

# Computer Science



*Written by André Lessa*

# About this book

Hi,

MY NAME IS ANDRÉ LESSA. I HAVE BEEN STUDYING COMPUTERS SINCE I WAS 11 YEARS OLD. TODAY, MY SON, JP, IS 9 YEARS OLD, AND IT IS HIS TURN TO LEARN. HE IS ALSO HELPING ME WITH THIS BOOK! THANKS JP!



BY READING THIS BOOK AND SOLVING THE PUZZLES THAT YOU WILL FIND ON SOME OF THE PAGES, I HOPE YOU WILL LEARN MORE ABOUT HOW COMPUTERS REALLY WORK.

HAVE FUN!

ANDRÉ LESSA  
PITTSBURGH, PENNSYLVANIA, USA

COMPUTER SCIENCE FOR KIDS  
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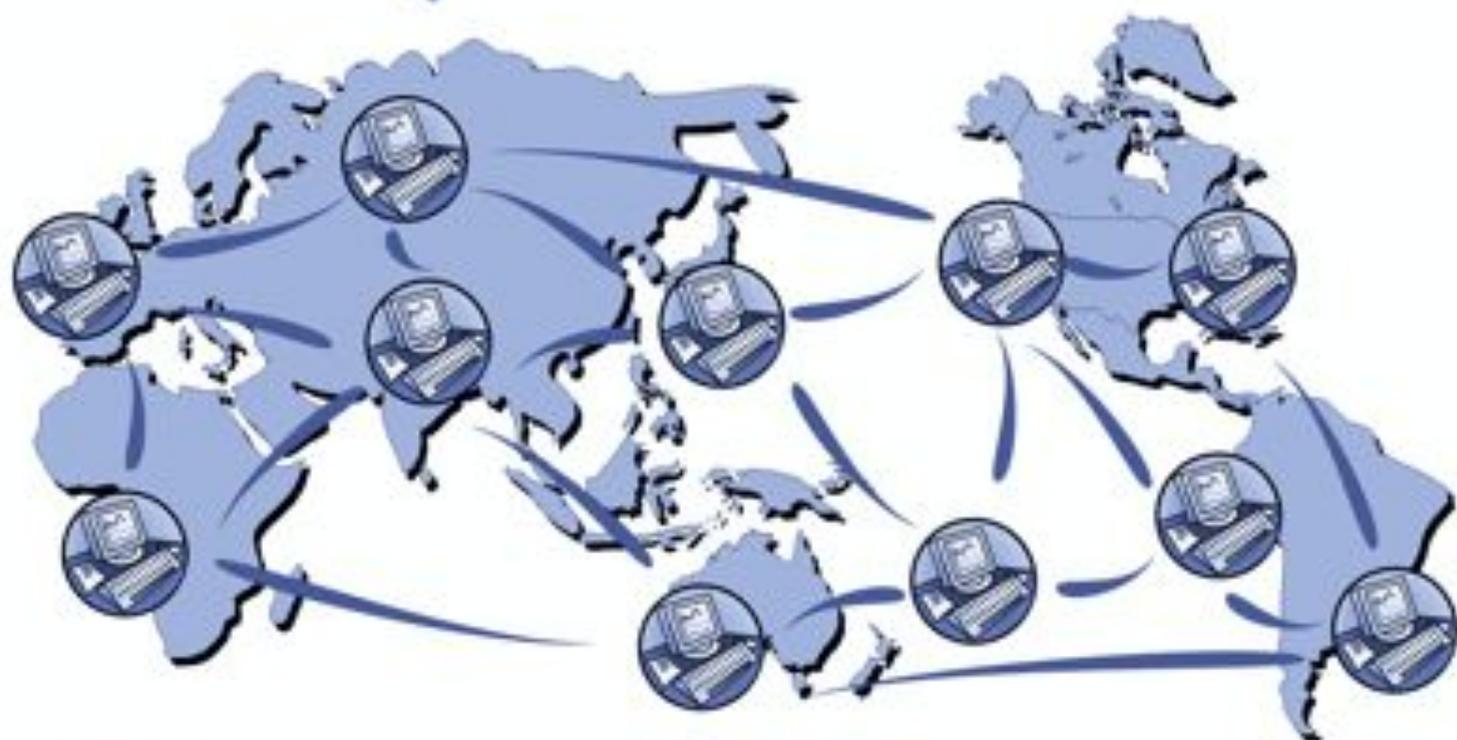


EVERY WHERE YOU SEE THIS MAN EXERCISING YOU WILL FIND A PUZZLE MADE JUST FOR YOU.

# Internet



THE WORLD HAS BILLIONS OF COMPUTERS AND THEY ARE LOCATED EVERYWHERE. WITH THE INTERNET, COMPUTERS CAN SEND MESSAGES TO EACH OTHER.



Wow !!!! THE INTERNET LOOKS LIKE A SPIDER WEB!!

[www.cartoonnetwork.com](http://www.cartoonnetwork.com),  
[www.nickjr.com](http://www.nickjr.com), and  
[www.disneychannel.com](http://www.disneychannel.com) ARE  
SOME EXAMPLES OF  
COMPUTER ADDRESSES. THEY  
ARE CALLED WEB SITES.



Web site is a PLACE ON THE WEB  
WHERE YOU CAN GO USING YOUR  
COMPUTER.

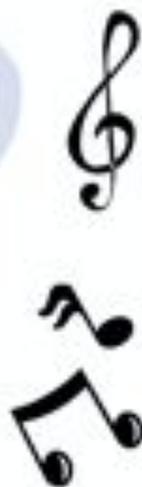
# A Computer System



COMPUTER TOWER  
(THIS IS THE ACTUAL COMPUTER)



SPEAKERS



MONITOR  
(THE DISPLAY)



KEYBOARD

MOUSE



MICROPHONE



MODEM  
(THE CONNECTION TO THE INTERNET)



PRINTER

# Inside the computer



COMPUTER TOWER

Inside the TOWER



CD/DVD DRIVE

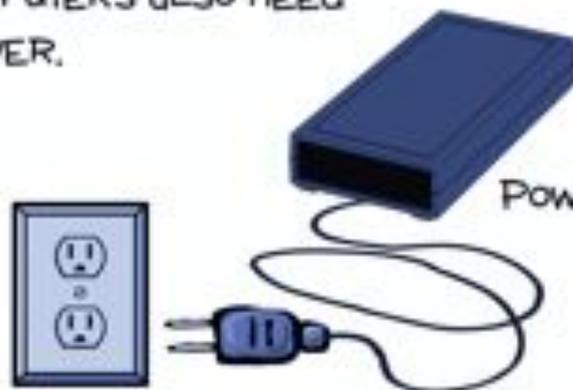
THIS IS WHERE WE PUT THE CDs and DVDs.



