

Dictionarys, Part 1

INTERMEDIATE PYTHON



Hugo Bowne-Anderson
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List

```
pop = [30.55, 2.77, 39.21]
countries = ["afghanistan", "albania", "algeria"]
ind_alb = countries.index("albania")
ind_alb
```

1

```
pop[ind_alb]
```

2.77

- Not convenient
- Not intuitive

Dictionary

```
pop = [30.55, 2.77, 39.21]
countries = ["afghanistan", "albania", "algeria"]
...
{
}
```

Dictionary

```
pop = [30.55, 2.77, 39.21]
countries = ["afghanistan", "albania", "algeria"]
...
{"afghanistan": 30.55, }
```

Dictionary

```
pop = [30.55, 2.77, 39.21]
countries = ["afghanistan", "albania", "algeria"]
...
world = {"afghanistan":30.55, "albania":2.77, "algeria":39.21}
world["albania"]
```

2.77

Let's practice!

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Dictionarys, Part 2

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Recap

```
world = {"afghanistan":30.55, "albania":2.77, "algeria":39.21}  
world["albania"]
```

```
2.77
```

```
world = {"afghanistan":30.55, "albania":2.77,  
        "algeria":39.21, "albania":2.81}  
world
```

```
{'afghanistan': 30.55, 'albania': 2.81, 'algeria': 39.21}
```

Recap

- Keys have to be "immutable" objects

```
{0: "hello", True: "dear", "two": "world"}
```

```
{0: 'hello', True: 'dear', 'two': 'world'}
```

```
{"just", "to", "test": "value"}
```

```
TypeError: unhashable type: 'list'
```

¹ Source: Wikipedia



Principality of Sealand

Dictionary

```
world["sealand"] = 0.000027
```

World

```
{'afghanistan': 30.55, 'albania': 2.81,  
 'algeria': 39.21, 'sealand': 2.7e-05}
```

```
"sealand" in world
```

True

Dictionary

```
world["sealand"] = 0.000028
```

World

```
{'afghanistan': 30.55, 'albania': 2.81,  
 'algeria': 39.21, 'sealand': 2.8e-05}
```

```
del(world["sealand"])
```

World

```
{'afghanistan': 30.55, 'albania': 2.81, 'algeria': 39.21}
```

List vs. Dictionary

List vs. Dictionary

List vs. Dictionary

List	Dictionary
Select, update, and remove with <code>[]</code>	Select, update, and remove with <code>[]</code>

List vs. Dictionary

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List	Dictionary
Select, update, and remove with <code>[]</code>	Select, update, and remove with <code>[]</code>
Indexed by range of numbers	

List vs. Dictionary

List	Dictionary
Select, update, and remove with <code>[]</code>	Select, update, and remove with <code>[]</code>
Indexed by range of numbers	Indexed by unique keys

List vs. Dictionary

List	Dictionary
Select, update, and remove with <code>[]</code>	Select, update, and remove with <code>[]</code>
Indexed by range of numbers	Indexed by unique keys
Collection of values — order matters, for selecting entire subsets	

List vs. Dictionary

List	Dictionary
Select, update, and remove with <code>[]</code>	Select, update, and remove with <code>[]</code>
Indexed by range of numbers	Indexed by unique keys
Collection of values — order matters, for selecting entire subsets	Lookup table with unique keys

Let's practice!

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Pandas, Part 1

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Tabular dataset examples

temperature	measured_at	location
76	2016-01-01 14:00:01	valve
86	2016-01-01 14:00:01	compressor
72	2016-01-01 15:00:01	valve
88	2016-01-01 15:00:01	compressor
68	2016-01-01 16:00:01	valve
78	2016-01-01 16:00:01	compressor

Tabular dataset examples

temperature	measured_at	location
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row = observations
column = variable

Tabular dataset examples

temperature	measured_at	location
76	2016-01-01 14:00:01	valve
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72	2016-01-01 15:00:01	valve
88	2016-01-01 15:00:01	compressor
68	2016-01-01 16:00:01	valve
78	2016-01-01 16:00:01	compressor

row = observations
column = variable

country	capital	area	population
Brazil	Brasilia	8.516	200.4
Russia	Moscow	17.10	143.5
India	New Delhi	3.286	1252
China	Beijing	9.597	1357
South Africa	Pretoria	1.221	52.98



