Macmillan Career English

# Computer Science

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World Publishing Corporation

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# Preface

This book is one of Macmillan's *Career English* series. *Career English* is intended for students who have some proficiency in English as well as a working knowledge of their own professional fields. The books are designed to teach the special terminology students need in order to communicate in English within their career areas.

Students will find the *Career English* books clear, lively, practical, and easy to use. Each chapter covers one specific topic and begins with a dialogue between an expert in the field and a student or a trainee. In the course of the dialogue, the key terms pertaining to the chapter topic are introduced in a realistic context. The dialogue is followed by a terminology practice in which each key term is defined and used in three sample sentences. At the end of each chapter, students will find a simple check-up exercise to determine whether or not they have mastered the terms introduced in the dialogue. An answer key to the check-ups is provided for self-correction. A glossary at the end of each book lists all the terms in the text with the numbers of the chapters in which they appear. In addition a cassette recording of the dialogues is available for each book. Use of the cassette is optional but highly recommended.

The books in the *Career English* series are designed to be equally useful for students studying in a classroom or independently.

*To the student*: If you are studying independently, the following suggestions will help you to use this book to its best advantage:

1. Read the dialogue from beginning to end.
2. Read the terminology practice.
3. If you have the tape, listen to it. Listen for the words in the terminology practice, paying special attention to pronunciation and intonation.
4. Reread the dialogue aloud. (If you have the tape, play it again to check your pronunciation.)
5. Do the end-of-chapter check-up to be sure you have mastered the terms introduced in the chapter. Check your answers with the answer key at the back of the book. If you have made an error in the check-up, use the terminology practice to look up the words you have not mastered. Find the terms in the dialogue, and reread the dialogue Correct your errors.
6. Now you are ready to go on to the next chapter.

*To the teacher*: The following suggestions will help you to use this book to its best advantage in your classroom:

1. Ask students to read the dialogue silently.
2. Have them read the terminology practice to themselves.
3. If you have the tape, play it for the class. Suggest that students follow along in their books, listening carefully for the words in the terminology practice and paying careful attention to pronunciation and intonation.
4. Read each word in the terminology practice aloud, asking students to repeat after you. Check for pronunciation. Have students take turns reading the sample sentences aloud.
5. Ask two students to read the dialogue aloud, taking the parts of the characters in the dialogue. (You may wish to have several pairs of students read each dialogue.) As the dialogue is being read, help the students with their pronunciation and intonation.
6. Ask students to do the end-of-chapter check-up to be sure they have mastered the vocabulary introduced in the chapter. If students have their own books, they may write their answers directly in the book. If the books will be used by others, ask students to write their answers on separate paper.
7. Students can check their answers with the answer key at the back of the book. If they have made any errors, suggest they look up the terms in the terminology practice, reread the definitions and sample sentences, and reread the dialogue. Then have them correct their check-ups.

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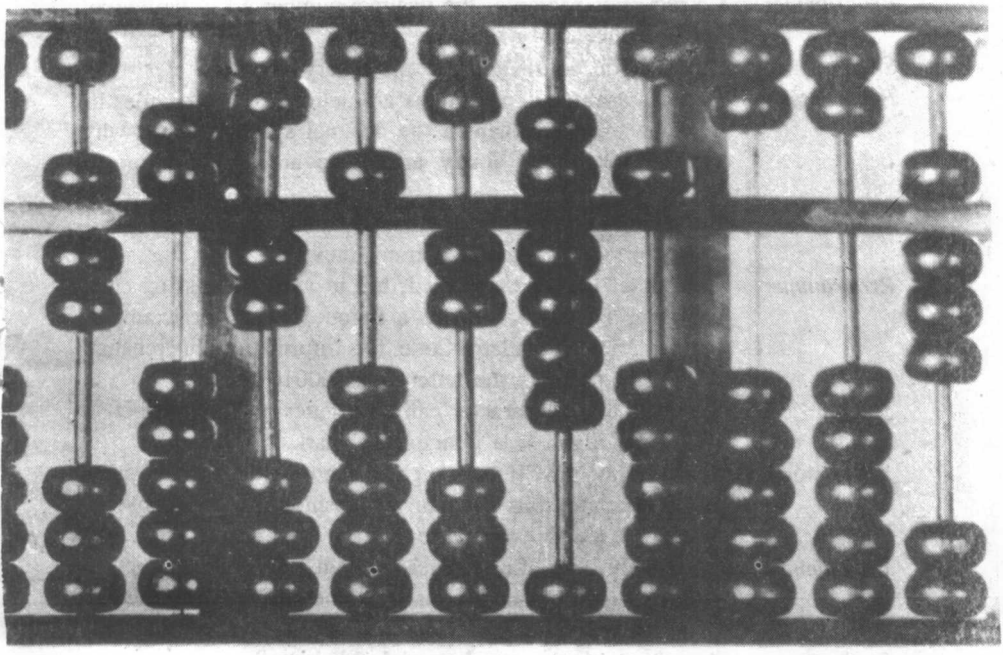


