Paper 7, TDC Part-3
Chapter– 1, Fundamental Concept of Digital Electronics
Lecture - 2

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Fundamental Concepts of Digital Electronics

In this lecture we will see some other basic gates.

- **OR Gate :-**

The OR operation is defined as:- When one or more than one inputs are at logic 1 then the output is also at logic 1 else the output is at logic 0. The OR Gate can have N inputs $(N \geq 2)$ and One output. The logical expression of OR operation is given by

Y = A OR B OR C OR …….. OR N

Y = A + B + C + …….. + N

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- **Symbol for OR Gate : -**

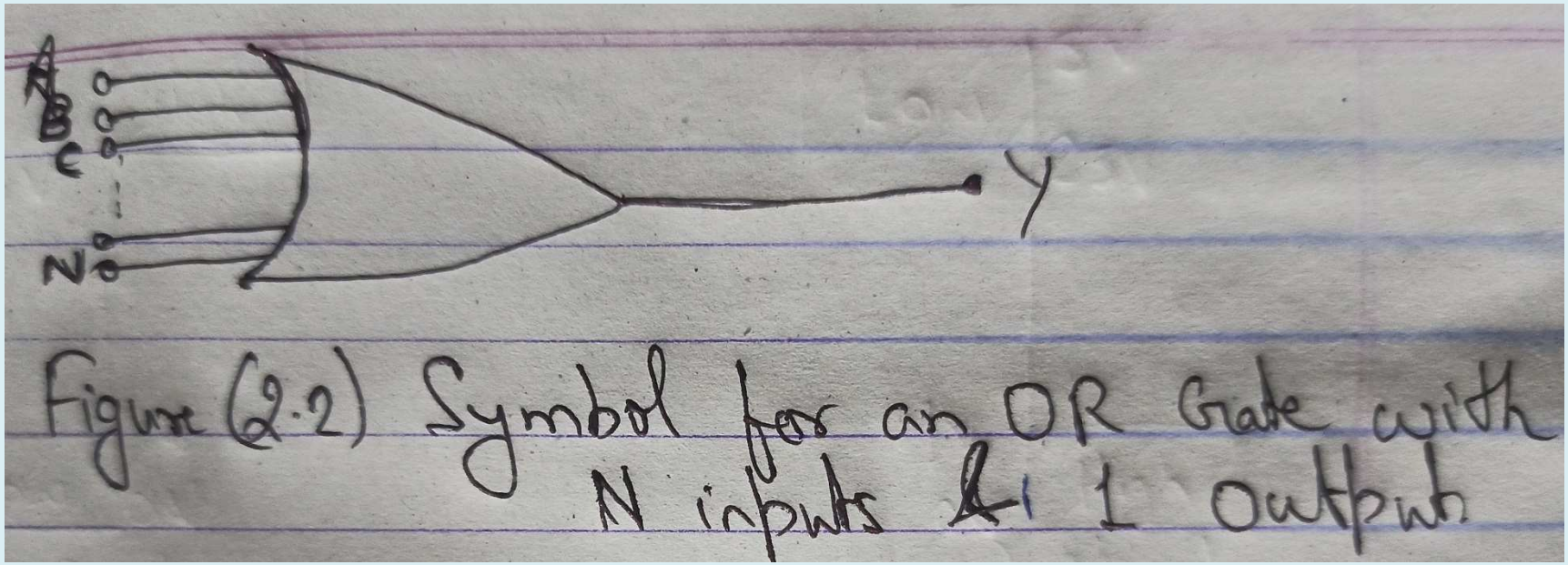

Figure (2.2) Symbol for an OR Gate with N inputs & 1 output

Operation of an OR Gate with any numbers of inputs can be shown through its truth table.

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- **Truth Table for OR Gate : -**

The below truth table is of an OR Gate with 2 nos. of inputs.

Input (A)	Input (B)	Output (Y)
0	0	0
0	1	1
1	0	1
1	1	1

Truth Table for 2- Input OR Gate

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Input (A)	Input (B)	Input (C)	Output (Y)
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Truth table of a 3- Input OR Gate

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Similarly the truth table for any numbers of input signals can be written. The output of an OR Gate will be “Low (0)” when all the input signals are “Low (0)” otherwise the output will be “High (1).

