

# Python Functions

# What is a function in Python?

- Is a group of related statements that perform a specific task
- Help break our program into smaller and modular chunks
- As program grows larger and larger, functions make it more organized and manageable
- Furthermore, it avoids repetition and makes code reusable

# Syntax of Function

```
def function_name(parameters):  
    """docstring"""  
    statement(s)
```

# Example of a function

---

#Function Definition

```
def greet(name):  
    """This function greets to  
    the person passed in as  
    parameter"""  
    print("Hello, " + name + ". Good morning!")
```

greet("Ram") #Function Call

|

# Docstring

---

#Function Definition

```
def greet(name):
```

```
    """This function greets to  
    the person passed in as  
    parameter"""
```

```
    print("Hello, " + name + ". Good morning!")
```

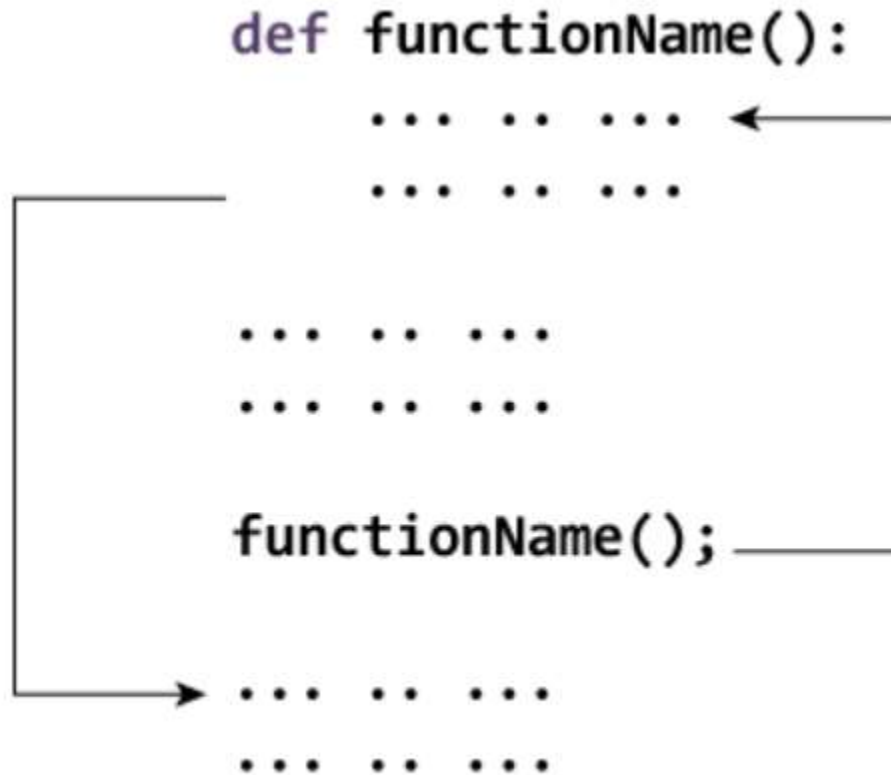
```
print(greet.__doc__)|
```

```
greet("Ram") #Function Call
```

# The return statement

```
def absolute_value(num) :  
    """This function returns the absolute  
    value of the entered number"""  
  
    if num >= 0:  
        return num  
    else:  
        return -num  
  
print(absolute_value(2))  
  
print(absolute_value(-4))  
  
print(absolute_value(0))
```

# How Function works in Python?



# Scope and Lifetime of variables

- Scope of a variable is the portion of a program where the variable is recognized
- Parameters and variables defined inside a function is not visible from outside. Hence, they have a local scope.
- Lifetime of a variable is the period throughout which the variable exists in the memory.
- The lifetime of variables inside a function is as long as the function executes.
- They are destroyed once we return from the function. Hence, a function does not remember the value of a variable from its previous calls.



