

INFORMATICS



TEXTBOOK

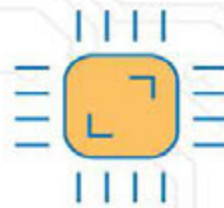


PHP

JAVA



C#



CODE



C++

PYTHON



8



АСТАНА
К И Т А Б

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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:

via email: admin@astanakitap.kz

via telegram app: [@astanakitap](https://www.instagram.com/astanakitap)

Best regards,
team of authors, “Астана-кітап”



CHAPTER 1

COMPUTER BASICS

1.1 CORRECT WAYS OF USING A COMPUTER

You will:

- identify harmful effects of electronic devices;
- learn ways of protecting from negative effects of using electronic devices.

Negative effects of using electronic devices:

- Computers and gadgets are made revolution in world of information. Now, we have an access to any information in the world in seconds. Today these powerful calculating machines are used in all fields of human activities, however these electronic devices may cause several problems.
- It is important to spend some time for outdoor activity with family and friends. The time spent using electronic devices may reduce outdoor activities.
- When people play violent games for a long period of time, they become more aggressive.
- People may have a difficulty in concentrating on their studies, when most of their time is spent on these devices.
- Spending too much time using computers can be addictive. This can negatively affect lifestyle, health, time management and eating habits.
- The effects of music players, like headphones, MP3 players, iPods and mobile phones, can cause hearing disabilities.

- Using the keyboard and mouse for a long time will cause pain in neck, shoulders and in the wrists.

Ways of protecting from negative effects of electronic devices:

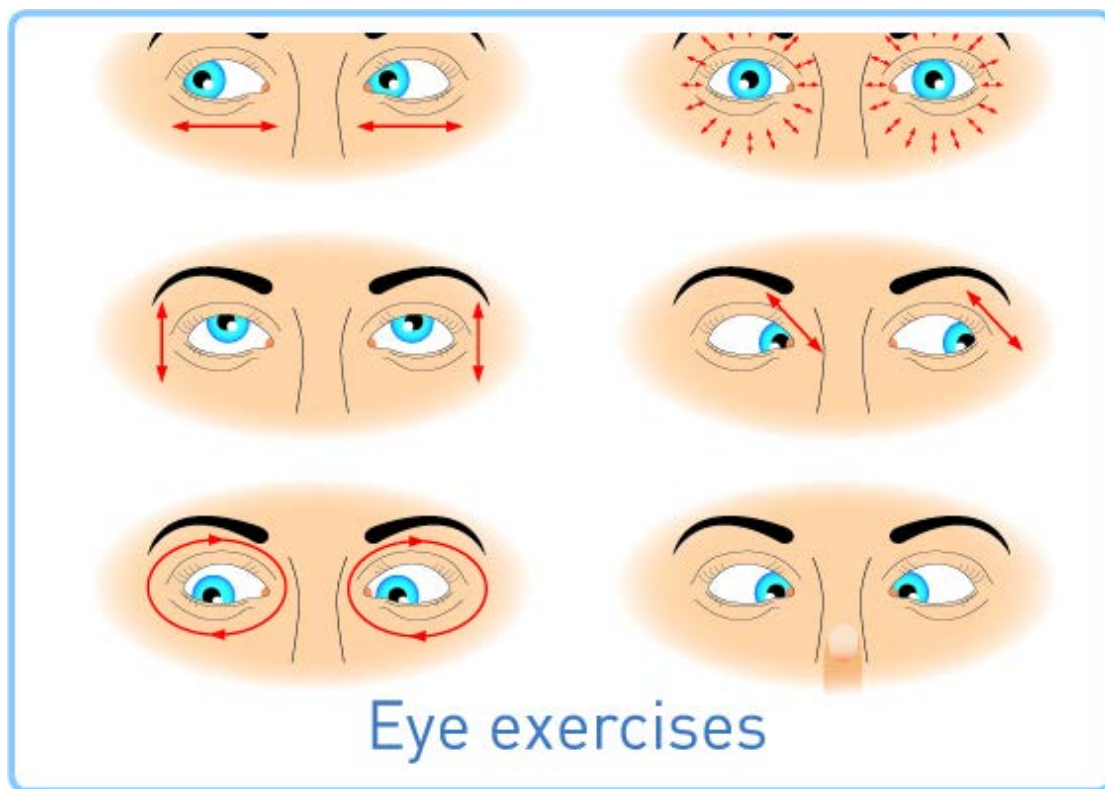
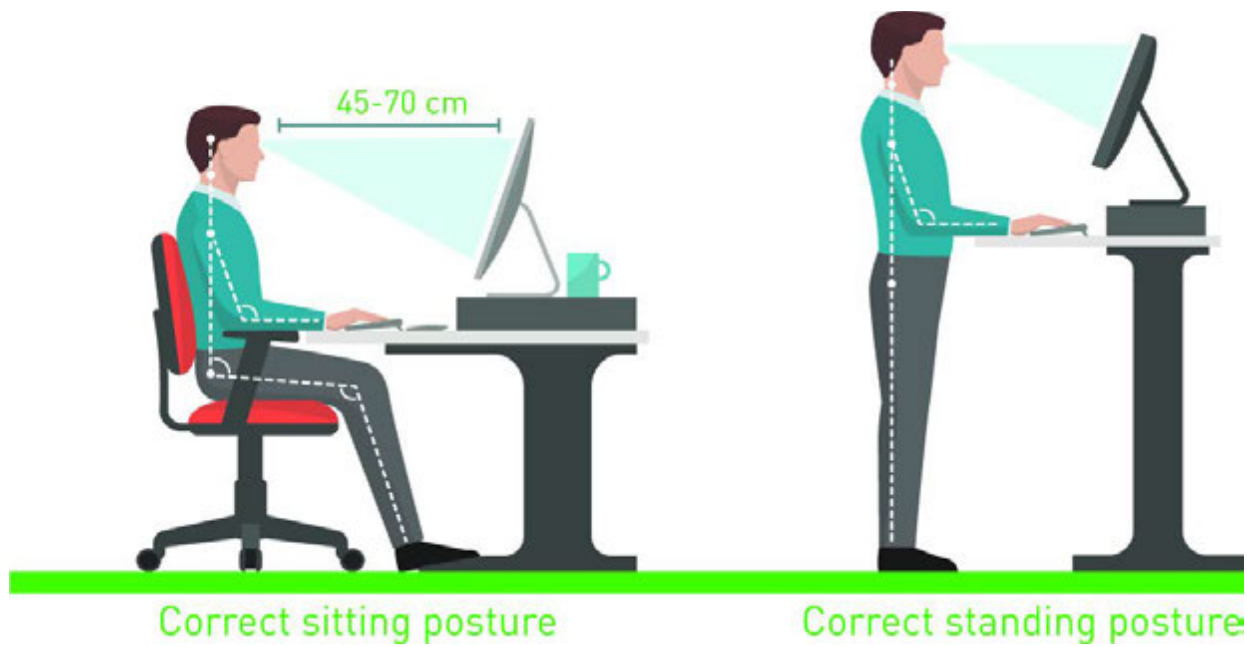
- Be careful when using media, including video games, television, movies, and the Internet. Inappropriate material can cause disinformation and harm psychologically.
- Make media rules. For example, place a time limit of how often or long to use an electronic device, including games and television.
- Pay attention to how to use electronic devices in correct ways.



Look at the picture below. Is the man using the electronic device correctly?




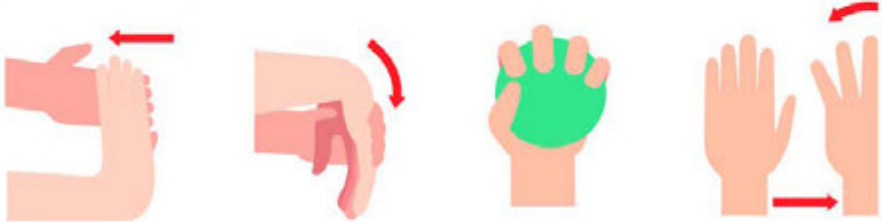
You can learn correct and incorrect ways of using electronic devices from the following pictures



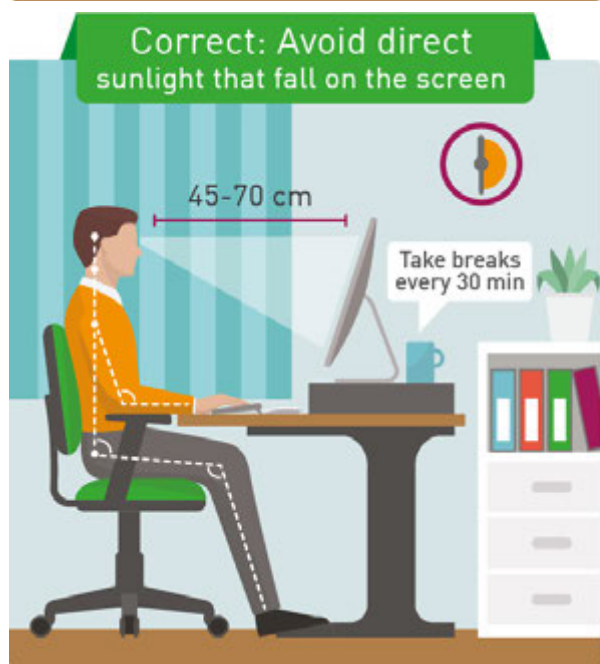


  **Rule 15/3: use a smartphone for 15 minutes**
do exercises for 3 minutes
Let's do an exercise from the picture

 **3 min**







Literacy

1. Do you use electronic devices correctly? Which pieces of advice are you going to use?
2. Explain what is wrong in these pictures. How would you like to improve the posture?



Terminology

- harmful - зиянды - вредный
- electronic devices - электрондық құрылғылар - электронные устройства
- screen - экран - экран
- to protect - қорғау - защищать
- posture - қалып - поза
- addiction - әдеттену - привыкание
- headphones - құлаққап - наушники
- inappropriate - үйлесімсіз - неприличный
- disinformation - жалған ақпарат - дезинформация
- attention - внимание - назар

1.2 MEASURING DATA: BITS AND BYTES

You will:

- learn how a computer stores information;
- learn how to convert binary to decimal and decimal to binary number system.

Bits and Bytes

A computer stores all data as numbers of 0 and 1. Electronic devices have 2 states: ON or OFF. We can use binary numbers to control these ON's and OFF's: ON = 1, OFF = 0. The smallest unit of information is called a bit. The word "bit" comes from "Binary digIT".

Group of 8 bits is called a Byte. The word byte comes from "BinarY TErm".

Binary and decimal:

Computing machines understand digits of 0 and 1 while people use digits from 0 to 9.

The digits from 0 to 9 are called decimal numbers. So to use the decimal numbers computers convert decimal numbers to binary. Now let us see how this conversion works:

In order to convert a decimal number to its binary equivalent, we will repeatedly divide the decimal number by 2, the base of the binary system. Division by 2 will either give a remainder of 1 (dividing an odd number) or no remainder (dividing an even number). Collecting the remainders from our repeated divisions will give us the binary answer.

The steps below show how to convert a decimal number 13 to a binary number using repeated division.

DIVISION	REMINDER	ANSWER
$13 / 2 = 6$	1	???1
$6 / 2 = 3$	0	??01
$3 / 2 = 1$	1	?101
$1 / 2 = 0$	1	1101

Converting from binary to decimal.

To find the decimal value of a binary number, we simply calculate the value of each binary digit and sum these values to convert the binary number to decimal number, we will calculate the position value for each binary digit and sum these values.

$$\text{Digit} * \text{Base}^{\text{position\#}}$$

We write the position values above each digit. The table below shows the position values in powers of 2 and their decimal value.

	2^4	2^3	2^2	2^1	2^0
Position Values	16	8	4	2	1
Binary Digits	1	1	1	0	1

Finally, we sum the values to get the decimal answer. $1 \cdot 16 + 1 \cdot 8 + 1 \cdot 4 + 0 \cdot 2 + 1 \cdot 1 = 29$ so, 11101(binary) = 29(decimal).

Activity

Today Assiya celebrates her 14th birthday. Her mother put 5 candles on a cake. Assiya knows binary numbers from informatics classes and wants to make the number '14' using 5 candles. She puts 5 candles in a row and tries to solve it. For example:



Which candles should Assiya light up to show number '14'?

Literacy

1. What is the smallest unit of information?
2. How do computers store information?
3. Discuss which of the followings might have bigger size: text, video, audio or image.
4. Calculate the greatest decimal number that 1 byte can store.

Terminology

- to convert - ауыстыру - переводить, менять
- data - деректер - данные
- binary - екілік - двоичный

- to transform - түрлендіру - преобразовывать
- decimal - ондық - десятичные
- to store - сақтау - хранить

1.3 ENCODING INFORMATION

You will:

- identify encoding standards;
- calculate the amount of information.

Computers do not speak Kazakh or any other human language. Computers' language consists of only 0s and 1s. So to understand letters, numbers and symbols, computers use an alphabet that is called ASCII.

ASCII is a collection of 8-bit characters. Every letter or symbol has its own ASCII code. For example, in ASCII the letter 'A' has its own code that is '01000001'.

Keep in mind:

NOTE:

A lowercase "b" is used for bits. An uppercase "B" is used for bytes.

For example, 100 KB (kilobytes) = 800 Kb (kilobits)

Fact:

Before 1963, there were more than 60 different ways of showing characters in computers. Computers could not communicate with each other.

That year, ASCII (pronounced "AS-KEE"), the American Standard Code for Information Interchange, became a common language of computers.

Practice 1

Your friend Steve has sent you a very important message, but your computer shows it as binary numbers.

Use your ASCII knowledge to convert and read Steve's message.

Message from Steve:

01110100 01101000 01101001 01101110 01101011 01100100
 01101001 01100110 01100110 01100101 01110010 01100101
 01101110 01110100 Hint: each symbol is equal to 1 byte.

Example: 01110100 (binary) = 84(decimal) = "T"

* Write a "Stay hungry!" message to Steve in binary number

Data measurement:

Everyday amounts of information become larger and larger. Having a lot of bytes led to new measurement units. Today devices have measurements such as kilobytes, megabytes, gigabytes, etc.

DATA STORAGE MEASUREMENT	
1 bit	1 bit
1 byte	8 bits
1 kilobyte	1,024 bytes
1 megabyte	1,024 kilobytes
1 gigabyte	1,024 megabytes
1 terabyte	1,024 gigabytes

DATA STORAGE MEASUREMENT

1 petabyte	1,024 terabytes
1 exabyte	1,024 petabytes

Fact

Petabyte (PB)

A Petabyte is 1,125,899,906,842,624 (250) bytes, 1,024 Terabytes.

- 938,249,922,368 pages of text (1,200 characters on each page)
- 4,691,249,611 books (200 pages or 240,000 characters)
- 671,088,640 web pages (with 1.6MB average file size)
- 357,913,941 digital pictures (with 3MB average file size)
- 268,435,456 MP3 audio files (with 4MB average file size)
- 1,651,910 650 MB CD's
- 239,400 4.38 GB DVD's
- 41,943 25 GB Blu-ray discs

Practice 2

Calculate:

1024 megabytes = _____ bits

9216 bytes = _____ kilobyte

1 terabyte = _____ kilobyte

131072 bits = _____ megabyte

25600 gigabytes = _____ petabyte

Literacy

1. What is the size of the text file with 100 symbols?
2. Convert the following symbols to binary: B, I, N, A, R, Y.

Terminology

- to encode - кодтау - кодирование
- measurement - өлшем - измерение
- amount - мөлшер - количество
- to measure - өлшеу - измерять
- character - таңба - символ
- lowercase - кіші әріп - строчная буква
- collection - жинақ - коллекция
- uppercase - бас әріптер - заглавная буква

1.4 CPU

You will:

- define the main functions of CPU;
- compare CPU performance.

CPU

CPU (Central Processing Unit or processor) controls other parts of a computer like human brain controls the body. CPU works on tasks(instructions). It reads the list of instructions one by one.

ALU

ALU is a part of CPU. ALU (Arithmetic Logic Unit) does simple arithmetic and logical operations. One or more ALUs get data from Cache and perform instructions of the CPU. Then ALU stores the result again in the Cache.

CU

The control unit (CU) is a component of a computer's central processing unit (CPU) that directs the operation of the processor. It tells the computer's memory, arithmetic/logic unit and input and output devices on how to respond to a program's instructions.

Cache

Cache is a part of CPU. Cache is a high-speed memory which stores, copies and retrieves instructions.

Fact

If human brain was a computer, it could perform 3800000000000000000 instructions per second. “BlueGene”, the world’s most powerful supercomputer, can manage only 0.002% of that performance.

Types of socket

A socket is a place where we set a CPU. Motherboards have different socket types.

Number of Cores

CPU can have several cores. Number of cores affects the performance of a CPU.

CPU speed

CPU’s speed is measured in Megahertz (MHz) and Gigahertz (GHz).

- One MHz processes one million instructions per second.
 - One GHz processes one billion instructions per second.
- Today most CPUs run at a speed of 2 - 3 GHz.

Transistors

Transistors are the devices through which information (bits) moves inside the CPU. Transistors store and move bits within the processor.

Practice 1

You have 3 computers with different CPUs. How many seconds do they need to process 100 billion instructions?

1. Computer with 300 MHz
2. Computer with 1.6 GHz
3. Computer with 2.9 GHz

Manufacturers of CPU

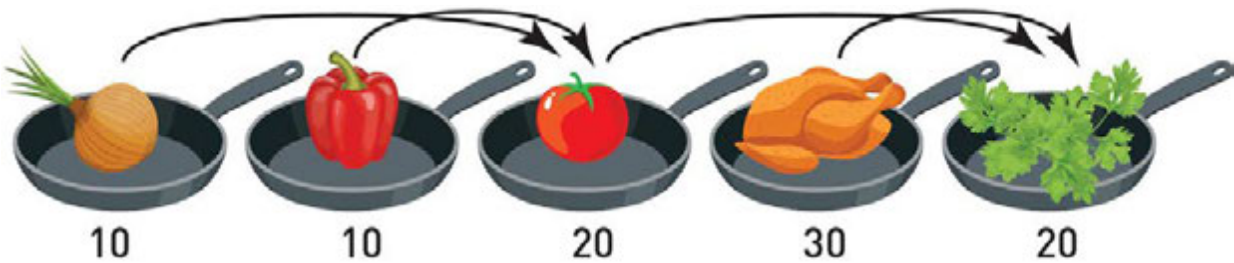
Here is a table of two popular manufacturers and their CPU types:

CPU Type	Number of cores	Socket Type	Speed in Gigahertz
INTEL			
Core 2	2, 4	LGA 775	1,86 – 3,5
Celeron (Dual-Core)	1, 2	LGA 775, 1156, 1155	1,6 – 2,5
Pentium (Dual-Core)	2	LGA 775, 1156, 1155	2,6 - 3
Core i3	2	LGA 1156, 1155	2,93 – 3,33
Core i5	2, 4	LGA 1156, 1155	2,67 – 3,6
Core i7	2, 4, 6	LGA 1366, 1156, 1155, 2011	2,66 – 3,6
AMD			
Sempron	1	Socket AM2+, AM3	2,6 – 2,8
Athlon II	2, 3, 4	Socket AM3, FM1	2,6 – 3,4
Phenom II	2, 4, 6	Socket AM2+, AM3	2,5 – 3,7
A-series	2, 3, 4	Socket FM1	2,1 – 3
FX-series	4, 6, 8	Socket AM3+	3,3 – 4,2

Activity

Aizhan loves to cook. Her favorite meal is fried chicken. When she uses a single (one) frying pan, Aizhan performs the following actions step by step:

1. Cook an onion **(10 minutes)**
2. Cook a bell pepper **(10 minutes)**
3. Combine the cooked onion and cooked bell pepper, add a tomato and cook them together **(20 minutes)**
4. Cook a chicken **(30 minutes)**
5. Combine everything from steps 3 and 4, add some spices, and cook it all. **(20 minutes)**



In total Aizhan needs 90 minutes to prepare her chicken. When Aizhan cooks at home she can use many frying pans. How much time she can save by using 2, 3, 4 frying pans?

