КРАМАТОРСЬК

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ENGLISH AND COMPUTER

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ УКРАИНЫ
ДОНБАССКАЯ ГОСУДАРСТВЕННАЯ МАШИНОСТРОИТЕЛЬНАЯ АКАДЕМИЯ

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АНГЛИЙСКИЙ И КОМПЬЮТЕР

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Данное пособие ставит своей целью выработать у студентов навыки чтения и понимания оригинальной технической литературы по архитектуре ЭВМ, программированию, видам программ, операционным системам, мини- и макро ЭВМ, автоматизированным системам управления для получения информации, ведения беседы в пределах пройденной тематики.

Тексты сопровождаются лексическими и грамматическими упражнениями, предназначенными для закрепления и активизации учебного материала и расширения словарного запаса студентов.

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СОДЕРЖАНИЕ

PART I

UNIT I

Grammar. The Verb (basic forms: Indefinite, Continuous, Perfect Active).

Text A. What is Computing?

Text B. Analogue computers.

Text C. Digital computers.

I. Read the international words and guess their meaning:

centre; figure; final; to stop; to cross; real; machine; information; ordinary; business; complex; modern; automatic; second; multiplication; division; arithmetical; mathematic; second; multiplication; division; arithmetical; mathematical; logical; display; computer; operation; physical; number; analog; hybrid; press; to combine

II. Read and memorize the following words and word combinations:

suppose	- предполагать
digit	- цифра, число, разряд, символ
column	- столбик, столбец
compute	- считать, вычислять
take in	- принимать (информацию)
data	- данные, информация
perform	- выполнять, производить (действие)
reasonable	- разумный
produce	- производить, порождать, синтезировать
sequence	- последовательность, ряд
receive	- отлучать
put out	- выдавать (информацию)
print	- печатать
number	- число, номер, цифра
keyboard	- клавишный пульт, клавиатура
press	- нажимать
total	- сумма, итог
key	- кнопка, клавиша, ключ
addition	- сложение
subtraction	- вычитание
multiplication	- умножение
division	- деление
store	- хранить, запоминать
hardware	- аппаратное обеспечение ЭВМ

express	- выражать
relation	- отношение, соотношение, зависимость, связь
compare	- сравнивать
select	- выбирать
display	- дисплей, показывать
numerical	- числовой, численный
measurement	- измерение, вычисление
property	- свойство, особенность

a set of figures	- ряд цифр, набор цифр
the right-hand column	- правый столбик
to take in (put in)	- принимать (информацию)
a sequence of reasonable operations	- последовательность разумных операций
the ordinary business adding machine	- обычная канцелярская суммирующая машина

TEXT A. WHAT IS COMPUTING?

Suppose you sit down with pencil and paper and centre your attention on adding a set of figures. You add first all the digits in the right-hand column, then all the digits in the next column, and so on – until you finally arrive at the answer.[1] When you do this, you are computing.

When you stop at a street corner, looking first to the left for any coming car, then to the right, to cross the street or to wait on the sidewalk[2] – you are computing.

When you are walking along a poorly marked path[3] in the woods, thinking if you are really on the path or have lost it[4]– you are computing.

When you are taking in information or data, performing reasonable operations (mathematical or logical operations) on the data, and are producing one or more answers – you are computing.

A machine can also do this. It can take in information or data, perform a sequence of reasonable operations on the information which it has received, and put out answers. When it does this, it is computing.

A very simple example of a computer is the ordinary business adding machine which prints on paper tape the number entered into its keyboard, and also prints a total when you press the total key. A complex example of a computer is a modern automatic digital computer which in each second can perform more than 100,000,000,000 additions, subtractions, multiplications, or divisions.

A computing machine can take in and store information because the hardware inside the machine expresses arithmetical and logical relation, such as adding or subtracting, comparing or selecting. A computer can also put out information, display the answers when it receives them. Hardware is useless without software which is computer instructions and programs.

The modern computers are of three kinds called analog, digital, and hybrid. An analog computer computes by using physical analogs of numerical measurements. A digital computer computers by using the numbers (digits) and yeses and noes expressed usually in 1's and 0's.[5] A hybrid computer is a machine which combines some properties of digital and analog computers.

Notes:

[1] until you finally arrive at the answer – до тех пор, пока вы наконец не получите ответ;

[2] to cross the street or to wait on the sidewalk – чтобы перейти улицу или подождать на тротуаре;

[3] a poorly marked path – едва заметная тропинка;

[4] if you are really on the path or have lost it – действительно ли вы находитесь на тропинке или заблудились;

[5] yeses and noes expressed usually in 1's and 0's – да и нет, выраженные обычно единицами и нулями.

EXERCISES

I. Give the Russian equivalents:

to centre attention on; to the right; to the left; a set of figures; and so on; a sequence of reasonable operations; to put out answers; to take in information; to store information; such as; to express mathematical and logical relations; hardware is useless without software; by using physical analogs; numerical measurements.

II. Give the English equivalents:

налево; направо; выдавать информацию или данные; последовательность разумных операций; правый столбик; ряд цифр; и так далее; сосредотачивать внимание.

III. Translate the words of the same root. Define speech parts:

to centre – a centre; to add – addition; to compute – a computer – computation; to mark – a mark; to inform – information; datum – data (mind! a date); to perform – performance; reasonable – a reason; to operate – operation; business – busy; to subtract – subtraction; to multiply – multiplication; to divide – division; logic – logical; arithmetic – arithmetical; measurement – to measure; relation – to relate.

IV. Answer the following questions:

1. How many operations does a modern computer perform? 2. What kinds of operations does an automatic digital computer perform? 3. What is a computer? 4. What is a very simple example of a computer? 5. Why does a computer take in and store information or data? 6. What kinds of modern computers do you know? 7. How does an analog computer compute? 8. How does a digital computer compute? 9. What is a hybrid computer? 10. What is hardware? 11. What is software?

V. Choose the 3rd form of the given verbs:

took, takes, take, taken; thought, think, thinks; arrive, arrives, arrived; did, done, do, does; speaks, speak, spoke, spoken; saw, seen, see, sees; was, were, is, am, be, been, are; writes, wrote, written; has, had, have; express, expressed, expresses; receive, received, receives.

VI. Translate the following sentences paying attention to the use of Indefinite, Continuous, Perfect Tenses in the Active Voice:

My friend studies at the department of Electrical Engineering. I study at the same department. We do research. Comrade Ivanov also does his research (научное исследование). We discussed various (различный) problems at the seminar. They did many operations on the computer ES-1045. Yesterday we went to the Institute library. I answered all the questions at the exam in mathematics. We shall solve this algebraic problem. They will do their work in time. I shall compare my results with yours. 2. When you came he was calculating (вычислять) his problem. She was discussing some questions with her instructor. I shall be waiting for you at 6 o'clock. 3. He has given a short answer to my question. I have just (только что) come from St. Petersburg. They have already gone home. They had written the program for the computer by June.

VII. Read Text B and translate it without a dictionary. Express its contents in Ukrainian:

TEXT B. ANALOGUE COMPUTERS

The computer is a universal information processing machine.[1] The installation of computers in certain organizations has already greatly increased the efficiency of these organizations. Computers are a million times faster than humans in performing computing operations.

Analogue and digital computers are now widely used in many fields. The two types of computers differ in fundamental concept. The analogue machine may be regarded as a model of a physical or mathematical problem. The values of the variables are represented in the machine by physical quantity and the result is obtained by the measurement of another quantity.

Analogue computers are usually designed for one application, although some machines can be adapted to a range of problems by changing interconnections between their various units. The analogue machine, although limited by the accuracy, can deal with continuous variables.[2]

Analogue computation is applied to solving the behaviour of a system. Some kind of analogue computation enables the engineer to obtain approximate solutions to his problems with a speed and ease.

The accuracy of operation of an analogue computer is much below that of a digital computer, but there are several compensating advantages.

Apart from cases that include simulation with actual components, any mechanical, electrical, biological or even economic system dynamics, involving motion or variation in time, may be studied.

Notes:

[1] a universal information processing machine – универсальная машина для обработки данных;

[2] can deal with continuous variables – может иметь дело с непрерывно изменяющимися величинами.

VIII. Read Text C and give its contents in short:

TEXT C. DIGITAL COMPUTERS

The digital computer performs three major roles. It operates as a calculating machine and finds widespread application in all branches of science and engineering. It is also used for data processing[1] in commerce and industry. The third role is in the monitoring and control[2] of industrial processes and communication systems.

The computers are used in chemical plants, power stations, road traffic control, etc.

The basic digital computer consists of four main sections: the store[3], arithmetic unit, control and input/output devices.

The store contains a numerical quantities and data which are to be processed. It also has a programme or list of instructions which are to be performed.

The arithmetic unit normally performs the operation of addition, subtraction, multiplication and division and certain other special operations.

The input and output devices are to supply information and to obtain it from the computer. These devices play a significant part in making the capacity of a computer effective.

Notes:

[1] for data processing – для обработки данных;
[2] in the monitoring and control – в управлении и контроле;
[3] the store – память.

UNIT 2

Grammar. Indefinite, Continuous, Perfect Passive. Modal Verbs and Their Equivalents.

Text A. What is a Computer?

Text B. What can computer do?

Text C. From the history of computers.

I. Read the international words and guess their meaning:

specific; navigate; general; rocket; machine; list; information; instruction; arithmetic; calculation; operation; peripherals; display.

II. Read and memorize the following words and word combinations:

circuit	- схема, цепь
purpose	- назначение, цель, намерение
button	- кнопка
spacecraft	- космический корабль
device	- устройство, прибор, механизм, элемент
store	- запоминать, хранить
storage	- запоминающее устройство, память
solve	- решать
cause	- заставлять, вынуждать
supply	- подавать
to make sure	- убедиться
special-purpose computer	- компьютер специального назначения
general-purpose computer	- компьютер общего назначения
to perform the desired operations	- выполнять нужные операции

TEXT A. WHAT IS A COMPUTER?

A computer is really a very specific kind of counting machine. It can do arithmetic problems faster than any person alive. By means of electric circuits it can find the answer to a very difficult and complicated problem in a few seconds.

A computer can «remember» information you give it. It stores the information in its «memory» until it is needed. When you are ready to solve a problem, you can get the computer to sort through its stored facts[1] and use only the proper ones. It works the problem with lightning speed. Then it checks its work to make sure there are no mistakes.

There are different kinds of computers. Some do only one job over and over again. These are special-purpose computers. Each specific application requires a specific computer. One kind of computer can help us build a spacecraft another kind of computer can help us navigate that spacecraft. A special-purpose computer is built for this purpose alone and cannot do anything else.

But there are some computers that can do many different jobs. They are called general-purpose computers. These are the «big brains» that solve the most difficult problems of science. They answer questions about rockets and planes, bridges and ships – long before these things are even built.

We used to think of a computer as a large machine with many buttons and flashing lights that took up a whole room.[2] But today computers are becoming smaller and smaller and are even being put inside other devices. Though these small devices are called microcomputers or minicomputers, they are still true computers.

We might list the essential constituent parts of a general-purpose computer as follows. First, core store, also called memory. It is best to think of computer memory simply as a place where information is stored. This information can be an instruction or an item of data. We can store many instructions or many items of data in a computer. Second, an arithmetic unit, a device for performing calculations. Third, a control unit, a device for causing the machine to perform the desired operations[3] in the correct sequence. Fourth, input devices whereby data (in the form of numbers) and operating instructions can be supplied to the machine, and fifth, output devices for displaying the results of calculations. The input and output devices are called peripherals.

Notes:

[1]you can get the computer to sort through its stored facts – можно заставить ЭВМ рассортировать накопленные факты;

[2]took up a whole room – занимал целое помещение;

[3]a device for causing the machine to perform the desired operations – устройство, заставляющее машину совершать нужные операции.

EXERCISES

I. Complete the following sentences:

1. A computer is really a very specific kind of …
2. By means of electric circuits it can find the answer to ...
3. A computer stores the information in its «memory» until …
4. Each specific application requires …

5. A special-purpose computer is built for …
6. A special-purpose computer is built for …
7. We used to think of a computer as …
8. The essential constituent parts of a general purpose computers are …
9. The input and output devices are called …

II. Translate the following sentences paying attention to the words in bold type:

a) 1. What **kind** of computer was it? – It was digital computer. 2. The computer can perform different **kinds** of operations. 3. This **kind** of logical problem is very simple. 4. Will you **kindly** explain to us the operation of this **kind** of machine? 5. Be so **kind**, show us the new equipment.

b) 1. **As** you already know logical relations in a computer are expressed by hardware. 2. **As** the ordinary business adding machine has the special equipment inside it, it can store information. 3. An electronic computer can add, subtract, multiply, and divide **as well**. 4. Natural sciences include mathematics, physics, chemistry, medicine, geology, biology, bionics, **as well as** the engineering sciences and other fields of knowledge. 5. **As** our professor was speaking of the history of computers, he mentioned P.L. Chebyshev and his great inventions. 6. My friend works at a plant **as** an engineer.

c) 1. Progressive people everywhere in the world must fight **for** peace. 2. Yesterday we heard an interesting lecture on modern electronics which was arranged **for** the students. 3. He asked me **for** a book on microcomputers' organization. 4. The first computing machines were not reliable (надежный), **for** there were no good electrical units. 5. The instructions are placed inside the computer, **for** the computer itself can select the numbers of instructions.

III. Read and translate the following sentences paying attention to the predicates in the Passive Voice:

These digits are easily multiplied. 2. I was asked many questions about my work. 3. They were explained how to solve this problem on a computer. 4. The sequence of reasonable operations has been performed by the computer. 5. The new department of mathematics has just been opened. 6. Many books on computers' organization and architecture had been translated from Russian into English by the end of last year. 7. The experiments on the new microcomputer were being carried out during the whole month. 8. All the digits are recorded on the paper tape when addition is performed. 9. The new key adding machine was transferred into the next room yesterday. 10. The sequence of reasonable operations is now being carried out by this microcomputer. 11. The conference was addressed by a well-known scientist. 12. The invention of computers was spoken of at the last lecture. 13. Modern personal computers are always looked at with interest. 14. Many new branches of industry have been developed in our country since World War II.

IV. Fill in the blanks with the verbs given below. Use them in the Passive Voice:

to express; to carry out; to invent; to record; to polarize; to tell; to store; to represent; to require; to construct.

1. All the digits inside the hardware … by the arranging of the special equipment. 2. Complex calculations … with the help of a computer. 3. A special counter wheel (счетное колесо) for an arithmometer … by a Russian engineer V. T. Ordner in 1874. 4. The answers of computations … Often in the form of tables. 5. Small spots on a surface inside a computer … magnetically. 6. By means of instruction any computer … what operations to perform. 7. All instructions … in registers, the units of hardware. 8. Any information … by the binary system. 9. Numbers or instructions … for solving a problem by a computer. 10. Several computing units … by M. V. Lomonosov for computational science.

V. Read and translate the following sentences paying attention to the modal verbs and the equivalents:

1. Information or data can be stored in the computer's memory or storage. 2. An analog computer is able to calculate by using physical analogs of numerical measurements. 3. The first automatic computers could operate at the low speed. 4. Your paper may be published at our Institute. 5. My friend was happy when at last he might work at the computing centre. 6. Our students are allowed to visit the computing centre to see the operation of the computer ES-1045. 7. Every student must know that a digital computer performs reasonable operations. 8. Some operations for this computer have to be changed and new instructions have to be added. 9. The instructions are recorded in the order in which they are to be carried out. 10. You should know the difference between the digital and analog computers. 11. We ought to help him to solve this problem by a personal computer. 12. According to (согласно) the time-table you are to begin your classes at 8 o'clock. 13. Every student of our speciality has to know what a hybrid computer is. 14. We were permitted to attend the conference on cybernetics.

VI. Find the sentences in which the verbs 'to have' and 'to be' are translated as «должен»:

1. This ordinary adding machine has ten keys for each column of digits. 2. The main task of this article was to show the results of research work. 3. This personal computer has been constructed at our lab. 4. The lecture was to begin at 9 o'clock. 5. Our aim is to study hard and master our speciality. 6. Our lab assistant has to construct this electronic device (прибор). 7. The general purpose of this unit (block) is to perform different arithmetic operations. 8. The participants of the scientific conference are to arrive tomorrow. 9. You have to

remember the names of the scientists who have contributed to the development of your speciality. 10. The results of the experiment have carefully been checked up today.

VII. Read Text B and retell in English:

TEXT B. WHAT CAN COMPURER DO?

Computers are thought to have many remarkable powers. However, most computers whether large or small, have three basic capabilities. First, computers have circuits for performing arithmetic operations, such as addition, subtraction, division, multiplication and exponentiation. Second, computers have a means of communicating with the user. After all, if we couldn't feed information in and get results back, these machines wouldn't be of much use. However, certain computers for example minicomputers and microcomputers are used to control directly things such as robots, aircraft navigation systems, medical instruments, etc.

Third, computers have circuits, which can make decisions. Computer can solve a series of problems and make hundreds, even thousands, of logical decisions without becoming tired or bored. It can find the solution to a problem in a fraction of the time it takes a human being to do the job. A computer can replace people in dull, routine tasks, but it has no originality; it works according to the instructions given to it. A computer cannot do anything unless a person tells it what to do and gives it the appropriate information.

