Data Storage Formats in Pandas

The different data storage formats available to be manipulated by Pandas library are text, binary and SQL.

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Format Type	Data Description	Reader	Writer
text	CSV	read_csv	to_csv
text	JSON	read_json	to_json
text	HTML	read_html	to_html
text	Local clipboard	read_clipboard	to_clipboard
binary	MS Excel	read_excel	to_excel
binary	HDF5 Format	read_hdf	to_hdf
binary	Feather Format	read_feather	to_feather
binary	Parquet Format	read_parquet	to_parquet
binary	Msgpack	read_msgpack	to_msgpack
binary	Stata	read_stata	to_stata
binary	SAS	read_sas	
binary	Python Pickle Format	read_pickle	to_pickle
SQL	SQL	read_sql	to_sql
SQL	Google Big Query	read_gbq	to_gbq

Reference: https://www.programmersought.com/article/4943826582

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CSV file and JSON file

https://pngtree.com/freepng/csv-file-document-icon_4175842.html

https://pngtree.com/freepng/json-file-document-icon_4172477.html

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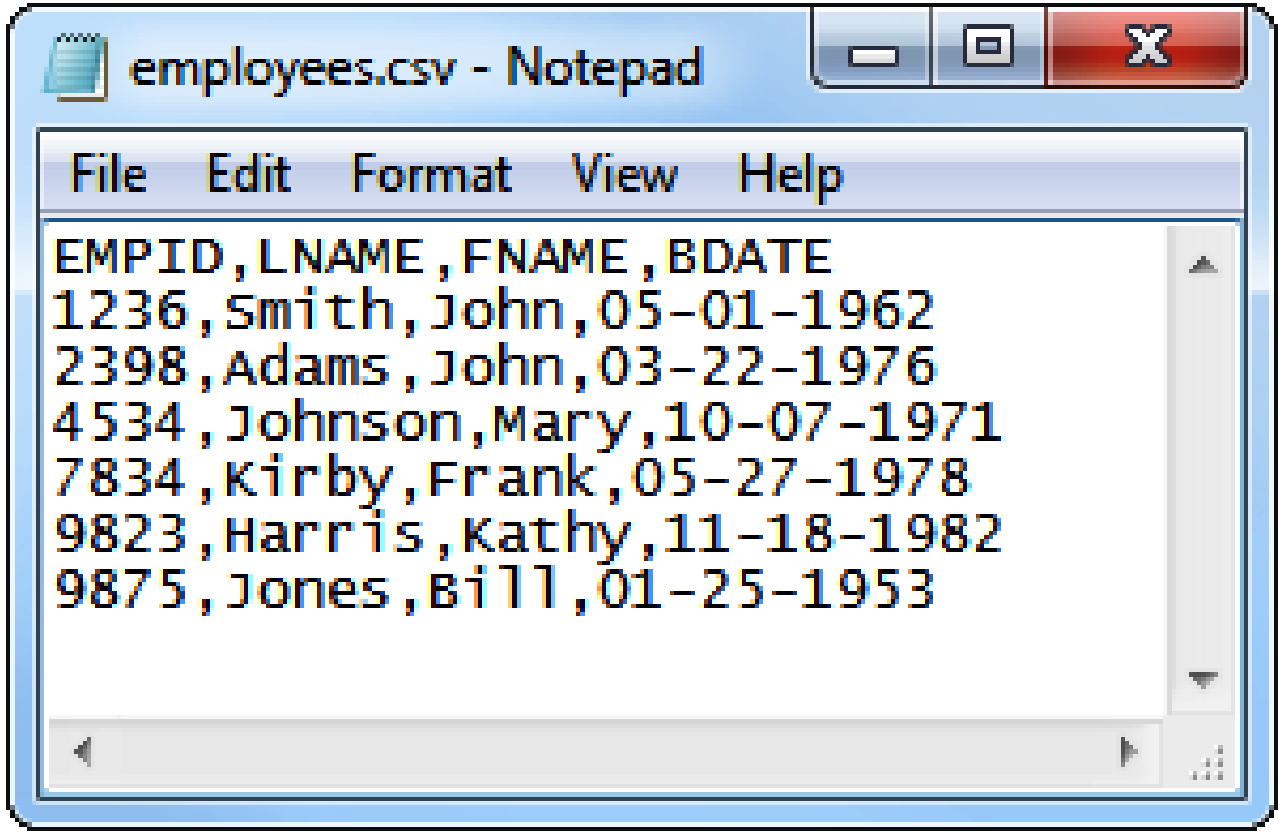
What is CSV file?

A CSV is a comma-separated values file, which allows data to be saved in a tabular format.



Reference: https://www.goanywhere.com/managed-file-transfer/more/tutorials/how-to-import-csv-file-into-database