Fact

History of the Transistors

In 1954, IBM stopped using vacuum tubes and introduced its first computer which was working using 2000 transistors. Today they are widely used in all electronic devices. Nowadays, the most powerful computer processors have more than 7 billion transistors.

Literacy

1. Explain how does a CPU work?
2. Compare which of the followings is better - "Intel i3" with 2 cores or "AMD A-series" with 4 cores. Explain why.

Terminology

- performance - өнімділік - производительность
- to retrieve - шығарып алу - извлекать
- to process - өңдеу - обработка
- arithmetic - арифметикалық - арифметика
- processor - процессор - процессор

- features - ерекшеліктері - функции
- instructions - нұсқаулар - инструкции
- core - ядро - ядро
- manufacturer - өндіруші - производитель
- vacuum tube - вакуумдық лампа - вакуумная лампа
- to save - үнемдеу - сэкономить, сохранить
- logical operations - логикалық амалдар - логические операции

1.5 NETWORK

You will:

- define how network works;
- identify network parts.

Definition of Network

Network is a connection of things. For example, roads connect different places. Connections with your friends create a network of people.

People use the following networks everyday:

- telephone network;
- public transport;
- the Internet.

1. Askar from Aktobe sends a message to his friend Marina. He uses a Personal Computer that is connected to the modem by a cable. Modem's IP address is **141.72.251.38**
2. Marina receives Askar's message and resends it to Aisha from Almaty. She uses a laptop that is connected by WiFi. IP address is **192.168.0.10**
3. Server receives Askar's message and directs it to Marina in Astana.
4. Server receives message from Marina and sends it to Aisha's smartphone in Almaty.
5. Aisha gets Marina's message on her smartphone. The smartphone is connected through 4G mobile network. Her IP address is **173.154.90.171**

Network cables **transmit** data in bits (0 or 1). Bits **represent** all the data (pictures, videos or songs)

IP address

Each device has its own **unique** address number within a network. An address number is called an **Internet Protocol** (IP address).

Server

A server is a device that **provides** services for other programs or devices, called “clients”. Multiple clients can share data through a server. A single server can serve multiple clients, and a single client can use multiple servers.

Fact

There are two versions of Internet Protocols:

1. IPv4 was designed in 1973 and adopted in 1980s. It provides 4,294,967,296 addresses worldwide.
2. IPv6 has 128 bits that is 340,282,366,920,938,463,463,374,607,431,768,211,456 addresses.

Example: IP address of “google.kz” website is 173.194.44.84

The ancestor of the Internet

In 1969 the US users met the first network called **ARPANET**. It is an ancestor of the Internet. ARPANET was invented for communication between computers.

Practice

What is your IP address?

Click “Start” button. Type “cmd” and press “Enter”. Type “ipconfig” command. Now you can see the IP address of your computer.

```
C:\Users\admin>ipconfig

Windows IP Configuration

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::1c88:3f21:d78b:68f2%11
    IPv4 Address. . . . . : 192.168.100.40
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.100.1
```

Activity

Instructions (Internet Protocol):

Divide into groups.

In each group there must be students who represent the following roles:

- internet users (IP addresses) (2-3 students);
- websites (2-3 students);
- server (1 student).

1. Give roles to each group member.
2. Form a circle.
3. Put server in the center of circle.

1-step.

An “Internet user” fills envelope “From: City. School. Class. Student” and “To: Website name”. Give envelope to “Server”.

From: Astana. Nurorda. 8a. Amanbol

To: www.youtube.com

2-step.

“Server” gives envelope to a receiver (Website).

3-step.

“Website” opens the envelope and puts its content (A4) into that. Then “Website” swaps “From” and “To” and gives the envelope back to “Server”.

4-step.

“Server” gives the envelope to its initial owner (Internet user).

5-step.

In the end “Internet user” will get the content of requesting website. Repeat these steps several times.

Literacy

1. How will information be transmitted if Aisha wants to send a message to Askar?

Terminology

- connection - байланыс - подключение
- envelope - конверт - конверт
- to connect - қосу - подключить
- ancestor - арғы ата - прородитель
- copper cable - мыс кабелі - медный кабель
- to represent - ұсыну - представлять
- to transmit - жолдау - передавать
- unique - бірегей - уникальный
- wireless - сымсыз - беспроводной
- to receive - қабылдау - получать

- to provide - қамтамасыз ету - предоставлять
- fiber-optic cable - талшықты-оптикалық кабель - опто-волоконный кабель

1.6 BANDWIDTH

You will:

- define what a bandwidth is;
- measure the bandwidth speed.

How fast is your internet speed?

A network cable is like a road and cars on the roads represent data (0 and 1). Data moves in both directions.

Bandwidth

Bandwidth in a network is like a road. Cars represent data that is transmitted through networks. The number of lines represent its bandwidth. So if there are 4 lines then 4 cars can move at the same time. It means that 4 bits of information can be transmitted at a moment.

Latency

The amount of time when data travel from one point to another is called Latency. Network devices use latency when they process and send data.

Delay

Data is like a car that travels on the road and faces stop signs and traffic lights. That can slow the movement of the car. Such situation happens with movement of data as well. Network devices and long cables can delay data transmissions.

Practice 1

Click 'Start' button. Type 'cmd' and press 'Enter'. Write 'ping astanakitap.kz' command. It will show you Latency.

```
Reply from 94.100.180.202: bytes=32 time=134ms TTL=55

Ping statistics for 94.100.180.202:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 126ms, Maximum = 154ms, Average = 137ms
```

Find latency of the following web addresses:

- a) astanakitap.kz
- b) code.org
- c) google.kz
- d) post.kz

Keep in mind

Bandwidth is a number of bits that can be sent per second. There are some examples of bandwidth measurements:

- b/s - bits per second (bps)
- kb/s - kilobits per second (kbps)
- Mb/s - megabits per second (Mbps)
- Gb/s - gigabits per second (Gbps)

Mbps: Megabits per second

MBps: Megabytes per second

8 bits = 1 byte

1 Mbps = 1,000,000 bits per second

1 MBps = 1,000,000 bytes per second = 8,000,000 bits per second = 8 Mbps

Upload and download speed

Upload speed is the speed of data transfer when you send something to another computer. Download speed is the speed of data transfer when you receive something from another computer.

Download speed

How much time do we need to download images, audio or video files?

Now we are going to learn how to calculate the download time. We take an example of 20 MB data.

Firstly, convert 20 Megabytes into bits:

$20 \text{ MB} = 20 * 1024 \text{ kilobyte} = 20 * 1024 * 1024 \text{ bytes} = 20 * 1024 * 1024 * 8 \text{ bits} = 167772160 \text{ bits}$. So, 20 MB = 167 772 160 bits.

Now convert your download speed into bits per second.

(Example: 512 Kbps) $512 \text{ Kbps} = 512 * 1000 \text{ bits per second}$. So, 512 Kbps = 512 000 bps.

Finally, divide file size by download speed (bits per second).

Download time = Data in bits / Download speed in bits.

Download time = 167 772 160 / 512 000 = 327.68 seconds.

Practice 2

You want to download a video. Its size is 1.5 GB. How much time will it take to download video? If your download speed is:

- a) 4 Mbps
- b) 10 Mbps
- c) 32 Mbps
- d) 1 Gbps

Find your own download and upload speeds. Calculate the time to download a 2.5 GB file and time to upload a 1.5 GB file.

Practice 3

Click 'Start' button. Type 'cmd' and press 'Enter'. This article describes TRACERT (Trace Route), a command-line utility that you can use to trace the path that an Internet Protocol (IP) packet takes to its destination.

Write path to the following web addresses:

- a. facebook.com
- b. astanakitap.kz
- c. egov.kz

```

C:\Users\admin>tracert mail.ru

Tracing route to mail.ru [94.100.180.199]
over a maximum of 30 hops:

  0  0 ms  0 ms  0 ms  0.0.0.0
  1   4 ms   7 ms  11 ms 192.168.100.1
  2  214 ms  213 ms 244 ms 92.46.223.158
  3   81 ms   92 ms  61 ms atyr-core-l2-1.online.kz [95.59.170.64]
  4   64 ms   79 ms 835 ms 95.59.172.46
  5  131 ms  230 ms 183 ms 95.59.172.25

```

Literacy

1. What factors affects the bandwidth work?
2. Explain ways to calculate time necessary to download a file.

Terminology

- transmission - жолдама - передача
- calculation - есептеу - расчет
- to delay - кешіктіру - задержка
- to divide - бөлу - делить
- to process - өңдеу - обработать
- approximate - шамамен - приблизительно
- bandwidth - желінің өткізу қабілеті - пропускная способность сети
- latency - желідегі ақпараттың кешігу
- уақыты - задержка по времени в сети
- delay - кешігу - задержка

1.7 CYBERSECURITY

You will:

- identify possible threats;
- learn how to protect computer against cybercrimes.

Cybersecurity

Cybersecurity is the security of computers and users' information. It protects from cybercrimes.

Cybercrime

Crimes committed by computers or network is called cybercrime. Those who commit cybercrimes are called hackers. Hackers attack computers in different ways.

The most common types of cybercrimes are:

- computer virus;
- phishing attack;
- DDoS.

Computer Virus

A computer Virus harms computers. It can also spread itself to other computers. Sometimes it looks like 'useful' programs.

For example, threats can mask itself as security update. A computer virus can:

1. steal or delete your files;

2. control programs;
3. allow someone to control your computer.

Phishing

Another cybercrime is to send spam emails to reveal people's confidential details. People can open the spam email and give their personal information. This is called phishing scam. Phishing scam can be something that seems like a trusted email. It can ask you to log into your account. But when you click the link, it takes you to a fake website.

If you log into the fake website, you can give your username and password away. Hackers can use your information to open your real accounts and steal information or even money.

DDOS-Attack

Hackers can attack websites with many computers worldwide. They use viruses and attack from millions of computers at the same time. In this case the victim can be overloaded and stop working. This kind of attack is called a Distributed Denial of Service (DDoS).

Keep in mind

Virus In Biology a virus is an organism that infects cells and uses those cells to copy itself. In the result, the infected organisms get ill and spread the virus to others. A computer virus acts similarly.

Activity

Pick one student in your class. Start asking different questions at the same time. Increase number of questions and observe how the student replies.

1. What is the maximum number of questions this student can answer?
2. How can you link this activity with DDoS attack?

Software Licensing

A software license is a legal agreement that provides terms and conditions for using a program. Software must have a license before installation. But there is also an open source software that is free and does not need any license or legal agreement.

Keep in mind

You cannot use a licensed software without a license similarly. according to the Law of the Republic of Kazakhstan dated June 10, 1996 № 6-І «On Copyright and Related Rights».

Internet Safety Tips

A software license is a legal agreement that provides terms and conditions for using a program. Software must have a license before installation. But there is also an open source software that is free and does not need any license or legal agreement.

1. Use only licensed security programs to protect your computer!
2. Do not give personal information online (e.g. address, passwords, email address or mobile number).

3. Think carefully before posting pictures or videos of yourself. If you put such pictures online, other users will be able to use it. So it will not be yours anymore!
4. Never tell your passwords to anyone!
5. While using a social network, do not add to friends the people you do not know. They could be much different than they look like.
6. Do not meet up in real life with people you met online. Tell your parents about people who suggest you to meet up.
7. Think carefully before you post something online!
8. Respect other people's views, even if you do not agree with them.
9. If something online makes you feel uncomfortable, unsafe or worried, leave the website, turn off your computer and tell your parents immediately

Keep in mind

Today cybercrime generates huge problems. There are many companies and law organizations that provide cybersecurity. They work to make the Internet safer, but it is not enough.

You may think when someone hacked your computer, the issue is the computer security. But in 90% of cases it is a simple human mistake.

Literacy

1. Which ways of hacking do you know? Why do people hack?
2. How to protect your personal data?

Terminology

- threat - қауып - угроза
- to steal - ұрлау - красть
- crime - қылмыс - преступление
- to update - жаңарту - обновить
- to infect - жұқтыру - заражать
- to trust - сену - доверять
- to spread - тарату - распространять
- fake - жалған - фиктивный
- to post - орналастыру - размещать
- rules - ережелері - правила
- to commit - жасау - совершать
- spam - спам - спам
- social network - әлеуметтік желі - социальная сеть

CHECK YOURSELF

1. Which parts of the body should paid attention to use electronic devices properly?
2. What kind of activities should be done to prevent from negative effects of using electronic devices?
3. The smallest unit of information is called _____ .
4. How is information stored in a computer?
5. Convert the following numbers from decimal to binary equivalents:
 - o 254 = _____
 - o 112 = _____
 - o 25 = _____
6. Convert the following numbers from binary to decimal equivalents:
 - o 100010 = _____
 - o 111010 = _____
 - o 100101 = _____
7. What is the encoding standard that computer uses to represent data?
8. Represent the following message in binary using ASCII: “Hello. I like to study ICT”
9. A computer transforms commands to computer language and vice versa. So it will transform next binary information into meaningful information for humans by using ASCII code. What will be the result?
 - o 01001011 01000101 01000101 01010000
 - o 01001100 01000101 01000001 01010010 01001110
 - o 01001001 01001110 01000111
10. In ASCII each character is coded as a _____ byte or _____ bits .
11. What will be the size of the fi le, if it has a text “Computer Science” inside?

12. Represent “15 + 4 = 19” in binary number system.
13. A device that controls other parts of the computer. It works same as the human brain controls the body.
14. Describe how parts of a CPU such as ALU, CU, Cache run calculator programs on a computer.
15. CPU speed is measured in _____ and _____.
16. Which types of network connection are used everyday?
17. IP address of your computer is 192.168.42.129. The computer understands only the computer language. So convert the IP address from decimal to binary.
18. Describe the network connections in “Instagram” application. Say why this connection is important for users.
19. What is the measurement of a network bandwidth?
20. Calculate the download speed if it takes 28 minutes to download 200 MB file?
21. You are sending a message to your friend using Internet. You want to attach a 15 MB file. Your download speed is 5 Mb/s and upload speed is 3 Mb/s. How much will it take to send this mail?
22. You are calling your friend by Skype or Facetime. Quality of image and voice signal is poor. Which of the following factors can cause this problem? Why?
 - Bandwidth
 - Latency
 - Delay
23. List common cyber attacks to a computer.
24. If you can download a 3 MB song in 3 seconds, how much time do you need to download a 1.5 GB movie using the same connection?
25. How is it possible to protect devices from cyber attacks? What common ways can we use?
26. What viruses in biology and informatics have in common? What are their differences?
27. Relate to Baurzhan Momyshuly’s quote, how does it relate to the topic of Software Licensing?

28. Fill in the blanks.

- A computer Virus can:
- _____ your private information.
- _____ your files, so you cannot find them.
- _____ your computer.

29. Which type of attacks is more dangerous for popular websites such as homebank.kz, egov.kz, kundelik.kz?

30. Match the following ways of network connections with its descriptions:

- I. Copper cable
- II. Fiber-optic cable
- III. Wireless connection

A. Uses radio signals or satellite

B. Uses electrical signals to transmit information between devices

C. Uses glass or fiber to send information as light pulses



CHAPTER 2

SPREADSHEETS

2.1 SPREADSHEETS

You will:

- identify what a spreadsheet program is;
- define the features of Google Sheets.

What is a spreadsheet?

Spreadsheet is an electronic table consisting of columns and rows. Using Data Tables or Spreadsheets helps us to manage big amounts of information in an easier way.

Spreadsheet features

- Cell: A single data element in a spreadsheet.
- Column: A vertical set of cells.
- Row: A horizontal set of cells.
- Table: A collection of columns and rows.
- Worksheet (Sheet): Sets of rows and columns that make one entire spreadsheet.
- Spreadsheet: The entire document containing all your worksheets. One spreadsheet can have several sheets.

In this chapter we will use a Google Sheets online program. You can also work with Microsoft Excel, Openoffice Calc or Numbers (for MacOS and iOS users).

Fact

Merrerr's diaries tell about papyrus spreadsheets used in ancient Egypt. Paper was one of only choices for managing big amounts of data.

Now, there are computers to complete all the work for us. VisiCalc is the first digital spreadsheet. It performed operations like writing data, calculating numbers and storing paper physically. Nowadays, software

like Excel or Google Sheets made digital spreadsheets one of the most popular programs.

Google Sheets features

With Google Sheets, you can organise data, create tables and use other spreadsheet features. The important feature of using Google Sheets is that you can create and edit spreadsheets in your web browser online. Also, more than one user can work at the same time. You can see other people's changes in real time.

Creating a Google account:

1. Open a web browser and go to 'www.gmail.com';
2. Click on Create an account;
3. Now you can see the Sign-up form. Follow the instructions and fill in the required information;
4. Now you are able to use some Google web-based features.
5. Hint: Use your surname and name to create an account name. (e.g. Omarov Almas -> omarov.almas@gmail.com)

Activity

The following table contains information about spreadsheet programs. Analyse this table:

1. Compare programs;
2. Decide which one is better for you.

SPREADSHEETS PROGRAMS	OPERATING SYSTEM	AVAILABLE ONLINE	MULTIPLE USER USAGE	COST
MS Office Excel	Windows, Mac OS	Yes	No	\$ 109.99
Openoffice Calc	Linux, Windows, Mac OS	Yes	No	Free

SPREADSHEETS PROGRAMS	OPERATING SYSTEM	AVAILABLE ONLINE	MULTIPLE USER USAGE	COST
Numbers	Only Mac OS	Yes	No	\$ 19.99
Google Sheets	All operating systems	Yes	Yes	Free

Fact

There are some programs that you can use within Google Drive:

- Spreadsheets: For storing and organizing information (similar to Microsoft Excel workbooks);
- Documents: For writing electronic text files (similar to Microsoft Word documents);
- Presentations: For creating slideshows (similar to Microsoft PowerPoint presentations);
- Forms: For making questionnaires;
- Drawings: For drawing graphics or diagrams.

