

# Learn Data Science in Python

Matrix and Data Frame

Feb 11, 2017

# Welcome!

February 4

1

Setup & Basics

February 11

2

Matrix & Data Frame

February 18

3

Loop & Function

February 25

4

Statistical Methods

March 4

5

Report & Data Viz

# Welcome!

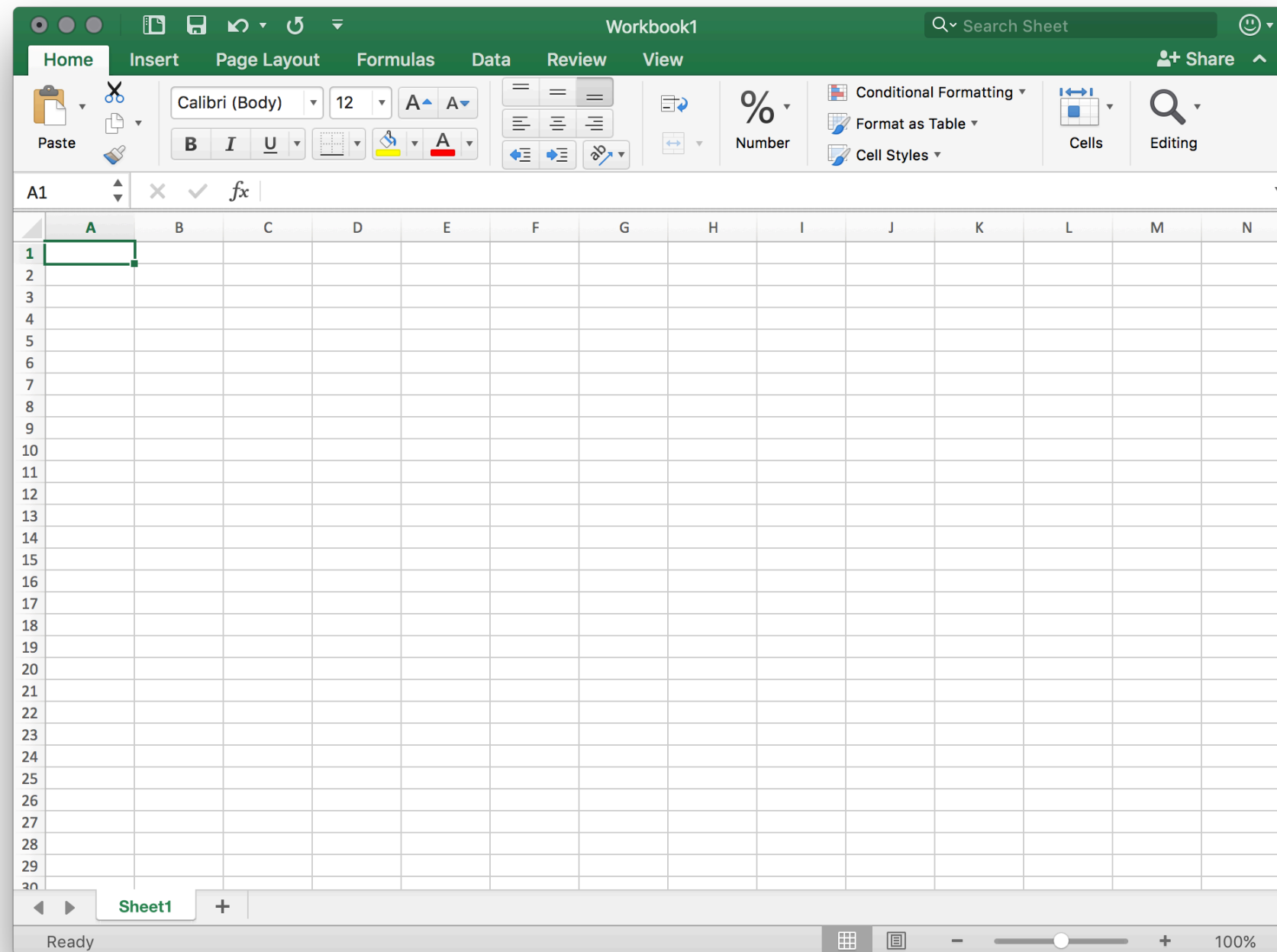
What we've learned previously:

How to assign variables

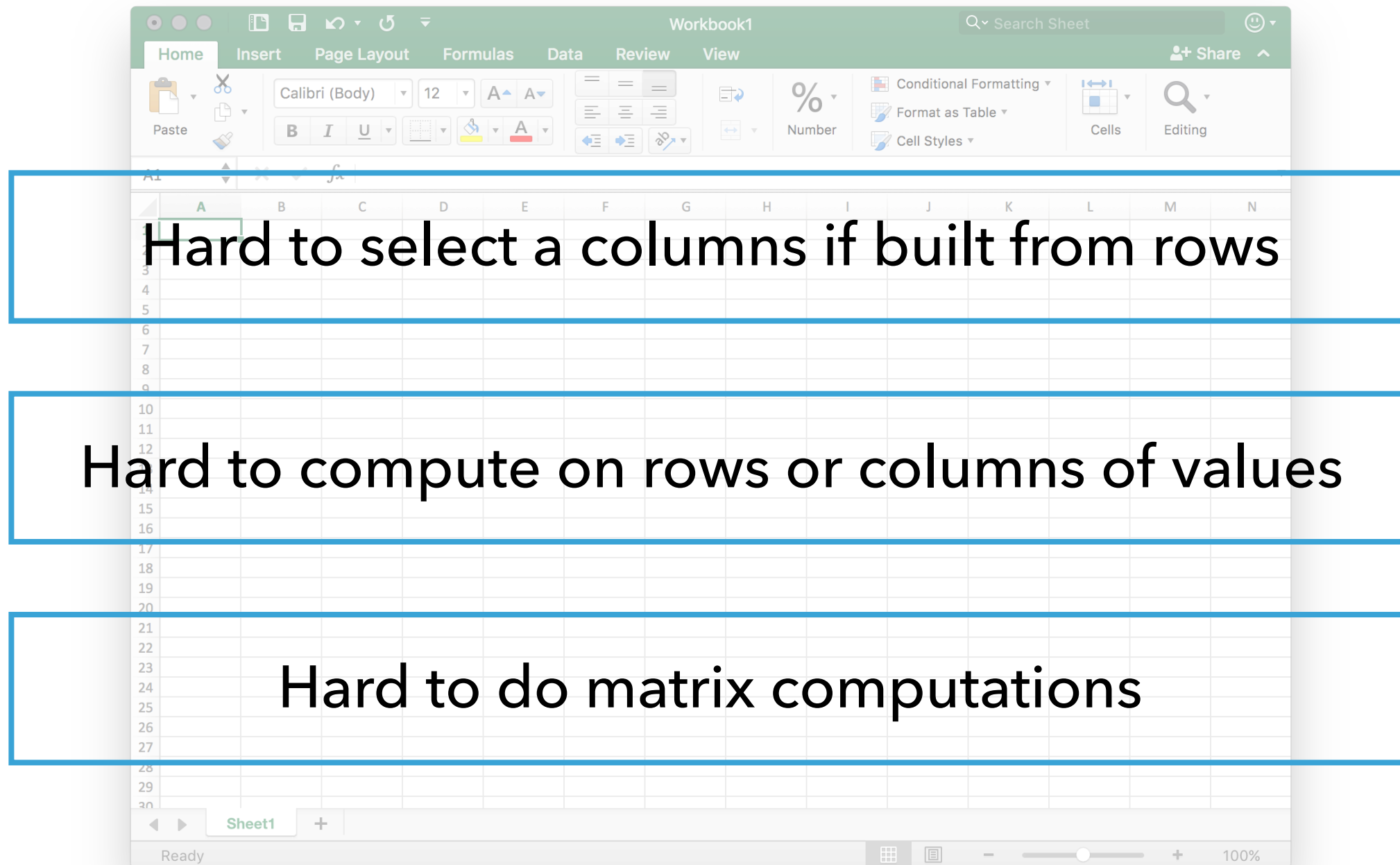
How to calculate numbers

How to manipulate strings and lists

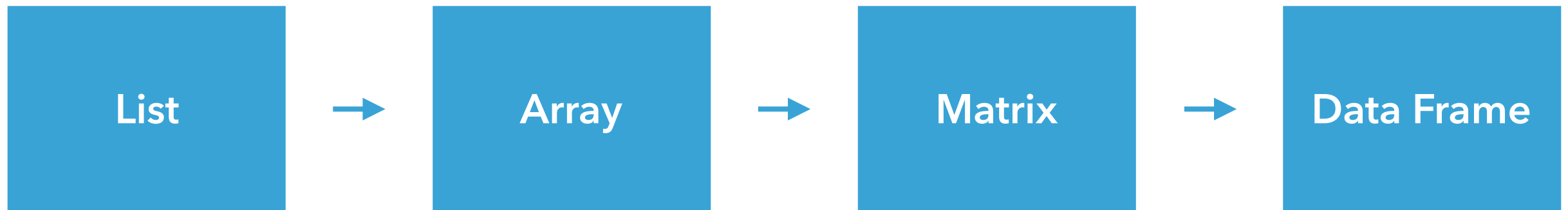
# How Far Ahead?



