Name _____ Date_____

LAB #4: SEVEN-SEGMENT DISPLAY

OBJECTIVE

Build a circuit that converts a list of BCD values into a 7-bit output that can be used to display the decimal equivalent and on a 7-segment display decoder. Design a circuit that takes a four-bit input $D_3D_2D_1D_0$ from the digital trainer and drives a 7-segment display decoder. Note that for the letters, some are capitalized and some are not. (The reason is that a capital B, for example, would come out the same as an 8 on a 7- segment display, so we will display a lower case b instead).

MATERIALS

- Digital prototyping board
- Logic gates available, as required
- #22 solid-core wire, as required
- Common anode 7 segment display (part no. A-521H) or (part no. HDSP-5501)

INTRODUCTION

Often, numbers must be displayed by a computer for the user to see. However, humans are not used to reading the binary numbers that computers work with. Therefore, it is beneficial to output values in decimal. A 7-segment display is a popular form used to display a digit. This lab will have the student build a circuit that takes in a list of binary numbers in (BCD) and then displays the decimal equivalent on a 7-segment display. The data sheets attached provide the pin-outs for the A-521H and HDSP-5501.

7 segment displays have 7 light emitting diodes (LED's), one for each segment. In order for an LED to give off light, a certain amount of voltage and current must be supplied. A common anode 7 segment display ties all of the + voltage sides of the LED's together (the commons). These commons are tied to 5 volts. In order to turn on a specific segment, you must supply a low voltage (logic 0). These 0's will be supplied from your logic gates.

Note that a logic 0 from your gate (approx. 0 volts) and 5 volts on your anode would create a 5 volt drop over the LED's. This is too much. Tie the outputs of

your logic gates to the specific input using a resistor. Some of the voltage will then drop over the resistor, protecting your LED. Current limiting resistor values are typically from 200 – 470 Ω.

D_3	D_2	D_1	D_0	Display
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
1	0	0	1	9
1	0	1	0	A
1	0	1	1	b
1	1	0	0	C
1	1	0	1	d
1	1	1	0	E
1	1	1	1	F

PROCEDURE

1. Create a truth table for your 4-bit inputs and the corresponding outputs necessary to light the proper segments of the display. For example, let the input be represented by $D_3D_2D_1D_0$:

D_3	D_2	D_1	D_0	a	b	c	d	e	f	g
0	0	0	0	0	0	0	0	0	0	1

   Since 0000 is decimal 0, all the outer LED's should be lit, the middle LED should be off. Unused input combinations should be filled with don't cares.
2. Construct K-maps and derive the simplified Booleans equations.
3. Synthesize the logic diagram with pin designators.
4. Build the logic circuit and wire the outputs to the proper pin on the 7-segment display (remember to use current limiting resistors).
5. Demonstrate your working circuit by displaying your numbers and letters to instructor

Name _____ Date_____

Arizpe	*4 6 8 A C*
Cantu	*4 7 9 b d*
Cedillo	*3 2 1 E F*
De Hoyos	*3 4 5 A d*
Fernandezdelara	*2 7 6 A F*
Flores	*1 9 8 b C*
Garcia	*1 7 5 b F*
Gonzalez	*3 7 8 E C*
Guillen	*0 1 2 E d*
Islas	*0 6 4 C F*
Lara	*8 5 2 A b*
Laurel	*6 1 3 d b*
Medina	*4 7 1 C A*
Moreno	*8 6 2 E A*
Reyes	*4 2 0 F d*
Reyna	*7 2 5 b d*
Rodriguez E.	*7 3 0 A d*
Rodriguez L.	*1 2 3 A C*
Villanueva	*1 3 4 C d*
Yao	*2 3 4 b d*
	3 7 8 A b
	4 5 6 C F
	5 8 9 A d

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