Literacy

1. Why do we use spreadsheets?
2. What are the advantages of Google Sheets?

Terminology

- digital - сандық - цифровой
- feature - мүмкіндік - опция
- to organize - ұйымдастыру - организовать
- set - жиынтық - комплект
- papyrus - папирус - папирус
- questionnaire - сауалнама - анкета
- available - қол жетімді - доступный
- multiple - бірнеше - множественный

- to manage - басқару - управлять

2.2 CREATING YOUR FIRST SPREADSHEET

You will:

- create a new spreadsheet;
- customize a spreadsheet.

Which way is more effective to store and control your todo list, using paper notebook or spreadsheet?

Creating a new spreadsheet

In this lesson we will make a to-do list in Google Sheets

1. To start the work open Google Drive (drive.google.com)
2. Click on “NEW” and select Google Sheets.
3. To rename a document click on “Untitled spreadsheet” field and write “My to-do list”. A new file will be created in your Google Drive.
4. Fill in exactly the same cells with the information below. The cell C3 contains ‘Deadline’, the cell D3 contains ‘Priority’ and E3 contains ‘Note’. Deadline is a date when you should complete your work.
5. If you want to resize columns click on the edge of the columns and drag. To drag means to hold something and move somewhere. You can also drag the rows.
6. Right click on a fourth row and select “Insert 1 above”.
7. Now we are going to combine several cells into one. Select cells and click on ‘Merge cells’. Then write ‘To do list’ in the merged area.

8. You can see that the cell is smaller than the text inside. You can easily resize rows or use “Text wrapping” command to break the text into multiple lines.
9. You can use “Freeze” command to pin some cells. Such cells will stay on the worksheet even when you scroll up/down or scroll right/left. Now you must freeze rows (1 to 4) and columns (A to E).
10. Finally, the table will look like this. You can add your own tasks or homeworks.

Keep in mind

You may notice that there is no “Save” button. This is because Google Drive uses Autosave, which automatically and immediately saves your files when you edit them.

Fact

Google Drive is the popular cloud storage service. It provides 15 gigabytes (15 GB) of free storage space. You can use Google Drive from any device if you have Internet connection.

Practice

What are your goals for this term?

Define and write them in a spreadsheet. Make sure you write starting date, ending date (deadline), priority and make some notes about this task.

Write at least 5 tasks.

Terminology

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

2.3 FORMATTING TABLE

You will:

- apply formatting to the table;
- use different data types.

Formatting

Sometimes it is difficult to view and read all of your information easily. You can customize the look and design of your spreadsheet by using formatting tools. It makes your table easier to view and understand.

Now we will continue with 'My to-do list' table. Open your Google Drive and open 'My to-do list' file. Follow step-by-step instructions to make the following table.

To-do list				
No	What to do	Deadline	Priority	Note
1	Prepare report about quadratic equation	19.12.2017	urgently	Submit to math teacher
2	Exercise 4, 5, 7 on page 23	18.12.2017	important	Physics
3	Read chapter 4	25.12.2017	not urgently	Kazakh history
4	Prepare for exam	20.12.2017	urgently	Geometry

1. alignment is a position of data in a cell. Change Alignment (or 'align');

2. change the font size. This highlights important information in the table;
3. choose a different font. Make the header cells in your table;
4. change the font style to Bold or Italic;
5. you can change the colour of the text or cell background; It makes your table look better;
6. you can use cell borders to create boundaries for your table.

Data types

Data could be a number, text, date or time. Types of information in Google Sheets are known as Data Types.

Data types in Google Sheets

Data type	Explanation	Example
Number	displays cell as number	5, 6.5, 2,500,000
Percent	displays cell as percentage with decimal places	50.00%
Scientific	displays cell as exponential like	5.6E+01
Financial	used for accounting	100 000 000,00
Currency	displays cell as currency with currency sign	\$2,999.00
Currency (rounded)	rounds the Currency value	\$3,000

Data type	Explanation	Example
Date	displays date formats	17-09-2016, 17th-Sep-2016
Time	displays time formats	1.30PM, 13.30
Date & Time	displays date and time formats	01.01.2017, 0:12:34
Duration	displays duration time	24:01:00
Automatic	default cell format of Cell	
Plain Text	displays cell as normal text. Letters of the alphabet, numbers, symbols such as % and \$, and spaces are all text type.	a, b, c, 55, %, \$

Practice

What are your favourite hobbies? Explain them. Make a table in Google Sheets and fill with the following contents:

1. name of hobbies;
2. category of the hobbies. For example: education, sport, entertainment, technology, etc;
3. how often you practice these hobbies;
4. advantages of these hobbies for you.

Write at least 5 hobbies. Apply formatting tools to make your table more attractive.

Fact

It is believed that each colour represents a human emotion.

BLACK

- sophistication
- power
- mystery
- formality
- evil
- death

WHITE

- freshness
- hope
- goodness
- light
- purity
- cleanliness
- simplicity
- coolness

GREEN

- life
- growth
- environment
- healing
- money
- safety
- relaxation
- freshness

GRAY

- stability
- security
- strength of character
- authority
- maturity

BLUE

- peace
- stability
- calmness
- confidence
- tranquility
- sincerity
- affection
- integrity

RED

- danger
- passion
- daring romance
- style
- excitement
- urgency
- energetic

Keep in mind

- Press **Ctrl+B** to make text **bold**.
- Press **Ctrl+I** to make text *Italic*.
- Press **Ctrl+U** to make text underlined.
- You can combine these commands together.

Terminology

- to modify - түрлендіру - модифицировать
- design - дизайн - дизайн
- tool - құрал - инструмент
- step-by-step - кезең-кезеңмен - поэтапно, шаг за шагом
- font - қаріп - шрифт
- separate - жеке - отдельный
- header - тақырып - заголовок
- bold - жуан - жирный
- boundary - шекара - граница
- background - фон - фон
- icon - белгіше - значок, иконка
- round - дөңгелек - круглый
- italic - курсив - курсив
- to underline - астын сызу - подчеркивать
- emotion - эмоция - эмоция
- category - санат - категория

2.4 FORMULAS

You will:

- learn how to use formulas;
- use relative and absolute values.

Formulas

In a spreadsheet program people mostly work with numbers. We can use formulas to do some calculations. We can add, subtract, multiply, divide and calculate the power operation. Formula is an expression which calculates the value of a cell.

Enter a Formula

To enter a formula, do the following steps:

1. type '7' in cell A1 and '3' in cell A2;
2. select a cell A3;
3. type an equal sign (=) to start a formula;
4. then, type 'A1 + A2'.

The cell 'A3' contains a formula which adds the value of cell A1 to the value of cell A2.

Tip: instead of typing 'A1' and 'A2' separately, just click on cell 'A1' and cell 'A2'

Copy/Paste a Formula

When you copy a formula from one cell to another, Google Sheets automatically set your formula to other cells. To understand this, do the following steps:

1. Enter the formula `=A1 * (A2 + A3)` into cell A4.
2. Right click on the cell A4, and then select Copy (or press CTRL + C).
3. Right click on the cell A4, and then select 'Paste' (or press CTRL + V).
4. Result: cell B4 shows the result using values from column B.

Relative and Absolute Values

Cells can have relative or absolute values. By default, all cell references are relative references.

For example, if you copy the formula `=A1+B1` from row 1 to row 2, the formula will become `=A2+B2`. An absolute reference never changes. It is marked in a formula by the addition of a dollar sign (\$).

A2	The column and row change when copied to another cell
\$A\$2	The column and the row do not change when copied to another cell
A\$2	The row does not change when copied to another cell
\$A2	olumn does not change when copied to another cell

Practice 1

Let us create a formula that calculates the area and perimeter of a rectangle. Our inputs are length and height of the rectangle.

Rectangle



Length

width

This program calculates area & perimeter of rectangle	
Width	60
Length	120
Area	7200
Perimeter	360

Practice 2

Data measurement

	A	B
1	Constant	1024
2	TB	15
3	GB	15360
4	MB	15728640
5	KB	16106127360
6	B	16492674416640
7		

There is 15 TB of information. You should convert it to gigabytes, megabytes, kilobytes and bytes. Use constant 1024.

***Hint:** to find GB you should multiply constant (B1) to TB (B2). Make constant as absolute and other as relevant value, copy that formula to other cells to find the answer.

Keep in mind

Cell address name

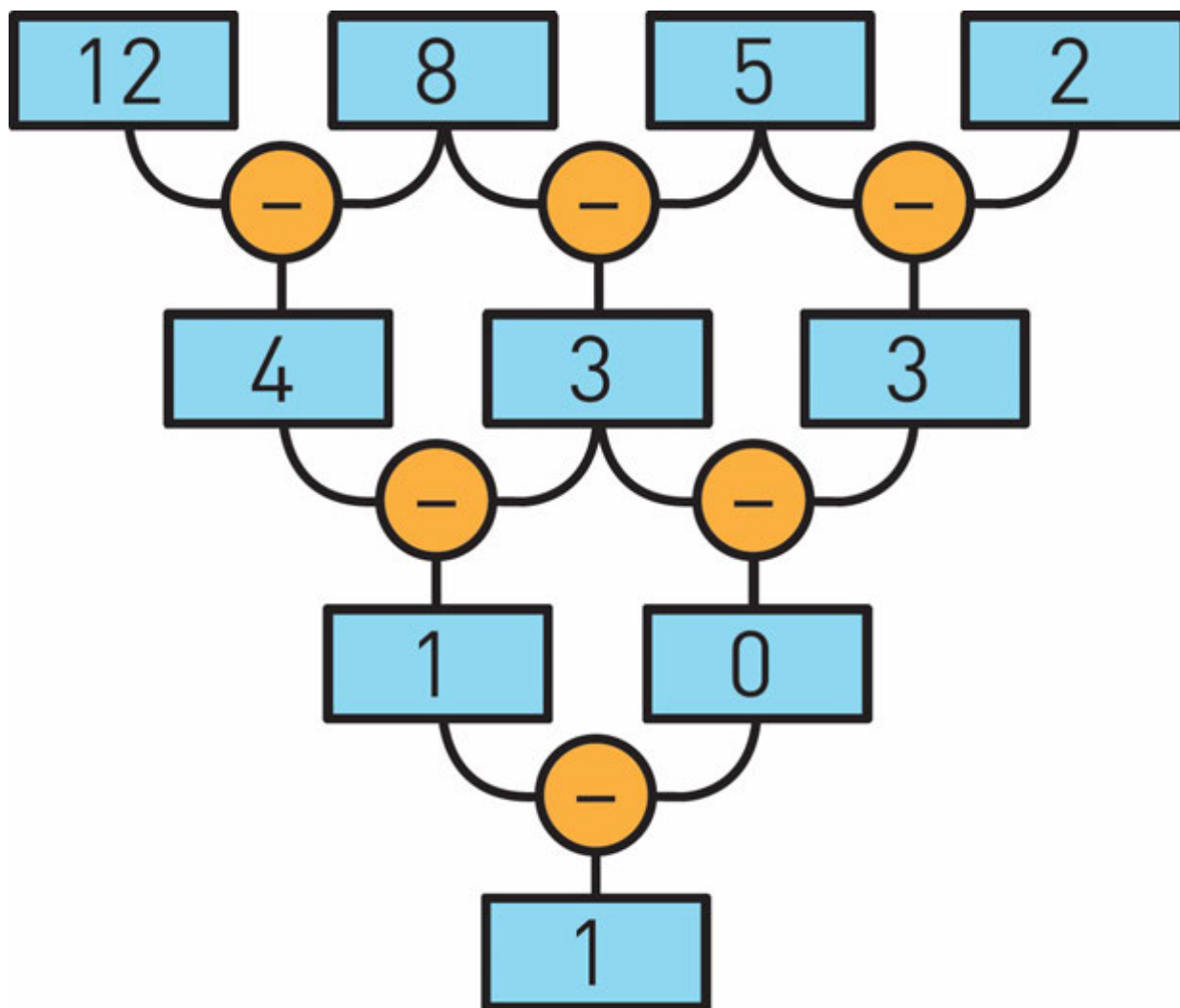
Columns and rows have own address names. Columns are represented in letters (A,B,C,D...) and Rows in numbers (1,2,3,4...). Each cell is represented by letters (column) and numbers (row). For example: a cell in column 'A' and row '1' has a name address of 'A1' and so on.

Errors

Sometimes there could be errors when Google Sheets defines the data of a cell. For example, division by zero is mathematically undefined, and Google Sheets cannot resolve this error. It will show the '#DIV/0!' result in this case.

Activity

The following machine takes 4 numbers in the first row as input. At each row, it computes differences. Here is an example:



Which of the following input numbers will give zero as a result in the last row?

1. 13 9 7 6
2. 16 9 4 1
3. 13 8 4 2
4. 5 5 5 1

Now try to solve this problem using Google Sheets.

Literacy

1. Why is it important to use formulas?

Terminology

- relation - қатынас - отношение
- expression - өрнек - выражение
- to enter - енгізу - вводить
- type - түрі - тип
- instead - орнына - вместо
- to input - енгізу - вводить
- undefined - анықталмаған - неопределенный
- to resolve - шешу - решать

2.5 FUNCTIONS

You will:

- identify Google Sheets functions;
- apply functions.

Functions

Functions are **predefined** formulas of Google Sheets. Here are some examples of functions in Google Sheets:

Function	
SUM	
AVERAGE	
COUNT	Co
MAX	
MIN	
More...	You can use

Range is a selection of cells, rows or columns.

In the beginning create a table. All incomes and expenses can be recorded and calculated in the table. The following table format can be used to make your own:

When finish the 'MY WALLET' table, create another one in the same spreadsheet and name it as "My account".

In 'My account', we are going to write functions to calculate all incomes and expenses.

The screenshot shows a Google Sheet with two tables. The first table, 'MY WALLET', has columns for No, Income / Expenses, Amount of money, Date, and Notes. It contains 11 rows of data with alternating positive and negative values. The second table, 'My account', has columns for Name of option and Amount. It contains summary statistics for the 'MY WALLET' table, such as Money Available, Count Income / expenses, Average Income / expenses, Max income, and Max expense.

1. To calculate 'Money Available', type `"=SUM(C3:C13)"` in the merged cell on the right.
2. To calculate a number of incomes and expenses, type `"=COUNT(C3:C13)"`. COUNT function calculates number of non-empty cells within a range

3. To calculate average income and expenses, use “=AVERAGE(C3:C13)” function. AVERAGE function calculates average values within a range.
4. To calculate the highest income, use “=MAX(C3:C13)” MAX function finds maximum value within a range of cells
5. To calculate the highest expense find the smallest value in the table. Use “=MIN(C3:C13)” function. MIN function finds minimum value within a range
6. To calculate total incomes and expenses of a specific thing (Snickers), type ‘=SUMIF(B3:B13, G8, C3:C13)’ in cell ‘I8’.
7. To calculate how many times you paid for a specific thing, type ‘=COUNTIF(B3:B13,G8)’ in cell ‘I9’.

‘**SUMIF**’ calculates sum of specific values in a range. Such values must meet rules that you specify.

For example: (B3:B13) is a range of incomes or expenses. We search for a specific thing that we set in G8 (Snickers). (C3:C13) is a range of values which we use to calculate the sum of ‘Snickers’

‘**COUNTIF**’ counts a number of specific values in a range.

For example: (B3:B13) is the range of incomes and expenses where we search for our specific thing. In G8 we set a specific thing (Snickers).

Keep in mind

You can use several ranges by separating them with commas.

For example, the function “=SUM(A1:A3, C1:C2, E1)” adds values of three separate ranges - (A1:A3), (C1:C2) and E1.

Practice

Everyone loves watching movies. In this practice you should work in pairs. Each pair should make a list of 5 favourite movies.

You should include:

1. name;
2. genre;
3. duration (in minutes);
4. country;
5. release date;
6. box office;
7. rating (imdb.com);
8. rating (kinopoisk.ru).

*Make sure your data are correct.

Then, do the following tasks:

1. find the shortest movie;
2. find the most successful movie;
3. add one more column and name it “Average”. Calculate average rating based on ‘imdb.com’ and ‘kinopoisk.ru’ websites;

4. count the movies of the USA production;
5. calculate total time that you need to watch all the movies (in minutes).

Literacy

1. How functions in Google spreadsheet are applied?
2. What is the difference between function and formula?

Terminology

- predefined - алдын ала анықталған - предопределенный
- comma - үтір - запятая
- to recognize - тану - узнавать
- non-empty - бос емес - не пустой
- record - жазу - запись
- specific - нақтылы - конкретный
- income - табыс, кіріс - доход
- genre - жанр - жанр
- expense - шығын - расход
- release - шығарылым - выпуск
- box office - кассалық табыс - кассовые сборы
- everal - бірнеше - несколько

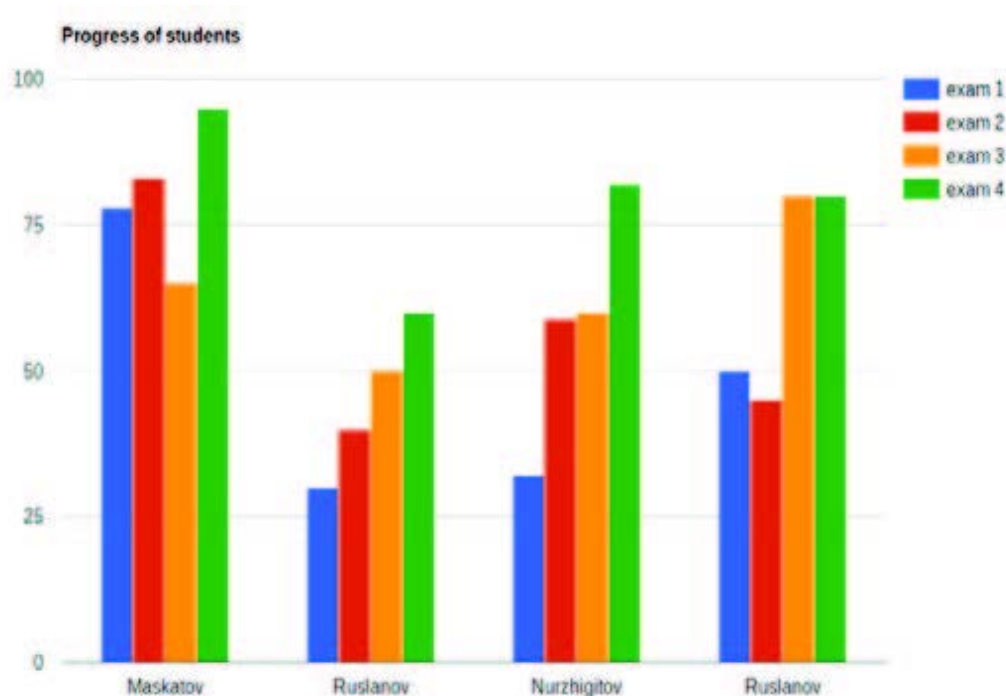
2.6 CHARTS/IF STATEMENT

You will:

- apply charts and diagrams;
- use If statement.

