Flow Control in Python

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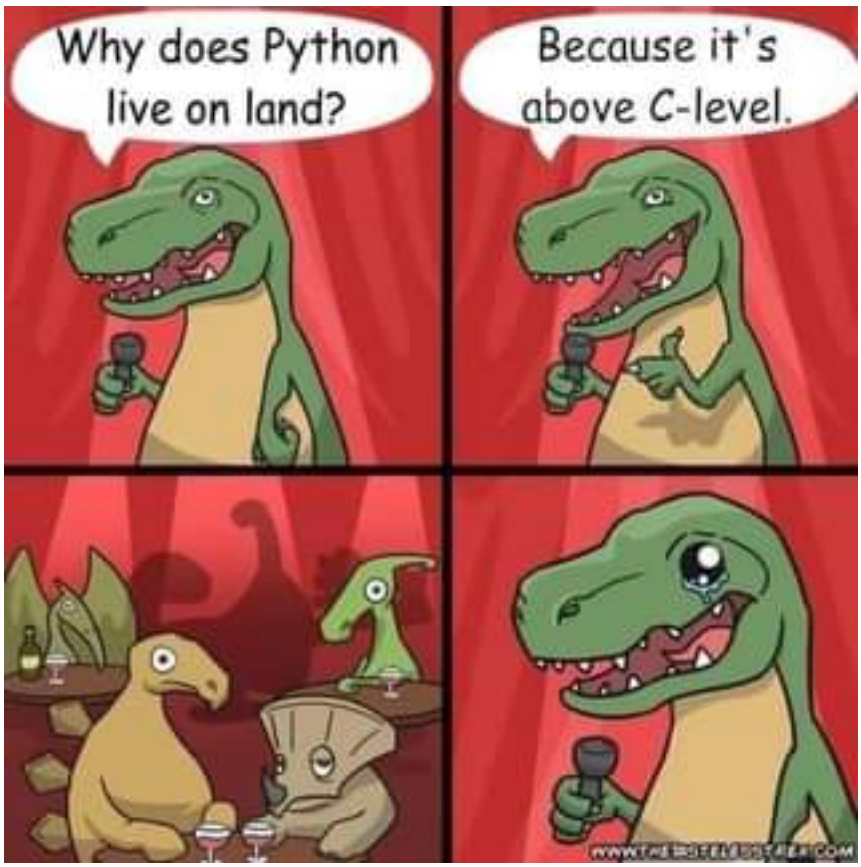
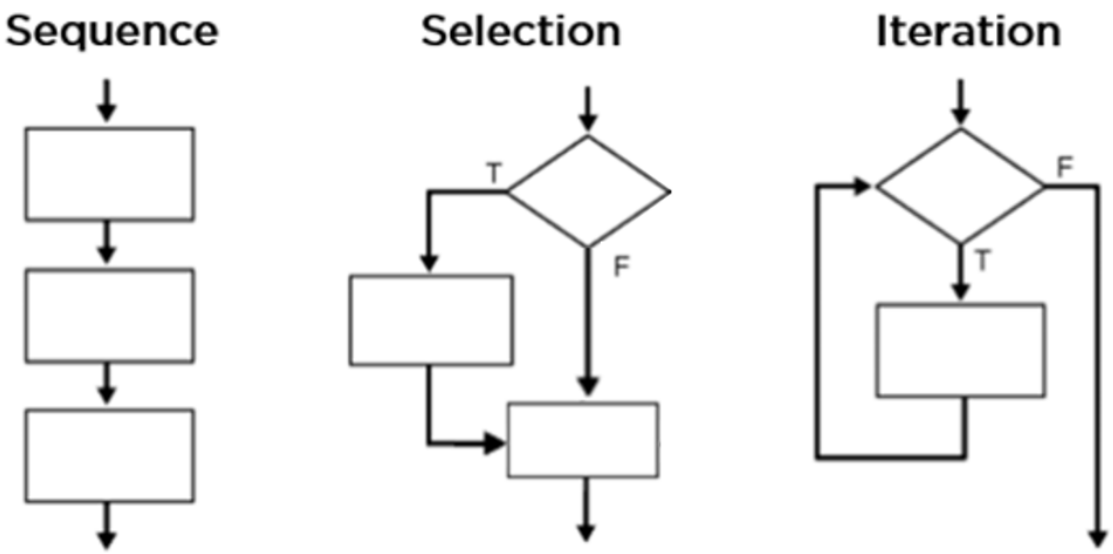
0.1 Python vs. C



0.2 Definition of Control Flow

- Control flow is the order in which statements and instructions are executed in a program
- Control flow can be affected by decision-making statements, loops, and function calls.



