UNIVERSITÄT BIELEFELD
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# Programming

## Programming & Python Basics

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# Recap

Loops

**Functions**

Classes, Modules & Packages

Programming Errors & Debugging

# Functions

```
def «functionName» ( «parameterName1», «parameterName2», ... ):
    «statement»
    return «statement»
```

⚠ Mind the indention!

*gray = optional*

# Variable Scope

**Functions have a separate variable scope!**

- internal variables are not accessible from outside
- calling global functions and variables is possible
  - Reading global variables is discouraged
- Changing global variables requires

  «`global variableName`»

  statement inside function (highly discouraged)

source: `https://www.learnpython.org/en/Functions`

# Functions—a simple example

```
1  def myFirstFunction():
2      print('this is my first function')
3
4  # call function
5  myFirstFunction()
6
7  # save return value in variable
8  hereComesNothing = myFirstFunction()
```

# Functions—example of code reuse

```
1  def findSubstringInStrings(stringCollection, pattern):
2      occ = list()
3      for i, s in enumerate(stringCollection):
4          j = s.find(pattern)
5          while j != -1:
6              occ.append((i, j))
7              j = s.find(pattern, j+1)
8      return occ
9
10 myStringList = ['the rain in spain', 'ain\'t no sunshine',
11     'she was greeted with disdain']
12
13 occOfAin = findSubstringInStrings(myStringList, 'ain')
```

# Quiz

Have you ever seen a function calling itself? Consider the following:

```
1 def fun(x):
2     if len(x) > 1:
3         return fun(x[1:])
4     return x
```

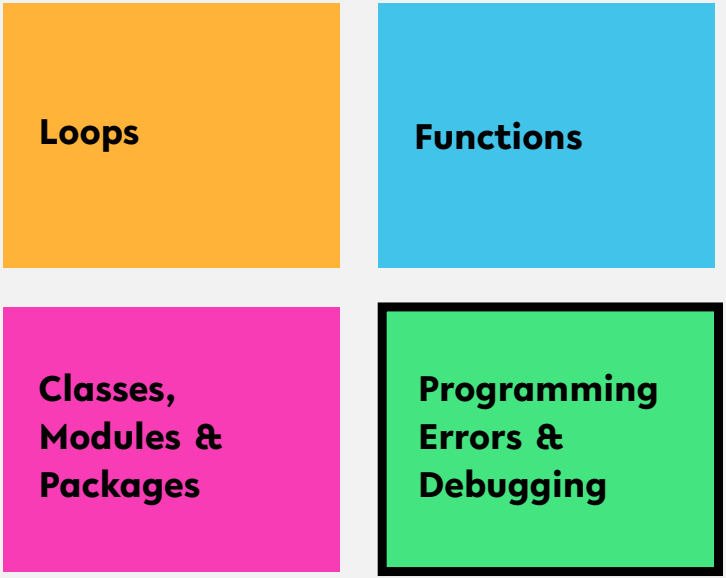
What does the function call `fun([1,2,3,4])` return?

# Quiz

Have you ever seen a function calling itself? Consider the following:

```
1 def fun(x):
2     if len(x) > 1:
3         return fun(x[1:])
4     return x
```

What does the function call `fun([1,2,3,4])` return? [4]


Loops
Functions
Classes, Modules & Packages
Programming Errors & Debugging

# Programming errors

Recognizing different types of errors:

- Syntactic: spelling & grammar mistakes
  - e.g. $avg = (x\,y)/2$
- Semantic: mistakes in meaning, context, or program flow
  - e.g. $avg = x + y/2$ or $avg = (x + z)/0$

Distinction between

- Compile-time errors (syntactic, semantic)
- Runtime errors (semantic)

# RuntimeError

## Changing the size of `my_dict` in loop

```
1 # dictionary filled with arbitrary elements
2 my_dict = {'key': 'value', 1: 'text', (1, 2)
    : 'text'}
3
4 # for-loop over keys of my_dict with control
    variable 'key'
5 for key in my_dict:
6     my_dict[(key, 1, 2, 3)] = 'new element'
```

# Catching exceptions

Controlled treatment of anticipated exceptions:

```
while True:
    try:
        x = int(input("Please enter a number: "))
        break
    except ValueError:
        print("Oops!  That was no valid number.  Try again...")
```

# Raising exceptions

Use `raise` keyword to throw exceptions:

```
1  def myFunction(collection):
2
3      if len(collection) == 0:
4          raise RuntimeError("Invalid input: empty collection")
5      # do something ..
6      return
7
8  myFunction(list())
```

# Raising exceptions

Check properties of input parameters using the `assert` statement:

```
1 def myFunction(collection):
2
3     assert len(collection) > 0, "Invalid input: empty collection"
4
5     # do something ..
6     return
7
8 myFunction(list())
```

Failed assertions result in an `AssertionError`

# Debugging

PDB—the Python debugger

- Enables step-by-step proceeding of statements in Python programs
- Interaction with Python program at runtime
- Debugger is invoked by *breakpoints*
- Set breakpoint in arbitrary location of your code by
  - calling builtin “`breakpoint()`” function (Python version $\geq$ 3.7)
  - statement “`import pdb; pdb.set_trace()`”

# Python debugger—example

```
1  # dictionary filled with arbitrary elements
2  my_dict = {'key': 'value', 1: 'text', (1, 2)
       : 'text'}
3
4  # invoke Python debugger
5  breakpoint()
6
7  # for-loop over keys of my_dict with control
       variable 'key'
8  for key in my_dict:
9      my_dict[(key, 1, 2, 3)] = 'new element'
```

# Quiz

- Is improper indentation a syntactic or semantic error?
- Consider the following code:

```
1 def str2int(x):
2     try:
3         return int(x)
4     _____________ ValueError:
5         return -1
```

What keyword should be used here?

`except` `raise` `else` `Exception`

source: https://quizizz.com/

# Quiz

- Is improper indentation a syntactic or semantic error? syntactic
- Consider the following code:

```
1 def str2int(x):
2     try:
3         return int(x)
4     _____________ ValueError:
5         return -1
```

What keyword should be used here?

except✔ raise else Exception

source: https://quizizz.com/