

Information technologies for 9th and 10th grades

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МИНИСТЕРСТВО НА ОБРАЗОВАНИЕТО И НАУКАТА

НАЦИОНАЛНА ПРОГРАМА

„Разработване на учебни помагала за обучение по общообразователни учебни предмети на чужд език, оценяване и одобряване на проекти на учебни помагала за подпомагане на обучението, организирано в чужбина, на проекти на учебници и на проекти на учебни комплекти“

МОДУЛ

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9.-10.
клас

Информационни технологии на английски език

Учебно помагало

Разработено от авторски екип
към Първа езикова гимназия – Варна

АЗ·БУКИ

Национално издателство за образование и наука

Информационни технологии за 9. – 10. клас на английски език

Учебно помагало, разработено от авторски екип
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Топачарова, 2021 г.

Редактор: Пресиана Тошева Йоргакиева-Калева, 2021 г.

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Графичен дизайн тяло и корица: инж. Дарина Атанасова, 2021 г.

Национално издателство за образование и наука „Аз-буки“

1113 София, бул. „Цариградско шосе“ 125, бл. 5,

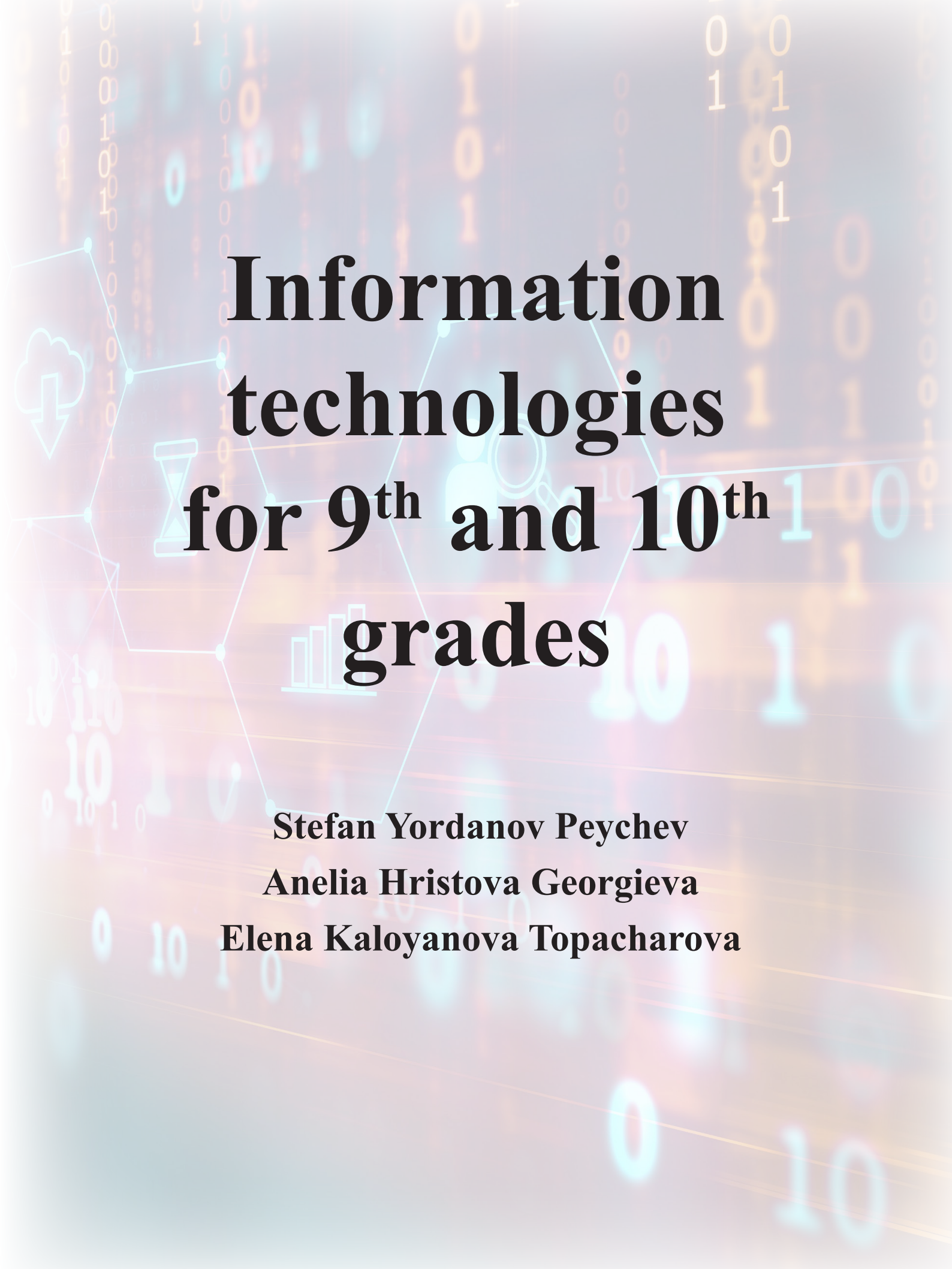
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Графично оформление: Мария Шопова

Първо издание, 2021 г.

Формат: 210x280 мм; 182 страници

e-ISBN 978-619-7065-86-2



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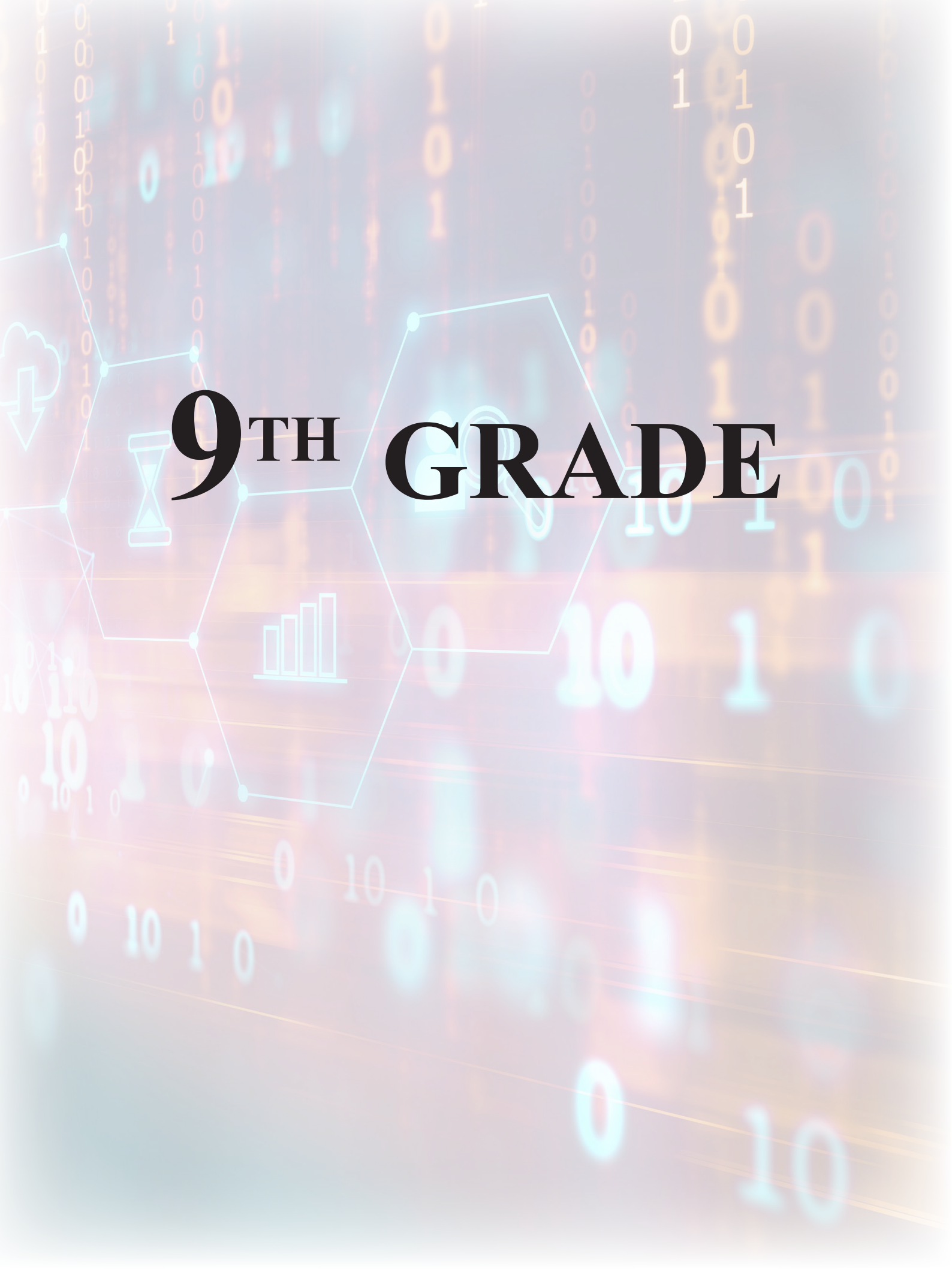
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9TH GRADE



I. COMPUTER SYSTEMS

1. SUPERCOMPUTERS

Let us remember:

Basic components of a computer system

1. Central processing unit (number of processor cores) – clock speed, cache memory, speed.
2. Operating memory (RAM) – size, speed.
3. Memory storage – HDD, SSD – size, speed – write speed and read speed.
4. Graphics (video) card – built into the motherboard or standalone module, speed, memory, etc.

1. What is a supercomputer?

A computer whose characteristics at the time of its creation are many times better than the characteristics of general-purpose computers is called a supercomputer. Particular attention is paid to data processing capacity or the speed at which the computer performs calculations.

Supercomputers are used to solve problems that require a huge number of calculations per second. The areas in which they are used can be (but not only):

- Problems in quantum mechanics.
- Weather forecasts and climate research.
- Chemistry - modeling of properties and structures of chemical compounds, polymers and crystals.
- Biology - biological macromolecules.
- Cryptanalysis.
- Physics – creation of physical simulations (tests of various technical devices such as airplanes, e.g., in wind tunnels, etc.) nuclear fusion, in CERN, etc.
- For military purposes – detonation of nuclear weapons, testing of military equipment in various conditions.



Fig. 1. Supercomputer

Supercomputers are mainly used by worldwide universities, scientific and military organizations.

2. History

In the 1960s, the Atlas is the third supercomputer project at the University of Manchester.

This is followed by a series of computers in the Control Data Corporation (CDC) that use innovative design and parallel data processing to achieve superior computing performance.



Fig. 2. Atlas

Atlas is a joint project of Ferranti – a British electrical engineering company, and the University of Manchester and is designed to run at processing speeds approaching one microsecond per instruction or about one million instructions per second. Construction of the first “Atlas” officially began on December 7, 1962 as one of the first supercomputers in the world considered the most powerful computers in the world at that time.

3. Supercomputers in Bulgaria

In the 1970s and 1980s, the production of computers in Bulgaria developed rapidly. At that time, the computer IZOT 1014 E was designed and created, which had a capacity of 100 million operations per second.

In 2008, Bulgaria enters position 126 in the ranking with its first supercomputer **Blue Gene**, located in the National Center for Supercomputer Applications. As of November 2009, it is ranked 377th, and by November 2012, it is already out of the top 500 in terms of productivity.



Fig. 3. IZOT

Since July 2016, the NESTUM cluster has been operating in Sofia Tech Park, based on a compact homogeneous PC architecture with a total of 768 processor cores, each with 4 GB of RAM (3 TB in total), with a theoretical computing capacity of 23,347 GFlops.

4. Performance measurement

The measure of computer performance is called flops (*FLoating point Operations Per Second*) – the number of floating point operations that a computer can perform in one second.

The **FLOPS** unit is similar to the **IPS** (or **MIPS**), which shows the number of instructions per second executed by a processor. The two terms are similar, but with different meanings, because different instructions take different amounts of time, so the number of instructions that the processor executes per second depends on the specific type of instructions. In particular, the performance of a processor in **MFLOPS** may be less or greater than that in **MIPS**, depending on the specific type of calculation, resp. instructions with which the measurement was performed.

The barrier of 1 PFLOPS (petaFLOPS) was first crossed by the Jaguar supercomputer in 2008.

The following table shows the derivatives of FLOPS units and the year in which the respective barrier was first jumped by a supercomputer:

Supercomputer performance		
barrier	year	FLOPS
FLOPS	1941	100
KFIOPS	1949	10 ³
MFLOPS	1964	10 ⁶
GFLOPS	1987	10 ⁹
TFLOPS	1997	10 ¹²
PFLOPS	2008	10 ¹⁵
EFLOPS	2010	10 ¹⁸
ZFLOPS	–	10 ²¹
YFLOPS	–	10 ²⁴

Glossary

Supercomputer – a computer whose characteristics at the time of its creation are many times better than the characteristics of general-purpose computers.

Cluster – a group of computers, united by a high-speed connection and representing from the point of view of the user a single resource; /e.g., several processor cores combined and working as one processor.

A **floating-point number** is a form of representation of real numbers in which the number is represented in an exponential notation as an ordered pair composed of the base and the exponent.

Questions:

1. Which are the main characteristics of a computer system?
2. What is Supercomputer?
3. Put into an increasing order the units of computer performance – Mflops, Flops, TerraFlops, GFlops, KFlops.

2. GRID AND CLOUD COMPUTING

Let us remember:

Cluster – a group of computers, united by a high-speed connection which from the point of view of the user represent a single resource (e. g. several processor cores combined and working as one processor).

FLOPS – (FLoating point Operations Per Second) – the number of floating point operations that a computer can perform in one second.

1. Grid technology

Grid technology combines many computer resources (e.g. processor time, data storage space, etc.), located in different places. The purpose of this unification is to achieve a common goal. The main difference between grid and high-performance computer systems, such as, clusters is that with grid each node (networked computer) performs a different task. Another difference is the geographical location of the computers - in clusters the computers are located close to each other while in grid we have more scattered nodes. One grid can be used for a specific application but is most often used for different purposes.

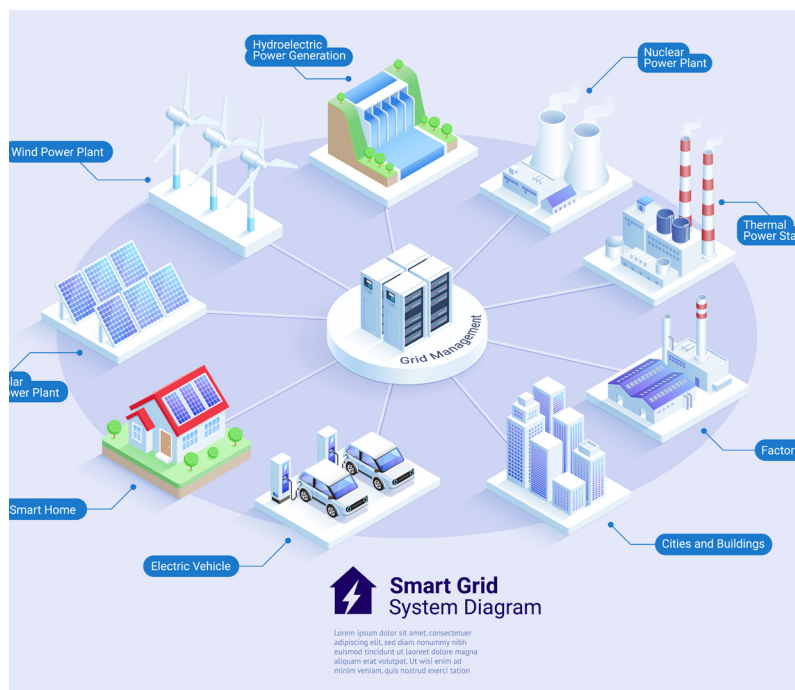


Fig. 1. Grid

One of the strategies used by grid is the use of the so-called Middleware, which divides and distributes parts of the program between several computers. It is possible that the number of these computers will reach several thousand.

The size of a grid can vary from small, limited to a company or corporation network, to large, which are used to collaborate between multiple companies and networks. The term "closed

grid" is used for the interaction between internal computers on the network, and "broad grid" refers to the communication between all nodes.

We can imagine grid as a virtual supercomputer, which is composed of many interconnected computer networks working together to perform a large task. This technology is used where intensive calculations are required: scientific and academic tasks, discovery of new drugs, economic forecasting, seismic analysis, web services and more.

2. CLOUD technology

Cloud technology or Cloud computing is the provision of computer services to users. For this purpose, the user connects via the Internet or through a specially leased communication line to a remote computer. The term Cloud also means the use of shared resources – software and information - located on computers and other network devices.

The term Cloud Computing combines the following concepts:

Software as a service – the necessary software and data are located in a cloud on the Internet and are provided to the user using a special client program, e.g. web browser.

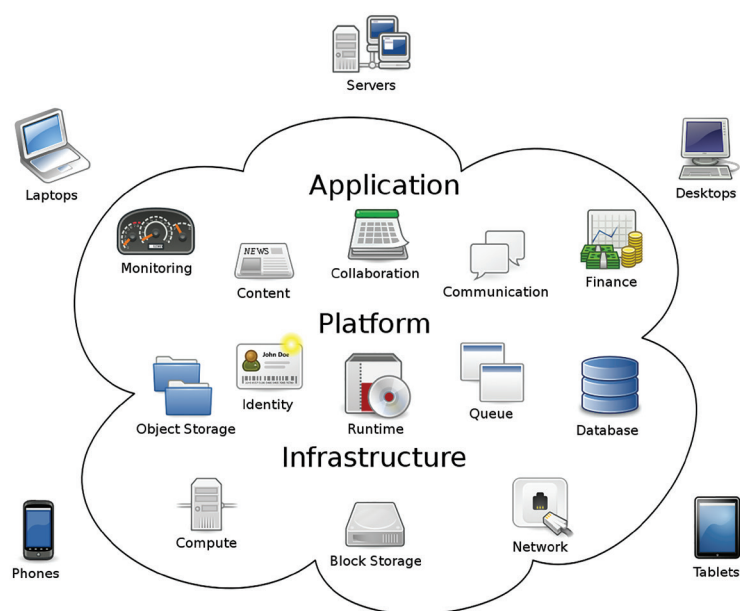


Fig. 2. Cloud computing

Infrastructure as a service – servers, equipment, computing power, etc., are provided for using by different users. The necessary resources, such as processors, memory, storage space, communication, etc. are hired by an external company – supplier, which has the necessary equipment and takes care of its maintenance.

Platform as a service – a type of service in which the Cloud Computing provider allows the user to develop and use various applications without having the necessary platform – software and infrastructure.

Generally speaking, the term Cloud technology refers both to the use of various software applications provided in the form of web services and to access to the hardware resources of the provider of these services. When we say “cloud”, we mean exactly the combination of access to software and hardware through the use of a computer network (usually the Internet). Some experts consider “cloud” and the Internet as similar concepts, because in computer network diagrams, the Internet is represented as a cloud.

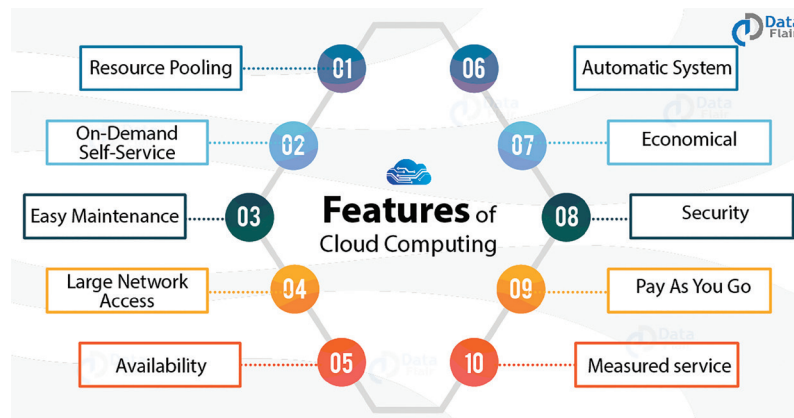


Fig. 3. Cloud computing features

The use of cloud technologies saves tenants the cost of purchasing software licenses, hardware, staff training and more.

Building and maintaining a cloud system requires huge resources and for this reason the supplier companies are relatively few – Amazon, Google, Microsoft, Apple iCloud, Salesforce, Sun Microsystems, IBM, Oracle, VMWare.

In Bulgaria, the provider of cloud services is the company Cloud.bg.

Glossary

Grid technology combines many computer resources (e.g. processor time, data storage space, etc.), located in different places.

Cloud technology or Cloud computing is the provision of computer services to users. For this purpose, the user connects via the Internet or through a specially leased communication line to a remote computer.

Questions

1. Describe some of the advantages and disadvantages of grid and Cloud technologies.
2. Point out some differences between grid and Cloud technologies.

3. WORKING IN GOOGLE FOR EDUCATION AND MICROSOFT OFFICE 365 CLOUDS

1. Using your G Workspace account

Once you have Google Workspace account you also have access to many different online applications such as Google Docs, Sheets, Slides, Sites and more. After you log-in to your account you have access to these applications by clicking on the grid-like icon in the top right corner of the screen.

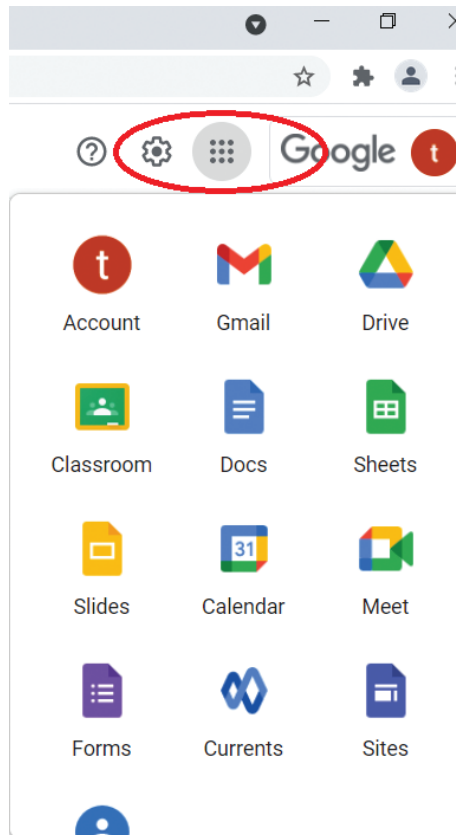


Fig. 1. GWorkspace

- Create or import files
 👉 **Create a new file**
In Docs, click **Blank** “+”.

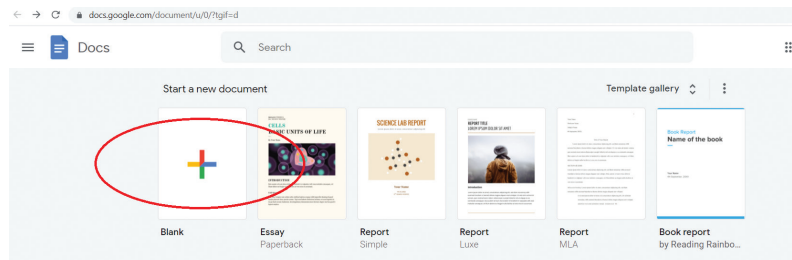


Fig. 2. GWorkspace

In Drive, click New and then next to Google Docs/Sheets/Slides, point to the Right arrow “>” and click Blank document/spreadsheet/presentation or Form a template.

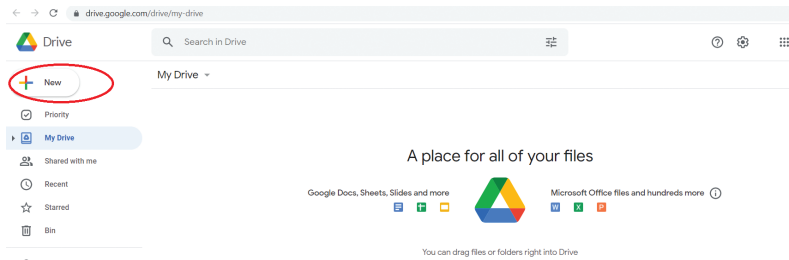


Fig. 3. GWorkspace

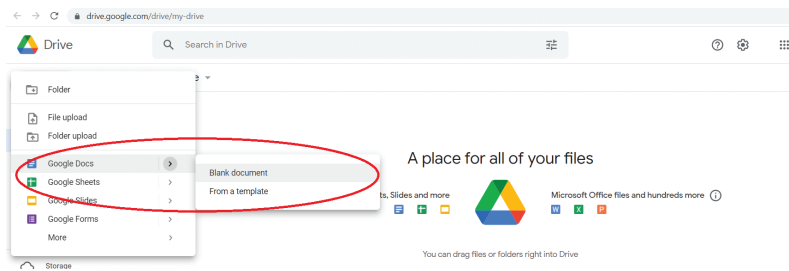


Fig. 4. GWorkspace

👉 Import and convert existing files

If you have existing files, you can import and convert them to Docs, Sheets, or Slides.

If you want to convert your files automatically then go to Settings and check the “Convert uploaded files to Google Docs file converter” option and then click Done.

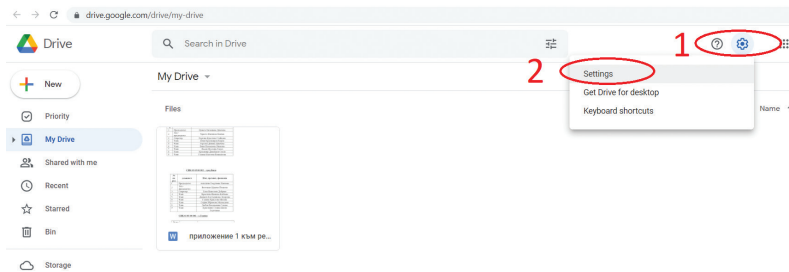


Fig. 5. GWorkspace

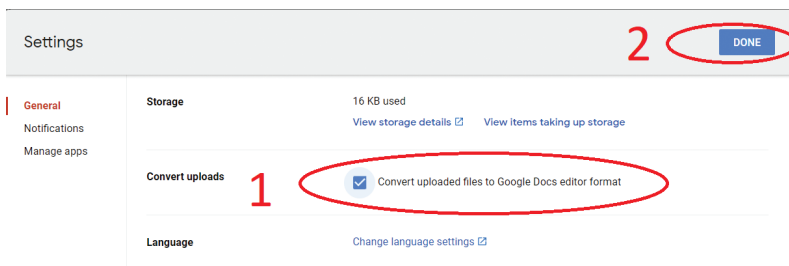


Fig. 6. GWorkspace

- a. Go to your Google Drive.
- b. Click New and then File Upload.
- c. Choose the file you want to import from your computer to add it to Drive.
- d. Click Open.

Converting your file from another program creates a copy of your original file in a Docs, Sheets, or Slides format. You can then edit the file in your browser.

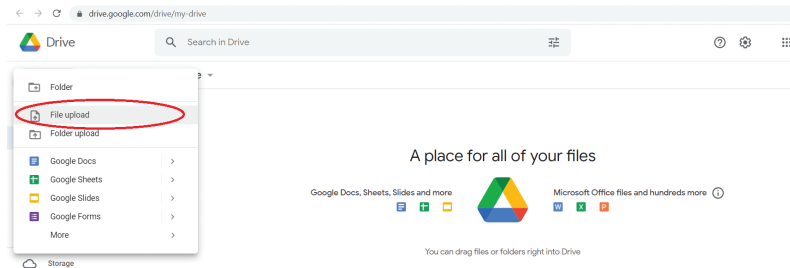


Fig. 7. GWorkspace

Import existing folders

- a. Go to your Google Drive.
- b. Click New and then Folder Upload.
- c. Choose the folder you want to import from your computer to add it to Drive.
- d. Click Upload.

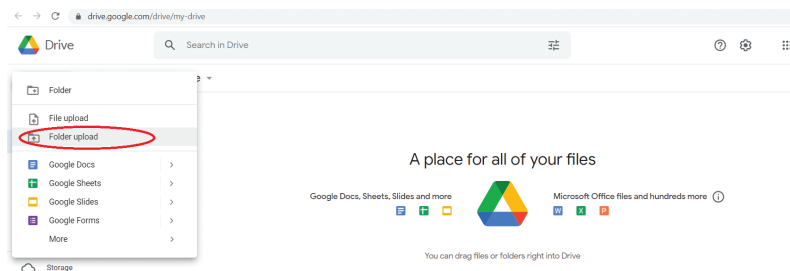


Fig. 8. GWorkspace

Sharing files and folders

- a. Select the file or folder you want to share.
- b. Click “Share” or “Get link”.
- c. Under “Get Link,” click “Change” and select “Anyone with the link” option.
- d. To decide what people can do with your public link when you share it, select Viewer, Commenter, or Editor.
- e. Click Done.

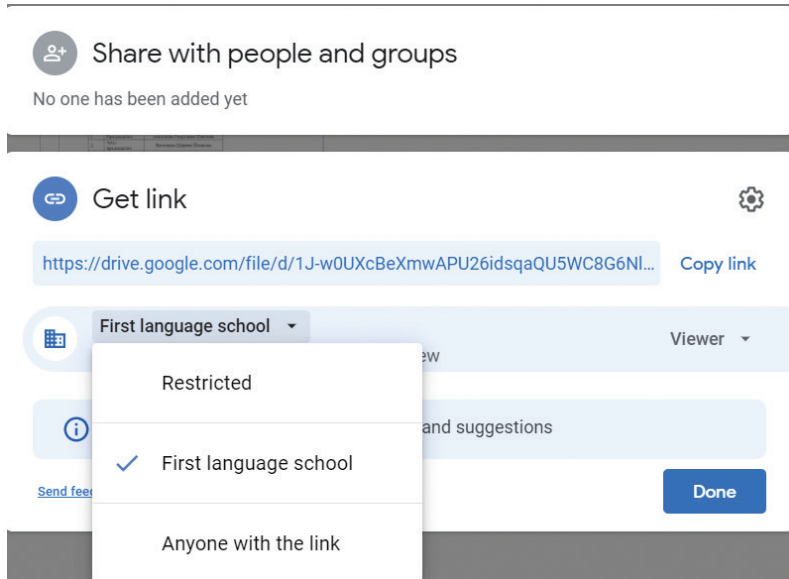


Fig. 9. GWorkspace

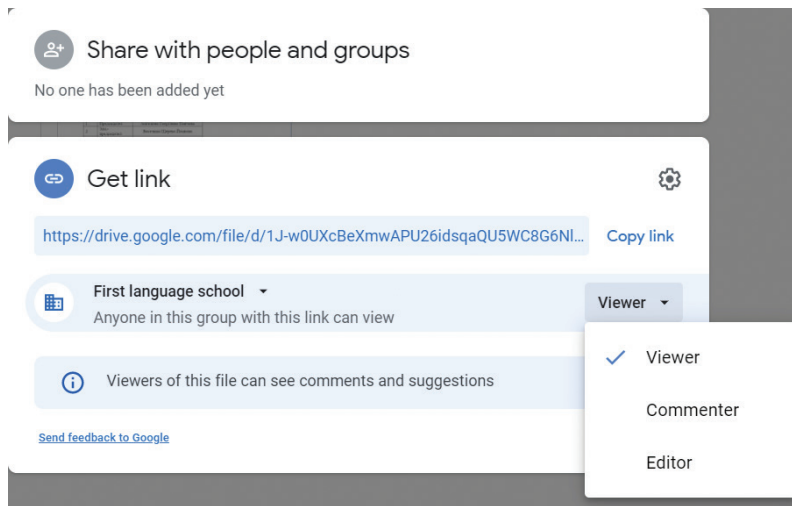


Fig. 10. GWorkspace

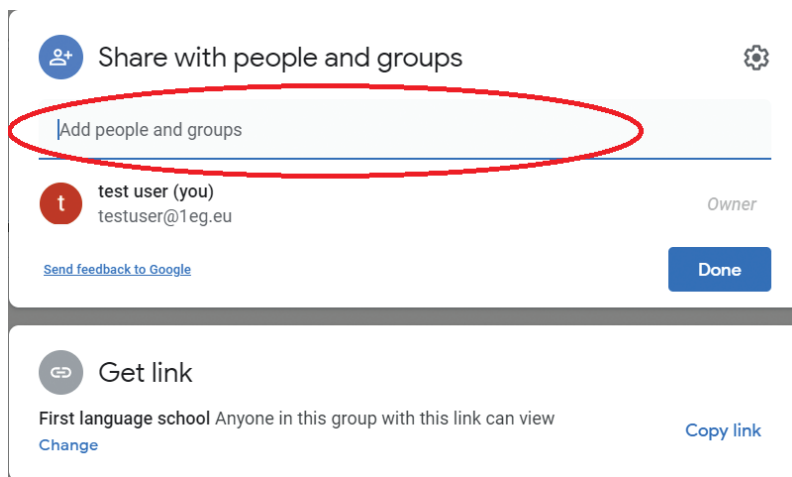


Fig. 11. GWorkspace

If you want to share your file or folder with specific people, you can write their e-mails in the “Add people and groups” field and then click Done.

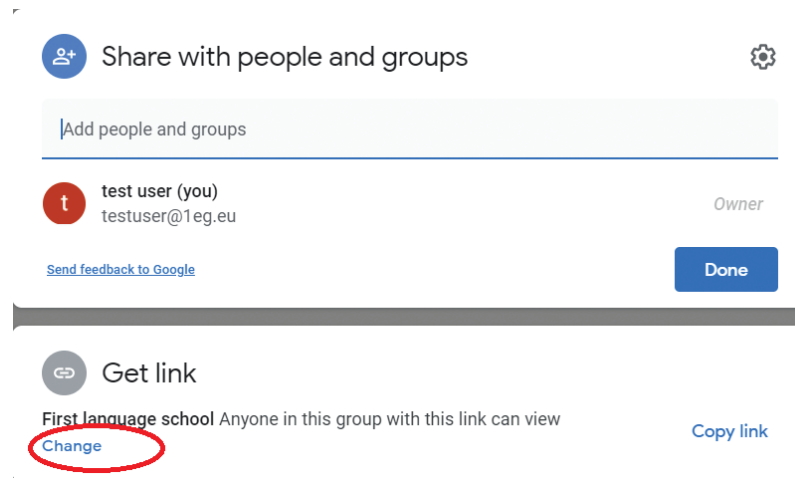


Fig. 12. GWorkspace

2. Using Microsoft Office 365 Cloud

- Create or import files.

☞ **Create a new file**

To create a new text file, spreadsheet, PowerPoint presentation or other you can use either the shortcut buttons on the left side of the screen or the ⊕ button.

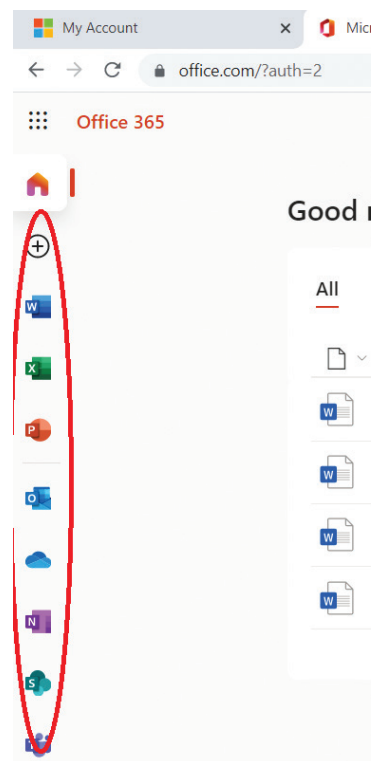


Fig. 13. Office365

✍ Import existing files

If you have existing files, you can import them by using the “Upload” button.

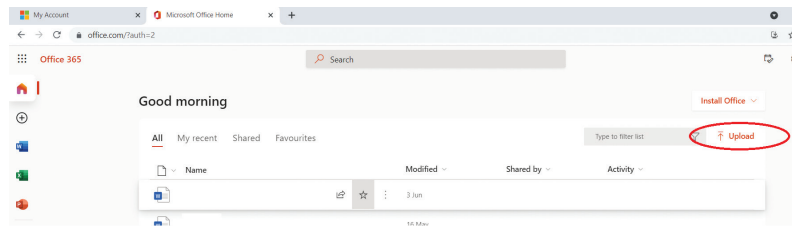


Fig. 14. Office365

✍ Import existing folders

To view and organize all your files you should use Microsoft OneDrive application. To access it, use the grid-like icon in the top left corner of the screen. You have access to all Microsoft applications from there.

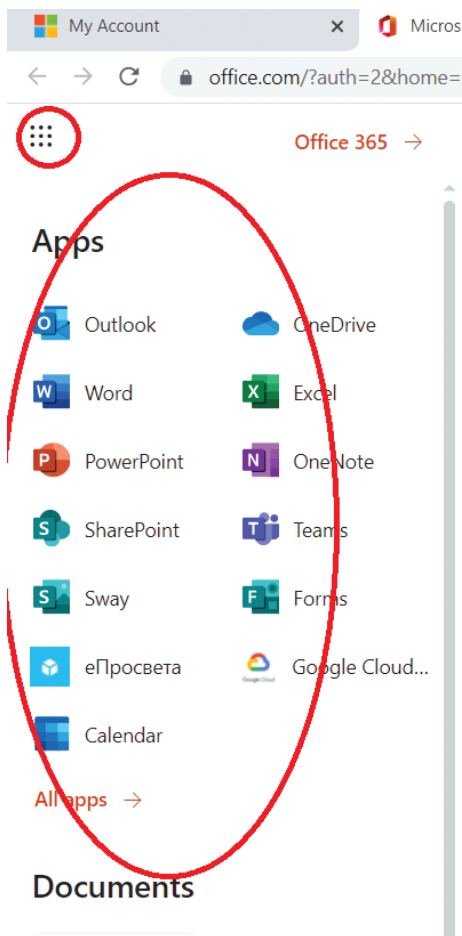


Fig. 15. Office365

Use the New or Upload button to create new File/Folder or to upload an existing one.

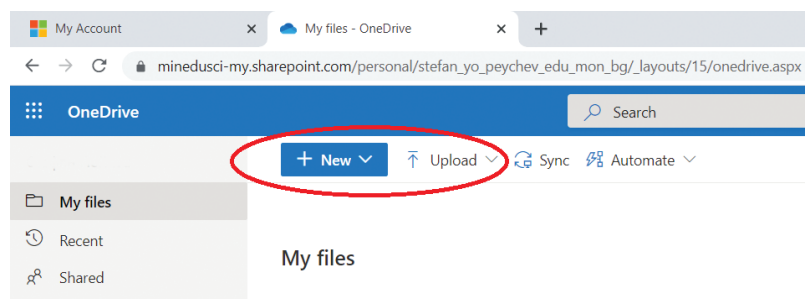


Fig. 16. Office365

☞ Sharing files and folders

- Select the file or folder you want to share.
- Click Share or Copy link.
- Click “People in...,” to change Link settings.
- Select people that you want to share your file/folder with and what they can do with your public link when you share it.
- Click Apply and then Send.

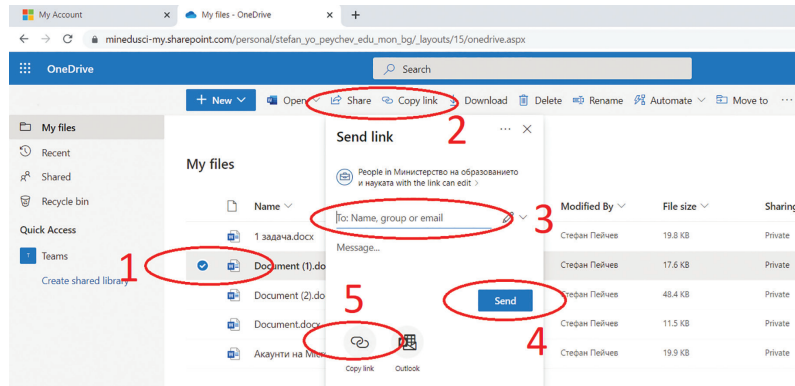


Fig. 17. Office365

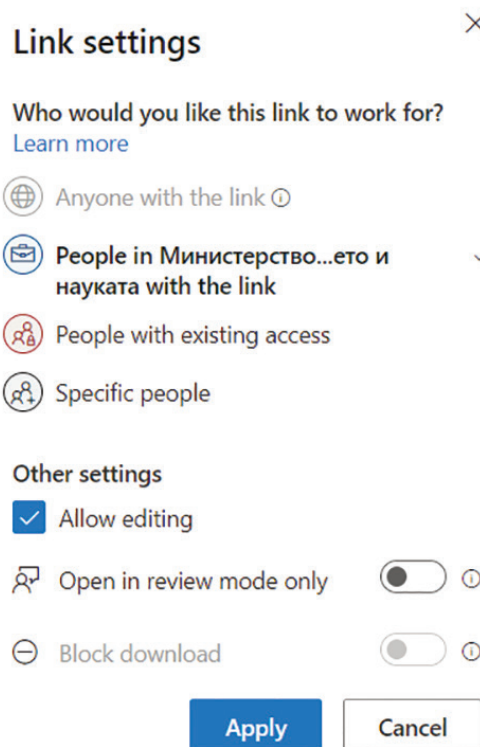


Fig. 18. Office365

4. GLOBAL POSITIONING SYSTEMS

1. History

The Global Positioning System (GPS), originally Navstar GPS, is a collection of space satellites, transmitters and ground receivers. The main purpose of this system is to determine the location of an object in real time, the distance traveled, speed, trajectory over the entire earth's surface. Each satellite involved in the system has a signal transmitter.



Fig. 1. GPS

GPS was developed by the US military and was originally used only for military purposes. The first satellite was launched on February 22, 1978. Over the next two years, the number of satellites in orbit rose to six. By the end of 1993, there had already been 24 satellites covering the entire globe, and in January 1994, the system began full operation.

Although originally intended for military use, GPS is now free and available worldwide for both military and civilian use. The reason for this was an accident with a South Korean civilian plane, which due to a navigation error entered the borders of the USSR and was shot down by a Soviet fighter jet. As a result, 269 people died. This made the US authorities realize that such incidents can be avoided via the use of GPS and allowed it for civilian use.

Currently, the GPS space network consists of 24 main working satellites and several additional ones, which are used in case of accidents. They orbit the globe at an altitude of about 19,300 km, making 2 full revolutions per day. The orbits of the satellites are calculated so that signals from at least 4 satellites can be received at any time from anywhere on Earth. The signals are received by special receivers, which process them and determine their exact location.

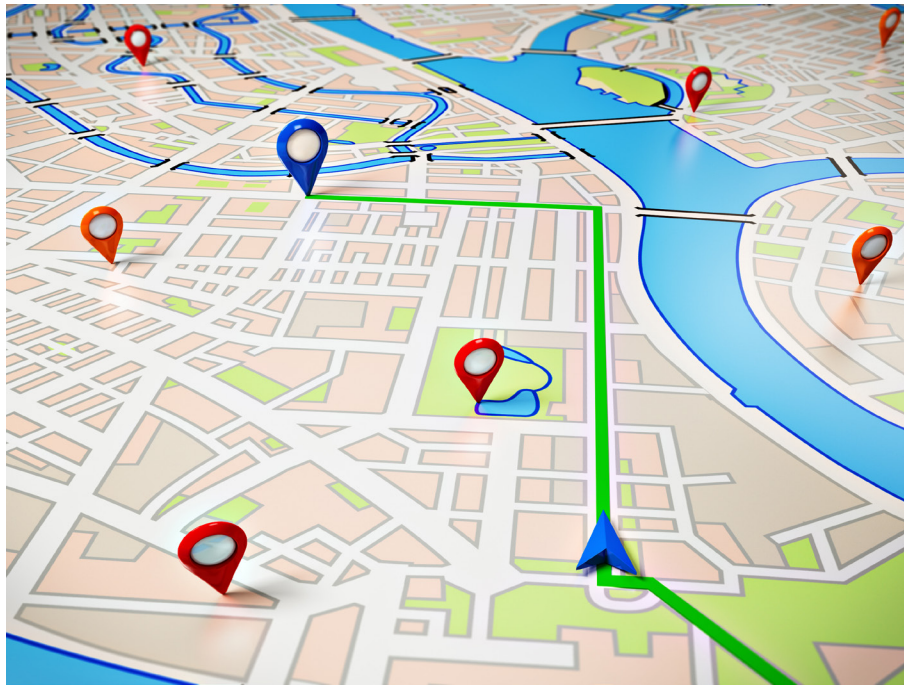


Fig. 2. GPS

Apart from the US GPS there are two other systems:

GLONASS is a Russian space-based satellite navigation system operating as part of a radionavigation-satellite service. It provides an alternative to GPS and is the second navigational system in operation with global coverage and of comparable precision.

Galileo is a global navigation satellite system that went live in 2016, created by the European Union through the European Space Agency (ESA), operated by the European Union Agency for the Space Programme (EUSPA), headquartered in Prague, Czech Republic, with two ground operations centers in Fucino, Italy, and Oberpfaffenhofen, Germany.

2. GPS Structure

This GPS consists of three segments: the space segment, the control segment and the user segment. The U.S. Space Force develops, maintains, and operates the space and control segments.

a. The GPS space segment consists of a constellation of satellites that fly in medium Earth orbit transmitting radio signals to users and also includes the payload adapters to the boosters required to launch them into orbit. As of February 2019, there are 31 satellites in the GPS constellation, 27 of which are in use at a given time with the rest allocated as standbys.

The United States is committed to maintaining the availability of at least 24 operational GPS satellites, 95% of the time.

b. The control segment (CS) is composed of:

1. a master control station (MCS),
2. an alternative master control station,
3. four dedicated ground antennas,
4. six dedicated monitor stations.

The MCS can also access Satellite Control Network (SCN) ground antennas (for additional command and control capability) and NGA (National Geospatial-Intelligence Agency) monitor stations.

The operation control segment (OCS) currently serves as the control segment of record. It provides the operational capability that supports GPS users and keeps the GPS operational and performing within specification.

OCS will continue to be the ground control system of record until the new segment, Next Generation GPS Operation Control System (OCX), is fully developed and functional.

The user segment is composed of hundreds of thousands of U.S. and allied military users of the secure GPS Precise Positioning Service and tens of millions of civil, commercial and scientific users of the Standard Positioning Service.

3. How does the global positioning system work?

The transmitters in the satellites transmit regular signals about their own position and exact time. These signals travel at the speed of light and signals from at least three different satellites reach each point on the earth's surface simultaneously.

The GPS receives these signals and calculates how long it takes for the messages to reach it. Based on these calculations, it can determine its exact position. This is based on a mathematical principle called trilateration in three-dimensional space.



Fig. 3. GPS

What is trilateration?

To simplify the explanation, we assume that each satellite emits a signal that reaches the Earth in the form of a circle. If a signal reaches a point on the Earth's surface, it is inside this circle and if there is no signal, it is outside it. The circle of the second satellite intersects the first partially and in this intersection area we have a signal from both satellites. However, the signal (circle)

of the third satellite intersects those of the first two at only one point and this is the exact position of the signal receiver. The more signals a receiver receives, the more accurately it determines its position.

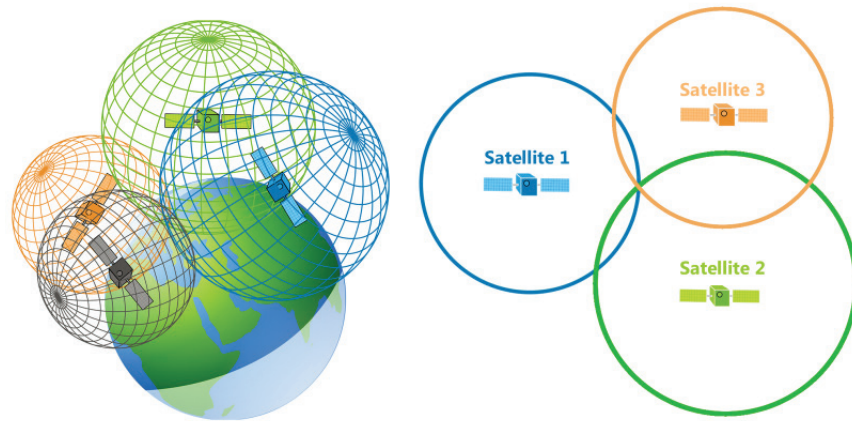


Fig. 4. Trilateration

In fact, the shape of the received signals is not a circle, but a sphere. This means that the three spheres will not have one but two intersection points. The receiver “uses” the Earth as a fourth sphere to determine in which of these two points it is at a given time.

GPS and time

In order to correctly calculate the spheres in which it is located, the receiver must “know” the exact distance to each of the satellites. The time for which the signals arrive from the satellite to the receiver is necessary to achieve this goal.

How does this happen?

At some point, the satellite begins to emit a long signal. Exactly at the same time, the receiver starts executing the same signal. After reaching the signal from the satellite to the receiver, the latter calculates the delay and by using the speed of light at which the signal travels, calculates the distance from itself to the satellite.

4. Obstacles to GPS

In order to correctly calculate the distance between a satellite and a receiver, it is necessary for both devices to have extremely accurate clocks that can synchronize their work to the nanosecond. For this purpose, the satellites have atomic clocks. They are precise enough but due to their high price (between 50,000 and 100,000 dollars) ordinary quartz clocks are used in the receivers. However, their synchronization is not as good as that of the atomic ones. To avoid this problem, the quartz clocks in the receivers are constantly reset, and thus the calculations use the absolutely synchronized time from the atomic clocks in the satellites.

The satellites move in predefined orbits and each receiver has the so-called almanac that contains information about the exact position of each satellite in every second. Using the data received from the signals and the almanac, the receiver calculates a correction that is applied to its

own clock and thus determines its exact coordinates. After finding the “correct” time, the quartz clock on the receiver is reset. And because this happens all the time, the quartz clock turns out to be almost as accurate as the atomic one in the sky.

Another obstacle to GPS is the slowing down of the satellite's signal as it enters the atmosphere. This delay may vary depending on the exact location of the receiver. The signal can be reflected by various large objects such as hills or skyscrapers and this can lead to additional delays.

Sometimes the information provided by the satellites to the receiver's almanac can also be incorrect.

Additional correction systems are available to avoid these errors and to achieve maximum measurement accuracy. The land-based stations with exactly known coordinates are an example of this.

Glossary

Global positioning systems - a collection of space satellites, transmitters and ground receivers used to determine the location of an object in real time.

