

# **Introduction to Python**

Session 10

**Introduction to Object Oriented Programming (OOP)**

**Exceptions**

# Exceptions

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```
x = int(input("Please enter a number: "))
```

If the input is not an integer, the conversion cannot be done.  
An exception is produced.

upf.

```
while True:  
  
    try:  
        x = int(input("Please enter a number: "))  
        break  
    except Exception:  
        print("Oops! That was not a valid number.  
              Try again...")
```

In this case, the exception is **handled**.

```
try:
```

```
...
```

```
...
```

Block of statements executed.

```
except Exception:
```

```
...
```

```
...
```

Block of statements executed if an error exception is produced.  
If there is no exception, this block is skipped

```
while True:  
  
    try:  
        x = int(input("Please enter a number: "))  
        break  
    except ValueError:  
        print("Oops! That was not a valid number.  
              Try again...")
```



In this case, the **exception is handled**.

```
while True:  
    try:  
        x = int(input("Please enter a number: "))  
        break  
    except TypeError:  
        print("Oops! That was not a valid number.  
              Try again...")
```

Not capturing the correct exception: if a ValueError exception is raised the script is only capturing a TypeError exception

In this case, the **exception is NOT handled.**

```
try:          Multiple except clauses captured
...
...
except (ValueError, TypeError, NameError):
    pass
```

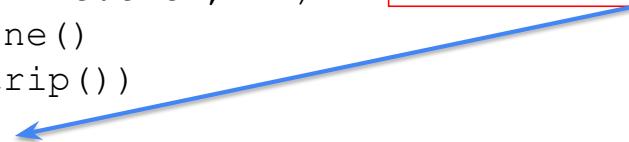
```
try:  
    f = open("myfile.txt", "r")  
    s = f.readline()  
    i = int(s.strip())  
  
except IOError as e:  
    print("I/O error (%s): %s" %(e.errno, e.strerror))  
  
except ValueError:  
    print("Could not convert data to an integer.")  
except:  
    print("Unexpected error")  
    raise
```



In this example, **different exceptions are handled differently**

```
try:  
    f = open("myfile.txt", "r")  
    s = f.readline()  
    i = int(s.strip())  
except IOError as e:  
    print("I/O error (%s): %s" %(e.errno, e.strerror))  
except ValueError:  
    print("Could not convert data to an integer.")  
except:  
    print("Unexpected error")  
    raise
```

Capture the exception object  
and assign it to a name (e)



In this example, **different exceptions are handled differently**

```
try:  
    f = open("myfile.txt", "r")  
    s = f.readline()  
    i = int(s.strip())  
except IOError as e:  
    print("I/O error (%s): %s" %(e errno, e.strerror))  
except ValueError:  
    print("Could not convert data to an integer.")  
except:  
    print("Unexpected error")  
    raise
```

Access attributes of the exception  
instance named e  
Specific attributes of IOError!

In this example, **different exceptions are handled differently**

```
def this_fails():
    x = 1/0

try:
    this_fails()
except ZeroDivisionError as detail:
    print("Handling run-time error: %s" %detail)
```

Capture the exception object  
ZeroDivisionError and assign it  
to the name detail



In this example, the exception is produced in the function  
`this_fails()`

As the exception is not handled inside the function, it is transmitted  
until some code handles it.

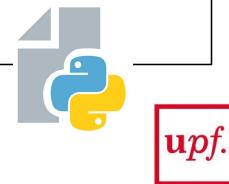
upf.

```
def function3():
    print("I am executing function 3")
    return 1/0

def function2():
    print("I am executing function 2")
    return function3()

def function1():
    print("I am executing function 1")
    return function2()

function1()
```



```
import sys

def function3():
    print("I am executing function 3")
    return 1/0

def function2():
    print("I am executing function 2")
    return function3()

def function1():
    print("I am executing function 1")
    return function2()

function1()
```

The diagram illustrates the call stack for the given Python code. Three blue arrows originate from the right side and point towards the corresponding function definitions. The top arrow is labeled "Call to function3", the middle one "Call to function2", and the bottom one "Call to function1". This visualizes how multiple functions are stacked and executed sequentially.

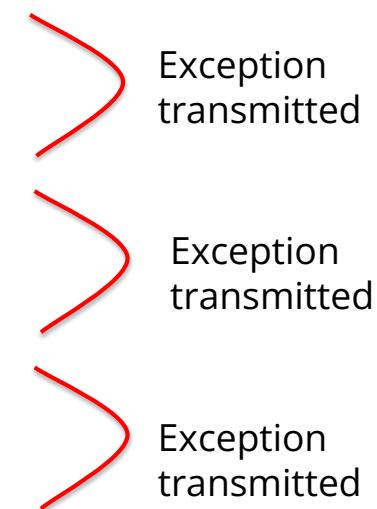
```
import sys

def function3():
    print("I am executing function 3")
    return 1/0
    Exception!!!

