Lecture 17: More functions and classes

Inheritance and lambdas

Functions as arguments

```
1   BASE_VAL = 100
2   #https://www.python.org/dev/peps/pep-0008/#constants
3
4   def value_tester(a, b):
5       val = a + b
6       if val > BASE_VAL:
7           statement = 'bigger than'
8       elif val == BASE_VAL:
9           statement = 'the same as'
10      else:
11          statement = 'smaller than'
12
13      print(f'The value is {statement} the base value.')
```

Functions as arguments

```python
BASE_VAL = 100
#https://www.python.org/dev/peps/pep-0008/#constants

def value_tester(a, b):
    val = a + b
    if val > BASE_VAL:
        statement = 'bigger than'
    elif val == BASE_VAL:
        statement = 'the same as'
    else:
        statement = 'smaller than'

    print(f'The value is {statement} the base value.')
```

```
In [2]: value_tester(10, 10)
The value is smaller than the base value.
```

Functions as arguments

```
19  def value_tester(a, b):
20      val = sum([a, b])
21      if val > BASE_VAL:
22          statement = 'bigger than'
23      elif val == BASE_VAL:
24          statement = 'the same as'
25      else:
26          statement = 'smaller than'
27
28      print(f'The value is {statement} the base value.')
```

```
In [10]: value_tester(10, 10)
The value is smaller than the base value.
```

Interlude: unpacking notation 2

```
In [11]: x, y = [10, 20]
    ...: print(x)
    ...: print(y)
10
20
```

From lecture 5

2 variables, 3 values

```
In [12]: x, y = [10, 20, 30]
Traceback (most recent call last):

  File "<ipython-input-12-be2cdddd258d>", line 1, in <module>
    x, y = [10, 20, 30]

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

Interlude: unpacking notation 2

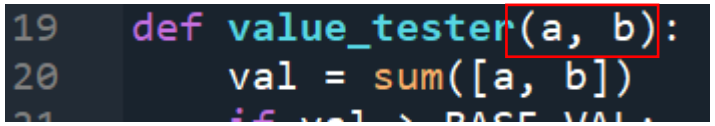
2 variables, 3 values

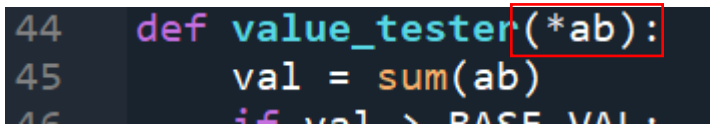
```
In [12]: x, y = [10, 20, 30]
Traceback (most recent call last):

  File "<ipython-input-12-be2cdddd258d>", line 1, in <module>
    x, y = [10, 20, 30]

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

```
In [15]: x, *y = [10, 20, 30]
    ...: print(x)
    ...: print(y)
10
[20, 30]
```

Using unpacking notation with arguments

What if we want a function to accept n arguments, rather than a hard-coded number?





Using unpacking notation with arguments

What if we want a function to accept n arguments, rather than a hard-coded number?

```
19  def value_tester(a, b):
20      val = sum([a, b])
```

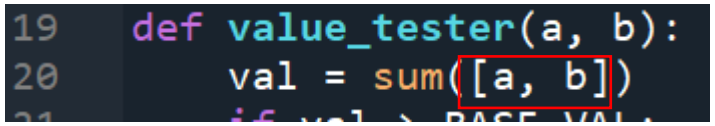
a = an integer
b = an integer

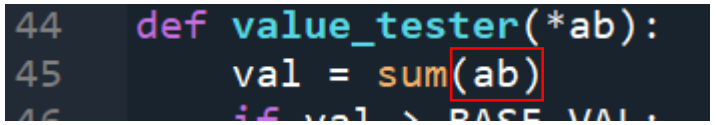
```
44  def value_tester(*ab):
45      val = sum(ab)
```

ab = a list containing
n integers

Using unpacking notation with arguments

What if we want a function to accept n arguments, rather than a hard-coded number?