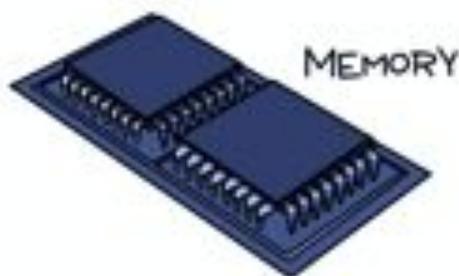
Just Like EVERYTHING ELSE in YOUR HOUSE, COMPUTERS ALSO NEED POWER.



THE MOTHERBOARD IS WHERE THE CPU LIVES. CPU IS HOW WE CALL THE BRAIN OF THE COMPUTER.



POWER SUPPLY



MEMORY

THE CPU IS VERY SMART BUT IT ONLY KNOWS ABOUT 0 AND 1  
1 MEANS "YES, THERE IS POWER"  
0 MEANS "NO, NO POWER"

# Zeros and Ones

LET'S PRETEND WE ARE A CPU!!!

THE CPU ONLY KNOWS ABOUT 0 AND 1. IT CALLS THEM BITS.

GROUPS OF BITS MEAN DIFFERENT THINGS ... CHECK THE EXAMPLES BELOW!  
EACH GROUP ON THE LEFT CORRESPONDS TO A DIFFERENT NUMBER.

0	0	0	0	----->	0
0	0	0	1	----->	1
0	0	1	0	----->	2
0	0	1	1	----->	3
0	1	0	0	----->	4
0	1	0	1	----->	5
0	1	1	0	----->	6
0	1	1	1	----->	7
1	0	0	0	----->	8

This bit is  
worth 8

This bit is  
worth 2



This bit is  
worth 4

This bit is  
worth 1

HERE'S HOW WE READ THE GROUP OF BITS ABOVE.

$$0 + 4 + 0 + 1 = 5$$

Can you tell what number the CPU thinks  
the bits below correspond to ???

**1 0 0 1**

- A  5  
B  8  
C  9

5

# Hardware and Software

What is different between



and a



???

That's right! One is HARD and the other one is SOFT.

In the COMPUTER WORLD, things you can touch are usually called HARDWARE. Things you cannot touch are usually called SOFTWARE.

Look at the game on the monitor's SCREEN!



THE MONITOR is a HARDWARE.  
What about the game?

WE know it is THERE but we can't REALLY touch it. THE game is a SOFTWARE.

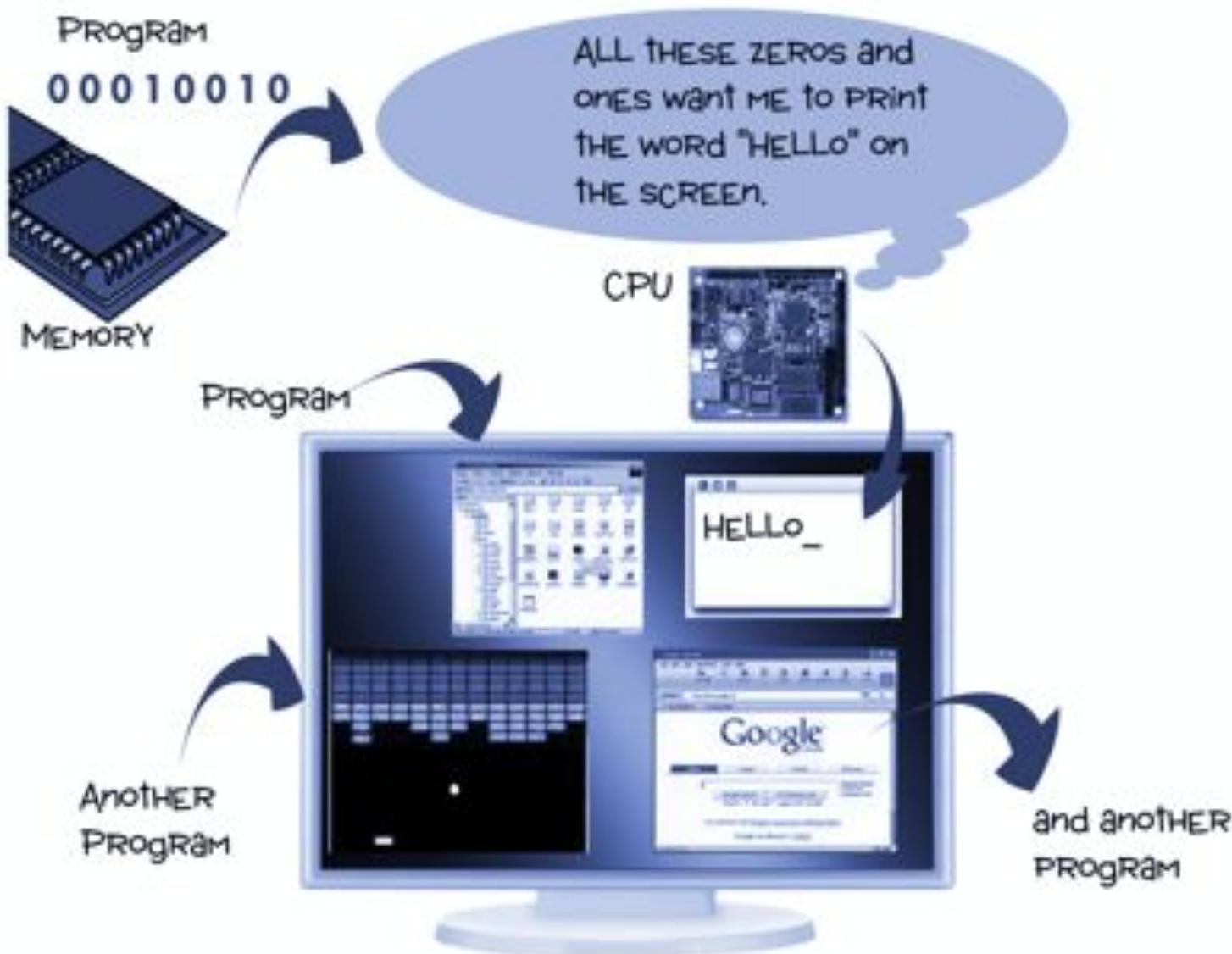
Can you tell what is HARDWARE and what is SOFTWARE?

MONITOR  
GAME  
PRINTER  
WEBSITE  
SPEAKERS

SOFTWARE

HARDWARE

# Programs



Just Like PEOPLE FOLLOW RECIPES to make FOOD taste the same, a CPU USES PROGRAMS to know what it NEEDS to do.

When You go to a web site, You use a PROGRAM CALLED WEB BROWSER.

