



INSTITUTE OF
TECHNOLOGY
DEVELOPMENT
OF CANADA

Problem Solving & Analytical Thinking

ICR110

Pseudo-code concepts

- When humans communicate with computers, there are 5 basic concepts we have to understand to allow us to simplify this process:
- Variables
- Input/Output
- If Statements (CONDITION)
- While Loops
- For Loops

Variables

- What is a variable?
- A variable is the one of simplest ways to store data
- A variable has a name, data type and a value

Variables

- The anatomy of a variable:
- `MyVariable = 10002`
- On the left hand side we have the name (MyValue)
 - We can call a variable whatever we want (X, num, ToasterOven)
 - When naming things we generally want to use meaningful names that relate to data being stored
- On the right hand side we have the value (10002)
- When it comes to assigning variables the `=` is not saying that x is equal to 10002, you can think about it as saying it will become equal to, because it is assigning the value not checking the value.

Variables

- Data types at the simplest form can be broken into two categories:
 1. Numbers
 2. Characters
- Numbers include:
 - Integers, Double/Real, Booleans
- Characters include
 - Characters ('A', 'B', '@', '\$', '!', '~')
 - Strings ("Hello", "Joyful")
 - Strings are basically groups of Characters
- Some languages the type has to be defined (int MyVariable = 10002) (C, C++, C# and many others)
- Some languages you don't have to define the type (MyVariable = 10002) (JavaScript, Python, PHP, etc.)

Variables

- Exercise:
- $X = 10$
- $Y = 2$
- $Y + X = ?$

- Variables are, at the base level, stored in RAM.
- When I write $X = 10$, this is called assigning a variable and the X holds the address to where the 10 is stored in RAM (Different languages may manage memory differently)
- Every time the X gets used, the computer will check the address of X in RAM for the data.

Variables

Reassignment:

- Variables can have their values changed as well, this is called reassignment.

1) $Z = 10$

$Z = Z + 1$

What will Z be?

2) $N = 5$

$N = 6$

What is N

- In some languages, like python, reassignment can change where the data is stored in memory

Variables

- Variables don't have to be just numbers, they can also be characters, or strings (which are multiple characters combined)

X = Hello

Y = ,

Z = world

X + Y + Z would be "Hello, world"

Inputs and outputs

- As we know, computers take in inputs and send outputs. Inputs and outputs are generally to/from a user or another program
- When we are writing out algorithms we have a few different ways to represent this
- Inputs :
 - Read, Get, Input
- Outputs:
 - Print, Display, Write

Inputs and outputs

- When we take an input into a program, it most often gets stored into a variable

1) FirstName = Read user input 1
 LastName = Read user input 2
 Print "Hello, FirstName + LastName"

2) X = 26
 Y = 2
 Print X*Y

3) DataSet = read Excel Spread Sheet
 Print DataSet

- In 99% of the cases, the process of an algorithm is not straightforward.
- There is always some **condition** that determines a decision, some **repeated actions** that have to be repeated a certain amount of time or until a certain point.
- These conditions and *loops* (repeated actions) have **always** to be clarified because, while they might be obvious for us, for a computer **they are not**.
- **A computer has no idea what we are doing:** it just performs exceptionally well what we tell it to do.
- For these reasons, we always need to give the computer the option to perform in any case. For example, if it has to repeat an action, or for example, what it has to do if it find itself in front of a “crossroads”.

- These clarifications that we have to write are **essential tools** to make everything work properly and in the best way possible.
- In particular, the fundamental ones are:
- INPUT/OUTPUT
- VARIABLES
- IF STATEMENT (CONDITION)
- WHILE LOOP
- FOR LOOP

IF STATEMENT

- The concept of the **if statement** is simple: it creates a condition, and the computer has to run the program differently depending on this condition.
- If it's true, the code will run.
- If it's not true, the code will not run, or it will run something different.
- It's also called **if/else statement**.
- **IF** this condition is true, do this. **ELSE**, do this other.

IF STATEMENT

IF STATEMENT

If the elevator is working

- Take the elevator

Else

- Take the stairs

IF STATEMENT

IF STATEMENT

If the weather is rainy

- Take the umbrella

Else

- Leave the umbrella at home

LOOP

What is a loop?

LOOP

- A series of action that get continuously repeated and which can potentially go on forever.
- In programming, there is basically two types of loop
- **Condition based.**
- **Counter based.**

CONDITION BASED LOOP: WHILE STATEMENT

- As the name says, a condition based loop is a loop that gets performed until the condition is met.
- The condition is a **Boolean**: a particular kind of data that can be either **true** or **false** - nothing else.
- Once the condition is not satisfied anymore (for example, the boolean from *true* becomes *false*), the loop stops.
- The while statement is exactly the same thing as the **if statement**, but in loop.

