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## Английский для статистиков

Рекомендовано Ученым советом федерального государственного бюджетного образовательного учреждения высшего профессионального образования «Оренбургский государственный университет» в качестве учебного пособия для студентов, обучающихся по программам высшего профессионального образования по направлениям подготовки 080100.62 Экономика, профиль «Статистика» и 080100.68 Экономика, профиль «Статистический анализ и прогнозирование социально-экономических процессов».

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Учебное пособие состоит из 12 разделов, каждый из которых представлен текстами по специальности «Статистика», системой лексико-грамматических и речевых упражнений, направленных на формирование навыков чтения и перевода узкоспециальных текстов и развития речевых умений. Учебное пособие содержит также ряд приложений, необходимых для формирования иноязычной компетентности студента: грамматический комментарий, глоссарий, список сокращений, тексты для дополнительного чтения.

Учебное пособие предназначено для студентов финансово-экономического факультета, обучающихся по направлениям подготовки 080100.62 Экономика, профиль «Статистика» и 080100.68 Экономика, профиль «Статистический анализ и прогнозирование социально-экономических процессов».

Пособие также может использоваться для самостоятельной работы студентов.

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## Введение

Данное учебное пособие предназначено для студентов, обучающихся по направлениям подготовки 080100.62 Статистика и 080100.68 Статистический анализ и прогнозирование социально-экономических процессов. Оно построено в соответствии с требованиями действующей программы по английскому языку для неязыковых специальностей высших учебных заведений. Цель учебного пособия – научить студентов читать и понимать англоязычную оригинальную литературу по специальности, развивать навыки профессионально-ориентированной иноязычной речи.

Учебное пособие состоит из 12 разделов. Ведущее место в разделе занимают тексты, имеющие разную учебно-целевую установку.

Лексико-грамматические упражнения направлены на расширение словарного запаса, корректировку навыков распознавания грамматических и лексических единиц по их формальным признакам, тренировку языковой догадки.

Пояснения к текстам и приложения снимают трудности при их чтении. Единая общая тематическая направленность содержания разделов позволяет обеспечить на всем протяжении курса обучения естественную повторяемость, как лексики, так и грамматических явлений.

# 1 Statistics. General Notion

## 1.1 Vocabulary activity

**1.1.1 Pronounce the following words after the announcer. Train the pronunciation of the words yourself. Remember them**

1) advertise	рекламный агент
2) prediction	прогноз
3) opinion poll	опрос общественного мнения
4) to depend on/upon	зависеть от
5) to make a decision	принять решение
6) to refer to	ссылаться на, обращаться
7) to interpret	перерабатывать, объяснять
8) treatment of data	обработка данных
9) investigation	исследование
10) representative	показательный, наглядный
11) comprehensive	исчерпывающий
12) to improve	улучшать
13) raw data	сырые данные
14) ballot	избирательный бюллетень
15) item	единица совокупности
16) to consider	рассматривать
17) observation	наблюдение
18) infinite	бесконечный
19) finite	конечный
20) to conduct	провести
21) census	перепись населения
22) to draw conclusion	сделать вывод
23) to obtain	получать
24) sample	выборка, образец
25) general aggregation	генеральная совокупность

### 1.1.4 Find pairs of synonyms

- |                        |                             |
|------------------------|-----------------------------|
| 1) to depend on/upon   | a) to gather                |
| 2) to interpret        | b) to better                |
| 3) to develop          | c) to explain               |
| 4) survey              | d) to work out              |
| 5) to conduct          | e) scientific study         |
| 6) to select           | f) to set up                |
| 7) accurate            | g) to choose                |
| 8) body                | h) exact                    |
| 9) to collect          | i) to be conditioned by     |
| 10) to improve         | j) to decide                |
| 11) to be aware of     | k) to know                  |
| 12) to make decision   | l) to form a final judgment |
| 13) to draw conclusion | m) system                   |

## 1.2 Reading

1.2.4 **Text 1 Read the text, try to understand it to be able to do the assignments that follow**

### Statistics

Statistics is the science of the collection, organization, and interpretation of data. It deals with all aspects of this, including the planning of data collection in terms of the design of surveys and experiments.

*A statistics* is a number that summarizes some characteristics about a set of data.

Anyone who listens to the radio, watches TV, reads newspapers, books, magazines cannot help but be aware of statistics. Statistics appears in the claims of advertisers, in predictions of election results & opinion polls & in business reports. Every science depends to some extent upon gathering of data by statistical methods. On the basis of statistics important decisions are made. Statistical techniques are used extensively in marketing, accounting, finance, international trade, economics, legislation, and other fields.

Statistics is the theory of principles and methods that has been developed for collecting, analyzing, presenting and interpreting large masses of numerical data.

Without statistical treatment of data there would be no way to put facts together to see what they mean.

The results of statistical investigations may sometimes be stated in a single sentence, as in weather forecasts. Usually they are organized in the form of numerical tables, graphs or charts. Statistical data are usually collected in one of the following ways:

- 1) by consulting existing source of material, such as periodicals and newspapers, or reports from industries, government agencies and research bureaus;
- 2) by setting up a survey and collecting data at first hand from individuals or organizations;

3) by conducting scientific experiments, measuring or counting under controlled conditions

Raw data must be collected in such a way that it is accurate, representative and as comprehensive as possible. Statistical treatment of data can not in any way improve the basic validity or accuracy of raw data.

The main aim of statistics is to find out something about population. A population, from a statistician's point of view, may consist of *individuals* such as all students in the Orenburg State University. It may also consist of *objects*, such as all the automobiles produced by Ford Company. A population may also consist of a group of *measurements*, such as all the heights of the basketball players in the NBA. Note that a population in the statistical sense of the word does not necessarily refer to people.

Usually it is not possible to gather data about all possible cases in a population. Some populations are *infinite*. Sometimes, it would take too much time or cost too much to collect data on each unit in them (e.g. every ten years the United States government conducts census of the whole population of the USA, but it is a gigantic and costly undertaking.)

The statistician usually gets the information from a relatively small number of cases called sample. From the cases in the sample he/she makes generalizations about the whole population. Such generalizations are called general aggregations.

The cases in the sample must be representative of the whole population! Otherwise the conclusion drawn from the sample would not be valid for the whole population.

The *size* of the sample is a factor too. Other things being equal, a larger sample is better than the smaller one. However, excellent results can be obtained with small samples that are properly set up. Most public opinion surveys are conducted on samples **tie\*** are made as representative as possible by means of stratified sampling techniques. It is a special technique of dividing country into various layers (strata). The aim of these techniques is to make proportions in the sample the same as in general population.

Basic to all sampling techniques is the idea of randomness. It means that any item of the population is equally likely to be included in the sample.

A statistician is someone who is particularly well versed in the ways of thinking necessary for the successful application of statistical analysis. Statistics is considered by some to be a mathematical science pertaining to the collection, analysis, interpretation or explanation, and presentation of data, while others consider it a branch of mathematics concerned with collecting and interpreting data. Because of its empirical roots and its focus on applications, statistics is usually considered to be a distinct mathematical science rather than a branch of mathematics. Statistical methods can be used to summarize or describe a collection of data; this is called descriptive statistics. This is useful in research, when communicating the results of experiments.

The basic steps of a statistical experiment are:

1) Planning the research, including finding the number of replicates of the study, using the following information: preliminary estimates regarding the size of treatment effects, alternative hypotheses, and the estimated experimental variability.

2) Design of experiments. At this stage, the experimenters and statisticians write the experimental protocol that shall guide the performance of the experiment and that specifies

the primary analysis of the experimental data.

3) Performing the experiment following the experimental protocol and analyzing the data following the experimental protocol.

4) Further examining the data set in secondary analyses, to suggest new hypotheses for future study.

5) Documenting and presenting the results of the study.

### **1.3 Text comprehension**

#### **1.3.1 Understanding the main ideas. Choose the right answer**

1. Statistical methods are used:
  - a) only in statistics;
  - b) in statistics and weather forecasts;
  - c) in every field of science.
2. Usually the results of statistical investigations are presented...
  - a) in a single sentence;
  - b) by raw data;
  - c) in numerical graphs, and charts.
3. From the point of view of a statistician the term population means:
  - a) a collection of all possible individuals, objects or measurements of interest;
  - b) all people in a country; '
  - c) all automobiles in the country.
4. A sample is...
  - a) a small number of people;
  - b) a portion, or part, of the population of interest;
  - c) a small number of units.
5. In order to obtain accurate forecasts a sample is to be...
  - a) small;
  - b) large;
  - c) well set up.
6. Every item in a sample is to be...
  - a) selected at random;
  - b) carefully selected;
  - c) an item of the larger population and selected at random.

#### **1.3.2 Looking for details. Find in the text the sentences expressing the same ideas**

- 1) Statistics is the science that deals with large masses of numerical data.
- 2) Statistics can be found in everywhere.
- 3) To gather statistical data statisticians may conduct scientific researches.
- 4) Every decade the US government collects data about all the US citizens.
- 5) To make a sample more representative a statistician uses special technique of



division the population in to certain layers.

**1.3.3 Match the beginnings of the sentences with their endings**

- |  |         |                               |
|--|---------|-------------------------------|
| 1) can find statistics in ...                  | We      | a) accurate                   |
| 2) istics is used for...                       | Stat    | b) periodicals and newspapers |
| 3) hods of presenting statistical data are...  | Met     | c) graphs                     |
| 4) collect statistical data we use...          | To      | d) collecting data            |
| 5) collected information is to be...           | The     | e) indexes                    |
| 6) types of the populations are..              | The two | f) comprehensive              |
| 7) Statistical treatment should not change ... |         | g) various surveys            |
| 8) Any item of a sample is to be selected...   |         | h) numerical tables           |
|  |         | i) interpreting information   |
|  |         | j) advertisements             |
|  |         | k) at random                  |
|  |         | l) representative             |
|  |         | m) measuring and counting     |
|  |         | n) charts                     |
|  |         | o) analyzing information      |
|  |         | p) opinion polls              |
|  |         | q) infinite                   |
|  |         | r) raw data                   |
|  |         | s) finite                     |

**1.3.4 In the right column choose sentences that express the same ideas as those statements in the left column**

<p>1. If you want to be well informed you <u>cannot help but</u> watch TV news.</p>	<p>A. If you want to be well informed you should not watch TV news. B. If you want to be well informed you are to watch TV news.</p>
<p>2. Anyone who reads newspapers is <u>aware of</u> statistics.</p>	<p>A. Anyone who reads newspapers knows about statistics. B. Anyone who reads newspapers tries not to read about statistics</p>
<p>3. The boy is <u>as tall as</u> his father.</p>	<p>A. The boy is smaller, than his father. B. The boy is just like a father.</p>
<p>4. The house was constructed in such <u>a way that</u> it was convenient and large</p>	<p>A. The house was constructed so that it was large and convenient. B. The house looked large and convenient</p>

### 1.3.5 Translate the following sentences

- a) Statistics is the science of the collection, organization, and interpretation of data.
- b) Anyone who listens to the radio watches TV reads newspapers cannot help but be aware of statistics.
- c) The aim of statistics is to interpret data making it as representative as possible.
- d) Statistical treatment can not in any way improve the raw data.

### 1.3.6 Say whether the following statements true or false. Explain why

- a) There is lie, damn lie and statistics. (M. Twain)
- b) Statistics is the science of numbers.

## 1.4 Grammar activity. Active Voice (see D 1 APPENDIX D)

### 1.4.1. Put the verbs in the necessary form

#### a) Present Simple – Present Progressive

1. Her day (to start) at 8 a.m.
2. Right now the company (to look) for a new CEO.
3. It (to take) longer than they thought it would.
4. She usually (not to finish) until late in the evening.
5. First, I (to get up), then I (to turn) on the radio.

#### b) Past Simple – Present Perfect

1. I (to buy) this car a year ago.
2. I just (to buy) this watch.
3. I (to play) football when I was a child.
4. I (to start) analyzing the data only some time ago.
5. Finally, I (to finish) the essay. I can have some rest.

#### c) Past simple – Past Perfect

1. We (to investigate) the situation before we collected necessary data.
2. When we arrived, the match (to start).
3. I (to live) in Warsaw before I moved to London.
4. I (to consult) the lawyer before I made the decision.
5. They developed the project after they (to investigate) all parameters.

#### d) Future forms ( to be going to, to be doing, will, will be doing, will have done)

1. I hope I (to visit) the company in July.
2. I (to visit) the company. I have bought the tickets.
3. I (to visit) the company tomorrow after 2 p.m.
4. I (to visit) the company soon, but I don't know when.
5. On Monday at 10 a.m. I (to visit) the company.
6. I think, I (to visit) with the company tomorrow.
7. I (to finish) this essay by tomorrow.

### **1.4.2 Put the verb *to go* in the necessary form**

1. ... to the swimming pool every Sunday. 2. I ... to the swimming pool yesterday. 3. I ... to that museum twice. Let's go somewhere else. 4. We ... to that museum tomorrow. We bought the tickets for everybody. 5. I think we... tomorrow.... Otherwise, it will be too late. 6. He ... to the shop before he came here. 7. Where ... you ...? May I go with you?

### **1.4.3 Translate into English**

1. Мы никогда не получали таких точных данных. 2. Вчера я работал в библиотеке. Сегодня у меня есть все необходимые данные. 3. Учёные работают над этой проблемой в течение долгого времени. 4. Менеджеры работают настолько эффективно, что компания всегда достигает своей цели. 5. Собрание состоится ровно в 5. 6. Когда ты позвонил, приказ был уже подписан. 7. Сейчас учёные проводят исследования об улучшении демографической ситуации в нашей стране. 8. Цены на электричество поднимались дважды в этом году. 9. Они закончат отбирать необходимые данные к концу рабочего дня. 10. В то время как благосостояние одной нации растёт, другие страны страдают от инфляции и роста безработицы.

## **1.5 Speaking Skills**

### **1.5.1 Read the statements. Express your agreement or disagreement**

- a) Statistics appears only in special journals.
- b) When we speak about statistics we can not but speak about numbers.
- c) Statistical data are seldom used to make important decisions.
- d) Graph and charts are usual ways of presenting statistical data.
- e) The small sample is the best sample.
- f) It is always possible to collect data about all items in the population.
- g) Any item can be included into a sample.

### **1.5.2 Enlarge the following statements**

- a) Statistics is used for treating data.
- b) There are three ways of gathering data.
- c) The word population in statistics has some specific meaning.
- d) A sample is a small portion of a population.

**1.5.3 Compare your translation with the translations of your fellow-students.  
Retell the text**

## **1.6 Check your knowledge**

### **1.6.1 Text 2 Read the article. Think of the suitable headline**

1. Washington- Diana Furchgott-Roth is a diminutive lady of gentle manners. But she is also a rigorous economist (American Enterprise Institute, the former President Bush's Office of Policy planning) who, together with historian Christine Stolba, has published monograph on the position of women in the American economy.

2. From their point of view women are no longer the victims of male discrimination. Ms. Furch-Roth and Ms. Stolba paint a picture of women as highly successful participants of the national economy.

3. Women now earn more than 50 percent of all bachelor's degrees and have done so since 1982. As one would expect the better education has led directly to higher wages. While it's true that the average of all women's wages is still lower than the average all men's wages (the so called wage gap), that is not a very accurate and representative statistics. It fails to refer to important factors like consecutive years of a job, education level, full or part-time work, public or private - sector employment. When you collect all these data, women earn almost identical wages to men.

### **1.6.2 Mark the following statements false or true**

- a) According to the paragraph 1, Diana Furch-Roth is a successful economist and huge lady.
- b) Paragraph 2 suggests that according to Ms. Furch-Roth's opinion women enjoy full rights in the sphere of national economy.
- c) Statisticians draw wrong conclusions about women wages because they do not consider important data like level of education and consecutive years of a job.

### **1.6.3 Describe how these words or phrases are used in colourful ways to add interest:**

- a) Lady;
- b) Economist;
- c) Monograph;
- d) Factors.

### **1.6.4 Give reasons why there is the so-called wage gap between women's and men's wages (pay attention on the underlined words in the article)**

### **1.6.5 Discuss the following ideas**

- a) Women nowadays have equal rights with men.
- b) Women should have equal rights with men.

### 1.6.6 Put questions to the words in bold (see D.2 Appendix D)

1. She is also a **rigorous** economist.
2. Diana Furchgott-Roth published monograph **on the position of women in the American economy**.
3. Women **are** no longer the victims of male discrimination.
4. **Ms. Furch-Roth and Ms. Stolba** paint a picture of women as highly successful participants of the national economy.
5. Women now earn **more than 50 percent** of all bachelor's degrees.
6. The average of all women's wages **is still lower than** the average all men's wages.
7. That is not a very accurate and representative **statistics**.
8. Women nowadays have equal rights **with men**.

**1.7 Look through the text. Give a short summary of it in Russian, using the following expressions. Pay attention to the impersonal character of the style**

## HELP BOX

### *Useful expressions for summarizing in Russian*

Текст посвящён проблеме ...

В начале текста:

-речь идёт о ...;

-даётся определение ...;

-обосновывается значимость ...;

-привлекается внимание к ...

Далее:

-описывается ...;

-рассказывается ...;

-рассматривается ...;

-излагается ...

В частности,

-отмечается, например ...;

-подробно излагается ...;

-описывается схема ...;

-указывается ...;

-доказывается мысль ...

Наконец

-раскрывается ...

В заключение

-приводятся примеры ...

Подытоживая сказанное, следует отметить ...

Как мне кажется, статья может представлять интерес для ...

Думается, статья может оказаться полезной для ...

## Summing Up Data with Statistics

The first step in understanding data is to hear what the data say, to “let the statistics speak for themselves.” But numbers speak clearly only when we help them speak by organizing, displaying, summarizing, and asking questions. That’s *data analysis*. Statistics are used to summarize some of the most basic information in a data set. Summarizing information has several different purposes. Picture your boss coming to you and asking, “What’s our client base like these days and who’s buying our products?” How would you like to answer that question— with a long, detailed, and complicated stream of numbers and statistics that are sure to glaze over her eyes? Probably, not. You want clean, clear, and concise numbers that sum up the client base for her, so that she can see how brilliant you are, and then send you off to collect even more data to see how she can include more people in the client base. (That’s what you get for being efficient.) So, statistics are often used to provide people with information that is easy to understand and that answers their questions (if answering their questions is possible).

Summarizing statistics has other purposes, as well. After all of the data have been collected from a survey or some other kind of study, the next step is for the researcher to try to make sense out of the data. Typically, the first step researchers take is to run some basic statistics on the data to get a rough idea about what's happening in the data. Later in the process, researchers can do more analyses to formulate or test claims made about the population, estimate certain characteristics about the population and look for links between items they measured, and so on.

Another big part of research is reporting the results, not only to your peers, but to the media and to the general public. While a researcher's peers may be waiting and expecting to hear about all the complex analyses that were done on a data set, the general public is neither ready for nor interested in that. What does the public want? Basic information. So, statistics that make your point clearly and concisely are commonly used to relay information to the media and to the public.

Although careful exploration of data is essential if we are to trust the results of inference, data analysis isn't just preparation for inference. To think about inference, we carefully distinguish between the data we actually have and the larger universe we want conclusions about. The Bureau of Labor Statistics, for example, has data about employment in the 55,000 households contacted by its Current Population Survey. The bureau wants to draw conclusions about employment in all 110 million U.S. households. That's a complex problem. From the viewpoint of data analysis, things are simpler. We want to explore and understand only the data in hand. What does concern us is a systematic strategy for examining data and the tools that we use to carry out that strategy.

## **1.8 Apply your knowledge. Express your idea**

Many times, statistics are used to give a quick and dirty summary of a situation that's actually pretty complicated. In such a situation, less is not more, and sometimes the real story behind the data can get lost in the shuffle. While you have to accept that getting sound bytes of information is a fact of life these days, be sure the group putting out the data isn't watering it down at the same time. Think about which statistics are reported, what these statistics really mean, and what information is missing.

## **2 Individuals and variables**

### **2.1 Vocabulary activity**

#### **2.1.1 Read the words. Try to understand their meanings**

Bureau  
Individuals  
Categories  
Distribution

**2.1.2 Pronounce the following words after the announcer. Train the pronunciation of the words yourself. Remember them**

1) to measure	a) измерять
2) to compile	b) составлять
3) to increase	с) увеличиваться, расти
3) to assess	d) оценивать
4) to convert	e) превращать, переводить
6) to serve	e) служить,
	выполнять
7) to determine	f) определять
8) to cover	g) покрывать
9) to include	h) включать
10) approach	i) подход
11) consumer	j) потребитель
12) retail sales	k) розничная торговля
13) convenient	l) удобный
14) evident	m) явный, очевидный
15) frequent	n) частый
16) diverse	o) разнообразный
17) recent	p) недавний
18) regarding	q) относительно (предлог)

**2.1.1 Choose the right Russian translation of the following words**

1) midterm	a) занятость
2) employment	b) рассматривать, заниматься (проблемой), иметь дело с
3) variables	с) промежуточный
4) currently	d) переменные
5) deal with	e) значение
6) make sense	f) передавать
7) enrolled	g) появляться
8) pie chart	h) гистограмма
9) transmit	i) в настоящее время
10) appear	j) иметь смысл, быть понятным
11) histogram	



- |                               |   |
|-------------------------------|---|
| 12) units of measurement      | k) внесенный в список, зарегистрированный                     |
| 13) to draw conclusions about | l) единицы измерения  |
| 14) choice of major           | m) делать выводы о  |
| 15) grade point average       | n) средний балл   |
| 16) value                     | o) годный, подходящий, пригодный, применимый, соответствующий |
| 17) suitable                  | p) категориальная переменная                                  |
| 18) quantitative variable     | q) количественная переменная                                  |
| 19) spreadsheet program       | r) программа табличных вычислений                             |
| 20) categorical variable      | s) множество, счет  |
| 21) scores                    | t) выбор приоритетов  |
|                               | u) круговая диаграмма   |

### 2.1.4 Translate the following sentences paying attention to the bold-typed words. Use them in the sentences of your own

Statistics is the science of data. The volume of data available to us is **overwhelming**. Each March, for example, the **Census Bureau** collects economic and employment data from more than 200,000 people. From the bureau's Web site you can choose to examine more than 300 items of data for each person (and more for households): child care assistance, child care support, hours worked, usual weekly earnings, and much more. The first step in dealing with such a **flood of data** is to organize our **thinking** about data.

## 2.2 Reading

### 2.2.1 Read the text, do the assignments that follow:

#### Individuals and variables

Any set of data contains information about some group of *individuals*. The information is organized in *variables*.

Individuals are the objects described by a set of data. Individuals may be people, but they may also be animals or things.

A variable is any characteristic of an individual. A variable can take different values for different individuals.

#### Are data artistic?

David Galenson, an economist at the University of Chicago, uses data and statistical analysis to study innovation among painters from the nineteenth century to the present. Economics journals publish his work. Art history journals send it back unread. "Fundamentally antagonistic to the way humanists do their work," said the chair of art history at Chicago. If you are a student of the humanities, reading this statistics text may help you start a new wave in your field.

A college's student data base, for example, includes data about every currently enrolled student. The students are the individuals described by the data set. For each individual, the data contain the values of variables such as date of birth, gender (female or male), choice of major, and grade point average. In practice, any set of data is accompanied by background information that helps us understand the data. When you plan a statistical study or explore data from someone else's work, ask yourself the following questions:

1. **Who?** What individuals do the data describe? How many individuals appear in the data?

2. **What?** How many variables do the data contain? What are the exact definitions of these variables? In what units of measurement is each variable recorded? Weights, for example, might be recorded in pounds, in thousands of pounds, or in kilograms.

3. **Why?** What purpose do the data have? Do we hope to answer some specific questions? Do we want to draw conclusions about individuals other than the ones we actually have data for? Are the variables suitable for the intended purpose?

Some variables, like gender and college major, simply place individuals into categories. Others, like height and grade point average, take numerical values for which we can do arithmetic. It makes sense to give an average income for a company's employees, but it does not make sense to give an "average" gender. We can, however, count the numbers of female and male employees and do arithmetic with these counts.

### **Categorical and quantitative variables**

A categorical variable places an individual into one of several groups or categories. Graphically it can be represented by pie charts and bar graphs which are quite difficult to be constructed by hand, but software will do the job for you.

A quantitative variable takes numerical values for which arithmetic operations such as adding and averaging make sense. The most common graph of the distribution of one quantitative variable is a histogram.

The distribution of a variable tells us what values it takes and how often it takes these values.

## **2.3 Text comprehension**

### **2.3.1 Understanding the main ideas. Choose the right answer**

1. Any set of data contains information about some group of...
  - a) individuals;
  - b) people;
  - c) products.
2. Individuals may be ...
  - a) people;
  - b) people, but they may also be animals or things;
  - c) animals or things.
3. Individuals are...
  - a) any set of data;

- b) a set of data about a person;
- c) the objects described by a set of data.
- 4. For each individual, the data contain the values of variables such as...
  - a) date of birth, gender, choice of major, and grade point average;
  - b) date of birth, gender (female or male);
  - c) grade point average.
- 5. In practice, any set of data is accompanied by background information ...
  - a) that helps us understand the data;
  - b) that is useful;
  - c) That helps us transmit the data.

**2.3.2 Looking for details. Find in the text the sentences expressing the same ideas**

- 1) Some variables, like gender and college major, simply distribute individuals into different groups.
- 2) Any set of data contains information about some group of objects, people, animals.
- 3) There are a great number of data available to us.
- 4) A variable can describe any characteristic feature of an individual. A variable can take different values for different individuals.
- 5) David Galenson, uses statistical methods to study innovation among painters from the nineteenth century to the present.

**2.4 Vocabulary activity. Fill in the gaps using appropriate words from active vocabulary**

- 1. Any set of data contains information about some group of ....
- 2. The information is organized in ....
- 3. How many students are ... in the data base?
- 4. Variables are divided into two types: categorical and ....
- 5. For height and ... we can do arithmetic.
- 6. ... are awkward to make by hand, but software will do the job for you.
- 7. Quantitative variable is represented in the form of ....

**2.5 Read the examples and do the assignments that follow**

**EXAMPLE.** A professor's data set

Here is part of the data set in which a professor records information about student performance in a course (Table 1)

Table 1

Name	School	Major	HW total	Midterm	Final Exam	Total	Grade
------	--------	-------	----------	---------	------------	-------	-------

Amaya, Jeaf	EDU	Ed Psych	95	80	88	263	A
Artur, Branda	LA	Phys	32	61	54	147	D
Bai, Jimmi	SCI	Biol	74	68	70	212	B
Beggs, Amanda	SCI	Math	86	75	94	255	A

The *individuals* described are the students. Each row records data on one individual. Each column contains the values of one *variable* for all the individuals. In addition to the student's name, there are 7 variables. School and major are categorical variables. Scores on homework, the midterm, and the final exam and the total score are quantitative. Grade is recorded as a category (A, B, and so on), but each grade also corresponds to a quantitative score (A = 4, B = 3, and so on) that is used to calculate student grade point averages.

Most data tables follow this format—each row is an individual, and each column is a variable. This data set appears in a spreadsheet program that has rows and spreadsheet columns ready for your use. Spreadsheets are commonly used to enter and transmit data and to do simple calculations such as adding homework, midterm, and final scores to get total points.

## 2.6 Apply your knowledge

### 2.6.1 Fuel economy

Here is a small part of a data set that describes the fuel economy (in miles per gallon) of 2010 model motor vehicles (Table 2)

Table 2

Make and model	Vehicle type	Transmission type	Number of cylinders	City MPG	Highway MPG
Acura NSX	Two-seater	Automatic	6	17	24
Audi A4	Compact	Manual	4	22	31
Buick Century	Midsize	Automatic	6	20	29
Dodge Ram 1500	Standard pickup truck	Automatic	8	15	20

- What are the individuals in this data set?
- For each individual, what variables are given? Which of these variables are categorical and which are quantitative?

### 2.6.2 A medical study

Data from a medical study contain values of many variables for each of the people who were the subjects of the study.

Which of the following variables are categorical and which are quantitative?

- a) Gender (female or male);
- b) Age (years);
- c) Race (Asian, black, white, or other);
- d) Smoker (yes or no);
- e) Systolic blood pressure (millimeters of mercury);
- f) Level of calcium in the blood (micrograms per milliliter).

## 2.7 Grammar activity

### 2.7.1 Choose the right voice form: Passive or Active Voice (see D1, D3 APPENDIX D)

- a) Statistics (use/is used) by managers, hospital administrators, accountants.
- b) Government agencies, businessmen, political parties (make/are made) decisions based upon statistics.
- c) Usually the results of statistical investigations (present/are presented) in graphs and charts.
- d) Statisticians usually (draw/ is drawn) their conclusions from samples.
- e) Census (conducts/is conducted) by the US government every ten years.
- f) Statisticians usually (collect/are collected) data by means of surveys.

### 2.7.2 Translate into English

1. Опрос общественного мнения часто используется в статистическом анализе.
2. Данные анализируются в данный момент.
3. Все образцы были включены в график.
4. Все методы будут использованы для решения проблем

### 2.7.3 Open brackets using the verb in Active or Passive Voice

1. Economists (to consider) a firm as an economic unit.
2. Average income in our country (to determine) as 15000 rubles per capita.
3. The living standard of population (to fall) last year,
4. The family income (not to rise) last year?
5. New workers (to employ) by the company every year?