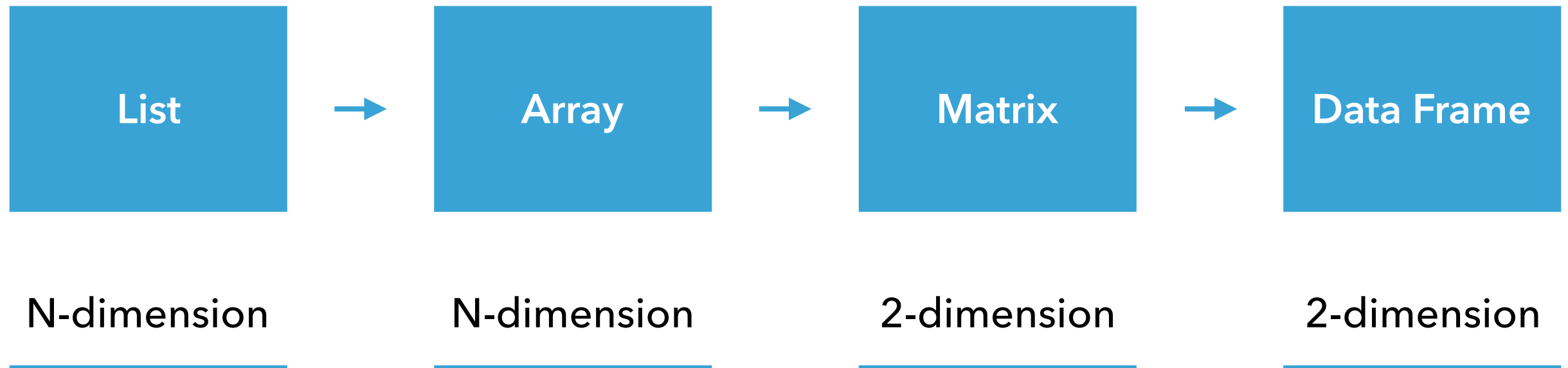
# How Far Ahead?



