# How to Clean Messy Data in Python

## DS 6001: Practice and Applications of Data Science

## Getting Yourself Unstuck

- Online Communities
- Using Python's built-in help documentation
- Good old Google
- Stack Overflow
- Interacting with other Python users on PySlackers
- Live chats with Python users on Freenode
- Python Mailing lists

## Loading Electronic Data into Python

- Electronic data files
- Changing the working directory
- Loading standard CSV files
- Looking at the data to see if it loaded correctly
- Loading messy CSV and other ASCII files
- Writing CSV and ASCII files
- Loading fixed width files

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- Using a Python interface (Jupyter, Spyder, etc.)
- Defining and working with objects
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If you are not comfortable with these skills, that's fine, but speak to us after class so we can help you get these skills.

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And you need to be able to perform these tasks instinctively, without having to think about it too much.

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But before we can teach you all those ninja skills, we have to talk about the most important programming skill of all, which is ...

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Here are at least six places to go for help:

1. Python documentation
2. Google
3. Stack Overflow
4. PySlackers
5. Internet relay chat (IRC) rooms with other Python users
6. Various Python mailing lists

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BUT, like any online community, there's the potential for a **toxic culture** to destroy everything.

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Actively toxic communities are easy to identify. They encourage and are characterized by **overt** sexism, racism, bigotry, and calls for violence or other aggression against individuals.

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- actively toxic behavior is usually explicitly banned by codes of conduct,
- and **individuals are often unaware of when they are acting in a passively toxic way**.

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Downvotes without explanation: this can be very upsetting to anyone, especially to people with less experience

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Overzealous curation: Being very quick to tag a question as a "duplicate" without checking to see nuanced ways in which the question comes from a new situation.

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Across society, small, homogeneous communities are much more likely to exclude or discriminate against people based on sex, race, class, language and other factors. And that leads to many ethical problems.

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# Python's Built-in Help Documentation

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3. The type – what kind of object is this?

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`x??` – same as `x?`, but shows the internal code of `x` if `x` is a Python function (not just a call to a C function)

The most important skill is to know how to read the docstring to quickly find the information you need.

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import sklearn.linear_model
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Help on class LinearRegression in module
sklearn.linear_model.base:

class LinearRegression(LinearModel,
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The header tells us that the `LinearRegression` object is a class, stored in the `linear_model.base` module within the `sklearn` package.

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2. The signature

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LinearRegression(fit_intercept=True, normalize=False,
copy_X=True, n_jobs=None)
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Some docstrings list the signature, although the signature can be accessed elsewhere. The signature lists all of the parameters of a function.

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The value each parameter is set equal to is the **default**. If the user doesn't specify the parameter, it's set to the default.

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3. The short description

```
Ordinary least squares Linear Regression.
```

A one-or-two sentence summary of what the function does.

# Python's Built-in Help Documentation

4. The parameters section is the most useful for learning how to use a function:

```
Parameters
----------
fit_intercept : boolean, optional, default True
    whether to calculate the intercept for this model. If set
    to False, no intercept will be used in calculations
    (e.g. data is expected to be already centered).

normalize : boolean, optional, default False
    This parameter is ignored when ``fit_intercept`` is set to False.
    If True, the regressors X will be normalized before regression by
    subtracting the mean and dividing by the l2-norm.
    If you wish to standardize, please use
    :class:`sklearn.preprocessing.StandardScaler` before calling ``fit`` on
    an estimator with ``normalize=False``.

copy_X : boolean, optional, default True
    If True, X will be copied; else, it may be overwritten.

n_jobs : int or None, optional (default=None)
    The number of jobs to use for the computation. This will only provide
    speedup for n_targets > 1 and sufficient large problems.
    ``None`` means 1 unless in a :obj:`joblib.parallel_backend` context.
    ``-1`` means using all processors. See :term:`Glossary <n_jobs>`
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Each parameter is described in a sentence or two to explain what the parameter does.

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5. The attributes

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Attributes
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coef_ : array, shape (n_features, ) or (n_targets, n_features)
    Estimated coefficients for the linear regression problem.
    If multiple targets are passed during the fit (y 2D), this
    is a 2D array of shape (n_targets, n_features), while if only
    one target is passed, this is a 1D array of length n_features.

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If the output is saved in an object named `regress`, to access the coefficients, type `regress.coef_`, and to access the intercept, type `regress.intercept_`.

# Python's Built-in Help Documentation

6. The examples

```
Examples
--------
>>> import numpy as np
>>> from sklearn.linear_model import LinearRegression
>>> X = np.array([[1, 1], [1, 2], [2, 2], [2, 3]])
>>> # y = 1 * x_0 + 2 * x_1 + 3
>>> y = np.dot(X, np.array([1, 2])) + 3
>>> reg = LinearRegression().fit(X, y)
>>> reg.score(X, y)
1.0
>>> reg.coef_
array([1., 2.])
>>> reg.intercept_ # doctest: +ELLIPSIS
3.0000...
>>> reg.predict(np.array([[3, 5]]))
array([16.])
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Examples are meant to be run, not just looked at. Copy-and-paste the examples into your notebook or script, run the code. See if you can do more things with the given objects than the examples do.

