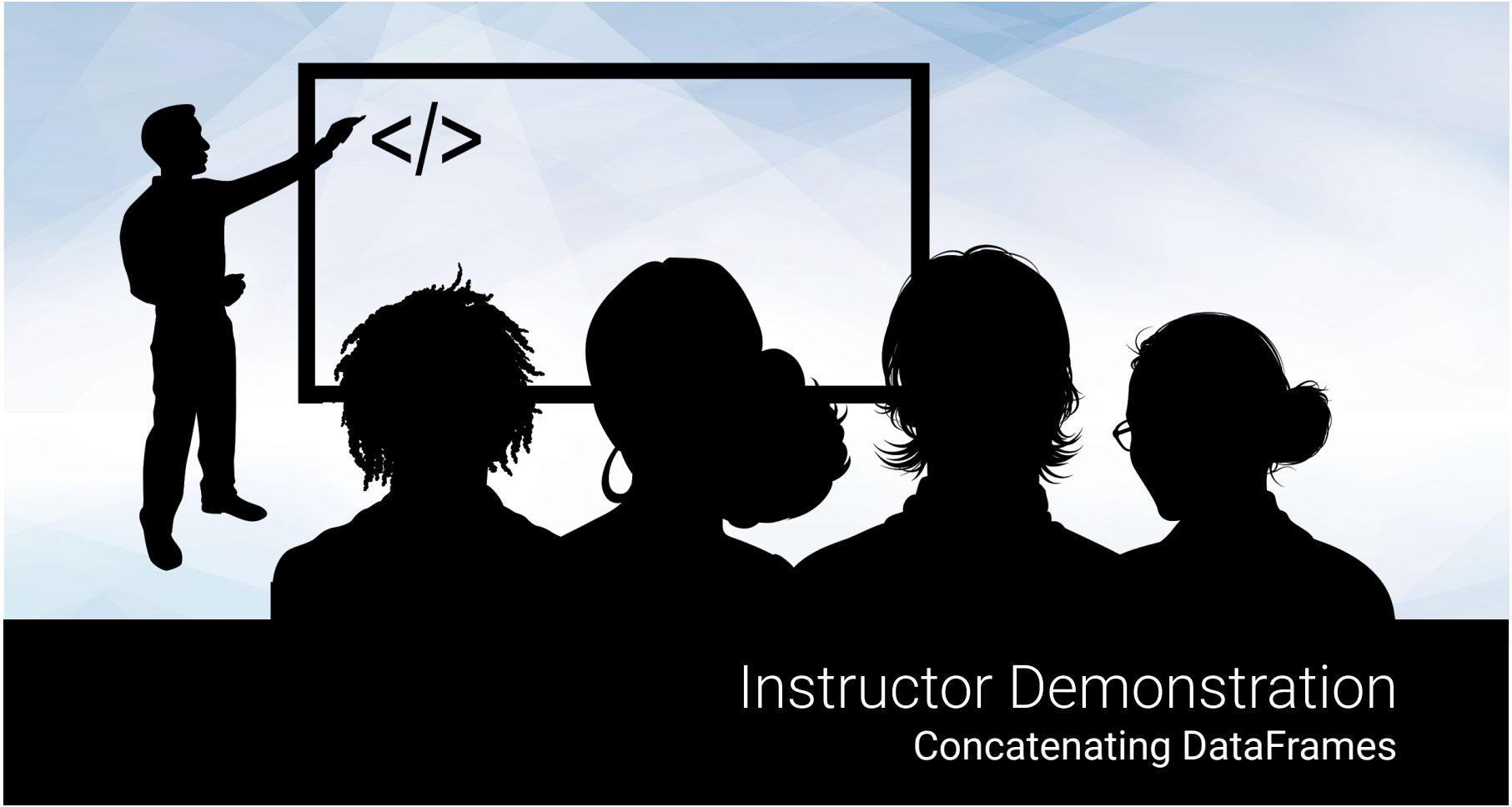
Concatenation is the process of joining one dataset with another.

Concatenation

Pandas has a `concat` function that can be used to combine DataFrames.

