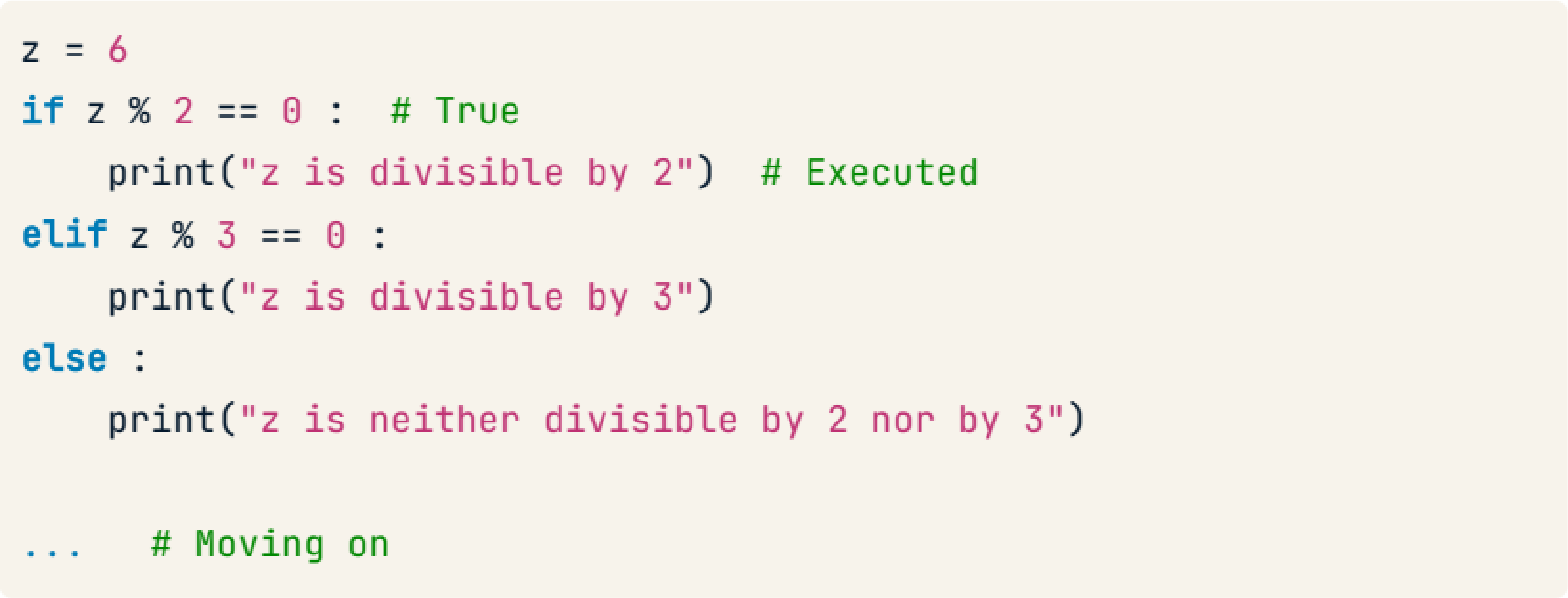
Loops

while loop

if-elif-else

Goes through construct only once!

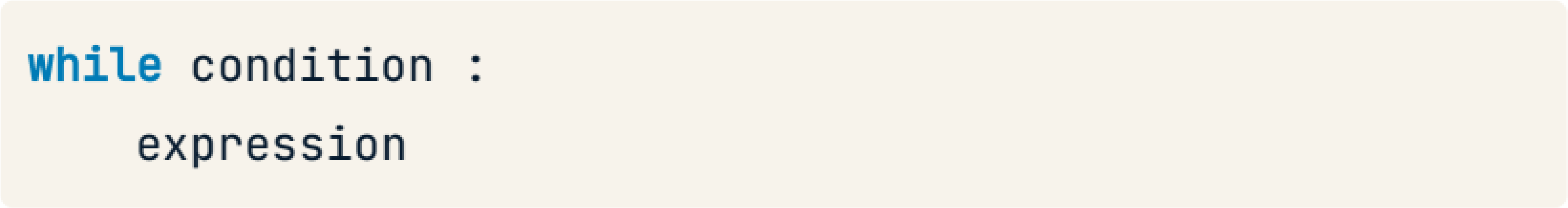


```python
z = 6
if z % 2 == 0 :  # True
    print("z is divisible by 2")  # Executed
elif z % 3 == 0 :
    print("z is divisible by 3")
else :
    print("z is neither divisible by 2 nor by 3")

...   # Moving on
```

While loop = repeated if statement

While

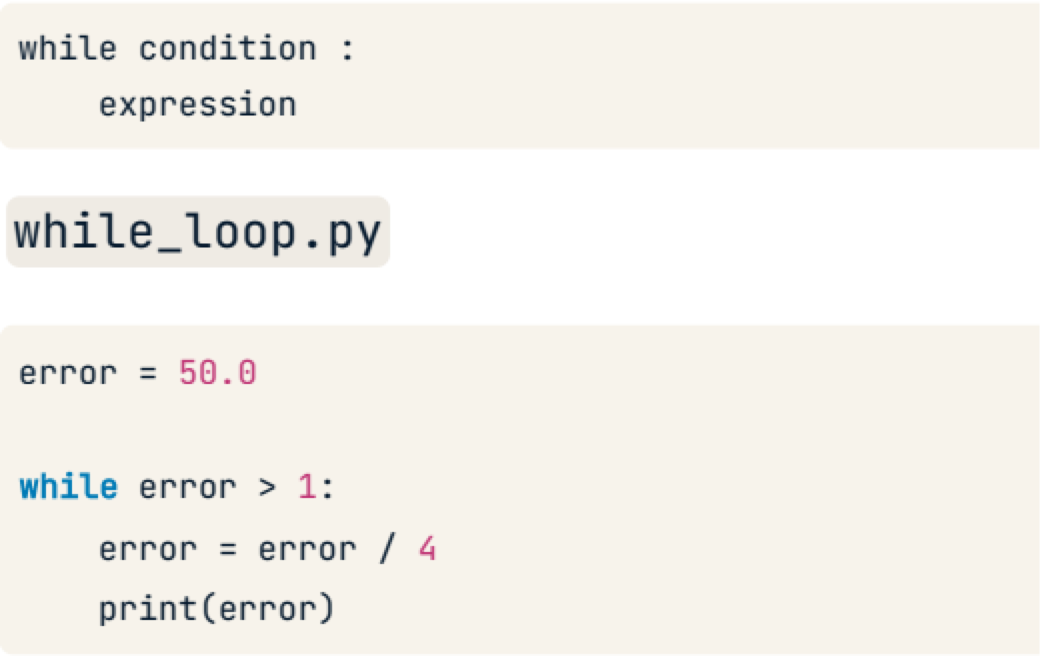


```
while condition :
    expression
```

- ✓ Numerically calculating model
- ✓ "repeating action until condition is met“
- ✓ Example
    - Error starts at 50
    - Divide error by 4 on every run
    - Continue until error no longer > 1

While

- ✓ Error starts at 50
- ✓ Divide error by 4 on every run
- ✓ Continue until error no longer > 1

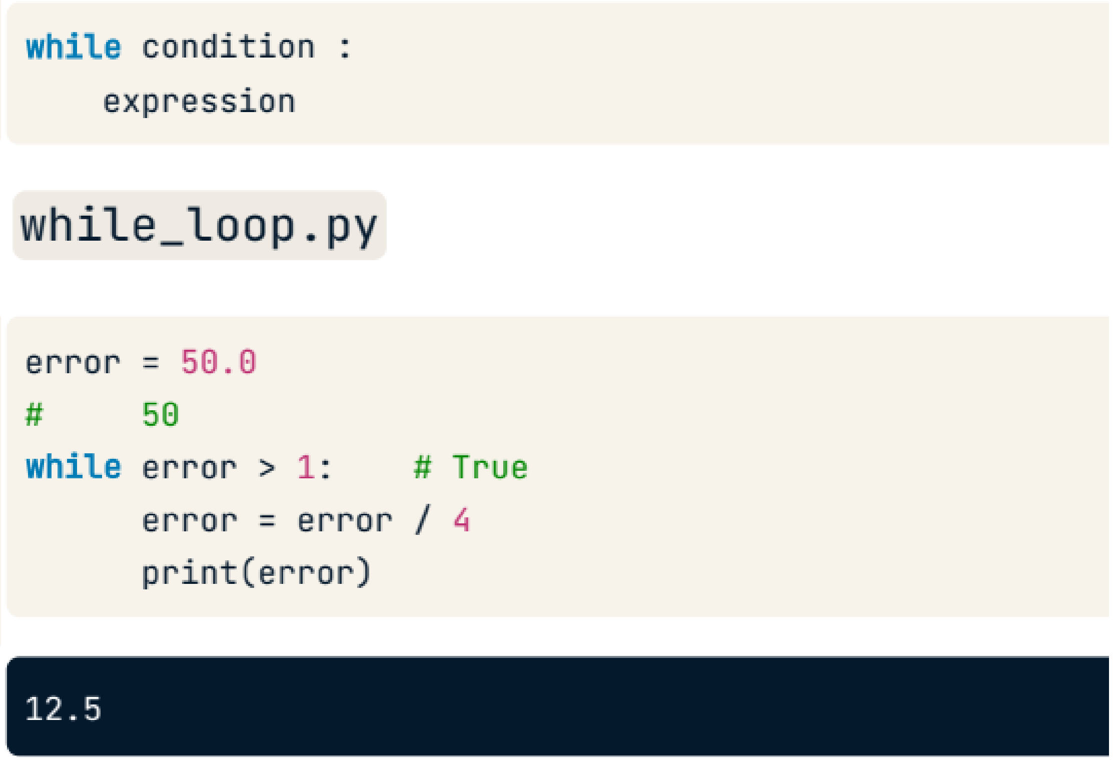


```
while condition :
    expression
```

while_loop.py

```
error = 50.0

while error > 1:
    error = error / 4
    print(error)
```



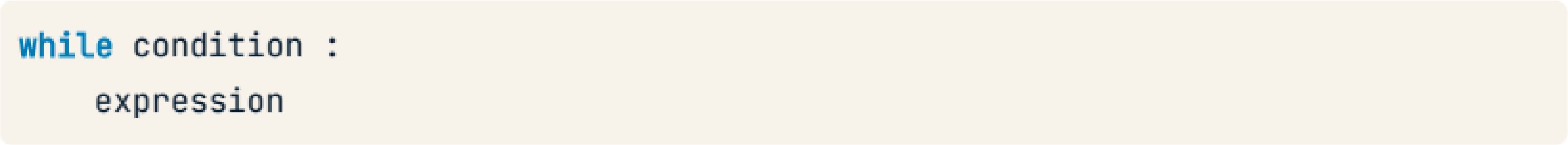
```
while condition :
    expression
```

while_loop.py

```
error = 50.0
#     50
while error > 1:    # True
      error = error / 4
      print(error)
```

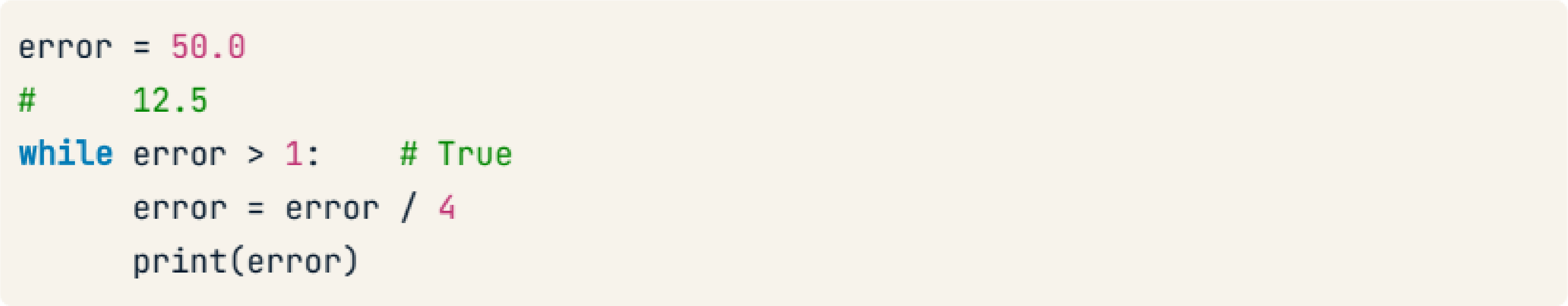
```
12.5
```

While

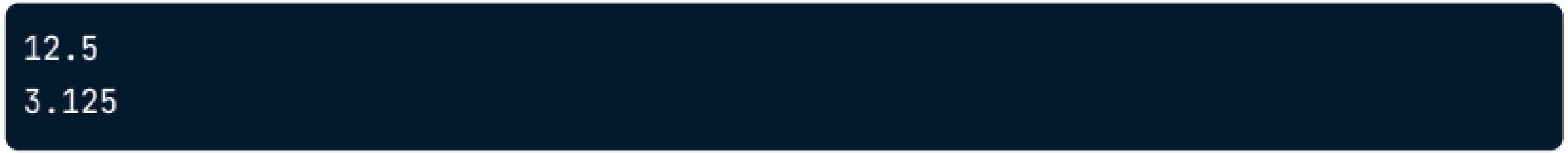


```
while condition :
    expression
```