Trilateration - determining a position by knowing your distance from at least 3 known points. It uses lines of known length but unknown angle (circles in other words) to find a point.

Tasks

1. Using a GPS receiver determine the exact coordinates of your home.
2. Using a GPS receiver create a route from home to school.

II. COMPUTER NETWORKS AND SERVICES

5. LOCAL AND GLOBAL COMPUTER NETWORKS

1. What is a computer network?

A computer network consists of two or more computers (or other communication devices) connected to each other by suitable hardware and software. The main purpose of connecting electronic devices to a network is to share common resources – storage space, printers, memory, CPU time and more.

2. Brief history of computer networks

The emergence and development of computer networks began in the middle of the twentieth century, when in order to better communicate and manage the US military decided to connect their computers to a network. Their main goal was to create a sustainable and reliable network that would survive a nuclear war.

Working together, scientists at MIT, the RAND Institute and the National Physics Laboratory (NPL) in the UK invented a new technology for transmitting information called packet switching. This technology is still used today.

In the late 1960s, again under the auspice of the US Department of Defense, the first packet-switched computer network called the ARPANET (Advanced Research Projects Agency Network) was created. In 1969, the first node (access point) to the ARPANET was installed at the University of California, Berkeley. A rapid development followed and in just five years the network covered the entire United States and reached Europe.

ARPANET existed until the 90s of the twentieth century when the Internet appeared. Later the Internet Society was formed and in 1994 the W3C organization was also established.

3. Advantages and disadvantages of computer networks

Advantages

- Access to shared resources such as CPU time, disk memory, files, I / O devices, and more. Sharing these resources reduces hardware costs.

- The performance of low-performance computers increases, for example they use the CPU time or disk memory of another computer.

- Enable access to shared databases and storage systems.

- Increase the efficiency of the work process by providing an opportunity for collective work on projects in a group, etc.

- They allow for fast electronic communication and distance learning.

- They can be connected to other networks.

Disadvantages

- Network Device Vulnerability – any device connected to a network can be attacked by malicious users.

- Reducing the network efficiency through congestion both locally and globally.

- Technical problems with connected devices disrupting connectivity between individual computers.

4. Classification of computer networks

According to the distance at which they are located

Local area network – covers one or several closely spaced buildings at most.

Wide Area Network – is located over long geographical distances, i.e., in one or more countries. The most famous global network is the Internet, which covers the entire globe.

According to the functions of the nodes connected in the network

Peer-to-peer networks – all computers simultaneously provide and receive services on the network.

Client-server networks – one computer is a server (provides services and manages the network) and the others only use the services provided to them.

According to the physical topology

Physical topology – a way of physical location and connection of computers in the network.

- **Bus topology** – all computers/devices are connected to the same communication medium (a cable), through which the information is transmitted.
- **RING topology** – computers are connected in series with each other.

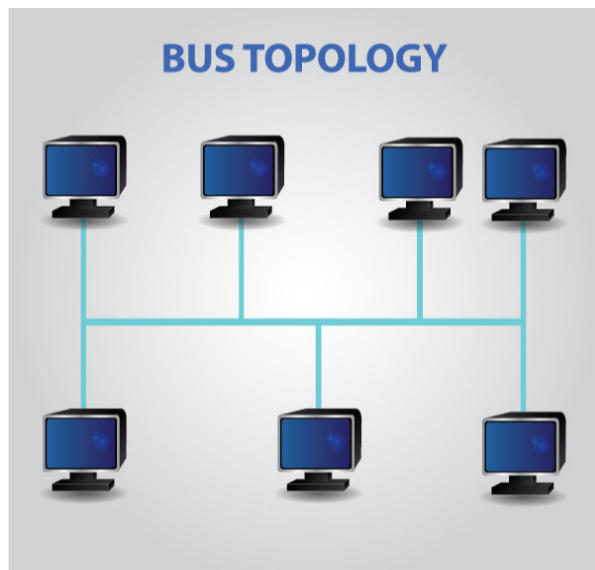


Fig. 1. BUS



Fig. 2. RING

- **Star topology** – all devices are connected to one central device, most often a switch.
- **Grid (mesh)** – each computer has a direct connection to any other computer. This type is not often used. Due to the very rapidly growing number of connections, only a few computers are involved.
- **Mixed or hybrid topology** – a combination of two or more different topologies.

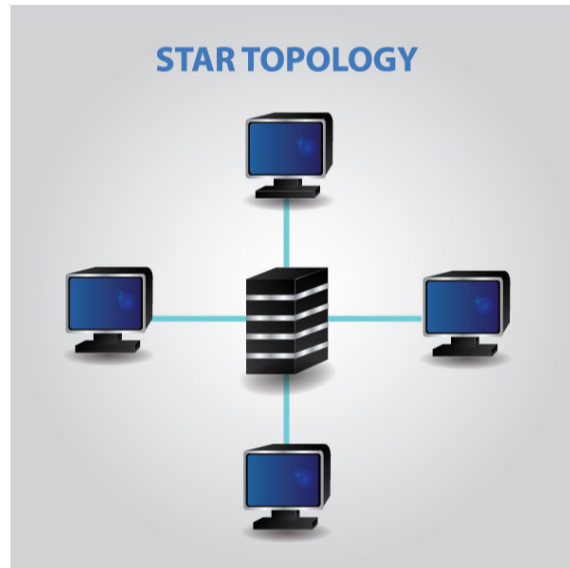


Fig. 3. STAR

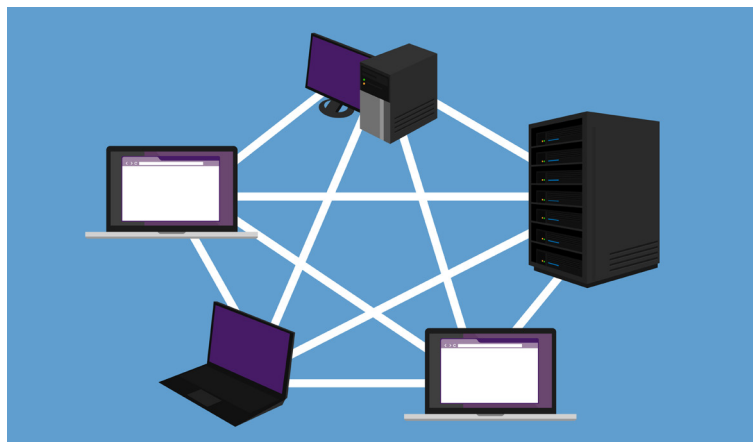


Fig. 4. MESH

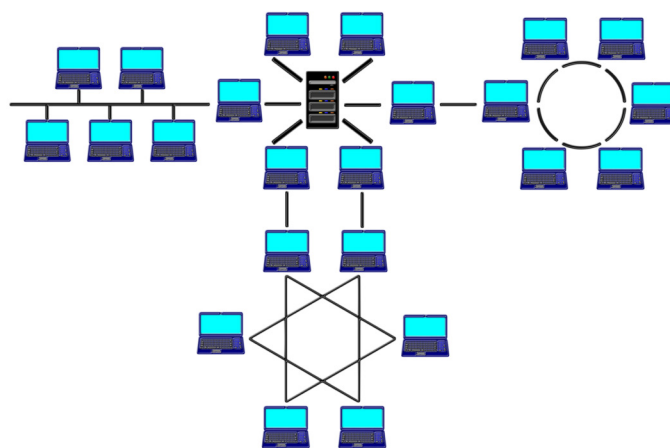


Fig. 5. Hybrid

According to the connection technology

Cable and wireless networks

In addition to physical, each network has a so-called logical topology. It is determined by the way the information is transmitted between the individual devices. According to their functions, devices in a network can be defined as end devices and intermediate devices. Intermediate devices provide network management and signal transmission in the network, whereas the end devices are called workstations.

Questions and tasks:

1. Point out the differences between LAN and WAN.
2. What is the difference between a server and a workstation?
3. Indicate the difference between physical and logical topology.
4. Point out some of the disadvantages of computer networks.

6. COMPUTER NETWORKS – WHAT I CAN DO ON-LINE?

EXERCISE

Everything that you can do online is located somewhere on the Internet. Social media sites, multi-player games, messaging centers that provide email, online courses – all of these Internet destinations are connected to local networks that send and receive information through the Internet.

Think about all of the activities that you have during the day which require you to be online. Use this worksheet to make a list to share with your classmates. Add additional lines or pages if necessary.

Sample:

Time	Device	Activity	Reason	Alternative
8:00 am	Phone	Check email	Address any important messages	none
8:15 am	Phone	Check overnight text messages	Update myself on what's happening	Call everyone?
8:30 am	Desktop	Login at Google Classroom/ Microsoft teams to check assignments	Get ready for class	Printed calendar, course schedule, and syllabus
8:35 am	Phone	Check Facebook and Instagram	Update	Print and share pictures. Copy videos to thumb drive and show people in person.
9:00 am	Phone	Played "Angry Birds"	Entertainment	Boredom
Noon	Phone	Used Google maps to find closest pizza restaurant	Hungry	Call directory assistance

Your Activities:

Time	Device	Activity	Reason	Alternative

Continue the list on a separate page if necessary.

Reflection

How many of your daily on-line activities would not be possible without being connected to the Internet or a local network?

How many different devices did you use to accomplish your on-line activities?

7. NETWORK SERVICES. INTERNET

1. Network services

☞ Local area network services

The resources in the local network called network services are provided by the so-called server. A server is an application program that implements a given service. With good enough technical parameters one computer system can serve several servers simultaneously.

Frequently used services:

- **File server** – allows you to store and download files.
- **Print server** – provides access to the printer on the computer on which it is installed.
- **E-mail server** – used to manage clients' mailboxes.
- **Web server** – provides information in the form of html documents.

☞ Internet Services

- **World Wide Web (www)** – the most commonly used multimedia service on the Internet. The information is provided in the form of hypertext documents.
- **File transfer** – allows you to exchange files between different applications.
- **Remote access or Terminal Network (Telnet)** – by using special programs allows access to a remote computer in order to run applications or access data on its hard drive. This is one of the first services to appear on the Internet.
- **E-mail** – ensures the sending and receiving of e-mails. The user needs to have a valid e-mail address.
- **Internet telephony or Voice over Internet Protocol (VoIP)** – this service allows the transmission of voice and multimedia information in the Internet environment using IP packets. It offers a cheap option for long distance calls.
- **Internet Relay Chat/IRC** – allows for real-time communication between users. After connecting to a special IRC server, the user receives a username and can send messages to all chat participants or only to selected ones.
- **Internet of Things** – a new technology that allows devices to communicate with each other and respond to changes in the environment.

2. Structure, organization, and rules of working on the Internet

The Internet is a global network that connects large and small local area networks located around the world. The structure of this network is hierarchical – networks at different levels are used. These networks have different complexity and importance.

Most of the applications/services on the Internet use client/server technology, in which the server executes a request for a service by the client. A special program is used for this purpose, e.g., Web Browser.

To communicate with each other, devices on the network use a set of rules – software programs – called protocols, which are integrated into the TCP / IP packet. The protocols “tell” the network how to offer its services and how to perform its functions. For a given service, e.g. an e-mail – there may be more than one protocol in use. All modern operating systems support the

TCP/IP package and provide Internet access to users.

In addition to these software rules, there are others used on the Internet. Some of them are determined by the organizations offering access to the Internet, and others are a consequence of certain ethical norms.

Examples of such rules are:

- Avoiding illegal access to foreign information resources.
- Prohibition of spreading unwanted information (spam).
- Prohibition of spreading personal information and information protected by the laws of different countries.

There are many other similar rules, which are united by the common name Netiquette – from the words “internet” and “etiquette”.

Glossary:

Protocol – a set of software rules under which applications exchange information.

Questions and tasks:

1. What is a protocol?
2. Point out what services you know on the Internet.

8. BASIC COMMUNICATION DEVICES AND COMMUNICATION ENVIRONMENTS

Let's remember: Devices in a computer network are called nodes. They can be end or intermediate.

1. Basic communication devices

- Network interface controller (NIC) or LAN card – each device (node) in a computer network must have a LAN card to connect to the network. Depending on how you connect, LAN cards can be wired or wireless.

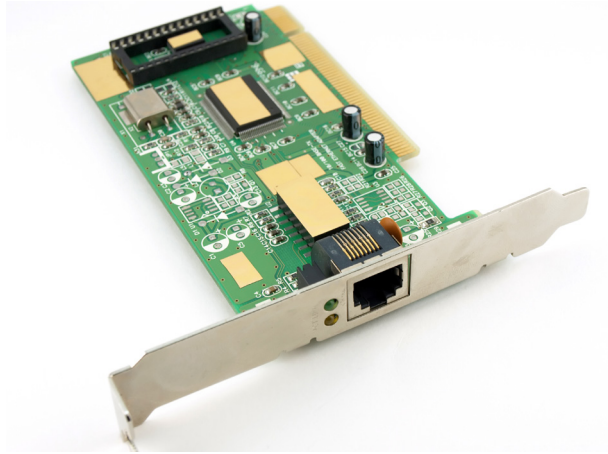


Fig. 1. NIC

- A modem/modulator/demodulator – an intermediate communication device for transmitting digital signals on analog (telephone or television) lines. It is most commonly used to connect individual users to a LAN or WAN. Access to the local network is provided by the so-called RAS-server (Remote Access Server). Modems can be external or internal. Currently, modems are most often used by television operators to deliver Internet on television lines. The technology for transmitting information over telephone lines is called DSL. It allows the simultaneous transmission of voice and data on one line.



Fig. 2. Modem



Fig. 3. bgModem – Bulgarian modem

- A switch - an intermediate device that allows you to connect additional devices to the local network. The entry points through which this is done are called ports, and the switch is called a multiport. There are 8, 16, 24, 32 port switches. The switch maintains the data rate on all its ports. It also allows connection to another switch, which increases the area covered by the LAN.



Fig. 4. Switch



Fig. 5. Switch1

- A router - an intermediate device with more functions than the switch. The router connects two separate networks while managing them and eliminating the differences between them. Also, the router can be used to divide a large network into several smaller ones. When there are several routes in the network for the information to reach the end device, the router chooses which of them to transmit the data to. Another function of the router is to serve as an entry point for Internet access and its distribution between end devices in the local network.



Fig. 6. Router

- An access point - an intermediate device in wireless networks that helps devices to connect to the network and use its services.



Fig. 7. AP

2. Communication media

Depending on the transmission medium used by computers networks are divided into wired and wireless.

The cable transmission medium can be comprised of the following types of conductors:

- A twisted pair of wires – consists of eight copper wires divided into pairs. Each pair is twisted and isolated from the others in order to reduce the influence of external factors on the transmitted information. There are two types of cables of this kind – Shielded Twisted Pair (STP) and Unshielded Twisted Pair (UTP). STP is more expensive and is used in places with high electromagnetic interference, while UTP is more flexible and inexpensive and is used in places where there is less electromagnetic interference. Modern LANs use UTP. The maximum length at which this cable can be used without a repeater (**Fig. 10**) is 100m.



Fig. 8. UTP

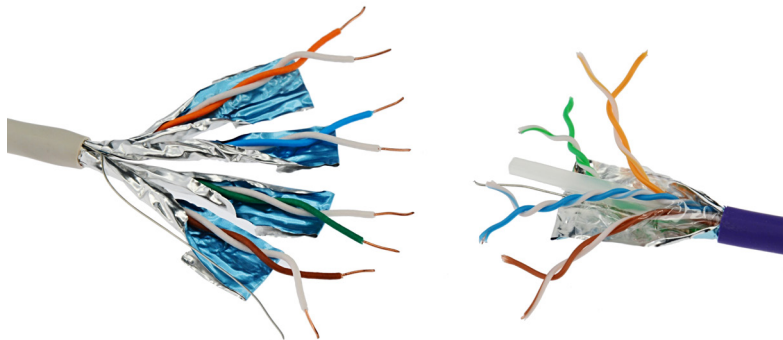


Fig. 9. STP



Fig. 10. Repeater

- A coaxial cable – a conductor covered with insulation, copper braid and outer sheath. The braid is used to shield the wire.

Some coaxial cables have a first insulating layer of foil and a second of braid. They are called double shielded. There are two types of coaxial cables – thinnet and thicknet. The thinnet one can carry information up to 185 m, and the thicknet one up to 500 m. Coaxial cable provides better protection against electromagnetic interference than a twisted pair cable.



Fig. 11. Coaxial

- Fiber optic cables – they are made of individual fibers made of glass or plastic. Each optical fiber consists of a core and a sheath and has a different refractive index. Thus, the information in the individual fibers of a cable cannot be intertwined. This also makes the cable flexible and allows it to be bent and twisted.

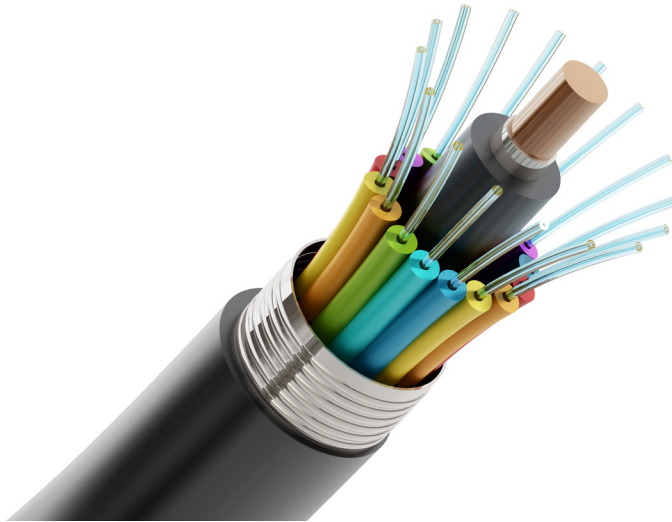


Fig. 12. FiberOptic

Fiber optic cables are the best transmission medium compared to coaxial cables and twisted pair because they are more resistant to signal attenuation and allow information to be transmitted over long distances. They also maintain high transmission speeds and are not susceptible to electromagnetic interference.

There are two types of transmission of information over a fiber optic cable:

- Single mode – light travels along the axis of the cable. Allows transmission of information up to 200 km and is used when building a WAN.
- Multiple mode – light enters the fiber at different angles and is refracted and reflected from the cable sheath. It is used in LAN networks and provides transmission of distances up to 500 m.
- Wireless environment – allows the transmission of information to take place without a cable. Lasers, infrared waves, radio frequencies can be used for this purpose. The transmission speed is slower than cable media. Wireless environment is used in Wi-Fi networks and in the networks of mobile operators.

Glossary:

Media – physical medium for transmitting information.

Repeater – a device that receives and transmits electrical, optical and wireless signals. Preserves signal quality and increases the distance over which data can be transmitted.

Internet Service Provider (ISP) – a company that provides individual home and office users with access to the internet.

Questions and tasks

1. Specify the differences between a switch and a router.
2. Which cable provides the best transmission environment?
3. Specify the correct order of the following terms: a switch, a printer, a router, a wireless access point, an internet provider, a laptop.
4. Describe the devices involved in building your home Internet connection. What kind of transmission medium does your ISP use?

9. BASIC COMMUNICATION DEVICES AND COMMUNICATION ENVIRONMENTS – EXERCISE

The path that a message takes from its source to destination can be as simple as a single cable connecting one computer to another or as complex as a network that literally spans the globe. The network infrastructure contains three categories of hardware components:

- End devices.
- Intermediary network devices.
- Network media.

Take a close look at the network you have at school. Record the network and end-user devices that are connected to the local network.

Sample

Manufacturer	Device	Location	Connection	Media
Apple	iPhone	Mobile	Wireless	WiFi & cell phone
Samsung	Galaxy Smart Phone	Mobile	Wireless	WiFi & cell phone
Cisco	Cable Modem	Home office	Wired	Cable TV coaxial cable and Ethernet cable
Linksys	Wireless Router	Home office	Wired	Ethernet cable
HP	Printer/Scanner	Home office	Wireless	WiFi
Apple	MacBook Air	Mikayla's Room	Wireless	WiFi
Beats by Dre	Headphones	My Room	Wireless	Bluetooth
Microsoft	Xbox	My Room	Wired	Ethernet Cable

Your Activities

Manufacturer	Device	Location	Connection	Media

Continue the list on a separate page if necessary.

Reflection

1. Are there other electronic devices that are not connected to the local network to share information or resources? What would be the benefit of having these devices online?

2. Which type of connectivity is used most frequently in your local network, wired or wireless?

3. Draw a diagram of your local network. Label each device with a name and location.

10. CONNECTING AND CONFIGURING A SMALL NETWORK

1. Network protocols

Let's remember: A protocol is a set of rules that determine how the devices connected to the network change information.

Internet Protocol (IP) – basic protocol in the network. It is used to determine the route along which the data packet is to be transmitted from the initial device (source), through the intermediate devices (switch, router, etc.) until the final device (receiver) is reached. To implement this function IP addresses are used. They uniquely identify each computer in the network, as well as to which network it belongs. Some devices – such as routers – may have more than one IP address.

Transmission Control Protocol (TCP) – a transport protocol that uses pre-established logical connections to transmit information between two communicating devices. Steps in transmitting information via TCP:

- A logical connection, which is called a session, is built, i.e. the two devices have “agreed” on all connection parameters.
- The information is transmitted in the form of packets. In this process, the TCP is responsible for avoiding mistakes and for the packages' correct arrangement.
- The logical connection between the two devices breaks down.

TCP can support multiple logical connections at once. For this reason, we can open several websites at the same time, listen to music on the Internet, download files and more.

User Datagram Protocol (UDP) – faster than TCP. In this case, no logical connection is established and the order of the packets is not monitored. For this reason, it is unreliable. Suitable for messages that can only be transmitted with one packet.

Hypertext Transfer Protocol (HTTP) – protocol for transmission of hypertext documents. A hypertext is a document that contains references (hyperlinks or only links) to other hypertext documents. This protocol works on the client/server scheme. The customer can be, e.g., a browser or other application that sends a request to an HTTP server. Requests use Uniform Resource Locator (URLs) addresses.

URL is a system for naming resources (files) in the network. Each URL consists of three parts: protocol type, computer name, full path to the file.

Example: <http://leg.eu/dokumenti/etichen-kodeks.pdf>

Protocol type	computer name	Path to the file / searched resource /
http://	leg.eu	/dokumenti/etichen-kodeks.pdf

Simple Mail Transfer Protocol (SMTP) – e-mail protocol. Ensures the transmission of an electronic message between the sender's and recipient's mail servers. It is usually used to send e-mail.

Post Office Protocol, version 3 (POP3) or Internet Message Access Protocol, version 4 (IMAP4) – protocols for reading and processing e-mail after receipt and on the recipient's server. One of the two protocols is used.

File Transfer Protocol (FTP) – used to exchange (transfer) files.

Dynamic Host Configuration Protocol (DHCP) – is used for automatic configuration of devices on the network (setting the IP address, default gateway, etc.) without the intervention of an administrator.

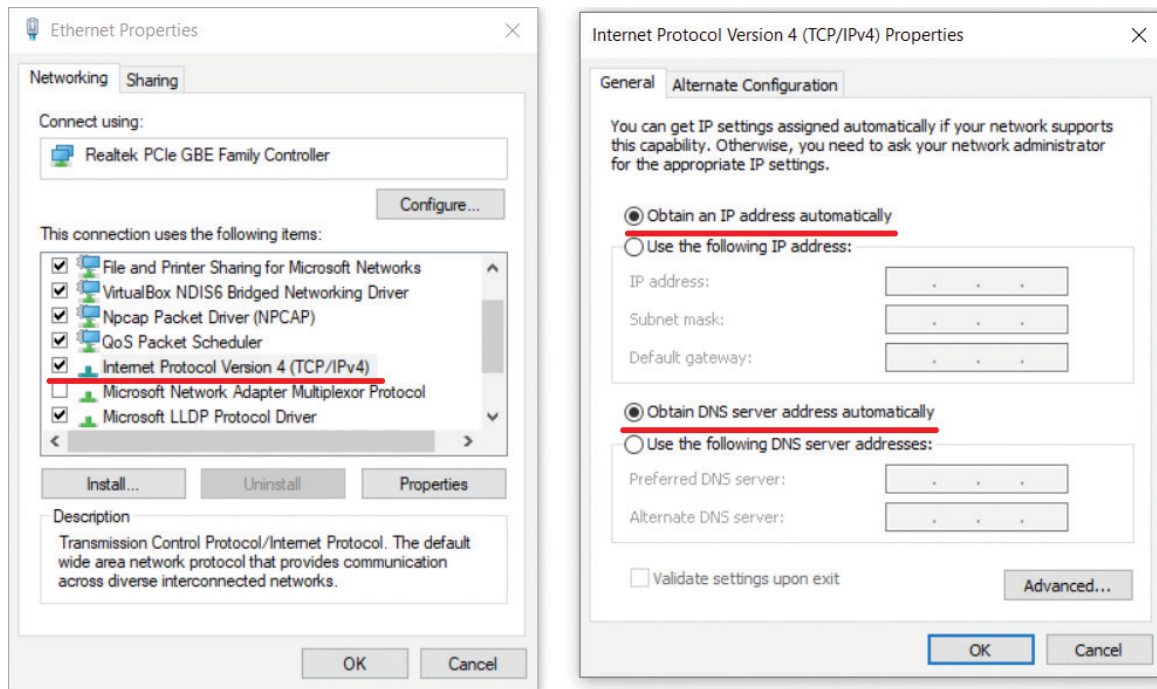


Fig. 1. DHCP

2. Computer address (IP address)

There are two different standards for presenting IP addresses, depending on the version of the IP protocol used. The current version is version four and is denoted by IPv4, and the newer standard is version 6 – IPv6.

For IPv4, the IP address is 4 bytes and is written with four numbers between 0 and 255 separated by a period.

For example: 192.168.1.240

Each IP address is logically divided into two parts - the network address (NetID), to which the host belongs and the address of the host (HostID).

Depending on the scope, IP addresses are divided into public and private. Public IP addresses are valid throughout the network. Private IP addresses are used when configuring local area networks so that public addresses are not occupied. They only work on the network in which they are set. When the local network connects to the Internet, private addresses are converted to public ones. This function is performed by the router that connects the LAN to the Internet.

3. Subnet mask

The network mask is the one that determines which part of the IP address shows the network address (NetID) and which host address (HostID). Subnet masks are 4 bytes as IP addresses and cannot exist on their own. Standard network masks use two numbers – 0 and 255. Where there are 255's is the network address and zeros indicate the host address.

For example:

IP address:	192.168.1		.15
Subnet mask:	255.255.255		0
	NetID		HostID

Fig. 2. IP

4. Domains

It is customary on the Internet to replace host IP addresses with names that make it easier for the user to use them. These names are arranged in a tree-like, hierarchical structure in the form of domains of names (Domain Names), which are called domains.

These names are managed by a system called the Domain Name System. The main function of this system is to associate an IP address with names. This allows the grouping of domains according to certain criteria – geographical area, affiliation to an organization, etc.

At the top of the hierarchy are three-letter designations for belonging to an organization or two-letter designations for belonging to a particular country. These are called top-level domains.

Examples:

- edu – educational institutions
- com – Trade (COMmercial) organizations
- org – other types of organizations
- bg – Bulgaria
- de – Germany

Users (people and organizations) can register second level domains – google.com, leg.eu. The second part (from right to left) of the name identifies the organization and each subsequent one is the name of a smaller division, the name of a computer or a device called a lower-level domain.

For example, in the address <https://tests.legit.eu/> – tests is a domain in the field legit.eu / third level domain, subdomain /

Glossary:

host – a device connected to a computer network.

Default gateway – a network node that serves as an access point to another network.

Questions and tasks

1. What is a host?
2. What is the subnet mask used for?
3. What is the difference between a network address and a host address on it?
4. What is DNS for?
5. What is the role of a DHCP server in a network?

11. BUILDING A SIMPLE NETWORK

Topology

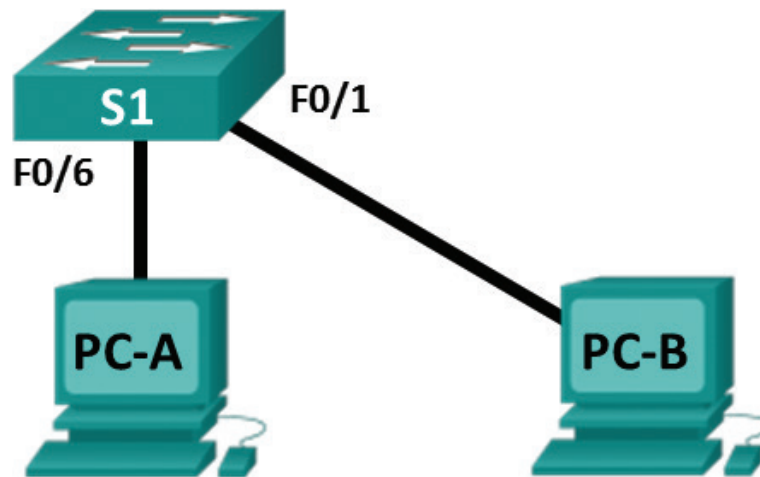


Fig. 1. Building a network

Addressing Table

Device	Interface	IP Address	Subnet Mask
PC-A	NIC	192.168.1.10	255.255.255.0
PC-B	NIC	192.168.1.11	255.255.255.0

Part 1: Set Up the Network Topology (Ethernet only)

In Part 1, you will cable the devices together according to the network topology.

Step 1: Power on the devices.

Power on all devices in the topology. The switches do not have a power switch; they will power on as soon as you plug in the power cord.

Step 2: Connect the PCs to the switch.

a. Connect one end of an Ethernet cable to the NIC port on PC-A. Connect the other end of the cable to F0/6 on S1. After connecting the PC to the switch, you should see the light for F0/6 turn amber and then green, indicating that PC-A has been connected correctly.

b. Connect one end of an Ethernet cable to the NIC port on PC-B. Connect the other end of the cable to F0/1 on S1. After connecting the PC to the switch, you should see the light for F0/1 turn amber and then green, indicating that the PC-B has been connected correctly.

Step 3: Visually inspect network connections.

After cabling the network devices, take a moment to carefully verify the connections to minimize the time required to troubleshoot network connectivity issues later.

Part 2: Configure PC Hosts

Step 1: Configure static IP address information on the PCs.

a. To configure the Network Settings on PC-A, click **Start**, then click **Settings**.

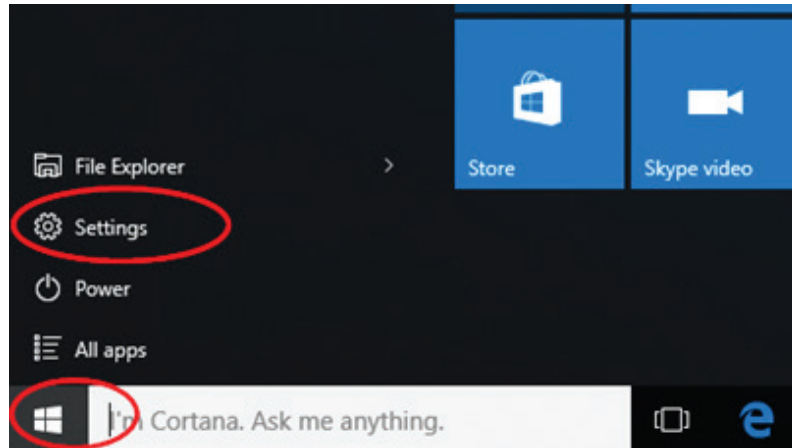


Fig. 2. Building a network

b. In the Settings window click **Network & Internet**.

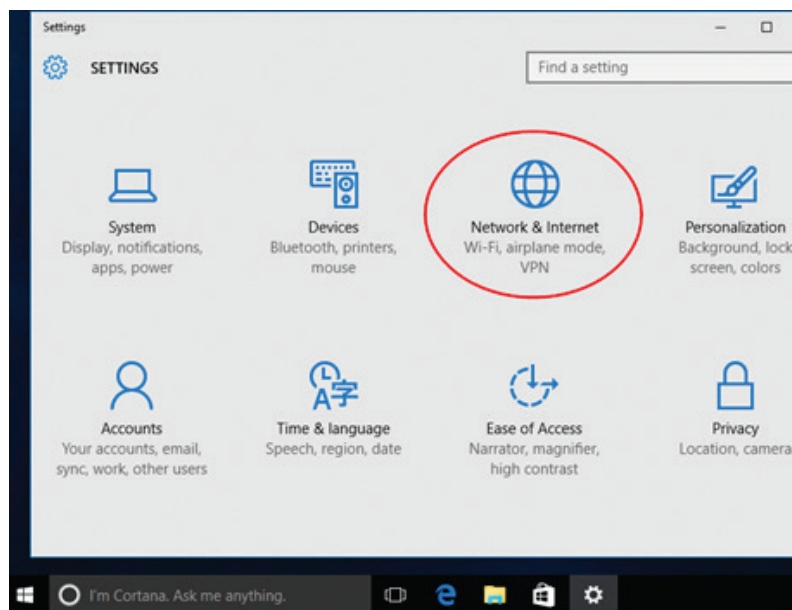


Fig. 3. Building a network

c. In the left pane select **Ethernet**, then click **Change adapter options**.

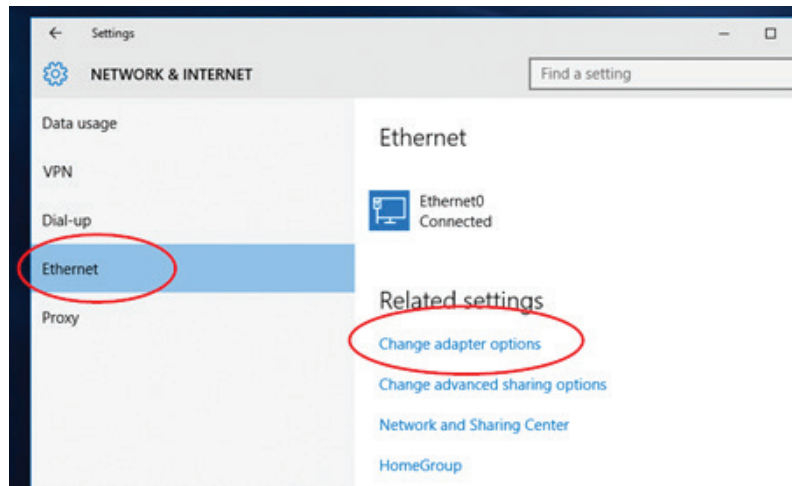


Fig. 4. Building a network

d. The Network Connections window displays the available network interfaces on the PC. Right-click the **Ethernet0** interface and select **Properties**.

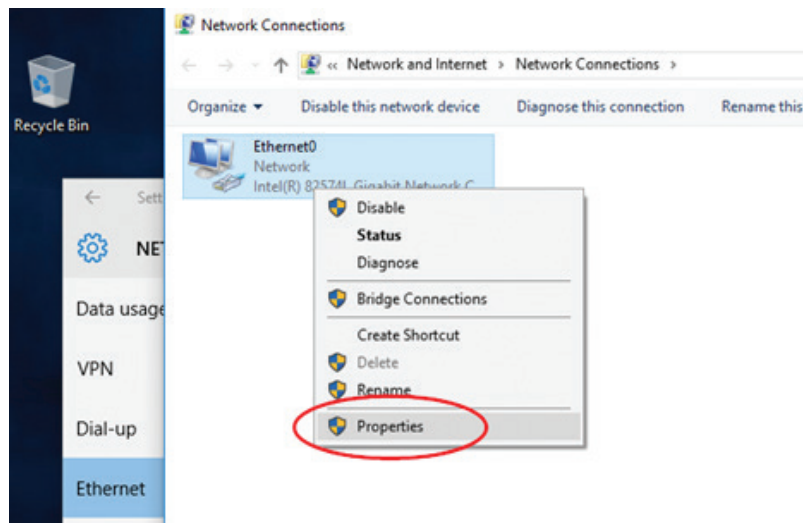


Fig. 5. Building a network

e. Select the **Internet Protocol Version 4 (TCP/IPv4)** option and then click **Properties**.

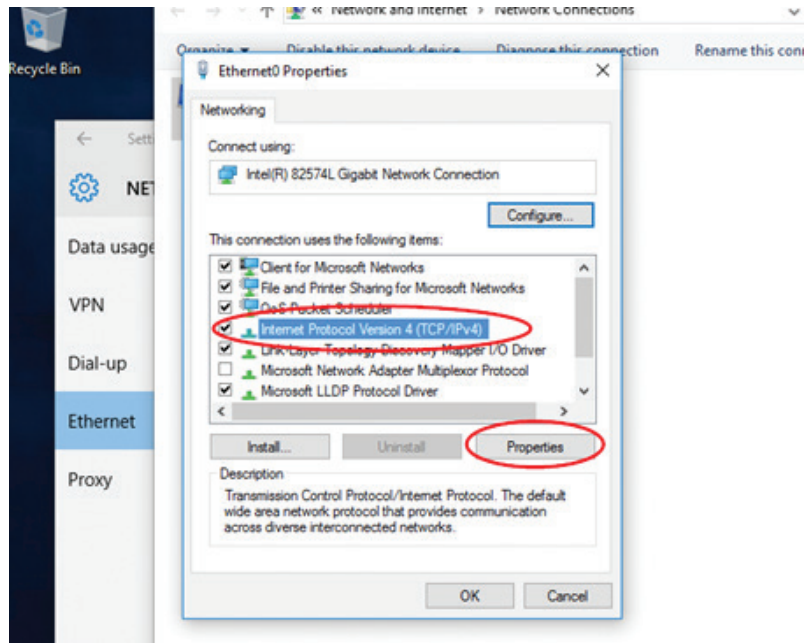


Fig. 6. Building a network

Note: You can also double-click **Internet Protocol Version 4 (TCP/IPv4)** to display the Properties window.

f. Click the **Use the following IP address** radio button to manually enter an IP address, subnet mask, and default gateway. Type in the IP address 192.168.1.10 and the subnet mask 255.255.255.0.

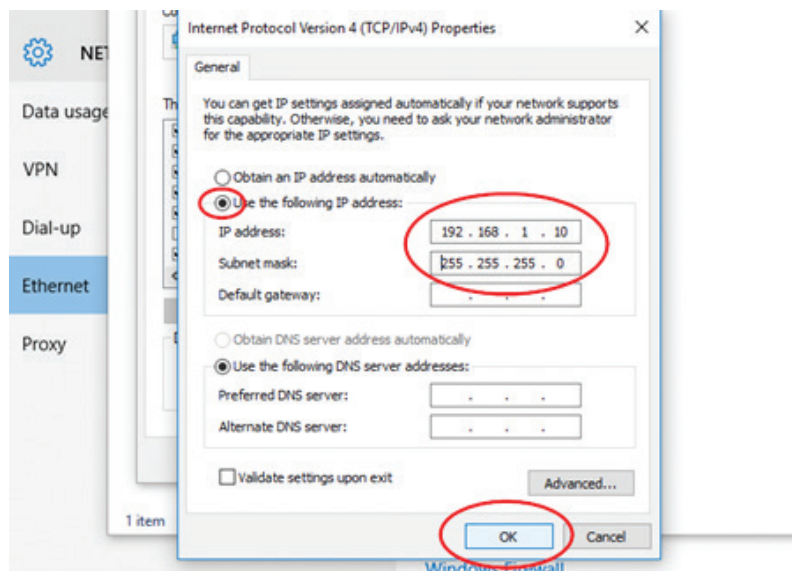


Fig. 7. Building a network

Note: In the above example, the IP address and subnet mask have been entered for PC-A. The default gateway has not been entered because there is no router attached to the network. Refer to the Addressing Table on page 1 for PC-B's IP address information.

g. After all the IP information has been entered, click OK. Click OK on the Ethernet0 properties window to assign the IP address to the LAN adapter.

h. Repeat the previous steps to enter the IP address information on PC-B.

Step 2: Verify PC settings and connectivity.

Use the Command Prompt to verify the PC settings and connectivity.

a. From PC-A, right-click **Start**, select **Command Prompt**.

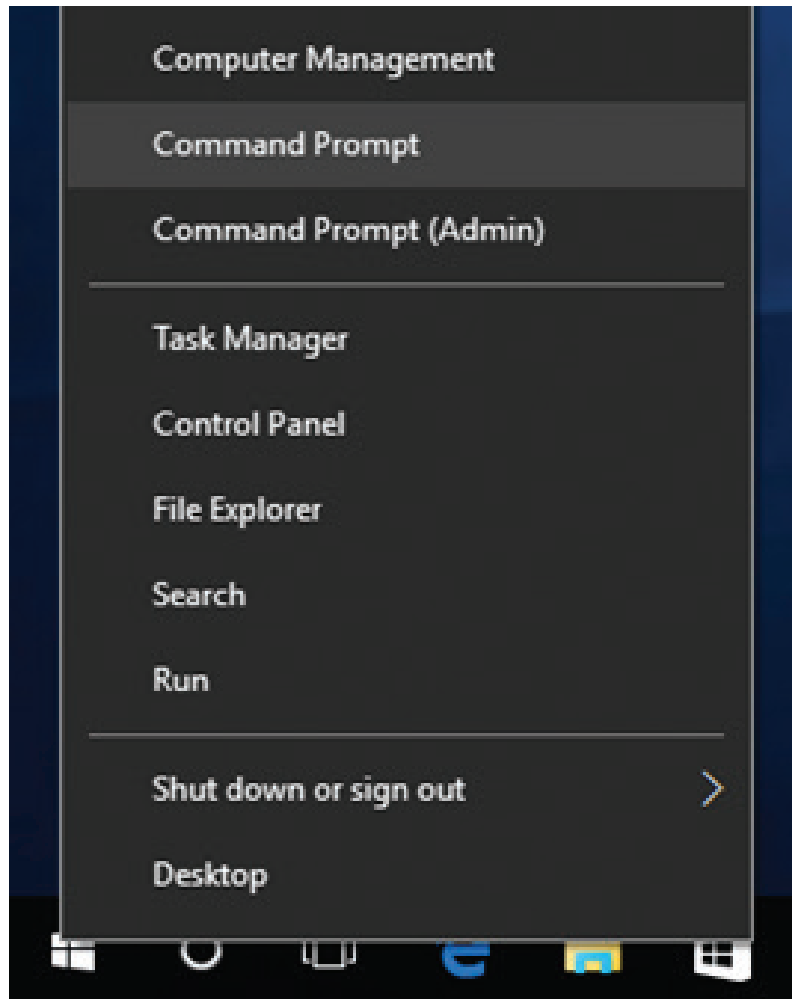


Fig. 8. Building a network

b. The cmd.exe window is where you can enter commands directly to the PC and view the results of those commands. Verify your PC settings by using the **ipconfig/all** command. This command displays the PC hostname and the IPv4 address information.

```
Command Prompt

C:\Users\Bob>ping 192.168.1.11

Pinging 192.168.1.11 with 32 bytes of data:
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\Bob>
```

Fig. 9. Building a network

c. Type **ping 192.168.1.11** and press Enter.

```
Command Prompt

Microsoft Windows [Version 10.0.10586]
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C:\Users\Bob>ipconfig /all

Windows IP Configuration

Host Name . . . . . : PC-A
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No

Ethernet adapter Ethernet0:

Connection-specific DNS Suffix . . . :
Description . . . . . : Intel(R) 82574L Gigabit Network Connection
Physical Address. . . . . : 00-0C-29-EB-1F-2D
DHCP Enabled. . . . . : No
Autoconfiguration Enabled . . . . . : Yes
Link-local IPv6 Address . . . . . : fe80::4d86:3d:47b:b083%4(Preferred)
IPv4 Address. . . . . : 192.168.1.10(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :
DHCPv6 IAID . . . . . : 33557545
DHCPv6 Client DUID. . . . . : 00-01-00-01-1F-25-7C-01-00-0C-29-EB-1F-2D
DNS Servers . . . . . : fec0:0:0:ffff::1%1
                       fec0:0:0:ffff::2%1
```

Fig. 10. Building a network

Were the ping results successful? _____

If not, there is a good chance that **Windows Firewall** is blocking ICMP echo requests (ping). Click **Start > Settings > Network & Internet > Ethernet > Windows Firewall** to turn it off.

Note: If you did not get a reply from PC-B, try to ping PC-B again. If you still do not get a reply from PC-B, try to ping PC-A from PC-B. If you are unable to get a reply from the remote PC, ask your instructor to help you troubleshoot the problem.

12. NETWORK RESOURCE SHARING

1. Shared resources

One of the main advantages of LAN is the ability to share resources in it. To implement this function, we must have the necessary hardware devices and specialized software.

Hardware devices include clients, servers, peripherals such as printers, plotters, disk drives, and more.

The specialized software covers the operating system used and the drivers of the respective devices.

The set of these tools is called network resources.

The main software that provides the ability to communicate between devices and share resources is the computer's operating system. Such a system is called a network operating system. All modern operating systems also support network functions.

To allow remote access to a resource (device or data), we need to create a shared resource. Resources given in this way are called shared. They are accessed in two ways:

- Through peer-to-peer networks.
- Through client/server networks.

2. Peer-to-peer networks – in these networks, each computer performs the functions of both a server and a client. Each user of the network administers the resources of his system. Due to the lack of a separate server computer, there is no hierarchical organization.

Advantages:

- Cheap to implement and install. There is no need of expensive server systems and staff to administer them.
- Greater stability compared to client/server networks. If the server stops working, access to the resources shared by it is terminated. In peer-to-peer networks if one workstation stops working, this does not cause the whole system to crash.

Disadvantages:

- Multiple passwords to access the resources of individual computers are needed. This forces users to keep copies of these passwords and creates a security issue.
- Users have different levels of technical knowledge, which also violates network security.
- Due to the lack of a central place to store shared resources, finding certain information becomes difficult. It is also difficult to maintain archive (backup) copies of the data. There is no guarantee that the user responsible for any information will perform this operation.
- Workstation performance may slow down when a remote user gets access to shared resources.
- The workstation must always be turned on to access shared resources, even if the user working on it is not.
- It is difficult to expand because the larger the network, the harder it is to manage. They are suitable for small organizations.

3. Client/server networks – they support central administration by a computer that works with specialized server software and network operating system. Each user gets access to the shared resources by entering a username and password. Access is granted by the server after verification of the entered data. The shared resources are located on separate computers (servers), which do not have a main user.

Advantages:

- Network security is managed centrally. All usernames and passwords are administered and verified centrally before a user gets access to a shared resource.
- Data backups are easy to maintain.
- There is no need to search for data on the network - they are stored in one place.
- The servers have powerful processors, more memory, larger and faster disks.
- It is easy to expand. Resources are located in one place and are managed centrally. The operation of the network does not depend on its size.

Disadvantages:

- High cost of server hardware and software.
- Specially trained staff takes care of their administration.
- Ability to deny the server. Different ways are used to overcome this problem, which leads to an increase in the cost of the network.

4. Network resource sharing

This process is managed and administered by the network operating system. Its function is to provide means to control access to shared resources. This is done in two ways:

- Share-level security.
- User-level security.

a) security at the level of shared resource - in this case the sharing of a resource, e.g. Folder, requires a password. To access the shared folder, the user must enter the correct password upon request.

b) user-level security - this method of protection is easier to manage in medium and large networks. Each user has an account (a username) and a password. Shared resources are configured so that only users with valid accounts can access them. This also allows tracking of whom is accessing a particular resource.

Questions and tasks

1. List some network resources in the LAN.
2. Which resources are called shared?
3. How many types of local networks do you know according to the way they are administered?
4. What levels of security can be achieved when sharing resources?

13. NETWORK RESOURCE SHARING – EXERCISE

1. Folder Sharing in Windows 10

To share a folder in Windows 10, follow these steps:

- Start Windows Explorer and find the folder you want to share.
- Right-click on the folder and from the context menu select Properties – Fig. 1.

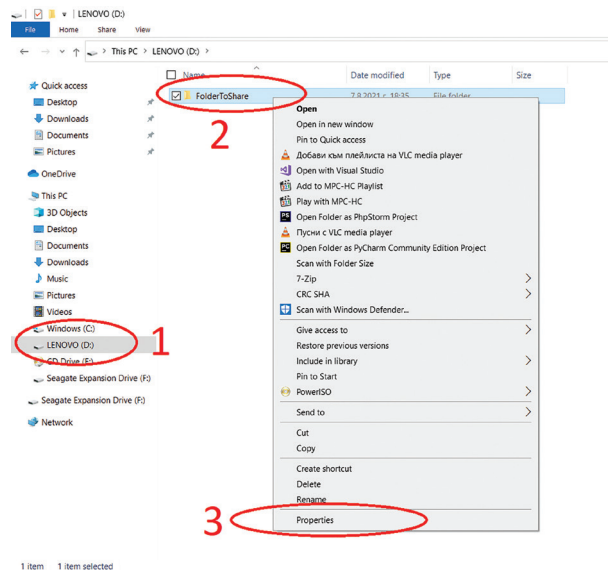


Fig. 1. Share

c) Select the Sharing tab and click the Share button. A new window opens where you need to specify an individual user or group which to share the resource with. To do this, use the drop-down menu to the left of the Add button. For example, the group Everyone is wanted. If it is missing, you should write it and then click on the Add button. The selected group should appear in the list below.

d) From Permission Level select the folder sharing level: Read - read only, Read/Write – read and write (allows modification and deletion) – Fig. 2.

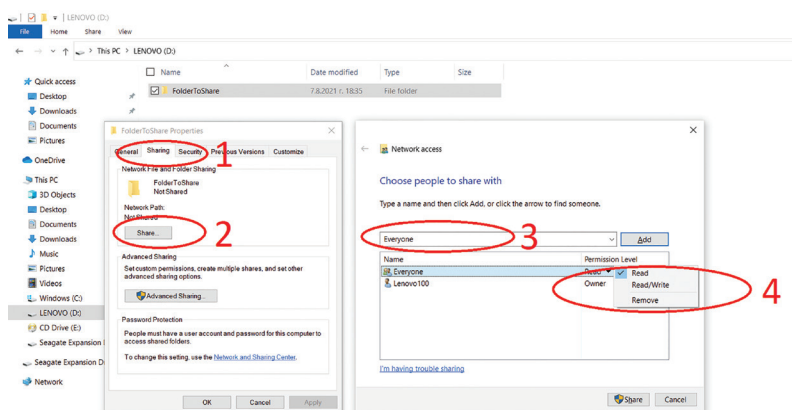


Fig. 2. Share

- e) It is confirmed with the Share button, after which a new window appears, indicating the way of writing the path for access to the folder from a computer in the local network – Fig. 3.
- f) Confirm with the Done button.

