Data Manipulation with Python

Introduction to Data Science

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Outline

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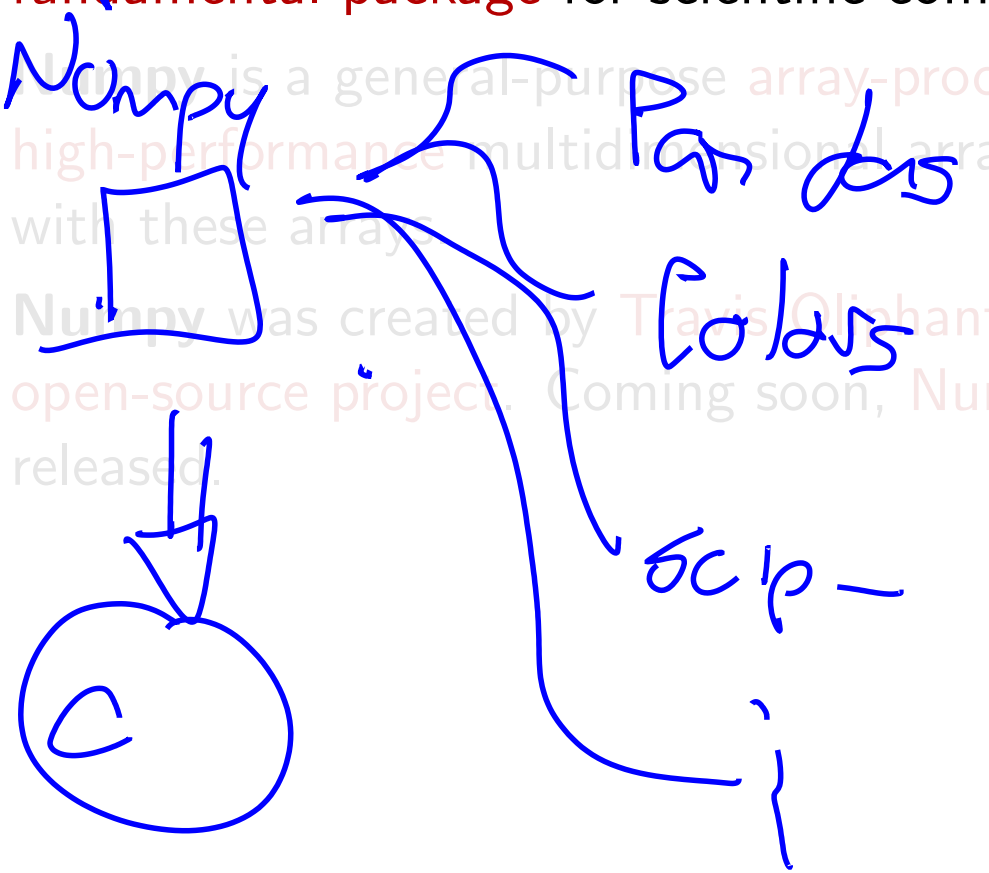
Numerical Python Library — Numpy

- **Numpy** is the core library for scientific computing in Python. It is the fundamental package for scientific computing with Python.
- Numpy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays.
- **Numpy** was created by Travis Oliphant in 2005, and it is an open-source project. Coming soon, Numpy version 2.0 will be released.



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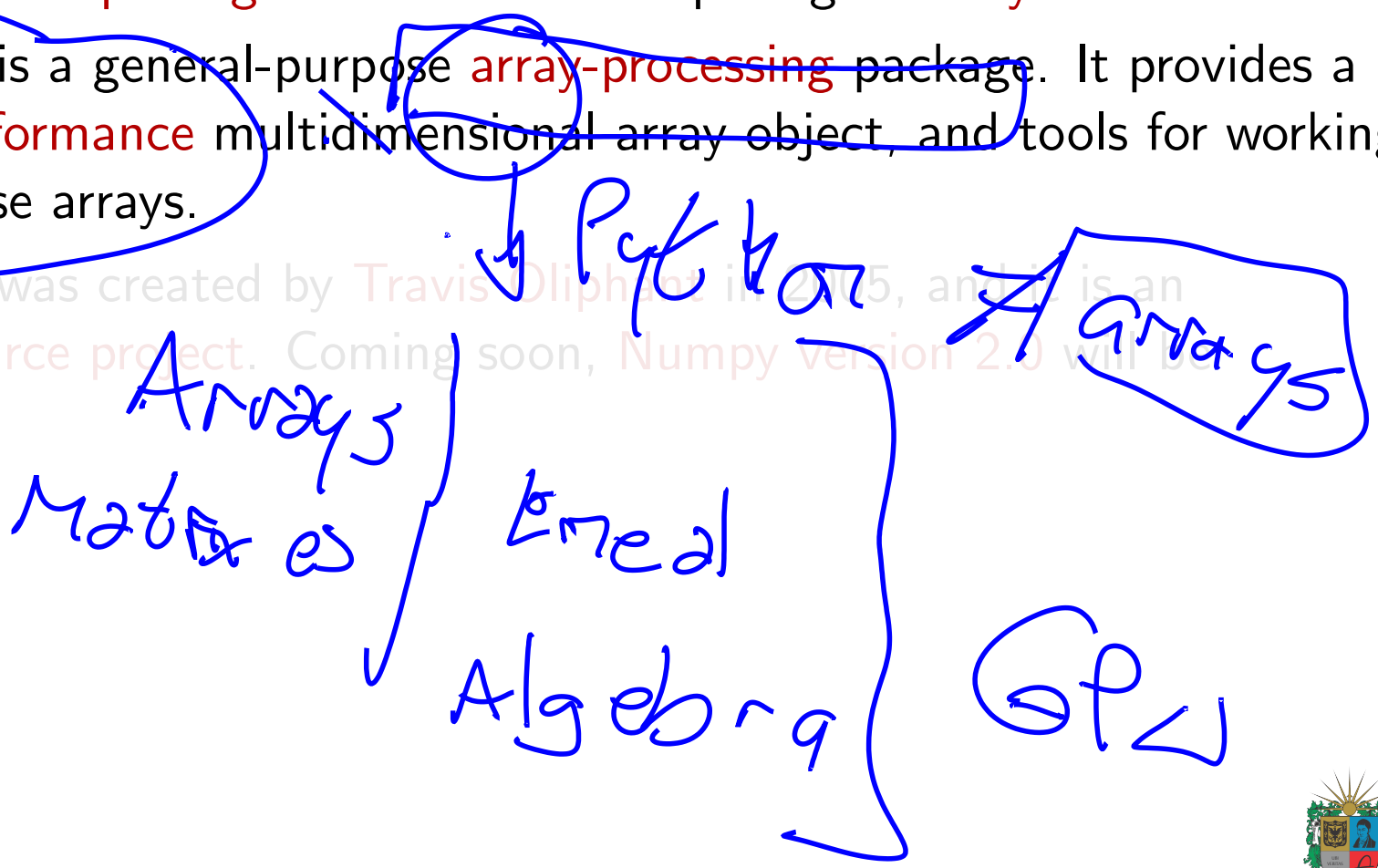