LESSON

# 1 Bits, Bytes, and Words

## A. Dialogue

*Student:* Do you know anything about computers?
*Programmer:* Yes, I write computer programs.
*Student:* Well, perhaps you can tell me what a bit is.
*Programmer:* Bit is short for binary digit. A binary digit is either 0 or 1. The binary system is composed of these two digits.
*Student:* What symbols are used in the decimal system?
*Programmer:* The symbols used are 0 through 9.
*Student:* So numbers are represented by different symbols when written in different systems.

*Programmer:* Correct. For example, the decimal number 13 is written as 1101 in the binary system.

*Student:* But why do computers use the binary system?

*Programmer:* Because arithmetic operations are defined by fewer rules in the binary system than in the decimal system. That's why circuits for doing binary arithmetic are much easier to build.

*Student:* But computers are used for more than arithmetic. Word processors are computers, aren't they?

*Programmer:* Of course. Bits are still used, but in word processing each character is represented by a unique code. For example, the American Standard Code for Information Interchange (ASCII) represents the letter A as 00010100.

*Student:* I assume that a character can be a letter of the alphabet, a numerical digit, or a punctuation mark.

*Programmer:* That's right. ASCII uses eight bits to define a given symbol. Groups of bits used in this fashion are called bytes.

*Student:* Are bits used to code pictures?

*Programmer:* Absolutely. For this application, tiny dots called picture elements (pixels) have certain numbers of bits assigned to them. Pictures are formed by putting many pixels together.

*Student:* Are those pixels stored as eight-bit bytes?

*Programmer:* No. They're stored as words. High-quality pictures sometimes have as many as 24 bits per pixel, so the system works with 24-bit words.

## B. Terminology Practice

**American Standard Code for Information Interchange (ASCII):** a code scheme that translates characters into binary digits

What types of computers use the ASCII coding scheme?
What special symbols does ASCII define?
The ASCII representation of a comma is 11000010.

**binary digit (bit):** 0 or 1; the smallest unit of information

Five bits are required to count from 0 to 31.
How many bits per byte are used in your company's computer?
High-quality pictures sometimes have as many as 24 bits per pixel.

**binary system:** a numbering system based on the digits 0 and 1

Binary system numbers, except 1 and 0, have more digits than the equivalent decimal system numbers.
Are there other number systems besides the binary and decimal systems?
In the binary system the symbol 10 represents the decimal number 2.

**byte:** a group of bits that represents a character and is processed as a single unit

Every character in ASCII is represented by an eight-bit byte.
A long word can consist of 4 eight-bit bytes.
Does this sytem use eight-bit bytes?

**character:** a graphic symbol used in writing or printing
The Roman alphabet has 26 characters.
ASCII is set up to represent 128 different characters.
What are some of the special characters?

**code:** a system of symbols for representing a language or numbers in a computer
Every computer system uses a code.
Can a code be devised to represent sounds?
Digital recording systems code sounds into 0's and 1's.

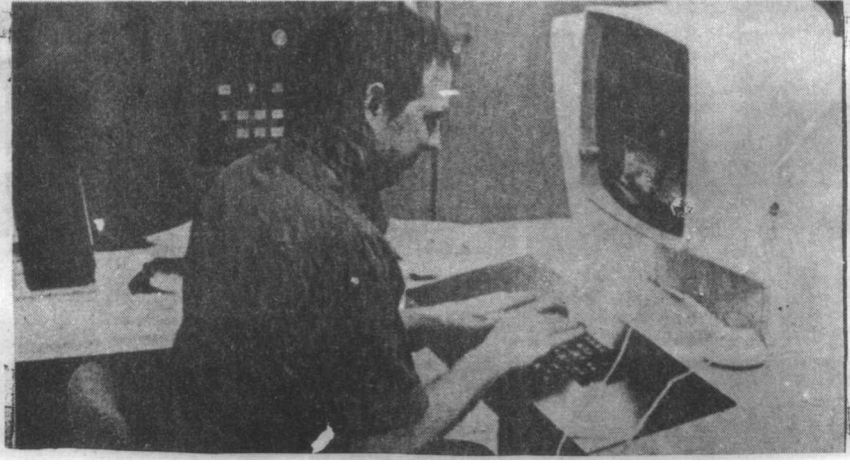
**decimal system:** a numbering system based on the digits 0 through 9
The number five is represented by the symbol 5 in the decimal system.
The decimal system consists of ten digits.
Why do we use the decimal system?

