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НАУКА И ТЕХНИКА

Методическое пособие по развитию навыков чтения
на английском языке для студентов 1-2-го курсов
В 2-х частях
Часть 2

SCIENCE AND ENGINEERING

Methodical Directions
on the Development of Reading Skills for the 1st and 2nd Year Students

Part 2

Минск 2006

УДК 802.0 (075.8)
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Целью пособия является обучение студентов чтению и пониманию научно-технической литературы на английском языке по специальности, развитие навыков аннотирования и реферирования.

Каждый раздел сопровождается комплексом лексико-грамматических упражнений и грамматическим справочником, а также ключами в конце пособия.

Работа может быть рекомендована для студентов дневной и вечерней форм обучения.

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Unit I
Laser
Vocabulary Study
Word List

Nouns and Noun Phrases

1) acronym - акроним, аббревиатура
2) amplification - усиление
3) blood vessels - кровеносные сосуды
4) coherent light beam - когерентный луч, пучок света
5) exposure time - время экспозиции, выдержки
6) fraction - доля, часть
7) frequency range - диапазон частот; полоса частот
8) frequency shift - сдвиг частоты
9) hostile ballistic missiles - вражеские баллистические ракеты
10) lesion - повреждение, поражение (тканей, органов)
11) light scattering - рассеяние светового пучка
12) low-loss optical fibers - оптоволокно с малыми потерями
13) machine-tool - станок
14) power density - концентрация энергии
15) retina - сетчатка (глаза)
16) sample - образец
17) spot - место; участок; точка
18) three-dimensional image - трехмерное (объемное) изображение
19) tissue - ткань
20) tool - инструмент, средство,приспособление
21) unprecedented accuracy - беспрецедентная точность
22) laser-activated switch - переключатель, управляемый лазерным лучом

Adjectives

1) earthbound - земной, связанный с Землей
2) enormous - громадный, огромный
3) precise - точный, определенный
4) surrounding - близлежащий, соседний
5) valuable - ценный; полезный, важный

Verbs

1) bore - сверлить
2) cauterize - прижигать
3) damage - повреждать, портить
4) drill - сверлить, просверливать
5) induce - вызывать, индуцировать
6) measure - измерять
7) melt - плавить(ся); расплавлять(ся)

8) range - колебаться в пределах
9) simplify - упрощать
10) vaporize - выпаривать, испарять

Adverbs

1) consequently - следовательно, в результате
2) extremely - крайне; чрезвычайно; в высшей степени
3) therefore - по этой причине; вследствие этого; поэтому, следовательно

I. Read and translate the following words. Arrange them into the groups: a) with one stress or stress on the first syllable; b) with the stress on the second syllable; c) with two or more stresses.

Amplification, frequency, light beam, enormous, extremely, range, tool, consequently, fiber, machine-tool, unprecedented, sample, lesion, hostile, missile, bore, fraction, simplify, cauterize, valuable, vaporize, precise, exposure time, tissue, coherent, induce.

II. Match the words on the left with the definitions on the right.

1) frequency
2) range
3) amplify
4) propagation
5) semiconductor
6) valuable
7) enormous
8) simplify
9) vaporize
10) heat

a. To make or become hot.
b. The spreading out of sound, or a wave form, from a source.
c. To make easy to do or understand.
d. Very great; immense.
e. The number of complete oscillations performed in one second.
f. To convert into steam.
g. The set of values (between two limits) of a quantity for which an event occurs or operates.
h. A substance with conducting properties intermediate between those of a conductor (a metal) and an insulator.
i. To increase the magnitude of a form of energy, especially energy traveling in waves.
j. Of great worth or use.

III. Choose:

a) a noun

1. a) amplify; b) amplification; c) amplified; d) amplifying
2. a) measurement; b) measuring; c) measureless; d) measured
3. a) determined; b) determine; c) determination; d) determining

4. a) reduction; b) reducing; c) reduced; d) reduce

b) a verb

1. a) exposure; b) exposing; c) expose; d) exposition
2. a) vapour; b) vaporous; c) vaporize; d) vaporizing
3. a) extent; b) extendible; c) extension; d) extend
4. a) communicate; b) communication; c) communicating; d) communicative

c) an adjective

1. a) classification; b) classify; c) classifier; d) classifiable
2. a) accelerative; b) acceleration; c) accelerate; d) accelerant
3. a) induction; b) inductor; c) inductive; d) induce
4. a) detection; b) detectable; c) detect; d) detector

d) an adverb

1. a) succeed; b) success; c) successful; d) successfully
2. a) consequently; b) consequent; c) consequential; d) consequence
3. a) preciseness; b) precisely; c) precision; d) precise
4. a) effect; b) effectively; c) effective; d) effectless

IV. Define the meaning of the "x" words.

1. Emit: emission = испускать: x.
2. Propagate: propagation = x: распространение.
3. Power: powerful = мощь, сила: x.
4. Relative: relativity = относительный: x.
5. Accurate: accuracy = x: точность.
6. Scatter: scattering = x: рассеяние.
7. Frequent: frequency = частый: x.
8. Selective: selectively = отборный, выборочный: x.
9. Health: healthy = x: здоровый.
10. Propose: proposal = предлагать: x.

V. Underline the suffixes and translate the following adjectives into Russian.

Scientific, powerful, effective, successful, selective, communicative, industrial, directional, spacious, molecular, chemical.

VI. *Arrange the words with similar meaning of the two groups in pairs.*

Emit, produce, propagate, highly, enormous, spot, precise, use, amount, cause, speed, detect, reduction, simplify, bore, propose.

Accurate, bring about, decrease, suggest, velocity, radiate, spread, apply, manufacture, facilitate, very, drill, quantity, huge, find out, place.

VII. *Match the words with their opposites.*

a) pure	1) impossible
b) solid	2) slow
c) narrow	3) receive
d) possible	4) friendly
e) valuable	5) impure
f) heat	6) accelerate
g) short	7) lose
h) effective	8) sick
i) fast	9) destroy
j) find	10) ineffective
k) slow down	11) long
l) transmit	12) cool
m) construct	13) liquid
n) healthy	14) wide
o) hostile	15) worthless

VIII. Match the verbs from "a" with the nouns from "b."

a) focus, use, melt, drill, develop, find, study, detect, determine, induce, cauterize, construct.

b) holes, spectra, tissues, beam, speed, lasers, chemical reactions, optical fibers, guidance systems, trace substances, material, techniques.

IX. Complete the sentences with the words given below.

1. It is possible to focus … laser beams on a small spot.
2. Lasers can serve as effective … of some types of air pollution.
3. With the help of laser light the doctors can cauterize … … and drill holes in the skull.
4. The use of lasers has been offered for high-density information ….
5. The scientists have developed laser …for lab tests of biological samples.
6. At present laser devices extend into the X-ray … range.
7. On the basis of the medium used lasers are divided into solid state, gas, …, or liquid.
8. Laser light may be … intense, highly directional, and very pure in colour.
9. A light beam is … when its photons propagate in step with one another.
10. We use lasers for shaping … and synthesizing new material.

Extremely, powerful, machine-tools, recording, detectors, frequency, blood vessels, coherent, semiconductor, techniques.

X. Translate into English.

1. С помощью лазеров ученые успешно изучают молекулярные структуры материи.

2. В открытом космосе лазерное излучение распространяется на большие расстояния с незначительным уменьшением уровня сигнала.
3. Лазеры идеальны для космической связи.
4. Были созданы лазерные системы управления ракетами и спутниками.
5. Ученые предложили использовать лазеры против вражеских баллистических ракет.
6. Посредством лазеров стало возможным точное определение расстояния между Землей и Луной.
7. В медицине лазеры используют для прижигания тканей, не повреждая близлежащие ткани.
8. Лазерные технологии широко применяются в промышленных, научных, медицинских и военных целях.
9. Лазеры могут выборочно вызывать химические реакции и определять скорость света с беспрецедентной точностью.
10. Лазер облегчает запись голограммы.

A. Text Study

I. Look at the title. What do you think this reading will be about? Read the text and define its main idea.

Text A

LASER

Laser is an acronym for light amplification by stimulated emission of radiation. Lasers are devices that amplify light and produce coherent light beams, ranging from infrared to ultraviolet. A light beam is coherent when its waves, or photons, propagate in step with one another. Laser light, therefore, can be made extremely intense, highly directional, and very pure in color. Laser devices now extend into the X-ray frequency range. Based on the laser medium used, lasers are generally classified as solid state, gas, semiconductor, or liquid.

Lasers have become valuable tools in industry, scientific research, communication, medicine, the military, and the arts.

Powerful laser beams can be focused on a small spot with enormous power density. Consequently, the focused beams can readily heat, melt, or vaporize material in a precise manner. Lasers have been used, for example, to drill holes in diamonds, to shape machine-tools, to heat-treat semiconductor chips, to synthesize new material. The powerful short laser pulse also makes possible high-speed photography with an exposure time of several trillionths of a second.

They are also the most effective detectors of certain types of air pollution. In addition, lasers have been used for precise determination of the earth-moon

distance and in tests of relativity. Very fast laser-activated switches are being developed for use in particle accelerators, and techniques have been found for using laser beams to slow down atoms for extremely precise studies of their spectra.

Because laser light is highly directional and monochromatic, extremely small amounts of light scattering or small frequency shifts caused by matter can easily be detected. By measuring such changes, scientists have successfully studied molecular structures of matter. With lasers, the speed of light has been determined to an unprecedented accuracy, chemical reactions can be selectively induced, and the existence of trace substances in samples can be detected.

Laser light can travel a large distance in outer space with little reduction in signal strength. Because of its high frequency, laser light can carry, for example, 1,000 times the television channels today carried by microwaves. Lasers are therefore ideal for space communications. Low-loss optical fibers have been developed to transmit laser light for earthbound communication in telephone and computer systems. Laser techniques have also been used for high-density information recording. For instance, laser light simplifies the recording of a hologram, from which a three-dimensional image can be reconstructed with a laser beam. Lasers are also used to play audio CDs and videodiscs.

Intense, narrow beams of laser light can cut and cauterize certain tissues in a small fraction of a second without damaging the surrounding healthy tissues. They have been used to "weld" the retina, bore holes in the skull, vaporize lesions, and cauterize blood vessels. Laser techniques have also been developed for lab tests of small biological samples.

Laser guidance systems for missiles, aircraft, and satellites have been constructed. The use of laser beams has been proposed against hostile ballistic missiles.

II. Read the text again carefully and answer the questions.

1. What is a laser?
2. When is a light beam coherent?
3. How are lasers generally classified?
4. Where have lasers become valuable tools?
5. What does the powerful short laser pulse make possible?
6. What are very fast laser-activated switches being developed for?
7. Why can extremely small amounts of light scattering be easily detected?
8. Can laser light travel a large distance in outer space?
9. What are lasers ideal for?
10. What has been developed to transmit light for earthbound communication in telephone and computer systems?
11. Where have lasers been used?
12. What does laser light simplify?

13. Are lasers used to play audio CDs and videodisks?
14. How are lasers used in medicine?
15. What has been proposed against hostile ballistic missiles?

III. Which of the vocabulary units used in paragraphs 1 could be regarded as scientific terms?

Amplification, classify, semiconductor, colour, step, photon, coherent light beams, use, range, emission, make, pure, solid state, extend, frequency, base.

IV. Read the translation of the forth paragraph. Compare it with the original and say if everything is right.

Они также являются более эффективными детекторами некоторых типов загрязнения воздуха. Дополнительно лазеры используются для точного определения расстояния между Луной и Землей и в тестах относительности. Разрабатываются очень быстрые переключатели, управляемые лазерным лучом, для использования в ускорителях частиц, а также были найдены технологии для использования лазерных пучков с целью замедления атомов для очень точных исследований их спектров.

V. Find the English equivalents of the following words and word combinations in paragraph 6.

Уменьшение, уровень сигнала, из-за, частота, канал, микроволны, связь, оптоволокно с малыми потерями, передавать, связь с Землей, запись информации, высокая плотность, например, упрощать, объемное изображение, пучок, использовать.

VI. Find passage about the use of lasers in communication and translate it into Russian.

VII. Choose a passage and read it aloud (1-2 minutes).

VIII. Find complex grammar structures in the text and divide them into simple ones.

IX. Find out the subject-matter and the means of its secondary expression.

X. Find the topic sentences, key words and phrases which express the general meaning of each paragraph best of all.

XI. Using the information obtained in the paragraphs make a plan of the text.

XII. Speak about lasers using key words, phrases, the topic sentences and the plan of the text.

B. Text Study

I. Look at the title of the text. Make your predictions about the contents of it. Read the text and answer the questions.

a .When do the electrons begin to move through conductors?
b .What are two main types of current?
c. What is the frequency of current?

Text B

DIRECT CURRENT AND ALTERNATING CURRENT

When a cell or any other generator is connected so as to form a continuous path of conductors the electrons begin to move through conductors forming an electric current or an electric circuit. This phenomenon is known to be the electricity flow through a circuit. If broken anywhere, the electric circuit will stop carrying a current. There are two main types of current: direct and alternating. When electrons flow in one direction only, the current is called a direct current. When electrons flow first in one direction and then in another in a periodic manner, the current is called an alternating current.

Alternating current flows in cycles. The number of cycles per second is accepted to be termed the frequency of current. In a 60-cycle alternating current circuit, the current flows in one direction 60 times per second and in the other direction 60 times per second.

Two frequencies are in use nowadays: the standard for Europe is 50 cycles per second, while the standard for the USA is 60 cycles per second. A standard frequency has a great advantage since different electrical systems can be interconnected.

Notes

cell — элемент
circuit — электрическая цепь
to term — называть, выражать
frequency — частота, частотность
to interconnect —связывать, объединять энергосистемы
cycle per second — герц

II. Read the text and define whether the following statements are true or false.

1. If broken anywhere, the electric current will continue carrying a current.
2. When electrons flow first in one direction and then in another in a periodic manner, the current is called a direct current.
3. The standard frequency for the USA is 60 cycles per second.

III. Expand the sentences.

1. There are two main types of current.
2. Alternating current flows in cycles.
3. Two frequencies are in use nowadays.

IV. *Now decide which of the following statements express important ideas or supporting details.*

1. a) One of the main types of current is termed alternating.
   b) The electrons moving through conductors form an electric current.

c) An alternating current is a current that changes its directions of flow through a circuit in a periodic manner.

2. a) The number of cycles per second is called the frequency of current.
   b) The standard frequency for Europe is 50 cycles per second.
   c) There are two frequencies in use nowadays.

V. Find the words – carriers of the primary and the secondary information in the text.

VI. Define the function of commas in the text.

VII. Find out the means of connection of simple, compound and complex sentences.

IX. Arrange the sentences in the logical order according to the text.

1. *In a 60-cycle alternating current circuit, the current flows first in one direction and then in another 60 times per second.*
2. *A standard frequency has a great advantage.*
3. *When electrons flow in one direction only the current is called a direct current.*

IX. Give the main points of the text in 4-5 sentences.

Text C

I. Translate from English into Russian.

Laser

In the “War of Worlds” written before the turn of the century H. Wells told a fantastic story of how Martians almost invaded our Earth. Their weapon was a mysterious “sword of heat”. Today Wells’ sword of heat has come to reality in the laser. The name stands for light amplification by stimulated emission of radiation.

