CONDITIONAL STATEMENTS IN PYTHON

Aims of the Lecture

- Learn and understand the different conditional statements contained in Python.
- Exemplify practical uses of each statement.
- Learn how data types and data structures interact with these conditional statements

Additional Reading and Sources

- w3schools (https://www.w3schools.com/python/python_for_loops.asp)
- Real Python (https://realpython.com/python-conditional-statements/)

The IF/ELIF/ELSE Conditional Statement

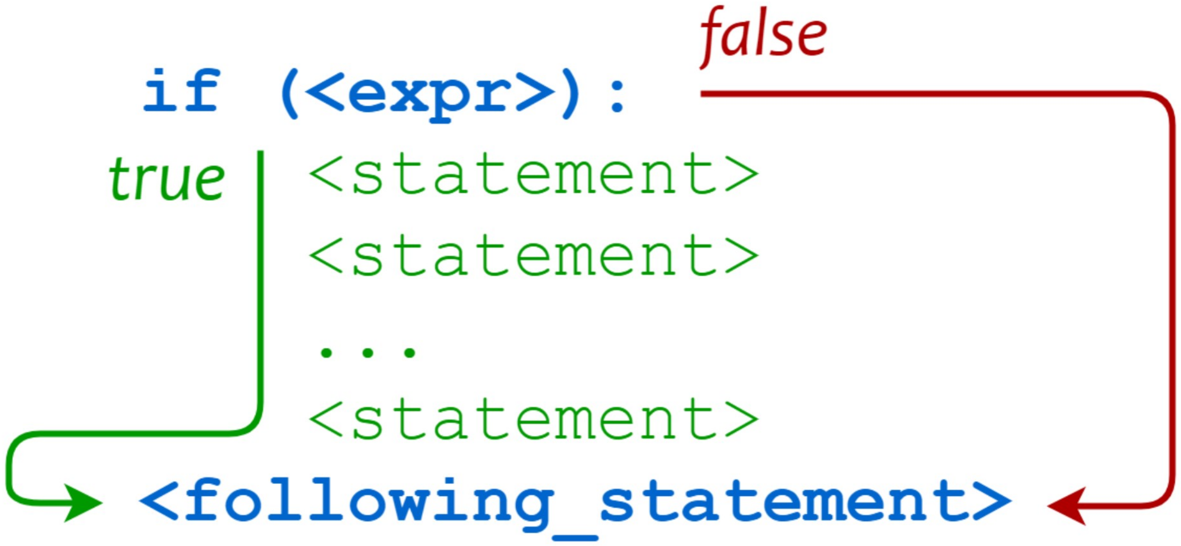
- In its most basic form, an *if* statement establishes a condition which, if met, executes the statement.
- We use colon (:) to finish the if condition(s).
- Then, we establish the statement using TAB/INDENT.