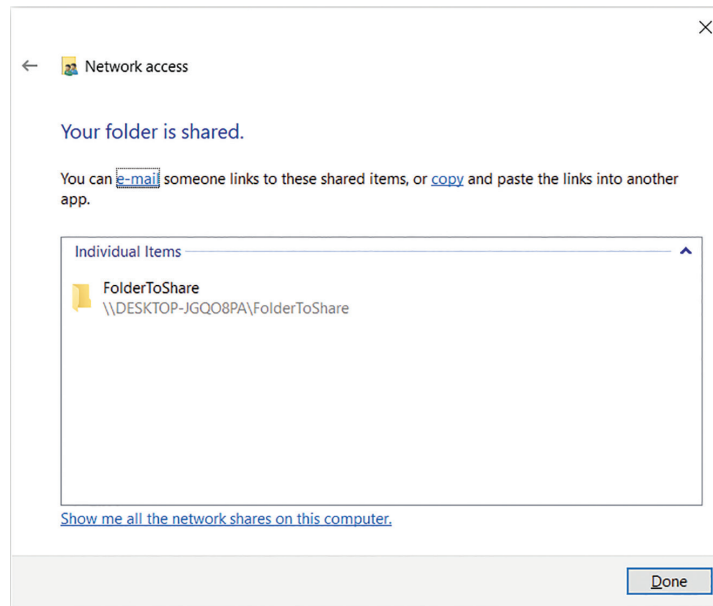


Fig. 3. Share

To allow access to the shared folder through the Security tab, follow these steps – Fig. 4.

- a) Select the Security tab and check whether the user or group with which the folder is shared exists in the suggested list. Usually, after using the Share button, the necessary changes to the Security tab are made automatically. If the target user or group is not in the list, they need to be added via the Add button.
- b) From the series of windows named Select Users or Groups, select the Advanced button, then Find Now to find the desired user or group and add them to the list of permissions.

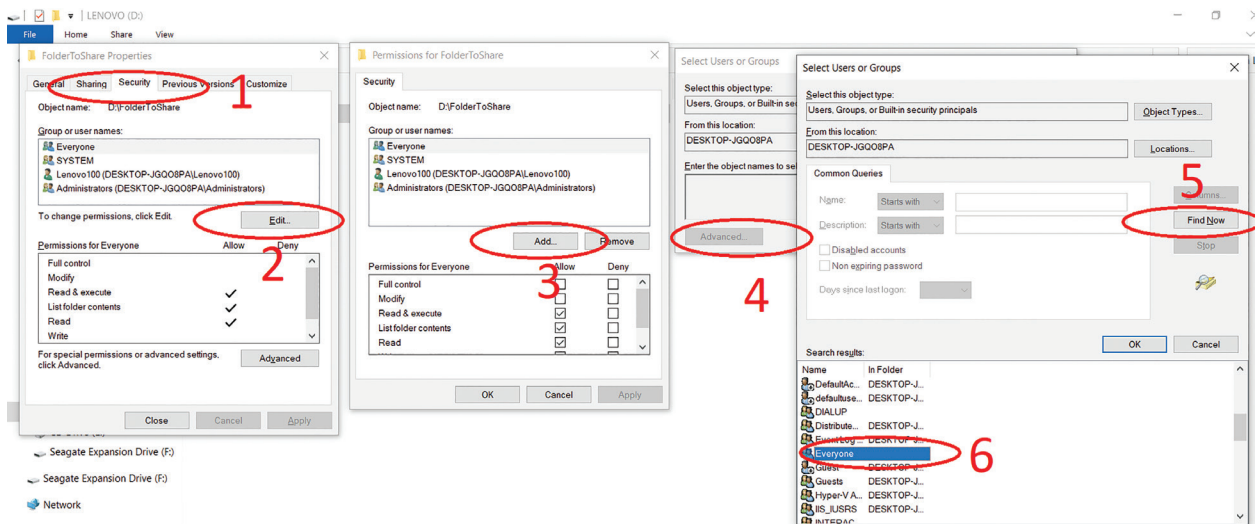


Fig. 4. Share

Access a shared folder via LAN

a) Access to the shared folder on the LAN can be obtained by starting File Explorer and selecting the Network location.

The desired computer is selected from the ones found in the network and the desired folder is accessed.

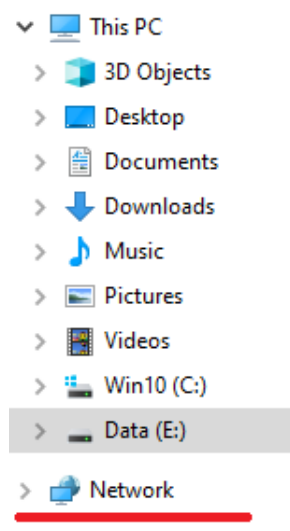


Fig.5. Share

The folder can also be accessed by typing the network path to it (name of a computer) FolderToShare – and with the IP address of the computer.

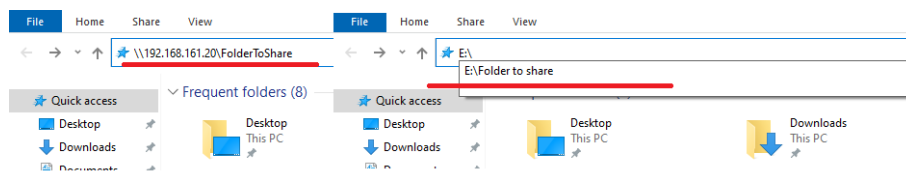


Fig. 6. Share

b) After accessing the folder, its contents can be copied in the standard way or modified/deleted, if allowed.

2. Using a network printer – to be able to use a printer on a LAN, it must be installed on a computer connected to the network and be shared, or the printer has a network card with which to connect directly to the LAN.

Printer sharing goes through the following steps:

a) Use the sequence of Control Panel/Devices and Printers commands to access the printers installed on the computer. Right-click on the desired printer to open the context menu and select the Printer properties option.

b) The Sharing tab is selected. Check Share this printer and enter a name by which the printer will be available on the network. Confirm with the OK button.

Using a shared LAN printer

To use a shared printer, you must install the appropriate network driver for that printer. If the printer is no longer installed, follow these steps:

a) File Explorer starts and the Network location is selected.

b) Select the computer from which the printer is shared and double-click the printer icon using the left mouse button. Wait for the driver to install. If the installation was successful, the printer should appear in Control Panel (Devices and Printers).

The installed printer is used in the standard way by any print-enabled application.

3. Additional network settings – for the proper functioning of the network and all shared devices it is necessary to open the Control Panel (Network and Internet / Network and Sharing Center) Change advanced sharing settings and mark the following options:

a) Turn on network discovery – allows the discovery of computers connected to the local network.

b) Turn on file and printer sharing – enables the process of sharing resources.

c) Turn on password protected sharing – this option requires a username and a password to access the resources.

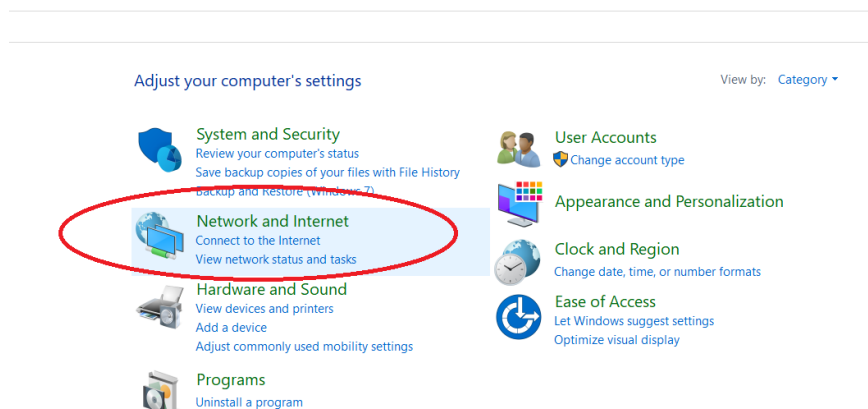


Fig. 7

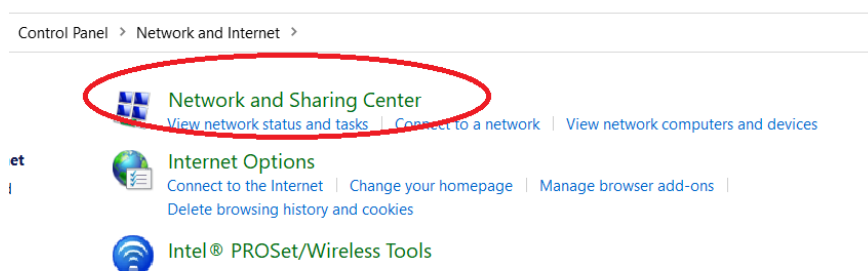


Fig. 8

Change sharing options for different network profiles

Windows creates a separate network profile for each network you use. You can choose specific options for each profile.

Private (current profile) ⌵

Network discovery ⌵

When network discovery is on, this computer can see other network computers and devices and is visible to other network computers.

- Turn on network discovery
- Turn on automatic setup of network connected devices.
- Turn off network discovery

File and printer sharing ⌵

When file and printer sharing is on, files and printers that you have shared from this computer can be accessed by people on the network.

- Turn on file and printer sharing
- Turn off file and printer sharing

Guest or Public ⌵

All Networks ⌵

Fig. 9

Change sharing options for different network profiles

Windows creates a separate network profile for each network you use. You can choose specific options for each profile.

Private (current profile) ⌵

Guest or Public ⌵

All Networks ⌵

Public folder sharing ⌵

When Public folder sharing is on, people on the network, including homegroup members, can access files in the Public folders.

- Turn on sharing so anyone with network access can read and write files in the Public folders
- Turn off Public folder sharing (people logged on to this computer can still access these folders)

Media streaming ⌵

When media streaming is on, people and devices on the network can access pictures, music, and videos on this computer. This computer can also find media on the network.

[Choose media streaming options...](#)

File sharing connections ⌵

Windows uses 128-bit encryption to help protect file sharing connections. Some devices don't support 128-bit encryption and must use 40- or 56-bit encryption.

- Use 128-bit encryption to help protect file sharing connections (recommended)
- Enable file sharing for devices that use 40- or 56-bit encryption

Password protected sharing ⌵

When password protected sharing is on, only people who have a user account and password on this computer can access shared files, printers attached to this computer, and the Public folders. To give other people access, you must turn off password protected sharing.

- Turn on password protected sharing
- Turn off password protected sharing

Fig. 10

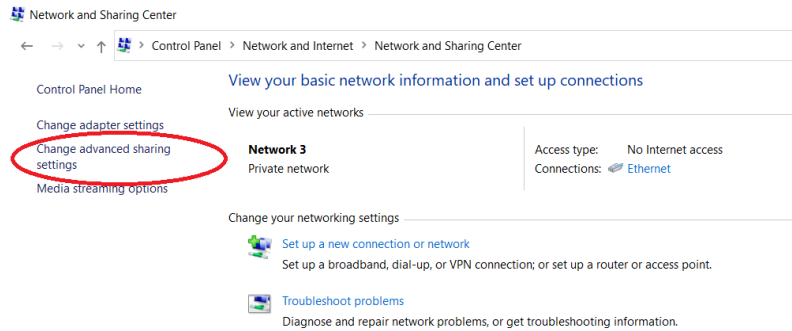


Fig. 11

Questions and tasks

1. Create a Test folder on your computer. Share the folder with the Everyone group and set full access rights to it.
2. Teamwork skills – try to access the folder shared by your classmate. Create a text document in it and save it.

14. PROTECTING INFORMATION IN A NETWORK ENVIRONMENT

The rapid development and improvement of computer networks and network services leads to the need to securely protect data from loss or misuse.

1. Hardware damage – can be a serious cause of information loss. Taking certain protection measures is not only necessary but also mandatory.

- Use of emergency power supply to avoid power supply problems. The most common option is to use battery-powered UPSs that can provide system uptime after a power outage.
- Data backup – special backup programs are used, and in case of hard drive damage or virus problem the information can be restored. It is a prerequisite that the archived data is stored on an additional device.

2. Network security - this is the main problem when using a computer network. There are many cases of unauthorized intrusion into the networks of various governmental and business organizations. There are also serious attacks with computer viruses.

a) external threats – occur when the local network is connected to another network, such as the Internet.

- unauthorized use of external usernames and passwords - each user of the resources of a system receives an account – a username and a password. Using an external account to access system resources is a prerequisite for security breaches. Each authorized user is responsible for the protection and use of the login data provided to him. There are also many ways to guess and crack external passwords.
- denial-of-service attacks – these attacks do not cause a system crash but flood the network with unnecessary data packets or simulate a network problem. In both cases, the established connection is interrupted (or it becomes impossible to establish such) and the communication stops until the problem is eliminated.
- IP spoofing - this type of attack changes the sender's IP address, and it appears that the data was sent from a secure source. The recipient does not know this and directs the accepted requests to the receiving host. DoS attacks use this method to overload the network.
- computer viruses and worms – self-replicating programs that spread from one computer system to another by attaching their code to various files without the user's knowledge and consent. Some of them are harmless – they only write an annoying message, for example, but others are aimed at stealing or destroying files.

A worm is a virus that uses the web to spread to end devices. It does not need to be attached to an existing program but is distributed as an attachment to an e-mail, HTML page and more.

- Trojans – malicious programs that present themselves as useful software. The purpose is to gather important information for the attacked user or to cause a security breach of the attacked system.

b) internal threats – can be carried out directly on the computer system or by breaking into the local network. The motives can be corporate espionage, dissatisfied employees and others.

3. Security measures

- use of operating systems with a high degree of security - all modern OSes meet this requirement. It is also important to regularly update the used OS and software applications. Updates released by the software vendor often close possible security breaches.
- authentication and identification – user authentication process. For this purpose, different identifiers are used – a password, a PIN code, a cryptographic key, an electronic signature, etc.
- data encryption – encryption uses a key to shuffle (encrypt) and then arrange (decrypt) the data in order to recover it. Special algorithms are used.
- use of Firewall and proxy server – the firewall is a filter of incoming and outgoing data packets. Depending on the settings made, the passage of a packet is allowed or prohibited.

The proxy server serves as an intermediary between the internal network and the computer systems of the external network.

- Use of antivirus software – modern antivirus programs monitor real-time virus infections, report them, and try to neutralize them. Again, it is important to keep our antivirus program up to date with information about the latest viruses.
- Restriction of physical access – servers and communication devices must be located in areas without access by individuals, except for those authorized to do so.

4. Basic methods and means of network protection

a) maintenance of users with different levels of access - the level of access of a user determines what data he has access to and what actions he can perform with them. There are two types of accounts available in Windows 10:

- Administrator – allows full control over the computer and access to all programs, settings and data.
- Standard – allows the user to use software and make changes that do not affect other users or system security.

b) Tips for use of secure passwords:

- not to use words or numbers, which due to the connection with the user can be easily guessed (name, surname, date of birth, etc.).
- easy for the user to remember so that it does not have to be recorded.
- use of lowercase and uppercase letters, numbers and special symbols.
- longer password length.
- change the password over a period of time, and the new password should not look like the old one.
- use of specialized software – password manager – allows you to set a long and complex password (random sequence of characters) for each user's account. These passwords are stored in encrypted form and the only password the user needs to remember is that of the password manager itself.
- file encryption – encrypts the file and the contents cannot be read by another. In Windows

10, this is done through the following steps: Properties (Advanced) Encrypt contents to secure data.

- use of electronic signature.
- e-mail security – it is recommended when receiving and/or sending messages via e-mail to provide a connection via encryption protocols (https). Other recommended tips are not to open e-mails without a sender and to ignore messages that contain only hyperlinks.
- maintaining up-to-date versions of software products.
- controlling access to the network through firewalls.

5. Set permissions on LAN resources in Windows 10

As we have already seen when sharing resources on a local network in Windows 10, a level of permission is set between the options Read – read only and Read/Write – read, modify and delete.

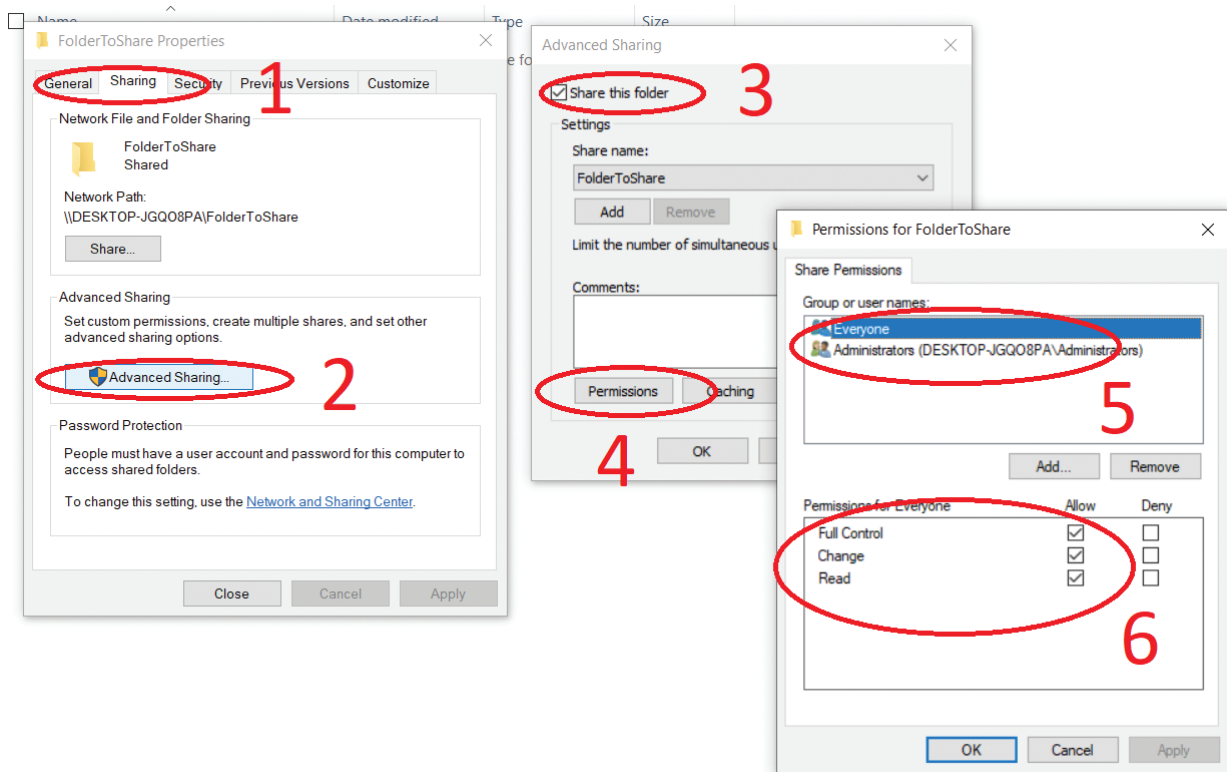


Fig. 1. Protection

The sharing of a resource (folder) can also be done by performing the following steps – Fig. 1:

1. Right-click on the selected folder and select Properties from the context menu.
2. In the open window select the Sharing tab.
3. Click the Advanced Sharing button.
4. Check the Share this folder option and specify the name with which the folder is shared.
5. The Permissions button sets the group or individual user with whom the folder is shared.
6. Check the desired modification options in the Allow column. The options are as follows:
 - Read – allows you to see the names of folders, files and their attributes, run programs and copy files.
 - Change – it allows everything from Read plus the ability to create folders, add files, change the contents of files, delete files and folders.
 - Full Control – it includes all the options from Change plus the ability to change the allowed actions with files and change the ownership of a file.

Questions and tasks

1. What are the risks of working in a network environment?
2. List some external security threats in a network environment?
3. What does data encryption mean?
4. What is the role of firewalls?
5. Specify ways and means to protect the network from unauthorized access.

15. INFORMATION AND SERVICES FOR CITIZENS ON THE INTERNET. E-COMMERCE

1. eGovernment: <http://ec.europa.eu/egovernment>

a) sites of state institutions – the state institutions are institutions performing the functions of the state according to the constitution and the laws.

According to the Constitution of the Republic of Bulgaria, the head of state is the President:

- President of the Republic of Bulgaria - www.president.bg

The authorities are divided into three - legislative (National Assembly), executive (Council of Ministers) and judicial (Supreme Judicial Council). These three authorities are independent of each other.

- National Assembly – www.parliament.bg
- Council of Ministers – www.government.bg
- Supreme Judicial Council – www.vss.justice.bg

Other important institutions:

- Ministry of Education and Science – www.mon.bg
- Ministry of Interior – www.mvr.bg
- Constitutional Court – www.constcourt.bg
- State Agency for Child Protection – www.sacp.government.bg

b) e-government – a term that refers to the use of information and communication technologies to provide services and information to citizens, businesses and other organizations. In Bulgaria, the State Agency for Electronic Government is responsible for e-government - www.egov.bg.

Some of the institutions in Bulgaria that offer electronic services are:

- National Revenue Agency (NRA) – www.nra.bg
- National Social Security Institute (NSSI) – www.noi.bg
- National Health Insurance Fund (NHIF) – www.nhif.bg
- Trade register – www.brra.bg
- Sites of municipal administrations

2. E-commerce

E-commerce or online commerce is the buying and selling of products and services through the use of electronic systems such as the Internet.

Principles:

- E-commerce is done online.
- Special sites called e-shops are used.
- The e-shop is constantly open and provides easy access to information about the products and services offered.
- There is no limit to the number of products and services sold.
- Every user with Internet access also has access to the e-shop.
- The order of products is done by filling in a form, which indicates the type and quantity of the desired products, delivery information, method of payment and more.
- Payment can be made by bank transfer, using a debit or credit card or cash on delivery (payment on delivery).

The advantages of e-commerce are that we have easy access to a large number of goods and services offered on the Internet, we can shop from around the world, easily find what we are looking for, the goods are delivered to our home.

The main disadvantage is that we can come across unscrupulous traders and be deceived. Another disadvantage is that the consumer does not actually see the product he orders and relies on photos and/or video material provided by the merchant in the e-shop.

3. Electronic money – is a monetary value stored and transferred as electronic information on various electronic devices.

Electronic money can be centralized when there is central control over its supply or decentralized when there is none. Decentralized electronic money is also known as a digital currency. The most well-known decentralized electronic money is cryptocurrencies, such as bitcoin.

Electronic money can only be exchanged electronically.

Main characteristics:

1. They represent monetary value through the debt of their issuer.
2. Can be stored on electronic devices.
3. They are guaranteed by legally recognized means of exchange, i.e. the money issued by the central bank of the country.
4. They include a mechanism for prepayment of the value.
5. They are convertible into central bank money.
6. They can be used for payments not only with their issuer.
7. Electronic money is stored in accounts with a higher degree of cybersecurity.
8. They can be sent to other licensed financial institutions around the world.

4. Law regulations

- Electronic Commerce Law
- Law on consumer protection
- Law on the provision of financial services at a distance
- Electronic Communications Law
- Electronic Document and Electronic Signature Law
- Directive 2000/31/ EC – electronic commerce in the EU
- Directive 2000/46/EC of the European Parliament and of the Council of September 18th, 2000 on the taking up, pursuit of and prudential supervision of the business of electronic money institutions
- Regulation (EU) (910/2014 of 23 July 2014 on electronic identification and certification services for electronic transactions in the internal market
- General Data Protection Regulation (EU) 2016/679
- Law on Personal Data Protection
- Law on Protection of Copyright and Related Rights

Glossary:

- **E-government** – a term that refers to the use of information and communication technologies to provide services and information to citizens, businesses and other organizations.
- **E-commerce** – the buying and selling of products and services through the use of electronic systems such as the Internet.
- **E-money** – a monetary value stored and transferred as electronic information on various electronic devices.

Questions and tasks

1. Do a survey on the Internet and write down what an electronic signature is and what its benefits are.
2. What are the main similarities and differences between traditional and electronic money?

III. APPLICATIONS

16. TEMPLATES AND THEMES IN A TEXT DOCUMENT

1. Templates

Template is a pre-formed document that is used in the preparation of multiple identical documents. The template can be a birthday card, an invitation, a business card, a calendar, a resume and more. The Microsoft Word text editor offers a choice of ready-made templates that can be changed according to the user's needs. In addition to ready-made templates, you can save your own template. In this text editor, templates are saved with a .dot, .dotx, or .dotm extension.

2. Using a ready template

Newer versions of Microsoft Word allow you to choose ready-made templates to use when developing your documents. Upon starting the text editor, you can select the needed template, and the most commonly used is a blank form. You can see the initial template selection window in Fig. 1.

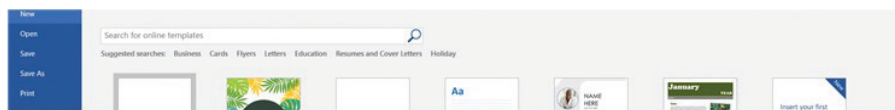


Fig. 1. Templates

If necessary, you can use the search engine (Fig. 2) to find the required template.

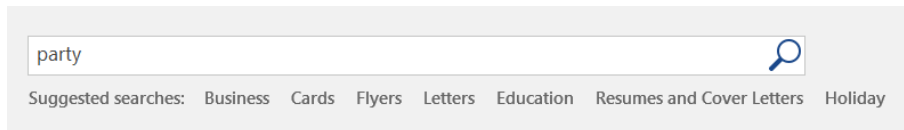


Fig. 2. Templates

If you need to make a party invitation and want to see the different template options, type 'party' in the search engine and press Enter (Fig. 3). You can see the results in Fig. 4.

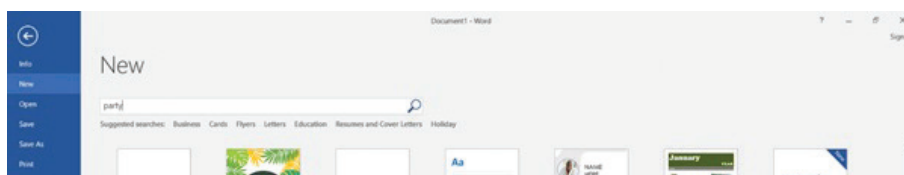


Fig. 3. Templates

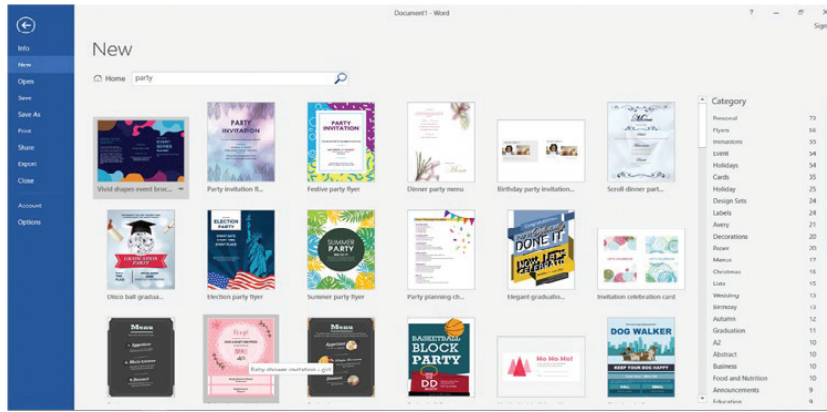


Fig. 4. Templates

After selecting the template, a window opens where you need to confirm the selection (Fig. 5). Select the Create button.

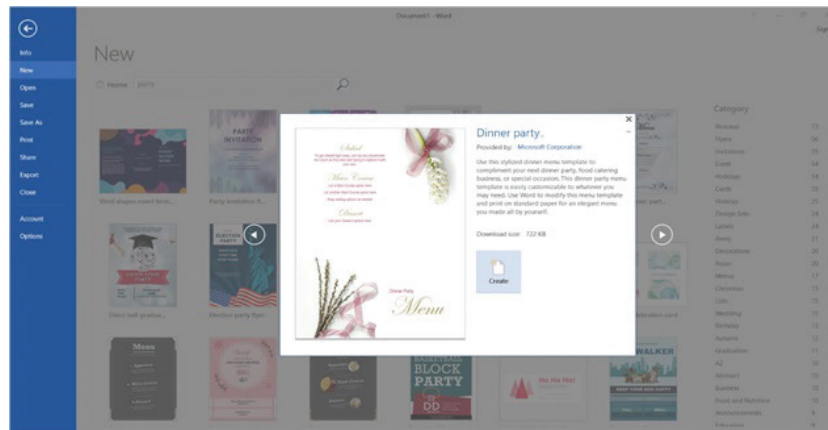


Fig. 5. Templates

After confirmation the document is loaded and you can now edit the content. Editing is the same as for any other document. If necessary, you can replace the content (Fig. 6).

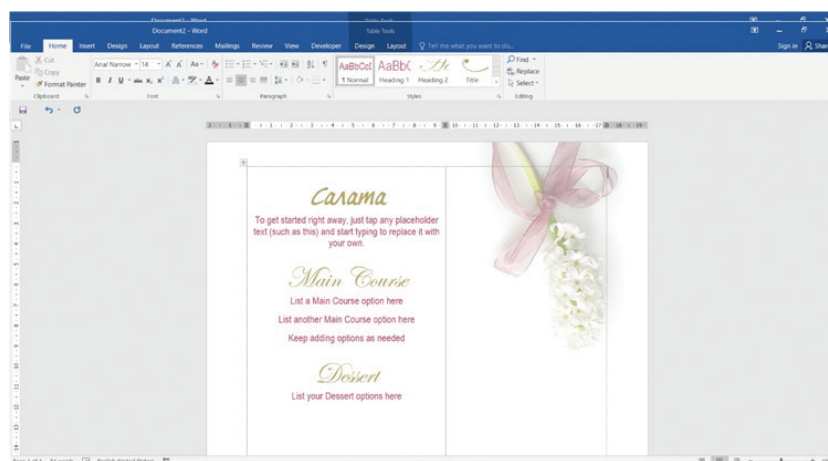


Fig. 6. Templates

3. Saving a template

If you have created a template that you want to save and use in the future, you can save it in the custom Office Templates directory. To store it there, you need to follow these steps:

1. From the File menu Select Save As (Fig. 7)

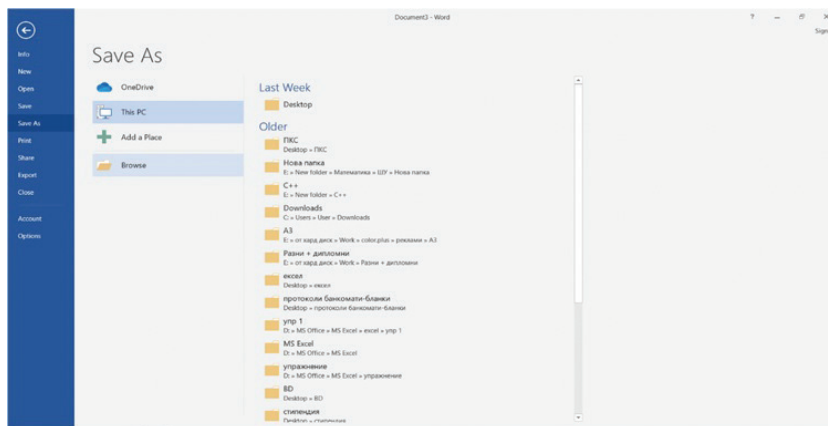


Fig. 7. Templates

2. Depending on the version of the office suite you use, there are two options:

- open the storage window directly.
- you must press the browse button to reach the window.

3. In the storage window, name your template and select Word Template as the file type (Fig. 8). After selecting this format, the default directory opens.

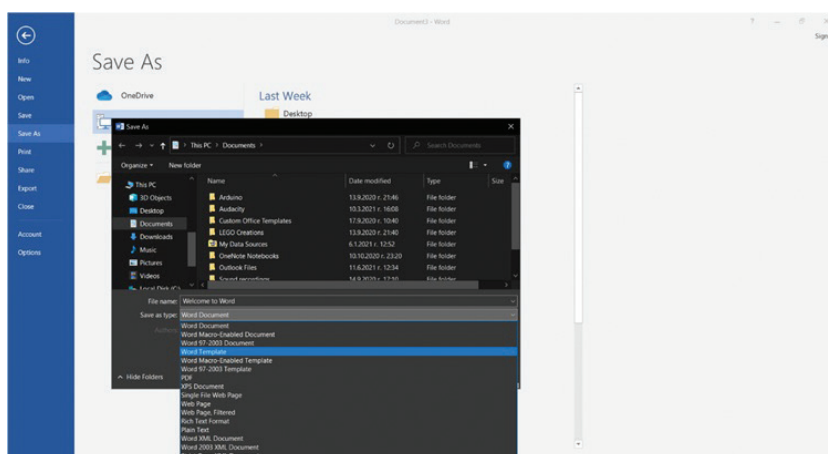


Fig. 8. Templates

4. Using themes

The themes you can use are in the Design menu (Fig. 9).



Fig. 9. Templates

They help you customize the look of your template. With the help of a theme, you can determine what each element of your document should look like (titles, figures, text, graphics, images, etc.) or change the color gamut (Fig. 10).

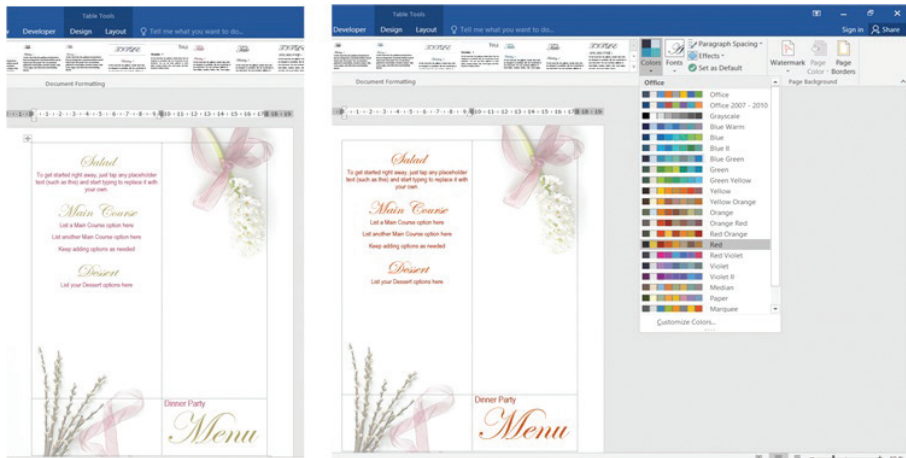


Fig. 10. Templates

Tasks:

1. Create a text document that can be used to present yourself (e.g., your CV, etc.) – education, interests, skills, and more. Use the template named Blue spheres resume. Add your photo and the information.
2. Select the appropriate template to create an invitation for an event of your choice. Save the created invitation with the name invitation.dotx.

17. SORT DATA IN A SPREADSHEET

Sorting means to sort data in a desired sequence. Only a list can be sorted. The list is a table that must meet the following conditions:

- The first row in the table must contain headers (heading row or column).
- The data in one column must be of the same type.
- The data in one line must be interconnected.

To be able to recognize the list correctly (List rule):

- The list must be pre-separated with a blank line and a column from the rest of the data in the sheet.
- Headers must be written on one line (No cell merging).
- No summary lines - Sum, Min, Max, etc. below the table.

Task 1: Open the file NVO-10klas.xlsx and sort data by age in descending order, and within the age the list should be sorted by name in alphabetical order.

List sorting:

1. Select a cell from the list that we want to Sort.
2. Select the Sort button from the Data menu, from the Sort & Filter panel (Fig. 1).

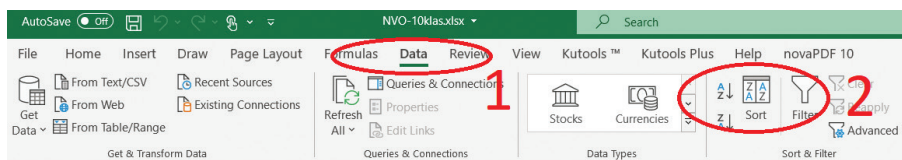


Fig. 1. Sort

3. The Sort dialog box opens (Fig. 2).

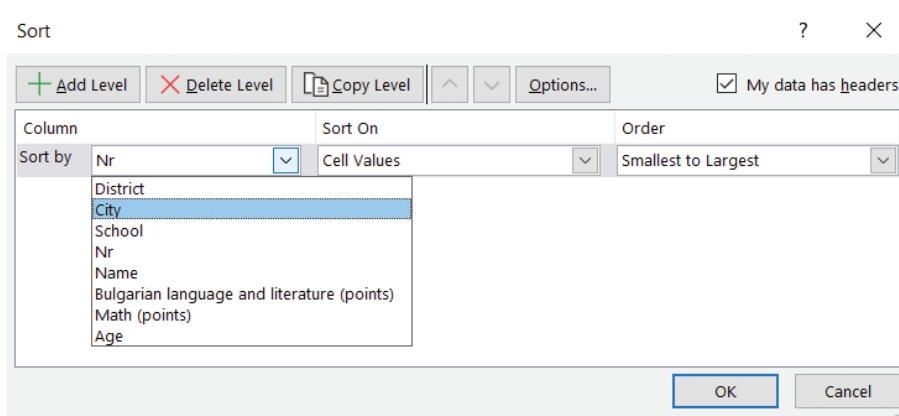


Fig. 2. Sort

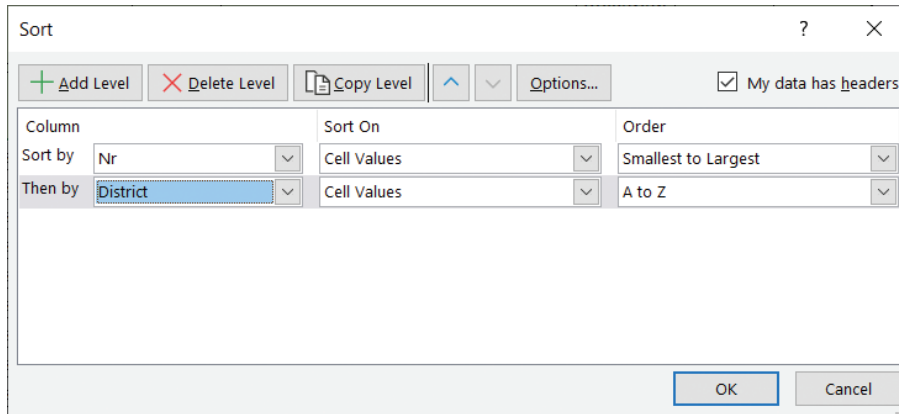


Fig. 3. Sort

- In Sort by we see the columns, but not with their names, which means that the list is not recognized => We should apply the list rule (Separate the title from the table with an empty row – Add a row above the table).
- Again Data/Sort – The Sort dialog box opens (Fig. 3)
- From Sort by we choose the first criterion by which we will sort – Age.
- From Sort On – value, cell or font color, or icon. The most common option is Values.
- From Order – set the sort order – ascending, descending, alphabetical.
- Add Level – we add more criteria – as in our task, the second criterion must be Names.
- My data has headers – When checked, the header row does not participate in the sort.
- Delete Level – deletes the specified criterion.

Tricks:

When sorting, Excel does not distinguish between lowercase and uppercase letters. If this distinction is necessary - we should use Data/Sort/Options... – Case sensitive option – Fig.4.

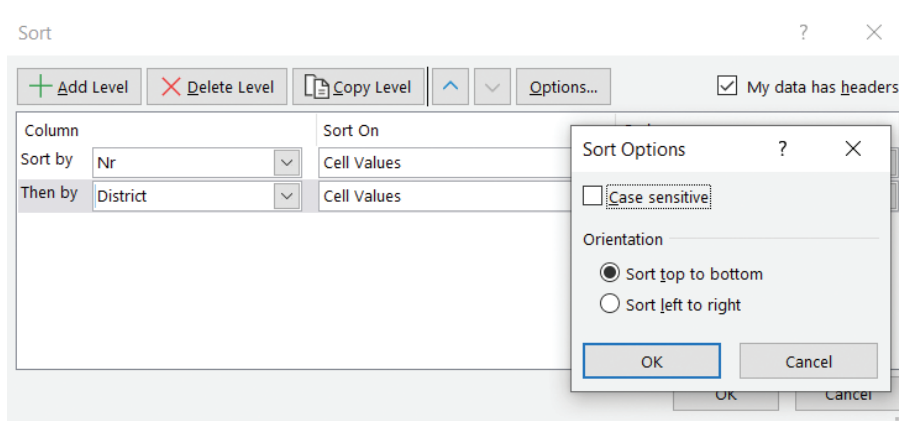


Fig. 4. Sort

In addition to columns, Excel can also sort by rows. This can be done by using the Data/Sort/Options... – Sort.

18. SPREADSHEET DATA FILTERING

Spreadsheet filtering provides the ability to see only part of the data that meets certain conditions (criteria) predefined by the user, and the rest of the data is temporarily hidden. It is performed from the Sort & Filter panel of the Data menu.

There are two types of filtering:

- Auto Filter
- Advanced Filter

1. Auto Filter

1. Select a cell from the list, that we want to filter.
2. Select the Filter button from the Data menu, from the Sort & Filter panel (Fig. 1).

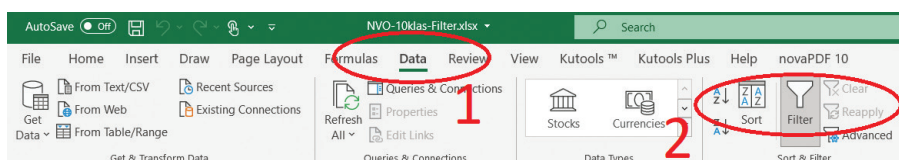


Fig. 1. Filter

3. In each header cell (cells in the title line) arrows appear. (Fig. 2).

	A	B	C
1			
2	District	City	School
3	VARNA	VARNA	First language school
4	VARNA	VARNA	First language school
5	VARNA	VARNA	First language school
6	VARNA	VARNA	First language school
7	VARNA	VARNA	First language school

Fig. 2. Filter

Click on the arrow of the corresponding header cell, a drop-down menu is displayed, and we apply the desired filter (Fig. 3). The drop-down menu contains a list of all values from the corresponding column. If the table is larger, this list will be large too. It is extremely difficult to look for values in it. Therefore, we can use the following options:

- Number Filters for numeric data.
- Text Filters for text data.
- Date Filter for dates.

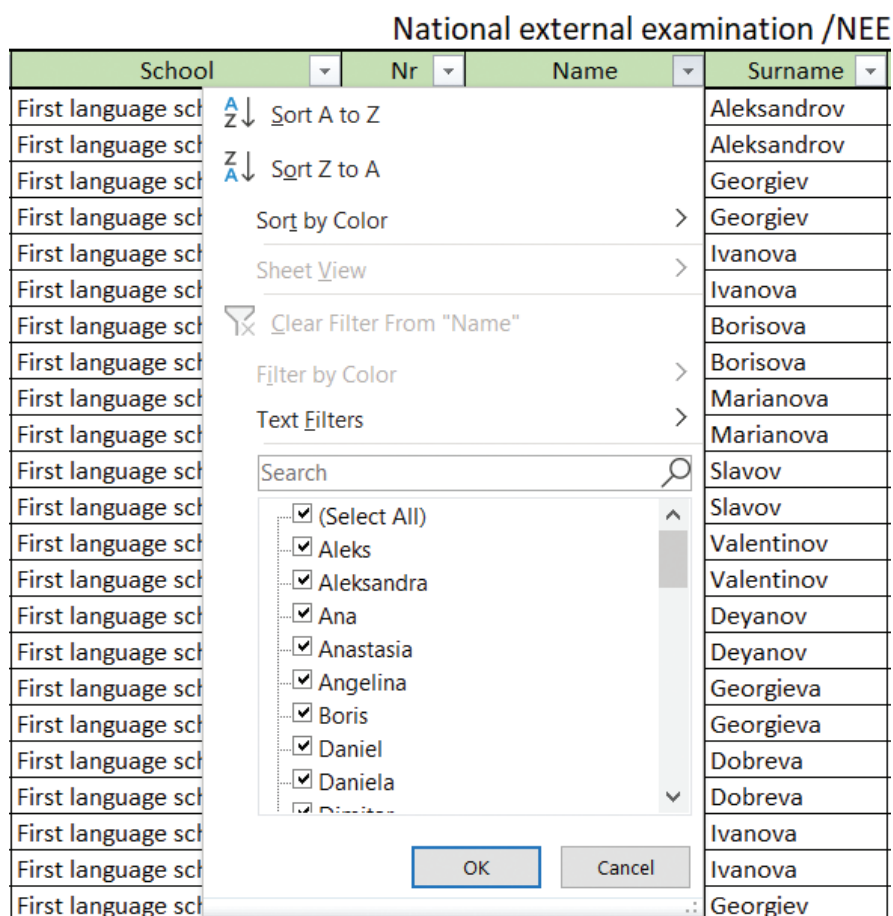


Fig. 3. Filter

All three options include Custom List – it allows you to define up to two conditions related to the logical AND and OR.

After filtering, a funnel appears in the name of the header cell. The connection between the individual filtered fields is of type “AND” – these data (records) are visualized, that meet all the criteria that are set. The Status Bar displays the number of filtered records.

Cancelling filtered records:

- From the already filtered field:
 - ☞ putting a check mark on Select All cancels one filter.
 - ☞ when selecting Clear Filter from we cancel one filter.
- Clear button from the Data menu, from the Sort & Filter panel – removes all filters at once, but keeps the arrows in the header cells.
- Filter button from the Data menu, from the Sort & Filter panel – completely removes filtering (removes arrows from header cells).

Task 1: Open the file NVO-10klas-Filter.xlsx and extract data only about students who have scored less than 10 points on NEE 10th grade.

In a cell in the list, select Data / Filter. In the header cell “Result in points”, select Number Filters / Less Than ... The Custom Auto Filter dialog box opens (Fig. 4). In the right field enter 10.

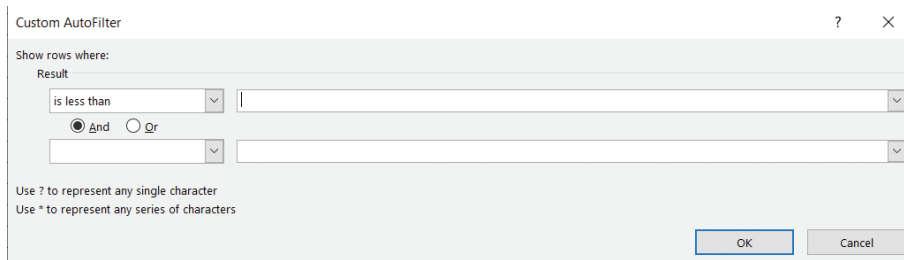


Fig. 4. Filter

Task 2: Open the file NVO-10klas-Filter.xlsx and extract data only about students who have scored less than 10 points and more than 48 points on NEE 10th grade.

In a cell in the list, select Data/Filter. In the header cell “Result in points”, select Number Filters/Custom Filter ... The Custom Auto Filter dialog box opens (Fig. 4).

- In the first row on the left we enter is less than and on the right field we enter 10.
- In the second row on the left we enter is greater than and in the right field – 48

Both conditions are connected with the logical “OR” (records must meet either criterion). The other possible choice is “AND” (simultaneous fulfilment of both criteria).

As a result, the data is shuffled, so we can now sort it – for example in descending order (Sort Largest to Smallest).

2. Advanced Filter (from the Data menu, from the Sort & Filter panel)

Preparation: Before running Advanced Filter, we need to create a small help table - Criteria range. We need to position it so as not to violate the list rule – to leave at least one blank row or column of other data.

Criterion consists of at least 2 lines:

- Header – must match the header from the list (copy it).
- Value – set the specific condition or value:
 - ☞ If the data is written on one line, then the connection between them is “AND”.
 - ☞ If the data is on different rows, then the connection between them is “OR”.

Realization:

- Select a cell from the list, that we want to filter.
- Select the Filter button from the Data menu, from the Sort & Filter panel (Fig. 5).
- The Advanced Filter dialog box opens (Fig. 6):
 - Action – Filter the list, in-place or Copy to another location.
 - List range – Excel marks the whole list by default, otherwise - we mark it.
 - Criteria range – we mark the small auxiliary table (criterion) that we have prepared.
 - Copy to – select a cell from which the filtered list will be displayed (an empty cell selected in such a way so as not to violate the list rule). If we do not want to see all the columns in the list, we can create a second additional table in advance. It consists of one row, only of headers and the columns we want to see. Then on the option Copy to, we mark the second additional table.

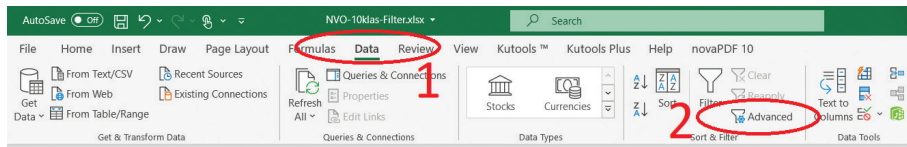


Fig. 5. Filter

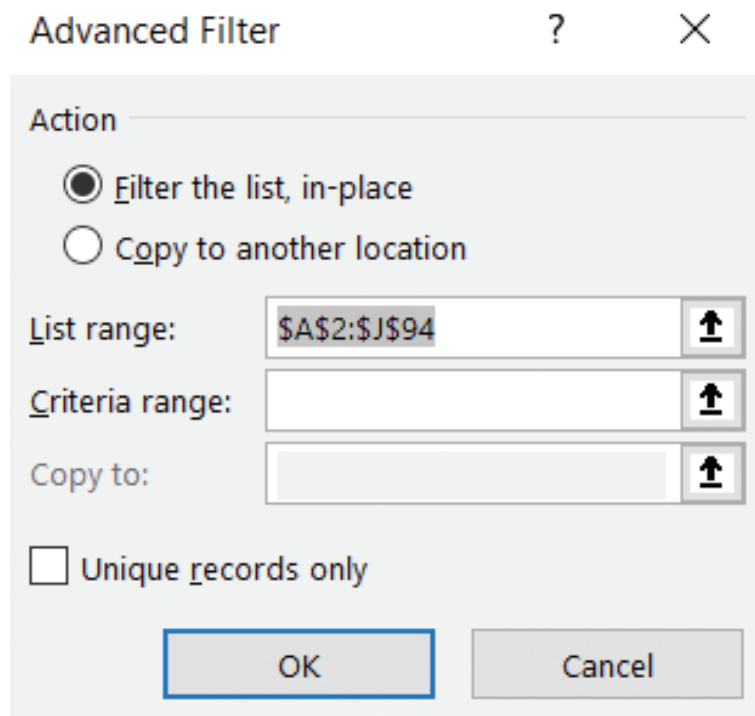


Fig. 6. Filter

Task 3: Open the file NVO-10klas-Filter.xlsx and extract information (make a reference) only about students Alex and Daniel, who are from Varna.