Laser, one of the most sophisticated inventions of man, produces an intensive beam of light of a very pure single colour. It represents the fulfilment of one of the mankind’s oldest dreams of technology to provide a light beam intensive enough to vaporize the hardest and most heat-resistant materials. It can indeed make lead run like water, or, when focused, it can vaporize any substance on earth. There is no material unamenable to laser treatment and by the end of 2000 laser will have become one of the main technological tools.

The applications of laser in industry and science are so many and so varied as to suggest magic. Scientists in many countries are working at a very interesting problem: combining the two big technological discoveries of the second half of the 20-th century – laser and thermonuclear reaction – to produce a practically limitless source of energy. Physicists of this country have developed large installations to conduct physical experiments in heating thermonuclear fuel with laser beams. There also exists an idea to use laser for

solving the problem of controlled thermonuclear reaction. The laser beam must heat the fuel to the required temperature so quickly that the plasma does not have time to disintegrate. According to current estimates, the duration of the pulse has to be approximately a thousand-millionth of a second. The light capacity of this pulse would be dozen of times greater than the capacity of all the world's power plants. To meet such demands in practice scientists and engineers must work hard as it is clear that a lot of difficulties are to be encountered on route.

The laser's most important potential may be its use in communications. The intensity of a laser can be rapidly changed to encode very complex signals. In principle, one laser beam, vibrating a billion times faster than ordinary radio waves, could carry the radio, TV and telephone messages of the world simultaneously. In just a fraction of a second, for example, one laser beam could transmit the entire text of the Encyclopaedia Britannica.

Besides, there are projects to use lasers for long distance communication and for transmission of energy to space stations, to the surface of the Moon or to planets in the solar system. Projects have also been suggested to place lasers aboard Earth satellites nearer to the Sun in order to transform the solar radiation into laser beams, with this transformed energy subsequently transmitted to the Earth or to other space bodies. These projects have not yet been put into effect, because of the great technological difficulties to be overcome and therefore the great cost involved. But there is no doubt that in time these projects will be realized and the laser beam will begin operating in outer space as well.

Grammar Study

Модальные глаголы
(Modal Verbs)

Модальные глаголы не называют действие или состояние, а выражают лишь отношение лица (подлежащего) к действию или состоянию, выраженному инфинитивом, т.е. имеют значение возможности, вероятности или необходимости совершения этого действия или данного состояния.

Модальные глаголы отличаются от других глаголов следующими особенностями:

1) у модальных глаголов нет инфинитива, причастия, герундия;
2) они не изменяются по лицам и числам;
3) эти глаголы не употребляются в повелительном наклонении;
4) вопросительную и отрицательную формы они образуют без вспомогательных глаголов.

Наиболее употребительные
модальные глаголы и их эквиваленты

Модальные глаголы и их эквиваленты	Present	Past	Future
1	2	3	4
Can	**can** The most powerful lasers **can cut** through metal and other materials. Самые мощные лазеры могут разрезать металл и другие материалы.	**could** Fifty years ago computers **could store** no more than thousand bytes. Пятьдесят лет назад компьютеры могли хранить не более тысячи байт информации.	-
To be able to	**am/is/are able to** Modern computers **are able to recognize** human speech. Современные компьютеры могут распознавать человеческую речь.	**was/were able to** In 1901 Marconi **was able to send** a radio message from Europe to America. В 1901г. Маркони смог отправить радиосообщения из Европы в Америку.	**shall/will be able to** Computers **will be able to interact** fully with their users. Компьютеры смогут полностью взаимодейст-вовать с поль-зователями.
Must *(долженствование)*	**must** We **must take action** to reduce environmental pollution. Мы должны принимать меры по уменьшению загрязнения окружающей среды.	-	-
Should	**should** The students **should know** the main laws of thermodynamics. Студенты должны знать основные законы термодинамики**.**	-	-

1	2	3	4
to have to *(необходимость выполнения действия)*	**Have (has) to** The water in this area **has to be purified** of undesirable chemicals. Вода в этом районе должна быть очищена от нежелательных химикатов.	**had to** The water in this area **had to be purified** of undesirable chemicals. Вода в этом районе должна была быть очищена от нежелательных химикатов.	**shall (will) have to** The water in this area **will have to be purified** of undesirable chemicals. Вода в этом районе должна будет очищаться от нежелательных химикатов
To be to (*запланированность действия)*	**am (is, are) to** The scientists **are to launch** a fundamental investigation next month. Ученые должны начать фундаментальное исследование в следующем месяце.	**Was (were) to** The scientists **were to launch** a fundamental investigation last month. Ученые должны были начать фундаментальное исследование в прошлом месяце.	-
May (*разрешение, позволение)*	**May** Our nuclear scientists **may investigate** this issue. Наши ученые – ядерщики могут исследовать эту проблему.	**Might** Our nuclear scientists **might investigate** this issue. Наши ученые-ядерщики могли исследовать эту проблему.	-

В языке научной литературы действие, выраженное перфектным инфинитивом, обычно относится к прошедшему времени. Глагол **must** с последующим **Perfect Infinitive** переводится *должен был, должно быть, вероятно,* глагол **could** – *возможно, мог, мог бы*, **may** – *возможно, может быть,* **might** – *мог бы*.

The explosion must have occurred long ago.
Взрыв, вероятно, произошел давно.
I could have gone to the conference, but I lost my invitation.
Я мог бы поехать на конференцию, но потерял пригласительный билет.
You might have proved that supposition by experiment.
Вы могли бы доказать эту гипотезу путем эксперимента.

Глаголы **can** и **could** в отрицательной форме в сочетании с **Perfect Infinitive** выражают сомнение в возможности совершении действия в прошлом и обычно переводятся *не может быть, чтобы* + глагол в прошедшем времени, *не мог* + неопределенная форма глагола.

Life couldn't have existed on that planet.

Не может быть, чтобы на той планете существовала жизнь.

I. Choose the correct word or phrase underlined in each sentence.

1. Look at those clouds. I think it can/might/must rain.
2. This is impossible! It can't be/mustn't be/may not be the answer.
3. Well done! You may be/must be/might be very pleased!
4. I've no idea where Jane is. She could be/must be anywhere!
5. I suppose it's possible. I might/can/must come to your party.
6. I'm not sure. I must not/ may not be able to get there in time.
7. That can't be/ mustn't be/ may not be David. He hasn't got a bike.
8. Lisa isn't here yet. She can be/must be on her way.
9. There's someone at the door. It can be/could be the postman.
10. Sorry, I can't /may not come out. I have to do my homework.

II. Rewrite each sentence, using can, can't, might or must, beginning and ending as shown.

1. Helen is really good at swimming. Helen *can swim really* well.
2. It's possible that our team will win. Our team…….. win.
3. I'm sure this isn't right road. This…….. the right road.
4. I'm sure you work very hard! You …….. very hard.
5. Carol isn't allowed to come to our party. Carol …… to our party.
6. It's possible that I'll see you tomorrow, but I'm not sure. I …….., but I'm not sure.
7. I'm afraid that your teacher is unable to come today. I'm afraid that …….. today.
8. I'm sure it's very hot here in summer. It …….. here in summer.
9. Excuse me, is it all right if I open the window? Excuse me, …….. the window?
10. I suppose you are Mrs. Perry. How do you do? You …….. Mrs. Perry. How do you do?

III. Put one suitable modal auxiliary in each space.

1. Soldiers …… to obey orders.

2. I think you …… take your umbrella.
3. Sorry, I …… go now. I don't want to be late.
4. I'm not sure, but I ……. to help you.
5. Helen isn't at home, so she …….. be on her way here.
6. We …….. better not leave any windows open.
7. It …….. be a star, it's too bright. Perhaps it's an alien spaceship!
8. I don't …….. to go to work today. It's a holiday.
9. Sorry, but I wasn't ……..to finish all the work you gave me.
10. I think you ……. to ask you teacher for some advice.

IV. Rewrite each sentence so that it has a similar meaning and contains the word given.

1. I'm sure you dropped your wallet at the bus-stop (**must).**
2. Maybe Joanna missed the last bus (**might).**
3. Peter knew how to skate when he was twelve (**able).**
4. Emma was wrong not to tell you the answer **(should).**
5. It wasn't necessary for us to pay to get in (**didn't).**
6. It wasn't necessary for me to buy any food yesterday (**need).**
7. I'm sure that Diana didn't take your books (**can't).**
8. Perhaps David didn't notice you **(might).**
9. Terry arrived early, but it wasn't necessary (**needn't).**
10. It was a bad idea for us to be rude to the policemen (**shouldn't).**

V. Complete each sentence so that it contains the words given.

1. I'm completely soaked! We are silly! We ….*should have taken an umbrella*.... (should/umbrella)
2. I've lost my bag. I think I ……(must/bus)……..….. .
3. I tried to phone Sam, but I ……(couldn't/get through)……... .
4. I forgot Kate's birthday. I ……(should/present)……... .
5. The cat doesn't like fruit! It ……(can't/orange)…….. .
6. Jo hasn't turned up yet. I suppose she …(might/address)…….. .
7. I did badly in the test. I ……(ought/harder)….. .
8. It's a shame we didn't go on holiday. We …(could/good time)…... .

Unit II

Networks

Vocabulary Study

Word List

Nouns and noun phrases

1) web - паутина, сеть
2) network - сеть

3) link - ссылка
4) access - доступ
5) set of rules - свод правил
6) software - программное обеспечение
7) screen - экран
8) hierarchy - иерархия

Adjectives

9) valuable - ценный, значимый
10) defining - характерный

Verbs and verbal phrases

11) spread - распространяться
12) be referred to - называться
13) store - хранить, запоминать

I. Read and translate the following words. Arrange them into the groups: a) with one stress or stress on the first syllable; b) with the stress on the second syllable; c) with two or more stresses.

Computer, network, information, resource, link, refer, document, multimedia, company, access (n), communication, worldwide, government, data, display, introduction, hierarchy.

II. Match the words on the left with the definitions on the right.

1) Network	a) programmes, not forming parts of a computer but used for its operation
2) data	b) known facts, information from which conclusions can be drawn
3) communication	c) surface on which an image is seen on a cathode ray tube
4) resource	d) a system of interlinked channels of communication
5) software	e) supplies of goods, information, materials, which a person has or can use
6) screen	f) passing on of news, information, feelings, etc.

III. Choose:

a) a noun

1. a) useless; b) user; c) usefully; d) to use.
2. a) imaginary; b) imagine; c) imaginative; d) image.
3. a) productive; b) to produce; c) product; d) productively.
4. a) valuable; b) value; c) to value; d) valueless.

b) a verb
1. a) reference; b) referable; c) refer; d) referee.
2. a) connective; b) connection; c) connect; d) connected.
3. a) explore; b) exploration; c) exploratory; d) explorer.

c) an adjective
1. a) specify; b) specifically; c) specific; d) specification.
2. a) publicity; b) publicly; c) publicize; d) public.

d) an adverb
1. a) interactive; b) interact; c) interactively; d) interaction.

IV. Define the meaning of the "x" words.
1. contain: container = содержать:x
2. explore: explorer = исследовать: x
3. store: storage = хранить: x
4. introduce: introduction = вводить: x
5. interaction: interactive = взаимодействие: x
6. define: defining = определять: x

V. . Underline the suffixes and translate the following adjectives into Russian.
Institutional, accessible, productive, governmental, featureless.

VI. Arrange the words with similar meaning of the two groups in pairs.
a) web, information, image, products, institution, company, valuable, research, web page, connect, display, feature, allow.
b) link, web site, show, network, enable, data, characteristics, useful, picture, goods, investigation, firm, organization.

VII. *Match the words with their opposites, like the example:* hard – easy.

a) worldwide	1) private
b) valuable	2) exclude
c) client	3) worthless
d) store	4) narrow
e) public	5) decoded
f) coded	6) real
g) wide	7) local
h) virtual	8) server
i) include	9) delete

VIII. Match the verbs from "a" with the nouns from "b".

Verbs	**Nouns**
a) use	b) information
move	display
carry	container
access	user
display	resources
connect	data
post	pages
communicate	computer
store	
introduce	
contain	

IX. Complete the sentences with the words given below.

1. WWW is a computer-based network of information _____.
2. Millions of users around the world rely on the Internet for information and entertainment as well as for business and personal _____.
3. At first _____only carried text but pictures, video, high-quality sound and other _____soon followed.
4. The Internet is a world wide _____of millions of _____ which can communicate with each other.
5. The _____ computers store the information resources that make up the web.
6. The browser on the client's computer displays the page on the _____.

a) network, b) websites, c) resources, d) screen, e) features, f) communication, g) server, h) computers.

X. Translate into English.

1. Всемирная паутина – это компьютерная сеть, по которой пользователь может передвигаться с помощью ссылок.
2. Сеть стала очень популярным информационным ресурсом в 1993 г.
3. Информация в сети содержится в разных форматах.
4. С помощью стандартного набора правил сеть объединяет компьютеры двух типов – серверы и персональные компьютеры пользователей.
5. Почти каждая веб-страница содержит гиперссылки на другие веб-сайты.
6. Изобретение браузера позволяет пользователям загружать веб-страницы с мультимедийной информацией.

A. Text Study

I. *Look at the title. What do you think this reading will be about? Read the text and define its main idea.*

Text A
WORLD WIDE WEB

World Wide Web (WWW) is a computer-based network of information resources that a user can move through by using links from one document to another. The information on the World Wide Web is spread over computers all over the world. The World Wide Web is often referred to simply as “the Web.”

The Web has become a very popular resource since it first became possible to view images and other multimedia on the Internet, a worldwide network of computers, in 1993. The Web offers a place where companies, institutions, and individuals can display information about their products, research, or their lives. Anyone with access to a computer connected to the Web can view most of that information. Museums, libraries, government agencies, and schools make the Web a valuable learning and research tool by posting data and research. The Web also carries information in a wide spectrum of formats. Users can read text, view pictures, listen to sounds, and even explore interactive virtual environments on the Web.

Like all computer networks, the Web connects two types of computers — clients and servers — using a standard set of rules for communication between the computers. The server computers store the information resources that make up the Web, and Web users use client computers to access the resources. A computer-based network may be a public network — such as the worldwide Internet — or a private network, such as a company's Intranet. The Web is a part of the Internet.

Enabling client computers to display Web pages with pictures and other media was made possible by the introduction of a type of software called a browser. Each Web document contains coded information about what is on the page, how the page should look, and to which other sites the document links. The browser on the client's computer reads this information and uses it to display the page on the client's screen. Almost every Web page includes links, called hyperlinks, to other Web sites. Hyperlinks are a defining feature of the Web — they allow users to travel between Web documents without following a specific order or hierarchy.

II. *Read the text again carefully and answer the questions.*

1. What is the World Wide Web?
2. How is the Web commonly abbreviated?
3. When did it become a wide-spread information resource?
4. What range of services does access to the Web mean for the users?

5. Can the Web provide instant access to museums, universities, libraries worldwide?
6. How does the Web link server and client computers?
7. What are the major functions of these 2 types of computers?
8. Where can private networks be found?
9. What invention enables client computers to display various websites?
10. How does the browser use coded information contained in Web documents?
11. Why are hyperlinks an essential feature of the WWW?