## 2.8 Speaking Skills

### 2.8.1 Read the statements. Express your agreement or disagreement

- a) A categorical variable places an individual into groups.
- b) The distribution of a variable tells us what values it takes.
- c) Weights might be recorded only in pounds.
- d) For height and grade point average we can do arithmetic.
- e) In practice, any set of data is accompanied by background information.

## 2.8.2 Enlarge the following statements

- a) A quantitative variable takes numerical values.
- b) Some variables simply place individuals into categories.
- c) For each individual, the data contain the values of variables.
- d) The students are the individuals described by the data set.
- e) A variable is any characteristic of an individual.

## 2.9 Text 2

### 2.9.1 Read the article. Think of the suitable headline

Statistical tools and ideas help us examine data in order to describe their main *exploratory data analysis* features. This examination is called **exploratory data analysis**. Like an explorer crossing unknown lands, we want first to simply describe what we see. Here are two basic strategies that help us organize our exploration of a set of data:

Begin by examining each variable by itself. Then move on to study the relationships among the variables.

Begin with a graph or graphs. Then add numerical summaries of specific aspects of the data.

The proper choice of graph depends on the nature of the variable. The values of a categorical variable are labels for the categories, such as “male” and “female.” The distribution of a categorical variable lists the categories and gives either the **count** or the **percent** of individuals who fall in each category.

### **EXAMPLE. Garbage**

The formal name for garbage is “municipal solid waste.” Here is a breakdown of the materials that made up American municipal solid waste in 2009 (Table 3)

Table 3

Material	Weight (million tons)	Percent of total
Food scraps	25.9	11.2
Glass	12.8	5.5
Metals	18.0	7.8
Paper, paperboard	86.7	37.4
Plastics	24.7	10.7
Rubber, leather, textiles	15.8	6.8
Wood	12.7	5.5

Yard trimmings	27.7	11.9
Other	7.5	3.2
<b>Total</b>	<b>231.9</b>	<b>100.0</b>

It's a good idea to check data for consistency. The weights of the nine materials add to 231.8 million tons, not exactly equal to the total of 231.9 million tons given in the table. What happened? **Round off error:** Each entry is rounded to the nearest tenth, and the total is rounded separately. The exact values would add exactly, but the rounded values don't quite.

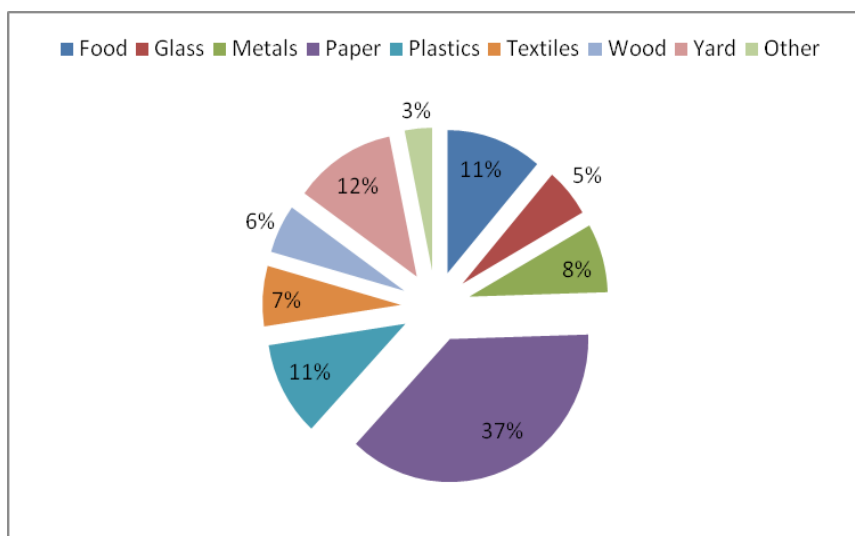


Figure 1- Pie chart of materials in municipal solid waste, by weight

The **pie chart** in Figure 1 shows us each material as a part of the whole. For example, the “plastics” slice makes up 10.7 % of the pie because 10.7 % of municipal solid waste consists of plastics. The graph shows more clearly than the numbers the predominance of paper and the importance of food scraps, plastics, and yard trimmings in our garbage. Pie charts are awkward to make by hand, they are usually made with the help of software.

We could also make a **bar graph** that represents each material's weight by the height of a bar. To make a pie chart, you must include all the categories that make up a whole. Bar graphs are more flexible. Figure 2 is a bar graph of the percent of each material that was recycled or composted in 2008. These percents are not part of a whole because each refers to a different material. We could replace the pie chart in Figure 1 by a bar graph, but we can't make a pie chart to replace Figure 2. We can often improve a bar graph by changing the order of the groups we are comparing. Figure 2 displays the recycling data with the materials in order of percent recycled or composted. Figures 1 and 2 together suggest that we might pay more attention to recycling plastics. Bar graphs and pie charts help an audience grasp the distribution quickly. They are, however, of limited use for data analysis because it is easy to understand data on a single categorical variable without a graph. We will move on to quantitative variables, where graphs are essential tools.

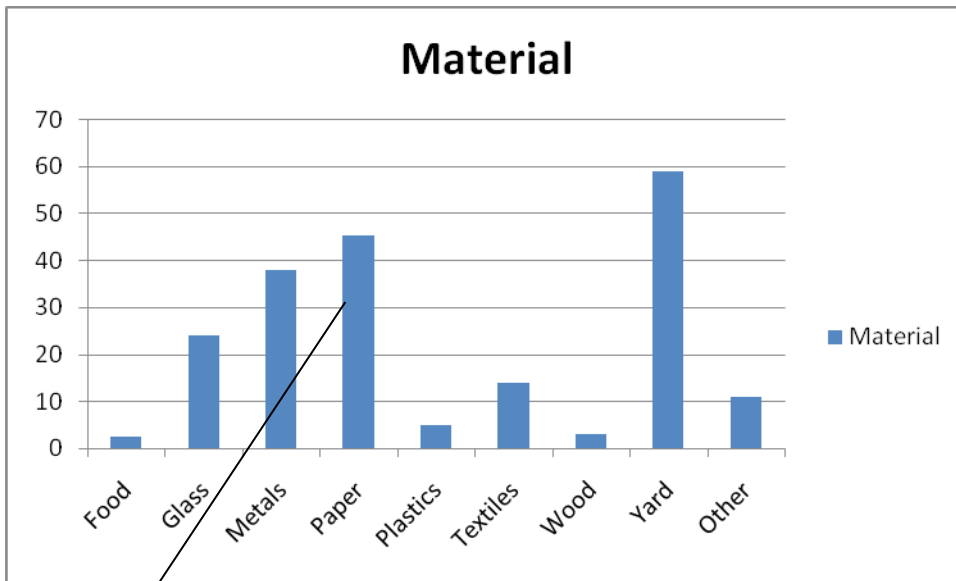


Figure 2- Bar graphs comparing the percents of each material in municipal solid waste that were recycled or composted  
 The height of the bar is 45.4 because 45.4 % of paper municipal waste was recycled

### 2.9.2 Read the text and do the tasks below

#### Quantitative variables: histograms

Quantitative variables often take many values. A graph of the distribution is clearer if nearby values are grouped together. The most common graph of the distribution of one quantitative variable is a **histogram**.

#### EXAMPLE. Making a histogram

One of the most striking findings of the 2010 census was the growth of the Hispanic population of the United States. Table 4 presents the percent of residents in each of the 50 states who identified themselves in the 2010 census as Spanish/Hispanic/Latino. The *individuals* in this data set are the 50 states. The *variable* is the percent of Hispanics in a state's population. To make a histogram of the distribution of this variable, proceed as follows:

Step 1. Choose the classes. Divide the range of the data into classes of equal width. The data in Table 4 range from 0.7 to 42.1, so we decide to choose these classes:

- $0.0 \leq \text{percent Hispanic} < 5.0$ ;
- $5.0 \leq \text{percent Hispanic} < 10.0$ ;
- $40.0 \leq \text{percent Hispanic} < 45.0$ .

Be sure to specify the classes precisely so that each individual falls into exactly one class. A state with 4.9 % Hispanic residents would fall into the first class, but a state with 5.0 % falls into the second.

Table 4– Percent of population of Hispanic origin, by state (2010)



State	Percent	State	Percent	State	Percent
Alabama	1.5	Louisiana	2.4	Ohio	1.9
Alaska	4.1	Maine	0.7	Oklahoma	5.2
Arizona	25.3	Maryland	4.3	Oregon	8.0
Arkansas	2.8	Massachusetts	6.8	Pennsylvania	3.2
California	32.4	Michigan	3.3	Rhode Island	8.7
Colorado	17.1	Minnesota	2.9	South Carolina	2.4
Connecticut	9.4	Mississippi	1.3	South Dakota	1.4
Delaware	4.8	Missouri	2.1	Tennessee	2.0
Florida	16.8	Montana	2.0	Texas	32.0
Georgia	5.3	Nebraska	5.5	Utah	9.0
Hawaii	7.2	Nevada	19.7	Vermont	0.9
Idaho	7.9	New Hampshire	1.7	Virginia	4.7
Illinois	10.7	New Jersey	13.3	Washington	7.2
Indiana	3.5	New Mexico	42.1	West Virginia	0.7
Iowa	2.8	New York	15.1	Wisconsin	3.6
Kansas	7.0	North Carolina	4.7	Wyoming	6.4
Kentucky	1.5	North Dakota	1.2		

Step 2. Count the individuals in each class. Here are the counts:

Class	Count	Class	Count	Class	Count
0.0 to 4.9	27	15.0 to 19.9	0	30.0 to 34.9	2
5.0 to 9.9	13	20.0 to 24.9	1	35.0 to 39.9	0
10.0 to 14.9	2	25.0 to 29.9	1	40.0 to 44.9	1

Step 3. Draw the histogram. Mark the scale for the variable whose distribution you are displaying on the horizontal axis. That's the percent of a state's population who are Hispanic. The scale runs from 0 to 45 because that is the span of the classes we chose. The vertical axis contains the scale of counts. Each bar represents a class. The base of the bar covers the class, and the bar height is the class count. There is no horizontal space between the bars unless a class is empty, so that its bar has height zero.

The bars of a histogram should cover the entire range of values of a variable. When the possible values of a variable have gaps between them, extend the bases of the bars to meet halfway between two adjacent possible values.

For example, in a histogram of the ages in years of university faculty, the bars representing 25 to 29 years and 30 to 34 years would meet at 29.5. Our eyes respond to the *area* of the bars in a histogram. Because the classes are all the same width, area is determined by height and all classes are fairly represented. There is no one right choice of the classes in a histogram. Too few classes will give a "skyscraper" graph, with all values in a few classes with tall bars. Too many will produce a "pancake" graph, with most classes having one or no observations. Neither choice will give a good picture of the shape of the distribution.

You must use your judgment in choosing classes to display the shape. Statistics software will choose the classes for you. The software’s choice is usually a good one, but you can change it if you want. Figure 3 is our histogram.

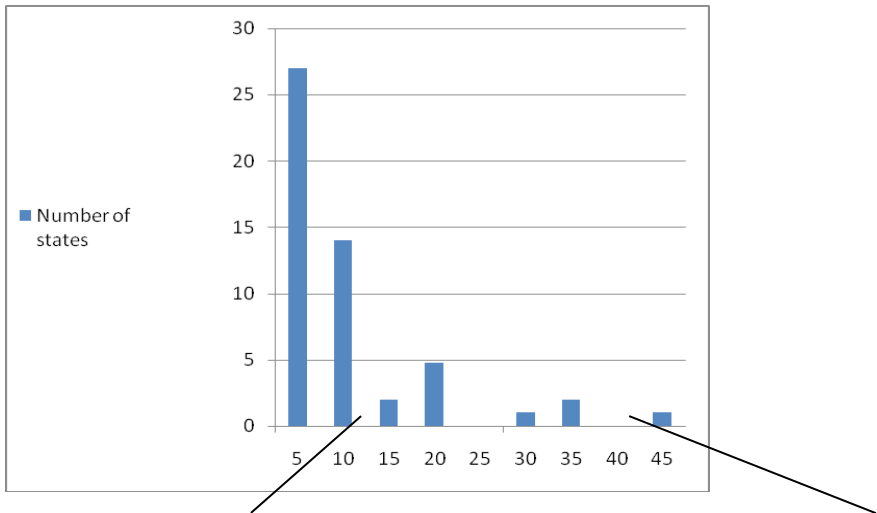


Figure 3 - Histogram of the distribution of the percent of Hispanics among the residents of the 50 states. This distribution is skewed to the right. The height of one bar is 13 (New Mexico), 42.1% (Hispanic), may be a high outlier, because 13 states had between 5.0 % and 9.9 % Hispanic residents.

### 2.10 Apply your knowledge. Draw the histogram

**The color of your car.** Here is a breakdown of the most popular colors for vehicles made in North America during the 2010 model year:

Color	Percent	Color	Percent
Silver	21.0	Medium red	6.9
White	15.6	Brown	5.6
Black	11.2	Gold	4.5
Blue	9.9	Bright red	4.3
Green	7.6	Grey	2.0

- What percent of vehicles are some other colors?
- Make a bar graph of the color data. Would it be correct to make a pie chart if you added an “Other” category?

### 2.11 Translate the following into Russian in a written form

There are four main levels of measurement used in statistics: nominal, ordinal, interval, and ratio. They have different degrees of usefulness in statistical research. Ratio measurements have both a meaningful zero value and the distances between different measurements defined; they provide the greatest flexibility in statistical methods that can

be used for analyzing the data. Interval measurements have meaningful distances between Measurements defined, but the zero value is arbitrary (as in the case with longitude and temperature measurements in Celsius or Fahrenheit). Ordinal measurements have imprecise differences between consecutive values, but have a meaningful order to those values. Nominal measurements have no meaningful rank order among values.

Because variables conforming only to nominal or ordinal measurements cannot be reasonably measured numerically, sometimes they are grouped together as categorical variables, whereas ratio and interval measurements are grouped together as quantitative or continuous variables due to their numerical nature.

### 3 Frequency Distribution

#### 3.1 Vocabulary activity

##### 3.1.1 Try to guess the meaning of the vocabulary. Use a dictionary if necessary

to draw a conclusion

to select

to refer to

raw data

to decide

to deal with

##### 3.1.2 Fill in the blanks with words from the list above

a) Usually statisticians work with large masses of data and before they... from such data they are to transform them into tables.

b) A statistician can make valid generalization about a population if the items are scientifically....

c) Advertisers, businessmen, politicians often... statistics in their reports.

d) In most cases ... would be of no use if there were no statistical tools to interpret them.

e) Managers often use statistical data when they are ... which of new production line to start.

##### 3.1.3 Match the words with their definitions or synonyms

1) Tool

2) Advantage

3) To complete

4) To condense

5) To require

a)

b)

c)

d)

e)

to have inside

favourable state

to finish

to reduce in size

to demand

- |               |                |                                  |
|---------------|----------------|----------------------------------|
| 6) Tally      | f)             | a record of how much you have    |
| 7) To contain | spent, won etc |                                  |
|               | g)             | something you need to do the job |

### 3.1.4 a) Match sentences with the different meanings of the word "table"

- |  |   |
|--|---|
| 1) In the kitchen we have a large table and four chairs.   | a) money which is paid secretly and illegally to get what you want; a "bribe"         |
| 2) An amendment to the proposal was tabled by Mrs. James.  | b) to suggest a proposal for other people to consider                                 |
| 3) The table shows, in four columns, the names of our members, how many years they have been with us, what department they work in and how much they are paid. | c) a piece of furniture   |
| 4) He voted for them since they offered him money under the table.   | d) a list of numbers, facts, or information arranged in rows across and down the page |

### b) Match sentences with the translations of the word "way"

- |   |                          |
|---|--------------------------|
| 1) Do you know the way to the train station?                                      | a) название улицы        |
| 2) Our offices are at the 17 King's Way.  | b) направление, дорога   |
| 3) I'm well on the way to completing report.                                      | c) никоим образом        |
| 4) I think we've discussed everything we need to- by the way what time is it now? | d) кстати                |
| 5) In which way does a zebra resemble a horse?                                    | e) по некоторым причинам |
| 6) In some ways it would be better if we met on Monday.                           | f) метод, способ         |
| 7) The report in no way suggests the increase in sales.                           | g) как , каким образом   |
| 8) There are many ways of solving problems.                                       | h) почти (закончил)      |

### c) Translate sentences from Russian into English. Pay attention to the word "order"

1. He came home early in order to see the children before they went to bed.
2. The teacher finds it hard to keep her class in order.
3. This old motorbike is still in perfect running order.'
4. Are your immigration papers in order?
5. When he gave the order the candidates opened their exam paper and started to write.
6. I've ordered the applications forms into three groups.

### 3.1.5 Translate the following words and word combinations:

- a) construction and business firm;
- b) sales manager;
- c) guidelines.

Notes: If you have some problems read the sentences below

- a) There are many teaching blocks in OSU. Some new buildings are under construction.
- b) Students live either in the hostels or rent rooms.
- c) Sales are number of items sold e.g. in a shop.
- d) A staff was given new guidelines for dealing with patients.

### 3.2 Reading

**3.2.1 Watch the following data for half a minute. Close it. Answer the questions below the table**

<p><u>Ages of Employees in Delta Air Lines</u> 25,46,18,38,59,62,35,23,47,43,29,25,30,47,42,45,37, 33,23,28,29,46,48,36,51,40,44,55,36,39,31,42,60.</p>
---

- 1. How old is the oldest employee?
- 2. How old is the youngest employee?
- 3. How many employees are between 30-40 years old?
- 4. Was it easy to answer the following questions?
- 5. How can these data be reorganized to describe the data better?

(If you cannot answer the following questions, read the following text.)

**3.2.2 Text 1 Read the text, try to understand it. While reading match tables below the text with the paragraphs of the text that describe them**

The statistician works with large masses of data. Before he can draw any conclusion from such data, he must arrange it in a usable form. Almost all tabulation that one can see is grouped in one way or another. The easiest way to summarize and describe a mass of statistical data is by means of the frequency distribution. There are several steps in the construction of a frequency distribution.

- 1. First step: collecting raw data. The sales manager of a large construction and rental firm specializing in vacation condominiums wants guidelines available regarding monthly rentals to send to potential vacationers. As a first step, she selected a sample of

120 rentals. They are shown in Table 6. These figures are generally referred to as *raw data*. We can find the lowest and the highest monthly rentals, but that is all we can do.

2. How can monthly rentals be reorganized to describe the data better? First of all we can set up an array. In other word you will have to order the observations from the smallest to the largest, or vice versa (Table 6).

The ordered array has some advantages. The lowest (\$640) and the highest (\$2187) values can be easily seen, and there seems to be a large number of rentals between \$1,400 and & 1,700. However the construction of an array is a difficult process - even though there are only 120 observations.

3. A better way to summarize the data is to organize them into a frequency distribution.

The second step in construction the frequency distribution (mind that the first is the collection of raw data) is to decide on a set of groupings called classes. A class might contain all the rentals from \$600 through \$799, inclusive. The next class would be \$800 through \$999 inclusive, and so on. These figures (\$600, \$799, \$800, \$999) are called class limits and distance between them is called class interval. The class intervals must be of the same size.

Each class has two limits- a lower stated class limit and an upper stated class limit. Both the upper and the lower limits are included into the class and there is no overlapping.

Using the \$200 as a class interval the classes would appear as in Table 7.

*Tally* the rental payments into classes. The usual practice is to use tally mark (/) to present a rental. The rental of \$1,170 in the upper left-hand corner of Table 8 is tallied in the \$ 1,000- \$ 1,199 class, and so on.

When completed, the tallies would appear as in Table 8.

4. Count the number of tallies in each class. Note there are three tallies, or **class frequencies**, in the \$600- \$799 class, seven class frequencies in the \$800-\$999, and so forth. The classes and the class frequencies are shown in Table 9 in the form of frequency distribution.

What observation can the sales manager now make about the monthly rentals?

1. The lowest is about \$600; the highest is about \$2,200.
2. Most of the rentals are between \$1,000 and \$1,800 a month.
3. The largest concentration is between \$1,400 and \$1,600.

It should be noted that forcing the monthly rentals into a frequency distribution has caused some loss of information. That is, by organizing the raw data into classes, we can no longer pinpoint exact rentals such as \$ 692 or \$ 1,218. However, the advantages of condensing information into an understandable and representative form have more than offset this disadvantage.

Table 5- Monthly Rentals of Condominiums

\$1170	\$1207	\$1581	\$1277	\$1305	\$1472	\$1077	\$1319	\$1537	\$1849
1332	1418	1949	1403	1744	1532	1219	896	1500	1671
1471	1399	1041	1379	821	1558	1118	1533	1510	1760
1826	1309	1426	1288	1394	1545	1032	1289	695	803
1440	1421	1329	1407	718	1457	1449	1455	2051	1677

1119	1020	1400	1442	1539	1962	1263	178 <sub>B</sub>	1981	1668
1352	1340	1459	1832	1451	1138	1592	982	1550	1091
1428	1603	1699	1237	1325	1590	1142	1425	1551	913
1470	1783	1618	1431	1557	896	1662	1591	1972	1612
1249	1419	2162	1373	1542	1631	1567	1221	1540	1714
949	1539	1634	1637	1649	1607	1640	1739	2091	2187
1752	1648	1978	640	1736	1222	1790	1188	1501	1829

Table 6 - Distribution of Monthly Rentals of 120 Condominiums Units

Monthly rentals		Number of units
\$ 600	\$ 799	3
800	999	7
1000	1199	11
1200	1399	22
1400	1599	40
1600	1799	24
1800	1999	9
2000	2199	4
total		120

Table 7

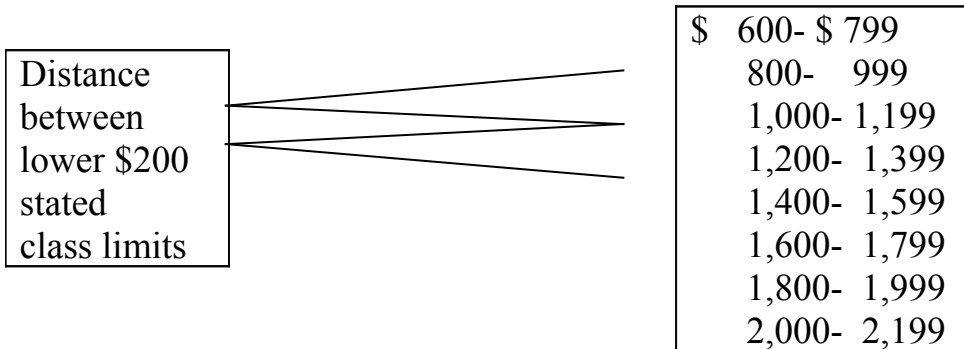
Monthly rentals		Number of units
\$ 600	\$ 799	///
800	999	//// ///
1000	1199	//// //// ///
1200	1399	//// //// //// //// //// //
1400	1599	//// //// //// //// //// //// //// //// //// //// ////
1600	1799	//// //// //// //// //// ////
1800	1999	//// //// /
2000	2199	////

Table 8

An ordered Array of 120 Monthly Rentals									
640	1041	1222	1332	1421	1470	1545	1607	1677	1829
695	1077	1237	1340	1425	1471	1550	1612	1693	1832
718	1091	1249	1352	1426	1500	1551	1618	1714	1849
803	1118	1263	1373	1428	1501	1557	1631	1736	1949
821	1119	1277	1379	1431	1510	1558	1634	1739	1962
396	1138	1288	1394	1440	1532	1567	1637	1744	1972
896	1142	1289	1399	1442	1533	1581	1640	1752	1978
913	1170	1305	1400	1449	1537	1581	1648	1760	1981
949	1188	1309	1403	1451	1539	1590	1649	1733	2051

982	1207	1319	1407	1455	1539	1591	1662	1788	2091
1020	1219	1325	1418	1457	1540	1592	1668	1790	2162
1032	1221	1329	1419	1459	1542	1603	1671	1826	2187

Table 9



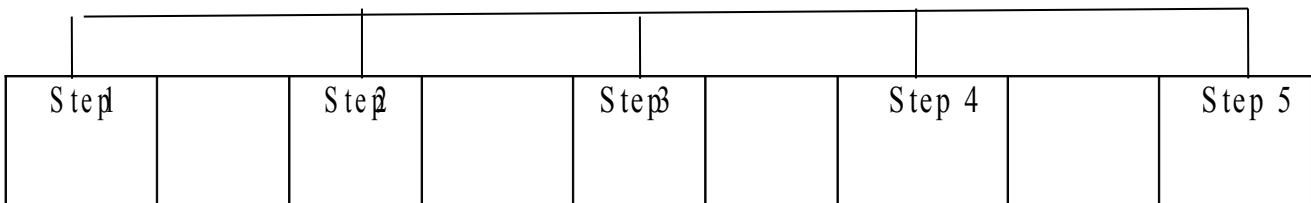
### 3.3 Text comprehension

#### 3.3.1 Translate into Russian the following terms

- frequency distribution;
- class limit;
- class interval;
- array.

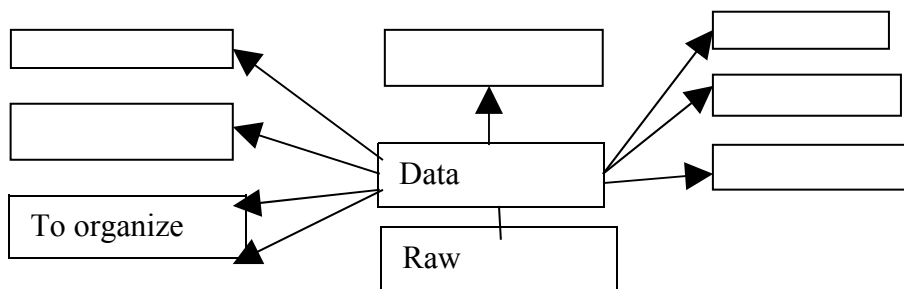
#### 3.3.2 Fill in the following mind-map

Steps in Construction Frequency Distribution



#### 3.3.3 Fill in the chart below





### 3.4 Grammar revision. Word formation (see D 5 APPENDIX D)

#### 3.4.1 a) Guess the meanings of the following international words

port	businessman
element	politician
import	demonstration
limit	detector
interval	president
conference	legacy
aggression	culture

#### b) Translate the international words into English

кредит, мораль, терминал, полицейский, статистик, математик, оппонент, прецедент, армия, терапия, сектор, фактор, оккупация, изоляция, резиденция, конференция, компетенция, компетентность, элегантность, агрессия, версия, структура, температура, процедура

#### 3.4.2 a) There is a set of words related to the word "statistics". Look at the table below and translate them (see D 5 APPENDIX D)

	Nouns	Adjectives	Adverbs	Verb
Statistic	ian	al	ly	
	s			

#### b) Fill in the blanks with the words from the table

1. Managers, accountants, quality control departments make extensive use of...
2. Very often governments occur in the situations that require the use of various... techniques.

3. Since... deals with numerical data computers play major role. The connection between ... and computers is so strong that most software packages have analysis routines.

4. use frequency distribution to carry on further calculations.

5. He insisted on interpreting the raw data....

**3.4.3 a) Make a similar table for the words related to the word "use". If necessary consult a dictionary**

**b) Fill in the blanks with suitable words from your table of the words related to "use"**

1. Raw unorganized data are ... for managers to make decisions.

2. A computer ...is exposed to sight detriment.

3. To find out whether a new hospital is needed or not various data must be collected and reorganized into a ... form.

4. Sampling techniques are very ... in accountancy.

5. Sport equipment is designed to withstand hard....

6. We have gone a lot of troubles to make the questionnaire as...as possible.

**3.5 Grammar revision. Degrees of comparison (see D 4 APPENDIX D)**

**3.5.1 Find adjectives in comparative and superlative degrees in text 1**

**3.5.2 Form comparative and superlative degrees of the following adjectives and adverbs**

Large, usable, small, difficult, low, high, often, hard, well, much, little.

**3.5.3 Construct the positive forms of the following adjectives and adverbs**

Earlier, better, the easiest, farmer, worse, the least, the furthest.

**3.5.4 Translate the following sentences. Define the type of comparisons:**

1. To collect business statistics is getting more and more difficult.

2. Statistics show that the faster you drive, the more dangerous it is.

3. We have to consider even higher taxation in the next year.

4. The smaller class intervals are, the less information we lose.

5. To organize data directly into a frequency distribution a less difficult process than the construction of an array.

6. A larger sample is better than a smaller one.

7. An array is not so user-friendly as a frequency distribution.

### 3.5.5 Form degrees of comparison of adjectives in brackets

1. The central regions of the country are (industrialized) than northern parts.
2. Living conditions in some Latin American countries are (bad) than in developing Asian countries.
3. Food, clothes and a house are (necessary) things for man's life.
4. Consumers were interested in (cheap) goods of (high) quality.
5. These data are as (accurate) as those data.

