Python Programming

Basics

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Python code understanding

- print – the basic printing command

```
>>>> print(”Hello, World”)
>>>> print(3+4)
>>>> print(4 * ”*”)
>>>> x = 2
>>>> print(”x= ”,x)
>>>> print(”abc”, ”def”, ”ghi”, sep=”; ”)
>>>> print(1,2, ”abc”, sep=”-”, end=”\n”)
>>>> print(”””abc def
               ghi jkl mno prs”””)
```

- Comments
  - #Greeting

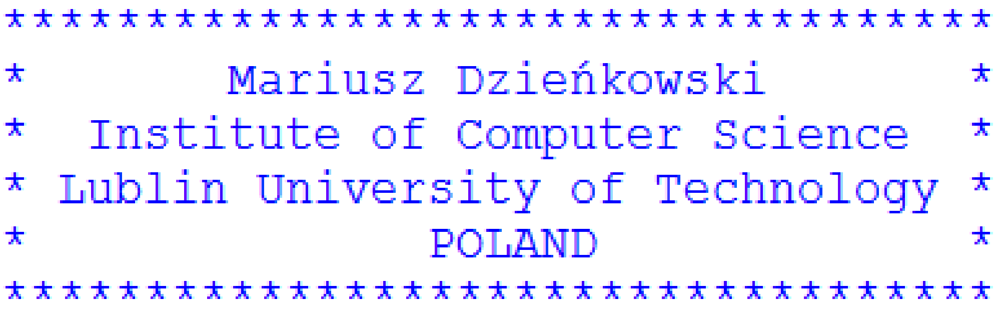
Python code understanding

- Special characters in strings
    - \ – continuation
    - \n – new line
    - \t – horizontal tab
    - \r – carriage return
- Operators for numbers
    - +
    - -
    - *
    - / or //
    - %
    - **
- Logical operators: and, or, not

Problem 1

Business card

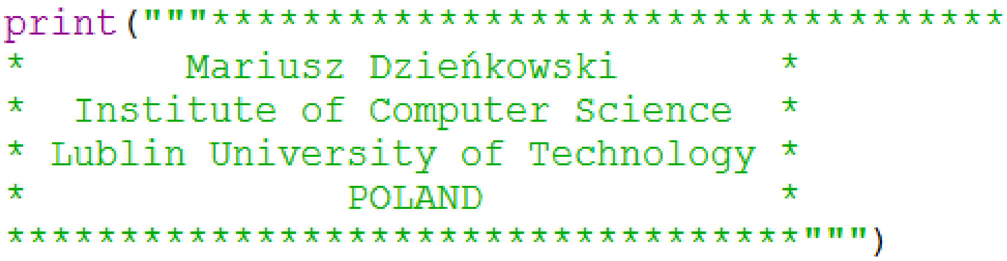
- Terminal app that displays short information about you:
  - 1st line: first name and surname
  - 2nd line: field of study
  - 3rd line: university
  - 4th line: country of residence
- Hint: use print function only once



```
***********************************
*       Mariusz Dzieńkowski       *
*  Institute of Computer Science  *
* Lublin University of Technology  *
*              POLAND             *
***********************************
```

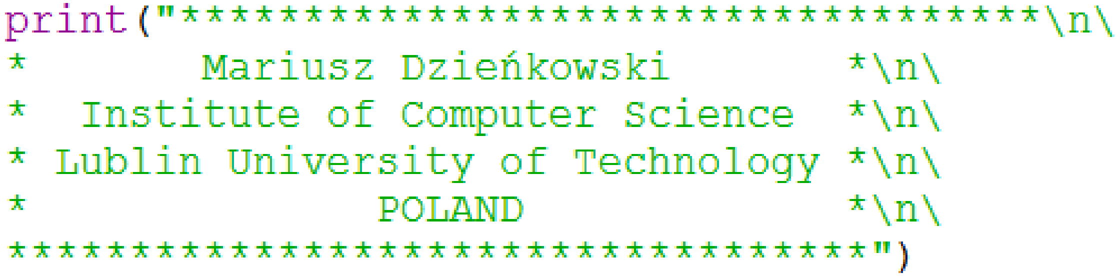
Problem 1 - solutions

- **Source code**
  - Variant 1



```
print("""***********************************
*       Mariusz Dzieńkowski       *
*  Institute of Computer Science  *
* Lublin University of Technology *
*             POLAND              *
***********************************""")
```