CONDITION BASED LOOP: WHILE STATEMENT

IF STATEMENT

If the weather is rainy

- Take the umbrella

Else

- Leave the umbrella at home

WHILE STATEMENT

While the weather is rainy

- Stay at home

When it's not raining anymore, go out walking

COUNTER BASED LOOP: FOR STATEMENT

- On the other hand, the **for statement** uses a counter.
- There's actually a condition here too, but it's strictly related with the counter itself.

COUNTER BASED LOOP: FOR STATEMENT

- Try to write your name

```
var name = "Mickey";  
  
console.log(name);
```

- Now try to write it 10 times.
- *Now try to write it 1000 times.* Instead of repeating 1000 times the exactly same code, we can just simply **create a loop** that works until we reach the number 1000.

COUNTER BASED LOOP: FOR STATEMENT

```
var name = "Mickey";
```

```
for (var i=0; i < 1001; i++) {  
    console.log(name);  
}
```

HERE WE DECLARE THE COUNTER.
THIS PART GET RUN ONLY THE
FIRST TIME.

COUNTER CONDITION. UNTIL IT'S
SATISFIED, THE LOOP GOES ON.

HERE WE INCREASE THE COUNTER
EVERY TIME ADDING 1

COUNTER BASED LOOP: FOR STATEMENT

```
var name = "Mickey";  
  
for(var i=0; i < 1001; i++) {  
    console.log(name);  
}
```


FOR VS WHILE

FOR LOOP

Write your name 100 times.

WHILE LOOP

Write your name until 12.00 AM.

PSEUDOCODE

What is pseudocode?

- Pseudocode is an easy way to write an algorithm.
- **Pseudocode is not a programming language**, but it's a simple informal way to structure an algorithm.
- Pseudocode **describe** the operating principles of an algorithm.
- **There's no syntax rules in it.**
- With pseudocode you basically use the tools of programming languages to design an algorithm, without really writing code.

PSEUDOCODE

What is pseudocode?

- Pseudocode is made by two words: *Pseudo* and *code*.
- *Pseudo* means **imitation**, because it imitates the code.
- *Code* because it uses the same tools of a programming language (If, while, for, etc.).
- The purpose of pseudocode is to help programmers to **think** and **draft** the program.
- Sometimes it's also used with **diagrams**.

PSEUDOCODE

THIS WHITE SPACE IS CALLED
INDENTATION. IT'S ESSENTIAL TO
UNDERSTAND THE THINGS THAT
DEPENDS ON SOMETHING ELSE.

What is pseudocode?

student's grade;

If student's grade is greater than or equal to 60



- Print "passed"

else

- Print "failed"

PSEUDOCODE

What is pseudocode?

```
class average;
```

```
total = 0;
```

```
grade counter = 1;
```

While grade counter is equal or less than 10

- Input the next grade
- Add the grade into the total

Set class average to total divided by 10

Print class average

PSEUDOCODE

What is pseudocode?

```
class average;
```

```
total = 0;
```

```
grade counter = 1;
```

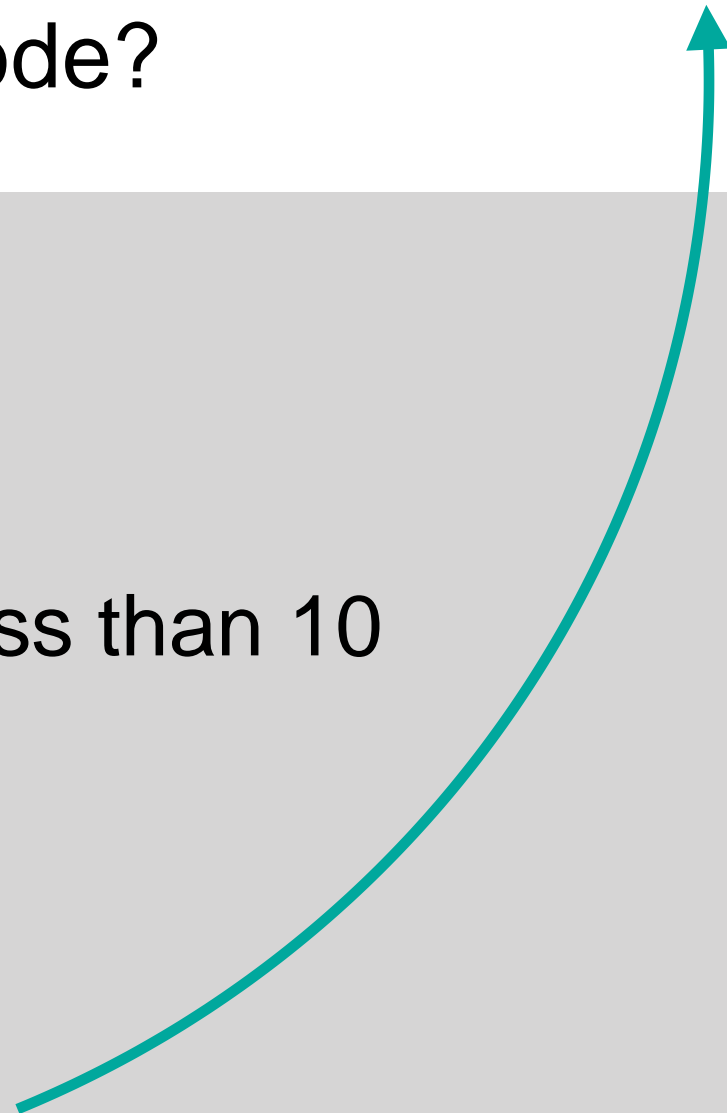
While grade counter is equal or less than 10

