Pandas

Data processing in Python

Python and Pandas

pandas

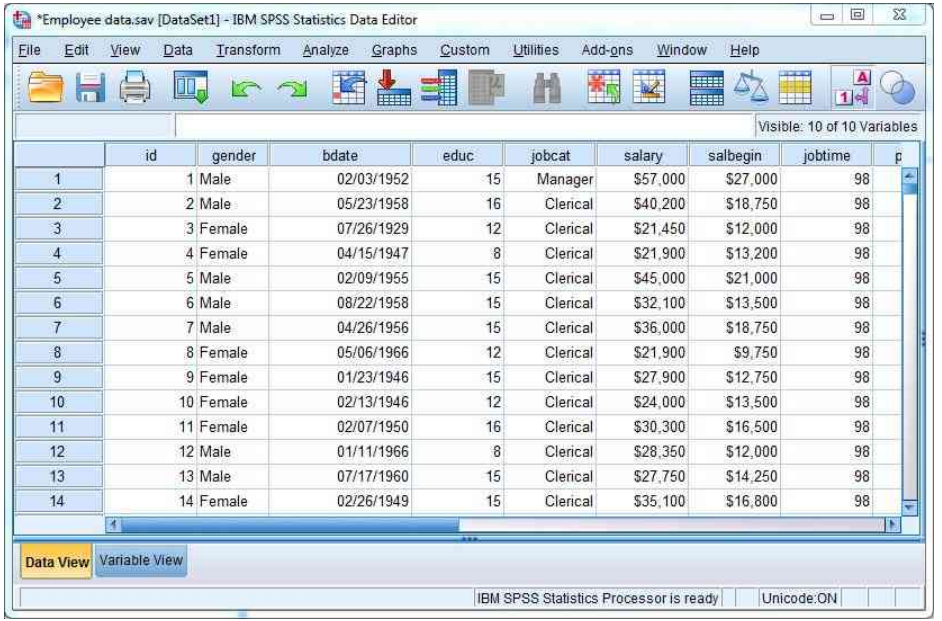
$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$

Pandas

- It is an extension/package/tool for Python to make data processing easier.

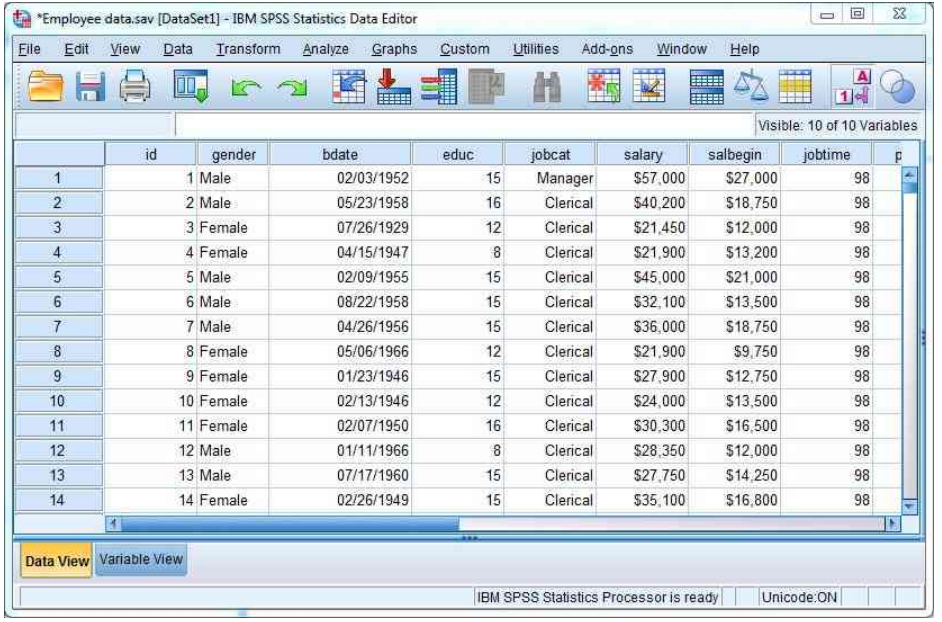
Why?