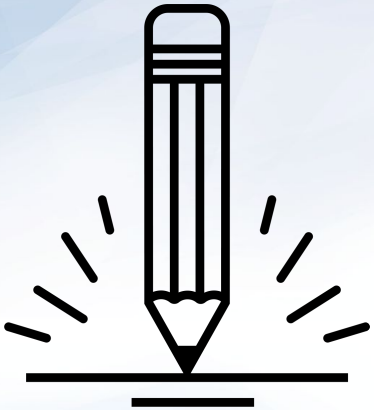
DataFrames can be concatenated so that the records from two DataFrames are combined.

DataFrames can be combined by column so that the columns from one DataFrame are placed adjacent to columns from another DataFrame.



Instructor Demonstration

Concatenating DataFrames



Activity:
Mastering Concatenation

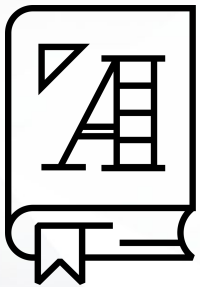
In this activity, you will combine multiple DataFrames using the `concat` function.

(Instructions sent via Slack.)

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.

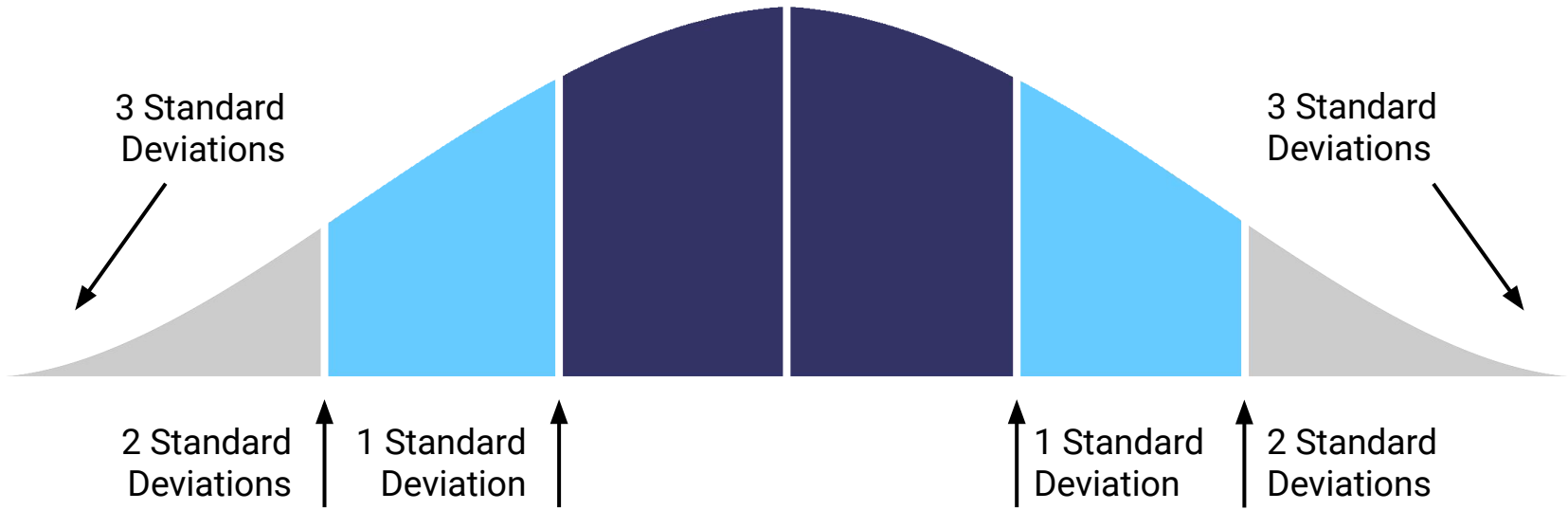
Standard Deviation and Risk



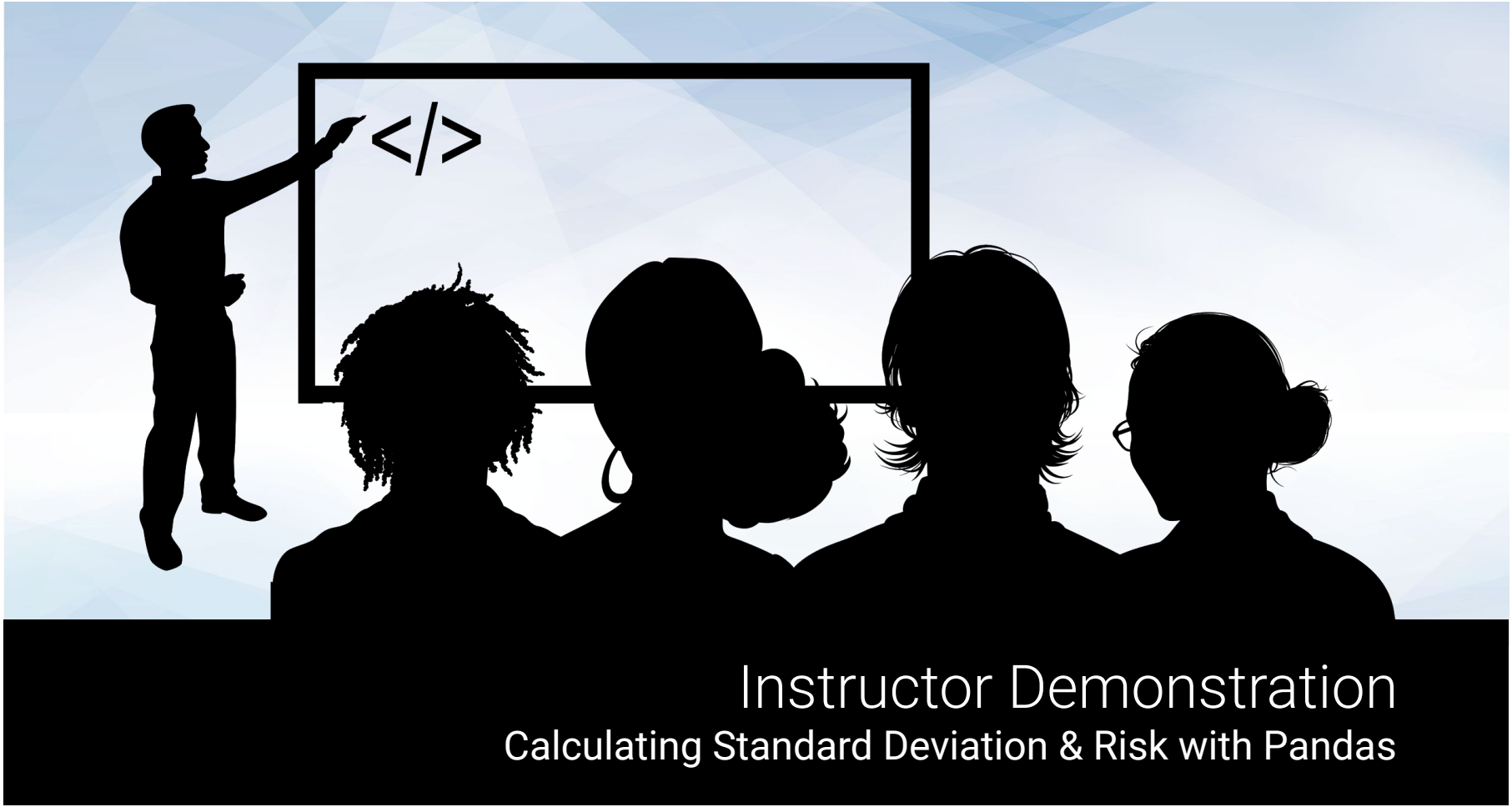
Standard deviation measures how dispersed a set of values are from their average.

Standard Deviation

The `std` Pandas function is used to calculate standard deviation for a DataFrame. Standard deviation can be used to determine the risk associated with an investment. Standard deviation is also used to calculate how much returns have been distributed from the average.



The greater the standard deviation, the greater the risk and the potential for a greater payout.



