03 | *pandas*

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GENERAL ASSEMBLY

Learning Objectives

After this lesson, you should be able to:

- Define a data science problem
- Write a Jupyter notebook to import, format, and clean data using *pandas*

Business Understanding

By asking a good question and setting a clear aim:

- You set yourself up for success
  - “A problem well stated is half solved” – Charles Kettering
- You help other data scientists learn from and reproduce your work
  - You establish the basis for making your analysis reproducible
- You also help them expand on your work in the future

The SMART Goals Framework for Data Science

(https://en.wikipedia.org/wiki/SMART_criteria)

SPECIFIC	The dataset and key variables are clearly defined
MEASURABLE	The type of analysis and major assumptions are articulated
ATTAINABLE	The question you are asking is feasible for your dataset and is not likely to be biased
REPRODUCIBLE	Another person (or you in 6 months!) can read your state and understand exactly how your analysis is performed
TIME-BOUND	You clearly state the time period and population for which this analysis will pertain

Trends often change over time and vary by the population of source of your data. It is important to clearly define who/what you included in your analysis as well as the time period for the analysis

Models, Feature Matrix X, Response Vector y, and Tidy Data

Before **modeling**, our data needs to be **tidy** and in the form of a **feature matrix $\boldsymbol{X}$** (i.e., the stimuli, e.g., *"ring bell"*) and a **response vector $\boldsymbol{y}$** (i.e., the response, e.g., *"dog salivates"*)

Feature Matrix X

	col0	col1	col2	col3
row0				
row1				
row2				
row3				

Response Vector y

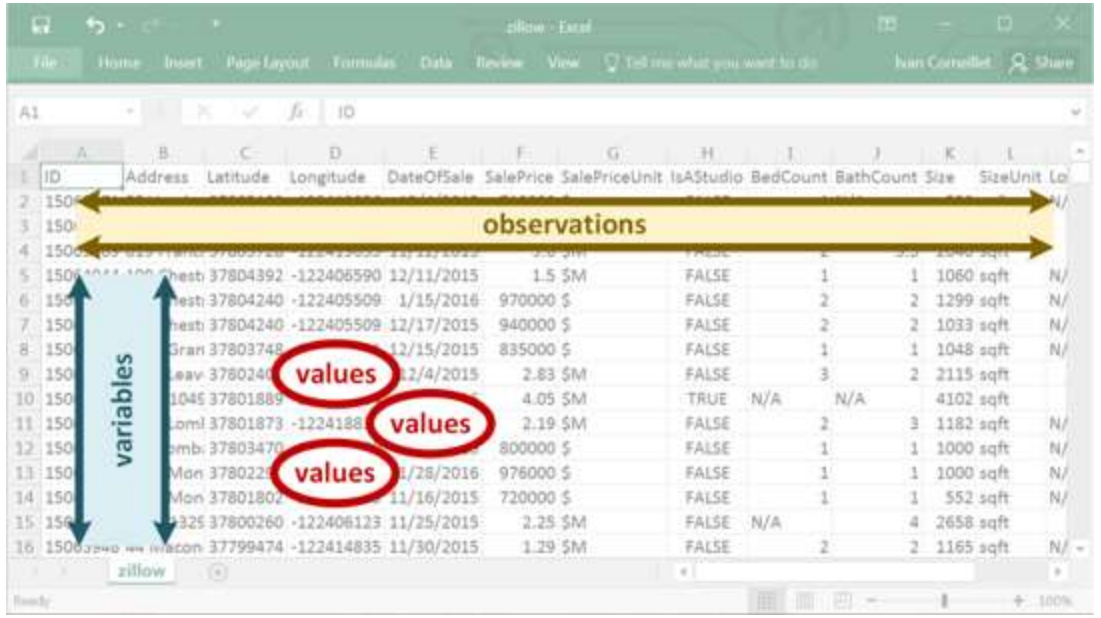
	col
row0	
row1	
row2	
row3	

San Francisco Dataset: a dataset we will use throughout this course

- Recently Sold Homes (Source: Zillow)
  - 1,000 homes sold in San Francisco between 11/10/2015 and 2/12/2016

What is Tidy Data?

- Your data is tidy if you follow these three rules:
  - Each **sample** (or **observation**) in the dataset is placed in its own **row**
  - Each **feature** (or **variable**) is placed in its own **column**
  - Each **value** is placed in its own **cell**

