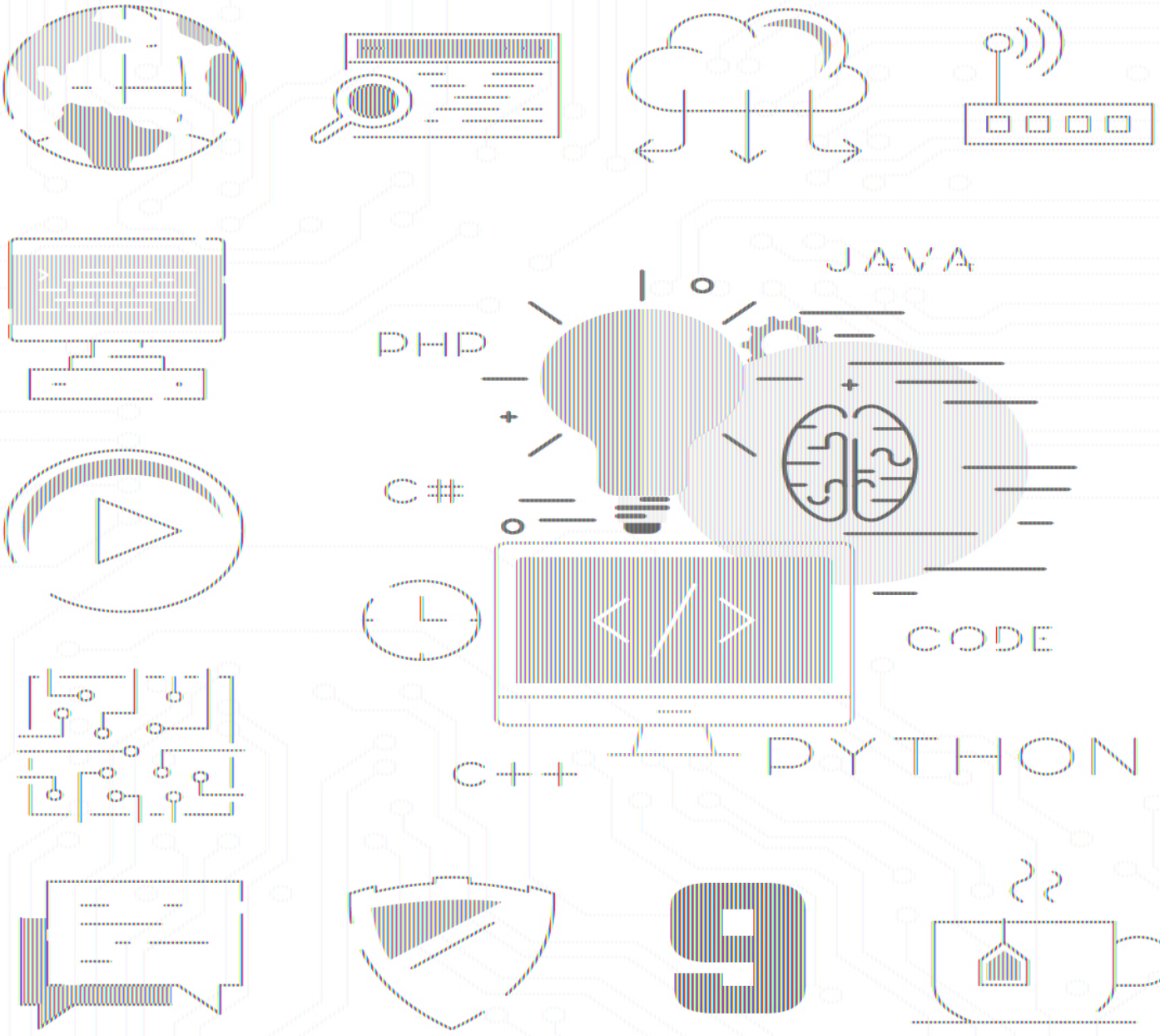
INFORMATICS

TEXTBOOK



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PREFACE

Natural science is an exciting and very useful subject. This textbook will show you all the beauty of it and will help you become true explorers. The main aim of this book is to answer the fundamental question: “What is science and what is its importance in our life?”

Starting from the first pages, you will realise that this textbook is completely different from any other usual textbook full of theoretical passages and formulas. Every chapter contains useful information, curious facts, tasks for individual and group work. You will also learn how to conduct research and experiments yourselves, search for information, make your own discoveries.

One more valuable feature of this textbook is the language. Every sentence has been carefully chosen so that it is not difficult for you to understand science in the English language. Each page contains translations of all the important terms, both in Kazakh and Russian. This textbook will not only help you improve your English, but it will also make you a part of a big international science community.

Please pay attention to the structure of this textbook. Remember: a textbook is no longer the only source of information in the modern world. With the help of carefully selected tasks, you are going to learn such important skills as critical thinking, problem solving, information analysis, creativity, imagination, teamwork, digital literacy etc.

If you have any questions, suggestions or ideas regarding the contents of this book, please feel free to contact us:

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Best regards,

team of authors, “Астана-кітап”

CHAPTER 1

COMPUTER LITERACY

1.1 NEGATIVE EFFECTS OF USING A COMPUTER FOR A LONG TIME

You will:

- Identify risks of using electronic devices for a long time.

How long do you spend using computer per day?

It is true that computers are useful in our life. Modern era requires everyone to be professional and technical. There are a lot of tasks that cannot be done without using a computer. However, there are also negative sides of using computers. In this lesson, you will learn some advice on how to reduce negative reactions of electronic devices.

Headache problem:

Nowadays, every third person suffers from headache. However, nobody tries to see the reason behind it. Did you ever notice how many hours you normally spend in front of a computer or a smartphone? Think about it. Using a computer for a long time affects the human brain and cause a headache.

Posture:

Sitting in front of computer for a long time and making less movements negatively affects our structure. It can also cause pains in our spines, hands and legs. Excessive use of computer also becomes the reason of body pain. It can be dangerous for you as body pain is the serious problem. Therefore try to avoid spending extra time on it.

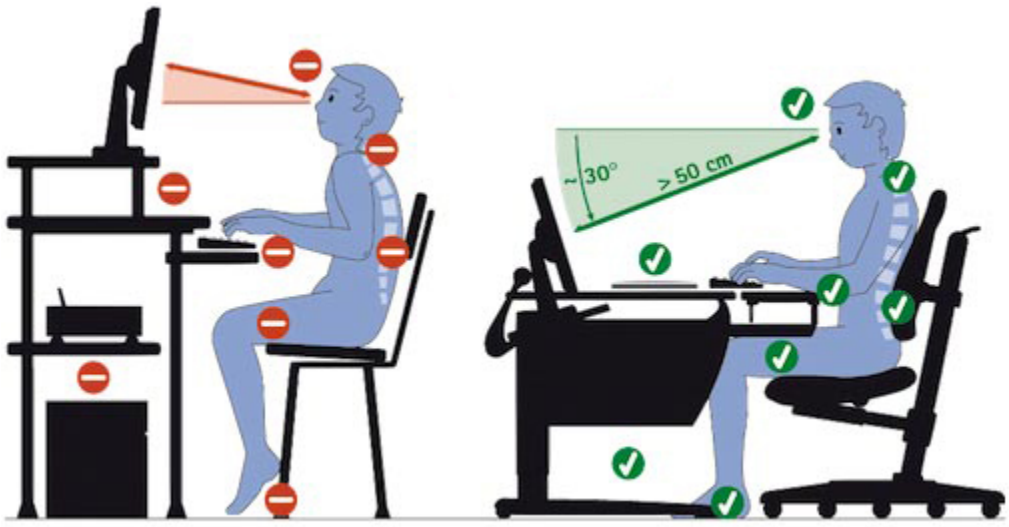
Cause Face Wrinkles:

Using computer for a long time affects our body appearance and facial beauty. Long usage of this machine can cause wrinkles on the face.

Dark circles:

Using computer for a long hours continuously becomes the reason of dark circles around your eyes. Basically, the heat of a computer affects human blood circulation that can cause serious health problems.

Correct and Incorrect postures:



Ways to Reduce the Negative Effects of Computers:

- If you are going to use a computer longer than an hour, you should have an LCD monitor. They do not put out radiation, and such a bright glare.
- Do not stare hard at the screen. Look away from the screen every ten to fi fteen minutes. Keeping your eyes on one spot is not good.
- Use eye drops in your eyes. If your eyes are sensitive you may want to put eye drops in every hour.
- Keep at least 60 centimeters away from the monitor. This allows space between your face and your monitor.

- Try to stand up at least once an hour. Your legs will start to hurt if you keep sitting for a long time. If you sit all day your muscles will atrophy over time.
- You can always try wearing monitor glare prevention glasses (Anti-Refl ective Coating) which help. They are mainly used by gamers.

Activity

According to the lesson materials make a poster that will contain most of the advices and negative aspects of using electronic devices.

Literacy

1. Which of the risks above do you face while using computer?
2. How to stay healthy while using computer for a long time?
3. Why do people use computers for a long time?

Terminology

- headache - бас ауруы - головная боль
- spine - омыртқа - позвоночник
- excessive - шектен тыс - излишний
- blood circulation - қан айналымы - циркуляция крови
- body appearance - дене келбеті - внешний вид
- wrinkle - әжім - морщина
- harm - зиян - вред
- spot - орын - место
- advice - кеңес - совет

1.2 INFORMATION PROPERTIES

You will:

- Define meaning of information;
- Identify properties of information.

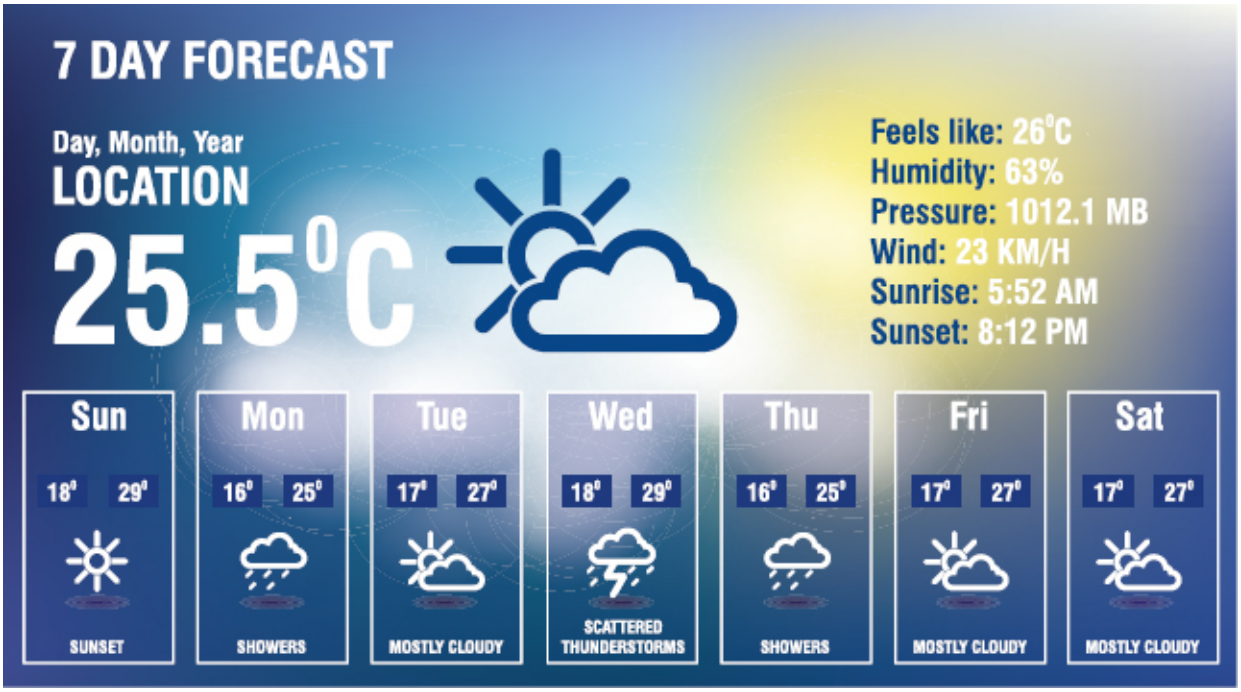
Through which body part do you receive more information?

Properties of information

In everyday life, the economic development of society, life and health of people depends on the properties of information. In any country, it is required to analyze the properties of information in order to assess whether it is understandable, relevant and useful to others, how reliable the information contained in it.

Relevance

- Importance of the information to a person or society
- Usefulness in a specific situation to solve a problem
- Only relevant, the timely received information can be useful to people



Why the weather forecast is notified the day/days in advance?

Availability

- Understandable form and language to receivers
- The same information can be presented in different forms.

Information becomes clear and available if it is shown in understandable form and language.

Reliability

The reliability of information is about how much it is correct and real. Incorrect information can lead to incorrect use.

Completeness

It is very important to have complete and exact information.

Imagine that you are talking by phone and cannot hear your friend properly because of some noise. So, in this case, you do not get complete information.

Authenticity of information content on the internet

In recent years, the Internet has become the most popular source of information. This is quite natural since the search for data on the Web is comfortable, easy and quick.

Can I trust the information that is published on the Internet?

Trusting everything that is written on the Web would be too stupid and naive, because the Internet is an area of free access, and absolutely everyone can take part in its filing. So what should you do?

- Search for a fact! What is the source of this information? Is it from authoritative sources?
- Search the same information on the other sites. If the information is published in several independent websites it is correct. Be careful and also look for their original sources. Often several websites can take wrong information from one source.
- Check for rating and authority of a website. You can also simply enter the name of the resource in any search engine and read reviews about it.
- Search for information about the status and competence of its author. with his other works, comments and feedback from readers.

Fact

Data and Information
Data is raw facts which do not have any meaning. Data can be something simple and useless until it is processed.
When data is processed, organized, structured or presented in a given context so as to make it useful, it is called information.

Activity 1

“Broken phone”
1. Divide into groups. Members of each group must stay behind each other.
2. Teacher whispers a phrase to group leaders so that other members could not hear it.

3. Players keep whispering quietly to one another till the last member hears the phrase.
4. Finally, the last player shouts loudly about what he has heard.
5. The winner is a team whose final phrase is mostly similar to the given word.

Activity 2

“Crocodile” game
1. The student explains the word to the class using only gestures, while others try to guess the word.
2. If anyone finds the word, he/she will replace the current student and explains the next word.
3. Discuss the property of information such as availability.

Practice

Find some information about artificial intelligence and make a small presentation. Then evaluate your information according to the following rubrics:

Property	Bad	Good
Relevance	Your information is not suitable for this topic	Your information is suitable for the topic
Availability	Your information is not clear to understand	Your information is clear to understand
Reliability	Your information is not true for this topic	Your information is true for this topic
Fullness	Your information does not fully represent your ideas	Your information fully represent your ideas

Literacy

1. Look around and give examples for data. How can you convert them into information?
2. Discuss which information property is the most important for you. Why?
3. How can wrong information affect your life?
4. How the world would be if everybody said reliable and complete information?
5. Give information about your friend using all information properties.

Terminology

- processed - өңделген - обработанный
- context - контекст - контекст
- relevant - өзекті - актуальный
- properties - қасиеттері - свойства
- suitable - жарамды - подходящий
- particular - нақтылы - конкретный
- whisper - сыбырлау - шептать
- gesture - ишарат - жест
- guess - табу - угадывать
- naive - аңқау - наивный

1.3 COLLABORATIVE WORK

You will:

- Identify online electronic services of collaborative work;
- Share and create document for working in groups.

Many heads are better than one.

Collaborative work

Sometimes while working in groups we need to share online documents by email or social media. It takes a lot of time simply to modify and send documents to each other.

However, there is a good solution to this problem. We can use Google Drive for team works. It gives us an opportunity to work on one document together at the same time. Users can view, comment, or even make changes to online documents

If you do not have an account

1. Open a web browser and go to www.gmail.com
2. Click on Create an account. It opens Sign-up form.
3. Follow the instructions and fill in the required information.
4. If you fill the questions correctly, you will see the Google welcome page. Now you are able to use some Google web-based features

Google drive

Google Drive is a cloud-based storage service that also includes Google office tools. Here are some advantages of using Google Drive:

- Cost - Google gives every user 15 GB of free storage.

- Collaboration - Confidently share your files so others can access them.
- Access - You can access your files from any device using any operating system. All you need is Internet access. Simply log in to your Google account.

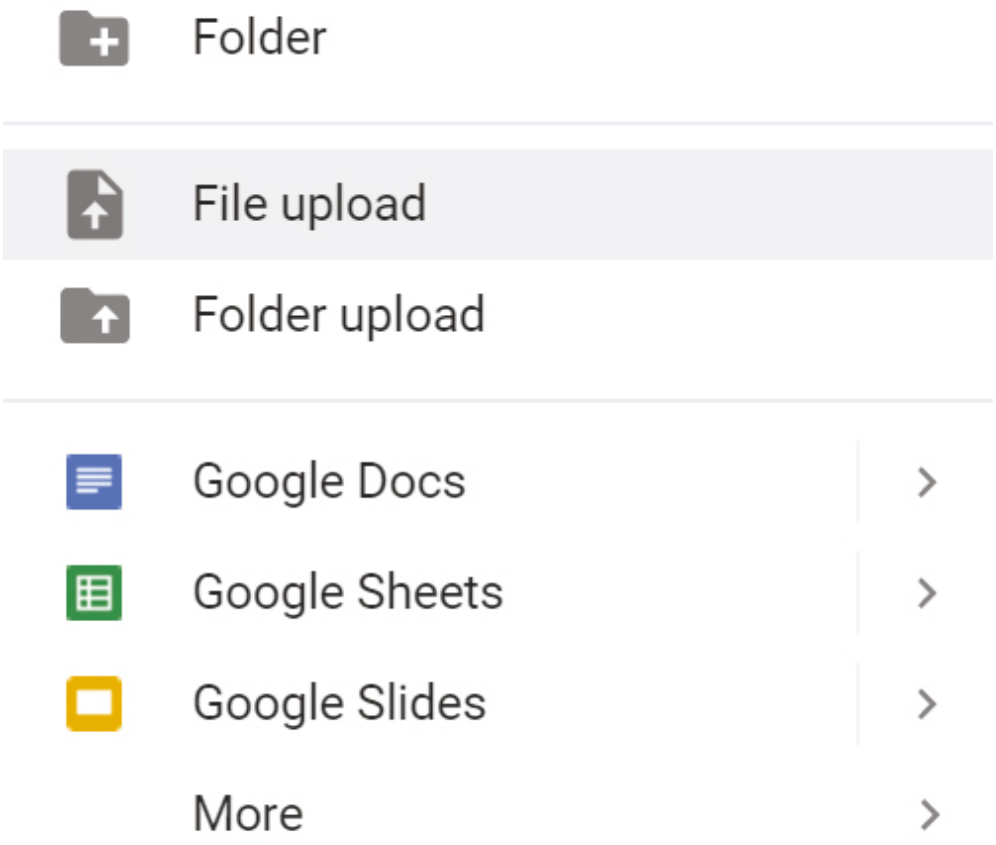
Importing Files

1. Drag and Drop Method

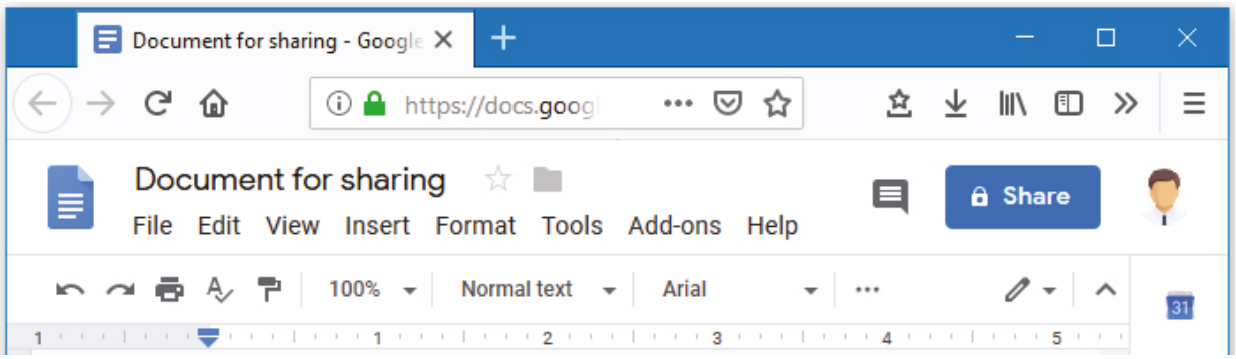
To import a supported file from the desktop, open your Google Drive. Then, drag the file from the desktop into your Google Drive. If you wish to upload the document to a specific folder, open that folder before beginning the import.

2. Uploading Directly in Google Drive

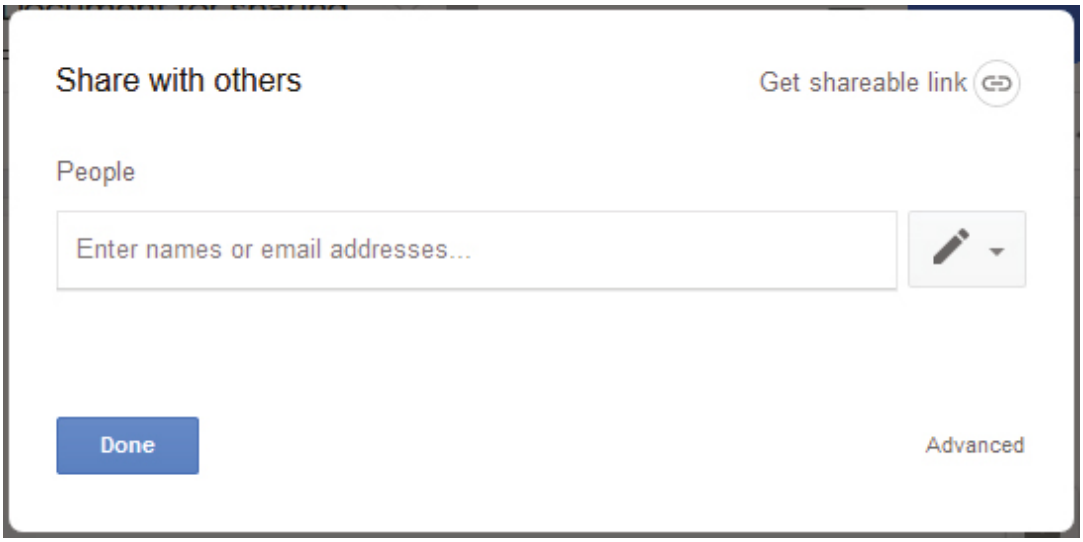
If the file you want to upload is not located on your desktop, you can also import directly from the Google Drive window. Click the New button in your Google Drive. A drop-down menu displays



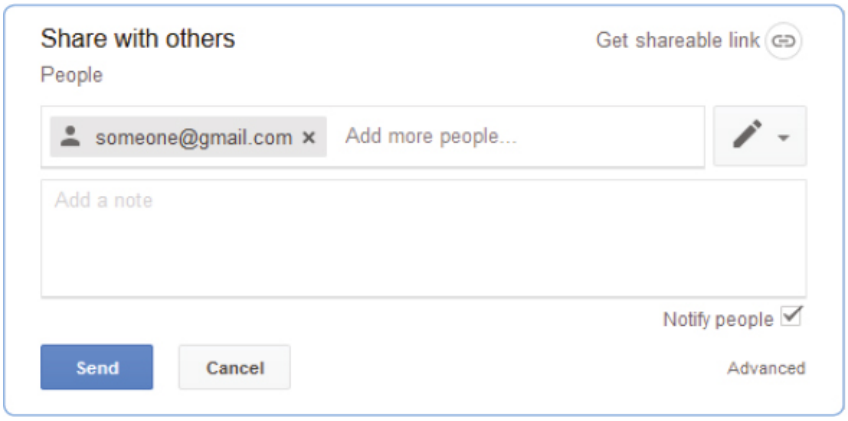
Sharing a document

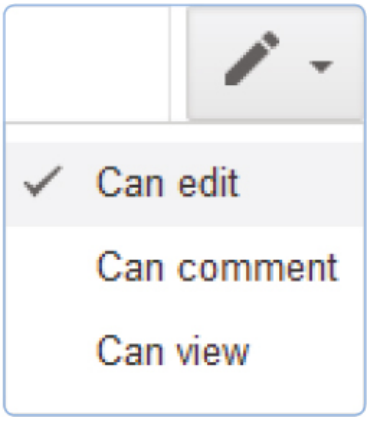


To change the setting, click on the Share button. The Share with others screen appears.