# Example

```
def my_func():  
    x = 10  
    print("Value inside function:",x)  
  
x = 20  
my_func()  
print("Value outside function:",x)
```

# Types of Functions

- Can be divided into the following two types:
  - Built-in functions: Functions that are built into Python
  - User-defined functions: Functions defined by the users themselves

# Arguments

```
def greet(name,msg):  
    """This function greets to  
    the person with the provided message"""  
    print("Hello",name + ', ' + msg)  
  
greet("Maan Bahadur","Good morning!")|
```

# Python Default Arguments

```
def greet(name, msg = "Good morning!") :  
    """  
    This function greets to  
    the person with the  
    provided message.  
  
    If message is not provided,  
    it defaults to "Good  
    morning!"  
    """  
  
    print("Hello", name + ', ' + msg)  
  
greet("Ram Bahadur")  
greet("Shyam Bahadur", "How do you do?")  
|
```

# Python Keyword Arguments

```
def greet(name, msg = "Good morning!") :  
    """  
    This function greets to  
    the person with the  
    provided message.  
  
    If message is not provided,  
    it defaults to "Good  
    morning!"  
    """  
  
    print("Hello", name + ', ' + msg)  
  
greet(name = "Ram Bahadur", msg = "How do you do?")  
greet(msg = "How do you do?", name = "Shyam Bahadur")  
greet("Hari Bahadur", msg = "How do you do?")|
```

# Python Arbitrary Arguments

---

```
def greet(*names):  
    """This function greets all  
    the person in the names tuple."""  
  
    # names is a tuple with arguments  
    for name in names:  
        print("Hello",name)  
  
greet("Gita")  
greet("Ram", "Shyam", "Hari", "Sita")  
|
```

# Python Recursion

- What is recursion in Python?
- Python Recursive Function
- Advantages of Recursion
- Disadvantages of Recursion

# What is recursion in Python?

- Recursion is the process of defining something in terms of itself
- A physical world example would be to place two parallel mirrors facing each other
- Any object in between them would be reflected recursively



# Python Recursive Function

---

```
# An example of a recursive function to  
# find the factorial of a number
```

```
def calc_factorial(x):  
    """This is a recursive function  
    to find the factorial of an integer"""  
  
    if x == 1:  
        return 1  
    else:  
        return (x * calc_factorial(x-1))
```

```
num = 4  
print("The factorial of", num, "is", calc_factorial(num))
```

```
calc_factorial(4)           # 1st call with 4
4 * calc_factorial(3)       # 2nd call with 3
4 * 3 * calc_factorial(2)   # 3rd call with 2
4 * 3 * 2 * calc_factorial(1) # 4th call with 1
4 * 3 * 2 * 1               # return from 4th call as number=1
4 * 3 * 2                   # return from 3rd call
4 * 6                       # return from 2nd call
24                          # return from 1st call
```

# Advantages of Recursion

- Make the code look clean and elegant
- A complex task can be broken down into simpler sub-problems using recursion

# Disadvantages of Recursion

- Sometimes the logic behind recursion is hard to follow through
- Recursive calls are expensive (inefficient) as they take up a lot of memory and time
- Recursive functions are hard to debug

# Python Anonymous/Lambda Function

- What are lambda functions in Python?
- How to use lambda Functions in Python?
  - Syntax of Lambda Function in python
  - Example of Lambda Function in python
  - Use of Lambda Function in python

# What are lambda functions in Python?

- In Python, anonymous function is a function that is defined without a name.
- While normal functions are defined using the `def` keyword, in Python anonymous functions are defined using the `lambda` keyword.
- Hence, anonymous functions are also called lambda functions.