VIII. Read Text C without a dictionary and retell it in English:

TEXT C. FROM THE HISTORY OF COMPUTERS

The development of mechanical calculating machines made the digital computers necessary. An ordinary arithmometer and a desk key calculator have given rise to electronic digital computers. Digital computers came into being in the first half of the 17^{th} century. Many outstanding Russian and foreign mathematicians of that time created mechanical calculating devices.

The famous Russian scientist M. V. Lomonosov compiled a lot of calculating tables and several computing devices concerning the different fields of science and engineering.

In 1874 the Russian engineer V. T. Ordner invented a special counter wheel[1] named after him the Ordner's wheel which is used in modern arithmometers and calculators.

P. L. Chebyshev, academician, made a valuable contribution to the field of computing machine. He is known to have many good ideas in mathematics, some of which have been named after him. For example, the Chebyshev's polynomials play a unique role in the field of orthogonal functions. In 1878 he constructed the original computing machine which was exhibited in Paris. In

1882 P. L. Chebyshev invented an arithmometer performing automatically multiplication and division. The principle of automatization put into this computing machine is still widely used all over the world when developing the most modern computers.

In 1884 Russia began to manufacture computing machines. In the period of World War I the output of computing machines ceased and was resumed only in the years of the Soviet Power.

At the end of the 1930s computing engineering began the new era. Electronic computers operating at high speed appeared, with electronic devices and units being applied.

Notes:

[1] a special counter wheel – специальное счетное колесико.

UNIT 3

Grammar. The Participle. The Absolute Participle Constructions.

Text A. Information, machine words, instructions, addresses and reasonable operations.

Text B. Addresses and reasonable operations.

Text C. Advantages in making computers of small sizes.

I. Read the international words and guess their meaning:

character; reaction; to react; instruction; register; code; bit; byte; typically; group; address; magnetic; polarize; differentiation; integration; binary; basic; physically; physical; selection; to sort; separate; part; standard; correct.

II. Read and memorize the following words and word combinations:

sign	-	знак; обозначение; символ; признак
character	-	знак; символ; цифра; буква; признак
typewriter	-	пишущая машинка
react	-	реагировать
unit	-	единица; блок; устройство; элемент
rotation	-	вращение; чередование
voltage	-	напряжение; разность потенциалов
variable	-	переменная величина
represent	-	представлять
include	-	включать
zero	-	нуль; нулевая точка
separate	-	отдельный

call	-	называть
consist (of)	-	состоять (из)
handle	-	управлять; оперировать
the same	-	тот же самый
arrangement	-	расположение; размещение
some	-	некоторый
polarize	-	поляризовать
surface	-	поверхность; плоскость
state	-	устанавливать; указывать
address	-	адрес; адресовать
contain	-	содержать
square	-	квадрат; площадь
power	-	мощность; сила; энергия; степень; способность
sorting	-	сортировка
matching	-	согласование
determine	-	определять

a number of = a set of	-	ряд; несколько; некоторое количество
per second	-	в секунду
a particular memory location or cell	-	особая ячейка памяти
its own unique address	-	свой собственный уникальный адрес
to take a square root	-	извлекать квадратный корень
to raise to a power	-	возводить в степень
as well as	-	так же как
instead of saying	-	вместо того, чтобы сказать

TEXT A. INFORMATION, MACHINE WORDS, INSTRUCTIONS

Information is a set of marks or signs that have meaning. These consist of letters or numbers, digits or characters, typewriter signs, other kinds of signs, and so on. A computer reacts differently to different digits or characters, and reacts to them as units that have meaning. For example, information for an analog computer has to be in the form of distances, or rotations, or voltages, or other physical variables. And for a digital computer information has to be in the form of digits or numbers.

Any information may be represented by the binary system including two digits: one (1) and zero (0). Each 1 and 0 is a separate binary digit called a bit. A bit is the smallest part of information. Bits are typically grouped in units that are called bytes. A byte is the basic unit of information used in modern computers and consists of eight bits.

The bytes are handled usually in standard groups called machine words or just words. There are two basic types of information or words that can be put into a memory cell or location: words that are numerical quantities[1] and words that are computer instructions. Regularly, an instruction to the machine is expressed as a word; and so the same set of characters may have meaning sometimes as a number, sometimes as an instruction. A speed of 96,000 characters per second is the same as a speed of 8,000 words per second. Most human beings could not take even 12-digit number per second.[2]

Physically the set of bits is a set of arrangements of some physical equipment. One of the ways of storing information in a computer is storing by using a set of small magnetically polarized spots (пятна) on a magnetic surface.

The computer is told what operations to perform by means of instructions. An instruction is a command to the computer. It consists of a verb (an operational code) and a noun (an operand). For example, if the computer is instructed «Add 365 the number of times (раз) stated in the register R», and if the register R stores the code for number 3? Then the computer will perform that operation three times. An instruction word looks like a number, and three is no way to tell from the word itself whether it is a quantity or an instruction. The computer must be told exactly (точно) which address contains an instruction and which contains a quantity.

Notes:

[1] numerical quantities – численные значения (величины);

[2] most human beings could not take even 12-digit number per second – большинство людей не смогли бы воспринять даже 12-значное число в секунду.

EXERCISES

I. Find the equivalents:

1) numerical measurements	1) физическое оборудование
2) by using physical analogs	2) скорость в секунду
3) the binary system	3) численные величины
4) any information	4) численные измерения
5) other physical variables	5) двоичная система
6) numerical quantities	6) любая информация
7) a speed per second	7) один из способов
8) physical equipment	8) особая ячейка памяти
9) one of the ways	9) используя физические аналоги
10) a particular memory cell	10) другие физические переменные

II. Arrange (a) synonyms and (b) antonyms in pairs and translate them:

a) to perform; to compute; to take in; a figure; to arrange; to show; to carry out; a digit; to calculate; little; to display; small; to receive; to position; instruction; data; location; command; information; cell;

b) inside; to the right; addition; multiplication; simple; to the left; division; outside; small; complex; big; subtraction; differentiating; at the right; integrating; at the left; right-hand column; the left-hand column.

III. Form nouns from the verbs by adding suffixes:

- ment

Model: to equip – equipment

to arrange, to require, to measure, to state, to develop

- sion

Model: to divide – division

to decide, to include, to conclude, to exclude

- ion

Model: to direct – direction

to subtract, to select, to react, to construct, to act

- ation

Model: to compute – computation

to inform, to combine, to determine, to represent, to differentiate, to integrate, to polarize

IV. Complete the following sentences:

1. Information is a set of marks or signs that … 2. Reasonable operations are … 3. Logical operations include … 4. A very important logical operation is … 5. Physically the set of bits is a set of arrangements of some … 6. Determining means which of two operations is to be performed … 7. The computer must be told exactly which address contains … and which contains … 8. The computer is told what operations to perform by means of … 9. Any information may be represented by the binary system including two digits: … and … 10. A bit is the smallest part of ….

V. Answer the following questions:

1. What is information? 2. What does a set of marks consist of? 3. What is one of the ways of storing information in a computer? 4. What is a byte? 5. What is a bit? 6. How many bits does a byte usually contain? 7. What is an instruction? 8. By means of what is the computer told what operations to perform? 9. What are machine words? 10. What does a machine word consist of?

VI. Translate the following sentences paying attention to the form and function of the Participle:

1. The input unit consists of some devices using different means. 2. Performing addition the computer must have two numbers to be added.

3. When pressing the keys the operator makes the adding machine operate. 4. The operator pressing the keys makes the adding machine operate. 5. A device invented by the German mathematician Leibnitz could control automatically the amount of adding to be performed by a given digit. 6. Logical operations performed by a computer are comparing, selecting, sorting, and determining. 7. Discussing the advantages of the new memory unit the professor gave the students all the necessary explanations. 8. Having punched holes in a card the operator put it into the computer. 9. When passed through the reading equipment the characters are read in a way similar to a way used for a magnetic tape. 10. The density of memorizing elements in MOS memory is very high.

VII. Translate the following sentences paying attention to the Absolute Participle Construction:

1. The first automatic computers of the 1940's not being very reliable, scientists went on improving them. 2. Specialists use computers widely, the latter helping in performing computations at great speeds. 3. Personal computers being used for many purposes, scientists go on improving their characteristics. 4. The computer SM-100 is used in industrial processes and scientific researches, its main function being to carry out reasonable operations with numbers and to calculate complex problems. 5. With the current on, the computer automatically begins operating. 6. A printer's line is usually between 60 and 150 characters long, with 120 characters being a common length.

VIII. Find the sentences in which the Absolute Participle Construction is used:

1. Register R storing the code for number 3, the computer will perform the operation 3 times. 2. When storing the code for number 3 register R makes the computer perform the operation 3 times. 3. The computer performs the operation 3 times. The code for number 3 being stored in one of the registers. 4. The register storing the code for number 3 is arranged in the computer's memory. 5. The code for number 3 being stored in register R, the operation will be performed by the computer 3 times.

IX. Read Text B and give its contents in Russian:

TEXT B. ADRESSES AND REASONABLE OPERATIONS

An address is the name of particular memory location or cell. Each memory location (word or byte) has its own unique address or number just like a post office box.[1] For example, if the computer contains 100 memory cells, their respective addresses might be the numbers[2] from 1 to 100 (or 0 through 99).

And instead of saying «A word is in a memory cell», the computer personnel say, «The contents (содержимое) of an address is a word.»

Reasonable operations are mathematical and logical. Mathematical operations include arithmetic and algebraic operations. Arithmetic operations are addition, subtraction, multiplication, division, taking a square root, etc.; and algebraic operations are called raising to a power as well as differentiating and integrating.

Logical operations include comparing, selecting, sorting, matching, etc. There are operations which may be performed either on numbers, or on expressions consisted of letters such as ordinary words. A very important logical operation performed by a computer is determining, i.e., which of two operations is to be performed next.

Notes:

[1] just like a post office box – точно так же, как почтовый ящик;

[2] their respective addresses might be the numbers – их соответствующими адресами могут быть числа

X. Read the text and tell what advantages small computers have:

TEXT C. ADVANTAGES IN MAKING COMPUTERS OF SMALL SIZE

There are several advantages in making computers as small as one can. Sometimes weight is particularly important. A modern aircraft, for example, carries quite a load of electronic apparatus. If it is possible to make any of these smaller, and therefore lighter, the aircraft can carry a bigger payload. This kind of consideration applies to space satellites and to all kinds of computers that have to be carried about.[1]

But weight is not the only factor. The smaller the computer, the faster it can work. The signals go to and fro at a very high but almost constant speed.[2] So if one can scale down all dimensions to, let us say, one tenth, the average lengths of the current-paths will be reduced to one tenth.[3] The speed of operation is scaled up to 10 times. Other techniques allow even further speed increases.

Another advantage is that less power is required to run the computer. In space vehicles and satellites this is an important matter; but even in a trial application we need not waste power. Sometimes a computer takes so much power that cooling systems which require still more power have to be installed to keep the computer from getting too hot, which would increase the risk of faults developing.[4]

Another advantage is reliability. Minicomputers have been made possible by the development of integrated circuits. Instead of soldering bits of wire to join separate components such as resistors and capacitors sometimes in the most sophisticated networks, designers can now produce many connected circuits in one unit which involves no soldering and therefore no risk of broken joints[5] at all.

If one of the component circuits develops a fault[6], all that is needed is to locate the faulty unit, throw it away and plug in a new one.

Notes:

[1] all kinds of computers that have to be carried about – всевозможные типы нестационарных ЭВМ;

[2] the signals go to and fro at a very high but almost constant speed – сигналы подаются поочередно то в одну, то в другую сторону с очень большой, но почти постоянной скоростью;

[3] the average lengths of the current-paths will be reduced to one tenth – средняя длина цепей, по которым протекает ток, сократится до одной десятой;

[4] which would increase the risk of faults developing – что увеличило бы вероятность возникновения неисправностей;

[5] involves no soldering and … no risk of broken joints – не связано с пайкой и … риском разрыва цепи

[6] if one of the … circuits develops a fault – если в какой-либо … цепи обнаружится неисправность.

UNIT 4

Grammar. Gerund. There be.
Text A. Computer system.
Text B. Peripheral equipment. Keyboards.
Text C. Memory.

I. Read the international words and guess their meaning:

function; element; mechanical; machinery; electronics; logical; control; documentation; collectively; peripheral; laboratory; industry; printer; component; routine; calculation; processor; category; categorize.

II. Read and memorize the following words and word combinations:

to process	-	обрабатывать
processing	-	обработка
to solve	-	решать
to provide	-	обеспечивать
means	-	средство

manual	-	руководство; инструкция
to require	-	требовать
storage	-	запоминающее устройство; память
device	-	устройство; прибор
terminal	-	терминал; конечное устройство
retrieve	-	поиск (информации)
to allow	-	позволять
to create	-	создавать
listing	-	распечатка; листинг
input	-	ввод
output	-	вывод
item	-	элемент; единица
converter	-	преобразователь
oscilloscope device	-	осциллоскоп
peripheral devices	-	периферийные устройства
medium	-	среда; средство; устройство

TEXT A. COMPUTER SYSTEM

A computer system is a collection of components that work together to process data. The purpose of a computer system is to make it as easy as possible for you to use a computer to solve problems. A functioning computer system combines hardware elements with software elements. The hardware elements are the mechanical devices in the system, the machinery and the electronics that perform physical functions. The software elements are the programs written for the system; these programs perform logical and mathematical operations and provide a means for you to control the system. Documentation includes the manuals and listings that tell you how to use the hardware and software.

Collectively these components provide a complete computer system: system hardware + system software + system documentation = computer system. Usually a computer system requires three basic hardware items: the computer, which performs all data processing; a terminal device, used like a typewriter for two-way communication between the user and the system; and a storage medium for storing programs and data. These three devices – the computer, the terminal and the storage medium – are the required hardware components of any computer system.

Optional peripheral devices are added to a computer system according to the specific needs of the system users. For example, computer systems that are used primarily for program development may have extra storage devices and a high-speed printing device. Computer systems used in a laboratory may have graphics display hardware, an oscilloscope device, and an analog-to-digital converter.

Peripheral devices are categorized as input/output (I/O) devices since the functions they perform provide information (input) to the computer, accept information (output) from the computer, or do both. Line printers are output devices because they perform only output operations. Terminals and storage devices are input/output devices because they perform both input and output operations.

System software is an organized set of supplied programs that effectively transform the system hardware components into usable tools. These programs include operations, functions, and routines that make it easier for you to use the hardware to solve problems and produce results. For example, some system programs store and retrieve data among the various peripheral devices. Others perform difficult or lengthy mathematical calculations. Some programs allow you to create, edit, and process application programs of your own.

System software always includes an operating system, which is the «intelligence» of the computer system. Usually the system software includes one or several language processors.

EXERCISES

I. Find the equivalents:

1) to process data	1) устройство памяти
2) to provide a means	2) обработка данных
3) data processing	3) компоненты аппаратного обеспечения
4) storage medium	4) обеспечить средство
5) to perform input operations	5) принимать информацию
6) hardware components	6) обрабатывать данные
7) to accept information	7) управлять системой
8) extra storage devices	8) двухсторонняя связь
9) two-way communication	9) выполнять операции ввода
10) to control the system	10) дополнительные устройства памяти

II. Translate the words of the same root. Define parts of speech:

to inform – information – informative – informed; to purpose – purpose – purposeful – purposely; to complete – completion; produce – product – production; to require – requirement – required; to perform – performance – performer; to create – creation – creative – creator; to store – storage – stored; to develop – development – developed; logic – logical – logician; to provide – provider – provision – provided; to add – addition – additional - additionally.

III. Translate the following sentences paying attention to ‘there + to be’:

1. There are many universities and institutes in our country. 2. There is students’ scientific and technical society at our Institute. 3. There are various computers at our computing centre. 4. There were only four departments in our Institute before the World War II. 5. There will be some engineers at the seminar on programming tomorrow. 6. There is a seminar on the History of Ukraine today. 7. There was a lecture on cybernetics yesterday. 8. There were many ways of solving the problem. 9. There are many complex parts and units in every computer. 10. There will be some new laboratories in our Institute next year.

IV. State the functions of the Gerund. Translate the sentences:

1. Logical operations consist of comparing, selecting, sorting, matching, and determining. 2. The way of solving this problem is very difficult. 3. After performing calculations a computer displays a result. 4. A set of marks or signs can be stored by polarizing little spots on a magnetic surface. 5. Differentiating and integrating are algebraic operations. 6. Registers are used for storing information. 7. Blaze Pascal’s merit consists in his constructing the first mechanical computer. 8. By performing the reasonable operations on a computer we solve different kinds of problems for our national economy.

V. Translate into English using the Gerund:

1. Одним из способов хранения информации внутри вычислительной машины является хранение с помощью ряда поляризованных точек на магнитной поверхности. 2. Путем размещения специальных устройств внутри вычислительной машины можно хранить информацию. 3. Возведение в степень и извлечение квадратного корня – математические операции. 4. Компьютер используется для решения сложных задач.