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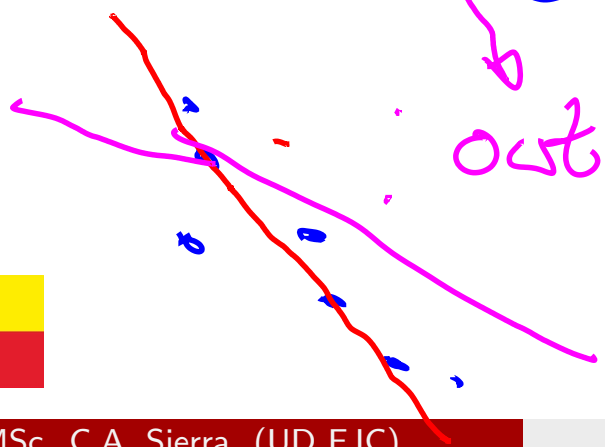

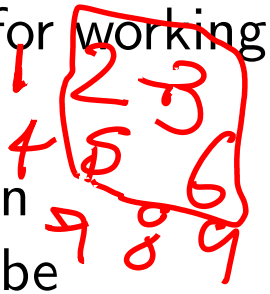

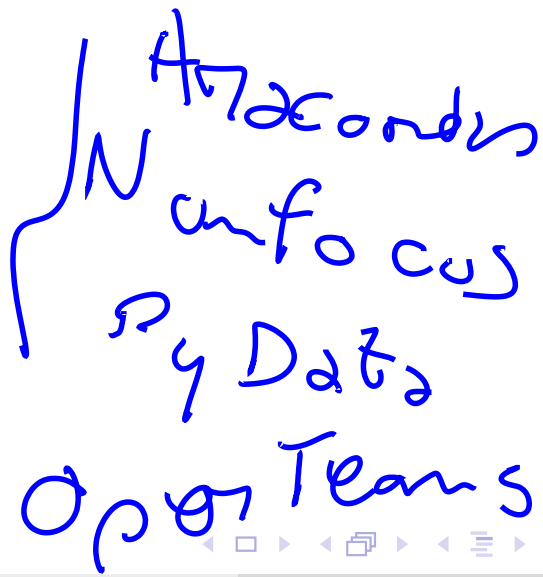

Lineal Algebra with Numpy

- **Numpy** provides a comprehensive set of linear algebra functions.
- **Numpy** provides the functionality to create and manipulate matrices.
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- **Numpy** provides the functionality to calculate the determinant of a matrix.
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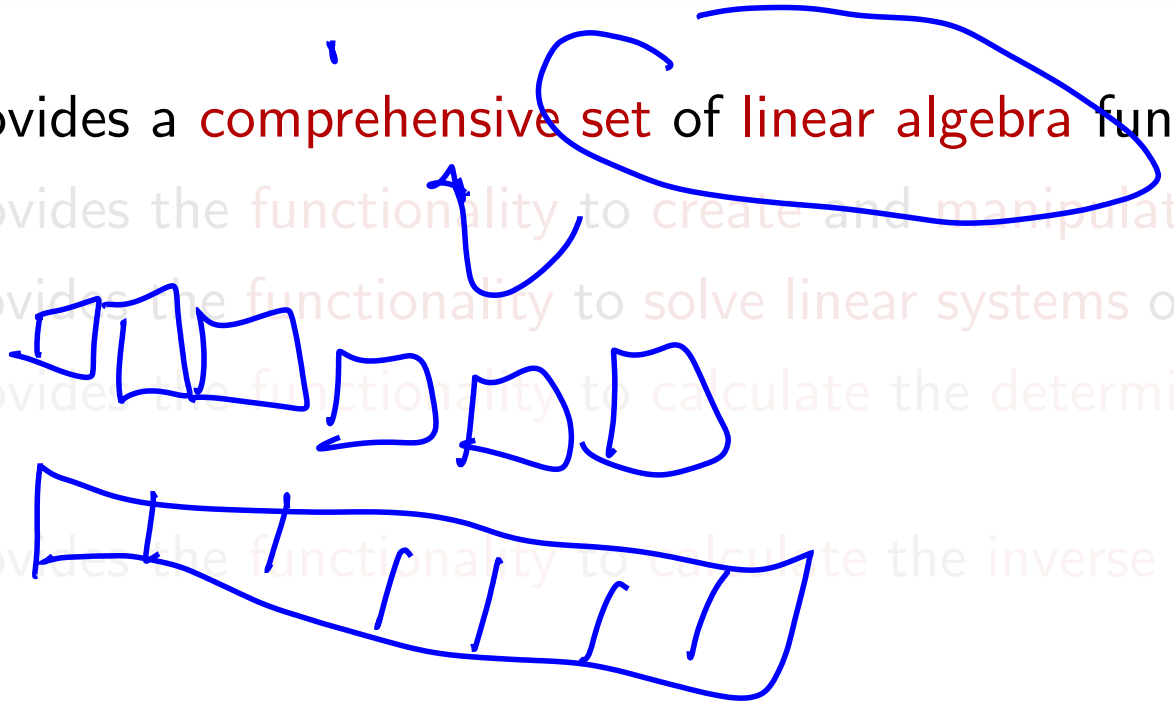

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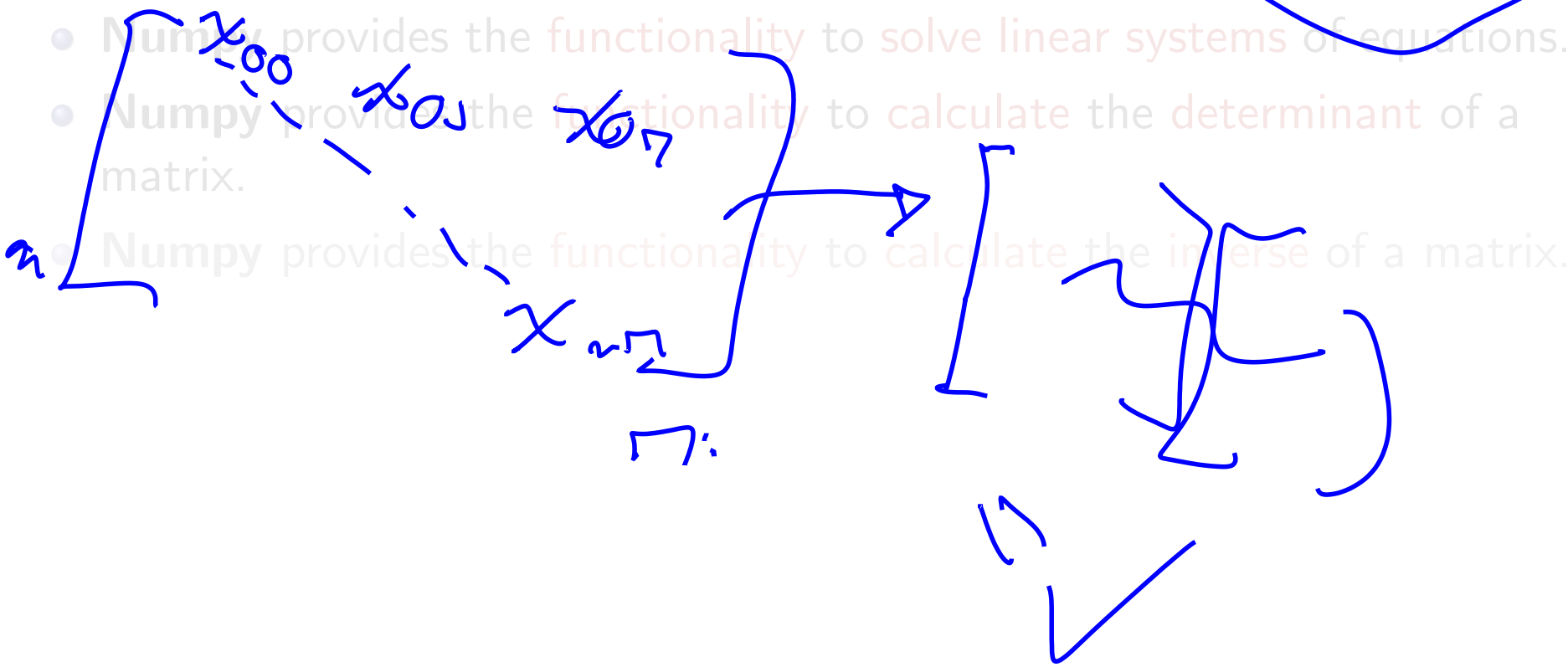

