

Logic Gates

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Physical Computing

5th Lesson
Grade 08

At the end of the lesson, you will be able to

- Identify Basic logic gates
- Connecting logic gates in circuits

What is Logic Gate ?

- Logic gates are the **building blocks of digital circuits**.
- They perform logical operations based on inputs to produce specific outputs.
- Logic gates are used in computers, calculators, and many other devices to process data.
- There are three types of basic logic gates.
 - ❖ AND Gate
 - ❖ OR Gate
 - ❖ NOT Gate

Let us consider the following analogy to understand function of the AND gate.

The following diagram of a water tank in a house is to fill water without overflowing. Two valves are used to prevent water waste.

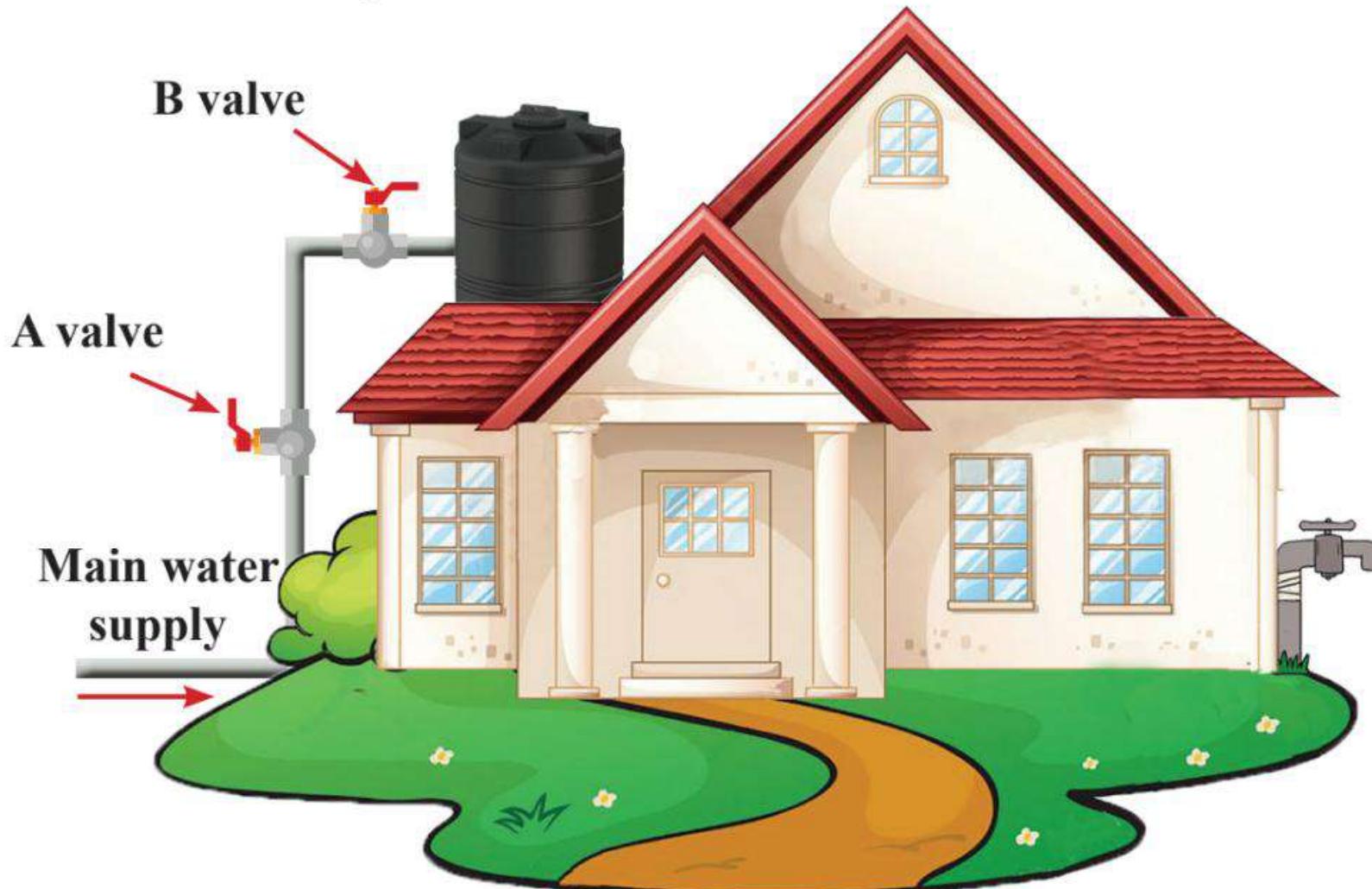
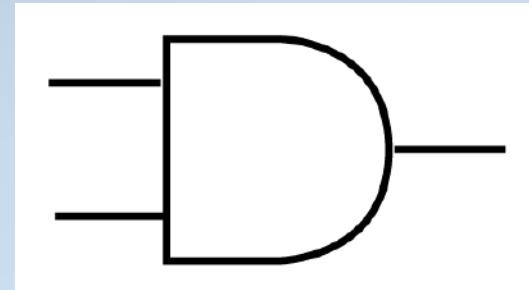