The OR operation is also referred to as logical sum and so it is also symbolised algebraically by a summation sign (+).

Let us see few problems

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Example 1.1) In a chemical process an Alarm is required to be activated if either temperature or pressure or both exceed certain limits. Is it possible to express this operation in terms of a digital operation? If yes, find the operation.

Solution:- Let the temperature and pressure be converted into electrical signals with the help of transducers. T=1 if Temperature exceeds the specified limit and P=1 if pressure exceeds the specified limit. If T=1 or P=1 or both T and P are 1 then the alarm is required to be activated, This operation can be expressed as,

$$Y = T \text{ OR } P$$

$$Y = T + P$$

This is an OR operation.

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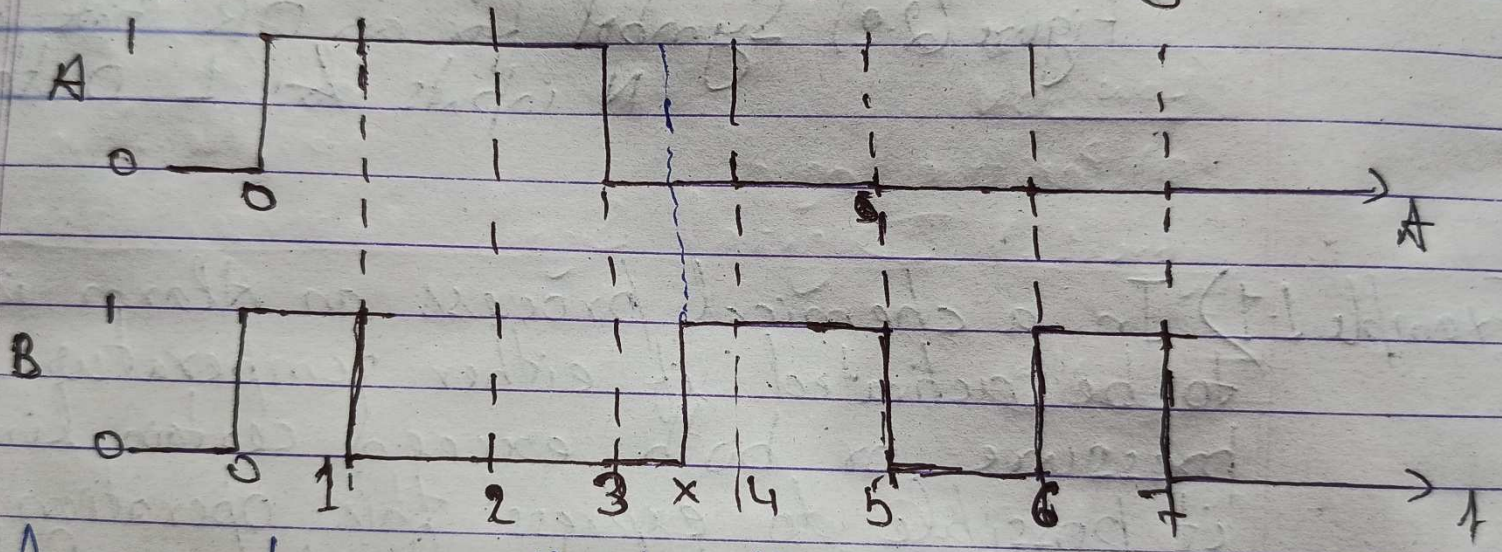
Example 1.2) Determine the output waveform ~~for~~ of a two input OR-Gate to which applied signals A & B ~~are~~ given below.



