Errors and exceptions

Inteligencia Artificial en los Sistemas de Control Autónomo

Objectives

1. To be aware of the error handling problem
2. Understand exceptions
3. Handle, create and raise exceptions in Python

References

Guido van Rossum, ``*Python Tutorial. Release* 3.2.3", chapter 8

Table of Contents

1. Definition
2. Handling exceptions
3. Exceptions with arguments
4. Clean-up actions

Exceptions

Exception definition (I)

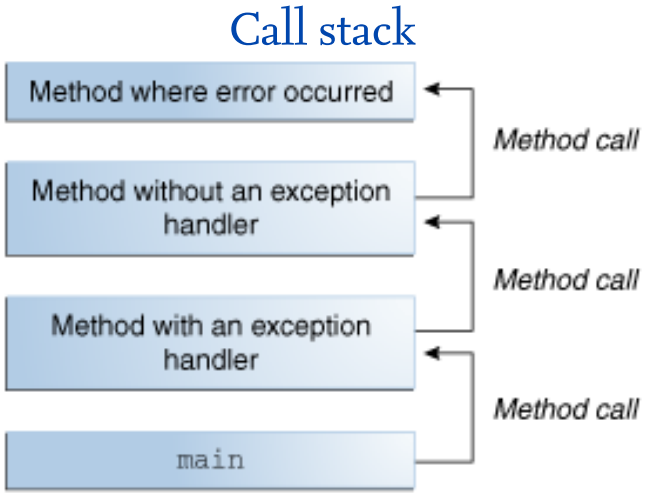
- Errors happen
  - We need a mechanism to handle errors
- Some errors happen before execution (*syntax errors*)
- Others are only detected in execution (*runtime errors*)

```
>>> while True print('Hello world')
  File "<stdin>", line 1
    while True print('Hello world')
                    ^
SyntaxError: invalid syntax
```

- Exception: An error that disrupts the normal execution flow
  - File not found, division by zero, invalid argument, etc
  - Code cannot be executed
  - Elegant solution to handle errors

Exceptions

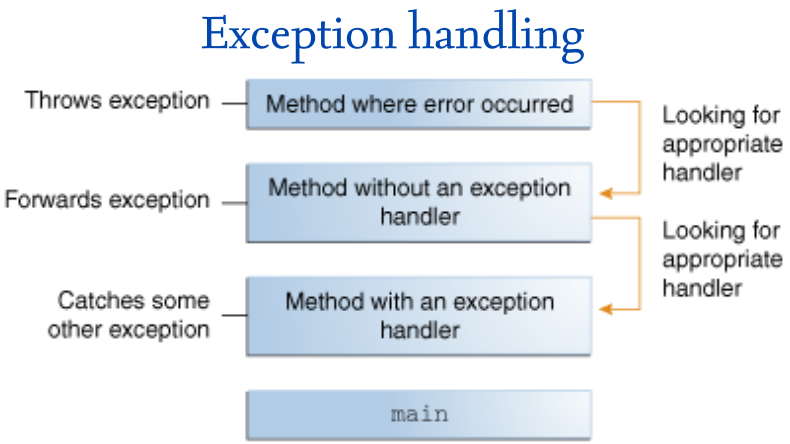
Exception definition (II)



Call stack: Sequence of invoked methods

Exceptions

Exception definition (III)



When an error happens ...

1. Code execution is stopped
2. An exception is thrown
3. The interpreter goes back in the call stack
4. When the interpreter finds an exception handler, it is executed

The exception handler catches the exception, the program finishes otherwise

Exceptions

Exception definition (IV)

```
>>> 10 * (1/0)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ZeroDivisionError: division by zero
>>> 4 + spam*3
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'spam' is not defined
>>> '2' + 2
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: Can't convert 'int' object to str implicitly
```

Exceptions

Handling exceptions (I)

Handling an exception requires a try-except statement

- `try`: Encloses the vulnerable code
- `catch`: Code that handles the exception

try-catch statement

```
try:
    # Risky code
except ExceptionType1:
    # Handle error
except ExceptionType2:
    # Handle error
except:
    # Handle errors
```

Exceptions

Handling exceptions (II)

try-catch example

```
1 try:
2     x = int(input("Please enter a number: "))
3 except ValueError:
4     print("Oop!, that was not a number!")
5 except KeyboardInterrupt:
6     print("Got Ctrl-C, good bye!")
```

The exception type contains the error

Exceptions

Handling exceptions (III)

try-catch example

```
1  try:
2      f = open('file.txt')
3      s = f.readline()
4      i = int(s.strip())
5  except IOError as err:
6      print("I/O error: {0}".format(err))
7  except ValueError:
8      print("Could not convert data to integer")
9  except:
10     print("Unexpected exception")
11     raise
```

New Python element

- Raise

Exceptions

Exceptions with arguments

Exception arguments: When we need more info

```
1  try:
2      raise Exception("spam", "eggs")
3  except Exception as inst:
4      print(type(inst))
5      print(inst.args)
6      print(inst)
7
8      x, y = inst.args
9      print('x =', x)
10     print('y =', y)
```

```
1  <class 'Exception'>
2  ('spam', 'eggs')
3  ('spam', 'eggs')
```

Exceptions

Clean-up actions

Sometimes we need to execute code under all circumstances

- Typically clean-up actions: Close files, database connections, sockets, etc
- The **finally** clause solves this problem

Example

```
1 try:
2     raise KeyboardInterrupt
3 finally:
4     print("Goodbye, world!")
```