Figure 5.1 : Analogy for AND gate

AND Gate

- The AND gate produces an output of **1** (True) only when **both inputs** are **1**.
- **Symbol:**
A symbol resembling a D-shape represents the AND gate.



- **Truth Table:**

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Input A	Input B	Output
0	0	0
0	1	0
1	0	0
1	1	1

Example: Think of a light that only turns on when **both switches** are turned on.

Questions

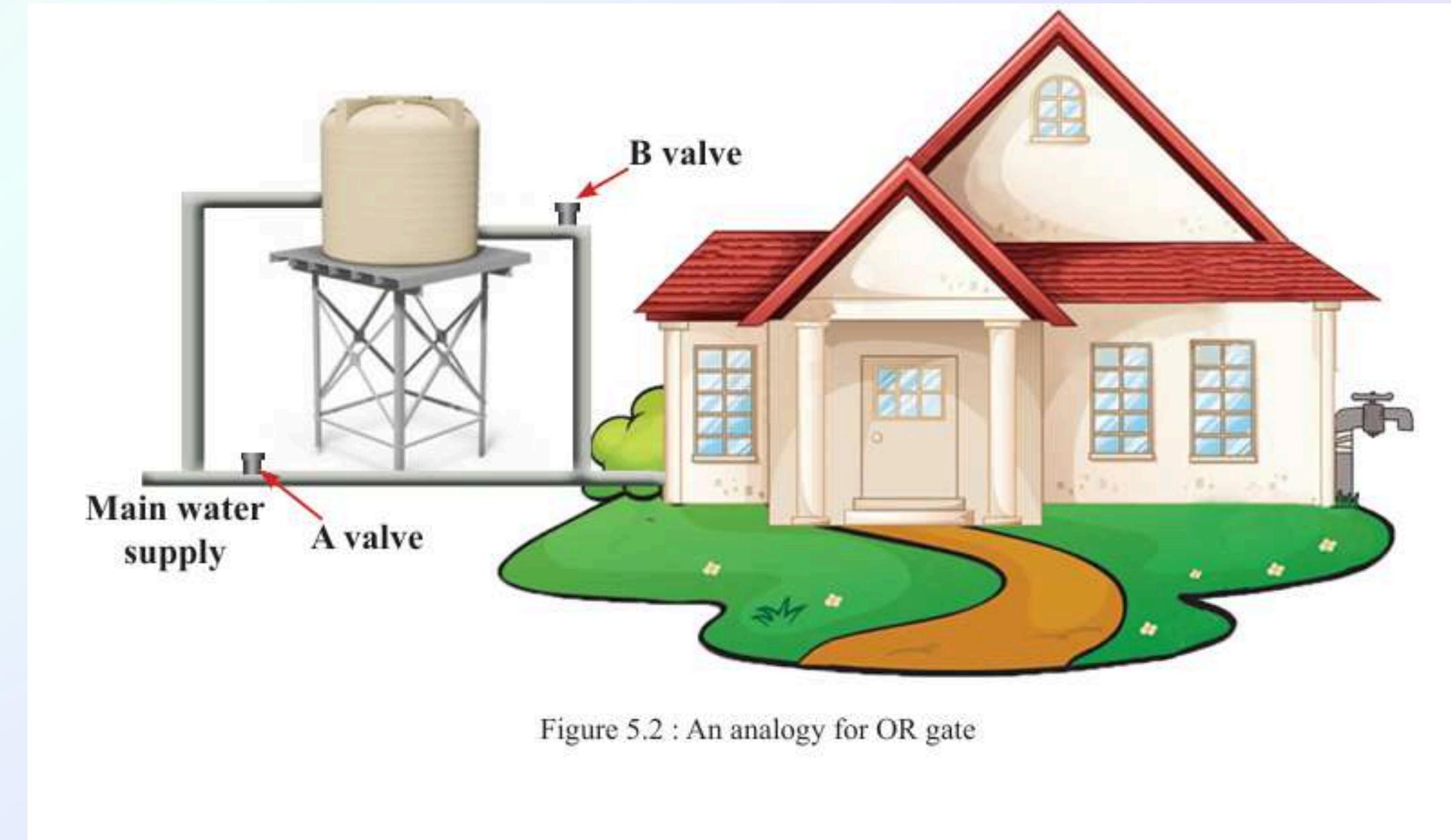
1. What are Logic Gates?
2. Name the three basic logic gates?
3. What is the output of an AND gate if the inputs are 1 and 0?
4. How are circuits constructed using logic gates?