# Python's Built-in Help Documentation

7. The related methods defines methods that expand the functionality of the one you are looking at, along with their own documentation:

```
Methods defined here:

__init__(self, fit_intercept=True, normalize=False, copy_X=True, n_jobs=None)
    Initialize self.  See help(type(self)) for accurate signature.

fit(self, X, y, sample_weight=None)
    Fit linear model.

    Parameters
    ----------
    X : array-like or sparse matrix, shape (n_samples, n_features)
        Training data

    y : array_like, shape (n_samples, n_targets)
        Target values. Will be cast to X's dtype if necessary

    sample_weight : numpy array of shape [n_samples]
        Individual weights for each sample

        .. versionadded:: 0.17
           parameter *sample_weight* support to LinearRegression.

    Returns
    -------
    self : returns an instance of self.
```

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Google will often take you to **Stack Overflow**.

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Finding a Stack Overflow post that's relevant to your problem can give you both the code and intuition to solve your problem.

Or maybe not! Small differences in the situation can make the solution irrelevant to you. **Be cautious** and don't treat a Stack Overflow post as automatically a definitive answer.

# How Stack Overflow Works

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Going for reputation is an **entirely optional** activity. If you don't want to worry about it, don't.

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If you do post to Stack Overflow, you are likely to get some very useful responses if you follow some guidelines. There's **a strategy for getting good responses**: stackoverflow.com/help/how-to-ask

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So spend a significant amount of time digging through the internet. If there's something similar, but not quite what you need, you can say so in your post.

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**Good**: How to place labels on top of points in a matplotlib scatterplot?

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- What is the expected output? What do you see instead?
- You can write the version of Python you are using, the version of the modules, and the operating system on your computer, in case the problem turns out to be specific to one of those

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If the code needs to run on data, can you use something pre-loaded in Python that everyone can access? (There are example datasets included with `psykitlearn`, for example.)

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If the code needs to run on data, can you use something pre-loaded in Python that everyone can access? (There are example datasets included with `psykitlearn`, for example.)

Make the code as short as possible, and use comments, to help people understand the code more quickly.

# A few additional things to keep in mind

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Don't ask about **homework problems**. (Here's an example of someone getting called out on this)

# Interacting with other Python users on PySlackers

The main slack page for the global community of Python users is **Pyslackers**: https://pyslackers.com/web

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Some useful channels:

- data_science
- python_
- job_advice

# Live chats with Python users on Freenode

The Python user community is world-wide, and for the most part, very supportive. There are active internet relay chat (IRC) networks where you can post a question to members who are also logged in, to possibly **get an answer right away**.

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Internet chatrooms can be rough places, but the #python channel claims to enforce this Code of Conduct: https://www.python.org/psf/codeofconduct/.

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3. To use the #python channel, you need to register your nickname. To check if your nickname is unique, click on the "freenode" tab on the left-hand sidebar. A text box will appear on the bottom of the screen. Type:

```
/msg NickServ info
```

# Live chats with Python users on Freenode

4. Step 3 will open a new tab. Switch to that tab. If no one else already has your nickname, you will see

```
NickServ: (notice) <nickname> is not registered.
```

If you see something else, it means someone already has your nickname. You can change your nickname right here by typing `/nick` followed by another nickname. Then type `/msg NickServ info` again. Repeat until you see the message listed above.

# Live chats with Python users on Freenode

Important note: DON'T use a password here that you use for important things like **email, bank accounts, etc.**

We shouldn't have the same faith in the security of Freenode's servers as we can have in Google's.

Also, this is the kind of platform that tends to attract hackers. And for people used to a graphical user interface, it might be easy to mistype in a way that accidentally displays your password in the chat.

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Use a unique, throwaway password!

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5. To register this nickname, type

```
/msg NickServ register <password> <email-address>
```

where `<password>` is a password you will use in the future, and `<email address>` is the email you want associated with this account.

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**You are free to chat away.** Pay attention to the guidelines that appear as links on the top of the screen.

# Python mailing lists and message boards

Usenet – a distributed discussion system (no central server) – was invented in 1979, and is still in use today. The Python Usenet message boards are at https://mail.python.org/archives. The `comp.lang.python` board is for general discussions and questions about Python.

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If you have a question for the Python core development team, send an email to help@python.org. The team is pretty busy, so be sure to check other resources and lists for an answer first.

