Pandas tutorials

What is Pandas?

Pandas is one of the most important libraries of Python. Pandas has data structures for data analysis. The most used of these are Series and DataFrame data structures. Series is one dimensional, that is, it consists of a column. Data frame is two-dimensional, i.e. it consists of rows and columns.

To install Pandas, you can use "pip install pandas"

Jupyter for beginners

Links: https://daily.dev/blog/jupyter-for-beginners#:~:text=Here%27s%20a%20quick%20guide%20to%20get%20you%20started%3A,Dive%20into%20writing%20and%20running%20code.%20More%20items

Pandas First Steps

Install and import

Pandas is an easy package to install. Open up your terminal program (for Mac users) or command line (for PC users) and install it using either of the following commands:

conda install pandas

OR

pip install pandas

Alternatively, if you're currently viewing this article in a Jupyter notebook you can run this cell:

!pip install pandas

Now to the basic components of pandas

Core components of pandas: Series and DataFrames

The primary two components of pandas are the Series and DataFrame.

A Series is essentially a column, and a DataFrame is a multi-dimensional table made up of a collection of Series.

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Series

DataFrame

	apples
0	3
1	2
2	0
3	1

	oranges
0	0
1	3
2	7
3	2

	apples	oranges
0	3	0
1	2	3
2	0	7
3	1	2

Series

Series

DataFrame

	apples
0	3
1	2
2	0
3	1

	oranges
0	0
1	3
2	7
3	2

	apples	oranges
0	3	0
1	2	3
2	0	7
3	1	2

Installation of Pandas

+

!pip install pandas

Requirement already satisfied: pandas in c:\users\rmnjs\appdata\local\programs\python\python39\lib\site-packages (2.1.1)

Requirement already satisfied: numpy>=1.22.4 in c:\users\rmnjs\
appdata\local\programs\python\python39\lib\site-packages (from pandas)
(1.26.0)

Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\rmnjs\appdata\local\programs\python\python39\lib\site-packages (from pandas) (2.8.2)

Requirement already satisfied: pytz>=2020.1 in c:\users\rmnjs\appdata\local\programs\python\python39\lib\site-packages (from pandas) (2023.3.post1)

Requirement already satisfied: tzdata>=2022.1 in c:\users\rmnjs\appdata\local\programs\python\python39\lib\site-packages (from pandas) (2023.3)

Requirement already satisfied: six>=1.5 in c:\users\rmnjs\appdata\

```
local\programs\python\python39\lib\site-packages (from python-
dateutil>=2.8.2->pandas) (1.16.0)

[notice] A new release of pip is available: 23.3.1 -> 24.2
[notice] To update, run: python.exe -m pip install --upgrade pip
```

Upgrade the pip package manager

```
pip install --upgrade pip
Requirement already satisfied: pip in c:\users\rmnjs\appdata\local\
programs\python\python39\lib\site-packages (23.3.1)
Collecting pip
 Downloading pip-24.2-py3-none-any.whl.metadata (3.6 kB)
Downloading pip-24.2-py3-none-any.whl (1.8 MB)
   ----- 0.0/1.8 MB ? eta -:--:--
  ----- 0.6/1.8 MB 13.8 MB/s eta
0:00:01
                        ----- 1.8/1.8 MB 23.1 MB/s eta
0:00:00
Installing collected packages: pip
 Attempting uninstall: pip
   Found existing installation: pip 23.3.1
   Uninstalling pip-23.3.1:
     Successfully uninstalled pip-23.3.1
Successfully installed pip-24.2
Note: you may need to restart the kernel to use updated packages.
```

Import Pandas:

Once Pandas is installed, import it in your applications by adding the import keyword:

```
import pandas
```

Example

```
cars passings
0 BMW 3
1 Volvo 7
2 Ford 2
```

Pandas as pd:

Pandas is usually imported under the pd alias.

alias: In Python alias are an alternate name for referring to the same thing.

Create an alias with the as keyword while importing:

```
import pandas as pd
```

Now the Pandas package can be referred to as pd instead of pandas.

Example

Checking Pandas Version:

The version string is stored under version attribute.

```
#Example
import pandas as pd
```

```
print(pd.__version__)
2.1.1
```

What is a Series?