  - Variant 2



```
print("***********************************\n\
*       Mariusz Dzieńkowski       *\n\
*  Institute of Computer Science  *\n\
* Lublin University of Technology *\n\
*             POLAND              *\n\
***********************************")
```

Assigment

- The first assignment to a variable creates it – no declaration, dynamic typing
- Assignment uses = and comparison uses ==

  -
    ```
    >>>> x = 2
    >>>> x
    2
    ```

  -
    ```
    >>>> x, y = 2, 3
    >>>> y
    3
    ```
- This makes it easy to swap values

  -
    ```
    >>>> x, y = y, x
    ```
- Assignments can be chained

  -
    ```
    >>>> a = b = c =d = 2
    ```

Basic datatypes

- Integers (default for numbers)

  a = 5 / 3 # Answer 1 -> integer division

- Floats

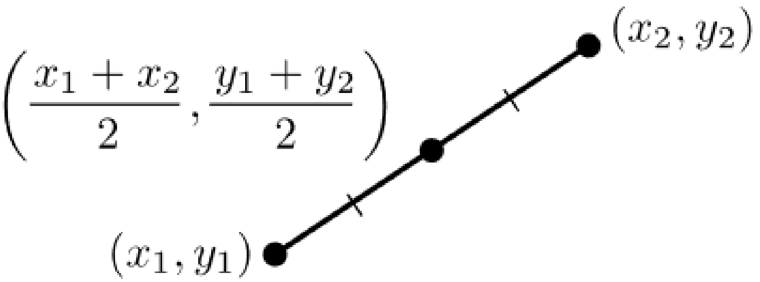
  b = 1.2345

- Strings
  - Can use ”... ” or ’...’
  - Use triple double-quotes for multi-line strings or strings that contain both ” and ’ inside of them

Problem 2

Midpoint calculation

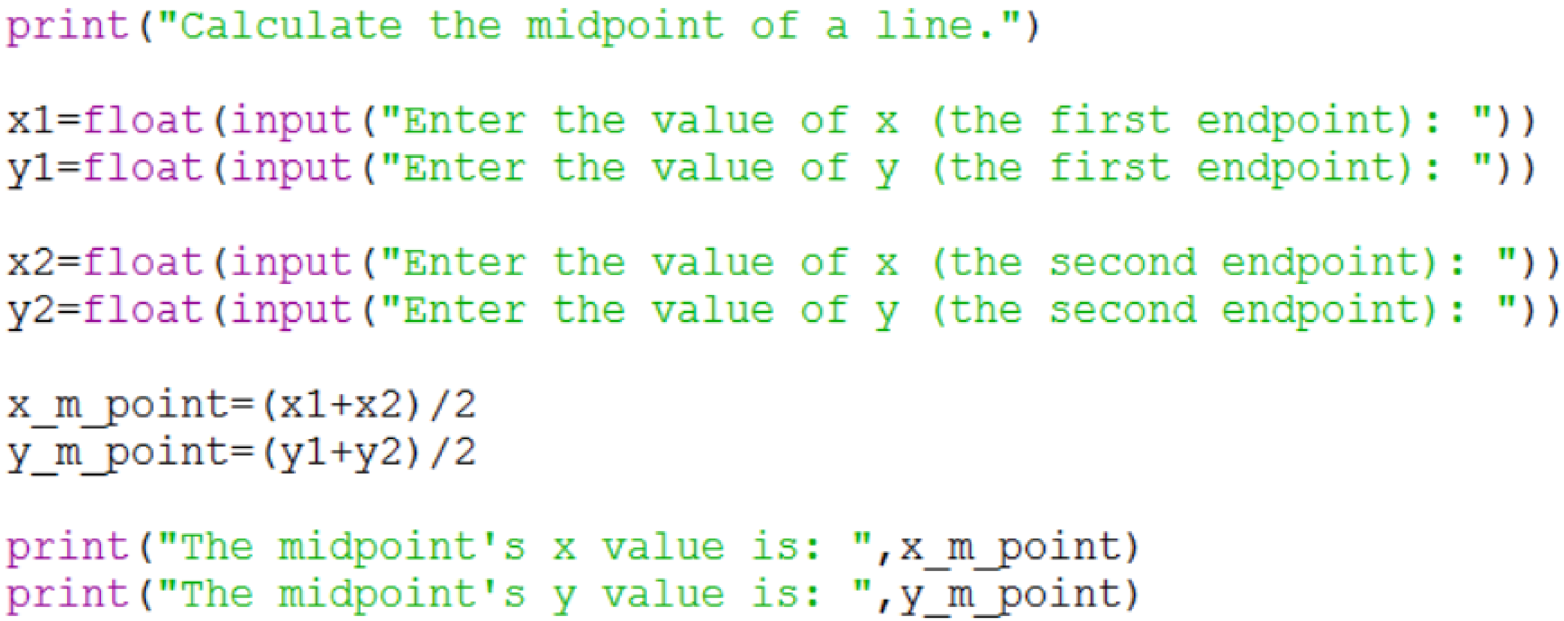
- Terminal app that calculates the midpoint of a line
- Problem solution
    - Take two values of the first point (x_1, y_1) and the second point (x_2, y_2)
    - Calculate the midpoint's value x and value y
    - Print the final result