# Many ways to do the same thing in Python

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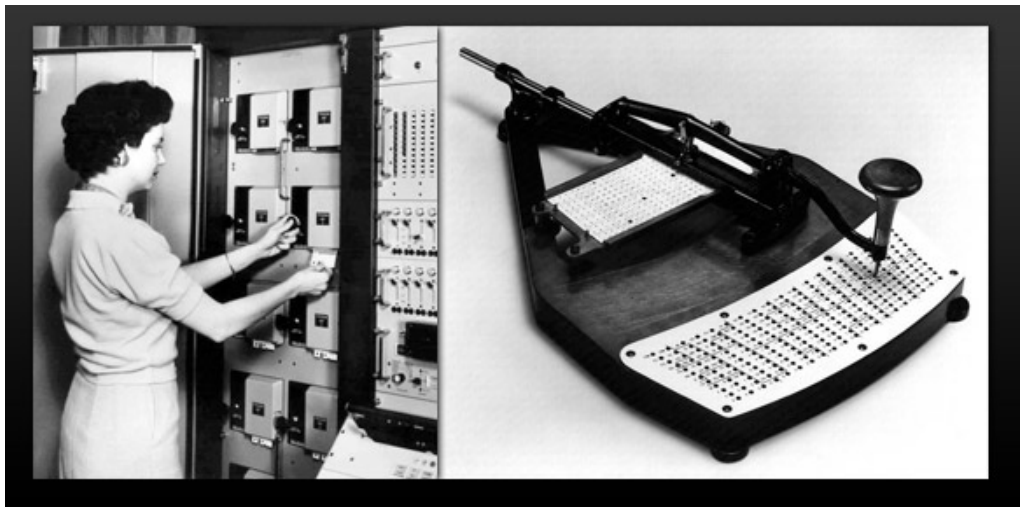
What follows is a set of *guidelines and suggestions*. NOT a definitive list of how to do things.

It's OKAY to mix styles, packages, and approaches. Use whatever works, but **keep track of what you do**.

# Electronic Data Files

Through the 1970s, data was stored on punch cards and fed directly to a mainframe computer capable of regression analysis.

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- Data points usually delimited by commas, spaces, or tabs. Might require a data dictionary to read.

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We will go over individual data files today, and databases soon.

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A comma-separated values (CSV) file:

```
sex,race,region,happy,life,sibs,childs,age,educ,paeduc,maeduc,speduc,prestg80,
occcat80,tax,usintl,obey,popular,thnkself,workhard,helpoth,hlth1,hlth2,hlth3,
hlth4,hlth5,hlth6,hlth7,hlth8,hlth9,work1,work2,work3,work4,work5,work6,work7,
work8,work9,prob1,prob2,prob3,prob4
2,1,1,1,1,1,2,61,12,97,12,97,22,3,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0, , , ,
2,1,1,2,1,2,1,32,20,20,18,20,75,1,1,0,5,4,1,2,3,1,1,2,2,2,2,2,2,2,2,2,1,2,
2,1,2,1,1,2,4,5,
1,1,1,1,0,2,1,35,20,16,14,17,59,1,0,1,5,4,1,2,3,2,2,2,2,2,2,2,2,2,2,2,2,2,
2,2,2,2,2, , , ,
2,1,1,9,2,2,0,26,20,20,20,97,48,1,1,0,4,5,1,3,2,1,2,2,2,2,2,2,2,2,2,1,2,2,
2,2,2,2,2,2,2, ,
2,2,1,2,1,4,0,25,12,98,98,97,42,3,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0, , , ,
```

# Kinds of ASCII files

Note: Although the CSV format is universal, Excel sometimes opens by default when you double-click on the CSV file. But, CSV files are NOT exclusive to Excel.

