

Task 1: Data Rep. and Boolean logic

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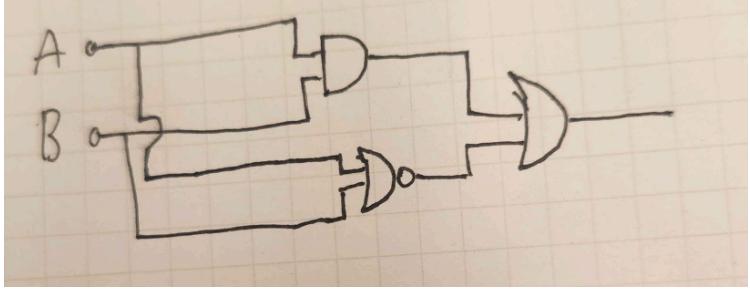
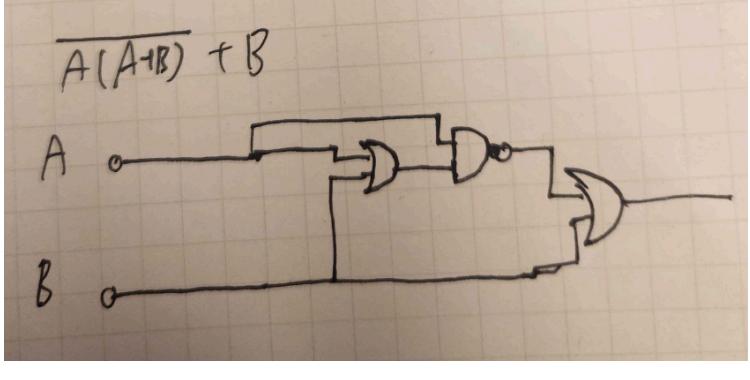
data_rep_boolean_log.md

💡 Resources (Learning Log):

4	Notes Topic 2:	Computer Architecture
5	Boolean Algebra	Video about boolean algebra
6	Examples Base Conversion	Whiteboard notes on conversion of numbers with different bases

Boolean Logic

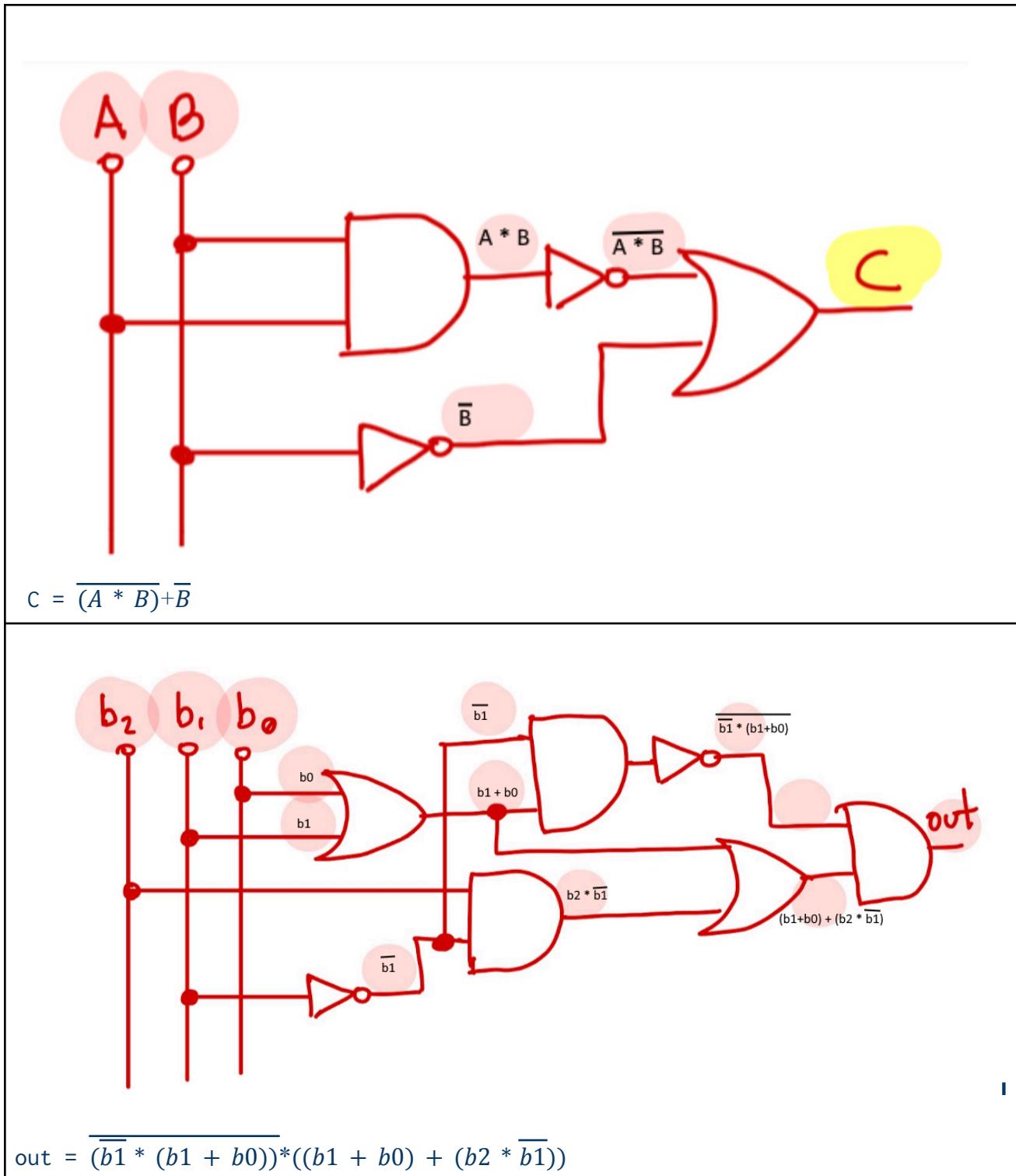
Draw the circuit for the boolean equations provided