In [ ]:
```
# example of an if statement
if 1<2:
    print('True!')
```

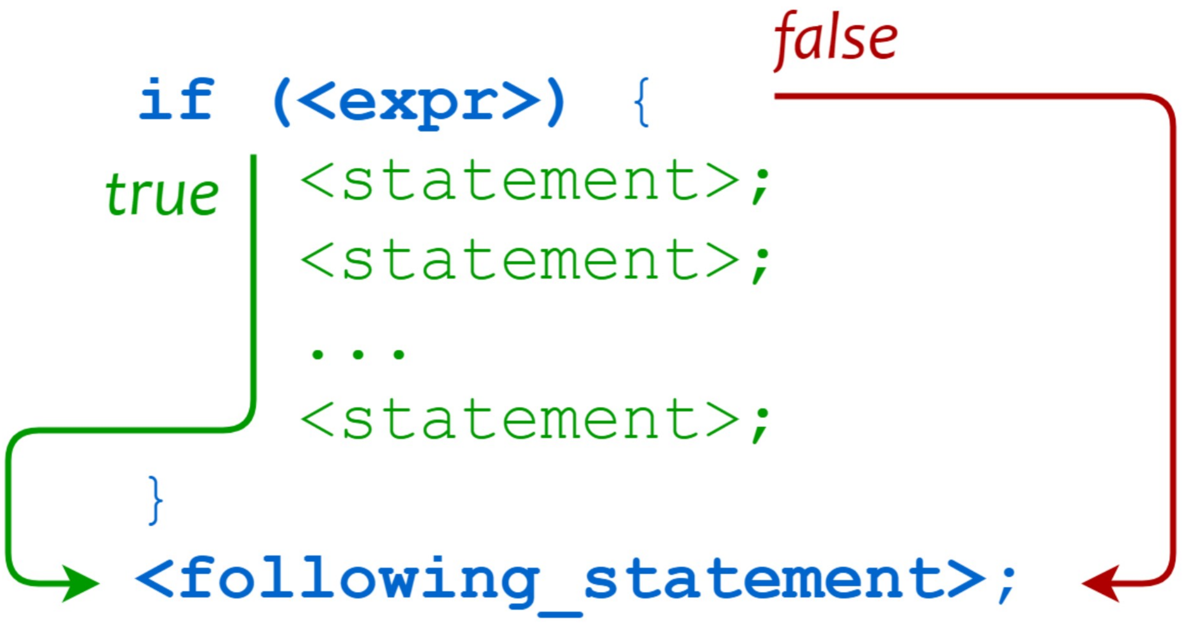
In [ ]:
```
# example of an if statement with two conditions
if 1<2 and 'P' in 'Python':
    print('Also true!')
```

- Python is all about indentation (off-side rule).
    - Coined after football!
- You need to be careful regarding how statements work!

- This is how Python does it.



- This is how other languages (i.e. C++/Java/Perl) do it.



```
if (<expr>) {
    <statement>;
    <statement>;
    ...
    <statement>;
}
<following_statement>;
```

In [ ]:

```python
# Example
if 3>2:
    print('This gets done...')
    print('...this also gets done...')
print('...and this too!')
```

In [ ]:

```python
# Example (inverted)
if 3<2:
    print('This gets done...')
    print('...this also gets done...')
print('...and this too!')
```

In [ ]:
```
# Does line execute?                             Yes    No
#                                                ---    --
if 'a' in ['a', 3.4, True]:                    #  x
    print('Outer condition is true')           #  x

    if 10 > 20:                                #  x
        print('Inner condition 1')             #        x

    print('Between inner conditions')          #  x

    if 10 < 20:                                #  x
        print('Inner condition 2')             #  x

    print('End of outer condition')            #  x
print('After outer condition')                 #  x
```

- If you want to test a condition, but after being false test another one, use *elif*.
- This has to go aligned with the *if*.

In [ ]:
```
if 10>20:
    print('nope')
elif 10<20:
    print('yep')
```

- If the conditions are not met, then we use *else*.

```
In [ ]: if 3<2:
            print('Unreal!')
        else:
            print('This is the case')
```

One-line Conditional Statements and Expressions

- Python allows to write conditional statements in one line of code.
- It does not make any difference in computational terms.
- Some people find it more practical.

```
In [ ]: if 1>0: print('Yes'); print('sure')
```

- Multiple statements can also be written.

```
In [ ]: x = 2
        if x == 1: print('a'); print('b'); print('c')
        elif x == 2: print('d'); print('e')
        else: print('f'); print('g')
```

- Conditional (or ternary) operations are also supported in Python.
- This has been proposed in other programming languages to "simplify" syntax.
- In this case you have to use the following convention:
    - (statement_if) if (condition) else (statement_else)

In [ ]:
```
# Let's try to run this code changing the rain to True and False
raining = False
print("Let's go to the", 'library' if raining==True else 'beach')
```

How would we write this in the usual way?

In [ ]:
```
raining = False
if raining:
    print("Let's go to the library")
else:
    print("Let's go to the beach")
```

- If you want to define a string with an apostrophe, enclose it in parenthesis.
- ...and vice versa!
- If you want to prove that something is true, you can explicitly say so OR just put the name of the variable

Pass

- Sometimes you DON'T want to do anything if a condition is met.
- In any other languages, you leave the content of the curly brackets blank.
- Python wouldn't understand that (as there is no such thing).
- Therefore, we need to explicitly tell state in the code that we want to pass.