- Spreadsheet like data:
  - Records with multiple fields
  - Multiple formats



	id	gender	bdate	educ	jobcat	salary	salbegin	jobtime
1	1	Male	02/03/1952	15	Manager	$57,000	$27,000	98
2	2	Male	05/23/1958	16	Clerical	$40,200	$18,750	98
3	3	Female	07/26/1929	12	Clerical	$21,450	$12,000	98
4	4	Female	04/15/1947	8	Clerical	$21,900	$13,200	98
5	5	Male	02/09/1955	15	Clerical	$45,000	$21,000	98
6	6	Male	08/22/1958	15	Clerical	$32,100	$13,500	98
7	7	Male	04/26/1956	15	Clerical	$36,000	$18,750	98
8	8	Female	05/06/1966	12	Clerical	$21,900	$9,750	98
9	9	Female	01/23/1946	15	Clerical	$27,900	$12,750	98
10	10	Female	02/13/1946	12	Clerical	$24,000	$13,500	98
11	11	Female	02/07/1950	16	Clerical	$30,300	$16,500	98
12	12	Male	01/11/1966	8	Clerical	$28,350	$12,000	98
13	13	Male	07/17/1960	15	Clerical	$27,750	$14,250	98
14	14	Female	02/26/1949	15	Clerical	$35,100	$16,800	98

- Select/Filter data
- Summarize per group
- Merging data
- Complex fields, e.g. dates



	id	gender	bdate	educ	jobcat	salary	salbegin	jobtime	p
1	1	Male	02/03/1952	15	Manager	$57,000	$27,000	98	
2	2	Male	05/23/1958	16	Clerical	$40,200	$18,750	98	
3	3	Female	07/26/1929	12	Clerical	$21,450	$12,000	98	
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14	14	Female	02/26/1949	15	Clerical	$35,100	$16,800	98	

IBM SPSS

Pandas: DataFrame data format

- 2-dimensional
- labeled data
- Indexed data
- Columns different types
- Very much like excel spreadsheet

	total_bill	tip	sex	smoker	day	time	size
1	16.99	1.01	Female	No	Sun	Dinner	2
2	10.34	1.66	Male	No	Sun	Dinner	3
3	21.01	3.50	Male	No	Sun	Dinner	3
4	23.68	3.31	Male	No	Sun	Dinner	2
5	24.59	3.61	Female	No	Sun	Dinner	4
6	25.29	4.71	Male	No	Sun	Dinner	4
7	8.770	2.00	Male	No	Sun	Dinner	2
8	26.88	3.12	Male	No	Sun	Dinner	4
9	15.04	1.96	Male	No	Sun	Dinner	2
10	14.78	3.23	Male	No	Sun	Dinner	2

Sidenote: DataFrames in R and Matlab

- R: software for data analysis and statistics:
  - Dataframe is the bread and butter data format

- Matlab: software for numerical calculations
  - Uses arrays as default data structure
  - Has recently also added the dataframe

The anatomy of a Pandas DataFrame

Pandas DataFrame

- Both numerical and textual data

1	0.3	A	xyz	True
5	0.6	B	abc	False
6	0.7	C	ddf	True
7	0.8	D	qer	False
9	0.9	E	dft	False

Pandas DataFrame

lab1	data1	sx	age	dft	type
0	1	0.3	5	xyz	True
1	5	0.6	9	abc	False
2	6	0.7	3	ddf	True
3	7	0.8	6	qer	False
4	9	0.9	1	dft	False

- Numbers and text as data
- Names for the columns
- Names for the rows [index]
  - Rows names can be numbers

Pandas DataFrame

lab1	data1	sx	age	dft	type
rt	1	0.3	5	xyz	True
dt	5	0.6	9	abc	False
qt	6	0.7	3	ddf	True
my	7	0.8	6	qer	False
op	9	0.9	1	dft	False

- Numbers and text as data
- Names for the columns
- Names for the rows [index]
  - Rows names can be numbers
  - Or textual labels

Pandas DataFrame

nms	lab1	data1	sx	age	dft	type
a	1	1	0.3	5	xyz	True
a	2	5	0.6	9	abc	False
b	1	6	0.7	3	ddf	True
b	2	7	0.8	6	qer	False
b	3	9	0.9	1	dft	False

- Numbers and text as data
- Names for the columns
- Names for the rows [index]
  - Row labels can be numbers
  - Or textual labels
- It is possible to have a multi index:
  - each rows has a unique combination of names

Selecting data based on data properties

nms	lab1	data1	sx	age	dft	type
a	1	1	0.3	5	xyz	True
a	2	5	0.6	9	abc	False
b	1	6	0.7	3	ddf	True
b	2	7	0.8	6	qer	False
b	3	9	0.9	1	dft	False

- Selecting a number of rows
  - Based on a selecting criterion
  - Here: age < 5

