IMD0905 - Data Science I

Lesson #10 - Exploring data with Pandas

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Agenda

- Select columns, rows and individual items using their integer location.
- Work with integer axis labels.
- How to use pandas methods to produce boolean arrays.
- Use boolean operators to combine boolean comparisons to perform more complex analysis.
- Use index labels to align data.
- Use aggregation to perform advanced analysis using loops.

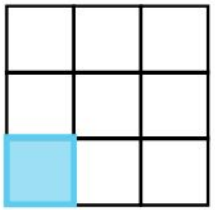
Update the repository

```
git clone https://github.com/ivanovitchm/IMD0905_datascience_one.git
```

Or ....

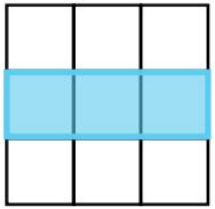
```
git pull
```

Introduction (Pandas vs Numpy)



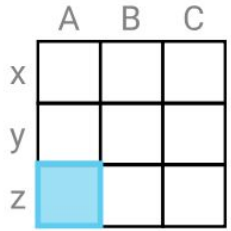
```
ndarray[2,0]
```

located at row **2**, *column* **0**



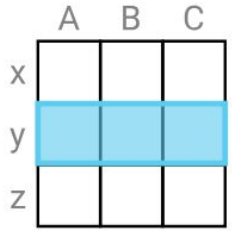
```
ndarray[1]
```

located at row **1**




```
df.loc["z","A"]
```

located at row with label **z**, *column with label* **A**



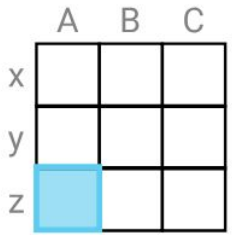

```
df.loc["y"]
```

located at row with label **y**

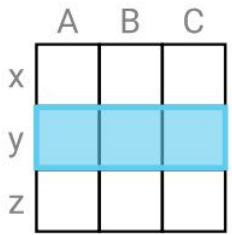
Numpy

Pandas

Using iloc to select by integer position




```
df.iloc[2,0]
```




```
df.iloc[1]
```

```
first_column = f500.iloc[:,0]
print(first_column)
```

```
0                          Walmart
1                     State Grid
2                  Sinopec Group
...
497    Wm. Morrison Supermarkets
498                            TUI
499                     AutoNation
Name: company, dtype: object
```

Slicing with iloc

With **loc[]**, the ending slice is **included**.
With **iloc[],** the ending slice is **not included**.

```
1 f500[1:4]
```

	rank	revenues
State Grid	2	315199
Sinopec Group	3	267518
China National Petroleum	4	262573

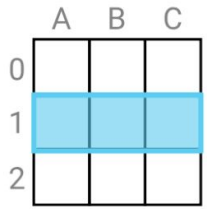
```
1 f500.iloc[1:4]
```

	rank	revenues
State Grid	2	315199
Sinopec Group	3	267518
China National Petroleum	4	262573

Loc vs iLoc

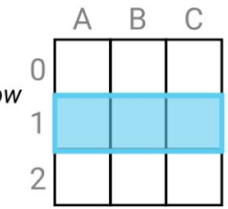
`df.iloc[1]`

`iloc[1]` *uses the integer position of the row to select the second row*



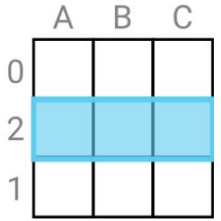
`df.loc[1]`

`loc[1]` *uses the label of the row to select the row with an axis label of* `1`.