When You want to HAVE Fun You PLAY a GAME PROGRAM.

That's it! SOFTWARE PROGRAMS ARE JUST LIKE RECIPES!

# Data and Information

3 APPLES  
5 COOKIES  
2 SOAP BARS

MOM BOUGHT 3 APPLES, 5  
COOKIES, AND 2 SOAP BARS  
AT THE GROCERY.

THIS SENTENCE DOES  
NOT MAKE ANY SENSE!!!

IT'S JUST A BUNCH OF  
WORDS.

WE CALL THIS DATA.

THIS SENTENCE MAKES  
SENSE!!!



WE CALL THIS INFORMATION.

Can you tell which one is  
information???

- A  BLUE, YELLOW, RED
- B  THE BIKE IS WHITE.
- C  CARS, GREEN, PEOPLE

# Be a computer!

EVERYTHING THAT RUNS ON A COMPUTER IS SOME TYPE OF PROGRAM.

THE MASTER OF ALL PROGRAMS IS A SUPER PROGRAM CALLED OPERATING SYSTEM. EVERY COMPUTER NEEDS AN OPERATING SYSTEM. WITHOUT THAT, THE OTHER PROGRAMS DON'T KNOW WHAT TO DO.

BUT HOW DO PEOPLE WRITE PROGRAMS? HOW CAN SOMEONE WRITE A WEB SITE OR A GAME?

PROGRAMS ARE LIKE RECIPES \_ THINK ABOUT THE STEPS YOU FOLLOW WHEN YOU ARE THIRSTY AT YOUR HOUSE.

GO TO THE KITCHEN

GET A BOTTLE OF WATER

IF THE BOTTLE IS EMPTY

GET A GROWN-UP

IF THE BOTTLE IS NOT EMPTY

POUR WATER IN A CUP

AND DRINK A SIP

WHILE YOU ARE STILL THIRSTY

DRINK ANOTHER SIP OF WATER

PUT THE BOTTLE BACK AND

EXIT THE KITCHEN

IF YOU WERE A CPU, THIS WOULD BE THE PROGRAM YOU WOULD USE TO DRINK WATER!!



# Languages

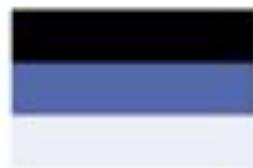
THE PROGRAM WE WROTE FOR THE WATER WAS WRITTEN IN ENGLISH.

COMPUTERS UNDERSTAND A LITTLE BIT OF ENGLISH.

BUT COMPUTERS NEED PEOPLE TO WRITE PROGRAMS IN SPECIAL LANGUAGES.

THOSE LANGUAGES ARE CALLED PROGRAMMING LANGUAGES.

PEOPLE USE LANGUAGES LIKE ENGLISH, GERMAN AND JAPANESE.



COMPUTERS USE LANGUAGES LIKE PYTHON, JAVA, AND RUBY.



In this book, you will learn a little bit about Python!!!!

# Code Blocks

THE VERY FIRST RULE TO REMEMBER IS THAT IT IS EASIER TO READ YOUR PROGRAM'S CODE IF YOU IMAGINE EACH INSTRUCTION AS A BLOCK.

A CODE BLOCK USUALLY STARTS ALL THE WAY TO THE LEFT, HOWEVER, THE BLOCKS BELOW IT CAN SOMETIMES SHIFT TO THE RIGHT.

```
APPLES = 1
ORANGES = 2
IF APPLES = 1
    PRINT "ONE APPLE"
IF ORANGES = "2"
    PRINT "TWO ORANGES"
EXIT
```



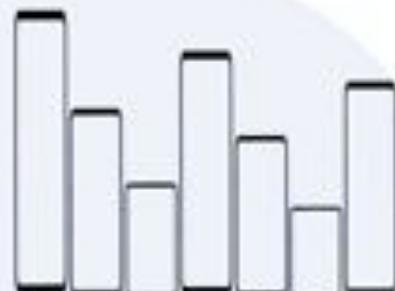
WHICH PROGRAM DO YOU THINK IS CORRECT AND FOLLOWS THE RULES?



A



B



C

# Catching Errors

PROGRAMS ARE WRITTEN BY PEOPLE and PEOPLE MAKE MISTAKES so it is ok to FIND ERRORS in PROGRAMS EVERY now and THEN.

WHEN SOMETHING GOES WRONG in a COMPUTER, WE USUALLY SAY it's a bug.



PROGRAMS DO EXACTLY WHAT WE EXPECT UNLESS a bug SHOWS UP.

TO CATCH ERRORS and HANDLE THE bugs, YOU CAN TELL THE COMPUTER WHAT TO DO WHEN SOMETHING DOES NOT GO AS EXPECTED.



TRY:

```
A = 5 / 0  
PRINT A
```

EXCEPT:

```
PRINT "SORRY! You cannot divide a number by ZERO."
```

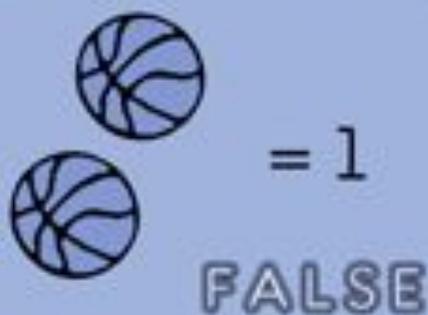
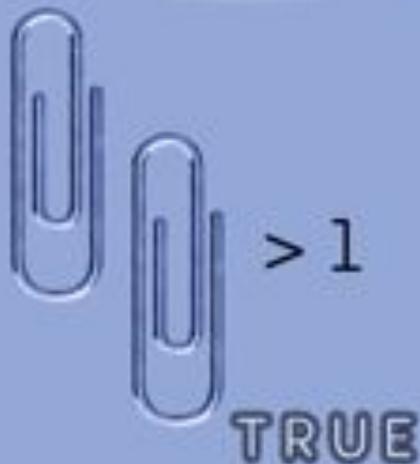
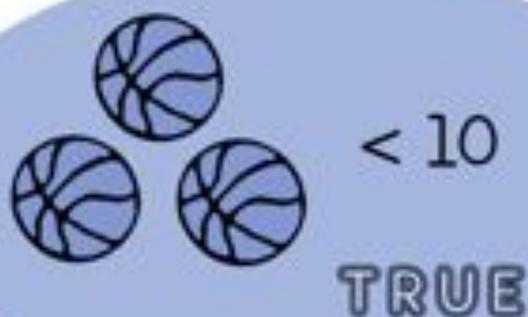
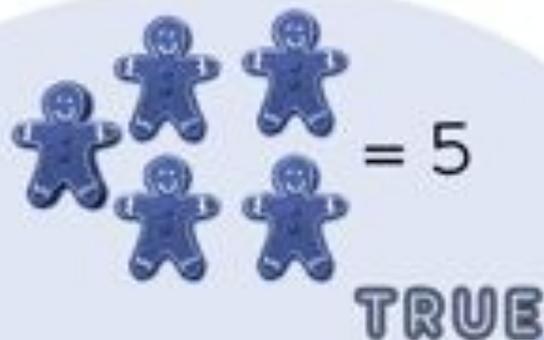
WHAT MESSAGE DO YOU THINK THE COMPUTER WILL PRINT?