**digit:** a single symbol to which a numerical value is assigned
The number seventeen has two digits in the decimal system.
All decimal numbers less than 1,000 can be written with fewer than four digits.
How many binary digits are needed to write the number 999?

**picture element (pixel):** a small rectangular division on a video screen
Pictures are clearer when there are more bits per pixel.
How many bits per pixel were used on the Voyager probe?
The Voyager probe processed 24 bits of information per pixel.

**program:** a detailed set of instructions that directs a computer to perform specific tasks
The person who writes programs is called a programmer.
What does that program do?
This program is used by our company's accounting department.

**programmer:** a person who writes computer programs
Are you a computer programmer?
Programmers are employed by many different kinds of companies.
Our company has recently hired six new programmers.



**system:** a group of interrelated parts or elements designed to achieve a specific goal

Our company has just invested in a computer system.
How does the payroll system work?
The accounting system is very efficient in our firm.

**word:** a group of bytes processed as a single unit

Many systems use words that have 2 eight-bit bytes.
The word "the" is composed of three bytes in ASCII.
Can programmers specify word lengths in their programs?

**word processor:** a computerized text editor

Word processors are used to prepare reports in offices.
How expensive are word processors?
My cousin bought a word processor last week.

## ASCII CHARACTER CODES

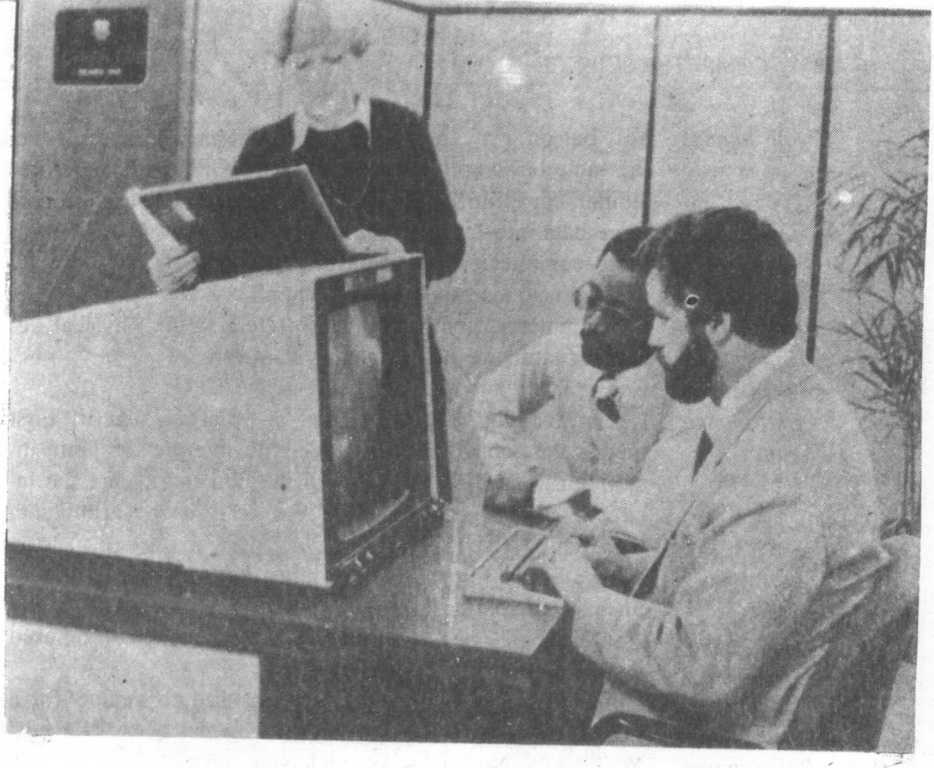
| Code | | Char | Code | | Char | Code | | Char | Code | | Char |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dec | Hex | | Dec | Hex | | Dec | Hex | | Dec | Hex | |
| 0 | 00 | NUL | 32 | 20 | SP | 64 | 40 | @ | 96 | 60 | ` |
| 1 | 01 | SOH | 33 | 21 | ! | 65 | 41 | A | 97 | 61 | a |
| 2 | 02 | STX | 34 | 22 | " | 66 | 42 | B | 98 | 62 | b |
| 3 | 03 | ETX | 35 | 23 | # | 67 | 43 | C | 99 | 63 | c |
| 4 | 04 | EOT | 36 | 24 | $ | 68 | 44 | D | 100 | 64 | d |
| 5 | 05 | ENQ | 37 | 25 | % | 69 | 45 | E | 101 | 65 | e |
| 6 | 06 | ACK | 38 | 26 | & | 70 | 46 | F | 102 | 66 | f |
| 7 | 07 | BEL | 39 | 27 | ' | 71 | 47 | G | 103 | 67 | g |