### 3.6 Apply your knowledge. Translate into English

Современный человек не может не знать о статистике. Статистические методы используются во всех областях науки. Статистик использует таблицы, графики и диаграммы, чтобы представлять данные. Чтобы собрать данные, статистик обращается к периодическим изданиям, проводит исследования, ставит эксперименты. Основные понятия статистики - это генеральная совокупность и выборка. Генеральная совокупность - это все люди, предметы или измерения, которые Вас интересуют. Выборка- это часть генеральной совокупности. Выборка применяется, если статистик не может собрать данные обо всех элементах генеральной совокупности. Элементы выборки должны быть представителями генеральной совокупности и выбраны случайно. Чем больше выборка, тем точнее статистические данные.

## 4 Portraying a Frequency Distribution

### 4.1 Vocabulary activity

**4.1.1. Find the right Russian translation of the following words. Remember them**

- 1) pie chart;
- 2) graph;
- 3) picture ( syn. portray);
- 4) histogram;
- 5) frequency polygon;
- 6) axis;
- 7) scale;
- 8) midpoint;
- 9) order.

### 4.1.2 Match the words with their definitions:

- |   |                 |
|---|-----------------|
| 1) a diagram presenting the relation between two or more varying series by means of curves; | a) variable;    |
| 2) tabulated facts;   | b) individuals; |
| 3) any characteristic of an individual;   | c) charts;      |
| 4) the objects described by a set of data.  | d) graphs.      |

## 4.2 Grammar activity. Word formation (see D 5 APPENDIX D)

### 4.2.1 Read and translate the words having one and the same stem; underline the suffixes of nouns

Finance - financier	science – scientist
Physics - physicist	academy - academician
Statistics - statistician	Mathematics - mathematician
Economy - economist	History - historian
To contribute - contributor	To translate - translator
To read - reader	To found - founder

### 4.2.2 Translate the words and write those from which they are formed

economist	interpreter	founder
mathematician	teacher	physician
ecologist	speaker	physicist
historian	writer	officer

## 4.3 Reading

### 4.3.1 Text 1 Read the text and do the assignments

Sales managers, stock analysts, hospital administrators, and other top executives often need a quick picture of a trend in sales, stock prices, or hospital costs. These trends can be shown by use of *charts and graphs*. There are two charts that help to portray a frequency distribution graphically. They are *the histogram and the frequency polygon*. (There is also cumulative frequency polygon.)

The histogram is one of the most easily interpreted charts. Its construction is illustrated below. We shall use the example of monthly rentals of vacation condominiums mentioned in chapter.

Table 10-Distribution of Monthly Rentals of 120 Condominiums Units

Monthly rentals (\$)		Number of units
600	799	3
800	999	7
1000	1199	11
1200	1399	22
1400	1599	40
1600	1799	24
1800	1999	9
2000	2199	4
	total	120

How is a histogram constructed for this frequency distribution?

Solution

To construct a histogram, the class frequencies are scaled on the vertical axis (Y-axis), and the stated limits are on horizontal axis (the X-axis).

Note from the frequency distribution that there are three rentals units in the \$600-\$799 class. Therefore, the height of the column for that class is three. There are seven units in the next class (\$800-\$999), and logically the height of the column is 7. The height of each bar, therefore, represents the number of observations in that class (Figure 4).

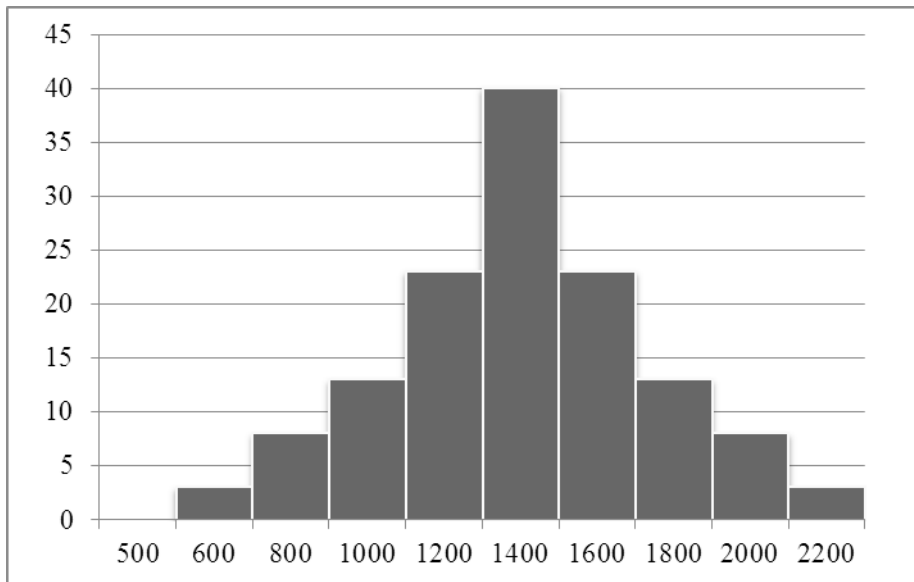


Figure 4

The construction of a frequency polygon is illustrated by using the monthly rentals of condominiums again. We need the class midpoints which are scaled on the X-axis, and the class frequencies, which are on the Y-axis.

Table 11

Stated limits	Midpoints	Class Frequencies
1	2	3
\$ 600-\$ 799	\$ 699.50	3
800-999	899.50	7
1,000-1,199	1,099.50	11
1,200-1,399	1,299.50	22
1,400-1,599	1,499.50	40
1,600-1,799	1,699.50	24
1,800-1,999	1,899.50	9
2,000-2,199	1,099.50	4

As noted, the \$600-\$799 class is represented by its midpoint, \$699.50. To make the first dot, move horizontally to \$699.50, the midpoint, and then vertically to 3, the class frequency, and place a dot. The X and Y values that form that dot are its *coordinates*. The coordinates of the next dot are X=\$899.50, Y=7 and so on. After all dots are put, they are connected *in order*. The point representing the first class is joined to the point representing the second class, and so forth.

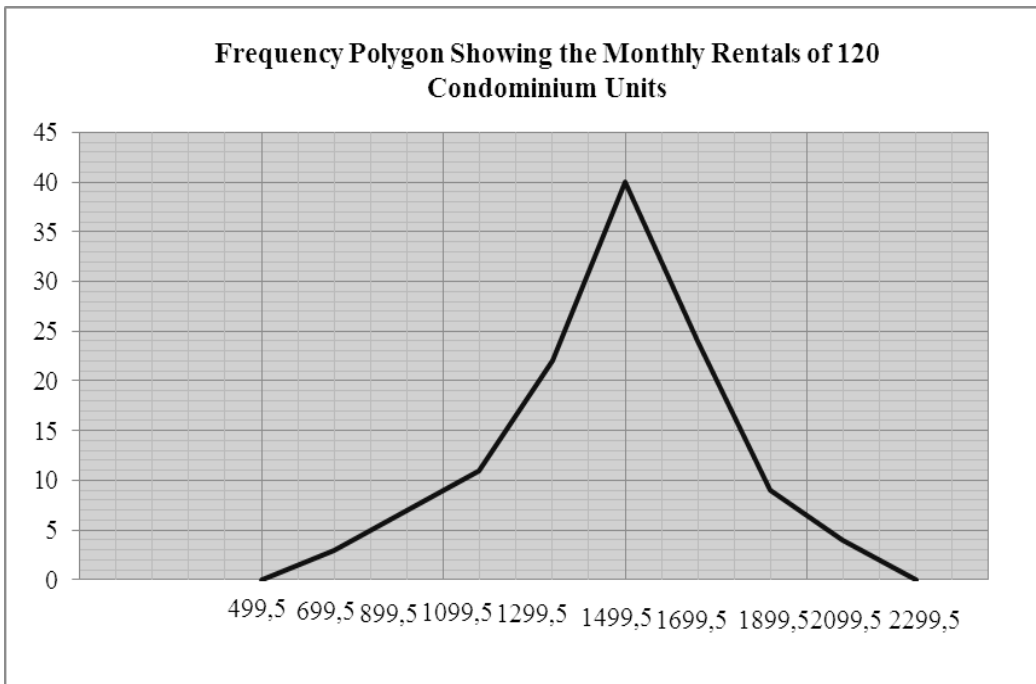


Figure 5 - Frequency Polygon Showing the Monthly Rentals of 120 Condominium Units

Note that to complete the frequency polygon, midpoints of \$499.50 and \$2, 299, 50 were added to the two extremes and the polygon was "anchored" to the horizontal axis at zero frequencies. By anchoring the two extremes of the frequency polygon to the X-axis, the total area under the polygon is now equal to the total of the frequencies (120).

Both the histogram and the frequency polygon give us a quick picture of the main characteristics of the data (highs, lows, points of concentration, etc).

#### 4.4. Text comprehension

##### 4.4.1 Match the words given below with their definitions

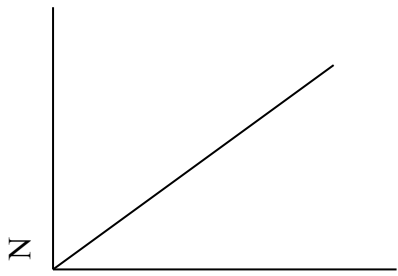
chart	a) a special graphical line format used to portray a frequency distribution
histogram	b) a picture of boxes of different height, in which each box represents a different amount
midpoint	c) the value that divides class into two equal parts
frequency polygon	d) information that is arranged in the form of a single picture

**4.4.2 Match the graphs below that describe cassette sales with their descriptions graphs . Define the tense forms used in the description**

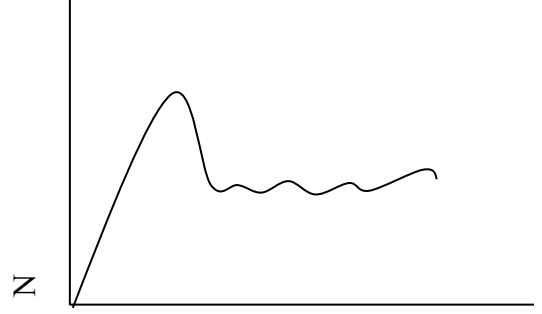
1. Sales rose dramatically about six years ago and remained stable ever since.
2. Sales have not changed for the last six years and are continuing to be stable.
3. Sales fell sharply 6 years, have remained stable for the past five years and are increasing slightly now.
4. Sales have risen sharply over the last six years and are continuing to increase.
5. Sales have fallen sharply and consistently over the past five years.
6. Sales have been increasing slightly for six years and are still going up.
7. Sales rose slowly five years ago and have been decreasing slightly ever since.
8. Sales have fluctuated for the last six years and are still going up and down
9. Sales fell dramatically six years ago and have remained stable ever since; they are continuing to be stable.
10. Sales have been slowly decreasing for the past six years and are still going down.
11. Sales went up about five years ago; they dropped immediately, remained stable and are now increasing again.
12. Sales went up rapidly five years ago and then decreased sharply; they have been stable ever since. (Figure 6)

N is the number of the sold.

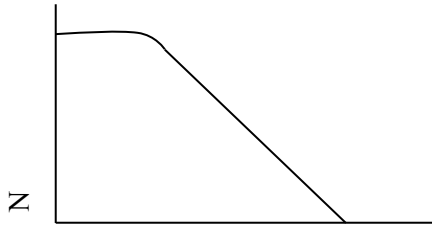




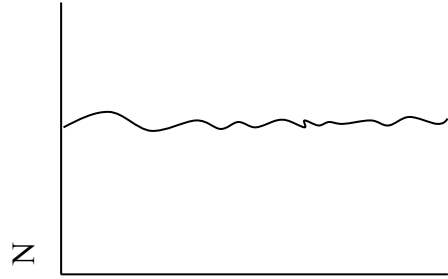
Now



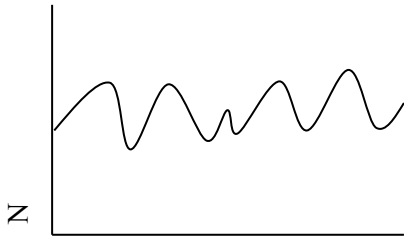
Now



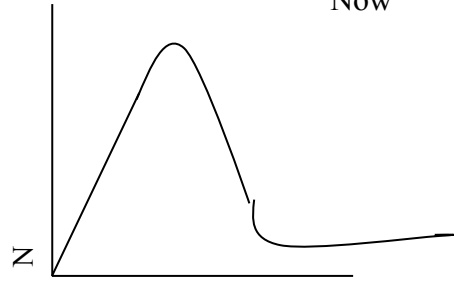
Now



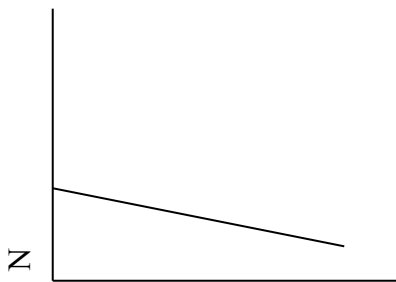
Now



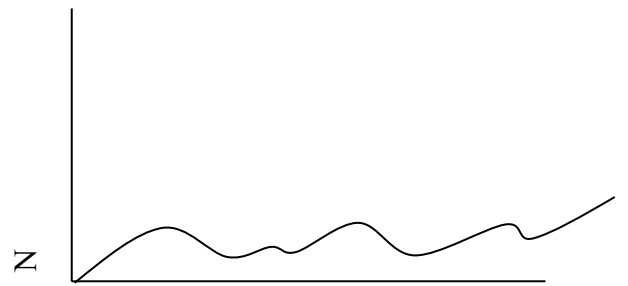
Now



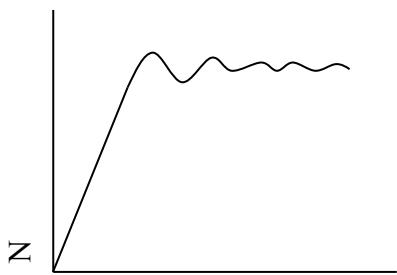
Now



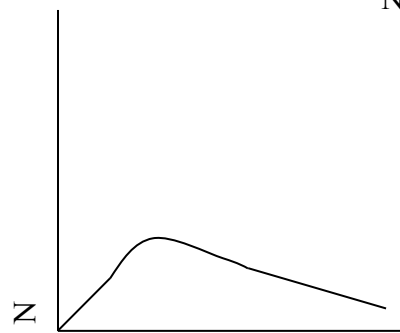
Now



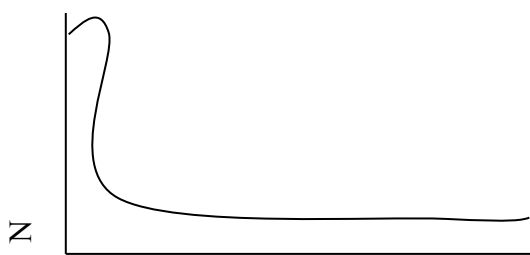
Now



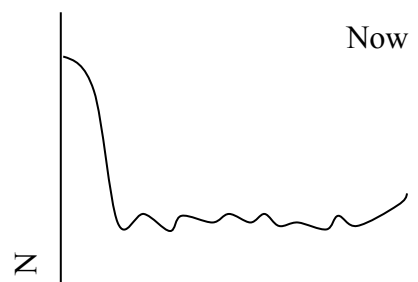
Now



Now



41



Now

Now  
Figure 6

## 4.5 Vocabulary activity

### 4.5.1 Read the text and notice all the nouns describing change in quantity


#### Twenty Years of British Education

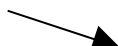
We have seen:

1. a dramatic increase in the number of comprehensive schools a steady decrease in the number of privately-owned secondary schools.
2. a constant rise in the number of university students a sharp fall in the number of foreign students –in the universities.
3. the growth of pupil-power a decline of discipline.
4. the raising of minimum standards and qualifications for prospective careers the lowering of the school starting age.
5. the enlargement of physical education equipment and facilities cuts in amenities like free milk and school dinners.
6. an upward trend in terms of physics, chemistry a downward trend in terms of religious instructions and literature.

### 4.5.2 Fill in the tables below with the words and phrases that are used to describe graphs (Table 12)

Table 12

UP 	
<b>noun</b>	<b>verb</b>
An increase	To increase

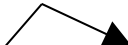
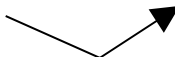
DOWN 	
<b>noun</b>	<b>verb</b>
A fall	To fall

### 4.5.3 Read the following passage, in which the Overseas Sales Manager describes the trends of the sales in the USA to a group of managers (the trends are illustrated in Table 12). While reading match the numbered sentences with corresponding parts of the graph







1. As you can see from the graph, results have been good during the five year period. We're extremely satisfied with our growth in the area.

2. Sales rose from just under \$1m in 1988 -that's an increase of 200%.
3. Looking at the trend in sales during that time, you can see that during 1984, they stayed roughly at the same level.
4. Then during 1985, they increased sharply to \$3m
5. We continued to do well in 1986 when our sales reached a peak of just over \$3 5m.
- 5 In 1987 they levelled off and last year dropped back to \$3m.
6. The future in the USA looks very bright for us. We've got a new distribution there -a company with a nation-wide sales network.
7. We estimate that the sales will double, and even treble in the next two years.
8. By the end of 1990- this is an optimistic forecast- they should be in the region of \$8m.

Table `13

NO CHANGE →		
To remain stable	To peak	To reach a low point

**4.5.4 The text below describes the company's performance in Europe. Substitute the arrows with suitable words from 4.5.2**

According to the graph, we have been doing well for the last five years. There has been a steady  since 1987. Although before, during 1985 our sales in Europe  from \$5m to \$4m. Thus they . In 1986 they  approximately. But the last two years has seen  in sales. So we expect  to continue in 1989 but then the process will slow down.

**4.6 Grammar activity**

**4.6.1 Gerund. (see D 6 APPENDIX D)**

**a) Read and translate the following sentences**

- 1) The Federal government is always interested in conducting national polling samples.
- 2) The tech department objected to making decisions in a hurry.
- 3) Instead of gathering observations from the whole population statisticians usually use samples.
- 4) We had great difficulties in collecting raw data.
- 5) Raw data always needs analyzing and interpreting.

- 6) The Chief manager will insist on conducting scientific experiments.
- 7) The quality assurance department suggests sampling of produced goods.
- 8) Results of a survey depends on collecting data in a right way.

**b) Ask and answer according to the model**

-What points shall we discuss now?  
I suggest discussing the statistical methods.

Prompts:

- 1) 1 results of statistical investigations
- 2) the aims of statistics
- 3) the ways of collecting raw data
- 4) the results of the last opinion polls
- 5) to present the results in charts
- 6) to use business reports

**c) Read the model**

We object to predicting results of opinion polls.

What would you say if you did not want ... (use the model)

- 1) to make report
- 2) to make generalization
- 3) to consult the reports of industries
- 4) to refer to census results
- 5) to present results in numerical tables

**d) Read the model**

The firm needs checking financial documents.

What piece of advice would you give if you thought that the firm should...(use the model)

- 1) to conduct consumer test
- 2) to set up a sample of produced goods
- 3) to collect data on the sources of financing
- 4) to refer to the report of the tech department

**e) Read the model**

Our department insists on accurate interpreting of raw data.

What would you say if you wanted....

- 1) to present data in graphs
- 2) to conduct the experiment
- 3) to know the probable results of the national elections
- 4) to collect raw data
- 5) to interpret raw data

**f) Say what statisticians are interested in...**

- 1) to collect, analyze and interpret data
- 2) to learn something about a population
- 3) to set up a sample in a right way
- 4) to collect data accurately
- 5) draw valid conclusion

**4.6.2 Ing-forms can be used after words *way, method, idea, risk* etc E.g. At the risk of sounding stupid, can I ask a simple question? Find in the text sentences where ing-forms are used after such words. Translate them**

**4.6.3 Match the beginnings of the sentences with their endings**

- |  |  |
|--|--|
| 1) Statistics is a set of principles for...                          | a) organizing raw data   |
| 2) There several ways of...  | b) losing some information   |
| 3) Stratified sampling techniques is a special method of...          | c) collecting, analyzing & interpreting large masses of numerical data |
| 4) The easiest way of...   | d) summarizing statistical data is by means of frequency distribution  |
| 5) A frequency distribution is a very Useful statistical tool for... | e) dividing a population into separate layers                          |
| 6) Constructing a frequency distribution you always run a risk of... | f) organizing raw data   |

**4.6.4 Answer the questions using gerunds. (Use words in brackets)**

- a) How can a statistician learn something about a population if he/she cannot gather observations from all items? (instead of ,to gather data from all items)
- b) What is statistics used for? (to collect, to analyze, to present, to interpret data)
- c) What does our government have difficulties in ? (to collect data about citizens incomes)
- d) How can you collect raw data?

## 4.7 Speaking Skills

### 4.7.1 a) Describe the company's performance in Europe (4.5.3)

b) Describe the company's performance in Great Britain (4.5.4) and in the USA (4.5.2)

## 4.8 Check your knowledge

### 4.8.1 Text 2. Learn to read newspapers

Work in pairs. One of you should read article A, the other article B. Then each of you should keep the company profile (the profile is given below the articles), using the information of his/her article. Finally, compare and complete the companies' profile

Article A	Article B
<p>Benson Inc., the department store group, announces this year's annual results on Wednesday. Once again, profits are expected to be well below expectations.</p> <p>Recently, Benson's performance has been extremely disappointing. Two years ago, pre-tax profit had fallen to just \$8.3m on a turnover of \$225m. This year, profits are expected to be down yet again. Sale per employee is also much lower than the industries average.</p>	<p>When Benson announces its annual results on Wednesday, it is expected that the group's profits will be about \$6m. This means a drop of some 25% compared with the previous year. Today, Benson's share price fell to just under \$7 in anticipation of the results. Two or three years ago the share price stood at \$10.</p>

COMPANY PROFILE - Benson Inc.		
	Most recent years	Previous years
1. Turnover		
2. Pre-tax profit		
3. Share price		
4. Sales per employee		

## 4.9 Apply your knowledge

### 4.9.1 Translate the article from English into Russian in written form

#### **GAZ is Paying out Dividends**

*Despite lower profits for this year's first quarter*

ОАО GAZ (Gorky auto plant Co.) is paying out dividends on 1999 performance in accordance with a decision passed by the recent annual meeting of shareholders.

The meeting of shareholders approved the annual report by GAZ President Nucolai Pugin. According to him, the auto plant's 1999 output growth was 21 % and the company's 1999 profit was 1.3 billion roubles.

However the workers at the giant maker of cars, trucks and buses are not exactly jubilant. The plant's profitability for this year's first quarter was a poor 2.5 % down from January 1999's 23.1 %. Profit began to decline last October. On top of that material expenses shot up to 82 % of production costs, while the wage share dropped from 13 % to seven percent.

The plant has so far managed to maintain stable prices for its vehicles, which raised no more than 15 % within a year.

## 5 Measures of Central Tendency

### 5.1 Vocabulary activity

**5.1.1. Match the words from the columns below to make meaningful expressions**

e.g. in alphabetical order

In	Accurate	Information
To give	carry on	Measurement
Alphabetical	Order	Assessment
To draw	Conclusion	Family business
To	Provide with	Conversation
		Researches
		Beer
		Facilities

**5.1.2 Read the following words and their translations. Try to remember their meanings**

Definite	Определенный
Average	Средний
To check	Проверять
Range	Диапазон
Rough	Грубый
Consumer	Потребитель
Purchase	Покупка

### 5.1.3 Translate the following expressions

Purchase price  
Price range  
Average price  
To budget the price

### 5.1.4 Match the following words with their translations

The arithmetic mean	Медиана
The median	Дискретные данные
The mode	Среднее арифметическое
Discrete data	Мода

## 5.2 Reading

### 5.2.1 Text 1. The paragraphs in the text are scrambled. Arrange them logically

#### Measures of Central Tendency

1. One method of summarizing data is a measure of central tendency or average. The purpose is to pinpoint the centre of a set of data.
2. A statistician uses frequency distributions and graphs to carry on further computations. Usually s/he wants to find one number that will represent all the data in some definite way.
3. Four measures of central tendency commonly used in business and economics are the arithmetic mean, median, mode and the geometrical mean.
4. The median price of the units is \$ 70,000 (Table 14)

Table 14

Prices ordered from low to high	Prices ordered from high to low
\$60,000	\$ 275,000
65,000	80,000
70,000	70,000
<Median>	
80,000	65,000
275,000	60,000



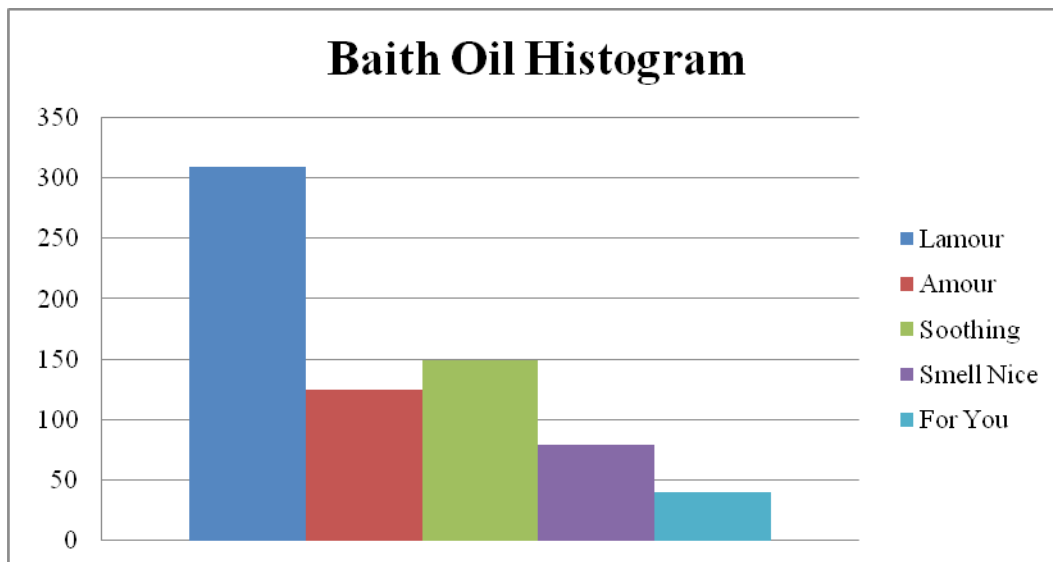


Figure 7

5. Mode is rather a rough average, but it is useful because it represents the most frequent or typical measure.

6. It should be pointed out that for data containing one or two extremely large or very small values, the arithmetic mean may not be representative. The centre point for such data can be better described, using a measure of central tendency called the median.

To illustrate the need for the median, suppose you are looking for an apartment in Palm Aire. Your agent said that the average price of the apartments is \$110,000. Would you still want to look? If you have budgeted your maximum purchase price between \$60,000 and \$75,000, you might think they were out of your price range. But checking the individual prices of the units might change your mind. They are \$65,000, \$70,000, \$80,000, and super deluxe penthouse costs \$275,000

The arithmetic mean price is \$110,000 as the real estate agent reported, but one price \$275,000 makes it to be an unrepresentative average. It does seem that the price between \$65,000 and \$75,000 is more representative than the arithmetic mean of \$110,000. In such cases the median provides a more accurate measure of central tendency.

7. The mode is very useful in describing discrete data. For example, a company has developed five bath oils. Fig 5.1 shows the result of marketing survey designed to find out which bath oil consumers prefer. The largest number of consumers favoured Lamoure. Thus Lamoure is the mode.

8. Geometrical mean. The geometrical mean of a set of numbers is defined as the  $N$ -th root of the product of  $N$  numbers. Thus the formula for the geometric mean is written:

$$\sqrt[n]{(X_1)(X_2)(X_3)\dots(X_n)}$$

It is especially useful if you want to determine the average percent change in sales, production or other business and economic series from one time period to another.

9. Arithmetic mean is the same measure that most people have in mind when they used the word "average". It is obtained by adding together all the values and dividing the resulting sum by the total number of values.

## 5.2 Text comprehension

### 5.2.1 Complete the following table

Measure of Central Tendency (average)	Usage	Computation
Arithmetic mean		
Median	For data containing one or two extremely large or very small values	
Mode		
Geometrical mean		The <i>n</i> -th root of the product of all values $\prod x_j$

## 5.3 Vocabulary activity

**5.3.1 The words "to call", "set", "to develop", "case" have several meanings. Match them with the meaning they have in the text**

To call	a) to have a particular name or title b) to telephone someone "c) to ask or order someone to come to you
A set	a) a television or a piece of equipment for receiving radio signals e.g. TV-set b) one part of a game such as tennis or volleyball c) a group of things that form a whole
To develop	a) to grow or gradually change into a larger or stronger stage b) to makes an argument or idea clearer c) to make a new idea, plan, product
A case	a) a large box or container b) a question or problem which is dealt with by a law court c) a situation
A product	a) something useful that is made in a factory b) the number you get by multiplying two or more numbers c) a result of someone's action

### 5.3.2 Word study

- a) Find in the text and translate sentences with the word "mind"  
 b) Match "mind"-phrases with their translations. Use dictionaries

- |                         |                    |
|-------------------------|--------------------|
| 1. To make up your mind | a) Не Ваше дело    |
| 2. To change your mind  | b) Прийти в голову |
| 3. To come to mind      | c) Скажите честно  |

- |                               |                           |
|-------------------------------|---------------------------|
| 4. To bring something to mind | d) Напомнить что-либо     |
| 5. To keep something in mind  | e) Помнить что-либо       |
| 6. Speak your mind            | f) Решить                 |
| 7. Would you mind             | g) Сменить мнение         |
| 8. Mind your own business     | h) Не будете ли Вы против |

**c) Tell in other words. Use "mind"- phrases**

1. He's decided to resign, and that's final. (e.g. He's made up his mind, and that's final.)
2. I've changed my opinion- I'll have beer instead.
3. We needed someone to look after the kids, and your name was the first we thought of.
4. These violent scenes remind me of the riots of last year.
5. It's a good idea- I'll remember it
6. Why don't just do what you are to do and leave me in peace?
7. May I open the window?