VI. Read Text B and retell it:

TEXT B. PERIPHERAL EQUIPMENT. KEYBOARDS

Peripheral equipment

The microcomputer has to communicate with the outside world, so that programs and data can be entered into its memory and processed information can be displayed or transmitted in some form to the microcomputer user.

There are various types of peripheral equipment that may be attached to microcomputers including keyboards and scanners for input, and visual display units (VDUs) and printers for output. Information may be output from the microcomputer on to disk for storage and re-entered when required.

Different sensors and actuators may be linked (interfaced) to the microcomputer for controlling instruments and machines.

Keyboards

A keyboard consists of a number of switches which are activated by pressure or simply by touching them. The keys are arranged as a matrix, so that the compression of any key can be detected by scanning the rows and columns of the matrix. Hardware may be used to sense which key has been pressed or this may be carried out by a software routine.

The layout of the keyboard may be similar to that of the conventional typewriter or may be designed for particular users. For example, if a large amount of the data to be entered is generally numeric, then a numeric key pad containing keys for decimal 0 through 9, full stop, and some special characters, is an essential feature.[1]

Notes

[1] is an essential feature – является существенной частью ЭВМ.

VII. Read Text C and translate it in writing:

TEXT C. MEMORY

In all types of computer systems memory plays a very important role. The function of the memory section of the computer system is either to hold information that the computer will need or information that the computer has already generated which will be used in the future, in other words, the memory of a computer is used for storing the program and data. There are two basic types of memory, namely read/write memory whose contents may be changed by writing new information into it and read only memory (ROM) whose contents are fixed. Read/write memory is usually referred to as random access memory (RAM) for historical reasons, although strictly speaking most modern read only memories can also be accessed in a random order.

The semiconductor RAM memory is of the volatile type. That is, when power is removed, all information previously written in memory is lost. ROM retains the information in it even without power.

ROMs, which are non-volatile, must have the information loaded into them somehow before they can be used. This can either be done during the manufacturing process or by the user. In the latter case they are referred to as programmable ROMs (PROMs).

Unit 5

Grammar. The Infinitive and its constructions.
Text A. Input and Output Units.
Text B. Reliability.
Text C. Computers compete.

I. Read the following international words and guess their meaning:

active; passive; practical; problem; programming; experiment; to consult; form; regularly; to construct; arithmometer; to energize; to control; peripheral; efficient; buffer; pulse; impulse; communication; interesting; to operate; functional; minute; record; line; factor; process.

TEXT A. INPUT AND OUTPUT UNITS (I/O UNITS)

The part of the computer that takes in information is called the input unit. The input unit or device provides the means of communication between the computer and the people who are interested in its operation.

To be accepted by the machine, information for a digital computer has to be in the form of digits 0, 1, 2, 3, 4, ..., 9 or characters A, B, C, D, …. These characters are regularly expressed for the computer's purposes as six or seven 1's and 0's. The 1's and 0's may be expressed for the computer: as punched holes (1) and blanks (0) in a card or a paper tape; as presence (1) and absence (0) of electrical pulse; or as polarized spots on a magnetic surface; for example, south-north is 1 and north-south is 0, or vice versa, etc.

So, the input unit makes possible communication from the other data-handling equipment and human being[1] to the computer. It is the functional part of the computer that accept the data to be operated on and programs for operating. It may consist of a keyboard operated tape punch,[2] a paper tape reader, a card reader, and an electric typewriter.

The part of a computer that puts out information is called the output unit. The computer can easily put out information in a form acceptable to human beings. For example, the computer may give impulses to an electric typewriter, so that the keys are energized in the proper sequence to type out a message in ordinary typed characters which human beings can read, etc.

The output of a computer is known to vary according to the capacity of the auxiliary equipment receiving the information. A computer can record on a magnetic tape at the rate of 1,000,000 characters per second. It can also control: a paper tape punch; or a card punch; or a high-speed line-printer. Input and output devices are usually called peripherals.

All this peripheral equipment is slow as compared with the computer. Consequently, for efficient use of the computer's tremendous calculating speed, devices called buffers may be used. A buffer is known to be a storage device which is able to take in information at a very high speed from the computer and release the information at the proper speed for the peripheral equipment.

A human being is known to write by hand at the rate of about 30 words per minute, or to type at the rate of about 60 words per minute, or to talk at the rate of 200 or 250 words per minute. The ratio between a computer speed of about 40,000 words per second, and the top output speed of a human being of about 4 words per second, gives a factor of advantage to the computer of about 10,000 to 1 at the beginning of the 60's. Nowadays this ratio is much more.

Notes:

[1] the input unit makes possible communication from the other data-handling equipment and human being – блок ввода позволяет установить связь от другого оборудования по управлению данными и человеком;

[2] of a keyboard operated tape punch – ленточного перфоратора, работающего от клавишного пульта.

EXERCISES

I. Find the equivalents:

1) the input of a computer	1) наличие и отсутствие
2) an auxiliary equipment	2) перфорированные отверстия
3) at the rate of	3) устройство вывода
4) a high-speed line-printer	4) высокоскоростное построчно-печатающее устройство
5) for efficient use	5) коэффициент преимущества
6) a storage device	6) со скоростью
7) a factor of advantage	7) для эффективного использования
8) the output unit	8) вспомогательное оборудование
9) punched holes	9) устройство ввода компьютера
10) presence and absence	10) запоминающее устройство

II. Insert prepositions where necessary:

1. A computer can record … magnetic tape … the rate … 1,000,000 characters … second. 2. As compared … the computer the auxiliary or peripheral equipment is rather slow. 3. A human being can write … hand … the rate … 30 words … minute. 4. … … the capacity … the peripheral equipment receiving information the output … a computer varies very much. 5. A factor … advantage … the computer compared … a human being is … 10,000 … 1.

III. Complete the following sentences:

1. The peripheral equipment is slow as compared with … 2. Devices called buffers may be used for efficient use of the computer's … 3. A human being is known to type at the rate … 4. The ratio between a computer speed and the output speed of a human being gives a factor of … to a computer. 5. The input unit accepts the data … and programs for …

IV. Answer the following questions:

1. What is the general purpose of the input unit? 2. How may the 1's and 0's be expressed for the computer? 3. What is the general purpose of the output unit? 4. What does the peripheral equipment consist of? 5. What is the general purpose of a buffer? 6. What is the ratio between a computer's speed and the top output speed of a human being? 7. How are input and output devices usually called?

V. Form adverbs from adjectives by adding the suffix '-ly':

easy; reasonable; usual; special; physical; functional; real; regular; magnetical; different; logical; mathematical; subsequent; consequent.

VI. Arrange (a) synonyms and (b) antonyms in pairs and translate them:

a) speed; peripheral; to control; to write; auxiliary; to do; to receive; rate; to record; to get; to make; to handle; device; unit; instruction; part; to accept; command; section; information; data; to take in;

b) to add; presence; hole; input; north; decimal; to multiply; to divide; binary; south; output; blank; absence; to subtract.

VII. Translate the following sentences paying attention to the Infinitive:

1. The assistant came to instruct students how to handle instructions. 2. The assistant came to be instructed by the professor. 3. The main purpose of the computers is to solve complex problems. 4. To perform reasonable operations a computer must have a way of accepting data. 5. To add and to subtract means to perform mathematical operations. 6. P. L. Chebyshev, a Russian scientist, was the first to construct an arithmometer. 7. The input unit to be described here is a new device. 8. Punched holes in a card or a paper tape are used to represent 1's and 0's. 9. To carry out the instruction, the computer must accept the data in the form of punched holes and blanks. 10. In order to program in a good way, the programmer needs detailed data about the program and the way it is to be done.

VIII. State the functions of the Infinitive and translate the sentences:

a) 1. To do the program the programmer must have a good understanding of the problem for the computer. 2. To do the program for a computer is the main duty of a programmer. 3. The programmer must do a program to give accurate instructions to the computer. 4. Electric typewriters are very slow and are used only by operators to communicate with a computer. 5. To make possible communication from a human being and a computer is the main purpose of the input unit.

b) 1. The experiments to be carried out will be very important. 2. M. V. Lomonosov was the first to receive the higher education among peasants in Russia. 3. Information to be computed is stored usually in registers – units of hardware. 4. The machine to operate with the keys is named an ordinary adding machine. 5. A sequence of reasonable operations to be performed will be done by computer «M-220». 6. The programmer to do the program for a computer must have a good knowledge of mathematics.

IX. Translate the sentences paying attention to the Subjective Infinitive Construction:

1. The input and output units are known to be the parts of a computer. 2. The human being seems not to be able to add or to multiply without using auxiliary devices such as pencil and paper. 3. Historically, linear programming proved to be especially effective in analyzing industrial processes. 4. This type of the output unit is said to use a punched paper tape. 5. Devices for accepting information are said to have been described in some magazines. 6. Automated Management Systems are known to have appeared quite recently. 7. Our programmers are known to be studying the theory of programming. 8. In ancient times the sun was thought to be revolving round the Earth. 9. Y.A. Gagarin is known to be the first cosmonaut who made an orbital flight around the Earth. 10. The French mathematician Pascal is known to construct the first mechanical computer.

X. Read Text B and translate it without a dictionary:

TEXT B. RELIABILITY

The first automatic computers of the 1940's were not reliable. The equipment of which they were made had not been accurate and reliable. The programmer for the problem usually had to program the check (проверка) by doing the same operation in another way. For example, in multiplication A times B he used the equipment differently from B times A, and so both (обе) operations might be programmed, and then the computer was given an instruction to compare the results. If a difference in results was more than a tolerance (допуск), the machine was stopped, and the operator in charge of (ответственный за) the computer and the mathematician in charge of the program consulted on how to get rid (избавиться) of the error (ошибка).

Those days have long since gone. Now computers can operate with extraordinary (чрезвычайный) reliability, with as many as a billion or ten billions operations between errors. Automatic checking of different kinds is built into the machine.

XI. Read Text C and give its contents in English:

TEXT C. COMPUTERS COMPETE

The first international chess match was played over 100 years ago. Naturally, the contestants were fellow creatures.[1] But an automatic «chess-playing device» had appeared as back as 1769. Kempelen, its inventor, had toured many European countries demonstrating its power. In 1809 the machine played in Vienna against Napoleon. The record of the moves[2] has been preserved. Napoleon lost the game.

Kempelen's «computer» didn't operate on radio tubes or transistors. Its secret lay in a crack player[3] being secretly hidden inside.

But the time has come for real computers to have a go.[4] The electronic computer of Stanford University in the USA pitted its «wits» against[5] its counterpart of the Institute of Theoretical Experimental Physics (USSR, Moscow). Four games were played simultaneously. Men acted as «coaches», and they had provided the programs for the machines. Strictly speaking, it is a match between programs. Which is more perfect? That's the answer the match has to provide. Hence the computers are doing things calmly[6] while the people, above all[7] mathematicians, are all worried.[8]

In this case, chess for the mathematicians is but one of means to an end.[9] Some of the most respected publications declared that a machine could never do anything that required thought, that it would never learn to play chess. The mathematicians retorted with: «It all depends on how you teach the machine.» Now there can be on talk about whether a computer can or cannot play chess. Because it can.

The Soviet program «Caissa», developed by Moscow scientists headed by the former world chess champion Mikhail Botvinnik, has won the world chess championship for computer programs several times.

Notes:

[1] fellow creatures – люди;
[2] moves – ход (в шахматной игре);
[3] a crack player – первоклассный игрок;
[4] to have a go – сделать шаг;
[5] to pit «wits» against – сразиться в «остроумии» с;

[6] calmly – спокойно;

[7] above all – больше всего, главным образом;

[8] to be worried – волноваться, беспокоиться;

[9] but one of means to an end – лишь одно из средств для достижения цели.

UNIT 6

Grammar. The Infinitive and its constructions.(cont.)
Text A. Memory or Storage Unit.
Text B. The Floppy Disks.
Text C. Bubble Memory.
Text C/. Cache Memory.

I. Read the following international words and guess their meaning:

final; base; container; register; object; subject; transmission; million; billion; disk; serial; track; resistor; transistor; millisecond; nanosecond; reaction; concentric; integration; technology; bipolar; diode; diameter; result; correct; to generate; element.

II. Read and memorize the following words and word combinations:

storage	-	запоминающее устройство (ЗУ); память
intermediate	-	промежуточный
final	-	окончательный; конечный
generate	-	генерировать; (вос)производить
access	-	обращение (к памяти); доступ; выборка (из памяти)
require	-	требовать
transmit	-	передавать
use	-	использование; использовать
quantity	-	количество; величина
hold	-	держать; удерживать; проводить
external	-	внешний; наружный
similar	-	подобный; похожий
circle	-	круг; окружность
internal	-	внутренний
main	-	главный; основной
core	-	сердечник; память на магнитных сердечниках
inch	-	дюйм (2,5 см.)
slow	-	медленный
fast	-	быстрый; скорый

circuit	-	схема; цепь; контур
integer	-	целое число
differ	-	отличаться; различаться
development	-	разработка; развитие
semiconductor	-	полупроводник
creation	-	создание
density	-	плотность; концентрация
allocation	-	размещение; распределение
chip	-	чип; кристалл
achievement	-	достижение
layer	-	слой
microcomputer	-	микрокомпьютер
primary	-	первичный; первоначальный
permanent	-	постоянный
programmable	-	программируемый
erasable	-	стираемый
firmware	-	программированное аппаратное обеспечение, встроенное в компьютер фирмой

during the course of computation	-	во время вычисления
an access time	-	время обращения (к памяти)
a floppy disk	-	гибкий диск
a series of concentric circles	-	ряд концентрических окружностей
a read/write head	-	записывающая головка
internal (main) memory	-	оперативная память (ОЗУ)
a film memory device	-	ЗУ на тонких пленках
general-purpose registers	-	регистры общего назначения
floating-point registers	-	регистры с плавающей точкой
control registers	-	регистры управления
either ….. or ….	-	Или …, или; либо …, либо
both …. and …	-	как …., так и …; и …, и ….
in the latter	-	в последнем (из двух упомянутых)
by spraying layers	-	путем напыления слоев

TEXT A. MEMORY OR STORAGE UNIT

The part of a digital computer which stores information is called storage or memory. The computer’s memory stores the numbers to be operated on; it stores intermediate results that are generated during the course of a computation; and it stores the final results. The instructions themselves are also stored in the computer’s memory.

There are two important factors about the memory unit: an access time and a capacity. The time required to transmit one computer word out of the memory to where it will be used is called the memory access time; it usually amounts to a few millionths of a second or less in modern fast computers. The speed of modern computers is the speed of access to their memories. The capacity of a computer is the quantity of data that its memory unit can hold.

There are many ways of memorizing information in memory cells of a digital computer. External memory or storage units may use magnetic tapes, magnetic drums, magnetic disks and floppy disks. The magnetic drum and magnetic disk are called a Direct Access, or Random Access, Storage Device (DASD).

The magnetic disk is very similar to the magnetic drum but is based upon the use of a flat disk with a series of concentric circles of magnetizable material, one read/write head being for each track. Memory units on magnetic disks may store more than 100,000,000 bytes.

Internal or main memory units were constructed of magnetic cores about 8 hundredths of an inch in diameter, each core storing one «yes» or «no», that is, each core representing one bit of information.

Information that is stored inside a computer is stored in registers, electronic units of hardware in which the positioning of physical objects stores information. Each register holds one machine word consisting usually of 32 bits or 4 bytes. Registers hold information temporarily during processing. The slower models of registers use magnetic cores; the faster models use special electronic circuits or film memory devices.

Usually the registers are of three types:

1. General-Purpose Registers are sixteen registers, each being able to contain one word. These registers are used for storing the integer operands taking part in binary arithmetic operations.

2. Floating-Point Registers are four registers, each being able to contain a doubleword. These registers hold the operands taking part in arithmetic operations on floating-point numbers.

3. Control Registers form a group of registers differing from one model to another.

The development of semiconductor integration technology has led to creation of memories on LSI circuits. For constructing memory units on LSI circuits either bipolar or MOS memory are used. The access time of bipolar memory is about 100 nanoseconds, while the access time of MOS memory is 500 nanoseconds. But on the other hand the density of memorizing elements allocation in the latter is very high and amounts to 4 thousand memorizing elements for one chip. The latest achievements of modern electronics is creation of memories on electronic circuits made by spaying layers of different memorizing materials.

Nowadays the main memory RAM which is regularly used in microcomputers can accept new instructions or information from a peripheral device. Terms synonymous with the computer's working memory RAM are: core, core storage, main memory, main storage, primary storage, read/write memory. Other memories. Such as ROM or PROM, which are used in microcomputers as well, store instructions or information permanently. ROM, PROM, EPROM, and EEPROM are all together called firmware which is 'hard' software.

EXERCISES

I. Find the equivalents:

1) the numbers to be operated on	1) числа с плавающей точкой
2) a magnetic core	2) самые последние достижения
3) an access time	3) напылением слоев
4) a computer's memory	4) во время обработки
5) intermediate results	5) крупномасштабная интеграция
6) Large Scale Integration	6) магнитный сердечник
7) during processing	7) память компьютера
8) by spraying layers	8) промежуточные результаты
9) the latest achievements	9) время обращения
10) floating-point numbers	10) числа, которые будут обрабатываться

II. Answer the following questions:

1. What is the general purpose of the memory or storage unit? 2. What information is stored in the computer memory? 3. Where is information stored inside the computer? 4. What is the memory access time? 5. What ways of memorizing words in a computer do you know? 6. What has led to creation of memories on LSI circuits? 7. What is the latest achievements of modern electronics? 8. What memories are used in microcomputers?