`while_loop.py`

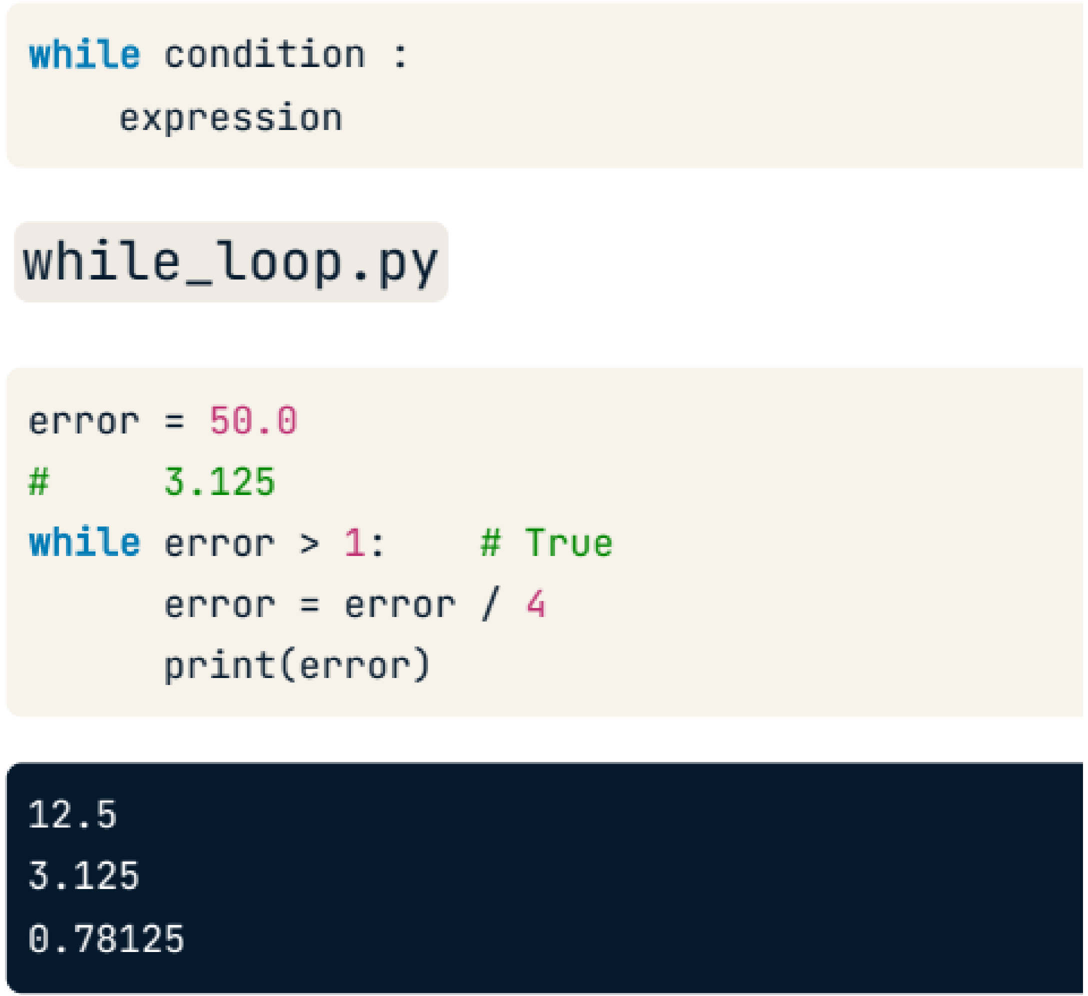


```
error = 50.0
#     12.5
while error > 1:    # True
      error = error / 4
      print(error)
```



```
12.5
3.125
```

While

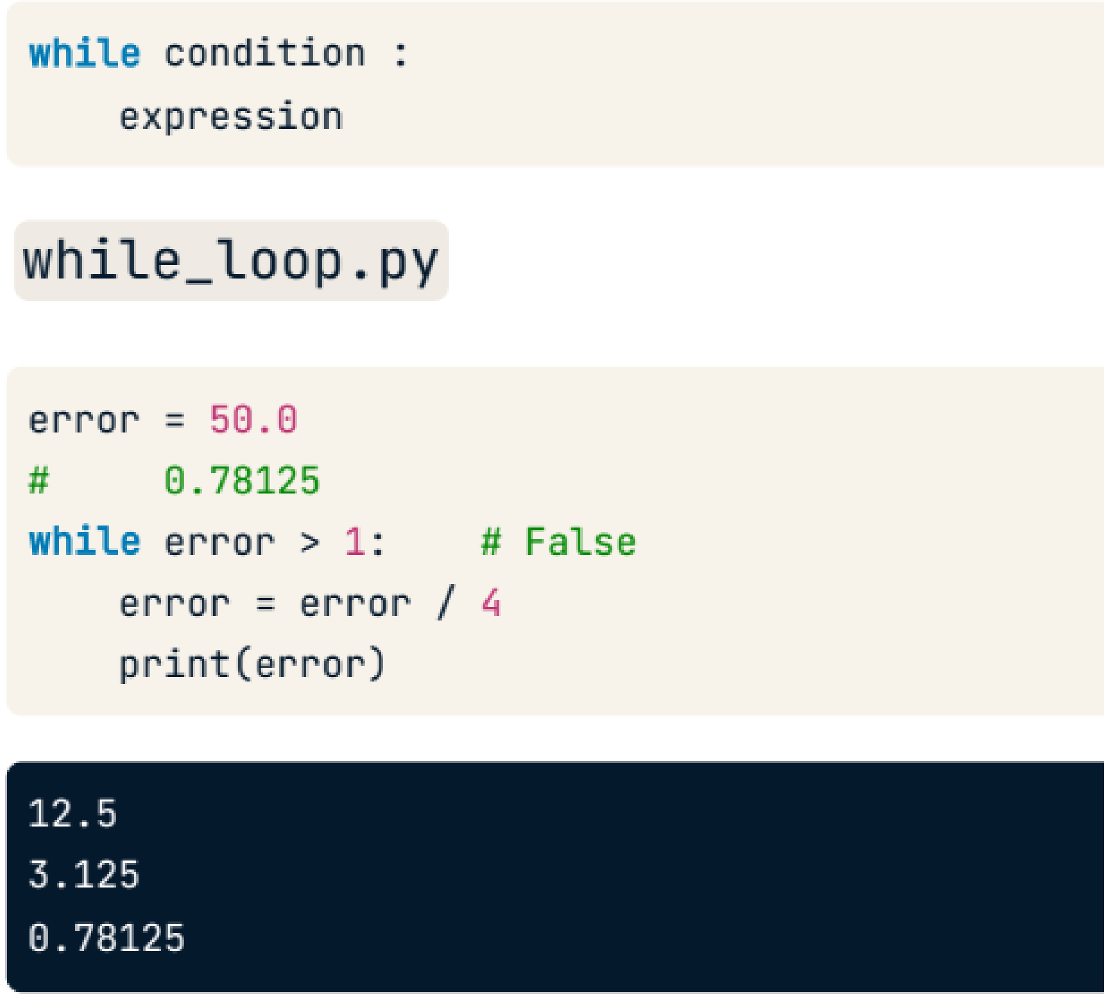


```
while condition :
    expression
```

while_loop.py

```
error = 50.0
#     3.125
while error > 1:    # True
    error = error / 4
    print(error)
```

```
12.5
3.125
0.78125
```



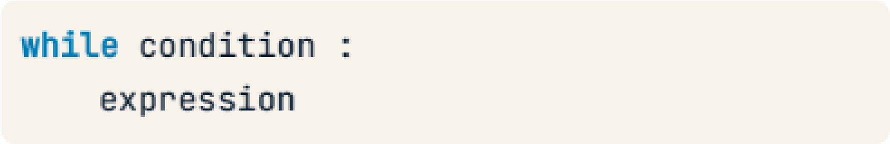
```
while condition :
    expression
```

while_loop.py

```
error = 50.0
#     0.78125
while error > 1:    # False
    error = error / 4
    print(error)
```

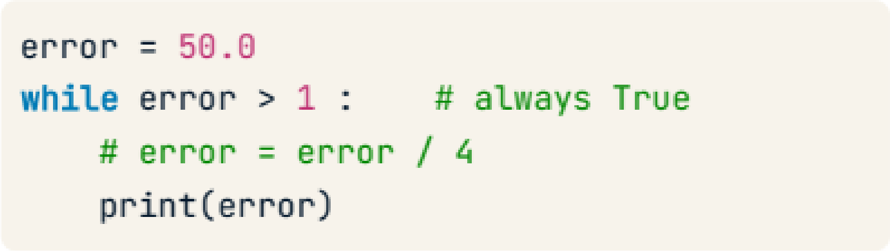
```
12.5
3.125
0.78125
```

While

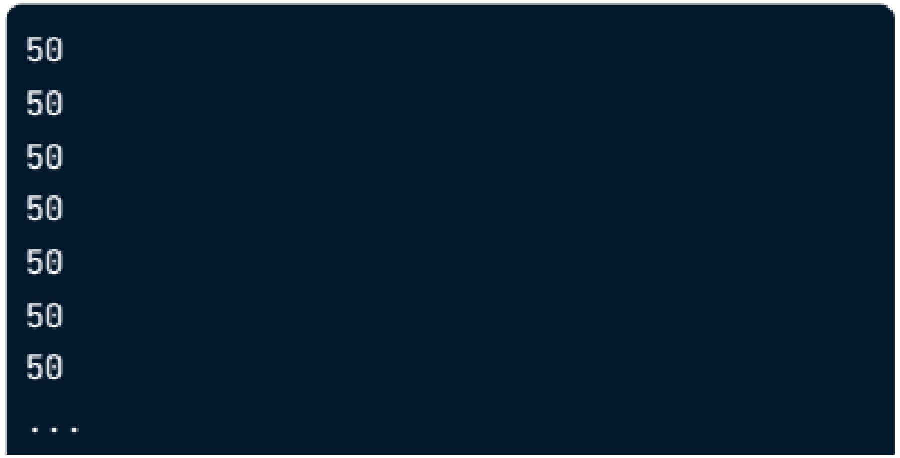


```
while condition :
    expression
```

`while_loop.py`



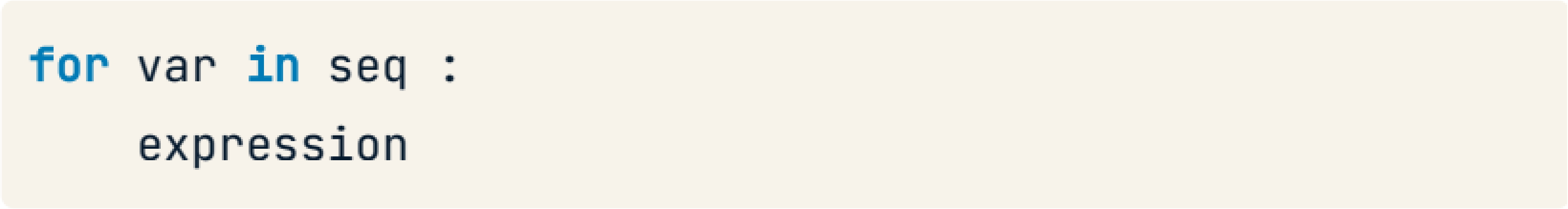
```
error = 50.0
while error > 1 :    # always True
    # error = error / 4
    print(error)
```



```
50
50
50
50
50
50
50
...
```

for loop

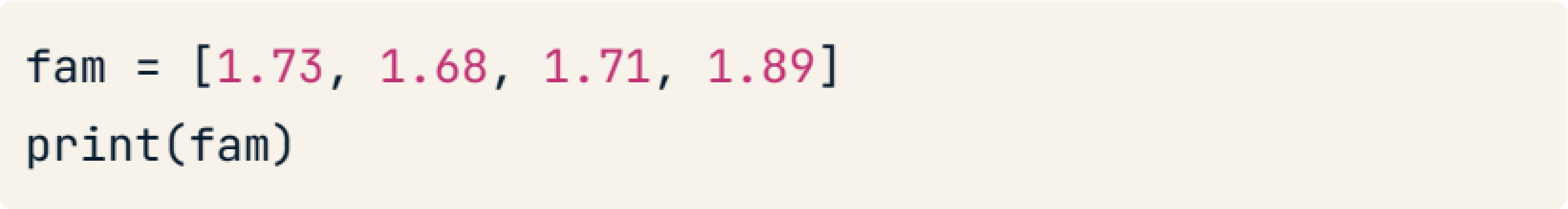
for loop



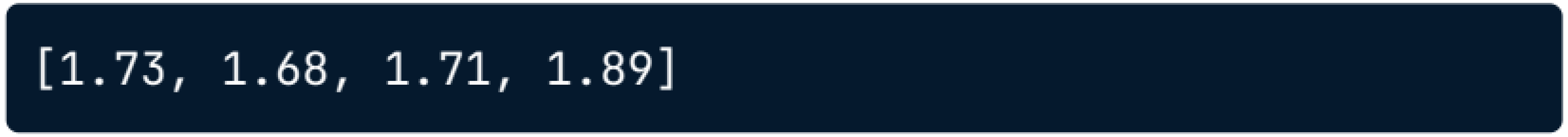
```
for var in seq :
    expression
```

- "for each **var** in **seq**, execute **expression**"