OR GATE

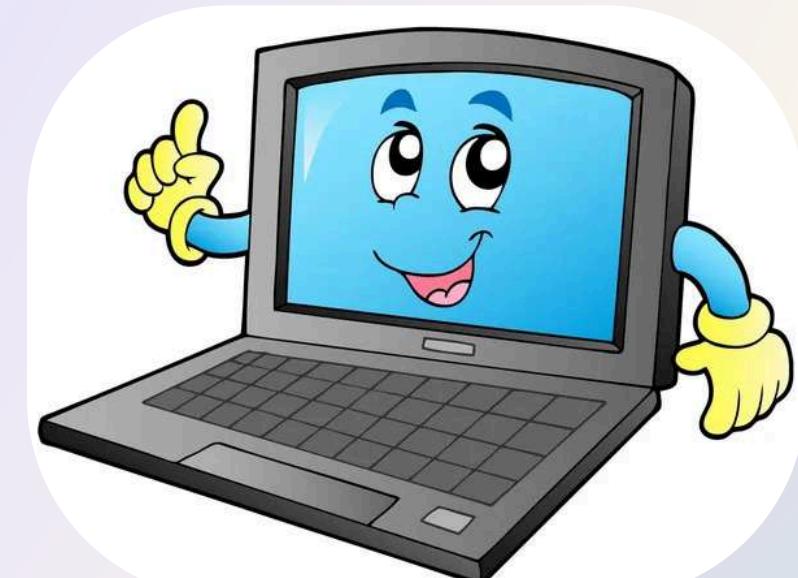


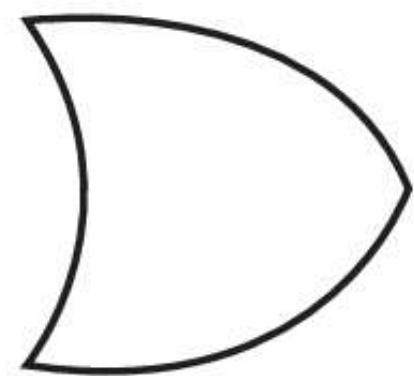
- Let us consider the following analogy to understand the function of the OR gate. As shown in the illustration below, the house has a water tank in addition to the regular main water supply. The tank is to ensure uninterrupted water supply. There are two valves A and B.