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$$2x + 3y = 5$$
$$3x + 7y = 12$$
$$\begin{bmatrix} 2 & 3 \\ 3 & 7 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 12 \end{bmatrix}$$

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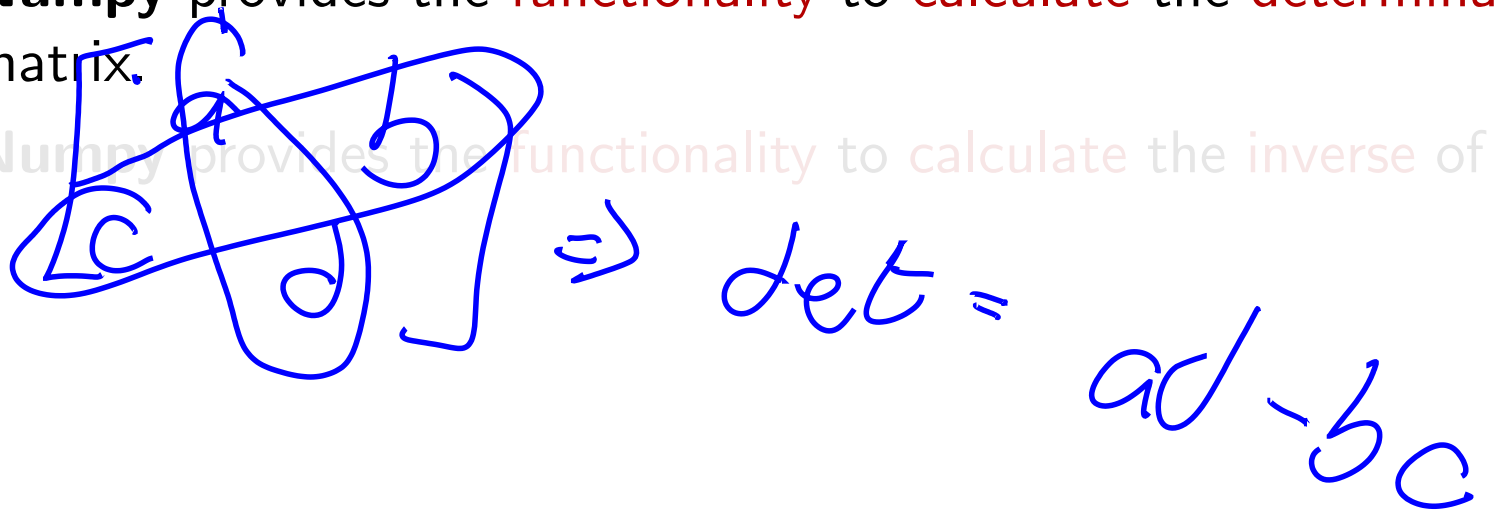

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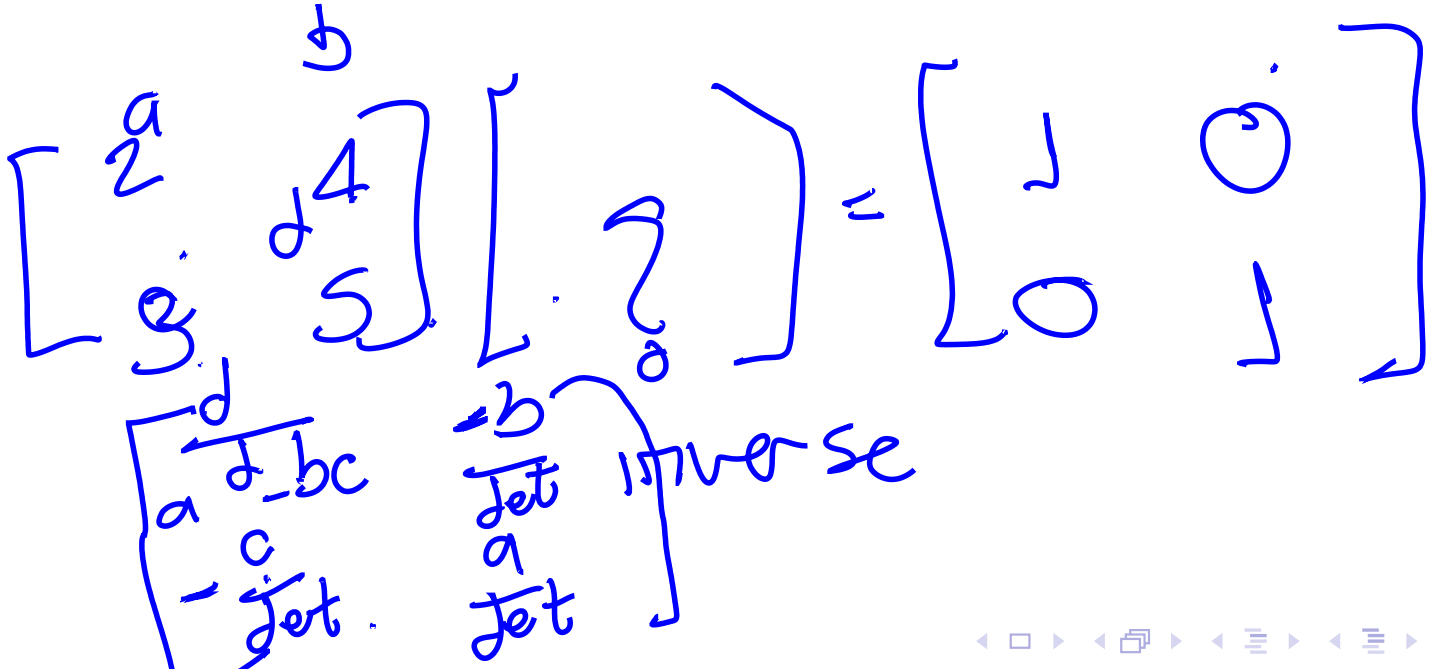