III. What do you call a unit which:

1. Accepts information from outside a computer? 2. Memorizes information to be operated on? 3. Brings information out of the computer? 4. Is able to take in information at the very high speed from a computer and then release it at the proper speed for the peripheral equipment?

IV. Translate the following sentences paying attention to the words in bold type:

a) 1. Every student must know **that** reasonable operations are logical and mathematical operations. 2. His experiment is simpler than **that** of yours. 3. The capabilities of a digital computer are greater than **those** of an analog computer. 4. It is clear **that** these diagrams are like **those** shown in Fig. 4.

b) 1. **As** science progresses the difference between manmade systems and natural systems may be reduced infinitely (бесконечно). 2. **As** you know information is a set of marks that have meaning. 3. **As** new operations can be composed of sub-operations, no new programming is needed. 4. The development of computers **as** machines for handling information has gone a long way. 5. **As** is known, program is a set of instructions.

c) 1. **One** of these problems has been solved by a computer. 2. By means of a computer **one** can easily solve any problem. 3. There is only **one** solution, the **one** stated above, when *n* and *m* are equal. 4. **One** should remember all these rules, while solving a problem.

V. Translate the text paying attention to the Infinitive:

The design of an automatic computer is not a simple matter. To understand how to use a computer one must fully appreciate its design. Therefore, a brief introduction to the logical design is necessary for the users to understand the underlying idea. To present some background material on theoretical and philosophical aspects of information processing is to give the user more profound understanding of computers' application. From what has been said above, it is clear that a computer may be thought of both as machine by which to handle information and a machine by which to transform one set of symbols into another. For the user it is a machine to process the information, a way to obtain an output by applying to an input a specified sequence of logical operations. The designer considers a computer to be a device for applying a sequence of logic operations to symbols representing information.

VI. Translate the sentences paying attention to the Objective and Subjective Infinitive Constructions:

1. We shall consider a controller to be a system of reactors.
2. We made this reaction run at reduced pressure.
3. High temperatures allowed the reaction to be carried out in two hours.
4. The method is reported to give good results.
5. People's knowledge is assumed to be well-organized and to facilitate the understanding of new information.
6. This process was expected to be more effective.
7. The real situation is likely to be very complex.

8. Unfortunately this approach is unlikely to be successful.

9. People make systems work.

10. Such functions can be proved to be equivalent to computable functions.

11. This sequence causes digitized images to be stored in core memory.

VII. Read Text B without a dictionary. Write out the keywords with the help of which you can give short characteristics of floppy discs:

TEXT B. FLOPPY DISKS

Floppy disks are a magnetic storage medium (среда) which can be recorded, erased and used over and over again. Floppy disks are flexible (гибкий) plastic disks which have several standard sizes. Full size floppy disks are 8 inches in diameter; minifloppy disks are 5 inches in diameter. Both full size floppy disks and minifloppy disks are housed in a paper-like plastic envelope, usually black, and remain (оставаться) in the envelope at all times.

Microfloppy disks are in sizes from 3 to 4 inches. They are housed in a rigid (жесткий) plastic shell (оболочка) of different design. The number of bytes that can be recorded on a floppy disk are about 80,000 to 1,000,000 and more. Floppy disks are used extensively in personal computers, small business computers, word processing, etc.

VIII. Read Text C and translate it without a dictionary. Retell it in Russian:

TEXT C. BUBBLE MEMORY

Bubble memory[1] is a storage for programs and information. It is a storage technology which combines both semiconductor and magnetic recording techniques[2] to create a solid state[3] storage device. Bubble memory is unique, because it is a disk that doesn’t spin.[4] The bits on the surface spin around the disk instead. Bubble memory units are only two square inches in size, and contain a thin film recording layer. The bits, called bubbles of their globular shape,[5] are electromagnetically generated in circular strings[6] inside this layer. In order to read or write the bubbles, the strings of bubbles are made to rotate past the equivalent (the string or bubbles) of a read/write head in a disk.

Bubble memory holds its contents without power, like disk and tape. It is considerably[7] faster than floppy disks and many hard disks. It is often used in portable terminals[8] and computers instead of disks.

Notes:

[1] bubble memory – память на магнитных доменах (пузырьковая память);
[2] techniques – технические приемы;
[3] solid state – полупроводниковый;
[4] to spin – вращаться;
[5] their globular shape – их округлая форма;
[6] string – цепочка; последовательность;
[7] considerably – значительно;
[8] portable terminals – портативные терминалы.

IX. Read Text C/ and summarize the information about the peculiarities of cache memory:

TEXT C/. CACHE MEMORY[1]

A cache memory is a small, high-speed system memory that fits between the CPU and the main memory. It accesses copies of the most frequently used main-memory data. When the CPU tries to read data from the main memory, the cache memory will respond first if it has a copy of the requested data. If it doesn't, a normal main-memory cycle will occur.

Cache memories are effective because computer programs spend most of their memory cycles accessing a very small part of the memory.

A cache memory cell has three components: an address memory cell, an address comparator[2] and a data memory cell. The data and address memory cells together record one word of cached data[3] and its corresponding address in main memory. The address comparator checks the address cell contents against the address on the memory address bus.[4] If they match, the contents of the data are placed on the data bus.[5]

An ideal cache memory would have many cache memory cells; each holding a copy of the most frequently used main-memory data.

Not all locations in the memory address space should be cached. Hardware I/O address shouldn't be cached because bits in an I/O register can and must change at any time, and a cache copy of an earlier I/O state may not be valid.

Notes:

[1] cache memory – кэш-память (сверхбыстродействующая память);
[2] comparator – компаратор
[3] cached data – данные кэш-памяти (кэшированные данные);
[4] memory address bus – адресная шина памяти;
[5] data bus – шина данных.

UNIT 7

Grammar. Revision of Non-Finite Forms of the Verb.
Text A. Central Processing Unit.
Text B. Microprocessors: a brain to the hardware.
Text C. Microelectronics in Data-Processing.

I. Read the international words and guess their meaning:

nerve; system; to coordinate; to control; activity; central; processor; separate; section; role; to discuss; function; to interpret; actual; interpretation; signal; to decode; generator; automatically; accumulator; argument; decoder.

II. Read and memorize the following words and word combinations:

activity	-	деятельность
apply	-	применять; прилагать; прикладывать
execute	-	выполнять; осуществлять
carry out	-	выполнять; приводить
process	-	процесс; обрабатывать
load	-	нагрузка; загрузка; ввод; загружать
convenient	-	удобный
consider	-	считать; полагать; рассматривать
previous	-	предыдущий; предшествующий
obtain	-	получать; достигать
accomplish	-	выполнять; совершать
separate	-	разделять; отделять
sense	-	считывать; воспринимать
choose	-	выбирать
cause	-	заставлять; причинять; вызывать
sequentially	-	последовательно
design	-	проект; конструкция; проектировать; конструировать
happen	-	случаться
transfer	-	передавать; переносить
hence	-	следовательно
involve	-	включать в себя; вовлекать
argument	-	аргумент
accumulator	-	накапливающий сумматор
a central processor	-	центральный процессор
a control unit	-	блок управления
an instruction decoder	-	дешифратор команд
an instruction register	-	регистр команд
a current-adress register	-	регистр текущего адреса
an arithmetic and logic unit	-	арифметическое логическое устройство

at the proper time	-	в надлежащее время
control signals	-	сигналы управления
in its turn	-	в свою очередь
on the basis of	-	на основе
at a time	-	за одно время
what to do next	-	что делать дальше
in this way	-	таким образом

TEXT A. CENTRAL PROCESSING UNIT

1. The central processing unit (CPU) or central processor is the nerve of any digital computer system, since it coordinates and controls the activities of all the other units and performs all the arithmetic and logic processes to be applied to data. All program instructions to be executed must be held within the CPU, and all the data to be processed must be loaded first into this unit. It is convenient to consider the central processor to have three separate hardware sections: an internal or main memory, an arithmetic and logic unit, and a control unit. The role of the internal memory was discussed more detailed in the previous lesson.

2. The CPU has two functions: it must (1) obtain instructions from the memory and interpret them, as well as (2) perform the actual operations. The first function is executed by the control unit. This unit in its turn must perform two functions: it must (1) interpret the instruction; then, on the basis of this interpretation (2) tell the arithmetic and logic unit what to do next. The latter function is accomplished through the use of electronic signals. According to these two functions we can separate the part of the control unit that interprets or decode the instruction called the instruction decoder from the part that generates the control signals called the control generator.

3. An instruction having been transmitted to the instruction decoder, where it is interpreted, the control generator senses this interpretation and then produces signals that tell the arithmetic unit which operation to perform. It also generates signals that choose the proper numbers from the memory and sends them to the arithmetic and logic unit at the proper time; and when operation has been performed, other control signals take the result from the arithmetic and logic unit back to the internal memory. After an instruction has been executed, the control generator produces signals that cause the next instruction to go from the memory to the instruction decoder. In this way the instructions are performed sequentially.

4. The second function of the CPU is performed by the arithmetic and logic unit which does the actual operations. This unit is capable of performing automatically addition, subtraction, multiplication, division, comparing,

selecting, and other mathematical and logical operations. Consider now what happens in the arithmetic and logic unit while an instruction is being executed. In most computers only one word at a time can be transferred between the arithmetic/logic unit and the memory. Hence, to perform an operation involving two arguments, the first argument must be transferred from the memory to the arithmetic/logic unit and stored there temporarily while the second argument is being transferred. The special memory cell in the arithmetic/logic unit for this purpose is called the accumulator. The operation being performed, the result is formed in the accumulator before it is transmitted back to memory.

EXERCISES

I. Find in (b) the Russian equivalents to the English words and word combinations in (a):

a) hence; for example; according to; by means of; i.e.; etc. ; always; just; on the other hand; since; any; in its turn; sometimes; the same ; while; instead (of); usually

b) то есть; например; всегда; только что; с другой стороны; так как; в свою очередь; иногда; тот же самый; любой; следовательно; и так далее; в то время как; таким образом; вместо; согласно; обычно; посредством

II. Arrange synonyms in pairs:

semiconductor technology; to execute; to write; to control; memory; to sense; to choose; to form; to feel; storage; to store; to set up; to handle; solid-state technology; to perform; to keep; to select; research; to put in; investigation.

III. Complete the following sentences:

1. The arithmetic/logic unit is capable of … 2. The access time is the time required for transmitting one computer … out of the … to where it … 3. The actual computations are executed in a central … 4. The part of the control that interprets the instruction is called … 5. The part of the control that generates the control signals is called … 6. The control signals choose the proper numbers from … and send them to … at the proper time.

IV. Answer the following questions:

1. What is the general purpose and function of the CPU? 2. How many parts is the CPU composed of? 3. What is the general purpose of the control? 4. What is the arithmetic/logic unit? 5. What is the instruction decoder? 6. What is the general function of the control generator? 7. What happens in the CPU while an instruction is being executed? 8. What is the accumulator?

V. What do you call a unit which:

1. Interprets instructions? 2. Senses the interpretation of instructions and produces control signals? 3. Performs mathematical and logical operations? 4. Choose the proper numbers from the internal memory and sends them to the arithmetic/logic unit at the proper time?

VI. Read and translate the following sentences paying attention to the objective infinitive constructions and for-phrases with the infinitive:

1. Our engineers want the complex problems to be solved by computers. 2. In the laboratory we saw the perforator punch holes in the cards of standard size. 3. It is quite necessary for the programmer to understand the work of all units of a computer. 4. We watched the floppy disk begin to operate. 5. The speed of the computer may be found by measuring the time which is required for it to transmit one word out of the memory to where it will be used. 6. We asked the lab assistant to show us the computer SM-2 operate. 7. There is a good reason for us to use this kind of the bubble memory in a personal computer. 8. Information has to be in the form of digits or characters for a digital computer to perform reasonable operations.

VII. Define the infinitive constructions and translate the sentences:

1. We know B. Pascal to be the first inventor of the mechanical computer. 2. B. Pascal is known to be the first inventor of the mechanical computer. 3. In the middle of the 17^{th} century it was possible for B. Pascal to invent only the mechanical computer. 4. The possibility for the problem to be solved is illustrated by the given formula. 5. Human beings seem to be able to find facts or even logical consequence of facts in their memory according to association. 6. The magnetic recording is done on a disk which permits an information to be stored or read at one or several points on it. 7. The students were explained the high-speed memory unit to use the LSI circuits. 8. For results to be obtained an instruction has first been put into a computer.

VIII. Translate the following sentences paying attention to the ing-forms:

1. According to the principles of their work computers are subdivided into three parts: analog, digital, and hybrid. 2. When applying mathematical methods to the solving of technical problems engineers are most often interested in obtaining a finite numerical results. 3. Proper relation between theory and practice must be observed in training young specialists. 4. Mathematical tables are necessary aids (необходимые средства) for performing computational work. 5. The students get the practical training when they are working at various plants. 6. In modern computers LSI circuits and RAM/ROM memories are used for executing sophisticated (усложненный) operations. 7. A memory unit is

used for storing information. 8. Electronics being used not only in industry but in many other fields of human activity as well, one should have an idea of what it is. 9. The processing of messages can be performed sequentially, i.e., a new task is not given until current one is completed. 10. Having conducted many experiments scientists proved that electricity had an atomic character. 11. The fast electronic machines, such as microcomputers, are effective for carrying out complicated computations.

IX. Read Text B and translate it with a dictionary. Write a short summery.

TEXT B. MICROPROCESSOR: A BRAIN TO THE HARDWEAR

The microprocessor forms the heart of a microcomputer. The first microprocessors were developed in 1971 as an off-shoot of pocket calculator development. Since then there has been a tremendous upsurge of work in this field and some years later there appeared dozens of different microprocessors commercially available.

The age of the microprocessor is not great. Yet we have seen the evolution of the microprocessor as it progressed from early applications in simple hand-held calculators through 4- and 8-bit controller applications towards more sophisticated processing operations.

Microprocessors are used primarily to replace or upgrade random logic design.

By taking advantage of the knowledge and concepts gained in mainframe and minicomputer applications better and more sophisticated microprocessors are beginning to emerge. What we see are: larger and denser chips; higher resolution; higher speed; specially designed RAMs (random access memory); and ROMs (read-only memory); specially designed I/O and peripheral interface circuits; on-chips clock and timing circuits; more extensive and more powerful instruction sets and lower power dissipation.

X. Read Text C and try to explain what you have leant about: a) a distributed-processing network; b) the organization of distributed-processing systems.

TEXT C. MICROELECTRONICS IN DATA-PROCESSING

In many computer systems today a number of processors are connected together to form a distributed-processing network. Most commonly the network consists of a number of minicomputers, but mainframe computers and microcomputers can also be incorporated into it. Input-output ports and data-transmission hardware are considered an active part of the network only if they are able to process information. Parts of a task are distributed among the elements of the network. Each element works independently for some period of time, communicating as necessary with other elements.

Distributed-processing systems can be organized in several ways. A large distributed-processing system can be organized into a hierarchical structure. At the top of the hierarchy is a single mainframe computer that communicates with processors in the network at a secondary level, which in turn can communicate with other processors on a tertiary level and so on. In a pure hierarchy the processors on any particular level cannot communicate directly with one another. Instead communications must be routed through the next higher level.

Alternatively a distributed-processing system can be organized into a peer structure. All the computers are on the same level and communicate with one another on an equal footing. Except for very small networks, however, it seldom happens that every element in the network can communicate with every other element. Instead the hierarchical structure and peer structure can be combined into a hybrid system in which the processors on a particular level can communicate with one another and with processors on the next higher level.

PART II. SOFTWARE

UNIT 8

Text A. Programming.
Text B. Stages in Programming.
Text C. Instruction Format.

I. Read and memorize the following words and combinations:

assign	- назначать, присваивать
Procedure-	- процедура, методика проведения
debugging	- наладка, отладка программы
error	- ошибка, погрешность
invalidate	- выводить из строя
technique	- метод; методика; технический прием
the over-all planning	- общее планирование
so-called	- так называемый
the actual coding	- действительное кодирование
debugging	- отладка кода
running the code on the computer	- прогон кода на компьютере
a single error	- единственная ошибка

TEXT A. PROGRAMMING

The word «program» has come into use to refer to the sequence of instructions which a computer carries out. A program for a computer is an exact sequence of instructions that it uses to solve a problem. It usually consists of subroutines or subprograms which are portions of it.

Programming for automatic computer requires a good deal of knowledge, common sense, and training. Specially, programming requires: (1) understanding the operations of a business or the steps of a scientific calculation; (2) understanding the best way for having a computer carry out these operations and steps; (3) arriving at a good sequence of commands for the computer to solve the problem; and (4) adequately translating these commands into the computer language.