- Input the next grade
- Add the grade into the total
- **Increase the grade counter by 1**

Set class average to total divided by 10

Print class average

IF WE DON'T SPECIFY TO INCREASE THE
COUNTER, THE ALGORITHM GOES ON
FOREVER.



PSEUDOCODE

What is pseudocode?

```
class average;
```

```
total = 0;
```

```
grade counter = 1;
```

While grade counter \leq 10

- Input the next grade
- total = total + grade;
- grade counter++ (grade counter += 1)

Class average = total / 10

Print class average

PSEUDOCODE

HOW DO YOU COME TO SCHOOL?

- Exit the house and go to the bus stop.
- Wait for bus 23.
- Once the bus has arrived, take the bus.
- Once it reaches Yaletown Roundhouse, get off the bus and go to the skytrain station and wait for the skytrain for Waterfront.
- Once the skytrain has arrived, take the skytrain.
- When the skytrain makes 2 stops (Waterfront), get off the skytrain.
- Exit the skytrain station and, if the school is open, enter the school.

PSEUDOCODE

HOW DO YOU COME TO SCHOOL?

Exit the house and go to the bus stop.

While the bus is not coming or if the upcoming bus is not the 23

- Wait for the bus

Take the bus

While the bus stop is not Yaletown Roundhouse yet

- Stay on the bus

Exit the bus and enter the Skytrain station

If the upcoming Skytrains are not for waterfront

- Wait for the skytrain

Take the skytrain

Until the skytrain has still to do 2 stops

- Stay on the skytrain

Exit the skytrain and exit the skytrain station too

If the school is open

- Enter the school

Else

- Go back home

PSEUDOCODE

HOW DO YOU COME TO SCHOOL?

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While the bus is not coming or if the upcoming bus is not the 23

- Wait for the bus

Take the bus

While the bus stop is not Yaletown Roundhouse yet

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Exit the bus and enter the Skytrain station