Type the names of people from your contacts or the email addresses of people you wish to share the document with.





Select the property of sharing.

Practice

Group work.

1. Create a folder in Google Drive and share access with others in the group.
2. Each team member should fill that document with information about himself.

Literacy

1. Why is it important to work together with the team?
2. Describe the method of working on one document with your team?
3. How to share an online document with people?
4. What kind of online service do you know that gives opportunities to work together with your team in a live time? (Except google)

Terminology

- collaborative – бірлесу – сотрудничать
- share – бөлісу - делиться
- opportunity – мүмкіндік – возможность
- required – қажетті – обязательный
- features – мүмкіндіктер - особенности
- cloud-based – бұлтқа негізделген - облачный
- cost – құны – стоимость
- access – қолжетімділік – доступ
- drag and drop – жылжыту – перетаскивание
- support - қолдау көрсету - поддерживать

1.4 NETIQUETTE

You will:

- Learn how to behave when communicating online.

Do unto others as you would have others do unto you

Netiquette

“Netiquette” is a set of rule on how to behave while talking on the Internet.

Knowing “netiquette” is very important because nowadays many people communicate on the Internet. When you answer an email or online message immediately, you do not always think about how your responses are taken by your friend.

There were some cases when arguments on the internet started over a small and simple misunderstanding that could be easily avoided. If not solved early, the argument could rise and cause verbal attacks on somebody.

In this lesson you will study the rules of proper Netiquette.

Basic rules of Netiquette:

Rule #1: Capital letters

Never communicate in ALL CAPITAL LETTERS. On the internet, this means somehow “shouting” and rude tone. Also if you have ever tried to read a document in ALL CAPITAL LETTERS, you know how it can strain your eyes.

Rule #2: Message title

Always indicate what you are sending within your mail messages. If the original message title was “Kazakh Language Homework” make sure your reply says “Re: Kazakh Language Homework”, or contains “Kazakh Language Homework” as a reference. That way, the recipient of your message will know what to expect. Keep your messages short and clear.

Rule #3: Read before

Do not start discussing immediately but read previous messages before you post.

Rule #4: Answers

Answer individual requests individually, and submit relevant responses of global interest to the public area.

Rule #5: Online vs Face-to-face

Do not type anything on your screen that you would not tell someone face-to-face. If you are rude, or if your words appear to be rude, you could start a “fl ame war” and end up being fl amed yourself.

Rule #6: Reference

If you reply to a previous post, always quote or refer the part you are replying to. Reference is appreciated, especially if the reply is delayed or if it arrives before the original message does.

Rule #7: Full answer

If you have nothing more than a “me too” to write, do not post at all. Try to write full and complete sentences and express them clearly.

Rule #8: Privacy control

Control your speech and lexicon. Email is not secure and someday, you may learn that the words you sent to one recipient, even in confi dence, have been

forwarded to strangers.

Rule #9: Smileys

Remember, no one can see you or hear your tone of voice. If you're not sure how your messages will be seen, insert an emoticon or a "smiley".

For example, here is "winky" smile for those times when you make a comment and hope the recipient will not take too seriously.

And here is a list of basic smileys:

Practice 1

Use emoji smileys above inside this text:
I am filled with sadness and sorrow in my heart as I write this letter. I am really sorry for letting you down on. I know I promised to be there and spent time with you as we have always been doing for the past holidays.

Practice 2

Guess the Kazakh proverbs below:

Practice 3

Write down the 5 Kazakh proverbs using smileys, as shown in practice 2.

Literacy

1. What are the main criteria for communicating online?
2. What is the meaning of netiquette?
3. What is the difference between communication online and live?
4. In which situation we should use emoji symbols?
5. Which of the netiquette rules come strange for you? And why?

Terminology

- communicate – қарым-қатынас жасау – общаться
- immediately – дереу – немедленно
- response – жауап – ответ
- misunderstanding – түсінбеушілік -
- недоразумение
- avoid – болдырмау – избежать
- verbal attack – ауызша шабуыл –

- словесная атака
- recipient – алушы – получатель
- rude – дөрекі – грубый

1.5 COMPUTER CONFIGURATION

You will:

- Be able to choose hardware according to specifi c requirements.

How can I assemble a powerful computer?

Before assembling, answer the following questions:

1. What will be the purpose of the computer?
2. Which components do I want to connect?
3. How much money do I have to spend?

Computers can be divided into several groups, depending on their functionality: home, offi ce or gaming. For example, for an offi ce computer, it is necessary to have a printer, for gaming computer it must have a powerful CPU, faster RAM, high-quality video card and a good monitor.

Compatibility of devices with the motherboard also matters. There is a specifi c processor interface (sockets) that serve for connection of motherboard with CPU. There are several different processor interfaces for various motherboard models. For example, Intel processors are compatible with Socket 1150 interfaces whereas AMD processors use Socket AM3, Socket Figure 1 FM2 and Socket S-AM2.

Past, present and future of technology and devices:

Typewriter

Laptop

Touchscreen desktop

5 things to consider when buying a computer:

CPU

First of all we must choose CPU (Central Processing Unit), because it executes all operations in computer. Choose processor according to financial

opportunities, personal preferences and tasks.

CPU performance:

Office purpose - 1800-2200 MHz
3D Graphics/Video Editing - 2800-3200 MHz.

Video card

There are 4 types of video cards: Integrated, PCI, AGP, PCI Express.

RAM

RAM (random access memory) is the place where current programs are stored temporarily. Speed of executing current operations depends on RAM size. Data remains in RAM while the computer is running. When the computer is turned off, RAM loses its data.

HDD (Hard Disk Drive) or SSD (Solid State Drive)

All files and folders are physically located in HDD. The data is stored on the hard drive permanently, even if the computer is turned off.

Motherboard

When choosing the motherboard (mainboard) it is important to pay attention to its processor interface (socket). CPU and motherboard must be compatible with each other.

Practice

Surf the internet and find suitable hardware for gaming PC.

Activity

All in one PC, Laptop or Desktop computer.

Discuss in groups the most suitable computer type for school, office, home, and self-usage.

Literacy

1. How to choose hardware according to specific requirements?
2. Compare types of hard drives (HDD or SSD) and define which one is better?

Terminology

- specific requirements – арнайы талаптар – особые требования
- assemble – жинау – собирать
- compatible – үйлесімді – совместимый
- manufacturer – өндіруші – производитель
- temporarily – уақытша – временно
- permanently – тұрақты – постоянно
- suitable – қолайлы – подходящий

1.6 SELECTING SOFTWARE

You will:

- Be able to choose right software according to computer spesifications.

How to choose the right software?

Software system requirements

Every year, software developers release more modern programs that receive not only a new interface but also some useful and interesting functions. Users, inspired by new features, hurry to purchase a new version and set it on their computer, without even looking at the section of system requirements. As a result, the software works with brakes and failures.

So how do you choose the software so that its use does not affect the speed of your computer?

Step #1: Analyze your need

Don’t pick an application just to have something new - figure out what you need from a tool, then research for an application that fits those needs.

Step #2: Specifications

You need to know what resources you have.

1. Open the menu: Start → Run

2. Enter the DXDIAG command and click OK.

You will see the “DirectX Diagnostic Tool” window, in which you can fi nd out all information about your personal computer.

Write down or remember the following data:

- operating system;

- CPU;

- memory (RAM);

- video card (Screen - Name);

- version DirectX.

Step #3: System Requirements

In this step, we will learn about the system requirements of installed software. To do this, open:
Start → Control Panel → Programs → Programs and Features
At the opened list you can see all the programs that are installed on the PC. Find applications, the speed of which you do not satisfy, and go to the offi cial developer site, where you can find the minimum recommended system requirements for the computer. Unsuitable? Then safely remove the program.

Step #4: Alternative software

Today it is very diffi cult to meet software that has no analogs. Typically, these applications include highly specialized software designed for accounting calculations, drawings and other projects. The rest of the programs can be easily replaced with
analogs.
There are more than hundreds of thousands of different programs, but in the fi eld of view are always the most popular and promoted. Not every computer user knows that programs like Adobe Reader, Skype, Microsoft Offi ce, and others can be replaced
with alternative programs. For example, Adobe Photoshop CS5 that requires high performance from the computer, but most users do not use

half of the utility's functions either. In such cases, you can use the free and easy analog - GIMP.
You can use services such as "SuggestUse", where it is enough to enter the name of your program so that the service gives out an impressive list of alternatives. You will have to familiarize yourself with the system requirements and software functionality to understand: is it suitable for your tasks and goals or not?

Keep in mind

A computer purchased in 2013 may not support games and applications released in
2019, as the minimum recommended system requirements are steadily increasing.

Practice

Find an alternative open source programs to:
1. Microsoft office
2. Antivirus Kaspersky
3. Promo Dj
4. Sony Vegas Pro

Literacy

1. Why do you need to care your computer specification when selecting software?
2. What is the difference between system software and application software?
3. Is it possible to install Windows application on Linux operating system?
4. What is advantages and disadvantages of using open source software?

Terminology

- impressive – әсерлі - впечатляющий
- inspired – шабыттану - вдохновенный

- unsuitable – жарамсыз - неподходящий
- performance – өнімділік - производительность
- system requirements - жүйелік талаптар - системные требования
- expect – күту - ожидать
- steadily - тұрақты түрде - постоянно
- release – шығарылым - выпуск
- purchase - сатып алу - покупка
- familiarize – танысу - ознакомиться
- features – мүмкіндіктер - функции

1.7 CALCULATING THE PRICE OF THE COMPUTER

You will:

- Be able to calculate the price of the computer according to its parts;
- Be informed how to assemble a basic desktop PC.

Which factors affect the computers price?

Project description

Your school was the best for this year and won a very big amount of money. School administration decided to update all computer in the school. So they are not familiar with computer types and ask you, as the best student in IT, to help them.

Your job

You should prepare 3 different types of computer and give the price of them to school administration.

1. Computers for administration;
2. Computers for informatics lab;
3. Computers for multimedia usage.

Instruction

1. Describe the usage of each computer
2. Assemble computers according to their performance and usage. Example: multimedia computer don’t need high speed and memory, it is enough to be 4GB RAM, 250 HDD, 2.0 GHz CPU power.
3. Search for prices of each device on computer

4. Calculate approximate price of computer.
5. Fill the report below.

	Computer for multimedia usage		Computer for informatics lab		Computer for administration	
	Type	Price	Type	Price	Type	Price
Motherboard						
CPU						
RAM						
Memory						
Video Card						
Network connections						
Power supply						
Cooling system						
CD/DVD						
Case						
Monitor						
Mouse						

	Computer for multimedia usage		Computer for informatics lab		Computer for administration	
Speakers						
Operating system						
Total price						

Steps to assemble a desktop PC

1. Prepare the Mainboard (motherboard).
2. Mount the CPU in the socket of the Mainboard.
3. Connect the CPU cooler to the Mainboard.
4. Attach the RAM(memory) modules in the corresponding slots.
5. Open the case and mount the power supply which is M-ATX type.
6. Attach the Mainboard back plate to the case and check the Mainboard mounting positions.
7. Suitably position the Mainboard in the case.
8. Mount the Hard disk and connect it to the power supply and the motherboard.
9. Connect the SATA connectors to the drives and the USB connectors and the case switches to the motherboard.
0. Connect the 20 or 24 pin ATX connector and the 4-pin power supply control connector to the motherboard.
1. Mount the DVD-ROM drive.
2. Finally, select a compatible operating system, and follow the instructions to install.

Fact

Static electricity is the biggest danger to the expensive parts you are about to assemble. Even a tiny shock which is much too small for you to feel can damage or ruin the delicate electronic traces many times smaller than a

human hair that make up your CPU, RAM, and other chips. It's important to use your antistatic wrist strap to prevent damage to these components. Once you have the power supply installed in the case, clip the end of the wrist strap to the outside of the power supply.
Never plug your computer in while you are connected to it by a wrist strap.

Literacy

1. Which fractures affect to computer price?
2. What kind of advices would you give to your friend when he wants to buy a new computer?
3. Which way would be most productive for you? To buy ready assembled computer or assemble it yourself?

Terminology

- assemble - жинау - собирать
- performance - өнімділік - производительность
- approximately - шамамен - примерно
- prevent - алдын алу - предотвращать
- corresponding - сәйкес - соответствующий
- suitably - тиісті түрде - подходяще
- compatible - үйлесімді - совместимый

CHECK YOURSELF

1. What should be the distance between you and monitor?
2. What are the risks of using computer for a long time?
3. Describe the following picture. What is the difference between data and information?

4. Match following terms and definitions
   - Relevance Correct and real information
   - Availability Full and exact information
   - Reliability Important at particular time and situation
   - Completeness Clear and understandable form
5. Write 5 concrete examples about what have you learnt in the 1st term. Pay attention that your answer will contain properties discussed in 1.2 chapter.
6. There are 4 main 21st century skills:
   - communication, collaboration, creativity, and critical thinking. Why collaboration is an important skill. Write your opinion in 3-5 sentences.
7. Describe step by step how to upload music to Google Disk and share it with several friends by using their Email addresses.
8. Which one is NOT type of a computer?
   - A) Desktop computer
   - B) Laptop
   - C) Tablet

- D) Monobook

9. Software divides into _____.
   - A) Operating System, Utilities, Applications
   - B) Operating System, Programs, Applications
   - C) Main, Operating System, Programs
   - D) Main, Programs, Games

0. Which one is NOT type of OS?
   - A) Mac OS
   - B) Linux
   - C) Windows
   - D) McAfee

1. Write the names of the following hardware components

2. Is it possible to use only Open Source software at school, at home and offices?
3. How to get information about computer specification?
4. Which factors are more important when calculating the price of the computer?
5. Arrange correctly steps to assemble a desctop PC
   - __Mount the Hard disk and connect it to the power supply and the motherboard.
   - __Connect the 20 or 24 pin ATX connector and the 4-pin power supply control connector to the motherboard.
   - __Connect the CPU cooler to the Mainboard.
   - __Attach the RAM(memory) modules in the corresponding slots.
   - __Select a compatible operating system, and follow the instructions to install.
   - __Open the case and mount the power supply which is M-ATX type.
   - __Prepare the Mainboard (motherboard).
   - __Mount the CPU in the socket of the Mainboard.
   - __Suitably position the Mainboard in the case.
   - __Connect the SATA connectors to the drives and the USB connectors and the case switches to the motherboard.
   - __Attach the Mainboard backplate to the case and check the Mainboard mounting positions.
   - __Mount the DVD-ROM drive.

CHAPTER 2

DATABASE BASICS

2.1 WHAT IS A DATABASE?

You will:

- Explain the meaning of a database;
- Explain the purpose of using databases;
- Identify the database components.

How does the librarian know if a book that you want exists or not in the library?

Database

Database is an organized collection of data. To solve the problem with searching a book we can create a database of books. We can classify all the books according to genre, publishing year and author. Such classifi cations can be made by creating a database. A database consists of fi elds and records.

Record is the information about a particular item.

Field is a column which stores the same types of information.

Student ID	Name	Surname	Class	Date of birth
1569	Assel	Alpysbayeva	9A	05.06.2003
1256	Assylbek	Bolatbekov	9A	16.12.2003
5865	Aliya	Zhumanova	9A	14.02.2004
1247	Ruslan	Torebek	9B	19.06.2003
1367	Sergey	Ivanov	9B	03.06.2003
7852	Alissa	Kim	9A	08.03.2004

Record → 5865

Field → Sergey

Example of records and fi elds in a database

Activity

Draw your own vision of the database of your class on a sheet of paper. You need to think about what kind of information must be in your database. Make 10 fi elds at least that may be ‘name’, ‘surname’, ‘birthday’, etc.

ID	Company	Last name	First name	Job title	City
1	Astana kitap	Aliyev	Amirzhan	owner	Astana
2	Hipo	Murzabayev	Askhat	owner	Almaty
3	021 Labs	Suleymenov	Arman	owner	Almaty
4	BMG	Bolatov	Alikhan	manager	Astana
5	d	Kaliyev	Diana	manager	Kokshetau
6	Kazakhmys	Shakenov	Abzal	worker	n
7	TRC	Amirova	Amina	worker	Taraz
8	ERG	Malikova	Nargiz	manager	Aktobe
9	NCOC	Omarov	Baglan	manager	Atyrau

Example of database in organized table

Database management system

Previously people have used journals or copybooks for keeping and storing data, but today such work is done by computers. The computers require faster access and protection, therefore programmers have developed DBMS (Database management system) - the program for managing and protecting data.

Examples of DBMS: Access, Oracle, PostgreSQL, MySQL etc.



Previously people have used journals or copybooks for keeping and storing data, but today such work is done by computers. The computers require faster access and protection, therefore programmers have developed DBMS (Database management system) - the program for managing and protecting data.

By using these programs we can:

- add new records and fields
- search according to some criteria
- delete recordings

Database components

Database system consists of 3 parts:

1. Table: The best way to keep all recordings in a database is to use tables. A table has rows and columns. Types of data will be stored in columns (fields) whereas recordings about each item will be stored in rows (records).
2. Query: Used for making operations within a database. Query is a some kind of functions that can be applied to data in a database. There are examples of queries like: find, sort, filter, different types of calculations and so on.
3. Report: By using a DBMS it is possible to show all your requested information in a specifi c report document. So after you filter the required information and make calculations using queries you can show the results in one report.

Literacy

1. How did people store information before database?
2. How they made such operations like searching, storing and managing information?
3. Where database used in daily life?

Terminology

- database – деректер қоры – база данных
- field – алаң – поле
- record – жазба – запись
- column – баған – столбец
- row – жол - строка
- access – қол жеткізу – доступ
- protection – қорғау – защита
- table – кесте – таблица
- query – сұраныс – запрос
- report – баяндама – отчет

2.2 DESIGNING A DATABASE

You will:

- Design a database;
- Identify data types.

What is the best way to keep information about books at a library?

Design a database

Tables are the central point of a database, which is why you should spend some time planning and organizing your tables.

Before starting to design a table you should decide:

- What is your aspect, and events to be tracked and processed? Answering this question identifies the content of the table and the name of the table.
- Which fi elds do you need to organize similar values and data? Answering this question identifies the name of the fields.
- Which type of data will you store in these fields? Answering this question identifi es the field types.

Database data types

Text - The text represents a group of characters such as names. Names, surnames, and addresses are examples of the text data type.

Number - The number is for numeric data. Age, amount, and weight are examples of the number type.

Date/Time - is used to store a date or time. Production date and birthdate are examples of this data type.

Currency - is used to represent a currency (money) value. Selling price and Loan fee are examples of this type.

Hyperlink - with Hyperlink, you can provide a link from your document to a fi le in your computer or to a web page on the Internet.

Keep in mind

A database system is a computer program for managing electronic databases. A very simple example of a database system would be an electronic address book.

Activity 1

Design a database for a library, that will store information about each book.

1. Take a piece of paper and plan fi elds for your new table.

2. Write the following fi elds on the paper: ID, Name of book, Author, Genre, Published date, Quantity, Popularity.

3. Now identify what fi eld types are required for the fi elds you have written.

Activity 2

Choose one of the options below and try to make a database design. Discuss database designs with your classmates. Think about what fi elds can be used.

1. Student registration form

2. Computer Lab inventory

3. Music and movie store

4. Social network users' database

Make at least 10 fields with different data types and apply them into your database.

Uses for database systems include:

- They store data
- They store special information used to manage the data. This information is called metadata and it is not shown to all the people looking at the data.
- They can solve cases where many users want to access (and possibly change) the same entries of data.
- They manage access rights (who is allowed to see the data, who can change it)
- When there are many users asking questions to the database, the questions must be answered faster. So, the last person to ask a question can get an answer in a reasonable time.
- Certain attributes are more important than others, they can be used to find other data. This is called indexing. An index contains all the important data and can be used to find the other data.
- They ensure that the data always has context (makes sense). There are a lot of different rules that can be added to tell the database system if the data makes sense. One of the rules might say November has 30 days. This means if someone wants to enter November 31 as a date, this change will be rejected.

Fact

A database administrator could...

Design a digital database of medical records that can be instantly transferred between clinics, unlike paper patient records.

Protect bank accounts from hackers by adding security features to a bank's financial database.

Make an inventory database for a chain of candy stores to help them keep the most popular candies in stock.

Create a database of DNA from people with multiple sclerosis to help researchers pinpoint the genes involved in the disease.

Literacy

1. How do we build a new database?
2. Where do we use a table in daily life?

Terminology

- immediate - тез арада - немедленный
- to-do list - жұмыстар тізімі - список дел
- to combine - біріктіру - объединить
- to resize - өлшемін өзгерту - изменить размер
- to scroll - айналдыру - прокручивать
- field - алаң - поле
- edge - шеті - край
- area - аудан - область
- to break - бөлу - разделить
- to customize - баптау - настроить

2.3 BUILDING A DATABASE

You will:

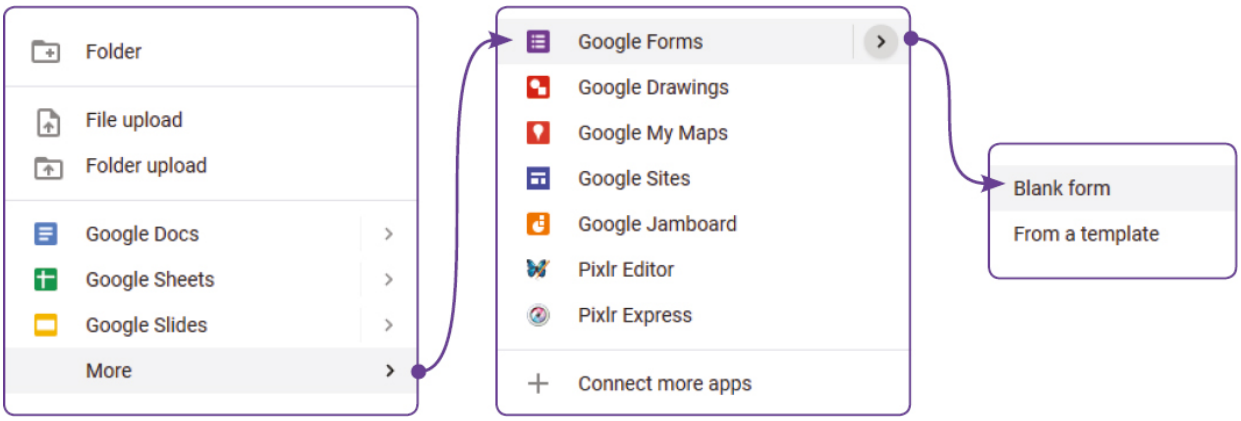
- Create forms;
- Create tables.

How to build a database system to find books in the library faster?

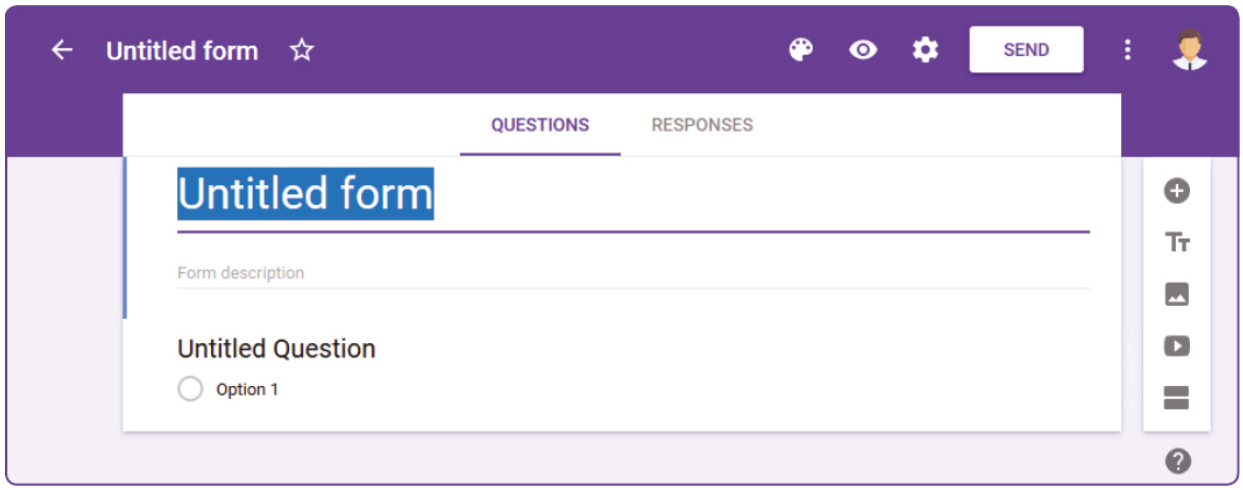
Creating form

To start our database, fi rst of all, we have to create a form that will add new information about books into our library.