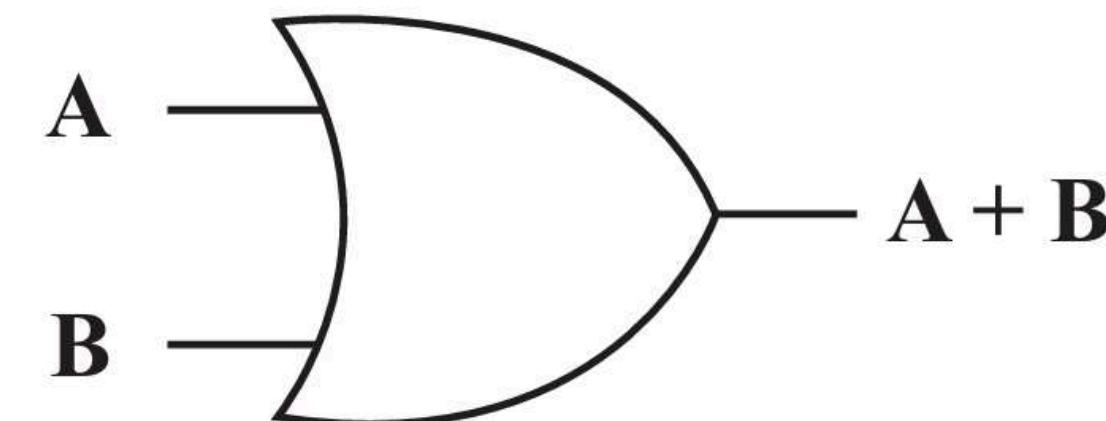
- The following table shows if the house receives water or not based on whether A and B gates are open or closed

A valve	B valve	Water supply to house
Closed	Closed	does not receive water
Closed	Open	receives water
Open	Closed	receives water
Open	Open	receives water





The standard symbol of the OR Gate



When A and B are inputs

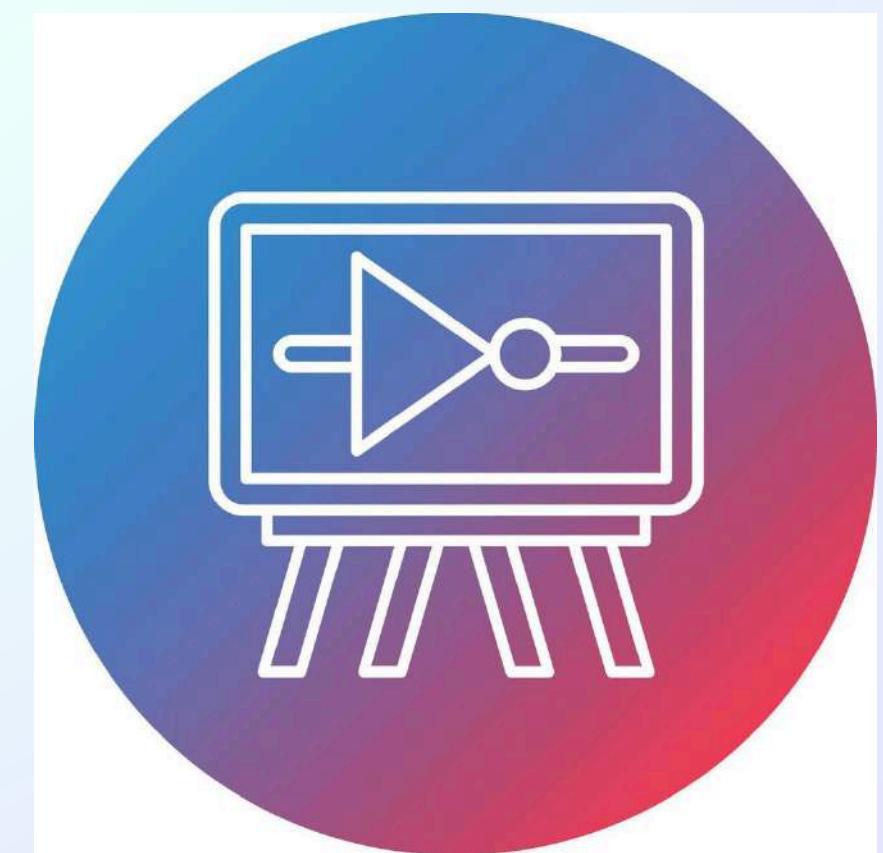


Truth Table of OR Gate

A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

**Output of
OR Gate is
state '1' when
at least one
input is in '1'
state**

NOT GATE



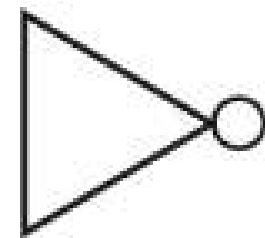
- Let us consider the following analogy to understand the function of NOT gate. It shows a street with streetlamps that are switched off during day time and switched on at night.