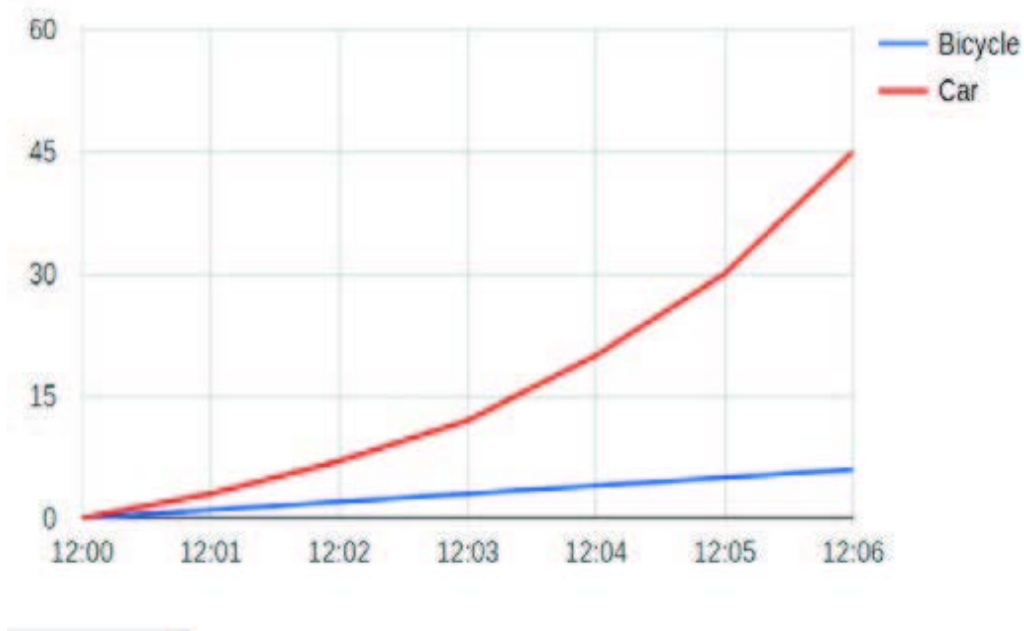
What is graphical representation of data?

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.



Bar chart.

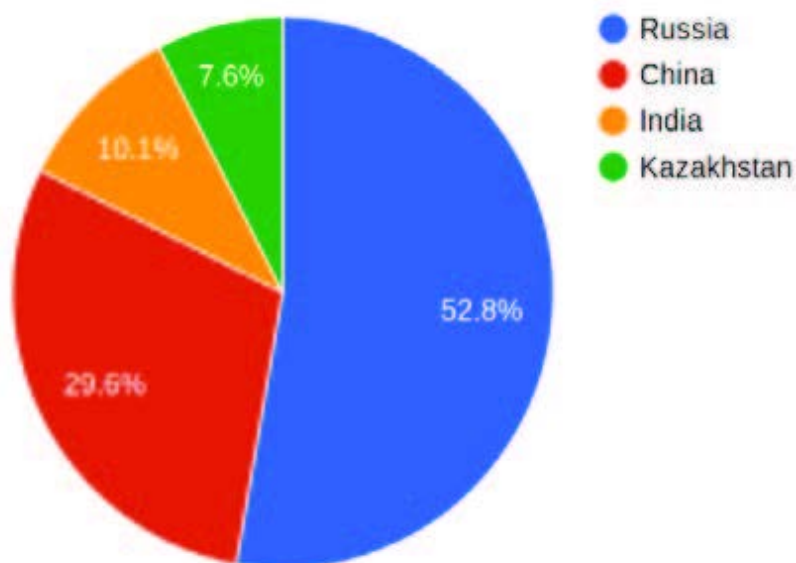
Bar charts are good to compare things (e.g. prices of different smartphones).



Line chart.

Line charts are good to show rate of change (e.g. change of temperature during the week).

List of Asian countries by area (km²)



Pie chart.

Pie charts are good to visualize a part to whole relationship in percentages (e.g. time spent for different activities).

Create a Chart

To create a line chart, do the following steps:

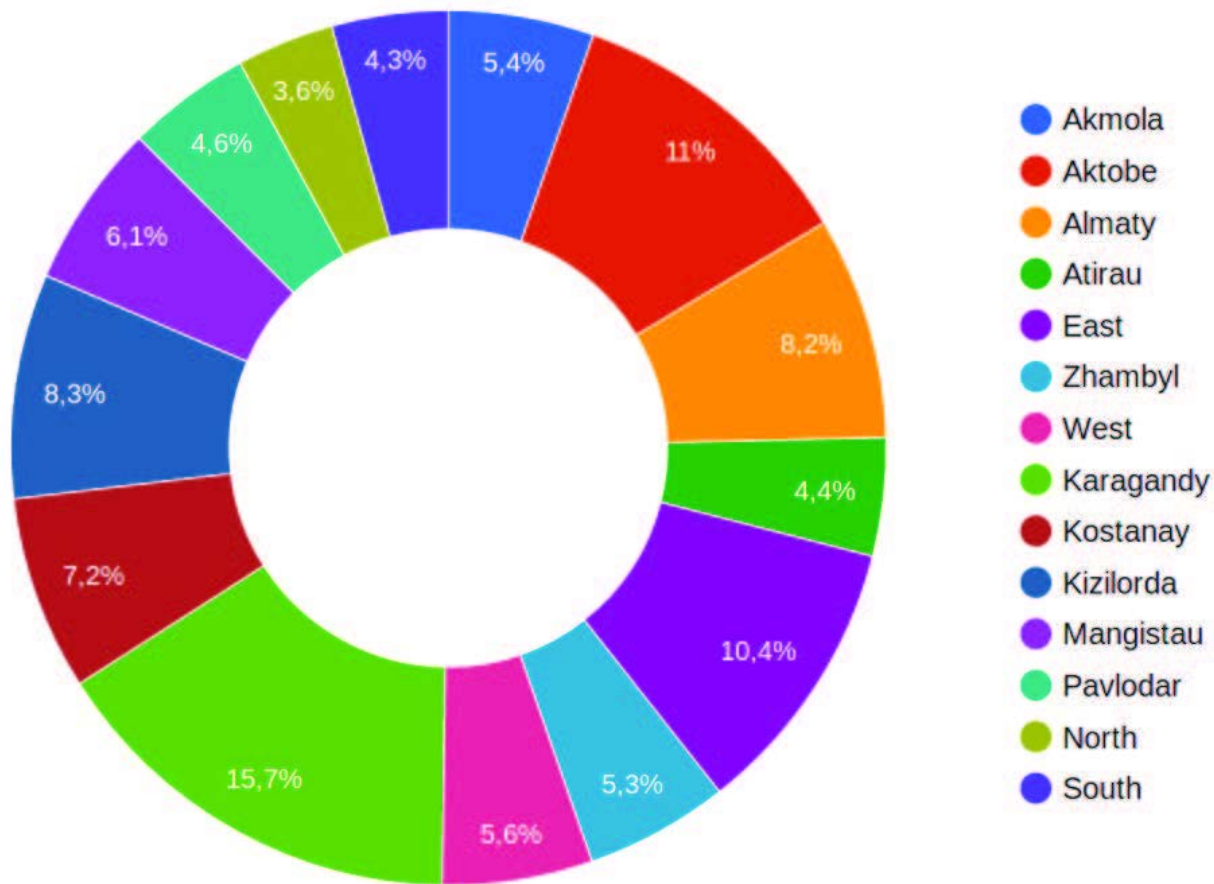
1. create a table on the range A1:E6;
2. select the range A2:E6;
3. click on Insert > Chart and choose Diagram.

Practice 1

As you know, there are 14 regions in Kazakhstan. Find information about areas of each region. Make a table using the following information:

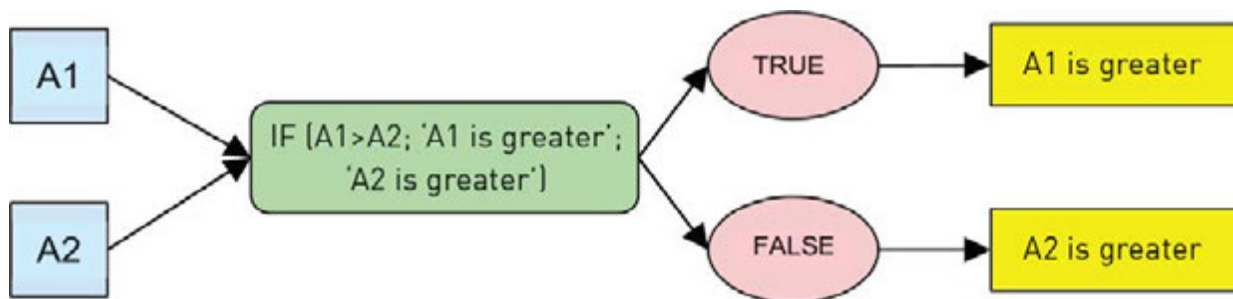
1. name of a region;
2. area size in km².

Make a pie chart to see percentage of each region's area. Example of a pie chart is below:



If statement

If statement shows a result if a logical expression is `TRUE` and another if it is `FALSE`.



For example: =IF(A1 > A2; "A1 is greater";"A2 is greater") If the value in a cell 'A1' is greater than value in cell 'A2', then show 'A1 is greater', else show 'A2 is greater'.

Practice 2

You have 2 different numbers: A and B. Find which number is greater. You must use IF function.

For example:

	A	B
1	A	75
2	B	100
3	Answer	B is bigger

	A	B
1	A	75
2	B	60
3	Answer	A is bigger

Practice 3

1. Create a table of the latest 4 exams of your class.
2. Calculate average of all 4 exams for each student

name	exam 1	exam 2	exam 3	exam 4	average
Gulnur	80	75	60	70	71.25
Aidyn	55	60	80	85	70
Aibek	30	25	23	60	34.5
Nurbol	95	90	95	60	85

3. Write the formula inside the cell G3:

if the value of F3 is greater than 60, it shows “Pass”, if not, it shows “Fail”.

Copy formula from G3 to other students results in column G.

fx =if(F3 > 60, "Pass", "Fail")							
	A	B	C	D	E	F	G
1	ICT exam results						
2	name	exam 1	exam 2	exam 3	exam 4	average	Pass/Fail
3	Gulnur	80	75	60	70	71.25	Pass
4	Aidyn	55	60	80	85	70	Pass
5	Aibek	30	25	23	60	34.5	Fail
6	Nurbol	95	90	95	60	85	Pass

Literacy

1. You have got several exams and now you want to analyse them all. Which chart is the best for doing this task?
2. Asset rides a bicycle only when he is in a hurry to school. Even when it rains outside, he usually walks (he hates riding a bicycle in the rain). Today it is raining and Asset is very late for the exam. What should Asset do?

Terminology

- chart - диаграмма - диаграмма
- statement - бекіту - утверждение
- to analyze - талдау - анализировать
- to compare - салыстыру - сравнить
- graphical - графикалық - графический
- region - аймақ - регион
- slice - тілім - часть, доля
- score - есеп - счет

- to execute - орындау - выполнять

2.7 PROBLEM SOLVING: FUNCTIONS AND FORMULAS

You will:

- use functions and formulas to solve problems.

Practice 1

According to the table, write the necessary formulas to calculate:

1. average salary of all employees;
2. maximum salary;
3. minimum salary;
4. total salary.

	A	B	C
1	Tree Star Trade Company		
2	Employee	City	Salary
3	Asanov Almas	Astana	\$1,520
4	Aliyev Temirlan	Atyrau	\$2,500
5	Yesetova Moldir	Zhezkazgan	\$1,800
6	Kim Roman	Kokshetau	\$3,200
7	Sidoranko Anna	Almaty	\$5,210
8	Alimkulova Akbota	Shymkent	\$850
9			
10	The average salary of all employees:		?
11	Maximum salary:		?
12	Minimum salary:		?
13	Total salary:		?

Practice 2

Everyday people exchange money of different currencies. Staff in exchange boxes are afraid of making mistakes. Therefore, they decided to make an exchange program.

The first part of the program (A2:B9) has a table of exchange. Here we show all currencies through a base one. (For us, the base currency is Tenge).

In the next part (A12: B13), we want to exchange currencies from one to another.

	A	B
1	EXCHANGE RATE	
2	Currencies	KZT (Tenge)
3	US Dollar	315.83
4	Euro	345.25
5	TL	88.45
6	GB Pound	407.42
7	Ruble	5.53
8	Yen	2.79
9	Dinar	0.27
10		
11	From	To
12	Dollar	Euro
13	10	9.15

Practice 3

Make a spreadsheet where you can automatically convert 8 digit binary numbers into decimals.

	A	B	C	D	E	F	G	H	I
1	Binary number	1	1	1	0	1	1	1	0
2		128	64	32	16	8	4	2	1
3		128	64	32	0	8	4	2	0
4									
5	Decimal number	238							
6									

Practice 4

Your teacher wants to monitor class attendance in Google sheets. A table should contain names, dates and number of absences.

Now teacher wants to find total absent days and hours for each student. Help him to solve this problem.

	A	B	C	D	E	F	G	H	I	J
1	1st Term Attendance Form									
2	id	Name & surname	04.09.2017	05.09.2017	06.09.2017	07.09.2017	08.09.2017	09.09.2017	Total Days	Total Hours
3	1	Almas Malikov	1	3					2	4
4	2	Artur Kozlov							0	0
5	3	Assel Asanova			2			3	2	5
6	4	Dauren Aliyev	7	7	7				3	21
7	5	Azamat Kozhakov							0	0
8	6	Batyrbek Amanov			3		1	1	3	5
9	7	Daniyar Mukazhan							0	0
10	8	Dias Alimov	1	1	1	1	2		5	6

Practice 5

Your country hosted 27th International Olympiad in Informatics (IOI). The Jury Committee prepared a table where they need to write some formula:

- Each participant's total score in column J;
- Percentage of the score (maximum score is 600) in column K.

	A	B	C	D	E	F	G	H	I	J	K
1	Rank	Contestant	Country	A	B	C	D	E	F	Score ▼	
2										Abs.	Rel.
3	1	Jeohak Yoon	Republic of Korea	100	100	100	100	100	100	600	100.00%
4	2	Mikhail Ipatov	Russia	100	100	100	100	100	61		
5	3	Andrew He	United States of America	100	55.72	100	100	100	100		
6	33	Bekzhan Bekbolatuly	Kazakhstan	100	55.55	34	100	100	26		
7	35	Meirambek Omyrzak	Kazakhstan	100	55.9	34	100	100	25		

Practice 6

Ismail and Aidyn like playing basketball. Their teams had a match last weekend. There are 4 periods in a basketball match. There is a table with information about match.

Calculate the final scores. Then find which of the following statements are true.

1. Ismail`s team won;
2. Aidyn`s team won;
3. It is a draw.

	A	B	C
1	Periods	Ismail	Aidyn
2	1	26	17
3	2	13	15
4	3	19	11
5	4	14	16
6	Total	72	59
7			
8	Ismail's team won		TRUE
9	Aidyn's team won		FALSE
10	It is a draw		FALSE

Practice 7

Ayaz Ata wants to deliver gifts to children who live in a block of flats with 5 floors and 5 entrances. He knows that there are

3 flats on each floor. Ayaz Ata wants to calculate the floor and the entrance of each flat in the block.

Write the formula that will take a flat number from the cell A2, then calculate the entrance number in B2 and the floor number in C2.

***Hint:** use ceiling and floor functions

	A	B	C
1	Flat #	Entrance #	Floor #
2	43	3	5

Terminology

- to interpret - аудару - интерпретировать
- entrance - кіреберіс - подъезд
- necessary - қажет - необходимый
- exchange - айырбастау - обмен
- to deliver - жеткізу - доставлять
- exchange box - ақша айырбастау - пункт обмен валюты
- floor - қабат - этаж
- attendance - қатысу - посещаемость
- through - арқылы - через
- participant - қатысушы - участник
- jury - әділ қазылар алқасы - жюри

CHECK YOURSELF

1. What kind of program is Google Sheets?

- A) Word processing
- B) Spreadsheet
- C) Database
- D) Graphics

2. Match the following information according to the picture below:



- A) Font style
- B) Cell background
- C) Alignment
- D) Font size
- E) Table borders
- F) Font family

3. Match the following shortcut keys:

- CTRL + B *Italic*
- CTRL + I Underlined
- CTRL + U **Bold**

4. Find the result in A5 cell with the given formulas below:

	A
1	10
2	20
3	30
4	40
5	?

- A) = SUM (A1:A4)
 B) = MIN (A1:A4)
 C) = AVERAGE (A1:A4)
 D) = COUNT (A1:A4)

5. Match the following function with definitions:

Functions
Min
Max
Average
Sum

Definitions
Calculates the average value of a list of numbers
Adds a list of numbers
Findes the smallest value in a list of numbers
Findes the largest value in a list of numbers

6. Use the following words instead of the blanks: smaller, larger. We use bar chart for _____ changes and line chart for _____ changes.

7. Which chart is better to show the ingredients of chocolate?

8. You are playing a game. And your final score is 97. The program tells you that previous high score was 96. You have to show if your score is a new high score. Which function do you have to enter into the active cell?

	A	B
1	High score	96
2	Your score	97
3	Have you reached high score?	

9. If you drag the mouse to the right side and drop, which value will appear in cell D1?

	A	B	C
1	5	10	15
2			
3			

10. Which of the followings is used to write multiple lines in a cell?

- A) Shrink to fit
- B) Wrap text
- C) Merge cells
- D) Orientation



CHAPTER 3

PROGRAMMING FUNDAMENTALS

3.1 INTRO TO PROGRAMMING

You will:

- identify types of software;
- understand the programming languages;
- understand the meaning of programming.

Software is a program or a set of programs used to control a computer



System software is a set of programs that manage the components of a computer system, such as a processor, RAM, Input / Output devices. E.g., operating systems, diagnostics, antiviruses, archivation, etc.



Application software used for specific tasks (word processing, web browsers, graphic editor, games, etc.). Application software does not work without system software.



Software development tool (compiler, code editor, debuggers, standard libraries) used for creating computer programs. E.g., Python, C/C++, Delphi, Lazarus, etc.