def function2():
    print("I am executing function 2")
    return function3()

def function1():
    print("I am executing function 1")
    return function2()

function1()
```



```
I am executing function 1
I am executing function 2
I am executing function 3
Traceback (most recent call last):
  File "sample_exceptions.py", line 16, in <module>
    function1()
  File "sample_exceptions.py", line 13, in function1
    return function2()
  File "sample_exceptions.py", line 9, in function2
    return function3()
  File "sample_exceptions.py", line 5, in function3
    return 1/0
ZeroDivisionError: integer division or modulo by zero
```

In standard error we can see all the traceback of the exception flow!

Very useful for  
**debugging!**

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```
import sys

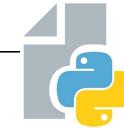
def function3():
    print("I am executing function 3")
    try:
        return 1/0
    except ZeroDivisionError as e:
        print("Trying to divide by 0!")
        return None

def function2():
    print("I am executing function 2")
    return function3()

def function1():
    print("I am executing function 1")
    return function2()

function1()
```

Exception!!!



The exception is handled in function 3 and not transmitted

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```
I am executing function 1  
I am executing function 2  
I am executing function 3  
Trying to divide by 0!
```

The exception is  
handled in function 3  
and not transmitted

To create an Exception instance:

```
e = ValueError("this is the message of the exception")
print(e)
This is the message of the exception
print(type(e))
ValueError
```

To throw an exception: **raise**

```
e = ValueError("Message of the error")
raise e
```

```
raise NameError("Message of the error")
```

## finally

The finally clause is always executed before leaving the try statement, whether an exception has occurred or not



Useful for closing the files whether an exception was raised or not



```
try:  
    fd = open("my_file.txt", "r")  
    x = 1 / 0  
  
finally:  
    fd.close()  
    print("Closing opened files")
```

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**try**

**except**

**else**

**finally**

**else** clause executes code that must be executed if the try clause does not raise an exception

```
def divide(x, y):  
    try:  
        result = x/y  
    except ZeroDivisionError:  
        sys.stderr.write("Dividing by 0. Returning infinite\n")  
        result = float("Inf")  
    else:  
        print("result is %s" %result)  
    finally:  
        print("executing finally clause")  
return result
```



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**else**

**finally**

```
def divide(x, y):  
    try:  
        result = x/y  
    except ZeroDivisionError:  
        sys.stderr.write("Dividing by 0. Returning infinite\n")  
        result = float("Inf")  
    else:  
        print("result is %s" %result)  
    finally:  
        print("executing finally clause")  
    return result
```

else clause executes code that must be executed if the try clause does not raise an exception

```
>>> divide(2,1)  
result is 2.0  
executing finally clause  
2.0
```

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**else**

**finally**

```
def divide(x, y):  
    try:  
        result = x/y  
    except ZeroDivisionError:  
        sys.stderr.write("Dividing by 0. Returning infinite\n")  
        result = float("Inf")  
    else:  
        print("result is %s" %result)  
    finally:  
        print("executing finally clause")  
    return result
```

else clause executes code  
that must be executed if  
the try clause does not  
raise an exception

```
>>> divide(2,0)  
Dividing by 0. Returning infinite  
executing finally clause  
inf
```

upf.

```
def divide(x, y):
    try:
        result = x/y
    except ZeroDivisionError:
        sys.stderr.write("Dividing by 0. Returning infinite\n")
        result = float("Inf")
    else:
        print("result is %s" %result)
    finally:
        print("executing finally clause")
return result
```

```
>>> divide("2","1")
executing finally clause
Traceback (most recent call last):
  File "sample_exceptions4.py", line 14, in <module>
    divide("2","1")
  File "sample_exceptions4.py", line 3, in divide
    result = x / y
TypeError: unsupported operand type(s) for /: 'str' and 'str'
```

# Exceptions

```
BaseException
|   +-+ SystemExit
|   +-+ KeyboardInterrupt
|   +-+ GeneratorExit
|   +-+ Warning
|       +-+ DeprecationWarning
|       +-+ PendingDeprecationWarning
|       +-+ RuntimeWarning
|       +-+ SyntaxWarning
|       +-+ UserWarning
|       +-+ FutureWarning
|       +-+ ImportWarning
|       +-+ UnicodeWarning
|       +-+ BytesWarning

+-+ Exception
    +-+ StopIteration
    +-+ StandardError
        |   +-+ BufferError
        |   +-+ ArithmeticError
        |       +-+ FloatingPointError
        |       +-+ OverflowError
        |       +-+ ZeroDivisionError
        |   +-+ AssertionError
        |   +-+ AttributeError
        |   +-+ EnvironmentError
        |       +-+ IOError
        |       +-+ OSSError
            |           +-+ WindowsError (Windows)
            |           +-+ VMSError (VMS)

