

# Exception Handling in Python

## Introduction

In any programming language, errors may occur during program development or execution. In Python, errors are broadly classified into **Syntax Errors** and **Runtime Errors**.

## Types of Errors

### 1. Syntax Errors

Syntax errors occur due to invalid syntax in the program. These errors are detected by the Python interpreter before program execution.

#### Examples:

```
x = 10
if x == 10
    print("Hello")
```

**Error:** SyntaxError: invalid syntax

```
print "Hello"
```

**Error:** SyntaxError: Missing parentheses in call to 'print'

**Note:** The programmer is responsible for correcting syntax errors. Program execution starts only after all syntax errors are fixed.

### 2. Runtime Errors

Runtime errors occur while executing the program and are also known as **exceptions**. These errors arise due to invalid user input, programming logic, or memory problems.

#### Examples:

```
print(10/0)      # ZeroDivisionError
print(10/"ten")  # TypeError
x = int("ten")   # ValueError
```

## What is an Exception?

An unwanted and unexpected event that disturbs the normal flow of a program is called an **exception**.

#### Common Exceptions:

- ☐ **ZeroDivisionError**
- ☐ **TypeError**
- ☐ **ValueError**
- ☐ **FileNotFoundError**
- ☐ **EOFError**

## Core Components

The primary keywords used for exception handling are:

**try:** This block contains the code that might raise an exception.

**except:** This block catches and handles the exception if one occurs in the try block. You can specify the type of exception to catch for more granular control.

**else:** The code in this optional block is executed only if the try block runs without any exceptions.

**finally:** This optional block of code will run regardless of whether an exception occurred or was handled. It is often used for cleanup operations, such as closing files or network connections.

## Different Types of Exceptions in Python

**NameError:** This Exception is raised when a name is not found in the local or global namespace.

**IndexError:** This Exception is raised when an invalid index is used to access a sequence.

**KeyError:** This Exception is thrown when the key is not found in the dictionary.

**ValueError:** This Exception is thrown when a built-in operation or function receives an argument of the correct type and incorrect value.

**IOError:** This Exception is raised when an input/output operation fails, such as when an attempt is made to open a non-existent file.

**ImportError:** This Exception is thrown when an import statement cannot find a module definition or a from ... import statement cannot find a name to import.

**SyntaxError:** This Exception is raised when the input code does not conform to the Python syntax rules.

**TypeError:** This Exception is thrown when an operation or function is applied to an object of inappropriate type.

**AttributeError:** occurs when an object does not have an attribute being referenced, such as calling a method that does not exist on an object.

**ArithmeticError:** A built-in exception in Python is raised when an arithmetic operation fails. This Exception is a base class for other specific arithmetic exceptions, such as ZeroDivisionError and OverflowError.

**Floating point error:** It is a type of arithmetic error that can occur in Python and other programming languages that use floating point arithmetic to represent real numbers.

**ZeroDivisionError:** This occurs when dividing a number by zero, an invalid mathematics operation.

**FileExistsError:** This is Python's built-in Exception thrown when creating a file or directory already in the file system.

**PermissionError:** A built-in exception in Python is raised when an operation cannot be completed due to a lack of permission or access rights.

**try:**

**# Code that might raise an exception**

**numerator = 10**

**denominator = int(input("Enter a denominator: "))**

**result = numerator / denominator**

**except ZeroDivisionError:**

**# Handle the specific ZeroDivisionError**

**print("Error: You can't divide by zero!")**

**except ValueError:**

**# Handle the specific ValueError (e.g., if input is not an integer)**

**print("Error: Please enter a valid number.")**

**else:**

**# This runs if no exception occurred in the try block**

**print(f"Result is: {result}")**

**finally:**

**# This block always runs**

**print("Execution finished.")**

## **Need for Exception Handling**

- Prevents abnormal termination of programs
- Ensures **graceful termination**
- Helps continue program execution using alternative logic
- Does not repair exceptions, but handles them

## **Default Exception Handling in Python**

Every exception in Python is an object. For every exception type, a corresponding class exists.

If an exception occurs and no handling code is available, Python terminates the program abnormally and prints exception information.