# How to use lambda Functions in Python?

- Syntax of Lambda Function in python

```
lambda arguments: expression
```

# Example of Lambda Function in python

```
# Program to show the use of lambda functions

double = lambda x: x * 2
square= lambda y:y**2

print(double(5))
print(square(4))
|
```



# Use of Lambda Function in python

```
my_list = [1, 5, 4, 6, 8, 11, 3, 12]
```

```
odd_list = list(filter(lambda x: (x%2 == 0) , my_list))
```

```
even_list= list(filter(lambda x:(x%2!=0),my_list))
```

```
print(my_list)
```

```
print(odd_list)
```

```
print(even_list)
```

```
# Program to double each item in a list using map()
```

```
my_list = [1, 5, 4, 6, 8, 11, 3, 12]
```

```
new_list = list(map(lambda x: x * 2 , my_list))
```

```
print(my_list)
```

```
print(new_list)
```

# Python Global, Local and Nonlocal variables

- Global Variables in Python
- Local Variables in Python
- Global and Local Variables Together
- Nonlocal Variables in Python

# Global Variables in Python

```
x = "global"

def foo():
    print("x inside :", x)

foo()
print("x outside:", x)|
```

```
x = "global"

def foo():
    x = x * 2
    print(x)

foo()
```

# Local Variables in Python

---

```
def foo():  
    y = "local"  
    print(y)
```

```
foo()  
|
```

# Global and Local Variables Together

---

```
x = "global"

def foo():
    global x
    y = "local"
    x = x * 2
    print(x)
    print(y)

foo()
|
```

```
x = 5
```

```
def foo():  
    x = 10  
    print("local x:", x)
```

```
foo()  
print("global x:", x)  
|
```



# Nonlocal Variables in Python

```
x = 0
def outer():
    x = 1
    def inner():
        nonlocal x
        x = 2
        print("inner:", x)

    inner()
    print("outer:", x)

outer()
print("global:", x)
```

# Python Global Keyword

- Python global Keyword
  - Rules of global Keyword
  - Use of global Keyword (With Example)
- Global Variables Across Python Modules
- Global in Nested Functions in Python

# Python global Keyword

- The basic rules for global keyword in Python are:
  - When we create a variable inside a function, it's local by default
  - When we define a variable outside of a function, it's global by default. We don't have to use global keyword.
  - We use global keyword to read and write a global variable inside a function.
  - Use of global keyword outside a function has no effect

```
c = 1 # global variable
```

```
def add():  
    print(c)
```

```
add()
```

```
|
```

```
c = 1 # global variable
```

```
def add():  
    c = c + 2 # increment c by 2  
    print(c)
```

```
add()  
|
```

---

```
c = 0 # global variable
```

```
def add():  
    global c  
    c = c + 2 # increment by 2  
    print("Inside add():", c)
```

```
add()  
print("In main:", c)|
```

# Global Variables Across Python Modules

```
#value.py  
a=0  
b="empty"  
|
```

```
#update.py|  
import value  
  
value.a = 10  
value.b = "alphabet"
```

```
import value
import update

print (value.a)
print (value.b)
```



# Global in Nested Functions

```
def foo():  
    x = 20  
  
    def bar():  
        global x  
        x = 25  
  
    print("Before calling bar: ", x)  
    print("Calling bar now")  
    bar()  
    print("After calling bar: ", x)  
  
foo()  
print("x in main : ", x)  
|
```

# Python Modules

- What are modules in Python?
- How to import modules in Python?
  - Python import statement
  - Import with renaming
  - Python from...import statement
  - Import all names
- Python Module Search Path
- Reloading a module
- The `dir()` built-in function

# What are modules in Python?

- File containing Python statements and definitions
  - Example: `example.py`, is called a module
- Use to break down large programs into small manageable and organized files.
- Provide reusability of code
- Can define our most used functions in a module and import it, instead of copying their definitions into different programs

# How to import modules in Python?

- Python import statement
- Import with renaming
- Python from...import statement
- Import all names

# Python import statement

---

```
# import statement example
# to import standard module math

import math
print("The value of pi is", math.pi)
|
```

# Import with renaming

---

```
# import module by renaming it
```

```
import math as m
```

```
print("The value of pi is", m.pi)
```

```
|
```

# Python from...import statement

```
# import only pi from math module
```

```
from math import pi
```

```
print("The value of pi is", pi)
```

```
|
```