                +-+ EOFError
                +-+ ImportError
                +-+ LookupError
                    |   +-+ IndexError
                    |   +-+ KeyError
                +-+ MemoryError
                +-+ NameError
                    |   +-+ UnboundLocalError
                +-+ ReferenceError
                +-+ RuntimeError
                    |   +-+ NotImplemented
                +-+ SyntaxError
                    |   +-+ IndentationError
                    |       +-+ TabError
                +-+ SystemError
                +-+ TypeError
                +-+ ValueError
                    +-+ UnicodeError
                        +-+ UnicodeDecodeError
                        +-+ UnicodeEncodeError
                        +-+ UnicodeTranslateError
```

# Defining our own exceptions

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```
class MyError(Exception):
    """My defined exception"""
    pass
```

```
e = MyError()
raise e
```

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# Defining our own exceptions

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```
class MyError(Exception):
    """My defined exception"""

    def __init__(self, value):
        self.value = value
        super().__init__(f"Incorrect assigned value: {value}")
```

Creates a new data  
attribute: self.value



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## **uID\_S10.py**

- 1) Create a new ValueError exception subclass named **IncorrectSequenceLetter**
- 2) The new exception instance should be created with the letter not found in the alphabet and the class name of the sequence. Example:

```
this letter does not match the alphabet  
e = IncorrectSequenceLetter("B", class_name)  
                                class name is protein, dna or rna??
```

- 3) The description string of the exception must be the following:

“The sequence item *B* is not found in the alphabet of class *ProteinSequence*”

- 4) Sequence class should raise an **IncorrectSequenceLetter** exception when a sequence is created using an incorrect letter not found in the alphabet.  
protein, dna or rna
- 5) Modify the **FASTA\_iterator** to be able to iterate in any type of Sequence (add a new argument in the generator function to specify the Sequence class to use)

## Exercises. Block 2. Part 4.

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letters don't match the alphabet, so when a seq have an incorrect letter, the code is stoped as well as its execution

- 6) Modify the `FASTA_iterator` generator function to **skip sequences having incorrect letters**. It must capture specifically the `IncorrectSequenceLetter` exception. When it happens, it should **print a message of error in the standard error** and continue with the **next sequence**. Do not handle other types of exceptions, only `IncorrectSequenceLetter` exceptions. creating our own incorrect seq and modify the `FASTA_iterator` to deal with that
- 7) When the script is executed as a **standalone** application (without being imported (i.e. code under `__main__` block), the script should read input DNA FASTA file(s) and calculate the **length** and **molecular weight** of their corresponding proteins (i.e. corresponding to `ProteinSequence` instances obtained **after translation**). The script must print the output to **standard output** or to a **file**. Output should be sorted by molecular weight, from lowest to greatest.  
not imported to another script

`Python uID_S10.py [IN] [OUT]`

7.1) If the script is executed **without arguments**, it looks for all ".fasta" or ".fa" files in the current directory, and process all of them with a single sorted output. Print the results to **standard output**.

7.2) If the script has a **single argument**, it corresponds to the input. If it is a directory, it looks for all ".fasta" or ".fa" files in the given directory, process them and print the results in standard output. If this single argument corresponds to a file (not necessarily ".fasta", or ".fa"), process it and print the results in **standard output**.

7.3) If the script has **two arguments**, the first one corresponds to the input and the second one to the output file.

7.4) The script should print to **standard error** a progression **log**

Input FASTA  
format:

```
>Identifier  
ATCTACTAACGTTAAGACTACTACACTTACAT  
CTAGCCCCATTGACGATACGTTAAA  
>Identifier2  
ACAATACTGGGTACCAGAT
```

Multiline fasta file

Progression log printed to **standard error**:

```
3 FASTA files found.  
input_path/Fasta_file1.fasta finished.  
input_path/Fasta_file2.fasta finished.  
input_path/another_file.fa finished.  
1213 sequences found.  
Sorting the sequences...  
Sort process finished.  
Program finished correctly.
```

How many fasta files are going to be processed.

For each FASTA file, indicate the process has finished.

Indicate when the sorting starts, when it ends and when the program has finished.

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### Output format

```
Identifier1    Length1    molecular_weight1  
Identifier2    Length2    molecular_weight2  
Identifier3    Length3    molecular_weight3
```

Hints:

- 1) Modify the `FASTA_iterator` function in **so it creates an instance of a specific subclass** (Until now, it created only `ProteinSequence` instances. To be useful for different scenarios it should create instances of a specific `Sequence` subclass. To achieve this, you can add an additional argument to the `FASTA_iteration` function to specify the subclass to be created).
- 2) If the input FASTA files are incorrect, i.e., for example, incorrect sequence monomers, skip the incorrect sequences by managing the exceptions.