Python for scientists

Lesson 3

Data comparison and conditional statements

```
def complementary(seq):
    nt_comp = {
        'A' : 'T',
        'C' : 'G',
        'G' : 'C',
        'T' : 'A',
    }
    for nt in seq:
        compseq += nt_comp[nt]
    return compseq
```

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Data comparison: boolean expressions

Data comparison: boolean expressions

A boolean expression is a comparison between two data values and returns *True* or *False*. *True* and *False* values are from another data type: **boolean type**.

```
>>> a = 'apples'
>>> b = 'pears'
>>> a == b
False
>>> c = 'apples'
>>> a == c
True
>>> b == c
False
>>> a = 123
>>> b = 456
>>> c = 579
>>> a == b
False
>>> a == c
False
>>> c == a + b
True
```

“True”

“False”

Data comparison: boolean expressions

A boolean expression is a comparison between two data values and returns *True* or *False*. *True* and *False* values are from another data type: **boolean type**.

```
>>> easter_countries = ['Poland','Ukraine']
>>> western_countries = ['France', 'Spain']
>>> easter_countries == western_countries
False
>>> copy_easter_countries = easter_countries.copy()
>>> copy_easter_countries
['Poland', 'Ukraine']
>>> easter_countries == copy_easter_countries
True
>>> a = 1
>>> b = 2
>>> a = b # Be careful '=' is not the same than '=='
>>> a == b
True
>>> a
2
```

‘=‘ and ‘==‘ are not the same thing

Data comparison: operators

Data comparison: operators

The comparison operators provided by Python are:

```
>>> a = 524
>>> b = 525
>>> a == b
False
>>> a != b
True
>>> a < b
True
>>> a > b
False
>>> a <= b
True
>>> a >= b
False
>>> a == b-1
True
```

x == y	x is equal than y
x != y	x is different than y
x < y	x is lower than y
x > y	x is greater than y
x <= y	x is lower or equal than y
x >= y	x is greater or equal than y

Data comparison: operators

The comparison operators provided by Python are:

```
>>> a <= b-1
True
>>> a >= b-1
True
>>> c = 'potatoes'
>>> d = 'pears'
>>> a == c
False
>>> a != c
True
>>> c != d
True
>>> c = 'pears'
>>> c != d
False
>>> c == d
True
```

x == y	x is equal than y
x != y	x is different than y
x < y	x is lower than y
x > y	x is greater than y
x <= y	x is lower or equal than y
x >= y	x is greater or equal than y

Data comparison: logical operators

The logical operators allow to combine multiple comparisons (boolean expressions):

“and” “or” “not”

```
>>> 1+1==2 and 2+2==4 # Both comparisons are true
True
>>> 1+1==2 and 2+2==5 # One comparison is true and one false
False
>>> 1+1==2 or 2+2==5 # One comparison is true and one false
True
>>> 1+1==3 or 2+2==4 # One comparison is false and one true
True
>>> 1+1==3 or 2+2==5 # Both comparisons are false
False
>>> not 1+1==2 # 'not' reverses true to false
False
>>> not 1+1==3 # or false to true
True
>>> 1+1==2 and not 2+2==5 # One comparison is true and one false but reversed with 'not'
True
>>> not 1+1==3 or not 2+2==5 # Both comparisons are false but...
True
```

Data comparison: logical operators

The logical operators allow to combine multiple comparisons (boolean expressions):

“and” **“or”**

A	B	A and B == 1	A or B == 1
1	1		
1	0		
0	1		
0	0		

Data comparison: logical operators

The logical operators allow to combine multiple comparisons (boolean expressions):

“and” **“or”**

A	B	A and B == 1	A or B == 1
1	1	1	1
1	0	0	1
0	1	0	1
0	0	0	0

Data comparison: conditional statements

Data comparison: conditional statements

A **conditional statement** decides about the execution or not of a block of code based in some data comparison:

