Software Development Lifecycle (SDLC)

What is SDLC?

The Software Development Lifecycle (SDLC) is a structured process that guides a development team in creating high-quality software. This team can include:

- **Client-facing personnel** (liaison between clients and developers)
- **Developers ("Code monkeys")** (write and maintain code)
- **Project management** (oversees development progress and timelines)

Two Main Approaches:

1. **Waterfall Model –** A structured, sequential approach
2. **Agile Approach –** A more flexible, iterative approach

Waterfall Model (Sequential Process)

Each phase must be completed before moving to the next.

1. Define Requirements to be met.

- Conduct interviews with clients
- Create requirements:
    - Project timeline and cost estimates
    - Technical requirements (e.g., Windows 11, macOS compatibility)
    - Functional requirements

2. Design Software

- **User Interface (UI) Design –** Visual aspects of the software
- **Logic & Algorithms –** Internal workings of the software
- **Flowcharting –** Visual representation of software processes

3. Development (Programming)

- Use **version control** (e.g., Git)
- Select the most suitable programming language
- Team-based coding approach

4. Testing

- Detect and fix bugs before deployment

5. Deployment (Releasing Software)

- Decide on release strategy:
    - **Phased Release** – Rolling out in stages (e.g., country by country)

6. Maintenance

- Ensure compatibility across different platforms
- Adapt to changing requirements (new features, bug fixes)

Pros & Cons of Waterfall

✅ **Pros:**

- Well-defined project phases
- Clear documentation
- Easier to estimate costs and timelines
- Reduces scope creep (clients continuously requesting additional features)

❌ **Cons:**

- Requires extensive upfront planning
- Difficult to make changes once a phase is completed
- Higher risk due to limited flexibility

💡 **Common Users of Waterfall:**

- Government agencies
- Large organizations (e.g., banks) that require highly secure and complete software

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Agile Approach (Iterative Process)

How Agile Works

Agile development follows an iterative process where teams work in short cycles called **sprints**. At the end of each sprint, the team:

- Reviews progress
- Shows the latest version to the client
- Assesses feedback
- Starts the next sprint

Key Features of Agile:

- **Sprints** – Short, focused development cycles (typically weekly)
- **Daily Check-ins** – Brief meetings to update progress and address challenges

- **Prototyping** – Frequent iterative versions to refine the software
- **Specifications & Requirements** – Flexible targets that evolve with client needs
- **Continuous Testing** – Ongoing testing throughout development to quickly fix issues

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Full Stack Development

A **Full Stack Developer** works on both the front end (user interface) and backend (server, database, logic).

1. Frontend Development

- Focuses on **UI (User Interface) & UX (User Experience)**
- Technologies: HTML, CSS, JavaScript

2. Backend Development

- Handles the logic and database interactions
- Technologies: Python, JavaScript (Node.js), PHP

3. Database Management

- Uses SQL (Structured Query Language) for data storage and retrieval
- Supports dynamic applications that react to user inputs

Reminder for Using ChatGPT to Order Notes:

✅ **Be Specific** – Clearly outline what you need formatted or explained

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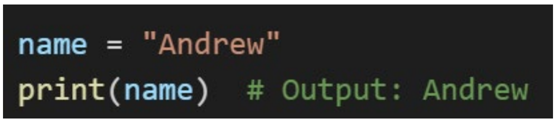
Data Types in Programming

What Are Data Types?

Data types define how information is stored in a computer's memory. They determine the type of data a variable can hold and how it can be used in a program.

Variables can store different data types and can be retrieved by referencing their variable names.

Example:

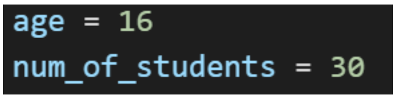


```
name = "Andrew"
print(name)  # Output: Andrew
```

Common Data Types and Their Uses

1. Integer (int)

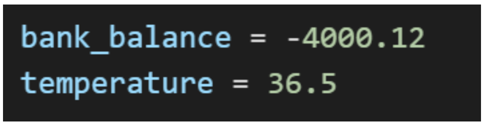
- Stores whole numbers (positive or negative)
- Used for counting and calculations
- **Example:**



```
age = 16
num_of_students = 30
```