Programming and algorithm

Programming is instructing the computer to do something. It uses algorithm (a step-by-step solution) to solve a task.

Computer program

There are three parts in a computer program (software):



IPO (Input Process Output) example of cooking “Besbarmak”

Why do we learn computer programming?

Programming stimulates creativity and logic. Programmers get the opportunity to create something from nothing and

use logic to translate everything to a form that a computer can understand.

Programming language

Programming language is a translator between us and a computer. Computers understand only binary numbers (0 and 1). Programmers write a code and the programming language translates code into binary. This process is called Compiling. We will use Python programming language in this book.

Activity

Choose one of the images below to write a program for your friend. Do not let them see which one you choose!


Write the program on a piece of paper using arrows. Can they draw your picture?

Use these symbols to write a program that would draw each image.


Move One
Square Right


Move One
Square Left

 Move One
Square Up

 Move One
Square Down

 Fill-in Square
with Color

Example



Algorithm of the picture above:



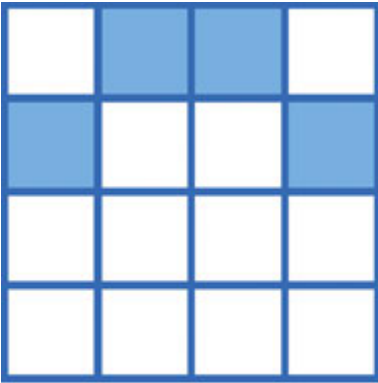


Image 1

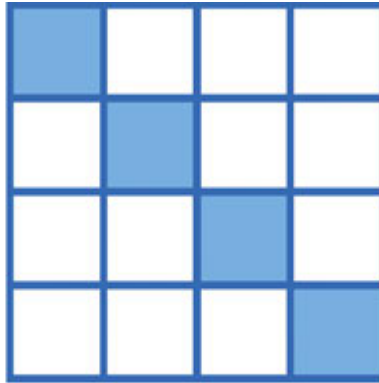


Image 2

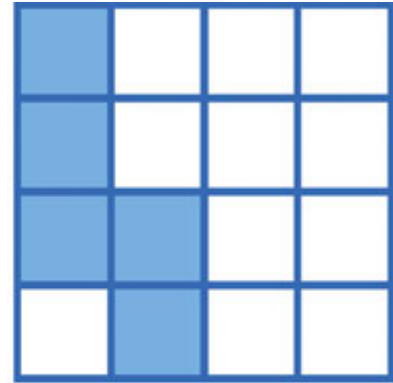


Image 3

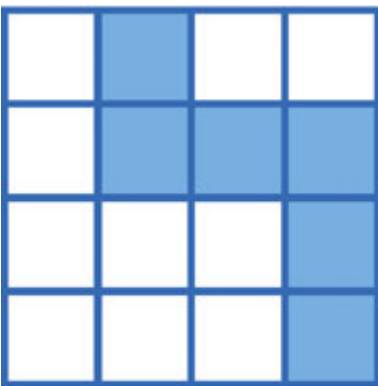


Image 4

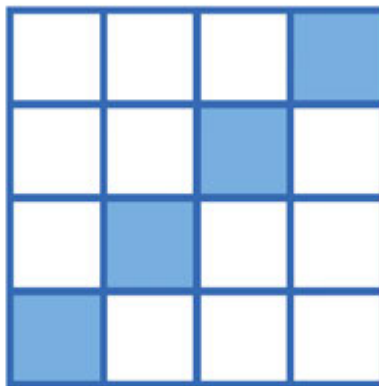


Image 5

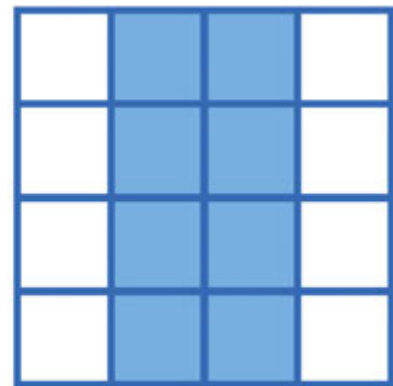


Image 6

Terminology

- software - бағдарламалық қамтамасыз ету - программное обеспечение
- programming language - бағдарламалау тілі - язык программирования
- programming - бағдарламалау - программирование
- compiling - құрастыру, компиляция - компилирование
- input - енгізу - ввод
- to stimulate - ынталандыру - стимулировать
- output - шығару - вывод
- opportunity - мүмкіндік - возможность
- set - множество - топтама

- to manage - басқару - управлять
- specific - конкретный - нақты

3.2 YOUR FIRST PROGRAM

You will:

- identify components of IDE;
- learn how to write a code in Python.

What is IDE?

IDE (Integrated Development Environment) is a software that contains basic developer tools needed to write and test software. Mostly they contain a code editor, a debugger and a compiler. Code editor is used to write, edit and modify source code. Debugger is used to check source code and find errors/mistakes to fix them. Compiler is used to translate source code to machine code (0, 1).

Why Python?

Python is a programming language which is much easier to learn than other programming languages. It has a compiler where we can write a program code and see how it compiles and executes written code.

Python can:



Installing Python

To install Python on your computer, follow the steps below:

1. go to <https://www.python.org/>;
2. click on Downloads and select your Operating System;
3. select latest Python 3 release, download and install it.

Getting started

1. Click on Start and type Python;
2. Select IDLE (Python GUI) to work with Python.
3. Open new file to write your first program code.

Printing text

How does a program print something on the screen? It has a very simple way. One line will be enough for doing that:

```
print("Hello World")
```

This code segment prints “Hello World” on the screen. Now type this into Python IDLE and see how it works.

You can write different words or phrases instead of “Hello World”. The computer will print anything you want. When you finish writing the code, press ‘F5’ button or click ‘Run -> Run Module’.

```
print ("Hello I am happy to learn Python")
```

```
===== RESTART: /Users  
Hello I am happy to learn Python
```

```
>>>
```

Remember, an output command in Python is very easy. Typing ‘print()’ is enough. Python prints any text inside the

brackets. Also the text has to be in double quotes around. Otherwise, the program will give you an error.

Code: *print("2 + 3")*
Output: *2 + 3.*

The next code segment does not have quotes around. Therefore, Python understands it as a mathematical statement. It will print '5' now

Code: *print(2 + 3)*
Output: *5*

The code segment on the right is an example of error cases. The computer tries to understand "Hello World" as a mathematical statement, and this does not work:

Code: *print(Hello world)*
Output: *SyntaxError*

Syntax means correctness of computer speech. The code above will print 'SyntaxError' which means that there is invalid syntax. In our case Python does not know what "Hello" and "World" mean.

A print statement can output several words or numbers at once. We can separate each item by a comma:

Code: *print("Your new score is", 1030 + 10)*
Output: *Your new score is 1040*

Python sees everything inside the quotes as text. Anything outside the quotes is a mathematical statement or a computer code:

Code: `print("Your new score is ", "1030 + 10")`

Output: *Your new score is 1030 + 10*

The numbers are not summed because they are inside the quotes.

The next code example does not work. This is because there is no separating comma between the text in quotes and numbers (1030+10):

Code: `print("Your new score is " 1030 + 10)`

Output: *Error*

Next code example works because there is a separating comma:

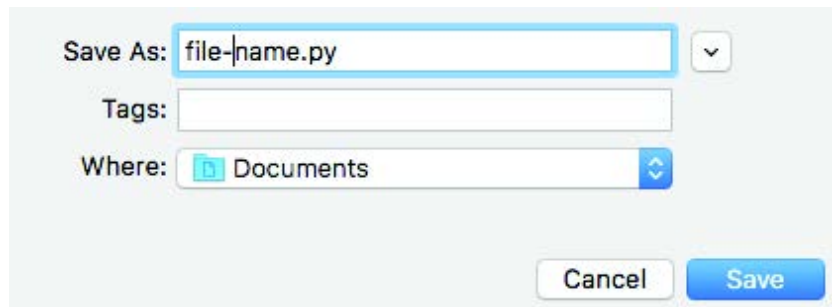
Code: `print("Your new score is,", 1030 + 10)`

Output: *Your new score is, 1040*

The separating comma must be outside the quotes.

Saving Python program

To save the program click on 'File -> Save' or press 'CTRL + S'. Then type a name of your program. Example:



Practice

1. Write at least 5 commands that will show information about yourself. Example:

```
print("Hi! My name's Bolat")  
print("I'm 14 years old")
```

2. Try to write code that represents the picture by using 'print' function.



3. Try this code, change expressions `print("23 + 54=", 23+54)`

Activity

Can you find what is missing from the following lines of code? Try to correct the errors:

1. *print(helloworld)*
2. *(print"how tall are you?")*
3. *('Game Over')*
4. *print('Game Over')*
5. *print('Bob's car has 4 wheels')*

Terminology

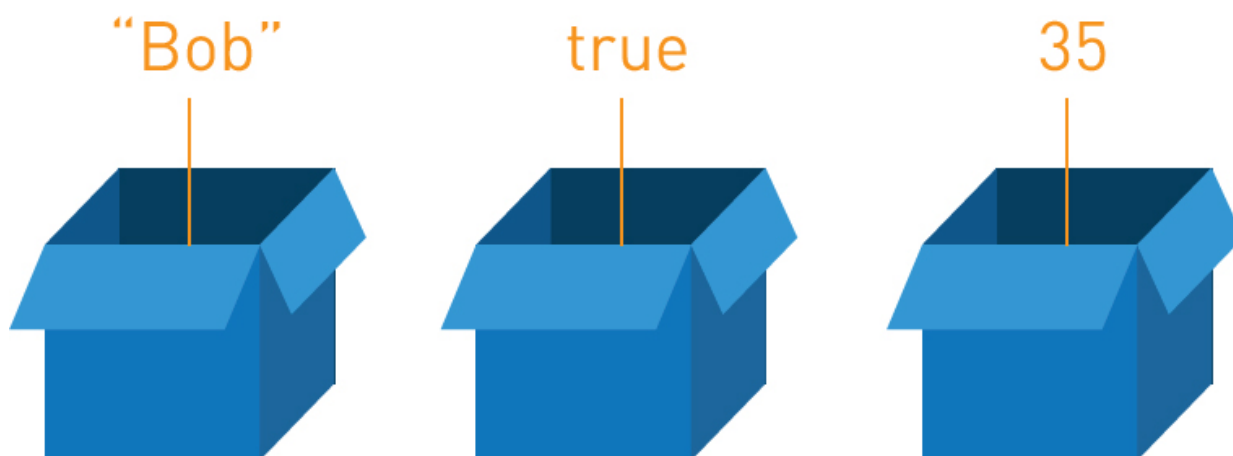
- compiler - компилятор - компилятор
- syntax - синтаксис - синтаксис
- phrase - сөз тіркесі - фраза
- item - зат - предмет
- double quotes - қос тырнақша - двойные кавычки
- separating - бөлетін - разделяющий
- mathematical statement - математикалық мәлімдемеде - математическое утверждение
- to modify - өзгерту - изменить
- source - бастапқы - исходный

3.3 VARIABLES

You will:

- learn purposes of variables;
- learn how to input data;
- solve problems in Python.

How to store and process data in programming language?



Variables

Imagine a box that stores an object inside. It becomes a container for any object of relevant size. Thus, such boxes are called variables in computing.

A variable is something like a container that can store a number, text, character or value. It can refer to it and can make changes to it, if you ask it to.

In a game, variables are usually the things that can change. Example: a score, a timer or lives of a player.

Example 1:

Code: `name = "Dias"`
`print("My name is ", name)`
 Output: `My name is Dias`

Example 2:

Code: `lives = 3`
`print("Number of lives: ", lives)`
`lives = lives + 1`
`print("Number of lives: ", lives)`
 Output: `Number of lives: 3`
`Number of lives: 4`

Keep in mind

Variable's name can be a lowercase or uppercase letter or a word. Nevertheless, uppercase letters should not be used normally. Variable's name is case sensitive. This can be confusing if a programmer is not expecting it. In the code below, the output will be 6 (not 5) because there are two different variables:

```
x and X
x = 6
X = 5 print(x)
```

Printing on new line

Code: `print("Hello world")`
`print("I am happy to study Python")`

Result: *Hello world*
I am happy to study Python

Printing in one line

Code: *print("Hello world", end = "")*
print(" I am happy to study Python", end = "")
 Result: *Hello world I am happy to study Python*

Practice 1

1. Following codes have errors. Find and fix them.

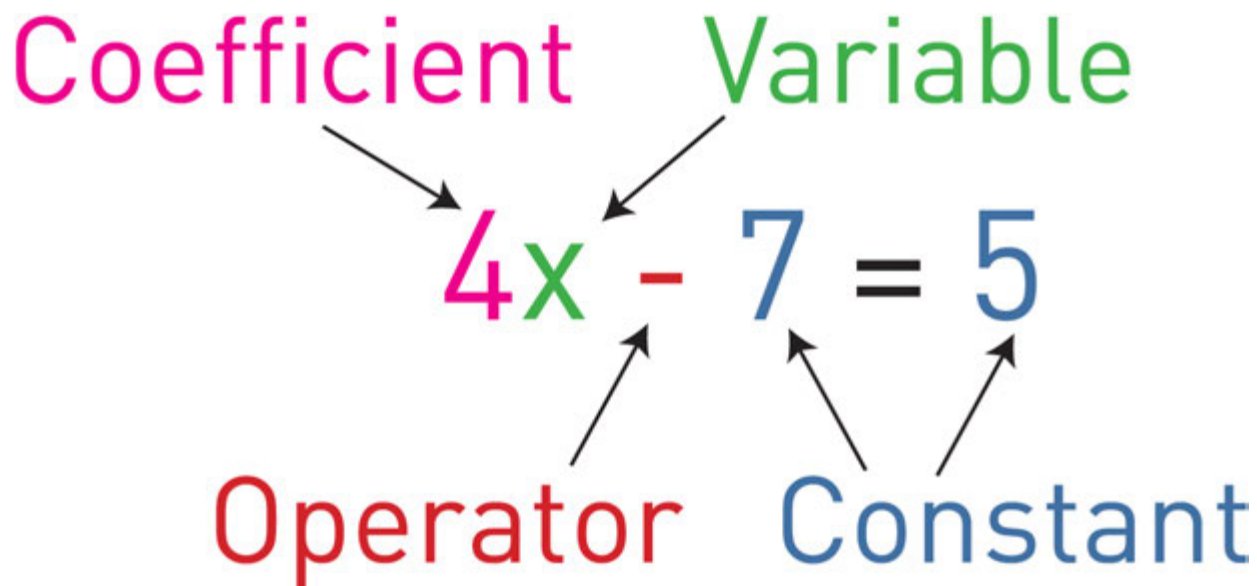
a) *bandName = "MuzArt"*
print(bandName,songs are very popular)

b) *bandName = "MuzArt"*
print("bandName,is the most popular music band in Kazakhstan)

2. Complete the following code:

```
name =
surname =
print("My name is ", _____)
print( _____ , _____)
```

Operators



A symbol for a number we do not know yet. It is usually a letter like x or y .

Example: in $x + 2 = 6$, x is the variable.

Operators are special symbols that perform specific operations on two or more variables, and then give a result.

Here are some common operators:

Operator	Operation	Example equation	Example code	Result
+	Addition	$3 + 2$	<code>a = 3 + 2</code>	<code>a = 5</code>
-	Subtraction	$3 - 2$	<code>a = 3 - 2</code>	<code>a = 1</code>
*	Multiplication	$3 * 2$	<code>a = 3 * 2</code>	<code>a = 6</code>
/	Division	$10 / 2$	<code>a = 10 / 2</code>	<code>a = 5</code>
//	Floor division	N/A	<code>a = 10 // 3</code>	<code>a = 3</code>

Operator	Operation	Example equation	Example code	Result
**	Power	2^3	<code>a = 2 ** 3</code>	<code>a = 8</code>
%	Modulus	N/A	<code>a = 8 % 3</code>	<code>a = 2</code>

Keep in mind

'Floor division' always rounds an output down to the nearest value. For example:

- $11//2$ is equal to 5, not 5.5.
- $99//100$ is equal to 0

Modulus (%) is the remainder after division. For example:

- $8 \% 3 = 2$
- $9 \% 2 = 1$

Practice 2

1. Let us make simple calculations using Python:

- $45 * 263 =$
- $85 / 23 =$
- $123 + 4568 =$
- $7894 - 456 =$
- $123.35 * 23.45 =$

2. Practice using following expressions in Python:

- $a + b$
- $a - b$
- $a * b$
- a / b
- $a // b$
- $a \% b$

- `a ** 2`
- `a ** b`

3. Calculate the following problems using Python:

- Dias has 500 KZT and Adilkhan has 1000 KZT. Print their total amount of money.
- Dias and Adilkhan want to buy an ice cream bucket which costs 1200 KZT. How much money will be left if they buy that bucket?
- Dias and Adilkhan finished eating the ice cream bucket, but still want to eat more. They found ice cream which costs 50 KZT. How many ice creams can they buy now?

Terminology

- object - нысан - объект
- nevertheless - соған қарамастан - тем не менее
- container - контейнер - контейнер
- to confuse - шатастыру - запутывать
- relevant - орынды - соответствующий
- bucket - шелек - ведро
- to refer - жүгіну - обращаться

3.4 INPUT. COMMENTS

You will:

- apply input commands to enter data;
- solve mathematical problems.

Input data

There are three parts in a computer program (software):
Input, Process and Output.

Input is everything that goes into the computer. A user can use 'input()' function in Python.

```
x = input('Enter the data') #gets data as string(text)
```

The variable(x) is a string that means that input data is a text.

```
a = int(input('Enter the data')) #gets data as  
int(number)
```

If you want to input numbers you should write int (for whole numbers) or float (for fractional numbers)

Keep in mind

Python supports four different numerical types:

- int (signed integers);
- long (long integers, they can also be represented in octal and hexadecimal);
- float (floating point real values);

- complex (complex numbers).

Comments

Sometimes we need to explain what exactly we have written with a programming code.

To do this, we add “comments” to the code. The comments are used mostly for programmers to read and understand the code.

There are two ways to create a comment:

1. The first is to use the ‘#’ symbol. The computer will ignore any text that is written after the ‘#’ symbol in that row.

```
Code:   #This is a comment, it begins with a ‘#’
sing
        #and the computer will ignore it
        print(“This is not a comment, the
computer will”)
        print(“run this and print it.”)
```

Output: *This is not a comment, the computer will run this and print it.*

2. Multiple line comments are slightly different. Use 3 single quotes (“”) before and after the part you want to comment.

```
Code:   """
        print(“We are in a comment”)
        print (“We are still in a comment”)
        """
        print(“We are out of the comment”)
```

Output: *We are out of the comment*

Example

Try this:

1. `a = int(input("Enter number:"))`
`print(a)`
2. `a = int(input("Enter number:"))`
`b = int(input("Enter number:"))`
`print("Sum of your numbers is",a + b)`

How to solve problems

Apples

You have N apples in a basket. And K students want to divide these apples equally. You cannot divide an apple into several parts. So it remains in the basket.