| 8 | 08 | BS | 40 | 28 | ( | 72 | 48 | H | 104 | 68 | h |
| 9 | 09 | HT | 41 | 29 | ) | 73 | 49 | I | 105 | 69 | i |
| 10 | 0A | LF | 42 | 2A | * | 74 | 4A | J | 106 | 6A | j |
| 11 | 0B | VT | 43 | 2B | + | 75 | 4B | K | 107 | 6B | k |
| 12 | 0C | FF | 44 | 2C | , | 76 | 4C | L | 108 | 6C | l |
| 13 | 0D | CR | 45 | 2D | - | 77 | 4D | M | 109 | 6D | m |
| 14 | 0E | SO | 46 | 2E | . | 78 | 4E | N | 110 | 6E | n |
| 15 | 0F | SI | 47 | 2F | / | 79 | 4F | O | 111 | 6F | o |
| 16 | 10 | DLE | 48 | 30 | 0 | 80 | 50 | P | 112 | 70 | p |
| 17 | 11 | DC1 | 49 | 31 | 1 | 81 | 51 | Q | 113 | 71 | q |
| 18 | 12 | DC2 | 50 | 32 | 2 | 82 | 52 | R | 114 | 72 | r |
| 19 | 13 | DC3 | 51 | 33 | 3 | 83 | 53 | S | 115 | 73 | s |
| 20 | 14 | DC4 | 52 | 34 | 4 | 84 | 54 | T | 116 | 74 | t |
| 21 | 15 | NAK | 53 | 35 | 5 | 85 | 55 | U | 117 | 75 | u |
| 22 | 16 | SYN | 54 | 36 | 6 | 86 | 56 | V | 118 | 76 | v |
| 23 | 17 | ETB | 55 | 37 | 7 | 87 | 57 | W | 119 | 77 | w |
| 24 | 18 | CAN | 56 | 38 | 8 | 88 | 58 | X | 120 | 78 | x |
| 25 | 19 | EM | 57 | 39 | 9 | 89 | 59 | Y | 121 | 79 | y |
| 26 | 1A | SUB | 58 | 3A | : | 90 | 5A | Z | 122 | 7A | z |
| 27 | 1B | ESC | 59 | 3B | ; | 91 | 5B | [ | 123 | 7B | { |
| 28 | 1C | FS | 60 | 3C | < | 92 | 5C | \ | 124 | 7C | \| |
| 29 | 1D | GS | 61 | 3D | = | 93 | 5D | ] | 125 | 7D | } |
| 30 | 1E | RS | 62 | 3E | > | 94 | 5E | ^ | 126 | 7E | ~ |
| 31 | 1F | US | 63 | 3F | ? | 95 | 5F | _ | 127 | 7F | DEL |

## C. Check-Up

*Fill in the blanks with the proper terms from the list.*

| | |
|---|---|
| binary system | digit |
| bit | pixels |
| bytes | program |
| characters | word |
| decimal system | word processor |

1. The _____ is based on the digits 0 and 1.
2. A computerized video picture is formed by many tiny _____.
3. The letter T and the number 5 are known as _____
4. Detailed instructions for a computer to perform specific tasks are known as a _____.
5. A single binary digit is called a _____.
6. ASCII uses eight-bit _____ to represent characters.
7. A single symbol that represents a number is known as a _____.
8. A group of bytes, processed as a single unit, is called a _____.
9. A _____ is a computerized text editor.
10. The _____ consists of ten digits.



LESSON

# 2 The CPU

## A. Dialogue

*Student:* What's a microprocessor?