If the upcoming Skytrains are not for waterfront

- Wait for the skytrain

Take the skytrain

Until the skytrain has still to do 2 stops

- Stay on the skytrain

Exit the skytrain and exit the skytrain station too

If the school is open

- Enter the school

Else

- Go back home

WHILE LOOP

WHILE LOOP

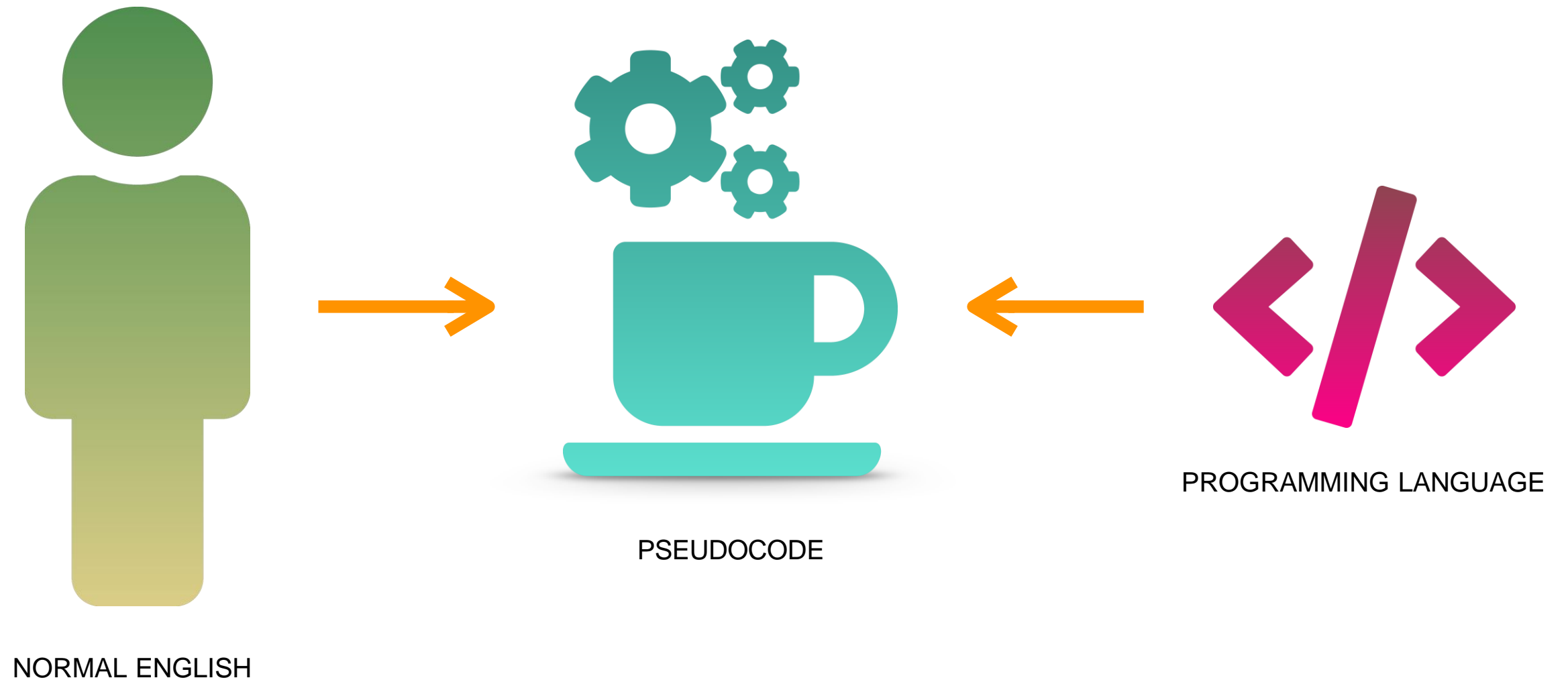
WHILE LOOP

FOR LOOP

IF/ELSE

PSEUDOCODE

What is pseudocode?



PSEUDOCODE

PSEUDOCODE QUIZ

- **What should I do if I want to sum all numbers from 0 to 100 included?**
- Find a solution using pseudocode and, if needed, the *if, for, while*, statements.

Quizzes solutions

IF STATEMENT

1. Start from number 3.
2. If the number is divisible by 3 or by 5 add the number to the sum.
3. If the number is greater than 1000 print sum and stop.
If not, increase the number by 1 and go to the next step.
4. Go to step 2.

PSEUDOCODE QUIZ

Set the number equal to 0 and an empty variable sum.

If the number is below or equal to 100

 number = number + 1

 sum = sum + number

If it's more than 100

 print sum

PSEUDOCODE QUIZ

```
var i;  
var sum= 0;  
for(i=0 ; i<=100; i+=1) {  
  sum = sum + i;  
}  
console.log("added numbers from 1 to 100 is: " + sum);
```


Javascript pseudocodes

IF STATEMENT

- If we list all the natural numbers below 10 that are multiples of 3 or 5, we get 3, 5, 6 and 9. The sum of these multiples is 23.
- **What should I do if I want to find all these multiples below 1000?**

The following slides contain Javascript pseudocodes which look much more similar to real code. They have been created using the previous examples made during this presentation.

IF STATEMENT

IF STATEMENT

If the elevator is working

- Take the elevator

Else

- Take the stairs

```
if (elevator) {  
    takeTheElevator ();  
} else {  
    takeTheStairs ();  
}
```

IF STATEMENT

IF STATEMENT

If the weather is rainy

- Take the umbrella

Else

- Leave the umbrella at home

```
if (weather == "rainy") {  
    takeTheUmbrella ();  
} else {  
    leaveTheUmbrellaAtHome ();  
}
```

CONDITION BASED LOOP: WHILE STATEMENT

WHILE STATEMENT

While the weather is rainy

- Stay at home

When it's not raining anymore, go out walking

WHILE STATEMENT

```
while (weather == "rainy") {  
    stayAtHome ();  
}  
  
goOutWalking ();
```

PSEUDOCODE

HOW DO YOU COME TO SCHOOL?

```
var mattia;

mattia.exitTheHouse();
mattia.goToBusStop();

while(upcomingBus != 23){
    mattia.waitTheBus();
}

mattia.takeTheBus();

while(busStop != "Yaletown Roundhouse"){
    mattia.stayOnTheBus();
}

mattia.exitTheBus();
mattia.enterSkyTrainStation();

while (skytrain.direction() != "Waterfront"){
    mattia.waitForSkytrain();
}

mattia.takeTheSkytrain();

for(var number_of_stops = 0; number_of_stops < 3; number_of_stops++){
    mattia.stayOnTheSkytrain();
}

mattia.exitSkytrainStation();

if (It'dCanada == "open"){
    mattia.enterTheSchool();
} else {
    mattia.goBackHome();
}
```

Thank You,