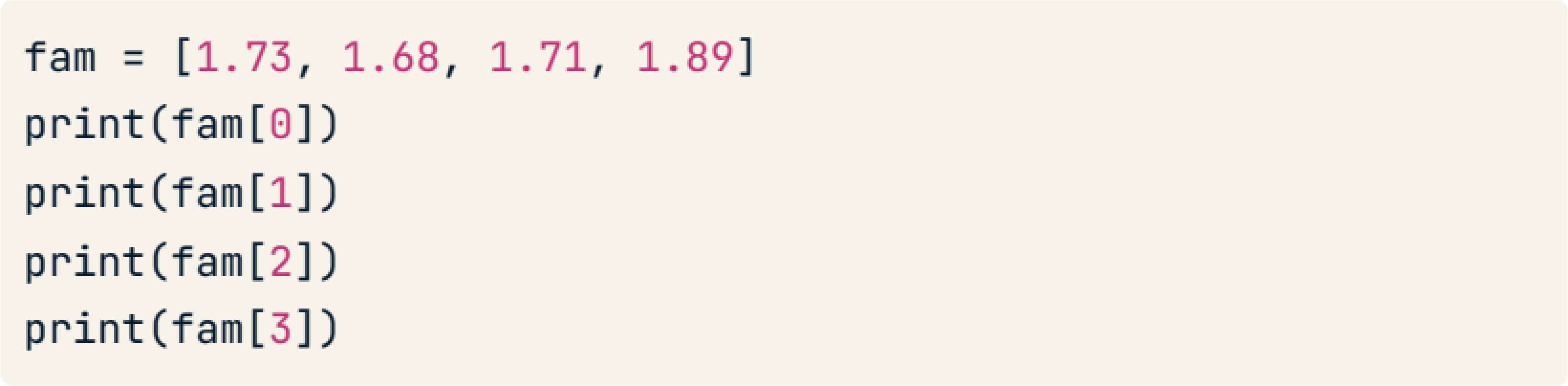
fam



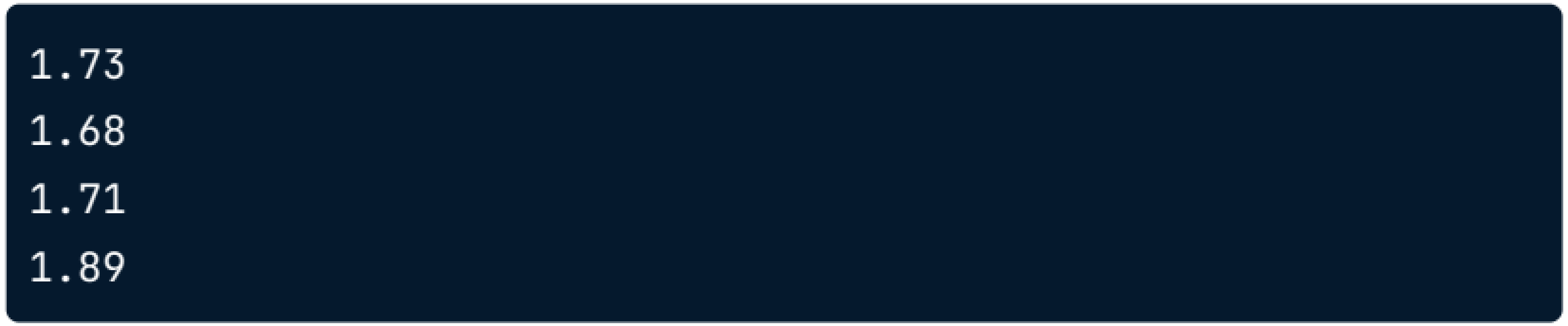
```
fam = [1.73, 1.68, 1.71, 1.89]
print(fam)
```



```
[1.73, 1.68, 1.71, 1.89]
```

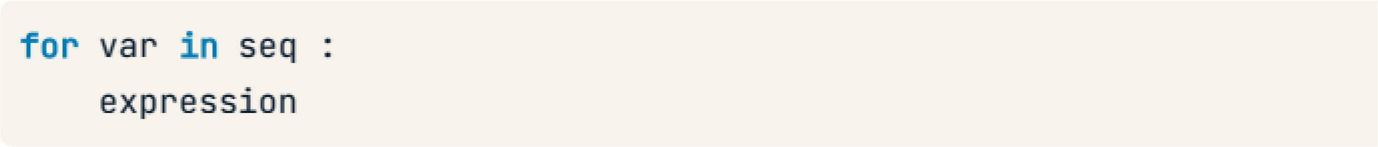


```
fam = [1.73, 1.68, 1.71, 1.89]
print(fam[0])
print(fam[1])
print(fam[2])
print(fam[3])
```



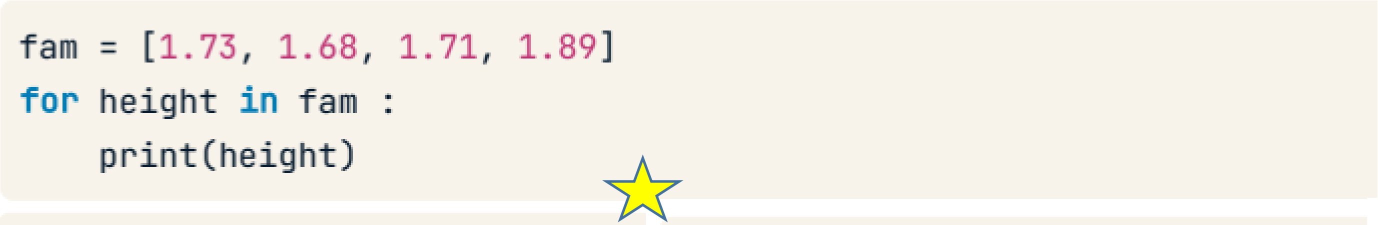
```
1.73
1.68
1.71
1.89
```

for loop

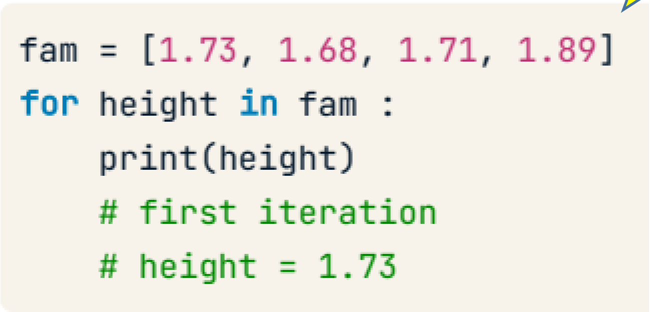


```
for var in seq :
    expression
```

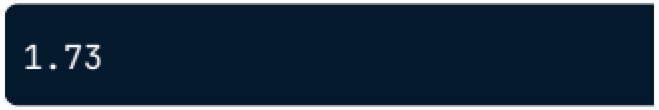
`family.py`



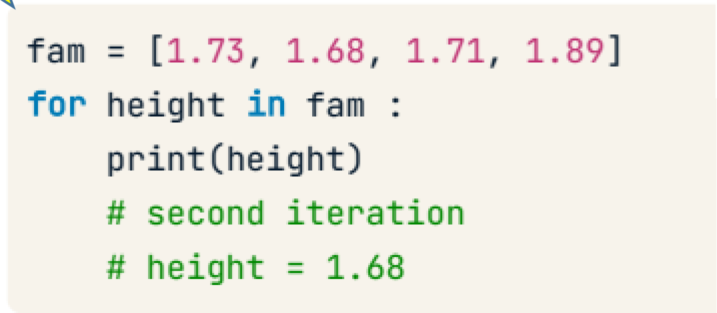
```
fam = [1.73, 1.68, 1.71, 1.89]
for height in fam :
    print(height)
```



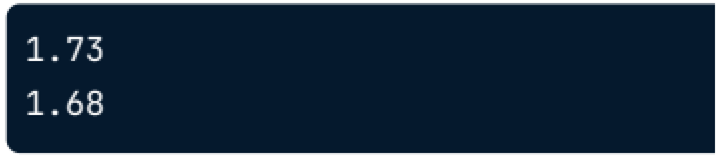
```
fam = [1.73, 1.68, 1.71, 1.89]
for height in fam :
    print(height)
    # first iteration
    # height = 1.73
```



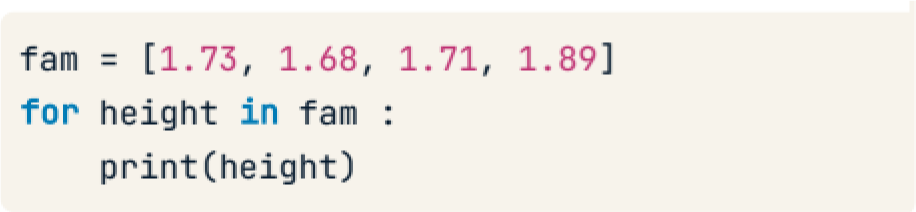
```
1.73
```



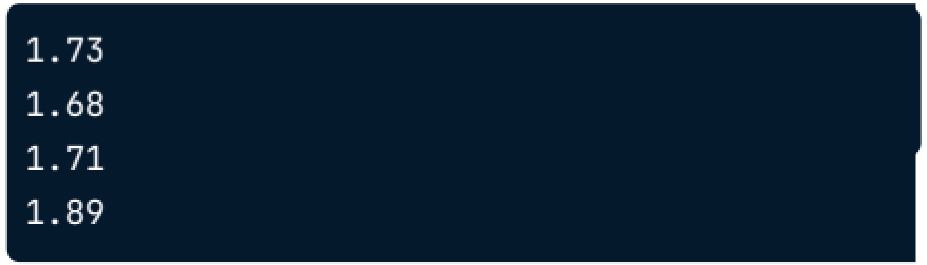
```
fam = [1.73, 1.68, 1.71, 1.89]
for height in fam :
    print(height)
    # second iteration
    # height = 1.68
```



```
1.73
1.68
```



