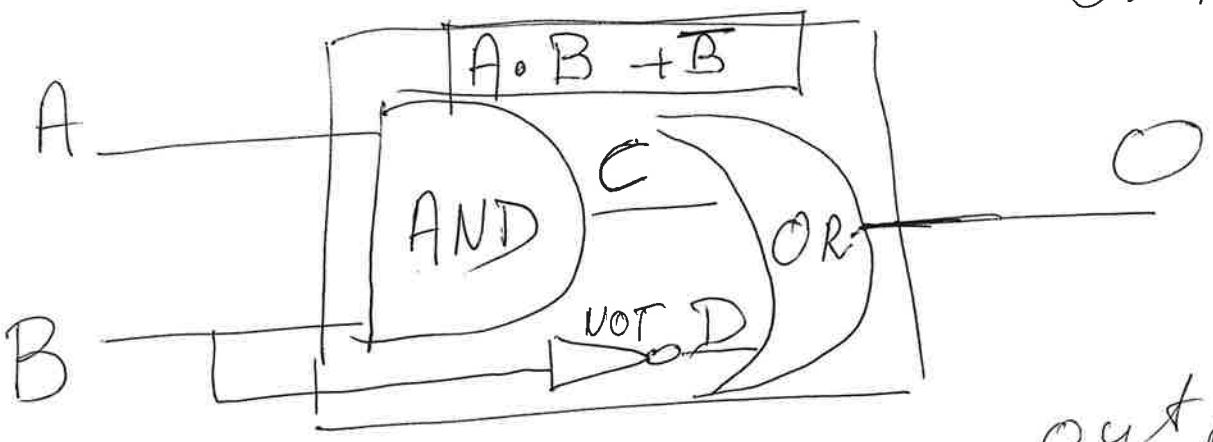
Discussion 1/31

Exercise 1

$O = C + \overline{D}$

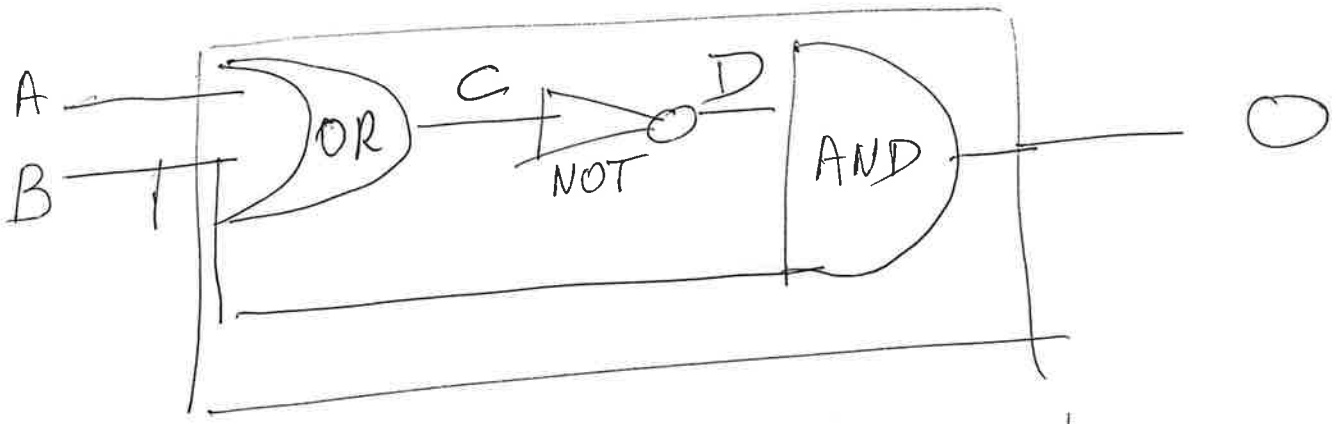
$O = A \cdot B + \overline{B}$



To understand this "machine", I build a logic table for its functions

A	B	C	D	O
1	1	1	0	1
1	0	0	1	1
0	1	0	0	0
0	0	0	1	1

Exercise 2



A	B	C	D	O
1	1	1	0	0
1	0	1	0	0
0	1	1	0	0
0	0	0	1	0

$$O = D \cdot B$$

$$O = \overline{C} \cdot B$$

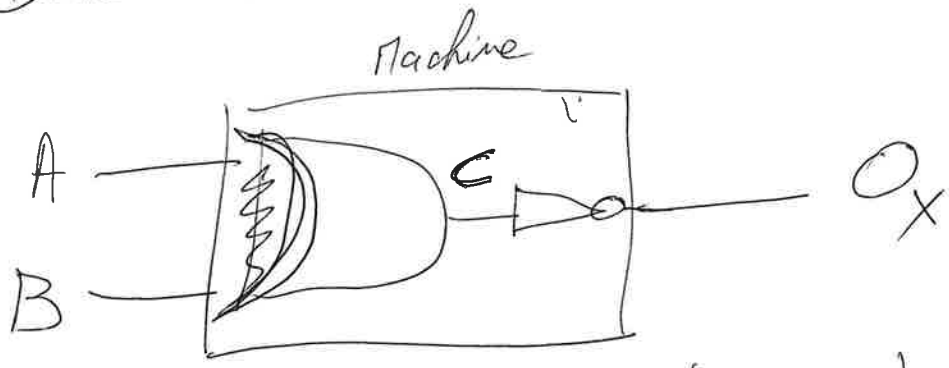
$$O = \left(\overline{A + B}\right) \cdot B$$

Exercise 3

Is it true that $\underbrace{\overline{A+B}}_{X} = \underbrace{\overline{A}+\overline{B}}_{Y}$?

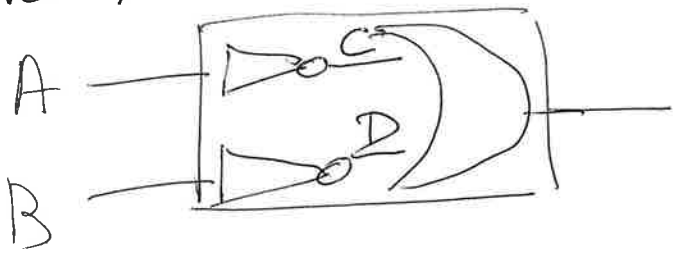
Do the gates X and Y have the same logic values ?

Gate X:



A	B	C	O_X
1	1	1	0
1	0	1	0
0	1	1	0
0	0	1	1

Gate Y



A	B	C	D	O_Y
1	1	0	0	0
1	0	0	1	1
0	1	1	0	1
0	0	1	1	1

A	B	$\overline{A+B}$
1	1	0
1	0	0
0	1	0
0	0	1

Y Gate:

A	B	$\overline{A}$	$\overline{B}$	$O_y = \overline{A}+\overline{B}$	$\overline{A} \cdot \overline{B}$
1	1	0	0	0	0
1	0	0	1	1	0
0	1	1	0	1	0
0	0	1	1	1	1

We just showed that $\overline{A+B} = \overline{A} \cdot \overline{B}$

You can show that $\overline{A \cdot B} = \overline{A} + \overline{B}$

These properties are referred to as De Morgan's laws of boolean algebra.

On the island of knights and knaves, (5)
you meet John, Kai and Tania.

John tells you: "Tania is not a knave"

Kai says: "John and Tania are both knights"

Tania says: "John is a knight, or Kai is a knave, or both".

Let us define: K: Knights, k: knaves

	John	Kai	Tania	John Says	Kai Says	Tania Says
(1)	K	K	K	T	T	T
(2)	K	K	k	F	F	T
(3)	K	k	K	T	T	T
(4)	K	k	k	F	F	T
(5)	k	K	K	T	F	F
(6)	k	K	k	F	F	F
(7)	k	k	K	T	F	T
(8)	k	k	k	F	F	T

(1) possible.

(2),(4) John K that is lying

(3) Kai k telling the truth.

5,7 John k telling the truth.

(6): Kai Knight, lying.

(8): Tania is a knave lying.