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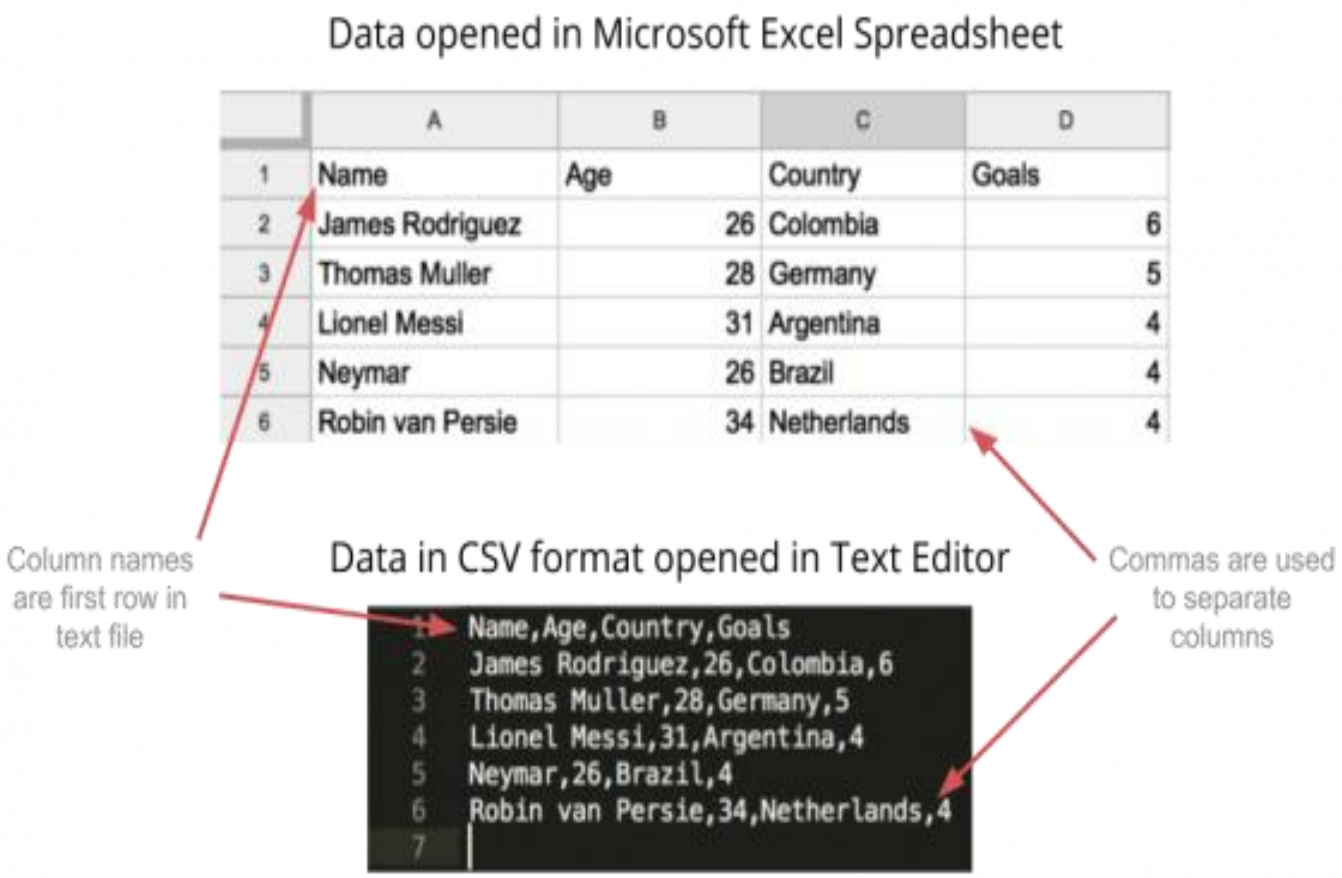
Why are .CSV files used?

- CSV files are plain-text files, making them easier for the website developer to create
- Since they're plain text, they're easier to import into a spreadsheet or another storage database, regardless of the specific software you're using.
- To better organize large amounts of data.



	A	B	C	D
1	Name	Age	Country	Goals
2	James Rodriguez	26	Colombia	6
3	Thomas Muller	28	Germany	5
4	Lionel Messi	31	Argentina	4
5	Neymar	26	Brazil	4
6	Robin van Persie	34	Netherlands	4

Reference: https://www.shanelynn.ie/python-pandas-read-csv-load-data-from-csv-files

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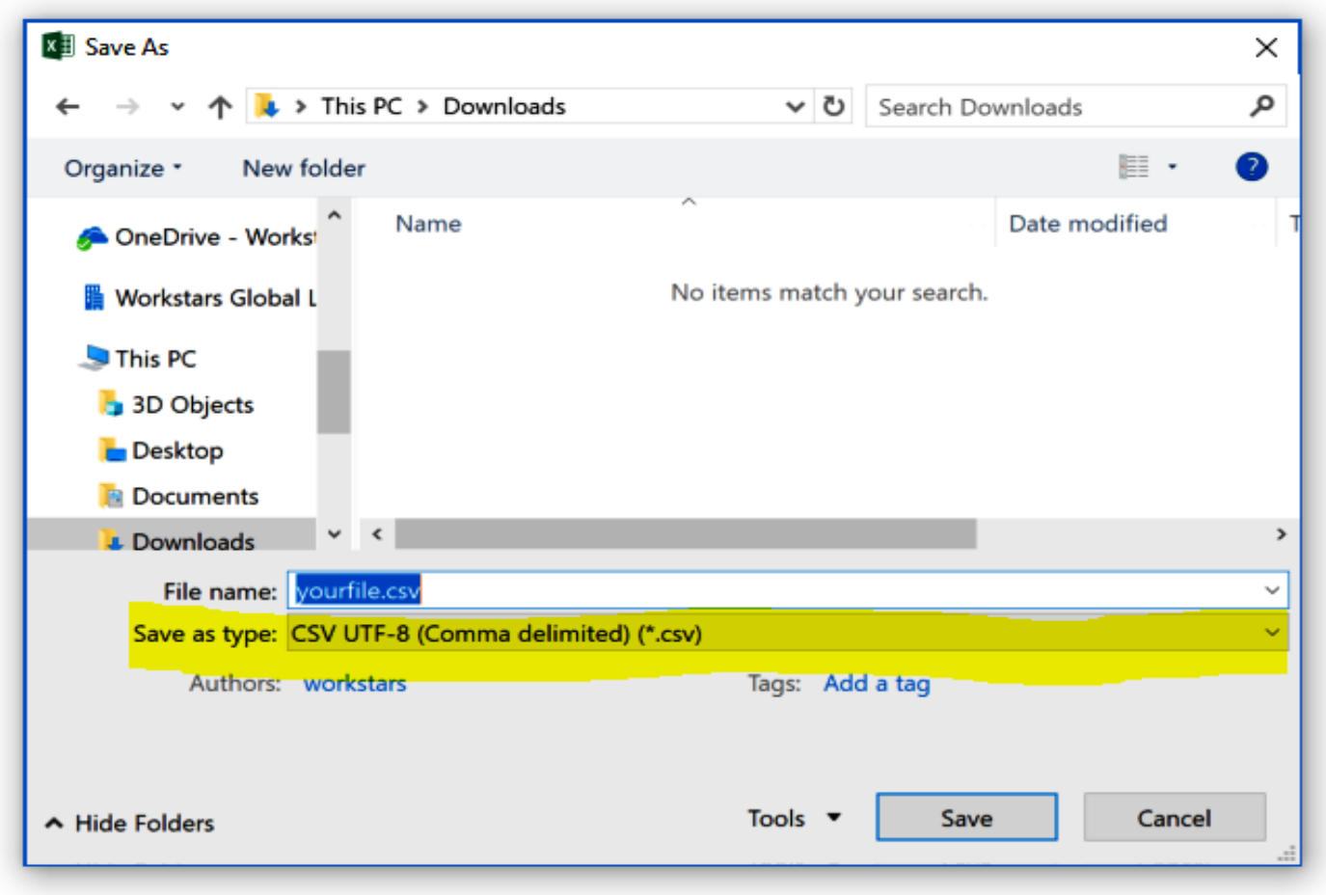
How do I save CSV files?