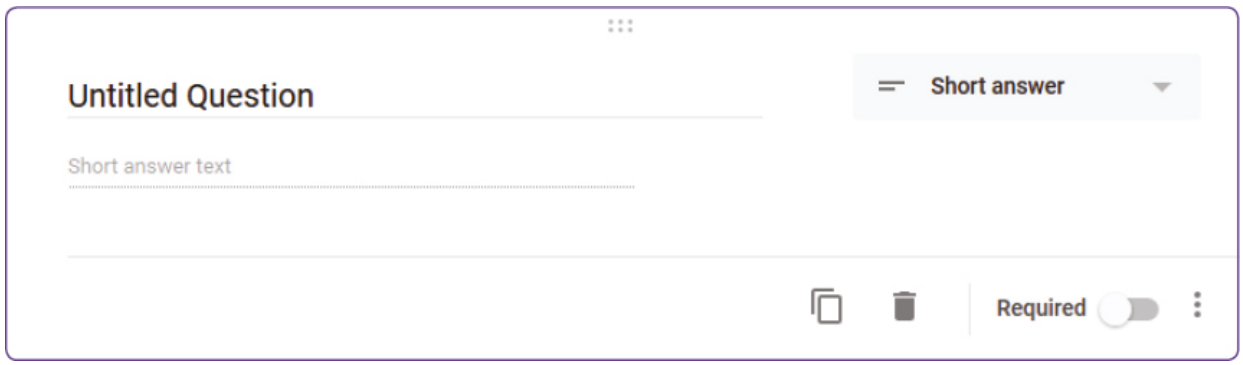
- Open Google drive
- Click “New” » “Google Forms” » “Blank form“



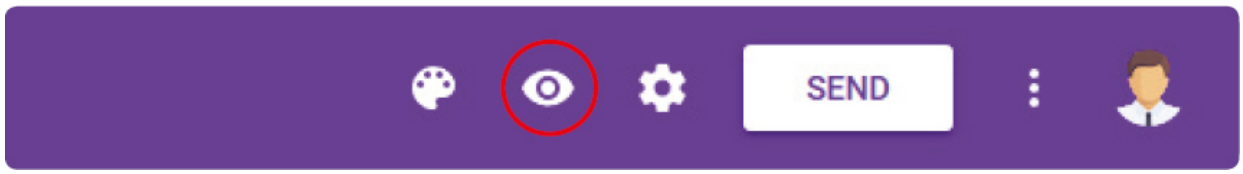
- Click “Untitled form” and type the name of your new Form. For example: “Add new book”



- Click “Untitled Question” to type a question. Example: “Name of the book”



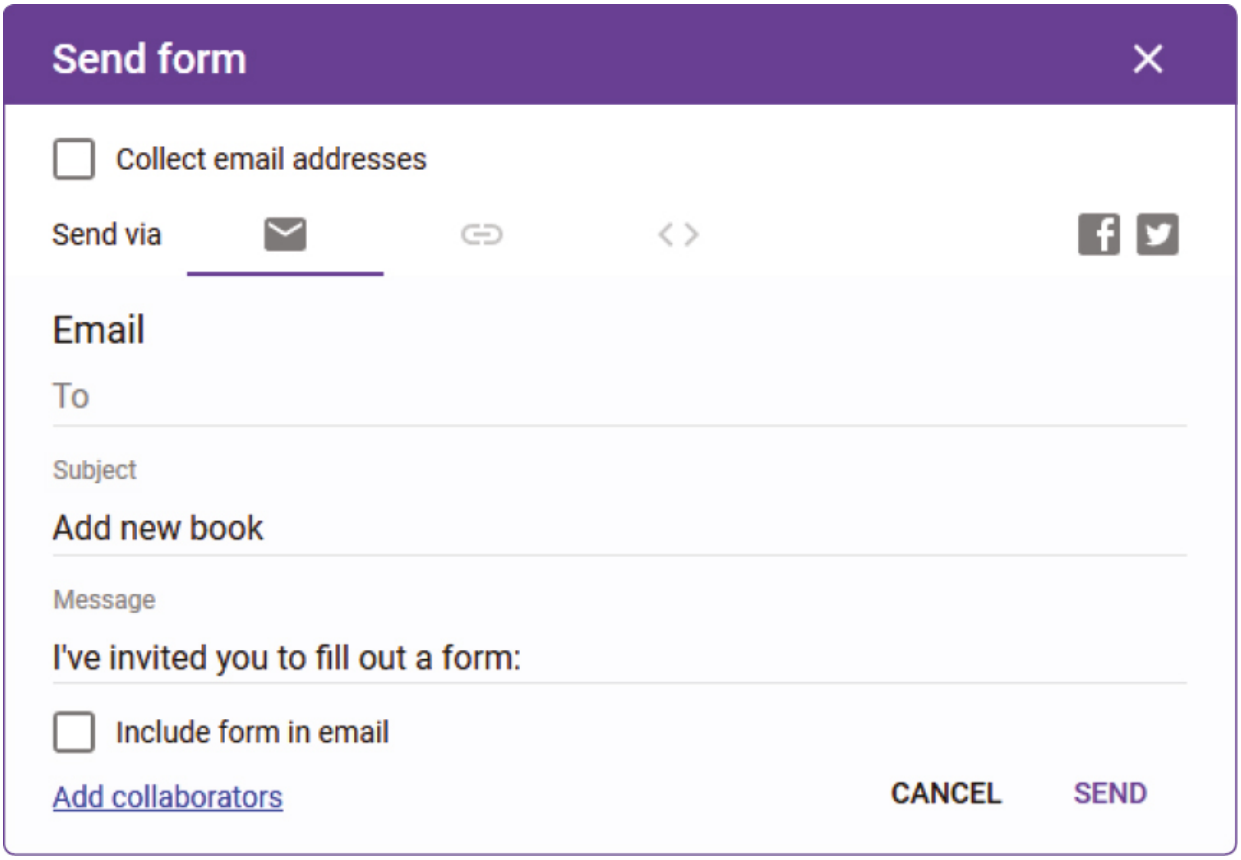
- Choose “Short answer” for answer type of your question.
- Click “+” sign on the right and add new questions:
  - “Author” with “Short answer” type
  - “Genre” with “Dropdown” type
  - “Published date” with “Date” type
  - “Quantity” with “Short answer” type
  - “Popularity” rate with “Linear scale” type
- Now fi ll in the database with 10 books at least. Click “Preview view” to fi ll in the form by yourself.



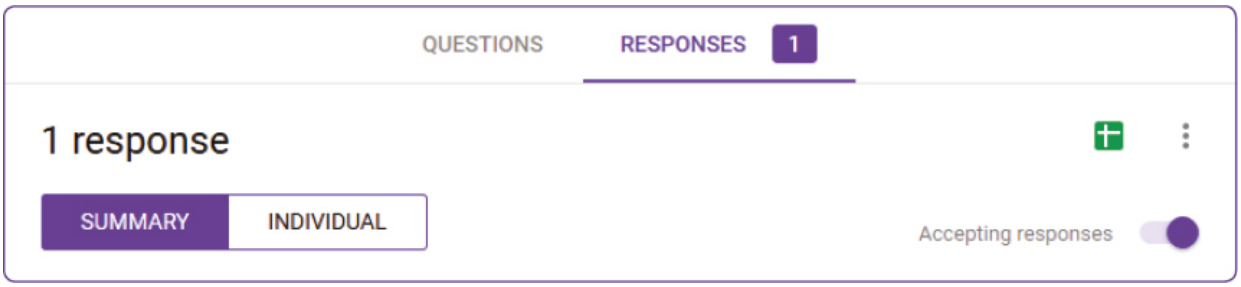
Share and responses

Using Google forms can help you to prepare surveys and share them with people. To share your form you can send it to others by email or give a link to your form.

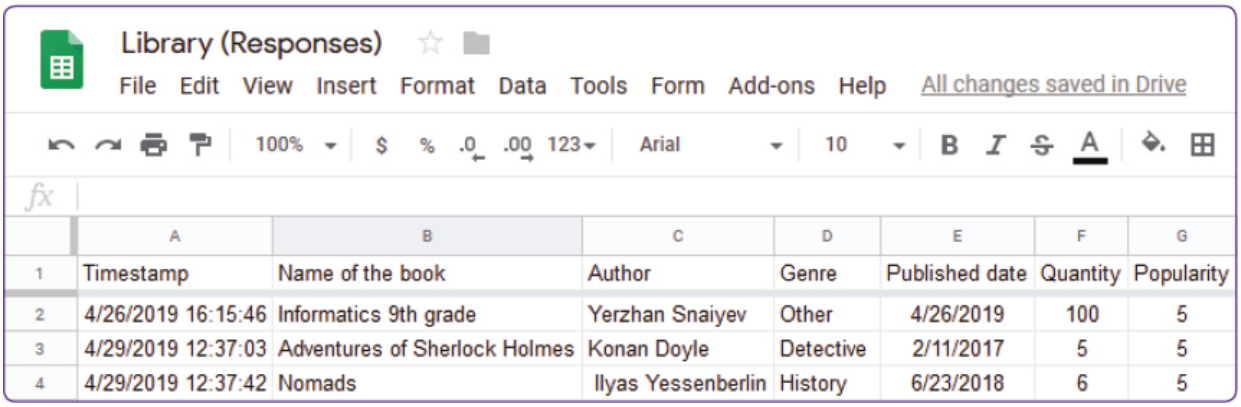
Click ‘SEND’ button to send your form



- Click “RESPONSES” and see the recordings you have;



- Click “Create spreadsheet”. This operation creates a new Google sheets table with your Google-form data recordings.



	A	B	C	D	E	F	G
1	Timestamp	Name of the book	Author	Genre	Published date	Quantity	Popularity
2	4/26/2019 16:15:46	Informatics 9th grade	Yerzhan Snaiyev	Other	4/26/2019	100	5
3	4/29/2019 12:37:03	Adventures of Sherlock Holmes	Konan Doyle	Detective	2/11/2017	5	5
4	4/29/2019 12:37:42	Nomads	Ilyas Yessenberlin	History	6/23/2018	6	5

Keep in mind

You can format your form style in the theme options menu, such as header image, theme color, background color, and font style.

Keep in mind

1. You can send your form via email;
2. You can copy and send a link;
3. You can share your form via social networks (Facebook, Google+, Twitter).

Literacy

1. How can we make a new Form?
2. What kind of Google features do you use/know?
3. Share your experience with classmates.

Terminology

- form – форма – форма
- drop-down – ашылатын – выпадающее
- upload – жүктеу – загрузить

- response – жауап – отклик
- icon – белгіше – значок

2.4 SORT AND FILTER DATA

You will:

- Apply basic sort;
- Apply basic filter.

What should we do with the book database to quickly find a book by some criteria?

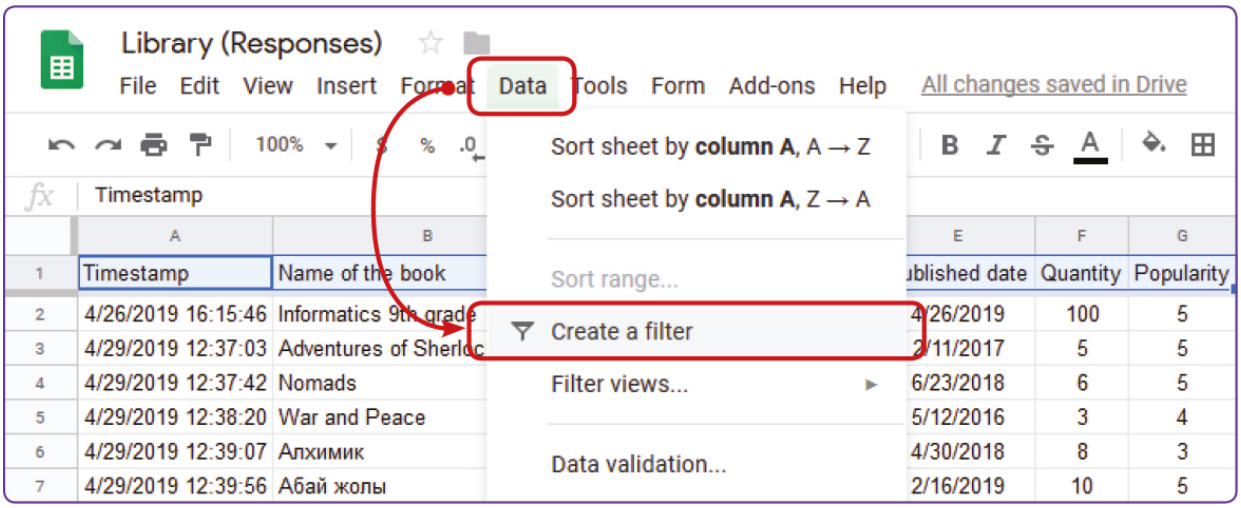
Sort and filter

In this lesson, we are going to learn how to work with data.

When we have a big amount of data it is difficult to find specific information about a required item. Because of that, we need to use sorting or filtering tools. Previously we have created a database for a library. Now we are going to continue our work with the previous exercise. Use the table that we have created to store all the information about books in our library.

Apply filter

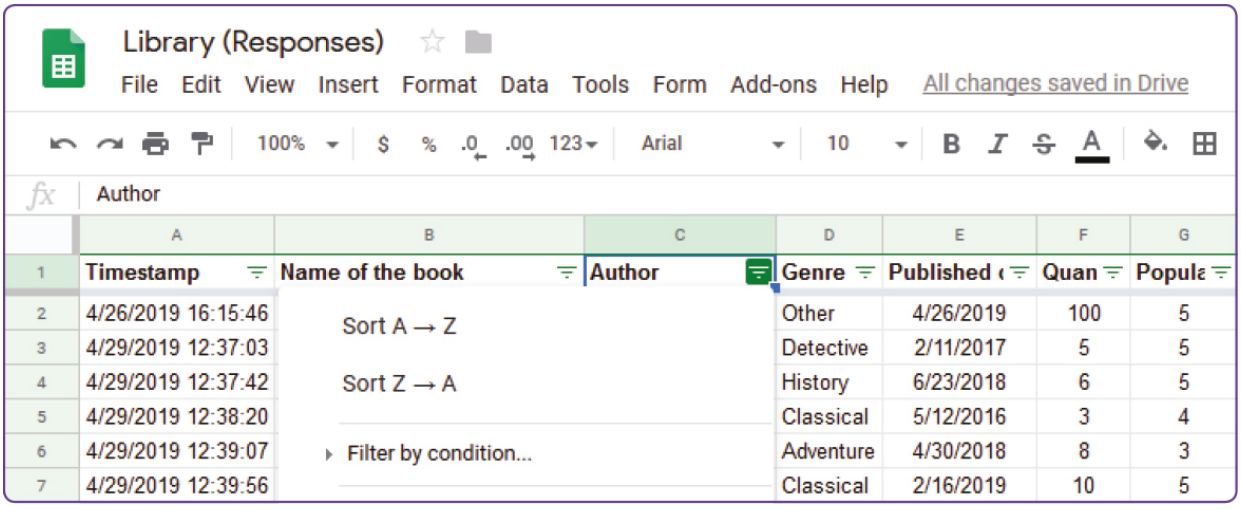
To apply “Filter” select headers of table, click “Data” tab and select “Create a filter” command.



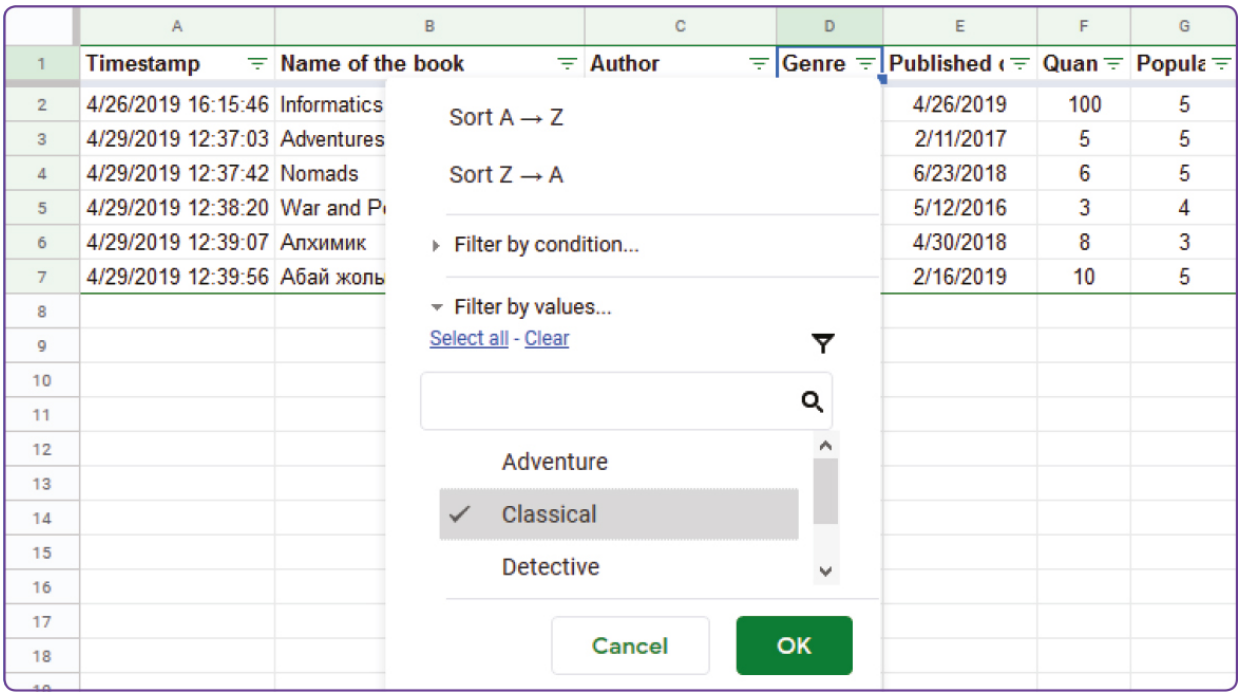
Apply sort features

To demonstrate the “Sorting” tool let us sort our books according to “Author“.

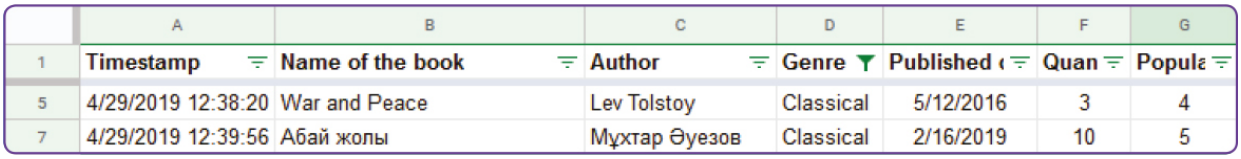
Click the arrow in the “Author” field and select one of two sortings available. The fi rst type sorts in ascending order whereas the second in descending.



In this example we have applied the “Filter” to show books with “Classical” Genre. To cancel the “Filter” click an arrow inside the “Filter” field and click “Select all”.

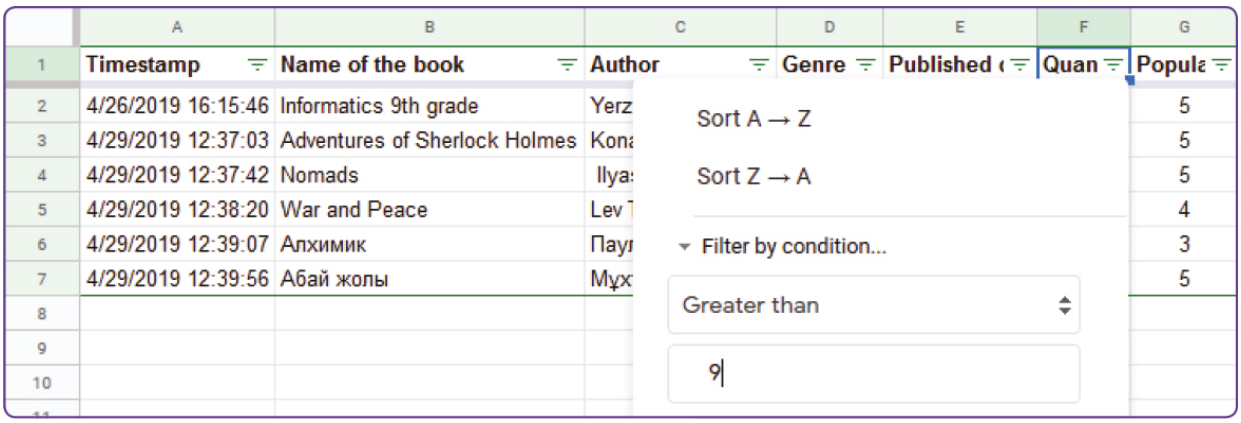


If any Filter was applied the following icon () would appear.



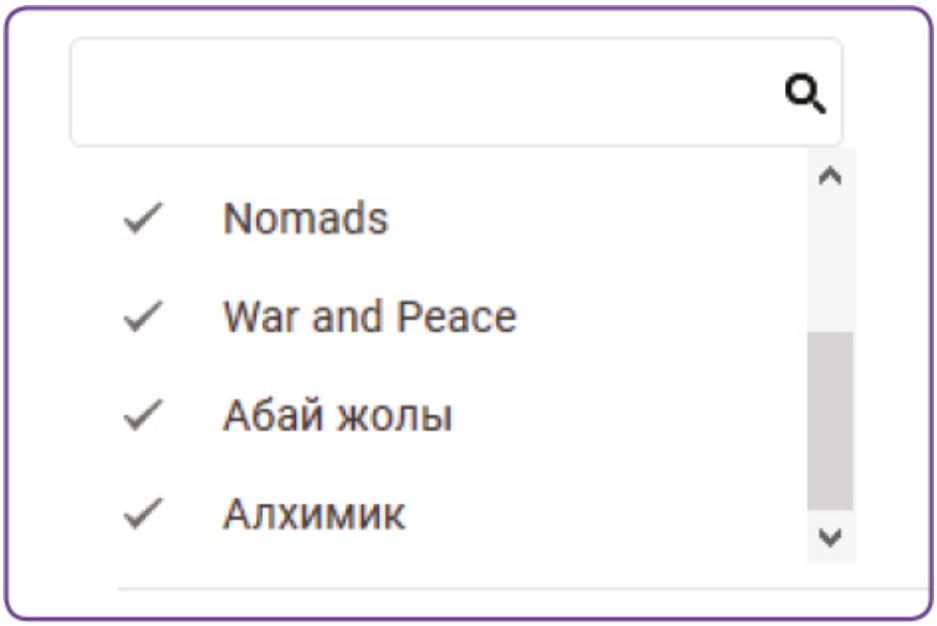
Filter by condition

Now we are going to apply Filters by condition (e.g) using “Greater than” or “Equal to”:



Search

If we want to find information about a particular book we can use ‘Search’ tool within the ‘Filter’ method.



Keep in mind

Cell address name Columns and rows have own address names. Columns are represented in letters (A,B,C,D…) and Rows in numbers (1,2,3,4…). Each cell is represented by letters (column) and numbers (row).

For example: a cell in column ‘A’ and row ‘1’ has a name address of ‘A1’ and so on.

Practice 1

1. Apply sorting to “Name of the book” in alphabetical order
2. Apply sorting to “Quantity” to find out what books prevail in your library

Practice 2

1. Apply Filter to “Genre” and find out what genres of books are more popular within your library.
2. Apply Filter to “Author” and look out which authors are more popular in your library.

Practice 3

1. Apply Filter to the books which “Quantity” is greater than 5.
2. Apply Filter to the books which “Popularity rate” is less than 5.