*Programmer:* It's a very small central processing unit (CPU), manufactured on a single integrated circuit (IC) chip in a microcomputer. A microcomputer has a primary storage range of 4 to 64K characters.

*Student:* Does K stand for kilo?

*Programmer:* Not exactly. It represents 1,024, and M represents 1,048,576. Both are used to measure storage capacity. But let's get back to CPUs.

*Student:* I've heard about CPUs before. If I recall correctly, the CPU is the brain of a computer system.

*Programmer:* That's right.

*Student:* Can a microprocessor do the same operations that a larger CPU does?

*Programmer:* Yes, but on a much smaller scale. The microprocessor has the same basic architecture as a larger CPU and, therefore, similar capabilities. However, larger systems can process more data into information in less time, as well as perform more complicated operations.

*Student:* What do you mean by architecture?

*Programmer:* In computer jargon, architecture refers to the physical design or structure of a system's hardware.

*Student:* Can you tell me something about the CPU?

*Programmer:* I can give you a general idea of what's inside it. First there's the control unit. Its task is to interpret program instructions and direct the rest of the unit to execute the instruction. The second part of the CPU is the arithmetic-logic unit (ALU).

*Student:* I assume this part of the CPU must perform all the mathematical calculations.

*Programmer:* And the logic operations, also. For instance, it can be used to compare groups of characters.

*Student:* I see. Can this logic capability be used to search for a name in a list of names?

*Programmer:* Yes, it can. Now that you understand that, let me tell you about the third CPU component—primary storage. Primary storage is the computer memory. It's composed of RAM and ROM.

*Student:* I've seen these terms, too. RAM stands for random access memory, and ROM stands for read only memory. But what do these words mean?

*Programmer:* RAM refers to the computer's capacity to store information while it is turned on. If the information is to be retrieved at a later time, it must be transferred to another storage device or it will be lost when the computer is turned off.

*Student:* And what's the ROM used for?

*Programmer:* The ROM is the part of primary storage that holds permanent information that can't be altered by program instructions.

## B. Terminology Practice

**architecture:** any design or orderly arrangement of either hardware or software

All computer hardware architecture contains input, output, CPU, and storage units.

Many courses ae offered in computer architecture.

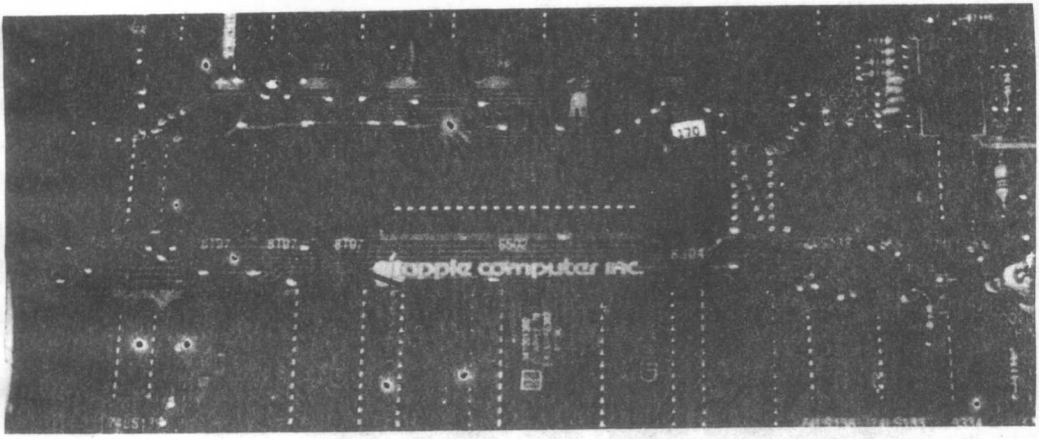
Is the structure of the ALU considered architecture?

**arithmetic-logic unit (ALU):** a part of the CPU that performs all arithmetic and logic operations

All ALUs have circuits capable of adding numbers.
Where is the ALU found on this chip?
The ALU manipulates millions of bits per second.

**central processing unit (CPU):** the brain of a computer system

How large is the CPU storage on your system?
A computer system cannot operate without a CPU.
All data ultimately pass through the CPU.




**chip:** a piece of semiconductor material on which integrated circuits are etched

Pocket calculators use only one chip for all their functions.
A one-centimeter-by-one-centimeter chip can contain a very powerful CPU.
How big is the CPU chip in your home computer?