1. Calculate how many apples each student will have.
2. Calculate how many apples will remain in the basket.

Input data:

- You will have two inputs. First input is number of students (K).
- Second input is number of apples (N).

Output data:

- You will have two outputs. The first output is number of apples given to each student.
- The second is number of apples that remain in the basket.

Sample tests:

№	Input	Output
1	5 6	11
2	3 17	5 2

Keep in mind

How to input 2 or more integers in one line in Python?

Code:

```
a, b = map(int,input("enter 2 variables:").split())
print (a, b)
```

Result:

```
enter 2 variables:
3 7
3 7
>>>
```

Code:

```
a, b, c = map(int,input("enter 3 variables:").split())
print (a, b, c)
```

Result:

```
enter 3 variables:
3 7 9
3 7 9
>>>
```

Editorial

Now let us talk about how to solve problems. Read the problem carefully. Pay attention on what you should find.

In this problem we must find number of apples given to each student and number of apples that remain in basket:

To find number of apples given to each student we just divide N by K.

$$answer1 = n / k$$

To find number of apples that remain in the basket we use modulus sign (%) to calculate remainder of division of N by K

$$answer2 = n \% k$$

Entire code will look like this:

```
k, n = map(int, input().split())
print ( n / k , " " , n % k )
```

Practice

Write a program that will ask personal questions like:

- What is your name?
- How old are you?
- What is your hobby? etc.

Write at least 5 questions. Then, collect all data and print as one text.

Example:

My name is Alikhan. I am 14 years old. I like playing piano, watching football and listening to folk music.

Terminology

- whole numbers - бүтін сандар - целые числа
- several - бірнеше - несколько
- fractional numbers - бөлшек сандар - дробные числа
- to remain - қалу - оставаться
- editorial - редакциялық - редакционный

3.5 TRACING AN ALGORITHM

You will:

- apply tracing an algorithm;
- solve the problems.

Tracing an algorithm

Many people make mistakes and try to correct them. Programmers write programs on the computer and can also make mistakes while programming. Therefore, it is important to understand how to find and correct errors. An error in a computer program is called a bug. The process of finding and fixing bugs is called tracing an algorithm or debugging. Example below shows how to do tracing of an algorithm:

Your initial input is number of minutes (n). Convert minutes into default time format (e.g. 12:00) and show it in the output.

The program must calculate 2 integers:

1. hours (0 - 23);
2. minutes(0 - 59).

	Input	Output
1	250	4 10
2	625	10 25

Code:

```
n = int(input())           # gets input
hours = n // 60          # calculating hours
```



```

hours = hours % 24      # hours according to 24 hours
format
minutes = n % 60       # calculating minutes
print (hours,minutes)  # printing answers

```

Table of tracing an algorithm

Numbers of steps	n	Hours	Minutes	Lines of code
1	1525			n = int(input())
2	1525	25		hours = n // 60
3	1525	1		hours = hours % 24
4	1525	1	25	minutes = n % 60
5	1525	1	25	print(hours, minutes)

Activity 1

Alexander's calculator has two displays (A and B) and 6 buttons. Buttons can add and subtract numbers on displays, then save result in one of the displays.

A	B
127	128
$A + B \rightarrow A$	$A + B \rightarrow B$
$A - B \rightarrow A$	$A - B \rightarrow B$
$B - A \rightarrow A$	$B - A \rightarrow B$

Which commands do you have to use to swap (change positions) numbers?

Practice 1

Previous and next number

Aygerim is 3 years old. She learns how to count. Now she can count till 10. Help Aygerim learn how to count greater numbers. Aygerim says one number and then asks you to find its previous and next number. You can easily find how to help her using your knowledge about programming language.

Example:

Input	Output
-------	--------

	Input	Output
1	26	Previous number: 25 Next number: 27

Practice 2

Binary to Decimal

Aidar likes computer programming. He studied binary data in the first chapter with you. Now he wants to write a program that converts a binary number to a decimal. But he got some problems in the code and needs your help.

You have an input of 8 bits (0 and 1) on each line. Solve this problem to help Aidar.

Example:

128 64 32 16 8 4 2 1

1 0 0 1 1 0 1 1

128+0+0+16+8+0+2+1
= 155

Explanation:

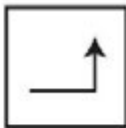
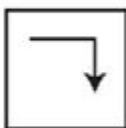
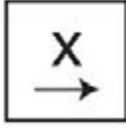
In example, you have a binary number 100110112. Image above shows you how to solve it.

	Input	Output
1	1 0 0 1 1 0 1 1	155

	Input	Output
2	1 0 1 0 1 0 0 0	168

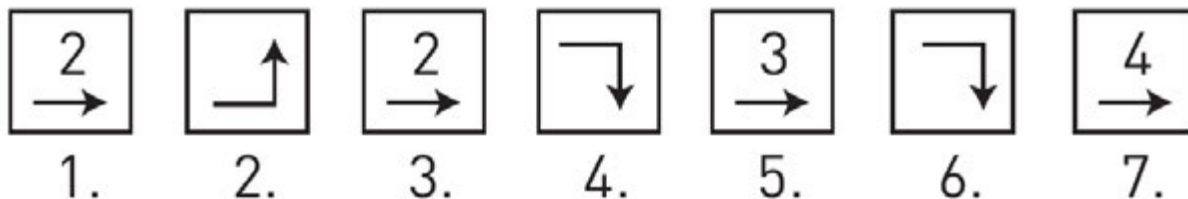
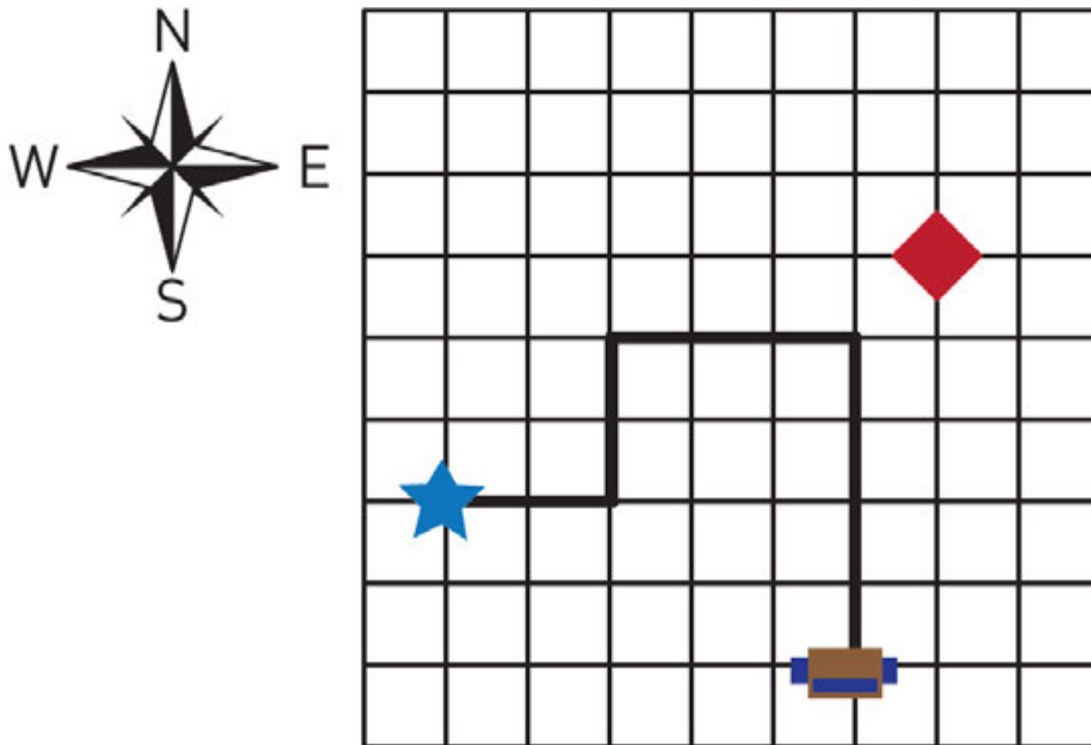
Activity 2

Three types of buttons control the R2D2:

	robot turns left
	robot turns right
	robot moves X units in the direction it is facing



The R2D2 starts at blue star facing to east. Zhanibek presses 7 buttons (as shown on the picture) to move the R2D2 to the red diamond on the map. Unfortunately, he has pressed two buttons by mistake.



Which two buttons were a mistake?

Terminology

- to add - қосу - прибавлять
- angry - ашулы - злой
- to subtract - шегеру - вычитать
- initial - бастапқы - начальный
- to swap - ауысу - замена
- to convert - түрлендіру - преобразовать
- unfortunately - өкінішке орай - к сожалению
- quotient - бүтін сан - целое число
- bug - қате - ошибка в коде

- remainder - қалдық - остаток
- debugging - түзету - исправление, улучшение

3.6 CONDITIONAL STATEMENTS (IF/ELSE)

You will:

- apply if statement;
- identify comparison operators;
- apply if/else statements.

Conditional statements

People make decisions everyday. For example, a boy in the picture on the left must decide whether to give a seat to other passenger or not. Now let us solve a problem where we must make a decision:

To drink a cup of tea, firstly, we must boil water in a kettle. Temperature of boiling is 100 Celsius. Let us understand if water is boiled or not.

We can simply write the following code:

```
temp = int (input ("What's temperature of water? "))  
if temp == 100:  
    print ("It is boiled. Have a nice tea time!")
```

In this code we make decisions by using 'if' function. So, if temperature of water becomes equal to 100 degrees Centigrade it will boil and we can have a cup of tea.

Keep in mind

Each line under the 'if' statement has an empty space. It is called 'indentation':

```
if a == 1:
    print("If a is equal to 1, this will print.")
    print("So will this.")
    print("And this.")
print("This will always print because it is not indented.")
```

Next code does not work because indentation must be the same:

```
if a == 1:
    print("Indented two spaces.")
    print("Indented four. This will generate an
error.")
    print("The computer will want you to
make up your mind.")
```

Keep in mind

Type comparison signs correctly! You cannot write '<=' or '>=' signs in different way! Also there must not be any space between them.

For example, neither '=<', nor '=>' sign will work.

Comparison operators

Comparison operators allow you to compare two values. It means checking if some value is bigger or less than another or equal or not equal to each other

5 > 3	We check that if 5 is greater than 3

5 < 3	If 5 is less than 3
5 >= 3	If 5 is greater or equal to 3
5 <= 3	If 5 is less or equal to 3
5 == 3	If 5 is equal to 3
5 != 3	If 5 is not equal to 3

Do not make mistakes when using equal signs. The double equal sign ‘==’ is used to make comparisons between variables.

Example 1:

```
if(5 == 5): #Here we compare two numbers
    print("They're equal")
```

The single equal sign ‘=’ is used to set a value to a variable. E.g (a = 5)

Example 2:

```
a = 5
b = 6
a = b #Here we assign b to a. Now both a and b are
equal to 6
```

If / else statement

If / else statement is a decision between two things. For example, if it is a weekday it is time to go to school. Otherwise, you can stay home.

We use 'if' statement for making only one decision. What can we do if there are two or more decisions?

For example, let us 'program' the following situation:

As you know, if temperature outside reaches -30 degrees, school will cancel the lessons. So let us write a code that will check if it is possible to stay home or not.

Code:

```
int temp = int(input("What's temperature today?"))
if temp <= -30:
    print("Tadaaa, stay home and have sweet dreams!")
else:
    print("Hey, get up! You have lessons today!")
```

Statements like 'if' or 'if / else' are called 'conditional statements' in computer programming.

Practice

1. Write a program that defines if an input number is positive or negative.
2. Write a program that defines whether a student has passed the exam or not. Percentage to pass is 50%.
3. Find three errors in the following code:

```
x = input("Enter a number:")
if x = 3
    print("You entered 3")
```

Terminology

- to boil - қайнату - кипятить
- conditional - шартты - условный
- condition - шарт - условие
- indentation - шегініс - отступ
- comparison - салыстыру - сравнение
- value - мән - значение
- variable - айнымалы - переменная

3.7 CONDITIONAL STATEMENTS (IF/ELIF/ELSE)

You will:

- apply if/elif/else statements;
- solve problems.

If/Elif/Else

Now we are going to work with multiple decisions. For example: Let us write a program 'Exam Grader'. It gets an input as percentage score and shows the output mark according to that score.

Code:

```
grade = int (input("How many percentages?\n"))
if grade > 79: #If more than 79 it shows 5
    print("You get 5")
elif grade > 59: #If more than 59 it shows 4
    print("You get 4")
elif grade > 39: #If more than 39 it shows 3
    print("You get 3")
else: #Otherwise it shows 2
    print("You get 2")
```

'Elif' means 'else if'. It is used when you want to add another statement that denies previous 'if' statements.

Activity 1

Solve the following activities in pairs.

1. Compare next two program codes. What is the difference between them? Which one will work properly?

<pre> grade = int(input("How many percentages? \n")) if grade >= 80: print("You get 5") elif grade >= 60: print("You get 4") elif grade >= 40: print("You get 3") else: print("You get 2") </pre>	<pre> grade = int(input("How many percentages? \n")) if grade >= 80: print("You get 5") if grade >= 60: print("You get 4") if grade >= 40: print("You get 3") else: print("You get 2") </pre>
--	--

Practice 1

1. Write a code that gets an input number from the user and defines if it is positive, negative, or zero.

Use if/ elif/ else operators. Using three 'if' statements is not acceptable for this task.

2. Write a code for the following task:

Input a day within a week (e.g. Monday).

Output: weekday or weekend (e.g. Monday is weekday)

Practice 2

Compare two numbers In this problem, you need to compare two numbers: A and B. Practice

Input: an integer

Output:

print "<" if A is less than B;

print ">" if A is greater than B;

print "=", if A and B are equal.

Example:

	Input	Output
1	5 7	<
2	7 -12	>
3	13 13	=

Practice 3

Basketball match

Ismail and Aidyn like playing basketball. Last weekend their teams had a match. As you know, there are 4 periods in a basketball match.

Here are the scores of each period of match. You must calculate the final score and decide whose team won. For example:

- *Ismail`s team won*
- *Aidyn`s team won*
- *It is a draw*

Example:

	Input	Output
1	26 17 13 15 19 11 14 16	72 59 Ismail's team won
2	14 15 17 18 20 20 15 17	66 70 Aidyn's team won
3	15 16 18 17 10 12 14 12	57 57 It is a draw

In computer science, there could be different ways of solutions for one specific problem. You may even use different programs to solve the same task. For example, to solve a 'Basketball match' problem we used Google Sheets previously.

Now try to solve it by using Python.

Practice 4

Divisible by 5

As you know, a number is divisible by 5 if its remainder is 0 or 5. Write a code that calculates if the number is divisible by 5 or not.

Input: *an integer*

Output: *remainder*

YES if it is divisible by 5

NO if it is not divisible by 5

	Input	Output
1	153	3 NO
2	320	0 YES

Practice 5

Friendship

Baurzhan is a very friendly and generous boy. He has got some chocolate and wants to share it with (K) number of friends. Size of the chocolate is (N x M) pieces. So, Baurzhan needs to divide the chocolate into equal parts. Help Baurzhan to calculate and understand if everyone can have equal pieces of chocolate.

Input: K, N, M

Output: "YES" if they can have equal prices and "NO" otherwise

	Input	Output
1	3 2 4	NO
2	6 5 12	YES

Activity 2

Aldar Kose always tells the truth on Mondays, Wednesdays and Fridays. The rest of the week he usually lies. Today he said: "Tomorrow I will tell the truth."

What day is it today?

Terminology

- to compare - салыстыру - сравнивать
- generous - үлкен - большой
- acceptable - жарамды - приемлемый
- to share - бөлісу - делиться
- specific - спецификалық - специфический
- to deny - мойындамау - отрицать
- remainder - қалдық - остаток

3.8 LOGICAL OPERATORS (AND, OR, NOT)

You will:

- learn and apply Logical operators (AND, OR, NOT).

Logical Operators

Sometimes when we want to make a choice, we can have several options or conditions.

'AND' operator

Let us look at the following example:

Everyday your parents must bring you to school by car. Also if the temperature outside is -30 degrees, then lessons will be canceled. Let us try to write a logical expression:

If: Parents can take me to school AND temperature is higher than -30 degrees Centigrade: Yahooo!, I will go to school and study hard!

Else: Oh no! I am staying home and watching cartoons.

In 'AND' operator final result is True if only all statements are True.

Another example on 'AND' operator:

We want to guess a 'happy number'. The number must be divisible by 4 and 7. Let us check if an input number is 'happy number' or not.

Code:

```
number = int ( input ( "Input number to check it" ) )
if number % 4 == 0 AND number % 7 == 0: # Here we check if our number is divisible
by 4 and 7
    print ( "Great!!! This's your happy number" )
```

'OR' operator

Imagine that your family are expecting guests today. Your mother wants to cook something tasty for everyone. Your favourite meals are Besparmak and Kuyrdak.

Will you feel happy today?

Code:

```
if meal == "Besparmak" OR meal == "Kuyrdak":
    print ( "I am very happy" )
```

In 'OR' operator, the final result is True if at least one of the statements is True. Let us talk about the happy number again. This time your happy number must be divisible by 4 or 7:

Code:

```
number = int(input("Input number"))
if number % 4 == 0 OR number % 7 == 0:
    print("This is your happy number")
```

'NOT' operator

Look at the following code:

Code:

```
If NOT rainy:
    print("I can walk outside today")
```

So if it is rainy today you cannot walk outside. But if it is NOT rainy, you can go out for a walk. 'NOT' operator is an opposite of a statement. E.g. NOT rainy.

Continue with the 'happy number':

The 'happy number' can be any number except those that are divisible by 4 and 7.

Code:

```
number = int(input("Input a number and check it"))
if NOT ( number % 4 == 0 AND number % 7 == 0 ):
    print ("This is your happy number")
```

Practice

a) There are three numbers as an input. Find the greatest number among them:

	Input	Output
1	5 7 4	7

b) 7 is an incredible number!

Input: *two integers.*

Output: *print "True" if one of the numbers is 7 or their difference or sum is equal to 7. Otherwise print "False".*

	Input	Output
1	3 7	True
2	15 8	True
3	1 2	False

c) Input number is an integer. If number is not equal to 7, print "not seven". Otherwise print "it is seven".

