Digital Electronics Practical 3 - Boolean Algebra (week 4)

Previous Next

Solutions will be uploaded at the end of the week.

SimCir

You can practice the techniques introduced in the lectures using SimCir (https://community.dur.ac.uk/cs.systems/password/SimCir/) to simulate circuit creation. You can use this online version: SimcirJS (kazuhikoarase.github.io) (https://kazuhikoarase.github.io/simcirjs/)

Boolean Algebra questions

Before you start: Make sure you have completed early work on circuits from last time in the DE Practical 2 item! Also, check the solutions to Digital Electronics' practical 2. If you don't understand anything - ask!

Objectives: The main objectives of this practical are to enhance your understanding of Boolean algebra and the notion of SoP (Sum of Products) and PoS (Product of Sums). As always, it is important that you confirm your understanding by showing your work to a demonstrator.

Note for those with a practical on Monday or Tuesday morning:

- Exercise 5 and part of Exercise 6 is on Karnaugh maps, which will be covered on Tuesday. If your practical is on Monday or Tuesday morning, I suggest you have a go at Exercises 1-4 and then if you have time go through the lecture slides on Karnaugh maps and have a go at Exercise 5 and 6. There will be more exercises on Karnaugh maps in the next practical.

Exercises

1.

a. Calculate the Sum of Products expression for the following truth table and then create a circuit (in SimCir (https://community.dur.ac.uk/cs.systems/password/SimCir/)) to realise that expression. Check it behaves as expected.

b. Simplify the SoP expression above using Boolean Algebra, so that it remains a sum of products. Check that the resulting circuit behaves the same using SimCir.
c. Calculate the Product of Sums expression for the following truth table and then create a circuit (in SimCir (https://community.dur.ac.uk/cs.systems/password/SimCir/)) to realise that expression. Check it behaves as expected.
d. Simplify the PoS expression above using Boolean Algebra, so that it remains a product of sums. Check that the resulting circuit behaves the same using SimCir.

A	**B**	**C**	**Y**
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

□□□

2. Taken from an old exam!)

Give a circuit diagram consisting only of NAND gates for the Boolean formula F = AB' + CD'

Note: the symbol ' indicates the NOT operation, so this formula is the same as (A AND NOT(B)) OR (C AND NOT(D)).

3. Using theorems of Boolean Algebra, transform the expression (A + B)'(C + D + E)' + (A + B)' to a product.

4. Simplify the expression AB + ABC + ABCD + ABCDE + ABCDEF using theorems of Boolean Algebra. Check that your result is correct.

5. Use a Karnaugh map to obtain a simple Boolean expression for the output Y of exercise 1. Check that it is the same as the simplified SoP expression that you got for exercise 1.b.

6. Have a go at parts (a)-(c) of this exam question from a few years ago. If you have time, try parts (d)-(e), too.

Example_exam_q.pdf