**5.3.3 Choose the correct word**

1. Average/rough earnings in the state are about \$ 1500a month.
2. She was able to give an accurate/average assessment of the situation.
3. Her hands were rough/ accurate from hard work.
4. Could you give me a rough/average idea of your plan?
5. An average/accurate student spends about two or three hours a night doing homework.

**5.3.4 Translate the sentences below. Pay attention to the translation of the word "average"**

1. The average of 3.8 and 10 is 7.
2. House prices have gone up by an average of 2 %.
3. On average men smoke more cigarettes the women.
4. The weekly profits average out at about \$1000.
5. Prices have risen by an average of 4 % .
6. My average daily income is about \$53.

**5.4 Grammar revision. Types of questions (see D 2 APPENDIX D)**

**5.4.1 Write general questions to the following sentences**

1. She speaks English well.

2. She has blue eyes.
3. They have already made the test.
4. He won't come to the party.
5. They are looking for jobs now.
6. Yesterday he went to his native town.
7. We have been living in this city for many years.

#### **5.4.2 Insert the following question words where necessary:**

who; where; why; what; how many; whose; when; how

- 1 ... are we going to the cinema? – On Friday.
- 2 ... is he by occupation? – Senior manager of a joint venture.
- 3 ...are you going to do on Friday? – I don't know yet.
- 4 ... textbooks do you have? – I have eight textbooks.
- 5 ... measures the central tendency?

#### **5.4.3 Write the alternative questions in such a manner that the following sentences would be answers to them**

1. I prefer coffee.
2. We are going by bus. It's cheaper.
3. She is English.
4. I think we will have a dictation.
5. I am more interested in Russian literature.
6. It was a very clean and nice place.
7. I have been to London.

#### **5.4.4 Put tail questions to the following sentences**

1. Yesterday Paul went to the swimming pool. 2. My new bag costs thirty dollars. 3. On Monday we have History, Psychology and English. 4. Most of the students in our group speak two foreign languages. 5. Children do not like to go to bed early. 6. My parents are planning a trip to Greece. 7. The shop will be closed until next month. 8. John cannot meet Mike because he is ill. 9. The Simpsons live on the second floor.

#### **5.5 Word order**

a) Use words in the column A to write questions to the text "Measures of Central tendency"

Column A	Column B
1. Why/use /statisticians/measures of central tendency/do?	a) arithmetic mean
2. The/measures of central tendency/are /what/four?	b) data with one or two extremely large or small values
3. The/most/used/what/is/average/commonly?	c) arithmetic mean, median, mode, geometrical mean
4. What kind/are/described/of data/better/with the median?	d) to summarise dots and to pinpoint the centre of a set of data
5. When/the mode/statisticians/do/ /use/the/mean/geometrical?	e) to describe discrete data; to average percents and ratios
1. How/the/ calculated/mean/ is/ geometrical	f) $n$ -th root of the product of $n$ numbers.

**b) Write full answers to the questions from the column A. Use words from the column B**

## 5.6 Speaking Skills. Retell the text "Measures of the Central Tendency"

### 5.7 Text 2. Learn to read newspapers

**a) Which of the following statements is true? Explain why you think so**

- Americans drink more than Russians.
- Russians drink more than Americans.

**b) Divide the words below into two groups: 1) Abstinence; 2) Alcohol addiction**

Hard-drinking minority, sober, heavy drinker, to drain the keg, hangover

**c) Read the article**

#### **Americans Seem to Drink a Lot or Hardly at All**

1. When you toast the New Year tomorrow night, will you be raising the medically correct one or two drinks, or will you feel more like draining the keg?

2. America's drinking habits were ever a story of extremes. On average, we're drinking less alcohol than at any time since the early 1960s. But a hard-drinking minority takes an extremely big swig of total alcohol consumption. About half of the alcohol drunk in the country is consumed in five or more drinks at a time, surveys shows.

3. "We're a light-drinking country with lots of abstainers, but we have a pocket of heavy-drinkers- especially among young men," says Thomas Greenfield, senior scientist at the Alcohol Research Group, Calif. -based non-profit agency. Fully one-third of Americans report they drink no alcohol at all. Of the two-thirds who drink, most do so moderately, he says.

4. Nationwide, the growth of abstinence and the decline of heavy drinking since 1980s is explained by rising health consciousness among the Americans and greater caution about the hazards\* of drinking and driving. The population of heavy drinkers

hasn't risen over the past decade.

---

\*опасность, риск

### 5.7.1 Summarize the main ideas of the article

- 1)..... the main idea of paragraphs 1 through  
2:.....  
2)..... the main idea of paragraphs 3 through  
4:.....

### 5.7.2 Fill in the blanks with the correct information from the articles

In general Americans drink.....alcohol than at any time since the early.....  
About 50 % of all the alcohol drunk in the country is ..... in five or more drinks  
at a time.

There are a lot of ..... in America, but at the same time there many heavy  
drinkers.

The number of heavy drinkers hasn't ..... over the past decade.

#### a) What do the phrases below mean?

- 1) a big swig of total alcohol consumption
- 2) to have a pocket of heavy drinkers
- 3) health consciousness
- 4) medically correct

#### b) Are the following statements facts or opinions? (Remember, a fact is information that can be proved)

1. Americans are drinking less alcohol than at any time since the early 1960s.
2. America is a light-drinking country.
3. One-third of Americans report they do not drink alcohol.
4. Two-thirds who drink, do so moderately.
5. In America there are as many heavy-drinkers as there were ten years ago.

## 6 Describing Distributions with Numbers

### 5.8 Vocabulary activity

a mean	средняя
--------	---------

a median	медиана
an outlier	выделяющееся значение
a notation	значение, система обозначений
skewed	асимметричный, неравномерный
a resistant measure	устойчивое измерение
odd	непарный, случайный, лишний
a bar	черта

### 6.1.1 Choose the right Russian translation of the following words

- |                        |                          |
|------------------------|--------------------------|
| 1) a mean              | a) значение              |
| 2) a median            | b) асимметричный         |
| 3) an outlier          | c) медиана               |
| 4) a notation          | d) устойчивое измерение  |
| 5) skewed              | e) выделяющееся значение |
| 6) odd                 | f) черта                 |
| 7) a resistant measure | g) средняя               |
| 8) a bar               | h) случайность           |

### 6.1.2 Match the parts of the sentences

The most common measure of center is  
The *median* is  
You will need to use software or a graphing calculator  
To find the *mean* of a set of observations,  
Medians require little arithmetic,

add their values and divide by the number of observations.  
to automate finding the median.  
is the ordinary arithmetic average, or *mean*.  
so they are easy to find by hand for small sets of data.  
is the formal version of the midpoint.

### 6.1.3 Match the words and their definitions

- |                                |   |
|--------------------------------|---|
| 1) mean;                       | a) is the midpoint of a distribution;   |
| 2) the symmetric distribution; | b) is the distribution which mean is farther out in the long tail than is the median; |
| 3) median;                     | c) is the measure that is not influenced by extreme observations;                     |
| 4) skewed distribution;        | d) is the ordinary arithmetic average;  |
| 5) resistant measure.          | e) is the distribution which parts are the same .                                     |

### 6.2 Read the text. Match the paragraphs and the titles

1. Measuring center: the mean
2. Comparing the mean and the median
3. Measuring center: the median

How much do people with a bachelor's degree (but no higher degree) earn? Here are the incomes of 15 such people, chosen at random by the Census Bureau in March 2011 and asked how much they earned in 2010. Most people reported their incomes to the nearest thousand dollars, so we have rounded their responses to thousands of dollars.

110 25 50 50 55 30 35 30 4 32 50 30 32 74 60

Table 15 is a stem plot of these amounts. The distribution is irregular in shape, as is common when we have only a few observations. There is one high outlier, a person who made \$110,000. Our goal is to describe with numbers the center and spread of this and other distributions. The most common measure of center is the ordinary arithmetic average, or *mean*.

Table 15.- Stem plot of the earnings (in thousands of dollars) of 15 people chosen at random from all people with a bachelor's degree but no higher degree

center	spread
0	4
1	
2	5
3	000125
4	
5	0005
6	0
7	4
8	
9	
10	
11	0

To find the **mean** of a set of observations, add their values and divide by the number of observations. If the  $n$  observations are  $x_1, x_2, \dots, x_n$ , their mean is

$$\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

or in more compact notation,

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$



The  $\Sigma$  (capital Greek sigma) in the formula for the mean is short for “add them all up.” The subscripts on the observations  $x_i$  are just a way of keeping the  $n$  observations distinct. They do not necessarily indicate order or any other special facts about the data. The bar over the  $x$  indicates the mean of all the  $x$ -values. Pronounce the mean  $\bar{x}$  as “x-bar.” This notation is very common.

When writers who are discussing data use  $x$  or  $y$ , they are talking about a mean.

**EXAMPLE.** Earnings of college graduates

The mean earnings for our 15 college graduates are

$$\begin{aligned} \bar{x} &= (x_1 + x_2 + \cdots + x_n) : n \\ &= (110 + 25 + \cdots + 60) : 15 \\ &= 666 = 44.4, \text{ or } \$44,400 \end{aligned}$$

In practice, you can key the data into your calculator and hit the mean key. You don't have to actually add and divide. But you should know that this is what the calculator is doing.

If we leave out the one high income, \$110,000, the mean for the remaining 14 people is \$39,700. The lone outlier raises the mean income of the group by \$4700. center: it is sensitive to the influence of a few extreme observations. These may be outliers, but a skewed distribution that has no outliers will also pull the mean toward its long tail. Because the mean cannot resist the influence of extreme observations, we say that it is not a **resistant measure** of center.

**B)** We used the midpoint of a distribution as an informal measure of center. The *median* is the formal version of the midpoint, with a specific rule for calculation.

The **median**  $M$  is the midpoint of a distribution, the number such that half the observations are smaller and the other half are larger. To find the median of a distribution:

1. Arrange all observations in order of size, from smallest to largest.
2. If the number of observations  $n$  is odd, the median  $M$  is the center observation in the ordered list. Find the location of the median by counting  $(n + 1)/2$  observations up from the bottom of the list.
3. If the number of observations  $n$  is even, the median  $M$  is the mean of the two center observations in the ordered list. The location of the median is again  $(n + 1)/2$  from the bottom of the list.

Note that the formula  $(n + 1)/2$  does *not* give the median, just the location of the median in the ordered list. Medians require little arithmetic, so they are easy to find by hand for small sets of data. Arranging even a moderate number of observations in order is very tedious, however, so that finding the median by hand for larger sets of data is unpleasant. Even simple calculators have an  $x$  button, but you will need to use software or a graphing calculator to automate finding the median.

**EXAMPLE 5.** Finding the median: odd  $n$

What are the median earnings for our 15 college graduates? Here are the data arranged in order:

4 25 30 30 30 31 32 **35** 50 50 50 55 60 74 110

The count of observations  $n = 15$  is odd. The bold **35** is the center observation in the ordered list, with 7 observations to its left and 7 to its right. This is the median,  $M = 35$ .

Because  $n = 15$ , our rule for the location of the median gives location of

$$M = (n + 1) : 2 = 16 : 2 = 8$$

That is, the median is the 8th observation in the ordered list. It is faster to use this rule than to locate the center by eye.

C) The mean and median of a symmetric distribution are close together. If the distribution is exactly symmetric, the mean and median are exactly the same. In a skewed distribution, the mean is farther out in the long tail than is the median. Distributions of incomes are usually skewed to the right—there are many modest incomes and a few very high incomes. For example, the Census Bureau survey in March 2011 interviewed 16,018 people aged 25 to 65 who were in the labor force full-time in 2001 and who were college graduates but had only a bachelor's degree. We used 15 of these 16,018 incomes to introduce the mean and median. The median income for the entire group was \$45,769. The mean of the same 16,018 incomes was much higher, \$59,852. Reports about incomes and other strongly skewed distributions usually give the median (“midpoint”) rather than the mean (“arithmetic average”). However, a county that is about to impose a tax of 1 % on the incomes of its residents cares about the mean income, not the median. The tax revenue will be 1 % of total income, and the total is the mean times the number of residents. The mean and median measure center in different ways and both are useful.

### 6.2.1. Answer the questions

1. What is the most common measure of a centre?
2. Do medians require little or much arithmetic?
3. Does a median need a specific rule for calculation?
4. In what cases the mean and the median of the curve are the same?
5. Are both the mean and the median useful in measuring centre?

### 6.2.2 Complete the sentences

1. The  $\Sigma$  (capital Greek sigma) in the formula for the mean ...
2. The mean and median of a symmetric distribution ...
3. To find the **mean** of a set of observations ....
4. Because the mean cannot resist the influence of extreme observations ...

### 6.2.4 Give a short summary of the text. Use phrases

#### HELP BOX

The text is titled ...

The text examines ...

The text covers the problems of ...

The main point of the text is ... Next comes ... To sum it up ...
---

### **6.3 Grammar activity. Participles. (see D 7 APPENDIX)**

#### **6.3.1 Open brackets use the verbs in the form of participles**

1. This article covers the problems (to describe) statistics.
2. (To build) graphs, charts or histograms we can analyse statistical data more accurately.
3. Statistical data (to give) in the report were shocking.
4. Inferences (to make) in statistics are of two types: estimation and hypothesis testing.
5. (To measure) all values scientists can take proper decisions.

#### **6.3.2 Using the given phrases say it in English**

##### **to analyse data**

учёные, анализирующие данные  
данные, которые анализируют  
проанализировав данные  
анализируя данные

##### **to illustrate the situation**

ситуация, которую проиллюстрировали  
иллюстрируемая ситуация  
статистик, иллюстрирующий ситуацию  
проиллюстрировав ситуацию

##### **to investigate the problem**

проблема, которую исследуют  
исследуемая проблема  
студент, исследующий проблему  
исследуя проблему

##### **to collect data**

собирая данные  
собранные данные  
данные, которые собирают  
сбрав все данные

### 6.3.4 Translate into English using participles

1. Статистические данные, используемые в науке, помогают принять правильные решения.

2. В документе представлена серия тщательно проверенных данных.

3. Во время эксперимента учёные использовали новейшие рекомендуемые методы.

4. Они проиллюстрировали статистические данные, используя различные формы графического представления.

5. Журналистам, принимающим участие в пресс-конференции, вход разрешён по специальному пропуску.

## 6.4 Apply your knowledge

### 6.4.1 Find the mean or the median for the data. Describe the procedure

**A. Sports car gas mileage.** Table 16 gives the gas mileages for the 22 two-seater cars listed in the government's fuel economy guide.

a) Find the mean highway gas mileage from the formula for the mean.

Then enter the data into your calculator and use the calculator's  $x$  button to obtain the mean. Verify that you get the same result.

b) The Honda Insight is an outlier that doesn't belong with the other cars. Use your calculator to find the mean of the 21 cars that remain if we leave out the Insight. How does the outlier change the mean?

Table 16 - Gas mileage (miles per gallon) for 2002 model two-seater cars

Model	City	Highway	Model	City	Highway
Acura NSX	17	24	Honda Insight	57	56
Audi TT Quattro	20	28	Honda S2000	20	26
Audi TT Roadster	22	31	Lamborghini Murcielago	9	13
BMW M Coupe	17	25	Mazda Miata	22	28
BMW Z3 Coupe	19	27	Mercedes-Benz SL500	16	23
BMW Z3 Roadster	20	27	Mercedes-Benz SL600	13	19
BMW Z8	13	21	Mercedes-Benz SLK230	23	30
Chevrolet Corvette	18	25	Mercedes-Benz SLK320	20	26
Chrysler Prowler	18	23	Porsche 911 GT2	15	22
Ferrari 360 Modena	11	16	Porsche Boxster	19	27
Ford Thunderbird	17	23	Toyota MR2	25	30

c) What is the median highway mileage for the 22 two-seater cars listed in Table 2.6? What is the median of the 21 cars that remain if we remove the Honda Insight?

d) Compare the effect of the Insight on mean mileage and on the median mileage. What general fact about the mean and median does this comparison illustrate?

**B. House prices.** The mean and median selling price of existing single-family homes sold in June 2010 were \$163,900 and \$210,900. Which of these numbers is the mean and which is the median? Explain how you know.

**C. Barry Bonds.** The major league baseball single-season home run record is held by Barry Bonds of the San Francisco Giants, who hit 73 in 2001. Here are Bonds's home run totals from 1986 (his first year) to 2002:

16 25 24 19 33 25 34 46 37 33 42 40 37 34 49 73 46

Bonds's record year is a high outlier. How do his career mean and median number of home runs change when we drop the record 73? What general fact about the mean and median does your result illustrate?

## 6.5 Translate from Russian into English

Средние величины – важнейшие статистические показатели. При вычислении по однородным данным они характеризуют типичные значения признаков. Показатель средней зависит не только от однородности, но и от объёма данных – при прочих равных условиях, чем больше объём наблюдения, тем более надёжна средняя величина.

Медиана относится к структурным характеристикам распределения. Мы часто используем среднюю распределения как неформальный центр измерения. Медиана – это формальная величина средней, для вычисления которой используется особое правило. Медиана делит совокупность на две равные части – со значениями признака меньше медианы и со значениями признака больше медианы.

## 7 Normal distribution

### 7.1 Text comprehension. Read the text and do assignments after it

We now have a kit of graphical and numerical tools for describing distributions. What is more, we have a clear strategy for exploring data on a single quantitative variable:

1. Always plot your data: make a graph, usually a histogram or a stem plot.
2. Look for the overall pattern (shape, center, spread) and for striking deviations such as outliers.
3. Calculate a numerical summary to briefly describe center and spread. Here is one more step to add to this strategy:
4. Sometimes the overall pattern of a large number of observations is so regular that we can describe it by a smooth curve.

The curve is a **mathematical model** for the distribution. A mathematical model is an idealized description. It gives a compact picture of the overall pattern of the data but

ignores minor irregularities as well as any outliers. It is easier to work with the smooth curve than with the histogram. The reason is that the histogram depends on our choice of classes, while with a little care we can use a curve that does not depend on any choices we make. Here's how we do it.

A **density curve** is a curve that is always on or above the horizontal axis, and has area exactly underneath it. A density curve describes the overall pattern of a distribution. The area under the curve and above any range of values is the proportion of all observations that fall in that range.

**Normal curve.** The density curve in Figure 8 (a) is a **normal curve**. Density curves, like distributions, come in many shapes. Fig.8 (b) shows two density curves: a symmetric normal density curve and a right-skewed curve. A density curve of the appropriate shape is often an adequate description of the overall pattern of a distribution. Outliers, which are deviations from the overall pattern, are not described by the curve. Of course, no set of real data is exactly described by a density curve. The curve is an approximation that is easy to use and accurate enough for practical use.

### **The median and mean of a density curve**

Our measures of center and spread apply to density curves as well as to actual sets of observations. The median and quartiles are easy. Areas under a density curve represent proportions of the total number of observations. The median is the point with half the observations on either side. So **the median of a density curve is the equal-areas point**, the point with half the area under the curve to its left and the remaining half of the area to its right. The quartiles divide the area under the curve into quarters. One-fourth of the area under the curve is to the left of the first quartile, and three-fourths of the area is to the left of the third quartile. You can roughly locate the median and quartiles of any density curve by eye by dividing the area under the curve into four equal parts. Because density curves are idealized patterns, a symmetric density curve is exactly symmetric. The median of a symmetric density curve is therefore at its center. It isn't so easy to spot the equal-areas point on a skewed curve. There are mathematical ways of finding the median for any density curve.

What about the mean? The mean of a set of observations is their arithmetic average. If we think of the observations as weights strung out along a thin rod, the mean is the point at which the rod would balance. This fact is also true of density curves. **The mean is the point at which the curve would balance if made of solid material.** A symmetric curve balances at its center because the two sides are identical. **The mean and median of a symmetric density curve are equal.** We know that the mean of a skewed distribution is pulled toward the long tail.

The **median** of a density curve is the equal-areas point, the point that divides the area under the curve in half.

The **mean** of a density curve is the balance point, at which the curve would balance if made of solid material.

The median and mean are the same for a symmetric density curve. They both lie at the center of the curve. The mean of a skewed curve is pulled away from the median in the direction of the long tail. We can roughly locate the mean, median, and quartiles of any density curve by eye. This is not true of the standard deviation. When necessary, we can

once again call on more advanced mathematics to learn the value of the standard deviation. The study of mathematical methods for doing calculations with density curves is part of theoretical statistics.

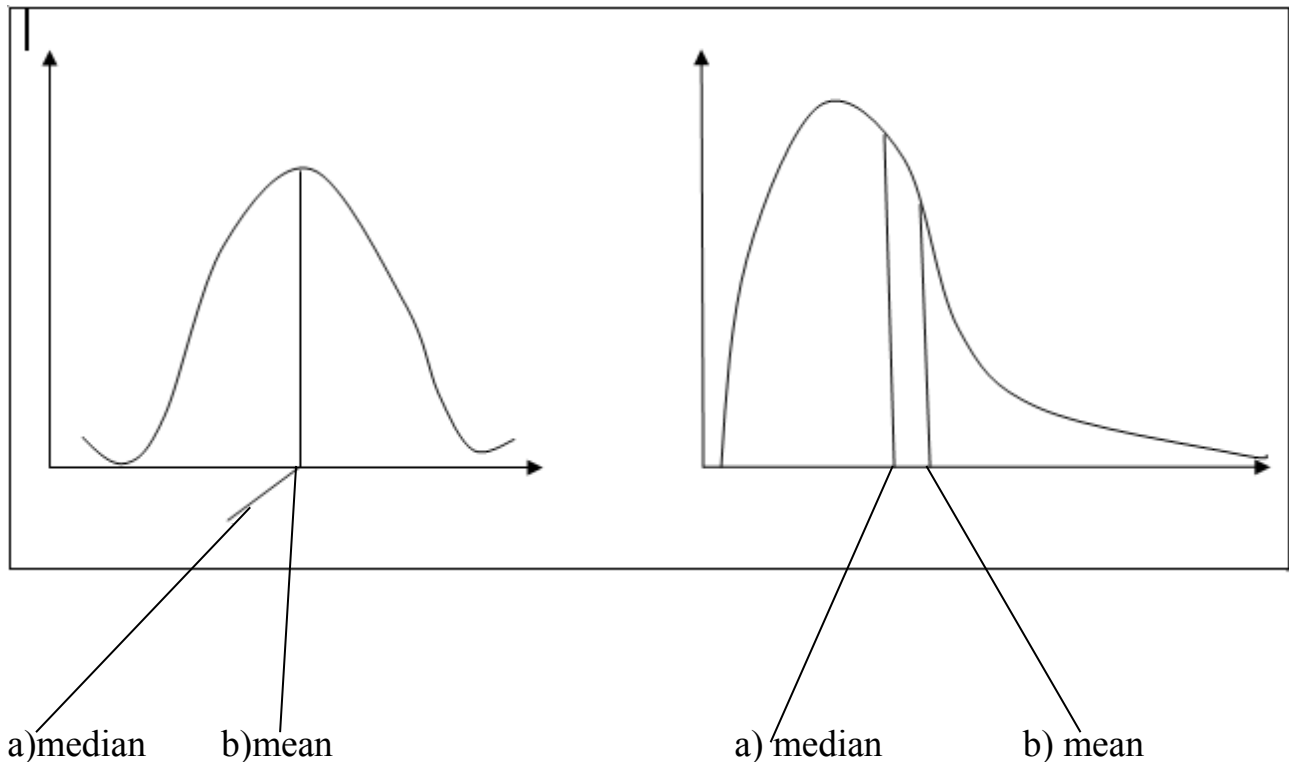


Fig 8 (a)-The median and mean of symmetric curve.

Fig 8 (b)-The median and mean of right-skewed curve.

### 7.1.1 Answer the questions

1. What is the strategy for exploring data on a single quantitative variable?
2. What is the curve for a distribution?
3. How can we describe the density curve?
4. What is the difference between normal curve and skewed curve?
5. Can be outliers described by a curve?
6. What is the median of a density curve?
7. What is the mean of a density curve?
8. How do the mean and the median look like in symmetric and skewed curves?

### 7.1.2 Find the English equivalents for the following Russian expressions

исследуемые данные; графические инструменты; гладкая кривая; математическая модель; с некоторой осторожностью; нормальная кривая; подобно распределениям; в разных видах; кривая, склонённая вправо; квартиль; одна четвёртая пространства; расположить на глаз; идеализированные образцы; математический способ нахождения; средняя арифметическая; точка балансирования; выполнение расчётов; часть теоретической статистики

### **7.1.3 Retell the text according to the patterns**

1. The strategy for exploring data.
2. A curve like a mathematical model.
3. A density curve.
4. A normal curve.
5. The median and mean of a density curve.

### **7.2 Vocabulary activity**

**7.2.1 There are no absolute synonyms, but one Russian verb can be expressed and represented by several English equivalents. Learn to distinguish and differentiate them in different contexts and styles. Consult the dictionary if necessary**

1. to say – to tell – to state – to claim – to hold – to assert – to maintain
2. to define – to determine – to identify – to specify – to fix the meaning
3. to understand – to make out – to follow – to apprehend – to comprehend
4. to estimate – to evaluate – to appreciate – to assess – to value
5. to denote – to indicate – to designate – to name – to appoint – to assign

### **7.3 Grammar activity. Word formation (see D 5 APPENDIX D)**

#### **7.3.1 Form as many nouns as you can from the verbs and translate them**

e.g. to employ – employment – unemployment – the employed – the unemployed – employer - employee

To regulate -  
To act -  
To produce -

To consume -  
To govern -  
To earn -

#### **7.4 Apply your knowledge. Picture data with a histogram**

Numerical data in their raw, unorganized form are hard to absorb. For example, look at which shows the 2000 population estimates for each of the 50 states (and the District of Columbia), put together by the U.S. Census Bureau. Stare at the table for 30 seconds or so. After you've done that that, go ahead and try to answer these questions quickly:

- Which states have the largest/smallest populations?
- How many people reside in most of the states? Give a rough range of values.
- How much variability exists between state populations? (Are the states very similar, or very different, in terms of their total population?)



Table 17 – Population Estimate by State (2000 Census)

State	Population	State	Population
Alabama	4,447,100	Montana	902,195
Alaska	626,932	Nebraska	1,711,263
Arizona	5,130,632	Nevada	1,998,257
Arkansas	2,673,400	New Hampshire	1,235,786
California	33,871,648	New Jersey	8,414,350
Colorado	4,301,261	New Mexico	1,819,046
Connecticut	3,405,565	New York	18,976,457
Delaware	783,6	North Carolina	8,149,313
District of Columbia	572,059	North Dakota	642,2
Florida	15,982,379	Ohio	11,353,140
Georgia	8,186,453	Oklahoma	3,450,654
Hawaii	1,211,537	Oregon	3,421,399
Idaho	1,293,953	Pennsylvania	12,281,054
Illinois	12,419,293	Rhode Island	1,048,319
Indiana	6,080,485	South Carolina	4,012,012
Iowa	2,926,324	South Dakota	754,844
Kansas	2,688,418	Tennessee	5,689,283
Kentucky	4,141,769	Texas	20,851,820
Louisiana	4,468,976	Utah	2,233,169
Maine	1,274,923	Vermont	608,827
Maryland	5,296,486	Virginia	7,078,515
Massachusetts	6,349,097	Washington	5,894,121
Michigan	9,938,444	West Virginia	1,808,344
Minnesota	4,919,479	Wisconsin	5,363,675
Mississippi	2,844,658	Wyoming	493,782
Missouri	5,595,211		
		<b>U.S. TOTAL</b>	<b>281,421,906</b>

Without some way of organizing these data, you have difficulty answering these questions.

Because the data are numerical, the categories are ordered from smallest to largest. The height of each bar of a histogram represents either the number of individuals in each group (also known as the *frequency* of each group) or the percentage of individuals in each group (also known as the *relative frequency* of each group). A histogram provides a more interesting organizational summary of a data set than a table does.

## 7.5 Translate into Russian

Statistics is the science of the collection, organization, and interpretation of data. It deals with all aspects of this, including the planning of data collection in terms of the

design of surveys and experiments. Statistics is closely related to probability theory, with which it is often grouped. A statistician is someone who is particularly well versed in the ways of thinking necessary for the successful application of statistical analysis. Such people have often gained this experience through working in any of a wide number of fields.