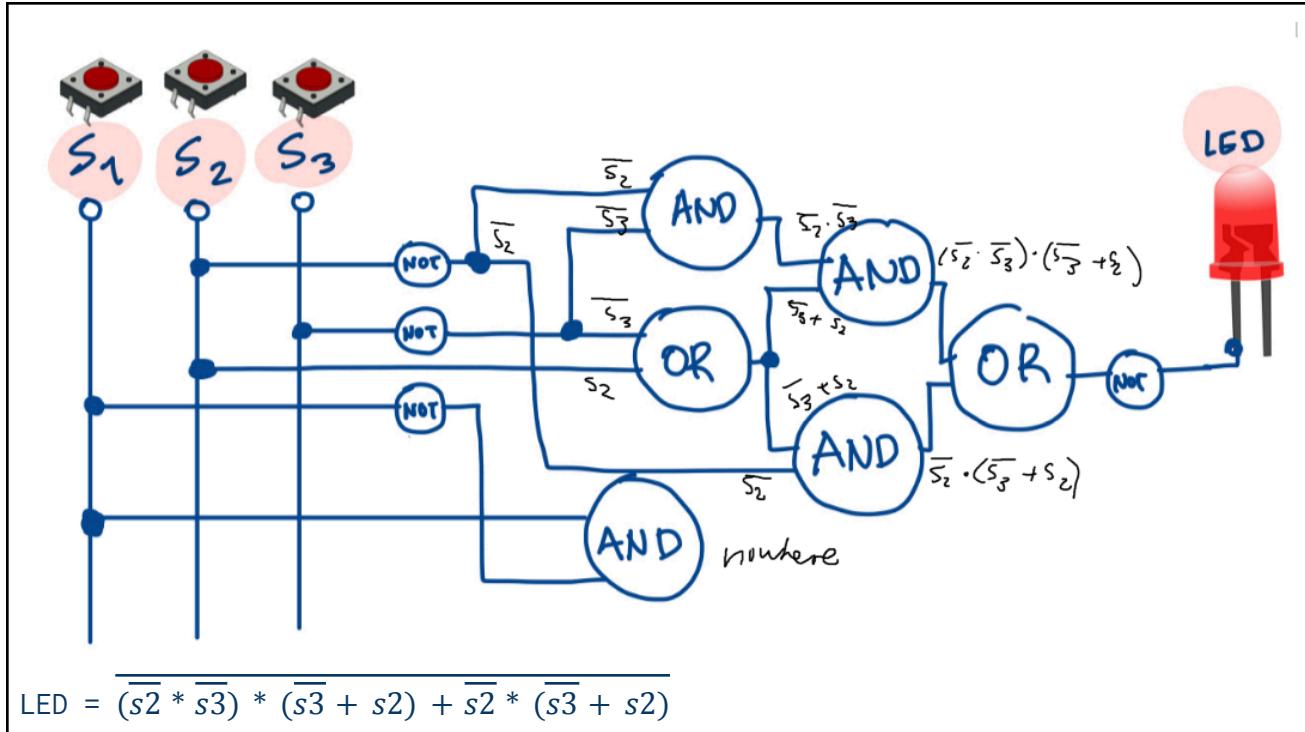
Boolean Equation	Circuit
$AB + \overline{A + B}$	
$\overline{A(A + B)} + B$	

$((\text{not } A) \text{ and } B) \text{ or } (A \text{ and } B)$	
$\overline{ACB} + \overline{(A + C)}B$	
[HL] $\overline{b_1b_2b_3} + \overline{(b_1 + b_3)}(b_1 + b_2)$	