First, we create the auxiliary table (criterion). Since it consists of at least 2 lines – a header and a value, we copy the header, in whose column are Alex and Daniel – “Name”, for value – we put “Alex” under Name.

The question is where to put Daniel? We define it according to the connecting union – “AND” (on the same line), “OR” (on different lines). Do we consider if one person can be called Alex and Daniel at the same time? The answer is no, therefore they are on different lines (one below the other).

Along with the name, we want them both to be from Varna. On the line of the header “Name” the header “City” is copied and as a value (below it) “VARNA” is copied. But even this is not enough, because it will bring us information about Alex from Varna and about Daniel, regardless which city the latter comes from. In order to fix only for Daniel from Varna, once again, I have to copy “VARNA”. The exact criterion (Fig. 7).

L	M
City	Name
VARNA	=Alex
VARNA	Daniel

Fig. 7. Filter

There is no information about Daniel from Varna in the filtered table, but there is information about Alexandra, whose name contains Alex.

To fix only Alex to appear, the criterion is the following: "=Alex"

Tricks:

With Auto Filter, entries can be filtered either by value or by color, but not simultaneously.

Filter by Color is possible only if we have the following for the column in which we will apply it: records (rows) with changed color of the symbols (by Font Color), background color (by Cell Color) or icons (by Cell Icon).

In advanced filtering, the criterion can be comparative (the examples discussed so far) or computational. Extract information about students who have above average points.

Instructions: 1. The header must be different from the one in the list or remain blank, but don't forget to mark it in the Criteria range.

Instructions: 2. The value =I3> average (\$I\$3:\$I\$94), where I3 is the first cell with a value from the "Result in points" column. We use "\$" to fix the search area.

Tasks:

1. Open the file NVO-10klas-Filter.xlsx, do the tasks with Auto Filter and Advanced Filter.
 - 1.1. Extract information about the students from Sofia with a score between 40 and 50 points.
 - 1.2. Open the file NVO-10klas-Filter.xlsx and extract data only for students who have scored less than 10 points and more than 48 points on NEE 10th grade.
 - 1.3. Get information about students Alex and Daniel.
 - 1.4. Get information about the students from First language school and St. Kliment Ohridski high school, who have 50 points.
 - 1.5. Extract information about students of this age, which is presented in the table in red.
- Instructions: Use Filter by Color for the Age header
- 1.6. Extract information about the results of NEE 10th grade only for high schools.
- Instructions: High schools have the word "high" before their names.
2. Open the file NVO-10klas-Filter.xlsx, do the tasks with Auto Filter and Advanced Filter
 - 2.1. Get information about the first two students with the highest score in math.
 - Instructions: Number Filters / Top 10. A dialog box opens, and we type 2.
 - 2.2. Get information about the results from NEE 10th grade of students from Varna who have taken the Bulgarian language and literature exam and their result is below average.

19. VALIDATION OF DATA IN A SPREADSHEET

Validation is:

- A function that allows you to set data limits as soon as you enter a cell.
- Does not allow incorrect data to be entered.

Sequence of actions:

1. First way of applying validation

- We select the area of cells for which we want to set a condition for data validity.
- Execute command Data Validation from the Data menu from the panel Data Tools (Data / Data Tools / Data Validation) (Fig. 1).

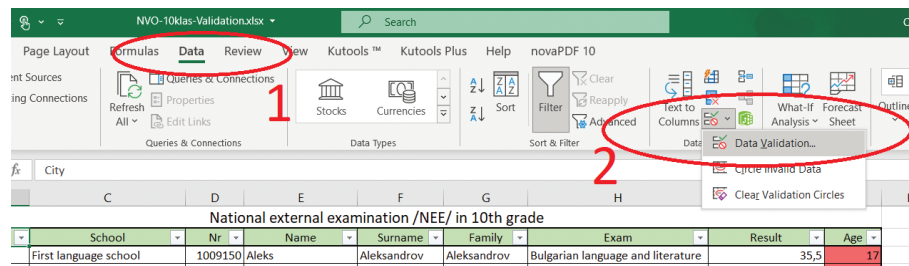


Fig. 1. Validation

2. Second way of applying validation

- Apply Data Validation per 1 cell – Data Validation from the Data menu from the Data Tools panel (Data / Data Tools / Data Validation) (Fig. 1).
- Multiplies as a function – in the lower right corner, getting a small black plus, hold the left mouse button and drag.

As a result, the Data Validation dialog opens (Fig. 2). There are 3 pages:

- Settings - condition for validation (correctness) of the data.
- Input Message – prompt message.
- Error Alert – error message.

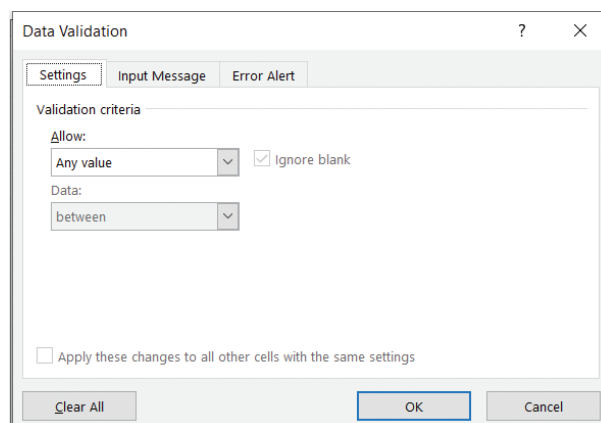


Fig. 2. Validation

Settings page – we set a condition for data validation	
Allow – determines what type of data is allowed to enter	Data – sets the restrictive conditions
any value	between
whole number	not between
decimal	equal to
list	not equal to
date	greater than
time	less than
text length	greater than or equal to
custom	less than or equal to

When List is selected:

- Data is entered using a drop-down list in a cell.
- The Source field is used to fill in the data in the drop-down list. There are 2 ways:
 - ☞ Direct input in the field Source (Fig. 3) - as the values are separated by a semicolon or only a comma (Question of settings). As a result, the values one below the other (Fig. 4.1) should be obtained, and not one line (Fig. 4.2).

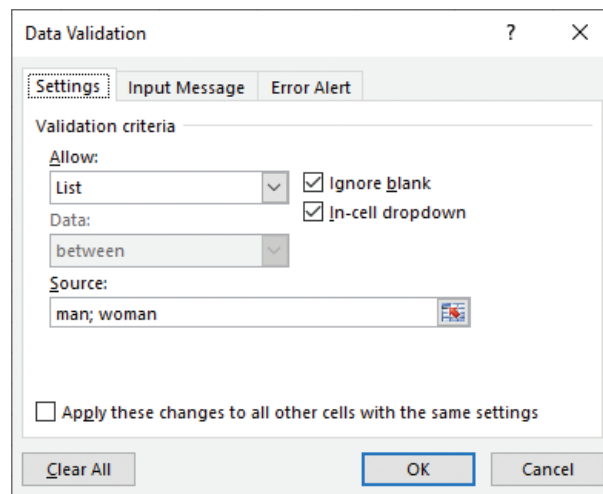


Fig. 3. Validation

- ☞ Pre-input into randomly selected cells (Fig. 5) and here only the area (Fig. 6) is marked.

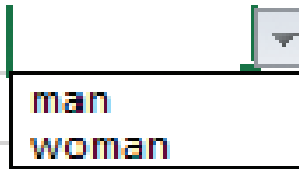


Fig. 4.1. Validation

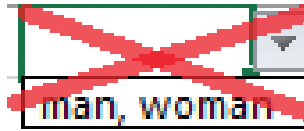


Fig.4.2. Validation

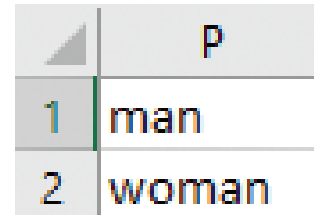


Fig. 5. Validation

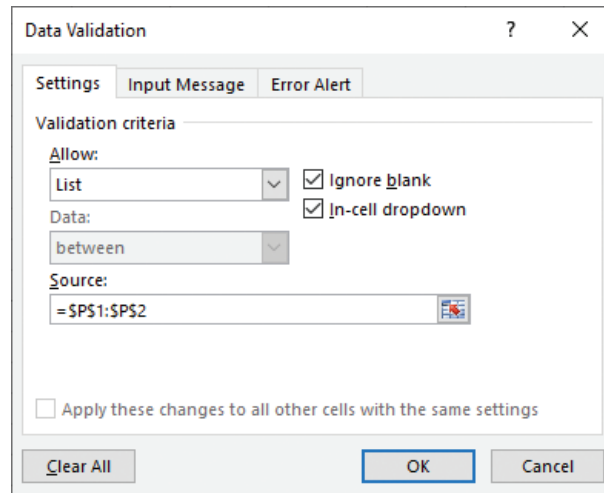


Fig. 6. Validation

- Input Message Page:
- A prompt message is created when entering data.
- Indication of what should be entered as a value in the cell.
- Appears when a cell is selected to enter data into it.
- Error Alert page:
- An error message is generated.
- There are three types (Fig. 7):
 - ☞ Stop - forbids entering invalid data. There are options: Try again, Cancel and Help.
 - ☞ Warning/Information - warn that the data is incorrect without restricting its input.

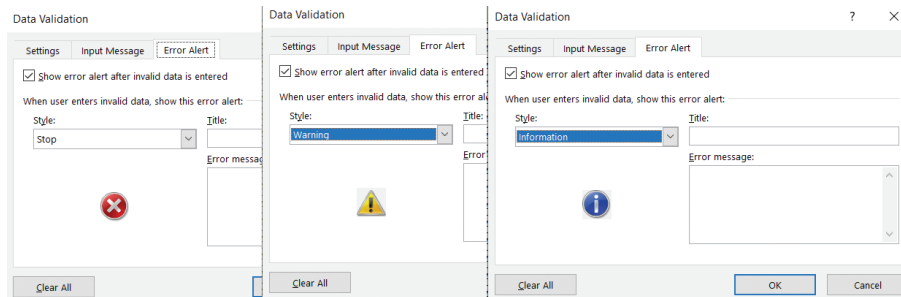


Fig. 7. Validation

Task 1: Open the file NVO-10klas-Validation.xlsx Add a new column – sex. Set a condition for the validity of the data in the sex column with two options – male and female.

1. We add a new column. We will work in the second way.
2. Select the first cell under the header.
3. Data / Data Validation / Data Validation (Fig. 1).
4. In Settings select List (Fig. 2).
5. In Source enter man; woman (Fig. 3).
6. The result is (Fig. 4.1).
7. We multiply as a formula.

Task 2: Open the file NVO-10klas-Validation.xlsx Set a condition for the validity of the data in the age column so that an integer is entered in the interval 13 through 60. Set a help message and an error message.

Enter an age between 13 and 60.

Enter the correct age - an integer between 13 and 60.

1. We will work the first way:
2. We mark the area J3: J94
3. Data / Data Validation / Data Validation (Fig. 1)
4. In Settings - select Whole number (Fig. 2)
5. We choose between Min - 13, Max - 60 (Fig. 8)
6. Help message and error message.
 - Data / Data Validation / Data Validation - Input Message (Fig. 9). After positioning a cell in the age column, a hint is displayed (Fig. 11).
 - Data / Data Validation / Data Validation - Error Alert (Fig. 10)

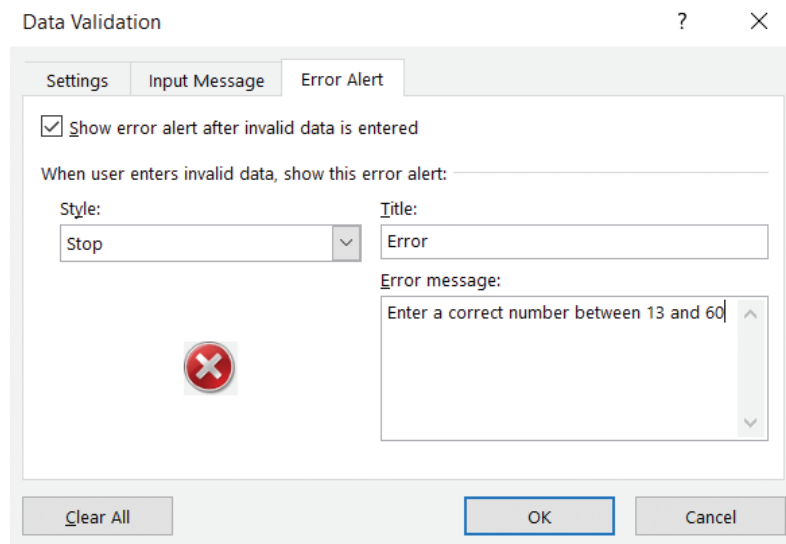


Fig. 8. Validation

Result	Age
35,5	17
15	
29,5	
19,5	
33	

Age
Enter number between 13 and 60

Fig. 9. Validation

Data Validation

Settings Input Message Error Alert

Validation criteria

Allow: Whole number Ignore blank

Data: between

Minimum: 13

Maximum: 60

Apply these changes to all other cells with the same settings

Clear All OK Cancel

Fig. 10. Validation

Data Validation

Settings Input Message Error Alert

Show input message when cell is selected

When cell is selected, show this input message:

Title: Age

Input message: Enter a number between 13 and 60

Clear All OK Cancel

Fig. 11. Validation

20. SPREADSHEET CALCULATION TECHNIQUES

The functions in MS Excel are divided into certain categories (Fig. 1). If we do not know in which category the required function is, we use Insert Function (Fig. 2). The dialog box opens (Fig. 3).

1. If we know how to write the function – write it in the Search for a function field and select the Go button.
2. If we know which category it is in, we choose the appropriate category.
3. If we do not know in which category the function is, we choose All. If we do not know how to write the function, we click in the field Select a function, and with the first letter of the function (example Sumif) – key “S”, we press so many times until the desired function appears.

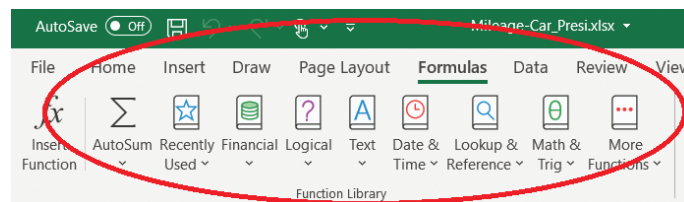


Fig. 1. Techniques

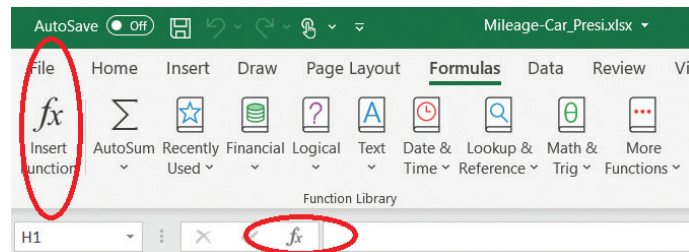


Fig. 2. Techniques

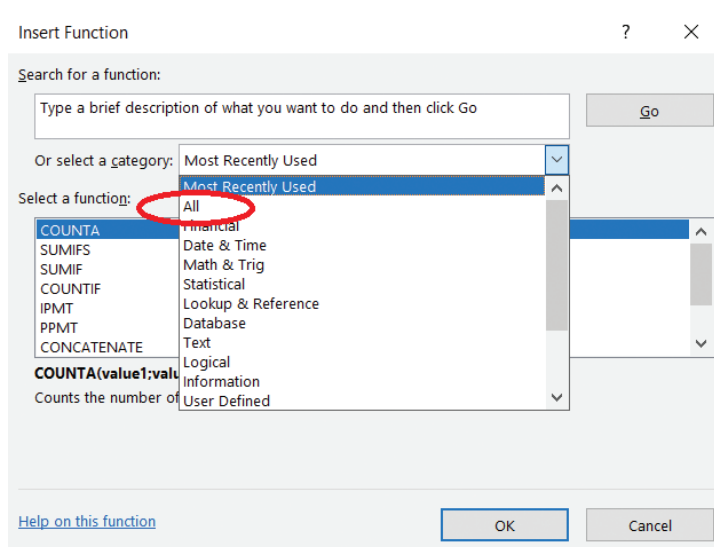


Fig. 3. Techniques

Let's remember:

Logical function if

Checks a certain logical condition (Fig. 4). There are 3 arguments:

- Condition.
- Value under fulfilled condition.
- Value under unfulfilled condition.

For example: = IF (D2> 1.5; “Yes”; “No”).

Another function, which is selected from the Name box (Fig.2, the field in which is written B4), can be put in the place of each argument.

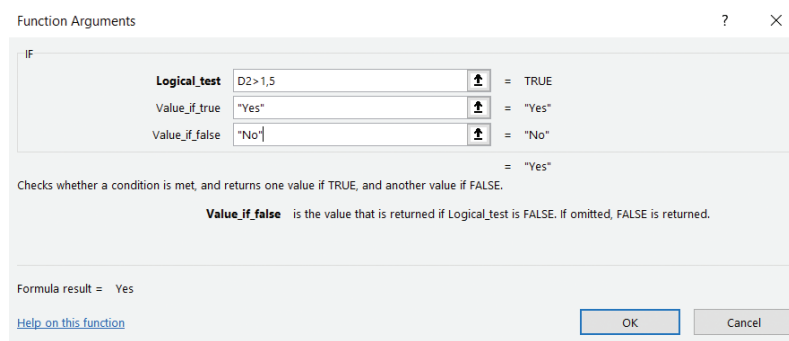


Fig. 4. Techniques

Basic statistical functions (Statistical category) are min, max, average, count. This category also includes: sumif and countif.

Countif function

- Counts the cells in a given area that meet a given criterion.
- There are 2 arguments:
 - ☞ Search area (**Where are we looking for?**).
 - ☞ Criterion (**What are we looking for?**).
- = countif (Range; Criteria) (Fig. 5)

Task 1: Open the **Mileage-Car.xlsx** file and find how many cars have achieved mileage 68.

1. Select the Insert Function button (Fig. 2).
 2. We select the function countif from the category Statistical or All.
 3. The Function Argument dialog window opens (Fig. 5).
 - Range - where can we find the criterion (mark an entire column).
 - Criteria - the criterion is set, in this case 68
 - ☞ By direct input – 68 (Fig. 5).
 - ☞ By the address of the cell that contains it - G14.
- 4 must be written in the marked box.

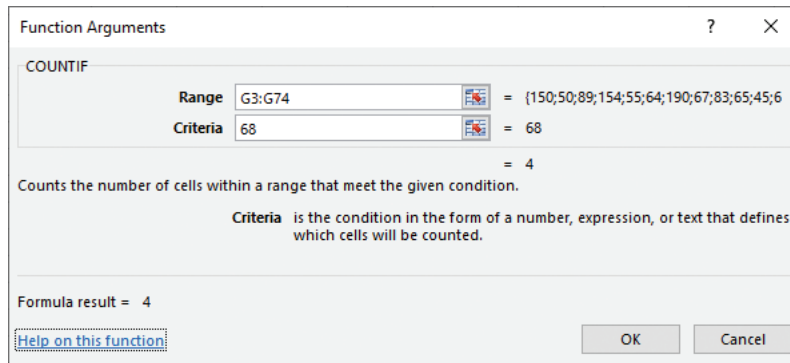


Fig. 5. Techniques

Sumif function

- Sums values of cells in a given area that meet a certain criterion.
- There are 3 arguments:
 - ☞ Search area (**Where are we looking for?**)
 - ☞ Condition - criterion (**What are we looking for?**)
 - ☞ Summation area (**If it meets the criterion of what to add**)
- =sumif (Range; Criteria; Sum_range) (Fig. 6)

Task 2: Open the file **Mileage-Car.xlsx** and calculate the total mileage of the cars that were produced in 2015.

Similar to the countif function.

- The last argument specifies what we will sum up - we mark the cells in the Mileage column. (Fig. 6)

As a result, 2086 must be written in the cell.

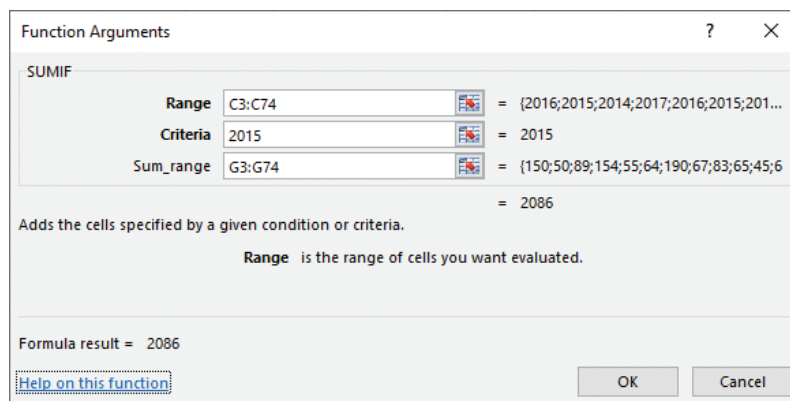


Fig. 6. Techniques

The criterion

- Can be set as a value or as a cell (Example - G14).
- The text can be written, but then put in quotes ("Opel"). It must be spelled correctly, with full compliance)

= COUNTIF (B3: B74; "Opel")

- May contain characters:

☞ <, >, =, <=, >=

☞ <> - different

= COUNTIF (B3: B74; "<> Opel")

"" - when the cell is empty.

Year of manufacture	Mileage
2015	
2016	
2017	

Fig. 7. Techniques

Tasks:

1. Open the Mileage-Car.xlsx file.

1.1. Find how many cars have run over 100.

1.2. Find how many cars have run over 50.

1.3. Calculate the total mileage for 2015, 2016 and 2017.

Directions: Create a new table within the worksheet (Fig. 7). It is not necessary to consider each year separately. For this purpose, in the formula, where we have an area (Range and Sum_range) the values are set with absolute addresses in order to use the property of copying formulas. Thus, the formula is written only on the first line and multiplied.

1.4. Calculate the total mileage realized by the cars for the previous day

Directions: Use today's function -1.

1.5. Calculate the total mileage for cars manufactured before 2015.

1.6. Calculate the total mileage of Ford cars.

Tricks:

Wildcards can be used to form the criterion.

Task 1: Calculate the total mileage realized by cars with a brand starting with "F".

Task 2: Calculate the total mileage achieved by cars with the last letter "a".

21. SPREADSHEET EXERCISE

Task 1: Make a lexicon in Excel. Set restrictive input conditions, a prompt message, and an error message. Save it with the name Leksikon. Share it with your classmates and have them complete it. There must be at least 20 records.

Directions may contain columns: Name, age (integer from 7 to 70), date of birth (integer from 1 to 31), zodiac sign (drop-down list of zodiac signs), GSM (length 10), favorite subject (drop-down list of 10 studied subjects), favorite season (drop-down list of seasons), etc.

Task 2: Open the Leksikon.xlsx file that you have created in Task 1. Sort information:

1. By zodiac signs in alphabetical order.
2. By zodiac signs and by age in ascending order.
3. By zodiac sign and by any favorite subject.
4. By seasons in the following sequence: summer, spring, autumn, winter.

Task 3: Open the Leksikon.xlsx file that you have created in Task 1. Use the function to find how many of those who have filled in the lexicon have a favorite season summer, spring, winter.

Directions Create an additional table (Fig. 1). The formula does not need to be written on every line. It must be written in a way that once written, we can multiply it for the other lines.

favorite season	number of people
summer	
spring	
winter	

Fig. 1. Exercise

Task 4: Open the Leksikon.xlsx file that you have created in Task 1. Refer to:

1. Only people born under Cancer zodiac sign.
2. People born under Cancer and Leo.
3. People who are born under Cancer and Leo and their favorite season is summer.

22. FORM LETTERS

Form letter

A form letter is a document that has a permanent part and a part that changes. The permanent part is used as a pre-created template, and the changing part is taken from a second document (data source document). Such documents are used when you need to send the same content to many people and it needs to be addressed individually, i.e. we change the name, surname, address or something else. In the form letter, we use two files – the first is our template with the text, which is intended for everyone, and the second is a table containing individual information about the people to whom the letter will be sent (it contains all the information that will be changed). Another purpose may be to create invitations, certificates or other documents that are intended for many people.

Creating a form letter

There are small differences in the creation of a form document with different versions of office suites. There are two ways of creating such a document:

- I. The first way is to use a creation wizard. We have the following actions with it
 1. We open the menu Mailings.
 2. Select the Start Mail Merge button.
 3. From the possible options, we choose Step-by-Step Mail Merge Wizard.

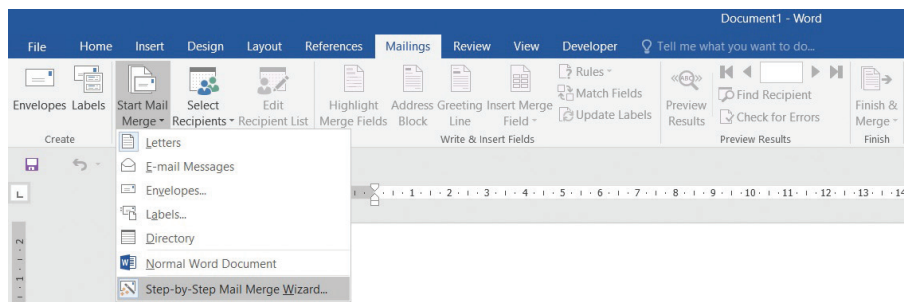


Fig. 1. Form letters

4. After starting the Step-by-Step Mail Merge Wizard in the main document opens an additional window that allows you to create your document following the steps.

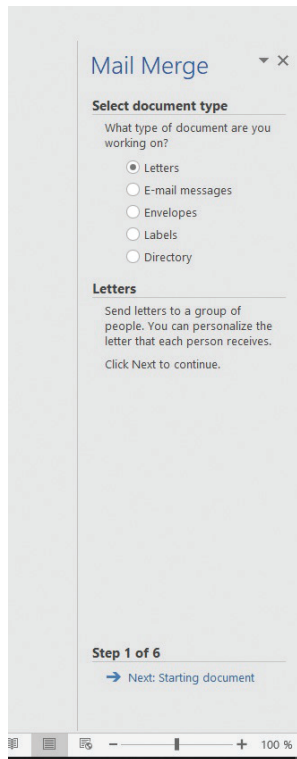


Fig. 2. Form letters

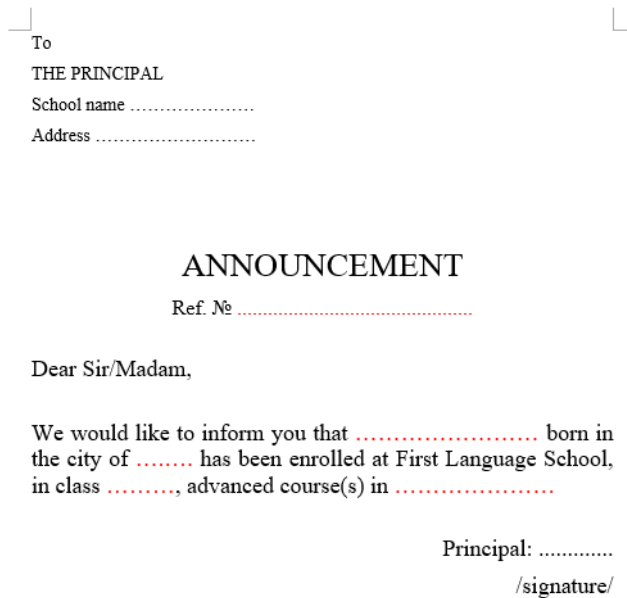


Fig. 3. Form letters

II. The second way also has a few steps:

1. We create the main document (template) - this is the main text that does not change (Fig. 3).
2. We create the data source file (this file can be created from the document itself or in another standalone document). Fig. 4 shows an Excel file that will be used to create the form document.

	A	B	C	D	E	F	G
1	Name	City	School	city of the school	class	Profile	Ex. №
2	A. Ivanov	Varna	SOU "Georgi Sava Rakovski"	Varna	8a	English	612513/17.08.2021
3	K. Rasheva	Varna	SOU "Akademik Boyan Petkanchin"	Kavarna	8b	English	612514/17.08.2021
4	G. Georgiev	Varna	OU "Shandor Petyofi"	Varna	8c	English	612515/17.08.2021
5	E. Lilova	Dobrich	OU "Sveti Kliment Ohridski"	Dobrich	8a	English	612516/17.08.2021
6	L. Palova	Kavarna	SOU "Vasil Levski"	Kavarna	8b	English	612517/17.08.2021
7	A. Yaneva	Varna	OU "Nikola Yonkov Vaptsarov"	Dobrich	8c	English	612518/17.08.2021
8	V. Ilieva	Varna	OU "Sv. Ivan Rilski"	Varna	8d	German	612519/17.08.2021
9	G. Kasparyan	Varna	OU "Hristo Smirnenski"	Varna	8d	German	612520/17.08.2021
10	K. Iliev	Dobrich	SOU "Sv. Paisiy Hilendarski"	Dobrich	8e	German	612521/17.08.2021
11	G. Popov	Kavarna	SOU "Georgi Sava Rakovski"	Kavarna	8e	German	612522/17.08.2021
12	D. Kisyova	Varna	SOU "Akademik Boyan Petkanchin"	Varna	f	German	612523/17.08.2021
13	B. Hasan	Varna	OU "Shandor Petyofi"	Varna	f	German	612524/17.08.2021
14	Z. Ali	Varna	OU "Sveti Kliment Ohridski"	Varna	e	German	612525/17.08.2021

Fig. 4. Form letters

3. We link the data source file and our main document:

- We open the menu **Mailings**.
- Select the button **Select Recipients** (Fig. 5).

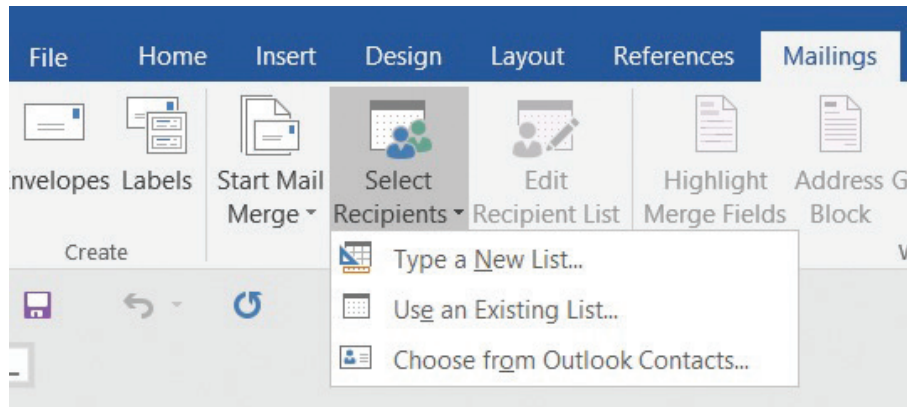


Fig. 5. Form_letters

- If you use an existing document, select the option **Use an Existing List** and a window opens which allows you to select the finished document (Fig. 6).

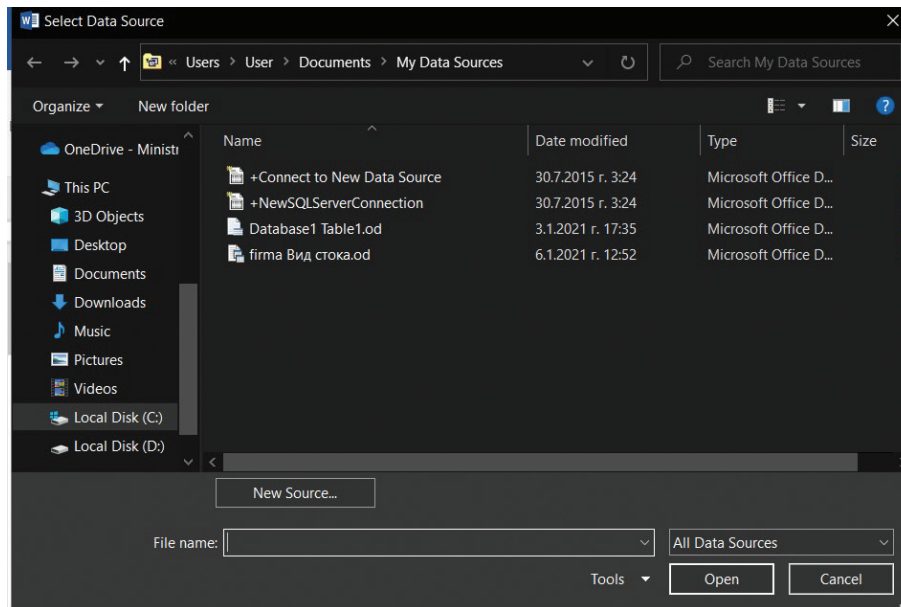


Fig. 6. Form_letters

- If you do not have a document ready to use, select the **Type a New List** option. A window opens that allows you to create a table (Fig. 7)

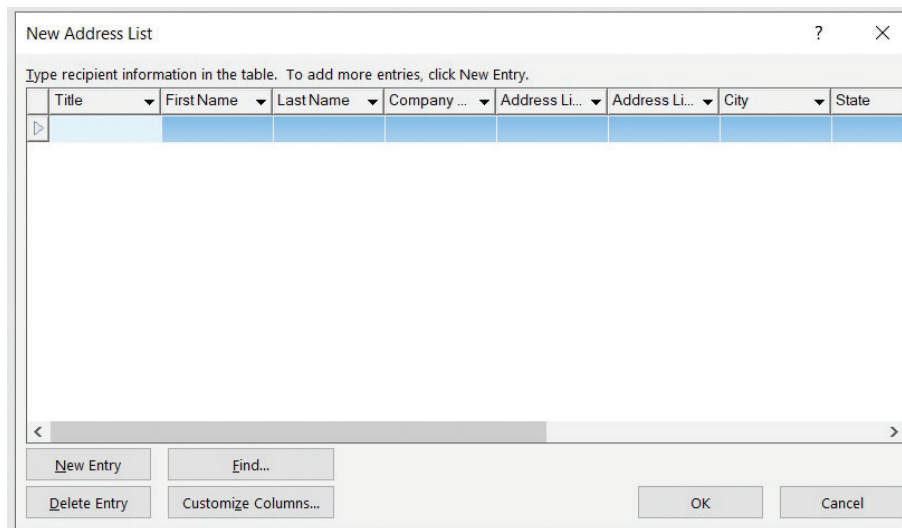


Fig. 7. Form letters

4. We indicate the places where the variable information will be generated.

When you add or create a data source document in the **Mailings** menu, the **Insert Merge Field** menu becomes active (Fig. 8).

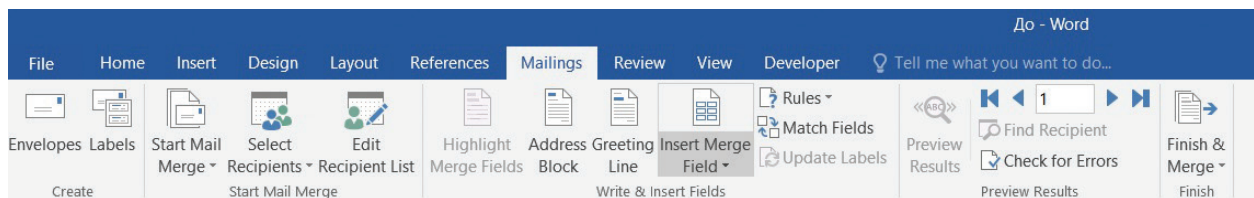


Fig. 8. Form letters

There you can see all the column names in your data source table (Fig. 9).

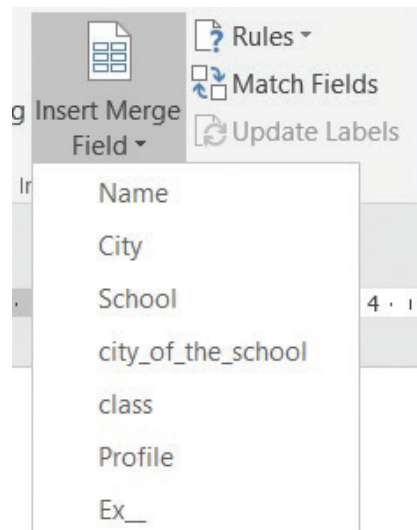


Fig. 9. Form letters

Place the cursor where you want to insert the information field and select the name of the corresponding column (Fig. 10).

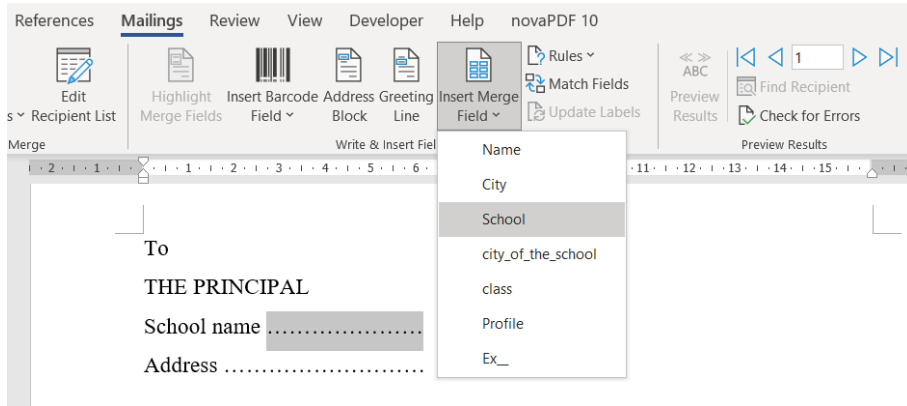


Fig. 10. Form letters

In the example, we place the fields in place of the red dots (Fig. 11).

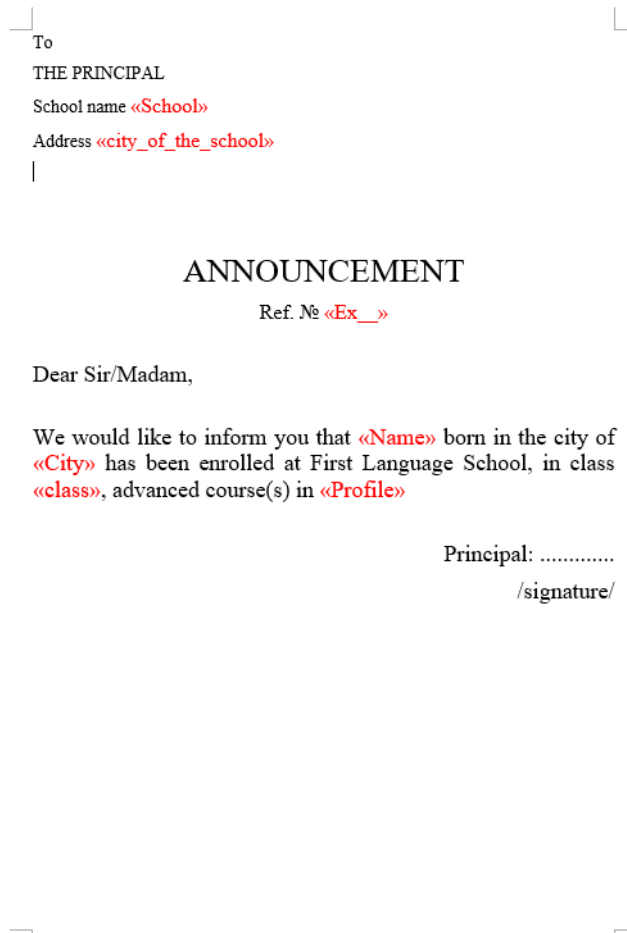
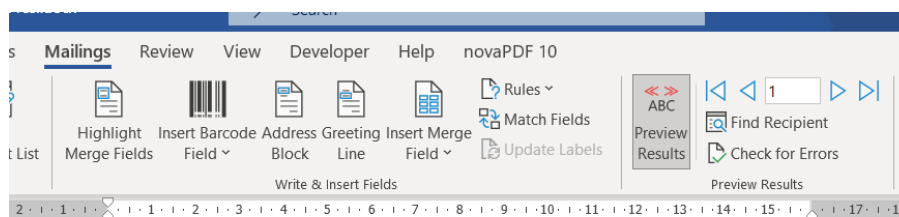


Fig. 11. Form letters

When you insert a field that will be replaced with information in the main document, it is surrounded by V-shaped arrows (<<column_name>>). They are not displayed when generating the document but only indicate from which column the information will be displayed.

Generating letters

After creating the form document, you can view the created records one by one by enabling the **Preview Results** option from the **Mailings** menu (Fig. 12).



To
THE PRINCIPAL
School name **SOU "Georgi Sava Rakovski"**
Address **Varna**

ANNOUNCEMENT

Ref. № **612513/17.08.2021**

Dear Sir/Madam,

We would like to inform you that **A. Ivanov** born in the city of **Varna** has been enrolled at First Language School, in class **8a**, advanced course(s) in **English**

Principal:
/signature/

Fig. 12. Form letters

You can view the different entries using the control arrows (Fig. 13).



Fig. 13. Form letters

You can generate all the letters in a new file. Each letter is generated on a different page of the document. This is done from the menu Mailings and the option Finish & Merge (Fig. 14).

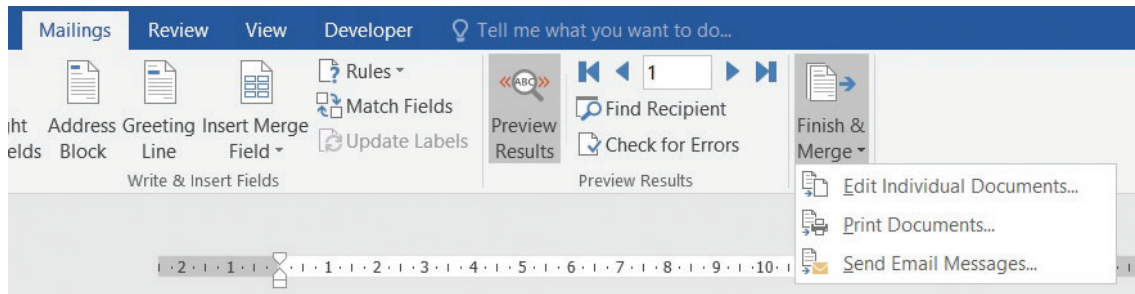


Fig. 14. Form letters

Tasks:

1. In a text document, create a form letter notifying the school principal of the student enrollment. Use the sample letter in Fig. 3. To fill in the form document, use the information in Fig. 4.
2. Use the invitation.docx file you created in the template theme. Create a table with the names of 10 of your friends. Use a form document to customize the invitation for each of your friends.

23. CREATING AN ENVELOPE

Creating a table for a form document

In the previous lesson, we learned how to add information from an existing file. To create a table in the text document itself, you must follow these steps:

1. Open the menu **Mailings**.
2. Select the **Select Recipients** button.
3. Select the option **Type a New List** (Fig. 1).

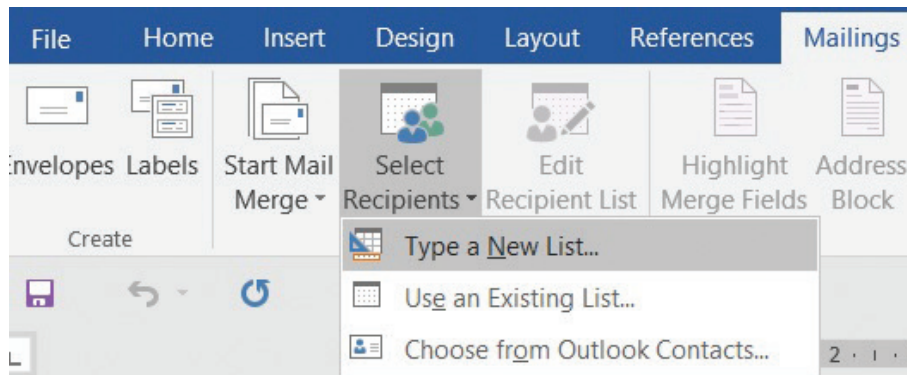


Fig. 1. Envelopes

4. A window opens that allows you to create a table (Fig. 2).

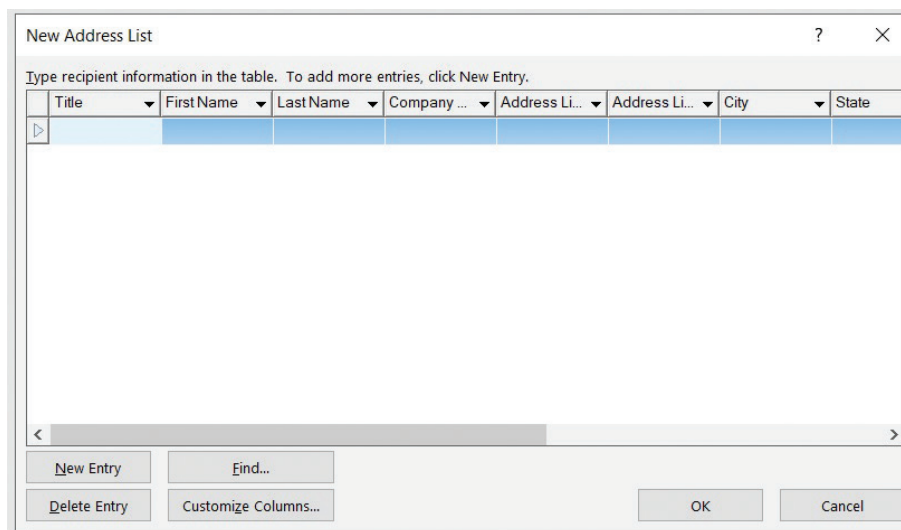


Fig. 2. Envelopes

On the first row are the names of sample columns that you can use. To change the names or number of these columns, select the button **Customize Columns**, which opens a new window where changes can be made (Fig. 3).

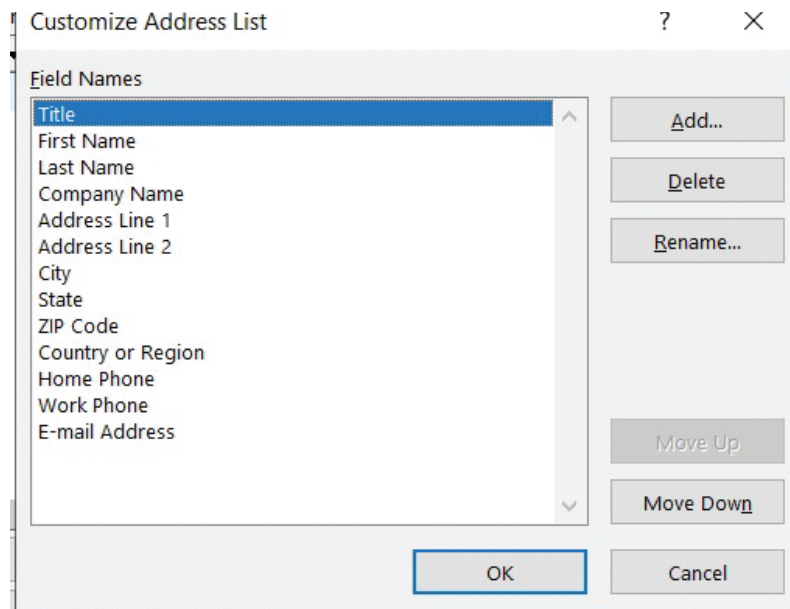


Fig. 3. Envelopes

It allows you to delete, add, rename, or rearrange the column sequence. After customizing the columns, you go back to the main window of Fig. 2. The filling in is done by having one record on each line. Use the New Entry button to add a new entry and the Delete Entry button to delete an entry.

5. After creating the table, save it by clicking on the OK button.

6. A new window opens (Fig. 4) that asks you to name the table and select a folder to save it (the table is saved as an access file).

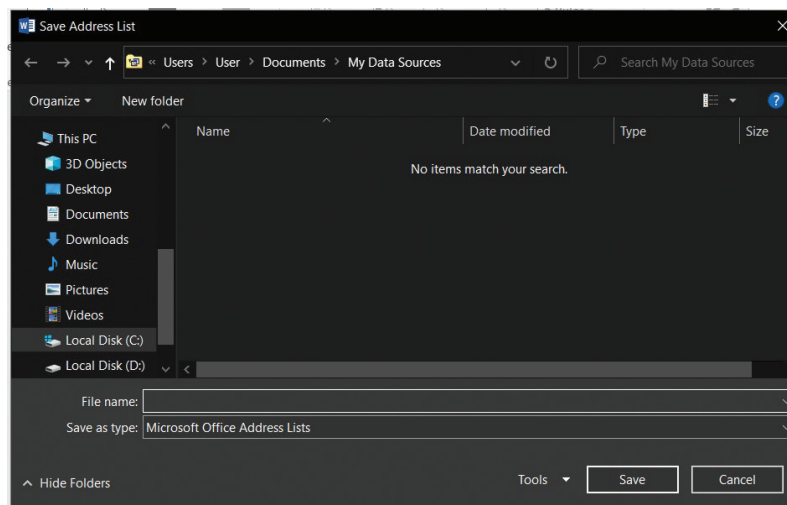


Fig. 4. Envelopes

7. After selecting the name and folder and pressing the **Save** button, in the **Mailings** menu the button **Insert Merge Field** becomes active. The process continues in the same way as when adding an information file.