# Import all names

```
# import all names from the standard module math
```

```
from math import *
```

```
print("The value of pi is", pi)
```

```
print("The value of e is", e)
```

```
|
```



# Python Module Search Path

- While importing a module, Python looks at several places.
- Interpreter first looks for a built-in module then (if not found) into a list of directories defined in `sys.path`.
- The search is in this order.
  - The current directory.
  - `PYTHONPATH` (an environment variable with a list of directory).
  - The installation-dependent default directory.

```
Python 3.6.3 (v3.6.3:2c5fed8, Oct 3 2017, 18:11:49) [MSC v.1900 64 bit (AMD64)]
on win32
Type "copyright", "credits" or "license()" for more information.
>>> import sys
>>> sys.path
['', 'C:\\Users\\Cab\\AppData\\Local\\Programs\\Python\\Python36\\Lib\\idlelib',
 'C:\\Users\\Cab\\AppData\\Local\\Programs\\Python\\Python36\\python36.zip', 'C:
\\Users\\Cab\\AppData\\Local\\Programs\\Python\\Python36\\DLLs', 'C:\\Users\\Cab
\\AppData\\Local\\Programs\\Python\\Python36\\lib', 'C:\\Users\\Cab\\AppData\\Lo
cal\\Programs\\Python\\Python36', 'C:\\Users\\Cab\\AppData\\Local\\Programs\\Pyt
hon\\Python36\\lib\\site-packages']
>>> |
```

# Reloading a module

```
#function.py  
print("Funtion module")
```

```
Python 3.6.3 (v3.6.3:2c5fed8, Oct 3 2017, 18:11:49) [MSC v.1900 64 bit (AMD64)]  
on win32  
Type "copyright", "credits" or "license()" for more information.  
>>> import function  
Funtion module  
>>> import function  
>>> import function  
>>> import imp  
>>> imp.reload(function)  
Funtion module  
<module 'function' from 'C:\\Users\\Cab\\AppData\\Local\\Programs\\Python\\Pytho  
n36\\function.py'>  
>>> |
```

# The `dir()` built-in function

- We can use the `dir()` function to find out names that are defined inside a module.

```
#function.py
a=40
b="Ram Bahadur"
def test():
    c=65.5
    print(c)
print(a,b)
test()
|
```

```
Python 3.6.3 (v3.6.3:2c5fed8, Oct 3 2017, 18:11:49) [MSC v.1900 64 bit (AMD64)]
on win32
Type "copyright", "credits" or "license()" for more information.
>>> import function
40 Ram Bahadur
65.5
>>> dir(function)
['_builtins_', '__cached__', '__doc__', '__file__', '__loader__', '__name__',
 '__package__', '__spec__', 'a', 'b', 'test']
>>> |
```