There is also a discipline called mathematical statistics, which - is concerned with the theoretical basis of the subject. The word statistics, when referring to the scientific discipline, is singular, as in "Statistics is an art." This should not be confused with the word statistic, referring to a quantity (such as mean or median), calculated from a set of data, which's plural is statistics, e.g. "This statistic seems wrong." or "These statistics are misleading."

### 7.5.1 Put 5 questions to the text

## 8 Index Numbers

### 8.1 Vocabulary activity

#### 8.1.1 Read the following words. Try to remember their meanings

1) to measure	1) измерять
2) to compile	2) составлять
3) to increase	3) увеличиваться, расти
4) to assess	4) оценивать
5) to convert	5) превращать, переводить
6) to serve	6) служить, выполнять
7) to determine	7) определять
8) to cover	8) охватывать
9) to include	9) включать
10) approach	10) подход
11) consumer	11) потребитель
12) retail sales	12) розничная торговля
13) convenient	13) удобный
14) evident	14) явный, очевидный
15) frequent	15) частый
16) diverse	16) разнообразный
17) recent	17) недавний
18) regarding	18) относительно (предлог)

#### 8.1.2 Match English words and their Russian translation

1) innovation	а) часть
---------------	----------

2) inflation	б) городской
3) heterogeneous	в) колебание
4) fluctuation	г) разрушать
5) series	д) пересматривать
6) to erode	е) разнородный
7) to revise	ж) ряд
8) proportion	з) нововведение
9) base period	и) базовый капитал
10) urban	к) инфляция

### 8.1.3 Read the passages. Choose the most suitable translation of the underlined words

1. Consumption patterns have changed greatly, hi the beginning of the century people started to buy automobiles instead of horses. In 1910 people spent little money on their children's higher education. But now they spend on it a sizable amount of their income:

- a) модель поведения потребителя;
- b) модель для покупателя;
- c) модель автомобиля.

2. Wage earners are heads of families. They are the main supporters of their families because they earn money:

- a) папа;
- b) наемный работник;
- c) кормилец.

3. Consumer Price Index measures the changes in the prices of a fixed market basket of goods and services. This basket nowadays includes 400 items. Among these items there are golf balls, hamburgers, beer, bread, haircuts:

- a) корзина для продуктов;
- b) корзина для рынка;
- c) потребительская корзина.

4. Consumer expenditure survey is conducted from time to time. Its aim is to investigate consumption patterns and to find out the items of a market basket:

- a) экспедиционное исследование;
- b) исследование модели поведения потребителей;
- c) поведение потребителей.

## 8.2 Reading

### 8.2.1 Read and translate the text

#### Index Numbers

Index numbers are very useful statistical tools. Many indexes, for example, consumer price index appears on the nightly television news/on the front of local newspapers, in *The Wall Street Journal*, and in other business publications.

#### Example

Consumer prices rose in May to 117.5 % of the 1982-84 average from 117.1 % in April...This was the smallest gain in the three months as clothing prices levelled off after increasing sharply earlier this year, the Labour Department reported..Although many economists still expect inflation to accelerate later this year, the May report suggests that price increases at the consumer level may remain moderate the next few months, except for anticipated jump in food prices.

Index number is a percent that measures the change in price, quantity, value, or some other items of interest from one time to another. The index number allows us to express a change in price, quantity, or value as a percent.

Compiling index numbers, such as the producer price index (PPI), is not a recent innovation. An Italian, G.R. Carli, has been credited with originating the first index numbers in 1764. They were incorporated in the report he made about price fluctuation in Europe from 1500 to 1750. No systematic approach to collecting and reporting data in index form was evident in the USA until about 1900. The cost-of-living index (now called the consumer price index) was introduced in 1913, and the list of indexes has increased steadily since then.

#### Why convert data into indexes?

An index is a very convenient way of expressing a change in a heterogeneous group of items. The consumer price index (CPI), for example, includes in itself about 400 items-such as golf balls, lawn mowers, hamburgers, funeral services, and dentists' fees. Prices are expressed in dollars per pounds, box, yard, and many other different units. Only by converting the prices of these many diverse goods and services to one index number every month can the federal government keep informed of the overall movement of consumer prices and inflation.

Converting data into indexes also make it easier to assess the trend in data sets composed of large numbers. For example, suppose 1989 retail sales were \$185,679,432,621.87 and 1982 sales were \$185,500,000.000.00. The increase of \$179,432,621.87 looks significant, Yet if the 1989 sales total were expressed as an index based on 1982 sales, the increase would be less then one tenth of 1 percent!

#### Consumer Price Index

Consumer price index (CPI) is one of the most important indexes. It measures the change in prices of a fixed market basket of goods and services from one period to another. In January 1978 the Bureau of Labour statistics began publishing CPIs for two

groups of the population. One index, for all urban consumers, covers about 80 % of the total population. The other index is for urban wage earners and clerical workers and covers about 32 % of the population.

In brief, the CPI serves several major functions. It allows consumers to determine the degree to which their purchasing power is being eroded by price increases. In that respect, it is a yardstick for revising wages, pensions, and other income payments to keep pace with changes in prices. It is also an important economic indicator of the rate of inflation in the USA.

The index includes about 400 items. About 250 part-time and full-time agents collect price data monthly. Prices are collected from more than 21,000 retail establishments and 60,000 housing units in 91 urban areas across the country. The prices of baby cribs, bread, beer, cigars, gasoline, haircuts, physicians' fees, taxes, and operating-room charges are just few of the items included in what is often termed a typical "market basket" of goods and services.

Originated in 1913 and published regularly since 1921, the *standard reference period* (the base period) has been updated periodically. The base period prior to the present (1982-84) period were 1967, 1957-59, 1947-49, 1935-39, and 1925-29.

The reason for frequent changes in the base period is obvious. It changes because the consumers always change the manner of spending money. The automobile has replaced the horse as a mode of transportation. In the 1910s and 1920s a relatively small part of the income of wage earners and clerical workers was spent on higher education. Now the typical family spends a sizable amount on the higher education of its children, and the CPI reflects all changes in costs of tuition, books, and home computers.

In addition to changing the base period, the Bureau of Labour statistics conduct an extensive consumer expenditure survey from time to time to determine what items are to be included in the CPI and the relative weights to be put on CDs, bananas, gasoline, rent, and so on.

The CPI is not one index. There are consumer price indexes for New York City, Chicago, and a number of other large cities. There are price indexes for food, apparel, medical care, and other items. A few of them are shown below for April 1988 (the prices of 1982-84 =100 %)

Table 18

<b>Items</b>	<b>April 1988</b>
All items	117.1
Food and beverages	116.7
Apparel and upkeep	117.0
Transportation	107.2
Medical care	136.9
Entertainment	119.6
Housing	117.3

Source: U.S. department of labour, *Monthly Labour Review*, June 1988.

A perusal of this listing shows that the weighted price of all items combined increased 17.1 % since 1982-84, medical care increased the most (36.9 %), and transportation went up the least (7.2 %).

### 8.3 Text Comprehension

#### 8.3.1 Select sentences that expresses the ideas of the text

1. Converting data into indexes is a very important statistical method.
2. Index numbers show the price differences in different countries.
3. G. R. Carli was first to compile index numbers.
4. American statisticians began to compile indexes only in the beginning of the 20<sup>th</sup> century.
5. There are as many indexes now as there were in 1913.
6. Index numbers make it easier to show changes in groups consisting of various items.
7. Consumer Price Index is used to measure changes in industry output.
- 8..... There are two CPI indexes.
- 9..... Base period has never been changed since 1913
10. Base period is changed because people start to spend money in a different way.
11. To find out the items of the CPI, the Bureau of Labour Statistics sets up special surveys.

#### 8.3.2 Scan the text to find out:

- 1) the definition of the index as a statistical method;
- 2) the meaning of Carli's indexes;
- 3) the items of the market basket of the CPI;
- 4) the percentage of the population covered by CPI for all- urban consumers;
- 5) the functions of the CP.

#### 8.3.3 Find the groups of synonyms. Read from the text the sentences with words from the right column

1) to help	a) to determine
2) to become larger	b) to cover
3) to include	c) to increase
4) trend	d) to make it easier
5) to unite	e) movement
6) rate	f) to incorporate
7) to decide	g) to encompass

8) to keep pace with	h) degree
9) to be interested in	i) to be concerned with
	j) to be on the same level with

**8.3.4 Scan each paragraph to find words that means the opposite to the words listed below:**

- 1) useless (1);
- 2) old (2);
- 3) decrease (2);
- 4) handy (3);
- 5) unimportant (5);
- 6) to improve (7);
- 7) unusual(8);
- 8) seldom (9).

**8.3.5 Match the following verbs with the correct nouns in order to get meaningful expressions:**

- |                 |           |                            |
|-----------------|-----------|----------------------------|
| 1) to measure   | a)        | into the market            |
| 2) to increase  | basket    |                            |
| 3) to convert   | b)        | prices                     |
| 4) to determine | c)        | several                    |
| 5) to assess    | functions |                            |
| 6) to include   | d)        | trends in prices           |
| 7) to serve     | e)        | wages                      |
| 8) to compile   | f)        | indexes                    |
| 9) to collect   | g)        | the                        |
|                 |           | purchasing power of dollar |
|                 | h)        | data                       |
|                 | i)        | changes                    |

**8.3.6 Answer the questions using the word combinations from the exercise above**

1. What are indexes used for?
2. How can the federal government assess correctly the trends in prices?
3. Why is the CPI compiled?
4. What items does the market basket consist of?
5. Who compiled first indexes?
6. How is the CPI compiled?

## **8.4 Grammar Revision**

### 8.4.1 Word formation

**Remember**  
**Suffixes of Adjectives**  
culture+al=cultural  
economy+ic=economic  
power+ful=powerful  
value+able=valuable

a) **Translate the adjectives and write the words from which they are formed:**

remarkable	variable	suitable
changeable	profitable	countable
exchangeable	marketable	fashionable
understandable	readable	charitable

b) **Form adjectives with the help of the suffixes and translate them:**

<b>-al</b>	<b>-ive/-tive</b>	<b>-ent/-ant</b>	<b>-ese</b>
environment	to relate	to differ	China
industry	to comprehend	to observe	Japan
government	quality		
form	quantity		
nation	resultive		

**8.4.2 Translate the following sentences. Pay attention to the gerund constructions**

1. Reflecting the university life is the main aim of the newspaper 'University News'
2. Collecting and analyzing numerical data are the most important tasks of statisticians.
3. The Chief Manager insists on converting the profit data in indexes.
4. Frequent revising of the base period is important.
5. Compiling indexes is not a recent innovation.
6. By converting data into indexes the federal government can assess the trends in prices.



**8.4.3 Word order. The words in the sentences are not in the correct order. Rewrite the sentences putting the words in a right way:**

- 1) are/ there/ for/ population/ two of/ CPIs;
- 2) measure/ Indexes/ the changes/ in various/ of interest/ items;
- 3) compiled/ Indexes/ G. R. Carli/the first;
- 4) contains/ basket/ the typical/ items/ market/ 400/;
- 5) The CPI/ to determine/ is/ the real/ is/ power/ purchasing/ of dollar;
- 6) Indexes/help/to see/ movement/in series/ numbers/ large/ of.

**8.4.4 Conditionals. (see D 7 APPENDIX D) Translate them:**

1. If the 2010 sales total were expressed as an index based on 1982 sales, the increase would be less than one tenth of a percent.
2. If the Bureau of Labour Statistics did not conduct consumer expenditure survey, it would not know what items to include into the market basket.
3. We will make correct decision if the data are accurate.
4. If they had estimated the situation correctly, the scientists wouldn't have made a mistake.

**8.4.5 Supply the correct form of the verbs**

1. If I (to be) to assess trends in the factory output I (to compile) an output index.
2. We (to change) the retail prices if the wholesale prices (to increase)
3. If the consumption patterns (to remain) the same, There would be no need in changing the base period.
4. I (to be able to do) more accurate forecast if I (to have) more time.
5. I (can) find a better job if I (not to have) children.

## **8.4 Speaking Skills**

**8.5.1 Say two or three sentences on each item from the plan below**

- 1) General notion of the index numbers;
- 2) History of indexes;
- 3) Application of indexes;
- 4) CPI;
  - a) CPI application;
  - b) Functions of the CPI;
  - c) The way of compiling CPI.

**8.6 Summarize the text**

## **8.7 Answer the following questions. Share your ideas with group-mates**

1. Where would you prefer to live in your own house or in your own flat?
2. What is the price of a single-family home in Orenburg? Of a flat? What does the prices depend on? (prompts: the location of the house (flat), the presence of modern conveniences, the size of the house (flat))
3. How do prices on immovable change? Do they grow or fall?

## **8.8 Apply your knowledge**

### **8.8.1 Text 2 Read the text about home sales in Washington. While reading guess the year reported, 1996 or 1997**

1. WASHINGTON- Sales of new single- family homes rose last year to their highest level in nearly two decades while overall economy posted little increase heading into 1997, new reports showed yesterday.

2. Indexes of home sales showed the rise of 13.3 percent last year. The total home sales were 756,000, even though sales fell 1.0 percent in December. That reversed the 0.4 percent decline of 1978, when sales reached 817,000, a government spokes- woman said.

3. Meanwhile, the index of leading economic indicators, a gauge of future economic growth, posted a 0.1 percent increase during December after rising a revised 0.2 percent in November.

4. But builders assess optimistically 1997.They measured the average price of a new home as \$173,000 in December, 1996.

### **8.8.2 Getting the main ideas. Mark the sentences below as true or false**

1. Sales of new homes dropped in 1996.
2. The US overall economy will increase slowly and steady in 1997.
3. According to the index if leading economic indicators the increase of 0.1 percent was evident in December, 1996.
4. Builders reported the perspectives of 1997 as bad ones.

### **8.8.3 Answer the questions**

1. What was the situation on a single-family homes market in 1996?
2. What was the index of leading economic indicators in November, 1996 and in December, 1996?
3. What did builders think about the sales of 1997 in 1996?

## **9 Statistics and Probability Theory**

### **9.1 Vocabulary activity**

#### **9.1.1 The words below are statistical terms. Choose correct definitions for them**

Population	a) the number of people living in a country b) a set of all possible individuals, objects or measurements of interest
Sample	a) a portion, or part, of the population of interest b) a small amount of a product

**9.1.2 a) Find in the dictionary meanings of the words "descriptive"; "inferential"**

**b) Read the paragraphs below. Which of them is about: a) descriptive statistics; b) inferential statistics**

A. This facet of statistics is referred to as "techniques and procedures used to organize and summarize masses of numerical data. These techniques are frequency distribution, different charts and measures of central tendency. All in all this facet of statistics is concerned with describing something that has already happened.	B. This facet of statistics is concerned with computing the chance that something will happen since very often we do not have a complete information from which to make a decision
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**c) How do you think which of these two facets of statistics deals with probability theory?**

## **9.2 Reading**

**9.2.1 Read the text. The paragraphs in the text are scrambled. Rearrange them according to the plan below:**

1. Two facets-of statistics.
2. Inferential statistics and probability theory.
3. Four basic terms of probability theory.
4. Definition of probability.
5. Experiment and event.
6. Objective probability.
7. Subjective probability.

### **Statistics and Probability Theory**

1. When we define statistics as "a set of principles for organizing, presenting and analyzing numerical data" we are speaking about "descriptive statistics".

But seldom does a decision maker have complete information from which to make a decision. In this case another facet of statistics, "inferential statistics", can be useful. Inferential statistics deals with inferences about population based on a sample taken from that population.

2. Because probability theory concepts are so important, any statistician should know the basic language of probability, including such terms as *experiment*, *event*, *objective probability* and *subjective probability*.

3. An experiment is an activity that is either observed or measured.

Example 1. Asking college students who tested three personal computers which one they preferred.

2. Counting the number of inmates in Nebraska State Prison who are 60 years or older.

To put it another way, an experiment is something we plan to do and whose outcome we are not sure about.

An experiment may result in one or more possible outcomes or events.

Experiment	Asking college students which home computer they prefer.
Event	1. Preferred the RDQ 2. Preferred the Izuo 3. Preferred the YY 4
Experiment	Counting the number of inmates 60 years old and older
Event	1. counted 48 inmates 60 or older

4. Since there is a considerable uncertainty in decision making, it is important to know and evaluate all the risks involved. Helpful in this evaluation is probability theory. The use of probability theory allows the decision maker with only limited information to analyze and minimize the risks, for example in marketing a new product.

5. What is probability? No doubt that you are familiar with this term. The weather forecast announces that there is a 70 percent probability of rain. Based on a survey of consumer who tasted a newly developed pickle, the probability is .03 that, if marketed it will be a financial success. Probability is a number between 0 and 1 that measures one's belief that a particular event resulting from an experiment occur.

6. A probability is expressed as a decimal, such as .70, .27, .50 or a fraction as 7/10, 27/100, 1/2.

7. Subjective probability, on the other hand, involves personal judgment, information, intuition, and other subjective evaluation criteria. The area of subjective probability is relatively new, having been first developed in the 1930s. The area is somewhat controversial; it is closely associated with Bayesian statistics and decision analysis. When an expert assesses the probability of a success of a merger offer, he or she is making a personal judgment based on how he or she knows or feels about the situation. Subjective probability is also called personal probability: one person's subjective

probability may very well be different from another person's subjective probability of the same event.

8. Objective probability is probability based on the symmetry of games of chance or similar situation. It is also called classical probability. This probability is based on the idea that certain occurrences are equally likely (the term equally likely is intuitively clear and will be used as a starting point for our definitions): the numbers 2, 2, 3, 4, 5, 6 on a dice are each equally likely to occur. Another type of objective probability is relative-frequency probability. If, in the long run, 20 out of 1,000 consumers given a taste test for a new soup like the taste, then we say that the probability that a given consumer will like the taste the soup is  $20/1,000=0.02$ . Like the probability in games of chance and other symmetrical situation, relative- frequency probability is objective in the sense that no personal judgment is involved.

### 9.3 Text comprehension

#### 9.3.1 Complete the summary of the text "Statistics and Probability Theory"

There are ... facets of statistics. They are... statistics and ... statistics.

Descriptive statistics ... with facts that has already happened. Inferential statistics to ... the chance that something will happen. That is why probability theory is ... .

The basic language of probability includes such... as ....., ....., .... .

Probability is expressed as a ... or ... and measure ... that a particular event will... . An ... is an activity measured or observed.

The basic idea of ... probability is that certain occurrences are ... likely.

... probability ... personal ... .

#### 9.3.2 Find in the text words that have the same roots as the words in the table. Translate them. Complete table 19

Table 19

<b>Глаголы</b>	<b>Прилагательные</b>	<b>Существительные</b>
		definition
Describe		
Inform		
Infer		
Evaluate		
	inclusion	
		announcement
<b>Глаголы</b>	<b>Прилагательные</b>	<b>Существительные</b>
Succeed		
	measureless	
	resultant	
	expressive	

### 9.3.3 Word Formation

<b>Suffixes and Prefixes of Verbs</b>	
<b>suffixes</b>	<b>prefixes</b>
penal – to penalize special – to specialize multiple – to multiply mobile – to mobilize wide – to widen broad – to broaden	to order – to reorder to lead – to mislead to believe – to disbelieve to lock – to unlock to pay – to overpay to base – to debase large – to enlarge

**a) Translate the verbs and write the words from which they are formed**

to finalize	to testify	to purify
to criticize	to certify	to simplify
to personify	to modify	to identify

**b) Form and translate verbs**

<b>re-</b>	<b>mis-</b>	<b>dis-</b>	<b>un-</b>
to write	to interpret	to satisfy	to mask
to read	to spell	to organize	to nerve
to open	to pronounce	to qualify	to leash
to construct	to understand	to regard	to do
<b>over-</b>	<b>under-</b>	<b>en-</b>	<b>de-</b>
to estimate	to eat	courage	to grade
to come	to sleep	list	to nationalise
to crowd	to do	rich	to classify
to tax	to pay	sure	to code

### 9.4 Vocabulary activity

**9.4.1 Group sentences below in five groups according to the meanings of the word "term":**

- 1) с точки зрения;
- 2) термин;
- 3) период времени;
- 4) условия;
- 5) отношения.

- a) In financial terms, the film was not a success;
- b) The main exams are at the end of the summer terms;
- c) I bought this car on very reasonable terms;
- d) We're on good terms with all our neighbours;
- e) Frequency distribution is a statistical term for a table;
- f) He had been on bad terms with his father for years;
- g) The president hopes to be re-elected to a second term of office;
- h) In terms of customer satisfaction, the policy can not be criticized.

## 9.5 Speaking skills

**a) Read the text and write an annotation of it. Use the phrases from the Help**

**Box:**

### HELP BOX

The text/the article under review ... (gives us a sort of information about ...)

The article deals with the problem of ...

The subject of the text is ...

At the beginning (of the text) the author

*describes ... ;*

*dwells on ...;*

*explains ...;*

*touches upon ...;*

*analyses ... ;*

*comments ... ;*

*characterises ... ;*

*underlines ... ;*

*reveals ... ;*

*gives account of ... .*

The article begins with the

*description ... ;*

*review of ...;*

*analysis of ... .*

The article opens with ...

Then (*after that, further on, next*) the author

*passes on to ... ;*

*gives a detailed (thorough) analysis (description) of ;*  
*goes on to say that ... .*  
To finish with, the author describes ...  
At the end of the article the author  
*draws the conclusion that ...;*  
*sums it all up by saying ... .*  
In conclusion the author ...

### c) **Make an algorithm of solving problems**

#### **Fundamental Concepts**

(a) *Probability* as a specific term is a measure of the likelihood that a particular event will occur. Just how likely is it that the outcome of a trial will meet a particular requirement? If we are certain that an event will occur, its probability is 1 or 100%. If it certainly will not occur, its probability is zero. The first situation corresponds to an event which occurs in every trial, whereas the second corresponds to an event which never occurs. At this point we might be tempted to say that probability is given by relative frequency, the fraction of all the trials in a particular experiment that give an outcome meeting the stated requirements. But in general that would not be right. Why? Because the outcome of each trial is determined by chance. Say we toss a fair coin, one which is just as likely to give heads as tails. It is entirely possible that six tosses of the coin would give six heads or six tails, or anything in between, so the relative frequency of heads would vary from zero to one. If it is just as likely that an event will occur as that it will not occur, its true probability is 0.5 or 50%. But the experiment might well result in relative frequencies all the way from zero to one. Then the relative frequency from a small number of trials gives a very unreliable indication of probability. If we were able to make an *infinite* number of trials, then probability would indeed be given by the relative frequency of the event.

As an illustration, suppose the weather man on TV says that for a particular region the probability of precipitation tomorrow is 40%. Let us consider 100 days which have the same set of relevant conditions as prevailed at the time of the forecast. According to the prediction, precipitation the next day would occur at any point in the region in about 40 of the 100 trials. (This is what the weather man predicts, but we all know that the weather man is not always right!)

(b) Although we cannot make an infinite number of trials, in practice we can make a moderate number of trials, and that will give some useful information. The *relative frequency* of a particular event, or the proportion of trials giving outcomes which meet certain requirements, will give an *estimate* of the probability of that event. The larger the number of trials, the more reliable that estimate will be. This is the *empirical* or *frequency approach* to probability. (Remember that “empirical” means based on observation or experience.)



### Example

260 bolts are examined as they are produced. Five of them are found to be defective.

On the basis of this information, estimate the probability that a bolt will be defective.

**Answer:** The probability of a defective bolt is approximately equal to the relative frequency, which is  $5 / 260 = 0.019$ .

(c) Another type of probability is the *subjective estimate*, based on a person's experience. To illustrate this, say a geological engineer examines extensive geological information on a particular property. He chooses the best site to drill an oil well, and he states that on the basis of his previous experience he estimates that the probability the well will be successful is 30 %. (Another experienced geological engineer using the same information might well come to a different estimate.) This, then, is a subjective estimate of probability. The executives of the company can use this estimate to decide whether to drill the well.

(d) A third approach is possible in certain cases. This includes various gambling games, such as tossing an unbiased coin; drawing a colored ball from a number of balls, identical except for color, which are put into a bag and thoroughly mixed; throwing an unbiased die; or drawing a card from a well-shuffled deck of cards. In each of these cases we can say before the trial that a number of possible results are *equally likely*. This is the *classical* or "a priori" approach. The phrase "a priori" comes from Latin words meaning coming from what was known before. This approach is often simple to visualize, so giving a better understanding of probability.

### Example

Three nuts with metric threads have been accidentally mixed with twelve nuts with U.S. threads. To a person taking nuts from a bucket, all fifteen nuts seem to be the same. One nut is chosen randomly. What is the probability that it will be metric?

**Answer:** There are fifteen ways of choosing one nut, and they are equally likely. Three of these equally likely outcomes give a metric nut. Then the probability of choosing a metric nut must be  $3 / 15$ , or 20 %.

### Example

Two fair coins are tossed. What is the probability of getting one heads and one tails?

**Answer:** For a fair or unbiased coin, for each toss of each coin

$$\Pr [\text{heads}] = \Pr [\text{tails}] = 1/2$$

This assumes that all other possibilities are excluded: if a coin is lost that toss will be eliminated. The possibility that a coin will stand on edge after tossing can be neglected.

There are two possible results of tossing the first coin. These are heads (H) and tails (T), and they are equally likely. Whether the result of tossing the first coin is heads or tails, there are two possible results of tossing the second coin. Again, these are heads (H) and tails (T), and they are equally likely. The possible outcomes of tossing the two coins are HH, HT, TH, and TT. Since the results H and T for the first coin are equally likely, and the results H and T for the second coin are equally likely, the four outcomes of tossing the two coins must be equally likely. These relationships are conveniently summarized in the following tree diagram, Figure 9, in which each branch point (or node) represents a point of decision where two or more results are possible.

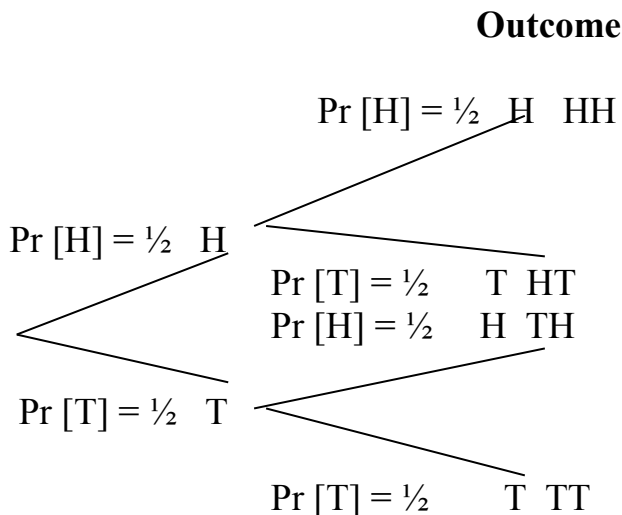


Figure 9 - Simple Tree Diagram (First Coin, Second Coin)

Since there are four equally likely outcomes, the probability of each is  $1/4$ . Both HT and TH correspond to getting one heads and one tails, so two of the four equally likely outcomes give this result. Then the probability of getting one heads and one tails must be  $2/4$  or  $1/2$  or  $0.5$ .

In the study of probability an event is a set of possible outcomes which meets stated requirements. If a six-sided cube (called a die) is tossed, we define the outcome as the number of dots on the face which is upward when the die comes to rest. The possible outcomes are 1, 2, 3, 4, 5 and 6. We might call each of these outcomes a separate event—for example, the number of dots on the upturned face is 5. On the other hand, we might choose an event as those outcomes which are even, or those evenly divisible by three. In Example 3 the event of interest is getting one heads and one tails from the toss of two fair coins.

(e) Remember that the probability of an event which is certain is 1, and the probability of an impossible event is 0. Then no probability can be more than 1 or less than 0. If we calculate a probability and obtain a result less than 0 or greater than 1, we know we must have made a mistake. If we can write down probabilities for all possible results, the sum of all these probabilities must be 1, and this should be used as a check whenever possible.

Sometimes some basic requirements for probability are called the axioms of probability. These are that a probability must be between 0 and 1, and the simple addition rule which we will see in part (a). These axioms are then used to derive theoretical relations for probability.

(f) An alternative quantity, which gives the same information as the probability, is called the fair odds. This originated in betting on gambling games. If the game is to be fair (in the sense that no player has any advantage in the long run), each player should expect that he or she will neither win nor lose any money if the game continues for a very large number of trials. Then if the probabilities of various outcomes are not equal, the amounts bet on them should compensate.

The fair odds in favor of a result represent the ratio of the amount which should be bet against that particular result to the amount which should be bet for that result, in order to give fairness as described above. Say the probability of success in a particular situation is  $3/5$ , so the probability of failure is  $1 - 3/5 = 2/5$ . Then to make the game fair, for every two dollars bet on success, three dollars should be bet against it. Then we say that the odds in favor of success are 3 to 2, and the odds against success are 2 to 3. To reason in the other direction, take another example in which the fair odds in favor of success are 4 to 3, so the fair odds against success are 3 to 4. Then

$$\text{Pr} [\text{success}] = \frac{4}{4+3} = \frac{4}{7} = 0.571.$$

In general, if  $\text{Pr} [\text{success}] = p$ ,  $\text{Pr} [\text{failure}] = 1 - p$ , then the fair odds *in favor* of success are  $\frac{p}{1-p}$  to 1, and the fair odds *against* success are  $\frac{1-p}{p}$  to 1.