Creating an envelope

Creating an envelope is one of the options when creating form documents. In addition to issuing diplomas, badges, labels, making a birthday invitation or sending a letter, you can also customize the envelope for the recipient. Creating an envelope is done in the following steps:

1. Open a blank Word document.
2. Open the menu **Mailings**.
3. Select the **Start Mail Merge** button and the option **Envelopes** (Fig. 5).

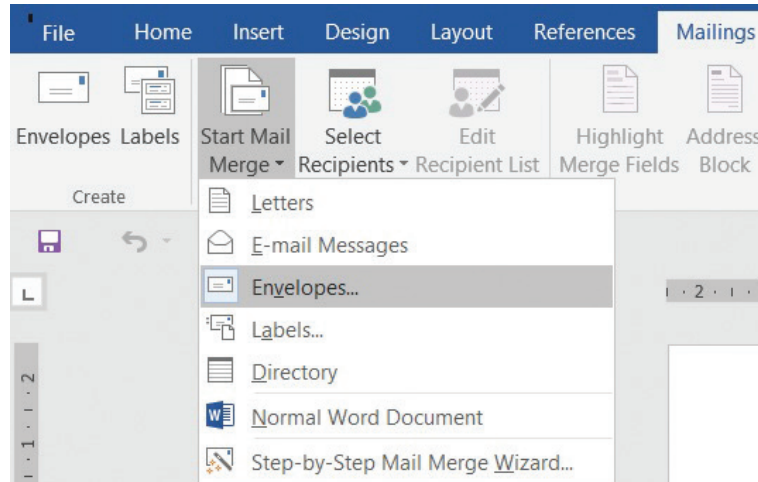


Fig. 5. Envelopes

4. A new settings dialog opens, which you can see in Fig. 6.

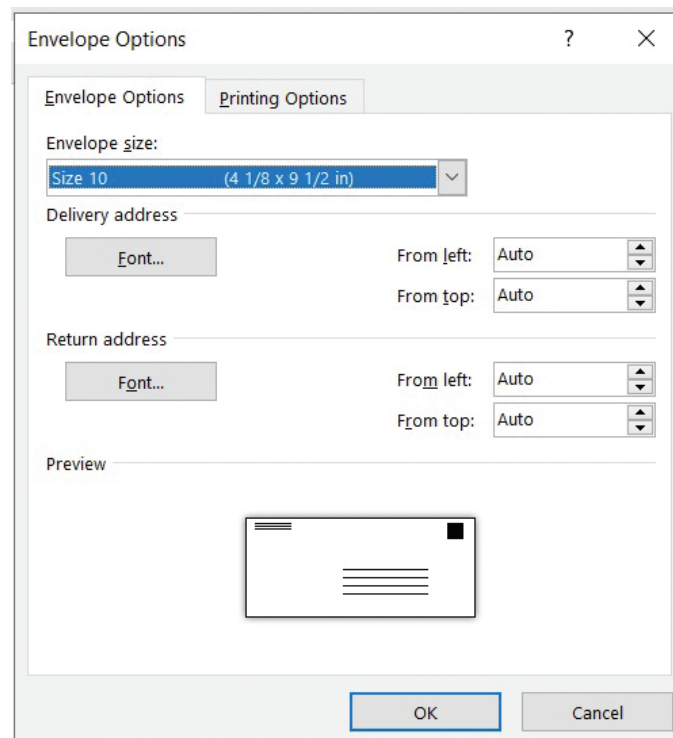


Fig. 6. Envelopes

In this window, you set the dimensions you want for the envelope, the default size is 6 3/4. In addition to the size, you can also adjust the printing options. After selecting the size, the worksheet is adjusted automatically and is ready to be used (Fig. 7).

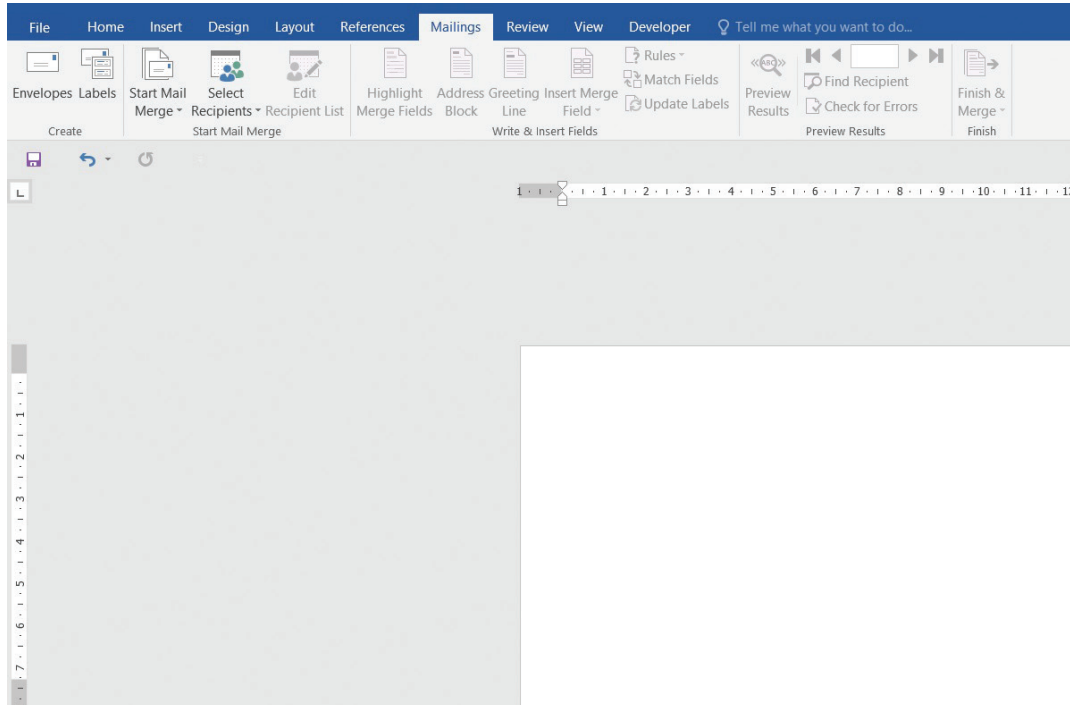


Fig. 7. Envelopes

5. The easiest way to place information is to use text boxes. They are added from the menu **Insert** and the button **Text Box** (Fig. 8).

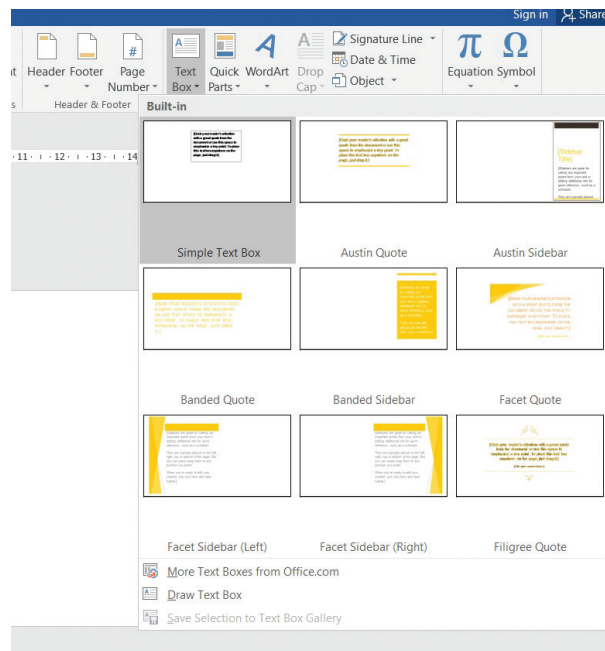


Fig. 8. Envelopes

24. TEMPLATES AND FORM LETTERS EXERCISE

Task 1

Use a template and create a form diploma document for seven of your classmates who took part in a math competition. The diploma must include the names of the student, the number of points received and the place where he/she has qualified.

Create a label

From the Mailings menu, the Start Mail Merge option - allows you to create a mail envelope, business card, label or other in addition to a form letter (Fig. 1).

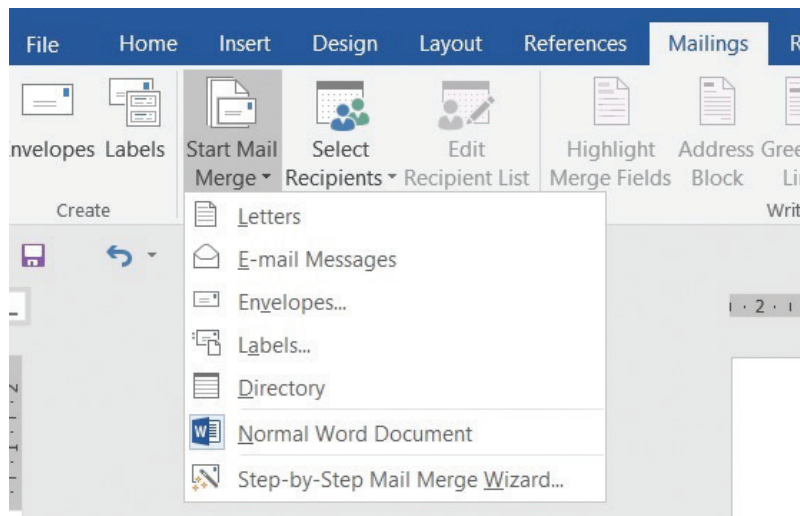


Fig. 1. Exercise

Selecting the Labels option opens a new dialog box that allows you to make additional settings and layout (Fig. 2).

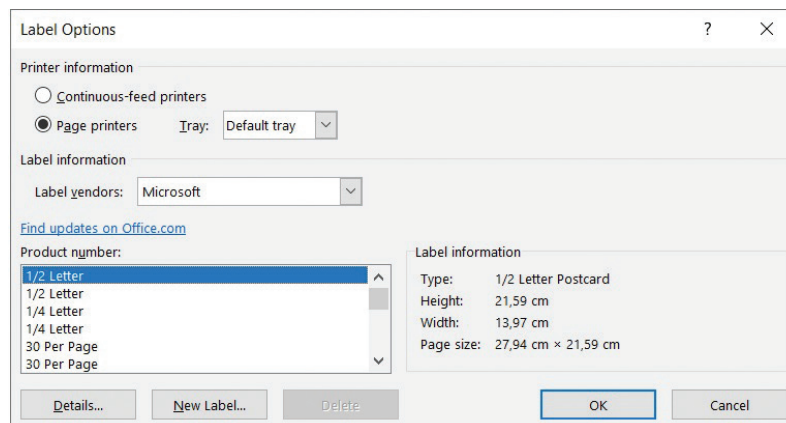


Fig. 2. Exercise

From the New Label button, you can adjust the size of the labels you want to create (Fig. 3).

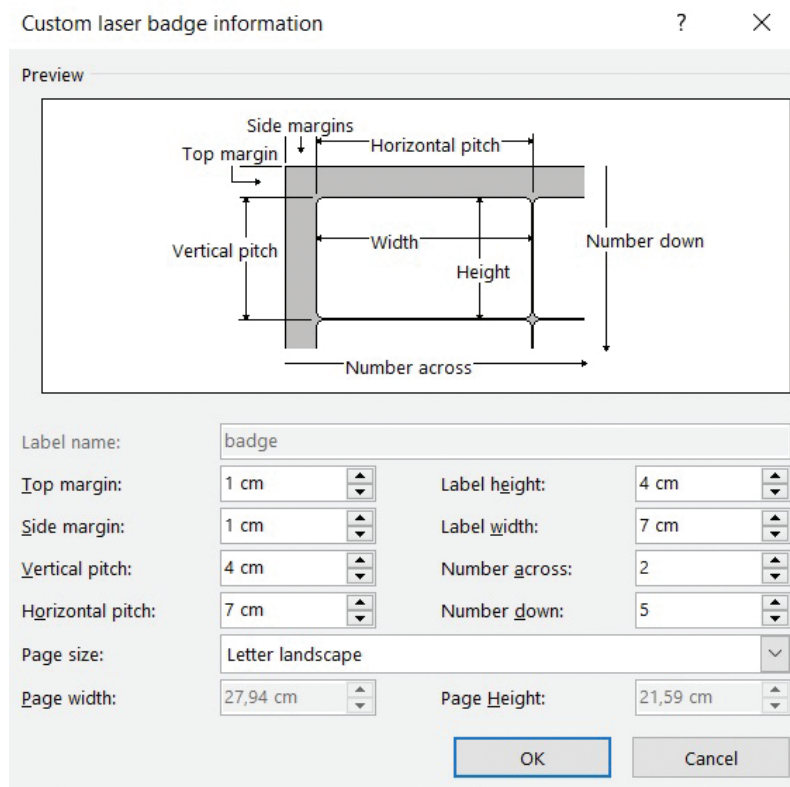


Fig. 3. Exercise

For the label, you can adjust the size of the margins, the height and width of the label as well as the number of labels per page. When using a form document when creating a label, you only need to format the first one, and then use the Update Labels button (Fig. 4).

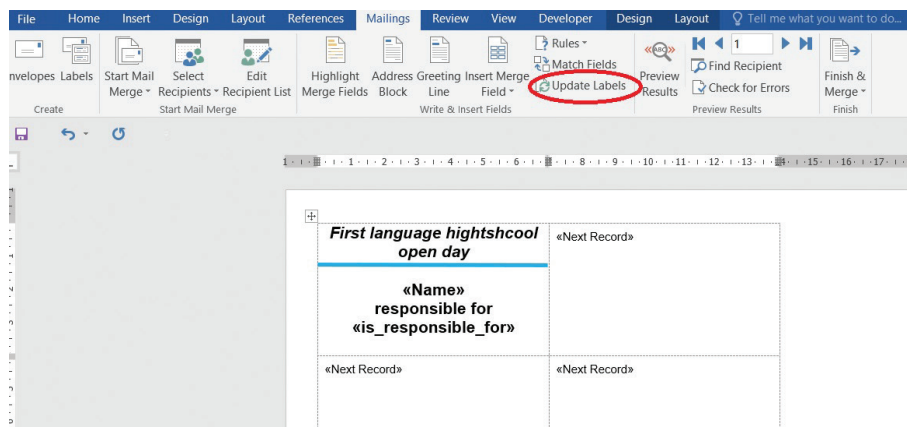


Fig. 4. Exercise

Task 2

For your school open day, you need to create badges for students who will guide visitors. Create a suitable design (select appropriate text, font, and color layout). Fill in the information about the badges with the help of a form document. The necessary information can be found in List.xlsx or in Fig. 5.

Name	class	is responsible for
A. Ivanov	11a	1 floor
K. Rasheva	10v	1 floor
G. Georgiev	9d	2 floor
E. Lilova	10e	2 floor
L. Palova	9a	3 floor
A. Yaneva	10a	3 floor
V. Ilieva	11a	4 floor
G. Kasparyan	10v	4 floor
K. Iliev	12v	computer rooms
G. Popov	9e	computer rooms
D. Kisyova	11e	assembly hall
B. Hasan	12e	assembly hall
Z. Ali	12a	sports hall
M. Ivanov	11e	sports hall

Fig. 5. Exercise

25. FORMS

Form

The form is a special document that has special fields to fill in. It is used to gather information. They can be created both in a text editor or online. There are different platforms that allow you to create a form.

- Microsoft Word allows you to create a form through the developer menu. Special fields are added using controls.
- An example of a platform that can create an online form is Google form.

Form in Microsoft office

When creating a form using Word, you must first turn on the developer menu. To do this, follow these steps:

1. Select the File menu (Fig. 1).

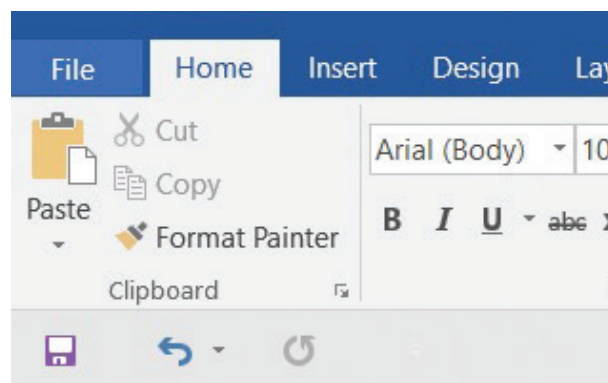


Fig. 1. Forms

2. From the File menu, select Options (Fig. 2).

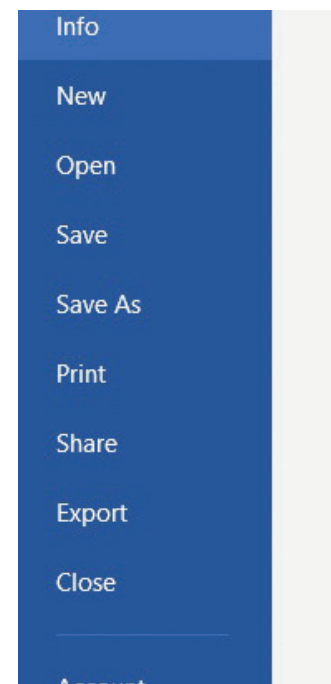


Fig. 2. Forms

3. In the window that opens, select Customize Ribbon (Fig. 3)=

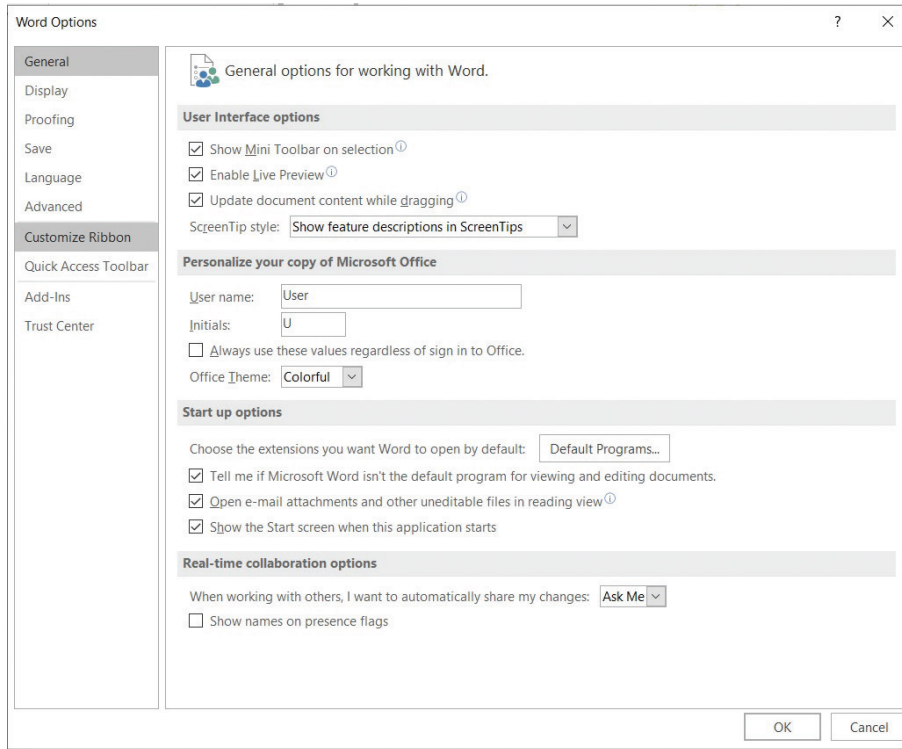


Fig. 3. Forms

4. From the options for Main Tabs you need to include the Developer menu (Fig. 4).

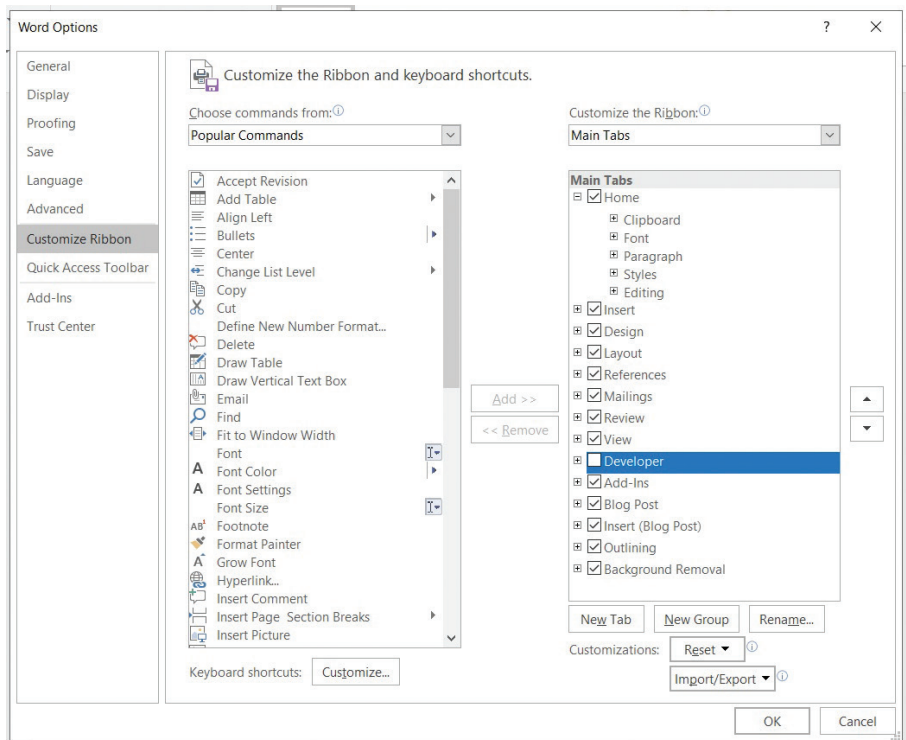


Fig. 4. Forms

After completing these steps, you will now see the Developer menu in the menu bar (Fig. 5). All the controls needed to create a form are located here (Fig. 6). Controls are graphical objects that receive or display data.

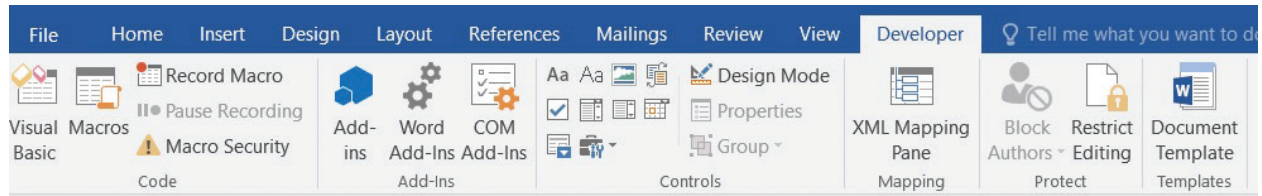


Fig. 5. Forms

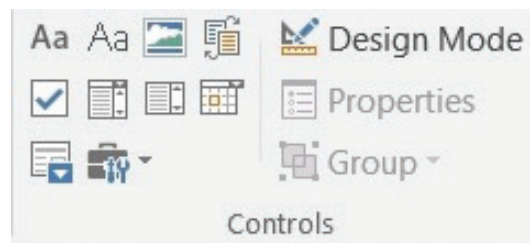


Fig. 6. Forms

- Types of Microsoft Word controls:
- Rich Text Content Control
- Plain Text Content Control
- Picture Content Control
- Building Block Gallery Content Control
- Check Box Content Control
- Combo Box Content Control
- Drop-Down List Content Control
- Data Picker Content Control

To add a control, you must first turn on Design Mode (Fig. 7) and place the cursor where you want to insert it and click on the selected control. The chosen control is automatically placed where the cursor is located (Fig. 8).

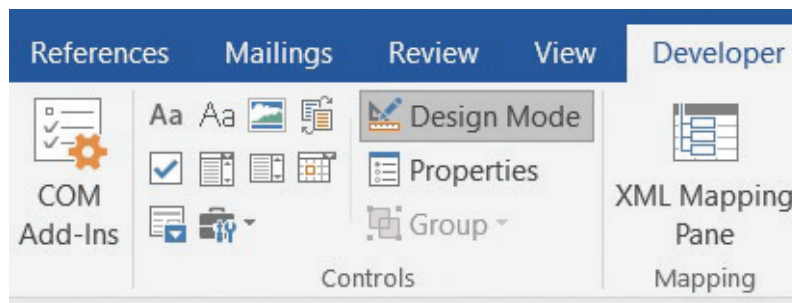


Fig. 7. Forms

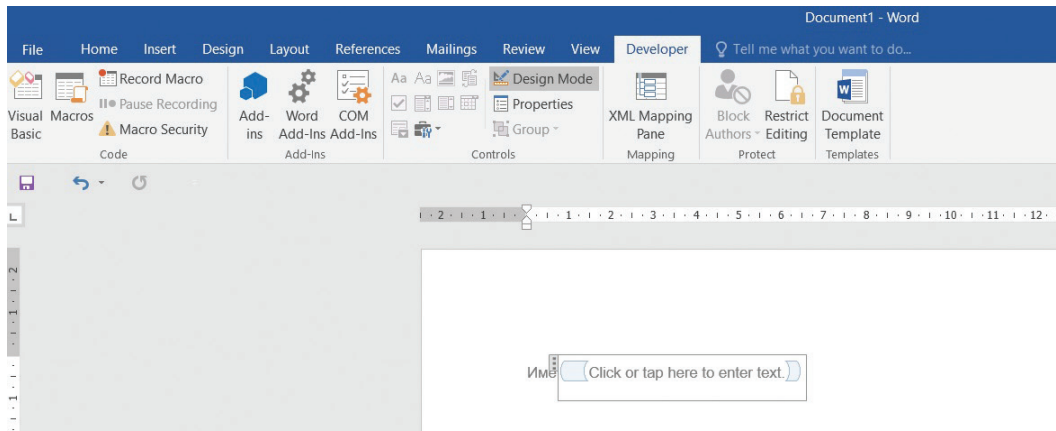


Fig. 8. Forms

Control settings

Additional settings of the controls are made by selecting the Properties option (Fig. 9). An additional dialog box opens, which has individual settings for each control (Fig. 10).

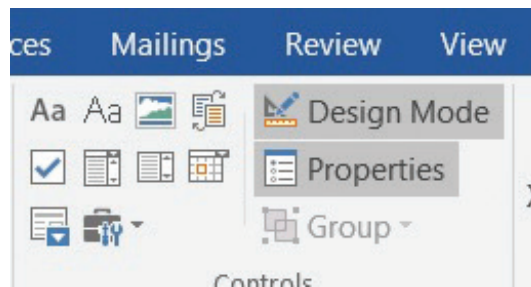


Fig. 9. Forms

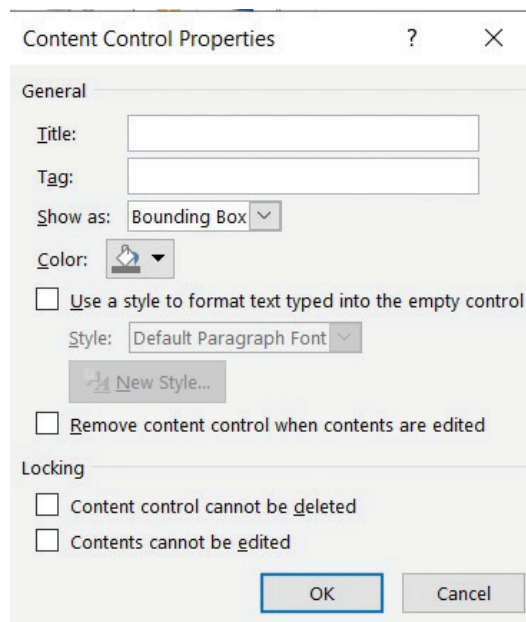


Fig. 10. Forms

- In the Plain Text Content Control, additional settings allow you to put prompt text (Fig. 10). After entering the sample text, it appears in front of the control itself (Fig. 11). After turning off Design Mode, this text appears only when the control is turned on for filling (Fig. 12).

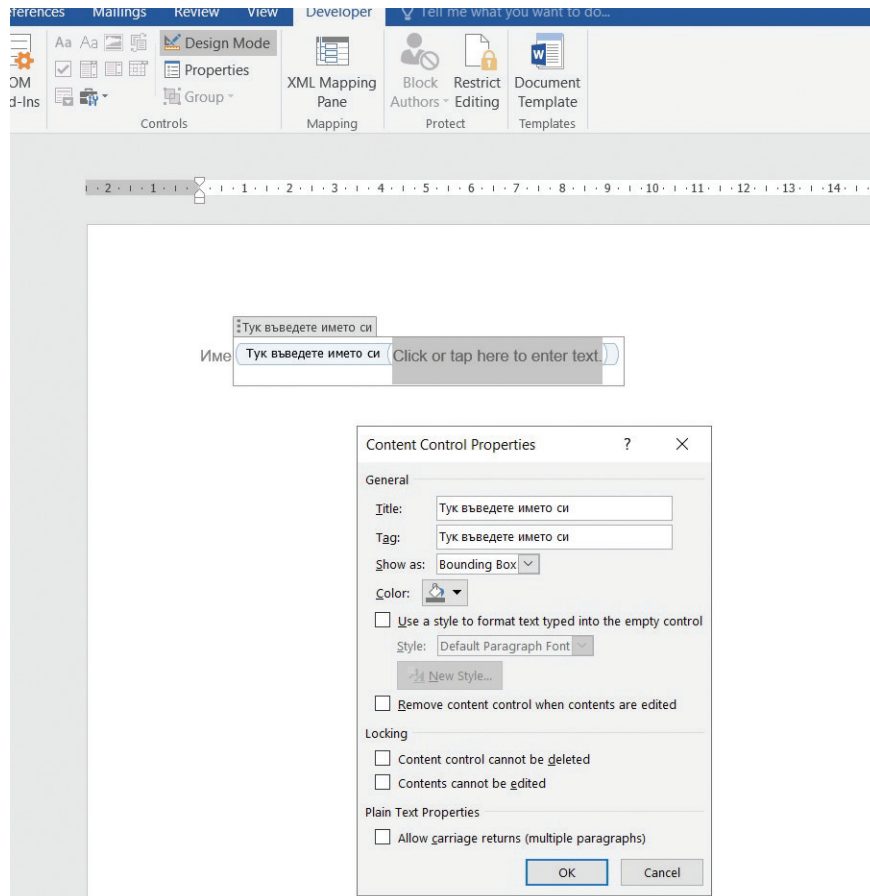


Fig. 11. Forms

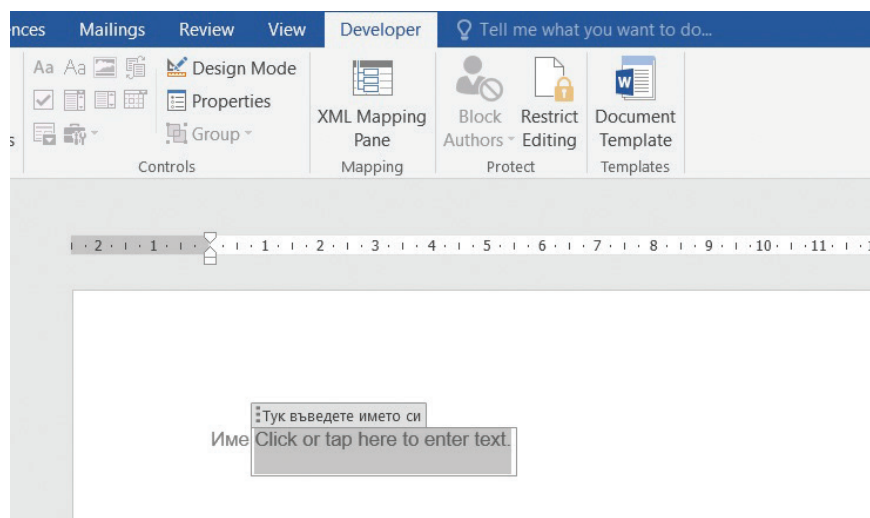


Fig. 12. Forms

- For Combo Box Content Control, the advanced settings window allows you to enter drop-down list information (Fig. 13). Adding selectable options is done with the Add button in the Drop-Down List Properties tab.
- With Date Picker Content Control, you can choose in what format to display the date (Fig. 14).

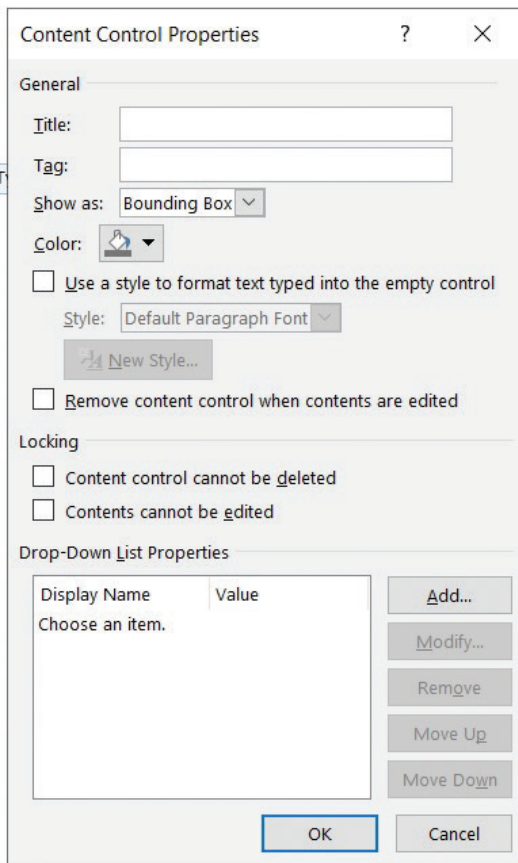


Fig. 13. Forms

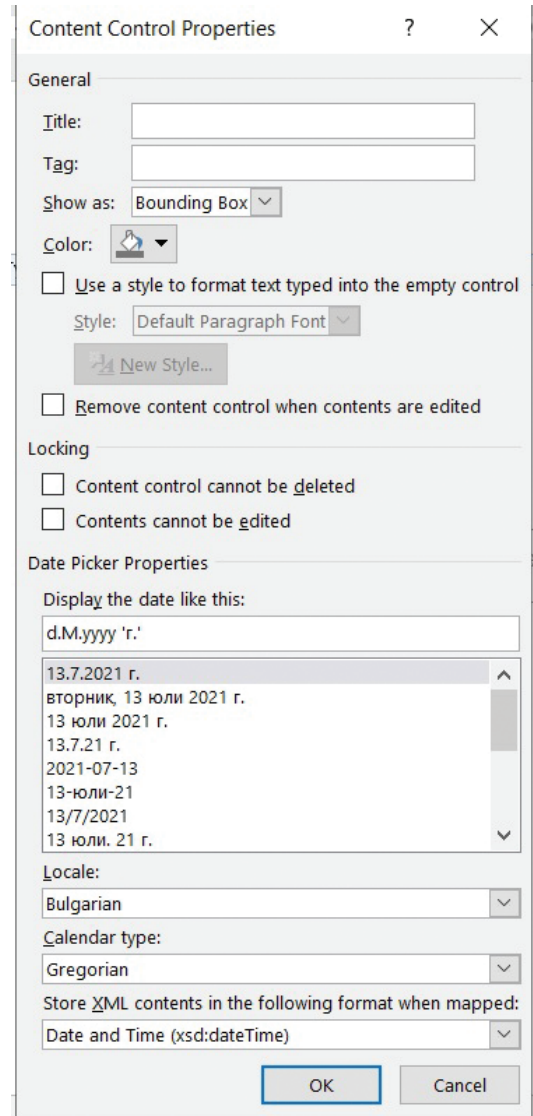


Fig. 14. Forms

- The Option Button control is used to create radio buttons. Radio buttons are used when only one of the several options needs to be selected. You can see the window for setting the radio button in Fig. 15. The value to be selected is entered in the Caption field.

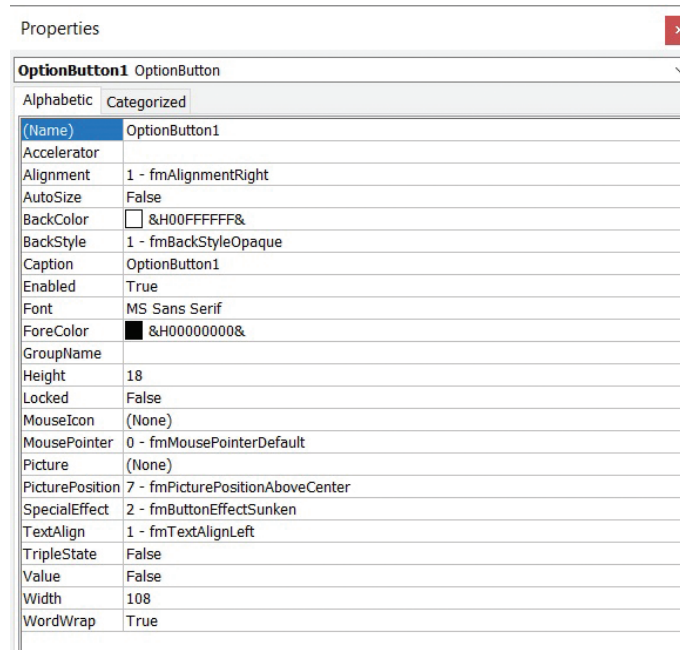


Fig. 15. Forms

- The Check Box Content Control is used to add a checkbox. They are used when several of the many options need to be selected. The window in the advanced settings (Fig. 16) allows you to change the view of the fill squares and add a title. Checkbox values are entered before or after the control itself, as plain text.

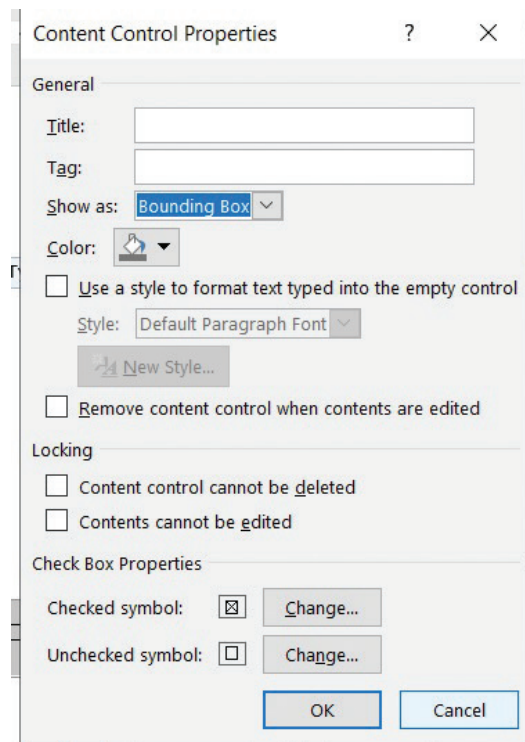


Fig. 16. Forms

Form Protection

The idea of the forms is to be filled in by different people, without being able to edit the form. To protect your form from editing, you can change its settings. You must turn off Design Mode before enabling form protection. Restricting access is done from the Restrict Editing button in the Developer menu (Fig. 17).

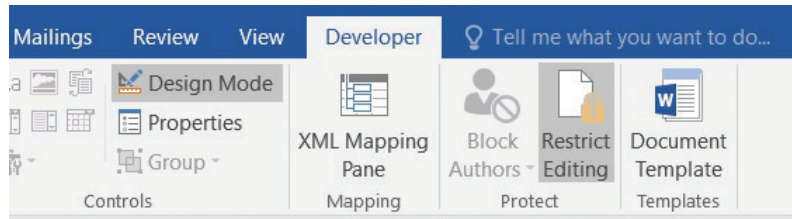


Fig. 17. Forms

After selecting this button, an additional settings menu opens, which you can see in Fig. 18. To limit the users to only be able to fill in the form is by ticking the second option and selecting an option from the drop-down menu.) In step 3 you must confirm your choice, after pressing the button, a new window opens. There you must enter a password to protect the document (Fig. 19).

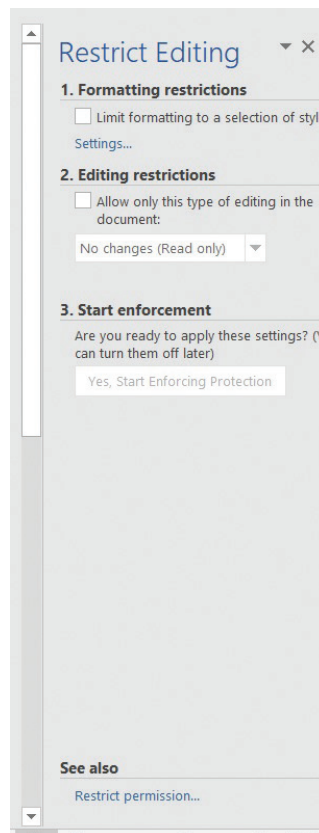


Fig. 18. Forms

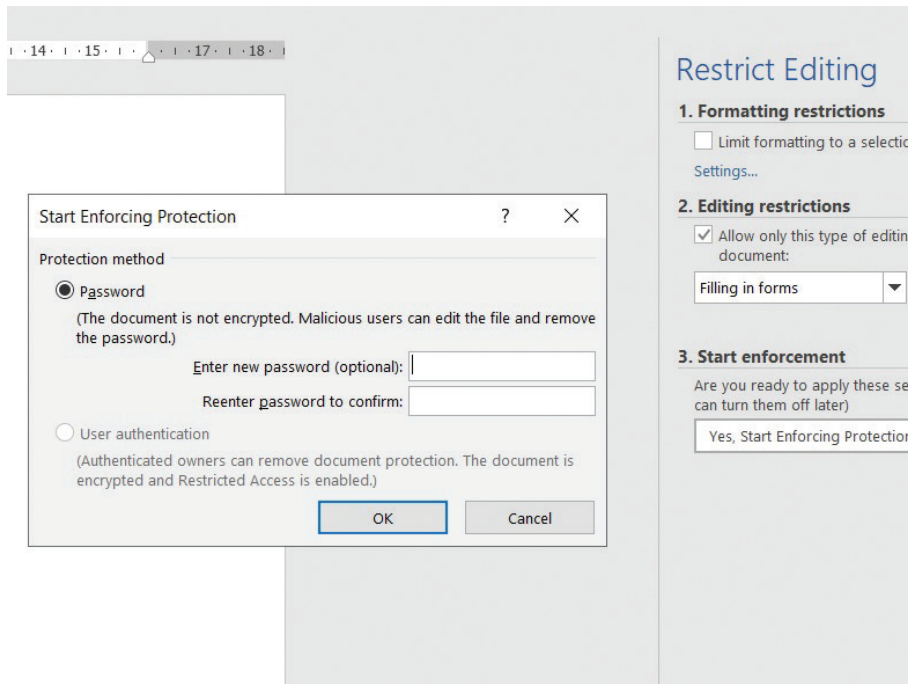


Fig. 19. Forms

Tasks:

1. In a text document, create a form that collects the following information:

- name - text input field
- family - text input field
- number - drop-down list with values from 1 to 10
- grade - drop-down list with values from 1 to 10
- gender - check button
- optional module - radio buttons with values mathematics, English, information technology, German, and informatics

Save the file as form.

2. For the form you created in the first task, set security settings. The form can only be filled in, and for editing put a password - numbers from 1 to 9.

26. PIVOT TABLES

The summarization can be done:

- Statically – Subtotal
- Dynamically – Pivot Table

Pivot tables are dynamic tables that allow the user to summarize data in one or more fields and present it differently. They are used to compare and analyze huge amounts of data. Data can be sorted and filtered.

Creating a Pivot Table:

1. Select a cell from the table (list).
2. Select the **Pivot Table** button from the **Insert** menu, from the **Tables** panel (Fig. 1).

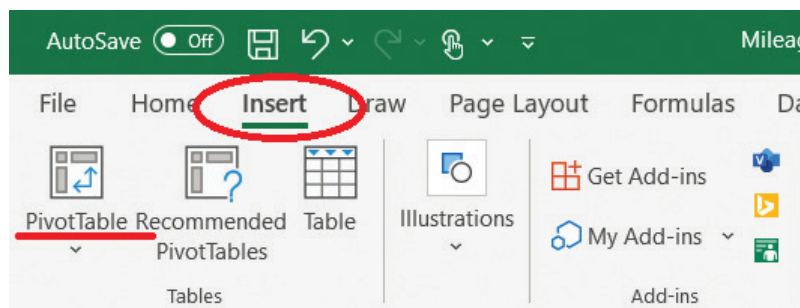


Fig. 1. Pivot

3. The Create Pivot Table dialog box opens (Fig. 2). The following must be determined:
 - Data Source – if we are positioned in a cell of the table before inserting the Pivot Table, the entire table is automatically selected.
 - Pivot Table location:
 - ☞ On a new worksheet.
 - ☞ On an existing (Existing Worksheet) with the ability to select a cell from which to display the Pivot table.
4. The structure of Pivot Table – Pivot Table Field opens (Fig. 3). There are two panels:
 - A panel with the names of the columns from the original table (list).
 - A panel with four sections to create a Pivot Table. The formation of the table is done by dragging the headers to the corresponding section using the mouse.

How do we determine where to place each header? – The data we put in Rows and Columns are interchangeable. We comply only with the Pivot Table itself – to be longer than wide. It is possible to place more than one header in Row and leave Column without. We put the calculated values in Values. The Sum function is automatically applied.

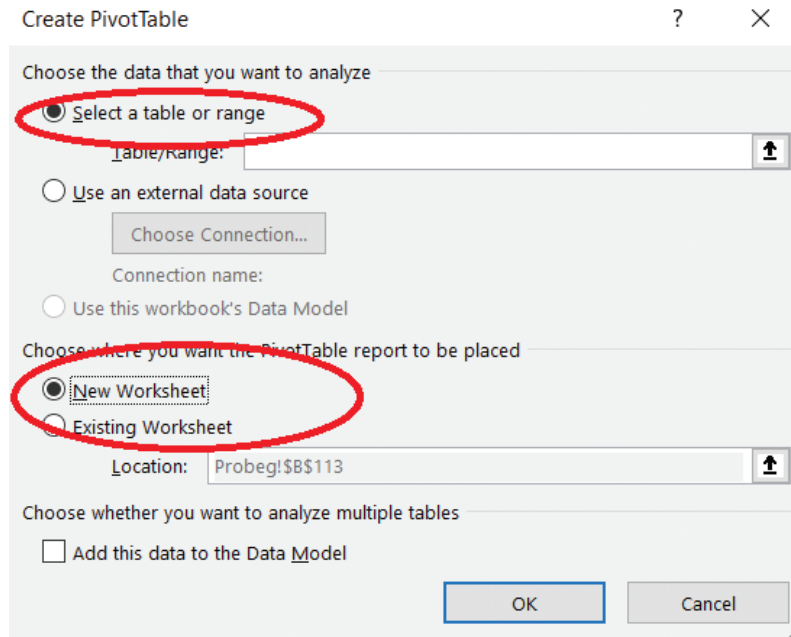


Fig. 2. Pivot

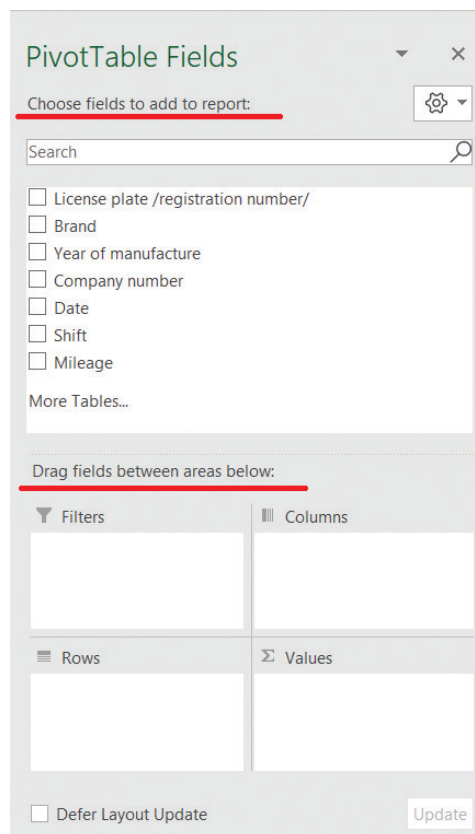


Fig. 3. Pivot

Task 1: Open the **Mileage-Car.xlsx** file. Create a report showing the total mileage of each car and each shift with the ability to filter by date. (For each car, i.e. each registration number.)

It does not matter where the registration number and the shift are placed, i.e. in a row or in a column, they are interchangeable. Since there are two shifts and more cars and we are used to the table being longer than wide, we put the shift in a column and the registration number in a row. Placement is done by dragging the headers from the panel with the names to the Columns section and the Rows section, respectively.

With the possibility to filter by date => We put the date in Filter. In Values, we set the mileage. (Fig. 4 and Fig. 5 - graphically represented). The finished Pivot Table is presented in Fig. 6.

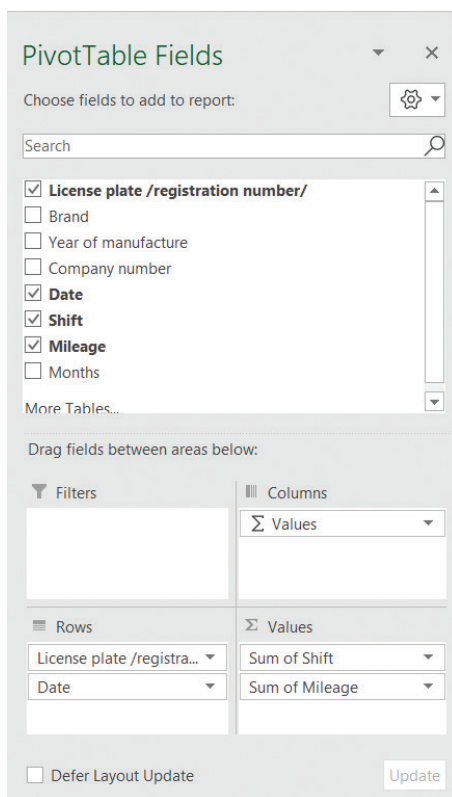


Fig. 4. Pivot

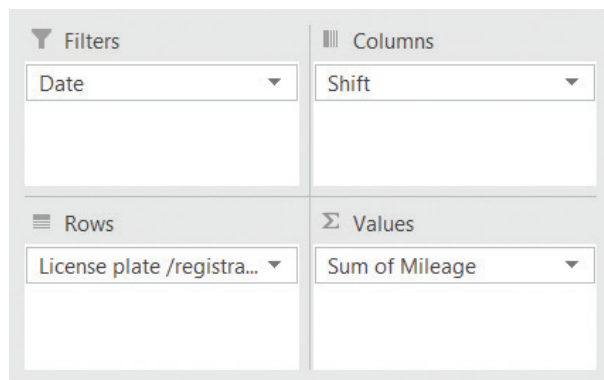


Fig. 5. Pivot

Date	(All)			
Sum of Mileage	Column Labels			
Row Labels		1	2	Grand Total
V 1010		493	555	1048
V 1212		351	678	1029
V 1313		440	716	1156
V 1319		440	716	1156
V 1414		557	515	1072
V 1415		557	515	1072
V 1515		536	456	992
V 1818		577	480	1057
V 1820		577	480	1057
Grand Total		4528	5111	9639

Fig. 6. Pivot

Sort and filter data in the Pivot Table

Sorting and filtering in the Pivot Table are done in the same way as in a regular spreadsheet. In some headers there are arrows which give us a chance to sort or filter (Fig. 7).