**Example:**

```
print("Hello")
print(10/0)
print("Hi")
```

## **Exception Hierarchy**

- Every exception in Python is a class
- All exception classes are child classes of **BaseException**
- Programmers usually deal with **Exception** and its child classes

## **Customized Exception Handling using try-except**

**Syntax:**

```
try:
    Risky Code
except ExceptionName:
    Handling Code
```

- Risky code is placed inside try
- Handling code is placed inside except

**Without try-except**

```
print("stmt-1")
print(10/0)
print("stmt-3")
```

**Result:** Abnormal termination

## With try-except

```
print("stmt-1")
try:
    print(10/0)
except ZeroDivisionError:
    print(10/2)
print("stmt-3")
```

**Result:** Normal termination

## Control Flow in try-except

```
try:
    stmt-1
    stmt-2
    stmt-3
except Exception:
    stmt-4
stmt-5
```

### Possible Cases:

- No exception → stmt-1,2,3,5 → Normal termination
- Exception matched → stmt-1,4,5 → Normal termination
- Exception not matched → Abnormal termination

## Printing Exception Information

```
try:
    print(10/0)
except ZeroDivisionError as msg:
    print("Exception description:", msg)
```

## Multiple except Blocks

Different exceptions require different handling logic.

```
try:
    x = int(input("Enter First Number: "))
    y = int(input("Enter Second Number: "))
```

```
print(x/y)
except ZeroDivisionError:
    print("Can't divide by zero")
except ValueError:
    print("Please provide integer values only")
```

**Note:** Order of except blocks is important. Python checks from top to bottom.

## Single except Block for Multiple Exceptions

```
except (ZeroDivisionError, ValueError) as msg:
    print("Invalid input:", msg)
```

## Default except Block

```
except:
    print("Default exception")
```

**Note:** Default except block must be the last except block.

## Finally Block

The finally block is used to maintain cleanup code such as resource deallocation.

### Syntax:

```
try:
    Risky Code
except:
    Handling Code
finally:
    Cleanup Code
```

- finally block is always executed
- Except when `os._exit()` is used

## else Block with try-except-finally

```
try:
    Risky Code
except:
    Exception Handling
else:
    Executes if no exception
finally:
    Always executes
```

## Nested try-except-finally Blocks

Nested exception handling is possible.

```
try:
    try:
        print(10/0)
    except ZeroDivisionError:
        print("Inner except")
    finally:
        print("Inner finally")
except:
    print("Outer except")
finally:
    print("Outer finally")
```

## Types of Exceptions

### 1. Predefined Exceptions

Also known as **in-built exceptions**. Raised automatically by Python.

Examples: - ZeroDivisionError - ValueError

### 2. User Defined Exceptions

Also known as **Customized Exceptions** or **Programmatic Exceptions**.

Programmers define and raise these exceptions explicitly using raise keyword.

## Defining and Raising Customized Exceptions

### Syntax:

```
class CustomException(Exception):
    def __init__(self, msg):
        self.msg = msg
```

Example:

```
class TooYoungException(Exception):
    def __init__(self, msg):
        self.msg = msg
```

```
class TooOldException(Exception):
    def __init__(self, msg):
        self.msg = msg
```

```
age = int(input("Enter Age:"))
```

```
if age > 60:
    raise TooYoungException("Please wait some more time")
elif age < 18:
    raise TooOldException("Not eligible")
else:
    print("You will get match details soon")
```

## Important Note

- raise keyword is best suitable for **customized exceptions**
- Not recommended for predefined exceptions

**Exception handling** is a critical feature of Python that helps **write robust, reliable, and error-resistant programs**. Proper use of **try, except, else, finally, and custom exceptions** ensures smooth program execution and graceful error handling.

## Important Definitions

- **Exception:** An unwanted and unexpected event that disturbs the normal flow of a program.
- **Runtime Error:** An error that occurs during program execution.
- **Graceful Termination:** Proper termination of a program without abrupt failure.
- **Custom Exception:** A user-defined exception created using a class that extends Exception.

## Programs

### Program 1: Handle Division by Zero

```
try:
    a = int(input("Enter a number:"))
    b = int(input("Enter another number:"))
    print(a/b)
except ZeroDivisionError:
    print("Cannot divide by zero")
```

### Program 2: Handle Multiple Exceptions

```
try:
    x = int(input("Enter First Number:"))
    y = int(input("Enter Second Number:"))
```



```
    print(x/y)
except ZeroDivisionError:
    print("Zero is not allowed")
except ValueError:
    print("Please enter integer values only")
```

### Program 3: Demonstrate finally Block

```
try:
    print("Inside try")
    print(10/2)
except:
    print("Inside except")
finally:
    print("Inside finally")
```

### Program 4: User Defined Exception

```
class InvalidAgeException(Exception):
    def __init__(self, msg):
        self.msg = msg

age = int(input("Enter Age:"))
if age < 18:
    raise InvalidAgeException("Age must be 18 or above")
else:
    print("Eligible")
```