isaac computer science

Units of data storage

A **binary digit** (or **bit**) is the fundamental unit of data storage, and will have a value of 0 or 1. A group of eight bits is called a **byte**. Four-bit numbers are called a **nibble**.

GCSE Units of data storage

Historically, storage capacity was expressed using the metric prefixes of **kilo** (1,000), **mega** (1,000,000), etc. Since 1998 there has been a move towards using the special prefixes developed to more accurately represent binary values (as per the International System of Units (SI) definition). For example, a kibibyte is equal to 1,024 bytes, whereas a kilobyte is equal to 1,000 bytes.

The differences between the two systems are shown below, pay close attention to which letters are capitalised or not:

Name	Notation	Power of 10	Value
kilobyte	kB	10^3	$1,000$ bytes
megabyte	MB	10^6	$1,000,000$ bytes
gigabyte	GB	10^9	$1,000,000,000$
terabyte	TB	10^{12}	$1,000,000,000,000$ bytes

Name	Notation	Power of 2	Value
kibibyte	KiB	2^{10}	$1024^1 = 1,024$ bytes
mebibyte	MiB	2^{20}	$1024^2 = 1,048,576$ bytes
gibibyte	GiB	2^{30}	$1024^3 = 1,073,741,824$ bytes
tebibyte	TiB	2^{40}	$1024^4 = 109,951,162,776$ bytes

A Level

How many values?

To start thinking about how many different values can be represented by a given number of bits, consider the following examples:

- **One** bit can represent $2^{1} = 2$ distinct binary sequences: 0 and 1
- **Two** bits can represent $2^{2} = 4$ distinct binary sequences: 00, 01, 10 and 11
- **Three** bits can represent $2^{3} = 8$ distinct binary sequences: 000, 001, 010, 011, 100, 101, 110, 111

Can you spot a pattern here? With every additional bit, the number of different arrangements of 0s and 1s doubles. Therefore, n bits can represent 2^{n} different binary sequences.

Number of bits (n)	Number of different binary sequences (2^{n})
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256

How many different values can be represented with 16 bits?

Click a button to show the answer

What is your level of confidence that your own answer is correct?

Low Medium High