Problem 2 - solution

Midpoint calculation

- Source code

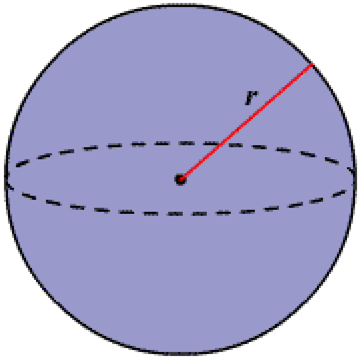


```
print("Calculate the midpoint of a line.")

x1=float(input("Enter the value of x (the first endpoint): "))
y1=float(input("Enter the value of y (the first endpoint): "))

x2=float(input("Enter the value of x (the second endpoint): "))
y2=float(input("Enter the value of y (the second endpoint): "))

x_m_point=(x1+x2)/2
y_m_point=(y1+y2)/2

print("The midpoint's x value is: ",x_m_point)
print("The midpoint's y value is: ",y_m_point)
```

Problem 3

Sphere volume

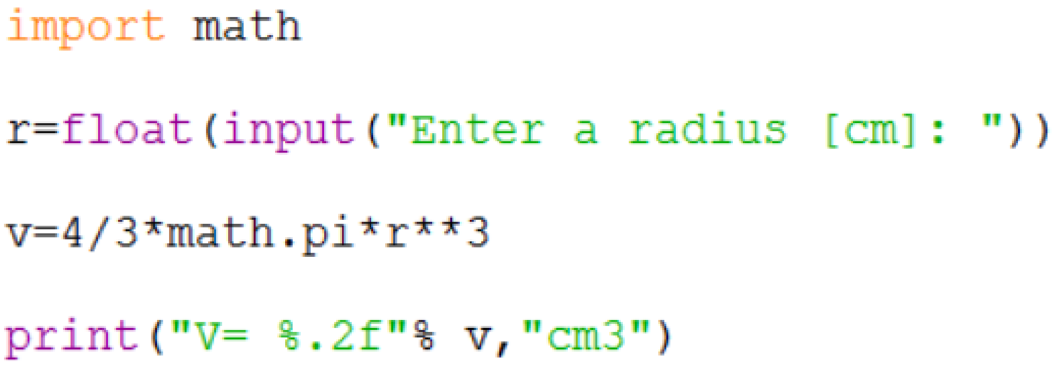
- Terminal app that calculates the volume of a sphere
- Problem solution
  - Take a radius
  - Calculate the volume of a sphere by using the formula: $V = \frac{4}{3}\pi r^3$
  - Print the final result



Problem 3 - solution

Sphere volume

- Source code



```
import math

r=float(input("Enter a radius [cm]: "))

v=4/3*math.pi*r**3

print("V= %.2f"% v,"cm3")
```