Vectorization with Numpy

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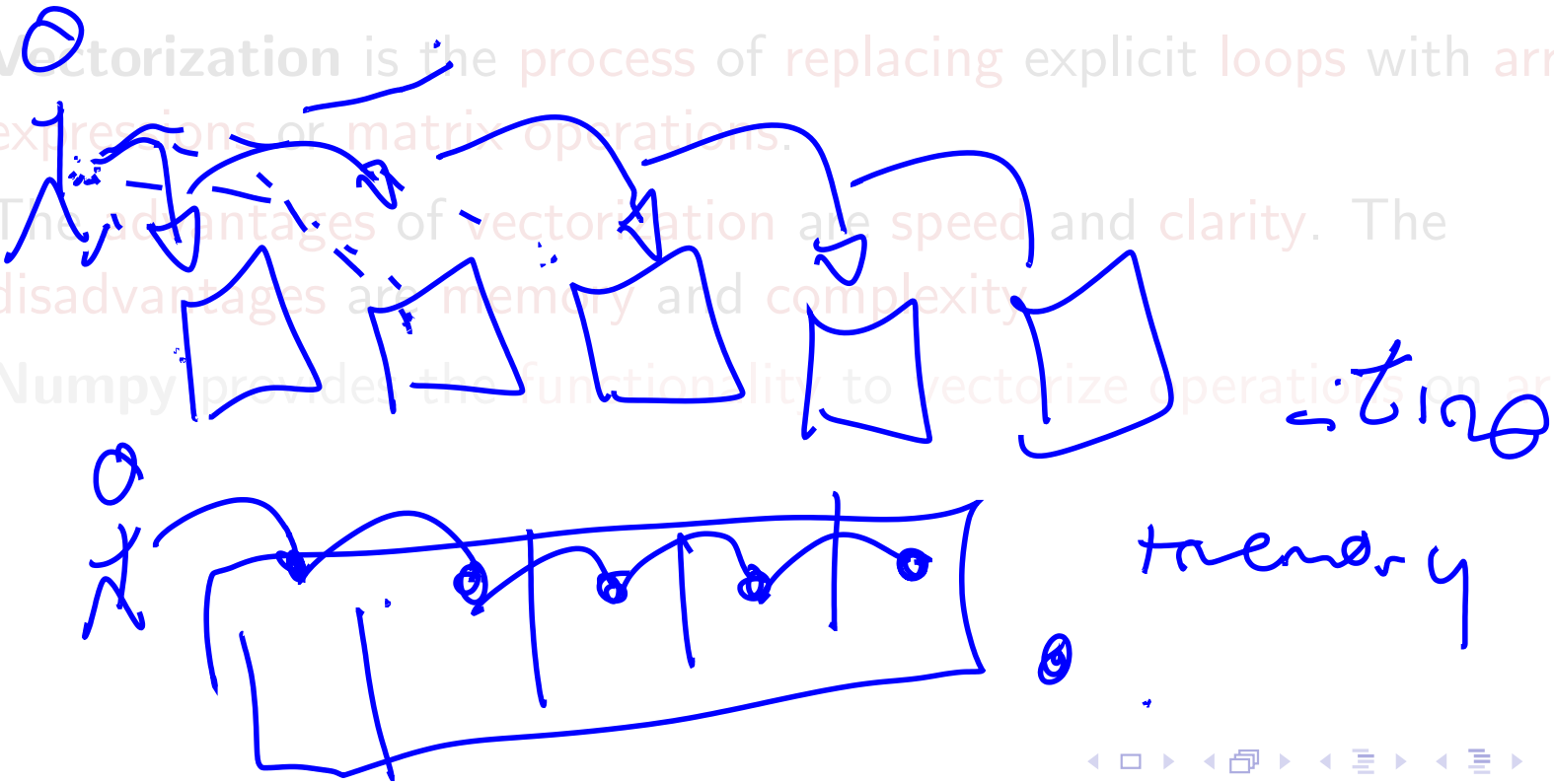

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- **Vectorization** is the process of replacing explicit loops with array expressions or matrix operations.
- The advantages of vectorization are speed and clarity. The disadvantages are memory and complexity.
- **Numpy** provides the functionality to vectorize operations on arrays.

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Typical Operations with Numpy

- **Numpy** provides the functionality to create and manipulate arrays.
- **Numpy** provides the functionality to perform element-wise operations on arrays.
- **Numpy** provides the functionality to perform matrix operations on arrays.
- **Numpy** provides the functionality to perform linear algebra operations on arrays.
- **Numpy** provides the functionality to perform statistical operations on arrays.

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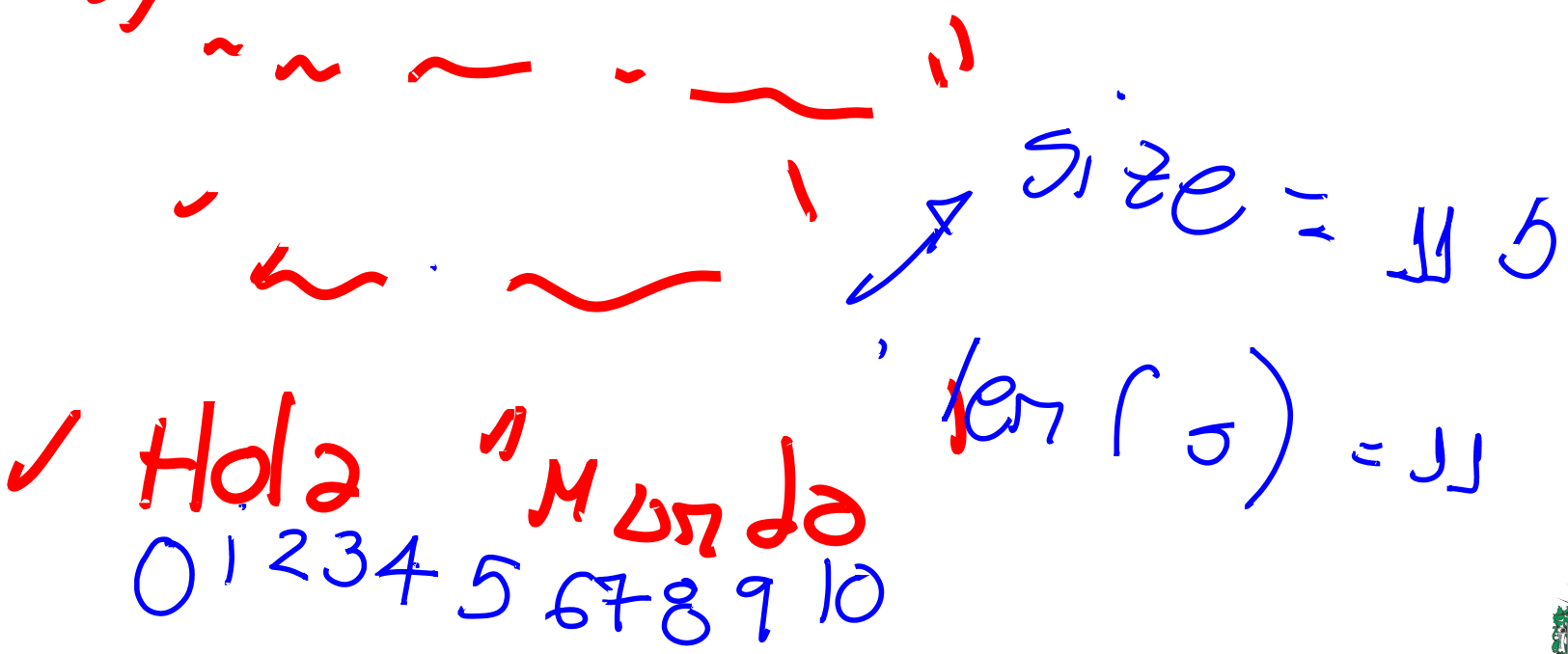
Strings in Python

Definition

A **string** is a *sequence* of *characters*. In Python, a *string* is a *sequence* of *Unicode characters*; also, *strings* are *immutable*, *ordered*, *iterable*, *indexable*,and *slicable*.