- A  0
- B  5
- C  SORRY! You cannot divide a number by ZERO.

# Math Review

BEFORE WE MOVE FORWARD, LET'S MAKE SURE YOU REMEMBER YOUR MATH CLASSES FROM SCHOOL.

LOOK AT THE EXAMPLES BELOW AND MAKE SURE YOU REMEMBER WHAT THE =, < and > SIGNS MEAN.



# Conditions

Many times your parents will look at you and say something like...

"If the TV Channel 39 is on, do not touch the TV."

"While it is raining outside, DO your homework."

"For each time you do your chores right, you will get one dollar."

There is always a condition for this, a condition for that .... In order to teach computers, programs need to use conditions too.



```
A = 1
B = 2
IF A < B:
    PRINT "10"
ELSE
    PRINT "5"
```

HERE'S what this code is doing ...

IF A is LESS than B, I want you to PRINT 10. OTHERWISE, I want you to PRINT 5.

GET it?

What number do you think the computer will print ?

- A  10  
B  5  
C  2

# Variables

What is a variable?

TOYS = 2



This is a variable.

Variable is like a nickname  
FOR things that I want to  
REMEMBER.

CARS = 5



CARS is another variable.



Look at THESE variables:

APPLES = 2

TABLES = 7

BANANAS = 5

GRAPES = 6

what variable  
Equals FIVE ?

- A  ORANGES
- B  BANANAS
- C  APPLES

# Strings

Strings ARE HOW COMPUTERS CALL WORDS. THEY ARE usually surrounded by " "

```
MESSAGE = "HELLO WORLD"
```

THESE ARE CALLED QUOTES.

This is a string

COMPUTERS COUNT LETTERS in a string starting WITH THE NUMBER ZERO.

```
H E L L O   W O R L D
0 1 2 3 4 5 6 7 8 9 10
```

LET'S SPLIT THE string:

```
A = "HELLO WORLD"
PRINT A [6:10]
```

```
WORLD
```

This will print LETTERS 6 to 10.

LET'S COMBINE SOME strings:

```
A = "Hello" + " " + "World"
PRINT A
```

```
Hello World
```

# Printing

WHenever you want the computer to show something on the screen, you need to use a command called PRINT.

PRINT makes the computer write on the screen.

```
PRINT "Hello World"
```

THE command above will print the words "HELLO WORLD" on the screen.

And the command below will print "APPLE" on the screen.

```
FRUIT = "APPLE."  
PRINT FRUIT
```

Look how cool! You can ask the computer to print anything you want!!!



# IF ...

Do you REMEMBER this sentence ?

"IF THE TV Channel 39 is on, do not touch the TV."



COMPUTERS might not understand a sentence like that, but look at the program below.

```
CHANNEL = 39
IF CHANNEL = 39:
    PRINT "DO NOT TOUCH THE TV"
ELSE:
    PRINT "OK, YOU CAN CHANGE THE CHANNEL"
```

You can use the command IF to test if a variable matches the condition you are looking for.

```
IF 3 > 2:
    PRINT "CORRECT, 3 is greater than 2"
```

```
IF 5 < 10:
    PRINT "TRUE, 5 is less than 10"
```



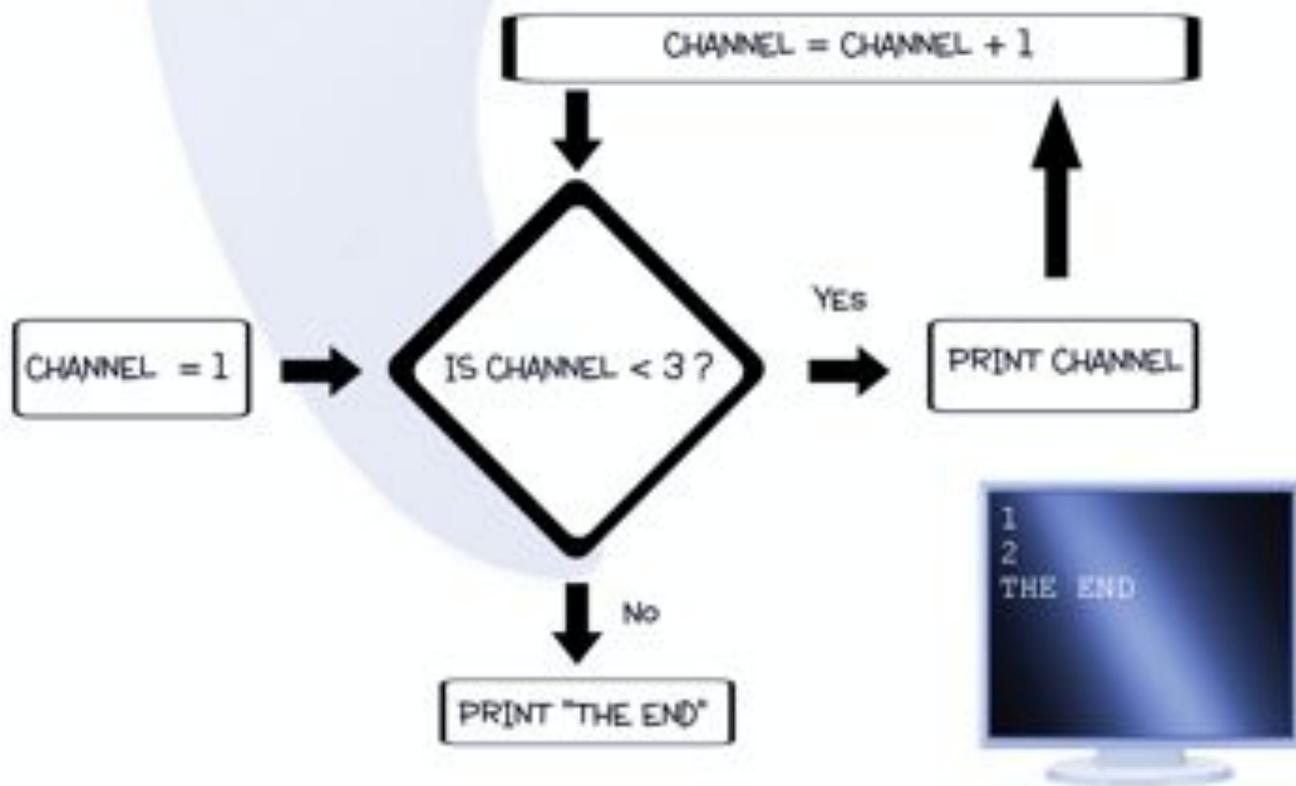
# WHILE ...

