Student able to convert from

Binary to Decimal *or vice versa*

Introduction *Binary*

Binary System

A numbering system that uses two (2) digits, 0 and 1, arranged in a series of columns to represent all numerical quantities.

Each column or place value has a weighted value of 1, 2, 4, 8, 16, and so on, ranging from right to left. Since this system uses two (2) digits, it has the Base 2.

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Introduction *Decimal*

Decimal System

A numbering system that uses ten (10) digits, from 0 to 9, arranged in a series of columns to represent all numerical quantities.

Each column or place value has a weighted value of 1, 10, 100, 1000, and so on, ranging from right to left. Since this system uses ten (10) digits, it has the Base 10.

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Mind Map *Binary*

Binary System

use two (2) digits,
0 and 1

known as,
Base 2

allowed digits,
0,1

used by,
Computer

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Mind Map *Decimal*

Decimal System

use ten (10) digits, from **0 to 9**

known as, **Base 10**

allowed digits, **0,1,2,3,4,5,6,7,8,9**

used by, **human**

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Convert

Binary to decimal

To convert binary to decimal, **basic knowledge** of how to read binary numbers may help. In the positional system of binary, each bit (binary digit) is a power of 2. This means that each binary number can be represented as powers of 2, with the **rightmost** being in position 2^0

For example :

Convert 11010_2 to decimal number.

Convert
Binary to decimal

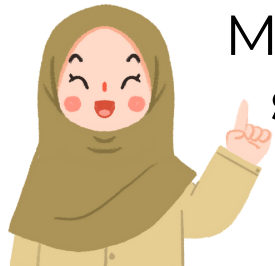
1st method :

$$11010_2$$

$$= (1 \times 2^4) + (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (0 \times 2^0)$$

$$= 16 + 8 + 0 + 2 + 0$$

$$= 26^{10}$$



Multiply each bit by 2^n, **starting from right**.

For example :

Convert 11010_2 to decimal number.

Convert
Binary to decimal

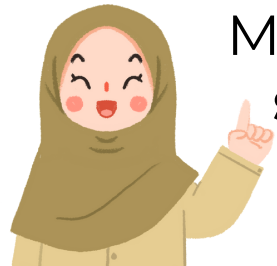
2nd method :

$$0 \times 2^0 = 0$$
$$1 \times 2^1 = 2$$
$$0 \times 2^2 = 0$$
$$1 \times 2^3 = 8$$
$$1 \times 2^4 = 16$$

Add (+)

$$= 26^{10}$$

$$11010_2 = 26^{10}$$



Multiply each bit by 2^n, **starting from right**.

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Convert

Decimal to binary

One of the methods to convert decimal to binary is by **dividing the given decimal number recursively by 2**. Then, the remainders are noted down till we get **0 as the final quotient**. After this step, these remainders are written in reverse order to get the binary value of the given decimal number.

For example :

Convert 66_{10} to binary number.

Convert
Decimal to binary

1st method :

2	66	
2	33	0
2	16	1
2	8	0
2	4	0
2	2	0
2	1	0
	0	1

read from below

$$66_{10} = 1000010_2$$

Written in **reverse order** to get the binary value

Divide each decimal by 2.

For example :

Convert 66_{10} to binary number.

Convert
Decimal to binary

2nd method :

Division by 2	Quotient	Remainder
$^{66}/_{2}$	33	0
$^{33}/_{2}$	16	1
$^{16}/_{2}$	8	0
$^{8}/_{2}$	4	0
$^{4}/_{2}$	2	0
$^{2}/_{2}$	1	0
$^{1}/_{2}$	0	1

$$66_{10} = 1000010_2$$

Conversion steps:

1. **Divide** the number by 2.
2. Get the integer **quotient** for the next iteration.
3. Get the **remainder** for the binary digit.
4. Repeat the steps until the **quotient** is **equal to 0.**