- A Pandas Series is like a column in a table.
- It is a one-dimensional array holding data of any type.

Example-

Create a simple Pandas Series from a list:

```
import pandas as pd
a = [1, 7, 2]
myvar = pd.Series(a)
print(myvar)
0    1
1    7
2    2
dtype: int64
```

Labels:

If nothing else is specified, the values are labeled with their index number. First value has index 0, second value has index 1 etc.

This label can be used to access a specified value.

```
# Example
# Return the first value of the Series:
print(myvar[0])
1
```

Create Labels:

With the index argument, you can name your own labels.

```
# Example
# Create your own labels:
import pandas as pd
a = [1, 7, 2]
myvar = pd.Series(a, index = ["A", "B", "C"])
print(myvar)
A     1
B     7
C     2
dtype: int64
```

When you have created labels, you can access an item by referring to the label.

Example:

Return the value of "y":

```
print(myvar["B"])
7
```

Key/Value Objects as Series:

You can also use a key/value object, like a dictionary, when creating a Series.

```
# Example-
# Create a simple Pandas Series from a dictionary:
import pandas as pd

calories = {"day1": 420, "day2": 380, "day3": 390}

myvar = pd.Series(calories)

print(myvar)
```

```
day1 420
day2 380
day3 390
dtype: int64
```

Note: The keys of the dictionary become the labels.

To select only some of the items in the dictionary, use the index argument and specify only the items you want to include in the Series.

DataFrames:

What is a DataFrame?

- A Pandas DataFrame is a 2 dimensional data structure, like a 2 dimensional array, or a table with rows and columns.
- Data sets in Pandas are usually multi-dimensional tables, called DataFrames.
- Series is like a column, a DataFrame is the whole table.

Example-

Create a DataFrame from two Series:

```
import pandas as pd
```

Locate Row:

- As you can see from the result above, the DataFrame is like a table with rows and columns.
- Pandas use the *loc* attribute to return one or more specified row(s)

Example-

Return row 0:

```
#refer to the row index:
print(myvar.loc[0])

calories    420
duration    50
Name: 0, dtype: int64
```

Note: This example returns a Pandas Series.

Example-

Return row 0 and 1:

```
#use a list of indexes:
print(myvar.loc[[0, 1]])

    calories duration
0     420     50
1     380     40
```

Note: When using list-[], the result is a Pandas DataFrame.

Named Indexes:

With the index argument, you can name your own indexes.

Locate Named Indexes:

Use the named index in the loc attribute to return the specified row(s).

Example-

Return "day2":

```
#refer to the named index:
print(df.loc["day2"])

calories    380
duration    40
Name: day2, dtype: int64
```

Pandas Read CSV

Read CSV Files:

- A simple way to store big data sets is to use CSV files (comma separated files).
- CSV files contains plain text and is a well know format that can be read by everyone including Pandas.
- In our examples we will be using a CSV file called 'data.csv'.

Link:

https://drive.google.com/file/d/10eJY42VtjD91oBQ8GmK50UZbKap8q 2DK/view?usp=sharing

```
# Example
# Load the CSV into a DataFrame:
import pandas as pd
df = pd.read csv('data.csv')
print(df.to string())
      Duration
                 Pulse
                         Maxpulse
                                     Calories
0
                   110
                                        409.1
            60
                               130
                                        479.0
1
            60
                   117
                               145
2
            60
                   103
                               135
                                        340.0
3
            45
                               175
                   109
                                        282.4
4
                                        406.0
            45
                   117
                               148
5
            60
                   102
                               127
                                        300.0
6
            60
                   110
                               136
                                        374.0
7
            45
                   104
                               134
                                        253.3
8
            30
                   109
                               133
                                        195.1
9
            60
                    98
                               124
                                        269.0
10
                                        329.3
                   103
                               147
            60
11
            60
                   100
                               120
                                        250.7
12
            60
                   106
                               128
                                        345.3
13
                               132
            60
                   104
                                        379.3
14
            60
                    98
                               123
                                        275.0
15
                    98
                               120
                                        215.2
            60
                   100
16
            60
                               120
                                        300.0
                    90
                               112
17
            45
                                          NaN
18
                   103
                               123
                                        323.0
            60
19
            45
                     97
                               125
                                        243.0
20
            60
                   108
                               131
                                        364.2
```