Under the "File name" section in the "Save As" tab, you can select "Save as type" and change it to "CSV (Comma delimited) (*.csv).



Reference: https://docs.workstars.com/en/latest/howto/save-csv-utf8.html

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What is a JSON file?

A JSON file is a file that stores simple data structures and objects in JavaScript Object Notation (JSON) format, which is a standard data interchange format.

```
{
    "Product": {
        "0": "Desktop Computer",
        "1": "Tablet",
        "2": "iPhone",
        "3": "Laptop"
    },
    "Price": {
        "0": 700,
        "1": 250,
        "2": 800,
        "3": 1200
    }
}
```

Reference: https://datatofish.com/export-pandas-dataframe-json

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Structures of JSON

JSON supports two widely used (amongst programming languages) data structures.

- A collection of name/value pairs.
- An ordered list of values.

```
{                                                        Object Starts
    "Title": "The Cuckoo's Calling"
    "Author": "Robert Galbraith",
    "Genre": "classic crime novel",
    "Detail": {                                          Object Starts
        "Publisher": "Little Brown"                      Value string
        "Publication_Year": 2013,                        Value number
        "ISBN-13": 9781408704004,
        "Language": "English",
        "Pages": 494
    }                                                    Object ends
    "Price": [                                           Array starts
        {                                                Object Starts
            "type": "Hardcover",
            "price": 16.65,
        }                                                Object ends
        {                                                Object Starts
            "type": "Kindle Edition",
            "price": 7.03,
        }                                                Object ends
    ]                                                    Array ends
}                                                        Object ends
```

Reference: https://www.w3resource.com/JSON/introduction.php

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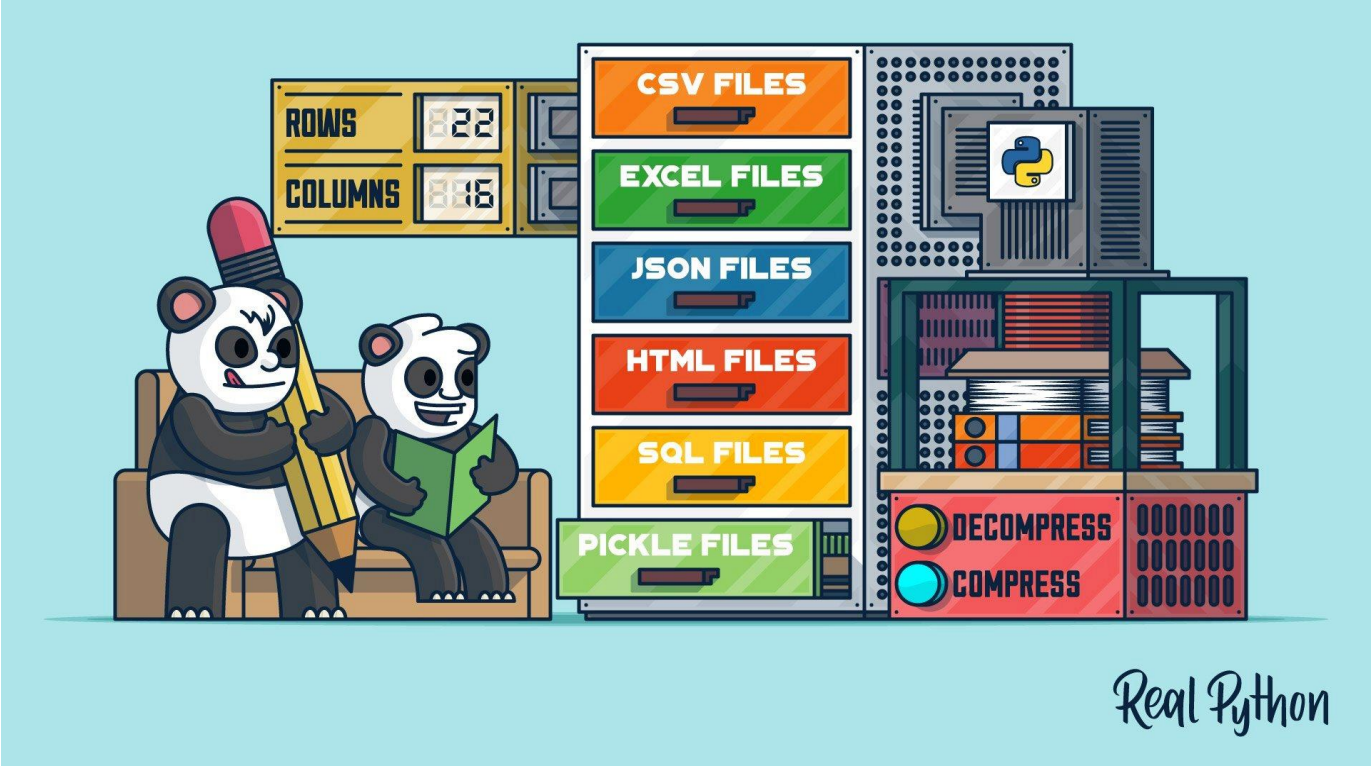
Reading data from files



Reference: https://realpython.com/pandas-read-write-files

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Load CSV files to Python Pandas

The basic process of loading data from a CSV file into a Pandas DataFrame is achieved using the “read_csv” function in Pandas.

```
In [18]: pd.read_csv("../pokemon.csv", header=[6,3,5,7], squeeze = True)
```

Out[18]:

	Charizard	Fire
	Venusaur	Grass
	Charmeleon	Fire
	Squirtle	Water
0	Wartortle	Water
1	Blastoise	Water
2	Caterpie	Bug
3	Metapod	Bug

Reference: https://www.geeksforgeeks.org/python-read-csv-using-pandas-read_csv

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Delimiters in Text Fields – Quotechar

The quote character can be specified in Pandas read_csv using the quotechar argument.