WHILE is another command you can use when writing a program. It works like this ...

WHILE MY CONDITION IS TRUE:  
DO WHAT I SAY

CHECK THIS OUT!

```
CHANNEL = 1  
WHILE CHANNEL < 3:  
    PRINT CHANNEL  
    CHANNEL = CHANNEL + 1  
PRINT "THE END"
```



# FOR ...

We use the command FOR to ask the computer to walk through a List of things.

So, if we want the computer to look at a List of things and print each one of them on the screen, we can do this ...

```
FOR NUMBER in [2, 8, 10, 5, 7]:  
    PRINT NUMBER
```

... and guess what will show up on the screen!!!



Now, if I have this command:

```
FOR NUMBER in [1, 2, 3]:  
    PRINT NUMBER  
PRINT "END"
```

Can you TELL THE LAST thing that will be printed on the screen?

- A  NUMBER
- B  3
- C  END



# Files

IF YOU ARE WORKING ON SOMETHING IMPORTANT, LIKE YOUR HOMEWORK, REMEMBER TO SAVE YOUR WORK IN A FILE.



FILES and FOLDERS can be stored inside the COMPUTER'S HARD disk OR outside, like in a CD.

FILES ARE SAVED IN FOLDERS.



SOME PEOPLE USE THE WORD "DIRECTORY" INSTEAD OF FOLDER.



**MALL**

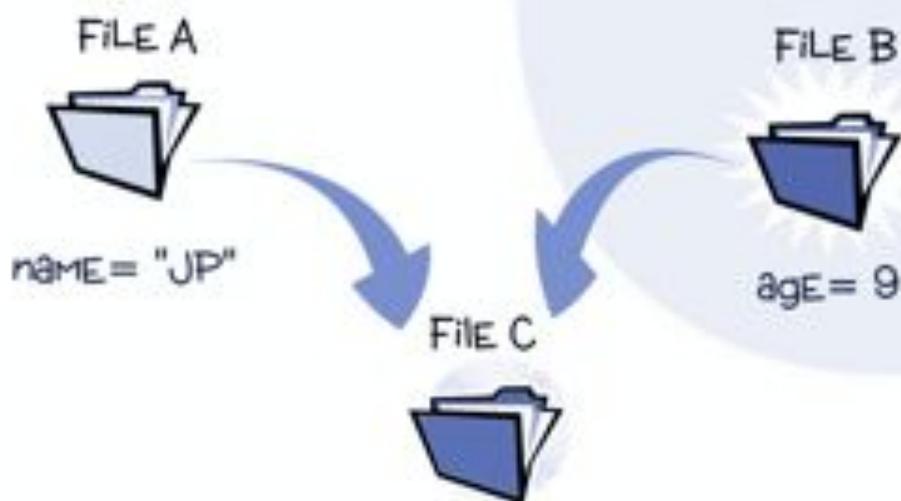
JUST LIKE THE MALL HAS A DIRECTORY TO SHOW YOU WHERE THE STORES ARE LOCATED, COMPUTER DIRECTORIES TELL YOU WHERE YOUR FILES ARE.

BY SAVING YOUR WORK, YOU MAKE SURE YOU DO NOT HAVE TO KEEP STARTING THE SAME THING OVER AND OVER AGAIN. WHEN YOU'RE READY TO CONTINUE WORKING, JUST OPEN YOUR SAVED FILE.

# Modules

A module is how you call a file that you are combining with a new file

In this example, FILE A and FILE B are modules that FILE C is using.



```
IMPORT FILEA  
IMPORT FILEB
```

```
PRINT name  
PRINT "is"  
PRINT age
```

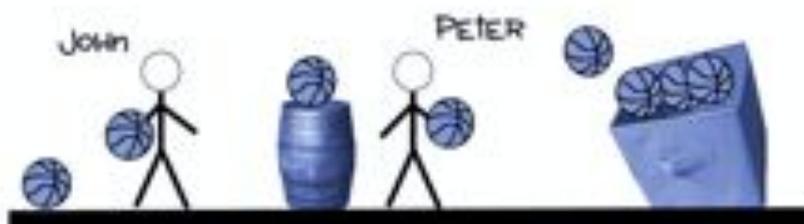


TO REUSE CODE FROM EXISTING FILES, YOU NEED TO IMPORT THOSE FILES.

BY adding one program to another, you don't have to type everything over again.

# Stacks and Lists

Last In - First Out (OR, LIFO)



JOHN KEEPS putting balls inside the barrel, but the Last ball HE puts in, is always the FIRST one PETER takes out of there. JOHN is stacking the balls and the Last one in, is the FIRST one out.

First In - First Out (OR, FIFO)



Look at JOHN tossing the balls down the ramp... THE FIRST one HE tosses down is the FIRST one PETER takes OFF the ramp and into his box. It's just like a LINE of PEOPLE waiting FOR something, but instead of calling it a LINE, COMPUTERS call it a List.

# Dictionaries

DICTIONARIES HELP PEOPLE GIVE MEANING TO THINGS. WE USE DICTIONARIES WHEN WE NEED TO LOOK UP THE MEANING OF WORDS.

What about COMPUTERS?

LET'S CREATE A DICTIONARY THAT OUR PROGRAMS CAN USE!  
OUR NEW DICTIONARY WILL BE CALLED "thing"!

```
thing["Dog"] = "animal"  
thing["apple"] = "FRUIT"  
thing["cat"] = "animal"  
thing["orange"] = "FRUIT"
```

```
Print "APPLE is a ..."  
Print thing["apple"]
```



Now, what if we were to say ...

```
Print "Cat is a ..."  
Print thing["cat"]
```

... what do you think THE COMPUTER would print?

- A  Cat
- B  FRUIT
- C  animal

# Functions

```
AGE = [7, 8, 9, 10]  
PRINT "THE oldest kid is " + MAX(AGE)
```

MAX() is a Function!

AGE is a PARAMETER.  
PARAMETERS HAVE  
PARENTHESIS AROUND  
THEM.

MAX() is a Function that TELLS us THE maximum  
NUMBER in a GROUP OF NUMBERS.

MIN() is ANOTHER Function!  
What do you think it does?

That's Right! it TELLS us WHAT  
THE SMALLEST number is!