Solution: As we know that the output of an OR Gate is ~~go~~ "low" or "0" only when all the input signals are "low" or "0" else the ~~out~~ output of the OR-Gate is "High" or "1"

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Gate is ~~for~~ low or "0" only when all the input signals are "low" or "0" else the ~~out~~ output of the OR-Gate is "High" or "1"

So from above wave form we can find the output of the OR-Gate

From $t=0$ to $t=1$; $A=1$, $B=1$ so, O/P (Y) = 1
" $t=1$ to $t=2$; $A=1$, $B=0$ so, O/P (Y) = 1
" $t=2$ to $t=3$; $A=1$, $B=0$ " , Y = 1
" $t=3$ to $t=X$; $A=0$, $B=0$ so, Y = 0
" $t=X$ to $t=4$; $A=0$, $B=1$ so, Y = 1
" $t=4$ to $t=5$; $A=0$, $B=1$ so, Y = 1
" $t=5$ to $t=6$; $A=0$, $B=0$ so, Y = 0
$t=6$ to $t=7$; $A=0$, $B=1$ so, Y = 1

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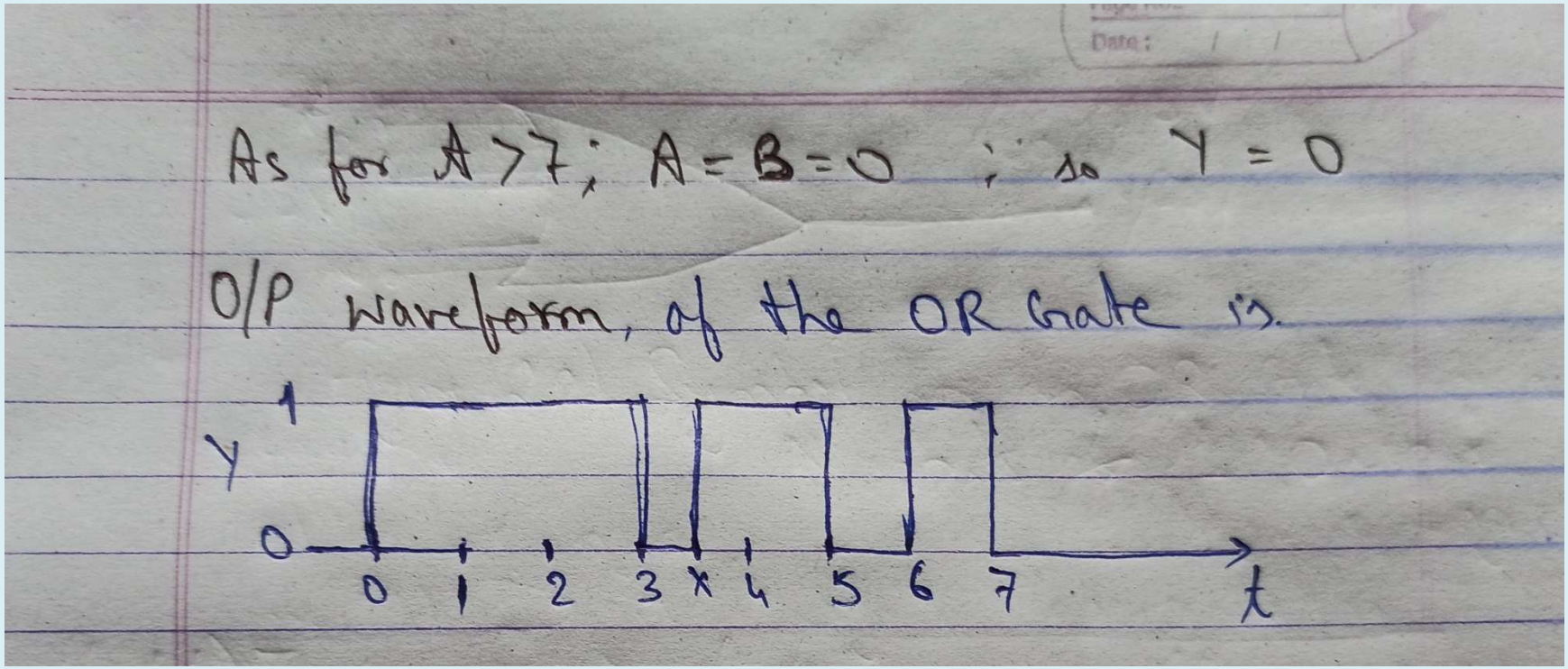