III. Which of the vocabulary units used in paragraph 2 could be regarded as international words?

IV. Read the translation of the second paragraph. Compare it with the original and say if everything is right.

Всемирная паутина станет самым популярным информационным ресурсом, так как в 1993 г. появилась возможность просматривать текстовые и мультимедийные документы по Интернету – локальной компьютерной сети. Паутина представляет компаниям, институтам и юридическим лицам пространство, на котором они могут разместить информацию о продуктах питания, исследованиях и разработках. Любой доступный компьютер, подключенный к всемирной паутине, может предоставить подобную информацию. Музеи, книжные магазины, правительственные учреждения и школы размещают в сети данные и результаты исследований, таким образом, превращая ее в эффективное средство обучения и исследований. Сеть содержит информацию широкого спектра. Пользователи могут читать текстовую информацию, просматривать графику, слушать звуковую информацию и даже исследовать окружающую среду с помощью сети.

V. Find the English equivalents of the following words and word combinations in paragraph 4.

Отображать веб-страницы, программное обеспечение, содержать кодированную информацию, гиперссылка, определяющая черта, определенная последовательность.

IV. Find passage about two types of computers connected by the Web and translate it into Russian.

V. Choose a passage and read it aloud (1-2 minutes).

VI. Find the topic sentences, key words and phrases which express the general meaning of each paragraph best of all.

VII. Using the information obtained from the paragraphs make a plan of the text.

VIII. Speak about the Web using key words, phrases, the topic sentences and the plan of the text.

B. Text Study

I. Look at the title of the text. Make your predictions about the contents of it. Read the text and answer the questions.

1. What is the origin of the term “modem”?
2. What kind of device is a modem?
3. What are the names of the two main types of modems?

Text B

MODEM

Modem is a device that enables computers, facsimile machines and other equipment to communicate with each other across telephone lines or over cable television network cables. In the strictest sense, a modem is a device that converts between analog signals, such as sound waves, and digital signals, which are used by computers. However, the term has also come to include devices that permit the transmission of entirely digital signals.

Modems transmit data at different speeds, measured by the number of bits of data they send per second (bps). A 28.8 Kbps modem sends data at 28,800 bits per second. A 56 Kbps modem is twice as fast, sending and receiving data at a rate of 56,000 bits per second.

An analog modem converts between the digital signals of the sending computer to analog signals that can be transmitted through telephone lines. When the signal reaches its destination, another modem reconstructs the original digital signal, which is processed by the receiving computer. A standard analog modem has a maximum speed of 33.6 Kbps.

The word modem is an acronym formed from the two basic functions of an analog modem: modulation and demodulation. To convert a digital signal to an analog one, the modem generates a carrier wave and modulates, or adjusts it according to the digital signal. The kind of modulation used depends on the application and the speed of operation for which the modem is designed. The process of receiving the analog signal and converting it back to a digital signal is called demodulation.

Cable modems permit the transmission of data over community antenna television (CATV) networks — that is, the network of cables used to distribute cable television. A cable modem transmits data from the network at about 3 Mbps and transmits data to the network at between 500 Kbps and 2.5 Mbps.

Like a standard analog modem, a cable modem converts between a digital signal and an analog signal. Cable modems are much more complex than standard analog modems. They also incorporate a tuner that separates the digital data from the rest of the broadcast television signal. Because users in multiple locations share the same cable, the modem also includes hardware that permits multiple connections and an encryption/decryption device that prevents data from being intercepted by another user or being sent to the wrong place.

II. Read the text and define whether the following statements are true or false.

1. A modem links computers by means of ordinary telephone lines.
2. Modems convert a computer's analog language into digital signals that can be transmitted via telephone cables.
3. The device is called "a modem" in honour of its inventor.
4. The process of converting analog signals into digital is called modulation.
5. Analog modems are more complicated than cable ones.

III. Expand the sentences.

1. A modem allows computer to communicate via telephone lines.
2. Modems transmit data at different speeds.
3. There are two main kinds of modems – analog and cable ones.

IV. Now decide which of the following statements express important ideas or supporting details.

1. a) Modem speeds are measured by the number of bits of data they send per second.
   b) A modem allows fast transmission of data to other computers over distances.
   c) A 28.8 Kb ps modem sends data at 28.800 bits per second.
2. a) Information travels through the Internet divided into "packets" of data that take different routes.
   b) Byte is a unit for measuring the amount of information stored or processed by a computer.
   c) The speed of data transmission by means of modem is measured in bits per second.
3. a) An analog modem converts between the digital signals to analog signals that can be transmitted through telephone lines.
   b) Cable modems send and receive information over the network of TV cables.
   c) There are analog and cable modems.

V. Find the words – carriers of the primary and the secondary information in paragraph 3.

VI. Define the function of commas in paragraph 1.

VII. Find out the means of connection of simple, compound and complex sentences

VIII. Arrange the sentences in the logical order according to the text.

1. Cable modems permit the transmission of signals over CATV networks.
2. Another modem reconstructs the original data when the signal reaches its destination.
3. A modem converts between analog and digital signals.
4. The term is an acronym formed from 2 basic functions of an analog modem.
5. A maximum speed of an analog modem is 33.6 Kbps.
6. Cable modems incorporate tuners, hardware for multiple connections and encryption/decryption devices.

IX. Give the main points of the text in 4-5 sentences.

C. Text Study

I. Translate from English into Russian.

Text C

ALEXANDER GRAHAM BELL

Alexander Graham Bell was born in Edinburgh in 1847. His father was a world-famous teacher of speech and the inventor of a system which he called "Visible Speech". It helped deaf persons to pronounce words they could not hear. Alexander chose the same profession, and as his father became a teacher of the deaf, he moved to the United States and began to teach deaf children to speak. At the same time he worked at improving his father's invention.

In 1866, the nineteen-year-old Bell started thinking about sending tones by telegraph. It was then that there came to his mind the idea of the "harmonic telegraph", which would send musical tones electrically from one place to another. Bell was not a scientist. So he had to give all his energy and time to one thing only – knowledge of electricity. There was little time for rest and little time to eat. Hour after hour, day and night he and his friend Watson worked at testing and experimenting with the telephone. Sometimes it worked and sometimes it did not. "We have to do something to make our telephone work better," Bell used to say again and again.

At last they decided to try a new kind of transmitter. The new transmitter was set in Bell's bedroom. Watson was sitting in the laboratory. He put his ear to the receiver and was waiting. Suddenly he heard Bell's voice. And not the voice only but the words too.

"Mr. Watson, come here. I want you."

It was on the 10th of March, 1876. Alexander Graham Bell had invented the telephone.

In a few years there were telephones all over the world. In 1915, the first transcontinental telephone line was opened. Graham Bell, a very old man now, sat in New York at a desk with a telephone before him, while his friend Watson was listening more than three hundred thousand miles away in San Francisco. People were interested what speech Bell had prepared for that great day, on which the telephone invented by him was to carry sound from the Atlantic coast to the Pacific.

Bell was sitting in a big hall; there were many people in it. Everyone expected to hear a serious, scientific speech. Suddenly everybody heard his clear voice as he spoke into his old transmitter, "Mr. Watson, come here. I want you." He repeated the words which he had said almost forty years ago. Much to the amusement of the people Watson answered, "I would be glad to come, but it would take me a week."

II. Translate from Russian into English.

1. Александр Белл мечтал стать музыкантом или учителем, а не изобретателем телефона.
2. В возрасте 25 лет Александр стал проводить опыты по передаче человеческого голоса на длинные расстояния.
3. Первая телефонная линия была построена в Германии в 1877 г.
4. В настоящее время проектные бюро по всему миру разрабатывают «видеофоны».
5. Видеокамера автоматически приспосабливается к различным условиям освещения.

Grammar Study

Согласование времён (Sequence of Tenses)

Сдвиг времен в придаточном дополнительном при главном предложении в прошедшем времени	
Present Indefinite → Past Indefinite Present Continuous → Past Continuous	Действие придаточного предложения происходит одновременно с действием главного.
Present Perfect Past Indefinite → Past Perfect	Действие придаточного предложения предшествует действию главного.
Future → Future-in-the Past	Действие придаточного предложения совершается позже действия главного.

Употребляя простые предложения в роли придаточных дополнительных при главном предложении в прошедшем времени, сдвигайте времена, как указано в таблице:	
Sequence of Tenses	
He lives in New York. I thought that he lived in New York	Одновременное действие
Mother is sleeping. I knew that mother was sleeping.	Одновременное действие
He has returned from London. I was told that he had returned from London.	Предшествующее действие
He bought a new car. I heard that he had bought a new car.	Предшествующее действие
He will send us a letter. I supposed that he would send us a letter.	Последующее действие

Прямая и косвенная речь (Direct and Indirect Speech)

Косвенная речь	
При переводе предложений в косвенную речь не забывайте заменять обстоятельства времени, как указано в таблице.	
Direct speech	Indirect speech
Today yesterday tomorrow … ago this … here last year last month last … next …	that day the day before the next day … before that … there the year before the month before the … before the following …
Indirect commands	
He told me: “Keep quiet! Don’t make noise!”	He asked me to keep quiet and not to make noise.

Indirect statements

He said		“I **am** an engineer. I **work** at a plant. In the evening I **study** English.”
He told me	that	he **was** an engineer and **worked** at a plant. He added that he **studied** English in the evening.
He said		“I **saw** my friend **yesterday**.”
He told me	that	he **had seen** his friend **the day before**.
He said		“We **lived** in Rome two years ago. My father **worked** there.
He told me	that	they **had lived** in Rome two years before and explained that his father **had worked** there.
He said		“I **shall tell** you about it **tomorrow.”**
He told me	that	he **would tell** me about it **the next day**.

Indirect questions		
Special questions	He asked (me) He wanted to know He wondered	
“Where **do** you **live**?” “Where **does** he **work**?” “What **is** Nick **doing**?” “What **have** you **prepared** for today?” “When **did** you **come** home yesterday?” “When **will** your mother **come** home?”	where I **lived**. where he **worked**. what Nick **was doing**. what I **had prepared** for that day. when I **had come** home the day before. when my mother **would come** home.	
General question	He asked (me) He wanted to know He wondered	
“Do you play chess?” “Does she go to school?” “Are you listening to me?” “Have you done your homework?” “Did you skate last winter?” “Will you see your friend tomorrow?”	 if whether	I played chess. she went to school. I was listening to him. I had done my homework before. I had skated the winter before. I should see my friend the next day.

I. Translate into Russian.

1. I knew that you were ill. 2. I knew that you had been ill. 3. We found that she left home at eight o'clock every morning. 4. We found that she had left home at eight o'clock that morning. 5. When he learnt that his son always received excellent marks in all the subjects at school, he was very pleased. 6. When he learnt that his son had received an excellent mark at school, he was very pleased. 7. We did not know where our friends went every evening. 8. We did not know where our friends had gone. 9. She said that her best friend was a doctor. 10. She said that her best friend had been a doctor. 11. I didn't know that you worked at the Hermitage. 12. I didn't know that you had worked at the Hermitage.

II. Convert the following sentences info the past tense.

1. My uncle says he has just come back from the Caucasus. 2. He says he has spent a fortnight in the Caucasus. 3. He says it did him a lot of good. 4. He says he feels better now. 5. He says his wife and he spent most of their time on the beach. 6. He says they did a lot of sightseeing. 7. He says he has a good camera. 8. He says he took many photographs while traveling in the Caucasus. 9. He says he will come to see us next Sunday. 10. He says he will bring and show us the photographs he took during his stay in the Caucasus.

III. Convert the following sentences info the indirect speech.

1. "My friend lives in Moscow", said Alec. 2. "You have not done your work well", said the teacher to me. 3. The poor man said to the rich man: "My horse is wild. It can kill your horse." 4. The rich man said to the judge: "This man's horse has killed my horse." 5. " This man spoke to me on the road," said the woman. 6. "I can't explain this rule to you," said my classmate to me. 7. The teacher said to the class: "We shall discuss this subject tomorrow." 8. The woman said to her son: "I am glad I am here." 9. Mike said: "We have bought these books today." 10. She said to me: "Now I can read your translation." 11. Our teacher said: "Thackeray's novels are very interesting." 12. She said: "You will read this book in a year." 13. Nellie said: "I read "Jane Eyre" last year."

IV. Convert the following special questions into the indirect speech.

1. I said to Nick: "Where are you going?" 2. I said to him: "How long will it take you to get there?" 3. Pete said to his friends: "When are you leaving St. Petersburg?" 4. He said: "Who will you see before you leave here?" 5. They said to him: "What time does the train start?" 6. Ann said to Mike: " When did you leave London?" 7. She said to Boris: " When will you be back home?"
8. Boris said to them: "How can I get to the railway station?" 9. Mary asked Tom: "What time will you come here tomorrow?" 10. She asked me: "Why didn't you come here yesterday?" 11. She asked me: "What will you do tomorrow if you are not busy at your office?" 12. I asked Mike: "What will you do after

dinner?" 13. I asked my uncle: "How long did you stay in the Crimea?" 14. Ada said to me: "Where did you see such trees?" 15. I said to Becky: "What kind of book has your friend brought you?" 16. Mother said to me: "Who has brought this parcel?" 17. He said to her: "Where do you usually spend your summer holidays?"

V. Convert the following general questions into the indirect speech.

1.I said to Boris: " Does your friend live in London?" 2. I said to the man: "Are you living in a hotel?" 3. Nick said to his friend: "Will you stay at the "Hilton"?" 4. He said to me: "Do you often go to see your friends?" 5. He said to me: "Will you see your friends before you leave St. Petersburg?" 6. Mike said to Jane: " Will you come to the railway station to see me off?" 7. She said to me: " Have you sent them a telegram?" 8. She said to me: "Did you send them a telegram yesterday?" 9. I said to Mike: " Have you packed your suit-case?" 10. I said to Kate: "Did anybody meet you at the station?" 11. I said to her: "Can you give me their address?" 12. I asked Tom: " Have you had breakfast?" 13. I asked my sister: " Will you stay at home or go for a walk after dinner?" 14. I said to my mother: "Did anybody come to see me?" 15. I asked my sister: " Will Nick call for you on the way to school?" 16. She said to the young man: "Can you call a taxi for me?" 17. Mary said to Peter: "Have you shown your photo to Dick?" 18. Oleg said to me: "Will you come here tomorrow?" 19. He said to us: "Did you go to the museum this morning?"

Причастия (The Participles)

В английском языке имеются причастие I и причастие II (Participle I, Participle II). Первое образуется путем добавления к основе суффикса –ing, второе – суффикса –ed и, таким образом, имеет внешне сходную форму с прошедшим временем Past Indefinite, от которого Participle II отличается по функции в предложении. Для образования Participle II нестандартных глаголов берется III форма.

Формы причастий

Participle I Indefinite	Active building	Passive being built	Выражает действие, одновременное с действием глагола-сказуемого.
Participle II		built	Выражает действие, одновременное с действием глагола-сказуемого или предшествующее ему.
Perfect Participle	having built	having been built	Выражает действие, предшествующее действию глагола-сказуемого.

Употребление Participle I Active и Passive
Функции в предложении и способы перевода

В предложении Participle I Active может быть:
1. Определением.
Переводится причастием действительного залога с суффиксами –ущ, -ющ, -ащ, -ящ, -вш, -ш или определительным придаточным предложением. В функции определения Participle I может стоять перед определяемым словом или после него.