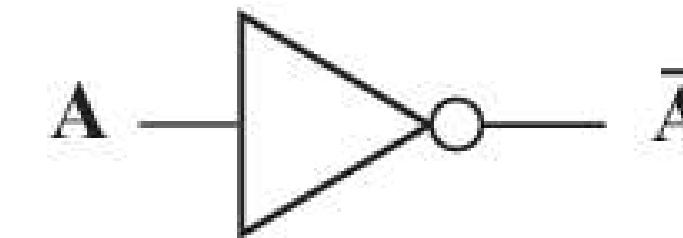
Figure 5.3 : Lighting street lamps automatically

Sunlight	Electric lamp
available	OFF
unavailable	ON

The symbol of NOT gate ;



Standard Symbol of NOT gate



When A is its input

Truth Table of NOT Gate;

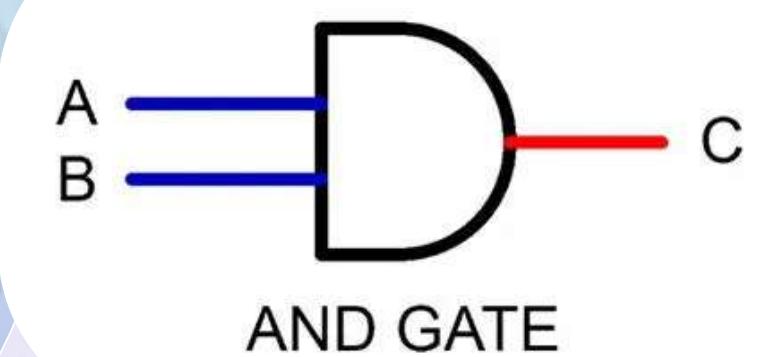
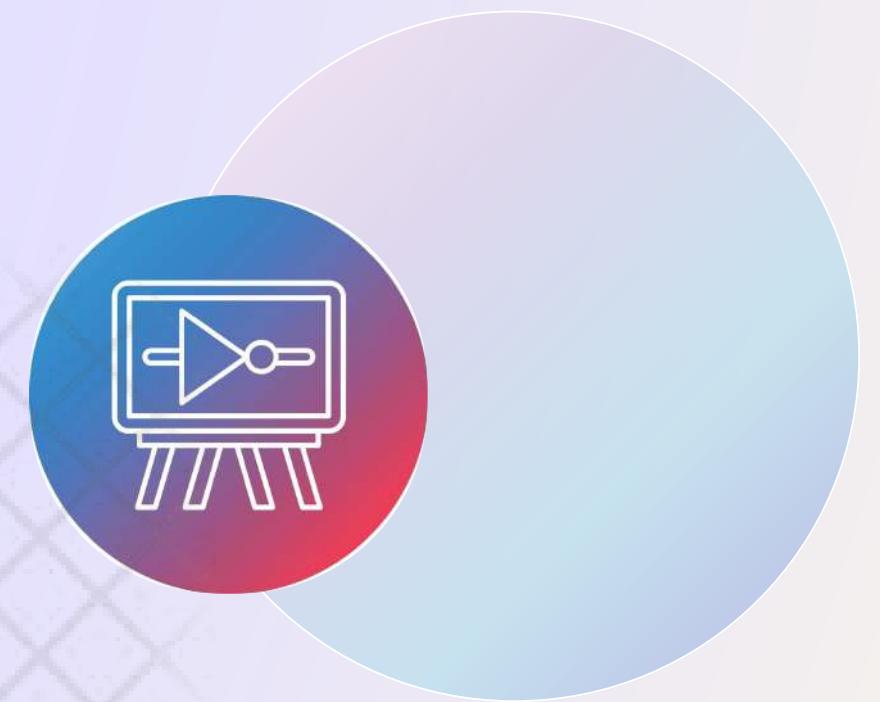
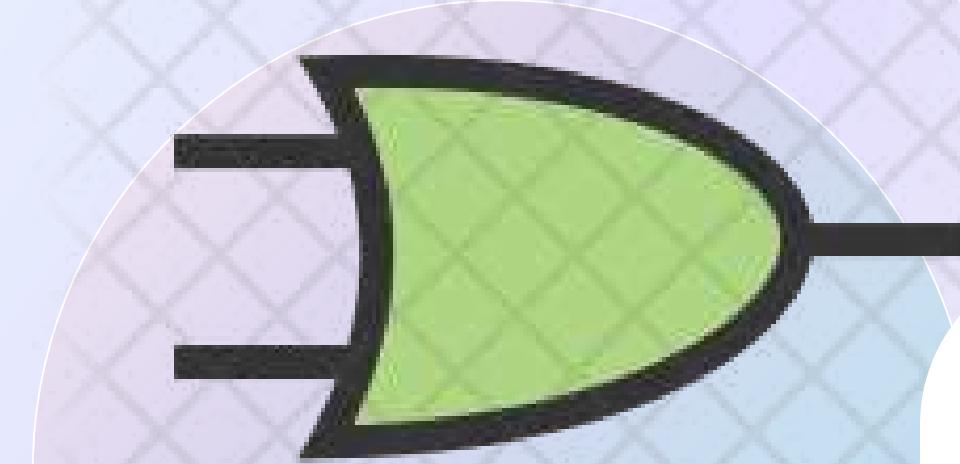
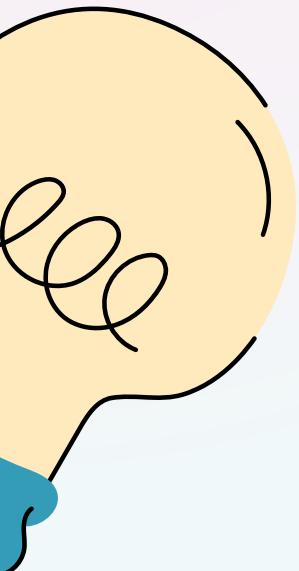
INPUT