Semi-colon separated data in text file

```
CustomerId; CustomerName; Address; Age; NickNames
1;Shane Lynn;Dublin, Ireland; 30;"Shaneo;Lynno;Slynn"
2;Johnny Ives;London, United Kingdom;40;"Johnson;Big John;Ivy"
3;Simon Smith;Rue de Rue, Paris, France;50;"Frenchy;Smitho;Hammer"
4;Ronald Mc Donald;The big Farm, McDonalds Farm; 60;"Ronnie;Maccie;Donnie"
5;Jonathan Swift;Celbridge Abbey, Celbridge, Ireland;70;"Jonno;Speedy;Swifter"
```

nicolons (;) are sed here to arate columns

The data in the column conta semicolons, so quotation char is used to 'qu the values

Semi-colon separated data loaded into Excel

	A	B	C	D	E
1	CustomerId	CustomerName	Address	Age	NickNames
2	1	Shane Lynn	Dublin, Ireland	30	Shaneo;Lynno;Slynn
3	2	Johnny Ives	London, United Kingdom	40	Johnson;Big John;Ivy
4	3	Simon Smith	Rue de Rue, Paris, France	50	Frenchy;Smitho;Hammer
5	4	Ronald Mc Donald	The big Farm, McDonalds Farm	60	Ronnie;Maccie;Donnie
6	5	Jonathan Swift	Celbridge Abbey, Celbridge, Ireland	70	Jonno;Speedy;Swifter

Semi-colon separated data loaded to Pandas

Specify the quotechar if necessary - the default is ".

```
pd.read_csv('test_delimted.ssv', sep=';', quotechar='"', encoding='utf8')
```

The 'sep' argument tells Pandas how to eak up data into columns

	CustomerId	CustomerName	Address	Age	NickNames
0	1	Shane Lynn	Dublin, Ireland	30	Shaneo;Lynno;Slynn
1	2	Johnny Ives	London, United Kingdom	40	Johnson;Big John;Ivy
2	3	Simon Smith	Rue de Rue, Paris, France	50	Frenchy;Smitho;Hammer
3	4	Ronald Mc Donald	The big Farm, McDonalds Farm	60	Ronnie;Maccie;Donnie
4	5	Jonathan Swift	Celbridge Abbey, Celbridge, Ireland	70	Jonno;Speedy;Swifter

Reference: https://www.shanelynn.ie/python-pandas-read-csv-load-data-from-csv-files

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Python – Paths, Folders, Files

When you specify a filename to Pandas.read_csv, Python will look in your “current working directory“.

```
In [26]: pd.read_csv('file_not_in_right_place.csv')

---------------------------------------------------------------------------
FileNotFoundError                         Traceback (most recent call last)
<ipython-input-26-f3609a36b9ff> in <module>()
----> 1 pd.read_csv('file_not_in_right_place.csv')

~/Envs/analysis/lib/python3.6/site-packages/pandas/io/parsers.py in parser_f(filepath_or_buffer, sep, delimiter, head
er, names, index_col, usecols, squeeze, prefix, mangle_dupe_cols, dtype, engine, converters, true_values, false_value
s, skipinitialspace, skiprows, nrows, na_values, keep_default_na, na_filter, verbose, skip_blank_lines, parse_dates,
infer_datetime_format, keep_date_col, date_parser, dayfirst, iterator, chunksize, compression, thousands, decimal, li
neterminator, quotechar, quoting, escapechar, comment, encoding, dialect, tupleize_cols, error_bad_lines, warn_bad_li
nes, skipfooter, doublequote, delim_whitespace, low_memory, memory_map, float_precision)
    676                     skip_blank_lines=skip_blank_lines)
    677
--> 678         return _read(filepath_or_buffer, kwds)
    679
    680     parser_f.__name__ = name

~/Envs/analysis/lib/python3.6/site-packages/pandas/io/parsers.py in _read(filepath_or_buffer, kwds)
    438
    439     # Create the parser.
--> 440     parser = TextFileReader(filepath_or_buffer, **kwds)
    441
    442     if chunksize or iterator:

~/Envs/analysis/lib/python3.6/site-packages/pandas/io/parsers.py in __init__(self, f, engine, **kwds)
    785             self.options['has_index_names'] = kwds['has_index_names']
    786
--> 787         self._make_engine(self.engine)
    788
    789     def close(self):
```

Reference: https://www.shanelynn.ie/python-pandas-read-csv-load-data-from-csv-files

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Pandas CSV File Loading Errors

- FileNotFoundError
- UnicodeDecodeError
- pandas.parser.CParserError

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Load JSON files to Python Pandas

Step 1: Prepare the JSON String

Product	Price
Desktop Computer	700
Tablet	250
iPhone	800
Laptop	1200

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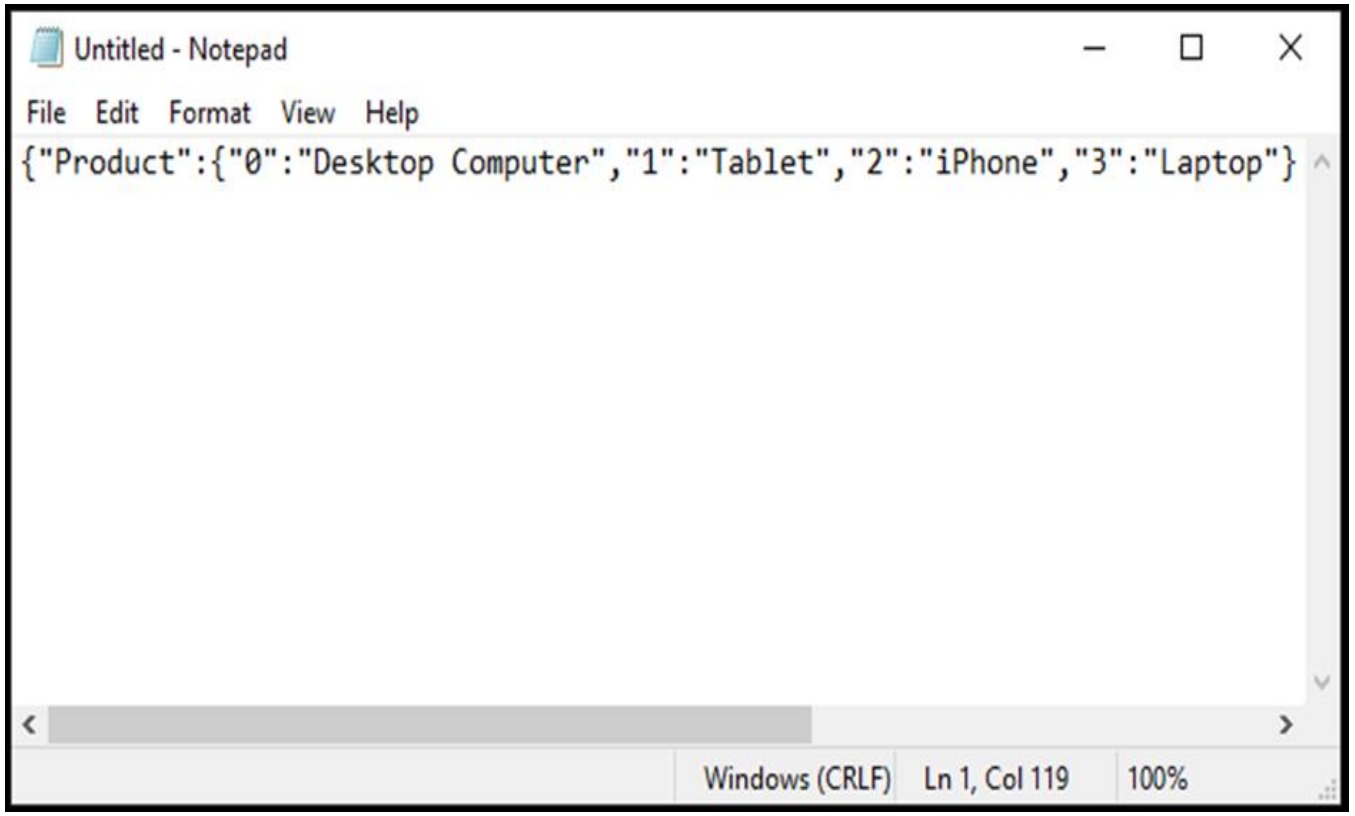
Load JSON files to Python Pandas

