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18CS30042

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PART : 1
(BCD to 7-Segment Display)

Aim:

Design, implement and test for transistor circuits to dislay 4-bit BCD to a 7-Segment LED Display with the following contraints.

1. Use comon anode 7-Segment LED Display.
2. Placement and values of current limiting resistors to be determined.
3. Permissible LED current: 20mA
4. Driving transistor: BC547

Apparatus Required:

Using only NOT, AND and OR gated IC chips to generate BCD outputs:

1. IC 4071 *1(OR, 2 Bits)
2. IC 4072 *2(OR, 4 Bits)
3. IC 4081 *3(AND, 2 Bits)
4. IC 4075 *1(OR, 3 Bits)
5. IC 4011 *2(NAND, 2 Bits)
6. BC547 Transistors *7
7. 7-Segment Display *1
8. 205 Ohm (Resistors) *7

Theory:

In Binary Coded Decimal encoding scheme each of the decimal numbers is represented by its equivalent binary pattern. Whereas, Seven segment display is an electronic device which consists of seven LEDs arranged in some definite pattern, which is used to display Hexadecimal numerals.

Two types of Seven-segment LED Display:

1. Common Cathode type:

In this type of display all cathodes of the seven LEDs are connected together to the ground or Vcc and LED display digits when some HIGH signals is supplied to the individual anodes.

2. Common Anode type:

In this type of display all the anodes of the seven LEDs are connected to battery or Vcc and LED display digits when some LOW signal is supplied to the individual cathodes.

But, the seven-segment display does not work by directly supplying voltage to different segments of LEDs. First, our decimal number is changed to its BCD equivalent signal then BCD to seven segment decoder converts that signals to the form which is fed to seven-segment display.

This BCD to seven segment decoder has four input lines (A, B, C, and D) and 7 output lines (a, b, c, d, e, f, and g), this output is given to seven segments LED display whichdisplays the decimal number depending upon inputs.

Design:

The truth table for BCD to a common anode 7-segment display with BC547 as driving transistor and LED current of 20 mA is as follows:

Digit	A	B	C	D	a	b	c	d	e	f	g
0	0	0	0	0	0	0	0	0	0	0	1
1	0	0	0	1	1	0	0	1	1	1	1
2	0	0	1	0	0	0	1	0	0	1	0
3	0	0	1	1	0	0	0	0	1	1	0
4	0	1	0	0	1	0	0	1	1	0	0
5	0	1	0	1	0	1	0	0	1	0	0
6	0	1	1	0	0	1	0	0	0	0	0
7	0	1	1	1	0	0	0	1	1	1	1
8	1	0	0	0	0	0	0	0	0	0	0
9	1	0	0	1	0	0	0	0	1	0	0

ABCD is the BCD value and a,b,c,d,e,f,g are the corresponding inputs to the 7-Segment LED display.The expressions for a,b,c,d,e,f,g with 2-level optimization using K-maps are given below:

Here X’ means the complement of

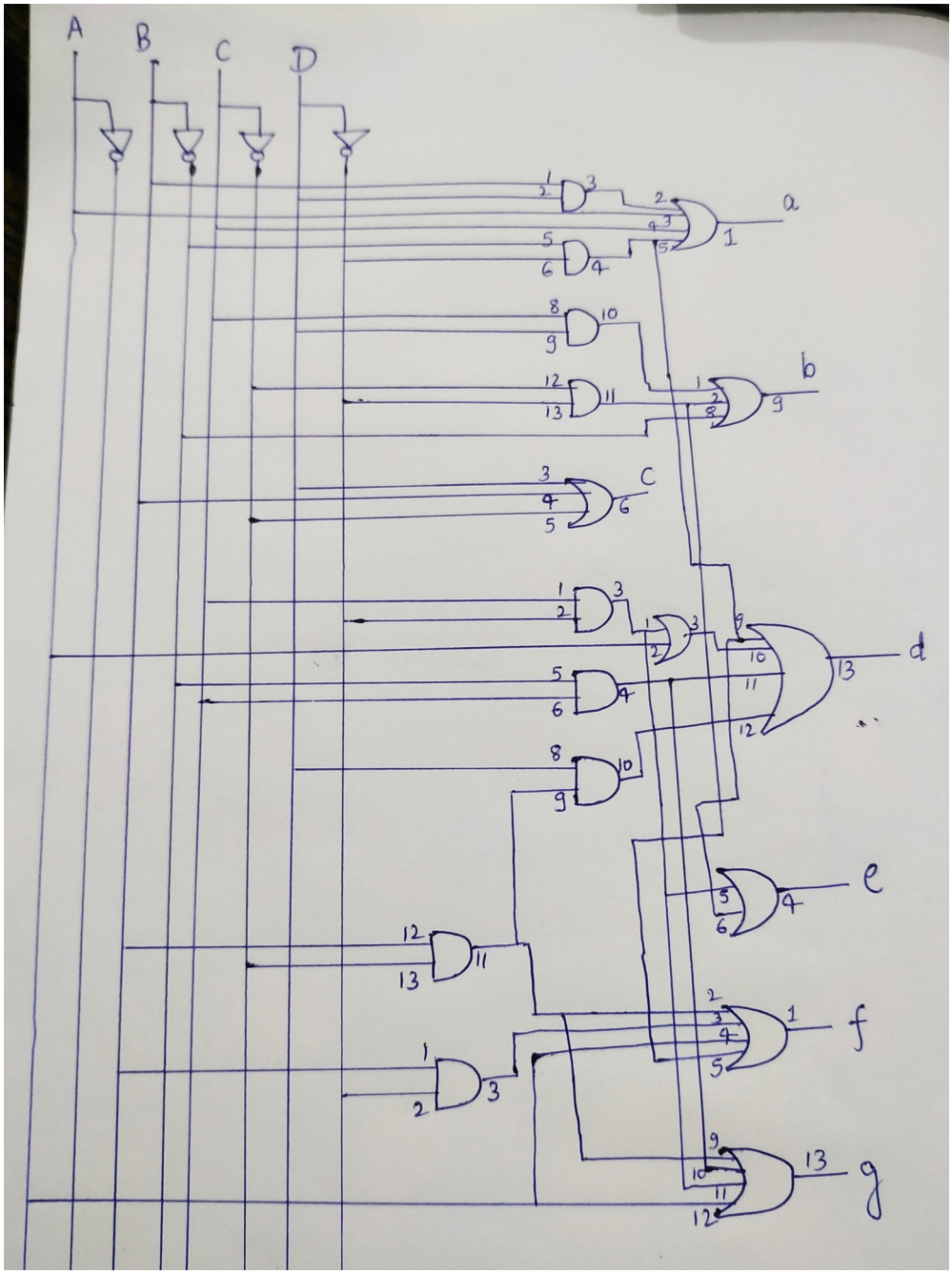
a = A+C+BD+B’D’
b = B’+C’D’+CD

c = B+C’+D
d = B’D’+CD’+BC’D+B’D+A
e = B’D’+CD’
f = A+C’D’+BC’+BD’
g = A+BC’+B’C+CD’

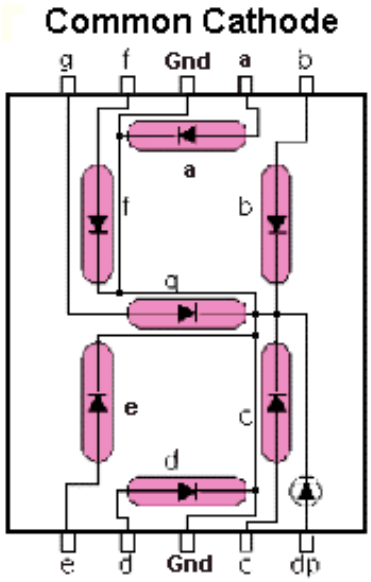
The value of resistance in driving transistor, given the current through LED, Vcc, Vd(diode cutoff voltage) and saturation voltage is given by:
Vcc = +5 V, Vsat = 0.2 V, Vd = 0.7V I = 20mA. Substituting these values in equation we get R = (5-0.2-0.7)/(20*0.001) ohm =205 ohm.

Circuit Diagram :

1. BCD to 7-Segment Decoder:



2. Seven Segment Display:



Results:

Correct displays are obtained as in the truth table.

Discussion:

1. In the process of constructing the circuit at each and every point, we verified the outpus to check whether it is on track or not.
2. If not verified at each step it is difficult to point out the errors in the circuit and Ics.
3. We observed that if one gate of an IC is not working then the connection done using that gets shorted and doesn't display the correct output.
4. While making the circuit we initially observed all the output in the output columns of the experiment board and then we connected the transistors and LED display.
5. For the truth table, we need to use a common anode LED display.
6. We finally verified the result.