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- **AND Gate : -**

The AND operation is defined as:- When all the inputs are at logic 1 then only the output is at logic 1 else the output is at logic 0. The AND Gate can have N inputs $(N \geq 2)$ and One output. The logical expression of AND operation is given by

Y = A AND B AND C AND ..... AND N

Y = A · B · C · ..... · N

Y = ABC ..... N

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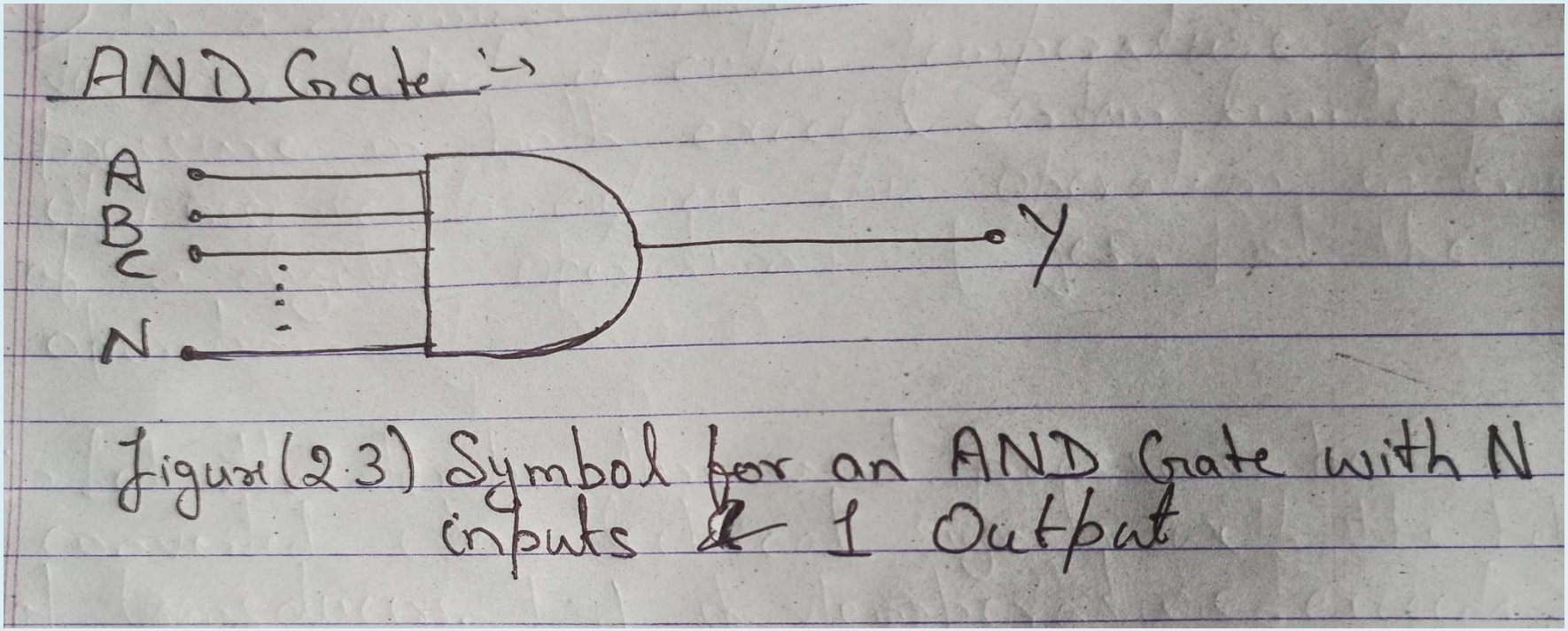
- **Symbol for AND Gate : -**



Operation of an AND Gate with N numbers of inputs can be shown through its truth table.

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- **Truth Table for AND Gate : -**

The below truth table is of an AND Gate with 2 nos. of inputs.

Input (A)	Input (B)	Output (Y)
0	0	0
0	1	0
1	0	0
1	1	0

Truth Table for 2- Input AND Gate

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Input (A)	Input (B)	Input (C)	Output (Y)
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Truth table of a 3- Input AND Gate

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Similarly the truth table for an AND Gate with any numbers of input signals can be written. The output of an AND Gate will be “High (1)” when all the input signals are “High (1)” otherwise the output will be “Low (0)”.