0.3 Indentation in Python

- Code blocks are a group of statements that are executed together.
- In Python, indentation is used to define **blocks of code**.
- Python uses whitespaces (spaces or tabs) at the beginning of a line to determine the indentation level of the line.
- The amount of indentation is flexible, but it must be consistent throughout that block.
- Generally, four spaces are used for each level of indentation.
- Example:

```
if True:
    print("This is within the if block")  # Indented with four spaces
    if True:
        print("This is within the nested if block")  # Indented with eight
        ↪ spaces
print("This is outside the if block")  # No indentation
```

0.4 Conditional Flow Control

- if-statement

The `if` statement is used for decision-making in Python programming. It tests a condition and executes a block of code only if that condition evaluates to `True`. If the condition is `False`, the block of code is skipped.

```
if expression:
    statement(s)
```

- if-else-statement

The `if` statement can be combined with `elif` and `else` clauses to control the flow of execution in the program, allowing for the implementation of more complex logical structures.

```
if condition1:
    # Code to execute if condition1 is True (Execute Block1)
elif condition2:
    # Code to execute if condition2 is True (Execute Block2)
else:
    # Code to execute if no conditions are True (Execute Block3)
```

0.5 Example : Age Category

Objective: Categorize life stages by age.

```
age = 20
if age < 13:
    print("Child")
elif age < 20:
    print("Teenager")
else:
    print("Adult")
```

```
Adult
```

0.6 Loops in Python

Loops in Python are used to execute a block of code repeatedly. Python provides two types of loops: `for` and `while`.

0.7 `for` Loops

A `for` loop is used to iterate over a sequence (e.g., a list, tuple, string, or range) and execute a block of code for each item in the sequence.

```
for element in sequence:
    statement(s)
```

- Example 1

```
for chr in "HELLO":
    print(chr)
```

```
H
E
L
L
O
```

- Example 2

```
for fruit in ["Apple", "Orange", "Banana"]:
    print(fruit)
```

```
Apple
Orange
Banana
```

- Example 3

```
for i in range(10):
    print(i)
```

```
0
1
2
3
4
5
6
7
8
9
```

0.8 `while` Loops

A `while` loop, on the other hand, continues to execute a block of code as long as a given condition evaluates to `True`.

```
while condition:
    statement(s)
```

- Example

```
index = 0
fruits = ["Apple", "Orange", "Banana"]
while index < 2:
    print(index, fruits[index])
    index += 1
```

```
0 Apple
1 Orange
```

0.9 Controlling Loop Execution

- **`break`**: Immediately exits a loop.

```
for i in range(10):
  if i == 5:
    break  # Exit the loop when i is 5.
  print(i)
```

```
0
1
2
3
4
```

- **`continue`**: Skips the remainder of the loop's body and immediately proceeds with the next iteration.

```
for i in range(10):
  if i % 2 == 0:
    continue  # Skip even numbers.
  print(i)
```

```
1
3
5
7
9
```

- **pass**: Acts as a placeholder, allowing for the definition of empty control structures.

```
for i in range(10):
  pass  # Placeholder for future code.
```

0.10 Python List Comprehensions

List Comprehensions in Python are a concise and efficient way to create lists. They allow for the construction of a new list by applying an expression to each item in an iterable, optionally filtering items to include only those that meet a condition.

0.10.1 Syntax

The basic syntax of a list comprehension is:

```
[expression for item in iterable if condition]
```

where:

- expression is the current item in the iteration, but it could also be any other valid expression that depends on it.
- item is the variable that takes the value of the item inside the iterable in each iteration.
- iterable is a sequence, collection, or an object that can be iterated over.
- condition is an optional part. If specified, the expression will only be applied to items that meet the condition.