Get the Equation

Write the boolean equation for the circuit shown





Truth table

Write the truth table for the equations below

Boolean Equation	Truth Table
$X = A \text{ and } B$	
$\text{Out} = \text{input1 or input2}$	
$\text{Light} = \overline{S_1} + \overline{(S_2 + S_3)} + S_1 S_2 \overline{S_3}$	
$\text{PARITY} = A \oplus B \oplus C$	#Parity checker
[HL] $\text{Login} = \overline{P_1 P_2 P_3} + \overline{(P_3 \overline{P_2} \overline{P_1})} + \overline{P_1} + \overline{P_3}$	

$$X = A \text{ and } B$$

A	B	X
0	0	0
0	1	0
1	0	0

1	1	1
---	---	---

Out = input1 or input2

input1	input2	Out
0	0	0
0	1	1
1	0	1
1	1	1

$$\text{Light} = \overline{S_1} + (\overline{S_2 + S_3}) + S_1 S_2 \overline{S_3}$$

S ₁	S ₂	S ₃	$\overline{S_1}$	$(\overline{S_2 + S_3})$	$S_1 S_2 \overline{S_3}$	Light
0	0	0	1	1	0	1
0	0	1	1	0	0	1
0	1	0	1	0	0	1
0	1	1	1	0	0	1
1	0	0	0	1	0	1
1	0	1	0	0	0	0
1	1	0	0	0	1	1
1	1	1	0	0	0	1

$$\text{PARITY} = A \oplus B \oplus C$$

A	B	C	A \oplus B	A \oplus B \oplus C
0	0	0	0	0
0	0	1	0	1
0	1	0	1	1
0	1	1	1	0
1	0	0	1	1
1	0	1	1	0

1	1	0	0	0
1	1	1	0	1

$$\text{Login} = \overline{P_1 P_2 P_3} + (\overline{P_3} \overline{P_2} \overline{P_1}) + \overline{P_1 + P_3} 1 \quad q$$

P_1	P_2	P_3	$\overline{P_2 P_1}$	$\overline{P_1 P_2 P_3}$	$\overline{(P_3 P_2 P_1)}$	$\overline{P_1 + P_3}$	Login
0	0	0	1	1	1	1	1
0	0	1	1	1	0	0	1
0	1	0	1	1	1	1	1
0	1	1	1	1	0	0	1
1	0	0	1	1	1	0	1
1	0	1	1	1	0	0	1
1	1	0	0	1	1	0	1
1	1	1	0	0	1	0	1

Data Conversion

Information can be represented in different systems, for example the number 10 in decimal (system base 10) can be represented in binary (system base 2) as 1010 or 12 in base 8.

It is critical for you to understand how to represent information in different ways, this will help you visualize how the computer processes data.

Original Number	Convert to
256 (Decimal)	Proof

256

256.

$$256 = 2^8$$

$$\Rightarrow 256 = \overbrace{1000}^{\overset{2^3}{\text{---}}} \overbrace{000}^{\overset{2^4}{\text{---}}} \overbrace{0}^{\overset{2^0}{\text{---}}}$$

\Rightarrow Base 4 in base 4 is 10000₍₄₎

$$256 = 216 + 36 + 4 = 1104_{(6)}$$

$$\begin{array}{r} 256 \\ 216 \cancel{|} 36 \\ \hline 4 \end{array} \Rightarrow 256 = \cancel{256} - \cancel{216} + 36 + 4$$

$$\begin{array}{r} 19 \\ \hline 32 | 14 \\ 0 \end{array}$$

$$\Rightarrow 256 = 100000000_{(2)} = 1104_{(6)} = 10000_{(9)}$$

Base 2 (Binary)

100000000

Base 4

10000

Base 6

1104

433 (Base 5)

Proof

$$\begin{array}{r} 433_{(5)} \\ \hline 3 \cdot 1 + 3 \cdot 5 + 4 \cdot 25 \\ 3 + 15 + 100 \\ = 118 \end{array}$$

in Dec is 118

in Oct is 166
in Hex is 76

Base 10 (Decimal)

118

Base 8 (Octal)

166

Base 16 (Hexadecimal)

76

FA32 (Base 16)

Proof

in hex is 70

0	64050	2
0	32025	2
1	16012	2
0	8006	13
0	4003	17
1	2001	11
1	1000	.
0	500	.
0	250	.
1	125	.
1	62	.
0	31	.
0	15	.
1	7	.

FA₁₆32 | 16³, 16², 16, 1
 $6 \cdot 1440 + 2560 + 48 + 2 = 64050$
 in Dec is 64050
 in bin is 1111101000110010
 in base 8 is 175062

Base 10

64050

Base 2

1111101000110010

Base 8

175062