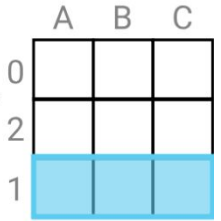
`df.iloc[1]`

`iloc[1]` *uses the integer position of the row to select the second row*

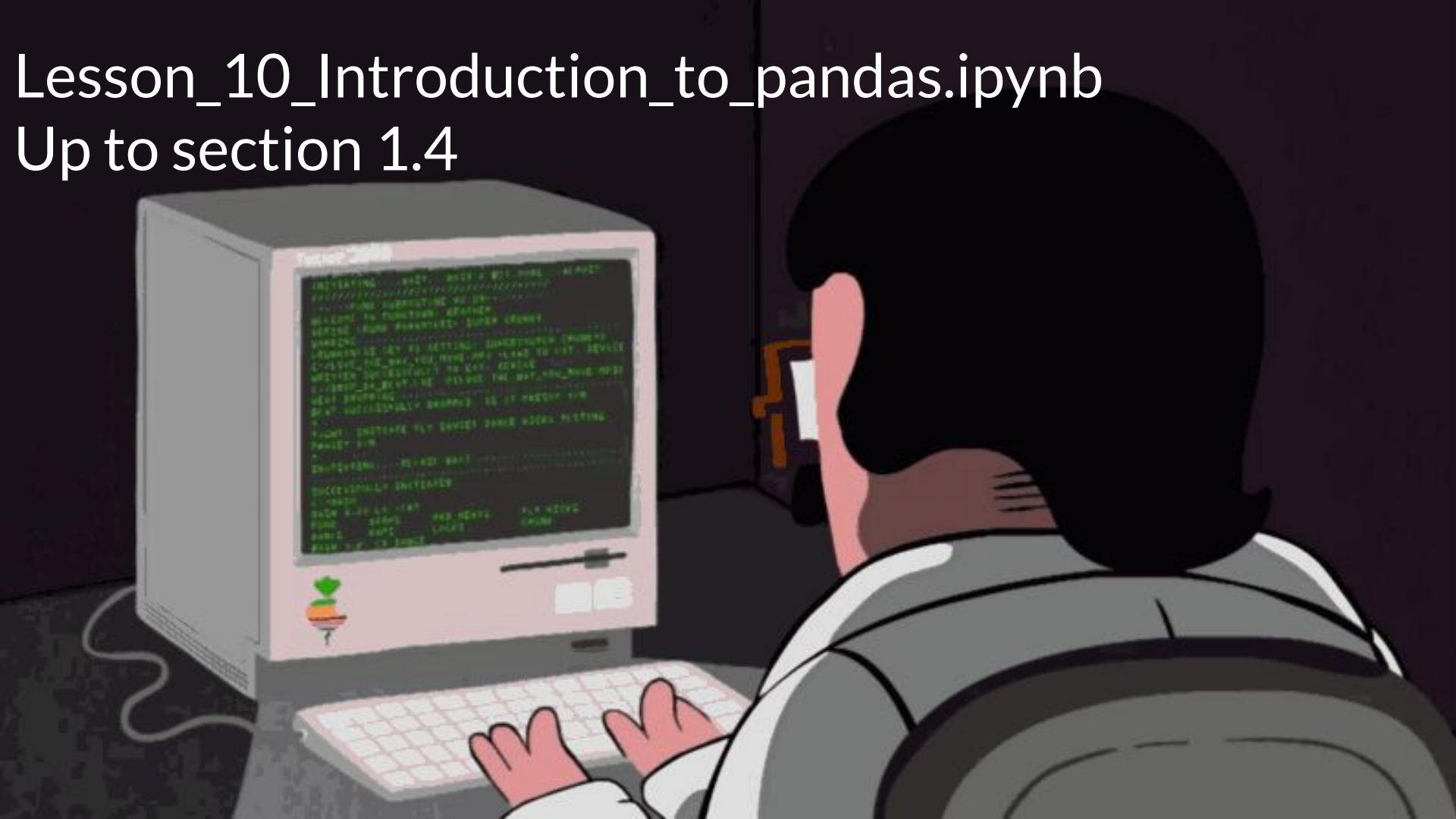


`df.loc[1]`

`loc[1]` *uses the label of the row to select the row with an axis label of* `1`.