LET'S DEFINE a Function that adds 5 to any number  
and RETURNS THE new number to us:

```
DEF ADDFIVE(number):  
    RETURN 5+number
```

```
C = ADDFIVE(2)  
C = 7
```

```
E = ADDFIVE(4)  
E = 9
```

```
X = ADDFIVE(10)  
X = 15
```

Now, can you GUESS what number will be RETURNED BY THE FOLLOWING  
Function call?

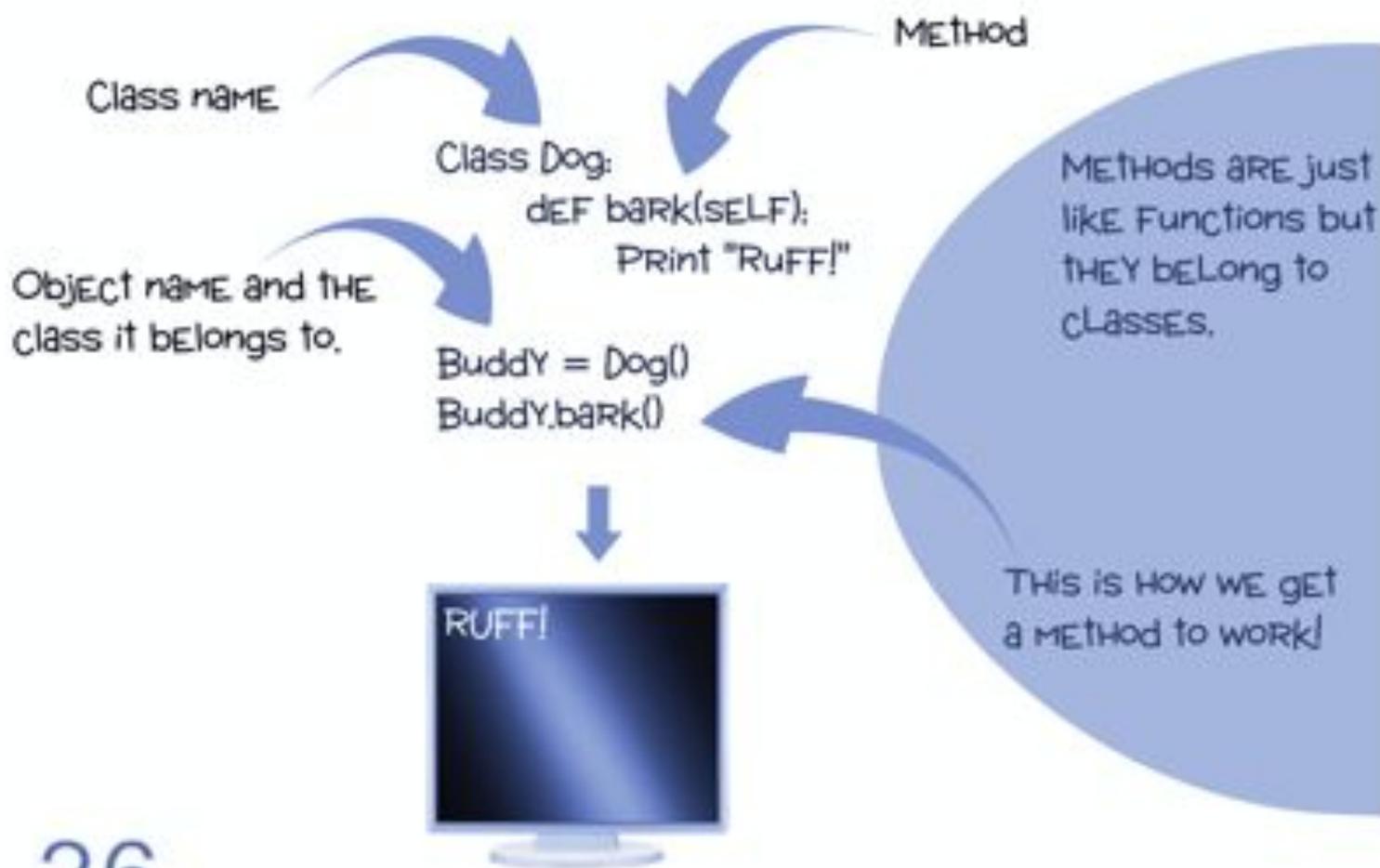
```
G = ADDFIVE(7)
```

- A  12
- B  2
- C  8

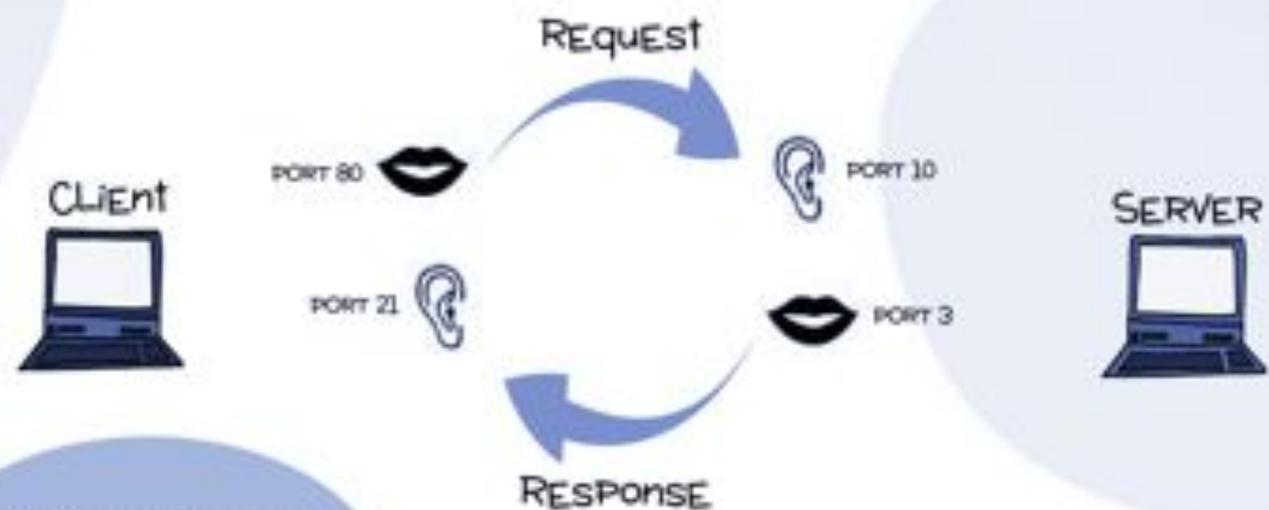
# Classes and Objects

A CLASS is HOW WE CALL a GROUP OF objects THAT BELONG (OR go WELL) TOGETHER.

FOR EXAMPLE, IF WE WERE TO CREATE a CLASS CALLED Dog, WE COULD HAVE objects CALLED Buddy, Rusty, and Bingo.