OUTPUT

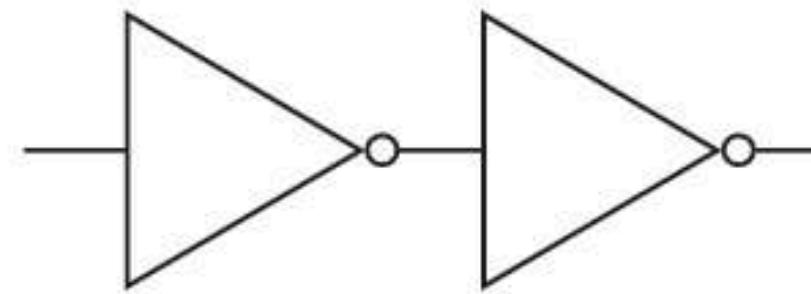
A	\bar{A}
1	0
0	1



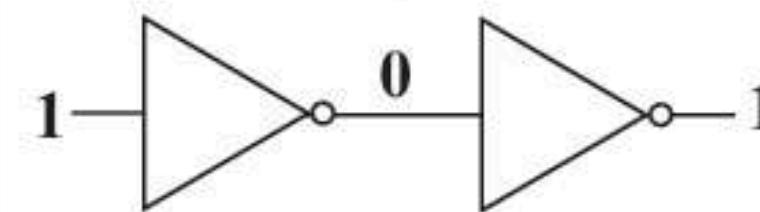
Connecting logic gates in circuits



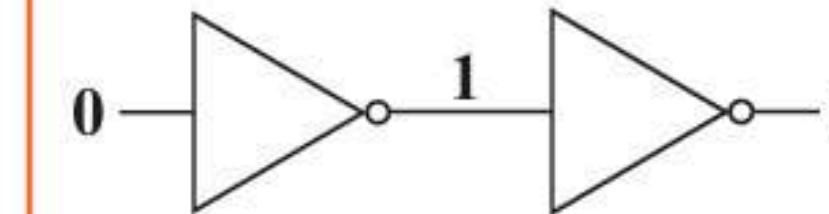
- Obtaining output from the circuit below where input is 1 or 0.