2. Floating Point (float)

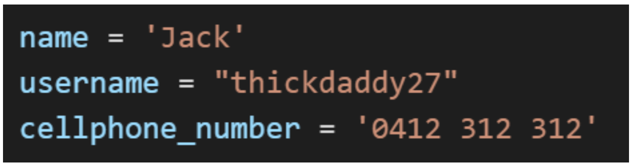
- Stores decimal numbers (positive or negative)
- Used for precise calculations (e.g., financial transactions)
- **Example:**



```
bank_balance = -4000.12
temperature = 36.5
```

3. String (str)

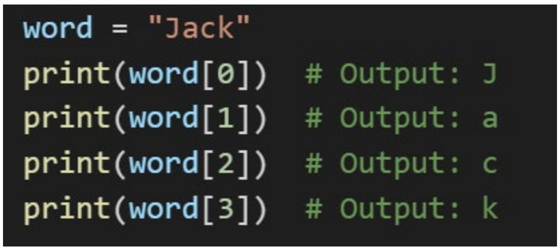
- Stores text data
- Enclosed in either single (') or double (") quotes
- **Example:**



```
name = 'Jack'
username = "thickdaddy27"
cellphone_number = '0412 312 312'
```

String Indexing

- Strings are stored as an **array of characters**, where each character has a specific index.
- **Example:**



```
word = "Jack"
print(word[0])  # Output: J
print(word[1])  # Output: a
print(word[2])  # Output: c
print(word[3])  # Output: k
```

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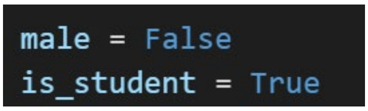
4. Boolean (bool)

- **Used for logical operations, often in if statements**
- **Represents True or False (binary: 1 for True, 0 for False)**
- **Example:**



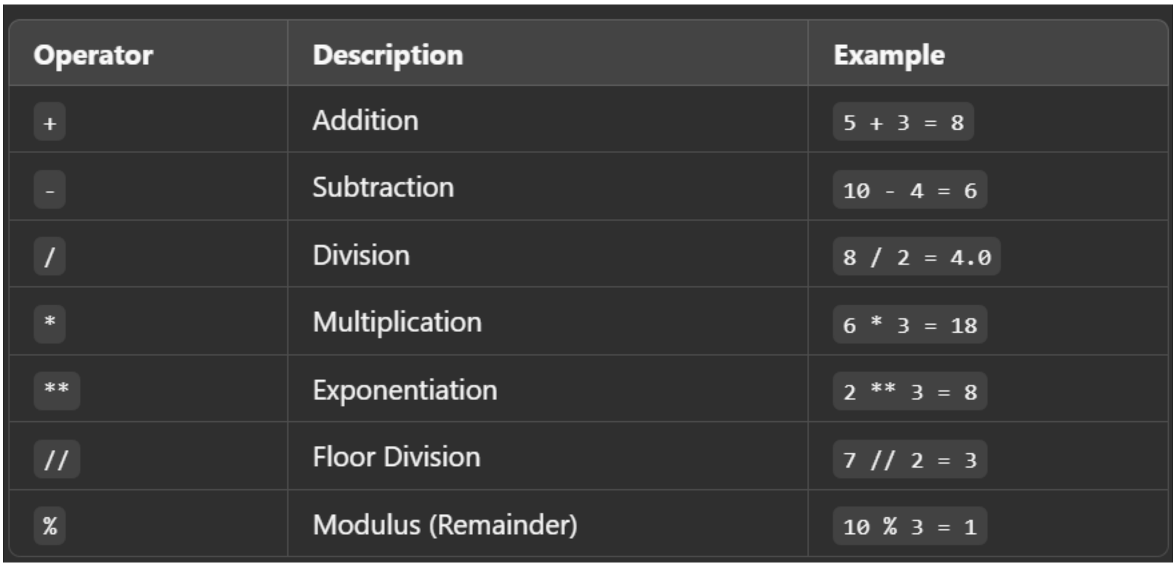
```
male = False
is_student = True
```

Summary

- **Integers are whole numbers.**
- **Floats are decimal numbers.**
- **Strings store text and are indexed character by character.**
- **Booleans are used for logical operations (True/False).**

- **Default Data Types as Classes**
- **In Python, default data types (e.g., str, int, float) are seen as classes.**
- **Each data type has methods attached that allow interactions.**
- **Developers can create their own custom data types using classes, allowing customized interactions.**