# Networks



NETWORKS ARE  
GROUPS OF  
COMPUTERS.

CLIENTS ARE THE  
ONES THAT START  
THE CONVERSATION.

COMPUTERS HAVE A  
LOT OF EARS AND  
MOUTHS AND THEY  
ARE CALLED  
PORTS.

SERVERS AND  
CLIENTS ARE JUST  
COMPUTERS.

EVERY COMPUTER PORT  
IS RECOGNIZED BY A  
DIFFERENT NUMBER.

Can you tell which sentence is true?

- A  SERVER SENDS REQUEST AND CLIENT SENDS RESPONSE
- B  CLIENT SENDS REQUEST AND SERVER SENDS RESPONSE
- C  SERVER SENDS REQUEST AND SERVER SENDS RESPONSE

# Compression

SOMETIMES WHEN A PROGRAM OR A FILE IS WAY TOO BIG, WE NEED TO COMPRESS IT TO SAVE SOME SPACE INSIDE THE COMPUTER.

LET'S SQUEEZE - I MEAN - COMPRESS SOME DATA TO SEE HOW IT WORKS!

1 1 1 1 1 1 1 1 1 1 1 1

1 2 x 1

ABOVE WE HAVE 12 bits!

HERE WE ONLY NEED 4 bits

AND THEY BOTH REPRESENT THE SAME THING!

THE OPPOSITE OF COMPRESS IS UNCOMPRESS.  
CAN YOU UNCOMPRESS THIS?

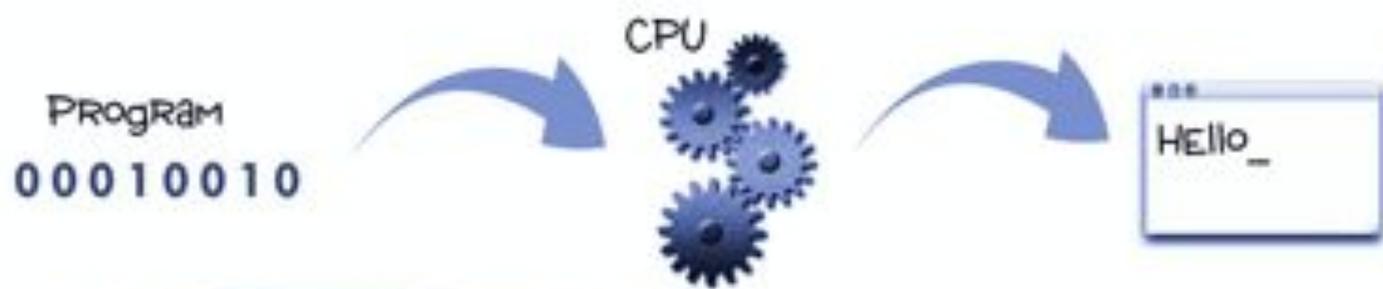
0 5 x 1

A  6 6 6 6 6

B  1 1 1 1 1

C  1 1 1 1 1 1 1 1 1 1

# Running Programs



THE CPU HAS TO HANDLE MANY TASKS.

READ THIS, WRITE THAT, COPY THIS, DISPLAY THAT, AND ALL AT THE SAME TIME.

Doing a lot of tasks at THE SAME TIME is called multi-tasking.

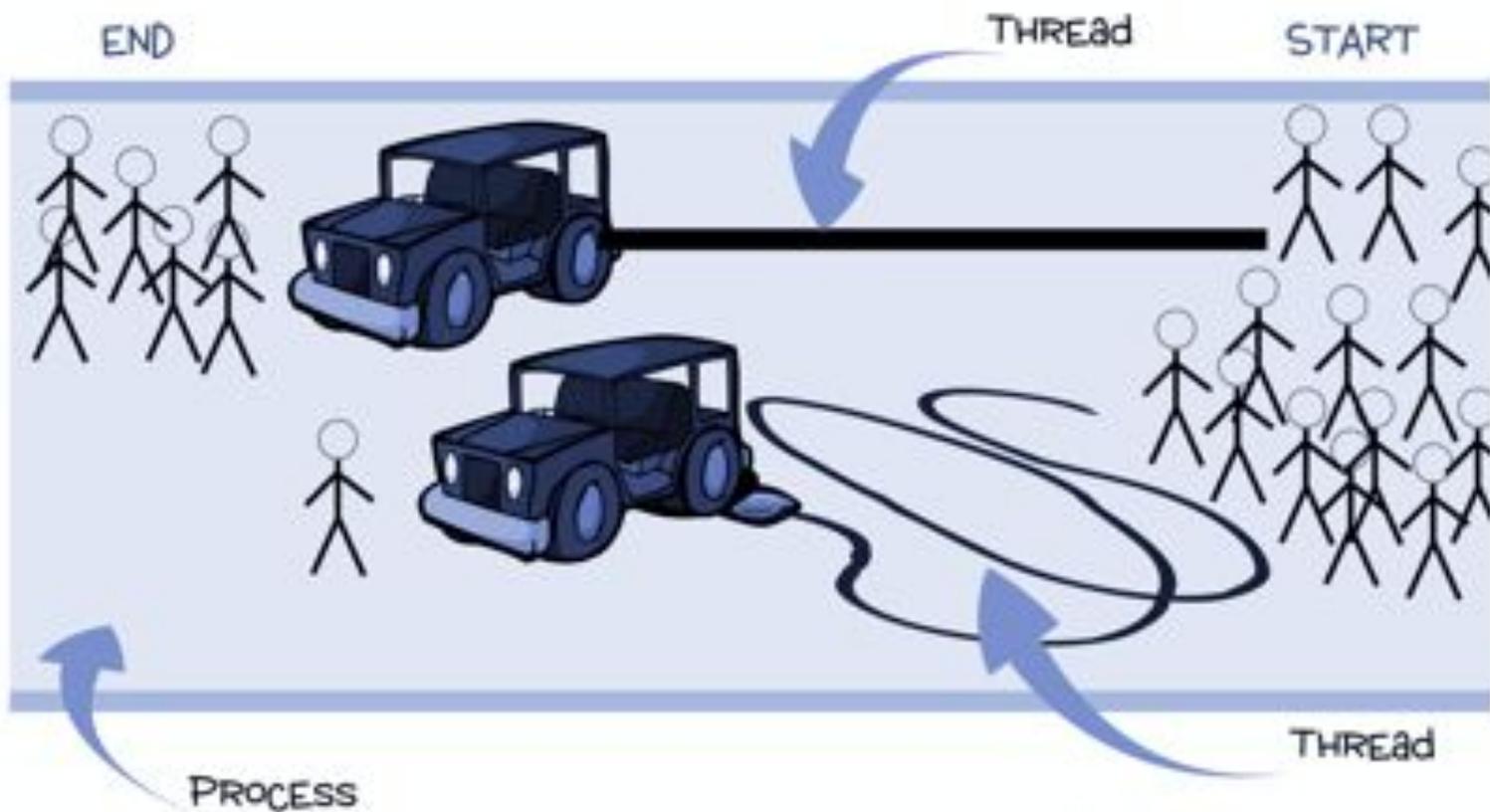
THE CPU KEEPS TRACK OF ALL THE TASKS BY GROUPING THEM INTO PROCESSES.

