THE BINARY SYSTEM AND THE UNITS OF MEASURE

Answer these questions.

a. Do you know how computer do their calculations?

b. Name at least four types of different computers.

c. What do you imagine the future of computers to be?

codon: *codone*
frame: *struttura*
to occur: *capitare*
overlapping: *che si sovrappone*
remainder: *resto*
string: *stringa, sequenza*

Two bytes meet. First byte asks: "Are you ill?" Second byte replies: "No, just feeling a bit off".

Storing, processing and transmitting data through electronic devices is possible because of the **binary system**, but what exactly is it? As the word 'binary' says, only two digits, 0 (zero) and 1 (one), are combined to express a number in a binary system, while the common decimal system is built on the combinations of 10 possible digits (0, 1, 2, 3, 4, 5, 6, 7, 8, 9).
The decimal system uses the power of 10, whereas the binary system uses the power of 2. So, for example, the number 3586 can be written in the decimal system as:

$$3 \times (10)^3 + 5 \times (10)^2 + 8 \times (10)^1 + 6 \times (10)^0.$$

Electronic devices can only understand the binary system, so it is necessary to convert the decimal numbers (or instructions) into binary numbers. To perform such a conversion we have to repeat the process of division by 2 till the quotient is 0 or less than 1. The binary number arises from the reading of the remainders from the bottom to the top. Here is the conversion, for example, of number 81:

	RESULT	REMAINDER
81 : 2 =	40	1
40 : 2 =	20	0
20 : 2 =	10	0
10 : 2 =	5	0
5 : 2 =	2	1
2 : 2 =	1	0
1 : 2 =	0,5	1

Number $81_{10} = 1010001_2$

When working with any kind of processor, each digit (0 or 1) corresponds to a **bit**. Every string of 8 bits is called **byte**. In ASCII code (American Standard Code for Information Interchange) any character you type on your keyboard is interpreted by the computer as a byte. For example, the letter "A" is expressed as the ASCII code 65, but 65 is a decimal number, so if you convert it to binary number, you get 01000001. These 8 digits, or byte, are known to the computer as the letter A.
When writing, you can identify bits and bytes by their spelling: upper case "B" is used for bytes and lower case "b" for bits. So 1MB is a MegaByte, 1Mb is a Megabit and 1kb is a kilobit. For example, monitoring data transfer speed when you download a file from the Internet, you may notice that your browser indicates the transfer rate in KiloBytes per second (KBps).
Here is a table showing the most common multiples of bits:

TERM	VALUES IN BYTES	VALUES IN 2N
bit	1/8 (= 1 character)	2^{1}
byte	1 (= 8 bits)	2^{8}
kilobyte (KB)	1,024	2^{10}
megabyte (MB)	1,048,576	2^{20}
gigabyte (GB)	1,073,741,824	2^{30}
terabyte (TB)	1,099,511,628,000	2^{40}

1 Listen to these scrambled paragraphs, put them in the right order and choose the right headline for each of them.

Protecting data • Starting and stopping • Byte sizes • Counting digits

Binary Code vs Genetic Code (by Daniel Walton)

Title: .... Paragraph no. ....

Both binary and genetic codes contain signals that indicate where to begin and end the reading of their messages. Computers use start and stop bits for this purpose, while the genetic code contains one start codon and three stop codons. However, DNA often exhibits greater flexibility in starting and stopping, as certain parts of the genetic code can be read in different, overlapping segments. These different interpretations are called open reading frames, and often each frame codes for an entirely different but still useful, final product.

Title: .... Paragraph no. ....

In digital code, a single inaccurate bit causes its byte to have a different value, which can introduce significant errors into a computer program. DNA is considerably more resilient in comparison, as many nucleotide changes do not result in changes to the value of the amino acid coded by a codon. Although 64 codons are possible, biological machinery uses only 20 amino acids in the construction of proteins. Many codons that differ by one nucleotide therefore code for the same amino acid, a property known as redundancy. Redundancy protects genetic data from some of the inevitable errors that occur in the replication and reading of DNA.

Title: .... Paragraph no. ....

The simplest unit of binary code is the binary digit, or "bit," which can have one of two values: 0 or 1. The simplest unit of DNA, on the other hand, is the nucleotide, which can have one of four bases: adenine, cytosine, thymine or guanine (A, C, T or G). This increased variation means that each nucleotide of DNA can hold twice as much information as each digit of a binary program.

Title: .... Paragraph no. ....

Computers and biological systems both read their respective codes in blocks of several units instead of analysing each bit or nucleotide individually. Binary information is grouped into sets of eight bits, called bytes; each byte thus has one of 256 possible configurations of zeros and ones. Genetic information on the other hand, comes in triplets of nucleotides known as codons, which represent different amino acids, meaning that each DNA "byte" has only 64 possibilities.

Adapted from: http://oureverydaylife.com/binary-code-vs-genetic-code-40378.html

2 Look at these words from the text above. Identify and underline their prefixes or suffixes and then write down another word using them with the same function.

	PREFIX/SUFFIX	FUNCTION	EXAMPLES
Overlap			
Useful			
Inaccurate			
Respective			
Possibility			
Biological			
Binary			
Computer			

ACTIVITIES