- **Arithmetic Operators in Python**
- **Arithmetic operators perform mathematical operations on numeric data types.**



Operator	Description	Example
`+`	Addition	`5 + 3 = 8`
`-`	Subtraction	`10 - 4 = 6`
`/`	Division	`8 / 2 = 4.0`
`*`	Multiplication	`6 * 3 = 18`
`**`	Exponentiation	`2 ** 3 = 8`
`//`	Floor Division	`7 // 2 = 3`
`%`	Modulus (Remainder)	`10 % 3 = 1`

- **Default data types are classes and can be extended using custom classes.**
- **Arithmetic operators allow mathematical operations on numbers.**

Control Structures

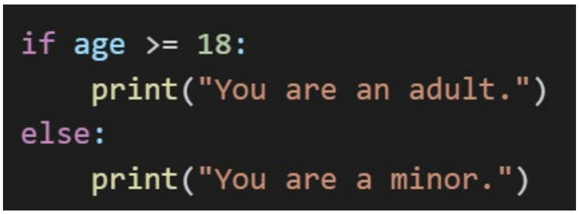
Control structures dictate the flow of execution in a program. The three main types are:

1. Sequences

- Instructions are executed in a linear, step-by-step manner.

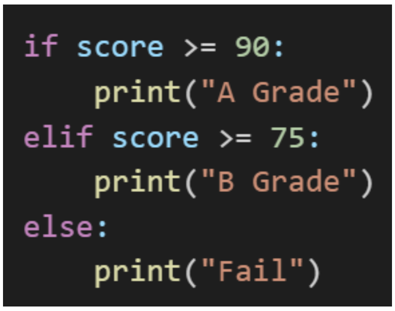
2. Conditionals (Decision Making)

- Used to execute specific blocks of code based on conditions.
- **If-Else Statements:** Execute one block of code if a condition is true; another if it is false.



```
if age >= 18:
    print("You are an adult.")
else:
    print("You are a minor.")
```

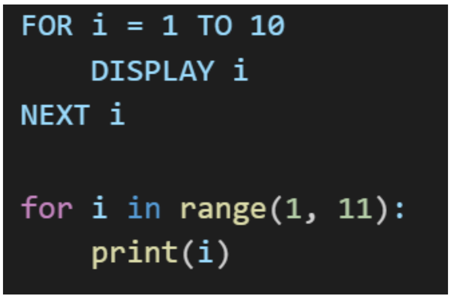
- **Elif (Else-If) Statements:** Allow multiple conditions to be checked sequentially.



```
if score >= 90:
    print("A Grade")
elif score >= 75:
    print("B Grade")
else:
    print("Fail")
```

3. Iteration (Loops)

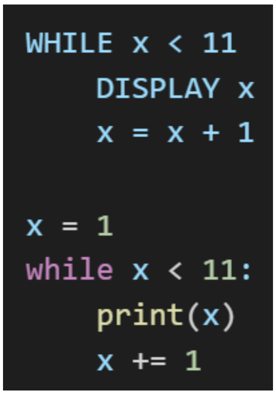
- Repeats a block of code multiple times.
- **For Loops:** Used for counted iteration.



```
FOR i = 1 TO 10
    DISPLAY i
NEXT i

for i in range(1, 11):
    print(i)
```

- **While Loops:** Executes as long as a condition is true (pre-test loop).

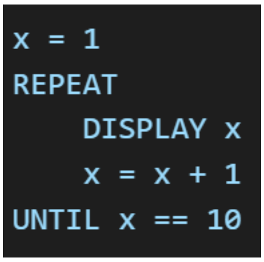


```
WHILE x < 11
    DISPLAY x
    x = x + 1

x = 1
while x < 11:
    print(x)
    x += 1
```

Repeat Until Loops (Post-Test Loop)

- Runs at least once and repeats until the condition is met.
- Not available in Python but present in some other languages.



```
x = 1
REPEAT
    DISPLAY x
    x = x + 1
UNTIL x == 10
```

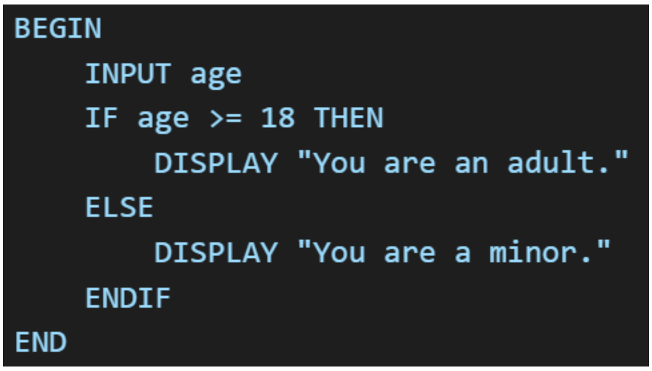
Summary - Control Structures manage the flow of a program: Sequences, Conditionals, and Loops.