Programming for the computers has several forms. One form is the construction of compiling programs or compilers which use computer to take subprograms out of a library and link them together appropriately so as to solve a new problem. A second form is the construction of programs called interpreters which accept instructions in certain standard words and translate these words into a machine language, so that the machine «knows» what the words «mean». A third form is the development of common languages for automatic programming for problems, so that any problem when expressed in such a language can be given to any automatic computer, and the computer will translate the common language into its own instruction code, and then solve the problem.

EXERCISES

I. Read and translate the following sentences paying attention to the meaning of the words and word combinations given below:

a) mean – средний; среднее число;
means – средство;
to mean – значить, означать;
meaning – значение;
by means of – посредством;
by no means – ни в коем случае.

1. The year mean temperature in our town is about + 8^0. 2. Electrical typewriters and keyboard devices are the common means of input into a computer. 3. This means that the ROM is the permanent memory chip for program storage. 4. By means of arranging memory registers inside hardware it is possible to store information and instructions. 5. By no means the computer can substitute a human being in all respects. 6. The meaning of the word «means» is «средство», «состояние».

b) term – термин; срок; семестр;
to term – называть;
in terms of – с точки зрения; на языке; в терминах.

1. The term «programming» means the process by which a set of instructions is produced for a computer to make it performing specified activity. 2. President of the USA is elected for a four-year term. 3. Each academic year at institutes and universities in our country consists of two terms. 4. A code can be written in terms of automatic language for then it is easy to make changes in it. 5. A code may be termed a program or a routine because they are synonyms. 6. If the language being described is called simply «the language», then the language in terms of which the description is being made is called «metalanguage».

c) available – доступный, имеющийся в наличии; пригодный.

1. A number of different computing devices available in our Institute's lab is very great. 2. The computer ES-1045 is now available for students' use. 3. Off all the instruments available the control generator is the most suitable for producing electrical impulses.

d) any – любой, всякий (в повествовательных предложениях).

1. Any operation performed by a computer must be interpreted into a machine code. 2. Any soft of likeness to human being is simply irrational while constructing robots.

e) instead – вместо; взамен;
instead of – вместо; взамен.

1. Boolean Algebra is an algebra like ordinary one but dealing instead with classes, propositions, on-off circuit elements, etc. 2. In digital computers octal notation (восьмеричное счисление) is sometimes used instead of binary numbers.

II. Translate the phrases paying attention to different means of modality:

1) the amount must be reached; 2) there must be a close relation; 3) the problem of consumption should be considered; 4) the task is to be executed in time; 5) the information has to be distributed equally; 6) the sign needs interpretation; 7) How is the phenomenon explained?

III. Translate the phrases paying attention to different levels of probability:

A) 1. What sort of life might exist in our solar system? 2. The scientist may choose any method of research. 3. The results can be reprocessed. 4. The error could appear. 5. The task would be solved.

B) 1. The concept is likely to be erroneous. 2. The fact cannot be denied. 3. One would expect the implementation.

IV. Read Text B and write a summary of it:

TEXT B. STAGES IN PROGRAMM

There are five stages in programming. First, the computations to be performed must be clearly and precisely defined. The over-all plan of the computations is diagramed by means of a so-called flow chart. The second stage is the actual coding. It is often best to write a code in terms of a symbolic language first, for then changes are easily made. Numbers are assigned to the symbols, and the final code is prepared. In the third stage some procedure is used to get the code into the memory of the computer. The fourth stage consists of debugging the code, i.e., detecting and correcting any errors. The fifth and final stage involves running the code on the computer and tabulating the results. In fact, it is well known that a single error in one instruction invalidates the entire code. Hence, programming is a technique requiring attention to details without loosing sight of the over-all plan.

TEXT C. KINDS OF PROGRAMS

There are two main kinds of programs which are subdivided as well. They are control programs and system service programs.

Control programs[1]. There are some control programs to handle interruptions (прерывание), I/O operations, transition between different jobs (задание) and different phases of the same job, initial program loading (IPL), and symbolic assignment of I/O devices.

Actually, the control program consists of three components:

1. IPL Loader. When system operation is initiated, the hardware IPL reads in this program which then clears unused core storage[2] to zeros, generally performs some housekeeping operations,[3] and then reads in the Supervisor.

2. The Supervisor. It can handle execution of any I/O operations and can provide standard processing for all interrupts. It may also queue I/O operations so that the operation will start as soon as the required channel and device are free.

3. Job Control[4]. This program senses and processes all cards; after the new job is loaded, it turns control over to the new job. This system of operation eliminates the necessity of operation intervention between jobs, something which is of particular importance on large computers where the average job time[5] may be less than one minute.

System Service Programs[6]. They are used to maintain the library; to place new programs into the library, to delete, replace, or change existing programs, to read programs from the library into memory, to link segments of programs written at different times into one program, etc. They are called Librarian[7] and Linkage Editor.[8]

Notes:

[1] control programs – управляющие программы;
[2] unused core storage – неиспользованная часть ОЗУ;
[3] housekeeping operations – вспомогательные операции;
[4] Job Control – управление потоком заданий;
[5] the average job time – среднее время счета заданий;
[6] System Service program – системная сервисная программа;
[7] Librarian – программа «Библиотекарь»;
[8] Linkage Editor – программа «Редактор связей».

UNIT 9

Text A. Programming Languages
Text B. Data Base management System (DBMS).
Text C. Procedural and non-procedural languages.

I. Read and memorize the following words and word combinations:

in use	- используемые (в наст. время)
direction	- указание
utilization	- использование
to be convenient	- быть удобным
convenience	- удобство
appropriate	- соответствующий
to identify	- определять
content	- содержание
in effect	- в действительности
to simplify	- упрощать
to assign	- назначать

TEXT A. PROGRAMMING LANGUAGES

How are directions to be expressed to the computer? The computer is not another human being with whom one can speak easily and clearly in common English. For expressing directions to a computer the programmer in practice uses special programming languages.

Because computers can accept letters and numbers, nearly all the programming languages express the directions in some combination of letters and numbers.

The programming languages in use[1] fall into three general categories in terms of their similarity to ordinary English: machine languages, symbolic languages, and automatic coding languages. In terms of their importance for computer utilization, the machine languages are the most basic, for the computers can use them directly. But symbolic and automatic coding languages are more convenient for the programmer use because they are more similar to English.

Some programming languages are used only with a particular model[2] of computer; some are used with more than one model of computer. For the convenience of the programmer, a language that can be used with several different models of computers is more useful.

Instructions in a machine language are almost always represented by particular combinations[3] of letters and numbers acceptable to a given computer. Programs written in an appropriate machine language can be directly accepted and used by a computer.

Symbolic languages use symbolic addresses in the operands and usually also as the addresses for the instructions. This is in contrast to machine languages, which use absolute addresses. An absolute address is one expressed in machine language. It identifies a specific and physical location of data in storage. An indirect address is an absolute or symbolic address which has as its contents the absolute address of the operand needed by the instruction. Indirect addresses allow greater flexibility in programming because the programmer by changing the contents of indirect addresses can, in effect, modify a program.

For data description in the symbolic languages, the programmer uses special commands. Being able to use these commands simplify the process of data description, because often these commands can be used with symbolic addresses as their operands. Thus in many programming languages the programmer can assign addresses in symbolic, relative, or absolute form, depending upon the character of the language and what is most convenient for the programmer at the time.

Notes:

[1] in use – используемые (в настоящее время);
[2] a particular model – определенная модель;
[3] a particular combination – определенная комбинация.

EXERCISES

I. Read and translate the following sentences paying attention to the meaning of the words and word combinations given below:

a) both of – оба;
both … and …. – как ….,так и ….; и ….и …

1. Both diagrams shown in Fig.10 are easy to understand. 2. Both of devices have been designed by our postgraduate students. 3. If decimal arithmetic is provided, both operands and results are located in storage. 4. Both punched cards and punched paper tapes are used for accepting information.

b) but – но, лишь; только; кроме; однако.

1. Individual computers differ, but enough similarity exists to make a general discussion of the more important points helpful. 2. Chess for mathematicians is but a means to show the ability to compile a program. 3. Because of the millions of characters of information that can be stored, magnetic tapes are common with all but the smallest computers. 4. But in future the machines will be able to solve many problems which today are in the competence of man.

c) since – так как; с тех пор как; с тех пор; с.

1. Ch. Babbage’s machine could not operate since there were no reliable and accurate electrical equipment at the beginning of the 18^{th} century. 2. We have been ready to begin our experiments since yesterday. 3. Since the beginning of the 40s the computing technique has started to develop successfully. 4. Since electronics became known, it began to be used in nearly all branches of industry. 5. Our lecturer left for Kiev and we have never seen him since.

d) a result – результат; следствие;
as a result of – в результате;
to result in – давать в результате; приводить к;
to result from - являться результатом; вытекать из.

1. After performing computations a computer displays the results. 2. The detection of mistakes (errors) in a program results in a program interruption. 3. The protection of a computer is recorded in bits 0-3 as a result of the channel operation. 4. These data result from the comparison operation. 5. The importance of microprocessors results from their ability to process information with unimaginable speeds. 6. The achievements of the science have resulted in a triumph for our country in many fields of science.

II. Read the text and give its contents in short (in Russian)

TEXT B. DATA BASE MANAGEMENT SYSTEM (DBMS)

The Data Base Management System is a software package[1] which acts as an interface between the user's program and the physical data base. The DBMS makes it easier to access all varieties of data or information stored in a computer. It allows users to request[2] data from the computer and keeps track of all the data. It also allows each user to have an individual view[3] of the data.

If a DBMS is not used, it requires more detailed programming to access data. The user's application program asks the DBMS to select that user's view and deliver it to the program or user: Only the DBMS knows where and how to get it.

The DBMS acts as a buffer between the programs and the physical structure of the data base. A portion of the DMBS resides[4] in the memory and is called by the application program each time when data must be transferred to or from the data base.

The main DBMS features are: data independence, security, application of high-level non-procedural languages.[5]

Notes:

[1] a software package – комплект программного обеспечения;
[2] to request – запрашивать;
[3] a view – вид, изображение;
[4] to reside – размещать(ся) (в памяти);
[5] a non-procedural language – непроцедурный язык.

III. Read the text and reproduce it in English

TEXT C. PROCEDURAL AND NON-PRPCEDURAL LANGUAGES

Procedural language is a language requiring the use of programming discipline. Programmers, writing in procedural languages must develop a proper order of actions in order to solve the problem, based on the knowledge of data/information processing operations and programming techniques, such as looping.[1] All conventional programming languages are procedural languages.

Non-procedural language is a language which does not require programming techniques. Non-procedural languages allow a user or a programmer to express a request to the computer in English-like statements, which specify what is to be done rather than how it is to be done. Query languages,[2] report writers,[3] and financial planning languages are examples of non-procedural languages.

Non-procedural languages generate the necessary program logic for the computer directly from a user's description of the problem.

Notes:

[1] looping – организация циклов;
[2] query language – язык запросов;
[3] report writer – язык по написанию отчетов.

UNIT 10

Text A. Object-oriented programming (OOP).
Text B. What is UML About?
Text C. Appreciating the Power of UML.

I. Read and memorize the following words and word combinations:

to release	- освобождать, избавлять
to scale	- масштабировать
abstraction	- абстракция
to resonate	- резонировать
domain	- домен, зона
to facilitate	- способствовать
reevaluation	- переоценка
to outstrip	- опережать
paradigm	- принцип, система понятий, парадигма
structured programming	- структурное программирование
expert system	- экспертная система
object-oriented programming	- объектно-ориентированное программирование

TEXT A. OBJECT-ORIENTED PROGRAMMING

Although the fundamental features of what we now call object-oriented programming were invented in the 1960's, object oriented languages really came to the attention of the computing public-at-large[1] in the 1980's.

Object-oriented programming (OOP) has become exceedingly popular in the past few years. Software producers rush to release object-oriented versions of their products. Countless books and special issues of academic and trade journals have appeared on the subject. To judge from this frantic activity, object-oriented programming is being greeted with even more enthusiasm than we saw heralding[2] earlier revolutionary ideas. Such as «structured programming» or «expert systems».

Why is OOP popular?

There are a number of important reasons why in the past two decades object-oriented programming has become the dominant programming paradigm. Object-oriented programming scales very well, from the most trivial of problems to the most complex tasks. It provides a form of abstraction that resonates with techniques people use to solve problems in their everyday life. And for most of the dominant object-oriented languages there are an increasingly large number of libraries that assist in the development of applications for many domains. Object-oriented programming is just the latest in a long series of solutions that have been proposed to help solve the «software crisis». At heart, the software crisis simply means that our imaginations, and the tasks we would like to solve with the help of computers, almost always outstrip our abilities.

But while object-oriented techniques do facilitate the creation of complex software systems, it is important to remember that OOP is not a panacea. Programming a computer is still one of the most difficult tasks ever undertaken by humans; becoming proficient in programming requires talent, creativity, intelligence, logic, the ability to build and use abstractions, and experience even when the best of tools are available.

Object-oriented programming is a new way of thinking about what it means to compute, about how we can structure information and communicate our intentions both to each other and to the machine. To become proficient in object-oriented techniques requires a complete revaluation of traditional software development.

Notes:

[1] public-at-large – широкая публика;
[2] heralding – сообщение о… .

EXERCISES

I. Read and translate the words meaning negation:

unusual; unused; unspecified; unlimited; unsatisfactory; unfrequently; unseparated; independent; indirect; indistinguishable; impossible; disadvantage; disjunction; decode; regardless; useless.

II. Read and translate the verbs meaning repetition:

retype; recompile; recycle; reuse; re-emphasize; relocate; reread; rewrite; reoccur; rearrange; reappear; replace; restart; rewind; review; return.

III. Translate the sentences paying attention to the means of modality:

1. Before discussing the patterns themselves it is necessary to examine factors which are likely to interfere with the results. 2. In order to shorten the time required to perform instructions, it is desirable to perform as many operations as possible in parallel. 3. Provision is made to complete computers for all initial boundary conditions to be applied. 4. Human needs and conventions have to be identified first and then converted to programs in the best possible way. 5. Sometimes the microcomputer system is to be used as a general purpose computer. 6. Engineers must deal with the evolution of the existing systems as well as the design of new systems. 7. Properly designed information systems might be viewed as black boxes. 8. The computer has made it possible to mechanize much of the information interchange and processing that constitute the nervous system of our society. 9. Architectures should provide adequate flexibility to support the growing trend to distributed systems. 10. Information systems grow and new ones are continuously added. The architecture must support such growth.

IV. Read the text and translate it with a dictionary.

TEXT B. WHAT IS UML ABOUT?

So, you've been hearing a lot about UML, and your friends and colleagues are spending some of their time drawing pictures. And maybe you're ready to start using UML but you want to know what it's all about first. Well, it's about a lot of things, such as better communication, higher productivity, and also about drawing pretty pictures.

The first thing you need to know is what the initial UML stand for. UML really stands for the Unified Modeling Language.

Well, maybe that's not the most important thing to know. Probably just as important is that UML is a standardized modeling language consisting of an integrated set of diagrams, developed to help system and software developers accomplish the following tasks:

- specification;
- visualization;
- architecture design;
- construction;
- simulation and Testing;
- documentation.

UML was originally developed with the idea of promoting communication and productivity among the developers of object-oriented systems, but the readily apparent power of UML has caused it to make inroads into every type of system and software development.

V. Read the text and give a brief summary of it in English.

TEXT C. APPRECIATING THE POWER OF UML

UML satisfies an important need in software and system development. Modeling –especially modeling in a way that's easily understood – allows the developer to concentrate on the big picture. It helps you see and solve the most important problems now, by preventing you from getting distracted by swarms of details. When you model, you construct an abstraction of an existing real-world system (or of the system you're envisioning[1]) that allows you to ask questions of the model and get good answers.

After you're happy with your work, you can use your models to communicate with others. You may use your models to request constructive criticism and thus improve your work, to teach others, to direct team members' work, or to garner praise and acclamation[2] for your great ideas and pictures. Properly constructed diagrams and models are efficient communication techniques that don't suffer the ambiguity[3] of spoken English, and don't overpower the viewer[4] with overwhelming details.

The technique of making a model of your ideas or the world is a use of abstraction. For example, a man is a model of the world – it is not the world in miniature. It's a conventional[5] abstraction that takes a bit of training or practice to recognize how it tracks reality, but you can use this abstraction easily. Similarly, each UML diagram you draw has a relationship to you reality, and that relationship between model and reality is learned and conventional.

The abstractions of models and diagrams are also useful because they suppress or expose detail as needed. This application of information hiding[6] allows you to focus on the areas you need – and hide the areas you don't. For example, you don't want to show trees cars and people on your map, because such a map would be cumbersome and not very useful. You have to suppress some detail to use it.

Notes:

[1] you are envisioning – вы себе представляете;
[2] to garner praise and acclamation – принимать хвалу и одобрение;
[3] ambiguity – двусмысленность;
[4] overpower the viewer – перегружать, нагружать зрителя;
[5] conventional – стандартный;
[6] information hiding – сокрытие информации.

UNIT 11

Text A. What is Jess?
Text B. Heuristics.
Text C. Artificial intelligence.