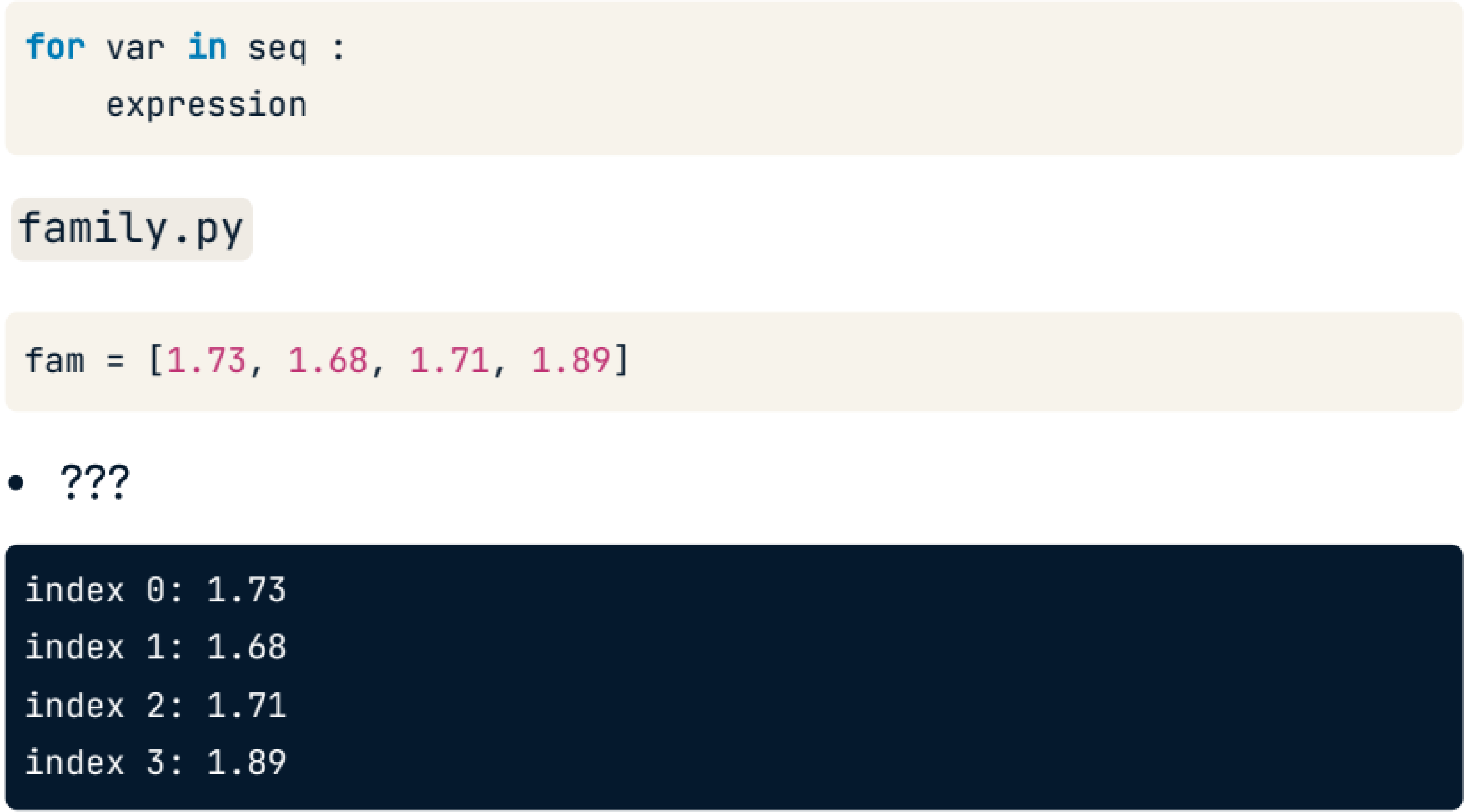
```
fam = [1.73, 1.68, 1.71, 1.89]
for height in fam :
    print(height)
```



```
1.73
1.68
1.71
1.89
```

✓ No access to indexes

for loop



```
for var in seq :
    expression
```

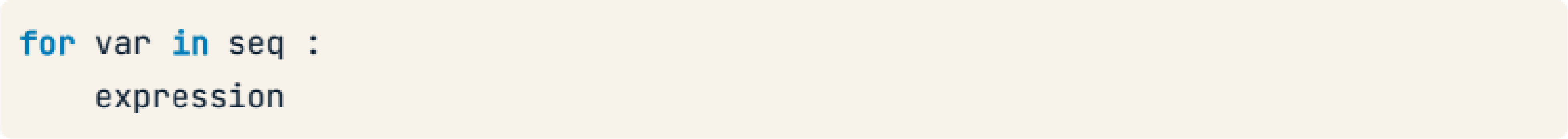
`family.py`

```
fam = [1.73, 1.68, 1.71, 1.89]
```

- ???

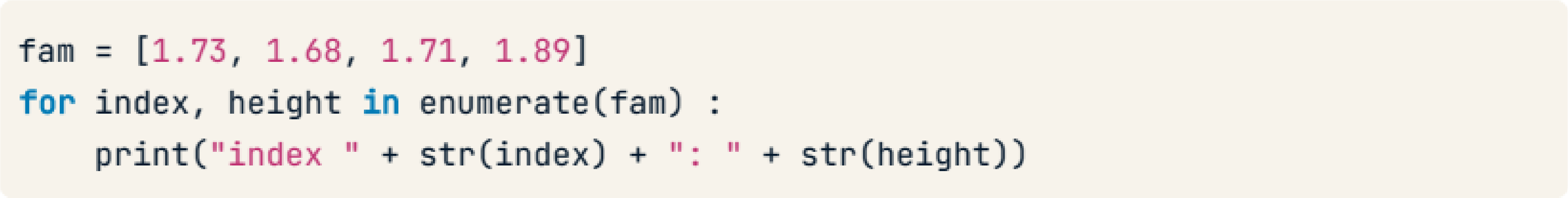
```
index 0: 1.73
index 1: 1.68
index 2: 1.71
index 3: 1.89
```

enumerate

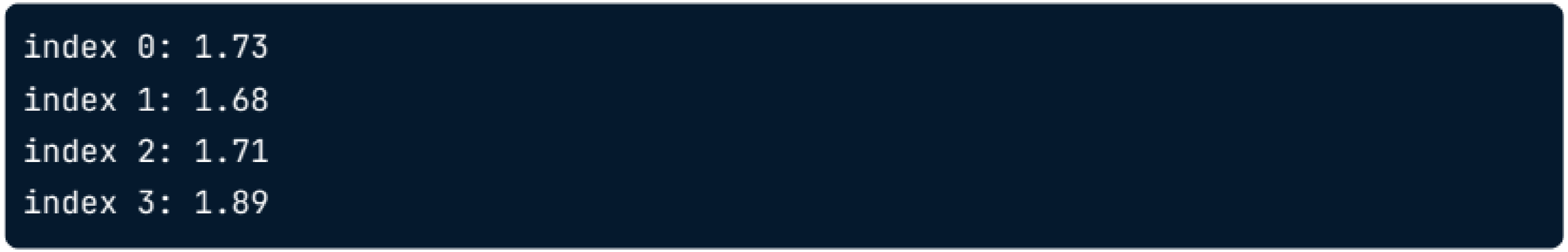


```
for var in seq :
    expression
```

`family.py`

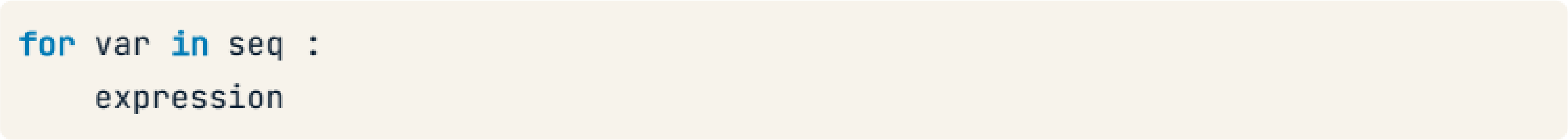


```python
fam = [1.73, 1.68, 1.71, 1.89]
for index, height in enumerate(fam) :
    print("index " + str(index) + ": " + str(height))
```



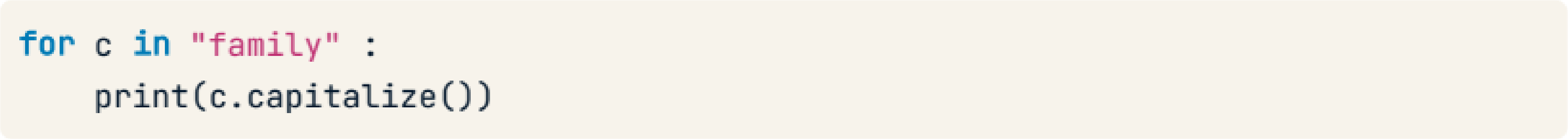
```
index 0: 1.73
index 1: 1.68
index 2: 1.71
index 3: 1.89
```

Loop over string

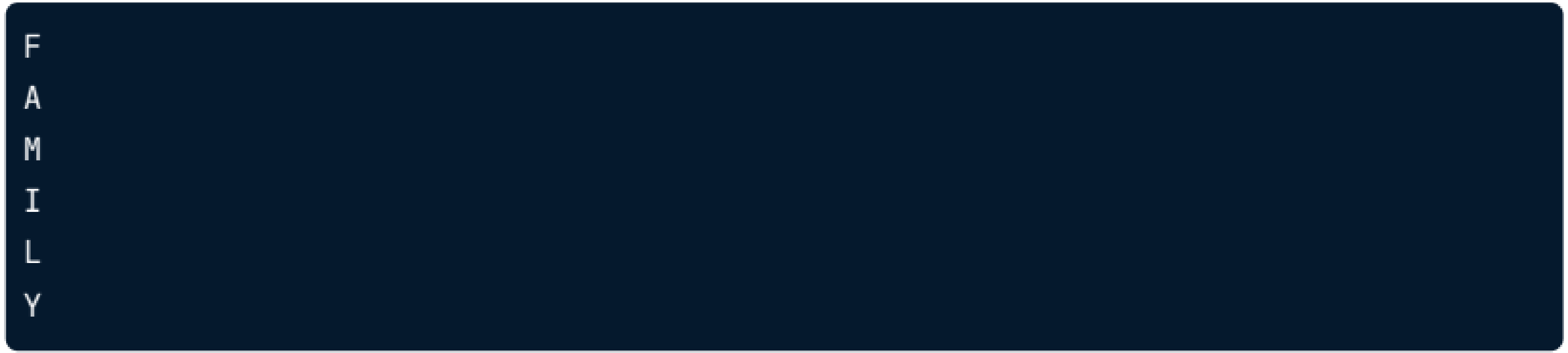


```
for var in seq :
    expression
```

`strloop.py`



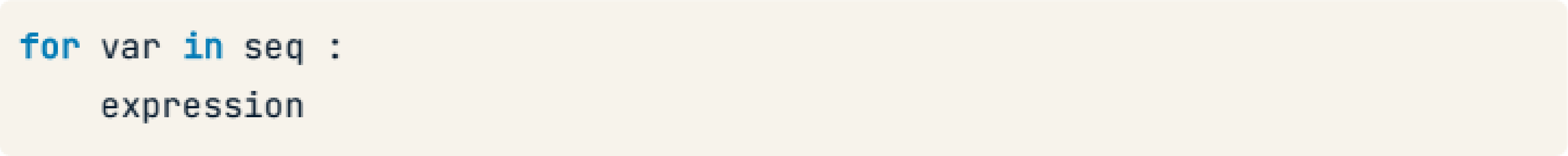
```
for c in "family" :
    print(c.capitalize())
```



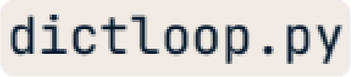
```
F
A
M
I
L
Y
```

Loop Data Structures Part 1

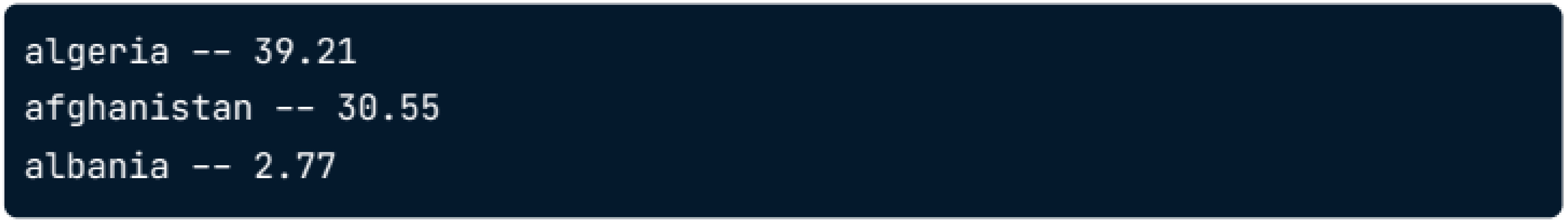
Dictionary



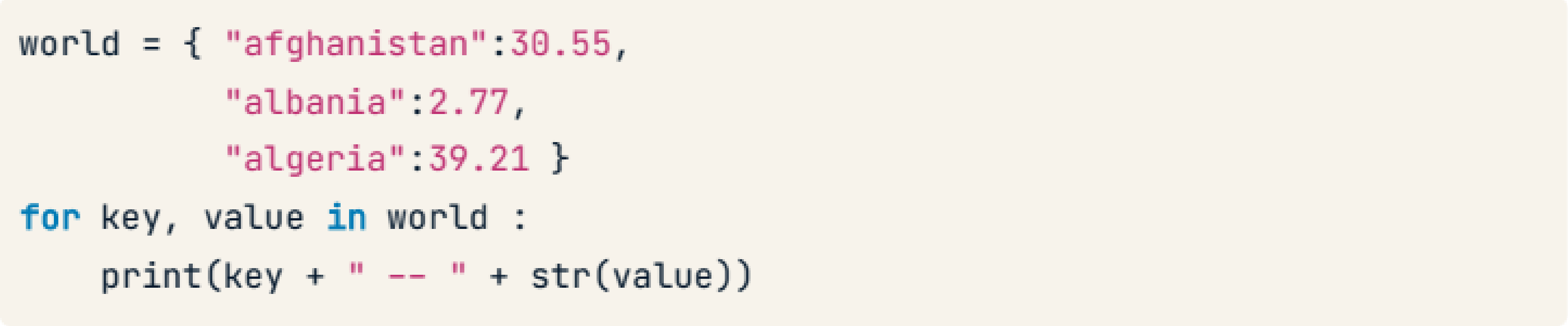
```
for var in seq :
    expression
```



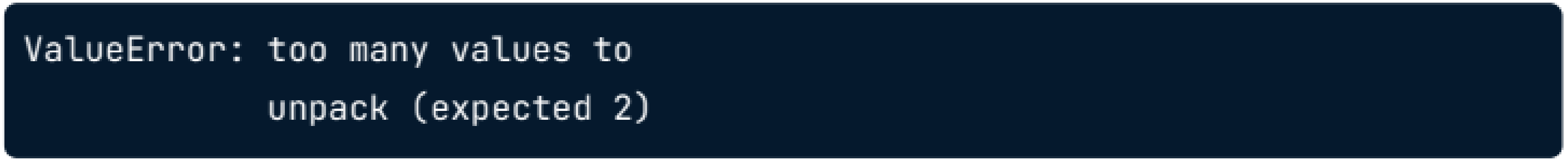
`dictloop.py`



```
algeria -- 39.21
afghanistan -- 30.55
albania -- 2.77
```