0.11 List Comprehensions - Example 1

```
squares = [x**2 for x in range(10)]
squares
```

```
[0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

0.12 List Comprehensions - Example 2

```
squares_even = [x**2 for x in range(1, 11) if x % 2 == 0]
squares_even
```

```
[4, 16, 36, 64, 100]
```

0.13 Error Handling in Python

Error handling is a critical aspect of writing robust Python programs. Python provides the `try` and `except` blocks to catch and handle exceptions, preventing the program from terminating unexpectedly.

0.13.1 Handling Division by Zero

A common error in programming is division by zero, which occurs when a number is divided by zero. Python raises a `ZeroDivisionError` exception in such cases.

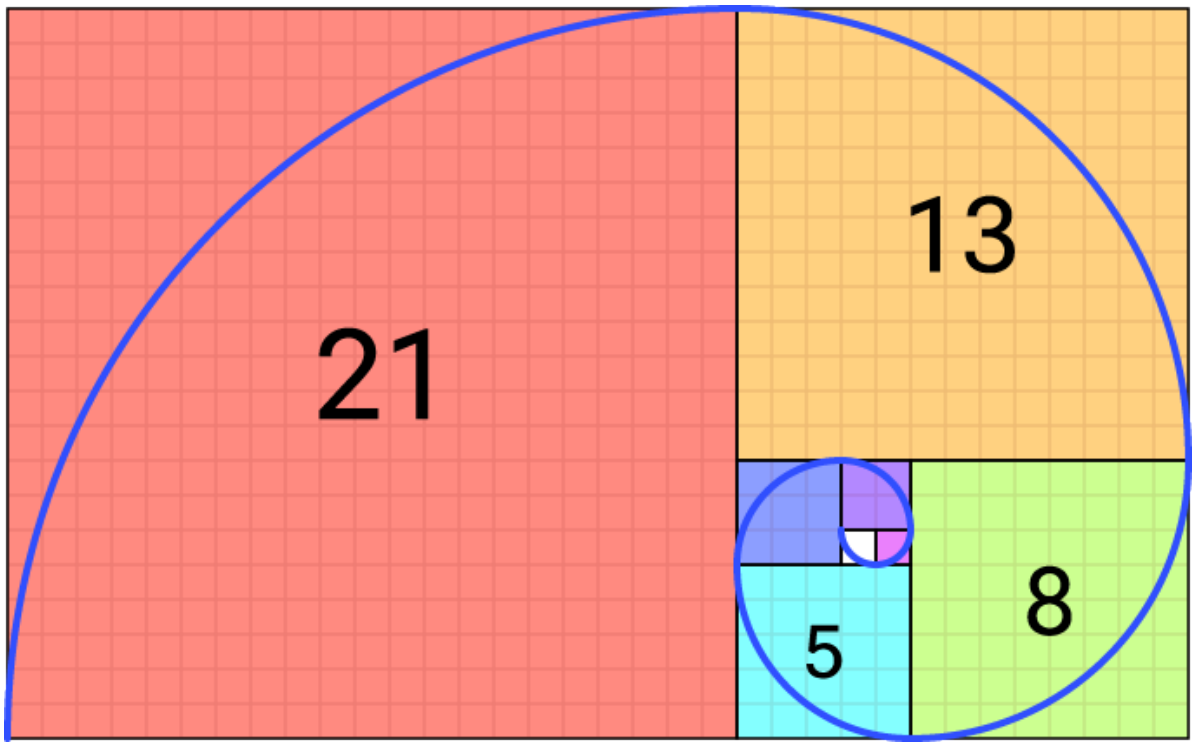
0.13.2 Syntax

The basic syntax for handling exceptions in Python is:

```
numerator = 10
denominator = 0
try:
    # Code block where exception can occur
    result = numerator / denominator
except ZeroDivisionError:
    # Code to execute if there is a ZeroDivisionError
    print("Cannot divide by zero!")
```

```
Cannot divide by zero!
```

0.14 Exercise: Fibonacci Sequence



Write a program that generates the first 20 numbers in the Fibonacci sequence.

Hints:

- The Fibonacci sequence is a sequence of numbers where each number is the sum of the two preceding numbers.
- The first two numbers in the sequence are 0 and 1.
- Use a for loop to generate the sequence.

Example output: `0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181`

Solution

```
# Initialize the first two numbers
a = 0
b = 1

# Print the first two numbers
print(a, end=" ")
print(b, end=" ")
```

```

# Generate the next 18 numbers
for _ in range(18):
    next_number = a + b
    print(next_number, end=" ")
    a = b
    b = next_number
```

```
0 1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987 1597 2584 4181
```