Literacy

1. Why do we use the “Sort” method?
2. What is the difference between “Filter” and “Sort”?

Terminology

- criteria - критерия - критерия
- required - міндетті - обязательный
- sort - сұрыптау - сортировать
- according - сәйкесінше - в соответствии
- ascending - өсу реті - по возрастанию
- descending - кему реті - по убыванию
- method - әдісі - метод
- filter - сүзгі - фильтр
- condition - жағдайы - состояние

2.5 PIVOT TABLE

You will:

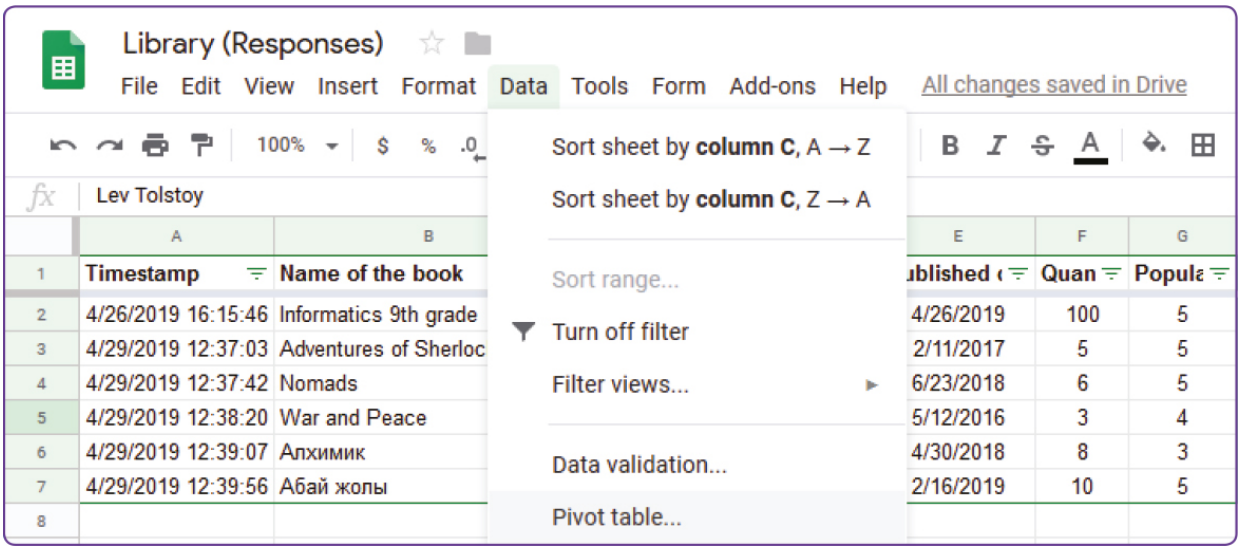
- Apply pivot tables;
- Make reports from a database.

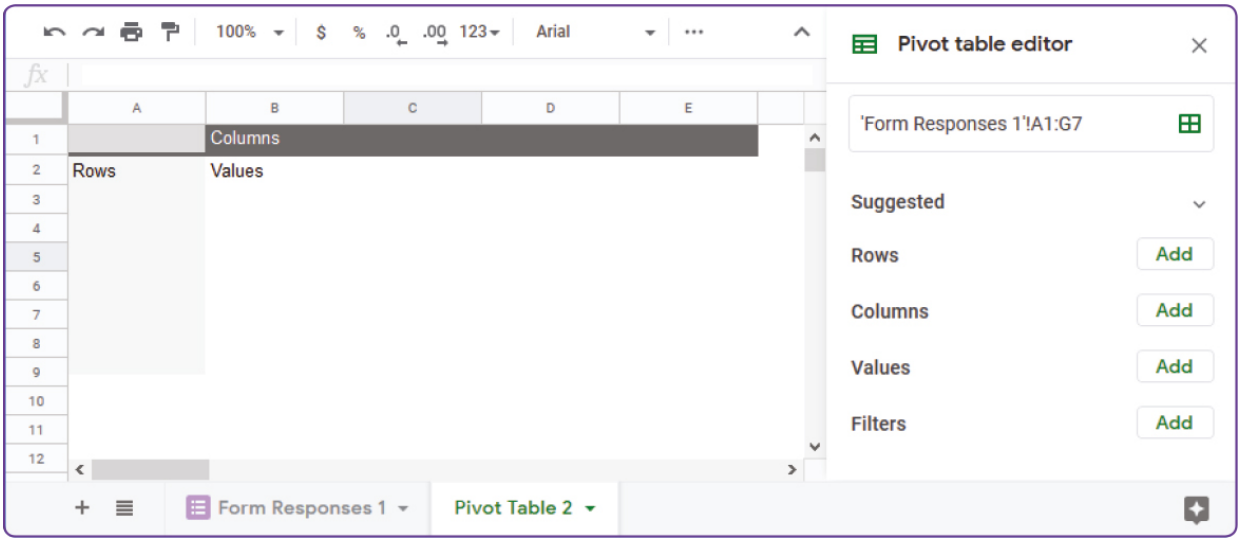
How to present all information from database in attractive view?

Pivot table

It is important how information is presented. At first, we have to define what kind of information we are going to present. To do that we shall prepare some tables that are called “Pivot tables”.

To apply a Pivot table click “Data” » “Pivot table…”.



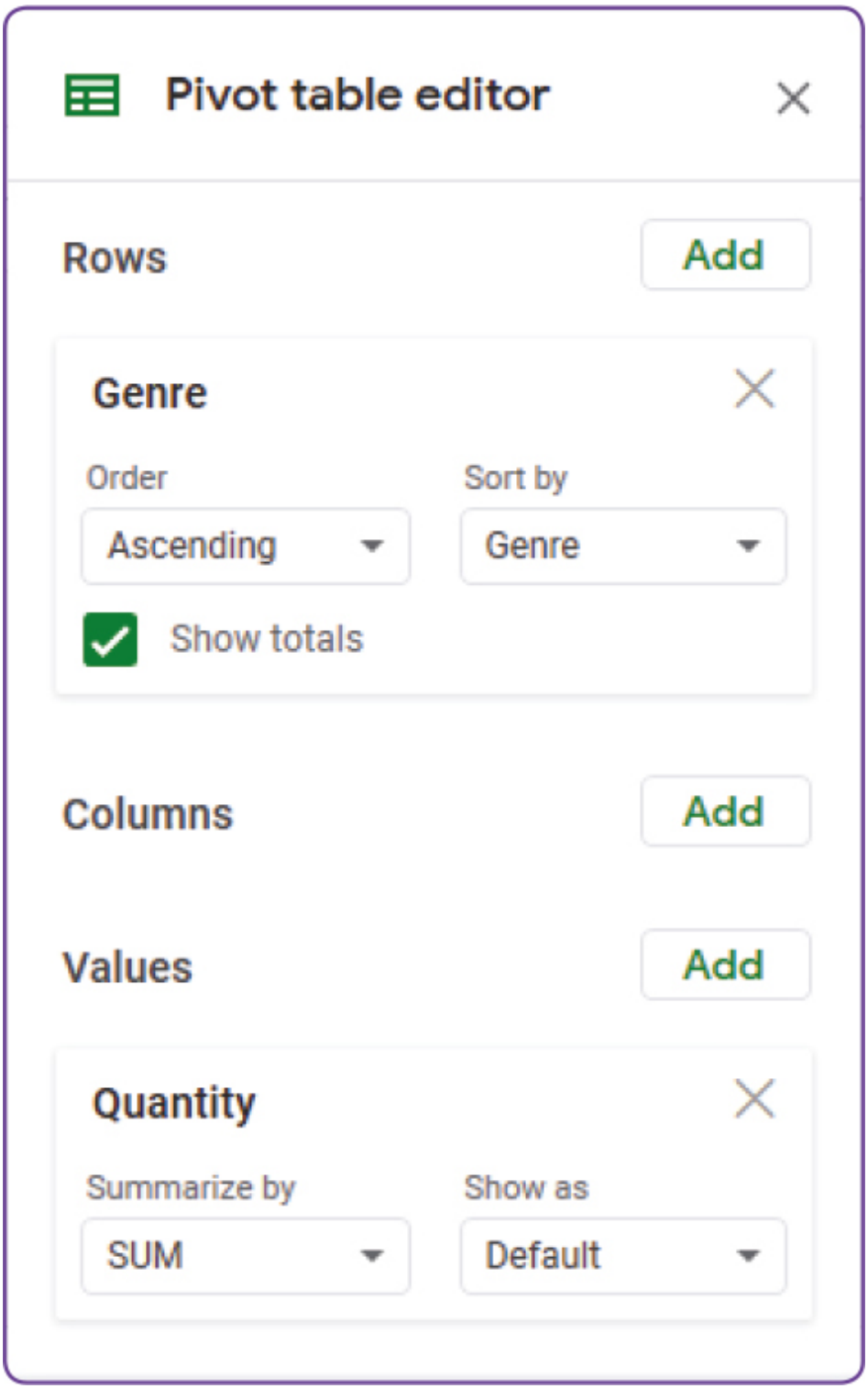


You should have the table shown above. Now let us consider each of three "Pivot table" options:

1. Preview of a Pivot table. All options that you choose in the next part will appear here;
2. Pivot table editor. Here you can choose the elements that you want to include within your table (rows, columns, values and filter);
3. Pivot table name. Here you can set title for your table.

Pivot table by rows

Now we are going to count amount of the books of different genres:



1. Click “Add field” and choose “Genre”;
2. Click “Quantity” and choose “Summarize by”: “SUM”.

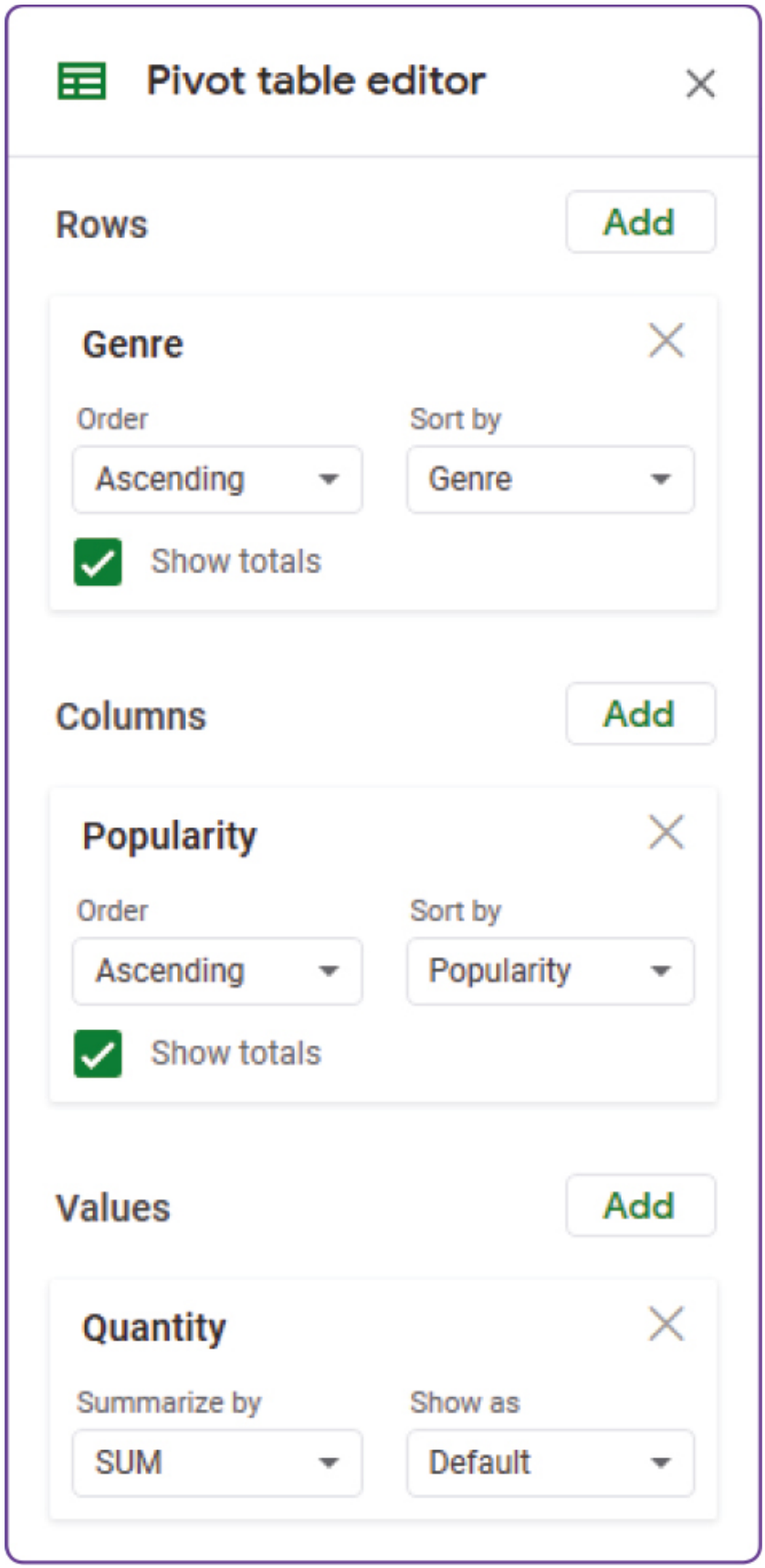
Finally, you should have a table showing quantity of books in total.

A	B
Genre	SUM of Quantity
Adventure	8
Classical	13
Detective	5
History	6
Other	100
Grand Total	**132**

Pivot table by rows and columns

Now we need to present quantity of the books of different genres and popularity rates.

Add three fi elds and choose “Genre” for “Rows”, “Popularity” for “Columns” and “Quantity” for “Values”.



Finally, you will have a preview of the table shown below.

	A	B	C	D	E
1	*SUM of Quantity*	*Popularity*			
2	*Genre*	3	4	5	Grand Total
3	Adventure	8			8
4	Classical		3	10	13
5	Detective			5	5
6	History			6	6
7	Other			100	100
8	**Grand Total**	**8**	**3**	**121**	**132**

We can see that we have 3 books with “Classical” genre which popularity rate is 4 and 10 books which popularity rate is 5. Also, the biggest amount of books are in “Other” genre with the popularity rate of 5 that has 100 items in total.

If we want to show information about a particular item, but not a total quantity, we can use “COUNTA” method in Summarize by menu:

	A	B	C	D	E
1	*COUNTA of Quantity*	*Popularity*			
2	*Genre*	3	4	5	Grand Total
3	Adventure	1			1
4	Classical		1	1	2
5	Detective			1	1
6	History			1	1
7	Other			1	1
8	**Grand Total**	**1**	**1**	**4**	**6**

Keep in mind

By using “Edit range...” we can change ranges of a table. We must add new records to use this function within a pivot table.

Practice 1

Show information about how many books of different authors are stored in your database.

Practice 2

Now prepare different pivot tables according to the following criteria:

1. How many books from different authors with different genres are stored?
2. How many particular books do you have from different authors with different popularity rates?

Practice 3

1. Apply Filter to the books which “Quantity” is greater than 5.
2. Apply Filter to the books which “Popularity rate” is less than 5.

Literacy

1. In which situations can we use pivot table?
2. What is needed for making reports?

Terminology

- pivot - жиынтық кесте - сводная таблица
- to consider - қарастыру - рассматривать
- record - жазба - запись
- quantity - саны - количество

2.6 CHARTS

You will:

- Apply charts forpresenting a database information.

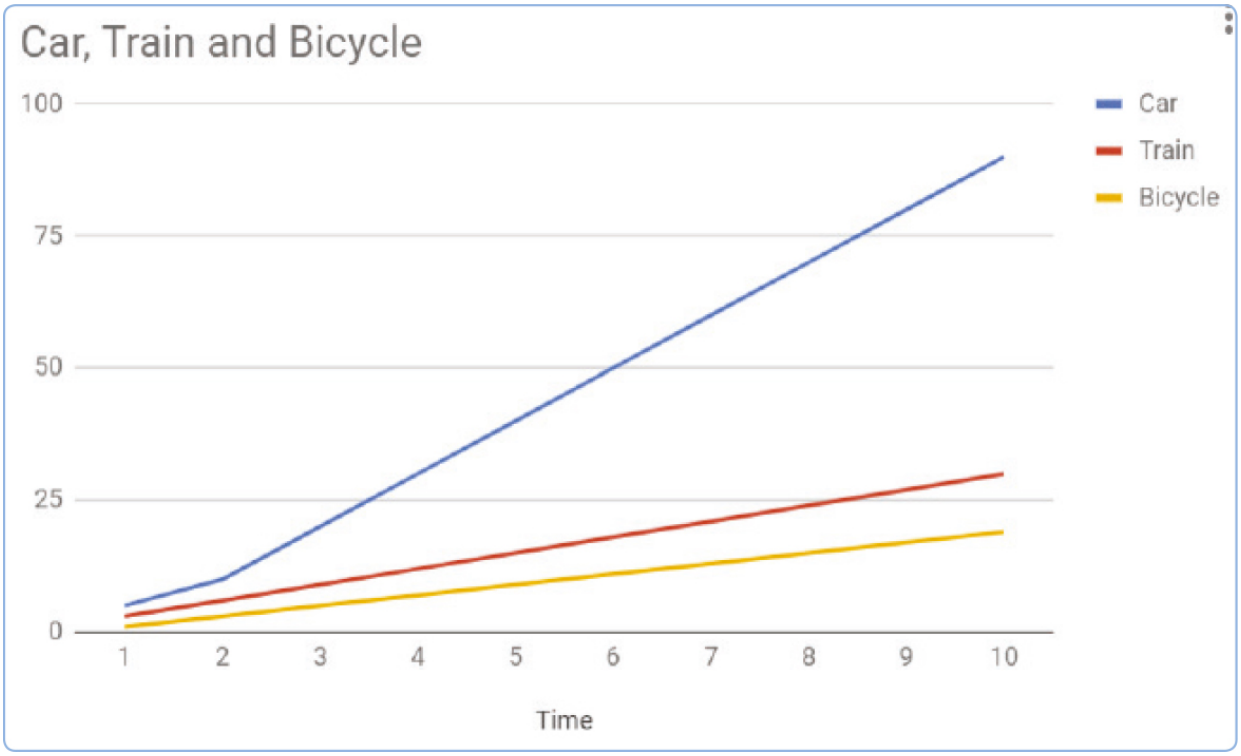
What is the best way to present information?

Charts/Graphs

A chart, also called a graph, is a graphical representation of data. Charts have different formats such as bar chart, line chart and a pie chart.

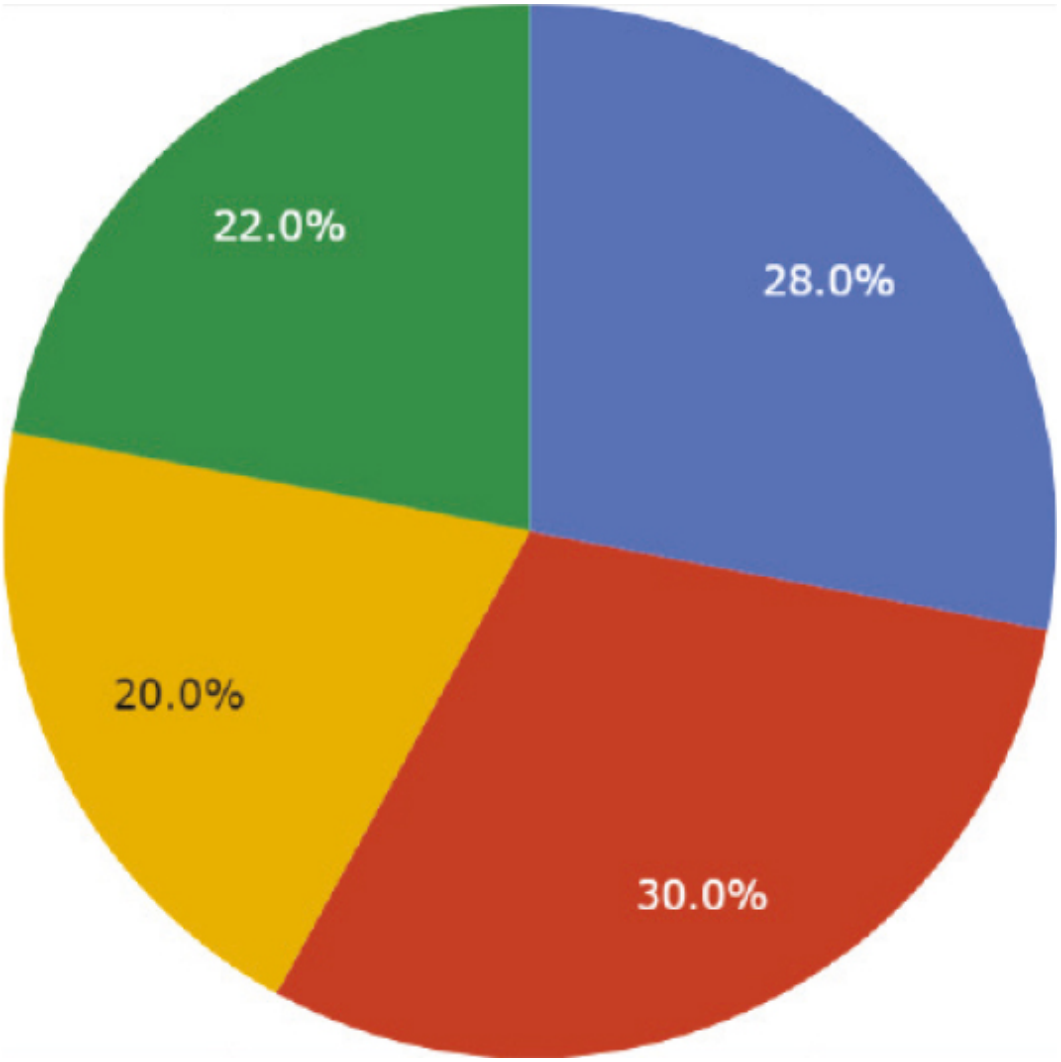
Line Charts.

We use Line graphs for viewing changes over short or long period of time. Line graphs are the best when showing small changes.



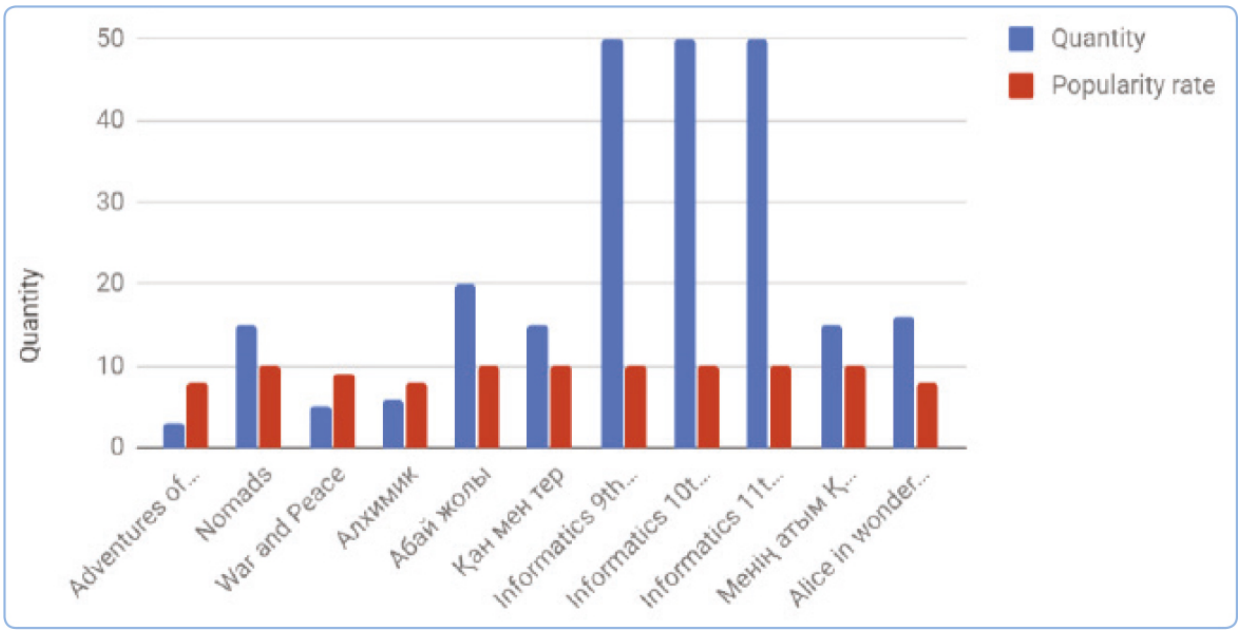
Pie Charts.