They were watching the **dancing** children.	Они наблюдали за **танцующими** детьми.

2. Обстоятельством (времени, причины, образа действия).
Переводится деепричастием с суффиксами –а, -я, -ав, -ив или обстоятельственным придаточным предложением.

Being familiar with the problem he didn't find it interesting.	**Так как он был знаком** с проблемой, он не нашел ее интересной.

Participle I с союзами when (когда) и while (в то время как) переводится:
a) деепричастием (или деепричастным оборотом) при этом союз опускается;
b) придаточным предложением с союзами когда, в то время как;
c) при + существительное.

When combining chemically hydrogen and oxygen form water.	**Вступая в** химическую реакцию, водород и кислород образуют воду. (Когда водород и кислород вступают в химическую реакцию, они образуют воду).
While making his experiment the lab assistant put down all the necessary data.	**Проводя** опыт, лаборант записывал все необходимые данные. (В то время как лаборант проводил опыт, он записывал … При проведении опыта … .)

3. Частью сказуемого во временах группы Continuous и Perfect Continuous.
Переводится глаголом в личной форме.

He is **playing** football now.	Сейчас он **играет** в футбол.

Употребление Participle II
Функции в предложении и способы перевода

В предложении Participle II может быть:
1. Определением.

Переводится причастием страдательного залога с суффиксами-окончаниями -нный, -емый, -имый, -тый, шийся, -вшийся. В функции определения Participle II может стоять перед определяемым словом или после него.

The devices **produced** by our plant are of **improved** quality.	Приборы, **выпускаемые** нашим заводом, улучшенного качества.
The information **obtained** is of great importance.	**Полученная** информация – очень важна.

Обратите особое внимание на перевод предложений, в которых за подлежащим следуют два слова с окончанием ~ed. Первое из них обычно является определением в форме Participle II и при переводе ставится перед определяемым словом, второе является сказуемым в Past Indefinite.

The problem **considered** called everybody's attention.	**Рассматриваемая** проблема привлекла всеобщее внимание.

2. Обстоятельством.

Перед Participle II в функции обстоятельства обычно стоят союзы *when (когда), if (если), unless (если не),* as *(как).* Такой причастный оборот переводится, как правило, придаточным обстоятельственным предложением, а иногда при+существительное.

As seen from the article these engines are produced in Minsk.	Как видно из статьи, эти двигатели изготавливаются в Минске.
When heated the polymer changed its properties completely.	Когда полимер нагрели, он полностью изменил свои свойства. (При нагревании полимер …)
When designed the car was given to the laboratory.	Когда машина была сконструирована, ее отдали в лабораторию.

3. Частью сказуемого в страдательном залоге и во временах группы Perfect. Переводится глаголом в личной форме.

I was told about this discovery a few days ago.
Мне сказали об этом открытии несколько дней назад.
They have developed the engine considerably.
Они значительно усовершенствовали двигатель.

ABSOLUTE PARTICIPIAL CONSTRUCTION
Независимый причастный оборот

Независимый причастный оборот – это сочетание существительного в общем падеже (или местоимения в именительном падеже) с Participle I

или Participle II, в котором существительное (или местоимение) выполняет роль подлежащего по отношению к причастию и не является подлежащим всего предложения. Такой оборот логически связан с предложением и по существу является его обстоятельством. Подобно обстоятельству, независимый причастный оборот может предшествовать подлежащему, т.е. стоять в начале предложения или следовать за группой сказуемого в конце предложения. Этот оборот всегда отделяется запятой от остальной части предложения.

В начале предложения в функции обстоятельства на русский язык этот оборот переводится, как правило, придаточным предложением причины, времени, условия с союзами *так как, когда, если* и др.;

The weather being fine, we went for a walk.	Так как погода была хорошая, мы пошли гулять.
Weather permitting, the airplane starts.	Когда погода позволит, самолет взлетит.

В конце предложения независимый причастный оборот переводится на русский язык чаще всего самостоятельным предложением или присоединяется союзами а, *и, причем:*

The cars at that time were very small, the engine being placed under seat.	Автомобили в то время были очень маленькими, и двигатель размещался под сиденьем.

Некоторые независимые причастные обороты, начинающиеся предлогом *with,* переводятся так же, как и обороты без *with.*

With supersonic planes at a speed five to six times above the speed of sound, it will be possible to cover the distance between Tokyo and Moscow in less than 2 hours.	Когда ультразвуковые самолеты будут летать со скоростью, в 5-6 раз превышающей скорость звука, можно будет пролетать расстояние между Токио и Москвой меньше чем за 2 часа.
The article deals with microwaves, wjth particular attention being pajd to radio location.	Статья посвящена микроволнам, причем особое внимание уделяется радиолокации.

I. Translate into Russian, paying attention to Participles I and II.

1. We need highly developed electronics and new materials to make supercomputers.
2. We are carried by airplanes, trains and cars with electronic devices.
3. Many countries have cable TV, a system using wires for transmitting TV programs.

4. The sixth generation of computers performing 100 billion operations a second will become available in the nearest future.
5. Computer components produced should be very clean.
6. New technologies reduce the number of workers needed.
7. A videophone is a device which allows us to see a room and the face of the person speaking.

II. Define the function of Participle I in the following sentences:

1. The scientist working at this project is well-known.
2. Carrying out the experiment he made use of some new devices.
3. These new devices are replacing their older equivalents.
4. Speaking about the chip fabrication the engineer told us many interesting details.
5. Radio occupies one of the leading places among the greatest achievements of modern engineering.
6. The electric current passing through a wire will heat it.
7. Transistors contain no moving components.
8. The stuff is carrying out an experiment.
9. Developing a new method they achieved good results.
10. When making the experiment he made notes.

III. Translate the following sentences, paying attention to the function of Participle II.

1. The discovery mentioned remained unknown to the world for a long time.
2. When passed through a motor, electric current can do work.
3. The students have carried out the experiments.
4. These instruments recorded the cosmic rays and the information obtained was sent back by the radar to the ground.
5. When heated, water vaporizes.
6. The results received changed with material used.
7. Unless repaired, this part cannot be used in the radio set.
8. The developed technology enables us to improve the quality of articles produced.
9. The first laser was developed in 1960.
10. If frozen, water becomes ice.
11. The investigation analyzed resulted in an interesting discovery.

IV. Find the Absolute Participial Construction. Translate the sentences.

1. Numerous experiments having been carried out at the orbital stations, it became possible to use results in industrial process.
2. A beam of light being transmitted forwards, it is possible to measure the distance between the car and the other cars in front of it.
3. With the first steam engine built in the 17-th century, people began to use them in factories.

4. The inventor was demonstrating his new device, with the workers watching its operation attentively.
5. Many substances are semiconductors, germanium and silicon being the most important of them.
6. We defined the volume, all the measurements having been done with respect to the instruction.
7. Transistors are very sensitive to light, some of them reacting even to starlight.
8. The cell being charged, a certain quality of electricity is passed through it.

Unit III
What is sound?

Vocabulary Study

Word List

Active Vocabulary

Nouns

1) altitude - высота
2) frequency - частота
3) pitch - зд. тон звука
4) range - диапазон
5) rarefaction - разреженность
6) threshold - порог
7) timbre - тембр

Adjectives

1) acoustic - акустический
2) dense - густой, плотный
3) equal - равный
4) particular - особый, отдельный
5) permanent - постоянный, неизменный
6) rigorous - суровый, строгий
7) vast - обширный

Verbs

1) boom - гудеть
2) clarify - очищать
3) collide - сталкиваться
4) involve - включать в себя, содержать
5) occur - иметь место, случаться
6) perceive - ощущать, воспринимать
7) saturate - насыщать

Adverbs

1) apart - в стороне, отдельно

2) completely - полностью
3) strictly - строго, точно

Passive Vocabulary

1) eardrum - барабанная перепонка
2) jet aircraft - реактивный самолет
3) nausea - тошнота
4) nuisance - неприятность, досада
5) vertigo - головокружение
6) vocal cords - голосовые связки

I. Read and translate the following words. Arrange them into the groups: a) with one stress or stress on the first syllable; b) with the stress on the second syllable; c) with two or more stresses.

Vast, collide, frequency, pitch, jet aircraft, altitude, perceive, engineer, acoustic, threshold, involve, occur, strictly, particular, permanent, sound-absorbing.

II. Match the words on the left with the definitions on the right.

1) range	a) the same in size, amount, number, degree, etc.
2) clarify	b) of the sense of hearing, of sound-waves
3) timbre	c) distance between limits
4) saturate	d) characteristic quality of sound produced by a particular voice or instrument
5) pitch	e) cause (one substance) to absorb the greatest possible amount of another
6) acoustic	f) make free from impurities
7) equal	g) degree of highness or lowness

III. Choose:

a) a noun
1) a) vast, b) range, c) to boom, d) completely
2) a) saturate, b) collide, c) equal, d) pitch
3) a) occurrence, b) dense, c) perceive, d) rigorous

b) a verb
1) a) acoustic, b) involve, c) particular, d) permanent
2) a) timbre, b) range, c) threshold, d) strict
3) a) frequency, b) altitude, c) rarefaction, d) occur

c) an adjective
1) a) completely, b) involve, c) acoustic, d) perceive
2) a) rigorously, b) collide, c) boom, d) dense
3) a) timbre, b) range, c) strict, d) apart

d) an adverb

1) a) apart, b) perceive, c) dense, d) altitude
2) a) rigorous, b) involve, c) particular, d) strictly
3) a) rarefaction, b) completely, c) collide, d) vast

IV. *Define the meaning of the "x" words.*

Frequency: частота – frequent: x.
Particular: особенный – particularity: x.
Occur: случаться – occurrence: x.
Density: плотность – dense: x.
Range: диапазон – to range: x.
Equal: равный – equalize: x.
Complete: полный – completion: x.

V. Arrange the words with similar meaning of the two groups in pairs.

Vast, perceive, range, involve, saturate, equally.
Apprehend, extensive, wave band, impregnate, to include, likewise.

VI. Match the words with their opposites, like the example:
gloomy – gay.

a) compression, frequent, saturate, dense, clarify, apart
b) rare, sparse, pollute, together, rarefaction, exhaust

VII. Match the verbs from a) with the nouns from b).

a)	b)
characterize	sound
make	a range
cover	noise
reduce	clarity
ensure	speech

VIII. Complete the sentences with the words given below.

1. The … range of possible frequencies and timbres makes sound an effective medium of communication.
2. A low sound is … as being less loud than a high sound of the same intensity.
3. Noise does not have any particular … .
4. Where the air molecules gather together a region of higher … occurs.
5. The speed is slower at high … as air less dense there.

Altitudes, vast, perceived, pitch, pressure.

IX. Translate into English.

1. Звук – это энергия и как любая другая форма энергии, он может быть полезен человеку.
2. Большая часть звуков не несет большой заряд энергии.

3. Звук столкновения двух автомобилей получается в результате вибрации корпусов сталкивающихся автомобилей.
4. Движение уплотнений и разреженностей в воздухе формирует звуковую волну.
5. Звук не может распространяться в вакууме.

A. Text Study

I. Look at the title. What do you think this reading will be about? Read the text and define its main idea.

Text A
WHAT IS SOUND?

Sound is energy and, like other forms of energy, can be useful to man. The vast range of possible frequencies and timbres that characterizes both speech and music makes sound an effective medium of communication. Even ultrasound – sound above the hearing range of man – has many practical uses. Most sounds don't carry great deal of energy. The noise of a symphony orchestra playing as loudly as possible involves for example, sound energy equivalent to the light and heat energy from only a low-powered electric lamp. Our hearing sense is more easily saturated (in energy terms) than our visual sense.

Sound is a particular form of kinetic energy (energy of motion) produced when an object vibrates and a medium, such as air, vibrates in response. The sound of a car crash booms out as the surfaces of the two colliding vehicles vibrate with the force of the collision; music comes from a radio as a loudspeaker vibrates; and talking and singing result from vibration of the vocal cords.

As an object vibrates it sets the air molecules around it vibrating. Where the air molecules gather together a region of higher pressure (compression) occurs. Where they move apart a region of lower pressure (rarefaction) occurs. As compressions and rarefactions move through the air they form a sound wave. At the ear they set the eardrum vibrating and we hear sound.

If a surface vibrates more strongly, the pressure difference between the compressions and rarefactions is greater and the sound is loud. The frequency of vibrations affects the pitch, or note, of the sound. Fast vibrations produce compressions and rarefactions that are close together and the pitch is high. A slower speed of vibration causes the compressions and rarefactions to be farther apart and the sound is lower in pitch.

A sound wave moves out from its source in all directions, traveling at a speed of 1,087 ft (331 m) per second or 741 mph (1,194 kph) in air at 0ºC at sea level. The speed is slower at high altitudes as air less dense there, and faster in water and metal because these substances are more elastic than air

and transmit vibrations more rapidly. The speed also correlates with temperature of the medium. Sound cannot move through a vacuum because there are no gas molecules to vibrate and transmit the sound.

Like other waves of energy, sound normally travels in straight lines, but sound can turn corners. It is reflected whenever it strikes a surface such as a wall or floor and is diffracted or spreads out as it passes through an opening such as a window.

The loudness of a sound can be measured with a decibel meter and the result given as a number of decibels (dB). The scale is logarithmic – a sound that is twice as loud as one at the threshold of hearing is 10 dB greater, not twice as great. Strictly, the meter measures the intensity of the sound, which is related to the pressure differences in the sound wave. (Loudness is the strength of the sensation received in the eardrum and transmitted to the brain). The human ear does not hear all frequencies of sound in the same way, and a low sound is perceived as being less loud than a high sound of the same intensity.

The number of the compressions occurring every second is called the frequency of the sound and is measuring in hertz (Hz), equal to cycles per second. The higher the frequency, the higher the pitch.

Noise does not have any particular pitch and covers a wide frequency range. Very loud noise is dangerous as well as a nuisance, because continuous exposure to sound of more than 100 dB – the levels produced by jet aircraft and machines in many factories – soon results in a permanent reduction in hearing ability. Low frequency noises are particularly hazardous because they do not seem to be as loud as higher pitches, and tests have shown that very high levels of low frequency sound and infrasound (sound below the hearing range of the ear) quickly result in vertigo, nausea, and other physical effects; military scientists have even experimented with using infrasound as a potential weapon.

Acoustic engineers work to reduce noise and improve sound in many ways. A consideration of acoustics in the design of a machine such as a jet engine can reduce the amount of noise it makes. Buildings can also be designed to prevent the transmission of sound through them. A steel framework tends to distribute sound throughout a building, but the use of sound-absorbing materials in and on floors, walls, and ceilings prevents sound from getting into and out of rooms. In concert halls the reflection of soft sound inside the hall is rigorously to provide an exact amount of echo and give the best quality sound. This may be assisted by electronic amplification, although very loud music loses clarity in a concert hall. Some recording studios have completely absorbent walls to remove all echo and ensure total clarity whatever the type of music being performed.

II. Read the text again carefully and answer the questions.

1. What makes sound an effective medium of communication?
2. Is our hearing or visual sense more easily saturated (in energy terms)?
3. Where does compression occur?

4. In which case is the sound loud?
5. What makes sound lower in pitch?
6. The speed of a sound wave doesn't correlate with the temperature of the medium, does it?
7. Can sound turn corners?
8. How can the loudness of a sound be measured?
9. Why are low frequency noises particularly hazardous?
10. Is it possible to reduce noise and improve sound?