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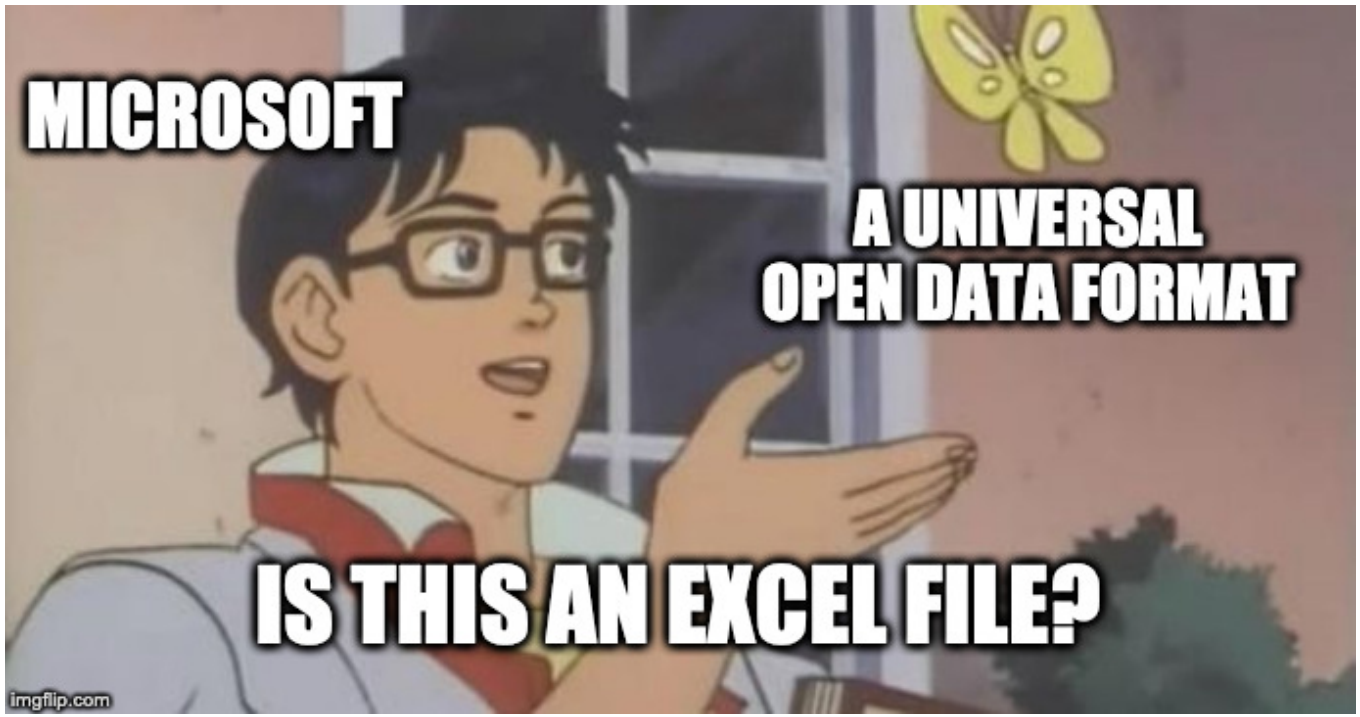

# Kinds of ASCII files

A tab delimited file:

```
sex    race    region  happy   life    sibs    childs  age     educ
paeduc  maeduc  speduc  prestg80    occcat80    tax     usintl  obey
popular thnkself    workhard    helpoth hlth1   hlth2   hlth3
hlth4   hlth5   hlth6   hlth7   hlth8   hlth9   work1   work2
work3   work4   work5   work6   work7   work8   work9   prob1
prob2   prob3   prob4
2   1   1   1   1   1   2   61  12  97  12  97  22  3   1   1   0
0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
0   0   0   0   0
2   1   1   2   1   2   1   32  20  20  18  20  75  1   1   0   5
4   1   2   3   1   1   2   2   2   2   2   2   2   2   2   1   2
2   1   2   1   1   2   4   5
1   1   1   1   0   2   1   35  20  16  14  17  59  1   0   1   5
4   1   2   3   2   2   2   2   2   2   2   2   2   2   2   2   2
2   2   2   2   2
2   1   1   9   2   2   0   26  20  20  20  97  48  1   1   0   4
5   1   3   2   1   2   2   2   2   2   2   2   2   2   1   2   2
2   2   2   2   2   2   2
2   2   1   2   1   4   0   25  12  98  98  97  42  3   1   1   0
0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
0   0   0   0   0
```

# Kinds of ASCII files

A fixed-width ASCII file with no delimination. Files like these minimize memory (no need to store a bunch of commas), but require a dictionary file to read them.

```
21111126112971297223110000000000000000000000...
21121213220201820751105412311222222222121211245
11110213520161417591015412322222222222222222...
21192202620202097481104513212222222221222222222.
22121402512989897423110000000000000000000000...
```

Dictionary:

- Variable 1: sex, column 1
- Variable 2: race, column 2
- ...
- Variable 8: age, columns 8-9

# Changing the working directory

Before we go over the functions, it is useful to set the working directory at the start of your script or notebook.

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This **sets the default folder** where Python looks for files. If all of your files are in the same folder, setting the working directory means you don't have to write out the paths each time you load or save a file.

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This **sets the default folder** where Python looks for files. If all of your files are in the same folder, setting the working directory means you don't have to write out the paths each time you load or save a file.

To set the working directory:

- Load the `os` package: `import os`
- Type the folder's address into `os.chdir("folder")`

# Changing the working directory

To **check** on the path Python is currently using as a default, type `os.getcwd()` into the console.

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To **check** on the path Python is currently using as a default, type `os.getcwd()` into the console.