We use Pie charts for comparing parts of a whole item.

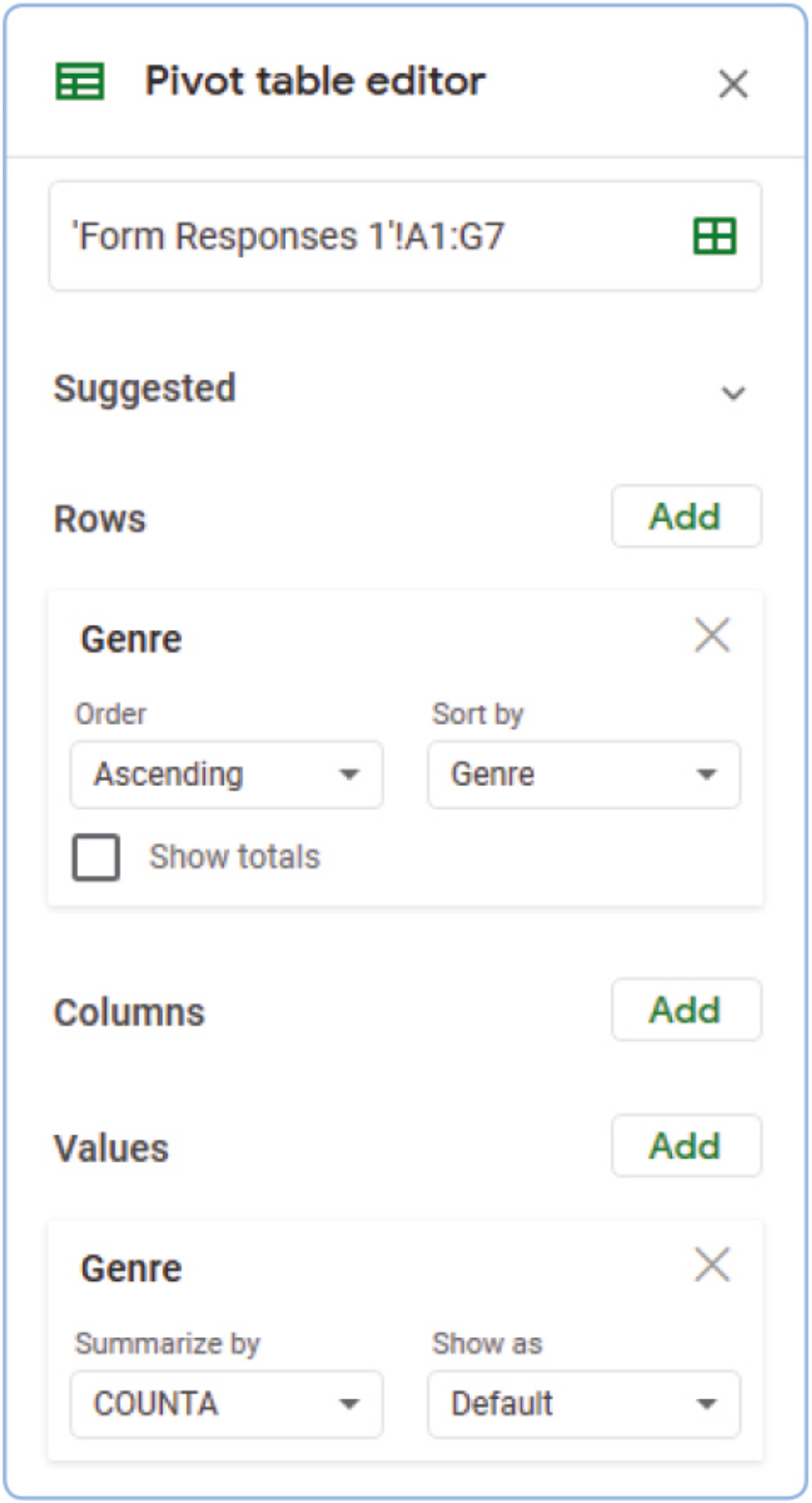


Bar Charts.

We use Bar graphs to compare things between different groups and view changes over time. Bar graphs are the best when showing big changes.



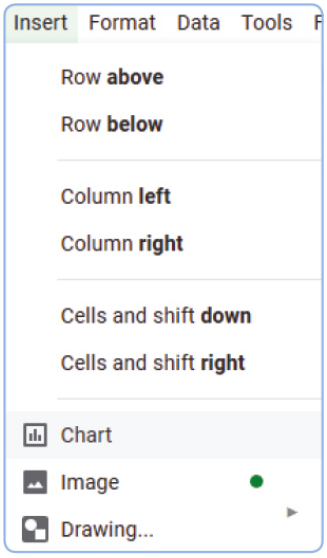
The best way for presenting your information is to prepare graphs. Previously we have made pivot tables which main purpose was to fi lter information. Now we are going to learn how to make graphs from pivot tables.

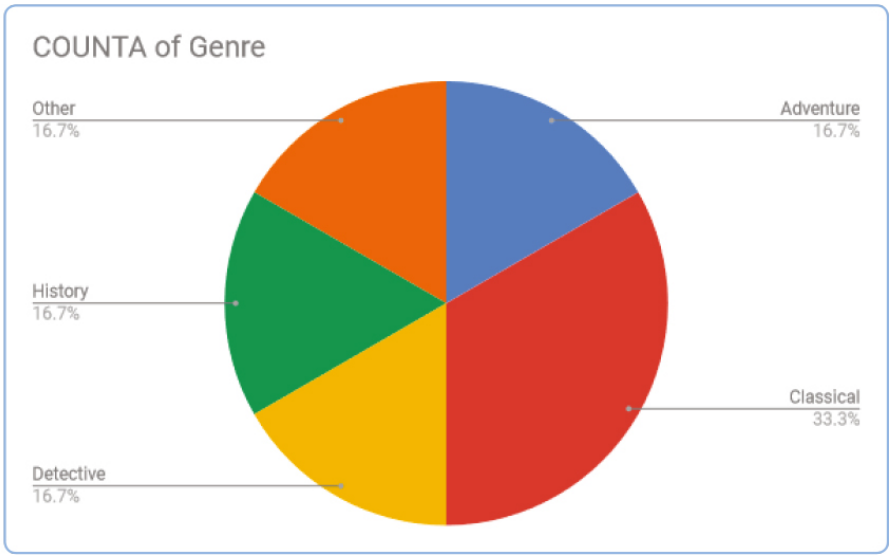


The table in Figure 5 shows how many books are in our database without showing total amount of books.

	A	B
1	Genre	COUNTA of Genre
2	Adventure	1
3	Classical	2
4	Detective	1
5	History	1
6	Other	1

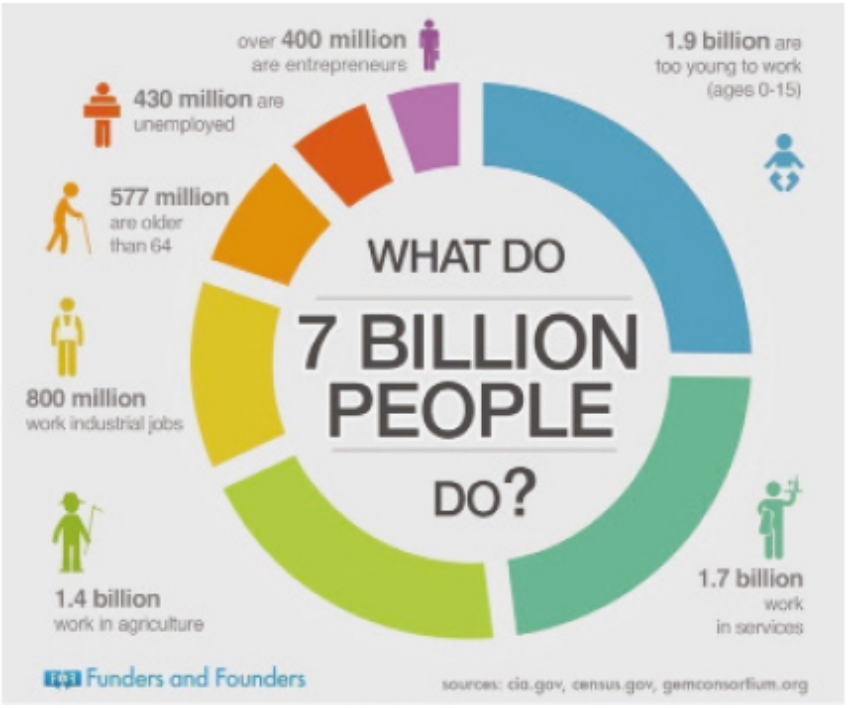
To insert a chart choose “Insert” » “Chart” option. You can change “Chart type” to “Pie chart“ from “Setup” menu in “Chart editor”.

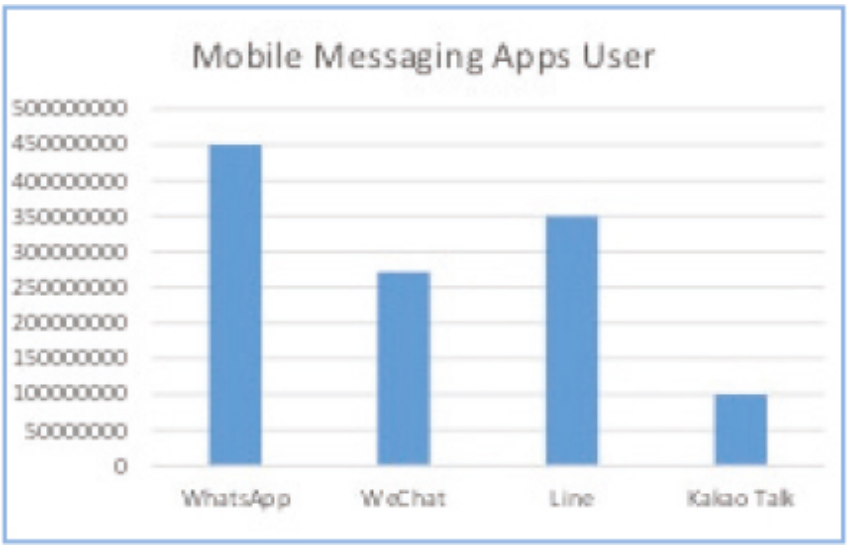


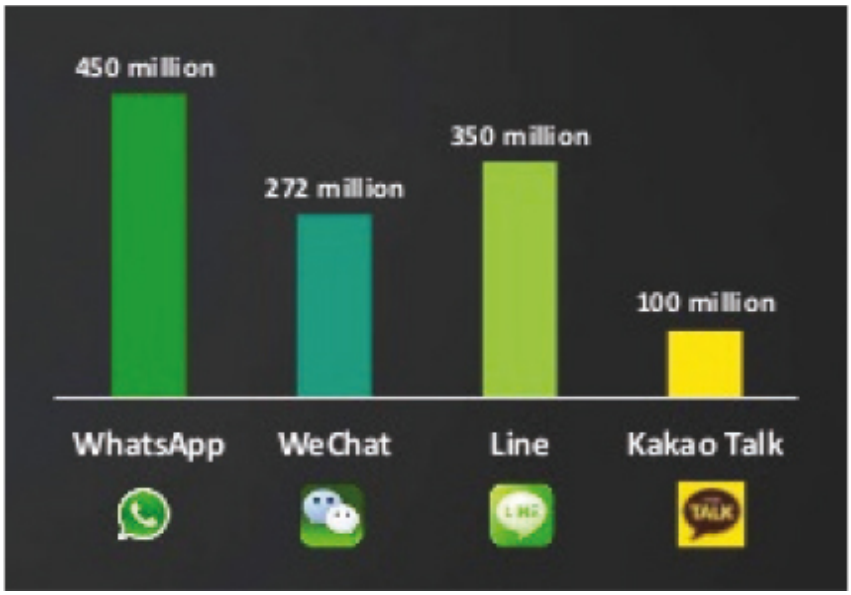


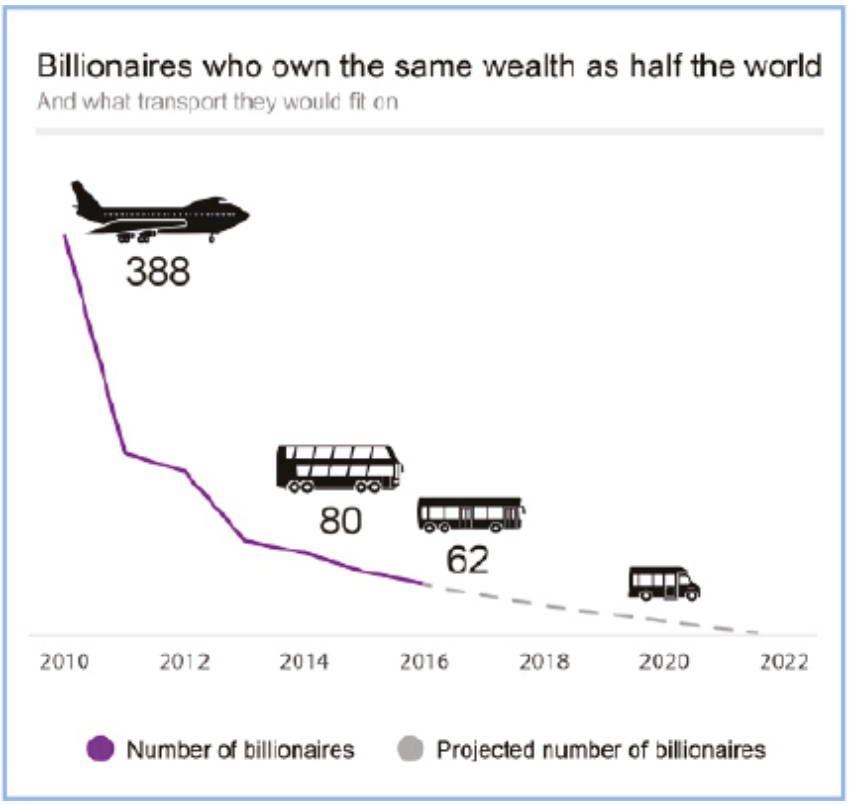
Activity

Analyze the charts below and discuss with your classmates the information that they give.









Practice

Apply charts for different pivot tables from the previous lesson.

Literacy

1. How to make charts in Google Sheets?
2. Discuss for which databases each chart type can be applied?

Terminology

- representation - көрсету - представление
- chart - диаграмма - диаграмма
- purpose - мақсаты - цель
- insert - кірістіру - вставить
- recommendation - ұсыныс - рекомендация

2.7 MINI PROJECT: FAMILY SHOP

You will:

- Create a database that will help to count goods in a shop;
- Get inforamation about Database types.

Would you like to help your family to arrange goods in your family shop?

Family shop database

In this lesson, we are going to make a small database that will help us to count goods in a shop/kiosk. At first, prepare a form that will provide easy information input for particular goods into your database.

Create a form with the title: “Our shop”. Add 5 fields with the following types:

1. Name of the product - Short answer;
2. Category of product - Dropdown (at least 4 categories);
3. Quantity - Short answer;
4. Price - Short answer;
5. Expire date - Date.

Practice 1

Add to database at least 5 products.

Practice 2

1. Now start working with the database table. Apply “sorting” of all goods according to ‘Price’ in descending order.
2. Filter all goods according to any two categories.
3. Add a pivot table to show all the records according to some types. For example: Show goods quantity in different categories
4. Finally, create a chart to represent information details.

Types of Database

Centralized database - Users from different locations can access this database from a remote location at the central database, that store entire information and application programs at a central computing facility for processing.

Operational database - This is more of a basic form of data that contain information relating to the operations of an enterprise.

End-user database - End user is the user of software, application or a product. This is a shared database which is shared by users and is meant for use by the end users, just like managers at different levels.

Commercial database - This is a database that contains information which external users may require. However, they will not be able to afford to maintain such huge database by themselves.

Personal database - The personal databases are maintained, generally, on personal computers. They contain information that is meant for use only among a limited number of users, generally working in the same department.

Distributed database - These databases have contributions from the common databases as well as the data captured from the local operations.

Fact

A databasemanagement system (DBMS) is a computersoftware application that interacts with endusers, other applications, and the database itself to

capture and analyze data. A generalpurpose DBMS allows the defi nition, creation, querying, update, and administration of databases.

Fact

Your responsibility as a database administrator (DBA) will be the performance, integrity, and security of a database. You'll be involved in the planning and development of the database, as well as in troubleshooting any issues on behalf of the users.

You'll ensure that:

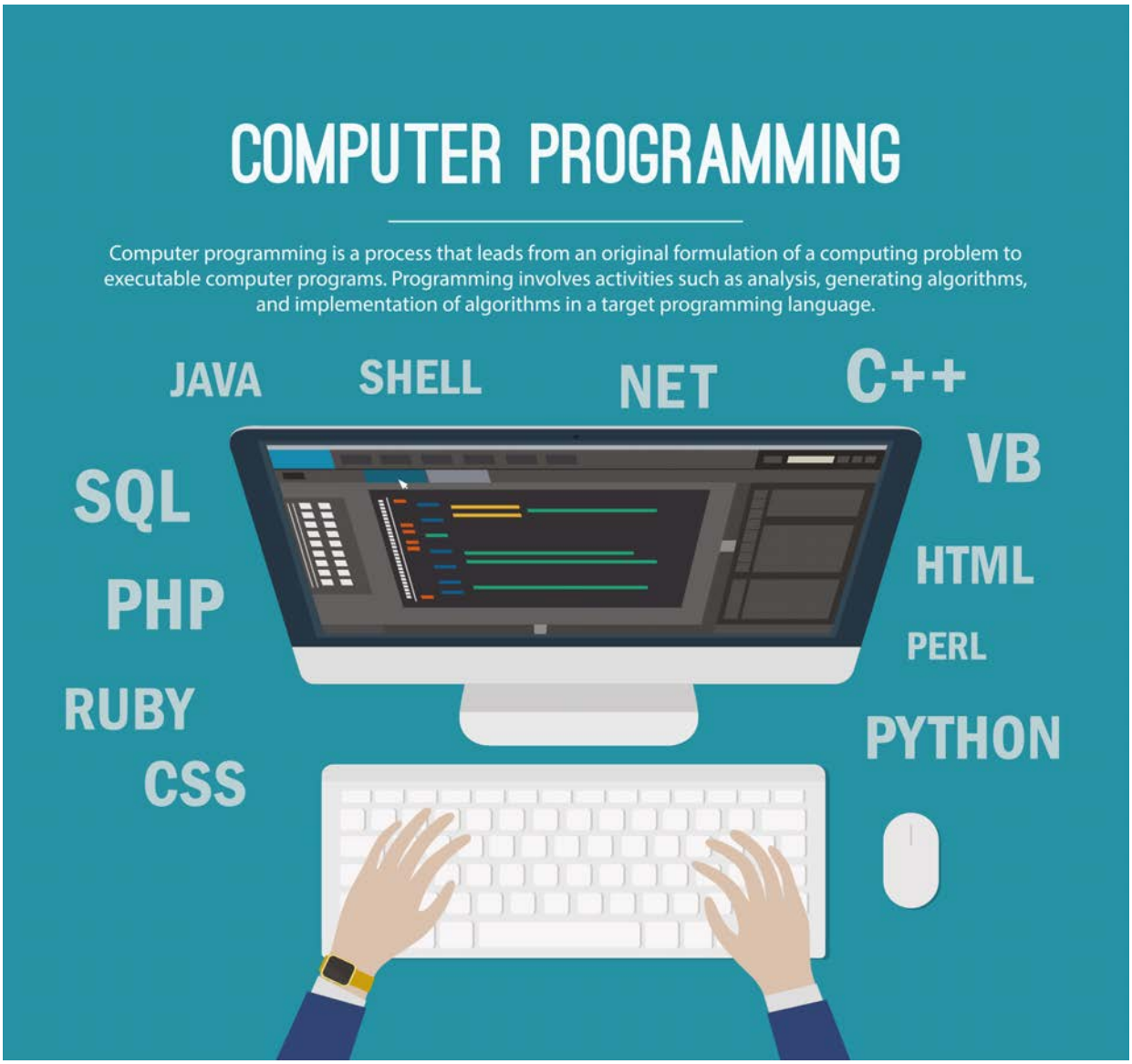
- data remains consistent across the database;
- data is clearly defi ned;
- users access data concurrently, in a form that suits their needs;
- there is provision for data security and recovery control (ensuring all data is retrievable in an emergency).

Terminology

- performance - өнімділік - представление
- integrity - тұтастық - целостность
- security - қауіпсіздік - безопасность
- troubleshoot - ақаулықтарды жою - устранение неполадок
- enterprise - кәсіпорын - предприятие

CHECK YOURSELF

1. Where can we use databases? (Give at least 3 examples)
2. Which parts does a database system consist from?
3. Describe the steps of planning a database
4. What data types do we have in Google Sheets?
5. What are the ways of creating a form?
6. How to apply a fi lter to table?
7. What is pivot table?
8. Describe the way of creating a spreadsheet table by using Form.
9. Describe functions of fi lter in Google sheet.
0. Describe way to apply pivot table.
1. Give 3 examples of where you can use Google Forms
2. Describe types of charts
3. Describe way to apply chart to your table.



CHAPTER 3

PROGRAMMING

3.1 PYTHON LIST

You will:

- Create python list and use;
- Learn to change list items.

How can you create a program that will store your classmates' names?

Python List

In this chapter, you'll learn everything about Python lists; how they are created, slicing of a list, adding or removing elements from them and so on.

What is a list in Python?

A list is a data structure for storing objects of different data types. In the list, you can store objects of different types (integer, fl oat, string, etc.). Size of the lists is not static (or not fixed), so you can change it however you want.

A list is a sequence of values in square brackets ([ ]). The values of a list are called elements and are separated by commas.

>>> [value, value, ...]

Example 1

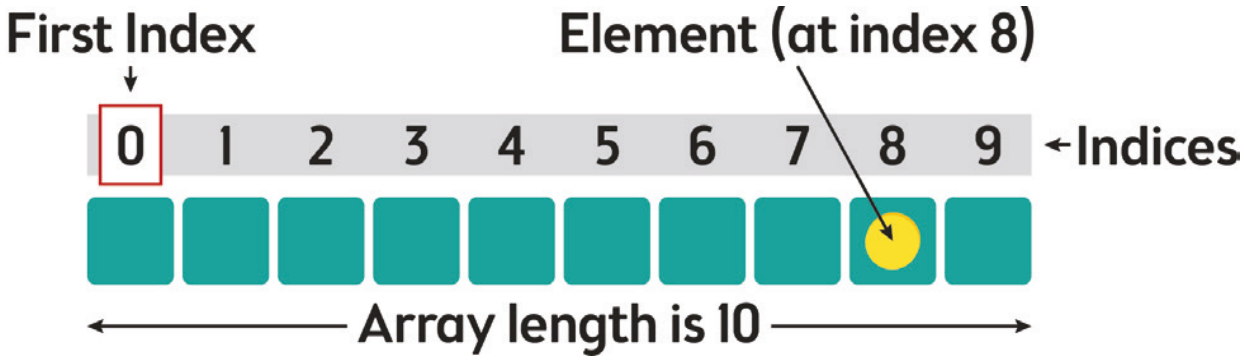
>>> data = [“This”, “list”, “has”, 4, “elements”]
>>> print (data)
This list has 4 elements

>>> numbers = [5, 3, 12, 4, 9, 12]
>>> print(numbers)

5 3 12 4 9 12

List Indexes

Each element in a list is accessed by an index. List indices start at 0.



An element can be accessed by an index using the following command:
list[index]

Example 2

```
>>> Fruits = [“apple”, “banana” , “orange”]
>>> print ( Fruits[0] )
>>> print ( Fruits[1] )
>>> print ( Fruits[2] )
apple banana orange
```

Keep in mind

Arrays and lists are both used in Python to store data, but they are different. The main difference between a list and an array is the functions that you can perform to them. Arrays have to be declared while lists don’t because they are part of Python’s syntax. So lists are used more often.