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58 20 153 172 226.4 59 45 123 152 321.0 60 210 108 160 1376.0 51 160 110 137 1034.4 52 160 109 135 853.0 53 45 118 141 341.0 54 20 110 130 131.4 55 180 90 130 800.4 56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	57	45	115	144	305.0		
50 210 108 160 1376.0 51 160 110 137 1034.4 52 160 109 135 853.0 53 45 118 141 341.0 54 20 110 130 131.4 55 180 90 130 800.4 56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	58	20	153	172	226.4		
50 210 108 160 1376.0 51 160 110 137 1034.4 52 160 109 135 853.0 53 45 118 141 341.0 54 20 110 130 131.4 55 180 90 130 800.4 56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	59	45	123	152	321.0		
51 160 110 137 1034.4 52 160 109 135 853.0 53 45 118 141 341.0 54 20 110 130 131.4 55 180 90 130 800.4 56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	60	210			1376.0		
52 160 109 135 853.0 53 45 118 141 341.0 54 20 110 130 131.4 55 180 90 130 800.4 56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	61						
53 45 118 141 341.0 54 20 110 130 131.4 55 180 90 130 800.4 56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	62						
54 20 110 130 131.4 55 180 90 130 800.4 56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	63						
55 180 90 130 800.4 56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	64						
56 150 105 135 873.4 57 150 107 130 816.0 58 20 106 136 110.4	65						
57 150 107 130 816.0 58 20 106 136 110.4	66						
58 20 106 136 110.4	67						
JJ JUU 14J 1JUU12							
	03	500	100	143	1300.2		

150 97 129 1115.0 60 109 153 387.6 90 100 127 700.0 150 97 127 953.2 45 114 146 304.0 90 98 125 563.2 45 105 134 251.0 45 110 141 300.0 120 100 130 500.4
90 100 127 700.0 150 97 127 953.2 45 114 146 304.0 90 98 125 563.2 45 105 134 251.0 45 110 141 300.0
150 97 127 953.2 45 114 146 304.0 90 98 125 563.2 45 105 134 251.0 45 110 141 300.0
45 114 146 304.0 90 98 125 563.2 45 105 134 251.0 45 110 141 300.0
90 98 125 563.2 45 105 134 251.0 45 110 141 300.0
45 105 134 251.0 45 110 141 300.0
45 110 141 300.0
120 100 130 500 <i>4</i>
120 100 150 500.4
270 100 131 1729.0
30 159 182 319.2
45 149 169 344.0
30 103 139 151.1
120 100 130 500.0
45 100 120 225.3
30 151 170 300.0
45 102 136 234.0
120 100 157 1000.1
45 129 103 242.0
20 83 107 50.3
180 101 127 600.1
30 90 107 105.3
15 80 100 50.5
20 150 171 127.4
20 151 168 229.4
30 95 128 128.2
25 152 168 244.2
30 109 131 188.2
90 93 124 604.1
20 95 112 77.7
90 90 110 500.0
90 90 100 500.0
90 90 100 500.4
30 92 108 92.7
30 93 128 124.0
180 90 120 800.3
30 90 120 86.2
90 90 120 500.3
210 137 184 1860.4
60 102 124 325.2
. 45 107 124 275.0
15 124 139 124.2
45 100 120 225.3
60 108 131 367.6
60 108 151 351.7
60 116 141 443.0
60 97 122 277.4
60 105 125 NaN
33 133 1131 Hull