Using unpacking notation with arguments

```
44  def value_tester(*ab):
45      val = sum(ab)
46      if val > BASE_VAL:
47          statement = 'bigger than'
48      elif val == BASE_VAL:
49          statement = 'the same as'
50      else:
51          statement = 'smaller than'
52
53      print(f'The value is {statement} the base value.')
```

```
In [19]: value_tester(10, 10)
The value is smaller than the base value.
```

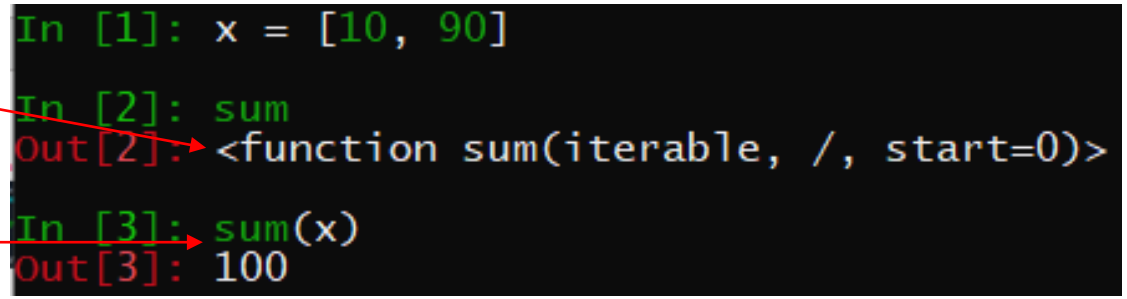
```
In [23]: value_tester(5, 5, 5, 5)
The value is smaller than the base value.

In [24]: value_tester(1)
The value is smaller than the base value.
```

We can enter any number of args

Functions themselves are objects

Function object

Calling the function
to get the result



Functions themselves are objects

Function object

Calling the function
to get the result

```
In [1]: x = [10, 90]

In [2]: sum
Out[2]: <function sum(iterable, /, start=0)>

In [3]: sum(x)
Out[3]: 100
```

```
In [25]: my_func = sum

In [26]: my_func(x)
Out[26]: 100
```

Functions themselves are objects

Function object

Calling the function
to get the result

```
In [1]: x = [10, 90]

In [2]: sum
Out[2]: <function sum(iterable, /, start=0)>

In [3]: sum(x)
Out[3]: 100
```

```
In [25]: my_func = sum

In [26]: my_func(x)
Out[26]: 100
```

```
In [27]: my_func is sum
Out[27]: True

In [28]: my_func == sum
Out[28]: True
```

Functions as arguments

```
58  def value_tester(*ab, func=sum):
59      val = func(ab)
60      if val > BASE_VAL:
61          statement = 'bigger than'
62      elif val == BASE_VAL:
63          statement = 'the same as'
64      else:
65          statement = 'smaller than'
66
67      print(f'The value is {statement} the base value.')
```

```
In [21]: value_tester(10, 10)
The value is smaller than the base value.
```

Functions as arguments

```
72  def value_tester(*ab, func=sum):
73      val = func(ab)
74      if val > BASE_VAL:
75          statement = 'bigger than'
76      elif val == BASE_VAL:
77          statement = 'the same as'
78      else:
79          statement = 'smaller than'
80
81      print(f'The value is {statement} the base value.')
```

```
In [5]: import numpy as np
   ...: value_tester(10, 10, func=np.prod)
The value is the same as the base value.
```

Anonymous functions

```
def my_func(a, b):
    return (a + b) / 2


lambda a, b: (a + b) / 2
```

Anonymous functions

```
def my_func(a, b):
    return (a + b) / 2


lambda a, b: (a + b) / 2
```

Anonymous functions

```
def my_func(a, b):
    return (a + b) / 2


lambda a, b: (a + b) / 2
```