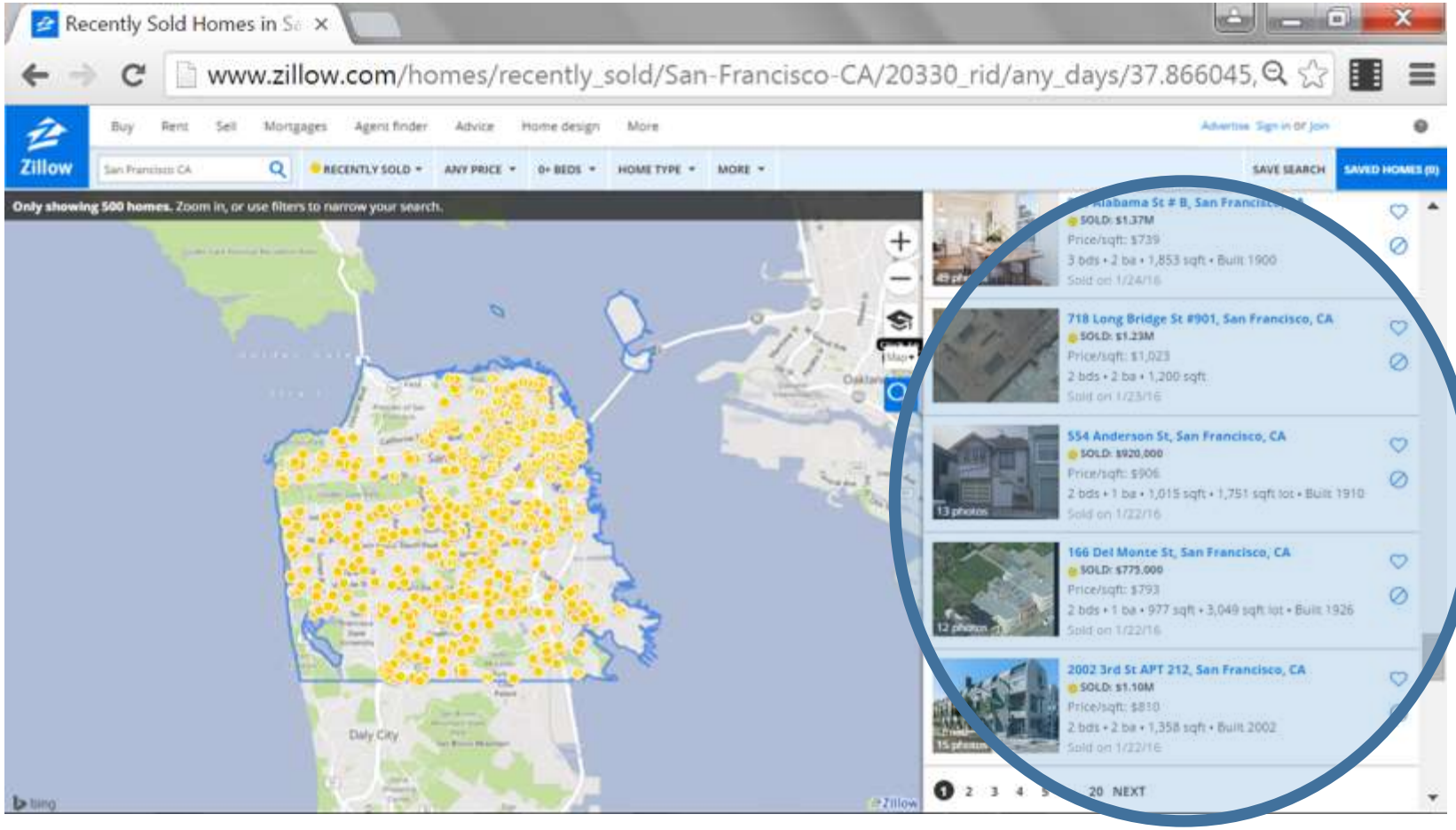


Unfortunately, data will usually come to you **raw**, i.e., **unstructured…**

```
<div class="property-info"
id="yui_3_18_1_1_1456167242885_71870"><strong
id="yui_3_18_1_1_1456167242885_71869"><dt class="property-address"
id="yui_3_18_1_1_1456167242885_71868"><a href="/homedetails/149-
Shipley-St-San-Francisco-CA-94107/15147894_zpid/" class="hdp-link
routable" title="149 Shipley St, San Francisco, CA Real Estate"
id="yui_3_18_1_1_1456167242885_71873">149 Shipley St, San
Francisco, CA</a></dt></strong><dt class="listing-type zsg-
content_collapsed" id="yui_3_18_1_1_1456167242885_71875"><span
class="zsg-icon-recently-sold type-icon"></span>Sold:
$1.18M</dt><dt class="zsg-fineprint"
id="yui_3_18_1_1_1456167242885_71877">Price/sqft: $1,116</dt><dt
class="property-data" id="yui_3_18_1_1_1456167242885_71880"><span
class="beds-baths-sqft">3 bds • 2 ba • 1,057 sqft</span><span
class="built-year" id="yui_3_18_1_1_1456167242885_71879"> • Built
1992</span></dt><dt class="sold-date zsg-fineprint"
id="yui_3_18_1_1_1456167242885_71975">Sold on 2/22/16</dt></div>
```

(E.g., raw/unstructured scrapped data)