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Conditionals and Loops with Strings

- **Strings** can be compared using conditional statements.
- You could validate if a substring is contained in a **string**.
- You could iterate over the characters of a **string**.

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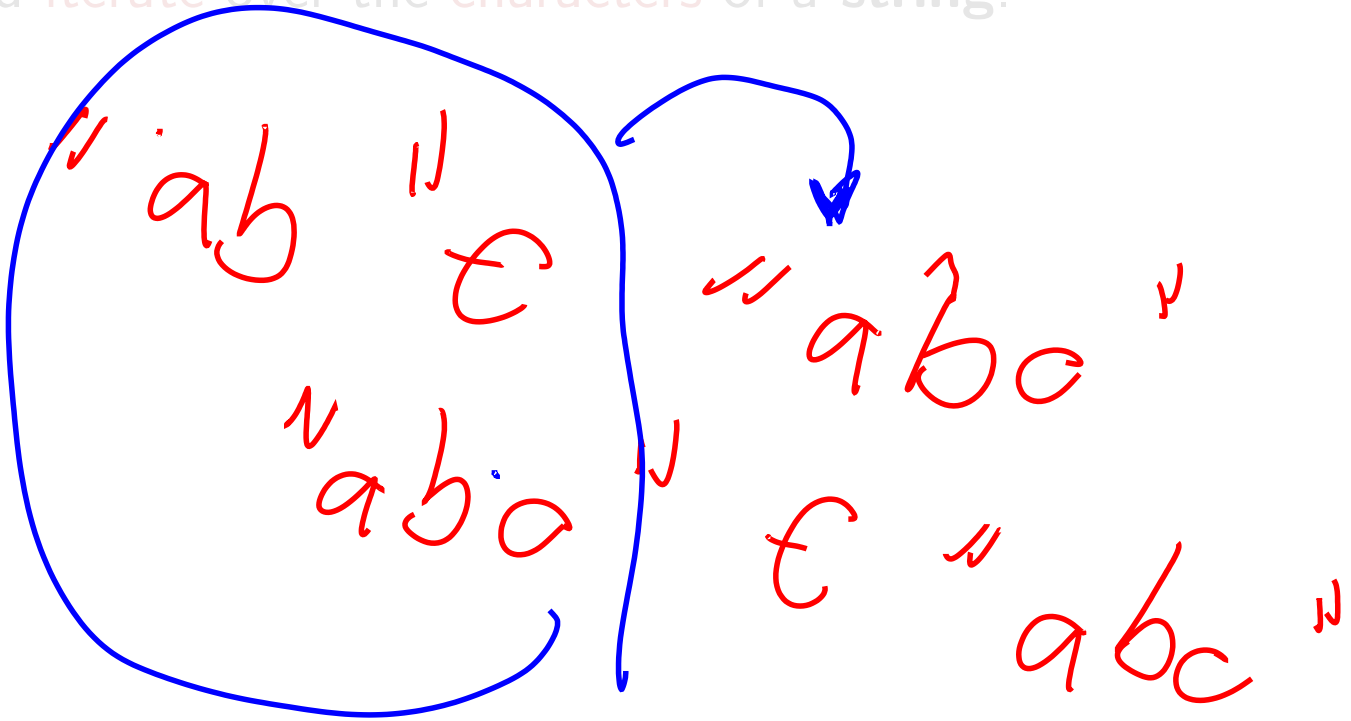

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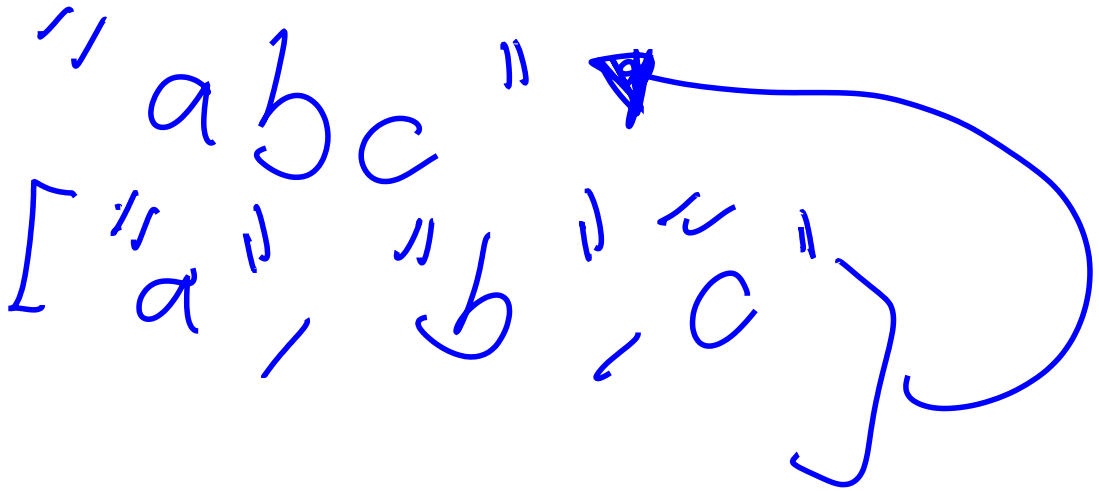

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Python Built-in Functions for Strings