III. Which of the vocabulary units used in paragraphs 1-3 could be regarded as scientific terms?

IV. Read the translation of the forth paragraph. Compare it with the original and say if everything is right.

Если поверхность вибрирует сильнее, разница давлений между уплотнениями и разреженностями больше; и звук получается менее громким. Частотные вибрации влияют на тембр звука. Частые вибрации производят уплотнения и разреженности, располагающиеся ближе друг к другу, и тон получается более высоким. Медленная скорость вибрации вызывает уменьшение расстояния и тон звуков становится ниже.

V. Find the English equivalents of the following words and word combinations in paragraph 10.

Передача, стальной каркас, звукопоглощающие, реактивный двигатель, предотвращать, отражение, инженеры-акустики, способствовать, усиление, звукозаписывающие студии, устранять.

VI. Find passages about dynamics pitch and frequency and translate them into Russian.

VII. Choose a passage and read it aloud (1-2 minutes).

VIII. Find complex grammar structures in the text and divide them into simple ones.

IX. Find the topic sentences, key words and phrases which express the general meaning of each paragraph best of all.

X. Using the information obtained from the paragraphs make a plan of the text.

X. Speak about sound using key words, phrases, the topic sentences and the plan of the text.

B. Text Study

I. Look at the title of the text. Make your predictions about the contents of it. Read the text and answer the questions.

a. Why was the group called the Groupe Special Mobile formed?
b. When was the commercial service started?

Text B

GSM

During the early 1980s, analog cellular telephone systems were experiencing rapid growth in Europe, particularly in Scandinavia and the United Kingdom, but also in France and Germany. Each country developed its own system, which was incompatible with everyone else's in equipment and operation. This was an undesirable situation, because not only was the mobile equipment limited to operation within national boundaries, which in a unified Europe were increasingly unimportant, but there was a very limited market for each type of equipment, so economies of scale, and the subsequent savings, could not be realized.

The Europeans realized this early on, and in 1982 the Conference of European Posts and Telegraphs (CEPT) formed a study group called the Groupe Special Mobile (GSM) to study and develop a pan-European public land mobile system. The proposed system had to meet certain criteria:

- good subjective speech quality
- low terminal and service cost
- support for international roaming
- ability to support handheld terminals
- support for range of new services and facilities
- spectral efficiency, and
- ISDN compatibility.

In 1989, GSM responsibility was transferred to the European Telecommunication Standards Institute (ETSI), and phase I of the GSM specifications were published in 1990. Commercial service was started in mid-1991, and by 1993 there were 36 GSM networks in 22 countries, with 25 additional countries having already selected or considering GSM. This is not only a European standard – South Africa, Australia, and many Middle and Far East countries have chosen GSM. By the beginning of 1994, there were 1.3 million subscribers worldwide. The acronym GSM now (aptly) stands for Global System for Mobile telecommunications.

The developers of GSM chose an unproven (at the time) digital system, as opposed to the then-standard analog cellular systems like AMPS in the United States and TACS in the United Kingdom. They had faith that advancements in compression algorithms and digital signal processors would allow the fulfillment of the original criteria and the continual improvement of the system in terms of quality and cost. The 8000 pages of the GSM recommendations try to allow flexibility and competitive innovation among suppliers, but provide enough guidelines to guarantee the proper interlocking between the components of the system. This is done in part by providing

descriptions of the interfaces and functions of each of the functional entities defined in the system.

II. Read the text and define whether the following statements are true or false.

1. During the early 1980s, analog cellular telephone systems were experiencing slow growth in Europe.
2. Each country developed its own system.
3. The market for each type of equipment was very limited.
4. In 1982 a study group called the European Telecommunication Standards Institute was formed.
5. Commercial service was started in 1990.
6. Australia hasn't chosen GSM.
7. A digital system chosen by the developers of GSM was unproven.

III. Expand the sentences.

1. During the early 1980s, analog cellular telephone systems developed rapidly in Europe.
2. Each country developed its own system.
3. The proposed system had to meet certain criteria.
4. In 1989, GSM responsibility was transferred to the European Telecommunication Standards Institute.
5. GSM is not only a European standard.

IV. Find the words – carriers of the primary and the secondary information in paragraph 4.

V. Define the functions of commas in paragraph 1.

VI.Find out the means of connection of simple, compound and complex sentences.

VII. Arrange the sentences in the logical order according to the text.

1. South Africa, Australia and many Middle and Far East countries have chosen GSM.
2. The situation was undesirable.
3. The acronym GSM now stands for Global System for Mobile telecommunications.
4. The developers of GSM chose an unproven (at that time) digital system, as opposed to the then-standard analog cellular systems in the USA and in the UK.
5. The Europeans realized this early.
6. Each country developed its own system.
7. There was a very limited market for each type of equipment.

VIII. Give the main points of the text in 4-5 sentences.

C. Text Study

I. Translate the text into Russian.

Text C

WHAT IS GPS?

GPS, short for Global Positioning System, is a space-based positioning system that uses satellites and computers to measure positions anywhere on the land, air, or sea at any time. This system is distinguished from other positioning systems by its 24-hour, seven-day per week availability and its pinpoint accuracy.

The system was born from communication problems U.S. troops experienced in the Vietnam conflict. During that time a localized system, LORAN, was used that was prone to problems inherent in radio communication such as poor reception during ominous weather or during the night. The U.S. Department of Defense responded to this problem by investing into a system known as the Navy Navigational Satellite System, TRANSIT, which most recently evolved into GPS.

GPS is a second generation, satellite-based, positioning system that is available anywhere and anytime and is capable of measuring land, air and sea positions with millimeter accuracy. GPS is referred to as a system because it is an assemblage of three distinct components or segments: Space, Control, and User.

The Space Segment refers to the constellation of satellites and the navigational data they provide. The Control Segment refers to monitoring and updating of the satellites' clocks and navigational messages by a master control station that uses five regional monitoring stations distributed around the world. Lastly, the User Segment refers to the GPS receivers that calculate the time required for a radio signal to travel from the visible satellites to the receiver in order to measure its position using a technique called triangulation.

GPS has a civilian and military user community. Although GPS is funded by the U.S. DoD, civilians worldwide can use GPS' Standard Positioning Service (SPS) provided a proper receiver is used. SPS provides positional accuracy of 100 meters in 2-Dspace with 95% confidence. The U.S. Military and its allies use a more highly accurate service called Precise Positioning Service (PPS) that is capable of accuracy within ten meters in 3-D space 95% confidence.

Grammar Study

Инфинитив
The Infinitive

Инфинитив – неличная форма глагола, которая только называет действие, не указывая ни лица, ни числа.
Признаком инфинитива является частица “to”, которая в некоторых случаях опускается.

Инфинитив обладает свойствами глагола и существительного.
В русском языке ему соответствует неопределенная форма глагола.

1. Формы инфинитива

Infinitive	Active	Passive	Действие
Indefinite	to ask	to be asked	Действие, одновременное действию, выраженному глаголом-сказуемым.
Continuous	to be asking (to be + Participle I	—	Длительное действие, одновременное с действием, выраженным глаголом-связкой.
Perfect	to have asked (to have + Participle II)	to have been asked (to have been + Participle II)	Действие, предшествовавшее действию, выраженному сказуемым.
Perfect Continuous	to have been asking (to have been + Participle I)		Длительное действие, совершавшееся в течение отрезка времени, предшествовавшего действию, выраженному глаголом в личной форме.

Инфинитив может служить в предложении:
1. Подлежащим:

To skate is pleasant.	Кататься на коньках приятно.

2. Именной частью сказуемого:

Your duty was **to inform** me about it immediately.	Вашей обязанностью было сообщить мне об этом немедленно.

3. Частью составного глагольного сказуемого:

She began **to translate** the	Она начала переводить статью.

article.

4. Дополнением:

I asked him **to help** me.	Я попросил его помочь мне.

5. Определением:

He expressed a desire **to help** me.	Он выразил желание помочь мне.

6. Обстоятельством:

I went to the station to see **off** a friend.	Я поехал на вокзал, чтобы проводить приятеля.

Субъектный инфинитивный оборот (Complex Subject)

Конструкция «субъектный инфинитивный оборот» выражена существительным в общем падеже или местоимением в именительном падеже и инфинитивом, стоящим после сказуемого.

The results are considered **to be satisfactory**.	Считают, что **результаты удовлетворительны**.

В конструкции «субъектный инфинитивный оборот» действие, совершаемое подлежащим, выражается инфинитивом. Глагол-сказуемое лишь указывает на отношение к этому действию. Перевод предложения следует начинать: а) со сказуемого (неопределенно-личным оборотом) и, если требуется по смыслу, вводится союз *что, б)* простым предложением с вводными словами *как известно, вероятно и т.п.*

These elements *are known* to have been found twenty years ago.	*Известно, что эти элементы были открыты двадцать лет назад.* *Эти элементы, как известно, были открыты двадцать лет назад.*

Между компонентами сложного подлежащего может стоять сказуемое, выраженное:

а) глаголами to say (говорить), to report (сообщать), to know (знать), to state (заявлять), to suppose (предполагать), to consider (считать), to see (видеть), to expect (ожидать), to believe (полагать) в форме страдательного залога: to say – to be said.

б) глаголом в форме действительного залога: to seem — *казаться,* to appear, to prove — *оказываться,* to happen — *случайно оказаться;*

в) сочетаниями: to be likely — *вероятно, возможно,* to be unlikely — *маловероятно,* to be sure — *несомненно,* to be certain — *безусловно.*

The group *is believed* to complete the research next month.	*Полагают,* что группа закончит исследование в следующем месяце.

This substance *seems* to possess useful properties.	*Кажется,* это вещество обладает полезными свойствами.
This *is unlikely* to be achieved.	*Маловероятно,* что это будет достигнуто.

Объектный инфинитивный оборот (Complex Object)

Объектный инфинитивный оборот состоит из существительного в общем падеже или личного местоимения в объектном падеже (me, him, her, you, them, us) и инфинитива. Этот оборот выполняет функцию сложного дополнения и переводится на русский язык дополнительным придаточным предложением, вводимым союзами "что", "чтобы".

Существительное или местоимение, стоящее перед инфинитивом, становится в русском языке подлежащим придаточного предложения, а инфинитив — сказуемым.

Объектный инфинитивный оборот употребляется после глаголов: to allow (разрешить), to assume (предполагать, допускать), to believe (полагать), to cause (заставлять, вызывать), to command (приказывать), to consider (считать), to demand (требовать), to enable (давать возможность), to expect (ожидать, полагать), to feel (чувствовать), to find (находить, признавать), to hear (слышать), to know (знать), to like (нравиться), should/would like (хотелось бы), to make (заставлять, вызывать), to permit (разрешать), to prove (доказывать, оказываться), to request (просить), to require (требовать), to see (видеть), to show (показывать), to suppose (полагать), to take (считать), to think (думать, считать), to want (хотеть), to wish (желать).

We know **this scientist to have made** an important discovery in electronics.	Мы знаем, что этот ученый сделал важное открытие в электронике.

После глаголов, выражающих чувственное восприятие: to see, to hear, to notice, to watch, to observe и глагола make, инфинитив употребляется без частицы to.

The engineer *made* **his assis-tants check** the results many times.	Инженер *заставил* ассистентов проверить результаты несколько раз.

Инфинитивный оборот с предлогом for

В этом обороте перед инфинитивом стоит существительное в общем падеже или местоимение в объектном падеже с предлогом for. На русский язык переводится чаще всего придаточным предложением:

For the decision to be correct, all facts must be considered.	Чтобы решение было правильным, нужно учесть все факты.

I. Comment on the forms of the infinitives. Translate the sentences into Russian.

1. He seems to be playing tennis now.
2. Carol didn't want to bother anyone.
3. I'm sorry to have done it.
4. For about 10 days we seemed to have been living on nothing but cold meat and bread.
5. The work seems to have been done in haste.
6. Have a sandwich. They're there to be eaten.
7. She understood what he must be going through, and she wanted to help him.

II. State the function of the Infinitive in the sentences. Then translate them into Russian.

1. It is never late to study.
2. There is no matter to discuss.
3. He said it to save your life.
4. I can speak English well.
5. He claims to be an expert on the subject.
6. He was the first to come.
7. Her desire was to have a dog.

III. Change the sentences so as to use the Complex Object as in the example.

Example: I believe that Shockley is a great scientist. – I believe Shockley to be a great scientist.

1. I admit that my accusation was right.
2. The method which will be used is reliable.
3. The measurements that must be made should be accurate.
4. The work that must be done is of great importance.
5. The equipment that is to be installed is very effective.
6. I consider that this problem is very important.
7. The firm can't expect that unskilled men will become experienced engineers overnight.

IV. Write the appropriate form of the infinitive.

1. I went *...to have gone..*
2. She has been playing .....
3. He had worked .....
4. It was read .....
5. They have been informed .....
6. He is writing .....
7. It is fixed .....
8. He will type .....
9. He was cleaning .....
10. She will be sleeping .....

V. Fill in the correct form of the infinitives.

1. My boss expects me ... *to work...* (work) overtime.
2. The suspect claimed .....(watch) TV at the time of the robbery.
3. Jill's teacher is worried about her as she seems(have) difficulty coping with her studies.
4. Young children often ask .....(take) to the zoo.
5. The burglars must have come in through the window as the lock seems ..... (force).
6. "I happen..... (pass) my driving test two years ago, you know," he said.
7. Robert is expecting ...(inherit) a large house when his grandfather dies.
8. "Mark appears..(overtake) John on the last lap. Yes, he's passed him!"
9. Leslie seems .....(enjoy) her new job.
10. I'd like .....(book) a return ticket to Denver, please.
11. Stop pretending..... (eat) your food – just finish it up, please.
12. The manager seems.....(get) impatient with the interviewee.

VI. Rephrase the following using the infinitive or the – ing form as in the example:

1. You have to eat your carrots.	I want *...you to eat your carrots.*
2. I must exercise more often.	I want
3. She has to take her medicine every day.	The doctor wants
4. I saw him give you the letter.	I remember
5. He has to talk to me politely.	I want
6. They mustn't go to bed late.	I don't want
7. We visited Sue before Christmas.	I remember

VII. Paraphrase the following sentences using Complex Subject.

1. It was expected that the members of the committee would come to an agreement. 2. It was reported that many buildings had been damaged by the fire. 3. It is reported that the delegation has left London. 4. It is expected that many people will attend the meeting. 5. It seems that she knows French perfectly well. 6. It happened that he was at home at that time. 7. It appears that

the house was built in the eighteenth century. 8. It seemed that he knew the subject well. 9. It is not likely that they will return soon. 10. It is certain that they will be here on Monday. 11. It is unlikely that the meeting will be postponed. 12. It is very likely that his article will be published in the newspaper.

VIII Translate into Russian, paying attention to the infinitive constructions.

1. A cargo of 5,000 tons of wheat has been sold to a foreign company, payment to be made in cash in exchange for the bill of lading and insurance policy. 2. The sellers charted a steamer for the transportation of the goods, the days at the port of loading not to commence before October 20. 3. By a contract dated August 15, A. sold to B. a quantity of timber, the goods to be shipped in two parcels. 4. The seller must provide documents entitling the buyer to obtain delivery of the grain and payment must be made in exchange for such documents, such payment to be made without prejudice to the buyer's rights under the contract.