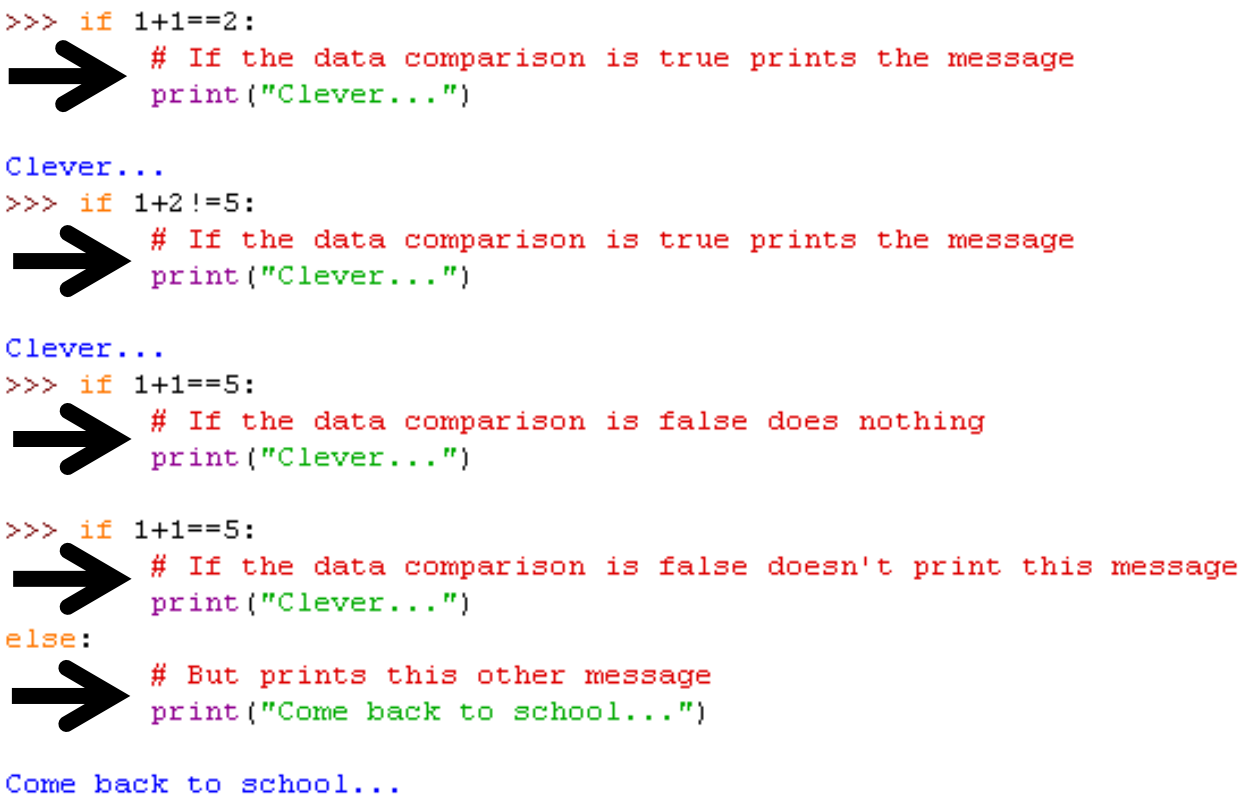
if <condition> **:**
    <code1>
else:
    <code2>

```
>>> if 1+1==2:
        # If the data comparison is true prints the message
        print("Clever...")

Clever...
>>> if 1+2!=5:
        # If the data comparison is true prints the message
        print("Clever...")

Clever...
>>> if 1+1==5:
        # If the data comparison is false does nothing
        print("Clever...")

>>> if 1+1==5:
        # If the data comparison is false doesn't print this message
        print("Clever...")
else:
        # But prints this other message
        print("Come back to school...")

Come back to school...
```

Data comparison: conditional statements

A **conditional statement** decides about the execution or not of a block of code based in some data comparison:

Code must be indented 4 spaces



```
>>> if 1+1==2:
        # If the data comparison is true prints the message
        print("Clever...")

Clever...
>>> if 1+2!=5:
        # If the data comparison is true prints the message
        print("Clever...")

Clever...
>>> if 1+1==5:
        # If the data comparison is false does nothing
        print("Clever...")

>>> if 1+1==5:
        # If the data comparison is false doesn't print this message
        print("Clever...")
else:
        # But prints this other message
        print("Come back to school...")

Come back to school...
```

Data comparison: conditional statements

```
if <condition1> :
        <code1>
else if <condition2> :
        <code2>
else if <condition3> :
        <code3>
else if <condition4> :
        <code4>
else:
        <code5>
```

```
>>> temperature=10
>>> if temperature<0:
        print("It's frozen")
elif temperature>=0 and temperature<20:
        print("It's cold")
elif temperature>=20 and temperature<25:
        print("It's warm")
else:
        print("It's hot")

It's cold


>>> city='Poznan'
>>> if city=='Madrid' or city=='Barcelona':
        print(city,"is in Spain")
elif city=='London' or city=='Manchester':
        print(city,"is in UK")
elif city=='Warsaw' or city=='Poznan':
        print(city,"is in Poland")
else:
        print(city,"is elsewhere")

Poznan is in Poland
```

Data comparison: looking for list values

```
>>> polish_cities=['Warsaw','Krakow','Poznan','Wroclaw','Lodz','Lublin']
>>> spanish_cities=['Madrid','Barcelona','Zaragoza','Sevilla','Valencia']
>>> british_cities=['London','Manchester','Liverpool','Glasgow','Edinburg']
>>> city='Zaragoza'
>>> if city in polish_cities:
        print(city,"is in Poland")
elif city in spanish_cities:
        print(city,"is in Spain")
elif city in british_cities:
        print(city,"is in UK")
else:
        print(city,"is unknown")

Zaragoza is in Spain
>>>
>>> world_cities={'Poland':polish_cities,'Spain':spanish_cities,'UK':british_cities}
>>> world_cities
{'Spain': ['Madrid', 'Barcelona', 'Zaragoza', 'Sevilla', 'Valencia'], 'UK': ['London', 'Manchester
', 'Liverpool', 'Glasgow', 'Edinburg'], 'Poland': ['Warsaw', 'Krakow', 'Poznan', 'Wroclaw', 'Lodz'
, 'Lublin']}
>>> city='Zielona Gora'
>>> if city in world_cities['Poland']:
        print(city,"is in Poland")
elif city in world_cities['Spain']:
        print(city,"is in Spain")
elif city in world_cities['UK']:
        print(city,"is in UK")
else:
        print(city,"is unknown")

Zielona Gora is unknown
```

if <value> **in** <list>:

Data comparison: nested conditionals

```
>>> spanish_cities=['Madrid','Barcelona','Zaragoza','Sevilla','Valencia']
>>> italian_cities=['Rome','Milan','Firenze','Venice','Napoly']
>>> polish_cities=['Warsaw','Krakow','Poznan','Wroclaw','Lodz','Lublin']
>>> german_cities=['Berlin','Hamburg','Munich','Cologne','Frankfurt']
>>> city='Poznan'
>>> temperature=17
>>> if ((city in spanish_cities or city in italian_cities) and temperature>=30) or ((city in polish_cities or
city in german_cities) and temperature>=25):
        print("It's hot")
elif ((city in spanish_cities or city in italian_cities) and (temperature<30 and temperature>=20)) or ((city
in polish_cities or city in german_cities) and (temperature<25 and temperature>=15)):
        print("It's warm")
else:
        print("It's cold")

It's warm
```