	Input	Output
--	-------	--------

	Input	Output
1	6	not seven
2	7	it is seven

Activity

Compare the next codes. Analyse what output of the following codes will be.

```
number = int ( input ( "Input number " ))
if number % 4 == 0 AND number % 7 == 0:
    print ( "that's your happy number" )
```

```
number = int ( input ( "Input number and check it" ))
if number % 4 == 0 OR number % 7 == 0:
    print ( "that's your happy number" )
```

```
number = int ( input ( "Input a number and check it" ))
if NOT ( number % 4 == 0 AND number % 7 == 0 ) :
    print ( "That's your happy number" )
```

Terminology

- to guess - табу - отгадать
- at least - кем дегенде - по крайней мере
- except - басқа - кроме
- incredible - ақылға сыймайтын - невероятный

3.9 PROBLEM SOLVING: CONDITIONAL STATEMENTS AND LOGICAL OPERATORS

You will:

- apply Logical operators (AND, OR, NOT).

Practice 1

Salary

There are 3 employees in a company. Their job salaries differ and the company's CEO wants to make them equal. Let us write a code that calculates difference between the highest and lowest salaries.

Input: *3 integers (salaries of three different workers)*

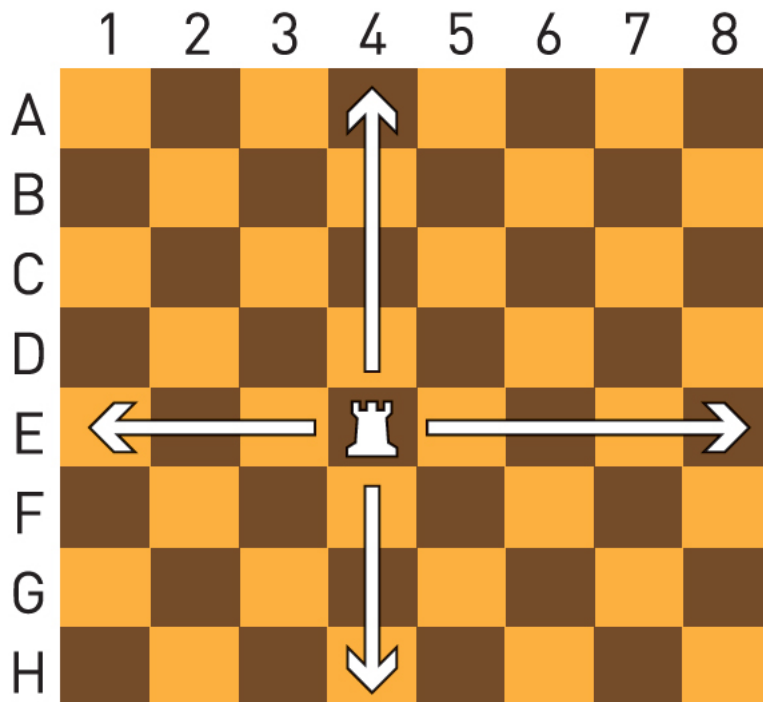
Output: *difference between the highest and lowest salaries.*

	Input	Output
1	100 500 1000	900
2	36 11 20	25

Practice 2

Chess Master - Rook

Zhansaya is a multiple winner of many chess competitions worldwide. Nevertheless, she did not become a chess player immediately. She was also studying hard how to play this game. Zhansaya was not afraid of making mistakes because she knew that practising makes her better. Now we want to know how she was learning to play with a rook. As you know, the rook moves horizontally or vertically on the chessboard. The initial position of the rook (letter, number) is shown on the picture. The rook has to reach the destination point (letter, number) in one move.



Input: *string variable (Letter) int variable (Number) of initial position. string variable (Letter) int variable (Number) of destination position.*
 Output: *'YES' if the rook can reach the destination, 'NO' if cannot.*

	Input	Output
1	A 1 B 2	NO
2	A 1 E 1	YES

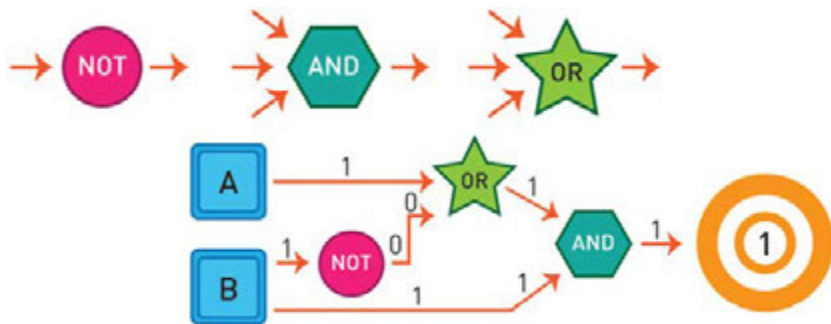
Activity

Do the following activity in pairs.

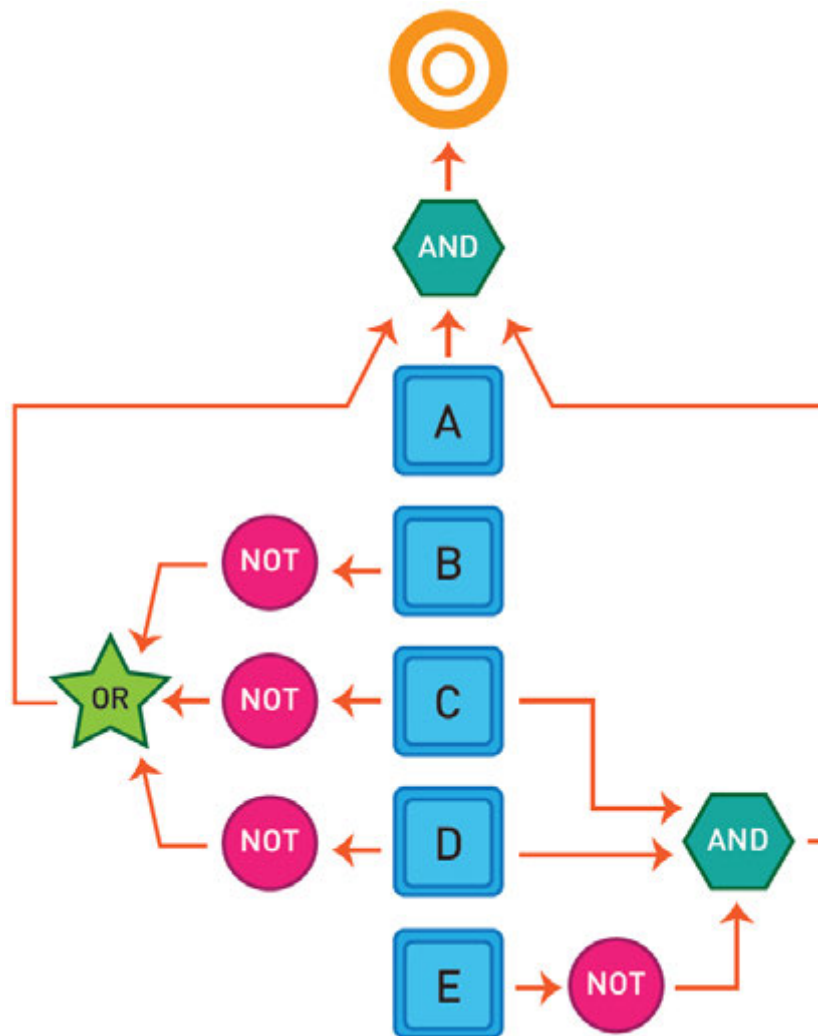
Kuanysh decided to install an electronic lock for home protection. To open the door Kuanysh must type a lock code by using buttons. The mechanism uses three lock operators, which convert the input signals from pressed buttons into a single output:

1. 'NOT' operator outputs an opposite signal 'ON' becomes 'OFF'.
2. 'AND' operator outputs 'ON' signal if all inputs are 'ON'.
3. 'OR' operator outputs 'ON' signal if at least one of the inputs is 'ON'.

For example, in the following picture the lock works if you press "A" and "B" buttons:



Which combination of operators will open the lock on the picture below?

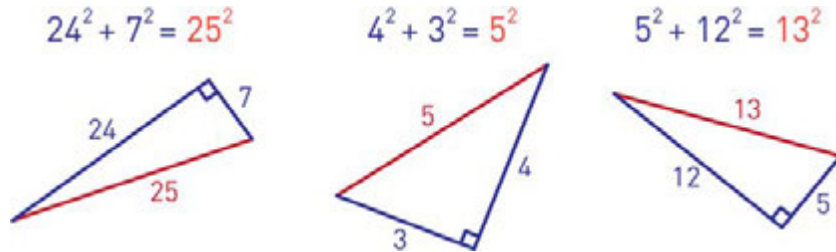


Practice 3

Hypotenuse rule

Write a code that checks if the given hypotenuse is correct or not.

Hypotenuse rule: $(\text{Longest sides})^2 = (\text{Side one})^2 + (\text{Side two})^2$.



Input: *Input is three values: side 1, side 2 and hypotenuse itself.*

Output: *We must check if the given hypotenuse is correct or not. print 'YES' if it is correct or 'NOT' if not.*

	Input	Output
1	5 13 11	NO
2	3 4 5	YES

Practice 4

Even or Odd

We have an input of three integers (A, B and C). Check if there is at least one even and one odd number at the same time. If it is true, print "YES", if not print "NO".

Input: *three integers (A, B and C)*

Output: *'YES' or 'NO'*

Look at the example here:

	Input	Output
1	3 4 5	YES
2	7 7 7	NO

Practice 5

Ascending Order.

Input is three integers (A, B and C). Arrange them in ascending order from A to C. Output must contain three integers.

	Input	Output
--	-------	--------

	Input	Output
1	2 1 2	1 2 2

Terminology

- salary - жалақы - зарплата
- destination - тағайындалған орын - место назначения
- to differ - басқаша - отличаться
- to arrange - ұйымдастыру - организовать
- rook - ладья - ладья
- ascending - өсу бойынша - по возрастанию

CHECK YOURSELF

1. Fix the following code:

```
userName = input("Enter your name:)"
```

2. Why does this code not calculate the average value?

```
print(3 + 4 + 5 / 3)
```

3. Explain mistake in the following code:

```
x = 4  
y = 5  
a = 3(x + y)  
print(a)
```

4. Write a Python program that gets an input number and print if it is positive, negative or zero. Use 'if/ elif/ else' operators.

5. Write a Python program that gets an input number and prints out 'Success' if it is greater than -10 and less than 10 inclusively.

6. This code compiles successfully, but there is something wrong. What is that?

```
userInput = input("A cherry is a:")  
print("A. Dessert topping")  
print("B. Desert topping")  
if user_input.upper() == "A":  
    print("Correct!")  
else:  
    print("Incorrect.")
```

7. There are two errors in the following code. The code tests if x is a positive value or not. One error prevents the code to run, and the other is logical. Make sure that if statement works no matter what x is set to. Try to fix both mistakes.

```
x == 4
if x >= 0:
    print("x is positive.")
else:
    print("x is not positive.")
```

8. What are four errors in the following code?

```
x = input("Enter a number: ")
if x = 3
print("You entered 3")
```

9. There are four errors in the following code. Find and fix all of them.

```
answer = input("What is the name of Dr. Bunsen
Honeydew's assistant? ")
if a = "Beaker":
print("Correct!")
else
print("Incorrect! It is Beaker.")
```

10. Look at the following code below. Guess what it prints. Then, run the code and see the result.

```
x = 5
y = 10
z = 10
print(x < y)
print(y < z)
print(x == 5)
```

```

print(not x == 5)
print(x != 5)
print(not x != 5)
print(x == "5")
print(5 == x + 0.000000000001)
print(x == 5 and y == 10)
print(x == 5 and y == 5)
print(x == 5 or y == 5)

```

11. Match the following software parts:

1	Input	a	is a set of activities to get a result.
2	Output	b	is the result of the program on the screen.
3	Process	c	is a data to solve a problem.

12. _____ is instructing computer to do something.

13. _____ is a step-by-step solution to solve a task.

14. _____ is a translator between us and a computer.

15. Convert your birth day, month and year to binary numbers.

16. Programmers write a code and the programming language translates code into binary. What is the name of this process?

17. What would happen with this code?

print (I love programming!)

18. Which of the following python code gives “One plus one is equal to 2” output (select four answers)

- a. *print(“One plus one is equal to ”, 1 + 1)*
- b. *print(One plus one is equal to 2)*
- c. *print(“One plus one is equal to 2”)*
- d. *print(One plus one is equal to 2, 1 + 1)*
- e. *print(“One plus one is equal to”, 2 + 3 % 2)*
- f. *print(“One plus one is equal to”2)*
- g. *print(“One plus one is equal to 2”, “1 + 1”)*
- h. *print(“One plus one is equal to”, 15 % 4 - 7 % 3)*

19. _____ is something like a container that can store a number or value.

20. What is the output of following code?

```
name = “Akbota”
print (“Hello, ”, name, “!”)
print (“Nice to meet you!”)
```

- a. Hello, Akbota! Nice to meet you!
- b. Hello Akbota! Nice to meet you!
- c. Hello Akbota!
Nice to meet you!
- d. Hello, Akbota!
Nice to meet you!
- e. hello, akbota!
nice to meet you!

21. What will be displayed by the following code?

```
print(“A”, end = ‘ ‘)
print(“B”, end = ‘ ‘)
```

```
print("C", end = ' ')
print("D", end = ' ')
```

- a. ABCD
- b. A, B, C, D
- c. A B C D
- d. A
B
C
D
- e. "A","B","C","D"

22) What is the output of following code?

```
a = 5
b = 3
c = 7
a = b + c
b = a + c
c = a + b
print ("a = ", a)
print ("b = ", b)
print ("c = ", c - 25)
```

- a. a = 5
b = 3
c = 7
- b. a = 10
b = 17
c = 27
- c. a = 10
b = 17
c = 2
- d. a = 10
b = 16
c = 28
- e. a = 10

```
b = 27
c = 12
```

23. Fix the code to get “I am happy to learn Python. It is wonderful!” output.

```
print("I am happy to learn Python." end = ' ')
print("It is wonderful!", end = ' ')
```

24. What is the output of the following code?

```
a = 11
b = 3
print (a // 2 % b + 10 / 2 + 2 ** 2)
```

- a. 9
- b. 10
- c. 11
- d. 12
- e. 13

25. Fix the code to get the correct result.

```
name = input('Enter your name: ')
birthYear = input('Enter your birth year: ')
currentYear = input('Which year is this? ')
age = currentYear - birthYear
print("Hello, ", name, "!")
print("You are ", age, "years old.")
```

26. Select the right commented two lines.

- a. // This is comment
- b. "" This is comment ""
- c. ! This is comment
- d. * This is comment

- e. # This is comment
- f. """ This is comment """

27. An error in a computer program is called a _____.
The process of finding and fixing problem is called _____.

28.

```
# print ("** ")
# print ("* ")
# print ("*** ")
# print ("** ")
# print ("*** ")
# print ("*** ")
# print ("***** ")
# print ("* ")
# print ("***** ")
# print ("***** ")
```

Uncomment some parts of code to get the following output:

```
*
**
***
****
*****
```

29. What is the output of the following code?

```
x = 0
if x < 4:
    x = x + 1
print("x is", x)
```

- a. x is 0
- b. x is 1
- c. x is 2

- d. x is 3
- e. x is 4

30. Suppose that $x = 1$, $y = -1$, and $z = 1$. What will be displayed by the following statement?

```
if x > 0:  
    if y > 0:  
        print("x > 0 and y > 0")  
elif z > 0:  
    print("x < 0 and z > 0")
```

- a. $x > 0$ and $y > 0$
- b. $x < 0$ and $z > 0$
- c. $x < 0$ and $z < 0$
- d. nothing displayed



CHAPTER 4

PROGRAMMING

4.1 LOOPS

You will:

- understand Loops;
- apply 'FOR' loop to solve the problem.

What is a 'Loop'?

In computer programming, a loop is an order of instructions that repeats for many times. Each repetition is called an iteration of the loop.

For example: The teacher asked the boy to write 'I will not throw paper airplanes in class' for 500 times. It is clear that doing the same thing again and again is very hard and boring. Nevertheless, computer programmers have an opportunity to write some code and make it repeat for several times. This trick is called 'FOR' loop.

```
Counter   Number of loops
  ↑       ↑
for i in range(5):
    print("Happy to learn Loops")
```

For example:

Let us write a program that will print 'Atannyn balasy bolma, adamnyn balasy bol!' for 100 times.

Code:

```
for i in range(100):
    print ( "Atannyn balasy bolma, adamnyn balasy bol!" )
```

LOOPS REPEAT ACTION... SO YOU DON'T HAVE TO

Practice 1

1. Use "FOR" loop to print your name for 10 times, and then print a word "Done" at the end.
2. Write a code that prints 'Study, study and STUDY AGAIN!' for 100 times on each separate line.

Starting value Ending value

value value

↑ ↑

```
for i in range(1, 11, 1):
```

Number of steps

↓

```
print(i, " - step")
```

Let us write a program that will display all numbers between 10 and 20 inclusively.

Code:

```
for i in range(10, 21, 1):
    print(i)
```

For example, let us calculate sum of all even numbers between 10 and 20 inclusively.

Code:

```
sum = 0
for i in range(10, 21, 2):
    sum = sum + i
print( sum )
```

Practice 2

1. There are 3 errors in the code. Find and fix them.

```
print ("This program takes three numbers and returns the
sum.")
total = 0
for i in range(3):
    x = input ("Enter a number:")
    total = total + i
print("The total is:", x)
```

2. Write a code that prints all even numbers from 2 to 100 inclusively. You must use 'FOR' loop. Example: 2 4 6 8 ... 100

3. Write a code that prints all odd numbers from 1 to 100. Example: 1 3 5 7 ... 99

4. Write a code that prints all numbers, divisible by 5, starting from 1 to 1000. Example: 5 10 15 20 ... 1000

5. Write a code that will print sum of all numbers from 1 to 60 inclusively.

Activity

Compare the following codes:

```
for i in range(5):  
    print("I am using Python")  
    print("It's really cool")
```

```
for i in range(5):  
    print("I am using Python")  
print("It's really cool")
```

Discuss any difference between them.

Literacy

1. What does this program print? Why?

```
for i in range(3):  
    print("a")  
for j in range(3):  
    print("b")
```

2. What does this print? Why?

```
for i in range(3):  
    print("a")  
    for j in range(3):  
        print("b")  
    print("Done")
```

Terminology

- loop - тізбек - цикл
- even - жұп - четные
- iteration - итерация - итерация

- inclusively - қоса алғанда - включительно
- trick - қулық - хитрость
- to fix - түзету - исправлять
- sum - сома - сумма
- divisible - бөлінетін - делимый

4.2 PROBLEM SOLVING: FOR LOOP

You will:

- apply 'FOR' Loop.

Practice 1

100 tenge

There are (N) number of coins on table. Some of them are tails, and some are heads. How many coins do we need to turn around so that all coins be of the same side?

