Exceptions

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Overview

1 Exceptions
- Exception handling
- Specifications and exceptions
- Using exceptions in your programs

Exceptions

An **exception** is an event that disrupts the normal flow of a program's code

- Exceptions are present and used in many programming languages
- They are raised by code to signal an exceptional situation
- Your code will both raise (create) exception as well as "treat" them

NB!

The presence of an exception does not automatically mean that there's an error in the code

Exceptions

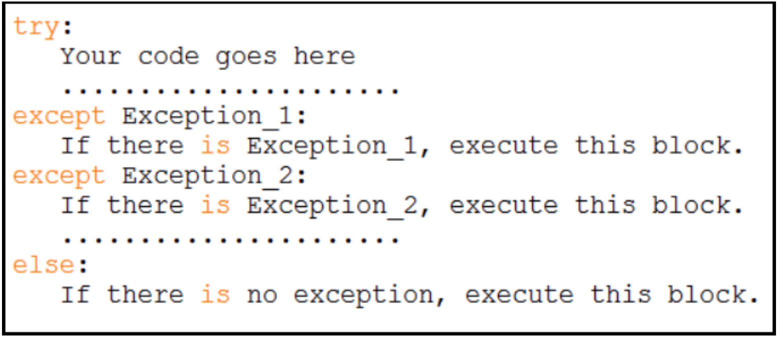
Most programming languages that support exceptions[1] use a common terminology and syntax

- Raising or throwing exceptions
- Catching or treating an exception
- Exception propagation
- **try** / **raise** (throw) / **except** (catch) keywords

[1] https://docs.python.org/3/tutorial/errors.html#exceptions

Exception handling

Exception handling is the process of handling error conditions in a program systematically by taking the necessary action.



```
try:
   Your code goes here
   .......................
except Exception_1:
   If there is Exception_1, execute this block.
except Exception_2:
   If there is Exception_2, execute this block.
   .......................
else:
   If there is no exception, execute this block.
```

Exception handling

A few points from the Python syntax above[2]:

- If you want to catch exceptions, the code has to be in a **try** - **except** block
- Exceptions are caught using their type
- One try block can catch **one**, **several** or **all** exception types
- Creating exceptions in your code is done using the **raise** keyword
- You can provide additional arguments (e.g. an error message) to any Exception you raise

[2] https:www.tutorialspoint.com/python/python_exceptions.htm

Exception handling

An exceptions can be **handled** by:

- The function where the exception was raised
- Any function that called the raising function
- The Python runtime - **this will crash your program**.

Discussion

If the phrase ”*unhandled exception has occured in you application...*” sounds familiar, now you understand what happened!

Exceptions

Demo

Exceptions example, **13-Exceptions.py**

Exception handling

When to use exceptions?

- Signal an exceptional situation - the function is unable to perform the promised situation (e.g. function preconditions are violated, or the function encountered a situation in which it cannot progress - a required file was not found, is not accessible, etc.)
- Enforce function preconditions
- Generally speaking, you should **not use** exceptions to control program flow!

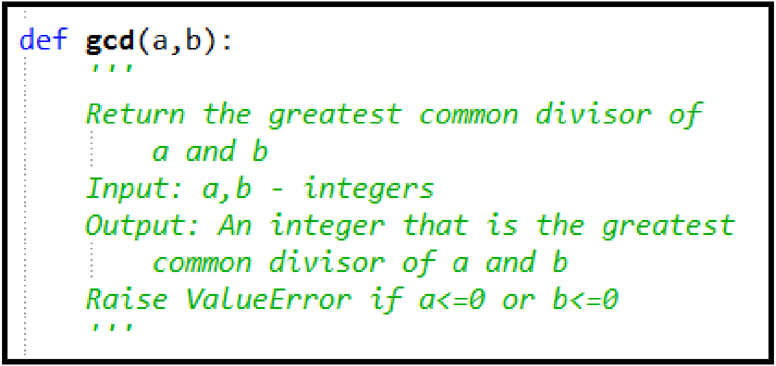
Function specification

Is a way for abstracting **functions** that will only work if we provide:

- Meaningful name for the function
- Short description of the function (the problem solved by the function)
- Type and meaning of each input parameter
- Conditions imposed over the input parameters (**preconditions**)
- Type and meaning of each output parameter
- Relation between the input and output parameters (**post condition**)
- **Exceptions** that the function may raise

Function specification

- **Precondition** - a condition that must be true just prior to the execution of some section of code.
- **Post condition** - a condition that must be true just after the execution of some section of code.



```
def gcd(a,b):
    '''
    Return the greatest common divisor of
        a and b
    Input: a,b - integers
    Output: An integer that is the greatest
        common divisor of a and b
    Raise ValueError if a<=0 or b<=0
    '''
```

Test case for exceptions

How do we integrate exceptions into our test cases?

- Sometimes, a function works correctly if it raises an exception, and this must be tested

Demo

Test cases for functions throwing exceptions, **08-TestDrivenDevelopment-2.py**, test function **testFindGoldbachPrimes()**

Exceptions and layered architecture

How do we integrate exceptions into layered architecture programs?

NB!

- UI module(s) should not do a lot of processing
- Non-UI modules should not have any UI input/output

Our solution:

- We create exception with an argument or error message
- We catch them in the UI and display the corresponding message

Exceptions and layered architecture

Demo

Let's take a look at **12-CalculatorModular.zip**, the feature for adding numbers