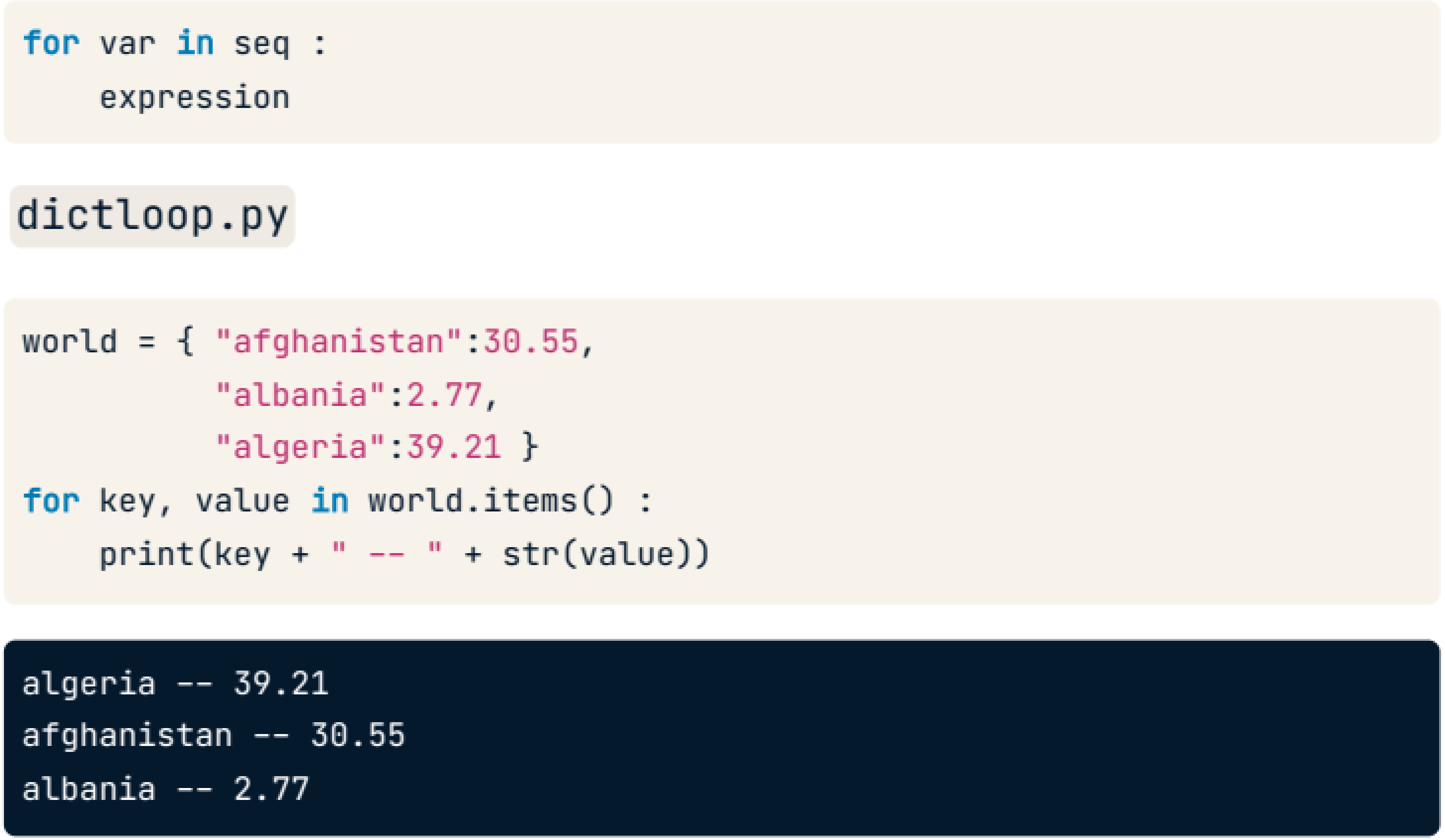


```
world = { "afghanistan":30.55,
          "albania":2.77,
          "algeria":39.21 }
for key, value in world :
    print(key + " -- " + str(value))
```



```
ValueError: too many values to
            unpack (expected 2)
```

Dictionary



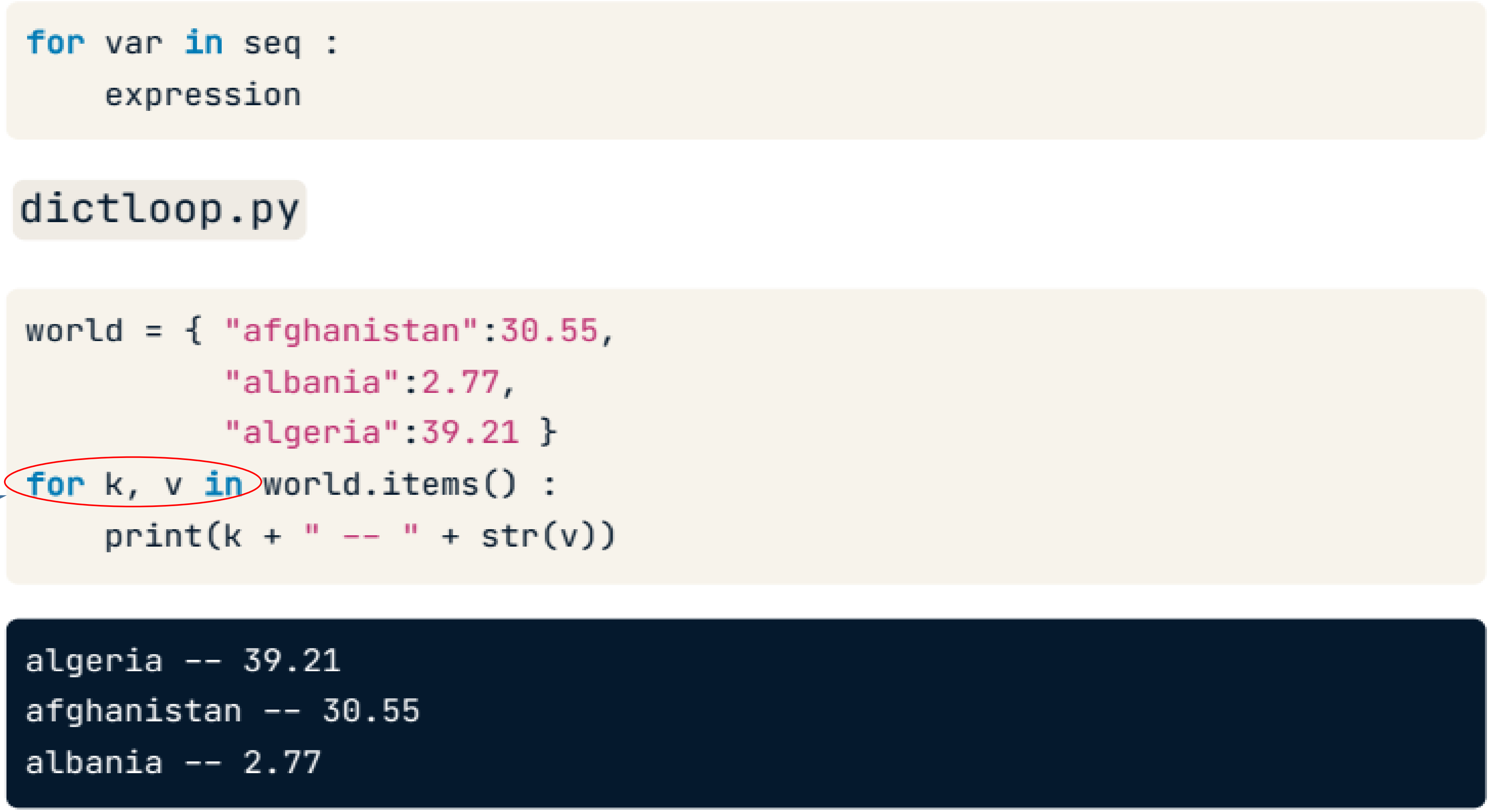
```
for var in seq :
    expression
```

`dictloop.py`

```
world = { "afghanistan":30.55,
          "albania":2.77,
          "algeria":39.21 }
for key, value in world.items() :
    print(key + " -- " + str(value))
```

```
algeria -- 39.21
afghanistan -- 30.55
albania -- 2.77
```

Dictionary



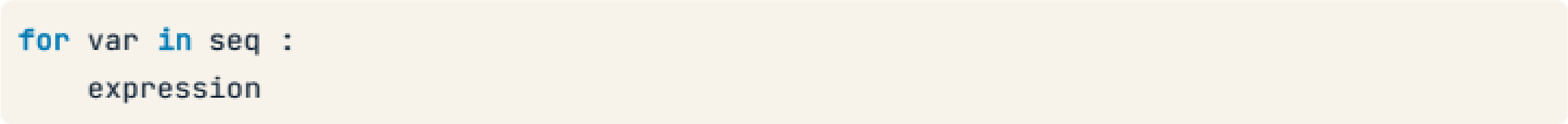
```
for var in seq :
    expression
```

`dictloop.py`

```
world = { "afghanistan":30.55,
          "albania":2.77,
          "algeria":39.21 }
for k, v in world.items() :
    print(k + " -- " + str(v))
```

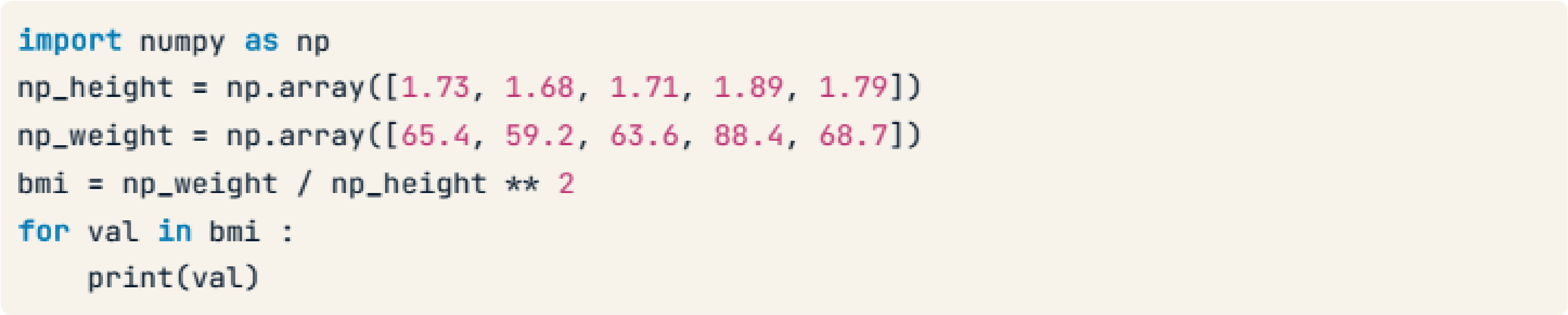
```
algeria -- 39.21
afghanistan -- 30.55
albania -- 2.77
```