Step 2: Create the JSON File.



https://datatofish.com/load-json-pandas-dataframe

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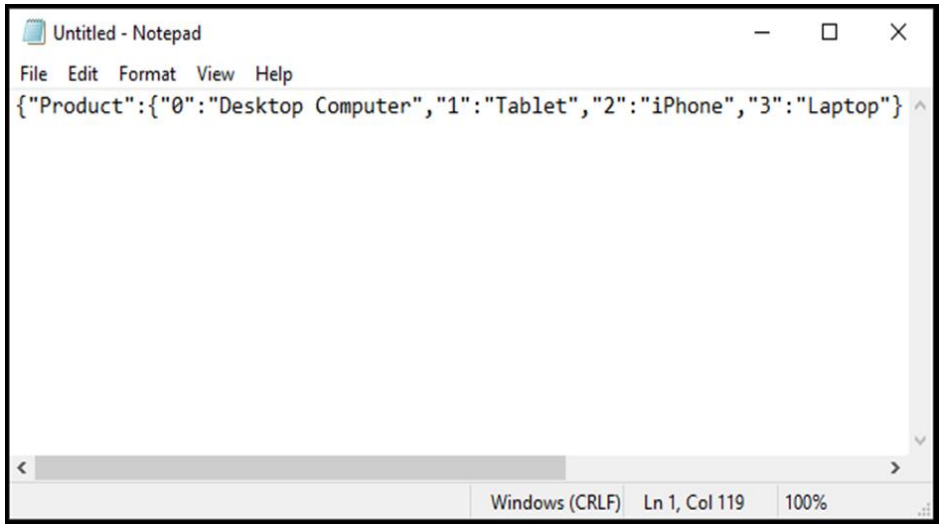
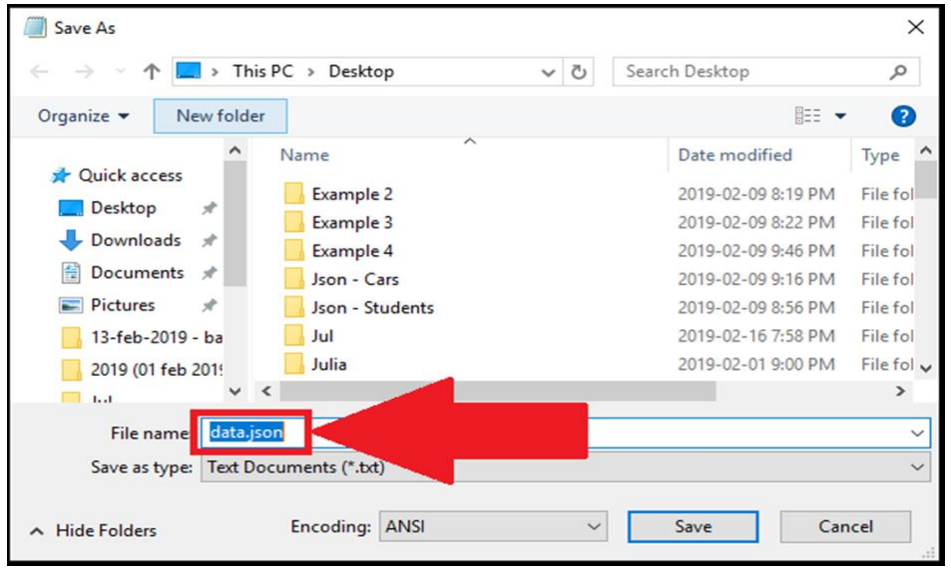
Load JSON files to Python Pandas

Step 2: Create the JSON File.





https://datatofish.com/load-json-pandas-dataframe

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Load JSON files to Python Pandas

Finally, load your JSON file into Pandas DataFrame.

	Product	Price
0	Desktop Computer	700
1	Tablet	250
2	iPhone	800
3	Laptop	1200

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3 different JSON strings

Below are 3 different ways that you could capture the data as JSON strings.