These are the relations which we use to relate probabilities to the fair odds.

**Note for Calculation: How many figures?**

How many figures should be quoted in the answer to a problem? That depends on how precise the initial data were and how precise the method of calculation is, as well as how the results will be used subsequently. It is important to quote enough figures so that no useful information is lost. On the other hand, quoting too many figures will give a false impression of the precision, and there is no point in quoting digits which do not provide useful information. Calculations involving probability usually are not very precise: there are often approximations. In this book probabilities as answers should be given to not more than three significant figures—i.e., three figures other than a zero that indicates or emphasizes the location of a decimal point. Thus, “0.019” contains two significant figures, while “0.571” contains three significant figures. In some cases, as in Example 1, fewer figures should be quoted because of imprecise initial data or approximations inherent in the calculation.

It is important *not to round off figures before the final calculation*. That would introduce extra error unnecessarily. Carry more figures in intermediate calculations, and then *at the end* reduce the number of figures in the answer to a reasonable number.

**9.6 Apply your knowledge. Solve the Problems**

1. A bag contains 6 red balls, 5 yellow balls and 3 green balls. A ball is drawn at random. What is the probability that the ball is: (a) green, (b) not yellow, (c) red or yellow?

2. A pilot plant has produced metallurgical batches which are summarized as follows:

Low strength - High strength

Low in impurities 2 27

High in impurities 12 4

If these results are representative of full-scale production, find estimated probabilities that a production batch will be:

- a) low in impurities;
- b) high strength;
- c) both high in impurities and high strength;
- d) both high in impurities and low strength.

3. If the numbers of dots on the upward faces of two standard six-sided dice give the score for that throw, what is the probability of making a score of 7 in one throw of a pair of fair dice?

4. In each of the following cases determine a decimal value for the probability of the event:

- a) the fair odds against a successful oil well are 10-to-1;
- b) the fair odds that a bid will succeed are 1-to-6.

5. Two nuts having U.S. coarse threads and three nuts having U.S. fine threads are mixed accidentally with four nuts having metric threads. The nuts are otherwise identical. A nut is chosen at random.

- a) What is the probability it has U.S. coarse threads?
- b) What is the probability that its threads are not metric?
- c) If the first nut has U.S. coarse threads, what is the probability that a second nut chosen at random has metric threads?
- d) If you are repairing a car engine and accidentally replace one type of nut with another when you put the engine back together, very briefly, what may be the consequences?

6. (a) How many different positive three-digit whole numbers can be formed from the four digits 2, 6, 7, and 9 if any digit can be repeated?

(b) How many different positive whole numbers less than 1000 can be formed from 2, 6, 7, 9 if any digit can be repeated?

(c) How many numbers in part (b) are less than 680 (i.e. up to 679)?

(d) What is the probability that a positive whole number less than 1000, chosen at random from 2, 6, 7, 9 and allowing any digit to be repeated, will be less than 680?

7. Answer question 6 again for the case where the digits 2, 6, 7, 9 can not be repeated.

8. For each of the following, determine (i) the probability of each event, (ii) the fair odds against each event, and (iii) the fair odds in favor of each event:

- a) A five appears in the toss of a fair six-sided die;
- b) A red jack appears in draw of a single card from a well-shuffled 52-card bridge deck.

## 10 Hypothesis Testing

### 10.1 Vocabulary activity

#### 10.1.1 Revise your vocabulary. Fill in the blanks with the words from the box

to refer to, to consist of, the difference, to draw conclusion

- 1 .The figures in the left-hand column ... our sales abroad.
- 2.....From those facts we ... about the trends in sales.
3.     There is no much ... .in prices.
4.     The management team of the company ... John, Betty and Ken.

#### 10.1.2. Read the words below. Try to remember their meanings

Income	ДОХОД
Tax	НАЛОГ
Senior citizens	ПОЖИЛЫЕ ЛЮДИ
Juvenile offender	МАЛОЛЕТНИЙ ПРЕСТУПНИК
Ball bearing	ПОДШИПНИК
Windshield	ВЕТРОВОЕ СТЕКЛО
Impact strength	СИЛА УДАРА

**10.1.3 a) Explain either in English or in Russian the difference between theory and hypothesis.**

#### **d) Read the statements in the column A. Answer the questions**

1.     Are these statements theories or hypothesis?
2.     Is it possible to prove these statements by checking every item or person ?

**c) Match explanations why it is impossible to check all items or persons (in the column B) with the appropriate hypothesis.**

Column A	Column B
1) The mean monthly income* from all sources for senior citizens is \$993. Column A	a) The quality assurance department does not have personnel to check every ball bearing. Column B
2) Twenty percent of juvenile offenders* are caught and	b) It is almost impossible to contact every senior citizen in the

sentenced\* to prison.

3) The mean outside diameter of ball bearings\* produced during the day is 1.000 inches.

4) The impact strength of the windshields\* produced by the Delaware Glass Company and Stable Pittsburgh Glass is the same.

5) Ninety percent of the federal income tax\* forms are filled correctly.

USA to find out his or her monthly income.

c) We can not test all the windshields because it means to test all of them.

d) We are never sure about the total number of offenders.

e) There is not enough personnel to check every form.

## 10.2 Reading

a) **Read the words below. Try to remember their meanings**

To accept - принять

To reject - отклонить

Error - ошибка

b) **Read the text about hypothesis testing**

Find in the text passages that answer the following questions:

1 What is hypothesis testing?

2 When do statisticians use hypothesis testing?

### Hypothesis Testing

A hypothesis from a statistician's point of view is a statement about a value of a population parameter.

All these hypotheses have one thing in common. The populations of interest are so large that for various reasons it would not be feasible to study all the items, or persons, in the population. In this case statisticians apply methods of hypothesis testing.

The terms hypothesis testing and testing a hypothesis are used interchangeably. Hypothesis testing starts with a statement (hypothesis) about a population parameter -such as population mean.

A hypothesis might be that the mean monthly commission of salespeople in retail computers stores, such a Computer land, is \$2000. We cannot contact all these salespeople to find out that the mean is in fact \$2000. The cost of locating and interviewing every salesperson in the United States would be exorbitant. To test the validity of the hypothesis we must select from the population consisting of all computer salespeople, calculate sample statistics, based on certain rules accept or reject the hypothesis.

A sample mean of \$1000 would certainly mean rejection of the hypothesis. However, suppose the sample mean is \$1.995. Is that close enough to \$2000 for us to

accept the hypothesis that the population mean is \$2000? Can we explain the difference of \$5 between the two means to sampling error, or is that difference statistically significant?

All in all, hypothesis testing is a procedure based on sample evidence and probability theory used to determine whether the hypothesis is a reasonable statement and should not be rejected, or is unreasonable and should be rejected.

е) пенсия

### 10.3 Text comprehension

#### 10.3.1 Find in the text words that mean the same as:

Possible

To use

Used instead of each other

Price

High (about price)

Important

#### 10.3.2 Complete the summary of the text "Hypothesis Testing". The number of points corresponds to the number of letters

A ... about the value of a population parameter is a hypothesis.

Very often it is not ... to study all ... in the population. For example, it is impossible to ... every senior citizen of the USA about his/ her monthly.... The ... is to take a ... from the population and calculate ... statistics. After that we can draw a ... either to ... or to accept the.... This conclusion is to be based on certain rules.

In fact hypothesis ... is a procedure based on a sample evidence and probability ... used to determine whether we can or can not ... the hypothesis.

### 10.4 Vocabulary activity

#### 10.4.1 Complete sentences with words from the box

Income, to accept, to reject, error
-------------------------------------

1. Did your boss ... your suggestion or ignore it?
2. Her pension is her only source of ... now that she's retired.
3. An opinion poll shows that the majority of Americans ... the idea that Russia is a military threat.
4. Mrs. Leigh's huge phone bill was the result of a computer ....

#### 10.4.2 The underlined words define various types of income. Match them with their Russian equivalents

1) Some students have <u>allowances</u> from their parents.	a) стипендия
2) He gets a pretty good <u>pension</u> from his old firm where he worked for thirty years.	b) пособие
3) My father gives us our <u>pocket money</u> every Saturday.	c) содержание
4) There are several benefits you can claim if you are unemployed e.g. <u>housing benefits</u> .	d) карманные деньги
5) We are hoping to get a student <u>grant</u> .	e) пенсия

### 10.4.3 a) What source of income has not been mentioned in 10.4.2?

### b) Read sentences and match underlined words with their definitions

1) She's moving to a new job with better <u>pay</u> .	a) A fixed amount of money that is paid monthly, usually directly to a bank account.
2) Every month he receives in the local bank his <u>salary</u> as chairman of the company.	b) The amount of money usually calculated hourly and paid weekly, especially in non-professional job.
3) Workers at Ford Motor Co. Usually get their <u>wages</u> on Thursday afternoon.	c) The total amount of money you earn from any work you do.
4) The basic pay is poor, but with overtime the average <u>earnings</u> are nearly \$80 per week.	d) The money that someone in non-professional job receives each week.
5) _____ They earn the basic <u>wage</u> of \$11.50 per hour.	e) The money that is paid to someone, either monthly or weekly, for regular job.

## 10.5 Grammar Revision

### a) Correct mistakes

1. What hypothesis is from the point of view of a statistician?
2. With what does hypothesis testing start?
3. What we must do to test the validity of a hypothesis?
4. Who pays income tax in the USA?
5. How call we the sum total of the incomes of all people living in the country?



**b) Wish-clauses (see D 8 APPENDIX D). Complete sentences with correct forms of the verbs in brackets**

A: Aren't you excited about the new mayor? He's an idealist!

B: Yes, I really am. But I wish he **(win)** the previous elections, because now the city is such a mess.

A: I know. He has a big job ahead of him. In any case, I really like his ideas.

B: Well, I wish he **(start)** his term by reducing taxes. The last mayor raised them three times.

A: I know. I wish he **(think)** about how those increases were going to affect the average person!

B: And after reducing taxes, I wish he **(do)** something about parking. There aren't enough parking garages.

A: I agree. But I wish he **(do)** something about crime before it's too late.

B: I know. I wish city hall **(double)** the size of the police force.

A: Well, he promised to do that in the first six months of his term.

B: Yes, but the last mayor made the same promise and didn't do anything about it.

A: I know, and the whole city wishes the last mayor **(pay)** more attention to all these problems.

B: You're right, and maybe that's why we have a new mayor now.

**10.6 Apply your knowledge.**

**10.6.1 Read the text below and complete the “income” chart**

Income is the money that people earn. Income distribution is the way in which money is shared around.

You, your family, have an income. You have an annual income that is what you earn in a year.

Just as you and your family have income, so nations, different countries, also have income- the national income. A national income is not the money that government gets. The national income is the sum total of the incomes of all the people living in that country. Governments can influence income distribution in two ways: 1) by transfer payment; 2) by taxation.

A target after-tax income is the amount of money left after you have paid your taxes (Figure 10)

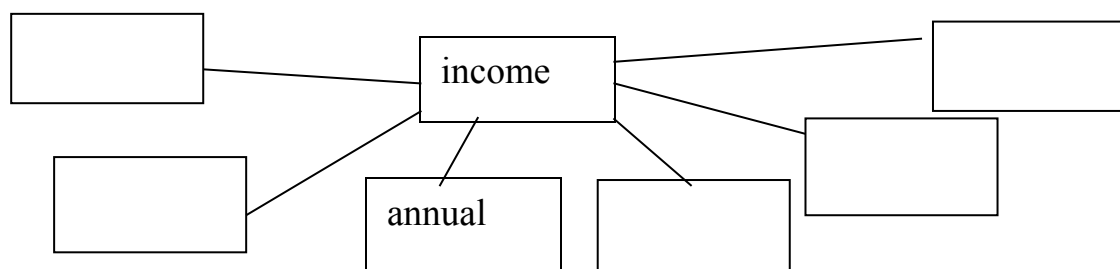


Figure 10

## 10.7 Read the text

**a) Explain either in English or in Russian what is the difference between direct and indirect taxes**

**b) Read the text about taxation in the USA and divide the taxes into two groups: 1) direct taxes; 2) indirect taxes**

Americans often say that there are only two things a person can be sure of in his life: death and taxes.

Taxes are money that you pay to the government.

People who earn more than four or five thousand dollars per year must pay a certain percentage of their salaries to the federal government. The federal government has a two-level income tax; that is 15 or 28 percent. Companies and firms have to pay corporation tax (a tax on profits).

State governments also levy taxes. Some states have income *tax* similar to that of the federal government. Other states a sales tax, which is a percentage, charged on any item which you buy in a state. (In Britain and Europe it is called VAT- value added tax).

There are also taxes for the city government. These taxes are property tax (people who own a home must pay taxes on it) and excise tax, which is taken on vehicle in a city.

## 11 Demographic Statistics

### 11.1 Reading

#### 11.1.1 Skimming for main ideas

Skimming means reading a text without attention to details in order to get an overview of the organization of the text and its main ideas. This will include attention to title, headings, introduction and conclusion, as well as the beginnings and ends of paragraphs. Skimming the text is an excellent pre-reading habit. When you do a close reading of the text after skimming it, you will find that you read more fluently and accurately.

**a) Skim through the text and write in the number of the paragraph that deals with each of the following topics:**

1. An important demographic indicator that was stopped being published.
2. The most often repeated Soviet propaganda claims.
3. The last openly available statistics on mortality.
4. Stalin's initiative.
5. Possible percentage of distortions.
6. The census that was declared defective.

7. Data over the definite period that could not possibly be used for propaganda purposes.
8. Resort to manipulation with data on life expectancy.
9. Special permission for data publication of demographic statistics.

**b) Answer the following questions:**

1. What was the final figure of population in documents that were published after the 17<sup>th</sup> Congress of the Communist Party?
2. Why do you think the Soviet military industrial complex influenced the demographic situation?

**11.1.2 Scanning through the text**

Scanning involves looking quickly through a text to find a specific piece of information. There are often times when it is necessary to do this, such as when studying for a test or writing a paper, so it is a useful skill to practice.

**Scan the text to find information on three aspects:**

1. The demographic situation in the Stalin era.
2. The demographic situation in the post-Stalin era.
3. The demographic situation in the 1970-s.

**11.1.3 Read the text, study Key Words and Word-Combinations and give the Russian equivalents for them**

**Demographic Statistics as Propaganda Vehicle**

The history of Soviet statistics knows plenty of examples of demographic data juggling for political purposes. Thus, in a bid to cover up the horrible aftermath of famine, Stalin, addressing the 17<sup>th</sup> Congress of the All-Union Communist Party (Bolsheviks), said that the population of the USSR had grown to 168 million by the end of 1933.

According to Mikhail Kurman, who at the time worked in the central office of the State Statistics Bureau (the statistics department often changed its name during the Soviet era), Stalin on his own initiative inflated the figure by approximately 8 million. In a subsequent conversation with the then head of the Soviet statistics agency, the dictator said he ought to know better which figure to cite in his report. Interestingly, documents of the Communist Party congress that were published later contained a figure 1 million below the originally mentioned.

Demographers conducting the 1937 census, which undermined Stalin's position, had to pay with their lives for an attempt to present objective data. Meanwhile, the census itself was declared "defective" and its results classified. In 1939, a new census was taken; its results were rigged.

The 1941-1945 war took a heavy death toll, the actual size of which is still debated. After the war, the demographic situation was aggravated by famine which claimed about 1 million lives. Naturally, data over that period could not possibly be used for propaganda purposes, so Stalin rejected the proposal by statisticians to hold a new census in 1949.

In the post-Stalin era the demographic situation in the Soviet Union improved but was still far from favourable. Meanwhile, the use of demographic statistics for propaganda purposes continued, hi 1961, speaking at the 22<sup>nd</sup> CPSU Congress, Nikita Khrushchev said that "mortality in the Soviet Union is the lowest in the world." Even after Khrushchev was removed from office, that he long remained one of the most oft repeated Soviet propaganda claims.

In 1967, the new Soviet leader Leonid Brezhnev, addressing a ceremony on the occasion of the 50<sup>th</sup> anniversary of the 1917 Bolshevik revolution, said: "Today the average life expectancy has reached 70 years - one of the highest in the world". Still, from 1965 on life expectancy in the Soviet Union kept falling and the subservient heads of Soviet statistics agencies had to resort to manipulation so as not to contradict Brezhnev's claim. To that end, life expectancy data were provided for the second half of 1970 and the first half of 1971 whereas normally that figure was given over a two-year period.

Another important demographic indicator - infant mortality - worsened in the Soviet Union in the 1970s, evoking a traditional response from official statistics: From 1975 on, these statistics were not published at all.

The number of suicides, murders, and deaths from dangerous infectious diseases (plague, cholera, etc), as well as international migration statistics were classified in the Soviet Union. In the mid-1970s, many other important demographic statistics also began to disappear from official publications, which were, of course, noticed by demographers throughout the world.

It was at that time that the Soviet military-industrial complex reached the peak of its influence, which had catastrophic implications for the demographic situation. The last openly available statistics on the age and gender structure of pre-perestroika society date back to 1975 while statistics on male and female mortality, to 1973-74.

Demographic statistics were published only on express permission from the Soviet Central Statistics Board or its regional divisions. Most of them were included in the List of Data Banned from Publication in the Open Press, Radio or Television. The list even included the number of newborn boys and girls.

The Soviet leadership never budged from its fundamental position: Information on the country's military capability and the condition of its penitentiary system were classified most secret. So, from the Stalin era on, every Soviet census was accompanied by a "special census" of military servicemen and convicts, and in the post-Soviet period also of residents of "closed" (secret) cities. The data were mixed with the basic results of each subsequent census and were not subject to publication. Thus, population size by the region was distorted.

The secrecy of demographic statistics, on one hand, provided wide scope for ideological manipulations, but on the other, what sensible planning or objective assessment of the country's condition could you talk about if distortions on the regional level sometimes reached 7 to 10 percent?

It would seem that in the past 10 years the country has changed beyond recognition. Still, it is not known just how tenacious the Soviet legacy in demographic statistics is going to be. Thus, one inevitable problem will be the credibility of the last Soviet census of 1989 against which the results of the new census will be compared. Yet, Russia has no other way to address it except be honest with itself and the world.

## **11.2 Text comprehension**

**11.2.1 Key Words and Word-Combinations. Find their meanings. Use dictionary if necessary:**

- 1) to juggle data for political purposes;
- 2) to cover up the aftermath of smth;
- 3) to cite figures (data);
- 4) available statistics;
- 5) to present objective data;
- 6) to take a heavy toll;
- 7) to be far from favourable;
- 8) to hold a new census;
- 9) to resort to manipulation;
- 10) to contradict (to) smb's claim;
- 11) to evoke a response;
- 12) data banned from publication;
- 13) a ceremony on-the occasion of smth;
- 14) to reach the peak of smth;
- 15) to have implications for smth;
- 16) to date back to;
- 17) to remove from office;
- 18) to reject the proposal;
- 19) penitentiary system;
- 20) to rig results;
- 21) to budge from smth;
- 22) average life expectancy;
- 23) to undermine one's position;
- 24) objective assessment;
- 25) express permission;
- 26) to the end that;
- 27) to subject to publication;
- 28) to change beyond recognition;
- 29) to have no other way to do smth;
- 30) to aggravate smth;
- 31) subsequent census;
- 32) to change name;
- 33) to disappear from official publications.

### 11.3 Vocabulary activity

**11.3.1 The vocabulary exercise below will help you master the key vocabulary. It will provide you with the required vocabulary to speak on the problem under consideration. Find English equivalents for the following**

Провести новую перепись; доступные статистические данные; объективная оценка; жонглировать данными в политических целях; запрещенные для публикации данные; более поздняя перепись; отвергать предложение; фальсифицировать результаты; подорвать чье-либо положение; средняя продолжительность жизни; специальное разрешение; исчезнуть из официальных публикаций; предоставить объективные данные; приводить данные (ссылаться на цифры); скрывать последствия чего-либо; нести большие потери; быть неблагоприятным; прибегать к манипуляции; противоречить чьему-либо утверждению; вызвать отклик; церемония по случаю чего-либо; достичь высшей точки; иметь значение для; относиться к определенному времени; отступить от чего-либо; подлежать публикации; измениться до неузнаваемости; не иметь другого способа что-либо сделать; исправительная система; сменить название; снять с поста; ухудшать (отягчать); с той целью, чтобы.

### 11.4 Grammar activity. Different types of clauses

**11.4.1 Complete the sentences using the proper form of the subjunctive mood (see D 8 APPENDIX D)**

1. Put down my address lest (to forget)
2. Make haste lest (to miss the train).
3. Don't sit in the draught lest (to catch cold).
4. It is necessary that we (to do) it at once.
5. It was important that he (to make) a report.
6. The teacher demanded that we (to translate) the text without a dictionary.

### 11.4.2 Translate into English

1. Необходимо, чтобы вопрос был улажен немедленно.
2. Мне предложили принять участие конференции.
3. Надо было, чтобы об этом событии узнали все.
4. Он включил радио, чтобы не проспать.
5. Она взяла книгу и начала читать, как будто ничего не случилось.
6. Жаль, что вы не посетили такую интересную лекцию.

## 11.5 Apply your knowledge

**A football team.** The University of Miami Hurricanes has been among the most successful teams in college football. Table 20 gives the weights in pounds and positions of the players on the 2002 team. The positions are quarterback (QB), running back (RB), offensive line (OL), wide receiver (WR), tight end (TE), kicker/punter (KP), defensive back (DB), linebacker (LB), and defensive line (DL).

(AP/Wide World Photos)

(a) Briefly compare the weight distributions. Which position has the heaviest players overall? Which has the lightest?

(b) Are any individual players outliers within their position?

Positions and weights (pounds) for a major college football team (Table 20)

Table 20

QB 200	QB 209	QB 190	QB 201	RB 210	RB 224	RB 196
RB 218	RB 229	RB 236	OL 281	OL 286	OL 320	OL 369
OL 298	OL 276	OL 293	OL 292	OL 285	OL 286	OL 265
OL 314	OL 318	OL 334	OL 276	OL 300	OL 290	WR 227
WR 178	WR 180	WR 193	WR 190	WR 163	WR 185	WR 200
TE 235	TE 233	TE 225	TE 253	TE 275	TE 200	KP 189
KP 214	KP 185	KP 204	DB 189	DB 173	DB 186	DB 220
DB 170	DB 166	DB 185	DB 194	DB 175	DB 194	DB 193
DB 179	LB 247	LB 208	LB 227	LB 219	LB 219	LB 208
LB 225	LB 203	DL 240	DL 261	DL 302	DL 214	DL 225
DL 250	DL 350	DL 230	DL 271	DL 294	DL 202	DL 297
DL 271	DL 260	DL 257	DL 262			

## 12 Education in Statistics

### 12.1 Vocabulary activity

#### 12.1.1 Guess the meaning of the next words

observation

processing

describing

time series analysis

smoothing methods

adjustment

set of measurement

sample surveys impact  
correlation analysis  
regression analysis

## 12.2 Translate the following sentences paying attention to the verbal nouns

1. He took part in **the sittings** of the Congress. 2. I was awakened by their loud **talking**. 3. We started **the reading** of English books last year. 4. All these **comings** and **goings** disturb me. 5. She gave the room a good **dusting**. 6. **The singing** of birds came from the wood. 7. Where quick **thinking** was required, he was the best. 8. I examined **the reading** of a thermometer. 9. **The solving** of different problems always gives him pleasure. 10. This is a good **beginning**. 11. He told me about his **doings**. 12. **The building** of this house began in 1945.

## 12.3 Point out whether the –ing – form in the following sentences is a participle, a gerund or a verbal noun

1. It is worth **noticing** that Kepler put to use math knowledge which had been developed by the Greeks almost two thousand years earlier.

2. The **preceding** discussion may be summed up by **saying** that except for the additional rule, the rules of arithmetic for complex numbers are the same as those for real numbers.

3. This, however, does not exclude the possibility of the equation **having** solutions which belong to a more general class of numbers.

4. We like **solving** problems with teacher's assistance.

5. Measurement is a process of **associating** numbers with certain objects.

6. Up to about twenty years ago the two main classes of problems considered by theoretical statisticians were those of **testing** hypotheses and of **estimating** parameters.

## 12.4 Reading

### 12.4.1 Read the following definitions of the subject. Find a similar definition in the Russian reference book. Translate it from Russian into English

Statistics, science of making valid inferences about the characteristics of a group or persons or objects on the basis of numerical information obtained from a randomly selected sample of the group.

(The new encyclopaedia Britannica vol. 11)

Statistics information based on a study of the number of times something happens or is present, or other numerical facts.

(Cambridge International Dictionary of English. 1995 -1415 p.)



In accordance with the standards on general orientation of teaching in statistics approved by the government the following subjects are taught: theory of statistics; economic statistics; social statistics; international statistics; mathematical statistics.

The "theory of statistics" is an introductory course and it deals with such topics as organization of statistical observation, elementary methods of processing of statistical series, describing set of measurement (e.g., frequency distribution, measures of variability), elements of time series analysis (smoothing methods, adjustment for seasonal factor, etc), theory of probability and sample surveys, theory of indices, axiomatic and economic theories of indices and their impact on the choice of various index formulas, correlation and regression analysis.

The economic statistics is introduced to the students when they have got acquainted with principles of the theory of statistics. The topics covered by this course, as a rule, include: system of national accounts, economic classifications (e.g., classification of economic activities by industries or classification of goods and services), statistics of employment and unemployment, statistics of prices, external trade statistics, balance of payment statistics, government finance statistics (GFS), monetary and financial statistics and some other topics. It is worth noting that this course is intended to familiarize the students with both methodology used by official national statistics as well as with the respective international standards that is with the recommendations elaborated by the international organizations. Such approach is employed in the most consistent manner by the statistical department of Moscow State University. It is worth noting in this context that the "Program of transformation of business accounting and statistics in accordance with the international standards" adopted by the Russian government several years ago envisages among other things introduction of the international standards in statistics in the educational curriculum.

The course on social statistics covers such topics as population and its major demographic characteristics (size of population and its structure, rates of birth, death, natural increase, etc), statistics of social conditions of life, such as housing and communal services, educational, medical and cultural services, distribution of income and final consumption of population, social security system and the role of social benefits, social stratification and mobility, etc. It should be noted in this context that several years ago MSU and some other universities in cooperation with the UNDP introduced a course on Human Development; in the framework of this course there is an important statistical part dealing with measurement of Human Development (HD) and calculation of index of HD; the lectures on this statistical aspects are normally organized by the statistical departments. In 2000 year the MSU released a special textbook for this course.

In the context of the course on international statistics the students study such topics as the history of international statistics, contemporary organization of international statistics, the most important standards of international statistics (in the field of national accounts, balance of payments, GFS, employment and so forth), the most important statistical publications released by the international organizations. Special attention is paid to the methodology of the international comparisons of the GDP and purchasing power parities which are carried out by the international organizations.

One of the most important kinds of statistics is mathematical statistics. The mathematical model that a statistician selects for a repetitive operation is usually one that enables him to make predictions about the frequency with which certain results can be expected to occur when the operation is repeated a number of times. Probability theory may be said to be essential math basis of statistical theory; in fact there would be little point in distinguishing between them except for a tendency to regard the theory of probability as a branch of pure maths, and statistical theory as the application of this math theory to statistical phenomena.

#### 12.4.2 Answer the questions

1. What kinds of statistics are mentioned in the article?
2. Are all these statistics taught in educational establishments?
3. What does each of them deal with?

#### 12.4.3 Prepare short retellings of the text according to the plan. Use 'Help box'

##### HELP BOX

**Classifying.** Classifying means putting things into groups or classes. Some typical expressions for classifying are:

- ... are classified into X types/categories
- ... are classified by ...
- ... can be divided into X types/categories
- ... include(s) ...
- ... consist(s) of ...
- There are X types/classes of ...
- X is a type of ...

1. Theory of statistics.
2. Economic statistics.
3. Social statistics.
4. International statistics.
5. Mathematical statistics.

#### 12.5 Translate the text using the glossary (Appendix C)

##### Sampling without replacement. The Representative Method

In practice, a sample from a finite population is often taken in such a way that a drawn individual is not replaced in the population before the next drawing.

A sequence of drawings of this type has obviously not the character of repetitions of a random experiment under uniform conditions, since the composition of the population changes from one drawing to another.

We talk here of sampling without replacement, as distinct from simple random sampling, which is a sampling with replacement.

When the population is very large and the sample only contains a small fraction of the total population, it is obvious that the difference between these models of sampling is unimportant, and in the limiting case when the population becomes infinite, while the size of the sample remains finite, the difference disappears.

Sampling without replacement plays an important part in applied statistics. When it is desired to obtain information as to the characteristics of some large population, such as the inhabitants of the country, the fir-trees of a district, the consignment of articles delivered by a factory etc., it is often practically impossible to observe or measure every individual in the whole population.

The method generally used in such situations is known as the representative method: a sample of individuals is selected for observation, and it is endeavored to make the sample as representative as possible of the total population.

The observed characteristics of the sample are then used to form estimates of the unknown characteristics of the total population. Usually in such cases samples are taken without replacement.