Task 2: Using task 1, filter the data only from the first shift for the previous day.

If we assume that today is 13.08.2021, then I will filter for the date 12.08.2021. From Column Labels, we choose the first shift. Fig. 7 shows the filtered table. The field on which it is filtered is changed from an arrow to a funnel.

Date	(All)			
Sum of Mileage	Column Labels			
Row Labels		1	2	Grand Total
V 1010		493	555	1048
V 1212		351	678	1029
V 1313		440	716	1156
V 1319		440	716	1156
V 1414		557	515	1072
V 1415		557	515	1072
V 1515		536	456	992
V 1818		577	480	1057
V 1820		577	480	1057
Grand Total		4528	5111	9639

Fig. 7. Pivot

Formatting data in the Pivot Table.

When working with Pivot Tables, an additional Pivot Table Tools menu opens with two submenus Analyze and Design. Formatting is performed from the Design menu (Fig.8).

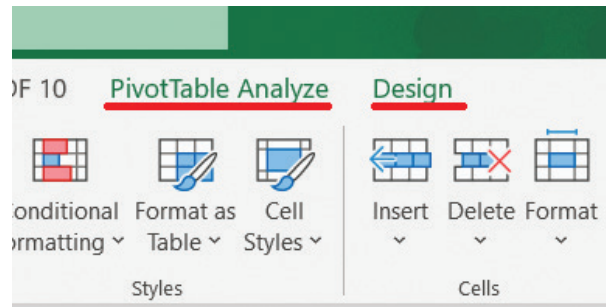


Fig. 8. Pivot

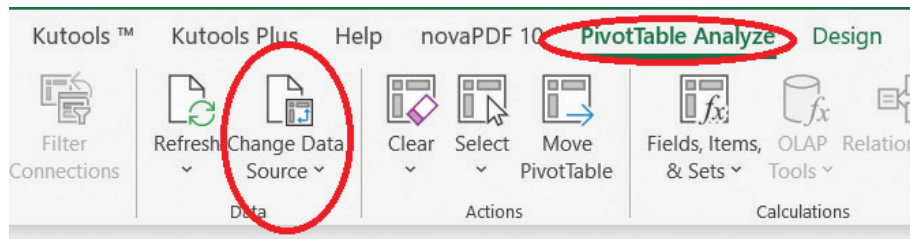


Fig. 9. Pivot

Tricks

If the data in the source table changes, the data in the pivot table does not change automatically. To update the data, select a cell from the table and the Refresh button from the Pivot Table Tools / Analyze menu, from the Data panel (Fig. 9). If more rows are added to the source table – Change Data Source (Fig. 9).

Tasks:

1. Open the **Mileage-Car.xlsx** file.
 - 1.1. Prepare a report showing the total mileage of each car and each date with the possibility of filtering by shift.
 - 1.2. Filter only for today.
 - 1.3. Filter only for the second shift.
 - 1.4. Filter for today's date and second shift.
 - 1.5. Format the pivot table of your choice.

27. PREPARATION OF REFERENCE - SUMMARY

One of the ways to prepare a report in MS Excel is through Summarization / Subtotals / - Subtotal. The command provides the ability to automatically summarize the values of one or more fields for each value of another field, using a function – Sum, Min, Max, Average, Count and others. In order for the summary to be correct, the data needs to be sorted by the summary field.

To implement the command, we must perform certain steps:

1. **We sort the table** according to a selected criterion against which the data will be summarized.
2. We position ourselves in the field of the table.
3. Select **Subtotal from the Data menu, from the Outline panel** (Fig. 1).

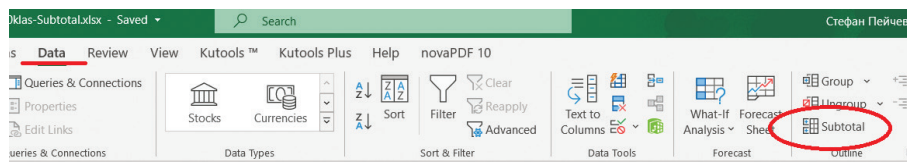


Fig. 1. Subtotal

The Subtotal dialog box opens (Fig. 2). In it we define:

- Summary field (At each change in) – select the column on which the intermediate calculations will be performed (the one on which the table is already sorted).
- Use function.
- Fields whose values will be summarized (Add subtotal to) – select the fields on which the selected function will be applied.

It is possible to summarize in more than one field and with several summary functions, for this purpose it is necessary to execute the Subtotal command several times, whereby the selection of the option **Replace current subtotals must be canceled** (otherwise the result of the second execution of Subtotal will replace that of the first).

Summary below data – there must be a check mark to see the intermediate calculations **below the grouped rows**, otherwise they are visible above the grouped rows.

Remove All – deletes the report, shows the table in its original form.

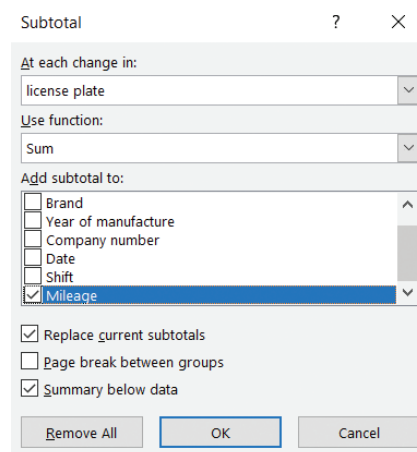


Fig. 2. Subtotal

Task 1: Open the **Mileage.xlsx** file. Prepare a report showing the minimum mileage for each car

1. Sort: by Registration Number (each car)
2. Select a cell from the table
3. Data / Subtotal (Fig. 2):
 - We choose what we have already sorted – Registration number
 - Function Min
 - Mark Mileage

Final version of the table (Fig. 3). The data are sorted by registration number. For each car (registration number), the minimum mileage is shown by adding a new line, and at the bottom is shown the grand summary (Grand Min). At the beginning of each of the added lines, there is a sign **minus** or **plus** respectively for **hiding** or **showing** of the detailed information.

1	2	3	A	B	C	D	E	F	G	H
	1	Information about the mileage of the taxi company "Car"								
	2		license plate	Brand	Year of manufacture	Company number	Date	Shift	Mileage	
	3	·	V 1010	Opel	2016	303	3.9.2021	1	150	
	4	·	V 1010	Opel	2016	303	3.9.2021	2	190	
	5	·	V 1010	Opel	2016	303	2.9.2021	1	53	
	6	·	V 1010	Opel	2016	303	2.9.2021	2	87	
	7	·	V 1010	Opel	2016	303	1.9.2021	1	32	
	8	·	V 1010	Opel	2016	303	1.9.2021	2	69	
	9	·	V 1010	Opel	2016	303	31.8.2021	1	68	
	10	·	V 1010	Opel	2016	303	31.8.2021	2	67	
	11	·	V 1010	Opel	2016	303	30.8.2021	1	96	
	12	·	V 1010	Opel	2016	303	30.8.2021	2	74	
	13	·	V 1010	Opel	2016	303	29.8.2021	1	94	
	14	·	V 1010	Opel	2016	303	29.8.2021	2	68	
	15	-	V 1010 Total						1048	
	16	·	V 1212	Skoda	2015	101	3.9.2021	1	50	
	17	·	V 1212	Skoda	2015	101	3.9.2021	2	67	
	18	·	V 1212	Skoda	2015	101	2.9.2021	1	64	
	19	·	V 1212	Skoda	2015	101	2.9.2021	2	45	
	20	·	V 1212	Skoda	2015	101	1.9.2021	1	51	
	21	·	V 1212	Skoda	2015	101	1.9.2021	2	97	
	22	·	V 1212	Skoda	2015	101	31.8.2021	1	67	
	23	·	V 1212	Skoda	2015	101	31.8.2021	2	205	
	24	·	V 1212	Skoda	2015	101	30.8.2021	1	46	
	25	·	V 1212	Skoda	2015	101	30.8.2021	2	64	
	26	·	V 1212	Skoda	2015	101	29.8.2021	1	73	
	27	·	V 1212	Skoda	2015	101	29.8.2021	2	200	
	28	-	V 1212 Total						1029	
	29	·	V 1313	Dacia	2014	205	3.9.2021	1	89	

Fig. 3. Subtotal

Task 2: Open the **Mileage.xlsx** file. Prepare a report showing the maximum and average mileage **for each car**

1. Sort: by Registration Number (each car)
2. Select a cell from the table
3. Data / Subtotal (Fig. 2):
 - We choose what we have already sorted – Registration number

- Function Max
- Mark the Mileage checkbox

Apart from the maximum, we also want the average mileage => We apply the Subtotal command once again, but this time we change the function to Average and **uncheck Replace current subtotals**.

Task 3: Open the **Mileage.xlsx** file. Prepare a report showing the total mileage **for each car** and the average mileage **for each shift**.

1. We sort:
 - As the first criterion – Change (for each shift)
 - As a second criterion – Registration number (for each car)
2. Select a cell from the table.
3. Data / Subtotal (Fig. 2):
 - We choose the first one we have already sorted by - Shift
 - Function Average
 - Check the Mileage checkbox

We apply the subtotal command once again, as **we do not forget to uncheck Replace current subtotals**.

- We choose the second one we have already sorted by – Registration number
- Function Sum
- Check the Mileage checkbox

Final version of the table (Fig. 4)

	A	B	C	D	E	F	G
1	Information about the mileage of the taxi company "Car"						
2	license plate	Brand	Year of manufacture	Company number	Date	Shift	Mileage
3	V 1010	Opel	2016	303	3.9.2021	1	150
33	V 1818	Fiat	2015	378	3.9.2021	1	64
34	V 1818	Fiat	2015	378	2.9.2021	1	78
35	V 1818	Fiat	2015	378	1.9.2021	1	203
36	V 1818	Fiat	2015	378	31.8.2021	1	75
37	V 1818	Fiat	2015	378	30.8.2021	1	79
38	V 1818	Fiat	2015	378	29.8.2021	1	78
39						1 Average	82,05556
40	V 1010	Opel	2016	303	3.9.2021	2	190
41	V 1010	Opel	2016	303	2.9.2021	2	87
68	V 1515	Mazda	2016	216	30.8.2021	2	67
69	V 1515	Mazda	2016	216	29.8.2021	2	148
70	V 1818	Fiat	2015	378	3.9.2021	2	68
71	V 1818	Fiat	2015	378	2.9.2021	2	23
72	V 1818	Fiat	2015	378	1.9.2021	2	95
73	V 1818	Fiat	2015	378	31.8.2021	2	36
74	V 1818	Fiat	2015	378	30.8.2021	2	82
75	V 1818	Fiat	2015	378	29.8.2021	2	176
76						2 Average	94,44444
77						Grand Average	88,25

Fig. 4. Subtotal

Tricks

If the rows were hidden before the data was aggregated, they participate in the calculation of the aggregated values.

Tasks:

- Open File NVO-10klas-Subtotal.xlsx
- Make a report showing the average number of points for each school.
- Make a report showing the minimum and maximum number of points for each school.
- Prepare a report showing the minimum and average age of the students who appeared at the exam for each school.
- Make a report showing the average number of points in each subject and for each school.
- Make a report showing the average number of points in each subject and for each school.

IV. WORK ON A PROJECT

28. WORK ON PROJECTS

Project Development in a Team

Project carrying out organized activities to create a specific product that has a clear purpose and leads to specific results. The project can be individual or performed in a team.

- When forming a team, the individual capabilities and preferences of the participants must be considered and, depending on them, specific tasks must be assigned to each of the participants.
- The topic must be relevant, interesting, and applicable. In some cases, the topic is formulated by the contracting authority, and in others it is chosen by the team members. In school projects, the teacher is the assignor of the project.
- The purpose of the project must be clear and consistent with the objectives.
- In order to implement the specific activities in the process of project planning, a plan for the project work must be developed. The tasks are distributed and the deadlines for their implementation are determined.
- Interim targets and deadlines need to be set and their implementation monitored.
- When working in a team, it is often necessary to share files, resources or to hold online meetings. Such an opportunity is provided by: Google Docs, Microsoft Office Online, Google Classroom, Microsoft Teams.

Project documentation

In parallel with the implementation of the project, begins the preparation of the documentation, which should contain the composition of the team and the distribution of roles in it, the topic and objectives of the project, the necessary resources and the work plan. The main groups of documents related to a working project are:

- Documents describing the project implementation process.
- Documents describing the created products.
- Documents describing the way the finished products work.

Integration of a project and presentation in front of an audience

Complete construction of the project - combining the results of specific activities in the project implementation.

Presentation of the project in front of an audience

A modern means of presenting ideas and products to the public is the computer presentation. In this case, the purpose of the project, the team that has implemented it, the activities performed as well as the materials used are described. For maximum impact on the audience when presenting a project, the most relevant information from it should be selected. This stage may include promoting the project in various ways, for example, through social networks.

29. PROJECT “NATIONAL EXTERNAL EXAMINATION – 10TH GRADE”

In connection with the conduct of NEE 10th grade, an organization should be established for the conduct of the exam. Each student must be notified in advance of the date, school, and hall where he/she will take the exam.

- Form a team to perform the specified job.
- Select a team leader.
- Prepare a work plan and share individual tasks between team members.
- Set a time limit for the implementation of the project.
- The team leader can create a group on a social network so that communication between team members is easier and faster.
- Work in shared documents.
- The team leader must ensure the quality and timely performance of the individual tasks.
- The manager must keep documentation – describe the process of implementation of the project and the activities carried out by each team member.
- Each member of the team must comply with the time limit set.

I. With MS Excel, do the following:

1. Create a table that contains the following columns: District, Municipality, City, School, Principal, Incoming Number, Name, Middle name, Family name, PIN, BLL (Bulgarian language and Literature) School, Math School, Foreign Language School, IT School (where the exam will take place), BLL Hall, Math Hall, Foreign Language Hall, IT Hall, Date BLL, Date Math, Date Foreign Language, Date IT, Access Code <https://priem.mon.bg/>.
2. All exams start at 8:00am.
3. Enter participants' info.
4. In the Hall box, enter the data validity from 101 to 105, 201 – 205, 301 – 305.
5. In the Date field, create a choice between three dates.
6. In the Access Code field, the length of the text must be five characters.
7. In the PIN field, set the text length to 10 characters.
8. Sort data by County and School alphabetically.
9. Filter data for your school only.
10. Refer to how many students will take a foreign language exam and how many an IT one.

II. Using the MS Word program, create a mail merge in the form of a business note to authenticate the place of attendance of NEE exams

OFFICIAL NOTICE

To certify the place for taking the exams by National external examination - 10th grade

This certificate is issued to:

<< Name >> << Surname >> << Family >>

PIN << PIN >> incoming number << incoming number >>

Student in X class in << School >>

Place << city >> municipality << municipality >> district << district >>

In the assurance that the student will take NEE exams as follows:

Nº	Subject	Date	School	Hall	Time
1	Bulgarian Language and Literature	<< date BLL >>	<< school BLL >>	<< BLL hall >>	8:00
2	Math	<< date Math >>	<< school Math >>	<< Math hall >>	8:00
3	Foreign language	<< date Foreign language >>	<< foreign language school >>	<< foreign language hall >>	8:00
4	IT	<< date IT >>	<< school IT >>	<< IT hall >>	8:00

Access code to <https://priem.mon.bg> :

Principal: << Principal >>

Fig. 1. Project 1

III. Present the project to the class

30. PROJECT “NATIONAL EXTERNAL EXAMINATION – 10TH GRADE” – RESULTS

After conducting the NEE exams – 10th grade, the results of each student must be announced.

- Form a team to carry out the given project.
- Choose a team leader.
- Set a deadline for project implementation.
- Prepare a work plan and distribute the individual tasks among the team members
- Let the team leader create a group on a social network so that communication between team members is easier and faster.
- Work in shared documents.
- The team leader must monitor the quality and timeliness of the individual tasks.
- The manager must keep documentation describing the process of project implementation and activities carried out by each member of the team.
- Each member of the team must comply with the set deadline.

I. Perform the following actions with MS Excel

1. Create a spreadsheet that includes the following columns: District, Municipality, City, School, Director, Incoming number, Name, Surname, Family name, PIN, BLL /Bulgarian language and Literature/ points, Math points, Foreign language points, IT points, access code <https://priem.mon.bg/>
2. In the Incoming number field, the length of the text must be five characters.
3. Enter data about participants.
 - In the BLL points and Math points fields enter data validity in the range from 0 to 100.
 - If the student has not appeared in the relevant Foreign language or IT exam, write “did not appear“.
4. In the access code field the length of the text should be five characters.
5. Sort the data by points by BLL.
6. Filter data only about your school.
7. Check how many students have appeared in a foreign language and how many in IT exam.

II. With the program MS Word, create a form letter as a notification letter to certify students' results from the exams

OFFICIAL NOTICE

for the results of the exams from National external examination - 10th grade

This certificate is issued to:

<< Name >> << Surname >> << Surname >>

PIN << PIN >> incoming number << incoming number >>
Student in 10th grade in << School >>
Place << city >> municipality << municipality >> district << district >>

In the assurance that the student has received the following results:

№	Subject	Number of points
1	Bulgarian Language and Literature	<< BLL points >>
2	Math	<< Math points >>
3	Foreign language	<< Foreign language points >>
4	IT	<< IT points >>

Access code to <https://priem.mon.bg> :

Principal: << Principal >>

Fig. 1. Project 2

III. Present the project to the class

31. PROJECT “LAKES”

I. Make a comparative analysis of the lakes in Bulgaria

- Form a team to carry out the given project.
- Choose a team leader.
- Prepare a work plan and distribute the individual tasks among the team members.
- Set a deadline for project implementation.
- Let the team leader create a group on a social network so that communication between team members is easier and faster.
- Work in shared documents.
- The team leader must monitor the quality and timeliness of the individual tasks.
- The manager must keep documentation describing the process of project implementation and activities carried out by each member of the team.
- Each member of the team must comply with the set deadline.

II. Perform the following actions with MS Excel

1. Create a spreadsheet that includes the following columns: lake type, name, location, volume, area, altitude, depth.
2. Fill in the table.
3. Make a reference by finding the total area and the average volume for each type of lake.
4. Make a report as for each type of lake to find the maximum altitude and minimum area.

III. Using MS Word, create an advertising brochure on the Lakes in Bulgaria

IV. Via MS Power Point program, create a presentation about the lakes in Bulgaria

V. Present the project to the class

10TH GRADE



I. PROCESSING OF INFORMATION AND COMMUNICATION

1. ASSESSMENT OF THE VALIDITY AND RELIABILITY OF INFORMATION

Information. Reliability of Information

The collection and spreading of information happen in many ways. Today one of the most commonly used sources of information is the Internet. There is a large amount of information on the network that is easily accessible and has multiple sources. With such a large amount of information and numerous sources, one of the main problems is the reliability of the information. Besides it, another problem in the network is the validity of the information.

Each search engine on the Internet offers additional settings to help search for information. Advanced Find allows you to search for information more precisely. Enables to set up the search engine to show you the most recent updated information. When searching for information on the Internet, it is important to make sure that it is up to date, you should check when it is published.

Verification principles

When searching for information, you should consider the following:

- Use information only from trusted sources. Anyone can post information on the Internet, and if the source is not reliable, then there is no way to verify its reliability.
- Some websites have been created for a long time and the information in them has not been updated, which means that the information may be old and not true.

Ways to search for information

When searching for information via a search engine, there are several ways for your search to be effective:

- "" - Quotation marks are used when searching for words that go together. The words that go together are placed in the quotation marks.
- * - The star replaces a word or phrase.
- intitle: Search in titles only.
- intext: – Search only in a text.
- ~ - Used when looking for synonym. It's put in front of the word whose synonym we're looking for.
- OR – Used between keywords or phrases.

RSS

RSS (Really Simple Syndication) is a system that allows you to obtain information without visiting the page. The information is obtained by subscribing. Programs that allow this are called an RSS reader or an RSS aggregator. This software can be a web-based application or software used for the installation of a desktop machine.

Spam and Phishing

Spam is called any unwanted message that most often contains an ad, quote, suggestion, or virus. Such messages are most often distributed for commercial purposes and the sender is unknown. Opening such letters can lead to infecting the device with a virus or stealing personal data.

Spam over Instant Messaging is a spam that is spread through real-time call programs.

Spit (Spam over Internet Telephone) is a spam that is distributed through an internet phone.

Phishing is a way to obtain important information by using e-mails or sites.

2. SELECTION AND USE OF MODERN TECHNOLOGICAL MEANS FOR DIGITAL COLLABORATION

Cloud Technologies

Cloud technologies are multiple applications offered by service providers. To use the services offered, you must create an account. Cloud technologies provide the opportunity for digital cooperation for their users, giving them access to e-mail, file storage, the ability to share work on various documents, calendar, video channel, etc. The most well-known providers of these services are large companies like Google and Microsoft, which can support the necessary infrastructure for the delivery of such services. Access to such services may be free of charge or require a surcharge.

Google Digital Collaboration Tools

Google offers many tools that users can use to collaborate. Every user who has Gmail account gets access to a set of Google tools through it (Fig. 1) and also has storage space at Google Drive that is available from all devices with Internet access.

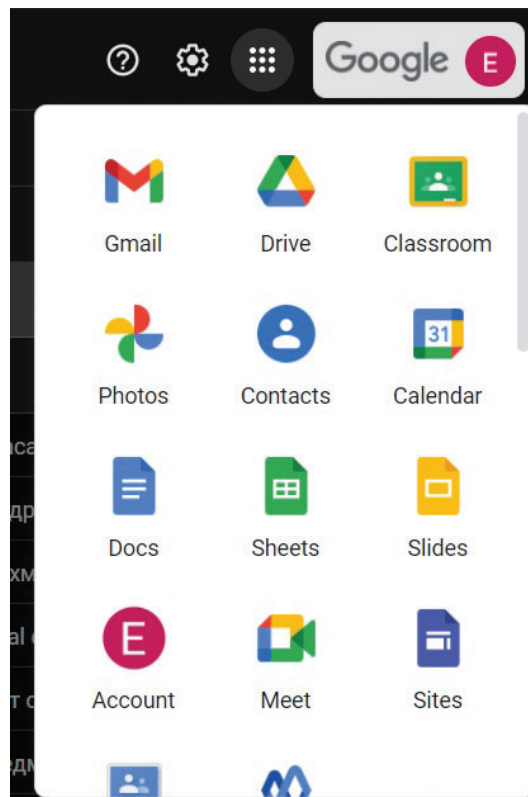


Fig. 1. Digital Collaboration

Google Drive allows you to create a variety of documents to share with other users with the ability to collaborate (Fig. 2).

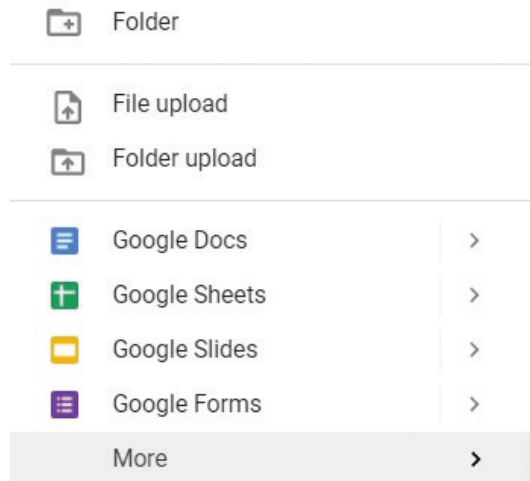


Fig. 2. Digital Collaboration

The documents that can be created on the Google disk are tables or sheets, text documents, formulas, presentations, and more. In addition to documents, entire folders can be created and shared. Another means of collaboration offered by Google is Google Classroom (Fig. 3).

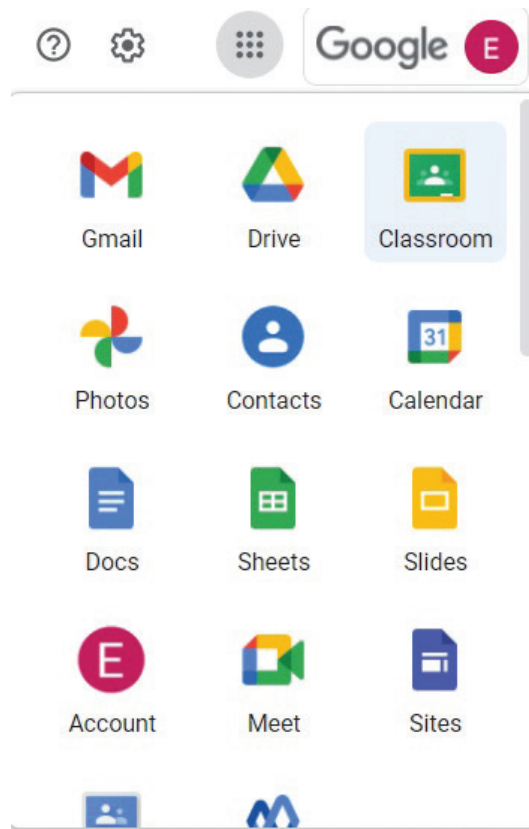


Fig. 3. Digital Collaboration

In this environment, users can create or join virtual classrooms (Fig. 4).



Fig. 4. Digital Collaboration

They have the chance to place and evaluate tasks, publish materials, publish texts and allow each user to monitor their progress (Fig. 5).

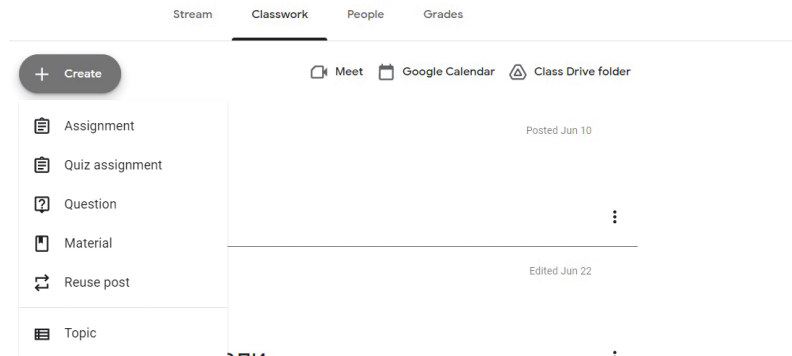


Fig. 5. Digital Collaboration

Google also enables its users to have real-time virtual encounters via the Meet app (Fig. 6).

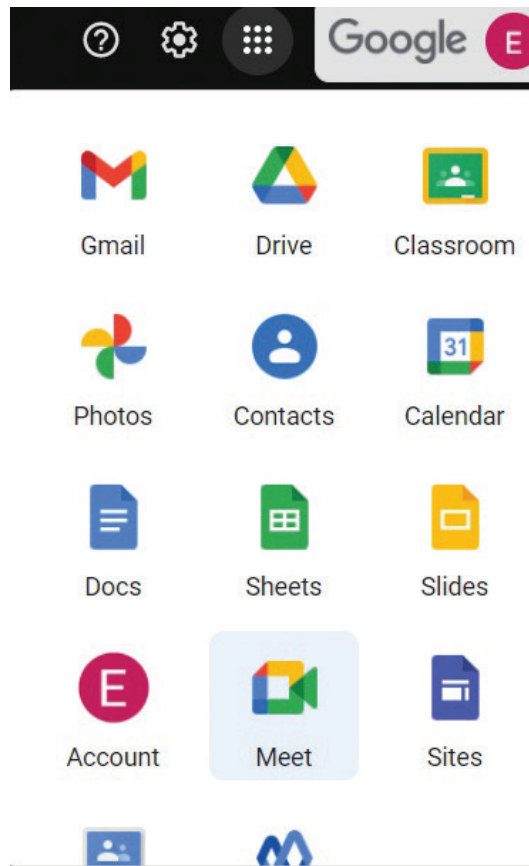


Fig. 6. Digital Collaboration

The Home screen allows you to choose whether to join an existing appointment or create a new one (Fig. 7).



Secure video conferencing for everyone

Connect, collaborate, and celebrate from anywhere with

Fig. 7. Digital Collaboration

When creating a new appointment, you can schedule a date and time to activate the link for it (Fig. 8).

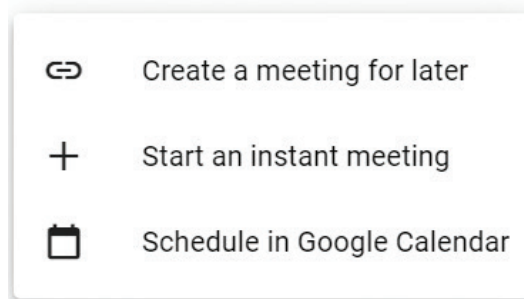


Fig. 8. Digital Collaboration

After starting the appointment, one can see a toolbar underneath. In the middle are the microphone control buttons, camera, hand-raising, enabling screen sharing and additional settings (Fig. 9).

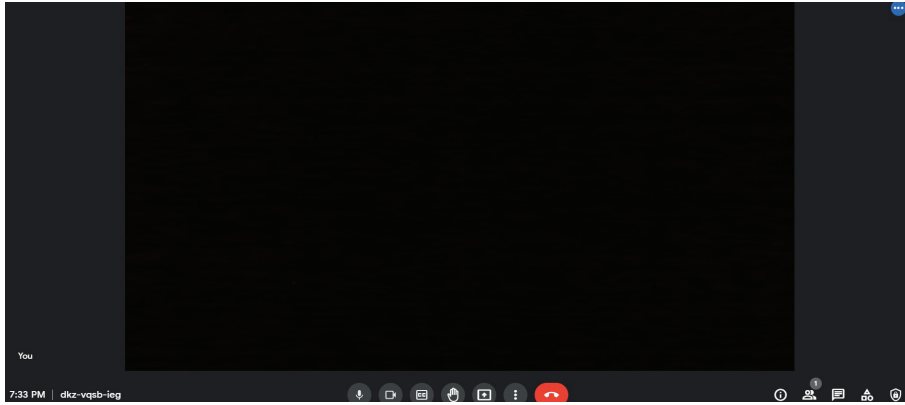


Fig. 9. Digital Collaboration

On the right stand buttons allowing to see the users in the conversation, the chat of the meeting, the ability to turn on a recording and start a whiteboard.

Microsoft Digital Collaboration Tools

Microsoft has developed its own digital collaboration tools. All applications are collected in Office 365, which gives access to create spreadsheets, presentations, text documents and more. To start Office 365, you need to go to the initial page - <https://login.microsoftonline.com/> (Fig. 10) and login with an account and a password.

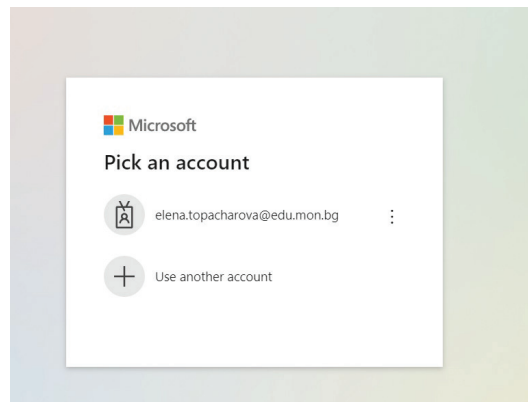


Fig. 10. Digital Collaboration

Here you also have access to a virtual disk for storing information OneDrive and the online version of the Microsoft Office Suite applications like MS Word, MS Excel, and etc. (Fig. 11). Teams app allows you to create virtual classrooms and support real-time meetings (Fig.12).

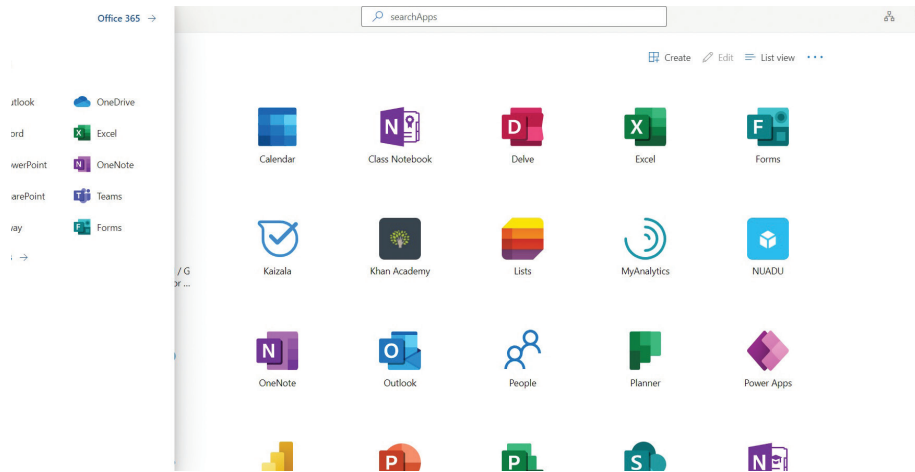


Fig. 10. Digital Collaboration

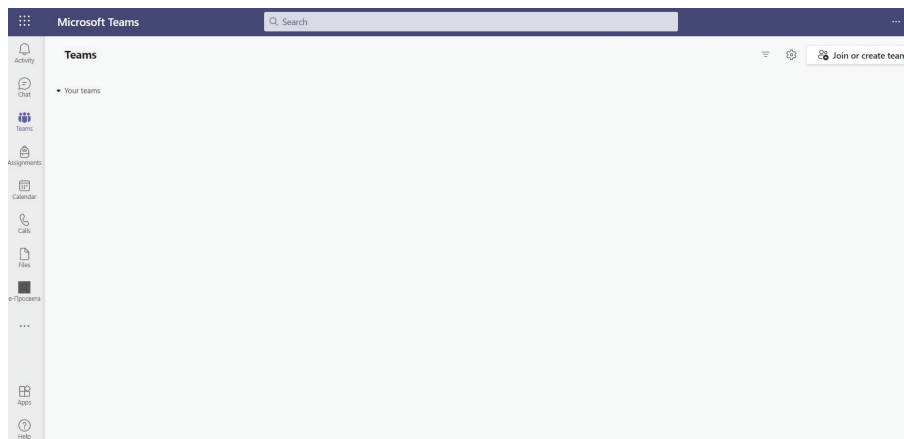


Fig. 11. Digital Collaboration

II. CONTENT CREATION

3. ALGORITHMS

1. Essence

1.1. Definitions

How to explain a complicated action to an executor who can do only simple ones? We should break up a complex action into small, simple steps, which an executor can do and this will lead to the desired result.

Safety rules for crossing the street for example, must be known and pedestrians must comply with them. Obligation of every parent is to provide accurate and clear instructions about these rules to their child. This is usually done even in early age. To be clear for the toddler, the instructions must be given in sufficiently understandable and detailed steps.

Rules for crossing the street:

1. The street must be crossed at a pedestrian crossing.
2. Before crossing, we must stop on the pavement.
3. We must look to the left.
4. If there is not a car coming from the left, we look to the right.
5. If there is not a car coming from the right, we cross the street at the pedestrian crossing.

The simple action that the executor can do on his own is called an **elementary action**.

Any implementation of an elementary action is called a **step**.

An algorithm is a system of instructions (commands), which sets elementary actions and the order of their execution to receive a certain outcome.

The word algorithm is named after the Persian mathematician al-Khwarizmi, who lived in the 9th century.

In 820, he wrote a scientific book about decimal numeral system, which was translated into Latin in the 12th century and led to the spreading of “computing art”.

1.2. Examples of algorithms

Task 1:

Let's have the AB segment. Compile an algorithm for the construction of the midperpendicular of the segment AB.

Solution:

1. We construct a circle k ($A, r > 1/2AB$).
2. Then we construct a circle k_1 ($B, r > 1/2AB$).
3. The next step is to construct intersection points S and S_1 of the circles k and k_1 .
4. We construct the straight line SS_1 , which is a midperpendicular of the segment AB.

Task 2:

The circle $k(O, r)$ and the point M , which is outside the circle, are given. Compile an algorithm for the construction of tangents to the circle k , passing through the point M .

Solution:

1. We construct a circle k_1 with a diameter of OM .
2. The next step is to construct intersection points T and T_1 of the circles k and k_1 .
3. Then we construct the straight lines $g=MT$ and $g_1=MT_1$, which are the tangents to the circle k in point M .

Task 3:

Compile an algorithm for the resolution of the square equation $ax^2+bx+c=0$, where $a \neq 0$

Solution:

1. Calculate $D=b^2-4ac$.
2. Check the sign of D . If $D < 0$, go to step 3. Otherwise, calculate $x_1 = \frac{-b+\sqrt{D}}{2a}$ and $x_2 = \frac{-b-\sqrt{D}}{2a}$. x_1 and x_2 are displayed. Go to step 4.
3. Displays the message: "The equation has no real roots".
4. End.

When we have complex algorithms one and the same sequence of actions has to be described and executed several times. This repetition can be avoided by separating this sequence into separate algorithm, called **subalgorithm**.

Subalgorithm is a separate sequence of elementary actions, which can be used in the general algorithm repeatedly.

2. Properties of algorithms

1. Discretion – each algorithm must consist of a finite number of elementary actions.
2. Clearness – each current step must be exactly specified, and it must be explicitly defined which one is next.
3. Formality – the executor can work formally and carry out the instructions, until he reaches the indication for end. This property allows the executor of the algorithm to be an automatic device.
4. Definiteness – it is when we use the same data to receive one and the same result.
5. Mass character – implies that each algorithm is applied successfully to resolve the tasks of the same type for different input data.
6. Feasibility – to describe this property, we will look at the algorithm for finding the 7th simple number:
 - Make a list of all natural numbers into increasing order.
 - In the received list, cross out all numbers that are not simple.
 - Bring out the 7th number as a result.

It is obvious that the first and the second steps cannot be done by a man or a computer. This means that this algorithm does not solve the problem. It is not feasible.

7. Finiteness - an algorithm terminates after a finite numbers of steps.
8. Effectiveness - the algorithm must always give a definitive result for each value of the many acceptable inputs.
9. Measuring effectiveness – when measuring the effectiveness of an algorithm the number of elementary actions (steps) and the input and interstitial data are very important. Defining of these two characteristics is very difficult even in the simplest cases.

It is not possible to define the line between effective and non-effective algorithms and how to measure it (in seconds, minutes, hours or days). It all depends on the certain problem and conditions.

3. Types of algorithms

There are three types of algorithms according to the sequence of actions, which they perform.

3.1. Linear algorithms

Algorithms, in which actions are implemented sequentially in the order in which they are set are called linear.

An example:

Task 4:

Find the perimeter of a triangle with sides a, b and c.

Input data: a, b and c, where $a > 0$, $b > 0$ and $c > 0$.

Result: P - the calculated perimeter.

Actions: Step 1: Start

Step 2: Input a

Step 3: Input b

Step 4: Input c

Step 5: $P = a + b + c$

Step 6: Output P

Step 7: End.

3.2. Branched algorithms

In practice we are facing situations in which decision must be taken to implement one or another action. Such situations are described by branched algorithms. The branch allows you to select one of two options for the continuation of the calculation process.

An algorithm, the implementation of which is divided into different sequences of actions depending on the truth of a given condition, is called branched.

An example

Task 5:

Compile an algorithm for the division of two numbers x and y .

Input data: x, y ;

Result: $z=x/y$ or the appropriate message.

Actions: Step 1: Start

Step 2: Input x

Step 3: Input y

Step 4: If $y=0$ then "Division is impossible"

Step 4.1 Go to step 6

Step 5: $z=x/y$

Step 6: Output z

Step 7: End.

3.3. Cyclic algorithms

Some of the actions often have to be executed repeatedly. When these repetitions must be executed one after another, this re-usable can be rationalised, using an algorithm for a cyclic (repetitive) process.

Algorithms, in which a group of actions is implemented the necessary number of times, are called cyclical.

An example

Task 6:

Find the sum of the numbers from 1 to 100.

Input: The numbers from 1 to 100, which are consistently generated in number.

Result: S - the sum of the numbers.

Actions: Step 1: $S=0$ – sets an initial value of the sum.

Step 2: $number=1$ – sets the first number 1.

Step 3: $S=S+number$ – each subsequent number is being added to the amount.

Step 4: $number=number+1$ – generates the next in turn number.

Step 5: If the value of the next number ($number$) is less than or equal to 100, go to step 3.

Step 6: The S is being displayed.

Step 7: End.

Apart from the sequence of actions algorithms can be classified by other characteristics too. For example, according to input data type algorithms are numerical, text, graphical, etc.

4. DESCRIPTION OF ALGORITHMS

In order to be developed, stored, and shared algorithms must be written down in a certain way. In informatics it is necessary to describe steps of the algorithm sequentially. For this purpose, different descriptions are used, the most frequently used of which are: verbal, graphic and by a programming language.

1. Verbal description

In mathematics and other natural sciences lessons teachers often use verbal description to explain the method (algorithm) to resolve the tasks of a different type. This way of expressing algorithms is the easiest to be comprehended and is widely used.

In this description, all steps of the algorithm are described consecutively in a natural language.

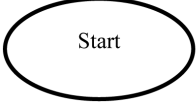
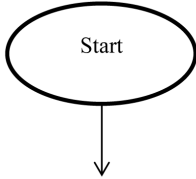
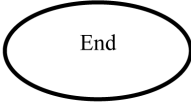
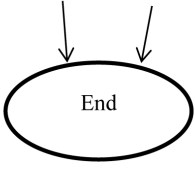
Examples of verbal description are the solutions to tasks 4, 5 and 6 at the end of the previous lesson.


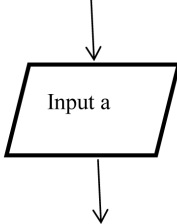

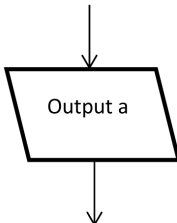

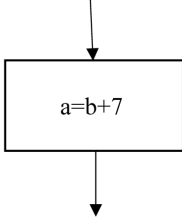
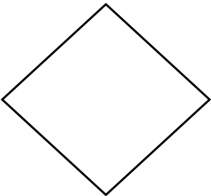
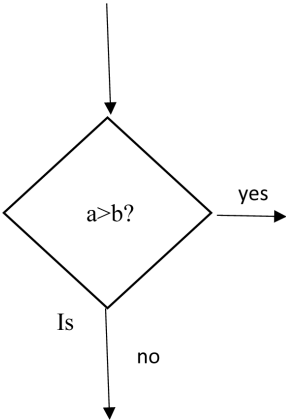
2. Graphical description


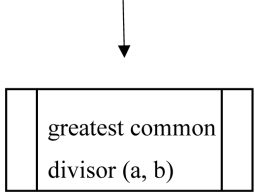

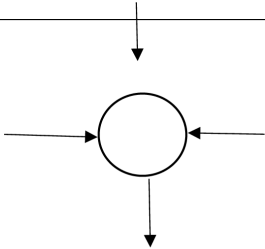
All steps of an algorithm are being set in a flowchart.

Flowcharts consist of blocks and arrows that connect blocks. The steps of the algorithm are described in blocks, connecting arrows indicate the sequence of implementation.

2.1. Types of blocks

Block	Description	Example
	Block for start - determines the place, the starting point of implementation of the algorithm. Do not enter arrows, but leave just one arrow	
	Block for end - determines the place, where the implementation of the algorithm ends. Any number of arrows can enter but there is not a single one to come out.	

	<p>Block for input - describes the input data for the algorithm</p>	
	<p>Block for output - it displays the final and intermediate results of the algorithm implementation</p>	
	<p>Processing block (functional block) - describes any number of unconditional operations over objects. Any number of arrows can enter and one comes out.</p>	
	<p>Logical block (block for checking the condition) - sets the logical condition. This block is used for branching out the implementation process of the algorithm. There are several numbers of arrows, but just two come out, they are marked with the "yes" for true (1) and "not" (0) for false. The truthfulness of the condition is being checked:</p> <ul style="list-style-type: none"> • If it is true, execution continues with the block, referred to by "yes" arrow; • If it is not true, implementation continues with the block, indicated by the "no" arrow. 	

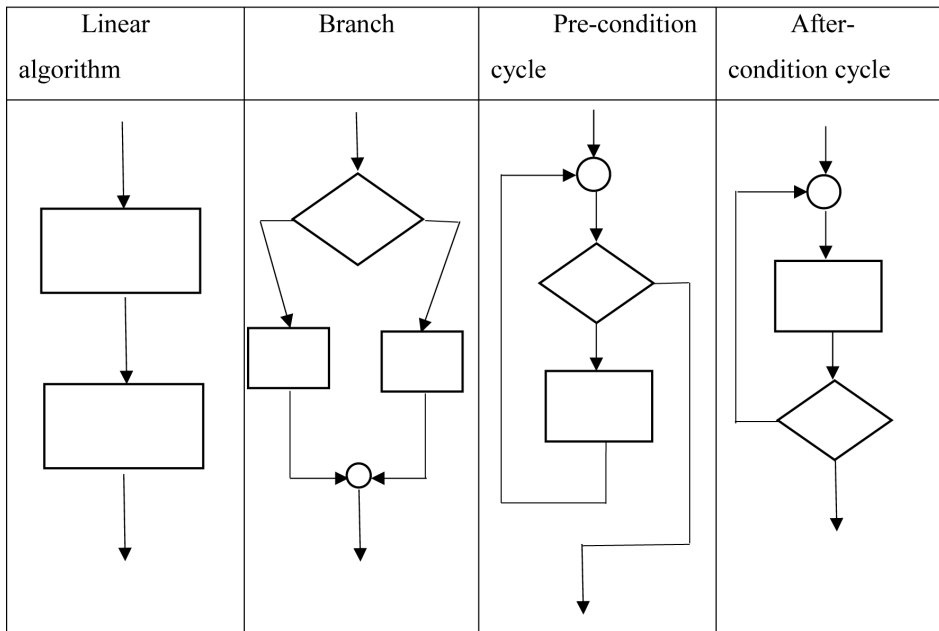
	<p>Subalgorithm block - it is used with complex algorithms, where part of the actions are organized separately.</p>	
	<p>Connector – it is used in large flowcharts written on several pages</p>	

2.2 Basic algorithmic structures

- Linear – actions are executed in the order in which they are set.
- Branched – step-by-step structure, in which the calculation process is branched off according to the truth of a condition.
- Cyclic – an action, or group of actions are repeated multiple times depending on the truth of a given condition.

The cyclic structure contains four basic components:

1. **Initialization** – sets the initial value of one or more control variables of the cycle.
 2. **Body of the cycle** – contains actions that are repeated multiple times.
 3. **Update** – preparation for the next execution of the body of the cycle.
 4. **Condition that provides the end of the cycle** – logical expression whose value is “true” or “false”. The truthfulness of the condition is being checked and depending on its value the cycle is terminated or continues its action with the implementation of cyclic part. The condition for end must ensure termination of repetitive action. If it is not well done, implementation can reach to the process of loop, i.e. endless repetition of the body of the cycle.
- Cycle with a pre-condition – the condition for end is set and checked before body of the cycle. Repetitive actions are implemented, while the condition is true.
 - Cycle with after-condition – the condition of end is set and checked after the body of the cycle. In the language C++ repetitive actions shall be executed until the condition is true, and in Pascal – until the condition is false.

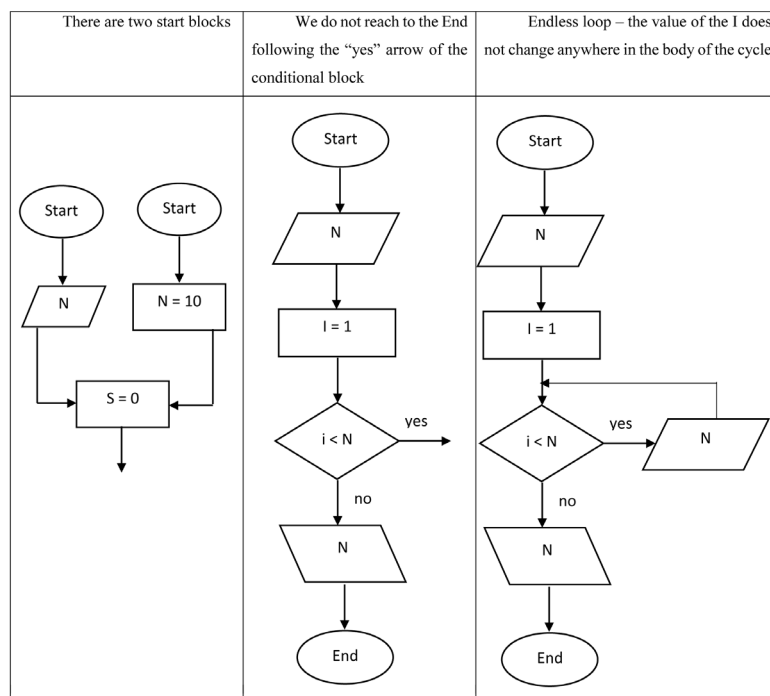


2.3 Basic requirements for the flowchart creating.

- Each block diagram must have exactly one “start” and at least one “end”.
- Except for the block for start, to any other block of the scheme, there must be a path from the beginning. Also, from each block there must be a path leading to the end.
- Blocks, describing cyclic structures, must not allow “endless loop”.

Common mistakes

There are two start blocks We do not reach to the End following the “yes” arrow of the conditional block Endless loop – the value of the I does not change anywhere in the body of the cycle



4. By programming language

A program that solves the given task is created by some programming language.

An example

Task 1: Find the surface of the circle with radius R. Display an appropriate message considering that the entered value of radius is not a positive number.

Verbal description

Input: R.