Pseudocode

Pseudocode is an informal way of describing an algorithm using simple, human-readable statements that resemble programming concepts but do not follow any strict syntax.

- Used for planning algorithms before coding.
- Able to be translated into other code languages
- Helps in understanding logic without focusing on syntax errors.

Example: (pseudocode)



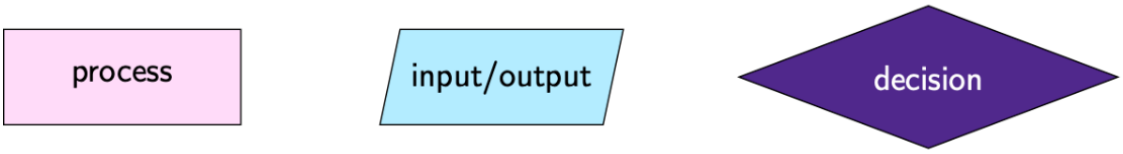
```
BEGIN
    INPUT age
    IF age >= 18 THEN
        DISPLAY "You are an adult."
    ELSE
        DISPLAY "You are a minor."
    ENDIF
END
```

Summary - Pseudocode is a simplified, structured way to represent algorithms.

Flowcharts

- A **visual representation** of an algorithm’s logic and process flow.
- Uses standard symbols:
    - **Oval**: Start/End
    - **Parallelogram**: Input/Output
    - **Rectangle**: Process
    - **Diamond**: Decision

Flowcharts help in better understanding and debugging of complex logic.



Summary - **Flowcharts** visually represent logic and processes.

Data Structures

What is a Data Structure?

A **data structure** is a format for organizing, storing, and processing data efficiently in a computer system. Data structures allow operations such as searching, sorting, finding maximum and minimum values, and more.

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1. Arrays

- An **array** is a collection of elements, all of the same data type, stored in contiguous memory locations.
- In most programming languages, arrays are zero-indexed, meaning the first element is at index 0.

Example:

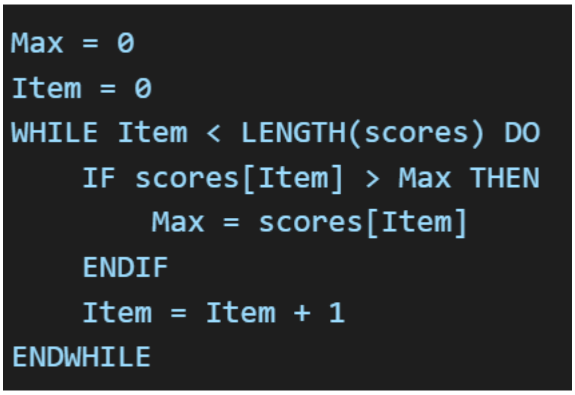
Array Declaration in Different Languages