Numpy Arrays

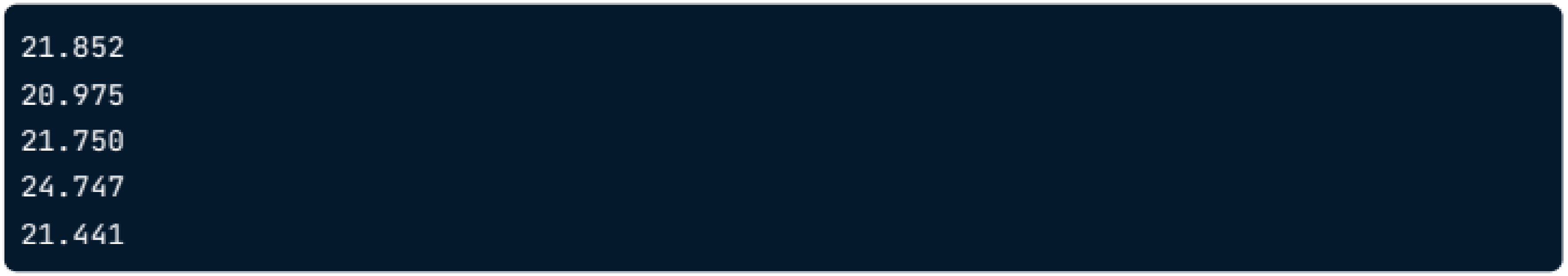


```
for var in seq :
    expression
```

`nploop.py`

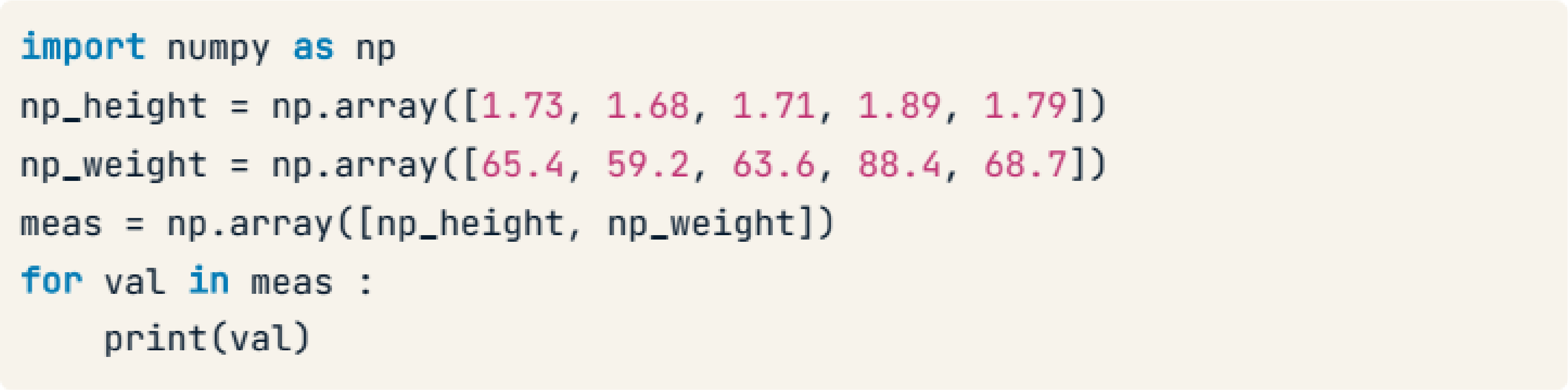


```python
import numpy as np
np_height = np.array([1.73, 1.68, 1.71, 1.89, 1.79])
np_weight = np.array([65.4, 59.2, 63.6, 88.4, 68.7])
bmi = np_weight / np_height ** 2
for val in bmi :
    print(val)
```

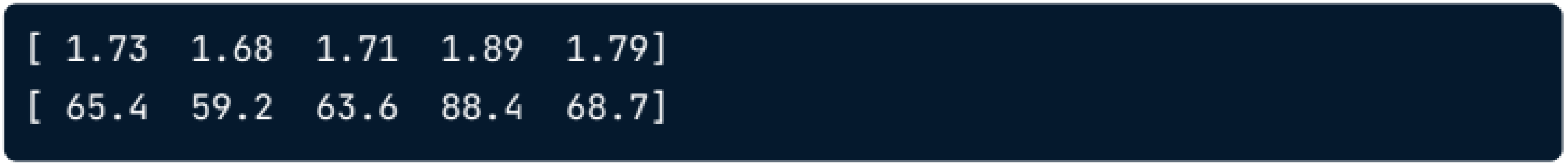


```
21.852
20.975
21.750
24.747
21.441
```

2D Numpy Arrays

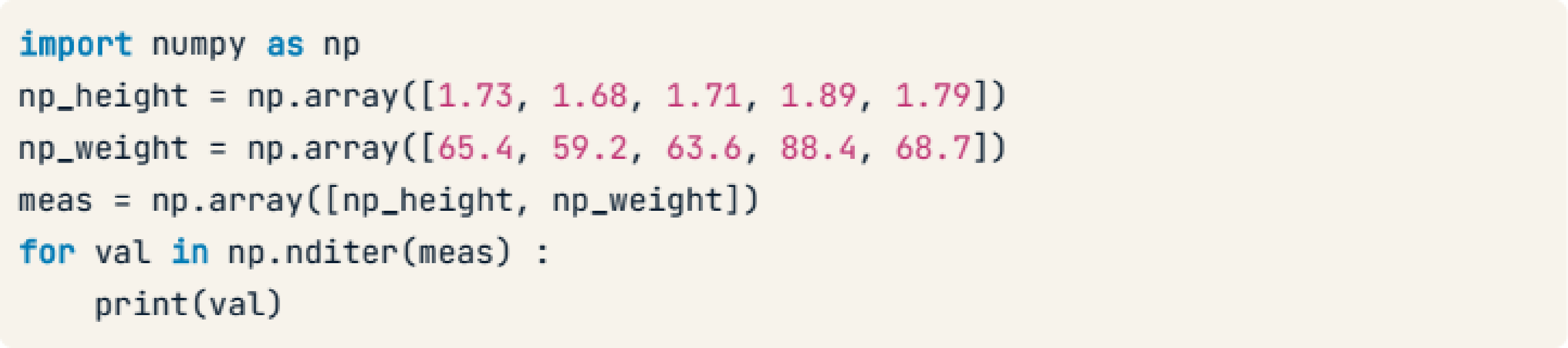


```python
import numpy as np
np_height = np.array([1.73, 1.68, 1.71, 1.89, 1.79])
np_weight = np.array([65.4, 59.2, 63.6, 88.4, 68.7])
meas = np.array([np_height, np_weight])
for val in meas :
    print(val)
```

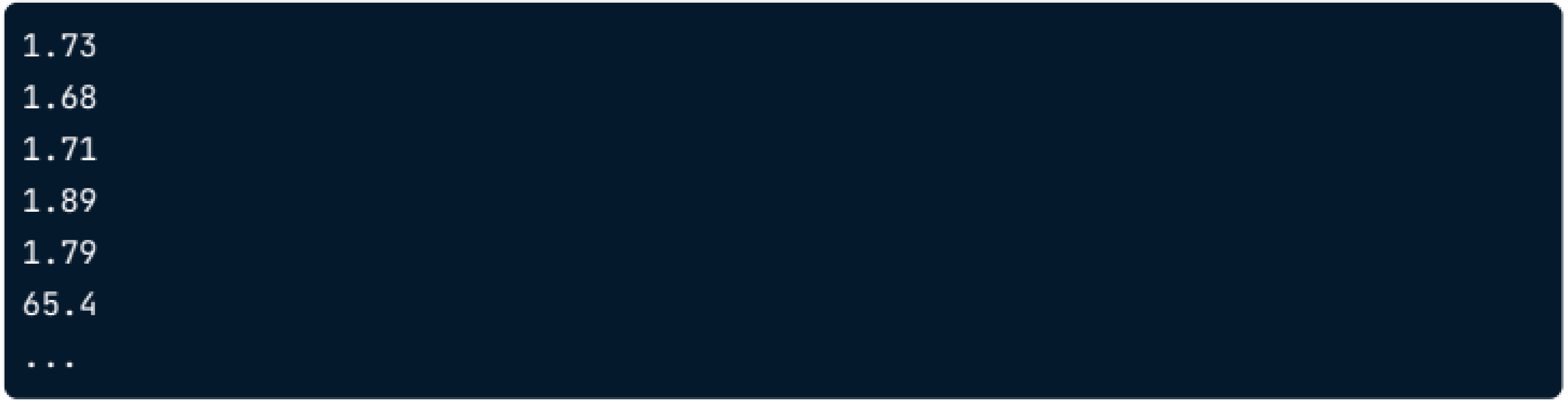


```
[ 1.73  1.68  1.71  1.89  1.79]
[ 65.4  59.2  63.6  88.4  68.7]
```

2D Numpy Arrays

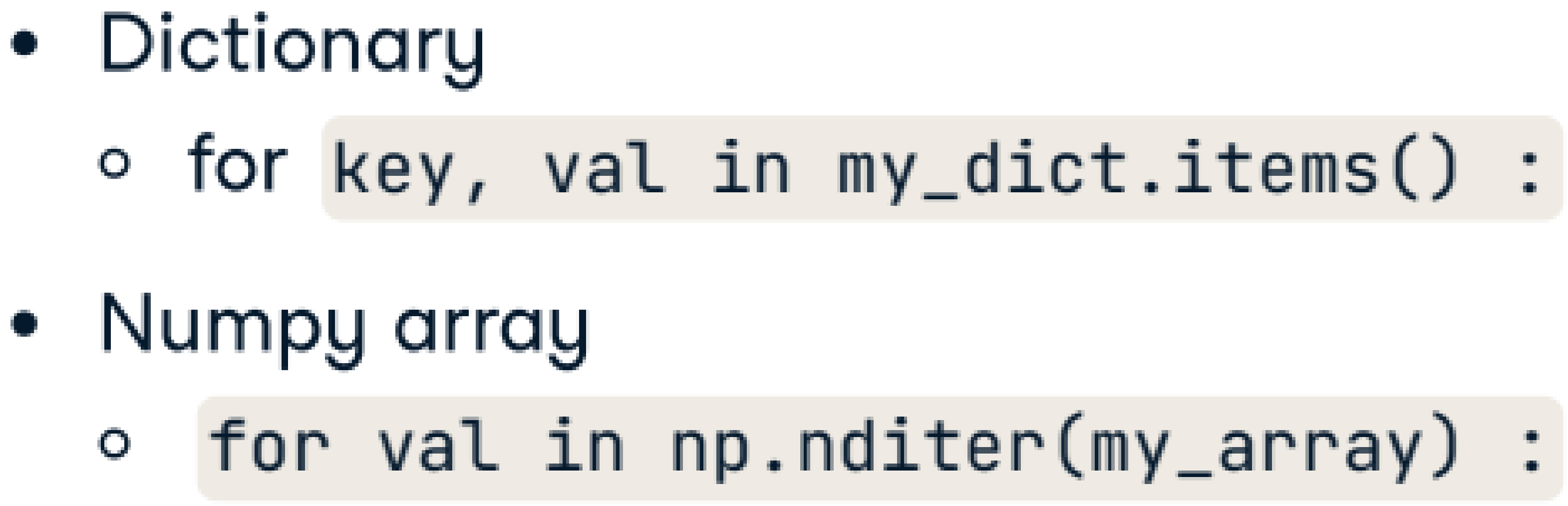


```python
import numpy as np
np_height = np.array([1.73, 1.68, 1.71, 1.89, 1.79])
np_weight = np.array([65.4, 59.2, 63.6, 88.4, 68.7])
meas = np.array([np_height, np_weight])
for val in np.nditer(meas) :
    print(val)
```