- You could concatenate strings using the + operator.
- You could repeat a string using the * operator.
- You could format a string using the format() method.
- You could split a string using the split() method.
- You could join a list of strings using the join() method.
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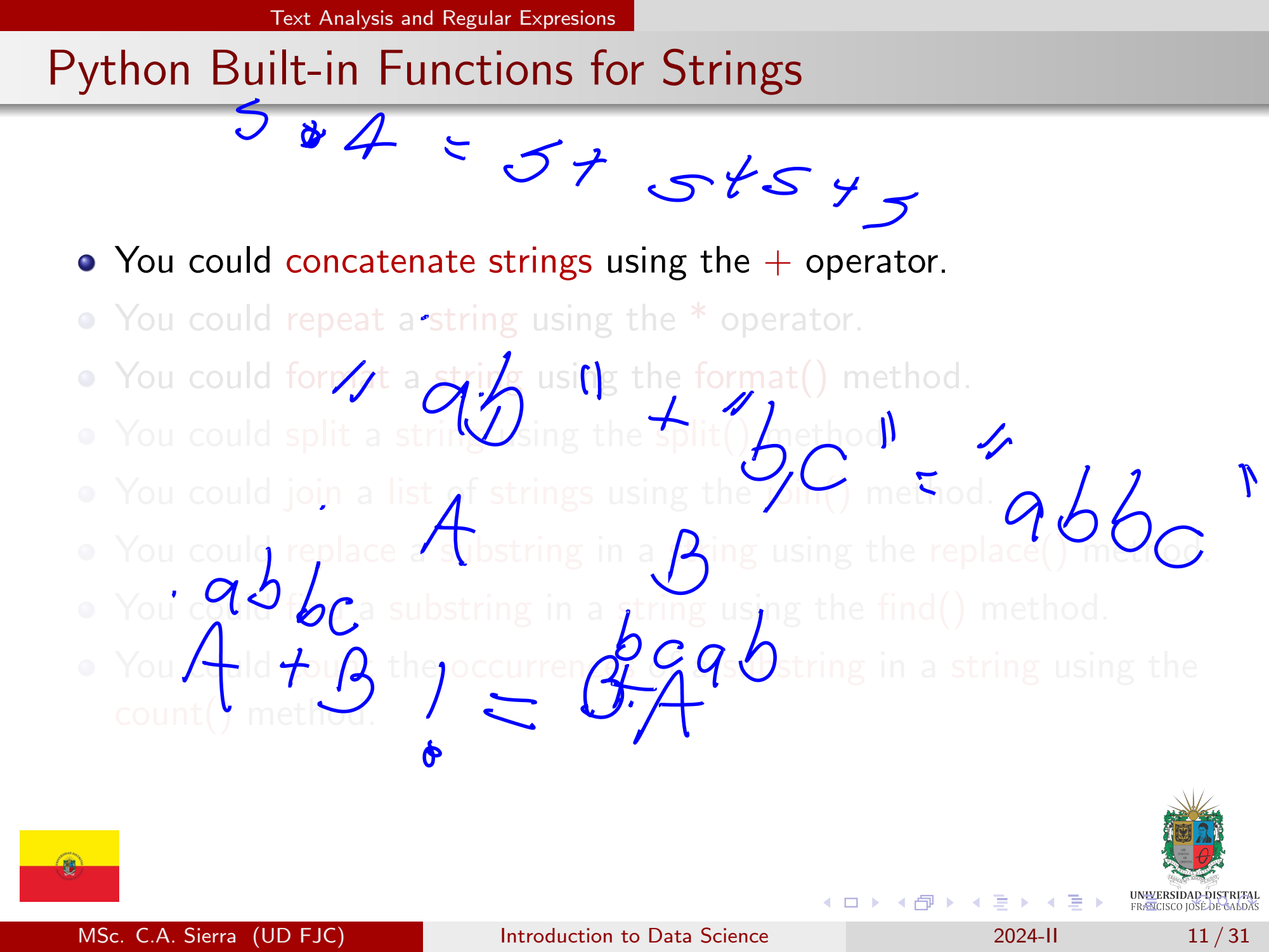

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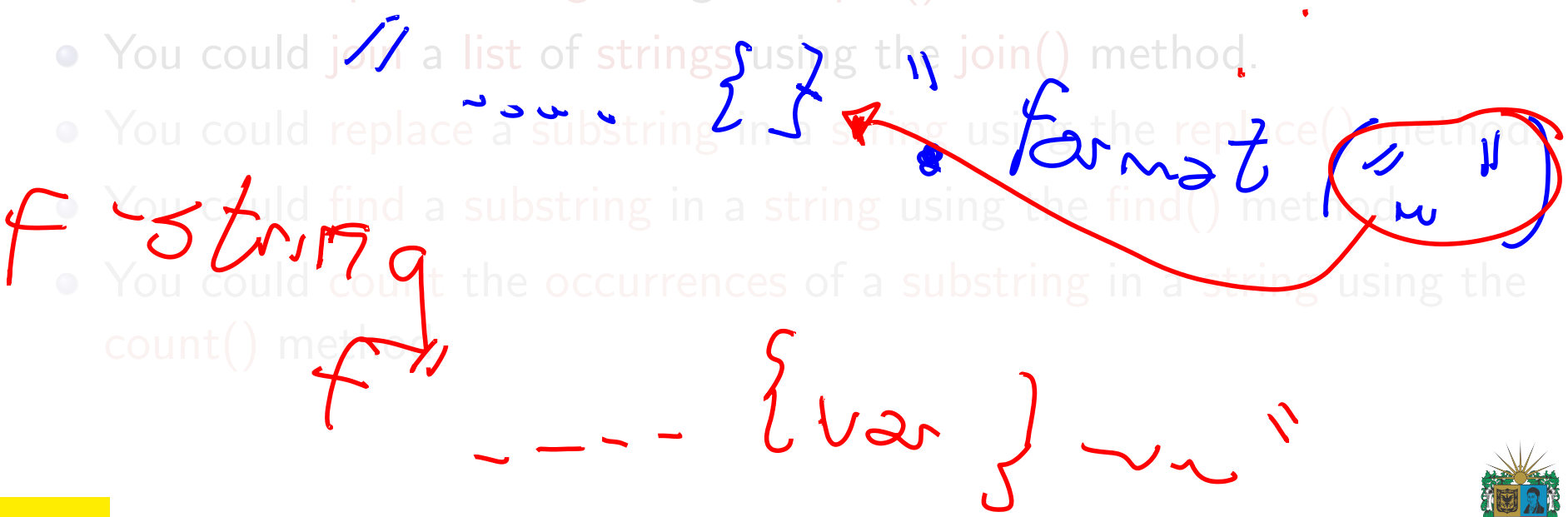

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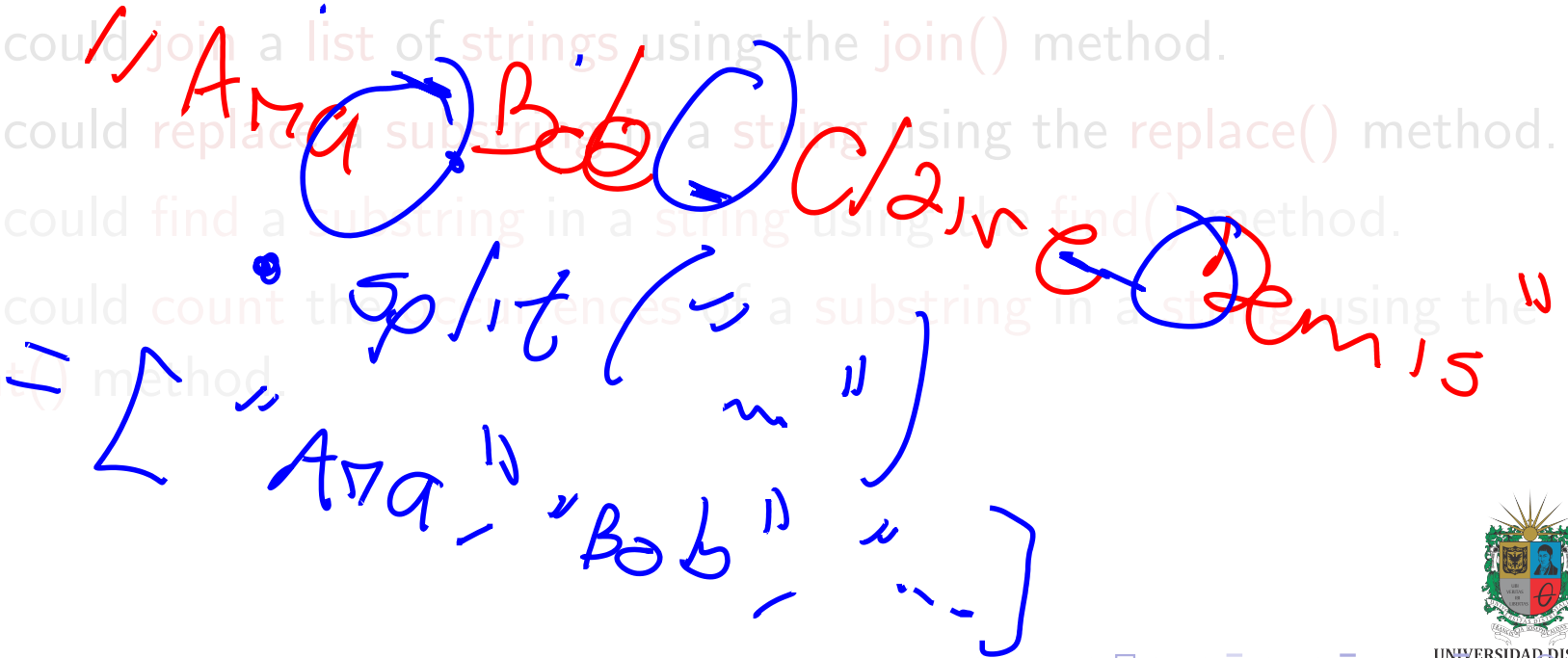