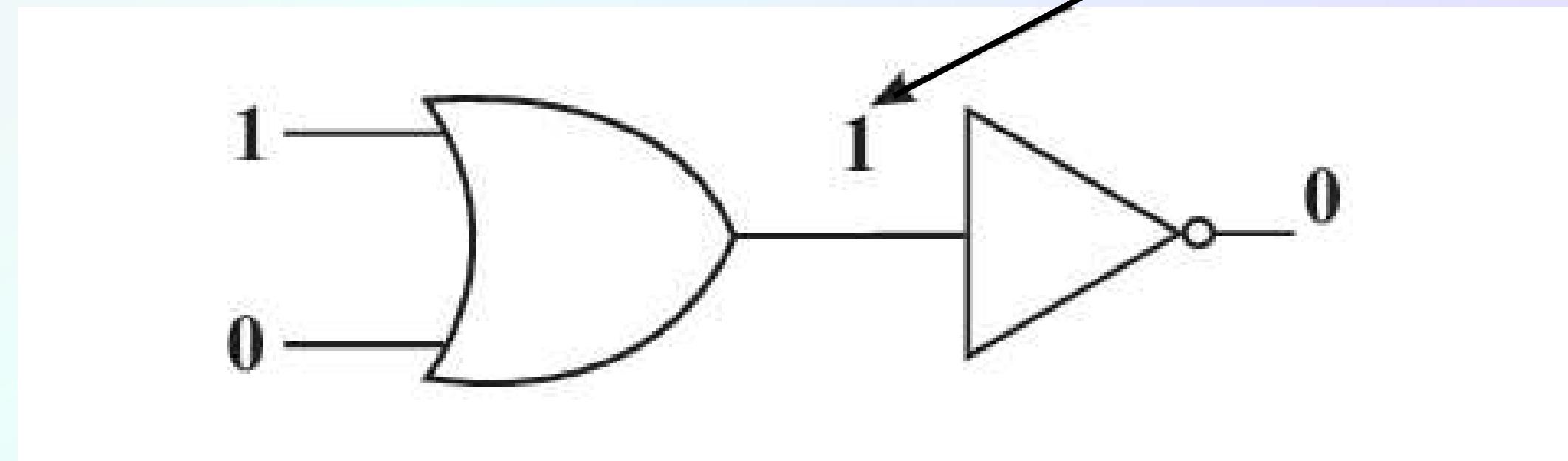
When input is 1



When input is 0



- Obtaining the relevant output according to the input given.
- In OR gate, the inputs are added to give the output $(1 + 0 = 1)$



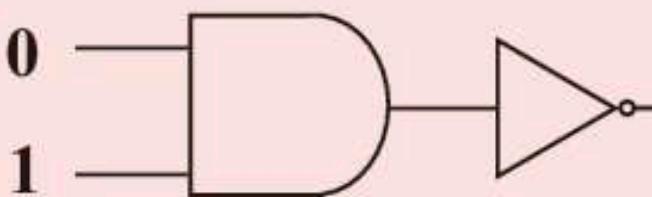
ACTIVITY TIME

Activity 5.1

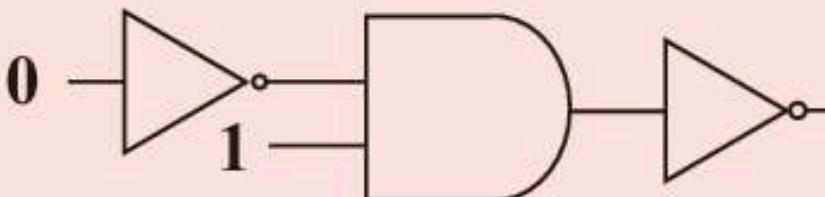


In the circuits given below, write the output for the given input.

1.



2.



3.