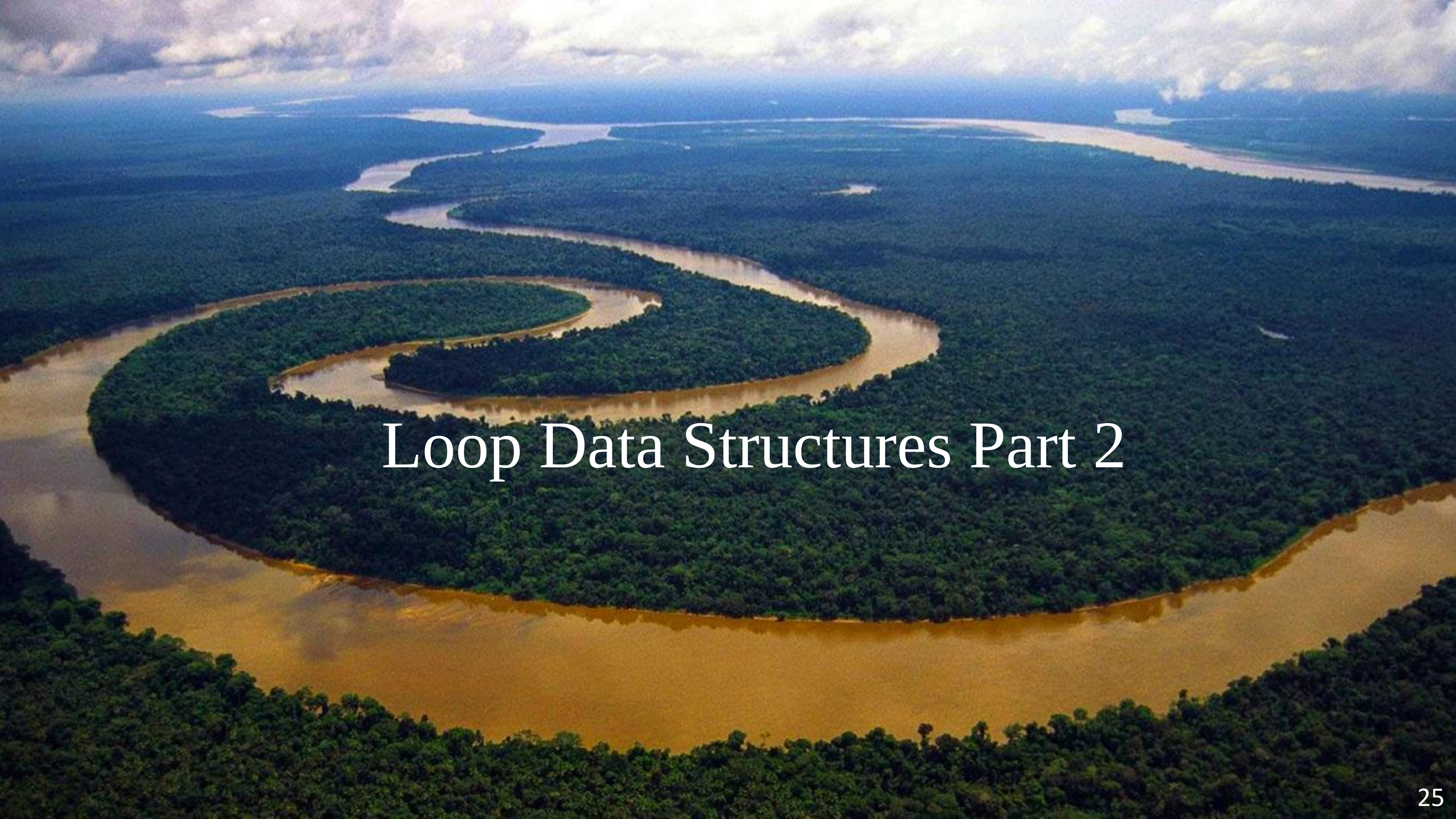


```
1.73
1.68
1.71
1.89
1.79
65.4
...
```

Recap

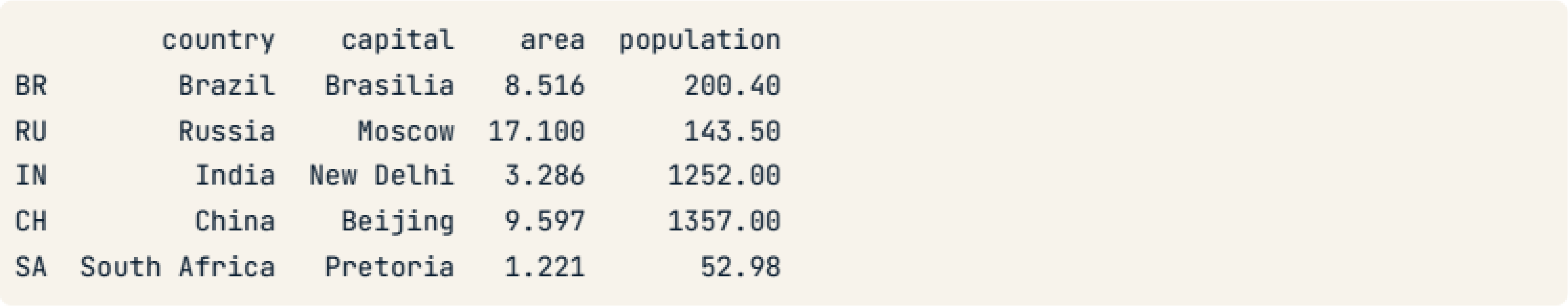


- Dictionary
  - for `key, val in my_dict.items() :`
- Numpy array
  - `for val in np.nditer(my_array) :`



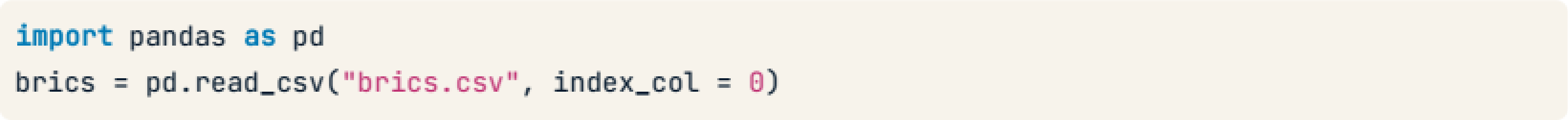
Loop Data Structures Part 2

brics



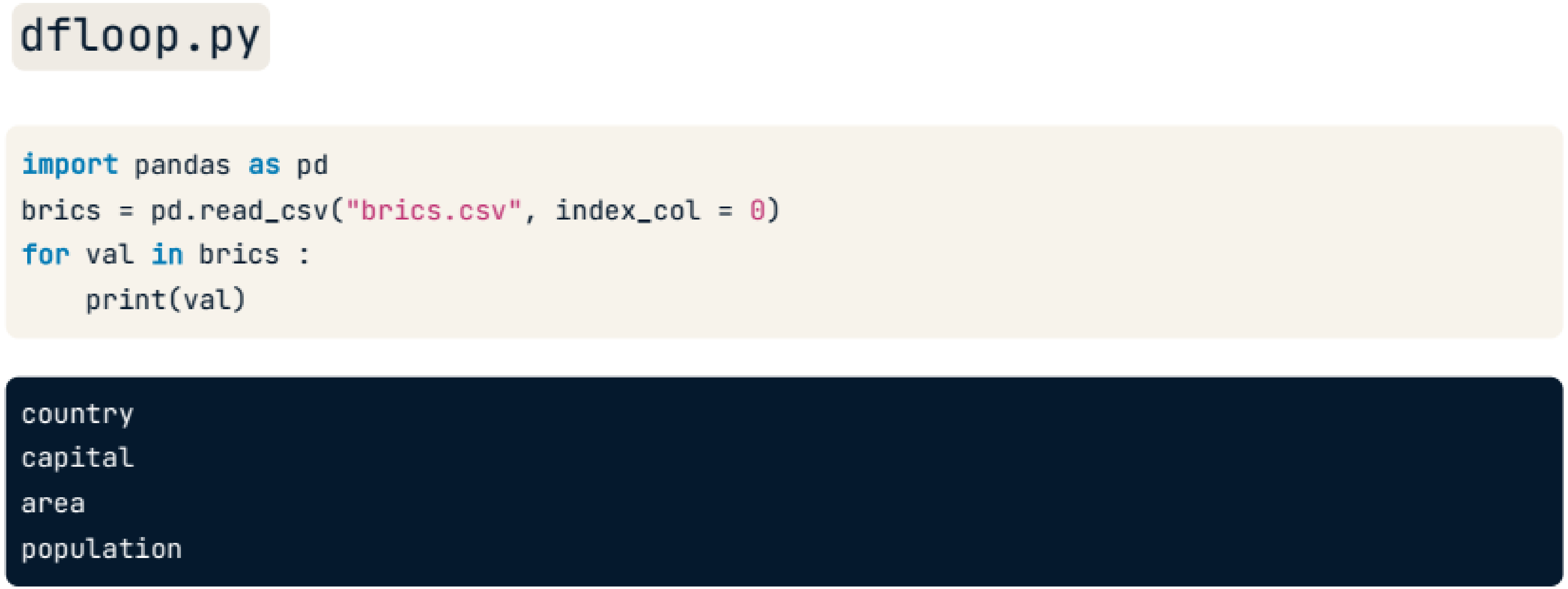
```
          country    capital    area  population
BR         Brazil   Brasilia   8.516      200.40
RU         Russia     Moscow  17.100      143.50
IN          India  New Delhi   3.286     1252.00
CH          China    Beijing   9.597     1357.00
SA   South Africa   Pretoria   1.221       52.98
```

`dfloop.py`



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

for, first try

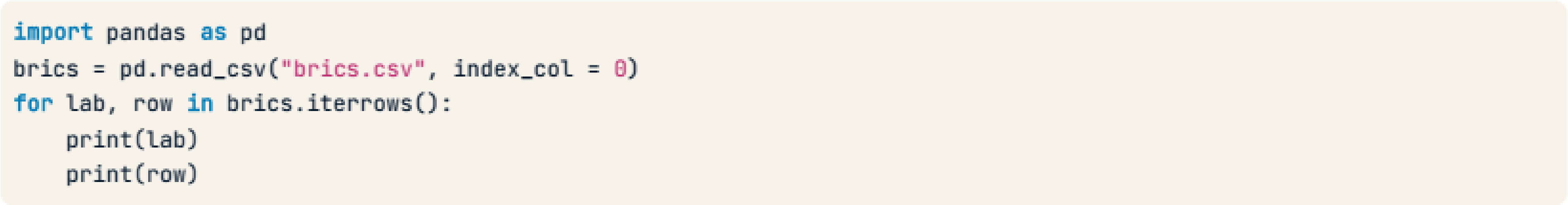


`dfloop.py`

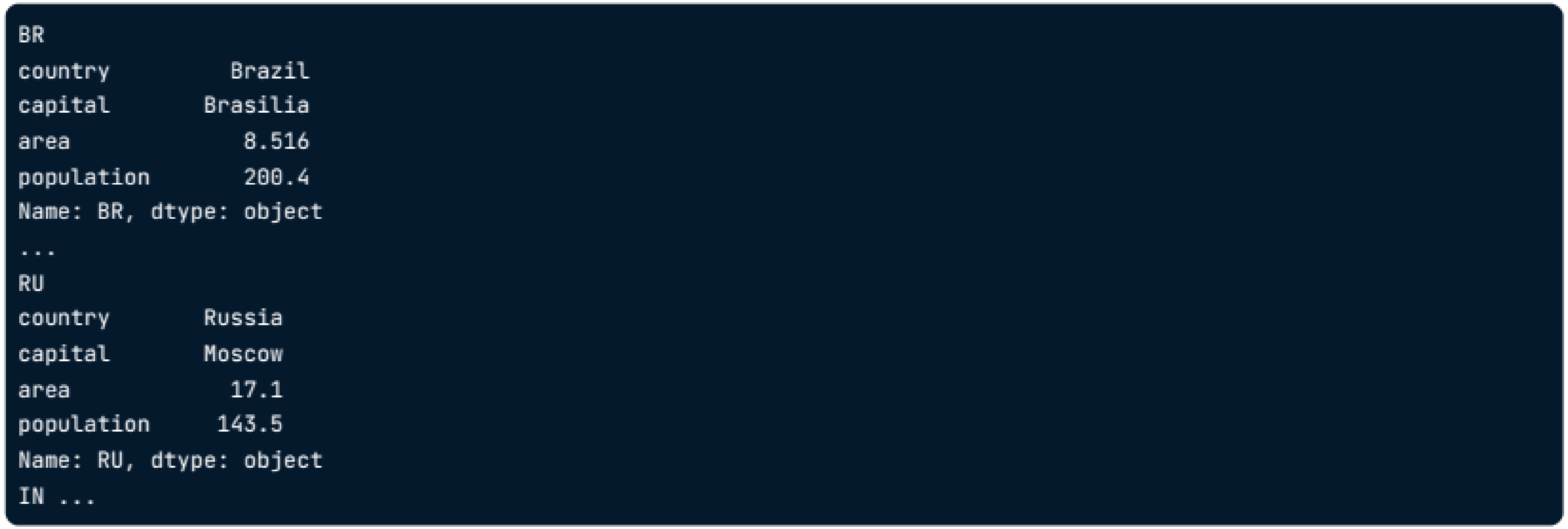
```python
import pandas as pd
brics = pd.read_csv("brics.csv", index_col = 0)
for val in brics :
    print(val)
```

```
country
capital
area
population
```