If you want to change the working directory back after you've run the relevant code:

```
import os
oldpath = os.getcwd()
os.chdir("folder")

#(Your code goes here)

os.chdir(oldpath)
```

# Loading CSV files

We will be using the Pandas package:

```
import pandas as pd
```

The main function for loading an ASCII data file is `pd.read_csv()`. There are lots of parameters, and we'll go over a few important ones, starting with this one:

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`filepath_or_buffer` – (string) one of three things:

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pd.read_csv(filepath_or_buffer)
```

`filepath_or_buffer` – (string) one of three things:

1. The **full file address and file name** of the data file
2. Just the file name of the data file if you've already set the working directory to the folder where the file exist
3. The URL of a data file that's accessible online

# Example: 2016 American National Election Study (ANES)

The ANES is a large survey, conducted every 4 years after the presidential election, that has 1000s of variables on topics no poll gets into. See https://electionstudies.org/

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I put several versions of the ANES data on our class GitHub page.

You can load the `anes_example.csv` data by either **downloading and unzipping** the file, or by using the URL:

https://raw.githubusercontent.com/NovaVolunteer/Practice_Application_DS/master/Week%205/anes_example.csv

# Example: 2016 American National Election Study (ANES)

If you download and unzip the ANES data, and you've already changed your working directory, then to load the ANES data, type

```
anes = pd.read_csv("anes_example.csv")
```

# Example: 2016 American National Election Study (ANES)

If you download and unzip the ANES data, and you've already changed your working directory, then to load the ANES data, type

```
anes = pd.read_csv("anes_example.csv")
```

If you want to load the data directly from the URL, save the URL as a separate object, then pass this to the function:

```
url = "https://raw.githubusercontent.com/NovaVolunteer/
    Practice_Application_DS/master/Week%205/
    anes_example.csv"
anes = pd.read_csv(url)
```

# Looking at the data to see if it loaded correctly

Before we get to the other parameters of the `pd.read_csv()` function, let's talk about the workflow of loading data.

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1. Run code to load a data file
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3. If you catch anything weird, return to 1. and try different parameters for `pd.read_csv()`

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The steps are

1. Run code to load a data file
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3. If you catch anything weird, return to 1. and try different parameters for `pd.read_csv()`

There's an important set of functions in Python that let you quickly explore a dataframe.

# Looking at the data to see if it loaded correctly

If you are using a Jupyter Notebook, typing the name of the data frame **in its own cell** will produce a good-looking HTML table illustrating the data frame.

```
[3]: anes
```

[3]:

| | caseid | turnout12 | turnout12b | vote12 | percent16 | meet | givefut | info |
|---|---|---|---|---|---|---|---|---|
| **0** | 1.0 | 1 | NaN | 2.0 | 100 | 1 | 3 | 4 |
| **1** | 2.0 | 2 | NaN | NaN | 50 | 4 | 5 | 4 |
| **2** | 3.0 | 1 | NaN | 1.0 | 100 | 1 | 1 | 1 |
| **3** | 4.0 | 1 | NaN | 2.0 | 100 | 5 | 4 | 5 |
| **4** | 5.0 | 1 | NaN | 1.0 | 100 | 2 | 1 | 3 |

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| **0** | 1.0 | 1 | NaN | 2.0 | 100 | 1 | 3 | 4 |
| **1** | 2.0 | 2 | NaN | NaN | 50 | 4 | 5 | 4 |
| **2** | 3.0 | 1 | NaN | 1.0 | 100 | 1 | 1 | 1 |
| **3** | 4.0 | 1 | NaN | 2.0 | 100 | 5 | 4 | 5 |
| **4** | 5.0 | 1 | NaN | 1.0 | 100 | 2 | 1 | 3 |

If you are using Spyder, look in the upper-right window and select the "Variable explorer" tab. Clicking on the data frame will open a separate window for viewing the data.

# Looking at the data to see if it loaded correctly

One annoying thing about Jupyter's interactive viewer is that it omits the columns in the middle for data frames with more than about 20 columns:

```
[3]: anes
```

[3]:

| | caseid | turnout12 | turnout12b | vote12 | percent16 | meet | givefut | info | march | sign | ... | votereg | pid3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1.0 | 1 | NaN | 2.0 | 100 | 1 | 3 | 4 | 1 | 2 | ... | 1 | 1 | |
| **1** | 2.0 | 2 | NaN | NaN | 50 | 4 | 5 | 4 | 2 | 2 | ... | 2 | 3 | |
| **2** | 3.0 | 1 | NaN | 1.0 | 100 | 1 | 1 | 1 | 1 | 1 | ... | 1 | 2 | |
| **3** | 4.0 | 1 | NaN | 2.0 | 100 | 5 | 4 | 5 | 2 | 2 | ... | 1 | 1 | |
| **4** | 5.0 | 1 | NaN | 1.0 | 100 | 2 | 1 | 3 | 1 | 2 | ... | 1 | 4 | |
| **5** | 6.0 | 1 | NaN | 3.0 | 100 | 3 | 3 | 2 | 2 | 1 | ... | 1 | 3 | |

# Looking at the data to see if it loaded correctly

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```
[3]: anes
```