Appendix.
Supplementary Texts

Major computer applications

A student learns French by playing a computer game in which the object is to successfully rent an apartment in Paris.

Instead of building a physical model, an aerospace engineer saves millions of dollars and thousands of hours by testing an airframe concept on a computer.

His electronics-industry counterpart, using powerful computer-aided-design (CAD) tools, creates a computer that would have required the work of 40 engineers two decades ago.

A production manager uses an off-the-shelf expert system to help her troubleshoot a complex piece of machine-tool manufacturing equipment.

A marketing executive stores thousands of data points from a massive survey of consumer preferences and correlates them with a list of product characteristics.

A publishing executive has begun a survey of computer technology because he senses a market for new kinds of information products.

Each of these people (and thousands more like them) has a vital interest in knowing what computers can (and cannot) do: if these managers and professionals are to succeed, they also need to know when the various rich promises of the technology will be realized in usable programs and devices. For the electronics and aerospace engineers improvements in computer speed are extremely important. The production manager would like to know when she will have a diagnostic system that can learn different malfunction patterns as they evolve. The publishing executive faces a question of when and how to get on the technology curve: he must decide whether to convince skeptical and traditionally minded colleagues to embark on the development of software products for hardware that has only just begun to reach the market.

The answers to these questions and many other challenges will unfold as computer science evolves. But that is too late for the men and women in business, government, the professions and academic life who must make plans now for how computers will be used. After all, these managers and professionals, although generally aware of the potential of computers, are not computer experts or even literate in the simplest computer languages and uses.

Peripherals

Terms that are often used when people talk about computers are hardware, software and peripherals.

The computer hardware can best be described as the actual parts that go together to make up the computer such as wires, switches, electronic circuits, microprocessors and anything else that is involved in the working parts.

Software refers to the programs that are input into the computer. Disks and cassettes are often referred to as software once they have computer programs on them but they are really peripherals.

The peripherals of the computer are the devices for input, output or storage of data and include the keyboard, visual display unit, cassettes, disk drives and printers. The VDU is also known as the monitor and the program and the results of the processing can be seen on this, as well as the data entered. The printer will produce the print-out of the results of the processing. This is often referred to as hard copy.

The highest quality of printer available is the daisy wheel. This consists of a wheel with flexible stems radiating from the centre. The letters are well-defined and can be read clearly. The printer moves bi-directionally printing both ways from left to right and then right to left. Remember that what is to be printed already exists in the memory of the computer and the daisy wheel does not have to type in sequence as would be expected from a human brain. The carriage therefore need not waste time returning at the end of each line.

The dot matrix is usually faster than the daisy wheel. The printer has a print head consisting of a row of needles. This moves speedily over the place where a letter has to be printed using dots to make up the letter. The needles print on to a special typewriter ribbon. The quality of print-out is not of a very high standard and would not generally be used at high business levels. However, it is often used for the production of rough drafts. Characters of different sizes can be built up with dot-matrix printers and some may have two-colour ribbons.

An ink-jet printer forms dot matrix characters by applying ejected droplets of ink, vibrated at an appropriate frequency, towards a special absorbent paper. A charged electrode is placed near the jet, so that each droplet carries a charge. By a special electrostatic technique the ink drops can be directed to particular parts of the paper. The printers use information that is stored digitally.

Thermal printers require a heat sensitive paper which is marked by a heated needle-like writing implement known as a stylus.

Laser printers are very fast and can use different sizes of paper. Since they are non-impact printers they are very quiet and can produce good graphics. The laser printer works by beaming a laser on to an electrically charged drum which creates an invisible image on the drum, revealed when a special substance, called toner, is poured over it. When the paper is brought into contact with the drum, the image melts on to the paper as it is heated.

The keyboard is where the data, or information, is input into the computer. It is usually arranged like an ordinary typewriter keyboard with a number of other keys added which carry out special functions.

Some computer programs display what are called icons on the computer screen. The icons may represent items of furniture in an office for instance. The user is able to instruct the computer by the use of a tiny moveable device known as a mouse which is connected to the computer by a cable and can be moved about the top of a desk. The desk represents the VDU screen and as the mouse moves about, it moves with the short bright line, known as the cursor, on the screen.

A. Expert systems

An expert system is a computer system which is able to draw reasoned conclusions from a body of knowledge in a particular field, and communicate to the user the line of reasoning by which it has reached a conclusion.

Objectives of Expert Systems

The purpose of an expert system is to provide reasoned advice at a comparable level to that provided by a human expert. This capability has two main aims: to enhance the abilities of leading experts in certain fields, and to make a high level of expertise available to less highly qualified practitioners.

The first aim takes note of the fact that some areas of human expertise, such as the diagnosis and treatment of cancer, are so complex that even the leading experts can benefit from the systematic, logical approach provided by a computer. A computer system will take into consideration all the knowledge at its disposal in the consideration of every case, and will follow known lines of reasoning exhaustively, no matter how complex they are. These capabilities complement the skills of a human expert, which are generally based on a mixture of knowledge, experience, insight and intuition.

The second aim attempts to raise the level of skill of professionals who are not themselves leading experts. A large number of medical practitioners fall into this category, particularly in developing countries. When expert systems become widely available, the skills of these practitioners should be significantly enhanced.

In some expert systems, the expert knowledge is fixed into the system when it is constructed. In others, there is a built-in ability to learn from experience, including from mistakes made by the system.

Applications of Expert Systems

A small number of expert systems are in use at present. These are mainly in the following fields:

- Medicine: Expert systems are in use for diagnosis and the planning of treatment in specialized fields. These include certain types of cancer, kidney diseases and some viral infections. Expert systems are also used to plan and monitor experiments, particularly in genetics. Expert systems for use by general practitioners in diagnosis and treatment are under investigation, but none are in widespread use at present.
- Geological Prospecting: Expert systems have already proved their worth in oil prospecting, and are now being used for other minerals.

- Designing Computer Configurations: Digital Equipment Corporation uses an expert system to design the computer configuration required when an order for a VAX minicomputer is placed. The expert system ensures that a compatible set of equipment is delivered, which meets the requirements of the customer.
- Chemistry: The analysis of chemical structures from mass spectrometer data is often done with the aid of an expert system.
- Legal Advice: Expert systems which give general legal advice, and assist in such matters as making Social Security claims, are at present under development.

Operating systems

Types of Computer Operation

Computers vary considerably in size, capability and type of application. Similarly, there is a wide variety of ways in which they can be operated. Each type of computer operation requires a different type of operating system.

Most microcomputers and some minicomputers can only process one program at a time. This is single program operation, and it requires only a simple operating system. The operating system supervises the loading and running of each program, and the input and output of data. Any errors occurring are reported.

Next in complexity is batch processing. A number of programs are batched together, and then run as a group. Although the programs are actually run one at a time, input and output from various programs can overlap to some extent. Programs are normally queued up for batch processing, and the operating system starts the next program in the queue as soon as sufficient computing resources are available for it.

Similar to batch processing, but much more sophisticated, is multiprogramming. At any one time, a number of programs are on the computer at various stages of completion. Resources are allocated to programs according to the requirements of the programs, and in order to maximize the usage of the different resources of the computer.

A particular type of multiprogramming, which is becoming increasingly popular, is transaction processing. Transaction processing is designed for systems which must run large numbers of fairly small programs very frequently, where each program run deals with a single transaction such as a withdrawal from a cash terminal.

The Nature of an Operating System

Like the question 'What is a computer? the question 'What is an operating system?' can be answered at several levels.

Firstly, an operating system is a program, or set of programs. Operating systems vary in size from very small to very large, but all are pieces of software.

In the past, almost all operating systems were written in a low level language. Currently, many operating systems are partly or completely written in a high level language.

Secondly, an operating system is, by virtue of its name, a system. It is a collection of parts, working together towards sonic common goals. The goals, or objectives, of an operating system are discussed below.

Thirdly, a computer may be regarded as a set of devices, or resources, which provide a number of services, such as input, processing, storage and output. The operating system of the computer may be regarded as the manager of these resources. It controls the way in which these resources are put to work.

Finally, an operating system is the lowest layer of software on a computer. It acts directly on the ‘raw’ hardware of the computer. It supports other layers of software such as compilers and applications programs. Part of the task of an operating system is to 'cushion' users from the complexities of direct use of the computer hardware.

In summary, an operating system is a program, or set of programs, driving the raw hardware of a computer, which manages the resources of the computer in accordance with certain objectives, providing higher layers of software with a simplified computer.

The Development of Operating Systems

Operating systems are as old as electronic computers. It was realized from the start that the hardware of a computer on its own is very difficult to use. Various supervisor, executive or monitor programs were written to make aspects of using a computer easier. As time went by, these programs became larger, more complex, and, unfortunately, more cumbersome and less reliable.

Today big operating systems face a new challenge, from cheap, plentiful microcomputers, which require only the simplest of monitor programs for their operation.

The problem with input and output is that different input/output devices have different characteristics, and run at different speeds. For example, a line printer outputs characters one line at a time, whereas a keyboard accepts input one character at a time. A line printer transfers characters more than one hundred times as fast as a keyboard.

The input/ output control module of an operating system deals with these problems by making input and output device independent from the point of view of the programmer. To a programmer, all devices have the same characteristics, and are instructed in exactly the same way. The operating system deals with the special characteristics of each type of device.

Computer structure

The definition of a computer is as follows:

A computer is a collection of resources, including digital electronic processing devices, stored programs and sets of data, which, under the control

of the stored programs, automatically inputs, outputs, stores, retrieves and processes the data, and may also transmit data to and receive it from other computers. A computer is capable of drawing reasoned conclusions from the processing it carries out.

From the hardware point of view, the essential features of this definition are 'a collection of … digital electronic processing devices'.

Computers vary enormously in size, processing power and cost. Nevertheless, all computers consist of one or more functional devices, each carrying out one or more of the tasks described above. Each device performs a precisely specified task, and connects to other modules via defined interfaces. Modules of the same type of computer may be exchanged, and new modules added, without modification to their internal workings. The phrase plug-compatible describes units which may be connected in this manner.

Mainframes, minis and micros

Very broadly speaking, there are three classes of computers, according to their size and complexity. These classes are known as mainframes, minicomputers (or minis) and microcomputers (or micros).

Mainframes are large computers, comprising a number of free-standing units. Mainframes are generally housed in specially designed, air-conditioned rooms. Connections between the units are made by wires running beneath the floor of the room. Mainframes are very powerful, and support a number of applications running concurrently. Examples of mainframes are the ICL 2900 series, the IBM 3000 series and the Burroughs B6700 series. Very large mainframes are known as supercomputers. These include the Cyber 205 and the Cray 2.

Minicomputers are smaller than mainframes, with several functional devices mounted in a rack in a single unit. Minicomputers do not generally require an air-conditioned environment. They are often to be found in laboratories, factories and offices. Minicomputers can support more than one application running concurrently, though not as many as mainframes. The Digital Equipment Vax series is the most popular minicomputer. Others are made by Prime, Data General and Hewlett Packard.

Microcomputers are the newest addition to the computer family. They are small and cheap, and are (generally) contained in a few small units. Their distinguishing feature is that processing is carried out on a single microprocessor chip. Although they are very versatile, microcomputers can only support one application at any one time. Examples of microcomputers are the IBM PC, the Apple Macintosh and the Research Machines Nimbus.

The classification of computers into mainframes, minis and micros is only very approximate. Computers are getting smaller and more powerful all the time. Micros are being introduced with the capability of minis only a few years old. Minicomputers are incorporating microprocessors to assume the capability of mainframes.

What is a high level language?

A high level language is a problem oriented programming language, whereas a low level language is machine oriented. In other words, a high level language is a convenient and simple means of describing the information structures and sequences of actions required to perform a particular task.

A high level language is independent of the architecture of the computer which supports it. This has two major advantages. Firstly, the person writing the programs does not have to know anything about the computer on which the program will be run. Secondly, programs are portable, that is, the same program can (in theory) be run on different types of computer. However, this feature of machine independence is not always achieved in practice.

In most cases, programs in high level languages are shorter than equivalent programs in low level languages. However, conciseness can be carried too far, to the point where programs become impossible to understand. More important features of a high level language are its ability to reflect clearly the structure of programs written in it, and its readability.

High level languages may be broadly classified as general-purpose or special-purpose. General-purpose languages are intended to be equally well suited to business, scientific, engineering or systems software tasks. The commonest general-purpose languages are Algol 68 and PL/1. The language Ada also falls into this category. Because of their broad capabilities, these languages are large and relatively difficult to use.

The commonest categories of special-purpose languages are commercial, scientific and educational. In the commercial field, Cobol still reigns supreme, while Fortran is still the most widely used scientific language. In the computer education field, Basic is widely used in schools, with Logo and Prolog gaining popularity. Pascal is the most popular language at universities. Pascal is a powerful general-purpose language in its own right.

Another way of classifying high level languages is as procedural and declarative languages. Procedural languages state how a task is to be performed, often breaking programs into procedures, each of which specifies how a particular operation is to be performed. All the early high level languages are procedural, with Algol, Pascal and Ada as typical examples.

Declarative programming languages describe the data structures and relationships between data relevant to a particular task, and specify what the objective of the task is. The process by which the task is to be carried out is not stated explicitly in the program This process is determined by the language translation system. Prolog is an example of a declarative programming language.

The defining characteristics of a high level language are problem-orientation and machine independence.

The first objective of a high level language is to provide a convenient means of expressing the solution to a problem. There are two other common ways of doing this - mathematics, and natural languages, such as English. Most

high level languages borrow, without much modification, concepts and symbols from mathematics. The problem with natural languages is that in their full richness and complexity, they are quite impossible to use to instruct a computer. Nevertheless, high level languages use words from natural languages, and allow these words, and mathematical symbols, to be combined according to various rules. These rules create the structure of programs written in the language. The result, in a good high level language, is a clear structure, not too different from our customary ways of thinking and expressing ourselves.

This discussion leads to the second objective of high level languages - simplicity. Simplicity is achieved by a small set of basic operations, a few clear rules for combining these operations, and, above all, the avoidance of special cases.

The third objective of a high level language is efficiency. Programs in the language must be able to be translated into machine code fairly quickly, and the resulting machine code must run efficiently. This objective almost always conflicts with the first two. Most high level languages reflect a compromise between these objectives.

The final objective is readability of programs. Many languages allow for the inclusion of comments or additional 'noise' words, to make programs easier to read. However, a good high level language should enable programs to be written which are clear to read without additional comments. Regrettably, some high level languages ignore this objective altogether.

Features of High Level Languages

The character set used by a language is the set of all characters which may be used in programs written in the language. Almost all languages use letters and decimal digits.

Most high level languages use reserved words. These are words which have a specific meaning in programs, and may not be used by the programmer for any other purpose. For example, in Pascal, reserved words include *read,* if … then … else and write. Some languages permit abbreviations of reserved words. The size and complexity of a language can he measured by the number of reserved words it uses. For example, Occam has 28 reserved words, while Ada uses more than sixty.

Perhaps the most important feature of a high level language is the way in which programs in it are structured. The structure of a program is specified by a set of rules, called rules of syntax. Different languages have different ways of expressing these rules. In some, the rules are written in concise English. Others use syntax diagrams, while others (notably Algol) use a notation originally called Backus-Naur form, now known as BNF.