- Index orientation
- Values orientation
- Column's orientation

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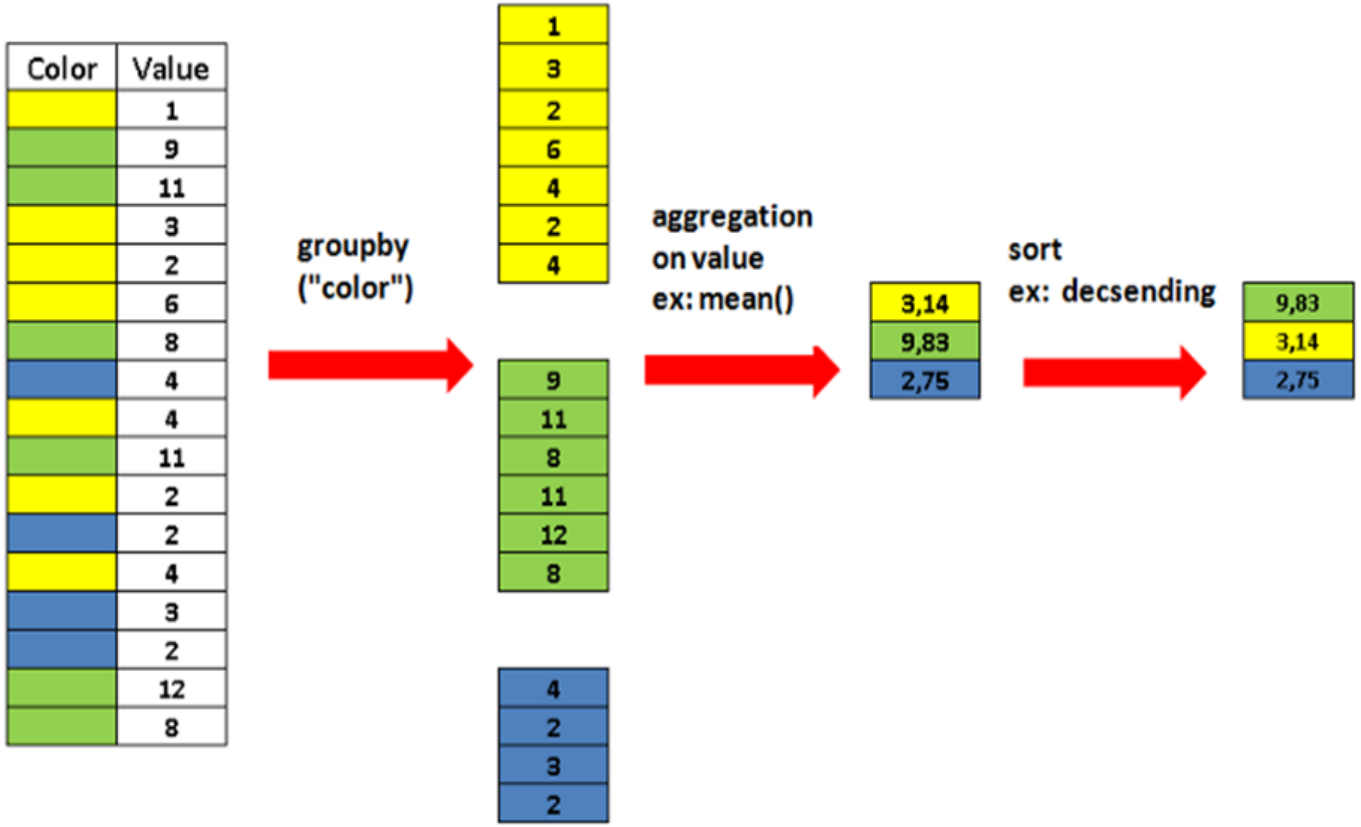
Groupby Methods

Pandas dataframe.groupby() function is used to split the data into groups based on some criteria. pandas objects can be split on any of their axes.



Reference: https://towardsdatascience.com/pandas-groupby-explained-453692519d0

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Groupby output format – Series or DataFrame?

As a rule of thumb, if you calculate more than one column of results, your result will be a Dataframe. For a single column of results, the agg function, by default, will produce a Series.

```
In [35]: data.groupby('month', as_index=False).agg({"duration": "sum"})
```

Out[35]:

	month	duration
0	2014-11	26639.441
1	2014-12	14641.870
2	2015-01	18223.299
3	2015-02	15522.299
4	2015-03	22750.441

Reference: https://www.shanelynn.ie/summarising-aggregation-and-grouping-data-in-python-pandas

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Pivot Tables

It’s a table of statistics that helps summarize the data of a larger table by “pivoting” that data.

Pivot

df

	foo	bar	baz	zoo
0	one	A	1	x
1	one	B	2	y
2	one	C	3	z
3	two	A	4	q
4	two	B	5	w
5	two	C	6	t

```
df.pivot(index='foo',
         columns='bar',
         values='baz')
```

bar	A	B	C
foo			
one	1	2	3
two	4	5	6

https://pandas.pydata.org/pandas-docs/version/0.25.3/user_guide/reshaping.html

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How to Build a Pivot Table in Python

In Pandas, we can construct a pivot table using the following syntax:

pandas.pivot_table(data, values=None, index=None, columns=None, aggfunc='mean', fill_value=None, margins=False, dropna=True, margins_name='All', observed=False)

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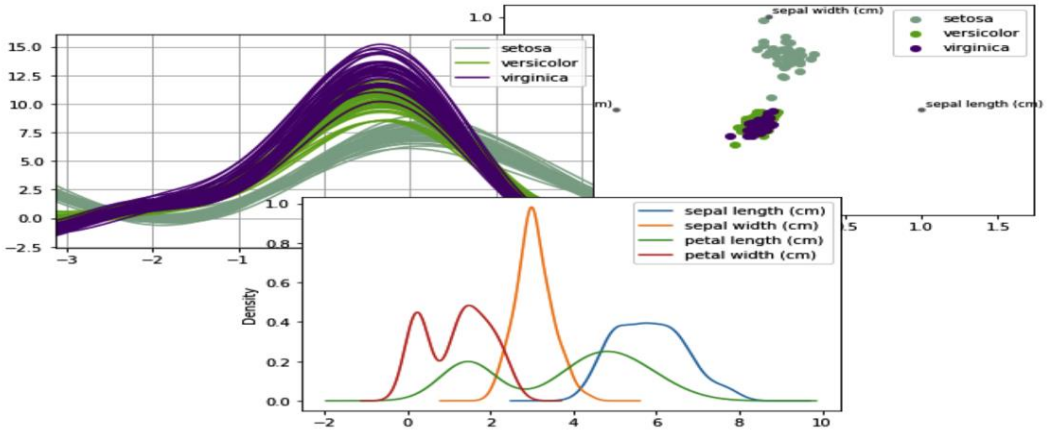
Pandas Plotting

Plotting in pandas utilises the matplotlib API so in order to create visualisations, you will need to also import this library alongside pandas.



https://towardsdatascience.com/the-best-pandas-plotting-features-c9789e04a5a0

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Plot a Scatter Diagram using Pandas

Scatter plots are used to depict a relationship between two variables.

