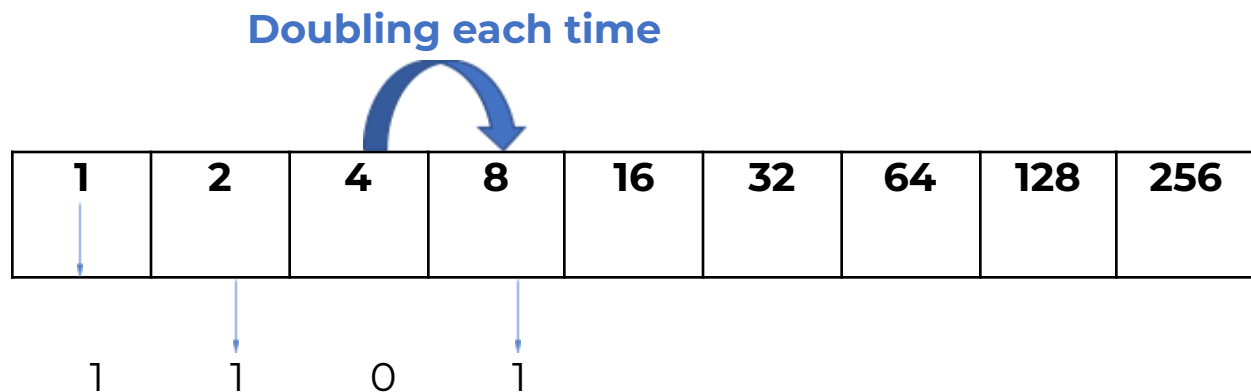


## Lesson 16 Binary Part 2

## How to convert **binary** into **decimal**, numbers we count in?

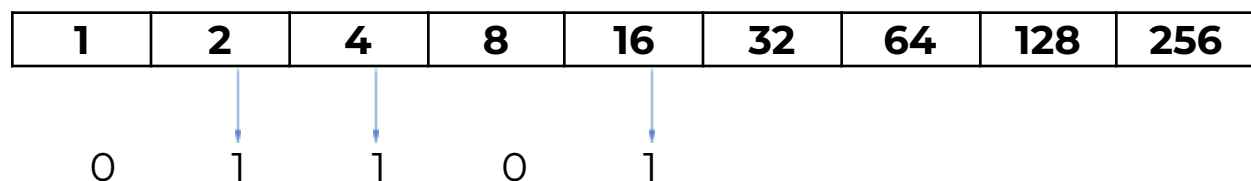
## What is 11 in binary?



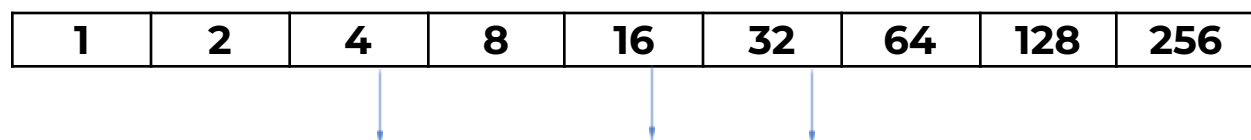
We add all the numbers that are represented by **one**, and we're done!

### Example:

**- Number 22:**



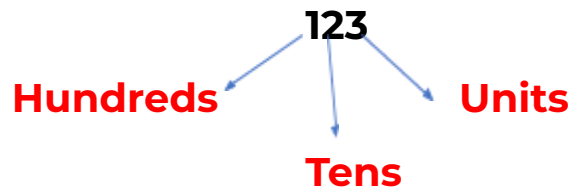
## - Number 52:





0      0      1      0      1      1

Converting **binary** into **decimal**:



Firstly, the decimal system uses **10** as a **base** and the numbers range from **0** to **9**. Therefore,

- **Units** column is represented by 10 raised to the power 0:  **$10^0$**

- **Tens** column is represented by 10 raised to the power 1:  **$10^1$**

- **Hundreds** column is represented by 10 raised to the power 2:  **$10^2$**

**By multiplying each number:**

$$\begin{array}{l} 3 * 10^0 = 3 \\ 2 * 10^1 = 20 \\ 1 * 10^2 = 100 \end{array} \quad \begin{array}{c} \nearrow \\ \longrightarrow \\ \nearrow \end{array} \quad + \quad \begin{array}{c} 3+20+100 \\ \longrightarrow \end{array} \quad 123$$



### Example: 1 1 0 1

Binary numbers are **base 2 numbers** and have only two values (0 and 1). Therefore, We'll do the same but this time we use **2** as the base:

$$\begin{array}{l} 1 * 2^0 = 1 \\ 0 * 2^1 = 0 \\ 1 * 2^2 = 4 \\ 1 * 2^3 = 8 \end{array} \begin{array}{l} \nearrow \\ \nearrow \\ \nearrow \\ \nearrow \end{array} \begin{array}{l} \\ 1+4+8 \end{array} \rightarrow 13$$