EACH PROCESS RUNS INSIDE THE CPU JUST FOR A LITTLE BIT OF TIME BUT EVERYTHING HAPPENS SO FAST THAT IT LOOKS LIKE THEY'RE ALL RUNNING AT THE SAME TIME!

CPUS CAN RUN LOTS OF PROCESSES AT THE SAME TIME.



# Threads



IF A CPU WERE A CITY AND ITS STREETS WERE CALLED PROCESSES, THE CARS WOULD BE THE PROCESS THREADS AND THE PEOPLE WOULD BE THE DATA TRAVELING BACK AND FORTH! SOME THREADS ARE FASTER THAN OTHERS.



IF A COMPUTER HAS 2 CPUs AND EACH CPU HAS 3 PROCESSES AND EACH PROCESS IS RUNNING 2 THREADS, HOW MANY THREADS IS THE COMPUTER RUNNING AT THE SAME TIME?

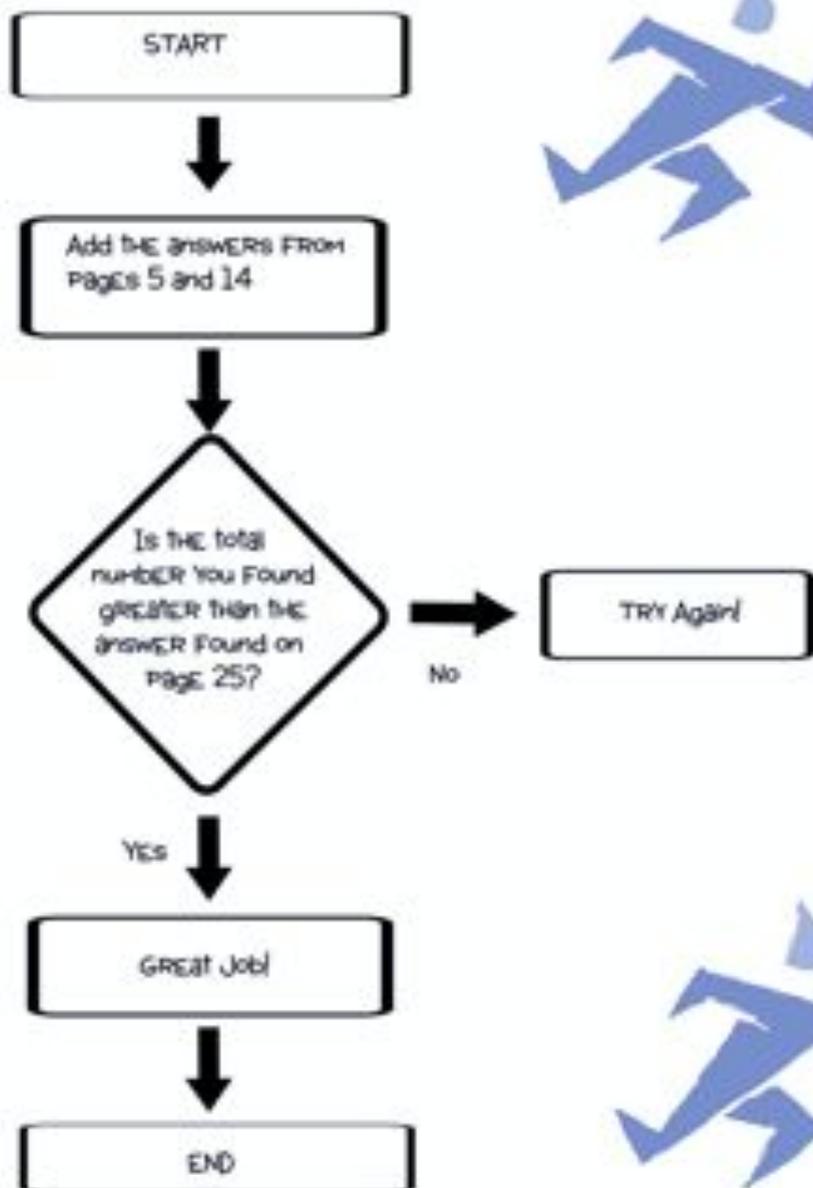
- A  2
- B  12
- C  232



# Homework

Can You Follow this PROCESS Flow FROM START to END ?

IF You don't get to THE End Right away, just TRY again!



# Dear Parents

"COMPUTER SCIENCE FOR Kids " was designed to introduce THE basic CONCEPTS OF COMPUTER SCIENCE to kids WHO ARE starting to LEARN about COMPUTERS at SCHOOL OR at HOME.

Book's web site:

[HTTP://www.LessaWorld.com/kids](http://www.LessaWorld.com/kids)

Suggestions and translation REQUESTS:

IF YOU HAVE any suggestions, CORRECTIONS, REQUESTS FOR THE next Edition OF THIS book OR would like to SEE THIS book translated to YOUR Language, PLEASE SEND an EMAIL to:  
[kids@LessaWorld.com](mailto:kids@LessaWorld.com)

Don't FORGET to BUY a PAPER COPY OF THIS book:

PLEASE VISIT THE Book's web site to Find out HOW.  
THANK YOU FOR YOUR SUPPORT!!!!

About PYTHON:

FOR MORE information about PYTHON, PLEASE VISIT [www.PYTHON.org](http://www.PYTHON.org)



## About the book:

"Computer Science For Kids" was created to introduce the basic concepts of computer science to kids who are starting to learn about computers at school or at home.

## About the author:

André Lessa is an experienced IT professional who has been all over the techie industry - Software Engineer, Business Analyst, IT Consultant, Database Administrator, CTO, Web Business Entrepreneur, Project Manager, Technical Book Author ... you name it! His interest in computer systems dates back to when he was 11 years old. That was his age when he got his first computer and started writing programs using programming languages like Basic and Pascal.

He has worked with A LOT OF technologies throughout his career: VB, C#, C, Java, JEE, MySQL, PHP, Python, Perl, Javascript, Oracle, SQL Server, XML, XPath, XSLT, LAMP, AWS, CSS, and AJAX to name a few.

For this one-of-a-kind book, he took care of everything (Concept, Design, Content, Development, Production, Publishing, etc.)

Thanks for your support!