Step 1: Prepare the data

Unemployment_Rate	Stock_Index_Price
6.1	1500
5.8	1520
5.7	1525
5.7	1523
5.8	1515
5.6	1540
5.5	1545
5.3	1560
5.2	1555
5.2	1565

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Plot a Scatter Diagram using Pandas

Step 2: Create the DataFrame

	Unemployment_Rate	Stock_Index_Price
0	6.1	1500
1	5.8	1520
2	5.7	1525
3	5.7	1523
4	5.8	1515
5	5.6	1540
6	5.5	1545
7	5.3	1560
8	5.2	1555
9	5.2	1565

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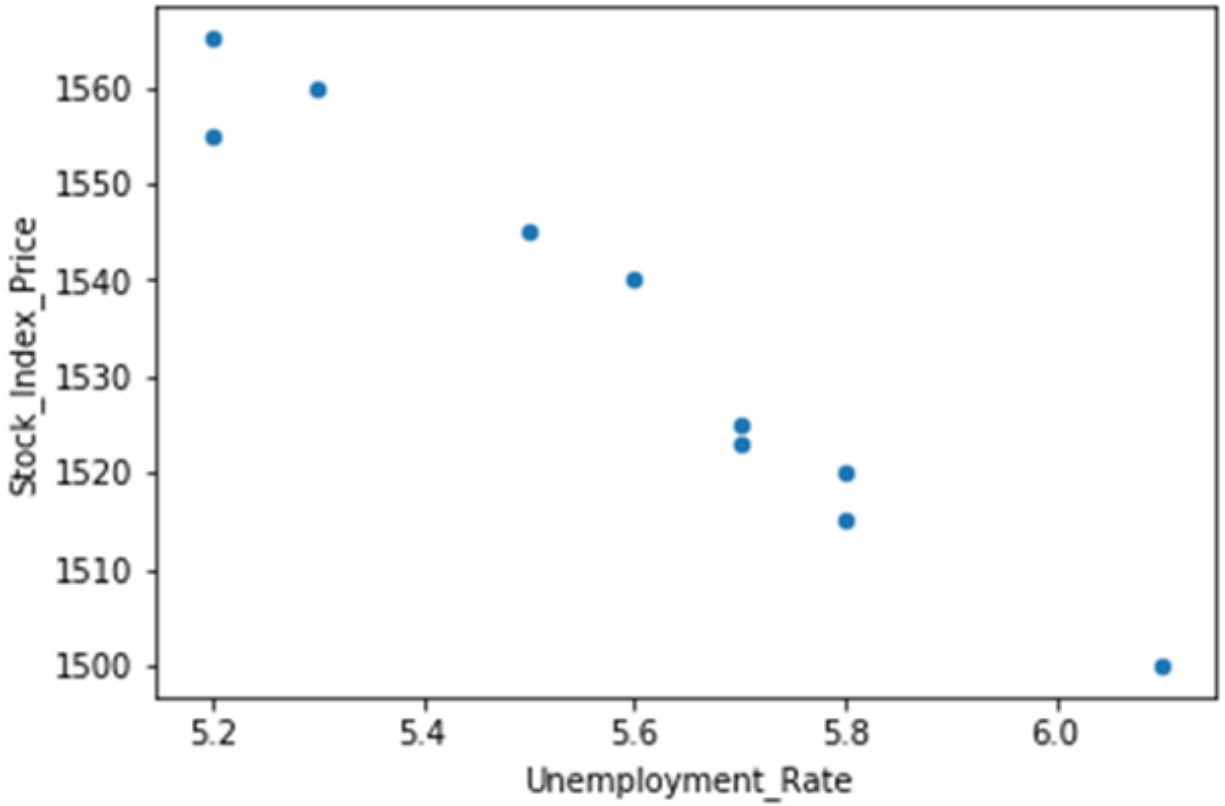
Plot a Scatter Diagram using Pandas

Step 3: Plot the DataFrame using Pandas



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Plot a Line Chart using Pandas

Line charts are often used to display trends overtime.

Step 1: Prepare the data

Year	Unemployment_Rate
1920	9.8
1930	12
1940	8
1950	7.2
1960	6.9
1970	7
1980	6.5
1990	6.2
2000	5.5
2010	6.3

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Plot a Line Chart using Pandas

Step 2: Create the DataFrame

	Year	Unemployment_Rate
0	1920	9.8
1	1930	12.0
2	1940	8.0
3	1950	7.2
4	1960	6.9
5	1970	7.0
6	1980	6.5
7	1990	6.2
8	2000	5.5
9	2010	6.3

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Plot a Line Chart using Pandas

Step 3: Plot the DataFrame using Pandas

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Plot a Bar Chart using Pandas

Bar charts are used to display categorical data.

Step 1: Prepare the data

Country	GDP_Per_Capita
USA	45000
Canada	42000
Germany	52000
UK	49000
France	47000

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Plot a Bar Chart using Pandas

Step 2: Create the DataFrame

	Country	GDP_Per_Capita
0	USA	45000
1	Canada	42000
2	Germany	52000
3	UK	49000
4	France	47000