I. Read and memorize the following words and word combinations:

shell	- программная оболочка
Java	- язык Java
prerequisites	- предпосылки, необходимые условия
to execute	- выполнять
execution	- выполнение
experience	- опыт
to cause	- вызывать, заставлять, побуждать
heuristic knowledge	- эвристические знания (решение проблемы опытным путем, методом проб и ошибок)
procedural knowledge	- процедурные знания
procedural languages	- процедурные языки (императивные)
integrated editor	- интегрированный редактор
fact-list	- список фактов
instance-list	- список объектов
inference	- логический вывод
inference engine	- механизм (метод логического вывода)
reasoning	- аргументация, объяснения
complete environment	- полная (укомплектованная) среда

TEXT A. WHAT IS JESS?

Jess is an acronym for Java Expert System Shell. It was written in Sun's Java Language by Ernest Friedman-Hill at Sandia National Laboratory in Livermore, Canada. Prerequisites are that you have a basic knowledge of expert systems and programming in a high-level languages such as Java or C.

Jess is a tool for building a type of intelligent software called expert systems. An expert system is a set of rules that can be repeatedly applied to a collection of facts about the world. It is specifically intended to model human expertise or knowledge.

Rules that apply are fired, or executed. Jess uses a special algorithm called Rete to match the rules to the facts. There are three ways to represent knowledge in Jess:

- rules, which are primarily intended for heuristic knowledge based on experience;
- functions, which are primarily intended for procedural knowledge;

- object-oriented programming, also primarily intended for procedural knowledge.

You can develop software using only rules, only object, or a mixture of objects and rules.

Jess is called an expert system tool because it is a complete environment for developing expert systems which includes features such as an integrated editor and a debugging tool. The word *shell* is reserved for that portion of Jess which performs inferences or reasoning. The Jess shell provides the basic elements of an expert system:

- fact-list and instance-list: global memory for data;
- knowledge-base: contains all the rules, the rule-base;
- inference engine: controls overall execution of rules.

A program written in Jess may consist of rules, facts and objects. The inference engine decides which rules should be executed and when. A rule-based system written in Jess is a data-driven program where the facts, and objects if desired, are the data that stimulate execution via the inference engine.

Here is one example of how Jess differs from procedural languages such as Java and C. In procedural languages, execution can proceed without data. That is, the statements are sufficient in those languages to cause execution. For example, a statement such as PRINT 2+2 could be immediately executed in BASIC.

This is a complete statement that does not require any additional data to cause its execution. However, in Jess, data are required to cause the execution of rules.

EXERCISES

I. Translate the following sentences paying attention to the meaning of the words given below:

a) aim –цель, намерение;
to aim – иметь целью.

1. The aim of this paper is to show the organization of a memory made on thin films. 2. PL/1 aims at mathematical and economical use. 3. This equipment aims at printing results on cards and displaying them on screens.

b) only – только;
the only – единственный.

1. In computers only two electrical states are used, 1 for one state, and 0 for the other. 2. The idea of an automatic computer that would not only add, multiply, subtract, and divide but perform a sequence of reasonable operations automatically was given by the English scientist Charles Babbage. 3. It was the

only way to solve this problem. 4. Petrov is the only student in our group who had worked at the computing centre before entering the Institute. 5. The access time is only a few millionth of a second for magnetic cores. 6. The printers are used only for output unit.

c) a record – запись;
to record - записывать.

1. A record of bytes on the floppy disks is read by the read/write head. 2. The problem of records of numbers has pressed upon human beings for more than five thousand years. 3. The reading equipment records digits and letters as they appear on a printed page. 4. In the world of business there are large quantities of records which are necessary to be handled by a computer. 5. To record each bit of information a computer must have the special equipment.

d) whether –ли;
whether …or not – ли …или нет; в любом случае;
whether … or – или …,или; то ли …,то ли; либо …, либо.

1. Whether the control function is executed as an immediate operation depends on the operation and the type of device. 2. Science fiction stories sometimes give rise to questions as to whether a conflict is possible between men and machines. 3. The condition code indicates whether or not the channel has performed the function specified by the instruction. 4. Whether or not the transfer of control operation actually occurs depends upon the results of the previous logical operation. 5. This program is used when it is necessary to define whether the device is out of order, or there are some errors in the previous program. 6. The type declaration is used to specify whether a variable is an integer, or a Boolean variable.

II. Translate the following sentences paying attention to the comparison degrees:

1. The commonest problem is there where a word could mean one of two different things. 2. A television set, a computer, a telephone system are simpler than a human being. 3. Another advantage in this case is that less power is required to run a computer. 4. A computer does arithmetic problems million times faster than any person. 5. The smaller the computer, the faster it can work. 6. The better we know the Universe, the better we know our Earth. 7. The symbols representing intermediate results appear later in the flow chart of the right-hand side of the equation. 8. In this case the instruction puts the number U into the largest number cell. 9. The left-hand function box in the flow chart represents 005 on the next lower level, and the lowest box represents 007.

III. Read and translate the text without a dictionary. Render it in Russian:

TEXT B. HEURISTICS

Nowadays the main usage of the word «heuristic» is mostly the adjective in the sense of «guiding discovery» or «improving problem solving». There might also be a slightly negative meaning attached to it or a lack of solution guarantee. The modern picture of a search for the solution leads to its origin in ancient Greece where the verb «heuriskein» means to find. In the history of science we find attempts to formulate methods for finding proofs and for arriving at new discoveries. They belong to what was sometimes called the art of discovery, or later, heuristics.

At all times, in all fields, methods that have grown out of experience are employed to deal with problems. One of the first fields where such methods were not only applied but explicitly stated was geometry in ancient Greece. The Greek mathematicians were mainly concerned with two kinds of problems, constructing geometrical figures from given data and finding proofs of theorems in geometry. They used two ways to find a solution. The first method was called analysis, the second synthesis.

The work of the 19^{th} century mathematician, Bernhard Bolzano, is dedicated to heuristics. The rules that are described and commented on in great detail are grouped into two classes: general rules that can be applied to any problem and special rules that are concerned with specific problems such as the analysis of concepts or propositions, or the causal analysis of events. Space forbids us to mention more than a few of the general rules. Many of them are psychological rules such as the following: Before one starts looking for a solution one should get a very clear picture of the problem; one should write down everything relevant to the problem in order to overcome the difficulty that the human mind can direct attention to only a few ideas at the same time; one should avoid strong stimulation of the senses while solving a problem; and so on.

IV. Read and translate the text into Russian in writing:

TEXT C. ARTIFICIAL INTELLIGENCE

Artificial Intelligence comprises all efforts at making computers solve problems that require intelligence such as, for example, playing chess, proving logical theorems, making medical diagnoses, designing and analyzing electronic circuits, understanding language or images, etc. Artificial Intelligence can be seen from two different viewpoints, from an engineering point of view and from a “scientific” point of view. From an engineering point of view, its goal is to produce machines that are increasingly powerful in increasingly diverse areas of application. From the second, more general point of view, Artificial Intelligence is a new approach to determine the prerequisites of intelligent behavior and to uncover its nature, independent of whether this behavior is produced by natural, biological, or an artificial system. In the last few years this second view has become very popular and has led to a new scientific paradigm called «Cognitive Science», which pursues this goal in an interdisciplinary effort among Artificial Intelligence, cognitive psychology, linguistics, and other disciplines. In Cognitive Science both man and machine are uniformly seen as systems that construct symbolic descriptions of the world and manipulate these descriptions. One consequence of this view is the separation of the physical realization of the symbols from their meaning, and thus it leads to the view that the study of the computation processes on the symbols can be distinguished from the study of the physical mechanisms that support the computation. From this position it is then natural that the results found in Artificial Intelligence can be carried over to man and can be used to understand his own intelligent behavior.

The history of Artificial Intelligence is intimately connected with the notion of heuristics or, to be more precise, the notion of heuristic search.

UNIT 12

Text A. The Rational Unified Process (RUP).
Text B. Rights.
Text C. The Value System.

I. Read and memorize the following words and word combinations:

constrain	- сдерживать
framework	- каркас, остов, конструкция
workflow	- трудовой процесс
deployment	- развертывание
roll out	- разворачивать; осуществлять
eventually	- в конечном счете, в итоге
artifact	- артефакт
cost	- стоимость, цена
demand	- требование, спрос
inferior quality	- низкого качества
break commitments	- нарушать обязательства
Rational Unified Process (RUP)	- рациональный универсальный процесс
keep track of	- придерживаться
concurrently	- одновременно
consign	- подвергать

TEXT A. THE RATIONAL UNIFIED PROCESS (RUP)

We use processes because we are afraid. We are afraid that:

- The project will produce the wrong product.
- The project will produce a product of inferior quality.
- The project will be late.
- We'll have to work 80 hour weeks.
- We'll have to break commitments.
- We won't be having fun.

Our fears motivate us to describe a process which constrains our activities and demands certain outputs. We draw these constraints and outputs from past experience, choosing things that appeared to work well in previous projects. Our hope is that they will work again, and take away our fears.

Over the years, we have come to recognize that many successful processes, though they differ in their particulars, seem to have a common shape. This text describes that shape. It provides a framework within which to build a process that may put our fears to rest. That framework is called the Rational Unified Process (RUP).

In its simplest form, RUP consists of some fundamental workflows:

1. Business Engineering. Understanding the needs of the business.

2. Requirements. Translating business need into the behaviors of an automated system.

3. Analysis and Design. Translating requirements into a software architecture.

4. Implementation. Creating software that fits within the architecture and has the required behaviors.

5. Test. Ensuring that the required behaviors are correct, and that all required behaviors are present.

6. Configuration and change management. Keeping track of all the different versions of all the work products.

7. Project Management. Managing schedules and resources.

8. Environment. Setting up and maintaining the development environment.

9. Deployment. Everything needed to roll out the project.

These activities are not separated in time. Rather, they are executed concurrently throughout the lifetime of the project.

The goal of a software process is the production of software. Software that works, software that is on time, software that is within budget, software that can be maintained, software that can be reused. If this goal is met while preserving the rights of the developers and customers, then the process is a success.

It may be necessary to produce something other than software in order to eventually produce the software that is our goal. It may also be necessary to produce some artifact that acts to support the software that is our goal. However, such intermediate artifacts are not the goal of the process. They are, at best, a means to an end. They also represent a cost. A good process will decrease the demand for such intermediate artifacts to the barest possible minimum.

When constructing a process from the RUP framework, always remember to keep your eye on the goal. It is far too easy to become focused upon the intermediate artifacts and to forget that our goal is the production of software.

EXERCISES

I. Speak on the following matters:

1.What are we afraid of while executing the project?
2. The fundamental workflows of RUP.
3. The goal of a software process.

II. Translate the following word combinations in Russian:

wrong product; inferior quality; break commitments; have fun; previous projects; common shape; intermediate artifacts; decrease the demand; keeping track of all the different versions; project management; roll out the project; throughout the lifetime of the project; within budget; to keep your eye on the goal; far too easy; preserve the rights of the developers and customers.

III. Topics for Essays oral or written reports:

1. What problems have accompanied the computer revolution?
2. Of all advantages that the computer has brought to the modern world, which is the most beneficial?
3. Describe the invention that has had the greatest effect on the 20^{th} century.
4. Computer – a God’s gift or a Devil’s toy?
5. If I were the inventor of computer …

IV. Read and translate the text with a dictionary:

TEXT B. RIGHTS

You, gentle reader, are most probably a software engineer. You are a software engineer because you like to write computer programs. You derive enjoyment and fulfillment from writing high quality software that serves your customers and employers well.

However, in order to do your job well, you have certain rights and needs. Ron Jeffries – and Kent Beck outlined these rights as follows:

The Developer Bill or Rights

- You have the right to know what is needed, via clear requirements, with clear declarations of priority.
- You have the right to say how long each requirement will take you to implement, and to revise estimates given experience.
- You have the right to accept your responsibilities instead of having them assigned to you.
- You have the right to produce quality work at all times.
- You have the right to peace, fun, and productive and enjoyable work.

Some of you who are reading this text are customers of the developers. Most likely you are project or product managers who need the product that the developers are producing. You too have certain rights and needs. Kent Beck outlined these rights too:

The Customer Bill of Rights

- You have the right to an overall plan, to know what can be accomplished, when, and at what cost.
- You have the right to see progress in a running system, proven to work by passing repeatable tests that you specify.
- You have the right to change your mind, to substitute functionality, and to change priorities.
- You have right to be informed of schedule changes, in time to chose how to reduce scope[1] to restore the original date.

These bills of rights are profound documents. If we could find a way to guarantee these rights, our fears would be greatly diminished. It is the job of a software process to provide that guarantee. Any process that violates or ignores one or more of these rights, is doomed to fail[2].

Notes:

[1] to reduce scope – сократить поле деятельности;
[2] is doomed to fail – обречен на провал.

V. Read the text and give brief characteristics of each value connected with the process.

TEXT C. THE VALUE SYSTEM

A process achieves its ends by promoting certain values. Practices that support those values are compatible with the process. Practices that violate those values are rejected from the process. The values that we hold to are ages old. Kent Beck names them: Communication, Simplicity, Feedback, and Courage.

Communication

Most of the bad things that can happen to a project are the result of miscommunication. If a project is late, it is because there was a miscommunication between those who managed the schedule, and those who executed the schedule. If the quality of the product is low, it is because of a miscommunication between those who needed the quality, and those who ensured it was present.

A good process facilitates communications. It provides the channels between the parties that need to communicate, and indicates the form, purpose and goal of that communication. Communication takes place between people, documents are secondary.

Simplicity

A process that is too complex will fail. Simplicity is a value to be intensely defended, both in our software, and in our process. We will not add activities or artifacts to our processes unless the need for them is critical. We will regularly sweep through our processes and remove accumulated complexity. Anything that cannot be completely justified, is eliminated. A process description should always look too small.

Feedback

If we try to do too much without checking our results, we will fail. Thus, we value small steps, where each step is tested for accuracy before taking the next.

A good process uses a method similar to that of the scientific method. Every step is at first nothing more than a hypothesis. Every hypothesis is tested by physical experiment. When enough experiments have been performed to establish the hypothesis as correct, the next step can be taken.

Courage

Alistair Cockburn says that a process can have only second order effects. First order effects are due to the people.

Of all the values, this is the most important. If we are to be successful, we must still have the courage to put our faith in people as opposed to a process. The moment we come to believe that a process is more important to success than the people who execute it, is the moment we consign our projects to failure.

Thus, when we define a process, we must take great care not to dehumanize it. It should protect us from the most critical of failures. It should remind us of the most important activities. It should establish the fundamental rules. But it should not and, and indeed cannot, protect us from every possible human failing.

When building a process, depend upon people in every instance where the risk is acceptable. The cost of a few uncorrected non-critical human errors is less than the cost imposed by a process that tries to prevent them.

TEXTS FOR SUPPLEMENTARY READING

MASTERS OF INVENTION

Their Computers Have Changed the Way We Work and Play

Computers are everywhere. You can use a computer to write a letter, design a house, draw a picture or exchange messages with someone around the world.

But it wasn't too long ago that computers could only work math problems. Those machines cost millions of dollars, and only a few huge companies had them. Now, more than a third of all U.S. families have a computer at home.

Computers have changed the way we live. The Information Age has jumped on the Information Super-highway. Meet some of the men who made it possible.

Charles Babbage (1792-1871)

The Englishman designed the first modern digital computer, but he never built it. He did build other useful devices, though, including a submarine.

English mathematician Charles Babbage designed the first modern computer in the 1830's. He called it an analytical engine.

If Babbage had been able to get enough money to build the computer the analytical engine would have been as big as a locomotive.

Charles Babbage was born the day after Christmas in 1792. As a child, he liked to take toys apart to see how they were made. He loved to work with math problems. He eventually became a professor at Cambridge University in England.

Babbage could be mean, and he sometimes yelled at people who disagreed with him. But he had a brilliant mind. In addition to designing the forerunner of today's digital computer, Babbage invented a railroad signal system, a device for examining eyes, a submarine and a system of flashing lights for lighthouses.

During the 70 years following Babbage's death in 1871, computer scientists improved on Babbage's original idea.

Howard Aiken (1900-1973)

He built the Mark I, the first working digital computer. A brilliant inventor, he was not a good fortune-teller. Said Aiken in 1947: "There will never be enough problems, enough work for more than one or two of these computers".

In 1944 Harvard University physicist Howard Aiken built the forerunner of today's computer.

Aiken's Mark I was the first working digital binary computer. It used thousands of electrical switches that clicked on and off to compute data. When it was running, the switches sounded like the clicking of knitting needles.

Howard Aiken grew up poor in Indianapolis, Ind. He had to work his way through school, but he made it through Harvard.

Aiken like Charles Babbage, had a prickly personality. While his computer, the Mark I, was being built, he drove the workers like slaves.

For 16 years the Mark I was used to solve the complex equations needed to aim the U.S. Navy's big guns. But it was much slower than later computers, which use electronic components instead of switches.

Bill Gates,
The Software King

Bill Gates (born in 1955) created the first software – the programs that help personal computers process different information. As founder of Microsoft, he is *now one of the richest men in America*.

Most of the computers in the world use software invented by Bill Gates, the founder of Microsoft Inc. of Redmond, Wash. Software is the set of programs that make computers – whether business or personal - perform various tasks.

Gates was born in Seattle, Wash., in 1955. As a boy, he was bright and curious. He was active in Scouting, reaching Life Scout rank in Troop 186. He especially loved hiking, camping and other outdoor adventures.