In [ ]:
```
# Let's say you don't want to do anything if 1 equal 1
if 1==1:

print('rest')
```

In [ ]:
```
# Let's say you don't want to do anything if 1 equal 1
if 1==1:
    pass
print('rest')
```

For loops

- This is the most elemental method to iterate over a specified range
- Works well with lists, ranges, etc.
- for x in y

In [ ]:
```
# print numbers in a range
for i in range(10):
        print(i)
```

In [ ]:
```
# print elements in a list
basket = ['banana','apple','grape']
for fruit in basket:
        print(fruit)
```

You can also do calculations while looping.

```
In [ ]:
# loop over a list of strings and calculate their length
words = ['Robert','Gordon','University']
for w in words:
    print(w,len(w))
```

```
In [ ]:
# loop over a list of strings and print their INDEX
for i in range(len(words)):
    print(i, words[i])
```

- Notice that we had to calculate the length of *words*, then produce a range of such length and then iterate the range.
- Instead of doing this, we can use the *enumerate* function.
- In this case you use two variables: the *index* and the *element*.

In [ ]:
```
# loop over a list of strings and print their INDEX
for i, word in enumerate(words):
    print(i, word)
```

Remember that strings are also *mutable* objects containing elements (i.e. letters) and thus they can also be iterated.

In [ ]:
```
for i, x in enumerate("banana"):
  print('The letter '+str(i)+' is '+x)
```

- Notice how the index can be converted into a string using the *str()* function.
- Then, it can be appended to the printed string.
- This comes very handy when we want to change the message given to a user depending the iterations/variables.

- But wait! People rarely identify things in the position "0".
- We usually start counting things by one!
- How can we change the previous code to reflect this?

```
In [ ]: for i, x in enumerate("banana"):
          print('The letter '+str(i+1)+' is '+x)
```

For + IF

- These two are typically used in conjunction.
- For instance, you can loop and find certain elements in a list.

In [ ]:
```
# finding certain elements in a list
basket = ['banana','apple','orange','grape']
for fruit in basket:
    if 'p' in fruit:
        print(fruit)
```

The Break

- This instructions lets you get out of a for loop.
- Typically used along with if.

In [ ]:

```
# finding certain elements in a list
basket = ['banana','apple','orange','grape']
for fruit in basket:
    if 'p' in fruit:
        print(fruit)
        if fruit == 'apple':
            break
```

Continue

- We use this statement when we want to stop the current iteration of the loop, BUT we don't want the next instruction to be done.

In [ ]:
```
# finding certain elements in a list
basket = ['banana','apple','orange','grape']
for i,fruit in enumerate(basket):
    if 'p' in fruit:
        print(fruit)
        if fruit == 'apple':
            continue
    print(i)
```

In [ ]:
```
# finding certain elements in a list
basket = ['banana','apple','orange','grape']
for i,fruit in enumerate(basket):
    if 'p' in fruit:
        print(fruit)
        if fruit == 'apple':
            continue
        print(i)
```

Nested Loops

- This is a very commonly used resource that lets you loop more than once.
- For instance, you can verify all elements of a matrix, an image, a coordinate plane, a table, etc...
- You can also use this technique to find all combinations between two data structures.

In [ ]:
```
adjective = ["red", "big", "tasty"]
fruits = ["apple", "banana", "cherry"]

for x in adjective:
    for y in fruits:
    print(x, y)
```

While

- This statement is also used as a loop, but it keeps going until a condition is not met.

In [ ]:
```
x = 0
while x<7:
    print(x)
    x=x+1
```

- Be very careful when establishing the stop condition, as you don't want to enter an endless loop!
- In this case, you will notice that the cell doesn't stop.
- You can go to Kernel -> Interrupt to stop the execution.

In [ ]:

```
x=0
while x>=0:
    print(x)
    x=x+1
```