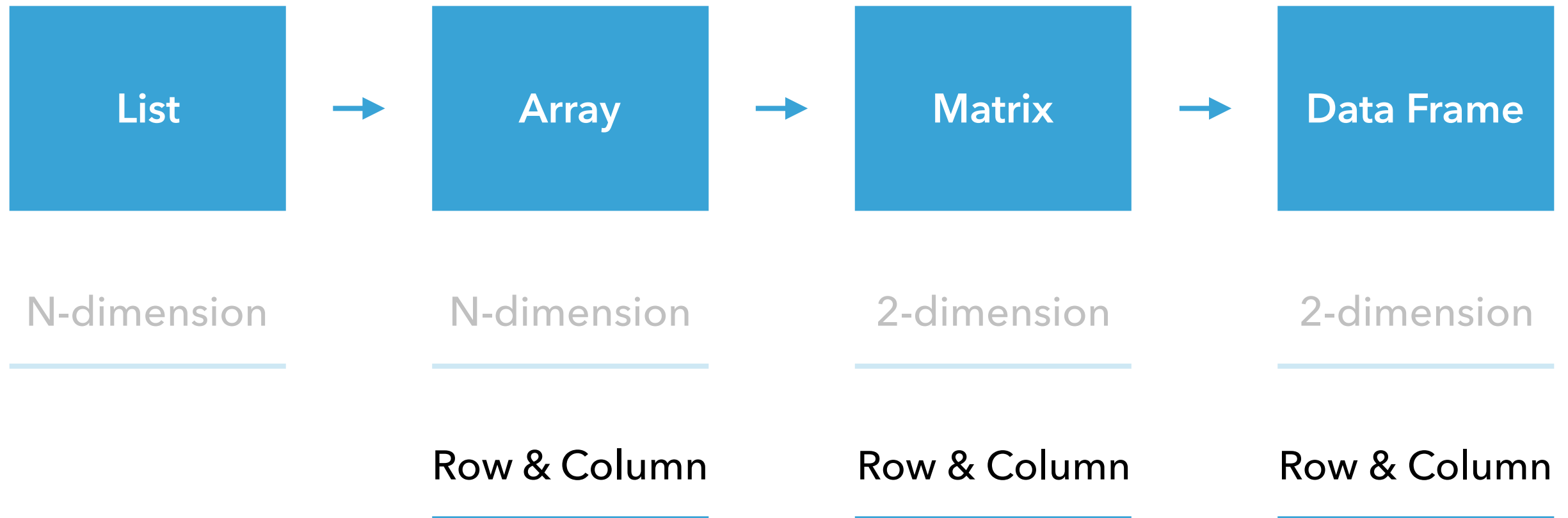
# Let's Move On



# Let's Move On

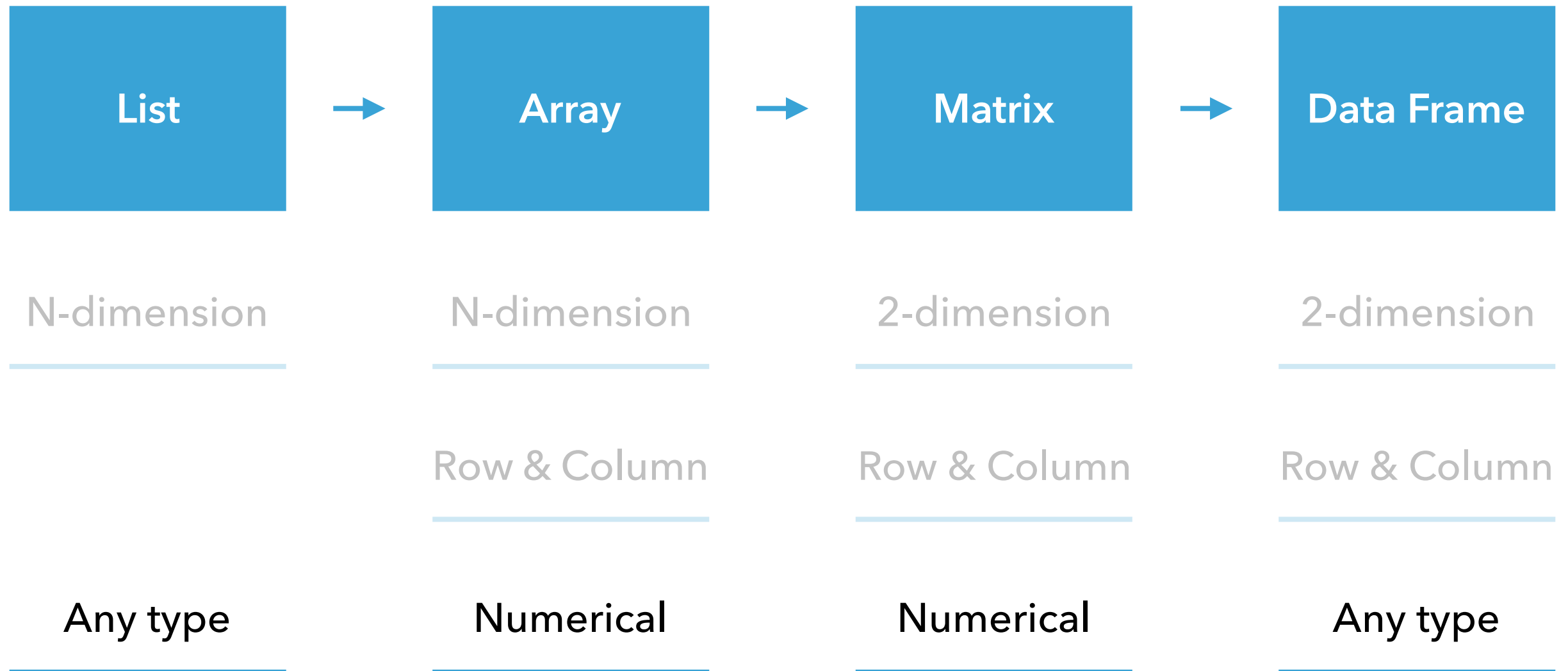


# Let's Move On

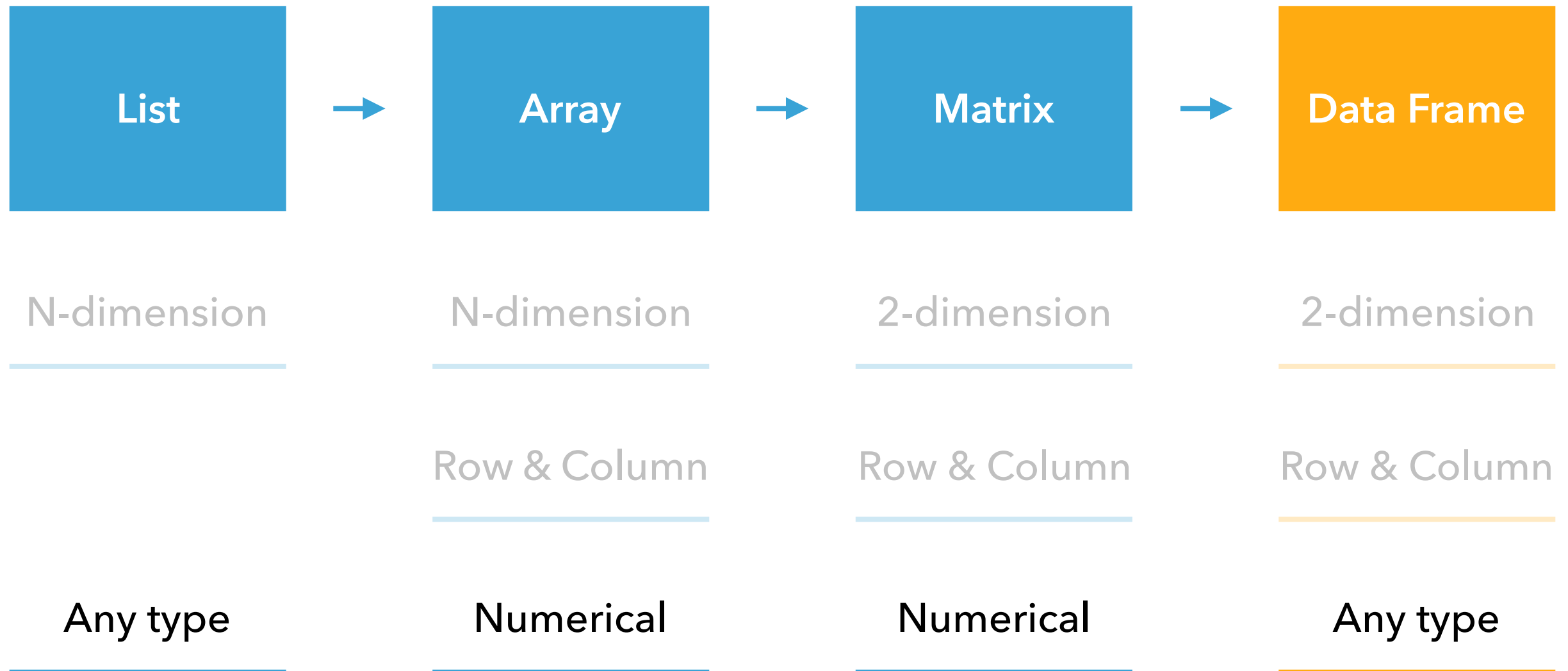




# Let's Move On



# Let's Move On



## **Array & Matrix**

After converting a list with