

# 1 Binary and Decimal Systems Review

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## **Learning Goals:**

- Be able to describe how computers process data using the binary number system
- Be able to describe binary numbers
- Be able to convert between the binary system and decimal system

Everyone is familiar with the concept of a number. The numbers that you would commonly think about belong to a number system called the **decimal system**, or **base 10**. However, computers need much simpler input in order to be able to function.

## **What is the binary system?**

**Binary** is a way of expressing information in terms of 1s (ones) and 0s (zeros) **only**. Computers store data and perform calculations in combinations of these 1s and 0s.

In general, 1 represents \_\_\_\_\_ and 0 represents \_\_\_\_\_

## **Key Terms:**

- Bit: A single 1 or 0
- Byte: Represents 8 bits of data – combinations of 0s and 1s

Binary is also referred to as \_\_\_\_\_. This is because a byte is not just 8 values (1s or 0s) but

rather, it could be a \_\_\_\_\_ of 1s and 0s in each “slot”. If you are trying to find how many decimal numbers a series of bits can possibly represent, use the pattern:

$$2^n \text{ where } n \text{ is the number of bits}$$

A byte can therefore represent the decimal numbers 0 to 255. ( $2^8 = 256$ , which is 0, 1, 2, 3....255)

## **Some examples of bytes:**

10110101 = 181	00000001 = 1	00010011 = 19
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Watch this [Binary Counter](#) video

Mathmo14159

## **How do computers process data using this system?**

In other words, how do computers know how to store characters like “A”, “?”

## **The ASCII Standard!**

Imagine if my computer tried to store “A” as 10100101 but yours tried to store it as 00000001... We would never

be able to read each other's files because the two computers wouldn't share the same binary! ASCII ("American Standard Code for Information Interchange") helps solve this problem.

Decimal	Binary	Octal	Hex	ASCII
64	01000000	100	40	@
65	01000001	101	41	A
66	01000010	102	42	B
67	01000011	103	43	C
68	01000100	104	44	D
69	01000101	105	45	E

*Small sample of the ASCII table*

### ***Converting from Binary to Decimal and back***

**Example 1:** Convert 8 to binary

**Example 2:** Convert 25 to binary

**Example 3:** Convert  $1010_2$  into decimal (radix method)

**Example 4:** Convert  $101101_2$  into decimal

**Example 5:** Convert  $101011_2$  into decimal