[3]:

| | caseid | turnout12 | turnout12b | vote12 | percent16 | meet | givefut | info | march | sign | ... | votereg | pid3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1.0 | 1 | NaN | 2.0 | 100 | 1 | 3 | 4 | 1 | 2 | ... | 1 | 1 |
| **1** | 2.0 | 2 | NaN | NaN | 50 | 4 | 5 | 4 | 2 | 2 | ... | 2 | 3 |
| **2** | 3.0 | 1 | NaN | 1.0 | 100 | 1 | 1 | 1 | 1 | 1 | ... | 1 | 2 |
| **3** | 4.0 | 1 | NaN | 2.0 | 100 | 5 | 4 | 5 | 2 | 2 | ... | 1 | 1 |
| **4** | 5.0 | 1 | NaN | 1.0 | 100 | 2 | 1 | 3 | 1 | 2 | ... | 1 | 4 |
| **5** | 6.0 | 1 | NaN | 3.0 | 100 | 3 | 3 | 2 | 2 | 1 | ... | 1 | 3 |

The columns it skipped (about **148** in this case) are replaced by a column of dots.

# Looking at the data to see if it loaded correctly

One annoying thing about Jupyter's interactive viewer is that it omits the columns in the middle for data frames with more than about 20 columns:

```
[3]: anes
```

[3]:

| | caseid | turnout12 | turnout12b | vote12 | percent16 | meet | giveput | info | march | sign | ... | votereg | pid3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1.0 | 1 | NaN | 2.0 | 100 | 1 | 3 | 4 | 1 | 2 | ... | 1 | 1 | |
| **1** | 2.0 | 2 | NaN | NaN | 50 | 4 | 5 | 4 | 2 | 2 | ... | 2 | 3 | |
| **2** | 3.0 | 1 | NaN | 1.0 | 100 | 1 | 1 | 1 | 1 | 1 | ... | 1 | 2 | |
| **3** | 4.0 | 1 | NaN | 2.0 | 100 | 5 | 4 | 5 | 2 | 2 | ... | 1 | 1 | |
| **4** | 5.0 | 1 | NaN | 1.0 | 100 | 2 | 1 | 3 | 1 | 2 | ... | 1 | 4 | |
| **5** | 6.0 | 1 | NaN | 3.0 | 100 | 3 | 3 | 2 | 2 | 1 | ... | 1 | 3 | |

The columns it skipped (about **148** in this case) are replaced by a column of dots.

To keep Python from skipping columns, you can change this behavior **globally** (for all subsequent code) or **locally** (for each line of code individually).

# Looking at the data to see if it loaded correctly

To always display all of the columns, type

```
pd.set_option('display.max_columns', None)
```

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```

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```

Caution: If you are working with large dataframes, it's probably not a good idea to always display ALL of the rows and columns.

# Looking at the data to see if it loaded correctly

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```
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```

To always display all of the rows, type

```
pd.set_option('display.max_rows', None)
```

Caution: If you are working with large dataframes, it's probably not a good idea to always display ALL of the rows and columns.

To keep a specific line of code from skipping variables, use the `anes.loc()` and `anes.iloc()` functions. (Replace "anes" with the name of your dataframe object.)

# Looking at the data to see if it loaded correctly

`anes.loc()` allows you to select columns of a data frame by name, and `anes.iloc()` allows you to select columns by column number.

# Looking at the data to see if it loaded correctly

`anes.loc()` allows you to select columns of a data frame by name, and `anes.iloc()` allows you to select columns by column number.

To see the "sign", "give12mo", and "ftobama" variables, type

```
anes.loc[:, ['sign', 'give12mo', 'ftobama']]
```

| | sign | give12mo | ftobama |
|---|---|---|---|
| **0** | 2 | 2 | 100.0 |
| **1** | 2 | 2 | 39.0 |
| **2** | 1 | 1 | 1.0 |
| **3** | 2 | 2 | 89.0 |
| **4** | 2 | 1 | 1.0 |
| **5** | 1 | 1 | 0.0 |
| **6** | 2 | 1 | 73.0 |
| **7** | 1 | 2 | 0.0 |
| **8** | 2 | 1 | 12.0 |