numeric values to a array or matrix, we can do the indexing and calculations in terms of columns or rows.

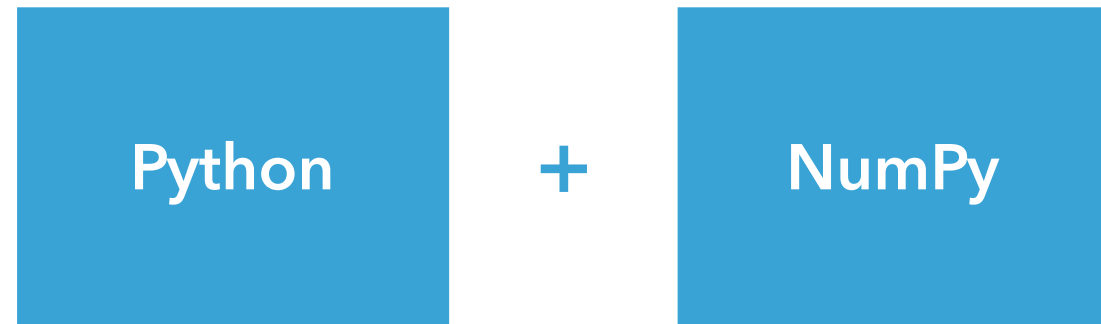
# NumPy

Python

+

NumPy

# NumPy



- Array and Matrix
- Useful statistical tools
- A solid foundation for other pkgs

