BBM233: Logic Design Lab
2021 Fall
Lab Experiment #3 Report

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Questions

- What is a 7-segment display and how it works?
  A 7 segment display is made of seven different illuminating segments. These are arranged in a way to form numbers and characters by displaying different combinations of segments. The binary information is displayed using these seven segments. Seven segment devices are generally made up of LEDs. These LEDs will glow when they are forward biased.

- How many types of 7-segment display are there and what differentiates them from one another?
  There are basically 2 types of 7 segment LED display:

  Common Anode: All the Negative terminals (Anode) of all the 8 LEDs are connected together. All the positive terminals are left alone.

  Common Cathode: All the positive terminals (Cathode) of all the 8 LEDs are connected together. All the negative thermals are left alone.

- Why do we need a decoder to use 7-segment displays?
  It can be seen that to display any single digit number from 0 to 9 in binary or letters from A to F in hexadecimal, we would require seven separate segment connections plus one additional connection for the LED's "common" connection. To get 8 connections, we need a decoder.

- If this assignment were about designing a common anode instead of common cathode, would there be any change in truth table and if yes what kind of change?
  If we were using a common anode in this experiment, we would consider zeros for the segments which would be on. So, the zeros and ones in the truth table would be the exact opposite.

- What happens if you apply inputs for which you used don't cares (X), i.e. 8-15? What is shown on the 7-segment display and why?
  For the inputs from 8 to 15, the display shows same results as for the inputs from 0 to 7. That is due to the fact that we never used the input A in our simplified functions. We made

our truth table in canonical form, so for the inputs from 0 to 7, input A was 0. When we fill the other lines from 8 to 15, the input A was 1. Since input A has no effect in our functions, the displayed letters will be the same.

Truth Table

Fig. 1.

LETTERS	INPUT LINES				OUTPUT LINES						
	A	B	C	D	a	b	c	d	e	f	g
A	0	0	0	0	1	1	1	0	1	1	1
E	0	0	0	1	1	0	0	1	1	1	1
L	0	0	1	0	0	0	0	1	1	1	0
M	0	0	1	1	1	1	1	0	1	1	0
N	0	1	0	0	0	0	1	0	1	0	1
P	0	1	0	1	1	1	0	0	1	1	1
R	0	1	1	0	0	0	0	0	1	0	1
S	0	1	1	1	1	0	1	1	0	1	1
	1	0	0	0	X	X	X	X	X	X	X
	1	0	0	1	X	X	X	X	X	X	X
	1	0	1	0	X	X	X	X	X	X	X
	1	0	1	1	X	X	X	X	X	X	X
	1	1	0	0	X	X	X	X	X	X	X
	1	1	0	1	X	X	X	X	X	X	X
	1	1	1	0	X	X	X	X	X	X	X
	1	1	1	1	X	X	X	X	X	X	X

Figure 1: completely filled out truth table.

K-Maps and Boolean Functions

Fig. 2.

Fig. 3.

Subject :

Date :...../...../.....

AB \ CD	00	01	11	10
00	1	1	1	0
01	0	1	1	0
11	X	X	X	X
10	X	X	X	X

Groups : (1,3,5,7,9,11,13,15) = D

(0,1,8,9) = B'C'

g = D + B'C'

AB \ CD	00	01	11	10
00	1	0	1	0
01	0	1	0	0
11	X	X	X	X
10	X	X	X	X

Groups : (0,8) = B'C'D'

(3,11) = B'CD

(5,13) = BC'D

b = B'C'D' + B'CD + BC'D

AB \ CD	00	01	11	10
00	1	0	1	0
01	1	0	1	0
11	X	X	X	X
10	X	X	X	X

Groups : (0,4,8,12) = C'D'

(3,7,11,15) = CD

c = C'D' + CD

AB \ CD	00	01	11	10
00	0	1	0	1
01	0	0	1	0
11	X	X	X	X
10	X	X	X	X

Groups : (1,9) = B'C'D

(2,10) = B'CD'