Datasets in Python

- 2D NumPy array?
 - One data type

Datasets in Python

country	capital	area	population
Brazil	Brasilia	8.516	200.4
Russia	Moscow	17.10	143.5
India	New Delhi	3.286	1252
China	Beijing	9.597	1357
South	Pretoria	1.221	52.98

float

Datasets in Python

country	capital	area	population
Brazil	Brasilia	8.516	200.4
Russia	Moscow	17.10	143.5
India	New Delhi	3.286	1252
China	Beijing	9.597	1357
South	Pretoria	1.221	52.98

str str float float

- pandas!
 - High level data manipulation tool
 - Wes McKinney
 - Built on NumPy
 - DataFrame

DataFrame

brics

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

DataFrame from Dictionary

```
dict = {  
    "country": ["Brazil", "Russia", "India", "China", "South Africa"],  
    "capital": ["Brasilia", "Moscow", "New Delhi", "Beijing", "Pretoria"],  
    "area": [8.516, 17.10, 3.286, 9.597, 1.221]  
    "population": [200.4, 143.5, 1252, 1357, 52.98]}
```

- keys (column labels)
- values (data, column by column)

```
import pandas as pd  
brics = pd.DataFrame(dict)
```

DataFrame from Dictionary (2)

brics

	area	capital	country	population
0	8.516	Brasilia	Brazil	200.40
1	17.100	Moscow	Russia	143.50
2	3.286	New Delhi	India	1252.00
3	9.597	Beijing	China	1357.00
4	1.221	Pretoria	South Africa	52.98

```
brics.index = ["BR", "RU", "IN", "CH", "SA"]  
brics
```

	area	capital	country	population
BR	8.516	Brasilia	Brazil	200.40
RU	17.100	Moscow	Russia	143.50
IN	3.286	New Delhi	India	1252.00
CH	9.597	Beijing	China	1357.00
SA	1.221	Pretoria	South Africa	52.98

DataFrame from CSV file

brics.csv

```
,country,capital,area,population  
BR,Brazil,Brasilia,8.516,200.4  
RU,Russia,Moscow,17.10,143.5  
IN,India,New Delhi,3.286,1252  
CH,China,Beijing,9.597,1357  
SA,South Africa,Pretoria,1.221,52.98
```

- CSV = comma-separated values

DataFrame from CSV file

- `brics.csv`

```
, country, capital, area, population  
BR, Brazil, Brasilia, 8.516, 200.4  
RU, Russia, Moscow, 17.10, 143.5  
IN, India, New Delhi, 3.286, 1252  
CH, China, Beijing, 9.597, 1357  
SA, South Africa, Pretoria, 1.221, 52.98
```

```
brics = pd.read_csv("path/to/brics.csv")  
brics
```

Unnamed: 0		country	capital	area	population
0	BR	Brazil	Brasilia	8.516	200.40
1	RU	Russia	Moscow	17.100	143.50
2	IN	India	New Delhi	3.286	1252.00
3	CH	China	Beijing	9.597	1357.00
4	SA	South Africa	Pretoria	1.221	52.98

DataFrame from CSV file

```
brics = pd.read_csv("path/to/brics.csv", index_col = 0)  
brics
```

	country	population	area	capital
BR	Brazil	200	8515767	Brasilia
RU	Russia	144	17098242	Moscow
IN	India	1252	3287590	New Delhi
CH	China	1357	9596961	Beijing
SA	South Africa	55	1221037	Pretoria

Let's practice!

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Pandas, Part 2

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brics

```
import pandas as pd  
brics = pd.read_csv("path/to/brics.csv", index_col = 0)  
brics
```

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

Index and select data

- Square brackets
- Advanced methods
 - loc
 - iloc

Column Access []

```
country      capital    area   population
BR          Brazil     8.516   200.40
RU          Russia    17.100   143.50
IN          India     3.286   1252.00
CH          China     9.597   1357.00
SA          South Africa 1.221   52.98
```

```
brics["country"]
```

```
BR          Brazil
RU          Russia
IN          India
CH          China
SA          South Africa
Name: country, dtype: object
```

Column Access []

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
type(brics["country"])
```

```
pandas.core.series.Series
```

- 1D labelled array

Column Access []

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics[["country"]]
```

	country
BR	Brazil
RU	Russia
IN	India
CH	China
SA	South Africa

Column Access []

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
type(brics[["country"]])
```