Instructor Demonstration

Calculating Standard Deviation & Risk with Pandas

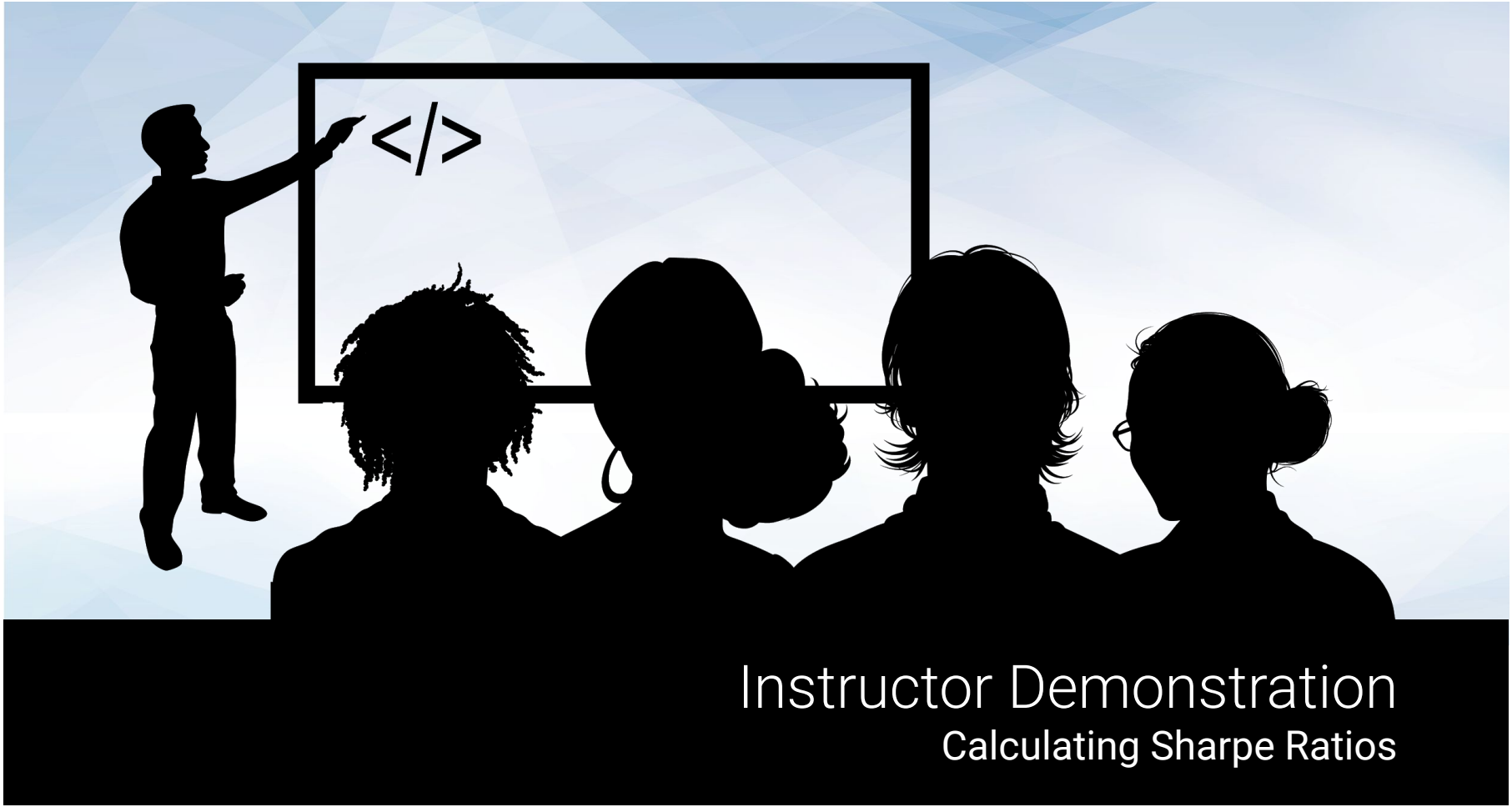
Sharpe Ratios

Sharpe Ratios

Whereas standard deviation calculates how dispersed a set of values are, **Sharpe ratios** identify how much excess reward is associated with an investment after risk has been accounted for.

Sharpe ratios are calculated by dividing annualized average returns by annualized standard deviation.

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{O_p}$$



Instructor Demonstration

Calculating Sharpe Ratios

Activity: Risky Business

It's time to put it all together. In this activity, you will prep data and use standard deviation and Sharpe ratios to analyze cryptocurrency portfolio performance.

(Instructions sent via Slack.)

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.

Congratulations!

You just leveled up and acquired the following skills:

- Data consolidation
- Data segmentation
- Data profiling and quality
- Investment and portfolio risk analysis

Questions?


The End