Selecting data based on column labels

nms	lab1	data1	sx	age	dft	type
a	1	1	0.3	5	xyz	True
a	2	5	0.6	9	abc	False
b	1	6	0.7	3	ddf	True
b	2	7	0.8	6	qer	False
b	3	9	0.9	1	dft	False

- Often by column label

Selecting data based on column labels and row labels

nms	lab1	data1	sx	age	dft	type
a	1	1	0.3	5	xyz	True
a	2	5	0.6	9	abc	False
b	1	6	0.7	3	ddf	True
b	2	7	0.8	6	qer	False
b	3	9	0.9	1	dft	False

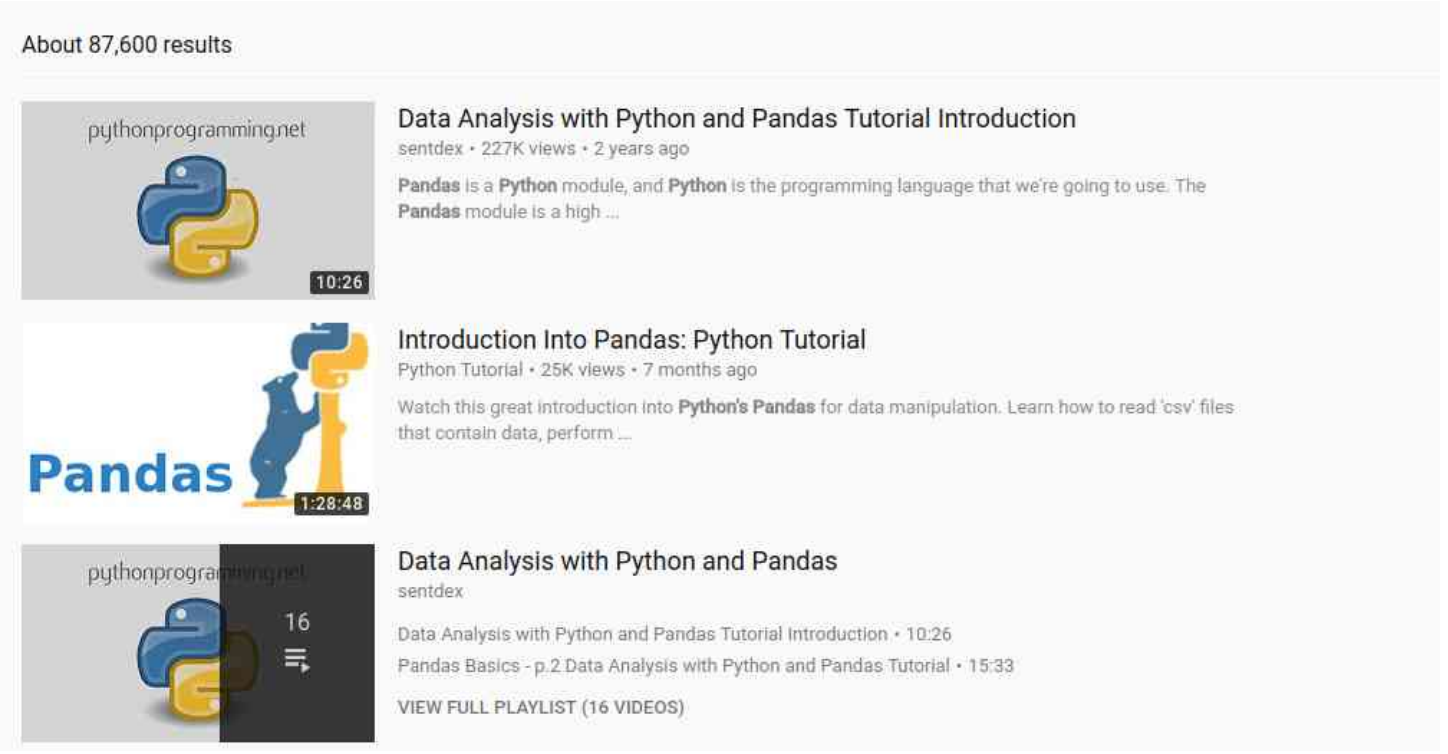
- Often by column label
- Sometimes: row & column labels
  - Rows: a,2 → b,2
  - Columns: sx → age

Summary

nms	lab1	data1	sx	age	dft	type
a	1	1	0.3	5	xyz	True
a	2	5	0.6	9	abc	False
b	1	6	0.7	3	ddf	True
b	2	7	0.8	6	qer	False
b	3	9	0.9	1	dft	False