# Looking at the data to see if it loaded correctly

To see all variables in between "sign", and "fthisp", type

```
anes.loc[:, 'sign':'fthisp']
```

| | sign | give12mo | compromise | ftobama | ftblack | ftwhite | fthisp |
|---|---|---|---|---|---|---|---|
| **0** | 2 | 2 | 1 | 100.0 | 100.0 | 100 | 100.0 |
| **1** | 2 | 2 | 1 | 39.0 | 6.0 | 74 | 6.0 |
| **2** | 1 | 1 | 2 | 1.0 | 50.0 | 50 | 50.0 |
| **3** | 2 | 2 | 1 | 89.0 | 61.0 | 64 | 61.0 |
| **4** | 2 | 1 | 2 | 1.0 | 61.0 | 58 | 71.0 |
| **5** | 1 | 1 | 2 | 0.0 | 50.0 | 51 | 51.0 |
| **6** | 2 | 1 | 1 | 73.0 | 100.0 | 70 | 100.0 |
| **7** | 1 | 2 | 1 | 0.0 | 70.0 | 70 | 69.0 |
| **8** | 2 | 1 | 2 | 12.0 | 50.0 | 50 | 50.0 |

# Looking at the data to see if it loaded correctly

To select columns and rows numerically, use `anes.iloc()`. To see rows 254 through 262 and all columns, type

```
anes.iloc[254:262, :]
```

# Looking at the data to see if it loaded correctly

To select columns and rows numerically, use `anes.iloc()`. To see rows 254 through 262 and all columns, type

```
anes.iloc[254:262, :]
```

To see all rows, columns 21 through 30, type

```
anes.iloc[:, 21:30]
```

# Looking at the data to see if it loaded correctly

To select columns and rows numerically, use `anes.iloc()`. To see rows 254 through 262 and all columns, type

```
anes.iloc[254:262, :]
```

To see all rows, columns 21 through 30, type

```
anes.iloc[:, 21:30]
```

To see rows 254 through 262 , columns 21 through 30, type

```
anes.iloc[254:262, 21:30]
```

# Looking at the data to see if it loaded correctly

To see only the first 10 rows of the data, type `anes.head(10)`. Replace 10 with however many rows you want to see.

# Looking at the data to see if it loaded correctly

To see only the first 10 rows of the data, type `anes.head(10)`.
Replace 10 with however many rows you want to see.

To see only the last 10 rows of the data, type `anes.tail(10)`.

# Looking at the data to see if it loaded correctly

To see only the first 10 rows of the data, type `anes.head(10)`. Replace 10 with however many rows you want to see.

To see only the last 10 rows of the data, type `anes.tail(10)`.

Typing `anes.info()` tells us the dimensions of the data, the number of variables of each type, and the size of the dataframe in memory:

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1200 entries, 0 to 1199
Columns: 168 entries, caseid to ever_vs_12mo_rand
dtypes: float64(76), int64(86), object(6)
memory usage: 1.5+ MB
```

# Looking at the data to see if it loaded correctly

`anes.columns` lists all the variable names.

If there are too many variables, Python will abbreviate the list with "..." To see the omitted items, use indexing – so to see the names for variables 30 through 40 type `anes.columns[30:40]`

# Looking at the data to see if it loaded correctly

`anes.columns` lists all the variable names.

If there are too many variables, Python will abbreviate the list with "..." To see the omitted items, use indexing – so to see the names for variables 30 through 40 type `anes.columns[30:40]`

`anes.dtypes` lists the variables along with their types (int64 for integers, float64 for numbers with decimals, object for variables that might be either categorical or string).

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`anes.dtypes` lists the variables along with their types (int64 for integers, float64 for numbers with decimals, object for variables that might be either categorical or string).

The output is an array, so you can get around abbreviation with indexing. To see the dtypes for rows 30-40, type