But Gates was obsessed with computers. While a student at Harvard University in 1975, Gates and a friend, Paul Allen, developed a computer language for an early version of the personal computer. Microsoft was born. Gates went on to develop operating systems, such as MS-DOS, and software programs.

Thanks to Microsoft, Gates is now one of the richest men in America. He is worth more than $ 8 billion.

A technical wizard and a fierce business competitor, Gates sees great things ahead for computers. He says they "are really going to change a lot of things in the world – the way we work, the way we play and entertain ourselves and even the way we are educated".

The binary number system

Early digital computers inspired by Howard Aiken's Mark I were huge, sometimes filling an entire room. That was because thousands of switches were needed to computer his binary number system.

In the binary number system, only two digits are recognized by the computer: **0** when a switch is off, and **1** when the switch is on. Different combinations of those two digits can represent thousands of letters and numbers.

The binary number system is still used in today's computers. The difference is that the thousands of electrical switches have been replaced by one tiny, solid-state chip that does the translations electronically. That's why your computer only fills up part of your desk, not your whole bedroom.

Computers in our life

Microsoft's Bill Gates and other computer experts saw great things ahead. Now you are able to sit at your computer and see high-quality video sent from any place on earth.

They predicted you would also have a wallet-size personal computer, and you would be able to store photographs, pay bills, get the news, send messages, see movies and open locks with digital keys.

At home on your TV-size PC you are able to see and talk with friends in other states, get medical advice, check magazine articles and pictures in a far off library and order a pizza.

A computerized control system can regulate your lighting, temperature and security system.

Big dreams have come true.

But engineers and scientists go on working.

TO YOUR HEALTH

Can all this computing be good for you? Are there any unhealthy side effects? The computer seems harmless enough. How bad can it be, sitting in a padded chair in climate-controlled office?

Health questions have been raised by the people who sit all day in front of the video display terminals (VDTs) of their computers. Are computer users getting bad radiation? What about eyestrain? And what about the age-old back problem, updated with new concerns about workers who hold their hands over a keyboard? What about repetitive-action injury also known as carpal tunnel syndrome? What about the risk of miscarriage?

Unions and legislators in many communities continue to push for laws limiting exposure to video screens. Many manufacturers now offer screens with built-in protection.

Meanwhile, there are a number of things workers can do to take care of themselves. A good place to begin is with an ergonomically designed workstation. Ergonomics is the study of human factors related to computers. A properly designed workstation takes a variety of factors into account, such as the distance from the eyes to the screen and the angle of the arms and wrists.

Experts recommend these steps as coping mechanisms:

- Turn the screen away from the window to reduce glare, and cover your screen with a glare deflector. Turn off overhead lights; illuminate your work area with a lamp.
- Put your monitor on a tilt-and-swivel base.
- Get a pneumatically adjustable chair. Position the seat back so your lower back is supported.
- Place the keyboard low enough to avoid arm arm and wrist fatigue. Do not bend your wrists when you type. Use an inexpensive, raised wrist rest. Do not bend your wrists when you type. Use an inexpensive, raised wrist rest. Do not rest your wrists on a sharp edge.
- Sit with your feet firmly on the floor.
- Exercise at your desk occasionally rotating your wrist, rolling your shoulders, and stretching. Better yet, get up and walk around at regular intervals.

GENERATIONS OF COMPUTERS

From the 1940s to the present, the technology used to build computers has gone through several revolutions. People sometimes speak of different generations of computers, with each generation using a different technology.

The First Generation. First-generation computers prevailed in the 1940s and for much of the 1950s. They used vacuum tubes for calculation, control, and sometimes for memory as well. First-generation machines used several other ingenious devices for memory. In one, for instance, information was stored as sound waves circulating in a column of mercury.

Vacuum tubes are bulky, unreliable, energy consuming, and generate large amounts of heat. As long as computers were tied down to vacuum tube technology, they could only be bulky, cumbersome, and expensive.

The Second Generation. In the late 1950s, the transistor became available to replace the vacuum tube. A transistor, which is only slightly large than a kernel of corn, generates little heat and enjoys long life.

At about the same time, the magnetic-core memory was introduced. Electric currents flowing in the wires stored information by magnetizing the cores. Information could be stored in core memory or retrieved from it in about a millionth of a second.

The Third Generation. The early 1960s saw the introduction of integrated circuits, with incorporated hundreds of transistors on a single silicon chip. The chip itself was small enough to fit on the end of your finger; after being mounted in a protective package, it still would fit in the palm of your hand. With integrated circuits, computers could be made even smaller, less expensive, and more reliable.

Integrated circuits made possible minicomputers, tabletop computers small enough and inexpensive enough to find a place in the classroom and the scientific laboratory.

In the late 1960s, integrated circuits began to be used for high-speed memory, providing some competition for magnetic-core memory. The trend toward integrated-circuit memory has continued until today, when it has largely replaced magnetic-core memory.

The most recent jump in computer technology came with the introduction of large-scale integrated circuits, often referred to simply as chips. Whereas the older integrated circuits contained hundred of transistors, the new ones contain thousands or tens of thousands.

It is the large-scale integrated circuits that make possible the microprocessors and microcomputers. They also make possible compact, inexpensive, high-speed, high-capacity integrated-circuit memory.

All these recent developments have resulted in a microprocessor revolution, which began in the middle 1970s and for which there is no end in sight.

The Fourth Generation. In addition to the common applications of digital watches, pocket calculators, and personal computers, you can find microprocessors – the general-purpose processor-on-a-chip – in virtually every machine in the home or business – microwave ovens, cars, copy machines, TV sets, and so on. Computers today are hundred times smaller than those of the first generation.

The Fifth Generation. The term was coined by the Japanese to describe the powerful, intelligent computers they wanted to build by the mid-1990s. Since then it has become an umbrella term, encompassing many research fields in the computer industry. Key areas of ongoing research are artificial intelligence (AI), expert systems, and natural language.

THE EARLY YEARS

Until the late 1970s, the computer was viewed as a massive machine that was useful to big business and big government but not to the general public. Computers were too cumbersome and expensive for private use, and most people were intimidated by them. As technology advanced, this was changed by a distinctive group of engineers and entrepreneurs who rushed to improve the designs of then current technology and to find ways to make the computer attractive to more people. Although these innovators of computer technology were very different from each other, they had a common enthusiasm for technical innovation and the capacity to foresee the potential of computers. This way a very competitive and stressful time, and the only people who succeeded were the ones who were able to combine extraordinary engineering expertise with progressive business skills and an ability to foresee the needs of the future.

Much of this activity was centered in the Silicon Valley in northern California where the first computer-related company had located in 1955. That company attracted thousands of related businesses, and the area became known as the technological capital of the world. Between 1981 and 1986, more than 1000 new technology-oriented businesses started there. At the busiest times, five or more new companies started in a single week. The Silicon Valley attracted many risk-takers and gave them an opportunity to thrive in an atmosphere where creativity was expected and rewarded.

Robert Noyce was a risk-taker who was successful both as an engineer and as an entrepreneur. The son of an Iowa minister, he was informal, genuine, and methodical. Even when he was running one of the most successful businesses in the Silicon Valley, he dressed informally and his office looked like everyone else's. A graduate of the Massachusetts Institute of Technology (MIT), he started working for one of the first computer-related businesses in 1955. While working with these pioneers of computer engineering, he learned many things about computers and business management.

As an engineer, he co-invented the integrated circuit, which was the basis for later computer design. As a businessman, Noyce co-founded Intel, one of the most successful companies in the Silicon Valley and the first company to introduce the microprocessor. The microprocessor chip became the heart of the computer, making it possible for a large computer system that once filled an entire room to be contained on a small chip that could be held in one's hand. The directors of Intel could not have anticipated the effects that the microprocessor would have on the world. It made possible the invention of the personal computer and eventually led to the birth of thousands of new businesses. Noyce's contributions to the development of the integrated circuit and the microprocessor earned him both wealth and fame before his death in 1990. In fact, many people consider his role to be one of the most significant in the Silicon Valley story.

HACKERS OF TODAY

Hackers, having started as toy railroad circuitry designers in the late fifties, are completely new people now. Once turned to computers, they became gods and devils. Nowadays holders and users of the World Wide Web hide their PCs under passwords when the keyword «hacker» is heard. When and how did this change take place? Why are we so frightened of Hacker The Mighty and The Elusive?

One of the legends says that hackers have changed under the influence of «crackers» – the people who loved to talk on the phone at somebody else's expense. Those people hooked up to any number and enjoyed the pleasure of telephone conversation, leaving the most fun – bills – for the victim. Another legend tells us that modern hackers were born when a new computer game concept was invented. Rules were very simple: two computer programs were fighting for the reign on the computer. Memory, disk-space and CPU time were the battlefield. The results of that game are two in number and are well known: hackers and computer viruses. One more story tells that the «new» hackers came to existence when two MIT students that attended the AI Lab found an error in a network program. They let people, responsible for the network, know but with no result. The offended wrote a code that completely paralyzed the network and only after that the error was fixed. By the way, those students founded The Motorola Company later.

Today, when the Internet has entered everyone's house there's no shield between a hacker and your PC. You can password yourself up, but then either hackers will crack your PC anyway or nobody will enter your site, because passwords kill accessibility. If your PC is easy to access no one can guarantee what'll happen to your computer – hackers, you know them.

Monsters? Chimeras? Not at all! Every hacker is a human being and has soft spots: good food, pretty girls or boys (it happens both ways), classical music, hot chocolate at the fireplace, apple pie on Sunday. Hacker is first of all a connoisseur, a professional with no computer secret out of his experience. And what is the application for skills depends on him, God, and Holy Spirit.

VIRTUAL REALITY

One of the most exciting new areas of computer research is virtual reality. Having been featured in TV sitcoms as well as public television documentaries, virtual reality is merely an ambitious new style of computer interface. Virtual reality creates the illusion of being in an artificial world – one created by computers.

Virtual reality visitors strap on a set of eyephones, 3-D goggles that are really individual computer screens for the eyes. Slipping on the rest of the gear allows you not only to see and hear, but also to sense your voyage. The world of virtual reality has been called cyberspace, a computer-enhanced fantasy world in which you move around and manipulate objects to your mind's content.

When you move your heard, magnetic sensors instruct the computer to refocus your eye phones to your new viewpoint. Sounds surround you, and a fiber-optic glove allows you to «manipulate» what you see. You may seek out strange new worlds, fight monsters in computer combat, or strap yourself into the seat of a Star Wars-type jet and scream through cyberspace, blasting all comers to oblivion (computer oblivion, at least). Or, with your stomach appropriately settled, you might even try out the most incredible roller coaster ride you will ever take in your life.

For the disabled, virtual reality promises a new form of freedom. Consider the wheelchair bound paraplegic child who is suddenly able to use virtual reality gear to take part in games like baseball or basketball. Research funded by the government takes a military point of view, investigating the possibility of sending robots into the real conflict while human beings don cyberspace gear to guide them from back in the lab.

IS IT POSSIBLE TO CREATE PERFECT VIRTUAL REALITY?

Human beings have always been seeking for a better place to live, better food to eat, better people to meet. The wise have concluded that there's no perfection itself. Human's brain identifies reality by its imperfection. And thus, the attempts to create ideal world turned to creating the world alike reality – virtual reality.

On the first stage, when technology wasn't so developed, virtual reality models just presented the essence of the current processes. But along with the development of technology and science a real world model is quite similar to our life. It's still something alike, a copy but not perfect. Copying itself isn't an example to follow, but this way we may explore the universe more carefully. So what are the problems of creating perfect virtual reality- cyberspace where you can't say whether it's cyberspace or not?

One of the difficulties is that it doesn't look like reality. We can't present the needed number of colors, the full palette our eye can catch. We can't introduce shades that really look like shades because the rendering algorithms we have are huge and approximate. And it's still not possible to show such a movie in real time.

If we'd like just to imitate the movements of molecules, which are easy to be programmed, and this way to model the reality, again, we have a great wall to be stepped over. Our knowledge of micro world is poor and even though Einstein himself worked at the Uniform Field Theory, it is still uncompleted. On the other hand, the molecules are so many that programming a single cell, let alone even an insect, is the work of life for hundreds of programmers. Nobody can imagine the difficulty of virtualization of a human being. To model the universe we should create another one.

There are tasks to be solved before we can create 99% acceptable virtual reality: e.g. the speed of processing, fractal algorithms for rendering, quark mechanics and so on. But has anybody thought of connecting a computer to human's brain and clipping the images you and your ancestors have seen to present for someone else, or maybe using the calculating and data processing capabilities of the cortex? By the way, the process of seeing, hearing, smelling, and feeling the world is just a bunch of electric signals entering the brain. May be, the answer is here, and the distance is not the unaccomplished technical achievements, but ideas, strategic decisions, some crazy projects like the Head

Of Professor Dowel. Will there be the final step to create perfect virtual reality? Let's see.

THE LANGUAGE OF E-MAIL

E-mail is the simplest and most immediate function of the Internet for many people. Run through a list of questions that new e-mail users ask most and some snappy answers to them.

What is electronic mail? Electronic mail, or e-mail as it's normally shortened to, is just a message that is composed, sent and read electronically (hence the name). With regular mail you write out your message (letter, postcard, whatever) and drop it off at the post office. The postal service then delivers the message and the recipient reads it. E-mail operates basically the same-way except that everything happens electronically. You compose your message using e-mail software, send it over the lines that connect the Internet's networks and the recipient uses an e-mail program to read the message.

How does e-mail know how to get where it's going? Everybody who's connected to the Internet is assigned a unique e-mail address. In a way, this address is a lot like the address of your house or apartment because it tells everyone else your exact location on the Net. So anyone who wants to send you an e-mail message just tells the e-mail program the appropriate address and runs the Send command. The Internet takes over from there and makes sure the missive arrives safely.

There is a set of guidelines which are known as netiquette (network etiquette). These guidelines offer suggestions on the correct interact with the Internet's users.

- Keep your message brief and to the point and make sure you clear up any spelling slips or grammatical gaffes before shipping it out.
- Make sure the Subject lines of your message are detailed enough so they explain what your message is all about.
- Don't SHOUT by writing your missives entirely in uppercase letters.
- Don't bother other people by sending them test messages. If you must test a program, send a message to yourself.

Is e-mail secure? In a word, no. The Net's open architecture allows programmers to write interesting and useful new Internet services, but it also allows unscrupulous snoops to lurk where they don't belong. In particular, the e-mail system has two problems: it's not that hard for someone else to read your e-mail, and it's fairly easy to forge an e-mail address. If security is a must for you, then you'll want to create an industrial strength password for your home directory, use encryption for your most sensitive messages, and use an anonymous remailer when you want to send something incognito.

PROGRAMMING LANGUAGES

FORTRAN & PL/1

FORTRAN. FORTRAN is an acronym for FORmula TRANslation. It is a problem oriented high level programming language for scientific and mathematical use, in which the source program is written using a combination of algebraic formulae and English statements of a standard but readable form. FORTRAN was the first high level programming language. It was developed in 1954, and was designed to easily express mathematical formulas for computer processing. There were several versions of FORTRAN. The most popular and used is FORTRAN-4.

A FORTRAN program consists of data items, executable statements and non-executable statements. The program is structured in segments which consist of a master segment and optional function segments and subroutines.

Data items in FORTRAN are either variables or constants, and are assigned alphanumeric names by the programmer. Groups of similar items of data can be processed as arrays, or tables of data, in each case the individual items are defined by their position or reference within the array by naming the array followed by one or more subscripts.

PL/1. PL/1 was introduced in 1964. It was developed as a general-purpose programming language, incorporating features from both COBOL and FORTRAN. PL/1 is used primarily on large mainframes. PL/1 stands for Programming Language 1. Commercial applications (COBOL) with their emphasis on efficient handling of large volumes of data have led to the development of languages with sophisticated I/O facilities; scientific problems (FORTRAN) with their emphasis on rapid definitions and descriptions of complex problems have led to the development of highly sophisticated algorithmic languages while neglecting the data handling aspects.

PL/1 aims at combining the problem-solving facility of scientific languages with the data-handling capabilities of commercial languages, in order to meet the needs of increasingly mathematical commercial analysis and increasingly large volumes of data being processed by scientific routines.

Among the more important features of PL/1 are the following:

1. The language is modular in structure. This means that the user needs only master the set of facilities necessary for his programming needs. More complex problems can use more extensive subsets of the language.

2. The language has a «default» feature by which every error or unspecified option is given a valid interpretation, thus minimizing the effects of programming errors.

3. The language structure is «free form». No special documents are needed for coding, since the significance of each statement depends on its own format and not on its position within a fixed framework.

PL/1 is much less sensitive to the peculiarities of the hardware than the machine language. This makes it possible to use the same program on different types of computers.

ALGOL

ALGOL was developed as an international language for the expression of the algorithms between individuals, as well as a programming language. It was introduced in the early 1960s and gained popularity in Europe more than in the United States.

ALGOL is an acronym for ALGOrithmic Language. It is a problem oriented high level programming language for mathematical and scientific use, in which the source program provides a means of defining algorithms as a series of statements and declarations (описаний) having a general resemblance to algebraic formulae and English sentences.