# NumPy

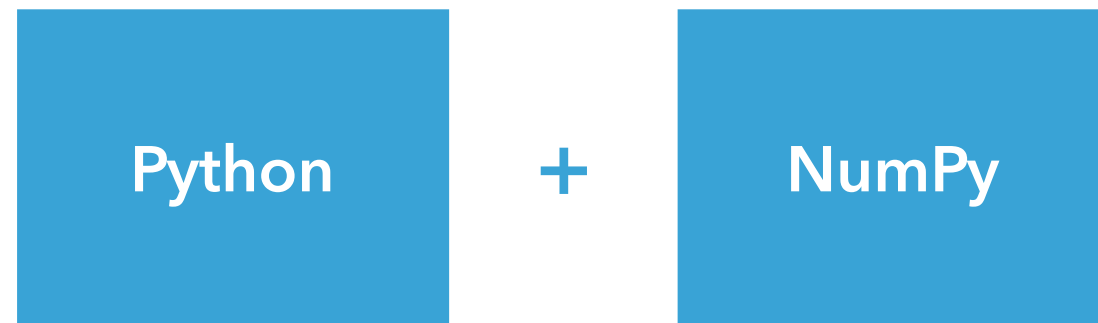
Python

+

NumPy

- Array and Matrix
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# NumPy



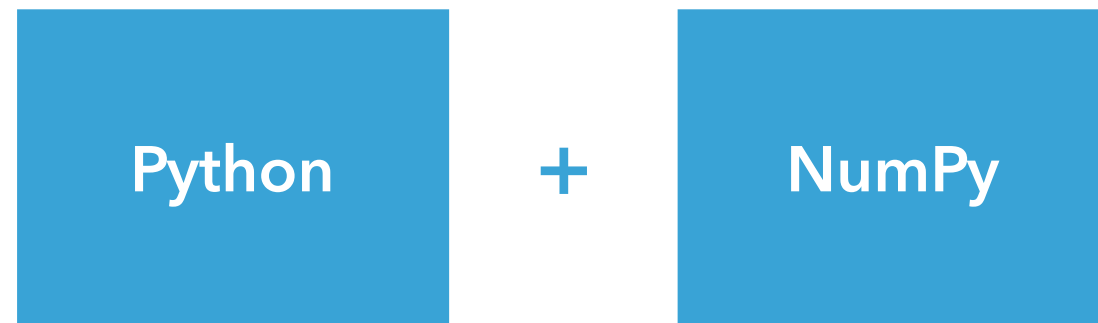
- Array and Matrix
- Useful statistical tools
- A solid foundation for other pkgs

`numpy.ndarray`

↓↑ 2D

`numpy.matrix`

# NumPy



- Array and Matrix
- Useful statistical tools
- A solid foundation for other pkgs

`numpy.ndarray`

↓↑ 2D

`numpy.matrix`

- Matrix calculation
- Subset an array/matrix by using row and column
- Basic manipulation



