5. Function and Lambda

PYTHON COURSE

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Functions in Python

1. Functions are a set of procedures that can be called to carry out a specific task.
2. Specific parameters/arguments can be passed into a function to be used.
3. Using functions can improve readability and structure of the code, making it more professional for others to co-work on it.

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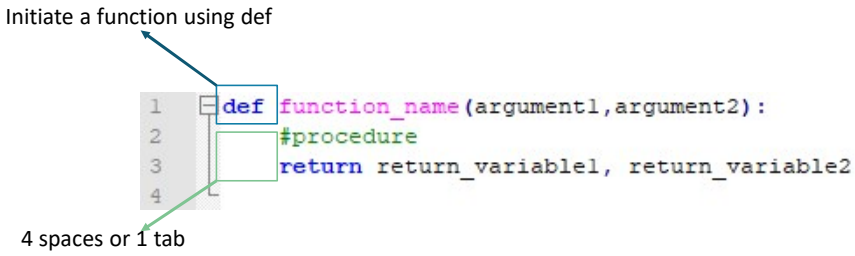
Function Syntax in Python



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Hello World as a function

```
1  def Hello_world_function(name):
2      print("Hello World "+ str(name))
3
4  def Get_username(question):
5      username=input(str(question)+"\n")
6      return username
7
8  Name=Get_username("What is your name?")
9
10 Hello_world_function(Name)
```

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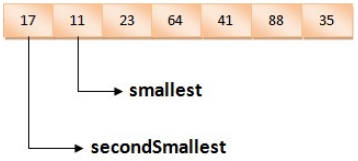
Challenge 1: Functions

Write a function to accept 2 numeric lists as the input arguments. For example the two lists can be [1,3,5,2] and [9,2,9,4,3].

The function must return the second smallest odd number.



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Challenge 2: Nested Functions

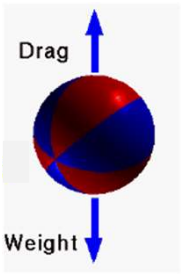
An spherical object with mass (M) and radius (r) is falling under gravity (g=9.81 N/kg)

The force due to gravity (W) is expressed as W=Mg

It is experiencing a resistive drag force (D) which is calculated as $D = Cd \frac{r V^2}{2} A$

Where Cd is drag coefficient, V is velocity, A is frontier area ($A=2\pi r^2$)

The terminal velocity (Vt) is V when W=D.



1. Write a function to evaluate W (argument= mass)
2. Write another function to evaluate D (argument= Cd, r, V)

(Use Cd=0.3, R=1, M=2 to check)

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Challenge 2 (Cont): Find terminal velocity

3. Write a function that increases V from 0 to 100 with 0.1 increment. Then this function compares W and D and finds the terminal velocity (Vt).

Use Cd=0.3, r=1, M=2

Analytical solution check: $V = \text{sqrt}\left(\frac{2\ W}{Cd\ r\ A}\right)$

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Lambda functions

1. Lambda functions are special kinds of functions.
2. Lambda functions are small and anonymous. They can take any number of arguments but can only have one expression.
3. Lambda functions are mainly used for mathematics/ numeric values.

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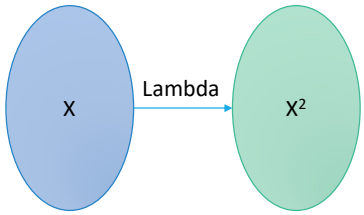
Lambda function example

Function name keyword

```
1  myfunction=lambda x : x**2
2
3  print(myfunction(2))
```



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Lambda function and lists

1. Lambda function can be used in lists.

2. Example: print the **square** of the first 10 whole number in a list.

```
1  f = lambda x: x*x
2  l=[f(x) for x in range(1,11)]
3  print(l)
```

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Challenge 3: Fibonacci using Lambda

You are given X=[1,1]. Add elements into the list so that the list shows the first 100 number of the Fibonacci series. Use lambda function to calculate all subsequent numbers.

The Fibonacci Sequence

1,1,2,3,5,8,13,21,34,55,89,144,233,377…

1+1=2	13+21=34
1+2=3	21+34=55
2+3=5	34+55=89
3+5=8	55+89=144
5+8=13	89+144=233
8+13=21	144+233=377

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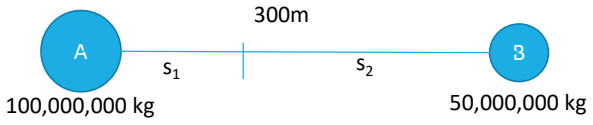
Homework: Two body systems

Two planets are attracted to each others by gravitational forces: $F = G\frac{m_1 m_2}{r^2} = m_1 a_1 = m_2 a_2$

The larger planet A has a mass of 100,000,000 kg and the smaller planet B has a mass of 50,000,000 kg. These two planets are 300 m apart.

1. Write a function to evaluate the gravitational attraction force, F.
2. Write a function to evaluate the acceleration of planet A and planet B
3. Find the time these two planet will meet. (Hint: $s=1/2at^2$ and see picture)



Meeting time: $s_1+s_2=300$

$G=6.67408 \times 10^{-11}\ m^3\ kg^{-1}\ s^{-2}$ Increment time by 1s with a maximum boundary of 100,000 s

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Conclusion

1. Functions in Python
2. Function syntax
3. Hello world in function
4. Function example
5. Nested function
6. Iterative evaluation
7. Lambda function
8. Lambda function in lists
9. Fibonacci using Lambda
10. Two body systems Homework

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