119	60	103	124	332.7		
120	30	112	137	193.9		
121	45	100	120	100.7		
122	60	119	169	336.7		
123	60	107	127	344.9		
124	60	111	151	368.5		
125	60	98	122	271.0		
126	60	97	124	275.3		
127	60	109	127	382.0		
128	90	99	125	466.4		
129	60	114	151	384.0		
130	60	104	134	342.5		
131	60	107	138	357.5		
132	60	103	133	335.0		
133	60	106	132	327.5		
134	60	103	136	339.0		
135	20	136	156	189.0		
136	45	117	143	317.7		
137	45	115	137	318.0		
138	45	113	138	308.0		
139	20	141	162	222.4		
140	60	108	135	390.0		
141	60	97	127	NaN		
142	45	100	120	250.4		
143	45	122	149	335.4		
144	60	136	170	470.2		
145	45	106	126	270.8		
146	60	107	136	400.0		
147	60	112	146	361.9		
148	30	103	127	185.0		
149	60	110	150	409.4		
150	60	106	134	343.0		
151	60	109	129	353.2		
152	60	109	138	374.0		
153	30	150	167	275.8		
154	60	105	128	328.0		
155	60	111	151	368.5		
156	60	97	131	270.4		
157	60	100	120	270.4		
158	60	114	150	382.8		
159	30	80	120	240.9		
160	30	85	120	250.4		
161	45	90	130	260.4		
162	45	95	130	270.0		
163	45	100	140	280.9		
164	60	105	140	290.8		
165	60	110	145	300.0		
166	60	115	145	310.2		

107 75 120 150 520.4					
168 75 125 150 330.4	167	75	120	150	320.4
	168	75	125	150	330.4

Tip: use to_string() to print the entire DataFrame.

If you have a large DataFrame with many rows, Pandas will only return the first 5 rows, and the last 5 rows:

Example

Print the DataFrame without the to_string() method:

```
import pandas as pd
df = pd.read csv('data.csv')
print(df)
     Duration
                Pulse
                       Maxpulse Calories
0
                  110
                             130
                                      409.1
1
            60
                  117
                             145
                                      479.0
2
                             135
            60
                  103
                                      340.0
3
                  109
                             175
                                      282.4
            45
4
            45
                  117
                             148
                                      406.0
164
            60
                  105
                             140
                                      290.8
                  110
                             145
165
            60
                                      300.0
166
            60
                  115
                             145
                                      310.2
            75
                  120
                             150
                                      320.4
167
168
            75
                  125
                             150
                                      330.4
[169 rows x 4 columns]
```

max_rows:

The number of rows returned is defined in Pandas option settings.

You can check your system's maximum rows with the pd.options.display.max_rows statement.

Example-

Check the number of maximum returned rows:

```
import pandas as pd
print(pd.options.display.max_rows)
```

In my system the number is 60, which means that if the DataFrame contains more than 60 rows, the print(df) statement will return only the headers and the first and last 5 rows.

You can change the maximum rows number with the same statement.

Example-

Increase the maximum number of rows to display the entire DataFrame:

```
import pandas as pd
pd.options.display.max rows = 9999
df = pd.read csv('data.csv')
print(df)
                 Pulse
                         Maxpulse
                                     Calories
     Duration
0
            60
                    110
                               130
                                         409.1
1
            60
                    117
                               145
                                         479.0
2
            60
                    103
                               135
                                         340.0
3
            45
                    109
                               175
                                         282.4
4
            45
                    117
                               148
                                         406.0
5
                    102
                               127
            60
                                         300.0
6
            60
                    110
                               136
                                         374.0
7
            45
                    104
                               134
                                         253.3
8
            30
                    109
                               133
                                         195.1
9
                               124
            60
                    98
                                         269.0
10
                    103
            60
                               147
                                         329.3
11
                    100
                               120
            60
                                         250.7
12
            60
                    106
                               128
                                         345.3
13
            60
                    104
                               132
                                         379.3
                                         275.0
                     98
                               123
14
            60
15
            60
                     98
                               120
                                         215.2
                    100
16
            60
                               120
                                         300.0
17
            45
                     90
                               112
                                           NaN
18
                    103
                               123
            60
                                         323.0
                     97
19
            45
                               125
                                         243.0
20
            60
                    108
                               131
                                         364.2
21
            45
                    100
                               119
                                         282.0
22
            60
                    130
                               101
                                         300.0
23
                               132
            45
                    105
                                         246.0
24
                    102
                               126
                                         334.5
            60
25
                    100
                               120
                                         250.0
            60
```