Lesson_10_Introduction_to_pandas.ipynb
Up to section 1.4



Using pandas methods to create boolean masks

```
>>> is_california = usa["hq_location"].str.endswith("CA")

>>> print(is_california.head())

0     False
7     False
8      True
9     False
10     True
Name: hq_location, dtype: bool
```

```
0        Bentonville, AR
7             Omaha, NE
8         Cupertino, CA
9            Irving, TX
10    San Francisco, CA
Name: hq_location, dtype: object
```

Using boolean operators to select items

	company	revenues	country
0	Walmart	485873	USA
1	State Grid	315199	China
2	Sinopec Group	267518	China
3	China Nation...	262573	China
4	Toyota Motor	254694	Japan

f500_sel

```
over_265 = f500_sel["revenues"] > 265000
china = f500_sel["country"] == "China"
```

	over_265
0	True
1	True
2	True
3	False
4	False

	china
0	False
1	True
2	True
3	True
4	False

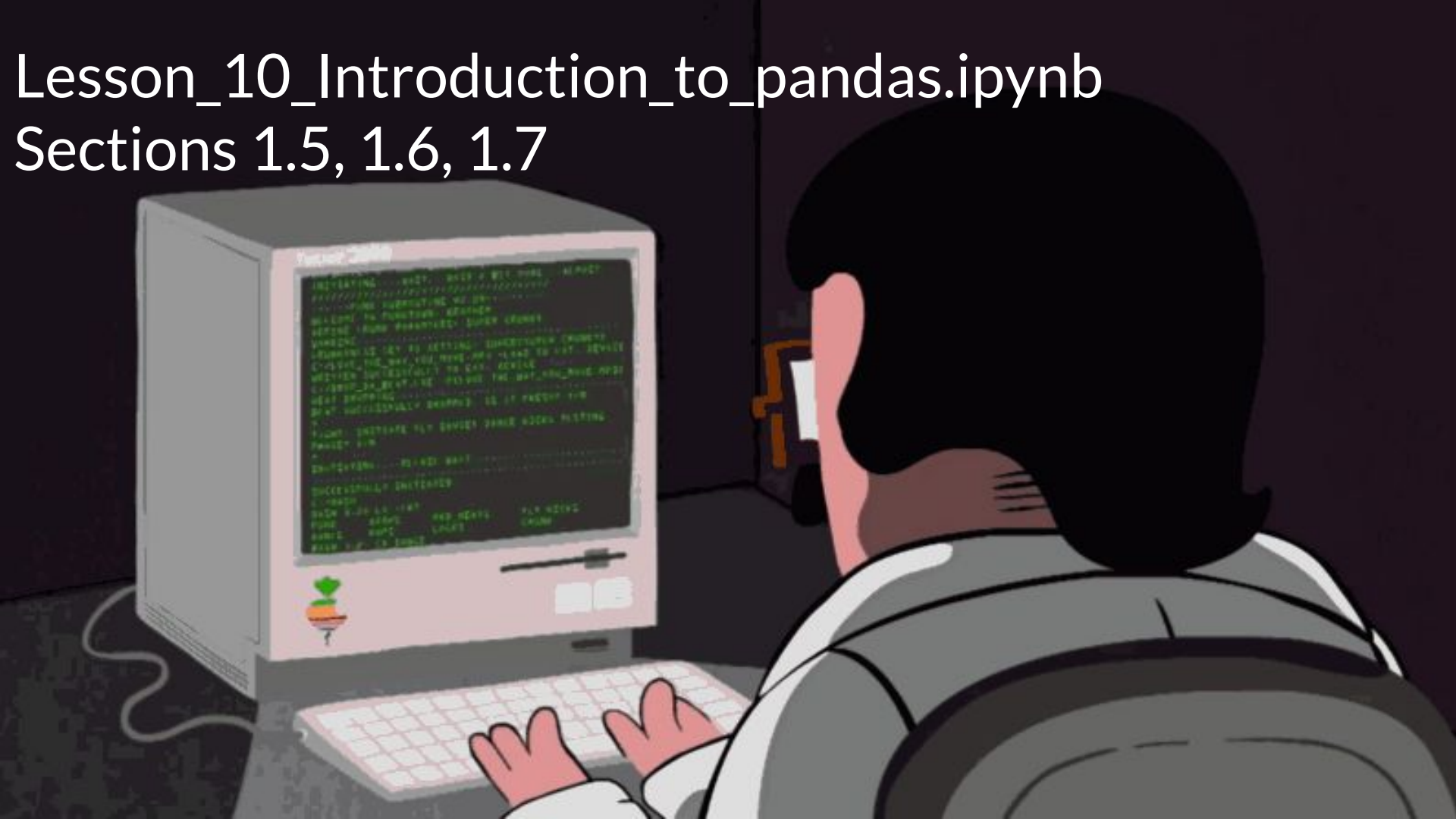
```
combined = over_265 & china
```

	over_265		china		combined
0	True	&	False	=	False
1	True	&	True	=	True
2	True	&	True	=	True
3	False	&	True	=	False
4	False	&	False	=	False