CASE STUDY



… and/or **messy**…

- Trouble tickets inspect and maintain manholes in New Year City
- "Service box," a common piece of infrastructure, had at least 38 variants, including `SB`, `S`, `S/B`, `S.B`, `S?B`, `S.B.`, `SBX`, `S/BX`, `SB/X`, `S/XB`, `/SBX`, `S.BX`, `S &BX`, `S?BX`, `S BX`, `S/B/X`, `S BOX`, `SVBX`, `SERV BX`, `SERV-BOX`, `SERV/BOX`, and `SERVICE BOX`

Source: Big Data: A Revolution That Will Transform How We Live, Work, and Think

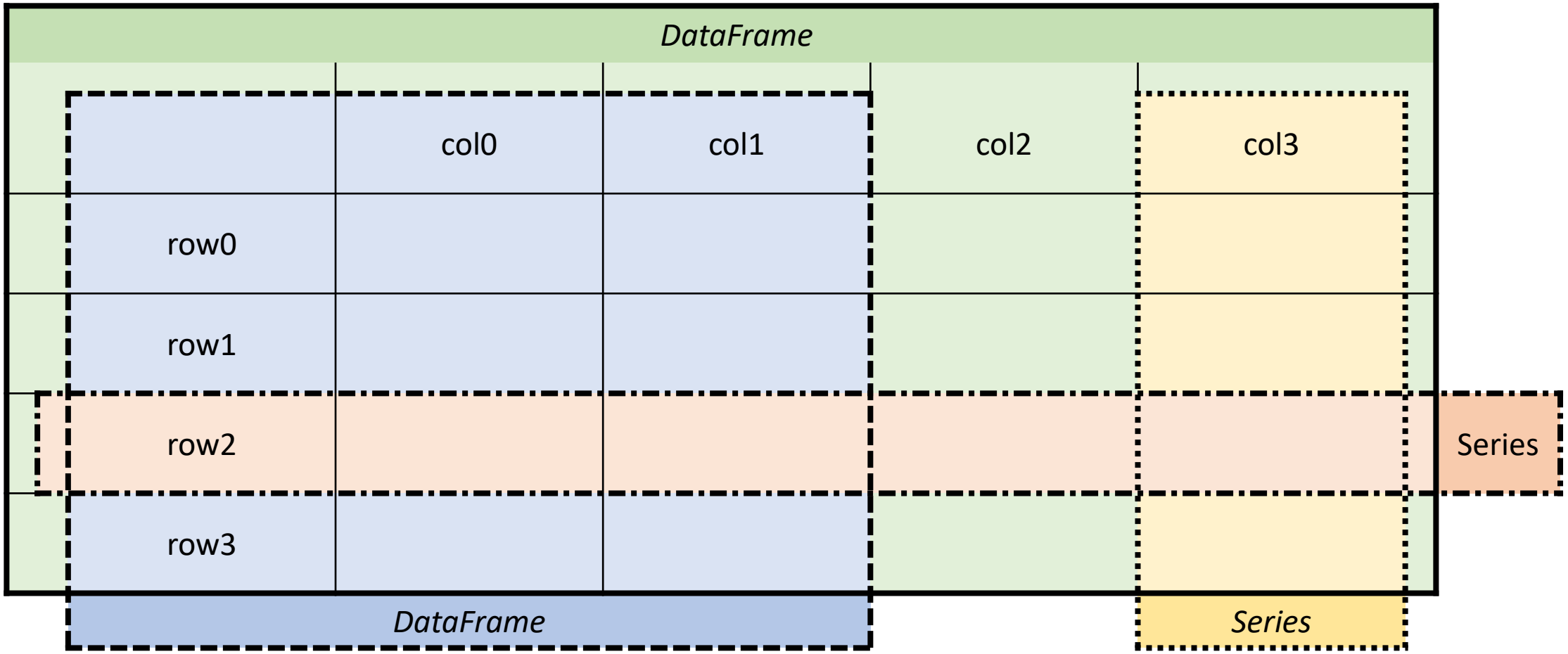
Question: What tool can we use to wrangle **raw data** into **tidy data**?

- Answer: *pandas*
  - *pandas* is a Python library that provides the ability to *index*, *retrieve*, *tidy*, *reshape*, *combine*, *slice*, tabular and other multidimensional datasets
  - *pandas* also provides facilities to perform statistical and mathematical analysis which will come handy for exploratory data analysis

- Wrangling data is the most fruitful skill you can learn as a data scientist. It will save you hours of time and make your data much easier to visualize, manipulate, and model
- Today, we will use *pandas* to explore and manipulate the San Francisco housing dataset

pandas

pandas.DataFrame and *pandas.Series* (cont.)



When reaching the **modeling** step, our **feature matrix $\boldsymbol{X}$** will be modeled as a **DataFrame** and the **response vector $\boldsymbol{y}$** as a **Series**

Feature Matrix X

DataFrame

	col0	col1	col2	col3
row0				
row1				
row2				
row3				

Response Vector y

Series

	col
row0	
row1	
row2	
row3	

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