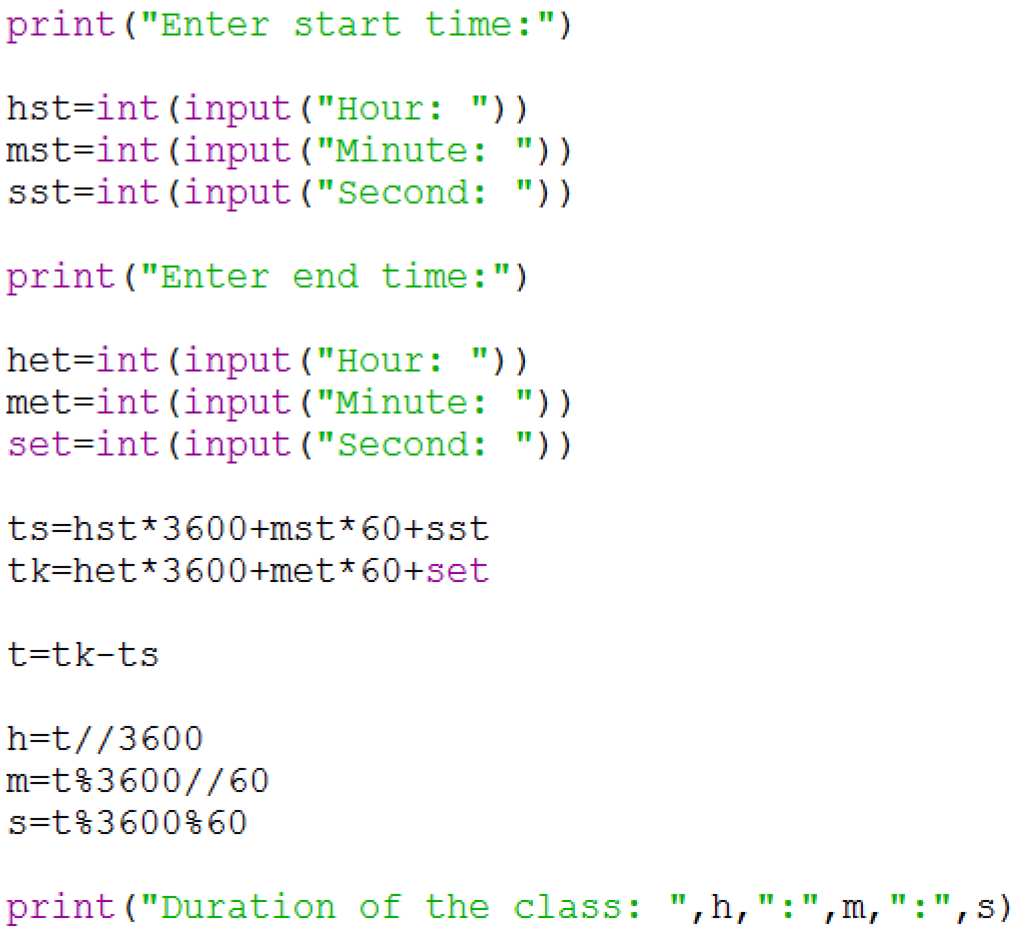
Problem 4

Duration time of a class

- Terminal app that calculates the duration time of a class – difference between the start time and the end time of the class
- Problem solution
    - Enter 3 values as the start time: hour, minute, second
    - Enter 3 values as the end time: hour, minute, second
    - Calculate the duration time
    - Print the final result in format hh:mm:ss