Using boolean operators to select items

```
final_cols = ["company","revenues"]
result = f500_sel.loc[combined,final_cols]
```

Lesson_10_Introduction_to_pandas.ipynb
Sections 1.5, 1.6, 1.7



Pandas Index Alignment

	fruit_veg	qty
tomato	fruit	4
carrot	veg	2
lime	fruit	4
corn	veg	1
eggplant	veg	2

food

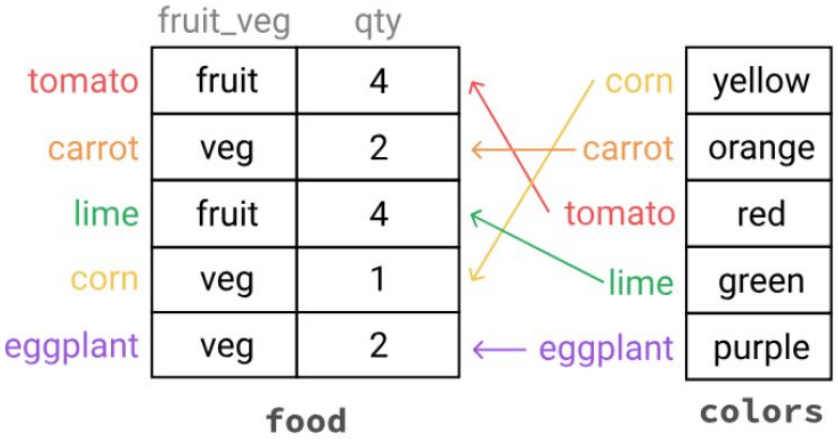
	colors
corn	yellow
carrot	orange
tomato	red
lime	green
eggplant	purple

colors

	fruit_veg	qty	color
tomato	fruit	4	red
carrot	veg	2	orange
lime	fruit	4	green
corn	veg	1	yellow
eggplant	veg	2	purple

food

```
food["color"] = colors
```



Pandas Index Alignment

	alt_name
arugula	rocket
eggplant	aubergine
corn	maize

```
food["alt_name"] = alt_name
```

	fruit_veg	qty	color	alt_name
tomato	fruit	4	red	NaN
carrot	veg	2	orange	NaN
lime	fruit	4	green	NaN
corn	veg	1	yellow	maize
eggplant	veg	2	purple	aubergine

food

Using Loops in Pandas

```
>>> print(df)

   A  B  C
x  6  1  0
y  1  8  8
z  3  8  7

>>> for i in df:
        print(i)

A
B
C
```

Because one of the key benefits of pandas is that it has vectorized methods to work with data more efficiently, we want to avoid using loops wherever we can

Challenge: calculating return on assets by sector

```
{'Aerospace & Defense': 'Lockheed Martin',
 'Apparel': 'Nike',
 'Business Services': 'Adecco Group',
 'Chemicals': 'LyondellBasell Industries',
 'Energy': 'National Grid',
 'Engineering & Construction': 'Pacific Construction Group',
 'Financials': 'Berkshire Hathaway',
 'Food & Drug Stores': 'Publix Super Markets',
 'Food, Beverages & Tobacco': 'Philip Morris International',
 'Health Care': 'Gilead Sciences',
 'Hotels, Restaurants & Leisure': 'McDonald\xe2\x80\x99s',
 'Household Products': 'Unilever',
 'Industrials': '3M',
 'Materials': 'CRH',
 'Media': 'Disney',
 'Motor Vehicles & Parts': 'Subaru',
 'Retailing': 'H & M Hennes & Mauritz',
 'Technology': 'Accenture',
 'Telecommunications': 'KDDI',
 'Transportation': 'Delta Air Lines',
 'Wholesalers': 'McKesson'}
```

$$\text{return on assets} = \frac{profits}{assets}$$

Lesson_10_Introduction_to_pandas.ipynb
Sections 1.8, 1.9, 1.10