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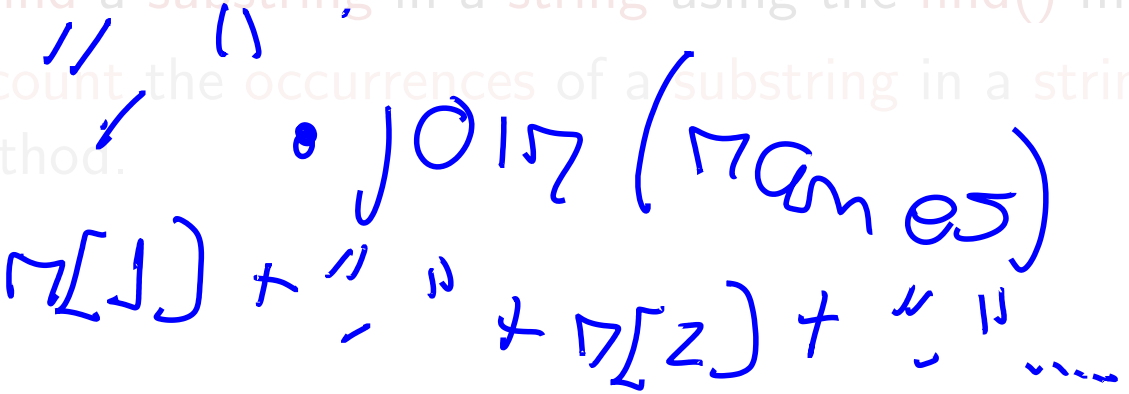

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"abc" => replace('a', 'A')

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Python Dates and Times

- **Python** provides the datetime module to work with dates and times.
- The datetime module provides the datetime class to work with dates and times.
- To create a datetime object, you could use the datetime() constructor.
- The datetime class provides the strftime() method to format a datetime object.
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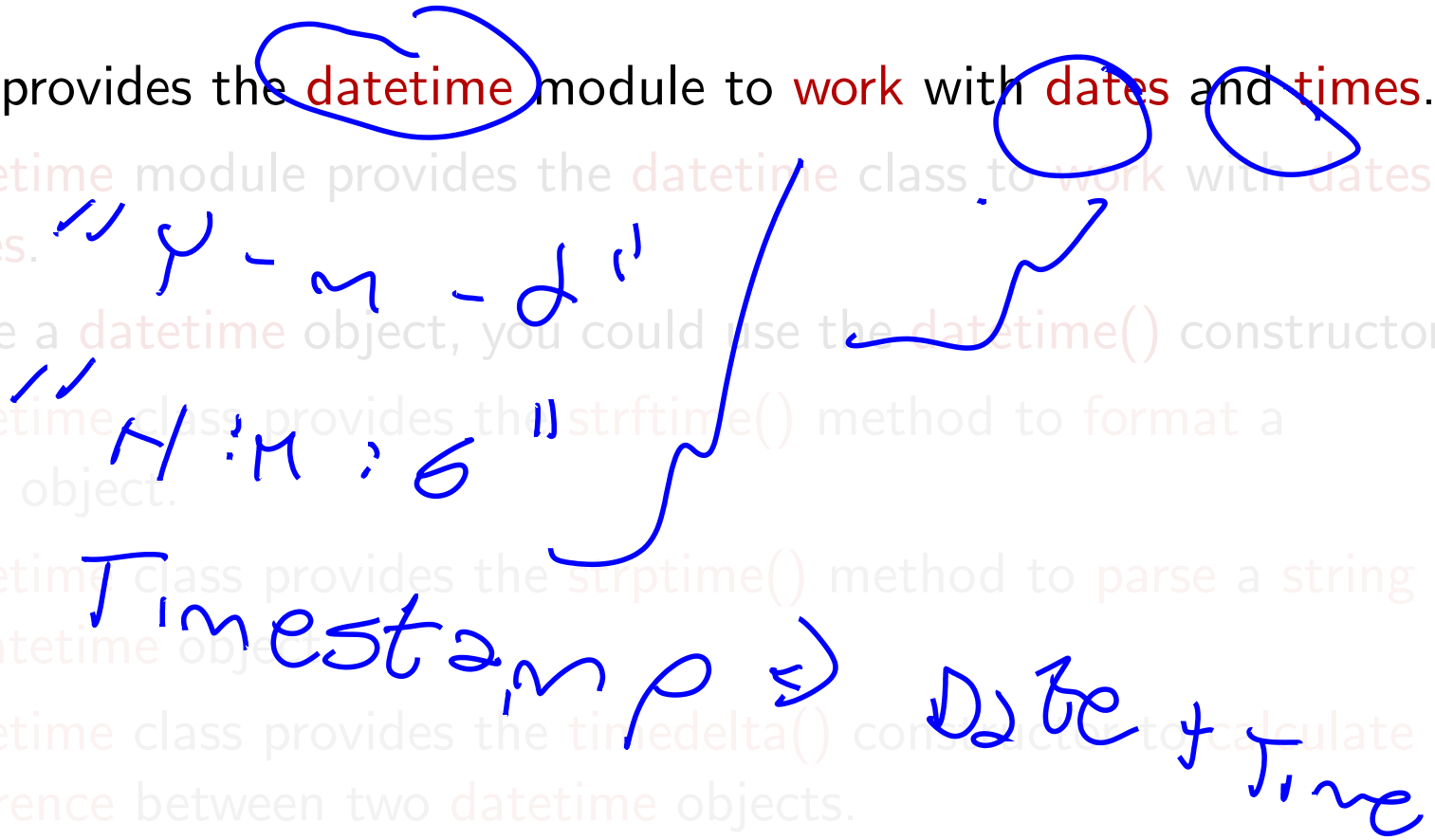