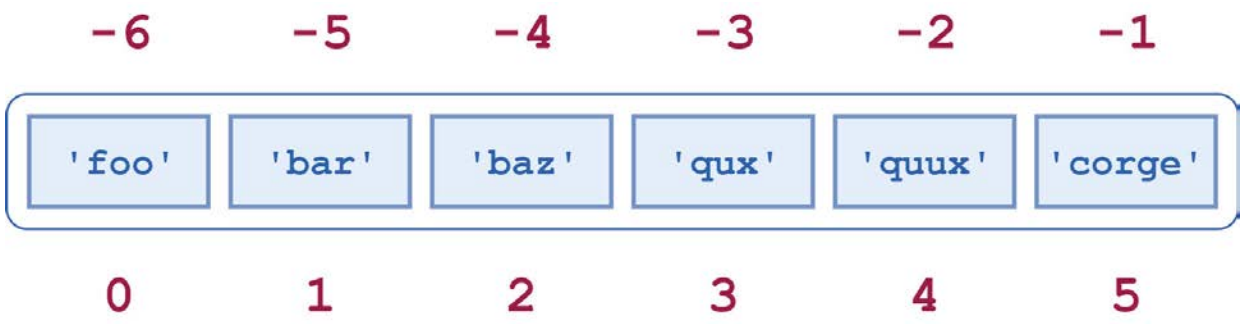
Practice 1

Print the second item in the fruits list.

fruits = [“apple”, “banana”, “cherry”]

Negative List Indexing

Virtually everything about string indexing works similarly for lists. For example, a negative list index counts from the end of the list:



Example 3

>>> a[-1]
‘corge’
>>> a[-2]
‘quux’
>>> a[-5]
‘bar’

Practice 2

Print the item with second negative index in the fruits list.

fruits = [“apple”, “banana”, “cherry”]

Negative List Indexing

In Python, lists can be modifi ed. For example, you can change the element at a certain index by assigning a new value to it.

list[index] = value

Example 4

>>> Fruits = [“apple”,”banana”,”orange”]
>>> Fruits[0] = “peach”
>>> Fruits[1] = “cherry”
>>> print (Fruits)
peach cherry orange

Practice 3

Change the value from “apple” to “kiwi”, in the fruits list.

fruits = [“apple”, “banana”, “cherry”]

Practice 4

There is a list of misspelled fruits within a list. Replace each mistake with the correct word.

fruits = [“aple”, “orang”, “bnanan”, “grapy”]

Literacy

1. Think about how to create a list of weekdays.
2. How can we change the start day of the week?

Terminology

- index – индекс – индекс
- element – элемент – элемент
- array – массив – массив
- comma – үтір – запятая
- value – шама – значение
- assign – тағайындау – присваивать
- store – сақтау – хранить

3.2 CREATING AND ADDING ELEMENTS TO A LIST

You will:

- Create python list and use;
- Add and insert elements to the List.

Creating and reading lists

Lists in Python can be created by just placing the sequence inside the square brackets[]. List doesn't need a built-in function for creation of list.

Example 1

```
# Creating a blank List
List = []
print("Intial blank List: ")
print(List)
```

Output

```
Intial blank List:
[]
```

Adding Elements to the List

Elements can be added to the List by using built-in append() function. Only one element at a time can be added to the list by using append() method, for addition of multiple elements with the append() method, loops are used.

append() method only works for addition of elements at the end of the List.

Example 2

```
# Adding elements to the List
List.append(1)
List.append(2)
List.append(4)
print("List after Addition of Three elements: ")
print(List)
```

Output

```
List after Addition of Three elements:
[1, 2, 4]
```

There's one more method for Addition of elements, extend(), this method is used to add multiple elements at the same time at the end of the list.

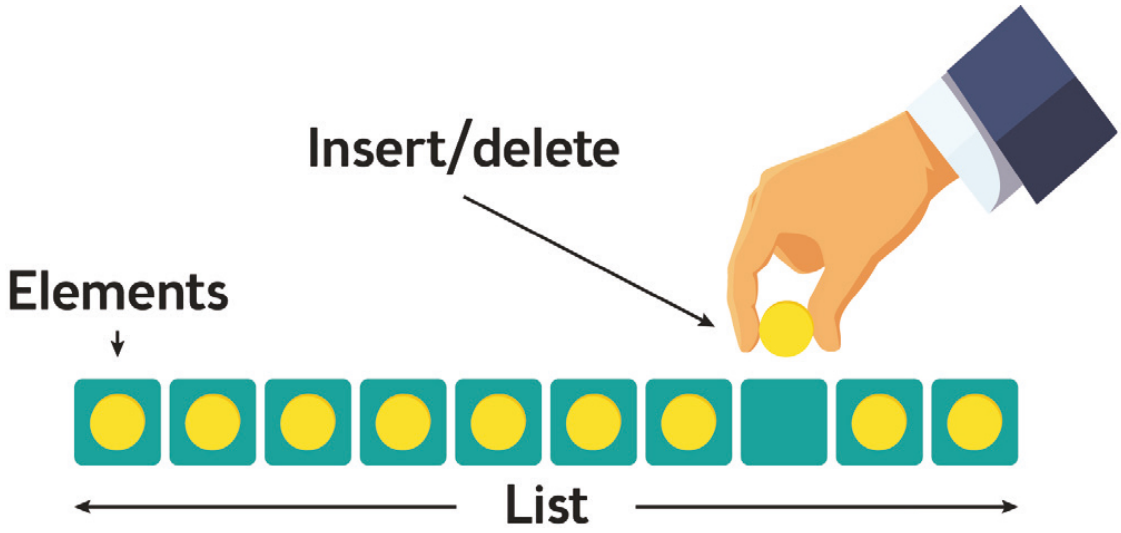
Example 3

```
# Adding multiple elements using Extend Method
List.extend([8, 'Python', 'List'])
print("List after performing Extend Operation: ")
print(List)
```

Output

```
List after performing Extend Operation:
[1, 2, 4, 8, 'Python', 'List']
```

For addition of element at the desired position, insert() method is used. Unlike append() which takes only one argument, insert() method requires two arguments (position, value).



Keep in mind

append() and extend() methods can only add elements at the end.

Example 4

```
# Adding element (using Insert Method)
List.insert(3, 12)
List2.insert(0, 'Python')
print("List after performing Insert Operation: ")
print(List)
```

Output

```
List after performing Insert Operation:
['Python', 1, 2, 4, 12, 8, 'Python', 'List']
```

For addition of multiple elements with the append() method, you can use loops.

Example 5

```
# Adding elements to the List using Iterator
```

```
for i in range(1, 4):
List.append(i)
print("List after Adding elements from 1-3: ")
print(List)
```

Output

```
List after performing Insert Operation:
['Python',1,2,4,12,8,'Python','List',1,2,3]
```

Practice 1

1. Create empty list.
2. Add at least 3 numbers and 2 strings to the list

Practice 2

Insert new item to the list, that you've created in Practice1, between first and second items.

Practice 3

1. Create new blank list
2. Add EVEN numbers from 2 to 10 using loop.

Literacy

1. How many methods of adding elements to the list do you know?
2. What is the difference between append(), extend() and insert() methods?

Terminology

- insert – кірістіру – вставить
- element – элемент – элемент

- extend – кеңейту – расширять
- even – жұп – четный
- odd – тақ – нечетный

3.3 SEARCH ELEMENT IN A LIST

You will:

- Methods of searching elements in list;

Do you have any method to find anything fast?

Ways to check if element exists in a list

List is an important container in python as it stores elements of all the data types as a collection. Now you will learn one of the basic list operations of ways to check the existence of an element in a list.

Method #1: using loop

This method uses a loop that iterates through all the elements to check the existence of the target element. This is the simplest way to check the existence of the element in the list.

Example 1

```
# Initializing list
my_list = [ 1, 6, 3, 5, 3, 4 ]
print("Checking if 4 exists in list (using loop):")
for i in my_list:
if(i == 4) :
print ("Element Exists")
```

Output

```
Checking if 4 exists in list (using loop):
Element Exists
```

Method #2: using “in”

Python in is the most conventional way to check if an element exists in list or not. This particular way returns True if element exists in list and False if the element does not exist in the list. The list need not be sorted to practice this approach of checking.

Example 2

```
# Checking if 4 exists in list using in
if (4 in my_list):
print (“Element Exists”)
```

Output

```
Checking if 4 exists in list (using in):
Element Exists
```

Method #3: using set() + in

Converting the list into set and then using “in” can possibly be more effi cient than only using “in”. But having effi ciency for a plus also has certain negatives. One among them is that the order of list is not preserved, and if you opt to take a new list for it, you would require to use extra space. Another drawback is that set disallows duplication and hence duplicate elements would be removed from the original list.

Example 3

```
# Initializing list
list_set = [ 1, 6, 3, 5, 3, 4 ]
print(“Checking if 4 exists in list (using set()+in):“)
list_set = set(list_set)
if 4 in list_set :
print (“Element Exists”)
```

Output

Checking if 4 exists in list (using set()+in):
Element Exists

Practice 1

1. Create and initialize a list;
2. Enter random 10 numbers into the list;
3. Input any number you like;
4. The program should check the number you like exists in the list;
5. Use different methods.

Practice 2

1. Create two lists;
2. Add 5 elements to the fi rst list using append() method;
3. Add 5 elements to the second list using extend() method;
4. The program should check the number you like exists in the list;
5. Check all items and print out elements that exist in both lists.

Hint: use for loop and in method.

Literacy

1. Explain the pros and cons of different ways of checking existence of element in the list.

Terminology

- loop – цикл – цикл
- element – элемент – элемент
- initialize – инициализациялау – инициализировать
- conventional – дәстүрлі – обычный

3.4 SWAP ELEMENTS IN LIST

You will:

- Learn to swap elements in a list;

How many ways do you know to swap items from two boxes?

Swapping Values in Python

Swapping the values of two variables in Python is actually a really simple task. Python makes it fairly easy to swap two values without a lot of bulky code. Check out how easy it is to swap two numbers with each other using the built-in methods below:

Example 1

```
x, y = 21, 64
print(x, y)
x, y = y, x
print(y, x)
```

Output

```
21 64
64 21
```

Python program to swap two elements in a list

Below given a program that swaps the two elements with given positions in the list.

Since the positions of the elements are known, we can simply swap the positions of the elements.

Example 2

```
List = [23, 65, 19, 90]
pos1, pos2 = 1, 3
print("List before swapping: ", List)
List[pos1], List[pos2] = List[pos2], List[pos1]
print("List after swapping 1st and 3rd
elements:")
print(List)
```

Intput

List = [23, 65, 19, 90], pos1 = 1, pos2 = 3

Output

List before swapping: [23, 65, 19, 90]
List after swapping 1st and 3rd elements:
[23, 90, 19, 65]

Practice 1

1. Create new blank list
2. Add numbers from 1 to 10 using loop.
3. Swap elements with index 3 and 7.
4. Swap elements with index 3 and 5.
5. Print List before and after swapping.

Practice 2

1. Create new blank list
2. Add ODD numbers from 3 to 20 using loop.
3. Swap elements with index 2 and 6.

4. Print List before and after swapping.

list.pop()

pop() is an inbuilt function in Python that removes and returns last value from the list or the given index value.

Example 3

```
List = [ 1, 2, 3, 4]
print(List.pop())
print("New List after pop: ", List)
```

Output

```
4
New List after pop: [1, 2, 3]
```

Example 4

```
List = [1, 2, 3, 4]
print(List.pop(2))
print("New List after pop: ", List)
```

Output

```
3
New List after pop: [1, 2, 4]
```

Swap items in a list using Inbuilt list.pop() function

Pop the element at pos1 and store it in a variable. Similarly, pop the element at pos2 and store it in another variable. Now insert the two popped element at each other's original position.

Example 4

```
List = [23, 65, 19, 90]
pos1, pos2 = 1, 3
print(“List before swapping: “, List)
first_element = List.pop(pos1)
second_element = List.pop(pos2 - 1)
List.insert(pos1, second_element)
List.insert(pos2, first_element)
print(“List after swapping 1st and 3rd elements:”)
print(List)
```

Output

```
4
New List after pop: [1, 2, 3]
```

Keep in mind

list.pop(index)

The value at index is popped out and removed.

If the index is not given, then the last element is popped out and removed.

When an index is out of range, it returns IndexError

Practice 3

1. Enter the number of elements in the list.
2. Enter the values of elements into the list.
3. Swap the first and last element in the list.
4. Print the newly formed list.

Terminology

- swap – орынындарын
- алмастыру – менять

- element – элемент – элемент
- pop – шығарып алу – вывезти
- even – жұп – четный
- odd – тақ – нечетный

3.5 SORTING IN PYTHON LIST

You will:

- Learn to swap elements in a list;

What's the fastest way to alphabetize your bookshelf?

Python list sort()

The sort function can be used to sort a list in ascending, descending or user-defi ned order.

To sort the list in ascending order.

List.sort() - sorts the given list in ascending order.

This function can be used to sort a list of integers, floating point number, string, and others.

Example 1

```
List = [1, 3, 4, 2]
#Sorting list of Integers in ascending
List.sort()
print(List)
```

Output

[1, 2, 3, 4]

To sort the list in descending order.

List.sort(reverse = True) - sorts the given list in descending order.

Example 2

```
List = [1, 3, 4, 2]
# Sorting list of Integers in descending
List.sort(reverse = True)
print(List)
```

Output

```
[4, 3, 2, 1]
```

Practice 1

1. Create a new blank list
2. Add at least 7 fruits.
3. Sort your list in reverse alphabetic order.
4. Print List before and after sorting.

Practice 2

1. Create a new blank list named “bookshelf”.
2. Add names of your favorite books. At least 10 books.
3. Sort your books in alphabetic order.
4. Print your sorted bookshelf.

Python sorted()

The sorted() method sorts the elements of a given iterable in a specifi c order - Ascending or Descending.

The syntax of sorted() method is:

```
sorted(iterable[, key][, reverse])
```

sorted() method returns a sorted list from the given iterable.

Example 3

```
# vowels list
pyList = [‘e’, ‘a’, ‘u’, ‘o’, ‘i’]
print(sorted(pyList))
# string
pyString = ‘Python’
print(sorted(pyString))
# vowels tuple
pyTuple = (‘e’, ‘a’, ‘u’, ‘o’, ‘i’)
print(sorted(pyTuple))
```

Output

```
[‘a’, ‘e’, ‘i’, ‘o’, ‘u’]
[‘P’, ‘h’, ‘n’, ‘o’, ‘t’, ‘y’]
[‘a’, ‘e’, ‘i’, ‘o’, ‘u’]
```

Bubble sort in python

Bubble Sort is the simplest sorting algorithm that works by repeatedly swapping the adjacent elements if they are in the wrong order.

Example 4

```
List = [64, 34, 25, 12, 22, 11, 90]
for i in range(n):
# Last i elements are already in place
    for j in range(0, n-i-1):
    # traverse the array from 0 to n-i-1
    # Swap if the element found is greater than the next element
        if List[j] > List[j+1]:
            List[j], List[j+1] = List[j+1], List[j]
print(“Sorted array is:”)
print(List)
```

Output

Sorted array is:
[11, 12, 22, 25, 34, 64, 90]

Keep in mind

Iterable - sequence (string, tuple, list) or collection (set, dictionary, frozen set) or any iterator.

Keep in mind

Use list.sort() when you want to mutate the list, sorted() when you want a new sorted object back. For lists, list.sort() is faster than sorted() because it doesn't have to create a copy.

Activity

Make small research about common sorting algorithms.

Literacy

1. Which method of sorting you usually use?
2. How often is sorting used in real life?

Terminology

- sort – сұрыптау – сортировать
- ascending – өсу тәртібі – по возрастанию
- descending – кему тәртібі – по убыванию
- reverse – кері – обратная
- traverse – айналдыру – перемещать

3.6 REMOVING ELEMENTS FROM A LIST

You will:

- Learn to swap elements in a list;

Previously we have added items to a list. Now we will be removing them from a list.

The pop() method removes and returns an element with a specified index or the last element if the index number is not given.

Example 1

```
clrs = [“Red”, “Blue”, “Black”, “Green”, “White”]
print(clrs)
clr = clrs.pop(3)
print(“{0} was removed”.format(clr))
```

Output

```
[‘Red’, ‘Blue’, ‘Black’, ‘Green’, ‘White’]
Green was removed
```

We take away the element which has index 3. The pop() method returns the name of the removed element; it is printed to the console.

Example 2

```
clr = clrs.pop()
print(“{0} was removed”.format(clr))
```

Output

White was removed

The last element from the list, namely “White” string, is removed from the list.

The remove() method removes a particular item from a list.

Example 3

```
clrs.remove(“Blue”)
print(clrs)
```

Output

[‘Red’, ‘Black’]

Practice 1

You’ve just earned 50 000 000 tenges, awesome! You decide to build a pool house and a garage. Can you add the information to the areas list?
areas=[“hallway”, 11.25, “kitchen”, 18.0, “chillzone”, 20.0, “bedroom”, 10.75, “bathroom”, 10.50]

Information: “poolhouse”, 24.5 “garage, 15.45

Example #3 removes a “Blue” string from the “clrs” list. From the output of the script we can see the effects of the described methods.

A del keyword can be used to delete list elements as well. In the example below, we have a list of strings. We use the del keyword to delete list elements.

Example 4

```
clrs = [“Red”, “Blue”, “Black”, “Green”, “White”]
```

```
print(clrs)
del clrs[1]
print(clrs)
```

Output

```
['Red', 'Blue', 'Black', 'Green', 'White']
['Red', 'Black', 'Green', 'White']
```

We remove the second string from the list. It is the "Blue" string.

Example 5

```
del clrs[:]
print(clrs)
```

Output

```
[]
```

Here we remove all the remaining elements from the list. The [:] characters refer to all items of a list.

Practice 2

1. Create and initialize a list;
2. Enter random 10 numbers into the list;
3. Remove 5 elements using different methods of removing;

Practice 3

There was a mistake! The amount of money you've earned is not that big after all and it looks like the pool house isn't going to happen. You decide to remove the corresponding string and float from the areas list.

areas = [“hallway”, 11.25, “kitchen”, 18.0, “chill zone”, 20.0, “bedroom”, 10.75, “bathroom”, 10.50, “poolhouse”, 24.5, “garage”, 15.45]

Keep in mind

We can delete only existing elements. If we write del clrs[15], we will receive an IndexError message.

Literacy

1. Explain the differences between pop(), remove(), del and [:]?
2. What would happen if write pop() with the same index?
3. What would happen if we try to delete an item that doesn’t exist?

Terminology

- remove – алып тастау – удалить
- alphabetize – әліпбилік ретпен қою – располагать по алфавиту
- corresponding – сәйкес келетін – соответствующий

3.7 TWO-DIMENSIONAL LIST IN PYTHON

You will:

- create twodimensional array in python;
- use two-dimensional array.

In real-world often tasks have to store rectangular data table. How to write them in python list?

Nested Lists

You have seen that an element in a list can be any sort of object. That includes another list. A list can contain sublists, which in turn can contain sublists themselves, and so on to arbitrary depth.

Example 1

```
>>> x = [‘a’, [‘bb’, [‘ccc’, ‘ddd’], ‘ee’, ‘ff ’], ‘g’, [‘hh’, ‘ii’], ‘j’]
>>> x
[‘a’, [‘bb’, [‘ccc’, ‘ddd’], ‘ee’, ‘ff ’], ‘g’, [‘hh’, ‘ii’], ‘j’]
```

The object structure that x references is diagrammed below:

x[0], x[2], and x[4] are strings, each one character long:

```
>>> print(x[0], x[2], x[4])
a g j
```

But x[1] and x[3] are sublists:

```
>>> x[1]
```

['bb', ['ccc', 'ddd'], 'ee', 'ff ']
>>> x[3]
['hh', 'ii']

To access the items in a sublist, simply append an additional index:

>>> x[1]
['bb', ['ccc', 'ddd'], 'ee', 'ff ']
>>> x[1][0]
'bb'
>>> x[1][1]
['ccc', 'ddd']

All the usual syntax regarding indices and slicing applies to sublists as well:

>>> x[1][1][-1]
'ddd'
>>> x[1][1:3]
[['ccc', 'ddd'], 'ee']
>>> x[3][::-1]
['ii', 'hh']

Practice 1

Write correct index to print out "big red apple".
fruits = [["banana", "cherry", "apple"], ["green", "orange", "red",],
["small", "medium", "big"]]

Creating nested lists

Suppose that two numbers are given: the number of rows of n and the number of columns m.

You must create a list of size n×m, filled with zeros.

A possible way: you can create a list of n elements (say, of n zeros) and then make each of the elements a link to another one-dimensional list of m

elements:

```
n = 3
m = 4
a = [0] * n
for i in range(n):
        a[i] = [0] * m
```

Another way: create an empty list and then append a new element to it n times (this element should be a list of length m):

```
n = 3
m = 4
a = [0] * n
for i in range(n):
        a[i] = [0] * m
```

But the easiest way is to use the generator, creating a list of n elements, each of which is a list of m zeros:

```
n = 3
m = 4
a = [[0] * m for i in range(n)]
```

In this case, each element is created independently from the others. The list [0] * m is n times constructed as the new one, and no copying of references occurs.

Practice 2

Create 5×5 list and change item at index[3][2].

Literacy

1. What is the difference between normal list and nested list?
2. Where we can use two-dimensional array?

Give three real-life examples.

Terminology

- Nested – кірістірілген – вложенный
- two-dimensional – екі өлшемді – двумерный
- arbitrary – ерікті, еркін – произвольный
- regarding – қатысты – относительно

3.8 SORTING TWO-DIMENSIONAL LIST

You will:

- learn to sort two- dimensional arrays.

Sort list of list by specified index

We can sort a list of the list using the conventional sort function. This sorts the list by the first index of lists. But more than often there can be circumstances that require the sorting of a list of the list by other index elements than first. Let's discuss certain ways in which this task can be performed.

Method #1 : Using sort() + lambda

sort() can be used to perform this variation of sort by passing a function as a key that performs the sorting according to the desired inner list index.

Example 1

```
# initializing list
List = [[“Darkhan”, 4, 28], [“Yerbol”, 2, 20], [“Aibek”, 1, 20], [“Askhat”, 3, 21]]
# printing original list
print(“Original list:”)
print(List)
# using sort() + lambda to sort list
List.sort(key = lambda List: List[1])
# printing result
print(“List after sorting by 2nd element:”)
print(List)
```

Output

Original list:
[[‘Darkhan’, 4, 28], [‘Yerbol’, 2, 20], [‘Aibek’, 1, 20], [‘Askhat’, 3, 21]]
List after sorting by 2nd element:
[[‘Aibek’, 1, 20], [‘Yerbol’, 2, 20], [‘Askhat’, 3, 21], [‘Darkhan’, 4, 28]]

The lambda keyword lets us define a mini-function which receives List (in this case, our row) and returns the second element of List (List[1]).

Method #2 : Using sorted() + itemgetter()

This method can also be applied to perform this particular task. The advantage of this method is that it does not modify the original list. itemgetter() is used to get the index element by which the sort operation needs to be performed.

Example 2

```
# import itemgetter
from operator import itemgetter
# initializing list
List = [[“Darkhan”, 4, 28], [“Yerbol”, 2, 20], [“Aibek”, 1, 20], [“Askhat”, 3, 21]]
# using sorted() + itemgetter to sort list
res = sorted(List, key = itemgetter(1))
# printing result
print(“List after sorting by 2nd element:”)
print(res)
```

Output

List after sorting by 2nd element:
[[‘Aibek’, 1, 20],
[‘Yerbol’, 2, 20],
[‘Askhat’, 3, 21],
[‘Darkhan’, 4, 28]]

Practice 1

1. Create and initialize two-dimensional list;
2. Every row should contain “Name” and “Year of birth”;
3. Sort list by Name;
4. Sort list by Year of birth.

Practice 2

1. Create a two-dimensional list;
2. Insert “Film names” and “Date of releases” to the list;
3. Sort list by Date of releases in ascending order and descending order.

Hint: use reverse.

Literacy

1. Is there any difference between sorting the normal list and multi-dimensional list?
2. What would be the result if we sort list by one element, then sort again by another element?

Terminology

- specified – арнайы – указанный
- circumstance – жағдай – обстоятельство
- perform – орындау – выполнять
- variation – вариация – вариация

3.9 INSERT/DELETE VALUES IN 2D LIST

You will:

- learn to insert values in a twodimensional list;
- learn to update values in a two-dimensional list;
- learn to delete values in a two-dimensional list.

Where two or three dimensional arrays can be used in real life?

Inserting Values in Two-Dimensional Array

We can insert new data elements at a specifi c position by using the insert() method and specifying the index.

In the below example a new data element is inserted at index position 2.