# Index, Slice, Subset

	Col 0	1	2	3
Row 0				
1				
2				
3				

`A[ row , col ]`

# Index, Slice, Subset

	Col 0	1	2	3
Row 0				
1				
2				
3				

`A[row,col]`

`A[0]`

# Index, Slice, Subset

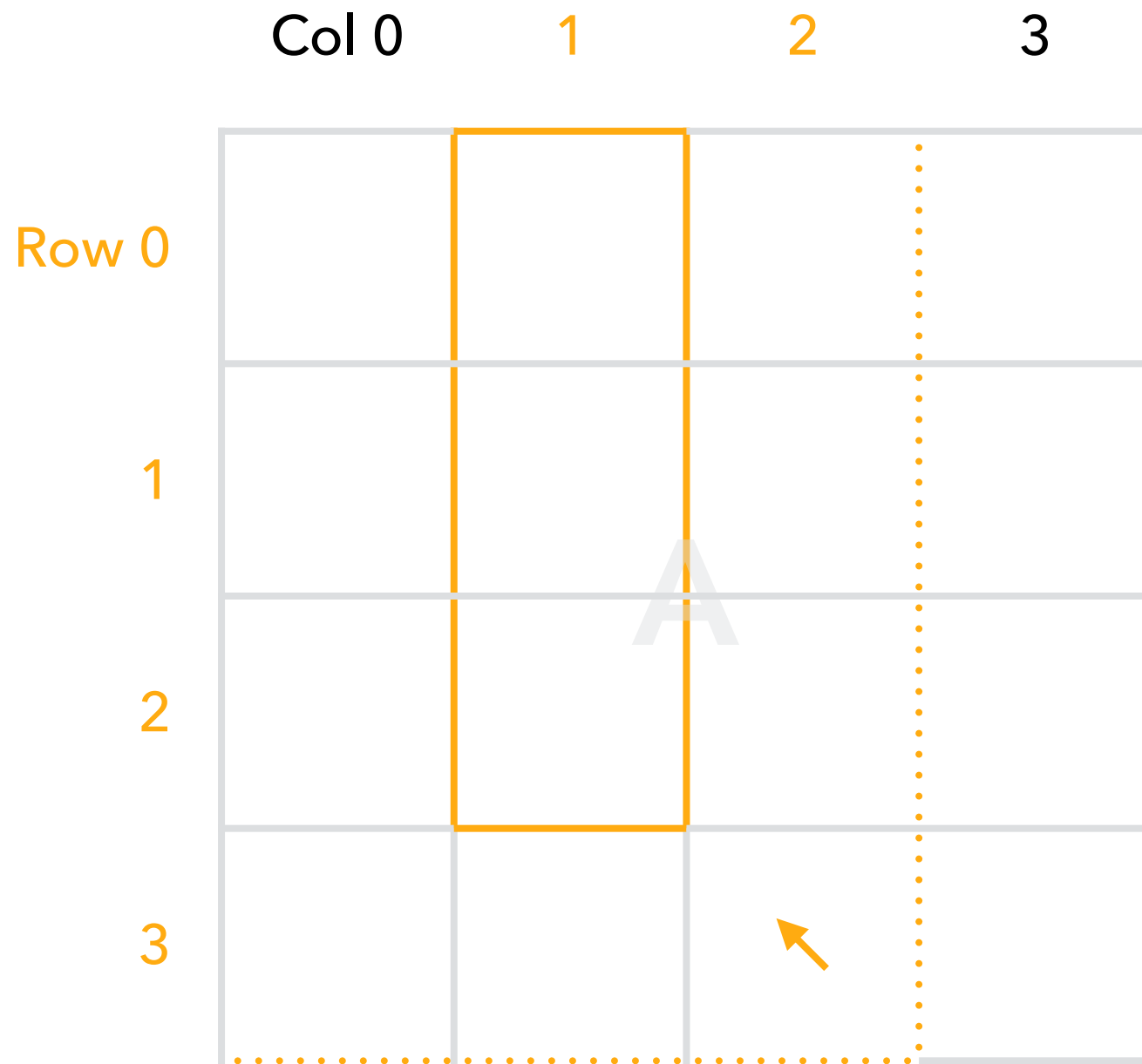
	Col 0	1	2	3
Row 0				
1				
2				
3				

`A[row,col]`

`A[0]`

`A[2,2]`

# Index, Slice, Subset



`A[row,col]`

`A[0]`

`A[2,col]`

`A[0:3,col]`

# Index, Slice, Subset

	Col 0	1	2	3
<u>Row 0</u>				
1				
2				
3				

`A[row,col]`

`A[0]`

`A[2,2]`

`A[0:3,1:2]`

`A[0:3:2,1]`

# Index, Slice, Subset

	Col 0	1	2	3
Row 0				
1				
2				
3				

`A[row,col]`

`A[0]`

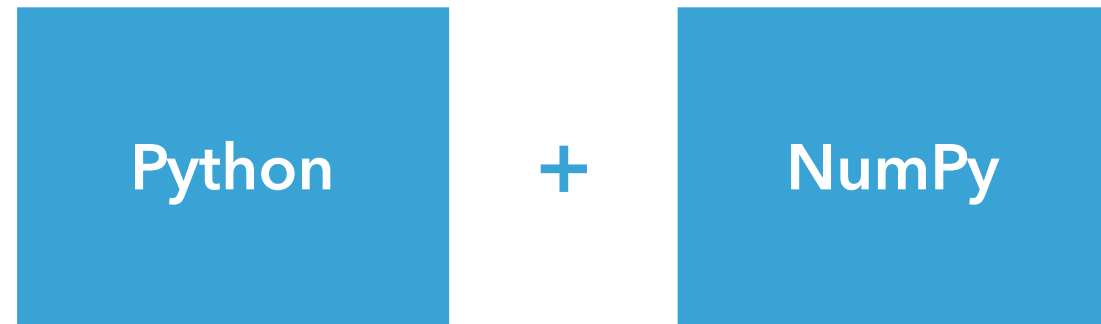
`A[2,2]`

`A[0:3,1:2]`

`A[0:3:2,1]`

`A[:,1]`

# Before We Move



- Array and Matrix
- Useful statistical tools
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# Before We Move

Python

+

NumPy

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Random Sampling

Summarize the Data



# Before We Move

Python

+

NumPy

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Random Sampling

Summarize the Data

- SciPy.org
  - Random sampling (numpy.random)
- *Python Data Science Handbook*
  - Computation on NumPy Arrays: Universal Functions
  - Aggregations: Min, Max, and Everything In Between
- Python-Course.eu
  - Python, Random Numbers and Probability



## Data Frame

After knowing how to assign values of different data types and index, slice or subset data, we are able to deal with data frame in the most natural way.