iterrows

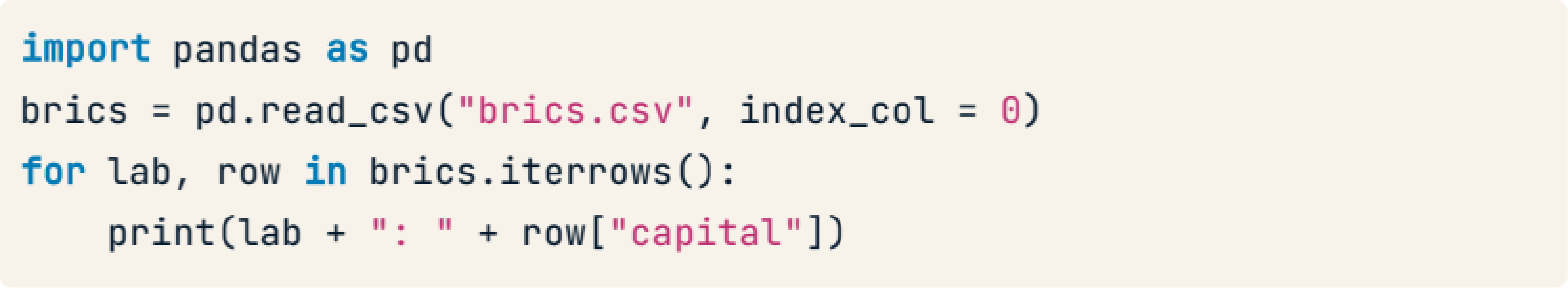


```python
import pandas as pd
brics = pd.read_csv("brics.csv", index_col = 0)
for lab, row in brics.iterrows():
    print(lab)
    print(row)
```

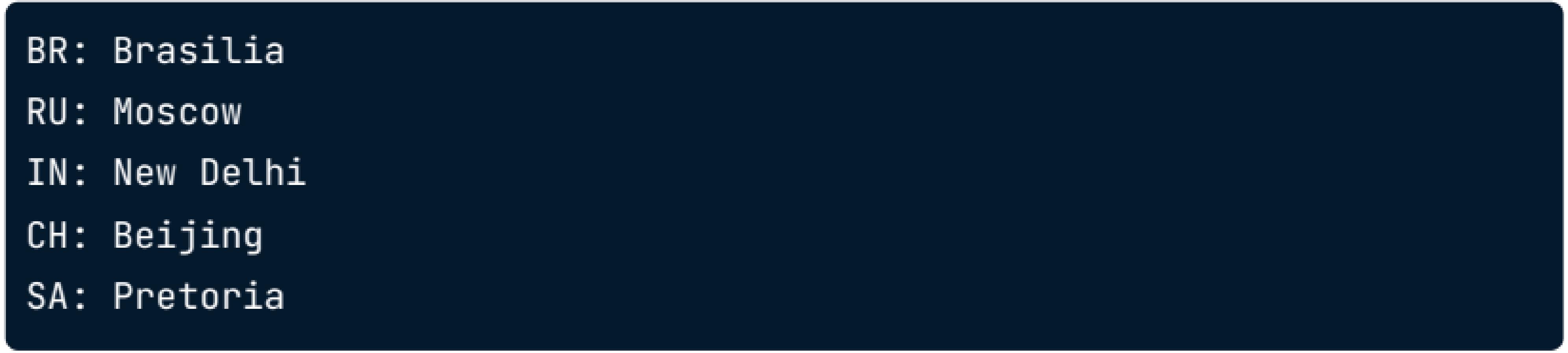


```
BR
country         Brazil
capital       Brasilia
area             8.516
population       200.4
Name: BR, dtype: object
...
RU
country       Russia
capital       Moscow
area            17.1
population     143.5
Name: RU, dtype: object
IN ...
```

Selective print

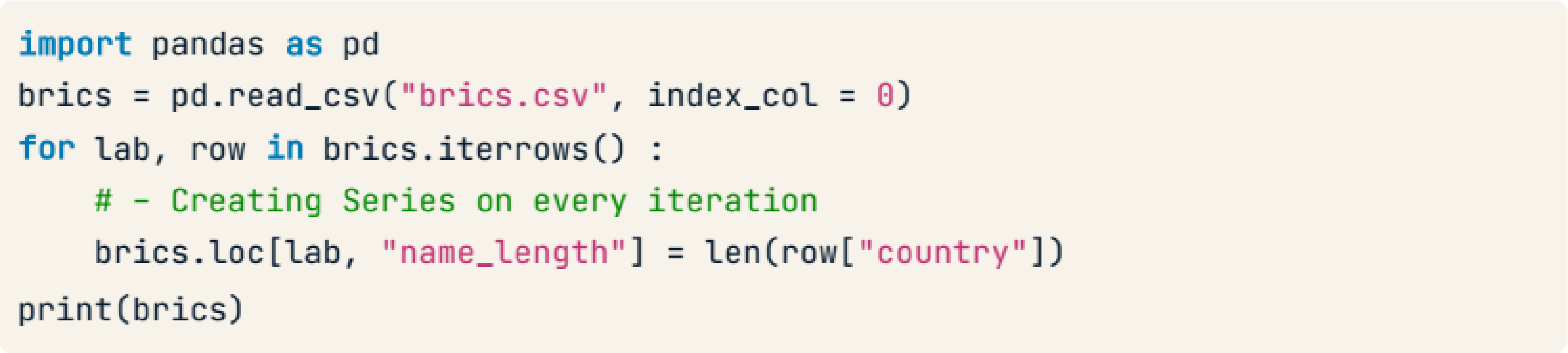


```python
import pandas as pd
brics = pd.read_csv("brics.csv", index_col = 0)
for lab, row in brics.iterrows():
    print(lab + ": " + row["capital"])
```

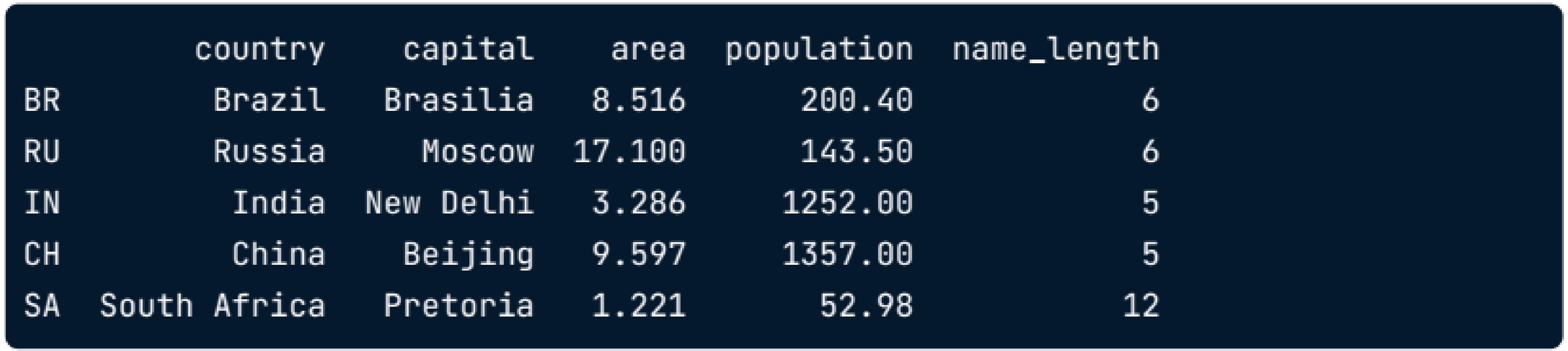


```
BR: Brasilia
RU: Moscow
IN: New Delhi
CH: Beijing
SA: Pretoria
```

Add column

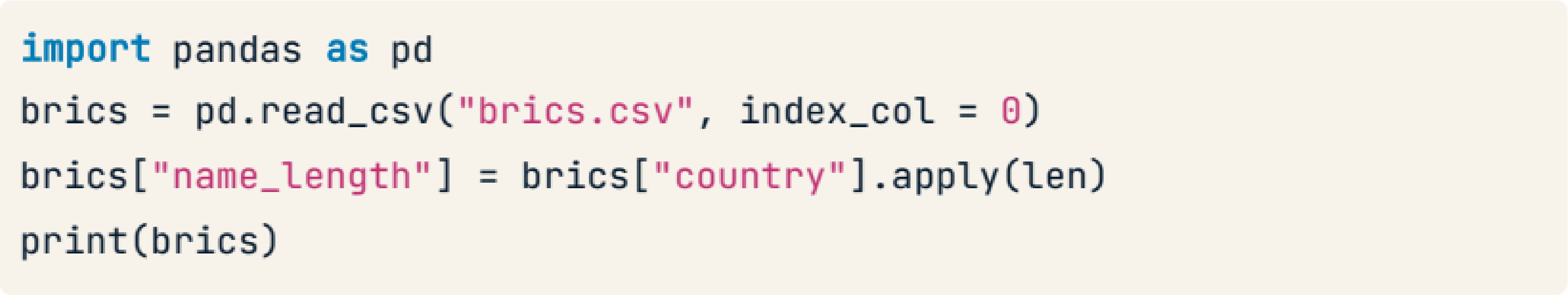


```
import pandas as pd
brics = pd.read_csv("brics.csv", index_col = 0)
for lab, row in brics.iterrows() :
    # - Creating Series on every iteration
    brics.loc[lab, "name_length"] = len(row["country"])
print(brics)
```

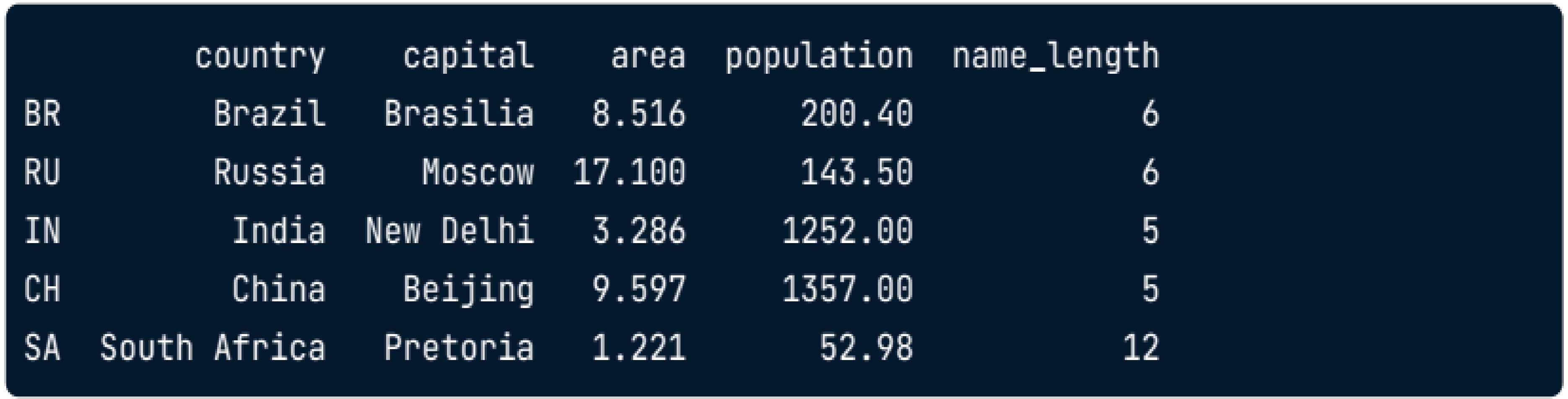


```
         country    capital    area  population  name_length
BR        Brazil   Brasilia   8.516      200.40            6
RU        Russia     Moscow  17.100      143.50            6
IN         India  New Delhi   3.286     1252.00            5
CH         China    Beijing   9.597     1357.00            5
SA  South Africa   Pretoria   1.221       52.98           12
```

apply



```
import pandas as pd
brics = pd.read_csv("brics.csv", index_col = 0)
brics["name_length"] = brics["country"].apply(len)
print(brics)
```



```
         country    capital    area  population  name_length
BR        Brazil   Brasilia   8.516      200.40            6
RU        Russia     Moscow  17.100      143.50            6
IN         India  New Delhi   3.286     1252.00            5
CH         China    Beijing   9.597     1357.00            5
SA  South Africa   Pretoria   1.221       52.98           12
```

Let's practice!