- Different types of data
- Unique column names
- Unique combination of row names
- Selecting data:
  - Rows by criterion
    - Example: age < 5
  - By column and/or rows label:
    - Example:
      - Colums: sx → age
      - Rows: a,2 → b,2

By the way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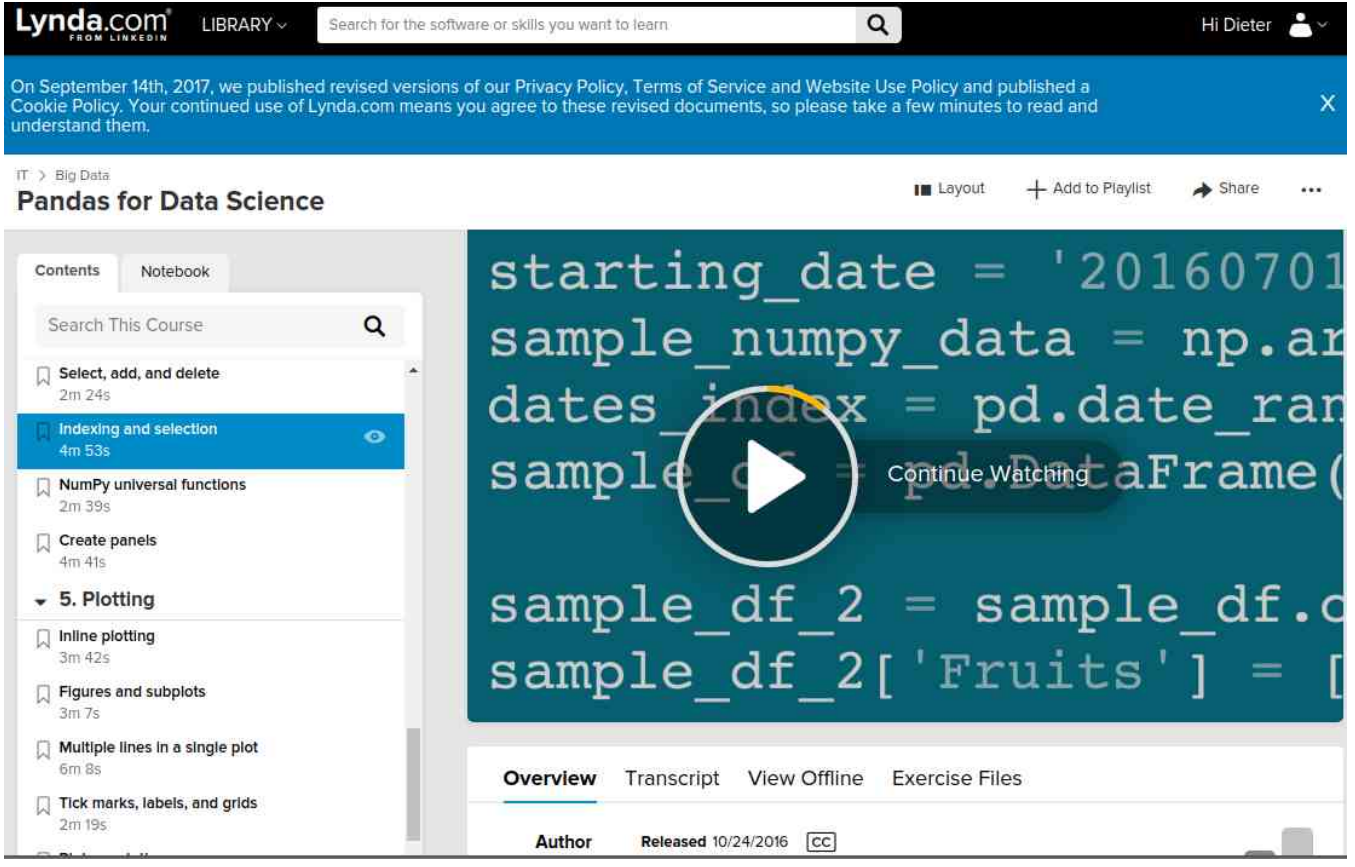
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4m 53s
NumPy universal functions
2m 39s
Create panels
4m 41s
5. Plotting
Inline plotting
3m 42s
Figures and subplots
3m 7s
Multiple lines in a single plot
6m 8s
Tick marks, labels, and grids
2m 19s
starting_date = '20160701
sample_numpy_data = np.ar
dates_index = pd.date_ran
sample_df = pd.DataFrame(
sample_df_2 = sample_df.c
sample_df_2['Fruits'] = [
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