Result: S or the appropriate message

Actions: Step 1: Set value for R.

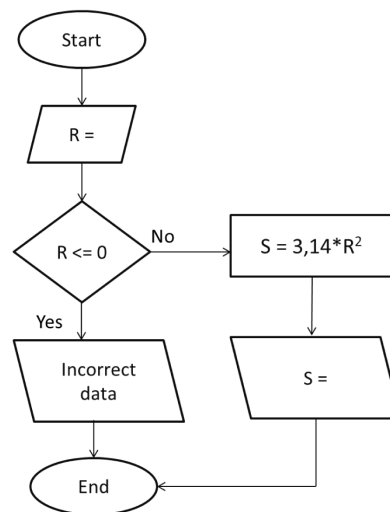
Step 2: If $R \leq 0$ displays the message: "Incorrect data" and go to step 5.

Step 3: Calculate $S = 3.14 * R^2$.

Step 4: The S is being displayed.

Step 5: End.

A graphic description



By programming language

In Pascal programming language	In C++ programming language
<pre> Program Surface; var R: real; Begin write("R="); readln(R); if R<=0 then writeln("Incorrect data!") else writeln('S=',3.14*R*R); end. </pre>	<pre> #include <iostream.h> int main() { double R; cout<<"R="; cin>>R; if (R<+0) cout<<"Incorrect data!"; else cout<<"S="<<3.14*R*R; return 0; } </pre>

5. ONLINE FORMS AND QUIZZES

Google form

Google Forms is a platform for online form creation. The advantage of electronic forms is the easier way of filling in, collecting, and summarizing the information.

There are several ways to create a Google form:

1. In Google Drive (Fig. 1).

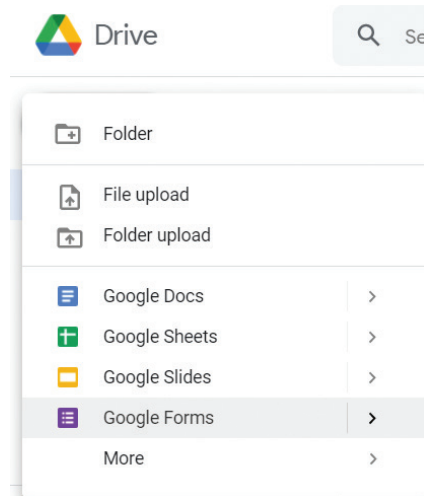


Fig. 1. GForms

2. open Google form directly (Fig. 2).

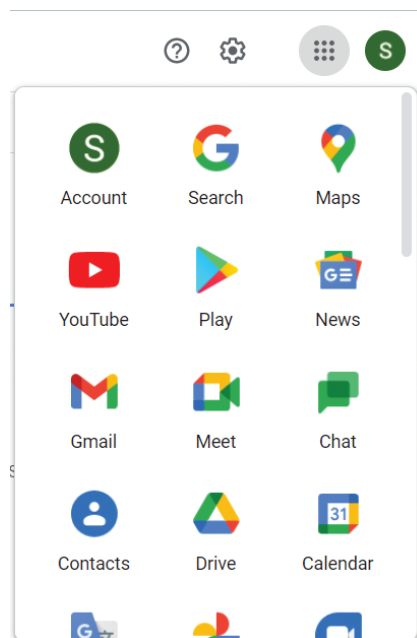


Fig. 2. GForms

With a blank Google form, only one question is initially loaded (Fig. 3).

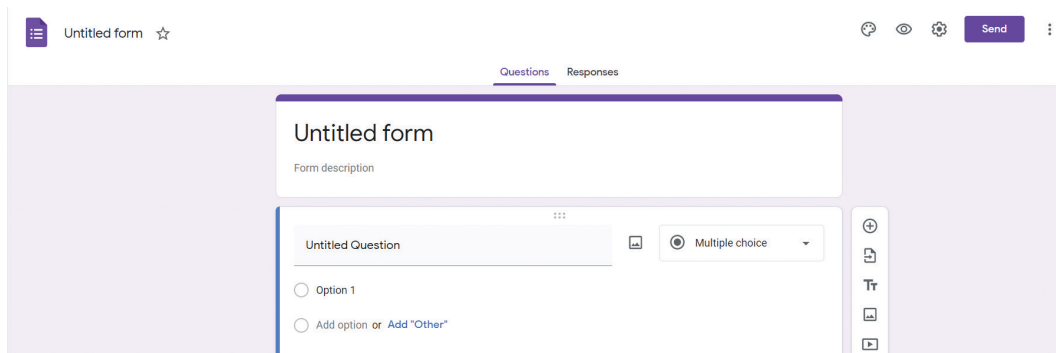


Fig. 3. GForms

At the top of the form are tools for working with it. In the left corner is the name of the form, and you can change it by double-clicking (Fig. 4).



Fig. 4. GForms

The center has two options for switching from questions to answers (Fig. 5).

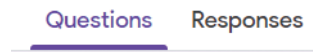


Fig. 5. GForms

In the right corner there are controls for setting up a Google form (Fig. 6):



Fig. 6. GForms

- Add-ons to the Google form.
- Change the color/theme of the Google form.
- Preview form (shows how the filler will see it).
- Google form settings.
- Submit.
- Additional settings.
- Adding questions
- Possible types of questions are:
 - question requiring a free answer – short or paragraph.
 - questions with optional radio button answers.
 - questions with optional checkbox button answers.
 - a question with a possible choice from a drop-down list.

- Scale.
- Table.
- to enter a date or time.
- Adding a question is done from the plus sign next to the highlighted question (Fig. 7). From there, the following is added:
 - import a question from another form.
 - an explanatory text and a title.
 - add an image.
 - add a video.
 - add a new section.

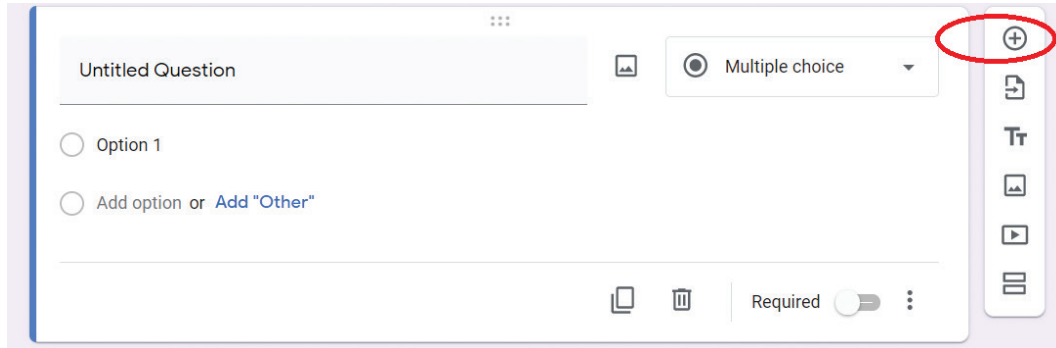


Fig. 7. GForms

Form settings

When you select the settings button at the top of a document (Fig. 6), a new window opens with three menus (Fig. 8).

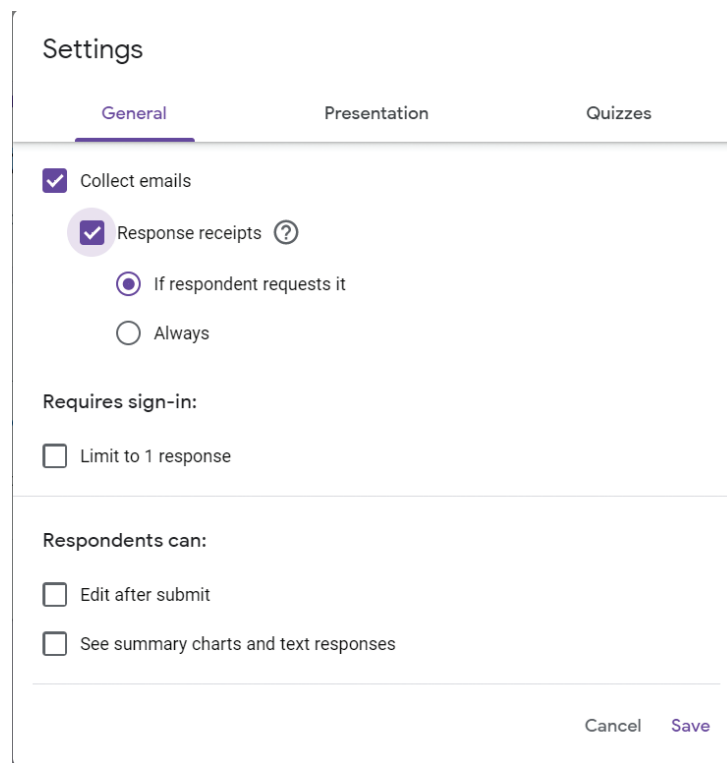


Fig. 8. GForms

This window sets a limit on who can fill it in, how many times they can fill it in, whether they can edit it after sending. It can be chosen whether the questions come out sequentially or to be shuffled for each user. The last menu allows you to set the form to be a test and the collected answers can be evaluated.






Sending the form

The Send button (Fig. 6) opens a new window that provides three possible options for sending the Google form (Fig. 9):

- sending by email.
- Sending via a link (there is a possibility of a secret link).
- embedding in html code.

Send form

Collect emails

Send via     


Email

To

Subject
Untitled form

Message
I've invited you to fill in a form:

Include form in email

 Add collaborators

Cancel Send

Fig. 9. GForms

Microsoft Office 365 form

Microsoft Office 365 also provides an opportunity online form creation. To create a MS Office 365 form, you should log in to your account at office.com and then My Apps – Forms (Fig. 10)

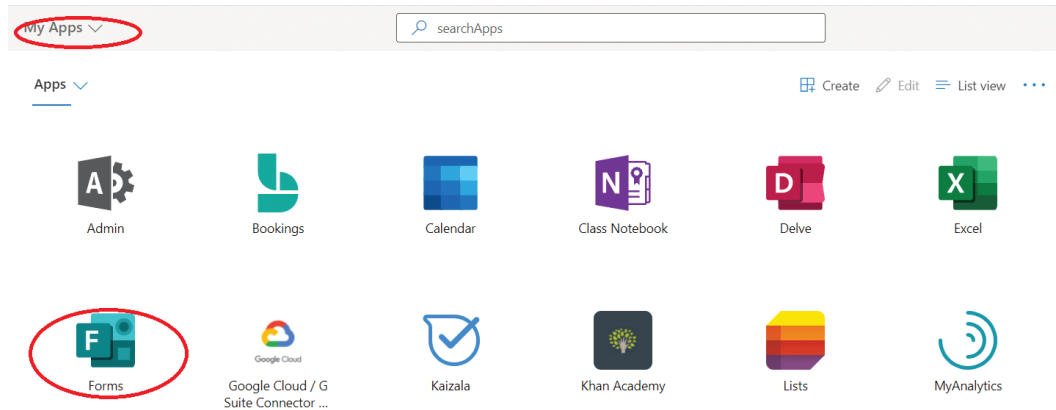


Fig. 10. MSForms

From there you have two options – to create a quiz or a form to collect data. (Fig. 11)

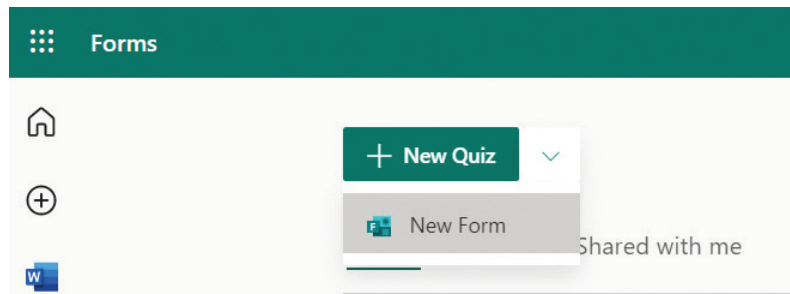


Fig. 11. MSForms

There are no initially loaded questions, and you need to add them by the “+Add new” button (Fig. 12).

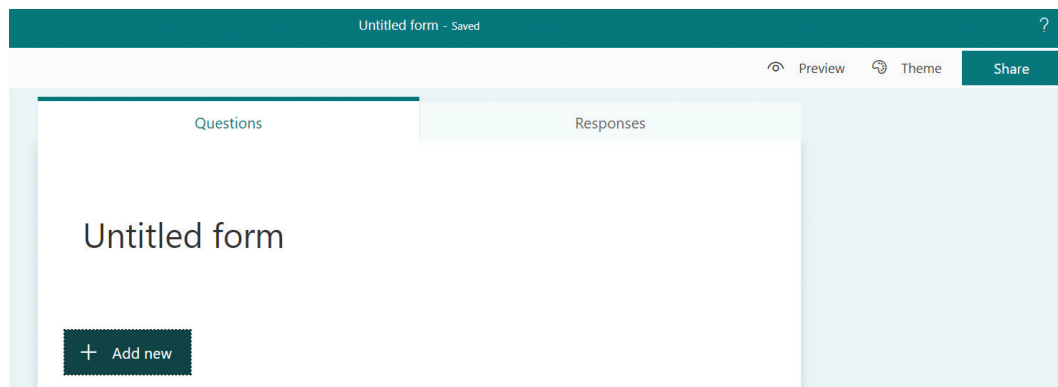


Fig. 12. MSForms

Possible types of questions are as in the Google form (Fig. 13 and Fig. 14).

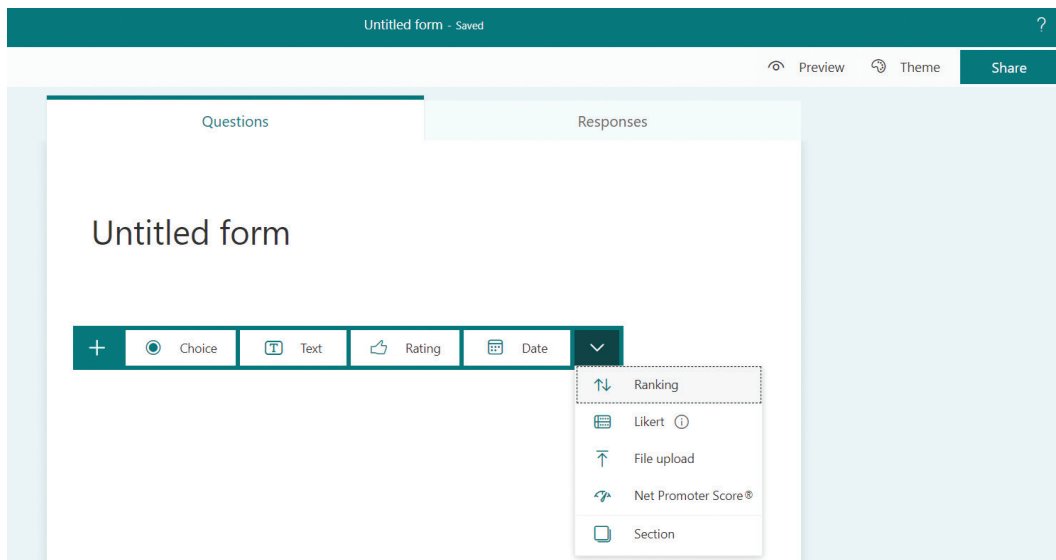


Fig. 13. MSForms

The center has two options for switching from questions to responses.

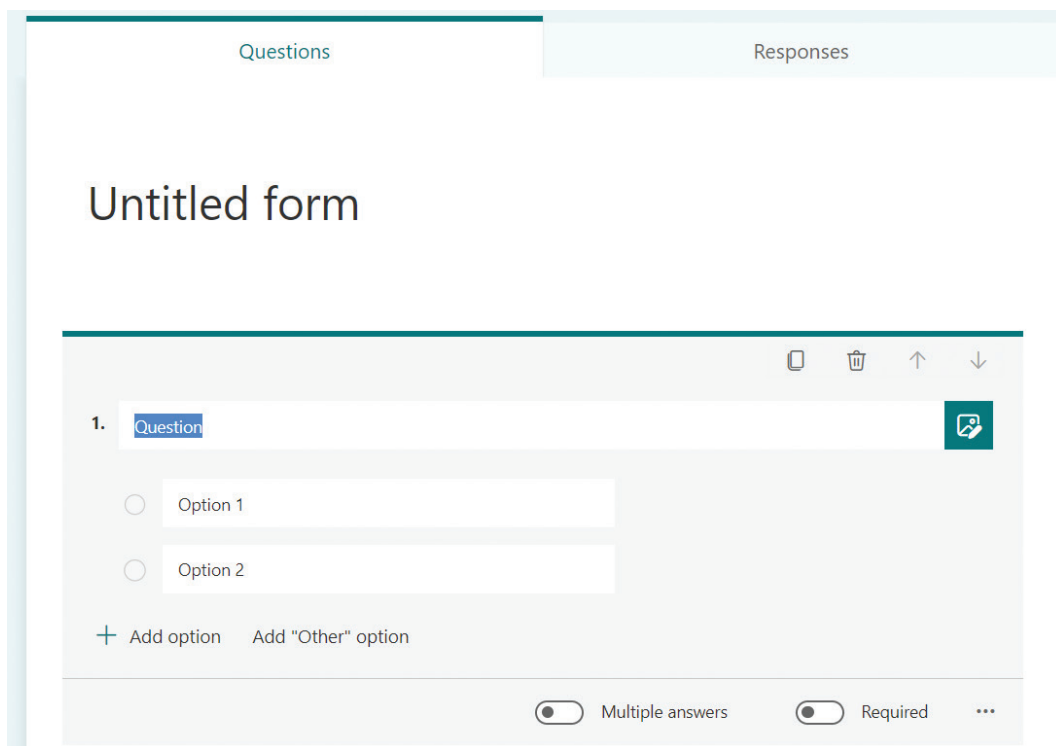


Fig. 14. MSForms

At the top of the form are tools for working with it. By using the three dots icon you can access settings of the form (Fig. 15 and Fig. 16).

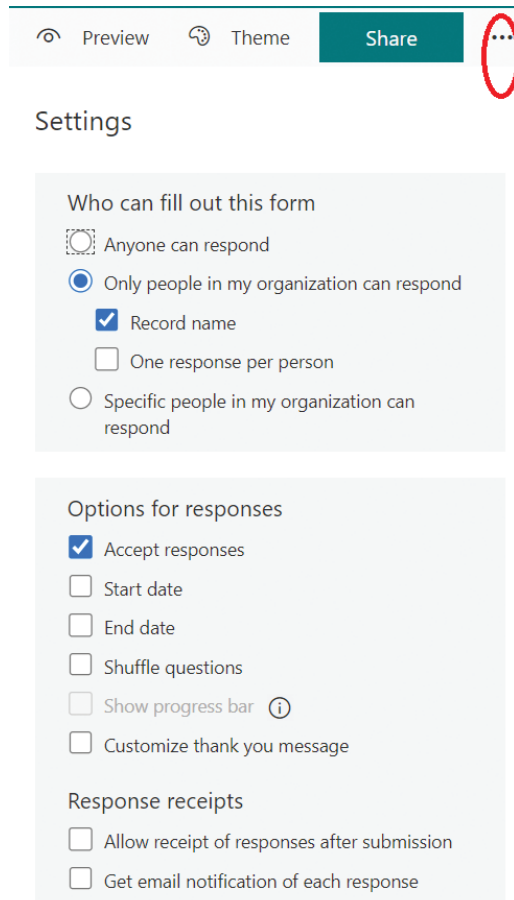


Fig. 15. MSForms

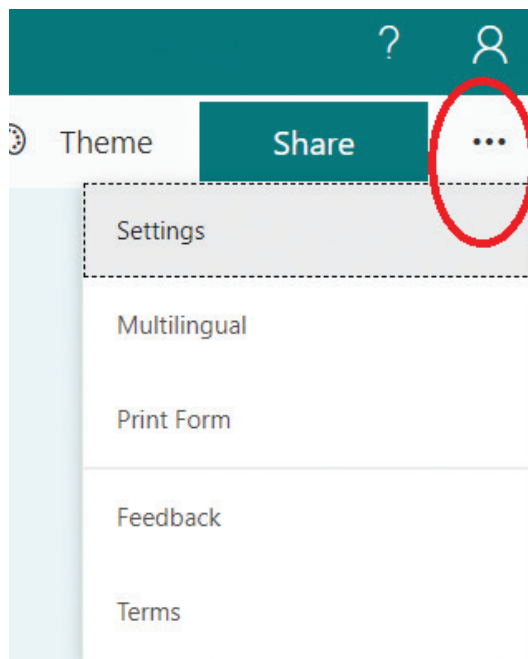


Fig. 16. MSForms

With the “Theme” button you can choose different themes for your form (Fig. 17).



Fig. 17. MSForms

Sharing the form

The Share button (Fig. 18) opens a new window that provides different possible options for sending the form (Fig. 18):

- sending by email.
- Sending via a link (there is a possibility of a secret link).
- embedding in html code.

From there, you also can choose who can respond to you form (Fig. 19).

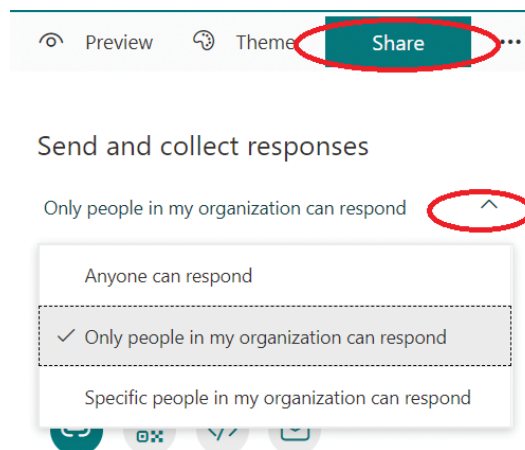


Fig. 18. MSForms

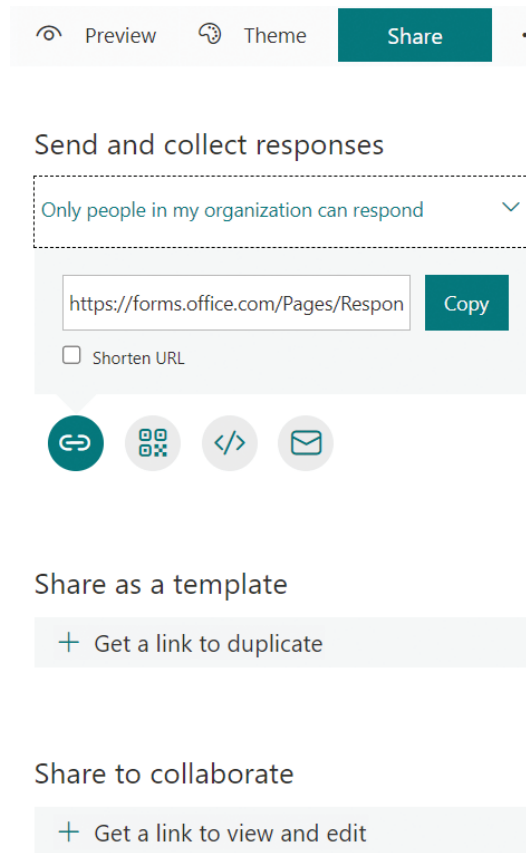


Fig. 19. MSForms

Tasks:

1. Create a Google form with the following questions:

- name – Short text.
- class – drop-down list with values from 8 to 12.
- number – multiple choice with values from 1 to 5.
- studied subjects – table (in columns it contains FUCH, IUCH and ZUCH, and in rows – Mathematics, Bulgarian language, Information technologies, English, and German language).
- how well you speak English - a linear scale starting with 1 for bad command and going up to 5 for very good command.

Customize the theme of your choice and save the finished form named sample.

2. Send the created form from task 1 to three of your classmates:

- via a link.
- by email.

6. MACROS

Macros

Macros are a set of instructions that are grouped into a common command and execute automatically at startup. When a macro is created, it remembers the actions performed with the mouse and the pressed keys, after saving it as a command and running it, it follows the same order of executed commands. After creating a macro, it can be changed. The actions in the macro are performed in the order in which they are written.

Microsoft office offers the creation of macros in its products. The applications have built-in functions that allow macro recording, and you can also use the program editor in Visual Basic for application (VBA).

Create a macro in Microsoft Word

In Microsoft Word Text Editor macro is created from the Developer menu by clicking on the Record Macro button (Fig. 1).

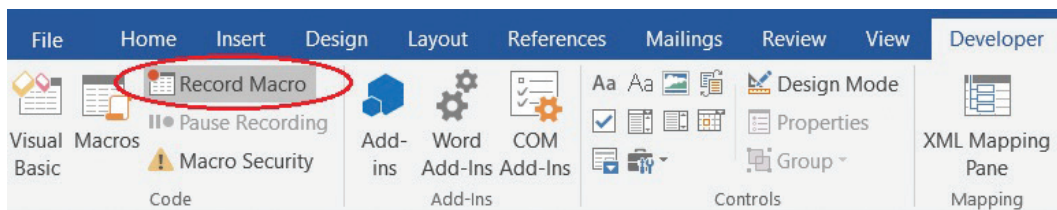


Fig. 1. Macros

The location from which the macro is created is from the View menu and from the Macros drop-down menu, select Record Macro (Fig. 2).

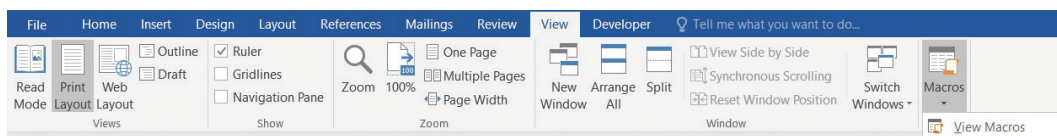


Fig. 2. Macros

After selecting the Record Macro command, a new window opens in which you should specify the name of the created macro and select whether to apply it only in the current document or in all of them (Fig. 3).

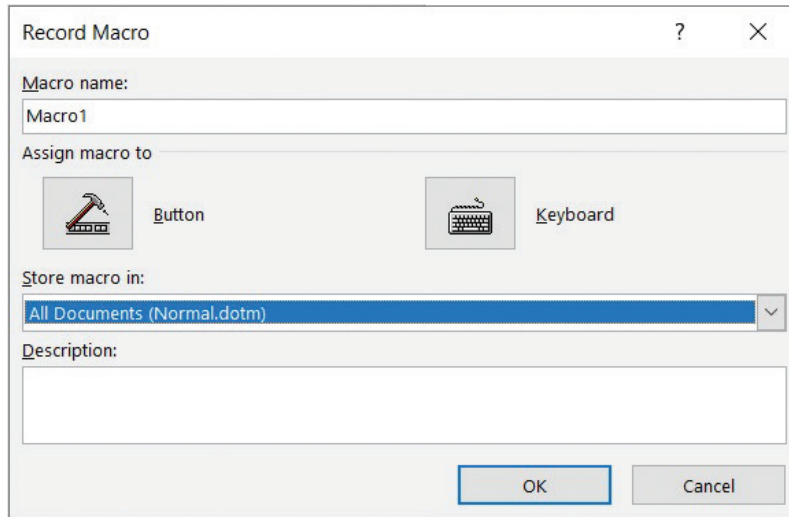


Fig. 3. Macros

In the Description field, you can enter a short description of the commands that the macro will execute. There are two ways to start the macro. They are selected from the same window in the Assign macro to tab:

- Using a button.

When selecting the option to start with a button, an additional settings window opens (Fig. 4).

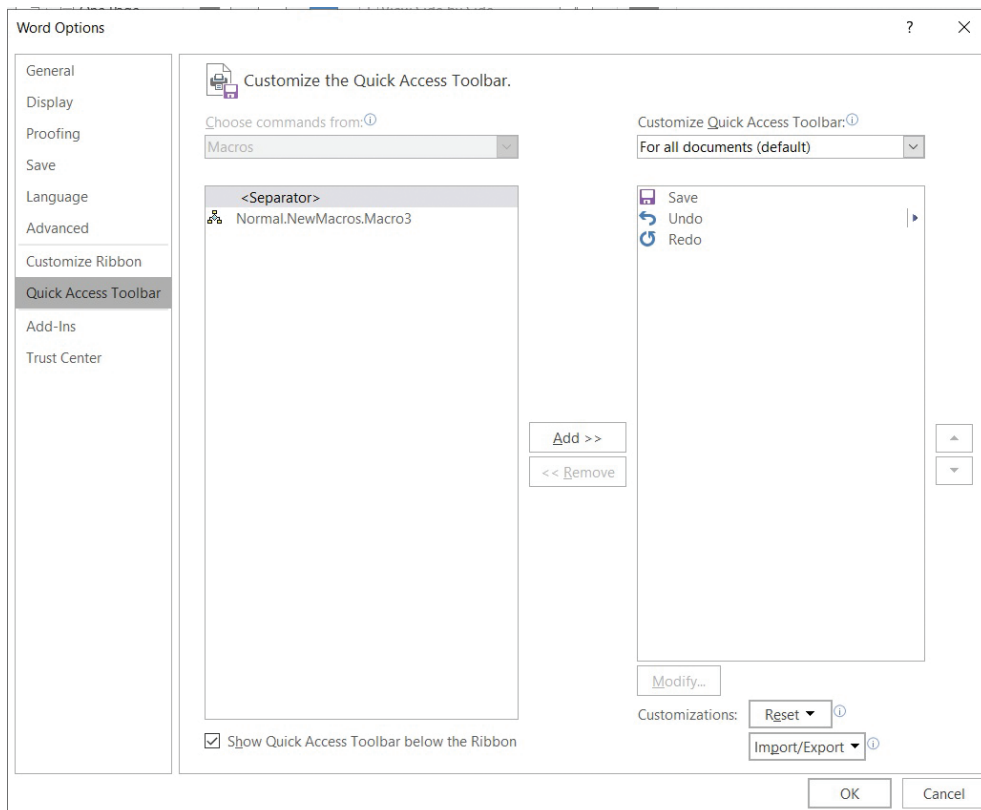


Fig. 4. Macros

To create a macro and start it with a button, from the menu that opens you need to add the macro to the toolbar (Fig. 5).

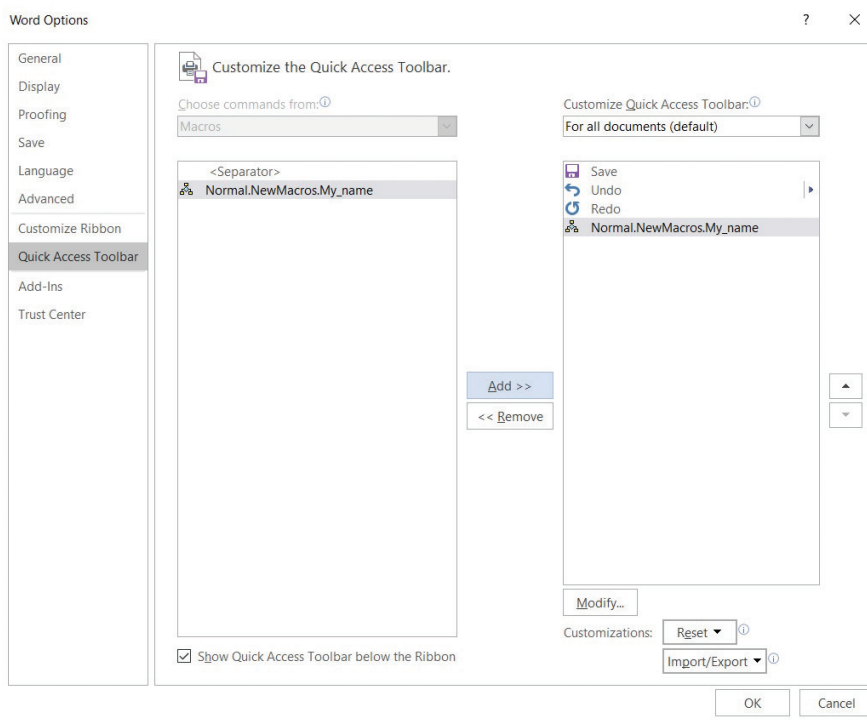


Fig. 5. Macros

The Modify button allows you to customize the icon of your macro, this button opens a new window in which you can select the icon (Fig. 6).

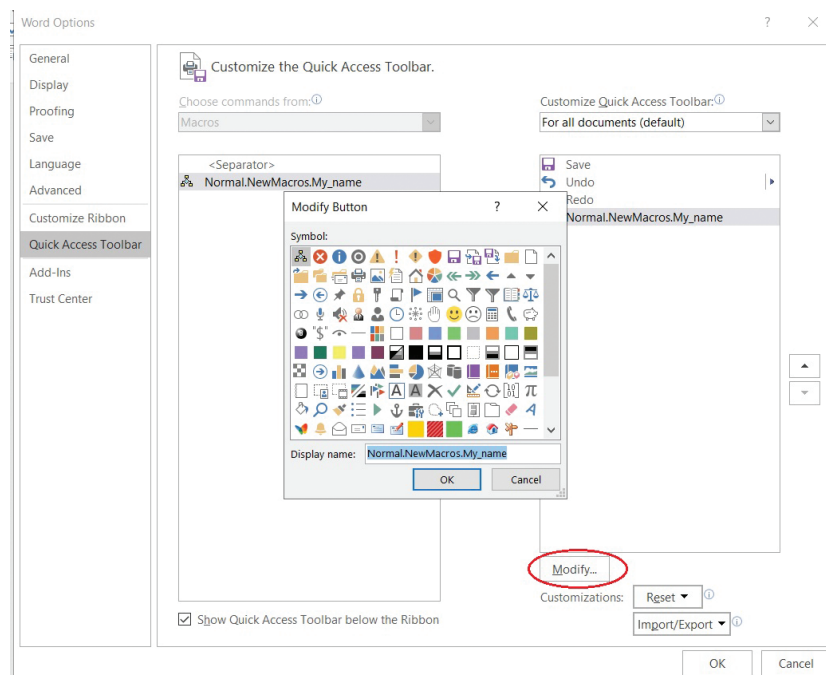


Fig. 6. Macros

After selecting an icon and pressing the OK button on the main window (Fig. 5), the macro recording starts. After performing the actions, you want to record in your macro, you must select the Stop Record button (Fig. 7).

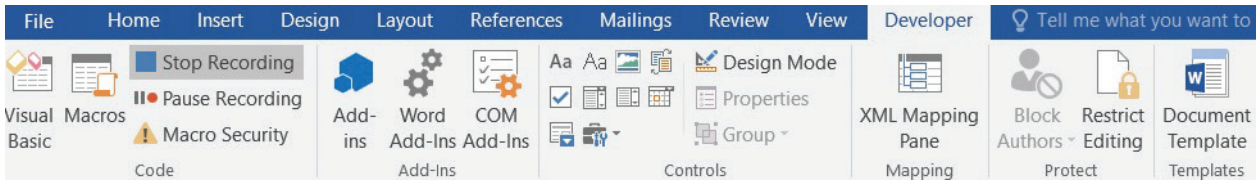


Fig. 7. Macros

After recording, you can see the button that appears in the toolbar and launches your macro (Fig. 8).

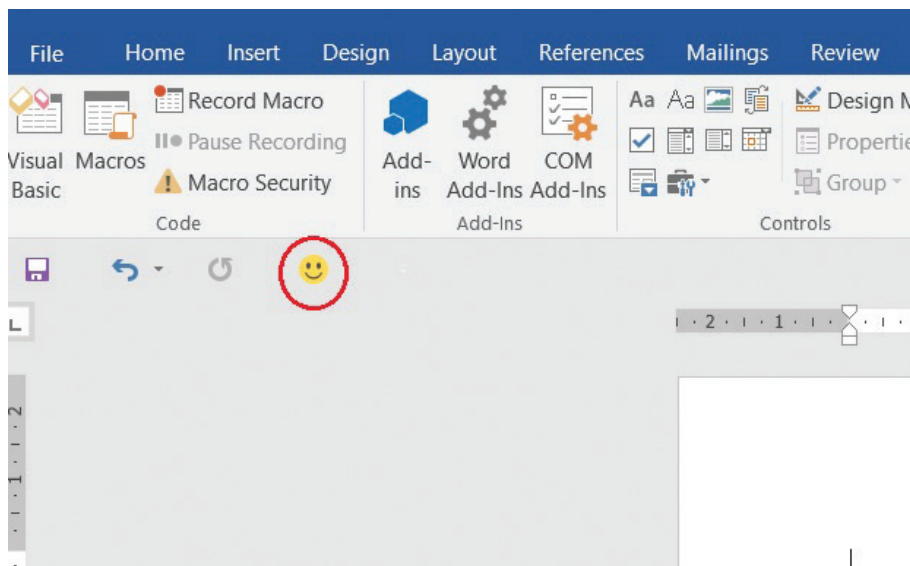


Fig. 8. Macros

When you select this button, the actions you have saved are performed automatically in the document (Fig. 9).

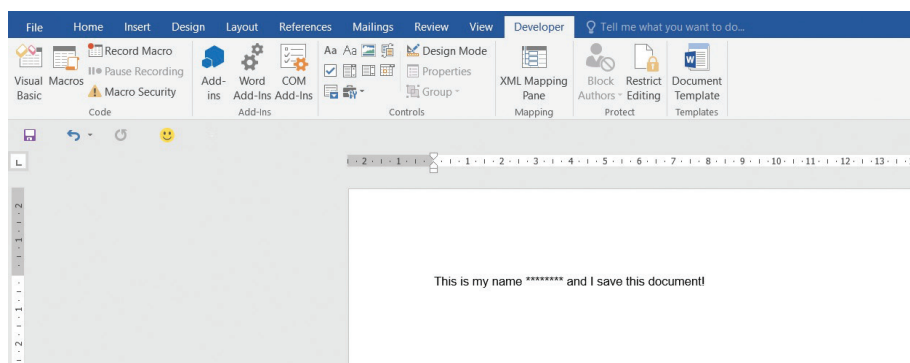


Fig. 9. Macros

- Using a Key Combination

Selecting the option to start with a keyboard shortcut opens an additional settings window (Fig. 10).

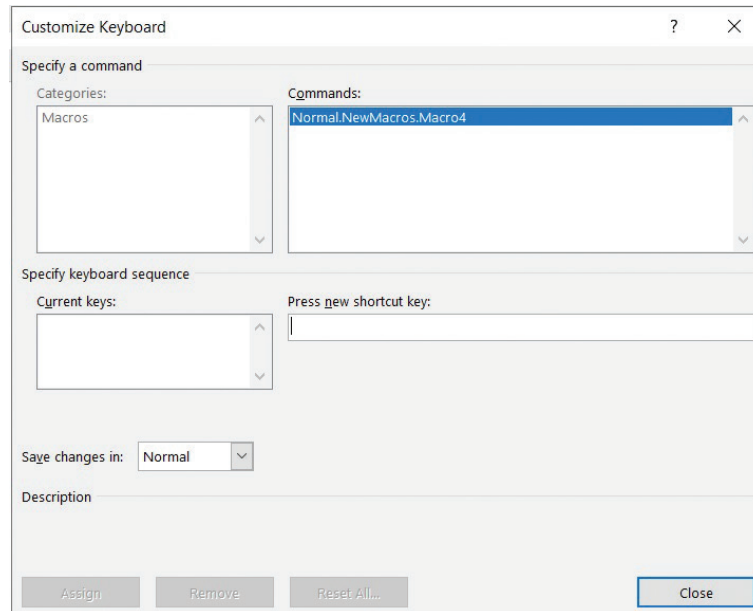


Fig. 10. Macros

The only difference is that here the macro is started with a keyboard shortcut that you have chosen instead of a button (Fig. 11).

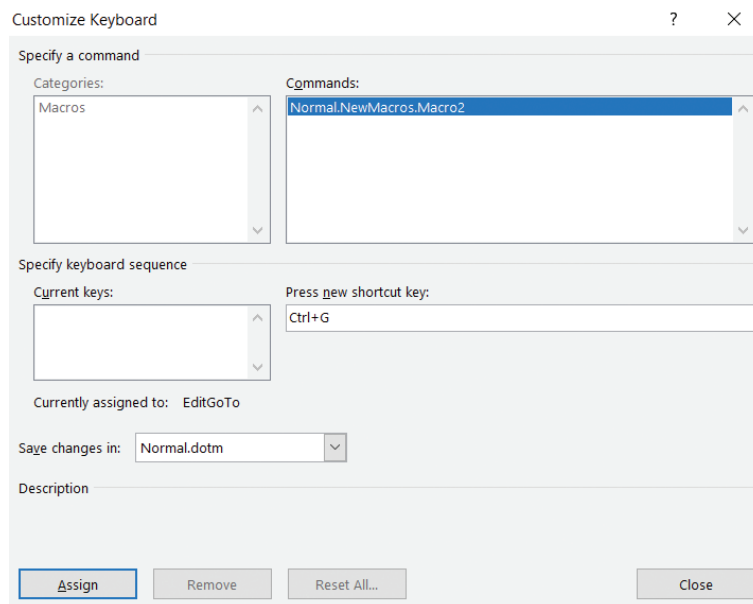


Fig. 11. Macros

After entering the keyboard shortcut, click on Assign and then on Close, followed by Record the macro and to finish the Stop Record button.

Edit created macros

If you want to view or edit already created macros, you must open the Macro window, which shows all created macros (Fig. 12).

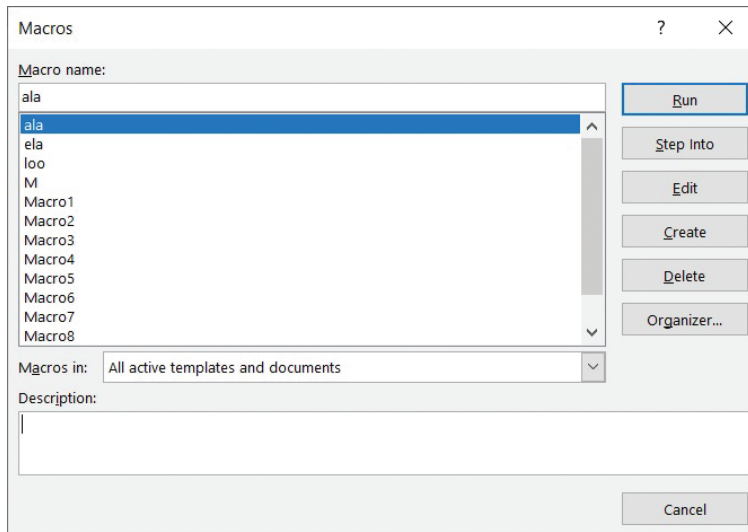


Fig. 12. Macros

From here you can view, delete, modify and run all created macros. You can open the Macros window from two places:

from the Developer menu and the Macros button (Fig. 13).

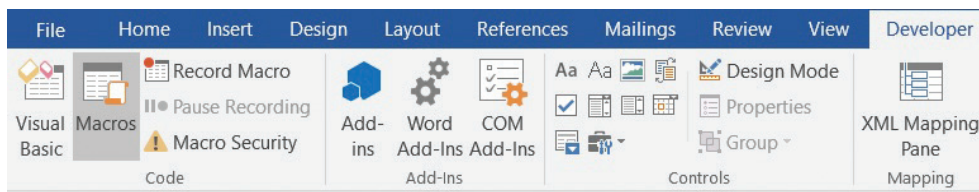


Fig. 13. Macros

from the View menu and the View Macros button (Fig. 14).

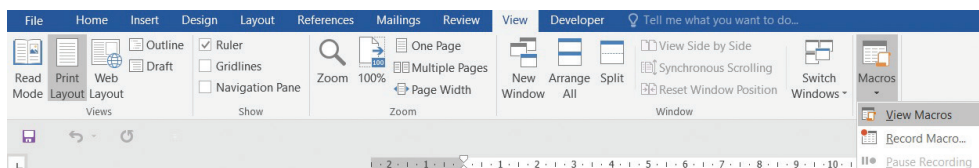


Fig. 14. Macros

Tasks:

1. Create a macro to start with Ctrl + T. The macro must insert a table 3x5 in the text document.
2. Create a macro that can be launched from a button. The macro must insert a 6x9 table in

7. FORM LETTER – CERTIFICATE

the text document.

Task:

Use your knowledge of a form document and template selection to create certificates for your computer science competition. You must first select a suitable template (Fig. 1).

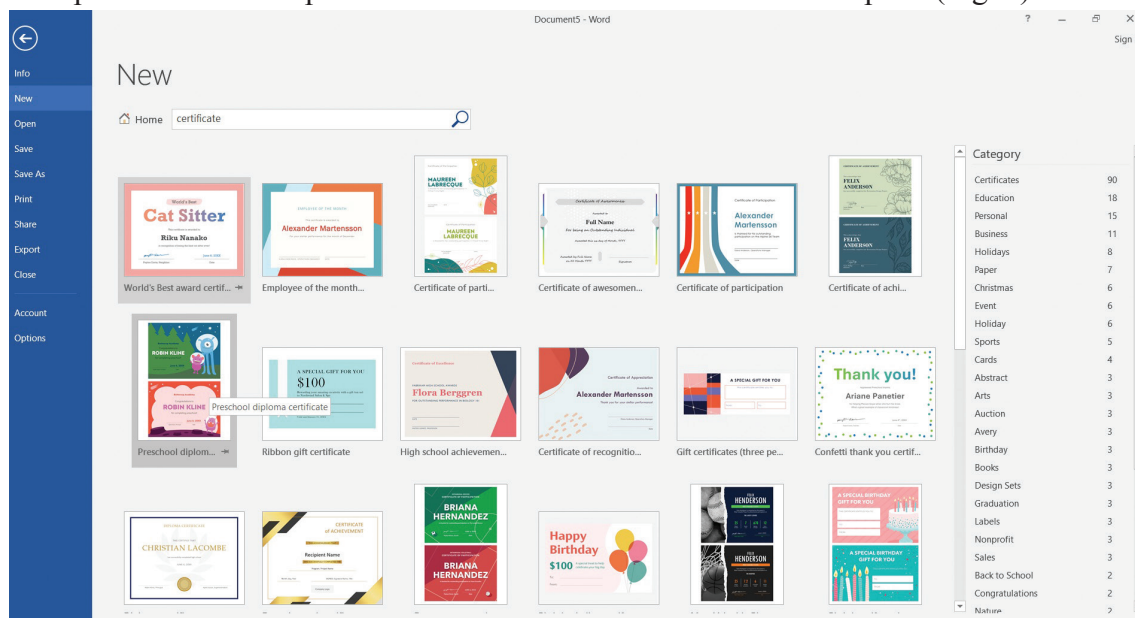


Fig. 1. Certificates

The information about the participants that must be included in the certificate for each student is shown in the table in Fig. 2.

Name	Age group	Place	School	City
A. Ivanov	8 - 9 class	I	"Georgi Sava Rakovski"	Varna
K. Rasheva	8 - 9 class	II	"Akademik Boyan Petkanchin"	Kavarna
G. Georgiev	8 - 9 class	III	"Shandor Petyofi"	Varna
E. Lilova	10 - 11 class	I	"Sveti Kliment Ohridski"	Dobrich
L. Palova	10 - 11 class	II	"Vasil Levski"	Kavarna
A. Yaneva	10 - 11 class	III	"Nikola Yonkov Vaptsarov"	Dobrich
V. Ilieva	12 class	I	"Sv. Ivan Rilski"	Varna
G. Kasparyan	12 class	II	"Hristo Smirnenski"	Varna
K. Iliev	12 class	III	"Sv.Paisiy Hilendarski"	Dobrich
G. Popov	7 class	I	"Georgi Sava Rakovski"	Kavarna
D. Kisyova	7 class	II	"Akademik Boyan Petkanchin"	Varna
B. Hasan	7 class	III	"Shandor Petyofi"	Varna

Fig. 2. Certificates

The next steps are like those for creating a form letter. You put the necessary information in the right place and then generate the ready-made certificates (Fig. 3).



Fig. 3. Certificates

8. FORM LETTER – CREATE A BUSINESS CARD

Task

In previous lessons, you have learned how to create a circular document and select a suitable template. Use this knowledge to prepare the business cards of Izgrev real estate agency. You must first select a suitable template (Fig. 1).

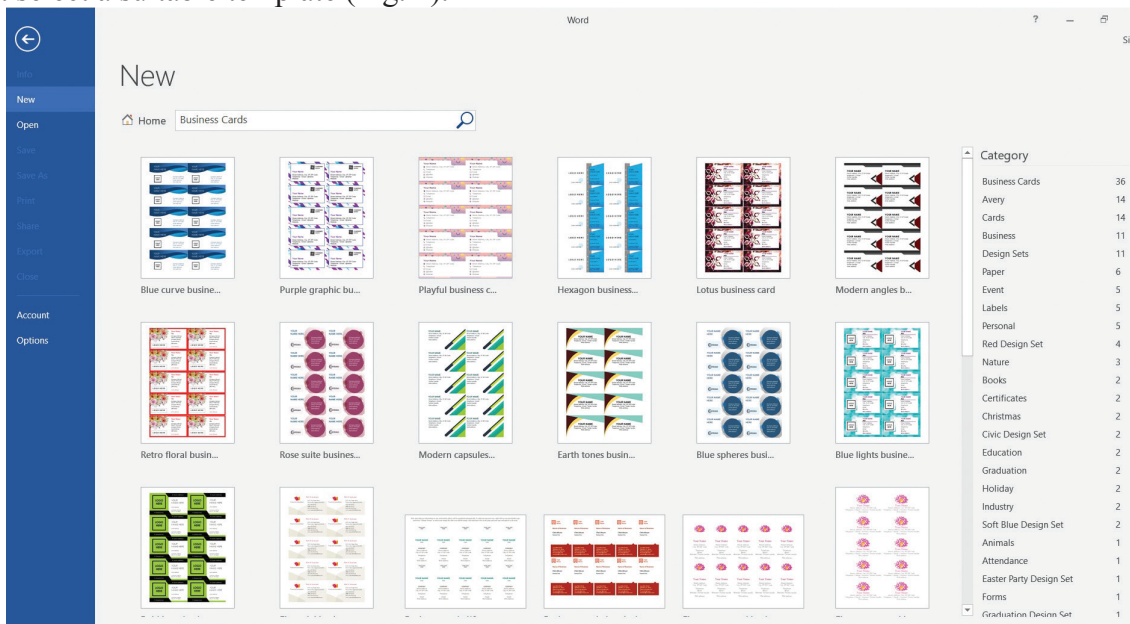


Fig. 1

The information about the employees of the company, which should be included in the business card of each one, is shown in the table in Fig. 2.