# Python Package

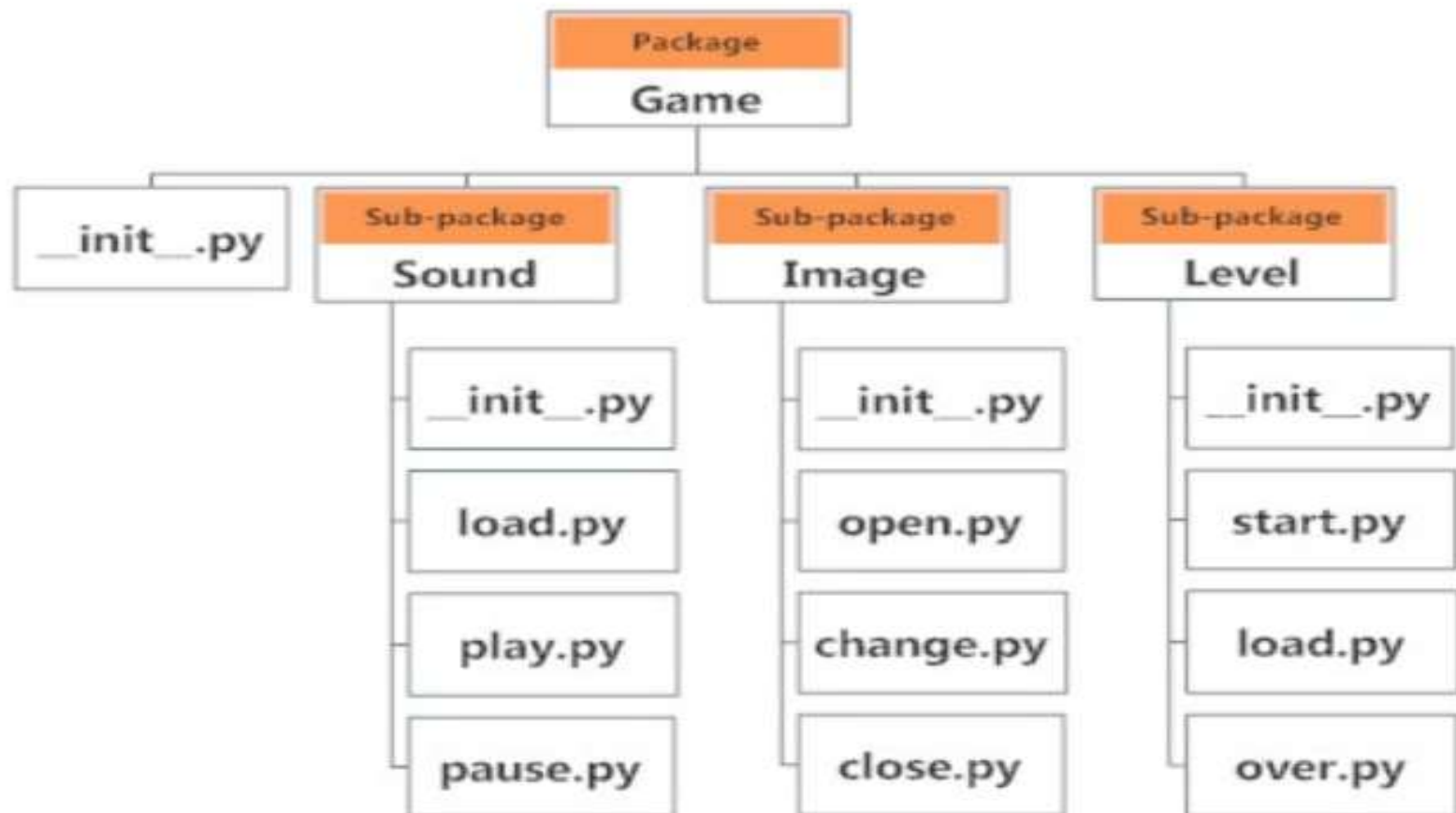
- What are packages?
- Importing module from a package

# What are packages?

- We don't usually store all of our files in our computer in the same location.
- Similar files are kept in the same directory, for example, we may keep all the songs in the "music" directory.
- Analogous to this, Python has packages for directories and modules for files.

- As our application program grows larger in size with a lot of modules, we place similar modules in one package and different modules in different packages.
- Similar, as a directory can contain sub-directories and files, a Python package can have sub-packages and modules.
- A directory must contain a file named `__init__.py` in order for Python to consider it as a package.
- This file can be left empty but we generally place the initialization code for that package in this file





# Importing module from a package

- We can import modules from packages using the dot (.) operator.
- For example, if we want to import the start module in the above example, it is done as follows.
  - `import Game.Level.start`
- Now if this module contains a function named `select_difficulty()`, we must use the full name to reference it.
  - `Game.Level.start.select_difficulty(2)`

- We can also import the module without the package prefix as follows
  - `from Game.Level import start`
- We can now call the function simply as follows.
  - `start.select_difficulty(2)`

- Yet another way of importing just the required function (or class or variable) from a module within a package would be as follows.
  - `from Game.Level.start import select_difficulty`
- Now we can directly call this function.
  - `select_difficulty(2)`

# Thank You !