Example 1

```
List = [[11, 12, 5, 2], [15, 6, 10], [10, 8, 12, 5],
List.insert(2, [0,5,11,13,6])
for x in List:
    for y in x:
        print(y, end = " ")
    print()
```

When the above code is executed, it produces the following result.

Output

```
11 12 5 2
15 6 10
0 5 11 13 6
10 8 12 5
```

Updating Values in Two-Dimensional Array

We can update the entire inner array or some specific data elements of the inner array by reassigning the values using the array index.

Example 2

```
List = [[11, 12, 5, 2], [15, 6, 10], [10, 8, 12, 5], [12,15,8,6]]
List[2] = [11,9]
List[0][3] = 7
for x in List:
    for y in x:
        print(y, end = " ")
    print()
```

Output

```
11 12 5 7
15 6 10
11 9
12 15 8 6
```

Practice 1

The list given below is the calendar for May.

1. Insert this information to the two-dimensional list;
2. Find the national holidays of Republic Kazakhstan and replace them with the word "Holiday".

Deleting the Values in Two-Dimensional Array

We can delete the entire inner array or some specific data elements of the inner array by reassigning the values using the del() method with index. But in case you need to remove specific data elements in one of the inner arrays, then use the update process described above.

Example 3

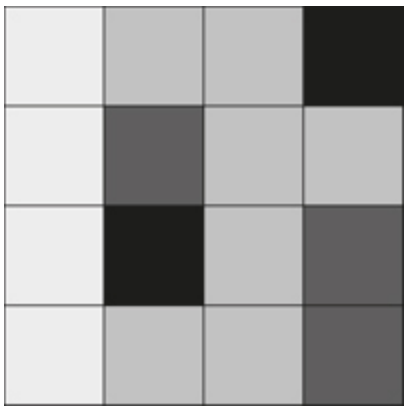
```
List = [[11, 12, 5, 2], [15, 6,10], [10, 8, 12, 5], [12,15,8,6]]
del List[3]
for x in List:
        for y in x:
                print(y, end = " ")
        print()
```

Output

```
11 12 5 2
15 6 10
10 8 12 5
```

Keep in mind

We can use this type of data structure to encode information about an image. For example, the following grayscale image could be represented by the following list:



x=[[236, 189, 189, 0],

[236, 80, 189, 189],
[236, 0, 189, 80],
[236, 189, 189, 80]]

Practice 2

1. Create 4×5 two-dimensional list;
2. Insert 0s and 1s to the list according to the letter shown in fi gure right;
3. Insert 0s where it's empty and 1s where it's fi lled in the fi gure;
4. Update list values so that to change letter K to letter O.

Literacy

1. What is the difference between inserting value and updating value?

2. What we should do to delete only one element from an inner array, not the entire row?

Terminology

- value – мәні – значение
- execute – орындау – выполнять
- reassign – қайта мән беру – переназначить
- inner – ішкі – внутренний

CHECK YOURSELF

1. What type is the following variable?
x = “Hi there”
a) float
b) integer
c) boolean
d) string

2. How many lines will this program print?
while True:
    print “hi”a) 0
b) 10
c) 100
d) an infi nite number of lines

3. How many lines will this program print?
x = 10
while x > 0:
    print x
    x = x - 3
a) 3
b) 4
c) 5
d) 6

4. Which of the following programs prints ten lines?
a) for i in range(10):
    print “hi”
b) for i = 1 to 10:
    print “hi”
c) for i in 1 - 10:
    print “hi”
d) for i from 0 to 9:
    print “hi”

5. Which of the following best describes the purpose of a for loop?
a) A for loop is for doing something an indeterminate number of times.
b) A for loop is doing something an infi nite number of times.
c) A for loop is for doing something a fixed number of times.
d) A for loop is for doing something three times.

6. Which Python keyword skips back to the beginning of a loop?
a) break
b) continue

7. Which Python keyword exits a loop?
a) break
b) continue

8. What does the following program print?
for i in range(2):
    for j in range(2):

```
        print i + j
```
a) 0
1
1
2
b) 0112
c) 0
1
0
1
d) 0101

9. How many lines does the following program print?
```
for i in range(3):
    for j in range(5):
        print “hi”
```
a) 3
b) 5
c) 8
d) 15

10. Which of the following while loops would continue to loop as long as num is in the range 3 to 12, exclusive?
a) while num > 12 and num < 3:
do something with num
b) while num < 12 or num > 3:
do something with num
c) while num <= 12 and num >= 3:
do something with num
d) while num < 12 and num > 3:
do something with num

11. What is the value of sum when this loop completes?
```
sum = 0
for i in range(3):
    sum = sum + 5
    for j in range(2):
        sum = sum - 1
```
a) 8
b) 9
c) 20
d) 0

12. Which of the following for loops would print the following numbers?
3
5
7
9
a)
```
for i in range(3, 10, 2):
    print i
```
b)
```
for i in range(3, 9, 2):
    print i
```
c)
```
for i in range(9):
    print i
```
d)
```
for i in range(3,9):
    print i
```

13. Which of the following for loops would print the following numbers?
0
1
2
3
4
5
a) for i in range(5):
    print i
b) for i in range(1, 5, 1):
    print i
c) for i in range(6):
    print i
d) for i in range(0,5, 1):
    print i

14. What does this program print?
for i in range(6):
    if i == 3:
        continue
    print i
a) 0
1
2
b) 0
1
2
3
c) 0
2
4
6
d) 0
1
2
4
5

15. Which of the following Python programs creates a list with the numbers 1 through 5?
a) my_list = (1, 2, 3, 4, 5)
b) my_list = [1, 2, 3, 4, 5]
c) my_list = 1, 2, 3, 4, 5
d) my_list = “1, 2, 3, 4, 5”

16. Look at the following program:
my_list = [“bananas”, “oranges”, “grapes”,
“pineapples”, “apples”]
You pick the code that goes here...
...
...
print my_list
Pick the code that results in the following output:
[‘apples’, ‘bananas’, ‘grapes’, ‘oranges’, ‘pineapples’]
a) my_list.sort()
my_list.reverse()

b) my_list.sort()
c) my_list.reverse()
d) my_list.remove(“grapes”)

17. What does this program print?
my_list = [-4, 2, 3, 2, -2, 5]
print [x % 2 == 0 for x in my_list]
a) [True, True, False, True, True, False]
b) False
c) [0, 0, 1, 0, 0, 1]
d) [-4, 2, 2, -2]

18. Which of the following lines of code will cause an error?
Use the following defi nition of ages:
ages = (12, 5, 8)
a) ages = ages + (1, 3, 5)
b) print ages[2]
c) ages = ages[2:]
d) ages[0] = 3

19. What does this code snippet print?
fruit = [“b”, “n”, “n”, “”]
print “a”.join(fruit)
a) bnn
b) ba na na
c) banana
d) abanana

20. What is the value of num after this code runs?
shapes = [“triangle”, “square”, “hexagon”,
“circle”, “pentagon”]
num = len(shapes)
a) 0
b) 4
c) 5
d) 35

CHAPTER 4

PROGRAMMING 2D GAMES

4.1 PYGAME LIBRARY

You will:

- Install PyGame library;
- use the PyGame library to create a window for the game.

What does ‘library’ mean in the case of programming languages?

What is PyGame?

PyGame (the library) is a Free and Open Source python programming language library for making multimedia applications. Pygame is highly portable and runs on nearly every platform and operating system.

PyGame makes it simple to:

- Draw graphic shapes
- Display bitmapped images
- Animate
- Interact with keyboard, mouse, and gamepad
- Play sound
- Detect when objects collide

How to install Pygame library

The best way to install pygame is with the pip tool (which is what python uses to install packages). Note, this comes with python in recent versions. We use the --user fl ag to tell it to install into the home directory, rather than globally.

py -m pip install -U pygame --user

To see if it works, run one of the included examples

py -m pygame.examples.aliens

If it works, you are ready to go!
The fi rst code a Pygame program needs to do is load and initialize the Pygame library. Every program that uses Pygame should start with Importing and initializing Pygame:

Import a library of functions called ‘pygame’

```
import pygame
# Initialize all imported pygame modules
pygame.init()
```

Simple Pygame Window

pygame.display.set_mode(resolution=(width, height))

This function will create a display Surface. The resolution argument is a pair of numbers representing the width and height.

Keep in mind

Important:

Don’t name any file “pygame.py”

The import pygame looks for a library fi le named pygame. If a programmer creates a new program named pygame.py, the computer will import that fi le instead! This will prevent any pygame programs from working until that pygame.py file is deleted

Practice 1

Create a simple PyGame window of 600 pixels in height and 400 pixels in width and run. What did you notice?

If you run the code above, a 600x400 pixel window will appear and close immediately.

Why does the window close immediately?

Because the program ends after the execution of these expressions. Neither init () nor set_mode () suggest cyclic event. That's why you need to create a loop, causing the program to hang. And now, create a loop:

Example 1

```
run = True
while run:
        for event in pygame.event.get(): # User did something
                if event.type == pygame.QUIT: # If user clicked close
                        run = False # Close clicked so exit this loop
```

To set the title of the window (which is shown in the title bar) use the following line of code:

pygame.display.set_caption("Title")

Ending the Program

Right now, clicking the "close" button of a window while running this Pygame program in IDLE will still cause the program to crash.
The problem is, even though the loop has exited, the program hasn't told the computer to close the window. By calling the command below, the program will close any open windows and exit as desired.

pygame.quit() # Uninitialize all pygame modules

Practice 2

1. Create a simple PyGame window(495x120 pixels).
2. Set title “Cool game in PyGame“.

Literacy

1. What is the PyGame library?
2. What functions does PyGame provide?
3. What can you get if you use it?

Terminology

- Library - кітапхана - библиотека
- package - пакет - пакет
- collide – соқтығысу - сталкиваться
- import – импорттау - импортировать
- surface – беті - поверхность
- initialize – инициализациялау - инициализировать
- event – жағдай - событие

4.2 BACKGROUND IMAGE IN PYGAME

You will:

- Set a background image.

What makes you want to play a 2d game?

How to create background

First of all, you need to add variables that defi ne colors that you use in program. Colors are defi ned in a list of three colors: red, green, and blue.

As you remember, lists in Python are surrounded by either square brackets or parentheses. Individual numbers in the list are separated by commas. Below is an example that creates variables and sets them equal to lists of three numbers. These lists will be used later to specify colors.

```
# Define some colors
BLACK = ( 0, 0, 0)
WHITE = ( 255, 255, 255)
GREEN = ( 0, 255, 0)
RED = ( 255, 0, 0)
BLUE = ( 0, 0, 255)
```

Clearing the Screen

The following code clears whatever might be in the window with a white background. Remember that the variable WHITE was defined earlier as a list of 3 RGB values.

 # Clear the screen and set the screen background
screen.fill(WHITE)

Keep in mind

To fi nd RGB code of color you need you can use online color picker at www.colorpicker.com

Flipping the Screen

Very important!
You must fl ip the display after you draw. The computer will not display the graphics as you draw them because it would cause the screen to fl icker. This waits to display the screen until the program has finished drawing. The command below “flips” the graphics to the screen.

 # Go ahead and update the screen with what we’ve drawn
pygame.display.flip()

Practice 1

1. Create a window (500 x 600 pixels);
2. Set background color to green;

Hint: use .fill() and .flip() methods.

Setting a background image

Any bitmap images used in a game should already be sized for how it should appear on the screen.
Don’t take a 5000 x 5000 pixel image from a high-resolution camera and then try to load it into a window only 800 x 600.
Loading an image is a simple process and involves only one line of code.

```
bkground_image = pygame.image.load("image.jpg")
```

"pygame.image.load" method is used to load an image.
The image needs to be converted to a format Pygame can more easily work with. To do that, we append .convert() to the command to call the convert function.

```
bkground_image=pygame.image.load("image.jpg").convert()
```

Call blit method to draw image on screen. This command should be done inside the loop so the image gets drawn each frame.

```
screen.blit(bkground_image, [0, 0])
```

This code blit's the image held in bkground_image to the screen starting at (0, 0).

Practice 2

1. Create a window (800 x 600 pixels);
2. Set title "Space Invaders";
3. Find a space image and set to background.

Keep in mind

This file must be located in the same directory that the python program is in, or the computer will not find it.

Keep in mind

Loading the image should be done before the main program loop.

Literacy

1. Explain the steps of setting background image.
2. What is the difference between setting background color and background image?

Terminology

- background - фон - фон
- fill - толтыру - заполнить
- flip - айналдыру - перевернуть
- load - жүктеу - загрузить
- append - қосу - присоединять
- appear - пайда болу - появляться

4.3 DRAWING SHAPES. PYGAME ANIMATION.

You will:

- Draw different shapes;
- Program character movement.

What is the most important element in video games?

Drawing shapes

A program can draw things like rectangles, polygons, circles, ellipses, arcs, and lines.

pygame.draw.rect(Surface, color, (x, y, width, height), thickness)

Draws a rectangular shape on the Surface.

Example 1

pygame.draw.rect(screen, WHITE, [100, 100, 400, 300], 2)

This example will draw a rectangle as a line

Keep in mind

The Surface.fill() method works just as well for drawing filled rectangles.

Example 2

pygame.draw.rect(screen, WHITE, [100, 100, 400, 300])

This example will draw a rectangle that is filled in.

Some other pygame modules for drawing shapes

pygame.draw.polygon - draw a shape with any number of sides
pygame.draw.circle - draw a circle around a point
pygame.draw.ellipse - draw a round shape inside a rectangle
pygame.draw.arc - draw a partial section of an ellipse
pygame.draw.line - draw a straight line segment
pygame.draw.lines - draw multiple contiguous line segments

Practice 1

1. Create a window (800 x 600 pixels);
2. Set background image;
3. Create blue rectangle (100 x 100 pixels) at the center of the window.

Moving the object with keyboard

In order to move your object within pygame you will need to find out whether the user has pressed a certain key or not from the value of the event's key property.

pygame.key - pygame module to work with the keyboard. This module contains functions for dealing with the keyboard.

The event queue gets pygame. KEYDOWN and pygame.KEYUP events when the keyboard buttons are pressed and released. Both events have a key attribute that is a integer ID representing every key on the keyboard.

Below is the script to move a square in the right or the left direction on the display screen.

```
# First initialize MOVE_LEFT or MOVE_RIGHT directions
MOVE_RIGHT = 1
MOVE_LEFT = 2
DIRECTION = 0

# put inside loop
for event in pygame.event.get():
    if event.type == pygame.QUIT:
        run = False
    if event.type == pygame.KEYDOWN:
        if event.key == pygame.K_LEFT:
            direction=left
        elif event.key == pygame.K_RIGHT:
            direction=right
    elif event.type == pygame.KEYUP:
        if event.key == pygame.K_LEFT:
            direction=0
        elif event.key==pygame.K_RIGHT:
            direction=0
if direction==left:
    x-=1
elif direction==right:
    x+=1
```

Practice 2

Continue the script above and move object UP and DOWN;

Hint: use event.key = pygame.K_UP, event.key = pygame.K_DOWN

Keep in mind

It is not possible to change a .jpg to another format just by renaming the fi le extension to .png. It is still a .jpg even if you call it something different. It requires conversion in a graphics program to change it to a different format.

Literacy

1. What is the difference between adding background image and character image?
2. Which image formats are better to use, if you are picking out an image that will be transparent? Why?

Terminology

- Draw - сызу - рисовать
- thickness - қалыңдық - толщина
- key – батырма - клавиша
- script – сценарий - сценарий
- direction – бағыт - направление
- transparent – мөлдір - прозрачный
- pick out – таңдау - выбрать

4.4 UPLOADING CHARACTER

You will:

- Upload ready characters for the game.

If you could be a video game character, who would you want to be and why?

Moving an Image

Now you will load a character image to your game. First of all, find and download any spaceship image. You can find a .gif or .png that you like with a white or black background.

Don't use a .jpg.

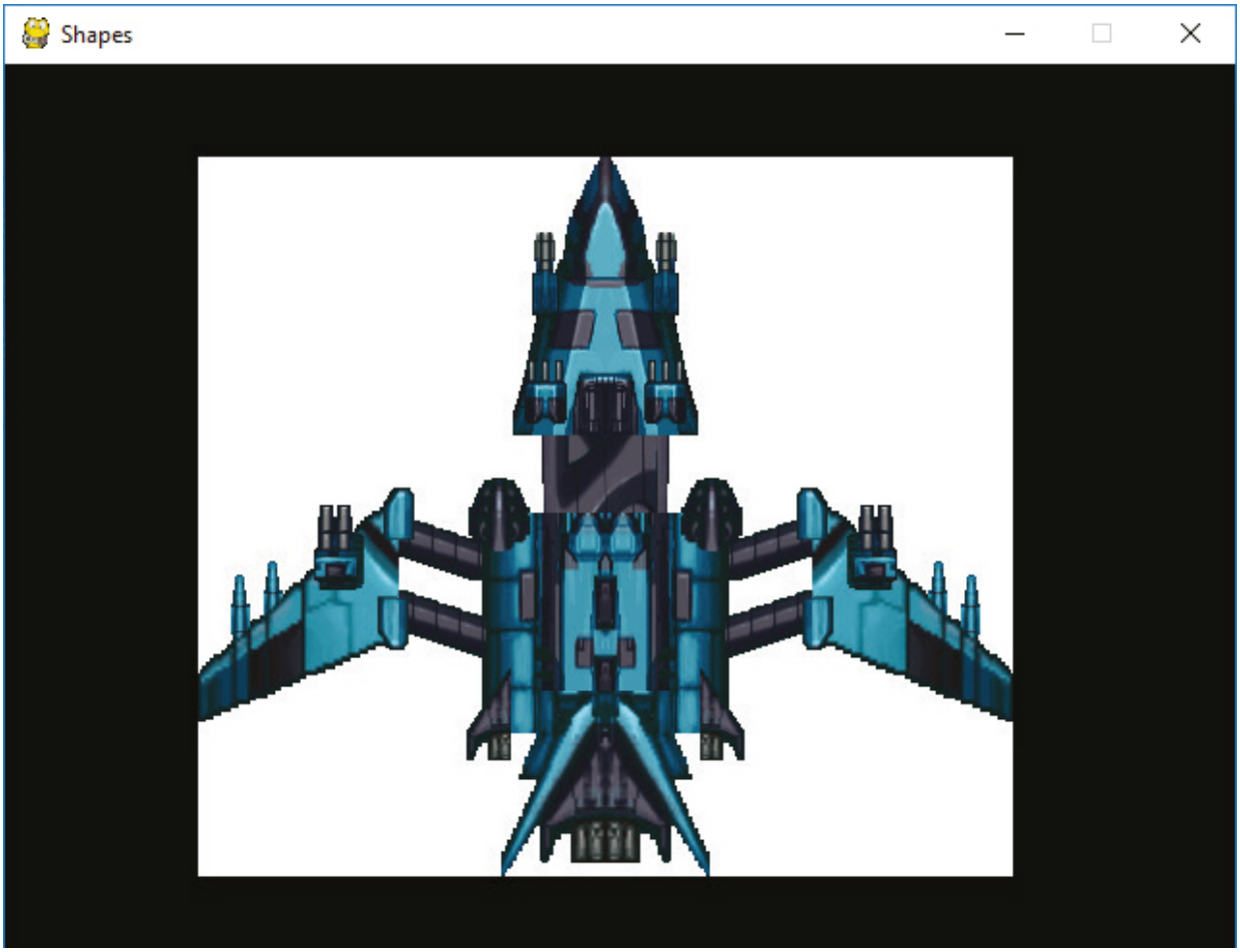
To load the image you need the same type of command that you used with the background image. In this case, assume the file is saved as player.png.

```
player_img = pygame.image.load("player.png").convert()
```

Then, copy an image to the screen.

```
screen.blit(player_img, [x, y])
```

But now, if you run the code, you will get the space ship image with a solid white background. So when the image is drawn the program shows Figure 2.

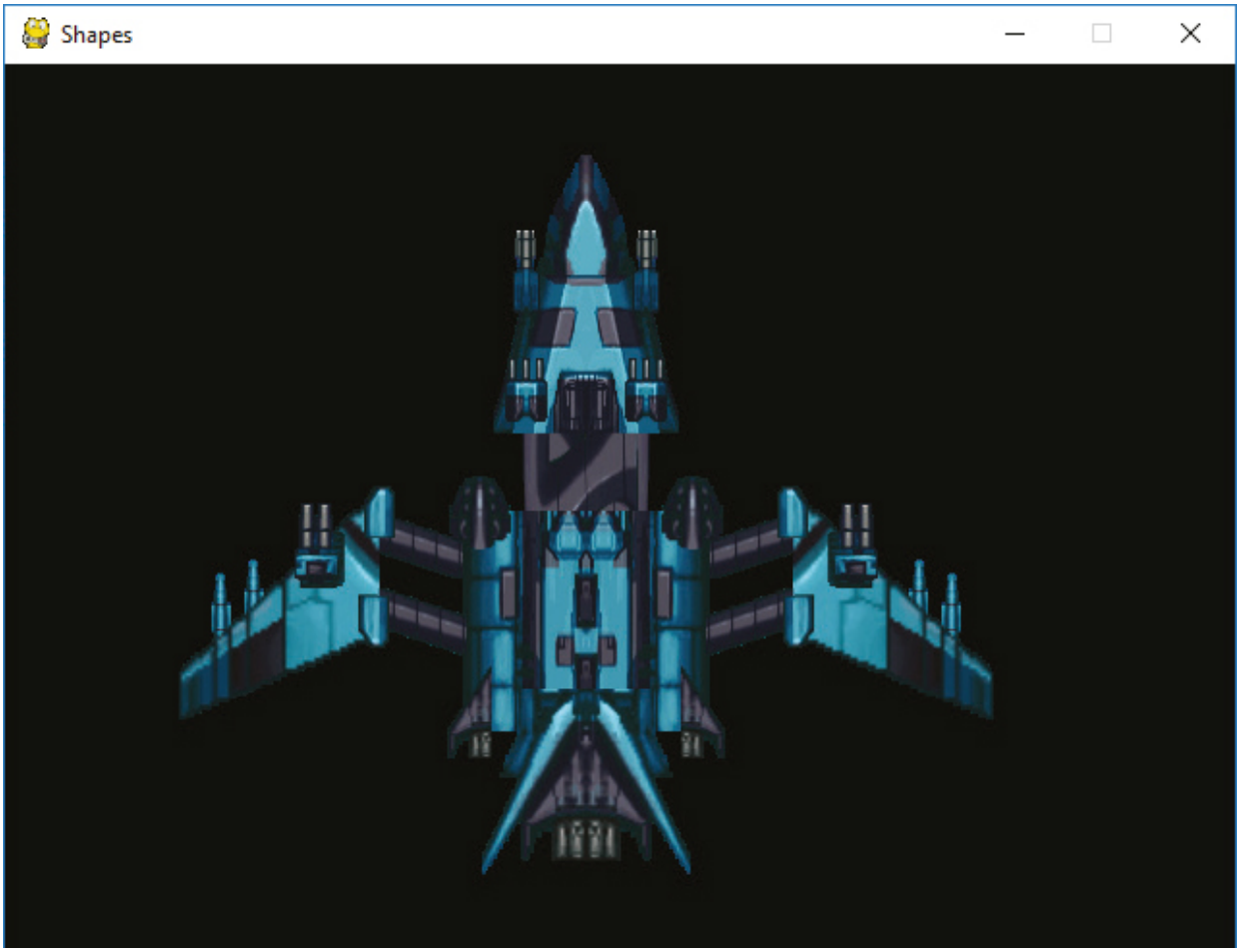


You only want the space ship, not a rectangular background! But all images you can load are rectangles, so how to show only the part of the image you want?