An ALGOL program consists of data items, statements and declarations, organized in a program structure in which statements are combined to form compound statements and blocks. Ingredients of the ALGOL, namely, characters, words, expressions (data items), statements, and declarations are really the hierarchical ingredients, because words are made from combination of characters, expressions are composed of groups of words, and statements consist of combinations of expressions.

Declarations used in ALGOL provide the compiler with information about quantities appearing in the program. The «type declaration» is used to specify whether a variable is an integer, a real number or a Boolean variable.

ALGOL was originally known as IAL or International Algebraic Language. Improvements and modifications are still being offered. There were some versions of ALGOL, the most known of them being ALGOL 60 and ALGOL 68.

COBOL

COBOL is an acronym for Common Business Oriented Language. It is internationally accepted programming language developed for general commercial use. COBOL is a problem oriented high-level language in which the source program is written using statements in English.

A COBOL program is written in four divisions: Identification Division, Environment Division, Data Division, Procedure Division. The Identification Division contains descriptive information that identifies the program being compiled. The Environment Division deals with the specification of the computer to be used for operating the object program, including such information as the size of memory, the number of tape decks (комплекты перфолент), printers and other peripheral devices that will be used; a description of the computer to be used for compiling the source program is also given here. The Data Division is used to allocate labels to all units of data on which operations are to be performed. All input and output files are defined and associated with the peripheral units to be used for input and output. The Procedure Division gives the step-by-step instructions necessary to solve the problem. These steps are specified by means of instructions expressed in English statements which can be recognized by the compiler and translated into a sequence of machine code instructions capable of being used by the computer to solve the problem.

The advantages of using COBOL are that it is relatively simple to learn, and programs can be quickly written and tested; programmers can easily understand programs not written by themselves, and thus associated documentation can be simplified; and programs can be used on other machines, within the limitations noted above.

The disadvantages are: 1) the relative inefficiency of the resulting object program as compared with a program written in machine code or machine oriented language and 2) the lack of flexibility imposed by the restrictions on the type of instructions and methods for performing operations in a highly standardized language.

BASIC & PASCAL

BASIC was developed in 1965 and stands for Beginners All-purpose Symbolic Instruction Code. It is a programming language designed for solving mathematical and business problems. BASIC was originally developed as an interactive programming language for time-sharing on large mainframes. It is widely used on all sizes of computers and has become extremely popular on microcomputers.

There are many different versions of BASIC available with limited versions running on small hand-held computers. BASIC is available in both compiler and interpreter form, the latter form being more popular and easier to use, especially for the first-time programmer. In interpreter form the language is conversational and can be used as a desk calculator. In addition, it is easy to debug a program, since each line of code can be tested one at a time.

BASIC is considered to be one of the easiest programming languages to learn. For simple problems BASIC programs can be written «on the fly», at the terminal. However, complex problems require programming technique, as in any conventional programming language. Since BASIC does not require a structured programming approach, like PASCAL, and since there is no inherent documentation in the language, as in COBOL, BASIC programs can be difficult to decipher later if the program was not coherently designed.

BASIC is used almost universally. There is no one BASIC language, but something like 90 different versions or dialects; however, all have certain common features that make it easy to use any version once the fundamentals are mastered. Since BASIC is job and human oriented, it cannot be understood by the computer as written, but must go through the intermediate step of a compiler or interpreter, as was said above. As far as the programmer is concerned, it makes very little difference whether a compiler or interpreter is used.

PASCAL. PASCAL is a general-purpose high level programming language. It is named after the famous French mathematician, Blaise Pascal, who in 1642 designed and built the first mechanical calculator, the «Pascaline». PASCAL is noted for its simplicity and structured programming design. It is available as both a compiler and an interpreter.

PASCAL was proposed and defined in 1971, and gained popularity in universities and colleges in Europe and the United States. It was later revised and appeared as standard PASCAL in 1975. Its principal features were on teaching programming and on the efficient implementation of the language.

PASCAL may be considered a successor to ALGOL-60, from which it inherits syntactic appearances(синтаксические признаки). The novelties of PASCAL lie mainly in extensive data structuring facilities such as record, set and file structures. It also affords more sophisticated control structures suitable to structured programming.

An algorithm of a computer program consists of two essential parts: a description of actions which are to be performed, and a description of the data, which are manipulated by these actions. Actions are described by statements, and data are described by declarations and definitions.

ADA & C

ADA is a high level programming language. It is a PASCAL-based language, but much more comprehensive than PASCAL, being designed for both commercial and scientific problems. ADA is a compiler language which can be compiled in separate segments and is noted for its multitasking capabilities.

ADA was named after Augusta Ada Byron (1815-1852), daughter of the English poet, Lord Byron.

C is a high-level structured programming language. It is a compiler language too which is noted for its ability to handle conditions that normally would have to be written in an Assembly Language. Some operating systems are written in C.

ARTIFICIAL INTELLIGENCE

«Artificial intelligence» is a metaphoric figure of speech designating an entire scientific trend which includes mathematicians, linguists, psychologists, engineers, and many other specialists. The essence of this trend is the intensification of man’s creative activities with the aid of computers.

Artificial intelligence (AI) is machine intelligence. It refers to applications of the computer which, in operation, resembles human intelligence. There are different categories of uses which all fall into the AI area. For example, robots or machines with sensory capabilities which detect and recognize sounds, pictures, etc., are one category. Another category is knowledge based systems, which contain a base of knowledge about a subject and can assist us in solving problems. Knowledge based systems being developed from the experience of human experts are called expert systems and can perform such tasks as medical diagnoses. AI will encompass many areas that have not been easily solved using traditional hardware and software.

AI will be incorporated into 5^{th}-generation computer systems. Then the average computer system should not require users to remember a lot of complex codes or commands. Rather, the user should ask: «Can you help me with this type of problem?» The master control program or operating system will be able to direct the user to the appropriate expert system through questions and answers.

AI programming is not magical; it does however imply a change in rules and methods for the traditional application programmer. Normal application programs follow a fixed algorithm: if this – do that. Given a set of input conditions, the output can be precisely determined. AI requires program design with more imagination. New methods of program organization and construction must be developed. AI programs may require the use of heuristic techniques, which are exploratory in nature and use trail and error methods. AI programs are often programmed in the LISP programming language, which allows the program designer to concentrate on the problem-solving logic more effectively than common languages like BASIC and COBOL.

It is impossible in principle to develop an artificial intelligence as it is sometimes understood literally, because the human brain is a very sophisticated system composed of tens of billions of interconnected cells. Each cell is extremely complex in itself. A rather probable hypothesis says that an individual cell processes the signals penetrating it like a computer. Therefore, even the most sophisticated machine we may imagine cannot even be compared to the brain. Man created the machine to fulfill his own requirements. A machine cannot have either human feelings, desires or emotions. Can anyone imagine a machine in love with someone? And what about the experience a person receives during his life in society through dealing all the time with purely human problems? A machine, in general, cannot think, either logically or figuratively.

But nevertheless, the research trend of artificial intelligence will acquire ever greater importance as time goes by, because the programming and technical means of artificial intelligence will ensure us of the opportunity to associate directly with the machine without the aid of a huge crowd of engineers, economists, biologists, chemists, and many other specialists. The question of AI acquires special importance for economic planning and management. In conditions when production is becoming automated, management must become automated as well.

One of the trends in AI now being intensively developed is to design so-called thinking robots, capable of a certain amount of independent activities.

The model of creative processes in computers gave birth to the term «artificial intelligence». But that doesn't mean that the computers possess it. The «intelligence» has been packaged in it by an expert who developed the programme for solving some practical creative problem. Man differs from the machine in that he does not simply fulfil the programs stored in his memory, but also develops them himself, depending on the goals facing him.

COMPUTER AS IT IS

The word «computer» comes from a Latin word which means to count. A computer is really a very special kind of counting machine.

Initially, the computer was designed as a tool to manipulate numbers and thus solve arithmetic problems. Although designed originally for arithmetic purposes at present it is applicable for a great variety of tasks.

Nowadays computers are considered to be complicated machines for doing arithmetic and logic. The computer may be stated to have become an important and powerful tool for collecting, recording, analyzing, and distributing tremendous masses of information.

Viewed in the contemporary scene and historical perspective the computer simulates man. Indeed, two important and highly visible characteristics of man are his intelligence and his ability to perform and control his environment.

As already stated, originally computers were used only for doing calculations.

Today it would be difficult to find any task that calls for the processing of large amounts of information that is not performed by a computer. In science computers digest and analyse masses of measurements, such as the sequential positions and velocities of a spacecraft and solve extraordinary long and complex mathematical problems, such as the trajectory of the spacecraft. In commerce they record and process inventories, purchases, bills, payrolls, bank deposits and the like and keep track of ongoing business transactions. In industry they monitor and control manufacturing processes. In government they keep statistics and analyse economic information.

Although accepted for different purposes computers virtually do not differ in structure.

Any computer is, architecturally, like any other computer. Regardless of their size or purpose most computer systems consist of three basic elements: the input-output ports, the memory hierarchy and the central processing unit.

Modern computers and microelectronic devices have interacted so closely in their evolution that they can be regarded as virtually symbiotic. Microelectronics and data processing are linked.

Today the hardware in data-processing machines is built out of microelectronic devices. Advances in microelectronic devices give rise to advances in data-processing machinery.

As previously pointed computers today are providing an expanding range of services to rapidly growing pool of users. Such facilities could make our lives easier, and indeed they already enhance the productivity. Yet a bottleneck remains which hinders the wider availability of such systems; this bottleneck is the man-machine communication barrier.

Simply put, today's systems are not very good at communicating with their users. They often fail to understand what their users want them to do and then are unable to explain the nature of the misunderstanding to the user. Communication with the machines is sometimes time-consuming. What are the causes of this communication barrier?

One of the most important causes of the man-machine communication barrier is that an interactive computer system typically responds only to commands phrased with total accuracy in a highly restricted artificial language designed specifically for that system. If a user fails to use this language or makes a mistake, however small, an error message is the response he can expect.

BIG PROBLEMS REQUIRE BIG COMPUTERS

The expanding role of the macro computer is due to the ever-increasing number of applications that transcend the capabilities of micros and minis. Certain real time problems – such as the preparation, launch, and guidance of a space vehicle or satellite, for example, require millions of calculations for each external stimulus, with response time of only one or two seconds at the most. The large on-line databases required to solve such problems and the interdependent nature of the calculations can be handled only by the huge memory capacities and high throughputs of large-scale computers.

Other problems are so complicated that millions of bytes of high-speed storage are necessary to fully describe them and solve them in time for the answers to be useful. A weather-prediction model and other complex simulations are cases in point.

For example, if weather prediction is to be possible, countless factors such as wind currents, solar effects, and even planetary configuration must be calculated, correlated, and simulated. Similar problems are involved in the mapping of ocean processes, and probing out of new energy sources.

Large-scale computers are necessary to do the complex processing, necessary to create intricate electronic and photographic image from the coded data sent by spacecraft and satellites.

In the realm of pure science macro computers may one day be used to model and bring some order to the incredibly complex realm of subatomic particles.

Some complex problems can be split into pieces and handled by several independent small computers or by a network of interconnected small computers. But when a multiplicity of operations must be accomplished simultaneously and/or where a high degree of data integration is necessary, the only answer is a macro computer.

TESTING OF PROGRAMS

Testing computer software is a good idea. While pretty much everybody involved in building or using computer systems would agree with this, software riddled with hidden defects continues to be deployed into production environments. Testing is obviously not a novel idea and a number of vendors sell testing methodologies and tools in pretty much any shape or form. So why are we not more successful in creating bug-free, high-quality software?

The first-part of the answer lies in the expression «high-quality». Before we can claim that a piece of software is of high quality we need to define what quality means to us. A high-quality system should not have any defects. We can define defects as deviations from the functional specification. So if the system behaves exactly like the specification we should be able to call it «high-quality». What if the system functions as specified, but not as expected? Also, what do we call a system that functions as specified but is difficult to enhance and maintain?

Apparently, «quality» and «testing» cover a long list of possible characteristics. We typically divide the list of requirements for a system into functional and non-functional requirements. Functional requirements define the business functions the system needs to support. Non-functional requirements (sometimes referred to as «ilities») define attributes that relate to the operation or maintenance of the system, such as scalability, maintainability, reliability, etc. Likewise, we can divide our testing efforts into functional tests and non-functional tests. Functional tests verify functional specifications while non-functional tests verify non-functional requirements. In addition to functional specifications while non-functional tests verify non-functional requirements. In addition to functional tests, developers execute «white-box» unit tests to verify individual code segments that may or may not be directly related to a piece of functionality.

Even though requirements may be well defined and the correct approach to testing is well understood, many projects still release buggy products. One common reason is the perception that «we don't have time to test more extensively». This is usually the fact because testing tends to be the last phase before the (firm) release data, and any slippage in the requirements or development phases are compensated for by shortening the testing phase.

ACCEPTENCE TESTS

Your goal is to produce software that does what the customer asks for. There are many factors that make this difficult. There can be a gap between what the customer thinks is clearly being expressed and your understanding of their needs. Often, in the process of writing the software, you discover issues that were not made explicit. As the software evolves, the customer thinks of new requirements or wants to make adjustments to existing requirements.

Let's assume that if you could figure out what a customer wants then you could write the code to make it work. How can you be sure you understand what a customer wants? You and your client try to capture your common understanding in a sequence of activities called acceptance tests. The customer should write these tests. That doesn't mean that the client will be writing code.

Acceptance tests help the customer discover and the developers understand what is expected of a particular user story. In XP[1], we look at user stories as describing a conversation. They are not hard and fast requirement documents. Acceptence tests are a way of asking the customer how they will determine that you have satisfied the goals of the user story. As with all facets of XP, a customer can add acceptance tests to a story if they think the costs of doing so are justified.

Acceptance tests are more useful if they can be automated. You want to be able to run the tests all the time. Acceptance tests point you in the direction of tasks that can be used to split the user stories. You don't need to write your acceptance tests before you write your production code in the same way that you write unit tests first. Acceptance tests will, however, focus your efforts on the customer requirements.

Using the Fit framework for writing acceptance tests has two chief advantages. First, customers are comfortable enough with spreadsheets and tables that they can write their own acceptance tests. Second, the approach is formal enough that developers can write the fixtures that tie the tests to the code being tested. In other words, with relatively little work on the part of customers or developers, acceptance tests can be written and run automatically so that both the customers and the developers can track the progress towards completing user stories.

THE FIT RFAMEWORK

There are four pieces to writing and automatically running acceptance tests.

- First, the customer has to write the acceptance tests. In the case of the Fit framework, the customer will be creating tables on a web page using either HTML[2] or a Wiki.
- Second, the developers will write the code that makes the acceptance tests pass. This is the shipping code that the developers will release to the customers every couple of weeks.
- Third, the developers will need to write a little bit of code that maps from the tests the customers write to the application being tested. These fixtures will extend classes in the Fit framework and will exercise the shipping code according to the customer specifications.
- Finally, there needs to be a framework that parses the HTML or Wiki tables and makes the appropriate calls in the test fixtures created in the third step. These are provided by the Fit framework and can be run from the command line or remotely using scripts written in Perl, Python, Ruby, or other languages.

Notes:

[1] XP – extreme programming (способ описания документов в WWW);

[2] HTML – Hypertext Markup Language (экстремальное программирование);

[3] to parse [pa:z] – делать грамматический или лексический разбор, анализировать;

[4] spreadsheet – крупноформатная таблица.

FUNCTIONALLY TESTING

Functionally Testing MIGHT BE:

- **Installability Testing:** Based on the following – can a product be installed on a clean system, can it be installed over a previous version of itself, and can it be completely removed from a system? All of these can have an effect on how a product functions.
- **Reliability Testing:** This kind of testing is based on how well a product handles failures, data integrity and safety and security. An extreme example would be hospital software that monitors a patient's heart rate – if it doesn't function correctly the patient's life may be at risk.
- **Scenario Testing:** A test technique that combines a series of simple tests that may individually produce no bugs, but collectively may produce a variety of problems.

Specification-Based Testing: A specification is anything that comes with the product – the box, the instructions, and any readme or help file. The functionality of a product can be tested against these specifications – the simple question can be asked, «Does it do what they say it should?»

Functionally Testing IS:

- **Black Box Testing:** UI and output are the focus of testing – not the internal program structure, or code.
- **Impacted by Testability:** In order to test the functionality of a product, it must be testable – it must be code complete, it must install, and all branches must be available. Any area that isn't complete or cannot be examined, obviously cannot be tested for functionality.
- **Concerned with Features:** Functionality is concerned with what works and how it works – not necessarily why it works. This includes menu items and UI options.

But what does this all mean?

Does it mean that we're going to quickly click through a few areas of obvious UI? Maybe.

Does it mean that we're going to check several menu options, attempt to follow every UI link, and enter data when prompted? Sometimes.

Does it mean that we're going to check all menu options, verify every link and jump in UI, enter a series of correct and incorrect data, and check against expected results based on implicit and explicit specifications, as well as user experience? Could be.

Truthfully, functionality testing can be all of the above, or one of the above – based on the needs of the customer, and the state of the product.

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