Problem 4 - solution

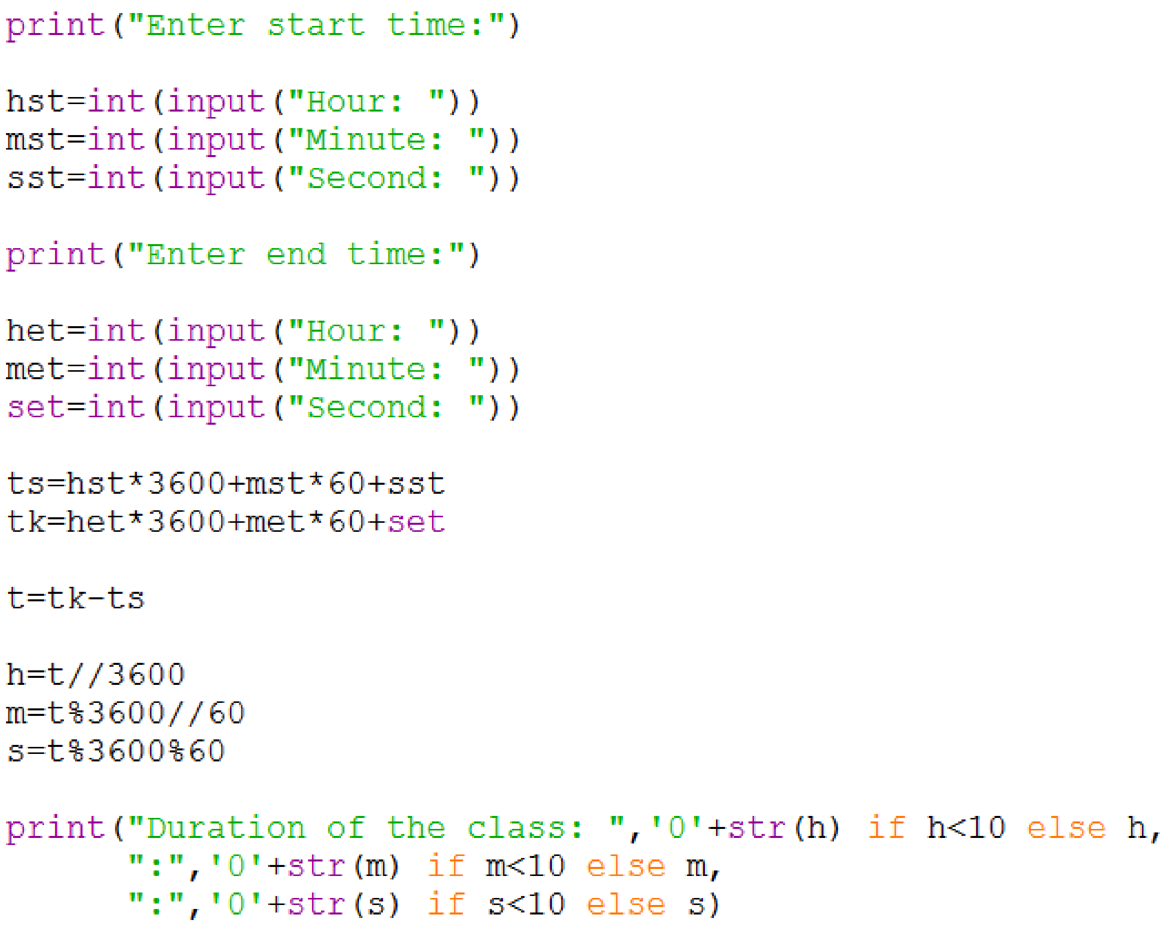
- Source code – version 1



```
print("Enter start time:")

hst=int(input("Hour: "))
mst=int(input("Minute: "))
sst=int(input("Second: "))

print("Enter end time:")

het=int(input("Hour: "))
met=int(input("Minute: "))
set=int(input("Second: "))

ts=hst*3600+mst*60+sst
tk=het*3600+met*60+set

t=tk-ts

h=t//3600
m=t%3600//60
s=t%3600%60

print("Duration of the class: ",h,":",m,":",s)
```

Problem 4 - solution

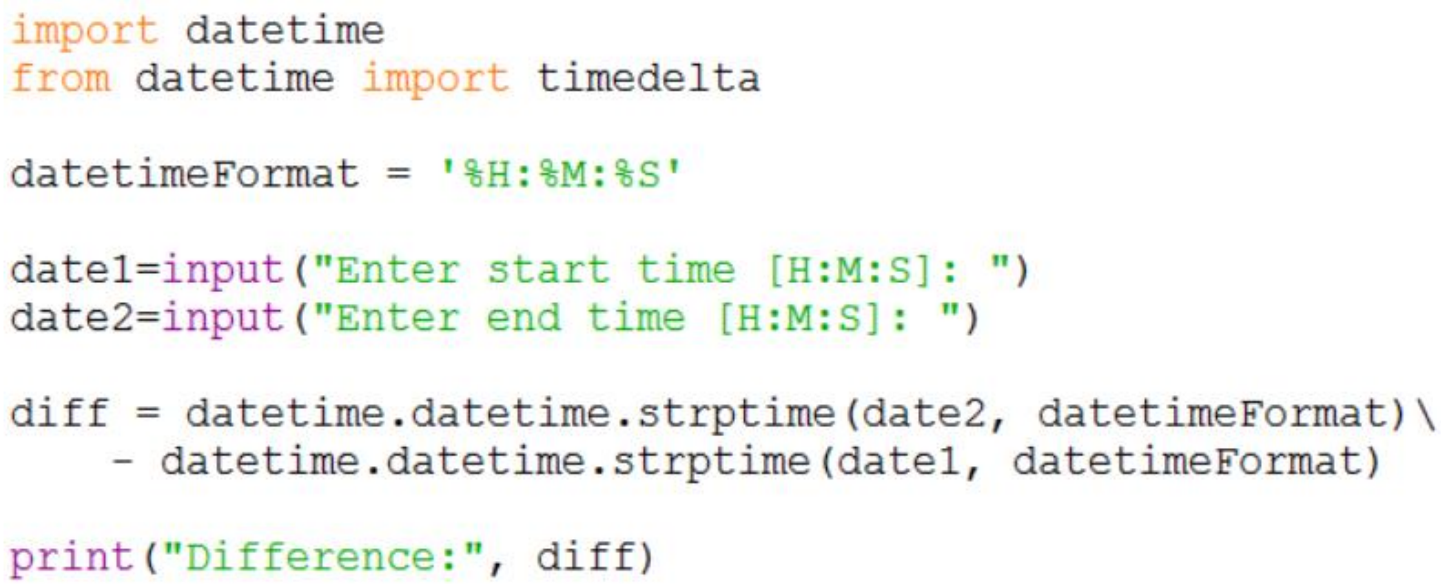
- Source code - version 2 (with a conditional operator)



```
print("Enter start time:")

hst=int(input("Hour: "))
mst=int(input("Minute: "))
sst=int(input("Second: "))

print("Enter end time:")

het=int(input("Hour: "))
met=int(input("Minute: "))
set=int(input("Second: "))

ts=hst*3600+mst*60+sst
tk=het*3600+met*60+set

t=tk-ts

h=t//3600
m=t%3600//60
s=t%3600%60

print("Duration of the class: ",'0'+str(h) if h<10 else h,
      ":",'0'+str(m) if m<10 else m,
      ":",'0'+str(s) if s<10 else s)
```