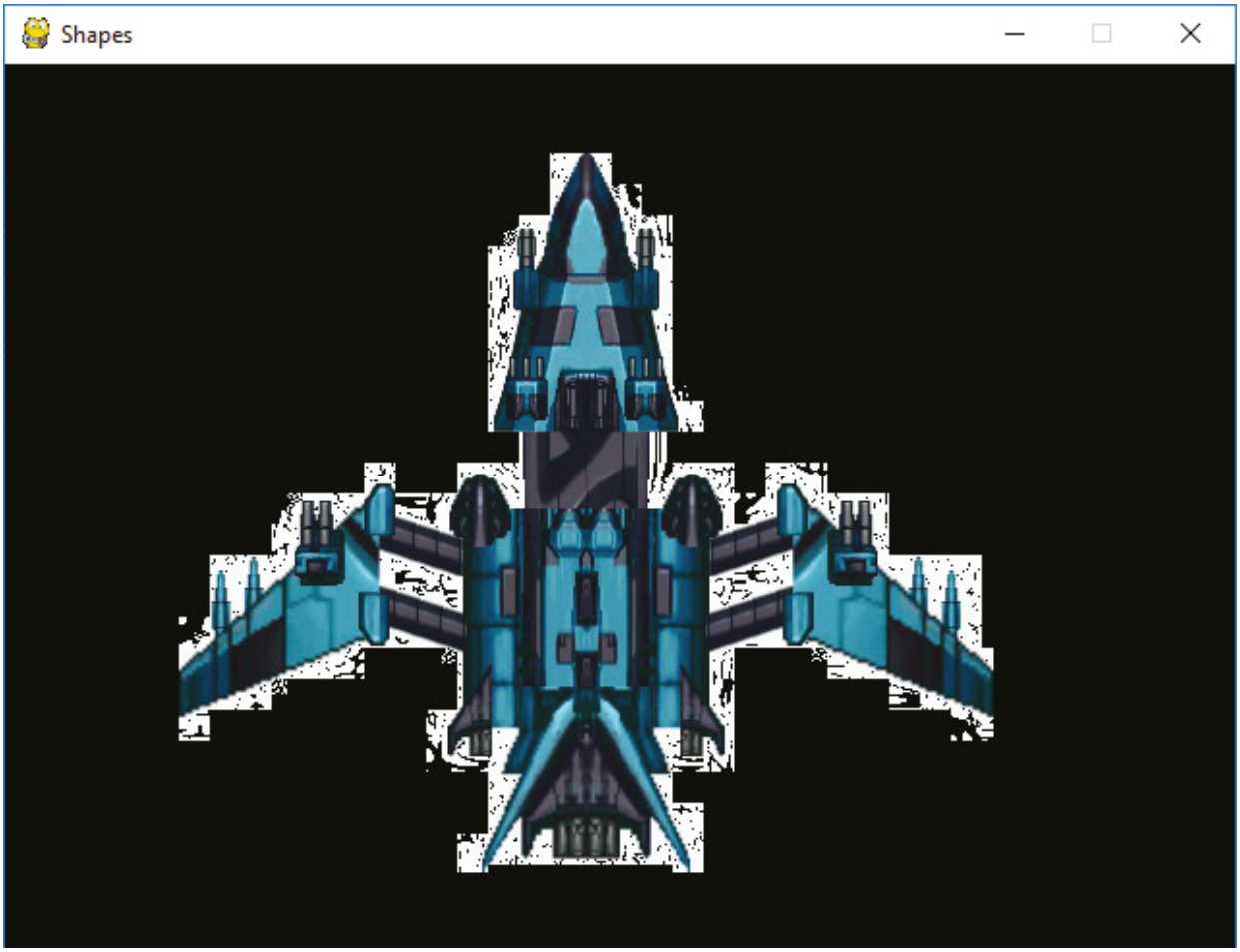
The way to get around this is to tell the program to make one color “transparent” and not display. This can be done immediately after loading. The following makes the color WHITE transparent (assuming WHITE is already defi ned as a variable):

```
player_image.set_colorkey(WHITE)
```

This will work for most fi les ending in .gif and .png. (Figure 3)



This does not work well for most .jpg fi les (Figure 4).



Keep in mind

It is not possible to change a .jpg to another format just by renaming the file extension to .png. It is still a .jpg even if you call it something different. It requires conversion in a graphics program to change it to a different format.

Practice

Add some different types of enemies to your game, such as spacecraft, space rocks, and asteroids.

Literacy

1. What is the difference between adding a background image and character image?
2. Which image formats are better to use if you are picking out an image that will be transparent? Why?

Terminology

- Assume - қабылдау - предполагать
- immediately - дереу - немедленно
- compression – қысу - сжатие
- character – кейіпкер - персонаж
- require – талап етеді - требовать
- conversion – түрлендіру - преобразование

4.5 MOVING CHARACTERS

You will:

- Learn to move an object with the mouse;
- learn to move an object with the keyboard.

Do you prefer multiplayer games or to go solo? Why?

Moving an image with the mouse

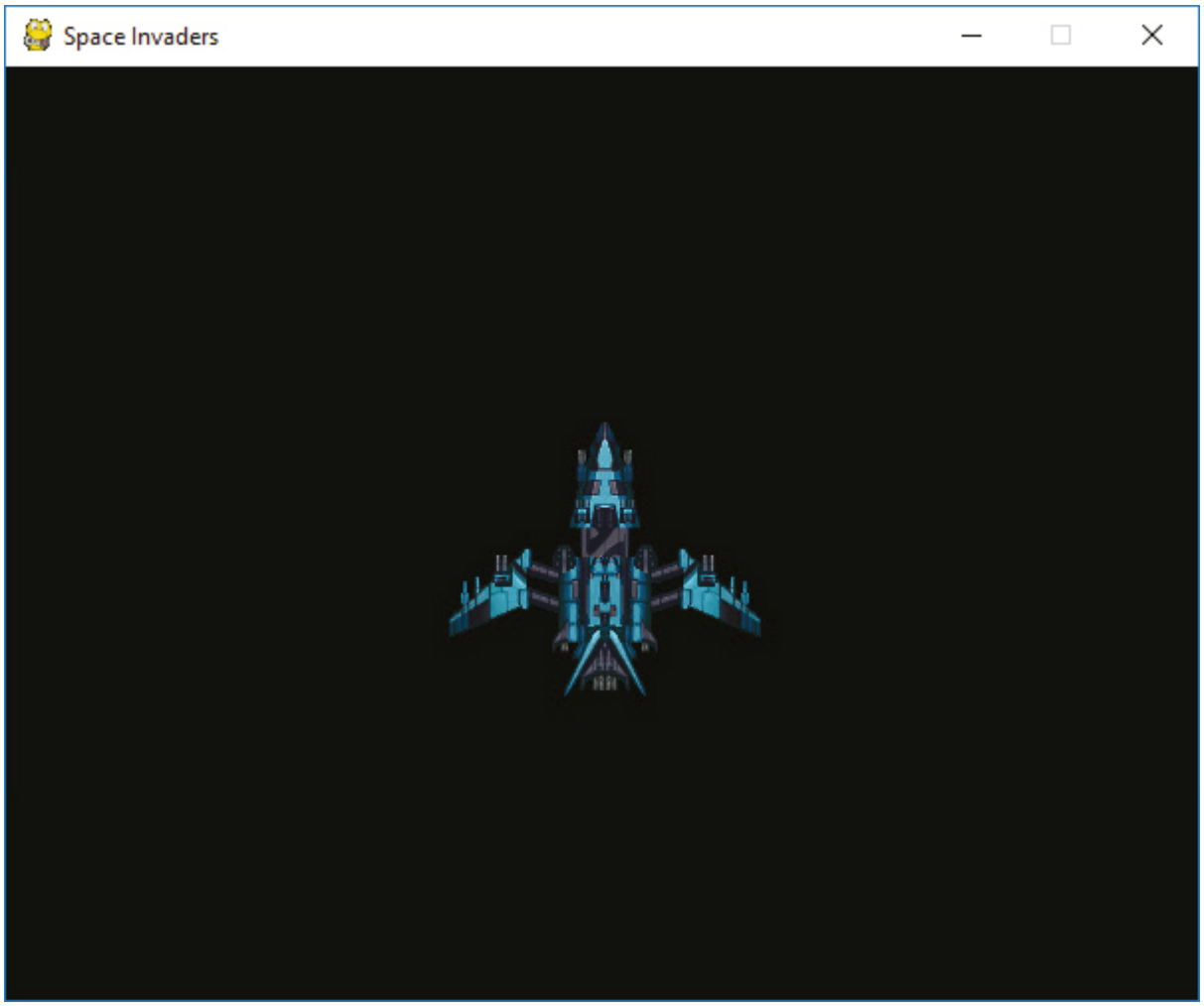
In the previous lesson, you've loaded character images. Now, you will move these characters.

Inside the main program loop, the mouse coordinates are retrieved, and passed to another blit function as the coordinates to draw the image:

```
# Get the current mouse position.
# This returns the position as a list of two numbers.
player_position = pygame.mouse.get_pos()
x = player_position[0]
y = player_position[1]

# Copy image to screen:
screen.blit(player_img, [x, y])
```

Add this parts of script to your game code. And you will control your spaceship using mouse.



Practice 1

1. Change the mouse pointer to the center of the spaceship;
2. Add the window edges. When spaceship reaches the edge of the window, it stops.

Moving an image with the keyboard

In the previous lesson, you've learned to move an object with the keyboard using method pygame.key. Now, you will learn to move image using the keyboard using a different method.

State checking

It’s possible to call functions from the pygame.key and pygame. mouse module to receive the state of the key and mouse. However, it’s not the recommended way to process events in pygame since there are some fl aws with it:

- You’ll receive the states when the function is called, which means you might miss events between calls if the user is pressing buttons fast;
- You cannot determine the order of the events;
- You still need to call one of pygame’s event functions for pygame to internally interact with the operating system,
- otherwise, it’ll warn that the program has become unresponsive.

State checking

The key module has a function pygame.key.get_pressed() which returns a list of the state of all keys. The list contains 0 for all the keys which are not pressed and 1 for all keys that are pressed. Its index in the list is defined by constants in the pygame module, all prefi xed with K_ and the key name.

Example

```
# Allow pygame to handle internal actions.
pygame.event.pump()
key = pygame.key.get_pressed()
    key = pygame.key.get_pressed()
    # moves image right if RIGHT_KEY is pressed
    if key[pygame.K_RIGHT]:
        x+=1
    # moves image left if LEFT_KEY is pressed
    if key[pygame.K_LEFT]:
        x-=1
```

Practice 2

1. Add the window edges. When spaceship reaches the edge of the window, it stops.
2. Add UP and DOWN keys to move image up and down.
3. Change LEFT, RIGHT, UP, DOWN keys to A, D, W, S keys.

Terminology

- Coordinates - координаттары - координаты
- retrieve - шығарып алу - извлекать
- position – позициясы - положение
- edge – жиегі - край
- flaws – кемшіліктер - недостатки
- internal – ішкі - внутренний
- unresponsive – жауап бермейді - не реагирующий
- to handle - орындау - обрабатывать

4.6 PROGRAMMING GAME CONDITIONS

You will:

- Define and create classes;
- learn to program arcade game with the ready scenario.

What is the most important aspect of video games today: story, graphics, or gameplay?

Introduction to Classes

Classes and objects are very powerful programming tools. They make programming easier. In fact, you are already familiar with the concept of classes and objects. A class is a “classifi cation” of an object. Like “person” or “image.” An object is a particular instance of a class. Like “Mary” is an instance of “Person.”

Objects have attributes, such as a person’s name, height, and age. Objects also have methods. Methods define what an object can do, like run, jump, or sit.

Defining and Creating Simple Classes

A better way to manage multiple data attributes is to define a structure that has all of the information. Then we can give that “grouping” of information a name, like Character. This can be easily done in Python and any other modern language by using a class.

Example 1

```
# This is a class that represents the main
# character in a game.
class Character():
# This is a method that sets up the variables
# in the object.
    def __init__(self):
        self.name = “Link”
        self.max_hit_points = 50
        self.current_hit_points = 50
        self.max_speed = 10
```

The def __init__(self): in a special function called a constructor that is run automatically when the class is created.

Adding Methods to Classes

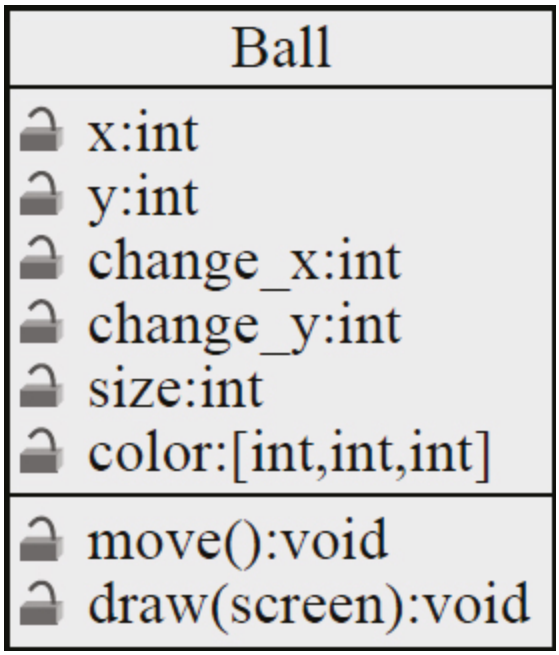
A method is a function that exists inside of a class. The code below adds a method for a dog barking.

```
class Dog():
    def __init__(self):
        self.age = 0
        self.name = “”
        self.weight = 0
    def bark(self):
        print(“Woof”)
```

Method definitions in a class look almost exactly like function defi nitions. The big difference is the addition of a parameter self. The fi rst parameter of any method in a class must be self. This parameter is required even if the function does not use it.

Example 2

This example code could be used in Python/Pygame to draw a ball. Having all the parameters contained in a class makes data management easier. The diagram for the Ball class is shown in Figure 1.




```
class Ball():
    def __init__(self):
    # --- Class Attributes ---
        # Ball position
        self.x = 0
        self.y = 0
        # Ball's vector
        self.change_x = 0
        self.change_y = 0
        # Ball size
        self.size = 10
        # Ball color
        self.color = [255,255,255]
    # --- Class Methods ---
        def move(self):
```

```
            self.x += self.change_x
            self.y += self.change_y
        def draw(self, screen):
            pygame.draw.circle(screen,self.color,
[self.x,self.y],self.size)
```

Below is the code that would go ahead of the main program loop to create a ball and set its attributes:

```
theBall = Ball()
theBall.x = 100
theBall.y = 100
theBall.change_x = 2
theBall.change_y = 1
theBall.color = [255,0,0]
```

This code would go inside the main loop to move and draw the ball:

```
theBall.move()
theBall.draw(screen)
```

Practice

1. Create a class called Cat.
2. Give it attributes for name, color, and weight.
3. Give it a method called meow.

Terminology

- Classification - жіктеу - классификация
- instance - мысалы - пример
- attributes – атрибуттар - атрибуты
- exists – бар - существует
- define – анықтау - определять

4.7 PROGRAM ARCADE GAMES

You will:

- create an algorithm that calculates the game result;
- learn to program arcade game with the ready scenario.

Introduction to Sprites

Our games need support for handling objects that collide. Balls bouncing off paddles, laser beams hitting aliens, etc. All of these examples require collision detection.

The Pygame library has support for sprites. A sprite is a two-dimensional image that is part of the larger graphical scene.

Basic Sprites and Collisions

Let's step through an example program that uses sprites. This example shows how to create a screen of black blocks, and collect them using a red block controlled by the mouse. The program keeps "score" on how many blocks have been collected.

```
import pygame
import random
BLACK = ( 0, 0, 0)
WHITE = (255, 255, 255)
RED = (255, 0, 0)
```

```
class Block(pygame.sprite.Sprite):
```

This class is a child class of the Sprite class. The pygame. sprite. specifies the library and package.

```
def __init__(self, color, width, height):
super().__init__()
```

The constructor for the Block class takes in a parameter for self just like any other constructor. It also takes in parameters that define the object's color, height, and width.

It is important to call the parent class constructor in Sprite to allow sprites to initialize.

```
self.image = pygame.Surface([width, height])
self.image.fill(color)
```

Create an image that will eventually appear on the screen.

There is one more important line that we need in our constructor, no matter what kind of sprite we have:

```
self.rect = self.image.get_rect()
```

Done with the Block class. Time to move on to the initialization code.

```
pygame.init()
screen_width=700
screen_height=400
screen=pygame.display.set_mode([screen_width,screen_height]
)
block_list = pygame.sprite.Group()
all_sprites_list = pygame.sprite.Group()
```

We can draw and move all the sprites with one command if they are in a group. We can also check for sprite collisions against an entire group.

```
for i in range(50):
    block = Block(BLACK, 20, 15)
    block.rect.x = random.randrange(screen_width)
    block.rect.y = random.randrange(screen_height)
    block_list.add(block)
    all_sprites_list.add(block)
```

The loop adds 50 black sprite blocks to the screen. Then adds the block to the list of blocks the player can collide with and adds it to the list of all blocks.

```
player = Block(RED, 20, 15)
all_sprites_list.add(player)
```

Created a RED player block and added to the all_sprites_list so it can be drawn, but not the block_list.

```
done = False
clock = pygame.time.Clock()
score = 0
while not done:
    for event in pygame.event.get():
        if event.type == pygame.QUIT:
            done = True
    screen.fill(WHITE)
pos = pygame.mouse.get_pos()
player.rect.x = pos[0]
player.rect.y = pos[1]

blocks_hit_list = pygame.sprite.spritecollide(player, block_list,
True)
```

This line of code takes the sprite referenced by a player and checks it against all sprites in block_list.

```
for block in blocks_hit_list:
    score +=1
    print(score)
```

This loop checks the list of collisions.

```
all_sprites_list.draw(screen)
```

The Group class that all_sprites_list is a member of has a method called "draw". With only one line of code, a program can cause every sprite in the all_sprites_list to draw.

```
clock.tick(60)
pygame.display.flip()
pygame.quit()
```

This lines flip the screen and call the quit method when the main loop is done.

Moving Sprites

Put this in the sprite:

```
def update(self):
    self.rect.y += 1
```

Put this in the main program loop:

```
block_list.update()
```

Practice 1

1. Write the whole code and run.
2. End the game, if all blocks are fallen.
3. Write the result of the game WIN or LOSE depending on the score.

Practice 2

1. Change the black and red blocks to character images.

CHECK YOURSELF

1. What is a Sprite?
a) A function that draws images to the screen.
b) A very bright color that seems to glow.
c) A sprite is to Tinkerbell as a human is to Bob.
d) A graphic image that the computer can easily track, draw on the screen, and detect collisions with.

2. What is the standard way to draw sprites in a program?
a) Call the sprite's .blit(screen) method.
b) Call the sprite's .draw(screen) method.
c) Call the sprite's .update(screen) method.
d) Add a sprite to a group. Then call .draw(screen) on the group.

3. Select the best class definition for an alien:
a) class Alien():
    def __init__(self):
    self.name = ""
    self.height = 7.2
    self.weight = 156
b) class alien():
    def __init__(self):
    self.name = ""
    self.height = 7.2
    self.weight = 156
c) class alien.name = ""
    class alien.height = 7.2
    class alien.weight = 156
d) class alien(
    def __init__(self):
    self.name = ""
    self.height = 7.2
    self.weight = 156
)

4. What does this code do?
d1 = Dog()
d2 = Dog()
a) Creates two objects, of type Dog.
b) Creates two classes, of type Dog.
c) Creates one object, of type Dog.

5. What code will get the x and y position of the mouse?
a)
```
pos = pygame.mouse.get_pos()
x = pos(x)
y = pos(y)
```
b)
```
pos = pygame.mouse.get_pos()
x = pos[x]
y = pos[y]
```
c)
```
pos = pygame.mouse.get_pos()
x = pos[0]
y = pos[1]
```
d)
```
x = pygame.mouse.get_pos(x)
y = pygame.mouse.get_pos(y)
```
e)
```
x = pygame.mouse.get_pos(0)
y = pygame.mouse.get_pos(1)
```

Tests answer keys:

Chapter 1:
8.d 9.a 10.d

Chapter 3:
1.d 2.d 3.b 4.a 5.c 6.b 7.a 8.a 9.d 10.d 11.b 12.a 13.c 14.d 15.b 16.b 17.a 18.d 19.c 20.c

Chapter 4:
1. d 2. d 3. a 4. a 5. c

GLOSSARY

A

Absolute Cell Reference – an absolute cell reference is one that does not change when it is copied.

Algorithm – a set of rules for solving a problem in a fi nite number of steps.

ASCII – a standard code, consisting of 128 7-bit combinations, for characters stored in a computer or to be transmitted between computers.

B

Binary number – number, expressed as 0 or 1.

BIt – also called binary digit. a single, basic unit of information, used inconnection with computers and information theory.

Bold – text that is darkened to help emphasize.

Bug – coding error in a computer program.

Byte – a group of bits, usually eight, processed as a single unit of data.

C

Cache – a temporary storage space or memory that allows fast access to data.

Cell – a cell is a rectangular area formed by the intersection of a column and a row.

Chart – a graphic representation, as by curves, of a dependent variable, as temperature, price, etc.; graph.

Column – columns run vertically on the spreadsheet screen.

Compile – to translate (a computer program) from a high-level language into another language, usually machine language.

Computer virus – an unauthorized program that inserts itself into acomputer system and then propagates itself to other computers vianetworks or disks.

CPU – central processing unit: the key component of a computer system, which contains the circuitry necessary to interpret and execute program instructions.

Cybersecurity – is the security of computers and users information.

D

Data – individual facts, statistics, or items of information.

DDoS – a method of attacking a computer systemby flooding it with so many messages that it is obliged to shut down.

Debugging – to detect and remove defects or errors from.

Decimal – any number used in the decimal system.

Delay – the interval between one event and another.

Digital – using data in the form of numerical digits.

DNS Server – networking system in place that allows us to resolve human-friendly names to unique addresses.

Download – to copy or transfer (data or a program) into the memory of one computer system from a larger one.

E

Electronic devices – a device that accomplishes its purpose electronically.

Encode – to convert (a message, information, etc.) into code.

F

Fiber-optic cable – a glass or plastic fiber that has the ability to guide light along its axis.

Field – any number of columns regularly used forrecording the information.

Formula – a formula is a spreadsheet data type that will calculate a result and display it in the active cell.

Function – functions are built-in formulas that are used to enter either commonly used or very complex formulas.

I

Information – important or useful facts obtained as output from a computer by means of processing input data with a program.

Input – data to be entered into a computer for processing.

Internet – a vast computer network linking smaller computer networks worldwide.

IP address – a code that identifi es a computer network or a particular computer or other device on a network, consisting of four numbers separated by periods.

Italic – style of printing types in which the letters usually slope to the right.

L

Laptop – a portable computer, usually batterypowered, small enough to rest on the user’s lap and having a screen that closes over the keyboard like a lid.

Latency – the time required online or in a network for the one-way or round-trip transfer of data between two nodes.

Loop – a series of instructions in a program, performedrepeatedly until some specified condition is satisfied.

M

Modem – an electronic device that makes possible the transmission of data to or from a computer via telephone or other communication lines.

Mp3 – the fi le extension for MPEG Audio Layer-3, a set of standards forcompressing and downloading audio files from the Internet.

N

Network – a system of computers and peripherals, such as printers, that are linkedtogether.

O

Online – connected by computer to one or more other computers or networks, as through a commercial electronic information service or the Internet.

Operator – a symbol for expressing a mathematical operation.

Output – the information produced by a computer.

P

Phishing – to send ruse e-mail with a link to a replica of an existing web page,designed to fool users into submitting personal, fi nancial, or passwordinformation.

Pixel – the smallest element of an image that can be individually processed in a video display system

Processor – another name for central processing unit.

Processor – a method of doing or producing something.

Programming – the act or process of planning or writing a program.

Programming language – a high-level language used to write computer programs.

R

Range – a range is a group of cells in a spreadsheet that have been selected.

Relative Reference – a relative cell reference is one that changes when it is copied.

Row – rows run horizontally on the spreadsheet screen.

S

Server – a computer that makes services, as access to data fi les, programs, and peripheral devices, available to workstations on a network.

Software – the programs used to direct the operation of a computer, as well as documentation giving instructions on how to use them.

T

Transistor – an electronic device that controls the flow of an electric current, most oftenused as an amplifier or switch.

Transmission – the act or process of sending a message, picture, or other informationfrom one location to one or more other locations by means of radiowaves, electrical signals, light signals, etc.

Transmit – to send or forward, as to a recipient or destination.

U

Update – to incorporate new or more accurate information in (a database, program, procedure, etc.).

Upload – to copy or transfer (data or a program) from one's own computer into the memory of another computer.

User – a person who uses a computer.

V

Variable – a quantity or function that may assume any given value or set of values.

W

Wireless – communicating without connecting wires or other material contacts.

Worksheet – a worksheet is the grid of columns and rows that information is inputted into.

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