Much attention has been devoted, in the development and use of high level languages, to the way in which programs are split up into blocks or modules, each module doing a specific task. In some languages, notably Fortran, these blocks are called subroutines, in others such as Algol and

Pascal, these blocks are called procedures or functions. Because of the careful structuring of programs into blocks which they permit, Algol, Pascal and similar languages are called block-structured languages.

Procedures, functions or subroutines are activated via calls from other parts of the program. For example, if a program contains a function to calculate the square root of a given number, this function is called every time a square root is required in the rest of the program. Most languages permit a procedure or function to call itself, a feature known as recursion. This is an extremely powerful feature for handling such data structures as lists, stacks and trees, and for such tasks as analyzing the structure of arithmetic expressions.

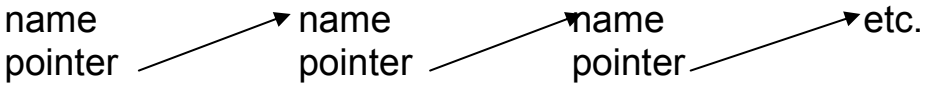
An important aspect of high level languages is the way in which they handle the data items and data structures used in a program. Broadly speaking, data items fall into two categories: variables, which can change their value during the running of a program, and constants, which keep the same value. In most program languages, variables are given names, or identifiers. In some languages, such as Fortran and Basic, constants are referred to by their values, while in others, such as Algol and Pascal, constants are also given identifiers.

Some program languages require that all variables be declared before they are used. Generally, variables are declared by listing them at the start of the procedure or subroutine in which they are to be used. An attempt to use a variable which has not been declared results in an error.

This gives rise to the idea of the scope of a variable. The scope of a variable is the part of a program in which it may be used. Variables which are declared for use in one procedure only are called local variables. Their scope is limited to that procedure. Variables which are declared for use in the whole program are called global variables. Their scope is the whole program. The intention of providing each variable with a scope is to enable a program to be broken up into 'watertight' blocks, or modules. Each block uses only the information it requires. This simplifies the task of designing, writing and testing programs, and limits the effects of errors.

Almost all high level languages include the notion of data types. In Basic language, the standard data types are numeric and character strings. These types can be incorporated into arrays, which are tables of items of the same type. In most high level languages, numbers can be integers or real numbers (generally stored in floating point form). PL/I even permits the number of significant figures in a number to be declared. Another common standard data type is Boolean, with the range of values ‘true' and 'false'. Data types can contain single elements, or be structures such as arrays, stacks, lists, trees, etc.

A pointer is a data type which contains the address of another data item. Pointers can be used to construct such data structures as lists and trees. For example, a list of peoples names could be constructed as follows:



Pointer types are only available in certain high level languages, notably Algol and Pascal. The problem with pointers is that careless use of them can result in program errors which are very difficult to detect and correct.

Some languages permit the programmer to declare his or her own data types, built up from standard data types. Records can be constructed, containing data of different types. The following section of a Pascal program shows how this can be done.

```
type name=array (1. . .20) of char;
day= (mon, tues, wed, thur, fri, sat, sun);
pay_record=record
employee-name: name;
payrate: real;
hours-worked: •integer;
pay: real;
payday: day end;
```

In the above example, char is a standard data type. Variables of type **char** have values consisting of a single character. The data type 'name' is an array of twenty characters. Variables of the data type 'day' can have one of the values listed in the brackets.

The purpose of data types is to make programs more meaningful, and to provide additional checks for errors. For example, if an attempt is made to add an integer variable to a character variable, then an error will be caused.

Computers and algorithms

PART 1

We live in the age of the computer revolution. Like any revolution, it is widespread, all-pervasive, and will have a lasting impact. It is as fundamental to our economic and social order as was the industrial revolution. It will affect the thinking patterns and life style of every individual.

The industrial revolution was essentially the augmentation of man's *physical* powers, the amplification of man's muscle. The pressing of a button could cause a large machine to stamp a pattern in a metal sheet. The movement of a lever could result in a heavy scoop scraping out a mass of coal. Certain repetitive aspects of man's physical activities were replaced by machines.

By analogy, the computer revolution is the augmentation of man's *mental* powers; the amplification of man's brain. The pressing of a button can cause a machine to perform intricate calculations, to make complex decisions, or to

store and retrieve vast quantities of information. Certain repetitive aspects of man's mental activities are being replaced by machines.

What is a computer, that it can have such a revolutionary impact? A first step toward an answer is to say that a computer is a machine which can carry out routine mental tasks by performing simple operations at high speed. The simplicity of the operations (typical examples are the addition or comparison of two numbers) is offset by the speed at which they are performed (about a million a second). The result is that large numbers of operations can be performed, and significant tasks can be accomplished.

Of course, a computer can accomplish only those tasks which can be specified in terms of the simple operations it can execute. To get a computer to carry out a task one must tell it what operations to perform—in other words, one must describe *how* the task is to be accomplished. Such a description is called an *algorithm.* An algorithm describes the method by which a task is to be accomplished. The algorithm consists of a sequence of steps which if faithfully performed will result in the task, *or process,* being carried out.

The notion of an algorithm is not peculiar to computer science—there are algorithms which describe all kinds of everyday processes.

In general, the agent which carries out a process is called a *processor.* A processor may be a person, a computer, or some other electronic or mechanical device. A processor carries out a process by obeying, or *executing,* the algorithm which describes it. Execution of an algorithm involves execution of each of its constituent steps.

From the discussion above it is apparent that a computer is simply a particular kind of processor. Of course, it is rather a special kind of processor; otherwise computers would not have had such a rapid and significant impact on so many areas of life. The features which make it special are described below.

(1) the central processing unit (CPU), which performs the basic operations,

(2) the memory, which holds;

(a) the algorithm specifying the operations to be performed

(b) the information, or data, upon which the operations are to act;

(3) the input and output devices (I/0 devices), through which the algorithm and the data are fed into the memory, and through which the computer communicates the results of its activities.

These components comprise the computer hardware: that is, the physical units from which a computer is built.

PART 2

(1) Speed

The CPU of a typical computer can perform between one million and ten million operations a second. Although these operations are very simple the formidable speed with which they are performed means that even quite complex algorithms, requiring large numbers of operations, can be executed very quickly. By comparison the human brain is very slow, so it is not surprising that

people have been replaced by computers in many activities where speed is a major requirement. Human beings do, however, currently retain significant advantages over computers. For example, it appears that the brain is capable of performing many operations at once whereas (with minor exceptions) a present-day computer can perform only one operation at a time.

Despite the high speed of computers there remain many processes which are simply too time consuming to be feasibly carried out. (An example is the formulation of a winning strategy for chess by studying all chess games which could possibly be played.)

(2) Reliability

Contrary to popular mythology computers seldom make mistakes, though they do occasionally break down. The mistakes which achieve prominence in the news media, such as an electricity bill for a million dollars or a false alert about nuclear attack, are almost invariably a result of a fault in the algorithm being executed or an error in the input data. On very rare occasions an electronic fault may cause a computer to execute an algorithm incorrectly, but the probability of this is minute, and in any case such malfunctions are usually detected immediately.

A computer is in a sense a totally willing and obedient slave: it will faithfully execute the algorithm it is given, and if necessary it will do so repeatedly without complaint. Such fidelity is of course both a strength and a weakness, since the computer will execute the algorithm quite blindly, whether or not it correctly describes the process intended.

(3) Memory

One of the prime characteristics of a computer is its ability to store vast quantities of information which it can access very quickly. Memory capacities and access speeds vary widely according to the storage medium used; some computers can store several thousand million items of information, and can access some of these items in as little as 100 nanoseconds (a nanosecond is 10^{-9} seconds, or one thousand millionth of a second). Impressive though these figures are, they are somewhat deceptive. As we shall see later, computer memory is organized in such a way that an item of information can be retrieved only if its location in the storage medium is precisely known. This means that a lot of effort must be put into keeping track of where information is located—effort which increases both the time to design an algorithm and the time to execute it.

The objectives of software engineering

Software engineering is the profession which is likely to replace programming and systems analysis over the next ten years. The objectives of software engineering are as stated above: the development of very large, complex , software items, which satisfy strict standards of performance and correctness, in a controlled, scheduled, budgeted and cost-effective way. Software engineers require, in addition to a proficiency in programming, a

knowledge of formal mathematics and logic, computing science, economics and management.

Software engineering is carried out by teams of people. When a software development project is started, the teams are set up with a management structure corresponding to the structure of the software itself. A schedule is drawn up for the project, and costs are allocated to the various portions and stages. Each team has a team leader, whose task is to make sure that the software developed by the team is correct, properly structured, has the right interfaces to the software being developed by the other teams, and is on schedule and within budget. This is a very difficult task, which requires a wide range of technical and management skills.

Software engineering is concerned with the entire lifecycle of a software project: design. development, testing, use and maintenance. All the work done is aimed at the highest possible standards at the lowest possible costs throughout this lifecycle.

Program structure

It is now quite clear that the only way of achieving the required standards of correctness, performance and reliability of software is through the very careful design of the structure of a program. A well-structured program must satisfy the following conditions:

• The program must have a clear overall structure in terms of modules, with each module carrying out a specific task. Modules may be implemented as functions, procedures or segments, depending on the programming language used.

• There must be a clearly defined interface between modules. This is particularly important when interfaces are between modules written by different software engineers.

• Each module should be a simple combination of the elementary constructions of the programming language. Modules should be easy to read by people other than their original programmer.

• There must be a close correspondence between the structure of *a* module and the structure of the data on which it operates.

• Each module should leave the data structures on which it operates in a state which is consistent with their defining properties. This is particularly important with pointers: they should not be left 'hanging loose' by one module, on the assumption that another module will tidy them up.

• A module must have no side effects: it must not make any changes to data values, or to the state of the program, apart from those it is intended to make.

Achieving a program structure which satisfies these conditions is a very difficult task. Some help is given by the program structuring properties of the language. New programming languages are being developed which will give

even greater assistance, particularly with the last two requirements of a structured program.

Program design

Program design is the means by which proper program structure is achieved. It is the technique for going from the initial statement of the requirements of a program, which is generally vague, incomplete and contradictory, to the final structured, tested and approved code. It is a long and difficult process, made more so by the lack of widely-accepted, tested techniques of program design. However, a number of methods of program design do exist, and their use is increasing all the time. In the foreseeable future, it is likely that all software development will be based on a formal technique of program design.

The simplest and one of the most popular methods of program design is stepwise refinement. It is based on the use of algorithms, which are written in a language somewhere between English and a programming language such as Pascal. The process itself may be described by an algorithm of this nature:

State the overall steps of a program in a brief, top-level algorithm.
Repeat
  Expand each statement of the algorithm as a detailed algorithm which describes the steps required to implement the statement.
Until the task has been specified in sufficient detail for the code of the program to be written.

Stepwise refinement is a **top-down** process, with details being added in an orderly fashion as the design progresses. If an algorithm turns out to be incorrect, it can be 'unplugged' and replaced by another without too much effect on the program structure as a whole.

Although stepwise refinement can bring about a great improvement in the structure of a program, it is not formal enough for many applications. In particular, there is no guarantee that data structures are left in a consistent state by the various modules. It is very difficult to prove the correctness of program module developed in this way.

A number of more formal methods of program design are coming into use, the most popular being functional decomposition. Like stepwise refinement, functional decomposition is a top-down method, starting with the overall requirements of a program, and adding detail in an orderly way. The difference is that at every stage, the essential properties of the data structures are specified, and each algorithm is expressed as a mathematical function which transforms these data structures. Each algorithm can be tested by various mathematical techniques, in order to prove that the properties of the data structures are not altered by the operations it performs on the data. Functional decomposition is particularly suited to some of the new functional programming languages which are being developed for fifth generation computers.

What will the word processor of the future be like?

Consider two propositions. First, word processors have improved by leaps and bounds since their advent about ten years ago. Second, what we actually do with word processors has not changed very much in the last decade. Both these statements may be true, but they create a tension: if the technology has been so revolutionary why should things remain pretty much as they always were?

One resolution to this slight conundrum is that the revolution has not yet begun in earnest. So far we have been watching a dress rehearsal: word processing is going to change radically in the next decade, and will make a huge difference to the way we write and think about writing. The improvements to the technology of word processing witnessed so far are preparatory to the really significant language and computing in a new light.

These changes are unlikely to come about through the gradual accretion of even more features to the already excellent packages in the market. Do we seriously imagine that Word Perfect 12.0 will arrive on our desks pretty soon with a manual three feet thick? Our guess is that several software innovations which are already hovering on the edge of the mainstream will blossom over the next five or ten years. These innovations will create niches for newcomers and simultaneously force the major packages to focus on parts of the language software market which they are best at. We will recognize that there is much more to language processing software than the rather similar functions covered by the best contemporary word processing packages.

Speech processing. It seems highly likely that speech processing will move more into the mainstream of personal computing. As ever with innovation, it may not happen in quite the way we first imagined. When speech processing was first mooted five years ago, it was seen as a way of circumventing the keyboard. Some of us have trouble with basic typing, and nearly all of us have difficulties with rarely-used command sequences or macros. While we look forward to the day we can instruct our machines to "print three copies", significant applications for speech processing are likely to appear before we get reliable automatic dictation machines. We will incorporate speech messaging well before we crack the problem of unconstrained speech recognition.

Most of the documentation that moves around corporations and between businesses is remarkably standard. The average document comes in about five almost-identical versions: file copies, agenda, schedules, minutes, ‘blind’ copies sent to colleagues, action copies sent to subordinates and so on. The five copies generally differ only in their destination and minor detail. A problem with such documentation is that it tends to be regarded as dross by its recipients, even if it is in fact important. An ideal way of giving apparent dross a high "impact factor” is to attach a voice message to some email.

Incorporating sound bites in documents may seem a superficial addition to the basic word processing function. But it is in line with the tendency towards

object-oriented programs and user interfaces, hypertexts and multi-media documents. And all these powerful trends in the technology will encourage us to think of word processing as much broader than the typing or typesetting functions predominant in today's word processing and desktop publishing programs. While word processing will encompass voice and graphics, we can also count on an equally strong tendency towards a more abstract and artificial view of the document as 'structured program'.

The drive to uncover structure in documentation is already very strong in the defence industries. We have all heard the story about the documentation for a Boeing 737 weighing more than the aeroplane itself, or the American frigates which carry more tons of paper than they do tons of missiles. But this mass of paper is no joke for the industries which build these machines, and they are consequently taking the lead in developing powerful tools for the automatic processing and interpreting of documentation.

SGML. One of the keys is the development of Standard Generalised Markup Language (SGML) schemes: SGML allows for documentation manipulation which is independent of the particular way in which the document has been processed or represented — on paper, screen, or magnetic tape for example. SGML has a real pay-off when your are dealing with large amounts of text. In typesetting or desktop publishing systems there is no way of distinguishing the italic into which you cast the title of a book from the italic you use for a foreign word.

The Next workstation, with its voice messaging and CD-ROM-based Digital Library is a pointer to the future.

But in SGML systems these differences are marked. The basic idea is that if you can treat the structure of documentation as abstract and *declarative* rather than being *procedural* and dependent on the manner of its representation, it should be much easier to make large-scale comparisons of documents. SGML markup is not easily intelligible to the human eye — quite the reverse, as it tends to look like a jumble of brackets and codes.