Problem 4 - solution

- Source code - version 3 (with a built-in Python functions)



```
import datetime
from datetime import timedelta

datetimeFormat = '%H:%M:%S'

date1=input("Enter start time [H:M:S]: ")
date2=input("Enter end time [H:M:S]: ")

diff = datetime.datetime.strptime(date2, datetimeFormat)\
    - datetime.datetime.strptime(date1, datetimeFormat)

print("Difference:", diff)
```

Problem 5

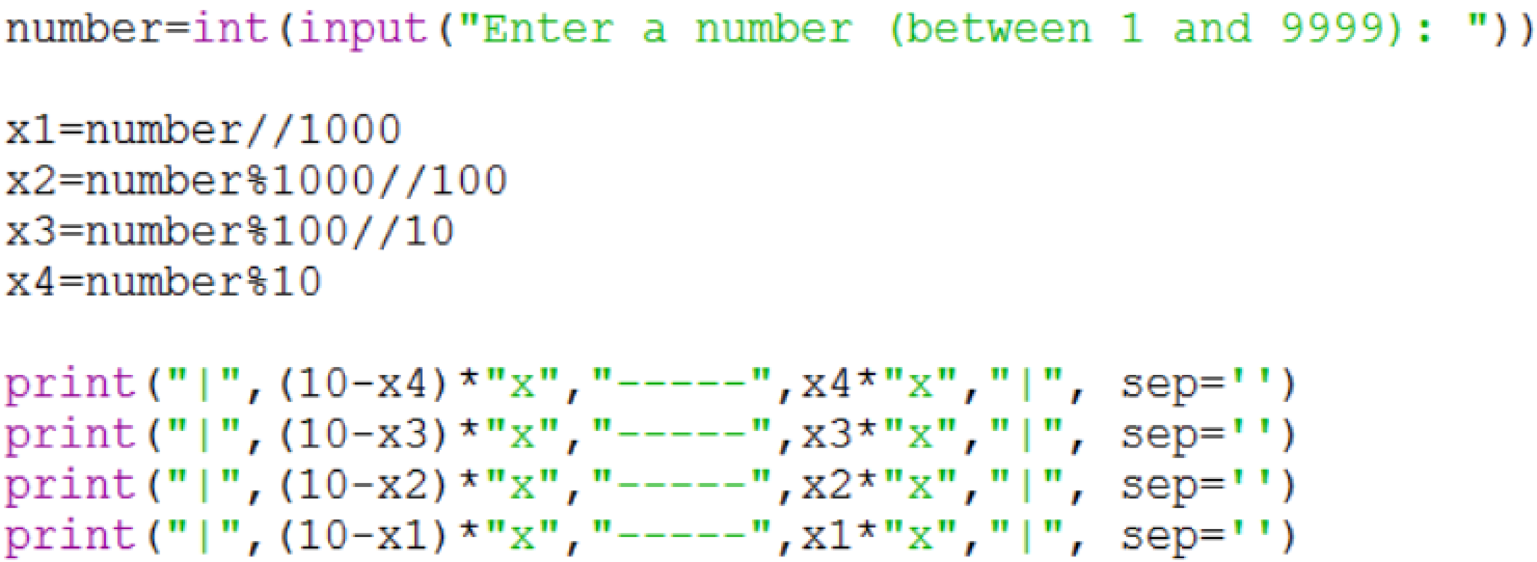
Abacus

- Terminal app that asks the user for a number (between 1 and 9999) and then displays the number on a simple abacus
- Result for the number 1852

```
|xxxxxxxx-----xx|
|xxxxx-----xxxxx|
|xx-----xxxxxxxx|
|xxxxxxxxx-----x|
```

Problem 5- solution

- Source code



```
number=int(input("Enter a number (between 1 and 9999): "))

x1=number//1000
x2=number%1000//100
x3=number%100//10
x4=number%10

print("|",(10-x4)*"x","-----",x4*"x","|", sep='')
print("|",(10-x3)*"x","-----",x3*"x","|", sep='')
print("|",(10-x2)*"x","-----",x2*"x","|", sep='')
print("|",(10-x1)*"x","-----",x1*"x","|", sep='')
```

Python conditions

- Simple if statement

```
if condition:
        indentedStatmentBlock
```

- if – else statement

```
if condition:
       indentedStatementBlockForTrueCondition
else:
        indentedStatementBlockForFalseCondition
```

- Multiple test and if – elif statement

```
if condition1:
       indentedStatementBlockForTrueCondition1
elif condition2:
       indentedStatementBlockForTrueCondition2
else:
       indentedStatementBlockForFalseCondition
```

if-else statment on one line

- Traditional if - else statement

```
if count ==N:
        count = 0
else:
        count = N + 1
```

- On one line

$$\underbrace{\texttt{count = 0}}_{\texttt{true}}\ \texttt{if}\ \underbrace{\texttt{count == N}}_{\texttt{condition}}\ \texttt{else}\ \underbrace{\texttt{N + 1}}_{\texttt{false}}$$

Problem 6

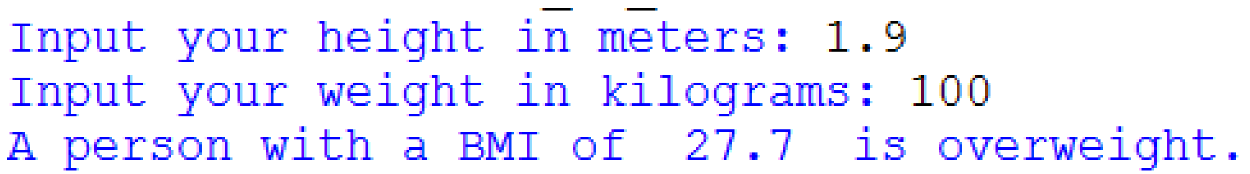
BMI (Body Mass Index)

- Terminal app to calculate the body mass index
- Problem solution
  - Enter weight in kilograms and height in meters
  - Print the bmi result, followed by the users' BMI classification:

    18.5 or less – underweight

    18.5 to 24.99 – normal weight

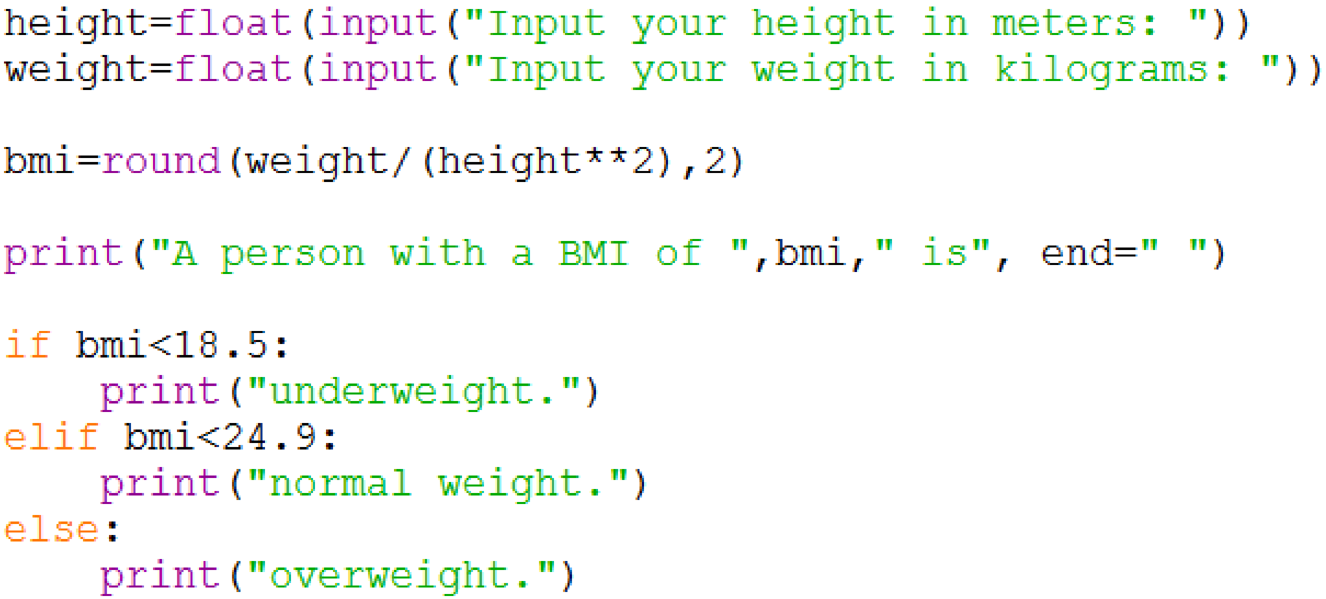
    25 or greater - overweight



```
Input your height in meters: 1.9
Input your weight in kilograms: 100
A person with a BMI of  27.7  is overweight.
```

Problem 6 - solution

- **Source code**



```
height=float(input("Input your height in meters: "))
weight=float(input("Input your weight in kilograms: "))

bmi=round(weight/(height**2),2)

print("A person with a BMI of ",bmi," is", end=" ")

if bmi<18.5:
    print("underweight.")
elif bmi<24.9:
    print("normal weight.")
else:
    print("overweight.")
```

Problem 7

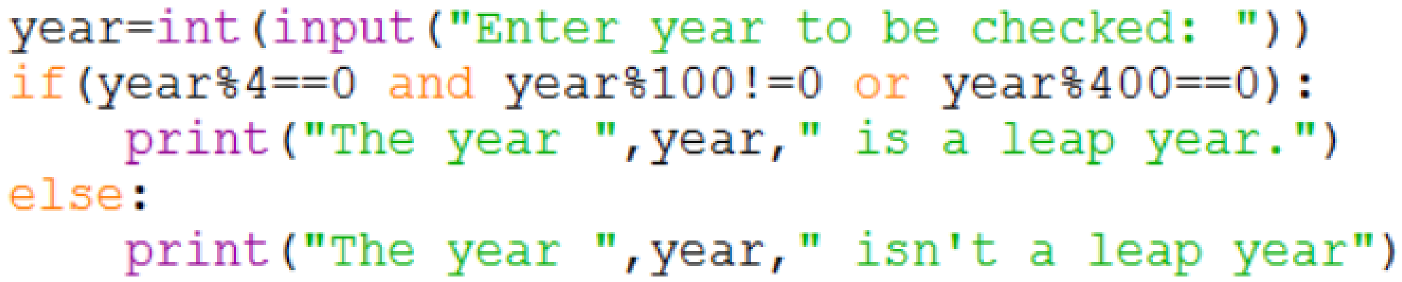
Checking Leap Year

- Terminal app that checks whether a given year is a leap year
- Problem solution
    - Take the value of the year as input
    - Using an if-statement, check whether the year is a leap year or not
    - Print the final result

Problem 7 - solution

Checking Leap Year – Program Explanation

- The if statement checks if the year is a multiple of 4 but isn’t a multiple of 100 or if it is a multiple of 400 (not every year that is a multiple of 4 is a leap year)
- Source code



```
year=int(input("Enter year to be checked: "))
if(year%4==0 and year%100!=0 or year%400==0):
    print("The year ",year," is a leap year.")
else:
    print("The year ",year," isn't a leap year")
```