PRACTICE 5: MEMORIES

1.- Objectives

This practice aims to familiarize students with the semiconductor memory by reading different positions of EPROM nonvolatile memory.

2.- Previous concepts

The student must know and understand the concept of memory, memory types available (volatile, non-volatile, etc.), The differences between management and content of the cell and how to address each of them. It is also necessary that students know the function of the lines that make up the integrated circuit memory (address, control and data lines).

3.- Materials Required

1 memory of 8 kbytes EPROM 27C64A (8Kx8)
1 555 timer
8 microswitches
1 7-segment display
8 resistors of 330Ω
1 4-bit counter 74HC193

4.- Procedure

Answer and undestand questions in the previous study. **Essential to pass the practice**

5.- PRACTICE DEVELOPMENT

Practice 5.1 (8 points)

It is desired to access the contents of a set of positions of 27C64A nonvolatile memory, **pre-programmed by the teacher**.

The address range is between the **300h and 30Fh**.

The content of each memory position will be displayed directly on the 7-segment display.
- The bit D0 corresponds to the segment "**a**",
- D1 with "**b**" and so on until bit D6 which corresponds to segment "**g**".
- Bit D7 has no effect and can be left unconnected.

The access to the positions must be **sequential and cyclic**, ie:
- Start at the first position 300h, following the second 301h and so on until reaching the last one 30Fh, starting again with the first one
- To do this you must use the 74HC193 4-bit counter and timer 555.
- It should display the contents of a new memory location **every second** approximately (you can use the same configuration 555 Practice 6).

Improvement (Optional) 5.2 (2 points)

Simulate an adder of 2 bit unsigned numbers (values 0-3 in each of the two addends) with **carry input**.

Show the result of addition operation (also **2 bits**) directly into a 7-segment display. That is, it will display a **decimal digit from 0 to 3**, which will be result of the addition and in case of carry-out, the display will show the letter **A**.

We will use an EPROM memory to implement logic functions.

As can be deduced, the sum function has five input bits (two for operand **X**, two for operand **Y** and one **input carry**) and 7 outputs (which are the inputs of the display).

- **The inputs** correspond to the least significant 5 lines of the address bus of the memory. Using a set of microswitches, introduce '1 'and '0' in the different bits of the operands and the carry input (affecting address lines).

- **The outputs** are the data bus lines of the memory to be connected to different segments of the display, as were connected in the previous section (5.1).

P5- Previous study. Use the data sheet of the chip

5.1 Circuit design. Make an outline of the integrated and connections.

5.2 IMPROVEMENT (2 points in the previous study note))

a) a.1: How many different memory positions are needed?

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a.2: What address are used (specify them with 4-digit numbers in hex: XXXX to YYYY)?

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b) Schematic circuit. It should be consistent with the truth table of the following page (part c)

Clearly identify X1-X0, Y0-Y1, and Carry with address lines

c) Define the truth table below (outputs expressed in binary and hexadecimal)

Address bits					Data bits	
A4	A3 A2	A1 A0			Segments (0= ON)	
	Op. X	Op. Y			g f e d c b a	
Carry	x1 x0	y1 y0	*Dirección*	Add	D7D6D5D4D3D2D1D0	Data (hex)
0	0 0	0 0	0			
			1			
			2			
			3			
			4			
0	0 1	0 1	5	2		
			6			
			7			
			8			
			9			
			A			
			B			
			C			
			D			
			E			
0	1 1	1 1	F			
			10			
			11			
			12			
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			1A			
			1B			
			1C			
			1D			
			1E			
1	1 1	1 1	1F			

(*) Hex value of D7-D0 to show 2 in the display