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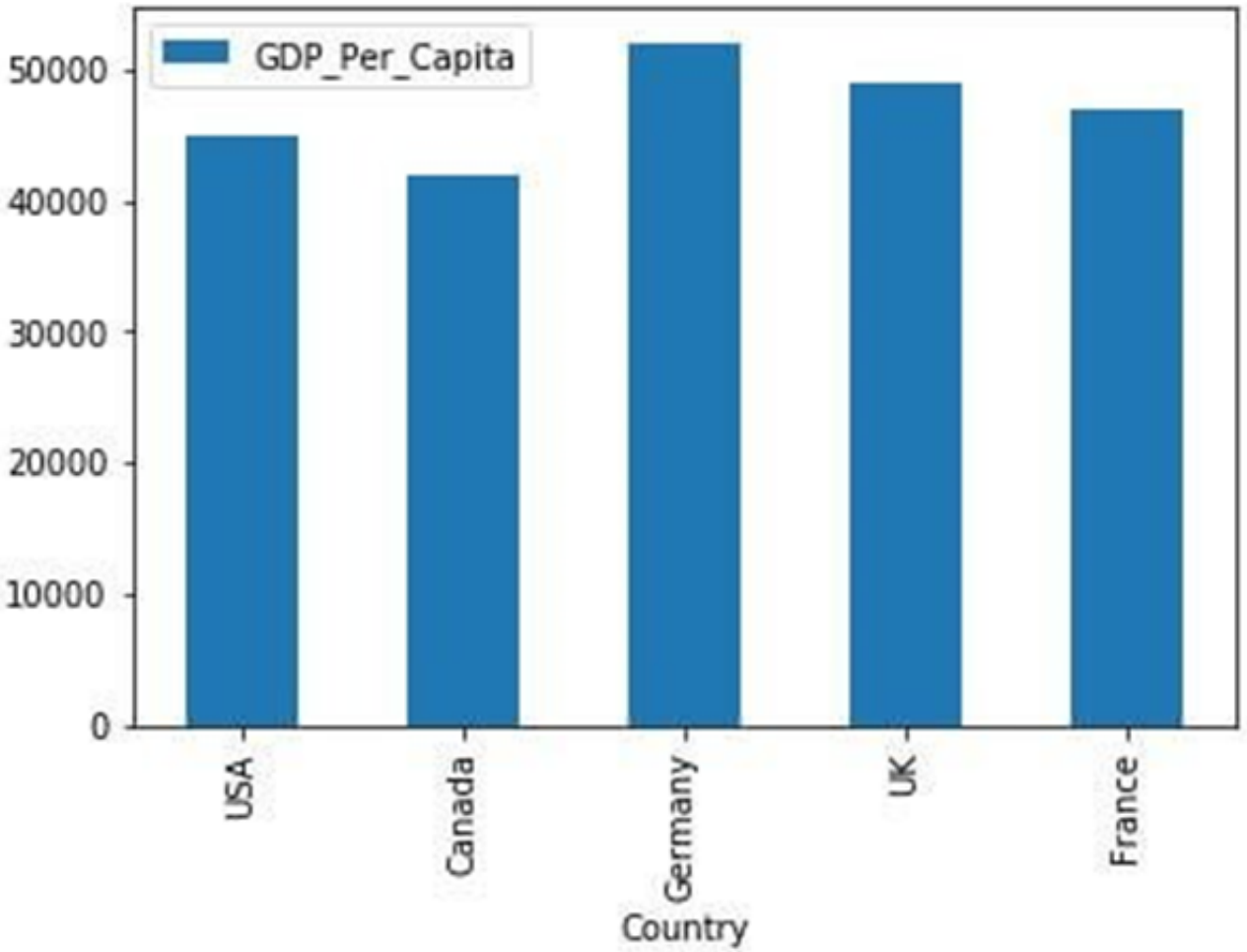
Plot a Bar Chart using Pandas

Step 3: Plot the DataFrame using Pandas



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Plot a Pie Chart using Pandas

A pie chart (or a circle chart) is a circular statistical graphic, which is divided into slices to illustrate numerical proportion.

Step 1: Prepare the data

Tasks Pending	300
Tasks Ongoing	500
Tasks Completed	700

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Plot a Pie Chart using Pandas

Step 2: Create the DataFrame

	Tasks
Tasks Pending	300
Tasks Ongoing	500
Tasks Completed	700

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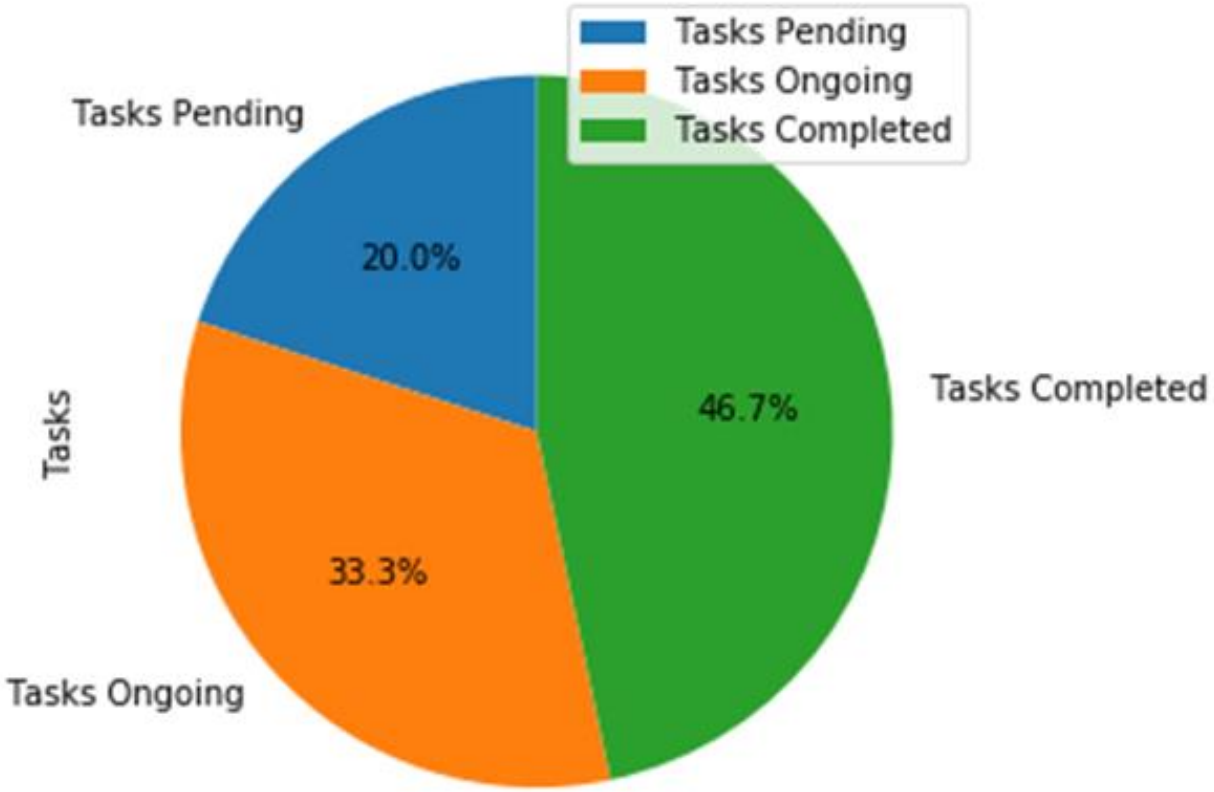
Plot a Pie Chart using Pandas

Step 3: Plot the DataFrame using Pandas



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3. https://fileinfo.com/extension/json
4. https://www.w3resource.com/JSON/structures.php
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10. https://pandas.pydata.org/docs/reference/api/pandas.pivot_table.html
11. https://datatofish.com/plot-dataframe-pandas

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