Programming Basics

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What is a programming language?

A set of instructions written by a programmer to deliver instructions to the computer.

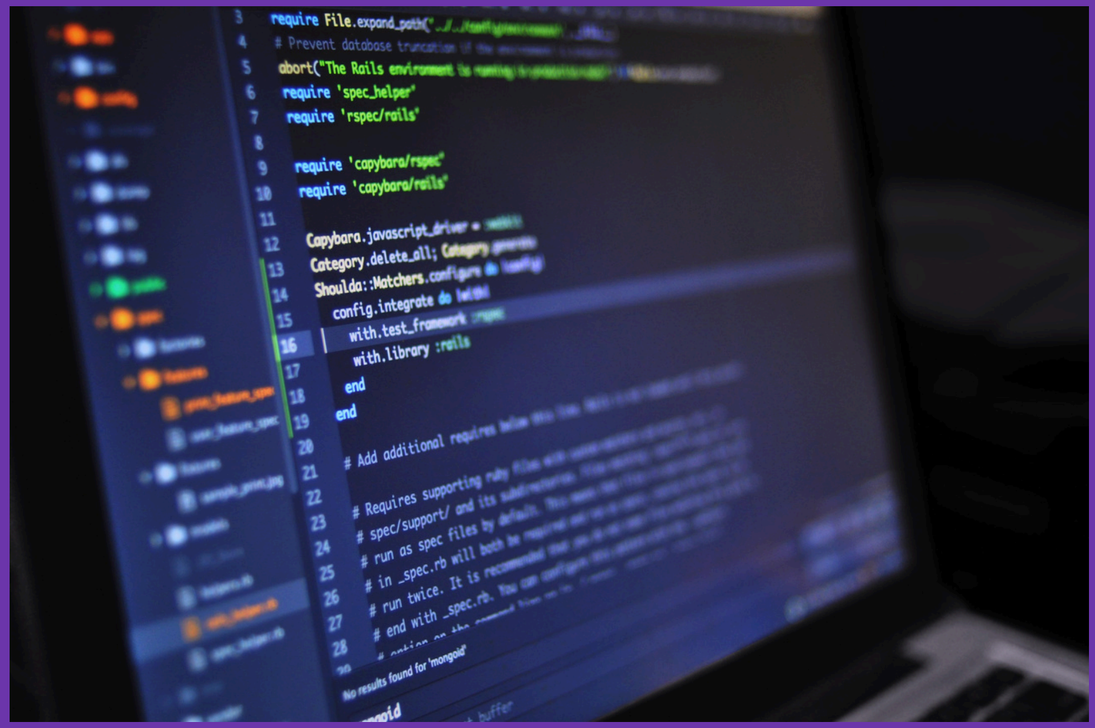
Programming Languages in FIRST

In FRC

- C++
- Java/Kotlin
- Python

In FTC

- Java/Kotlin



Basic Concepts

Variables

What are they?

- Are containers used to store information to be referenced and manipulated in a computer program.
- They allow you to store and manipulate data during program execution.
- When you declare a variable, you give it a name and assign a value to it.

What are their types

- Data types define the kind of data that a variable can hold. Different programming languages have various built-in data types.

```
Common Data Types

int number = 15;
double decimals = 15.5;
string text = "Hello World";
bool isTrue = true;
```

Operators

What are they?

Operators are essential symbols that perform operations on variables and values.

What types are there?

- **Arithmetic Operators**: Perform basic mathematical operations.
- Examples:
  - + (addition)
  - - (subtraction)
  - * (multiplication)
  - / (division)
  - % (modulo)

```
// Addition
int sum = 5 + 5; // C++ and Java
sum = 5 + 5 // Python

// Subtraction
int difference = 10 - 5; // C++ and Java
difference = 10 - 5 // Python

// Multiplication
int product = 5 * 5; // C++ and Java
product = 5 * 5 // Python

// Division
int quotient = 10 / 2; // C++ and Java
quotient = 10 / 2 // Python

// Modulus
int remainder = 10 % 3; // C++ and Java
remainder = 10 % 3 // Python
```

Operators

What types are there?

- **Comparison Operators:** Compare two values and return a Boolean result (True or False).