# Pandas and Data Frame

```
numpy.ndarray
```

```
pandas.DataFrame
```

# Pandas and Data Frame

`numpy.ndarray`

	Col 0	1	2	3
Row 0				
1				
2				
3				

`pandas.DataFrame`

	Var A	B	C	D
Obs 1				
2				
3				
4				

# Pandas and Data Frame

`numpy.ndarray`

	Col 0	1	2	3
Row 0				
1				
2				
3				

`pandas.DataFrame`

	Var A	B	C	D
Obs 1				
2				
3				
4				

# Pandas and Data Frame

`numpy.ndarray`

	Col 0	1	2	3
Row 0				
1				
2				
3				

`pandas.DataFrame`

	Var A	B	C	D
Obs 1				
2				
3				
4				

# Pandas and Data Frame

`numpy.ndarray`

	Col 0	1	2	3
Row 0				
1				
2		number		
3				

`pandas.DataFrame`

	Var A	B	C	D
Obs 1				
2				
3		any type		
4				

# Pandas and Data Frame

`numpy.ndarray`

`pandas.DataFrame`

	Col 0	1	2	3
Row 0				
1	Numerical Calculation			
2				
3				

	Var A	B	C	D
Obs 1				
2	Data Analysis			
3				
4				



# Index, Slice, Subset

	Var A	B	C	D
Obs 1				
2				
3				
4				

# Index, Slice, Subset

	Var A	B	C	D
Obs 1				
2				
3				
4				

Index

[ 1 , 1 ]

Label

[ 2 , B ]

# Index, Slice, Subset

	Var A	B	C	D
Obs 1				
2				
3				
4				

Index	[ 1 , 1 ]
-------	-----------

Label	[ 2 , B ]
-------	-----------

`D.loc[ 2 , B ]`

`D.iloc[ 1 , 1 ]`

`D.ix[ 2 , B ]`

# Dictionary

	Latitude	Longitude
Los Angeles	34.0207504	-118.6919233
San Luis Obispo	35.2725611	-120.7054056
San Francisco	37.757815	-122.5076402
San Jose	37.2972061	-121.9574961

# Dictionary

	Latitude	Longitude
Los Angeles	34.0207504	-118.6919233
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San Francisco	37.757815	-122.5076402
San Jose	37.2972061	-121.9574961

List  
Index  
Column

Dictionary

# Dictionary

Key & Value	Latitude	Longitude
Los Angeles	34.0207504	-118.6919233
San Luis Obispo	35.2725611	-120.7054056
San Francisco	37.757815	-122.5076402
San Jose	37.2972061	-121.9574961

- Create dictionaries for each **column**: { 'key' : value }

# Dictionary

	Latitude	Longitude
Los Angeles	34.0207504	-118.6919233
San Luis Obispo	35.2725611	-120.7054056
San Francisco	37.757815	-122.5076402
San Jose	37.2972061	-121.9574961

- Create dictionaries for each column: `{ 'key' : value }`
- Use `pd.Series ( )` and combine them into another dictionary

# Dictionary

	Latitude	Longitude
Los Angeles	34.0207504	-118.6919233
San Luis Obispo	35.2725611	-120.7054056
San Francisco	37.757815	-122.5076402
San Jose	37.2972061	-121.9574961

- Create dictionaries for each column: `{ 'key' : value }`
- Use `pd.Series()` and combine them into another dictionary
- Use `pd.DataFrame()` to create a data frame



# More About Data Frame

	Latitude	Longitude
Los Angeles	34.0207504	-118.6919233
San Luis Obispo	35.2725611	-120.7054056
San Francisco	37.757815	-122.5076402
San Jose	37.2972061	-121.9574961

Different Data Types

Convenient Methods

- PyData.org
  - 10 Minutes to pandas
  - Merge, join, and concatenate
- *Python Data Science Handbook*
  - Data Indexing and Selection
- Greg Reda
  - Intro to pandas data structures



## Lab: Import

Normally we don't create but import data to our working space, so here's how you can work like a data scientist.