26	60	92	118	241.0
27	60	103	132	NaN
28	60	100	132	280.0
29	60	102	129	380.3
30	60	92	115	243.0
31	45	90	112	180.1
32	60	101	124	299.0
33	60	93	113	223.0
34	60	107	136	361.0
35	60	114	140	415.0
36	60	102	127	300.0
37	60	100	120	300.0
38	60	100	120	300.0
39	45	104	129	266.0
40	45	90	112	180.1
41	60	98	126	286.0
42	60	100	122	329.4
43	60	111	138	400.0
44	60	111 99	131	397.0
45 46	60 60	109	119 153	273.0 387.6
47	45	111	136	300.0
48	45	108	129	298.0
49	60	111	139	397.6
50	60	107	136	380.2
51	80	123	146	643.1
52	60	106	130	263.0
53	60	118	151	486.0
54	30	136	175	238.0
55	60	121	146	450.7
56	60	118	121	413.0
57	45	115	144	305.0
58	20	153	172	226.4
59	45	123	152	321.0
60	210	108	160	1376.0
61	160	110	137	1034.4
	160	109	135	853.0
63	45	118	141	341.0
64	20	110	130	131.4
	180	90	130	800.4
	150	105	135	873.4
	150	107	130	816.0
68	20	106	136	110.4
	300	108	143	1500.2
	150	97	129	1115.0
71	60	109	153	387.6
72	90	100	127	700.0
73	150	97	127	953.2
74	45	114	146	304.0

75	90	98	125	563.2	
76	45	105	134	251.0	
77	45	110	141	300.0	
78	120	100	130	500.4	
79	270	100	131	1729.0	
80	30	159	182	319.2	
81	45	149	169	344.0	
82	30	103	139	151.1	
83	120	100	130	500.0	
84	45	100	120	225.3	
85	30	151	170	300.0	
86	45	102	136	234.0	
87	120	100	157	1000.1	
88	45	129	103	242.0	
89	20	83	107	50.3	
90	180	101	127	600.1	
91	45	107	137	NaN	
92	30	90	107	105.3	
93	15	80	100	50.5	
94	20	150	171	127.4	
95	20	151	168	229.4	
96	30	95	128	128.2	
90 97	25	152	168	244.2	
98	30	109	131	188.2	
98 99	90	93	124	604.1	
		95 95	112	77.7	
100	20				
101	90	90	110	500.0	
102	90	90	100	500.0	
103	90	90	100	500.4	
104	30	92	108	92.7	
105	30	93	128	124.0	
106	180	90	120	800.3	
107	30	90	120	86.2	
108	90	90	120	500.3	
109	210	137	184	1860.4	
110	60	102	124	325.2	
111	45 15	107	124	275.0	
112	15	124	139	124.2	
113	45	100	120	225.3	
114	60	108	131	367.6	
115	60	108	151	351.7	
116	60	116	141	443.0	
117	60	97	122	277.4	
118	60	105	125	NaN	
119	60	103	124	332.7	
120	30	112	137	193.9	
121	45	100	120	100.7	
122	60	119	169	336.7	
123	60	107	127	344.9	

124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163	60 111 60 98 60 97 60 109 90 99 60 114 60 107 60 103 60 106 60 103 20 136 45 117 45 115 45 113 20 141 60 108 60 97 45 100 45 122 60 136 45 106 60 107 60 107 60 109 60 109 60 109 60 109 60 109 30 150 60 105 60 105 60 105 60 105 60 105 60 105 60 105 60 104 60 109 60 109	151 122 124 127 125 151 134 138 133 132 136 156 143 137 138 162 135 127 120 149 170 126 136 146 127 150 134 129 138 167 128 151 131 120 150 120 120 120 120 120 131	368.5 271.0 275.3 382.0 466.4 384.0 342.5 357.5 335.0 327.5 339.0 189.0 317.7 318.0 308.0 222.4 390.0 NaN 250.4 335.4 470.2 270.8 400.0 361.9 185.0 409.4 343.0 353.2 374.0 275.8 328.0 368.5 270.4 270.4 382.8 240.9 250.4 260.4 270.0 280.9	
162	45 95	130	270.0	

Pandas Read JSON

Read JSON

Big data sets are often stored, or extracted as JSON.

JSON is plain text, but has the format of an object, and is well known in the world of programming, including Pandas.

In our examples we will be using a JSON file called 'sample.json'.