- Examples:
  - == (equal)
  - != (not equal)
  - < (less than)
  - > (greater than)
  - <= (less than or equal to)
  - >= (greater than or equal to)

```
// Equal to
bool isEqual = 5 == 5; // C++ and Java
isEqual = 5 == 5 // Python

// Not equal to
bool isNotEqual = 5 != 5; // C++ and Java
isNotEqual = 5 != 5 // Python

// Greater than
bool isGreaterThan = 5 > 5; // C++ and Java
isGreaterThan = 5 > 5 // Python

// Less than
bool isLessThan = 5 < 5; // C++ and Java
isLessThan = 5 < 5 // Python

// Greater than or equal to
bool isGreaterThanOrEqual = 5 >= 5; // C++ and Java
isGreaterThanOrEqual = 5 >= 5 // Python

// Less than or equal to
bool isLessThanOrEqual = 5 <= 5; // C++ and Java
isLessThanOrEqual = 5 <= 5 // Python
```

Operators

What types are there?

- **Logical Operators:** Combine multiple conditions and return a Boolean result. (True or False).
- Examples:
  - and (logical AND)
  - or (logical OR)
  - not (logical NOT)

- **Assignment Operators**: Assign a value to a variable.
- Examples:
  - = (simple assignment)
  - += (addition assignment)
  - -= (subtraction assignment)
  - *= (multiplication assignment)

```
// AND
bool andResult = condition && condition; // C++ and Java
andResult = condition and condition // Python

// OR
bool orResult = condition || condition; // C++ and Java
orResult = condition or condition // Python

// NOT
bool notResult = !condition; // C++ and Java
notResult = not condition // Python
```

```
// Assignment
x = 5; // C++, Java, and Python

// Addition assignment
x += 5; // C++, Java, and Python

// Subtraction assignment
x -= 5; // C++, Java, and Python

// Multiplication assignment
x *= 5; // C++, Java, and Python

// Division assignment
x /= 5; // C++, Java, and Python
```

Functions

What are they?

- Functions are reusable blocks of code that perform specific tasks.
- They allow you to break down complex logic into manageable pieces.
- Functions can take input (arguments) and can produce output (return values).

```
Example of function in C++
type nameOfFunction(input) {
    return output;
}

Example of function in Java
type nameOfFunction(input) {
    return output;
}

Example of function in Python
def nameOfFunction(input):
    return output
```

Control Flow

Loops

Loops repeat a block of code multiple times.

Common types:

- **for loop**: Iterates over a sequence (e.g., a list, range of numbers).
- **while loop**: Repeats as long as a condition is true.

```cpp
// For loop in C++
for (int i = 0; i < 10; i++) {
    // do something
}

// For loop in Java
for (int i = 0; i < 10; i++) {
    // do something
}

// For loop in Python
for i in range(10):
    // do something
```

```cpp
// While loop in C++
while (condition) {
    // do something
}

// While loop in Java
while (condition) {
    // do something
}

// While loop in Python
while condition:
    // do something
```

Control Flow

Conditional Statements

Conditional statements allow your program to make decisions based on conditions.

Common ones include:

- **if**: Executes a block of code if a condition is true.
- **else**: Executes a block of code if the condition is false.
- **else if** or **elif**: Allows checking multiple conditions.

```
// if statement
if (condition) { // C++ and Java
  // code to be executed if condition is true
}

if condition: // Python
  // code to be executed if condition is true
```

Control Flow

Conditional Statements

```
// if else statement
if (condition) { // C++ and Java
  // code to be executed if condition is true
} else {
  // code to be executed if condition is false
}

if condition: // Python
  // code to be executed if condition is true
else:
  // code to be executed if condition is false
```

```
// else if statement
if (condition1) { // C++ and Java
  // code to be executed if condition1 is true
} else if (condition2) {
  // code to be executed if condition2 is true
} else {
  // code to be executed if condition1 and condition2 are false
}

if condition1: // Python
  // code to be executed if condition1 is true
elif condition2:
  // code to be executed if condition2 is true
else:
  // code to be executed if condition1 and condition2 are false
```

Resources

What free resources are there for learning.

- Youtube
- Github (Read other peoples code)
- Hackerrank (For practice)
- W3 Schools (Basics on multiple topics)
- Etc...