**control unit:** the part of the CPU that decodes and directs the flow of program instructions

Every CPU has a control unit.
Can you show me the control unit on this chip?
There is a malfunction in the control unit.

**data:** a collection of independent and unorganized facts

Each ASCII-coded character contains eight bits of data.
Some storage devices store millions of bytes of data.
Does the CPU manipulate data?

**hardware:** the physical components of a computer system

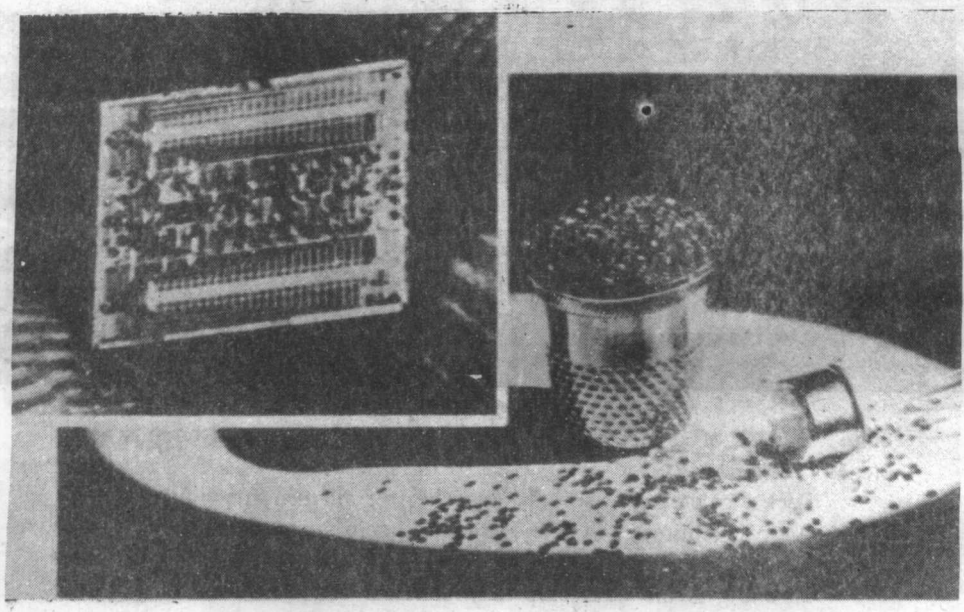
The CPU is part of the system hardware.
Do you specialize in hardware?
The physical manipulation of data is done by the system hardware.

**information:** meaningful and useful facts that have been processed from data by a computer

Data is input into the computer, and information is output.
Have you received the information yet?
I'd like to discuss this information with you.

**integrated circuit (IC):** the physical components mounted on a chip, designed to work as a unit

ICs are very complex devices
Many ICs have over 10,000 circuit components on one chip.
How big is a typical IC?



**K:** a symbol for 1,024

How much K is in this computer's RAM?
We can expand the primary storage to 32K.
A microcomputer has a maximum primary storage of 64K.

**logic operation:** a computer operation in which a decision is made

Putting a list of names in alphabetical order is a logic operation.
A logic operation enables a user to write a program that searches a list for a particular name.
Can all computers perform logic operations?

**M:** a symbol for 1,048,576

A 4M storage capability is equivalent to 4,000,000 bytes.
Is it possible to expand the storage capacity to 2M?
This system's primary storage is much smaller than 1M.

**microcomputer:** a small-scale, low-cost computer system with a primary storage range of 4 to 64K characters

The brain of the microcomputer is the microprocessor.

Does your company have a microcomputer?

Microcomputers are often referred to as personal or home computers.

**microprocessor:** an entire CPU on an IC chip

All microcomputers have microprocessors as their CPUs.

How large is a microprocessor's memory?

Many microprocessors have an area smaller than one square centimeter.

**primary storage:** the most rapidly accessible data storage area, located in the CPU

What is the capacity of the primary storage on home computers?

Typically, a home computer has a primary storage capacity of between 8,000 and 16,000 bytes in its RAM.

The CPU cannot function without the primary storage.

**program instruction:** a single operation specified by the programmer which, with other instructions, constitutes a program

How many program instructions are needed to cover all possibilities?

This program instruction isn't necessary.

Program instructions often contain arithmetic operations.

**random access memory (RAM):** a storage system that holds information while the computer is turned on

The size of the RAM helps determine how powerful the CPU is.

A CPU with a very large RAM is capable of running very complex programs.

Information stored in the RAM is instantaneously accessible.