(7,15) = BCD

d = B'C'D + B'CD' + BCD

AB \ CD	00	01	11	10
00	1	1	1	1
01	1	1	0	1
11	X	X	X	X
10	X	X	X	X

Groups : (0,1,2,3,8,9,10,11) = B'

(0,1,4,5,8,9,12,13) = C'

(0,2,4,6,8,10,12,14) = D'

e = B' + C' + D'

AB \ CD	00	01	11	10
00	1	1	1	1
01	0	1	1	0
11	X	X	X	X
10	X	X	X	X

Groups : (0,1,2,3,8,9,10,11) = B'

(1,3,5,7,9,11,13,15) = D

f = B' + D

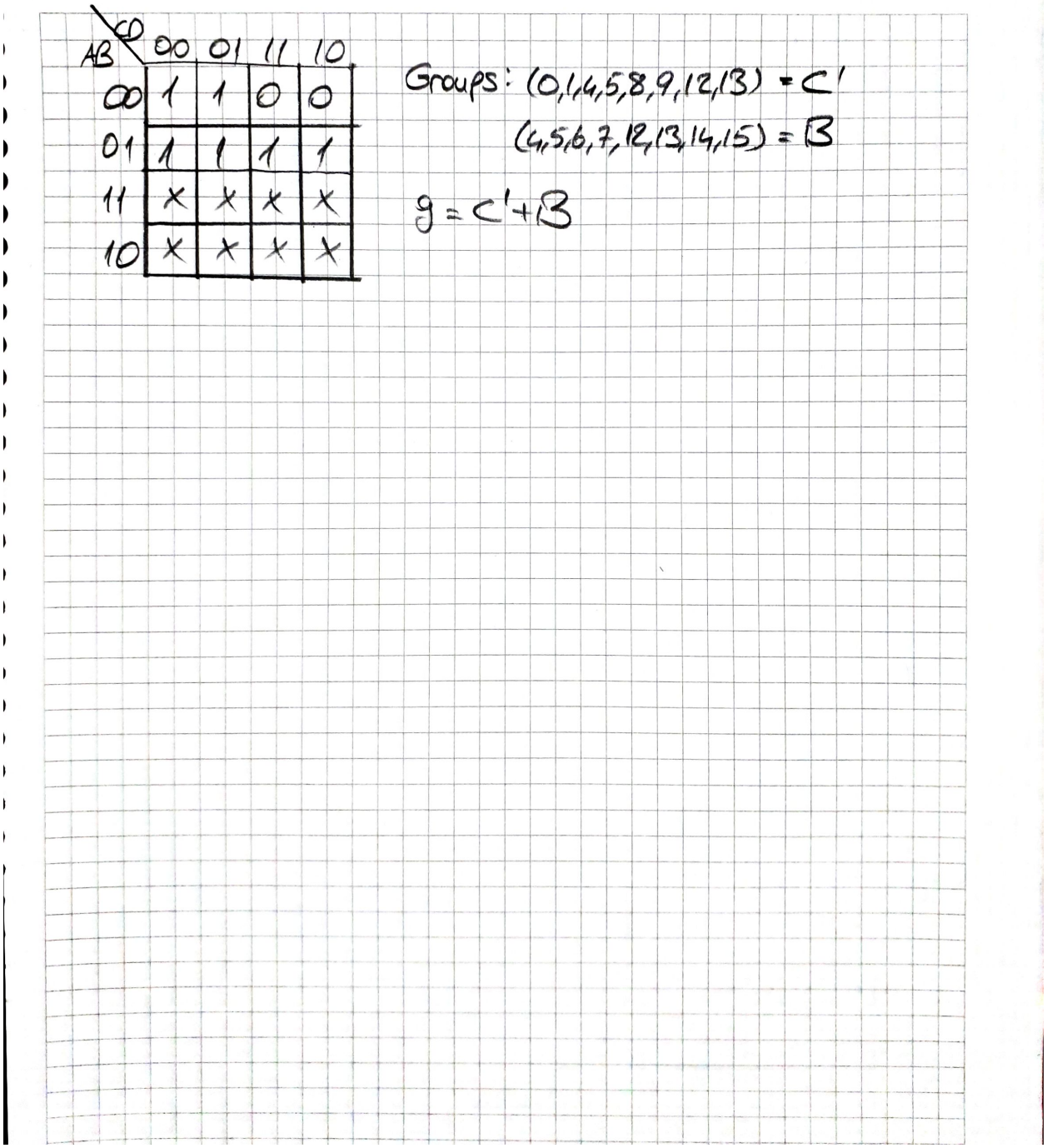

Figure 3: K-maps and boolean functions.

Final Circuit

Fig. 4.

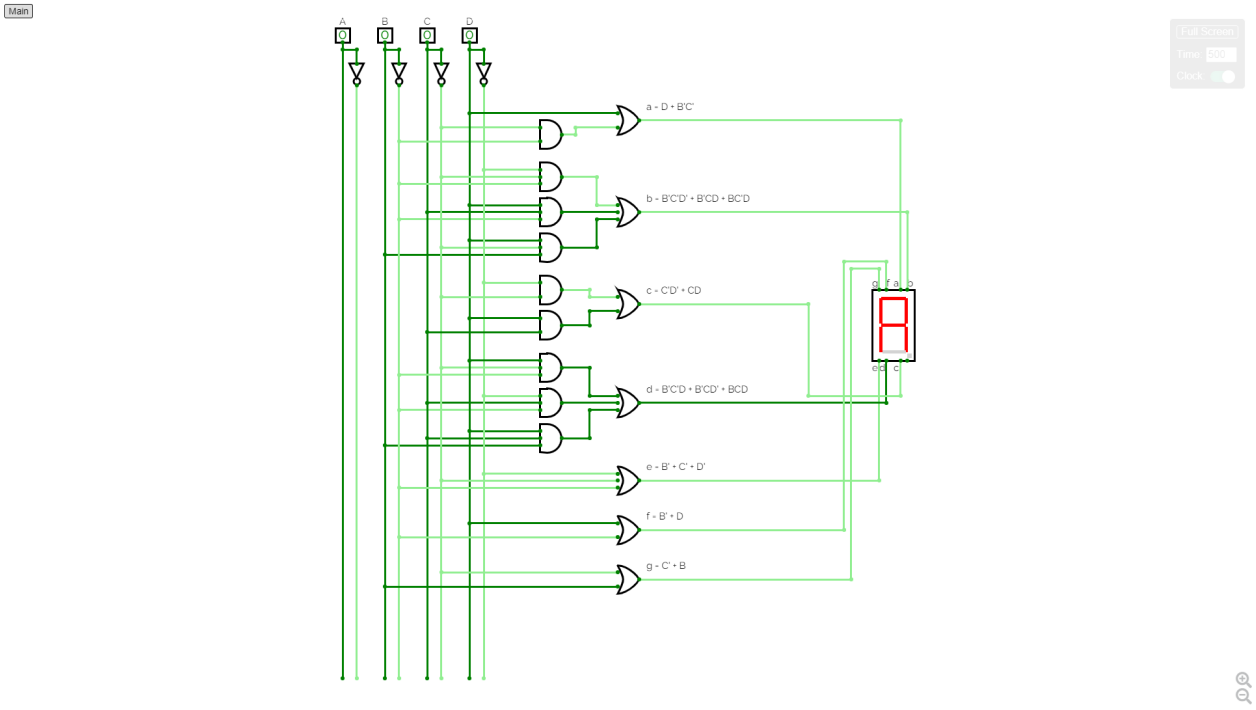

Figure 4: The Final Circuit.

References

- https://www.electronicsforu.com/resources/7-segment-display-pinout-understanding
- https://www.electronics-tutorials.ws/combination/comb_6.html
- BBM231 and BBM233 Lecture Notes