```
anes.dtypes[30:40,]
```

# Looking at the data to see if it loaded correctly

`anes.describe()` shows basic summary statistics for every variable in the dataframe.

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There are different summary statistics for different types of variables. By default, `anes.describe()` displays stats only for the `float` and `int` types:

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- `count` – number of non-missing observations

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There are different summary statistics for different types of variables. By default, `anes.describe()` displays stats only for the `float` and `int` types:

- `count` – number of non-missing observations
- `mean` – the sample mean

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There are different summary statistics for different types of variables. By default, `anes.describe()` displays stats only for the `float` and `int` types:

- `count` – number of non-missing observations
- `mean` – the sample mean
- `std` – the sample standard deviation

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`anes.describe()` shows basic summary statistics for every variable in the dataframe.

There are different summary statistics for different types of variables. By default, `anes.describe()` displays stats only for the `float` and `int` types:

- `count` – number of non-missing observations
- `mean` – the sample mean
- `std` – the sample standard deviation
- `min` – the minimum value

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There are different summary statistics for different types of variables. By default, `anes.describe()` displays stats only for the `float` and `int` types:

- `count` – number of non-missing observations
- `mean` – the sample mean
- `std` – the sample standard deviation
- `min` – the minimum value
- 25% – the 25th percentile

# Looking at the data to see if it loaded correctly

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There are different summary statistics for different types of variables. By default, `anes.describe()` displays stats only for the `float` and `int` types:

- `count` – number of non-missing observations
- `mean` – the sample mean
- `std` – the sample standard deviation
- `min` – the minimum value
- 25% – the 25th percentile
- 50% – the median value

# Looking at the data to see if it loaded correctly

`anes.describe()` shows basic summary statistics for every variable in the dataframe.

There are different summary statistics for different types of variables. By default, `anes.describe()` displays stats only for the `float` and `int` types:

- `count` – number of non-missing observations
- `mean` – the sample mean
- `std` – the sample standard deviation
- `min` – the minimum value
- 25% – the 25th percentile
- 50% – the median value
- 75% – the 75th percentile

# Looking at the data to see if it loaded correctly

`anes.describe()` shows basic summary statistics for every variable in the dataframe.

There are different summary statistics for different types of variables. By default, `anes.describe()` displays stats only for the `float` and `int` types:

- `count` – number of non-missing observations
- `mean` – the sample mean
- `std` – the sample standard deviation
- `min` – the minimum value
- 25% – the 25th percentile
- 50% – the median value
- 75% – the 75th percentile
- `max` – the maximum value

# Looking at the data to see if it loaded correctly

Use the `percentiles` argument to display different percentiles.

To see the 20th, 37.5th, and 74.23th percentiles, type

```
anes.describe(percentiles = [.20, .375, .7423])
```

# Looking at the data to see if it loaded correctly

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anes.describe(percentiles = [.20, .375, .7423])
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- `freq` – the frequency of the top value

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There are many reasons why a load might have failed. Fortunately, there are parameters within the `pd.read_csv()` function to deal with many of these issues.

# Loading messy CSV and other ASCII files

```
pd.read_csv(filepath_or_buffer, sep, header)
```

`sep` or `delimiter` – (string) The symbol that is used in the file to separate one datapoint from the next on the same row. By default, it looks for commas.

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- `header=j` uses the $j_{th}$ row for variable names, and deletes all higher rows

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In general, don't use this parameter unless the data file is too large to load in its entirety. You can delete columns later.

# Loading messy CSV and other ASCII files

```
pd.read_csv(filepath_or_buffer, sep, header, usecols,
skiprows, skipfooter, nrows )
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`nrows` – (integer) only loads the first several rows, as specified by the user

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To replace all these values with `NA` across the whole data frame, type `na_values = [-7, -8, -9, 998]`.

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Caution: Only specify missing codes in the `pd.read_csv()` function if the code ALWAYS means a missing value. If 998 is a valid datapoint for some variables, you can replace the missing codes for relevant variables later.

# Loading messy CSV and other ASCII files

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pd.read_csv(filepath_or_buffer, sep, header, usecols,
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Careful: if the comment-symbol appears ANYWHERE on the row, the remainder of the row is not read. That's a problem if the data contain tweets, and one tweet reads "UVA is #1!".

# Writing CSV and ASCII files

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Suppose the `anes` object contains a cleaned dataframe. To save it as a CSV, use `anes.to_csv()`. There are several parameters, you can see with `help(anes.to_csv)`.

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Let's talk about two important parameters:

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`sep` – (string) the character to use as a delimiter. A comma by default. Use `sep="\t"` for a tab-delimited file.

To save the `anes` dataframe as a standard CSV file, type:

```
anes.to_csv("anes_cleaned.csv", sep=",")
```

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But that makes the data impossible to parse without an external list of which variable is stored where. The first and most important step is to get this list.

Then follow these steps:

# Loading fixed width files

1. Find the variable names, and save them in a list object.

```
datanames = ['psraid', 'sample', 'int_date', 'area',
'state', 'cregion', 'density', 'usr', 'cc1', 'cc1a',
'cc2', 'cc3', 'cc4', 'cc5', 'cc6', 'cc7', 'ql1', 'ql1a',
'qc1', 'hh1', 'employ', 'par', 'sex', 'age', 'educ2',
'hisp', 'race', 'inc', 'income', 'reg', 'party',
'partyln', 'iphoneus', 'hphoneus', 'recage', 'receduc',
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'racethn', 'standwt', 'raceos']
```

2(a). If you know how many characters each variable takes, at maximum, save these widths as a list object.

```
datawidths = [6, 1, 6, 3, 2, 1, 1, 3, 1, 1,
              1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
              1, 1, 1, 2, 1, 1, 1, 2, 1, 1,
              1, 1, 1, 1, 1, 1, 1, 4, 30]
```