```
pandas.core.frame.DataFrame
```

Column Access []

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics[["country", "capital"]]
```

	country	capital
BR	Brazil	Brasilia
RU	Russia	Moscow
IN	India	New Delhi
CH	China	Beijing
SA	South Africa	Pretoria

Row Access []

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics[1:4]
```

	country	capital	area	population
RU	Russia	Moscow	17.100	143.5
IN	India	New Delhi	3.286	1252.0
CH	China	Beijing	9.597	1357.0

Row Access []

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics[1:4]
```

	country	capital	area	population
RU	Russia	Moscow	17.100	143.5
IN	India	New Delhi	3.286	1252.0
CH	China	Beijing	9.597	1357.0

Discussion []

- Square brackets: limited functionality
- Ideally
 - 2D NumPy arrays
 - `my_array[rows, columns]`
- pandas
 - `Loc` (label-based)
 - `iloc` (integer position-based)

Row Access loc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.loc["RU"]
```

```
country      Russia  
capital     Moscow  
area        17.1  
population  143.5  
Name: RU, dtype: object
```

- Row as pandas Series

Row Access loc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.loc[[ "RU" ]]
```

	country	capital	area	population
RU	Russia	Moscow	17.1	143.5

- DataFrame

Row Access loc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.loc[[ "RU" , "IN" , "CH" ]]
```

	country	capital	area	population
RU	Russia	Moscow	17.100	143.5
IN	India	New Delhi	3.286	1252.0
CH	China	Beijing	9.597	1357.0

Row & Column loc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.loc[[ "RU" , "IN" , "CH" ], [ "country" , "capital" ]]
```

	country	capital
RU	Russia	Moscow
IN	India	New Delhi
CH	China	Beijing

Row & Column loc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.loc[:, ["country", "capital"]]
```

	country	capital
BR	Brazil	Brasilia
RU	Russia	Moscow
IN	India	New Delhi
CH	China	Beijing
SA	South Africa	Pretoria

Recap

- Square brackets
 - Column access `brics[["country", "capital"]]`
 - Row access: only through slicing `brics[1:4]`
- loc (label-based)
 - Row access `brics.loc[["RU", "IN", "CH"]]`
 - Column access `brics.loc[:, ["country", "capital"]]`
- Row & Column access

```
brics.loc[  
    ["RU", "IN", "CH"],  
    ["country", "capital"]  
]
```

Row Access iloc

```
country    capital      area  population
BR        Brazil     8.516    200.40
RU        Russia    17.100   143.50
IN        India     3.286    1252.00
CH        China     9.597    1357.00
SA        South Africa 1.221    52.98
```

```
brics.loc[["RU"]]
```

```
country    capital      area  population
RU        Russia    17.1     143.5
```

```
brics.iloc[[1]]
```

```
country    capital      area  population
RU        Russia    17.1     143.5
```

Row Access iloc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.loc[[ "RU" , "IN" , "CH" ]]
```

	country	capital	area	population
RU	Russia	Moscow	17.100	143.5
IN	India	New Delhi	3.286	1252.0
CH	China	Beijing	9.597	1357.0

Row Access iloc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.iloc[[1, 2, 3]]
```

	country	capital	area	population
RU	Russia	Moscow	17.100	143.5
IN	India	New Delhi	3.286	1252.0
CH	China	Beijing	9.597	1357.0

Row & Column iloc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.loc[[ "RU" , "IN" , "CH" ], [ "country" , "capital" ]]
```

	country	capital
RU	Russia	Moscow
IN	India	New Delhi
CH	China	Beijing

Row & Column iloc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.iloc[[1,2,3], [0, 1]]
```

	country	capital
RU	Russia	Moscow
IN	India	New Delhi
CH	China	Beijing

Row & Column iloc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.loc[:, ["country", "capital"]]
```

	country	capital
BR	Brazil	Brasilia
RU	Russia	Moscow
IN	India	New Delhi
CH	China	Beijing
SA	South Africa	Pretoria

Row & Column iloc

	country	capital	area	population
BR	Brazil	Brasilia	8.516	200.40
RU	Russia	Moscow	17.100	143.50
IN	India	New Delhi	3.286	1252.00
CH	China	Beijing	9.597	1357.00
SA	South Africa	Pretoria	1.221	52.98

```
brics.iloc[:, [0,1]]
```

	country	capital
BR	Brazil	Brasilia
RU	Russia	Moscow
IN	India	New Delhi
CH	China	Beijing
SA	South Africa	Pretoria

Let's practice!

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