The method of selection may be random or purposive: in the latter case we deliberately choose the individuals entering into our sample in order to obtain a representative sample. Often also mixed methods are used.

### **12.5.1 Find English equivalents of the following Russian expressions**

выбор из конечной совокупности; следующее вынимание; последовательность выниманий; случайный эксперимент; при неизменных условиях; состав основной совокупности; выбор без возвращения; случайный выбор; выбор с возвращением; малая часть всей совокупности; вид выбора; предельный случай; совокупность становится бесконечной; прикладная статистика; измерить каждый индивидуум; метод репрезентативной выборки; наблюдаемые характеристики; получение оценки; метод выборки; случайный метод; преднамеренный метод; выбирать обдуманно; смешанный метод.

### **12.5.3 Find all words with –ing endings and point out whether they are participles, gerunds or verbal nouns**

## **12.6 Speaking skills**

### **12.6.1 Read the text and express your agreement or disagreement to the following**

There are two broad sub-divisions of this subject: descriptive statistics and theoretical statistics. The principal descriptive quantity derived from sample data is the mean, which is the arithmetic average of the sample data.

It serves as the most reliable single measure of the value of a typical member of the value of the sample. If the sample contains a few values that are so large or so small that they have an exaggerated effect on the value of the mean, the sample is more accurately represented by the median, the value that half the sample values fall below and half above. As measures of the dispersion of the values about their mean, the quantities most commonly used are the variance and its square root, the standard deviation. The variance is calculated by determining the mean, subtracting it from each of the sample values (yielding the deviation of the samples), and then averaging the squares of these deviations. The mean and standard deviation of the sample are used as estimates of the corresponding characteristics of the entire group from which the sample was drawn.

They do not, in general, completely describe the distribution of values within either the sample or the parent group; indeed, different distributions may have the same mean and standard deviation. They do, however, provide a complete description of the so-called normal distribution, in which positive and negative deviations from the mean are equally common and small deviations are much more common than large ones. For a normally distributed set of values, a graph showing the dependence of the frequency of the deviations upon their magnitudes is a bell-shaped curve. About 68% of the value will differ by less than three times the standard deviation.

### **True or False**

1. The principal descriptive quantity derived from simple data is the mean, which is the arithmetic average of the simple data.
2. The principal descriptive quantity derived from sample data is the mean, which is the algebraic average of the sample data.
3. The principal descriptive quantity derived from sample data is the mean, which is the arithmetic average of the simple data.
4. The principal descriptive quantity derived from sample data is the mean, which is the arithmetic average of the sample data.
5. If the sample contains few values that are so large or so small that they have an exaggerated effect on the value of the mean, the sample is represented by the median.
6. If the sample contains a lot of values that are so large or so small that they have an exaggerated effect on the value of the mean, the sample is represented by the median.
7. If the sample contains a few values that are so large or so small that they have an exaggerated effect on the value of the mean, the sample is represented by the median.
8. If the sample contains only some value that is so large or so small that they have an exaggerated effect on the value of the mean, the sample is represented by the median.

### **12.6.2 Put questions to the text**

### **12.6.3 Retell the text using help boxes from previous units**

## **12.7 Grammar activity**

### **12.7.1 Read the text and choose the right tense form**

The theory of statistics is grounded in mathematical probability and in idealized concepts of the group under study, called the population, and the sample. The statistician may view the population as a set of balls from which the sample is selected at random, that is, in such a way that each ball has the same chance as every other one for inclusion in the sample. The characteristic of interest in the population is idealized as a physical property of the balls; for example, they may be of two colours, red and blue. As an illustration, suppose one is studying opinions on a certain issue, and the characteristic is described as the favouring of an associated policy.

The members of the population having this characteristic may be identified with the red balls, and those not having it may be identified with the blue balls. The problem under study is usually stated in the form of a question about the proportions of balls having special colours; for example, one may wish to test whether a majority of the population is in favour of the policy under consideration. The model described above has been studied in the context of probability theory since the 17<sup>th</sup> century. It has been shown that when the sample is drawn at random, the membership of the sample is governed by the composition of the population according to well-determined laws of probability. Statistics makes use of these laws by devising methods of inferring the composition of the population from that of the sample. The theory of statistics makes it possible to evaluate the performance of a statistical procedure in terms of the proportions of sample leading to a correct conclusion.

1. The theory of statistics (is grounded / grounds) in mathematical probability.
2. The characteristic of interest in the population (idealizes / is idealized) as a physical property of a set of balls.
3. One (is studying / is being studied) opinions on a certain issue.
4. The members of the population (may identify / may be identified) with balls of a certain colour.
5. Statistics (is made / makes) use of laws of probability.

## **12.8 Apply your knowledge**

### **12.8.1 Translate the following text with the help of the dictionary. The work should be done in 30 minutes**

Inferences made in statistics are of two types. The first is estimation, which involves the determination, with a possible error due to sampling, of the unknown value of a population characteristic, such as the proportion having a specific attribute or the average value of some numerical measurement. Estimates of population characteristics are generally accompanied by the 'standard errors' of the estimates; these are margins

that determine the possible errors arising from the fact that the estimates are based on random samples and not on a complete population census.

The second type of inference is hypothesis testing. It involves the definitions of a 'hypothesis' as one set of possible population values and an 'alternative', a different set. There are many statistical procedures for determining on the basis of a sample whether the true population characteristic belongs to the set of values in the hypothesis or the alternative.

Statistics is used in every type of scientific work and in much commercial and industrial work. For very large populations, the size of the sample needed for standard statistical procedures is entirely independent of the size of the underlying population.

This is illustrated in a very dramatic way in general elections for public office. Statisticians are able to make very accurate estimates of the outcome of the election on the basis of very small sample returns.

Statistics, science of making valid inferences about the characteristics of a group or persons or objects on the basis of numerical information obtained from a randomly selected sample of the group.

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## APPENDIX A (обязательное)

### Texts for additional reading

#### Text 1 History of statistics

Some scholars pinpoint the origin of statistics to 1663, with the publication of *Natural and Political Observations upon the Bills of Mortality* by John Grant. Early applications of statistical thinking revolved around the needs of states to base policy on demographic and economic data, hence its *stat-* etymology. The scope of the discipline of statistics broadened in the early 19th century to include the collection and analysis of data in general. Today, statistics is widely employed in government, business, and the natural and social sciences.

Its mathematical foundations were laid in the 17th century with the development of probability theory by Blaise Pascal and Pierre de Fermat. Probability theory arose from the study of games of chance. The method of least squares was first described by Carl Friedrich Gauss around 1794. The use of modern computers has expedited large-scale statistical computation, and has also made possible new methods that are impractical to perform manually.

In applying statistics to a scientific, industrial, or societal problem, it is necessary to begin with a population or process to be studied. Populations can be diverse topics such as "all persons living in a country" or "every atom composing a crystal". A population can also be composed of observations of a process at various times, with the data from each observation serving as a different member of the overall group. Data collected about this kind of "population" constitutes what is called a time series.

For practical reasons, a chosen subset of the population called a sample is studied — as opposed to compiling data about the entire group (an operation called census). Once a sample that is representative of the population is determined, data is collected for the sample members in an observational or experimental setting. This data can then be subjected to statistical analysis, serving two related purposes: description and inference.

Descriptive statistics summarize the population data by describing what was observed in the sample numerically or graphically. Numerical descriptors include mean and standard deviation for continuous data types (like heights or weights), while frequency and percentage are more useful in terms of describing categorical data (like race). Inferential statistics uses patterns in the sample data to draw inferences about the population represented, accounting for randomness. These inferences may take the form of: answering yes/no questions about the data (hypothesis testing), estimating numerical characteristics of the data (estimation), describing associations within the data (correlation) and modelling relationships within the data (for example, using regression analysis). Inference can extend to forecasting, prediction and estimation of unobserved



values either in or associated with the population being studied; it can include extrapolation and interpolation of time series or spatial data.

## **Text 2 The Philosophy of Statistics**

The concept of correlation is particularly noteworthy for the potential confusion it can cause. Statistical analysis of a data set often reveals that two variables (properties) of the population under consideration tend to vary together, as if they were connected. For example, a study of annual income that also looks at age of death might find that poor people tend to have shorter lives than affluent people. The two variables are said to be correlated; however, they may or may not be the cause of one another. The correlation phenomena could be caused by a third, previously unconsidered phenomenon, called a lurking variable or confounding variable. For this reason, there is no way to immediately infer the existence of a causal relationship between the two variables. (See Correlation does not imply causation.)

For a sample to be used as a guide to an entire population, it is important that it is truly a representative of that overall population. Representative sampling assures that the inferences and conclusions can be safely extended from the sample to the population as a whole. A major problem lies in determining the extent to which the sample chosen is actually representative. Statistics offers methods to estimate and correct for any random trending within the sample and data collection procedures. There are also methods for designing experiments that can lessen these issues at the outset of a study, strengthening its capability to discern truths about the population. Statisticians describe stronger methods as more "robust".(See experimental design.)

Randomness is studied using the mathematical discipline of probability theory. Probability is used in "Mathematical statistics" (alternatively, "statistical theory") to study the sampling distributions of sample statistics and, more generally, the properties of statistical procedures. The use of any statistical method is valid when the system or population under consideration satisfies the assumptions of the method.

Misuse of statistics can produce subtle, but serious errors in description and interpretation — subtle in the sense that even experienced professionals make such errors, and serious in the sense that they can lead to devastating decision errors. For instance, social policy, medical practice, and the reliability of structures like bridges all rely on the proper use of statistics. There is further discussion later. Even when statistical techniques are correctly applied, the results can be difficult to interpret for those lacking expertise. The statistical significance of a trend in the data — which measures the extent to which a trend could be caused by random variation in the sample — may or may not agree with an intuitive sense of its significance. The set of basic

## **Text 3 Selected aspects of education in statistics in Russia**

Statistical education in Russia was always and still is an integral element of the system of high economic education in Russia. At present time statistics is taught at the universities and at the insinuations with economic orientation such as economic

academies, universities, institutes and colleges. It is also taught at the institutes with so called humanitarian orientation such as, for example, Juridical Institute or the Institute of History and Archives and so forth; the mathematical statistics is taught in many non-humanitarian institutes.

The largest statistical educational establishments are located in Moscow, St. Petersburg, Novosibirsk, Rostov-on-Don, Samara, Kazan, Nizhniy Novgorod, Yaroslavl, Saratov, Voronezh, Stavropol and some other towns.

Broadly speaking, there are two types of economic institutions where statistics is taught.

The institutions where statistics is a predominant subject and where future professional statisticians are trained belong to the first type; the majority of graduates from these institutions work in national or regional statistical offices of the country, though some graduates may find jobs elsewhere: in government, research institutions or in business.

The Moscow State University of Economics, Statistics and Informatics (also known as Moscow Economic University) is a leading centre of statistical education in Russia (it belongs to the first type). Prior to 1996 it was known as Moscow Institute of Economics and Statistics (MIES). It was established in 1932 and its major objective was to train statisticians as professionals who could work in national and regional statistical offices of the former USSR. The MIES also carried out intensive research in the field of economics and statistics, published textbooks and teaching programs on various branches of statistics, released recommendations on the methods of teaching of statistics and rendered assistance to statistical departments of other institutes and universities. The MIES had a system of post graduate training which made it possible to release specialists of high level of qualification capable to work as teachers in statistics and in other capacities in various government bodies and branches of economy.

In 1996 MIES was transformed into Moscow Economic University which took over the above mentioned functions of the MIES on a larger scale and a range of subjects taught at the university has been considerably expanded to include computerization of statistical process, econometrics, models usually emphasize the role of population quantities of interest, about which we wish to draw inference.

#### **Text 4 Know the Big Secret**

Statisticians know one secret thing that makes them seem smarter than everybody else.

The primary purpose of statistics as a scientific methodology is to make probability statements about samples of scores. Before we jump into that, we need some quick definitions to get us rolling, both to understand this hack and to lay a foundation for other statistics hacks.

Samples are numeric values that you have gathered together and can see in front of you that represent some larger population of scores that you have not gathered together and cannot see in front of you. Because these values are almost always numbers that indicate the presence or level of some characteristic, measurement folks call these values

scores. A probability *statement* is a statement about the likelihood of some event occurring.

Probability is the heart and soul of statistics. A common perception of statisticians, in fact, is that they mainly calculate the exact likelihood that certain events of interest will occur, such as winning the lottery or being struck by lightning. Historically, the person who had the tools to calculate the likely outcome of a dice game was the same person who had the tools to describe a large group of people using only a few summary statistics.

So, traditionally, the teaching of statistics includes at least some time spent on the basic rules of probability: the methods for calculating the chances of various combinations or permutations of possible outcomes. More common applications of statistics, however, are the use of descriptive statistics to describe a group of scores, or the use of inferential statistics to make guesses about a population of scores using only the information contained in a sample of scores. In social science, the scores usually describe either people or something that is happening to them.

It turns out, then, that researchers and measurers (the people who are most likely to use statistics in the real world) are called upon to do more than calculate the probability of certain combinations and permutations of interest. They are able to apply a wide variety of statistical procedures to answer questions of varying levels of complexity without once needing to compute the odds of throwing a pair of six-sided dice and getting three 7s in a row.

## **Text 5 Computer and statistics**

The rapid and sustained increases in computing power starting from the second half of the 20th century have had a substantial impact on the practice of statistical science. Early statistical models were almost always from the class of linear models, but powerful computers, coupled with suitable numerical algorithms, caused an increased interest in nonlinear models (such as neural networks) as well as the creation of new types, such as generalized linear models and multilevel models.

Increased computing power has also led to the growing popularity of computationally intensive methods based on resampling, such as permutation tests and the bootstrap, while techniques such as Gibbs sampling have made use of Bayesian models more feasible. The computer revolution has implications for the future of statistics with new emphasis on "experimental" and "empirical" statistics. A large number of both general and special purpose statistical software are now available.

There is a general perception that statistical knowledge is all-too-frequently intentionally misused by finding ways to interpret only the data that are favourable to the presenter. The famous saying, "There are three kinds of lies: lies, damned lies, and statistics", which was popularized in the USA by Samuel Clemens and incorrectly attributed by him to Disraeli (1804-1881), has come to represent the general mistrust [and misunderstanding] of statistical science. Harvard President Lawrence Lowell wrote in 1909 that statistics, "...like veal pies, are good if you know the person that made them, and are sure of the ingredients."

## **Text 6 Russia's State Statistics**

Russia's state statistics has travelled a long and diverse path of formation and development. Its history has been preconditioned by the peculiarities of the socio-economic structure of Russia, and in the first place, by the long-time persistence of serfdom.

The change of the economic policy at the end of the XVIIIth century, becoming apparent in the revitalization of free entrepreneurship, influenced the nature of Russian statistics by revealing some features of an instrument of social cognition, and by reflecting, in a broader way, the state of economy and public life. This period was characterized by quite a few important and interesting scientific developments.

At the beginning of the XIXth century there were carried out major reforms touching upon the system of management.

Together with the new organization of management, there was changed the system of statistical work and restored the submission of reports by the provinces. After the setting-up in 1811 of a statistical section under the Ministry of Police, a new historical stage emerged in the development of Russian statistics. Up to the early 1860ies, this stage was characterized by the improvement in organization and methodology of state statistical bodies and by the appearance of profound statistical studies conducive to the reform of 1861.

The post-reform period (1861-1917) went down in history as the period of development of government and zemstvo (at a district administrative level) statistics. The vast statistical materials collected and worked out by zemstvo statisticians became a reliable basis for deep investigations of Russia's post-reform economics. Statistical science of this period was renowned for its thorough theoretical documentation, and it played a leading role in elaborating the general concept of mathematical statistics.

The initial period of Soviet statistics (1917-1930) was noted for its exceptionally intense activities: a great many special statistical censuses and surveys were carried out, the first balance of the national economy was prepared. This period was also characterized by pluralism of opinions, concepts, ideas, by critical use of foreign statistical achievements.

The subsequent development of Soviet statistics was impeded by the creation in the 30ies of an administrative bureaucratic system, by mass repressions affecting, among others, the best economists and statisticians.

Statistics during this period was engaged in accomplishing operative tasks, appraising the implementation of current plans, at the expense of its neglected analytical functions.

During the years of the Great Patriotic War, statistics solved huge problems in the line of taking inventory of labour and material resources, controlling the transfer of the productive forces to the Eastern territories of the country. After the war, the role of statistics increased, work on the balance was expanded, the theory of the index method

was made more exhaustive, economic and mathematical models and methods were widely disseminated.

At present, Russia's state statistics solves not only the current problems of catering to the society's demands for information but it also works on a complex of problems with a view to getting better adapted to the market economy. The main directions for reforming the state statistics up to 2000 were expounded by Chairman of Goskomstat of Russia at the All-Russian Conference of Statisticians in November 1995.

### **Text 7 Models in Statistics**

Statistical methods are essentially methods for dealing with data that have been obtained by a repetitive operation. For some sets of data, the operation that gave rise to the data is clearly of this repetitive type. This would be true, for example, of a set of diameters of a certain part in a mass production manufacturing process or a set of percentages obtained from routine chemical analyses. For other sets of data, the actual operation may not seem to be repetitive, but it may be possible to conceive of it as being so.

This would be true for the ages at death of certain insurance-policy holders or for the total number of mistakes an experimental set of animals made the first time they ran a maze.

Experience indicates that many repetitive operations or experiments behave as though they occurred under essentially stable circumstances. Games of chance, such as coin tossing or dice rolling, usually exhibit this property. Many experiments and operations in the various branches of science and industry do likewise. Under such circumstances it is often possible to construct a satisfactory mathematical model of the repetitive operation. This model can then be employed to study properties of the operation and to draw conclusions concerning it. Although mathematical models are especially useful devices for studying real-life problems when the model is realistic of the actual operation involved, it often happens that such models prove useful even though the operation is not highly stable.

The mathematical model that a statistician select for a repetitive operation is usually one that enables him to make predictions about the frequency with which certain results can be expected to occur when the operation is reported a number of times. For example, the model for studying the inheritance of colour the propagation of certain flowers might be one that predicted three times as many flowers of one colour as of another colour. In the investigation of the quality of manufactured parts the model might be one that predicts the percentage of defective parts that can be expected in the manufacturing process.

### **Text 8 Introduction to Mathematical Statistics**

Because of the nature of statistical data and models, it is only natural that probability should be the fundamental tool in statistical theory. The statistician looks on probability as an idealization of the proportion of times that a certain result will occur in repeated trials of an experiment; consequently, a probability model is the type of mathematical model selected by him. Because probability is so important in the theory and

applications of statistical methods, a brief introduction to probability is given before the study of statistical methods as such is taken up.

The idea of mathematical model for assisting in the solution of real-life problems is a familiar one in the various sciences. For example, a physicist studying projectile motion often assumes that the simple laws of mechanics yield a satisfactory model, in spite of the complexity of the actual problem. For more refined work, he introduces a more complicated model. Since a model is only an idealization of the actual situation, the conclusions derived from it can be relied on only to the extent that the model chosen is a sufficiently good approximation to the actual situation being studied. In any given problem, therefore, it is essential to be well acquainted with the field of application in order to know what models are likely to be realistic. This is just as true for statistical models as for models in the various branches of science.

There is the similarity between certain of the statistical methods and certain scientific methods in which the scientist sets up a hypothesis, conducts an experiment, and then tests the hypothesis by means of his experimental data.

Statistical theory is concerned not only with how to solve certain problems of the various sciences but also with how experiments in those sciences should be designed. The theory of statistics can be treated as a branch of mathematics in which probability is the basic tool; however, the theory developed from an attempt to solve real-life problems, much of it would not be fully appreciated if it were removed from such applications.

**APPENDIX B**  
**(обязательное)**

**Glossary**

А	
abnormality (n)	анормальность
accept (v)	принимать
acceptance boundary	граница, линия приёма
accountant (n)	бухгалтер
accurate (adj)	точный
adjustment	регулирование, корректировка
adjustment function	функциональная характеристика статистической совокупности
advantage (n)	преимущество предпочтение
advertiser (n)	рекламный агент
aggregate (n)	множество
aggregate chart	составная таблица
aggregate of simple events	множество элементарных событий
aggregation (n)	множество, совокупность
allowance (n)	допуск
antimode (n)	антимода, точка минимума плотности распределения
appear (v)	появляться
application (n)	применение
approach (n)	подход
approximation (n)	приближение, аппроксимация
1.array (n)	1. размещение выборочных объектов в определённом порядке, масса, совокупность, таблица, матрица, порядок;
2. array (v)	2. упорядочить последовательность
assess (v)	оценивать
association (n)	зависимость между величинами, ассоциация
at first hand	из собственного опыта
average (adj)	средний
average deviation	среднее отклонение
available statistics	доступные статистические данные
be aware of	знать, понимать
axe (n)	плоскость

<b>B</b>	
bar (n)	черта
bar graph	столбиковая диаграмма
ballot (n)	избирательный бюллетень
<b>C</b>	
calculate (v)	вычислять
categorical variable	категориальная переменная
census (n)	перепись населения
Census Bureau	Бюро переписи населения
central tendency	среднее значение распределения
chart (n)	карта, график, диаграмма, схема
check (v)	проверять
choice of major	выбор приоритетов
circle graph	секторная диаграмма
compile (v)	составлять
complete (v)	завершить
comprehensive (adj)	исчерпывающий
condense (v)	уплотнять, уменьшать объём
conduct (v)	выполнять, проводить
consider (v)	рассматривать, полагать
consist of (v)	состоять из
consumer (n)	потребитель
contain (v)	содержать
convert (v)	превращать, преобразовывать
correlation analysis	корреляционный анализ
cover (v)	покрывать, охватывать
cumulative (adj)	кумулятивный, совокупный
currently (adv)	в настоящее время
<b>D</b>	
data (pl. n)	данные
deal with (v)	иметь дело с, рассматривать, заниматься проблемой
decimal fraction	десятичная дробь
decrease (v)	уменьшать
definite (adj)	определённый
density curve	кривая плотности
depend on/upon (v)	зависеть от
determine (v)	определять
disadvantage (n)	недостаток
distribution density curve	кривая плотности распределения
diverse (adj)	разнообразный
draw (v)	вынимать
draw conclusion	делать вывод



drawing (n)	вынимание
<b>Е</b>	
employment (n)	занятость
enrolled (part.)	внесённый в список
error (n)	ошибка
equal areas point	точка равного пространства
essay (n)	эссе, очерк
event (n)	событие
evident (adj)	очевидный
exploratory data analysis	исследовательский анализ данных
<b>Ф</b>	
facet (n)	грань
favorable state	благоприятное состояние
finite (adj)	конечный
flood of data	поток данных
forecast (n)	прогноз
Frequency array	распределение частот в выборке
frequency distribution	плотность распределения, распределение частотности
frequency polygon	многоугольник частот
<b>Г</b>	
gender (n)	пол (человека)
general aggregation	генеральная совокупность
grade point average	средний балл
graph (n)	график, схема
guideline (n)	руководство. установка
<b>Н</b>	
histogram (n)	гистограмма
hypothesis (n)	гипотеза
hypothesis testing	проверка гипотезы
<b>И</b>	
imaginary	воображаемый
importance of a sampling	значимость выборки
improve (v)	улучшать
include (v)	включать
income (n)	доход
Inconsistent estimator	несостоятельная оценка
increase (v)	увеличивать
index (n)	индекс, показатель
index number	показатель числа
individual (n)	человек, отдельный элемент, индивидуум

inference (n)	вывод, умозаключение
inferential statistics	статистика вывода
infinite (adj)	бесконечный
interpret (v)	перерабатывать, объяснять
interval statistics	промежуточная статистик
investigation (n)	исследование
item (n)	единица совокупности
<b>М</b>	
locate by eye	определить на глаз
make sense	иметь смысл, быть понятным
mathematical model	математическая модель
mean (n)	средняя величина
measure (v)	измерять
measurement (n)	измерение
median (n)	медиана
midpoint (n)	средняя точка, середина
midterm (adj)	промежуточный
mode (n)	мода, вид, разновидность
<b>N</b>	
normal curve	нормальная кривая
normal distribution	нормальное распределение
nominal statistics	статистика номинальных данных
normal distribution	нормальное распределение
notation (n)	понятие
number (n)	номер, количество, число
numerical (adj)	числовой
<b>O</b>	
objective probability	объективная вероятность (оценка)
observation (n)	наблюдение
observed characteristics	наблюдаемые характеристики
obtain (v)	получать
odd (n)	случайность, непарность, вероятность
opinion poll	опрос общественного мнения
order (n)	1. порядок, закон, приказ
order (v)	2. применить, привести в порядок
in order to	чтобы
ordinal statistics	статистика порядковых числительных
outlier (n)	выступающая часть, выброс, резко выделяющееся значение
<b>P</b>	
penitentiary system	исправительная система
picture (syn, portray) (v)	изображать

pie chart	круговая диаграмма, секторная диаграмма
pinpoint (v)	определять
population (n)	совокупность
prediction (n)	прогноз
probability theory	теория вероятности
procedure (n)	процедура,
provide with (v)	предоставлять, обеспечивать
purchase (n)	покупка
purpose (n)	цель, намерение
purposive	преднамеренный
<b>Q</b>	
quality (n)	качество
quantitative variable	количественная переменная
quintile (n)	квантиль
<b>R</b>	
radix (n)	основной объект выборки для обследования
random	случайный
randomness (n)	редкость, случайность
range (n)	диапазон
ratio statistics	статистика коэффициентов
raw data	необработанные данные
recent (adj)	недавний
reduce in size	уменьшиться в объёме
refer to (v)	ссылаться на, обращаться к
regarding (prep)	относительно
reject (v)	отклонить
replacement (n)	возвращение
represent (v)	представить
representative (n) representative (adj)	1. представитель 2. показательный, наглядный, репрезентативный
representative method	метод репрезентативной выборки, репрезентативный метод
report (n)	отчёт
resistant measure	устойчивое измерение
retail sales	розничная торговля
rig results	фальсифицировать результаты
root (n)	корень
rough (adj)	грубый
round off error	ошибка округления
<b>S</b>	

sample (n)	образец, выборка
sampling (n)	выбор, выборка
scale (n)	масштаб
scan	производить поиск
scatter	разброс, рассеивание
scatter diagram	диаграмма разброса, рассеивания
score (n)	множество, счёт
sequential analysis	последовательный анализ
set (n)	набор
skewed (part.)	асимметричный
skewed curve	асимметричная кривая
skewed distribution	неравномерное распределение
smooth curve	гладкая кривая
smoothing	сглаживание
solid (adj)	цельный, непрерывный, прочный
spreadsheet program	программа табличных вычислений
standard deviation	среднеквадратическое или стандартное отклонение
statistical (adj)	статистический
statistician (n)	статистик
statistics (n)	статистика
stem plot	столбцовая диаграмма
subjective probability	субъективная вероятность (оценка)
suitable (adj)	годный, подходящий
summarize (v)	суммировать, подводить итог
survey (n)	обзор
<b>Т</b>	
table (n)	таблица
tail (n)	хвост кривой
take a heavy toll	собрать много данных
tally (n)	счёт, вычисление, число
tax (n)	налог
time series analysis	анализ временных рядов
tool (n)	инструмент
total (adj)	весь, целый, общий, итоговый
transmit (v)	передавать, сообщать
treatment of data	обработка данных
tree diagram	древовидная диаграмма
two-way array	двухмерная классификация
<b>У</b>	
unbiased error	случайная ошибка
unbiased estimator	несмещённая оценка
unbiased sampling	беспристрастный выбор

unit of measurement	единица измерения
univariate distribution	одномерное распределение
<b>V</b>	
validity (n)	вескость, обоснованность, аргументированность
value (n)	величина, значение

**APPENDIX C**  
**(справочное)**

**List of contractions**

a.m. (ante meridiem)	до полудня
amt. (amount)	сумма
a/or (and/or)	и/или
app.(appendix)	приложение
approx. (approximately)	приблизительно
av. (average)	среднее число
Comp. (company)	общество, компания
Corp(n) (corporation)	корпорация
e.g. (exempli gratia – for example)	например
etc. (et cetera)	и так далее
f.e. (for example)	например
fig. (figure)	цифра
id. (idem)	тот же, то же
i.e. – ie (id est – that is)	То есть
max. (maximum)	максимум
min. (minimum)	минимум
p. (pp.) (page – pages)	страница (страницы)
p.c. (per cent)	проценты
ref. (reference)	справка, смотрите
v.,vs. (versus)	против

**APPENDIX D**  
**(обязательное)**

**Grammar Reference**

**D 1 Активный залог (Active Voice)**

**Таблица видовременных форм глагола**

Время (Tense)	Неопределённое (Simple) Обычные, повторяющиеся действия.	Длительное (Progressive) Действие происходит в определённый момент	Завершённое (Perfect) Действие завершилось к определённом у моменту	Завершённо-длительное (Perfect-Progressive) Действие длится некоторое время до определённого момента
Present	V <sub>1</sub> (Vs) Do not V <sub>1</sub> Does not V <sub>1</sub>	Am (is, are) Ving	Have (has) V <sub>3</sub>	Have (has) been Ving
Past	V <sub>2</sub> Did not V <sub>1</sub>	Was (were) Ving	Had V <sub>3</sub>	Had been Ving
Future	Will V <sub>1</sub>	Will be Ving	Will have V <sub>3</sub>	Will have been Ving

**Simple Tenses**

Простые времена, в отличие от глагольных времён других групп, употребляются лишь для констатации совершения действия в настоящем, прошедшем и будущем, без указания на длительность и законченность действия и безотносительно к какому-либо другому действию или моменту.