Python:

```
scores = [5, 7, 9, 11]
```

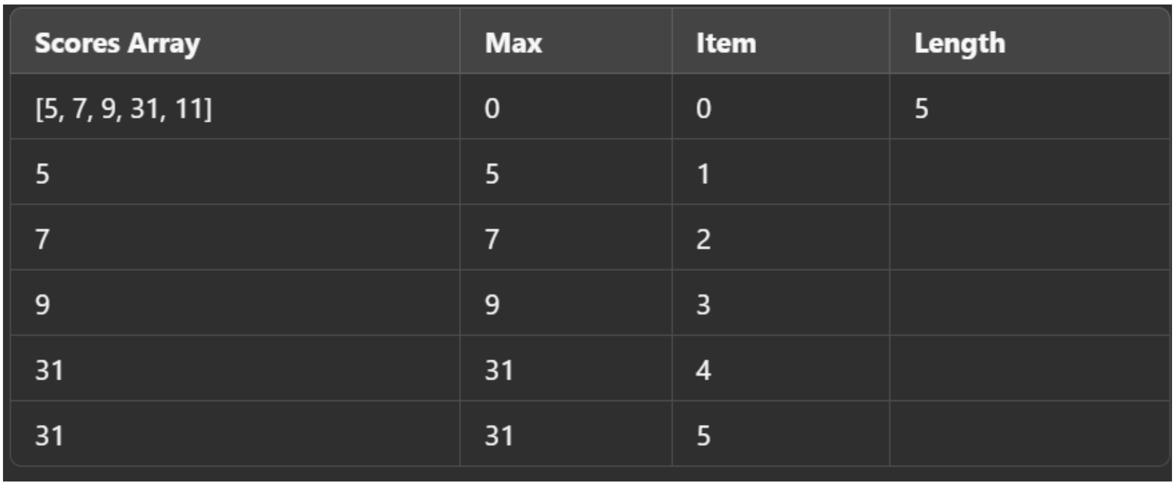
Finding the Maximum Value in an Array

A simple algorithm to find the largest number in an array:



```
Max = 0
Item = 0
WHILE Item < LENGTH(scores) DO
    IF scores[Item] > Max THEN
        Max = scores[Item]
    ENDIF
    Item = Item + 1
ENDWHILE
```

How It Works (Step-by-Step Execution)



Scores Array	Max	Item	Length
[5, 7, 9, 31, 11]	0	0	5
5	5	1	
7	7	2	
9	9	3	
31	31	4	
31	31	5	

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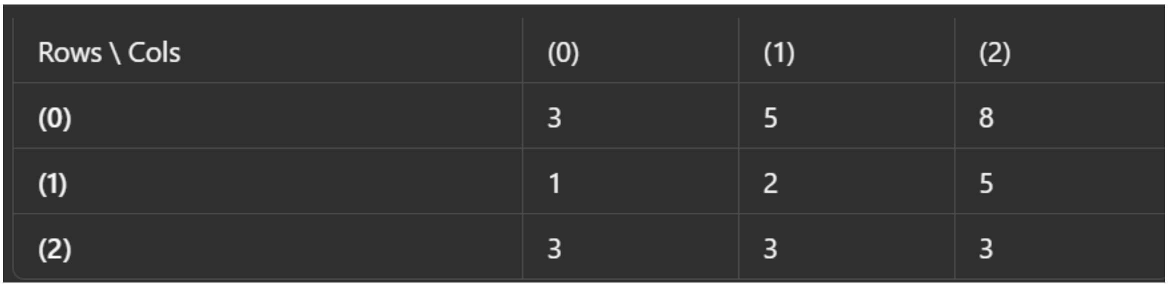
2. Two-Dimensional Arrays

A 2D array is an extension of a one-dimensional array where data is stored in a grid format (rows and columns).



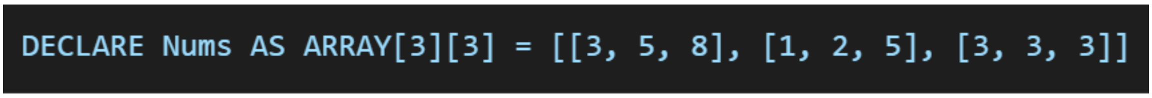
Rows \ Cols	(0)	(1)	(2)
(0)	3	5	8
(1)	1	2	5
(2)	3	3	3

Referencing Values in a Grid

- Nums[0,2] → 8
- Nums[2,2] → 3

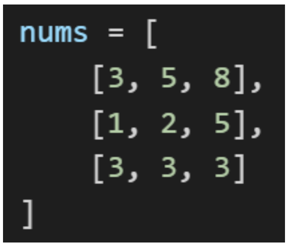
Writing a 2D Array in Code

Pseudocode representation



```
DECLARE Nums AS ARRAY[3][3] = [[3, 5, 8], [1, 2, 5], [3, 3, 3]]
```

Python representation



```python
nums = [
    [3, 5, 8],
    [1, 2, 5],
    [3, 3, 3]
]
```

Looping Through a 2D Array

Displaying an Entire Row

```
FOR row = 0 TO 2 DO
  FOR col = 0 TO 2 DO
    DISPLAY nums[row, col]
  ENDFOR
ENDFOR
```

S