The AND operation is also referred to as logical multiplication and so it is also symbolised algebraically by a multiplication dot (·).

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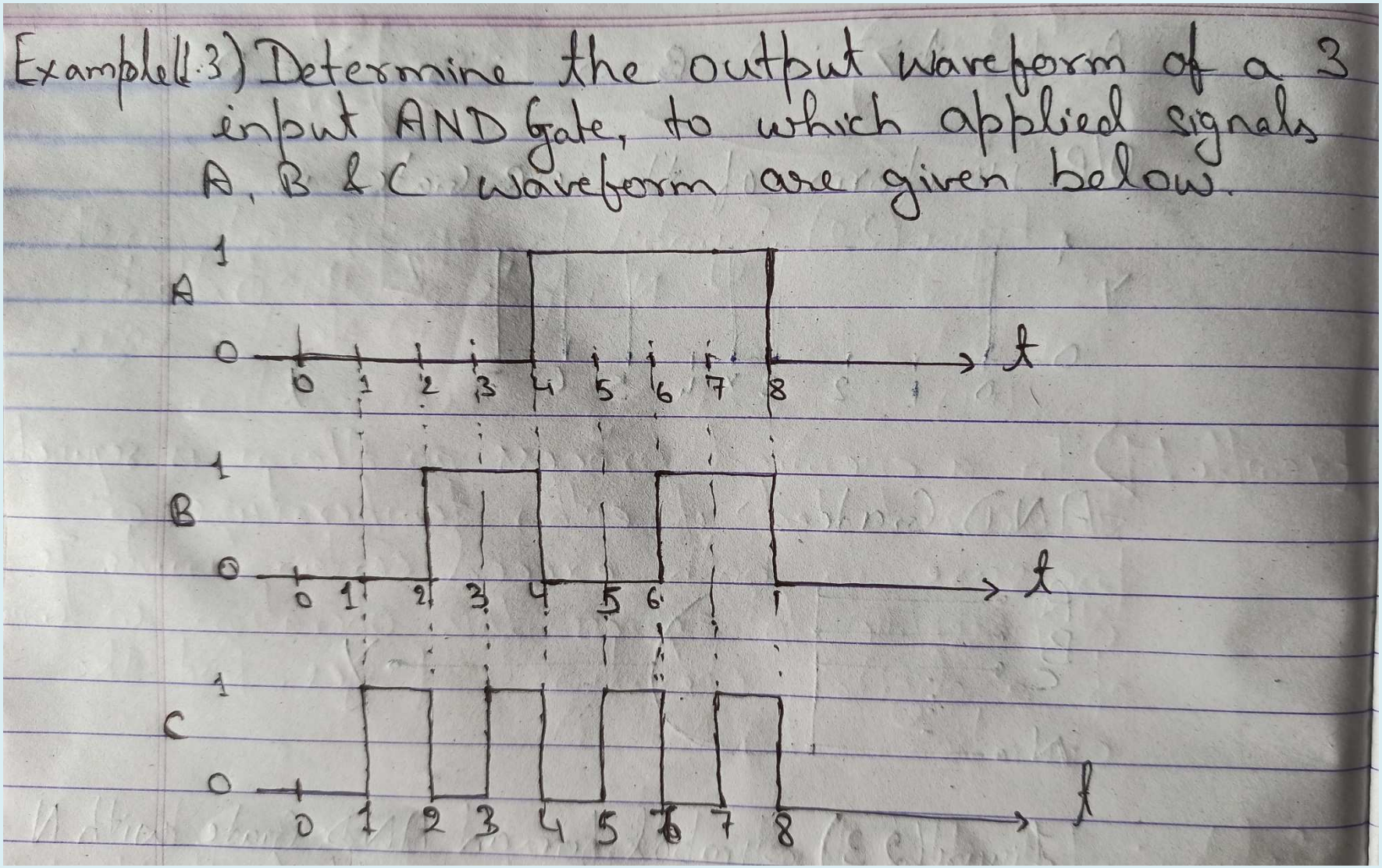

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