Anonymous functions

??

```
def my_func(a, b):
    return (a + b) / 2


lambda a, b: (a + b) / 2
```

Lambda functions

```
In [7]: value_tester(10, 10, func=lambda ab: sum(ab) / len(ab))
The value is smaller than the base value.
```

```
In [9]: value_tester(150, 50, func=lambda ab: sum(ab) / len(ab))
The value is the same as the base value.
```

Lambda functions

```
In [7]: value_tester(10, 10, func=lambda ab: sum(ab) / len(ab))
The value is smaller than the base value.

In [9]: value_tester(150, 50, func=lambda ab: sum(ab) / len(ab))
The value is the same as the base value.
```

arg

body

Lambda functions are:

- Anonymous (don’t have a name)
- One line

Lambda functions

```
In [7]: value_tester(10, 10, func=lambda ab: sum(ab) / len(ab))
The value is smaller than the base value.
```

```
In [9]: value_tester(150, 50, func=lambda ab: sum(ab) / len(ab))
The value is the same as the base value.
```

```
In [14]: def my_func(arg):
    ...:     return arg + 10
    ...: my_func(10)
Out[14]: 20
```

```
In [15]: my_func = lambda arg: arg + 10
    ...: my_func(10)
Out[15]: 20
```

Lambda functions

```
In [7]: value_tester(10, 10, func=lambda ab: sum(ab) / len(ab))
The value is smaller than the base value.
```

```
In [9]: value_tester(150, 50, func=lambda ab: sum(ab) / len(ab))
The value is the same as the base value.
```

```
In [14]: def my_func(arg):
    ...:     return arg + 10
    ...: my_func(10)
Out[14]: 20
```

```
In [15]: my_func = lambda arg: arg + 10
    ...: my_func(10)
Out[15]: 20
```

Equivalent

Wrong!

https://www.python.org/dev/peps/pep-0008/#id51

Class inheritance

```
 99  class Vehicle():
100      def __init__(self, kind):
101          self.kind = kind
102
103      def what_am_i(self):
104          print(f'I am a {self.kind}.')
105
106      def fuel(self):
107          print('I use oil for fuel.')
```

```
In [26]: vehicle = Vehicle('car')
    ...: vehicle.what_am_i()
    ...: vehicle.fuel()
I am a car.
I use oil for fuel.
```

Class inheritance

```
 99  class Vehicle():
100      def __init__(self, kind):
101          self.kind = kind
102
103      def what_am_i(self):
104          print(f'I am a {self.kind}.')
105
106      def fuel(self):
107          print('I use oil for fuel.')
```

```
113  class Bicycle(Vehicle):
114      def fuel(self):
115          print('I am people-powered.')
116
117      def peddle_me(self):
118          print('You have to peddle fast.')
```

Class inheritance

```
 99  class Vehicle():
100      def __init__(self, kind):
101          self.kind = kind
102
103      def what_am_i(self):
104          print(f'I am a {self.kind}.')
105
106      def fuel(self):
107          print('I use oil for fuel.')
```

inherited

inherited

overwritten

```
113  class Bicycle(Vehicle):
114      def fuel(self):
115          print('I am people-powered.')
116
117      def peddle_me(self):
118          print('You have to peddle fast.')
```

overwrites

adds

Class inheritance

```
113  class Bicycle(Vehicle):
114      def fuel(self):
115          print('I am people-powered.')
116
117      def peddle_me(self):
118          print('You have to peddle fast.')
```

```
In [29]: bike = Bicycle('bike')
    ...: bike.what_am_i()
    ...: bike.fuel()
    ...: bike.peddle_me()
I am a bike.
I am people-powered.
You have to peddle fast.
```

Arg comes from inherited __init__

Class inheritance

Python's base string class

```
126  class MyString(str):
127      def say_hello(self):
128          print('Hello world!')
129
130      def lower(self):
131          print("No, I don't want to be in lower case!")
```

```
In [39]: ms = MyString('Hello my name is Jeff.')

In [40]: ms.lower()
No, I don't want to be in lower case!

In [41]: ms.upper()
Out[41]: 'HELLO MY NAME IS JEFF.'

In [42]: ms.say_hello()
Hello world!
```