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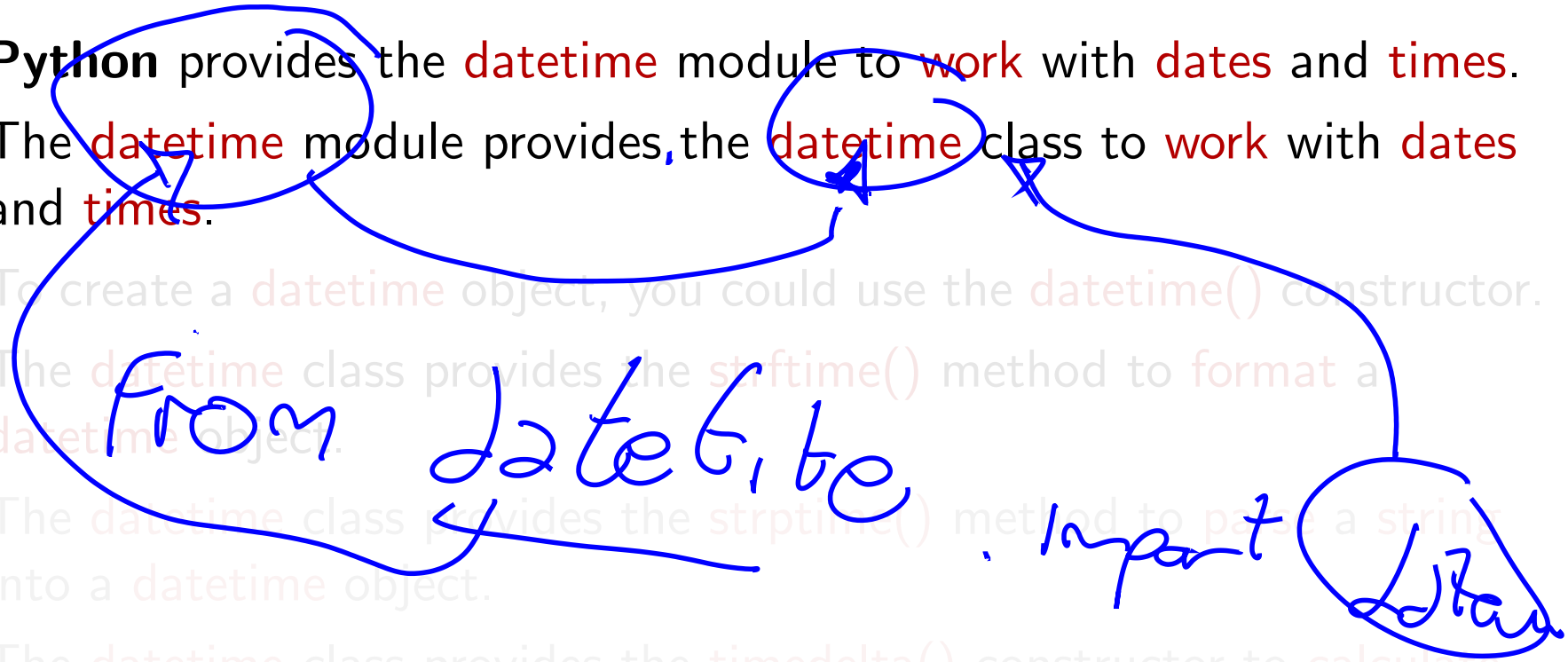

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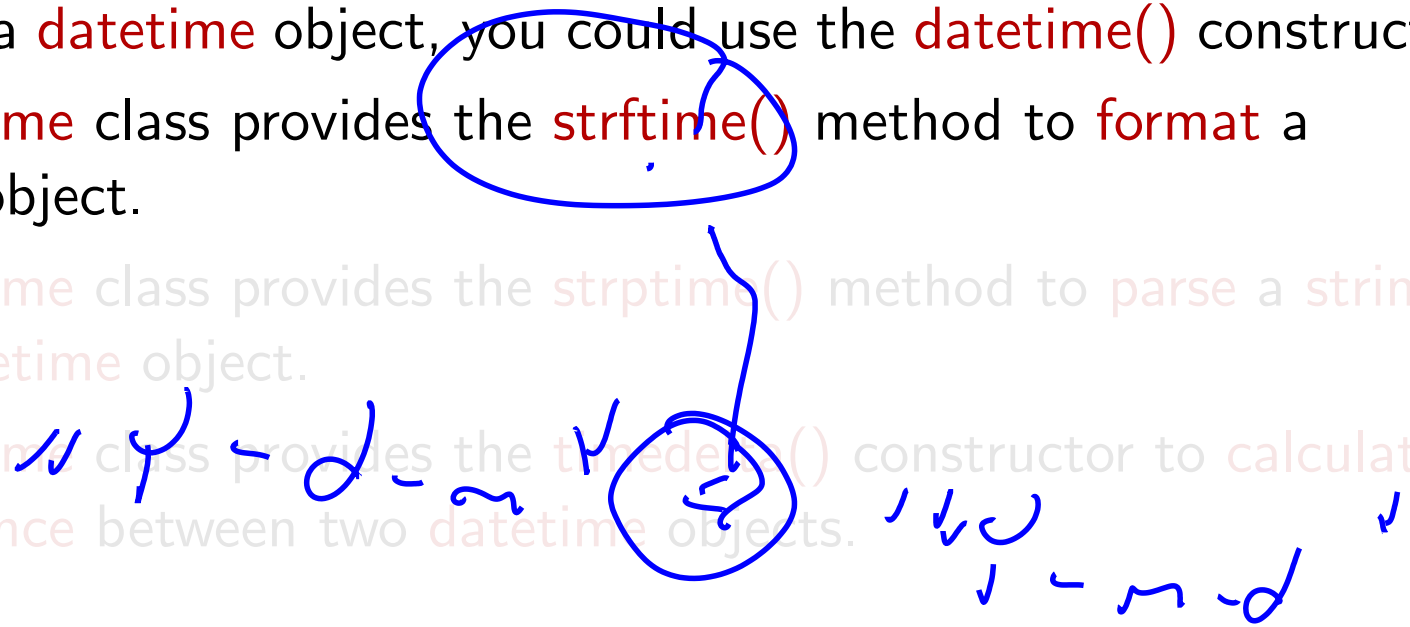

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Regular Expressions — ReGex

- A **regular expression** is a sequence of characters that define a search pattern.
- **Regular expressions** are used to search for patterns in strings.
- In **Python**, the re module provides the functionality to work with regular expressions.
- The re module provides the compile() function to compile a regular expression pattern.
- The re module provides the search() function to search for a pattern in a string.

"a" "b"

"[ab][0-9]*"

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Introduction to Pandas

- **Pandas** is a fast, powerful, flexible, and easy-to-use open-source data manipulation and data analysis library built on top of the Python programming language.
- **Pandas** is a high-level data manipulation tool developed by Wes McKinney in 2008.
- **Pandas** is a fast and efficient data manipulation tool that is built on top of NumPy.
- **Pandas** is one of the most popular and widely-used data manipulation libraries in the world.

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The "Series" Data Structure

- A **Series** is a one-dimensional array-like object that contains a sequence of values and an associated array of data labels, called the index.
- The index of a **Series** is an array of labels that correspond to the values in the **Series**. The index of a **Series** is an optional parameter that defaults to a sequence of integers starting at zero.
- The **Series** object is a core data structure in **Pandas**.

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Basic Statistical Testing

You could perform statistical tests as:

- t-tests using the ttest_ind() method from the scipy library.
- ANOVA using the f_oneway() method from the scipy library.
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Goodhart's Law

Definition

When a measure becomes a target, it ceases to be a good measure.

Outline

Thanks!

Questions?

Repo: *https://github.com/EngAndres/ud-public/tree/main/courses/data-science-introduction*

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