This is a big mess

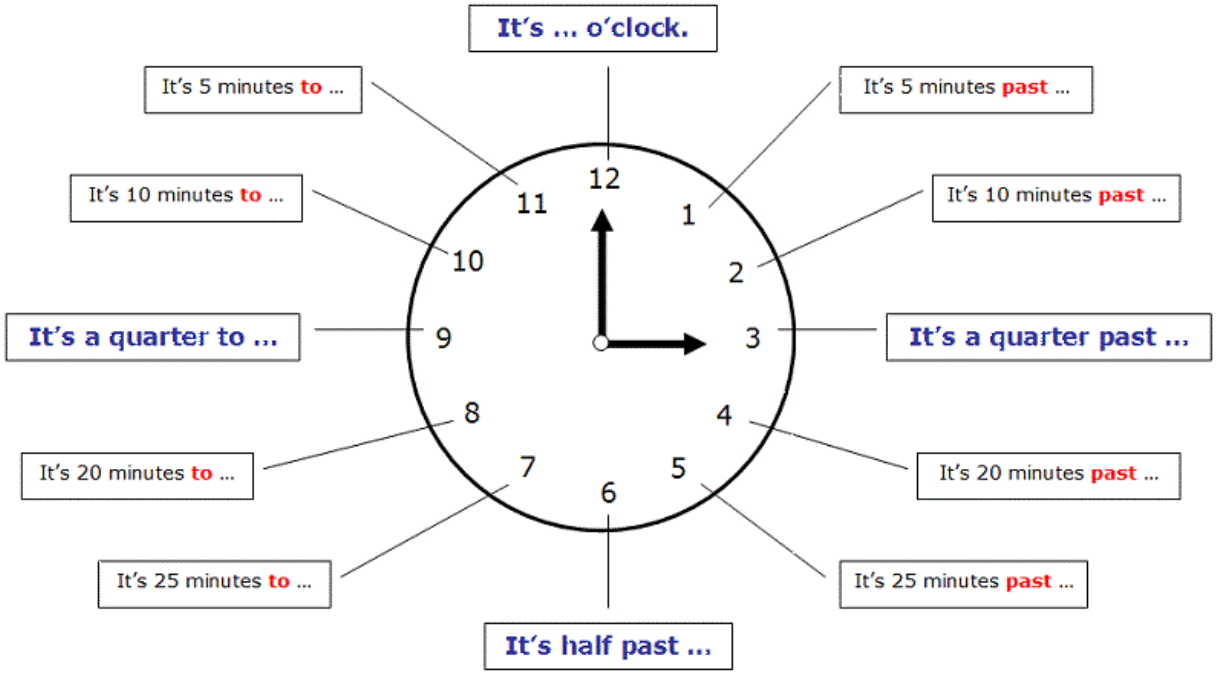
```
>>> city='Zaragoza'
>>> if city in spanish_cities or city in italian_cities:
    if temperature>=30:
        print("It's hot")
    elif temperature<30 and temperature>=20:
        print("It's warm")
    else:
        print("It's cold")
elif city in polish_cities or city in german_cities:
    if temperature>=25:
        print("It's hot")
    elif temperature<25 and temperature>=15:
        print("It's warm")
    else:
        print("It's cold")

It's cold
```

Using nested conditionals we can improve code readability

Exercise:
What's the time?

Exercise: What's the time?

Write a Python code to tell the hour in English or Polish formal way.



Exercise: What's the time?

A little help…

```
>>> hour = 10
>>> minutes = 40
>>> if minutes>30 and minutes<60:
        minutes2=60-minutes
        hour2=hour+1
        print("It's",minutes2,"minutes to",hour2)


It's 20 minutes to 11
```

else if…

else if…

else …

Python for scientists

Next lesson...

User data input and 'while' loops

```
def complementary(seq):
    nt_comp = {
        'A' : 'T',
        'C' : 'G',
        'G' : 'C',
        'T' : 'A',
    }
    for nt in seq:
        compseq += nt_comp[nt]
    return compseq
```

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