But new software will use SGML while concealing it from the user, in much the same way as our word processors now use and exchange ASCII without our needing to notice it. SGML will come into its own when users are able to incorporate documents, standard form contracts or advertising brochures into their databases, agreement files or catalogues without needing to consciously translate the structure to the formats they prefer to use.

The nature and objectives of fifth generation computers

Fifth generation computers aim to be able to solve highly complex problems, ones which require reasoning, intelligence and expertise when solved by people. They are intended to be able to cope with large subsets of natural languages, and draw on very large knowledge bases. In spite of their complexity, fifth generation computers are being designed to be used by people who are not necessarily computer experts.

In order to achieve these very ambitious aims, fifth generation computers will not have a single processor, or a small number of tightly coupled processors as computers do today. They are being designed to contain a large number of processors, grouped into three major subsystems: a knowledge base system, an inference mechanism and an intelligent user interface.

The knowledge base system has a very large store of knowledge, structured in one of the ways described above, with a set of processors which access and update the knowledge. It is likely that knowledge bases will evolve from current work in relational databases. Operations on knowledge bases require the manipulation of large numbers of individual elements: this manipulaton will be done in parallel by the arrays of knowledge processing elements.

The inference mechanism draws reasoned conclusions from the knowledge base. Much of its processing will be drawing logical inferences of the:

if <condition> then <action>

variety. Accordingly, the processing power of a fifth generation computer is expressed in logical inferences per second (lips). The target is in the range 50 to 1000 million lips (compared with a current performance of 10 to 100 thousand lips). Most of this improved performance is planned to be achieved via highly parallel architectures, such as the dataflow and graph reduction architectures discussed below.

The intelligent user interface is the point of contact between a fifth generation computer and its user. Many of these will be based on communication in a large subset of a natural language. Others will make extensive use of advanced graphics, including image processing. The intention is to build a user interface which is close to the natural way of thinking of the user, rather than close to the way of working of the computer, as is the case with contemporary user interfaces. The intelligent interface will contain its own set of processing elements - image processing systems may have an array of processors, one per pixel of the display.

The fifth generation development programmes

There are five major programmes under way to develop fifth generation computers: the Japanese **Icot** programme, the **MCC** and **Darpa** projects in the USA, the **Esprit** initiative in the EEC and the **Alvey** programme in Britain. There is a certain measure of collaboration between the programmes, but the research results in each project are intended to be implemented within the region. Most research and development is being carried out by consortia of corporations and universities.

Japan: the icot programme

The Japanese Icot project is regarded as a critical element in Japan's industrial performance, and continuing prosperity, in the 1990s and beyond. A central institute (Icot) has been set up, where the basic research takes place. Development work is done under contract by Japanese computer corporations and universities. A number of main research streams are being followed, including advanced computer architecture, systems software, VLSI chip technology and applications for the new computers. A cyclic progression is intended, with advances in each area being used to assist in the next stages of all the others. For example, the first series of workstations for the researchers are sequential inference computers, programmed in a derivative of Prolog: Advances in architecture are intended to lead to the development of parallel inference computers for the next phase of the research.

Intelligent knowledge based systems

Intelligent knowledge based systems (IKBS) are the central elements of fifth generation computers. They use inference to apply knowledge to perform a task. They require at least the following capabilities: classification, concept formation, summarizing, selection, searching, reasoning, planning, modelling, the use of ‘common sense' rules, and the ability to learn. Most of these are beyond the capabilities of present-day computers.

Research and development work is under way on various aspects of these problems, the most important - and the most difficult - being an adequate method of knowledge representation. A number of techniques of knowledge processing are being tried out. These include evidential reasoning, based on the way people draw conclusions from bodies of evidence, such as that presented as a trial, and procedural learning, based on the way experts learn to solve difficult problems. Efficient methods of searching large databases are also being investigated.

Intelligent user interfaces

Intelligent user interfaces aim to make fifth generation computers usable by far more people than use computers at present. This is in spite of the complexity of the systems, and the fact that many users will not be computer experts. The technique is to make the computer behave much more as a person would expect. Two main channels of communication are being emphasized: the use of natural language and image processing.

Although a complete natural language will be beyond the capabilities of even a fifth generation computer, the intention is to enable them to use a large enough subset to make a number of voice-driven applications possible. Image processing requires the computer to be able to accept video pictures as input, and generate output of the same quality. Some approximation to three-dimensional vision is required. Intelligent interfaces will be supported by a

complete hardware and software subsystem of the computer, as described above.

Applications of fifth generation computers

A very wide range of applications are planned for fifth generation computers, although their precise capabilities will not become clear until more development work has been done. Many applications will be expert systems of some sort.

The main industrial application is likely to be intelligent robots, with some degree of visual perception, and the ability to be instructed to attain certain goals, rather than to perform a sequence of steps, as at present. The robot will work out the sequence of steps to be performed, according to the goals, and external conditions of which it is aware.

Military applications include strategic and tactical planning and decision support systems, and automated weapons systems. The latter include intelligent guidance systems for missiles, and missile defence systems for aircraft and ships. Digital communications systems which are secure against electronic counter-measures are a likely by-product of VLSI chip design.

In commerce, corporate knowledge bases are likely to be constructed on top of corporate databases. Decision support systems for managers will use these knowledge bases to assist with planning and evaluation. The voice-activated word processor is the ultimate aim of a number of fifth generation projects, with a very large potential market awaiting the first team to achieve it. Automatic, or (more realistically) semi-automatic language translation systems are a similar application.

Conclusion

The fifth generation development projects are the main thrust of computer development for the next five to ten years. Large sums of money, and the time and energy of some of the leading IT experts in the world are being devoted to the work. The risks are very high, since many of the principles on which fifth generation computers are to be built did not exist five years before the start of the projects. However, the risks of withdrawing from the work are even higher. It is quite clear that if any national or regional group achieves a significant lead in the development of fifth generation computers, that group will be the dominant force in information technology.

VII. PROGRAMS AND PROGRAMMING LANGUAGES

Computers can deal with different kinds of problems if they are given the right instructions for what to do. Instructions are first written in one of the high-level languages, e.g. FORTRAN, COBOL, ALGOL, PL/I, PASCAL, BASIC, or C, depending on the type of problem to be solved. A program written in one of

these languages is often called a source program, and it cannot be directly processed by the computer until it has been compiled, which means interpreted into machine code. Usually a single instruction written in a high-level language, when transformed into machine code, results in several instructions. Here is a brief description of some of the many high-level languages:

FORTRAN acronym for FORmula TRANslation. This language is used for solving scientific and mathematical problems. It consists of algebraic formulae and English phrases. It was first introduced in the United States in 1954.

COBOL acronym for COmmon Business-Oriented Language. This language is used for commercial purposes. COBOL, which is written using English statements, deals with problems that do not involve a lot of mathematical calculations. It was first introduced in 1959.

ALGOL acronym for ALGOrithmic Language. Originally called IAL, which means International Algebraic Language. It is used for mathematical and scientific purposes. ALGOL was first introduced in Europe in 1960.

PL/I Programming Language I. Developed in 1964 to combine features of COBOL and ALGOL. Consequently, it is used for data processing as well as scientific applications.

BASIC acronym for Beginner's All-purpose Symbolic Instruction A. Code. Developed in 1965 at Dartmouth College in the United States for use by students who require a simple language to begin programming.

C developed in the 1970s to support the UNIX operating system. C is a highly portable general-purpose language.

Other such languages are APL (developed in 1962), PASCAL (named after Blaise Pascal and developed in 1971), and LISP and PROLOG, both of which are used for work in artificial intelligence. LOGO is a development of LISP which has been used to develop computer-based training (CBT) packages.

When a program written in one of these high-level languages is designed to do a specific type of work such as calculate a company's payroll or calculate the stress factor on a roof, it is called an applications program. Institutions either purchase these programs as packages or commission their own programmers to write them to meet the specifications of the users.

The program produced after the source program has been converted into machine code is referred to as an object program or object module. This is done by a computer program called the compiler, which is unique for each computer. Consequently, a computer needs its own compiler for the various high-level languages if it is expected to accept programs written in those languages. For example, in order that an IBM RS/6000 may process a program in FORTRAN, it needs to have a compiler that would understand that particular model and the FORTRAN language as well.

The compiler is a systems program which may be written in any language, but the computer's operating system is a true systems program which controls the central processing unit (CPU), the input, the output, and the secondary memory devices. Another systems program is the linkage editor, which fetches required systems routines and links them to the object module (the source program in machine code). The resulting program is then called the load module, which is the program directly executable by the computer. Although systems programs are part of the software, they are usually provided by the manufacturer of the machine.

Unlike systems programs, software packages are sold by various vendors and not necessarily by the computer manufacturer. They are a set of programs designed to perform certain applications which conform to the particular specifications of the user. Payroll is an example of such a package which allows the user to input data - hours worked, pay rates, special deductions, names of employees - and get salary calculations as output. These packages are coded in machine language (Os and Is) on magnetic tapes or disks which can be purchased, leased, or rented by users who choose the package that most closely corresponds to their needs.

Computer networks

Computer networks link computers by communication lines and software protocols, allowing data to be exchanged rapidly and reliably. Traditionally, networks have been split between wide area networks (WANs) and local area networks (LANs). A WAN is a network connected over long distance telephone lines, and a LAN is a localized network usually in one building or a group of buildings close together. The distinction, however, is becoming blurred. It is now possible to connect up LANs remotely over telephone links so that they look as though they are a single LAN. Originally, networks were used to provide terminal access to another computer and to transfer files between computers. Today, networks carry e-mail, provide access to public databases and bulletin boards, and are beginning to be used for distributed systems. Networks also allow users in one locality to share expensive resources, such as printers and disk-systems.

Distributed computer systems are built using networked computers that co-operate to perform tasks. In this environment each part of the networked system does what it is best at. The high-quality bit-mapped graphics screen of a personal computer or workstation provides a good user interface. The mainframe, on the other hand, can handle large numbers of queries and return the results to the users. In a distributed environment, a user might use his PC to make a query against a central database. The PC passes the query, written in a special language (e.g. Structured Query Language-SQL), to the mainframe, which then parses the query, returning to the user only the data requested. The user might then use his PC to draw graphs based on the data. By passing back

to the user's PC only the specific information requested, network traffic is reduced. If the whole file were transmitted, the PC would then have to perform the query itself, reducing the efficiency of both network and PC.

In the 1980s, at least 100,000 LANs were set up in laboratories and offices around the world. During the early part of this decade, synchronous orbit satellites lowered the price of long-distance telephone calls, enabling computer data and television signals to be distributed more cheaply around the world. Since then, fiber-optic cable has been installed on a large scale, enabling vast amounts of data to be transmitted at a very high speed using light signals.

The impact of fiber optics will be considerable to reduce the price of network access. Global communication and computer networks will become more and more a part of professional and personal lives as the price of microcomputers and network access drops. At the same time, distributed computer networks should improve our work environments and technical abilities.

Key

Unit I

I.

A	B	C
frequency	enormous	amplification
range	extremely	light beam
tool	machine-tool	exposure time
consequently	unprecedented	
fiber	precise	
sample	coherent	
lesion	induce	
hostile		
missile		
bore		
fraction		
simplify		
cauterize		
valuable		
vaporize		
tissue		

II.

1) e; 2) g; 3) i; 4) b; 5) h; 6) j; 7) d; 8) c; 9) f; 10) a.

III.

A	**B**	**C**	**D**
1) b;	1) c;	1) d;	1) d;
2) a, b;	2) c;	2) a;	2) a;
3) c;	3) d;	3) c;	3) b;
4) a, b;	4) a;	4) b;	4) b.

IV.

1. эмиссия, испускание
2. распространять (ся)
3. мощный, сильный
4. относительность
5. точный
6. рассеивать
7. частота
8. выборочно, избирательно
9. здоровье
10. предложение

V.
scientific – научный
powerful – мощный, сильный
effective – эффективный, действенный, результативный
successful – успешный
selective – избирательный, выборочный
communicative – коммуникабельный, контактный, общительный
industrial – промышленный
directional – направленный
spacious – обширный, просторный
molecular – молекулярный
chemical – химический

VI.
emit – radiate
produce – manufacture
propagate – spread
highly – very
enormous – huge
spot – place
precise – accurate
use – apply
amount – quantity
cause – bring about
speed – velocity
detect – find out
reduction – decrease
simplify – facilitate
bore – drill
propose – suggest

VII.
a) 5; b) 13; c) 14; d) 1; e) 15; f) 12; g) 11; h) 10; i) 2; j) 7; k) 6; l) 3; m) 9; n) 8; o) 4.

Unit II

I. a) network, link, document, company, access, government, data, hierarchy, b) computer, resource, refer, display, c) information, multimedia, communication, worldwide, introduction.

II. 1d, 2b, 3f, 4e, 5a, 6c.

III. a) 1 b, 2 d, 3c, 4b; b) 1 c, 2 c, 3 a; c) 1 c, 2 d; d) 1 c.

IX. 1 c; 2 f; 3 b, e; 4 a, h; 5 g; 6 d.

Unit III

I. a) *vast, frequency, pitch, altitude, threshold, strictly, permanent*
b) collide, perceive, acoustic, involve, occur, particular
c) jet aircraft, engineer, sound-absorbing

Grammar Study

VII. 1. The members of the committee were expected to come to an agreement. Ожидали, что члены комитета придут к соглашению. 2. Many buildings were reported to have been damaged by the fire. Многие здания, как сообщали, были повреждены огнем. 3. The delegation is reported to have left London. Сообщают, что делегация выехала из Лондона. 4. Many people are expected to attend the meeting. Ожидают, что много народу будет присутствовать на собрании. 5. She seems to know French well. Она, кажется, хорошо знает французский язык. 6. He happened to be at home at that time. Он случайно был дома в это время. 7. The house appears to have been built in the eighteenth century. Этот дом, по-видимому, был построен в восемнадцатом столетии. 8. He seemed to know the subject well. Он, казалось, хорошо знает этот предмет. 9. They are not likely to return soon. Маловероятно, что они скоро вернутся. 10. They are certain to be here on Monday. Они непременно будут здесь в понедельник. 11. The meeting is unlikely to be postponed. Вряд ли собрание будет отложено. 12. His article is very likely to be published in the newspaper. Очень вероятно, что его статья будет помещена в газете.

VIII. 1. … payment to be made in cash in exchange for the bill of lading and insurance policy. Иностранной компании продан груз в 5.000 тонн пшеницы, причем платеж должен быть произведен наличными в обмен на коносамент и страховой полис. 2. … the days at the port of loading not to commence before October 20. Продавцы зафрахтовали судно для перевозки товаров, причем время в порту погрузки не должно начинаться до 20-го октября. 3. … the goods to be shipped in two parcels. По контракту, датированному 15-м августа, А. продал Б. некоторое количество леса, причем товар должен быть отгружен двумя партиями. 4. … such payment to be made without prejudice to the buyer's rights under the contract. Продавец должен обеспечить документы, дающие право покупателю получить поставку зерна, и платеж должен быть произведен в обмен на такие документы, причем такой платеж должен быть произведен без ущерба для прав покупателя, предусмотренных в контракте.

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Часть 2

Корректор Е.Н. Батурчик

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