PRACTICE 0
Introduction to the internal workings of a computer. simulator MSX88

Goals:

The practice shows how a computer operates. You should enter a program in assembler and then assemble and link to use in a computer simulator.

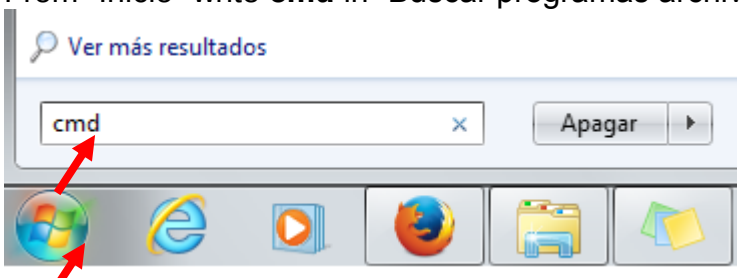
To simulate we will use a freeware program that shows the internal work of a i8088.
The software comes with an assembler program (ASM88) and its corresponding linker (LINK88) to generate an executable file (.EJE) which can be used in the simulator.

1ª PART:

Explanation:
Write a program that performs the sum of two immediate data (10h and 20h) They are in the AX and DX registers processor. The result will be stored in AX register.

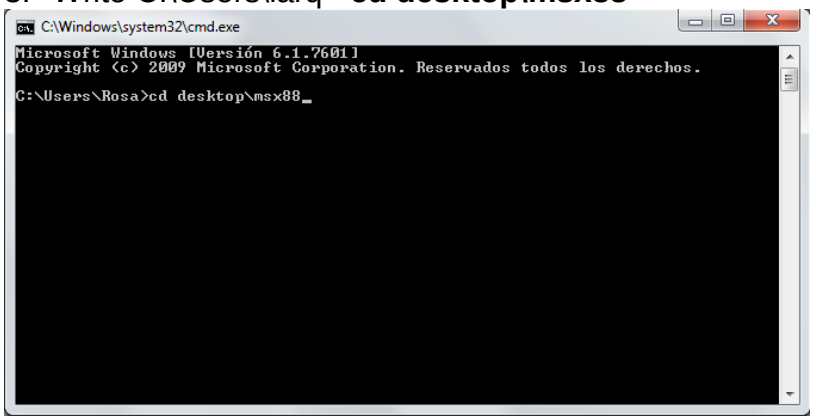
Steps to follow:
1. Open Windows
2. Open a MS-DOS sesion:

From “Inicio” write **cmd** in “Buscar programas archivos”



This open a MSDOS sesion:

3. Write C:\Users\larq> **cd desktop\msx88**



4. Once in msx88 directory we write the .asm file, to do it, write in the command line:
   C:\Users\larq\desktop\msx88> **edit pr1.asm**

5. Once the program has been opened (blue windows) enter the following code, save and exit the editor.

```
ORG 2000h

MOV AX, 10H
MOV DX, 20H
ADD AX, DX

END
```

File-> Save then File> Exit

Now we are going to use MSX88 simulator, the icon appears on the desktop.

CLIC on the ICON MSX88

It opens a new MSDOS window, in the command line write the orders:

6. Assemble the previous file. To do this, type in the command line:
   ASM88 PR1.ASM;
7. Link the PR1.O file created. From the command line write:
   LINK88 PR1.O;
8. Display (edit) the new files created, the object and the executable file PR1.O PR1.EJE (edit PR1.O and then edit PR1.EJE)
   Are they the same?

   Try to identify the machine code instructions. In what numerical system are the data represented?

9. . Run the program MSX88. To do this, type in the command line: **MSX88**
10. Load the program PR1.EJE in the simulator, for it on the MSX88 screen of orders, write: **L PR1**

QUESTIONS:

1. Identify the different computer functional units.
   (Arithmetic logic unit, control unit, memory, Buses):

2. What size (in bits) have the records?

3. What size (in bits) has the address bus?

4. What is the size of the memory?

5. What size (in bits) has the data bus?

6. Observe the program counter or instruction pointer register IP
What is his value?

Carry out simulation program:
To simulate the program, you can press the **F6** key to execute instruction by instruction or by the **F7** key to execute each instruction in its machine cycles program. (modify speed using + and -)

QUESTIONS:

7. The instruction register is the IR register. What is it used for?

What are the operation codes of the instructions?

8. As instructions are executed, what happens to the IP instruction pointer register?

9. Once the last instruction of the program is completed, how have changed the AX and DX registers?
What is the result of the operation? Where is it stored?

10. For simplicity, the data are in hexadecimal rather than binary. Pass the final result of the operation to binary.

11. Review records of flags What value does the sign bit S?
And the parity? Why?

Remember that once the execution of the program (all other memory locations are 00) if you want to run the program again, you will need to put on record the value IP 2000 in the command line:

> **R IP 2000**

2ª PART:

Exit the MSX88 simulator.

Change the program by one to perform a subtraction. The new assembly instructions are:

```
ORG 2000h

MOV AX, 1000H
MOV DX, 1234H
SUB AX, DX

END
```

IMPORTANT: Remember that is the **.EJE** the file to run in the MSX88, So, we must **repeat the steps of the first PART**
(Edit the new file, save it and then assemble and link before opening MSX88)

Perform the simulation of the new program and answer the following questions

QUESTIONS:

12. After the last instruction of the program How have changed the registers AX and DX?
What is the result of the operation? Where is it stored?

13. For simplicity, data are in hexadecimal rather than binary.
Note that the result is a negative number.
In what format is it represented?

Performs the necessary calculations to check the result

14. Review record of flags What value does the sign bit S?
And the parity P? Why?