**Present Simple**

Случаи употребления настоящего простого времени:

1. Для выражения общеизвестной истины.

Water boils at 100 degrees Centigrade.

2. Для выражения обычного, регулярно повторяющегося действия в настоящем.

She cleans the flat daily.

3. Для выражения обычного факта в настоящем.

Kate teaches English at school.

2 Для выражения последовательных действий в настоящем.

I get up, wash, shave, dress and have breakfast.

3 Для выражения заранее намеченного или запланированного действия в будущем. В этом случае обычно используются такие глаголы, как: to begin, to go, to start, to come, to arrive, to leave, to return, to visit.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I (you) ask. He (she, it) asks.	Do you (I) ask? Does she (he, it) ask?	I (you) don't ask. She (he, it) doesn't ask.
Мн. ч.	We (you, they) ask.	Do we (you, they) ask?	We (you, they) don't ask.

#### Обстоятельства времени

every day (month, year, week) – каждый день (месяц, год, неделю)

in the morning (in the afternoon, in the evening, at night) - утром, днём, вечером,

ночью

usually - обычно

always - всегда

sometimes- иногда

often - часто

never - никогда

seldom – редко

#### Past Simple

Прошедшее простое время выражает действие, которое однократно произошло или совершалось повторно в прошлом и не связано с настоящим.

По способу образования прошедшего времени глаголы делятся на правильные и неправильные: правильные образуют форму прошедшего времени путём прибавления суффикса –ed (V-ed); формы прошедшего времени неправильных глаголов следует заучивать наизусть.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I (you, she, he, it) asked.	Did you (I, she, he, it) ask?	I (you, she, he, it) didn't ask.



Мн. ч.	We (you, they) asked.	Did we (you, they) ask?	We (you, they) didn't ask.
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### Обстоятельства времени

yesterday  
the day before yesterday  
a year ago  
last year  
in the morning  
in 1992  
on Sunday  
in summer  
on March, 14  
on other day  
all day long  
the whole month

### Future Simple

Означает неопределённое действие в будущем

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I shall (I'll) ask. You (she, he, it) will ask.	Shall I ask? Will you (she, he, it) ask?	I shan't ask. You (she, he, it) won't ask.
Мн. ч.	We shall ask. You (they) will ask.	Shall we ask? Will you (they) ask?	We shan't ask. You (they) won't ask.

Современный язык допускает использование вспомогательного глагола 'will' во всех лицах и числах.

Сокращённая форма глаголов shall, will – 'll  
shall not – shan't  
will not – won't

### Обстоятельства времени

tomorrow  
the day after tomorrow  
in some days  
some time

Намерение, относящееся к будущему времени, может также быть выражено оборотом 'to be going to' (намереваться что-то сделать).

## Progressive Tenses

### Present Progressive

Выражает действие, совершаемое в момент речи, т.е. в данный момент, в настоящее время. Оно выражает действие в процессе его совершения.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I am asking. You are asking. She (he, it) is asking.	Am I asking? Are you asking? Is she (he, it) asking?	I'm not asking. You're not asking. She (he, it) isn't asking.
Мн. ч.	We (you, they) are asking.	Are you (we, they) asking?	We (you, they) aren't asking

#### Обстоятельства времени

now  
just now  
at the moment  
at the present time

Кроме того, настоящее продолженное действие выражает будущее действие, когда имеет место намерение совершить действие, либо речь идёт о заранее намеченном действии.

f.g. We are leaving for London tomorrow.

В настоящем продолженном времени не употребляются некоторые глаголы, главным образом – это глаголы, означающие чувства, желание, восприятие посредством органов чувств, умственную деятельность.

to see, to sound, to hear, to love, to hate, to know, to resemble, to want, to wish, to desire, to require, to understand, to consider, to remember, to forget, to regret, to like, to smell, to appear, to belong, to doubt, to taste, to seem, to cost, to mean, to deserve, to equal, to own, to contain, to fit, to prefer, to consist of.

Следует отметить, что некоторые глаголы, означающие умственную деятельность или чувственное восприятие могут, все же, употребляться в продолженном времени.

e.g. I think it's a very interesting offer. – Я думаю, это очень интересное предложение.

Но:

I'm thinking of going there next summer. – Я думаю поехать туда следующим летом. (обдумываю идею)

e.g. We consider this their best model. – Мы считаем это их лучшей моделью.

Но:

We are considering buying one of these computers. – Мы рассматриваем вопрос о покупке одного из этих компьютеров.

### Past Progressive

Выражает незаконченное длительного действия в процессе его совершения в определённый момент или период времени в прошлом.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I (she, he, it) was asking. You were asking.	Was I (she, he, it) asking? Were you asking?	I (she, he, it) wasn't asking. You were not asking.
Мн. ч.	We (you, they) were asking.	Were you (we, they) asking?	We (you, they) were not asking.

### Обстоятельства времени

at that moment  
at noon  
at midnight  
during the summer  
all day yesterday  
from ... till (to) ...  
the whole morning last Sunday

Если момент времени выражен придаточным предложением, используются союзы when или while.

e.g. I looked through papers while the director was signing the document.

e.g. She was working when Pete entered the room.

### Future Progressive

Выражает длительное незаконченное действие, которое будет совершаться в определённый момент или период времени в будущем.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I (you, she, he, it) will be asking.	Will I (you, she, he, it) be asking?	I (you, she, he, it) won't be asking.
Мн. ч.	We (you, they) be asking.	Will we (you, they) be asking?	We (you, they) won't be asking.

## Perfect Tenses

### Present Perfect

Выражает действие, которое закончилось к определённом моменту в настоящем моменту времени, при этом оно может означать действие, завершившееся непосредственно перед моментом речи или в отдалённом прошлом.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I (you) have asked. She (he, it) has asked.	Have I (you) asked? Has she (he, it) asked?	I (you) haven't asked. She (he, it) hasn't asked.
Мн. ч.	We (you, they) have asked.	Have you (we, they) asked?	We (you, they) haven't asked.

Случаи употребления настоящего совершенного времени

1. Употребляется с такими наречиями неопределённого времени, как:

just – только что

already - уже

never - никогда

ever – когда-либо

yet – уже (в вопросительных предложениях)

ещё нет (в отрицательных предложениях)

lately – в последнее время

recently – недавно

2. Употребляется с наречиями, обозначающими незаконченный период времени.

today

this week (morning, month, year)

3. Употребляется в предложениях, чтобы сделать акцент на совершённом действии, где нет обстоятельства времени.

Различия в употреблении Past Simple и Present Perfect

1. Present Perfect выражает действие, имеющее непосредственное отношение к моменту речи в настоящем. Past Simple выражает действие, полностью относящееся к прошедшему периоду времени, оно обычно употребляется в повествовании о прошлых событиях.

2. Past Simple подразумевает употребления таких обстоятельств времени, как: yesterday, two years ago, last week, etc. Present perfect употребляется с такими обстоятельствами времени, которые включают момент речи: today, this week, lately.

3. Специальные вопросы в Present Perfect задаются с вопросительным словом 'How long', а в Past Simple - с вопросительным словом 'When'.

## Past Perfect

Выражает действие, которое уже совершилось до определённого момента в прошлом.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I (you, she, he, it) had come.	Had you (I, she, he, it) come?	I (you, she, he, it) hadn't come.
Мн. ч.	We (you, they) had come.	Had you (we, they) come?	We (you, they) hadn't come.

Момент времени в прошлом может обозначаться часом, датой, месяцем, годом, к которым действие уже закончилось

by 7 p.m. yesterday

by the 19<sup>th</sup> of November last year

before she came

when she came

## Future Perfect

Выражает действие, которое завершится к определённому моменту в будущем.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I (you, she, he, it) will have finished.	Will you (I, she, he, it) have finished?	I (you, she, he, it) won't have finished.
Мн. ч.	We (you, they) will have finished.	Will you (we, they) have finished?	We (you, they) won't have finished.

Момент времени в будущем обозначается предлогом 'by'.

## Perfect Progressive Tenses

### Present Perfect Progressive

Выражает действие, которое началось до определённого момента в настоящем и длится известный период времени, включающий этот момент.

Число	Утвердительная форма	Вопросительная форма	Отрицательная форма
Ед. ч.	I (you) have been doing.	Have you (I) been doing? Has she (he, it) been	I (you) haven't been doing.

	She (he, it) has been doing.	doing?	She (he, it) hasn't been doing.
Мн. ч.	We (you, they) have been doing.	Have you (we, they) been doing?	We (you, they) haven't been doing.

Употребляются обстоятельства времени с предлогами:

for – в течение

since – с какого-либо времени

Present Perfect Progressive употребляется также с такими указаниями времени, как:

still – всё ещё

to this day (up to this point) – до сей поры

С глаголами, которые не употребляются в продолженных временах, вместо времён группы Perfect Progressive употребляются времена группы Perfect.

Формы прошедшего и будущего совершенно-длительного времён употребляются крайне редко.

## **D 2 Типы вопросов (Types of Questions)**

Основные типы вопросов, используемые в английском языке.

### **Общий вопрос (General question)**

Общий вопрос относится к о смыслу всего предложения в целом, и ответом на него будут слова **yes** или **no**.

#### **Порядок слов в общем вопросе:**

1. вспомогательный (модальный, глагол-связка) глагол;
2. подлежащее (существительное или местоимение);
3. смысловой глагол (или дополнение);
4. второстепенные члены предложения.

#### **Например:**

1. Do you like music?
2. Does he live not far from here?
3. Did they travel a lot last summer?
4. Can you speak English?
5. Are you a student?
6. Have you seen my brother?
7. Is she working now?

### **Специальный вопрос (Special question)**

Специальный вопрос относится к какому-нибудь члену предложения или их группе и требует конкретного ответа.

**Порядок слов в специальном вопросе:**

1. вопросительное слово (what, why, where, who, when, what kind of, whose, whom, which, how, how many (much), how long);
2. вспомогательный глагол (модальный глагол, глагол-связка);
3. подлежащее;
4. смысловый глагол;
5. второстепенные члены предложения.

**Например:**

1. Where does he work?
2. Why did you buy this thing?
3. How long has he been doing this work?
4. What are you writing?
5. When will you come to our town?
6. How much have you done?

В специальных предложениях, обращённых к **подлежащему**, в формах Present Simple и Past Simple не употребляются вспомогательные глаголы **do, does, did**, а основной глагол (в **Present** или **Past Simple**) или вспомогательный глагол (во всех других временах) сохраняет форму 3-его лица, единственного числа, порядок слов в предложении – прямой. В предложениях, относящихся к настоящему времени, основной глагол всегда имеет окончание **-s (-es)**.

**Например:**

1. Who knows him better than you?
2. Who lives in the room next to you?
3. What troubled you so much?
4. Who is playing the piano at the moment?
5. Who has helped you in this work?
6. What has happened?

**Альтернативный вопрос (Alternative question)**

Альтернативный вопрос предполагает выбор из двух возможностей:

Do you like tea or coffee?

Альтернативный вопрос начинается как общий вопрос, затем следует союз **or** и вторая часть вопроса.

**Например:**

1. Do you prefer football or hockey?
2. Does he or she help you?
3. Are you going for a walk or staying at home?
4. Has she come from Moscow or St. Petersburg?

## Разделительный вопрос (Tail question)

Разделительный вопрос состоит из двух частей. Первая часть – это повествовательное предложение (вопросительное или отрицательное), вторая – краткий вопрос **tail**, который состоит из:

1. вспомогательного глагола, соответствующего предложению;
2. отрицательная частица (если первая часть вопроса утвердительная);
3. подлежащее, выраженное местоимением.

### Например:

1. Your name is Jackson, isn't it?
2. He came in time, didn't he?
3. Mr. Jones will give presentation at the conference, won't he?
4. They are not satisfied with the situation, aren't they?
5. You don't like black coffee, do you?

## D 3 Страдательный залог (Passive voice)

Формы глагола в страдательном залоге образуются при помощи вспомогательного глагола *to be* в соответствующем времени, лице, числе и причастия II смыслового глагола : The book is written.

В страдательном залоге нет времен Perfect Continuous, Future Continuous и Future Continuous in the Past.

Инфинитив *to be written*

	Present	Past	Future	Future in the Past
Indefinite	The book is written.	The book was written.	The book will be written.	The book would be written.
Progressive	The book is been	written. The book was being written.	—	—
Perfect	The book has been written.	The book had been written.	The book will have been written.	The book would have been written.

Отрицательная, вопросительная и вопросительно-отрицательная формы страдательного залога образуются по тем же правилам, что и соответствующие формы действительного залога, а именно:

1) В отрицательной форме частица *not* ставится после вспомогательного глагола: The book is not written.

При сложной форме вспомогательного глагола частица *not* ставится после первого вспомогательного глагола: The book has not been written.

Сокращенные формы образуются аналогично сокращенным формам глагола в действительном залоге: The book isn't written, the book hasn't been written.

2) В вопросительной форме вспомогательный глагол ставится перед



подлежащим: Is the book written? При сложной форме вспомогательного глагола перед подлежащим ставится первый вспомогательный глагол: Has the book been written?

3) В вопросительно-отрицательной форме вспомогательный глагол (или первый вспомогательный глагол—в сложной форме) ставится перед подлежащим, а частица not после подлежащего: Is the book not written? Has the book not been written?

При сокращенной вопросительно-отрицательной форме частица not ставится перед подлежащим и сливается с вспомогательным глаголом, причем буква o в слове not выпадает как в написании, так и в произношении: Isn't the book written? Hasn't the book been written?

#### D 4 Степени сравнения прилагательных и наречий (Degrees of comparison)

Имена прилагательные в английском языке имеют три степени сравнения: положительную (the Positive Degree), сравнительную (the Comparative Degree) превосходную (the Superlative Degree).

Сравнительная и превосходная степени в английском языке образуются двумя способами: а) посредством прибавления суффиксов и б) с помощью специальных слов.

1. Степени сравнения односложных прилагательных образуются путем прибавления суффиксов к прилагательным в положительной степени: в сравнительной степени прибавляется суффикс **-er**, в превосходной степени -суффикс **-est**.

Таким же способом образуются степени сравнения двусложных прилагательных, оканчивающихся на **-le**: simple простой, humble скромный и т. п.; на **-y**: happy счастливый, heavy тяжелый и т. п.; на **-er**: clever умный, bitter горький, резкий и т. п.; на **-ow**: narrow узкий, shallow мелкий и т. п., и некоторых других двусложных прилагательных.

<i>Положительная степень</i>	<i>Сравнительная степень</i>	<i>Превосходная степень</i>
short короткий high высокий	shorter короче, более короткий higher выше, более высокий	shortest кратчайший, самый короткий highest высочайший, самый высокий

При образовании степеней сравнения прилагательных путем прибавления суффиксов **-er** и **-est** соблюдаются следующие правила правописания:

1) В написании удваивается конечная согласная буква, если односложное прилагательное оканчивается на одну согласную с предшествующим кратким гласным звуком:

hot	горячий	hotter	hottest
big	большой	bigger	biggest

flat	плоский, ровный	flatter	flattest
------	--------------------	---------	----------

2) Конечная гласная у меняется на **i** перед суффиксами **-er** и **-est**, если гласной у предшествует согласная буква

happy	счастливый	happier	happiest
dry	сухой	drier	driest
<b>но:</b> grey	серый	greyer	greyest

3) Конечная гласная **e** (немое **e**) опускается перед фиксами **-er**, **-est**:

large	большой	larger	largest
white	белый	whiter	whitest

2. Второй способ образования степеней сравнения заключается в прибавлении специальных слов к прилагательному в положительной степени: в сравнительной степени прибавляется слово **more**, в превосходной степени слово **most**.

Этим способом образуются степени сравнения большинства двусложных и всех многосложных прилагательных:

<i>Положительная степень</i>	<i>Сравнительная степень</i>	<i>Превосходная степень</i>
useful полезный	more useful более полезный, полезнее	most useful самый полезный, наиболее полезный
difficult трудный	more difficult более трудный, труднее	most difficult самый трудный труднейший
numerous многочисленный	more numerous более многочисленный	most numerous самый многочисленный

Для выражения степеней сравнения, указывающих уменьшение качества или свойства предмета, употребляются слова **less** в сравнительной степени и **least** в превосходной степени:

<i>Положительная степень</i>	<i>Сравнительная степень</i>	<i>Превосходная, степень</i>
difficult трудный	less difficult менее трудный	least difficult наименее трудны
considerable значительный	less considerable менее значительный	least considerable наименее значительный

Некоторые прилагательные образуют степени сравнения от других корней, так же как и соответствующие слова в русском языке:

<i>Положительная степень</i>	<i>Сравнительная степень</i>	<i>Превосходная степень</i>
good хороший	better лучше	best лучший, самый лучший, наилучший
bad плохой	worse хуже	worst худший, самый плохой, наихудший
little маленький	less меньше	least самый маленький, наименьший
much, many много	more больше	most наибольший

## **D 5 Словообразование (Word formation)**

### **Наиболее употребительные префиксы существительных**

re- - reconstruction, rewriting  
 co- - cooperation, coordination  
 dis- - disadvantage, destruction  
 in- - inaccuracy, independence  
 im- - impossibility, impatience  
 il- - illegality, illiteracy  
 un- - unemployment, unreality  
 mis- - misunderstanding, misprinting

### **Наиболее употребительные суффиксы существительных**

-er/or – teacher, actor  
 -ist – scientist, artist  
 -ment – movement, development  
 -ess – fortress, hostess  
 -ian – musician, technician  
 -ance – distance, importance  
 -(t)ion – revolution, operation  
 -ity(ty) – popularity, morality  
 -hood – childhood, neighborhood  
 -y – energy, assembly  
 -ship – friendship, leadership  
 -age – passage, marriage  
 -ism – heroism, capitalism  
 -ant – assistant, consultant

-ence – conference, difference  
-ure – culture, agriculture  
-ing – building, reading  
-dom – freedom, kingdom  
-sion, -ssion – revision, discussion  
-ness – happiness, darkness  
(-s)ure – pleasure, treasure

### **Наиболее употребительные префиксы глаголов**

co- -coexist, collaborate  
de- - decode, decompose  
dis- - disbelieve, disapprove  
in- - input, inlay  
im- - immigrate, implant  
inter- - interact, interchange  
ir- - irritate, irradiate  
over- - overcome, overheat  
re- - readjust, rebuild  
mis- - misprint, misunderstand

### **Наиболее употребительные суффиксы глаголов**

-en – deepen, lighten  
-fy – classify, electrify  
-ize (ise) – organize, characterize  
-ate – indicate, activate

### **Наиболее употребительные префиксы прилагательных**

un- - unhappy, uncomfortable  
in- - independent, indirect  
dis- - disappointing, disconnecting  
im- - impossible, imperfect  
non- - nonferrous, nongovernmental  
ir- - irregular, irresponsible  
post- - post-war, post-operational  
inter- - interdependent, interchangeable  
il- - illegal, illiberal

### **D 6 Герундий (Gerund)**

Герундий —это неличная форма глагола, соединяющая в себе свойства существительного и глагола.

Формы герундия:

	Indefinite	Perfect
Active	writing	having written
Passive	being written	having been written

Герундий может выполнять различные функции в предложении. Герундию в качестве определения большей частью предшествует предлог of (иногда for). Герундий в функции определения переводится на русский язык существительным в родительном падеже, существительным с предлогом или неопределенной формой глагола:

- a) the method of doing work - метод выполнения работы
- b) the process of stamping - процесс штамповки
- c) the possibility of using - возможность использования
- d) the operation of removing - операция по удалению
- e) the possibility of seeing - возможность увидеть
- f) the way of speaking - манера говорить
- g) the capacity for doing work - способность производить работу

h) I'm glad to have the opportunity of talking to you, Doctor. -- Я рад возможности поговорить с вами, доктор.

The data set appearing in a spreadsheet program has rows and columns. -Совокупность данных, представленных в крупноформатной таблице распределена в ряды и колонки.

Функции герундия в предложении

1. Подлежащее: Герундий в функции подлежащего переводится на русский язык именем существительным или неопределенной формой глагола: Skating is a favorite sport with the youth -- Катание на коньках -любимый вид спорта молодежи.

2. Часть составного сказуемого: Герундий в функции именной части составного именного сказуемого или части составного глагольного сказуемого обычно переводится на русский язык существительным или неопределенной формой глагола: The snow had ceased falling, and the patrols might easily find his tracks. -- Снег перестал идти, и патруль мог легко напасть на его след.

3. Прямое дополнение: Герундий в функции прямого дополнения переводится неопределенной формой глагола, существительным или глаголом в личной форме (в функции сказуемого) в составе придаточного предложения.

Герундий употребляется в функции прямого дополнения после глаголов:

- to avoid - избегать;
- to mention - упоминать;
- to postpone - откладывать;
- to excuse - извинять;
- to propose - предлагать;
- to require - требовать;
- to need - нуждаться в;
- to suggest - предлагать;
- и некоторых других глаголов.

e.g. Induction is a method of charging a conductor from a charged object which does not require bringing the two into contact -- Индукция - это метод зарядки проводника от заряженного предмета, который не требует, чтобы проводник и заряженный предмет были приведены в соприкосновение.

Предложное дополнение: Герундий в функции предложного дополнения переводится неопределенной формой глагола, существительным или глаголом в личной форме (в функции сказуемого) в составе придаточного предложения. Обычно герундий употребляется в функции предложного дополнения после глаголов, прилагательных и причастий, требующих после себя определенных предлогов. К числу таких наиболее употребительных глаголов, прилагательных и причастий относятся:

- to depend (on) - зависеть (от);
- to rely (on) - полагаться (на) (чем-либо или кем-либо);
- to insist (on) - настаивать (на);
- to object (to) - возражать (против);
- to agree (to) - соглашаться (на);
- to prevent (from) - помешать, препятствовать;
- to be interested (in) - интересоваться (чем-либо);
- to succeed (in) - преуспевать в чём-либо;
- to be connected (with или to) - быть связанным (с).

e.g. Under the conditions of war our country succeeded in rapidly converting industry to war production - В условиях войны нашей стране удалось быстро перевести промышленность на военное производство.

#### 5. Определение:

6. обстоятельство: Герундий в функции обстоятельства употребляется всегда с предлогом и обычно переводится существительным с предлогом, деепричастием несовершенного или совершенного вида или глаголом в личной форме (в функции сказуемого) в составе придаточного предложения: In moving about molecules make repeated collisions with their neighbours -- Находясь в движении, молекулы все время сталкиваются с соседними молекулами.

Герундий часто входит в состав сложных существительных для указания назначения предмета, обозначенного существительным: writing-paper почтовая бумага, писчая бумага (бумага для письма), driving force движущая сила (сила для производства движения), drilling machine буровая машина (машина для бурения)

## **D 7 Причастие (Participle)**

### **Причастие I (Participle I)**

Причастие I (причастие настоящего времени), образованное при помощи окончания **-ing**, имеет активную и страдательную формы:

**Активная** (несовершенный вид) – **asking**;

**Активная** (совершенный вид) – **having asked**;

**Страдательная** (несовершенный вид) – **being asked**;

**Страдательная** (совершенный вид) – **having been asked**.

**Причастие I** употребляется в качестве:

**1. Определения:**

The man <b>sitting</b> at the table is our teacher.	Человек, <b>сидящий</b> за столом – наш учитель.
The houses <b>being built</b> in our town are not very high.	Дома, <b>строящиеся</b> в нашем городе, невысокие.
The question <b>having been asked</b> by her seemed very strange.	<b>Заданный</b> ею вопрос, показался странным.

### Причастие II (Participle II)

Причастие II (причастие прошедшего времени) всегда **пассивно**. Оно образуется прибавлением суффикса **-ed** к основе правильного глагола или путём чередования звуков в корне неправильного глагола.

**Причастие II** употребляется в функции:

**1. Определения:**

The book <b>translated</b> from English is very interesting.	Книга, переведённая с английского я Языка, интересная.
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**1. Обстоятельства:**

<b>Given</b> the task he began to work.	<b>Когда ему дали задание</b> , он начал работать.
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**2. Обстоятельства:**

<b>Going</b> home I met an old friend.	<b>Идя</b> домой, я встретил старого друга.
<b>Having finished</b> work I went home.	<b>Закончив</b> работу, я пошёл домой.

### D 8 Сослагательное наклонение (Subjunctive Mood)

Сослагательное наклонение выражает предположительное или желательное действие и переводится на русский язык глаголом в форме, совпадающей с прошедшим временем, с частицей «бы».наиболее употребительная форма сослагательного наклонения в английском языке – аналитическая форма should (would)+ инфинитив.

e.g. He would tell me the news.

Он рассказал бы мне эту новость.

Форма сослагательного наклонения should (would) + Indefinite Infinitive употребляется для выражения предполагаемого действия, относящегося к настоящему или будущему времени. Для передачи действия, относящегося к прошлому, в этой модели употребляется перфектный инфинитив.

e.g. I should have gone to the country with you but I fell ill.

Я бы поехал с тобой за город, но я заболел.

Другой формой сослагательного наклонения является форма, состоящая из вспомогательного глагола should (для всех лиц единственного и множественного числа) и инфинитива. Этот вид сослагательного наклонения используется в следующих типах придаточных предложений:

1) в придаточных предложениях типа ‘It is necessary’:

e.g. It is impossible that they should have done this.

Невозможно, чтобы они такое сделали.

2) в придаточных дополнительных после сказуемого, выраженного глаголами to suggest, to demand, to order. Инфинитив после этих глаголов не употребляется:

e.g. The doctor demanded that the patient should stay in bed for some more days.

Врач потребовал, чтобы больной соблюдал постельный режим ещё в течение нескольких дней.

3) в придаточном предложении обстоятельства цели после союза lest (чтобы не):

e.g. We had to take a taxi lest we should be late for the performance.

Мы взяли такси, чтобы не опоздать на спектакль.

Следует помнить, что глагол ‘Be’ во всех лицах и числах имеет форму were.

Present Subjunctive редко используется в современном английском языке. Past и Perfect Subjunctive широко используются в:

1) придаточном сравнительном с союзами as if и as though (как будто, словно);

2) придаточном с союзами при глагольных связках to be, to feel, to look, to seem;

3) в придаточных дополнительных предложениях, зависящих от главного, с глаголом-сказуемым **wish**, употребляется Past Subjunctive от глагола to be или используется форма Past Indefinite всех других глаголов в значении сослагательного наклонения: **I wish he were here!** **Я хотел бы**, чтобы он был здесь! **I wish we had a rest.** - **Я хотел бы**, чтобы мы отдохнули.

4) или

	Form	Use
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<b>I wish</b>	<b>Past Simple (Were)</b>	<b>Сожаление о настоящем</b>
e.g. I wish I were more beautiful (but I am not beautiful)		
<b>I wish</b>	<b>Past Perfect</b>	<b>Сожаление о том, что случилось или не случилось в прошлом</b>
e.g. I wish I had gone to Ann's party last night.		

## D 9 Условные предложения (Conditionals)

Условные предложения в английском языке вводятся союзами **if** - если, **provided (that)** – если, при условии, что, **unless** – если не, **in case (that)** – в случае, если, **supposing (that)** – если предположить, что, **on condition (that)**. Условные предложения делятся на три типа:

1. Условные предложения I типа (реального условия): действие относится к будущему времени.

Главное предложение	Придаточное предложение
Future Simple Shall (will) V <sub>1</sub>	(if) Present Simple

e.g. If labour resources are used properly, labour efficiency will grow. – Если трудовые ресурсы будут использоваться правильно, производительность труда возрастет.

2. Условные предложения II типа (маловероятного условия): действие относится к настоящему или будущему времени.

Главное предложение	Придаточное предложение
Future Simple – in – the - Past Should (would) V <sub>1</sub>	(if) Past Simple

e.g. If we applied new highly efficient equipment. we would decrease the production cost. – Если мы использовали бы новое высокоэффективное оборудование, мы снизили бы себестоимость.

3. Условные предложения III типа (абсолютно нереального условия): действие относится к прошедшему времени.

Главное предложение	Придаточное предложение
Future Perfect – in – the - Past Should (would) have V <sub>1</sub>	(if) Past Perfect

e.g. If they had used double entry book-keeping system. they would have easily found the error in balances. – Если бы они использовали двойную систему бухгалтерской записи, они легко обнаружили бы ошибку в балансах.

Иногда возникают ситуации, когда условие и следствие относятся к различным временам (например, придаточное предложение относится к прошедшему времени, а главное – к настоящему или будущему, или наоборот). Тогда образуется условное предложение смешанного типа:

e.g. If they **knew** the language, they **would have gone** abroad last year.

2-й тип

3-й тип

Если бы они знали язык, они уехали бы за границу в прошлом году.

e.g. If he **had been** there, we **should go** there too.

3-й тип

2-й тип

Если бы он уже побывал там, мы тоже поехали бы туда.