Name	Position	Email	Telephone
A. Ivanov	CEO	A. Ivanov@sunrise.com	0877562540
K. Rasheva	Regional director	K. Rasheva@sunrise.com	0877562541
G. Georgiev	Regional manager	G. Georgiev@sunrise.com	0877562542
E. Lilova	Finance manager	E. Lilova@sunrise.com	0877562543
L. Palova	IT Manager	L. Palova@sunrise.com	0877562544
A. Yaneva	Sales broker	A. Yaneva@sunrise.com	0877562545
V. Ilieva	Sales broker	V. Ilieva@sunrise.com	0877562546
G. Kasparyan	Sales broker	G. Kasparyan@sunrise.com	0877562547
K. Iliev	Sales broker	K. Iliev@sunrise.com	0877562548
G. Popov	Rental broker	G. Popov@sunrise.com	0877562549
D. Kisyova	Rental broker	D. Kisyova@sunrise.com	0877562550
B. Hasan	Rental broker	B. Hasan@sunrise.com	0877562551
Z. Ali	Rental broker	Z. Ali@sunrise.com	0877562552

Fig. 2

Once you have selected the appropriate template, you need to make the field size settings. Exemplary dimensions can be found in Fig. 3.

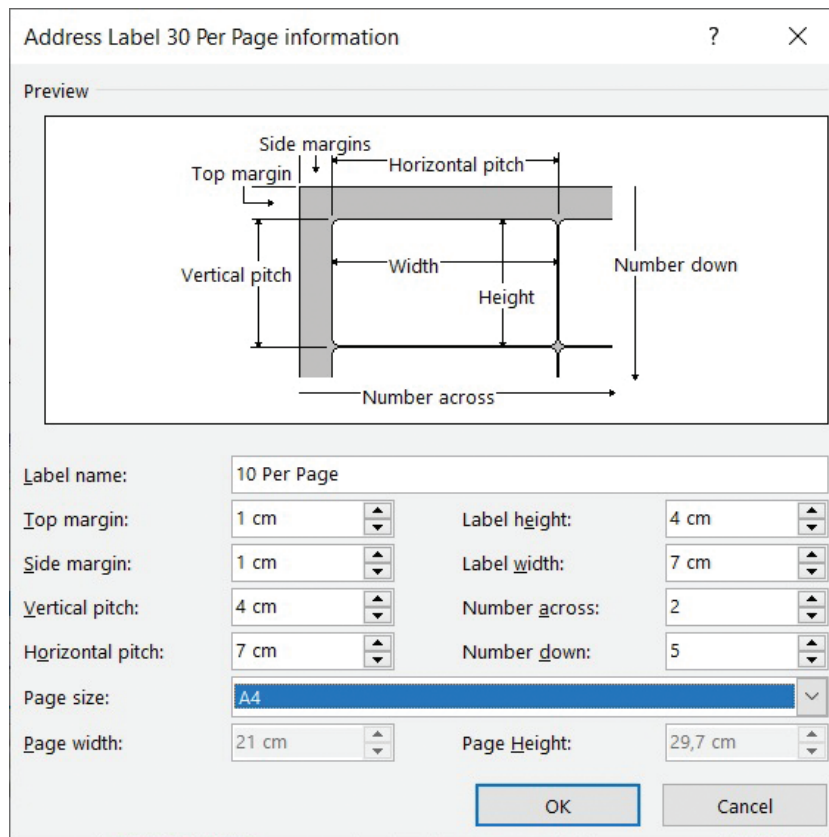


Fig. 3

In order to be able to set the exact dimensions from the menu **Mailings**, select the button **Start Mail Merge** and the option **Labels** (Fig. 4).

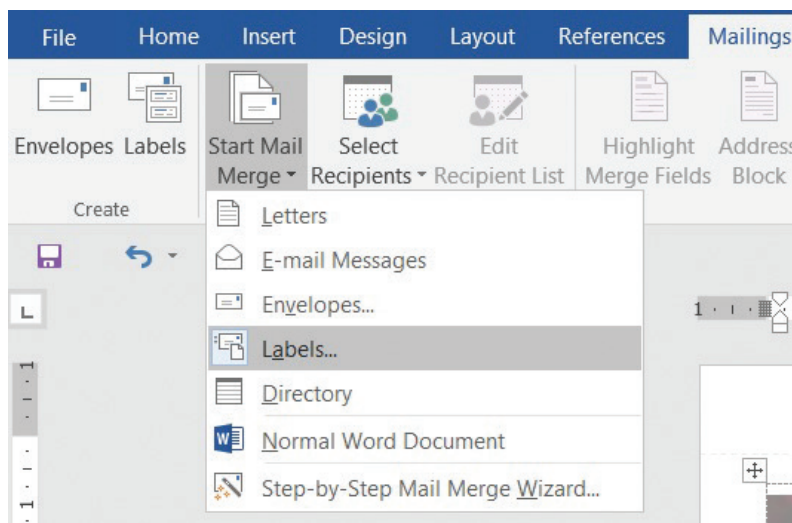


Fig. 4

After selecting the dimensions, dotted fields with that size appear on your template. Using the mouse, you can move and place them more precisely on the business cards you will create (Fig. 5).

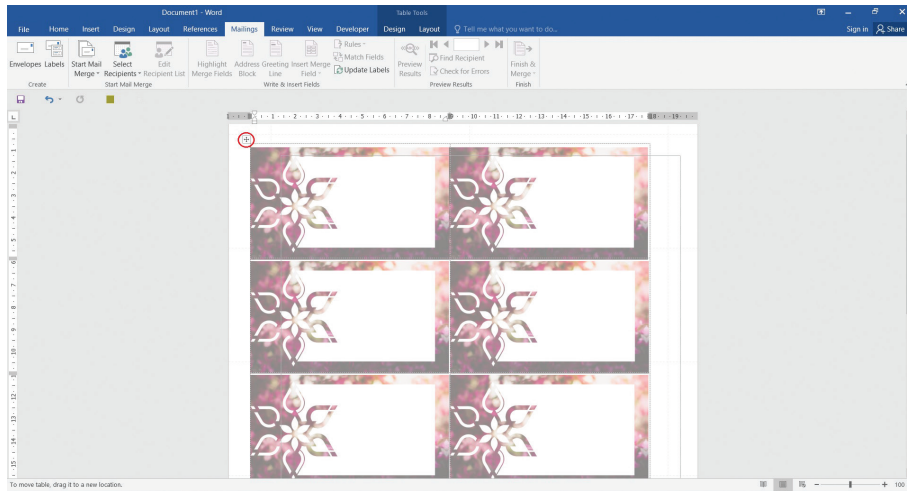


Fig. 5

The next steps are similar to those for creating a Form letter. Put the necessary information in the right place and then generate the finished business cards.

III. TROUBLESHOOTING AND SAFETY

9. TROUBLESHOOTING AND SAFETY

Basic types of problems

The modern world is increasingly tied to digital technologies. We use computers in most of our daily lives, thus facing various technical problems: hardware and software.

The most common hardware problems:

- CPU problems.
- memory problems.
- video card problems.
- problems with peripherals.
- problems with network devices.
- reduced performance of the computer system.

Most common software problems:

- operating system problems.
- problems related to the operation of a specific program.

Task 1: Check what operating system you are using and search the internet for its minimum and recommended requirements.

Device Manager

The easiest way to manage the devices on your computer is through the built-in Windows device management module called **Device Manager**. It shows the devices installed on the computer and the resources allocated to them. With it you can:

- view what devices are installed on your computer and change hardware settings.
- stop certain devices.
- remove, change, or update installed drivers for a device.
- turn off, turn on, and uninstall devices.
- to troubleshoot problems with devices.

You must be logged on as an administrator to use most features in Device Manager.

There are several ways to start Device Manager (Fig. 1):

- the Start / Windows System / Control Panel menu.
- Right-click on the Start menu and select Device Manager.
- click on the Start menu, then select Run ... and in the dialog that will appear type “devmgmt.msc”.

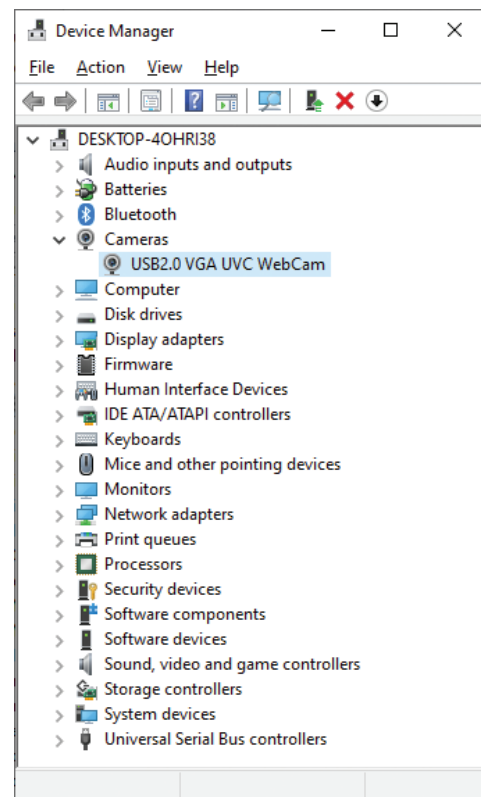


Fig. 1. Problems

- Right-click on My Computer / Manage / Device Manager.
- Right-click on My Computer / Manage / Device Manager.
- click on the Start menu and select Settings/Device.
- type the following command at the command prompt (click on the Start/Run – cmd menu): start devmgmt.msc.

Depending on where you start it from, the window may or may not be divided into two parts. To see the characteristics of a device, select the device type and then select the specific device (or right-click Properties). A dialog box opens (Fig. 2):

- The General section (Fig. 2) contains general information about the device. The Device status field describes the status of the device. For a normally functioning device, the status in the Device status field must be: “**This device is working properly**”. If there is a problem, an error code is displayed. More information can be obtained by entering the code in a search engine (Google).
- The Driver tab (Fig. 3) contains information about the drivers of the selected device (Driver Details), Update, Disable, Uninstall.

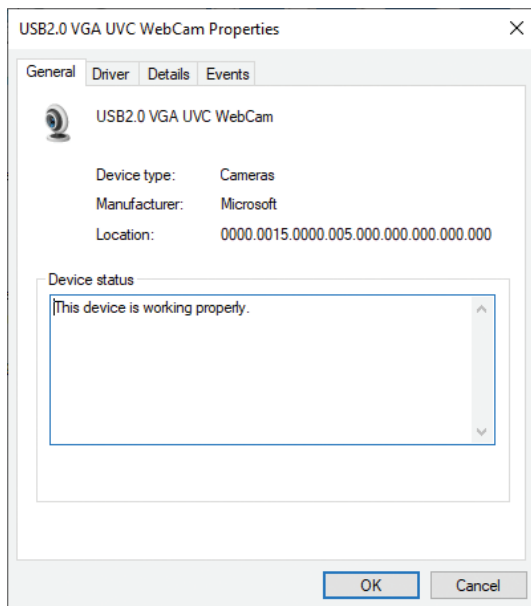


Fig. 2. Problems

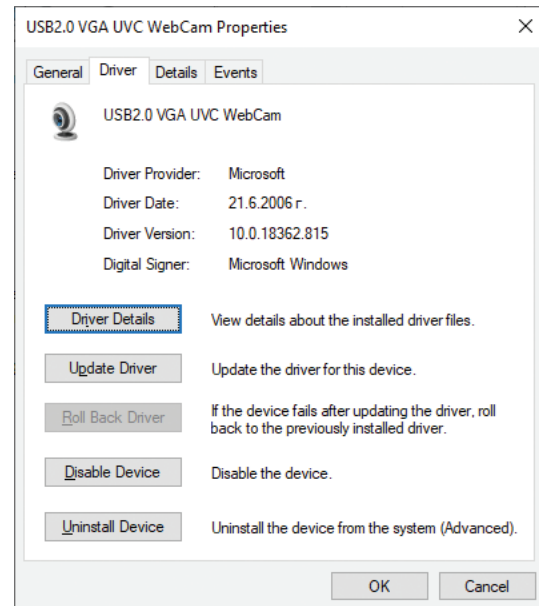


Fig. 3. Problems

Task 2: View the hardware devices on your computer and their settings (via Device Manager).

Task 3: Uninstall a hardware device from your computer.

- Start Device Manager - right-click on the Start menu and select Device Manager (Fig. 1).
- Select the device you want to uninstall and in the Driver section select Uninstall Device. Dialog box opens (Fig. 4).

On some devices, the computer needs to be restarted to perform the uninstall process.

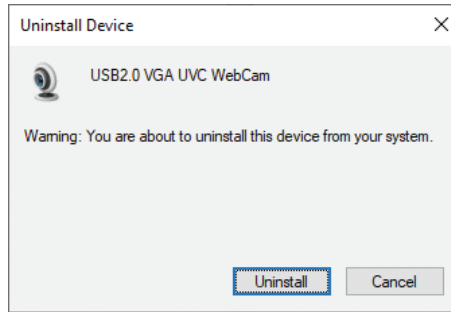


Fig. 4. Problems

Hardware Problems	Solution
Problems caused by hardware failure	Removing damaged components
Removing external media from the device during operation – USB, CD / DVD, etc.	Restart the operating system
General electrical interference	Hardware checking and / or restarting the operating system
Installing a new device (RAM, HDD, etc.) incomparable with the hardware	Hardware checking. Remove the device causing the error.
In case of touchpad problems	Settings-> Devices-> see if it is not turned off by software or to reinstall / update the touchpad drivers.
In case of a mouse problem	For example, a wireless mouse that freezes may require a change of the battery, while a wired mouse that freezes may need to be repaired or replaced.
In case of problems with the WiFi network	check that the network card drivers are updated to the latest version. This is done in Control Panel> Device Manager> Network Adapters
In case of camcorder problems	Check the camcorder drivers in Control Panel> Device Manager> Imaging Devices.

Task Manager

Task Manager is a popular Windows tool used to monitor and manage running processes and services. Task Manager can be used for various purposes:

forced shutdown of processes, checking the consumption of hardware resources by a process, monitoring the use of resources for the system as a whole, enabling or disabling startup programs, etc.

Starting Task Manager:

- by right-clicking on the Start menu and selecting Task Manager.
- by right-clicking on the taskbar and selecting Task Manager.
- With a keyboard shortcut from Ctrl + Alt + Del and selecting the Task Manager option.
- with the keyboard shortcut Ctrl + Shift + Esc.

A dialog box opens (Fig. 5). When selecting More details, a window of Fig. 6 appears:

- The Processes section (Fig. 6) shows all opened programs (Apps) and all processes currently running on the computer (Background processes, Windows processes). Provides information about the system resources consumed by each process - processor, RAM, disk, network, graphics processor, etc. By left-clicking on the title bar of a column, you can sort the processes in ascending or descending order. For example, if your system is too slow, you can check that an application (process) consumes more resources than normal, or sort at the top the processes that consume the most system memory, processor, etc. From here you can forcibly stop a process. This is done with the End Task button or the Delete key. This step is used in case a program is blocked and does not want to close in the usual way.
- In the Performance section (Fig. 7) you can see the total capacity of the system and what part of the resources (processor, hard disk, memory, network, graphics processor) are currently used.
- App history tab – Shows a history of how many resources are used by the current user account.
- Start-up tab – Shows all applications that start with Windows when you log on.

Task Manager is used to close a program that is not working properly or has been blocked. But when closed, data that is not saved is lost.

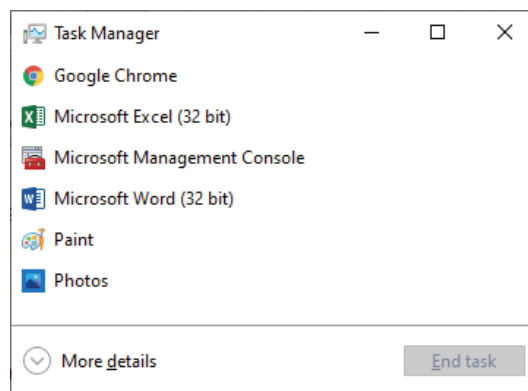


Fig. 5. Problems

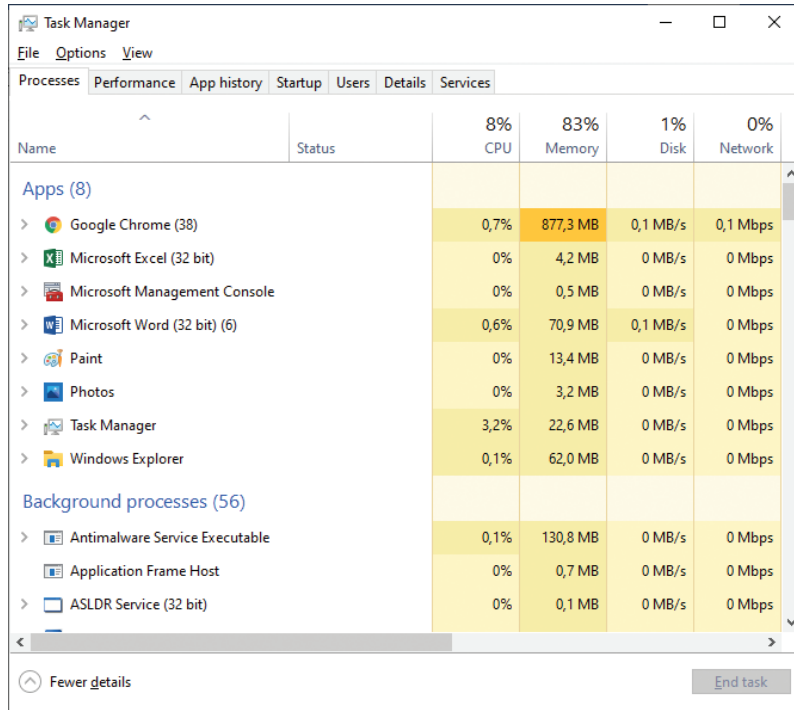


Fig. 6. Problems

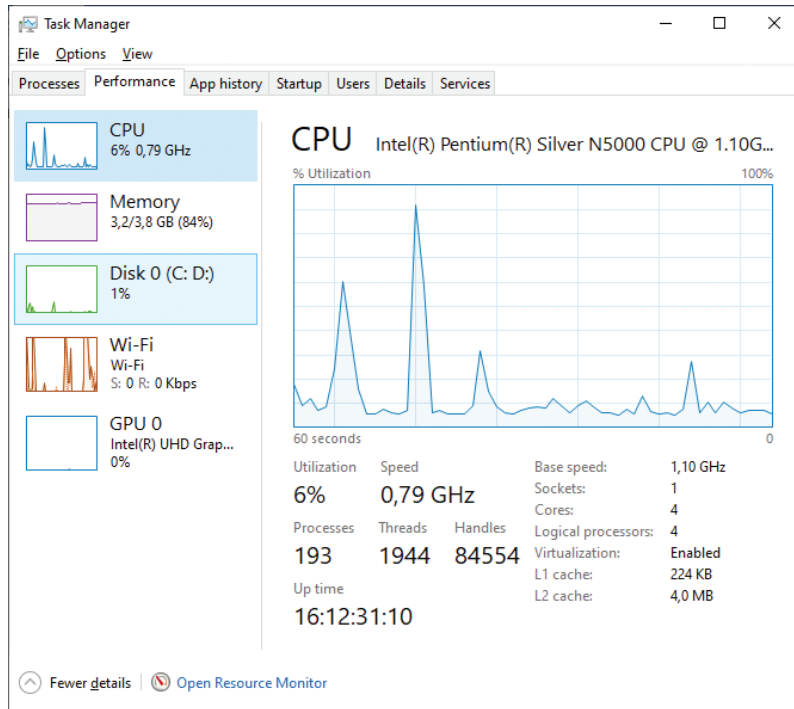


Fig. 7. Problems

Software problems	Solution
Internal to the operating system	Reinstall the operating system
Caused by a program	Restart and uninstall a program
Caused by a conflict between the driver and the operating system	Driver update
Caused by lack of resources (RAM)	Stopping redundant programs and processes
Minimize all programs with one click	You have to press Microsoft button + D at the same time and so all programs will be minimized.

Task 4: Open the Task Manager on your computer and view CPU, memory, and network traffic.

Task 5: Use Task Manager to stop a program that you have started.

- Open the task manager - by right-clicking on the Start menu and selecting Task Manager.
- In the Processes tab, select the desired program.
- Select the End Task button.

Lack of sufficient free disk space on the system partition.

The operating system needs some free disk space on the main partition where it is installed to function properly. Reducing it below the critical size slows down the system and generates a Low Disk Space error. In this case, you need to clean the system partition.

Task 6: Open This PC (for Windows 10) and determine the system partition of the device. Right-click on it, select the Properties option, then the Disk Cleanup button. In the next window, click the Clean up system files button. Wait for the operation to complete. Comment on the bookmarks that can be selected when opening individual windows.

Questions and tasks:

1. What are the main hardware and software problems that occur when using a computer?
2. How to uninstall a hardware device?
3. How does a task manager terminate a program?
4. Check the hardware device drivers on your computer: update with a new version, uninstall.
5. Suggest solutions to the following problems:
6. When working with a specific program, it does not work properly.
7. A specific hardware device is not working properly on your computer.
8. When a flash drive is inserted, it does not appear in the list of disks.

Curious:

If you work on a network, network security settings may restrict access to some features in Device Manager.

10. SOLVING PRACTICAL AND THEORETICAL PROBLEMS THROUGH DATA ANALYSIS (EXERCISE)

Task 1: The Alphabet Book Exchange prepares a daily report on the books sold. For this purpose, fill in the table in the sheet “**Alphabet**” from the file **Sales.xlsx** (Fig.1):

								Discount
								Bulgarian authors
								Foreign authors
Sales reference								
Order	Title	Author	Origin	Cover price (in lv)	Discount (in lv)	Available quantity (per copy)	Requested quantity (per copy)	Residual
12	c	c	foreign	4	3	10	3	
2	a	d	Bulgarian	5	4	23	2	
3	b	r	foreign	6	5	2	1	

Fig. 1. Exercise

- The numbers are filled with consecutive numbers.
- Enter at least 10 titles of books and their authors, including Bulgarian and foreign authors. Enter a cover price.
- The origin must be selected from a drop-down list (**Data / Data Validation**).
- The discounted price depends on the origin of the book. In case the book is Bulgarian, it is calculated according to the formula:

Cover price * (1 – Discount for Bulgarian authors)

If the book is foreign, then the discounted price is calculated by the formula:

Cover price * (1 – Discount for foreign authors)

The percentage of the discount for Bulgarian and foreign authors is in boxes I2 and I3, respectively.

- Enter the available and requested quantity.
- The residue is calculated by the formula:

Quantity available - Requested quantity

- In cell I5, use the appropriate function to display the current date.

1. Develop the table from the sheet “**alphabet**”. The values in the columns cover price, discounted price to be displayed with two characters after the decimal separator. Present the values in the columns **available** and **requested quantity** and **the remainder** as an integer.

2. Copy **the Alphabet** sheet and name it **Summary**. In it, display the average amount of the available and ordered quantity. Summarize the data by origin and, within the origin, by cover price. Show only summary rows.

***Directions:** First we sort, then we summarize by what we have already sorted. The sort order matches the summary order.*

3. Add a new sheet named **Advanced Filter**. Generate a reference for books of foreign origin and with a balance of less than 10 and more than 100 copies.

Directions: When the criteria are located on one line they are connected with the logical "and", and when they are on different lines – with "or".

4. Add a new sheet named **Pivot**. Create a Pivot Table that displays the total cover price, the discounted price and the minimum quantity ordered by origin and title. Numeric values should be displayed with two characters after the decimal separator.

5. With Pivot graphics in a new sheet called "**diagram**" present the rest of the books by origin - Bulgarian and foreign.

Questions and tasks:

1. Create a list of your class. It must include class number, name, average grade from the past school year, scholarship. As it is in the column Scholarship 'yes' or 'no' will be written depending on the entered value of average success. If it is over 5.5 write 'yes', otherwise – 'no'.
2. Prepare a report for the students who will receive a scholarship. The report can be prepared in three ways: via Subtotal, Filter and Pivot.
3. With the Pivot chart in a new sheet called a "chart" present the ratio between students who take a scholarship and those who do not.
4. With the Pivot chart in a new sheet called a "chart 1" present the percentage ratio between students who take a scholarship and those who do not.

11. DATA ANALYSIS AND DATA PROCESSING WITH MS EXCEL

Let's remember - Data analysis with MS Excel includes:

- Sorting - arranging data from a specific column in the desired sequence.
- Filtering - provides the ability to see only part of the data that meets certain conditions (criteria) pre-set by the user, and the rest of the data is temporarily hidden.
- Preparing reports.
- Summary - provides the ability to automatically summarize the values of one or more fields for each value of another field, using the function - Sum, Min, Max, Average, Count and others. For the summarization to be correct, the data must be sorted by the summarization field and the summarization must be performed on the same field.
- Comparison, calculations, etc.

The analysis can be performed using Pivot Tables. Pivot tables are dynamic tables that allow the user to summarize data in one or more fields and present it differently. They are used to compare and analyze huge amounts of data. Data can be sorted and filtered. Data cannot be entered or modified in the summary table. If changes are required, they are made in the data source table.

Task 1: Create a pivot table to illustrate how many kcal, protein, fat and carbohydrates are contained in 100 g of a product. The products should be divided into categories. Use the **Health.xlsx** spreadsheet.

Creating a Pivot Table:

1. Select a cell from the table (list).
2. Select the **Pivot Table** button from the **Insert** menu, from the **Tables** panel (Fig. 1).

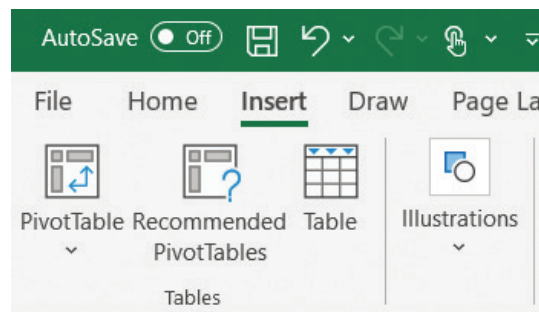


Fig. 1. Analiz

3. The **Create Pivot Table** dialog box opens (Fig. 2). The following must be determined:
 - Data source - If we are positioned in a cell of the table before inserting the Pivot Table, the whole table is automatically marked, otherwise - we select the whole table.
 - Pivot Table location:
 - ☞ On a new worksheet.
 - ☞ On an existing worksheet with the ability to select a cell from which to display the Pivot table.
4. The structure of Pivot Table - Pivot Table Field opens (Fig. 3). There are two panels:
 - Panel with names of the headers from the original table (list).
 - A panel with four sections to create a Pivot Table. The formation of the table is done by

dragging with the mouse the headers to the corresponding section.

How do we determine where to place each header? - The data we put in **Rows** and **Columns** are interchangeable. We comply only with the Pivot Table itself – to be longer than wide. It is possible to place more than one header in Row and not in Column. We put the calculated values in Values. The **Sum** function is automatically applied.

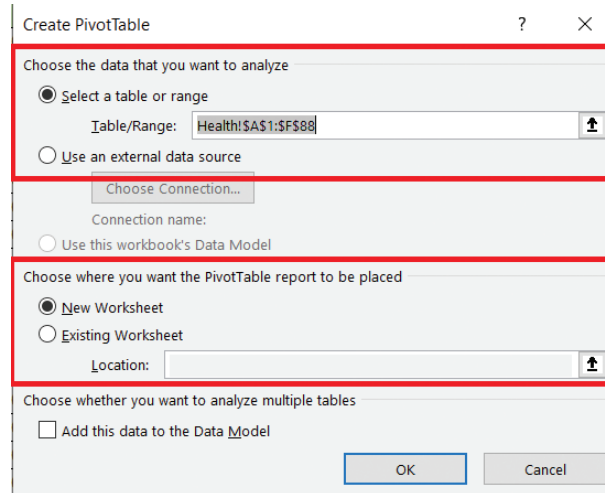


Fig. 2. Analiz

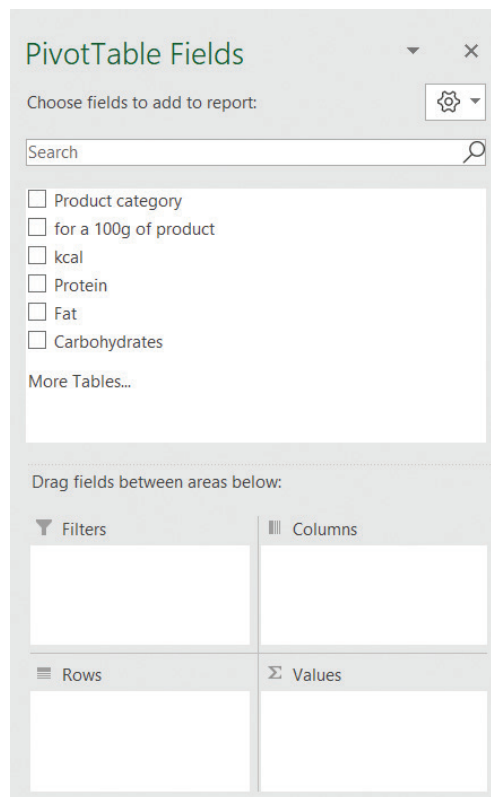


Fig. 3. Analiz

Graphically Pivot Table is presented in Fig. 4. and the completed table in FIG. 5. As the table is very large, it is good to present the information by categories (choosing the minus sign in front of each category).

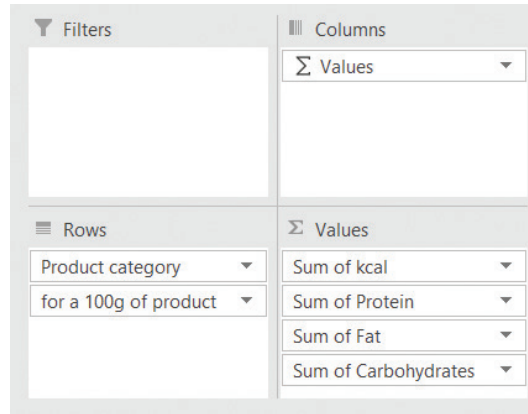


Fig. 4. Analiz

Row Labels	Sum of kcal	Sum of Protein	Sum of Fat	Sum of Carbohydrates
⊕ dairy products	657	53,18	46,18	3,68
⊖ fish and seafood	2110	338,24	66,63	0
Black mussels (raw)	74	12,77	0,97	0
Carp (raw)	127	17,83	5,6	0
Catfish (raw)	95	16,38	2,82	0
Cod (raw)	82	17,81	0,67	0
Green-lipped mussel (raw)	71	11,63	1,03	0
Lefer (raw)	124	20,04	4,24	0
Lobster	110	18,03	4,2	0
Mackerel (raw)	206	18,6	13,89	0
Molluscs and snails (raw)	90	16,1	1,4	0
Octopus (raw)	82	14,91	1,04	0
Oysters (raw)	81	9,45	2,3	0
Perch (raw)	94	18,62	1,63	0
Pike (raw)	105	16,14	4,04	0
Salmon (raw)	119	20	5	0
Sepia (raw)	79	16,24	0,7	0
Shark (raw)	130	20,98	4,51	0
Shrimp (raw)	106	20,31	1,73	0
Squid (raw)	92	15,58	1,3	0
Trout (raw)	148	20,77	6,61	0
Turbot (raw)	95	16,05	2,95	0
⊕ fruits	1177	18,2	5,94	294,01
⊕ meat products	2306	316,7	669,68	0
⊕ vegetables	806	49,24	8,76	211,93
Grand Total	7056	775,56	797,19	509,62

Fig. 5. Analiz

It is possible to change the summary function. From the drop-down list of the field selected in the Values area, select Value Field Settings ... (Fig. 6) and the Value Field Settings dialog box opens (Fig. 7). In the Custom Name field, the name itself is preceded by Sum of, which can be replaced with an appropriate title.

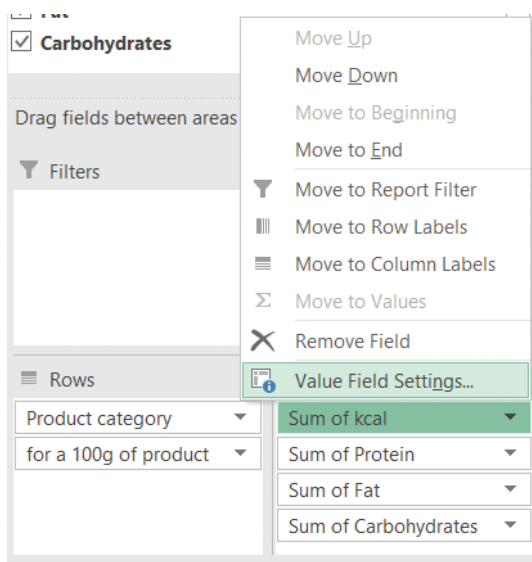


Fig. 6. Analiz

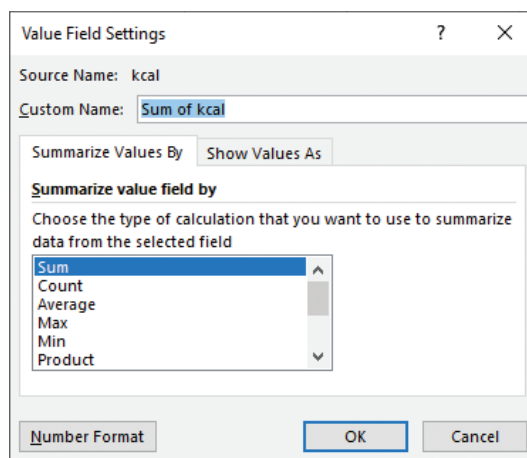


Fig. 7. Analiz

Update data in the Pivot Table

When working with Pivot Tables, an additional Pivot Table Tools menu opens with two submenus Analyze and Design (Fig. 9).

When you change the data in the base table, the data in the summary table does not change automatically. To update the data, select a cell from the Pivot Table and the Refresh button from the Pivot Table Tools / Analyze menu from the Data panel (Fig. 8). If more rows are added to the main table to be reflected in the Pivot Table, Change Data Source is selected (Fig. 8).

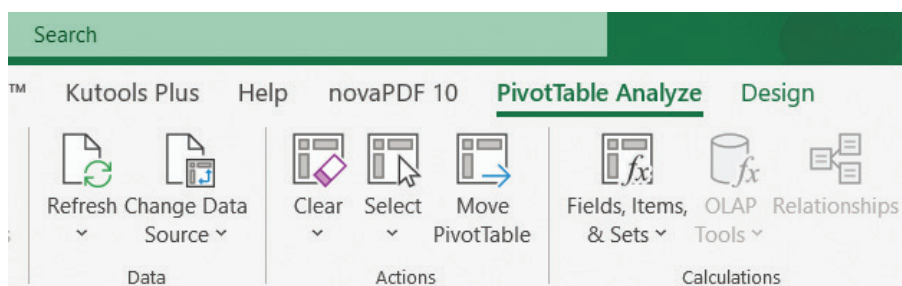


Fig. 8. Analiz

Task 2: Using the already created Pivot Table from Task 1:

- Enable filtering by product category - move product category from Rows field to Filters field.
- Analyze data for fruit category - by filtering (from the arrow in the header All).
- Analyze dairy category data - kcal, fats and carbohydrates - We remove proteins from field Values by dragging.
- Sort alphabetically (from the arrow in the Row Labels header).
- Change the category of dairy products to eggs - the change is made in the main table and follows update (Refresh).
- Add information about dairy products. It is in the same file on page More. (The information is copied and updated via Change Data Source).

Pivot Table Design

The Pivot Table is formatted from the Pivot Table Styles panel of the Design menu of the additionally open Pivot Table Tools menu (Fig. 9).

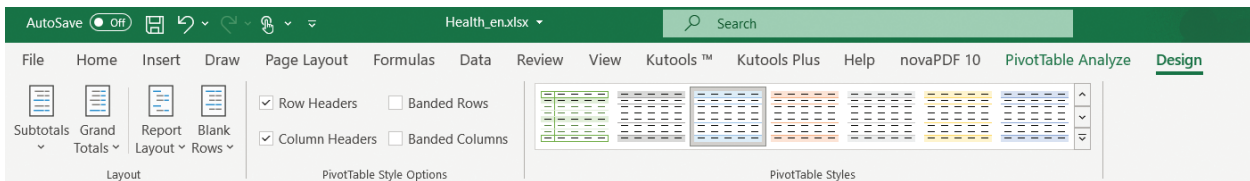


Fig. 9. Analiz

Additional settings of the Pivot Table are set from the layout panel of the Design menu (Fig. 10):

- Visualization of partial summaries of the data by groups (Subtotal button) - whether to have them, whether to be above or below the respective group.
- Final summaries of data by rows and columns (Grand Totals).
- Preview of the summary table view (Report Layout).

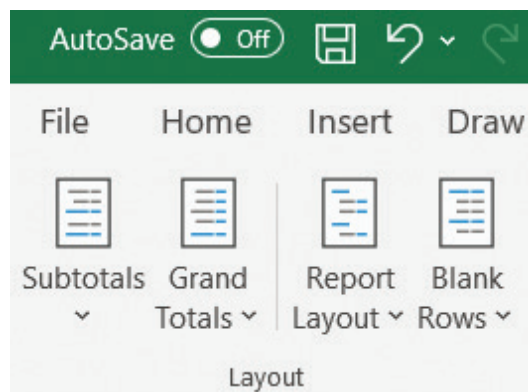


Fig. 10. Analiz

Creating a Pivot Chart

1. Select a cell from the summary table.
2. Selecting the **Pivot Chart button from the Analyze menu (Pivot Table Tools menu) from the Tools panel** (Fig. 11) opens the Insert Chart dialog box. Select the desired chart type.

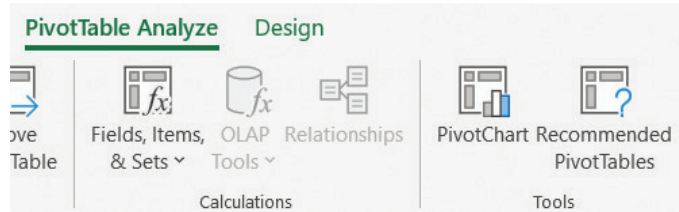


Fig. 11. Analyz

Task 3: Create a pivot diagram using the pivot table from problem 2.1. Filter to view data for fish and seafood category only (Fig. 12)

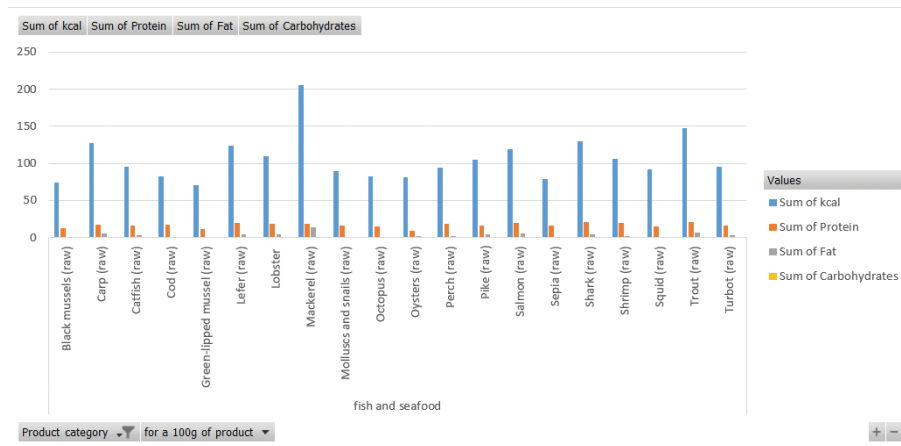


Fig. 12. Analyz

Questions and Tasks:

1. Open the file **Min_Wage.xlsx** and create a summary table (Fig. 13), which will display the minimum wage by country and year and allow filtering by continent.
2. Sort countries alphabetically.
3. Directions: Germany is at the top - The available spaces before the first character are also considered when sorting – they must be deleted.
4. Add information about five more countries. It is in the same file on page **More**. Update Pivot Table.
5. Format the table.
6. Filter by continent.
7. Create a pivot diagram to visualize the average minimum wage by continent and year (Fig. 14).

Continent	(All)					
Sum of Minimal wage	Column Labels					
Row Labels	2017	2018	2019	2020	2021	Grand Total
Germany	1414,4	254	1584	1584	1610	6446,4
Belgium	1531,93	2430	1593,81	1594	1626	8775,74
Bulgaria	235,62	259	311,89	312	332	1450,51
Estonia	470	1141	584	584	584	3363
France	1480,27	2342	1539,42	1539	1555	8455,69
Greece	586,08	1306	758	758	758	4166,08
Ireland	1480	2908	1656,2	1656	1724	9424,2
Latvia	380	709	430	430	500	2449
Lithuania	380	722	607	607	642	2958
Luxembourg	1998,59	3495	2141,99	2142	2202	11979,58
Malta	1697,6	1545	771	777	785	5575,6
Netherlands	1551,6	2989	1635,6	1654	1685	9515,2
Poland	454,52	793	610,73	611	614	3083,25
Portugal	557	1122	740,83	741	776	3936,83
Romania	321,17	490	466,23	466	472	2215,4
Slovakia	435	770	580	580	623	2988
Slovenia	804,96	1080	940,58	1019	1110	4954,54
Spain	707,6	1767	1050	1108	1108	5740,6
Grand Total	16486,34	26122	18001,28	18162	18706	97477,62

Fig. 13. Analiz

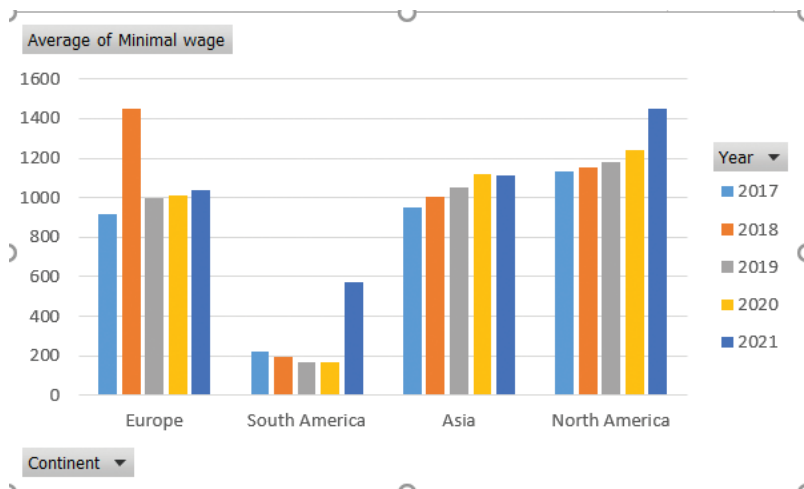


Fig. 14. Analiz

12. TECHNICAL AND ORGANIZATIONAL SECURITY WHEN WORKING IN A DIGITAL ENVIRONMENT

1. Electronic identity

A person's identity is a set of characteristics that allows them to be unambiguously identified and distinguished from others. The identity of a person is certified by the state. There are different procedures in different countries, but when a person is born they receive a birth certificate in which their names are entered, an individual number (not always) and these data are entered in a common database. On this basis, various identification documents are issued – ID card, passport, driver's license and more.

Why is this important? In today's civilized world, it is especially important to be able to distinguish one person from another. The driver's license, for example, certifies that we have just taken the exam and know how to drive a car. The notary deed certifies that the owner of a property is Ivan Ivanov, and the ID card certifies that this is exactly Ivan Ivanov – the owner of the property.

In order to travel, for example, we also need identification to prove that we have the right to travel in the respective country.

Other examples may be the fight against crime, taking a bank loan, starting a job and more.

Our “offline” identity is important, but so is our “online identity” – a way to prove who you are on the Internet. When a person performs legally significant actions, or when communicating with the state in order to obtain services, data or certificates, the service provider must be able to prove whom he is “dealing” with. Here comes the “electronic identification” process, which was recently defined in an EU regulation, and which in most cases means owning an issued by the state hardware that only the owner knows how to “unlock”.

Like anything, identity can be stolen or falsified, and this is called “identity theft”.

An example is the use of somebody else's identity document. In other cases, someone can forge an identity document by making it contain what they need, which can lead to very bad consequences for unsuspecting citizens. However, governments and experts are trying to fight against this problem.

2. Electronic signature

An electronic signature is a requisite of an electronic document intended for its protection against forgery. It is issued by a certification body and contains the name of the holder, serial number, date of validity and a copy of the public key. Electronic signatures can be verified in special registers. Electronic signatures are used in the distribution of software, in financial transactions and everywhere else where important information is exchanged electronically. This is very important in order to detect in time any falsification or attempted falsification.

A qualified electronic signature has the meaning of a handwritten signature. It ensures the authenticity of the signed electronic documents. The signed document remains signed regardless of whether you store it on magnetic, optical or other media, whether you send it by e-mail or access it via the Internet.

The affixing of an electronic signature means that:

- you identify yourself as the author of an electronic document.
- you agree with the contents of the document.
- the document is protected from subsequent changes.

“Qualified electronic signature” means an advanced electronic signature which is created by a qualified electronic signature creation device and which is based on a qualified certificate for electronic signatures.

“Qualified electronic signature certificate” means an electronic signature certificate issued by a qualified certification service provider.

The certificate for qualified electronic signature contains information about the signatory (a Holder) and the legal entity with which it is associated, such as:

- Names (of a company or an organization).
- PIN (or personal number of a foreigner).
- Unique Identification Code - UIC (The holder is associated with a legal entity).
- Address.
- Other data.

3. Biometric data

Biometrics combines methods for uniquely recognizing people based on their inherent physical or behavioral traits. In information technology, biometrics is used to identify people as an access control. It is also used to identify individuals in groups that are under surveillance.

Biometric characteristics can be divided into two main groups:

- Physiological characteristics are related to the shape of the body. Examples of this are fingerprints, facial shape recognition, DNA, palm geometry, iris recognition (which largely replaces retinal scanning).
- Behavioral – these are characteristics related to human behavior. Examples of these are voice recognition, writing rhythm and gait.

The voice is strictly part of the physiological characteristics because each person has a different voice system, but voice recognition is based on the way a person speaks, which is classified as a behavioral characteristic.

- A feature can be used as biometric if it meets the following conditions:
- Versatility – each person has a given characteristic.
- Uniqueness – how well a characteristic separates individuals.
- Persistence – measures how well a given biometric characteristic behaves over time (whether there are changes with the aging of the individual, etc.).
- Collectability – how easy it is to measure.
- Workability – accuracy, speed and durability of the technology used.
- Acceptability – the extent to which the technology used is accepted.

Biometric systems operate in the following two modes:

- Verification – direct verification of whether the collected biometric data correspond to a template to determine whether the individual is the one for whom they present themselves. It is used in conjunction with a card, identification code or username (possibly a combination).
- Identification – compares the data collected for compliance in a database of biometric data to establish the identity of an unknown individual. The identification is performed when a complete match is found in the database.

13. THE IMPACT OF THE USE OF DIGITAL TECHNOLOGIES ON HEALTH AND THE ENVIRONMENT

The rapid development of the Internet and digital technologies (DT) in the 21st century has ushered in a new era in communication and access to information in modern society. Electronic devices in all their diversity – computers, tablets, laptops, smartphones, TVs, Playstations, etc., have become an integral part of our daily lives.

The intensification of digitalization has led to the formation of new concepts such as “digital worldview”, “digital environment”, “digital friendships”, which are very often present only in our “digital world”. New professions such as influencers, bloggers and others have emerged directly related to the development of social networks and digital technologies.

The state of emergency imposed in Bulgaria in March 2020 as a result of the Covid-19 pandemic strengthened digital dependence in conditions of social isolation. Compulsory distance learning for children in Bulgaria and forced work from home, the so-called “Home office” for their parents, will be more and more present after the end of the pandemic and the return of life to its normal course. However, the negative physiological and psychological effects of excessive screen exposure will inevitably affect the human body.

As good sides from the rapid development of technologies we can mention:

1. Better medicine - with advances in healthcare, pharmacology and molecular biology, we live longer. Modern medicine has effectively doubled the average life expectancy of a person for a little over a century.
2. Technical gadgets are improving health and fitness – with the development of the health technology revolution, it has become easier for people to access their health indicators using various smart devices. Fitness bands, smart watches and sensors and technologies with medical applications such as blood sugar monitors, health technologies are now widely accepted by many people who want to take personal responsibility for their health. For example, using a smart scale connected to an application allows you to track your weight loss goals and progress.

On the other hand, the damage is not small either.

1. Smartphones cause “musculoskeletal problems” – with the increased use of smartphones, tablets and laptops, more and more people visit their doctors with complaints of the musculoskeletal system.
2. Sleep deprivation and screen tension – there is evidence that our daily 'screen time' has many negative effects on our mental health, causing sleep disturbances, headaches and mood problems, including generalized anxiety disorder and depression. Looking at the screen for too long can exhaust our eyesight, blur our vision and dry our eyes. You may also experience tension in your head as another result of digital eye strain.
3. Sedentary lifestyle and mental health – when we are at home, we rarely have to move further from the TV to the bed. With the spread of mobile technology, there is already an application for everything. In addition to the obvious problems associated with a sedentary lifestyle, such as obesity and diabetes due to poor diet and lack of exercise, the effect of mental health should also be considered. It has never been easier to connect with someone, anywhere, at any time – but is the experience the same as a face-to-face conversation?

The negative effect of technology on the environment affects every living thing. Animals that are more vulnerable fall under this weight. Although there are other factors that contribute to the extinction of some different species, technology also plays a very important role.

Information and communication technologies (ICT) can be a favorable factor for the environment. ICTs are increasingly being used to address environmental challenges such as climate change. ICT systems achieve more sustainable consumption and production. They have the potential to influence consumer choice and behavior – less travel, remote work; change in driving style; rational use of energy through “smart technologies”.

On the other hand, the increasing use of ICTs leads to an increase in the energy used and thus they have a direct impact on the environment in terms of energy use, durability of materials and treatment of equipment after the end of its life.

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