We have total number of coins (N). Next N rows contain the numbers 1 (if a coin is up tail) or 0 (if a coin is up head). Find the minimum number of coins that you must turn.

Input: *The first line is a total number of coins, next lines are values of tails or head.*

tails = 1, head = 0

Output: *Minimum number of coins that we must turn*

	Input	Output
1	4 1 0 1 1	1

Practice 2

Exercises

Bakhtiyar likes to do morning exercises. He knows that it makes him feel better and healthier. Also he wants to count time that he spends for exercises everyday. Can you help him?

Input: *first line is a total number of exercises (n) next (n) lines are minutes for each exercise*

Output: *total number of minutes that he spends to do exercises.*

№	Input	Output
1	4 2 2 1 3	8
2	5 2 1 2 1 1	7

Activity

Solve the following activity in pairs.

Eldar uses a controller with a circuit to light 16 LED lamps which are labeled from 1 to 16. When the controller a gives

signal to a LED lamp, it changes its state (ON or OFF).

In the beginning, all the LEDs are switched OFF. Eldar has found a sequence of lightning:

*On the 1st second controller lights ON all LED lamps.
(1...2...3...)*

On the 2nd it lights ON the LEDs that are even in the circuit.

(2...4...6...)

On 3rd second it lights every third LED in the circuit.

(3...6...9...)

And so it continues in similar way...

Which LEDs must be switched ON after the 16th second?

Practice 3

Positive numbers

Print all positive divisors of X from 1 to itself in ascending order.

Input: *natural number X*

Output: *all positive divisors.*

№	Input	Output
1	10	1 2 5 10
2	21	1 3 7 21

Practice 4

Positive, negative or zero?

You have N amount of numbers. Define which of the N numbers are zero, positive or negative numbers. Print total count of zeros, then positive numbers and finally negative numbers.

Input: *in the first line we have total amount of numbers after the first line we get each number particularly.*

Output: *print total count of zero, positive and negative numbers.*

	Input	Output
1	5 2 16 0 -8 0	2 2 1

Terminology

- divisor - бөлгіш - делитель
- controller - тексеруші - контролер
- head - тиынның сыртқы беті - орел
- circuit - тізбек - цепь
- independence - тәуелсіздік - независимость
- ascending - өсу - восходящий
- ancestor - арғы ата - предок
- particularly - атап айтқанда - в частности
- LED - жарық диодты индикатор - светодиод
- independent - тәуелсіз - независимый

4.3 WHILE LOOP

You will:

- improve understanding of Loops;
- apply 'While' loop.

Let us discuss the following situation:

You are throwing a bucket into the well to get water. You will throw it several times until the bucket comes up being full of water.

This is how loop works:

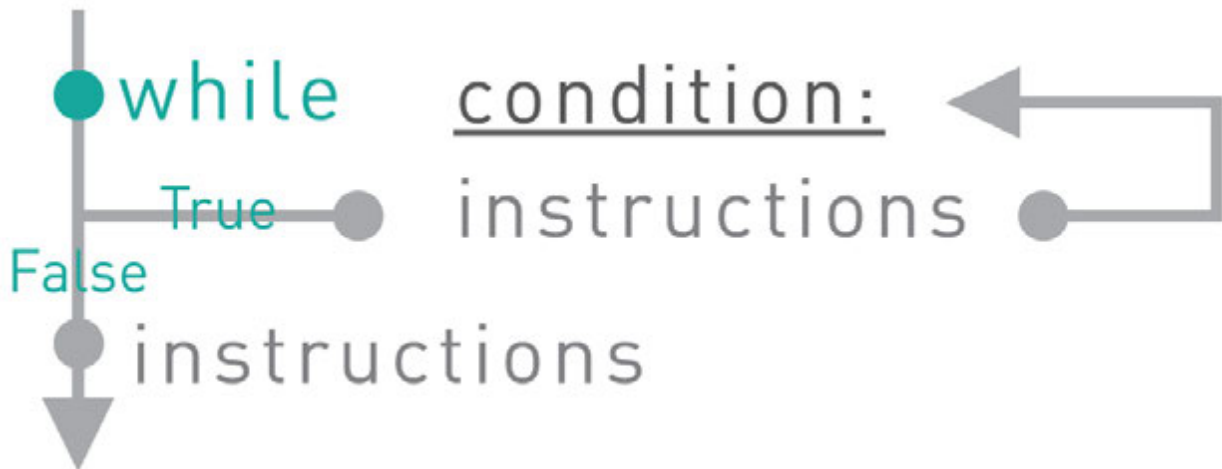
- loop is repeating until some condition happens (throwing the bucket);
- condition has happened and shows the final result (bucket is full of water and we can pull it up).

While loop

A 'FOR' loop is usually used when we repeat something for definite number of times.

A 'WHILE' loop is used when a program needs to loop until a particular condition happens.

For example, while wheels of the train rotate, the train keeps moving. If they stop the train also will stop.



The WHILE loop repeats a block of tasks (or instructions) while some condition is True.

Example:

A program that prints numbers from 1 to 5

Code:

```
number = 1
while number <= 5:
    print ( number )
    number = number + 1
```

Try to write this code by using “for“ loop

Practice 1

1. What is the output of the following code?

```
i = 1
while i < 2 ** 3:
    print(i)
    i *= 2
```

2. A programmer wants to count down from 10 to 0. What is wrong in the code? Can you fix it?

```
i = 10
while i == 0:
    print(i)
    i -= 1
```

3. There is a mistake in the following loop that is trying to count up from 1 to 10. Can you identify the problem and then fix it?

```
i = 1
while i < 10:
    print(i)
```

'WHILE' loop structure

1st step: Initialization.

Setting up a variable and giving initial value to it.

```
variable = initial value
```

2nd step: Condition.

The 'WHILE' loop repeats instructions while the condition is True and unless it becomes False.

```
while variable < maximum value:
```

3rd step: Increment.

A counter that leads condition to be False and end the loop.

```
while variable < maximum value:
```

```
    variable = variable + 1
```


For the condition above, each loop repetition increments the variable unless it reaches the maximum value.

Increment operators

It is also possible to shorten the code:

variable = variable + 1 to variable += 1

In 'WHILE' loop it looks like this:

```
i = 0
while i < 10:
    print(i)
    i += 1
```

This can be done with subtraction and multiplication as well.

For example:

*i *= 2* is similar to: *i = i * 2*

Practice 2

1. Find the multiplication product of all numbers divisible by 3 starting from 3 to 100. You can use a 'WHILE' loop.
2. Write a program using a 'WHILE' loop to count from 10 to 0 inclusively. In the end print 'Let's Go!'
3. Write a program that does the following things:
 - Asks 7 numbers from a user
 - Prints total sum of user's numbers
 - Counts total amounts of positive and negative inputs, and inputs equalled to zero. Use 'if', 'elif' and 'else' decision operators for this task.

Literacy

1. Which loop should be used to write the same message 100 times?
2. What is the difference between 'FOR' and 'WHILE' loops?

Terminology

- bucket - шелек - ведро
- increment - өсу - инкремент, приращение
- well - құдық - колодец
- condition - шарт - условие
- particular - нақты - конкретный
- crossroad - жол қиылысы - перекресток
- initialization - жүктеу - присвоение
- to identify - анықтау - определять

4.4 PROBLEM SOLVING: WHILE LOOP

You will:

- identify Loops;
- apply 'For and While' loops.

```
// programmer's quote  
always:  
try{  
    your best and;  
    do{  
        what you need to do;  
    }while (you still have the time);  
    for(opportunity; comes; only once){so grab the chance;  
    }  
if(you fail)  
    throw "all your worries";  
}catch(yourself){  
    everytime you fall;  
    and you know to Whom you should go to always;  
}
```

Practice 1

Power of 2

Computers store all data in bits. Bits are stored in binary numbers (as 0 and 1). They can be converted into decimal numbers through summing up powers of two.

For example, $1 \times 2^0 + 1 \times 2^2 + 1 \times 2^3 + \dots + 1 \times 2^n$.

That means that all data storage devices such as USB cards, CPU, RAM and memory hard disks consist of 'power of two' numbers. So now let us solve next problem related to this paragraph:

Under the number N print all integer powers of two, does not exceed N, in ascending order.

Do not use exponentiation operation!

Input: *an integer (N)*

Output: *print all 'power of two' integers that do not exceed the given number (N) in ascending order.*

	Input	Output
1	60	1 2 4 8 16 32

Practice 2

Sum of digits

Write a program that gets a number and then calculates sum of its digits.

Input: *three-digits number*

Output: *first line is a sum of digits*

	Input	Output
1	317	11

	Input	Output
1	123	6

Practice 3

Divisible by 3

As you know a number is divisible by 3 if sum of its digits are divisible by 3. So write a program that calculates sum of all digits of a number and defines if it is divisible by 3 or not.

Input: *three-digits number*

Output: *first line is sum of digits second line is 'YES' if it is divisible and 'NO' if not*

	Input	Output
1	317	11/NO
1	123	6/YES

Practice 4

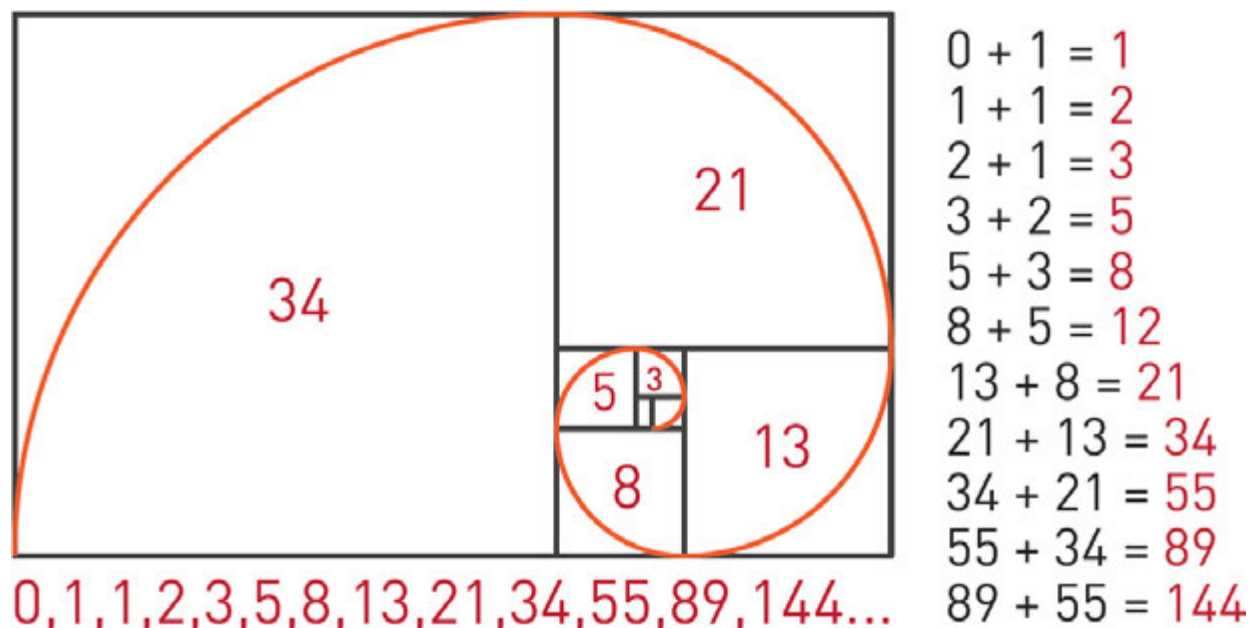
Fibonacci numbers

Fibonacci numbers are integers that increase in some sequence. Every third number in the sequence is the sum of two previous numbers.

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144...

Look at the picture on the right and try to understand the sequence:

You have a number N. Find the N-th Fibonacci number.

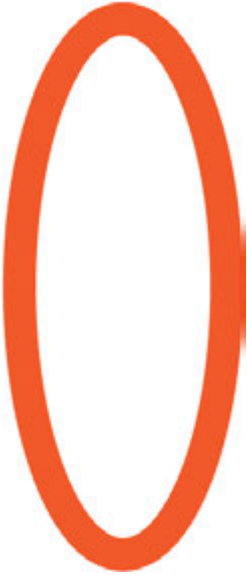


Activity

Everything works automatically in the chocolate factory. Sweets are sliding on the conveyer and the robot draws different shapes on them.

Robot can perform these commands:

1. Leaf - draws:



2. Circle - draws:



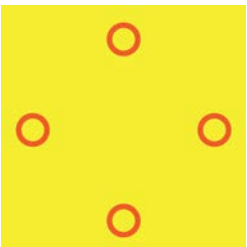
3. Rotate k - rotates sweet clockwise by k degrees.

4. Repeat n

[...

] - repeats commands inside brackets n times.

For example, to perform



Repeat 4

[Circle

Rotate 90]

Robot will draw picture of flower as following:

Which of the following sequences are not suitable for drawing the figure of Flower below?



<p>A. Repeat 6 [Rotate 30 Circle Rotate 30 Leaf]</p>	<p>B. Repeat 6 [Leaf Rotate 60] Rotate 330 Repeat 6 [Circle Rotate 300]</p>	<p>C. Repeat 6 [Leaf Rotate 60] Repeat 6 [Circle Rotate 60]</p>	<p>D. Repeat 6 [Rotate 120 Repeat 2 [Leaf Rotate 20 Circle Rotate 150]</p>
--	---	---	--

Fact

The golden ratio is a specific number approximately equal to 1,618.

Here is the relationship between Fibonacci numbers and Golden Ratio:

$$144 / 89 = 1,6179$$

$$89 / 55 = 1,6181$$

$$55 / 34 = 1,6176$$

$$34 / 21 = 1,6190$$

Golden Ratio often appears in nature, art, architecture, geometry and other areas.

4.5 PROJECT WORK 1: GUESS THE NUMBER

You will:

- make a project.

Need to know

- Variables
- Integers
- Input / Output
- Print
- While loop
- If / Else statements
- Random numbers (provided in this chapter)

Guess the number

Let us play a game.

A program thinks out a number that remains unknown to us. Our task is to find that number. If our input is incorrect, the program must indicate what is exactly wrong with the guess (e.g. 'your number is too high or too low'). If the guess is correct, the program must give a message 'You are right, man!'.

Random Numbers (and Modules)

Random number is a number that is picked without any order or rule. In programming, it is very difficult to think out and

write an algorithm that can randomly pick numbers. In Python, such difficult calculations like 'random' are stored in form of packages and are called 'modules'. In this exercise we need to use a module that generates random numbers. This module is called 'random'.

To use a module, type the following at the top of your file:

```
import random
```

This means that you allow to use a module called 'random' in your code. To generate a random integer type:

```
a = random.randint(2, 6)
```

Once you run this code, the variable *a* becomes equal to a random integer between 2 and 6 inclusively.

Terminology

- random - кездейсоқ - случайный
- to locate - орналастыру - разместить
- package - жинақ - набор, пакет
- search - іздеу - поиск
- to generate - түрлендіру - генерировать

Activity

Archer Arnur would like to hit a target with his arrow. The target is in a range between 0 m and 10 m. After each shoot, his friend Maxat tells Arnur where an arrow has dropped - before or after the target.

The target has a width of 50 cm. What is the minimal number of arrows that we need to hit the target, no matter where it is located?

Explanation:

Correct answer is 5. The best strategy is to use binary search.

The first shot is done at 5 m (halfway), which divides the shooting area into two 5-meters areas. Either the target has been hit, or it is still in one of the two areas.

The second shot is done at either 2.5m or 7.5m. After that shooting area divides into two 2.5-meter wide areas. The target may still be missed.

The third shot will decrease the shooting area to 1.25-meter areas.

The fourth shot to 0.625-meter areas.

The fifth shot decreases the shooting area to 0.3125-meter, that is less than 50 cm. In that case we will hit the target!

Source code of project

```
import random
guesses_made = 0
name = input("Hello! What is your name?")
number = random.randint(1, 100)
print ("Well, {0}, I am thinking of a number between 1 and
100.".format(name))
while guesses_made < 7:
    guess = int(input('Take a guess: '))
    guesses_made += 1
    if guess < number:
        print ("Your guess is too low.")
    if guess > number:
        print ("Your guess is too high.")
    if guess == number:
        break
```

```
if guess == number:  
    print ("Good job, {0}! You guessed my number in {1}  
guesses!".  
format(name, guesses_made))  
else:  
    print ("Nope. The number I was thinking of was  
{0}").format(number)
```

4.6 PROJECT WORK 2: A QUIZ GAME

You will:

- simulate solution for solving problem;
- make a project.

Need to know

- Variables
- Input and output
- While loop
- If statement
- Date and time library

A quiz game

In this project we will create a quiz game. A user must solve logical problems to win. He has 10 lives initially. Each wrong answer decreases total lives by one.

Date and time

Sometimes we need to count time while something is happening. In Python we can do it by using 'datetime' module.

Let us look at the example below:

```
from datetime import datetime  
now = datetime.now()  
print (now)
```

Printing variable inside the text

Sometimes we need to print variables inside the text. We can use `‘.format()’` structure as follows:

```
name = input("Enter your name: ")
surname = input("Enter your surname: ")
print ("Hello, {0} {1}! Welcome to my
game!".format(name, surname))
```

Instead of `{0}` and `{1}` python will place `‘name’` and `‘surname’` input variables.

Step 1 - Entering a Name

Write a code to get the following output:

```
>>>
```

```
Enter your name: Arman
```

```
Hello, Arman! You are here to solve the quiz. Your goal is to
spend less time and save your all 5 lives! Each wrong answer
will reduce your live.
```

```
To start the game type GO. GOOD LUCK!!!
```

```
>>>
```

Step 2 - Starting the Game

Check if user has typed `“GO”` and started the game:

```
>>>
```

```
Enter your name: Arman
```

```
Hello, Arman! You are here to solve the quiz. Your goal is to
spend less time and save your live. Each wrong answer will
```

reduce your live.

To start the game type GO. GOOD LUCK!!!

GO

informatics: What is the brain of computer? cpu

Step 3 - Checking Answers

Check user's answer. If the answer is correct go to next question, else reduce one live.

If answer is true print:

>>>

Enter your name: Arman

Hello, Arman! You are here to solve the quiz. Your goal is to spend less time and save your all 5 lives! Each wrong answer will reduce your live.

To start the game type GO. GOOD LUCK!!!

GO

Informatics: What is the brain of computer? cpu

Right. Keep going!

Math: $2x + 18 = 84$ $x =$

If answer is false print:

>>>

Enter your name: Arman

Hello, Arman! You are here to solve the quiz. Your goal is to spend less time and save your all 5 lives!

Each wrong answer will reducee your live.

To start the game type GO. GOOD LUCK!!!

GO

Informatics: What is the brain of computer? cpu

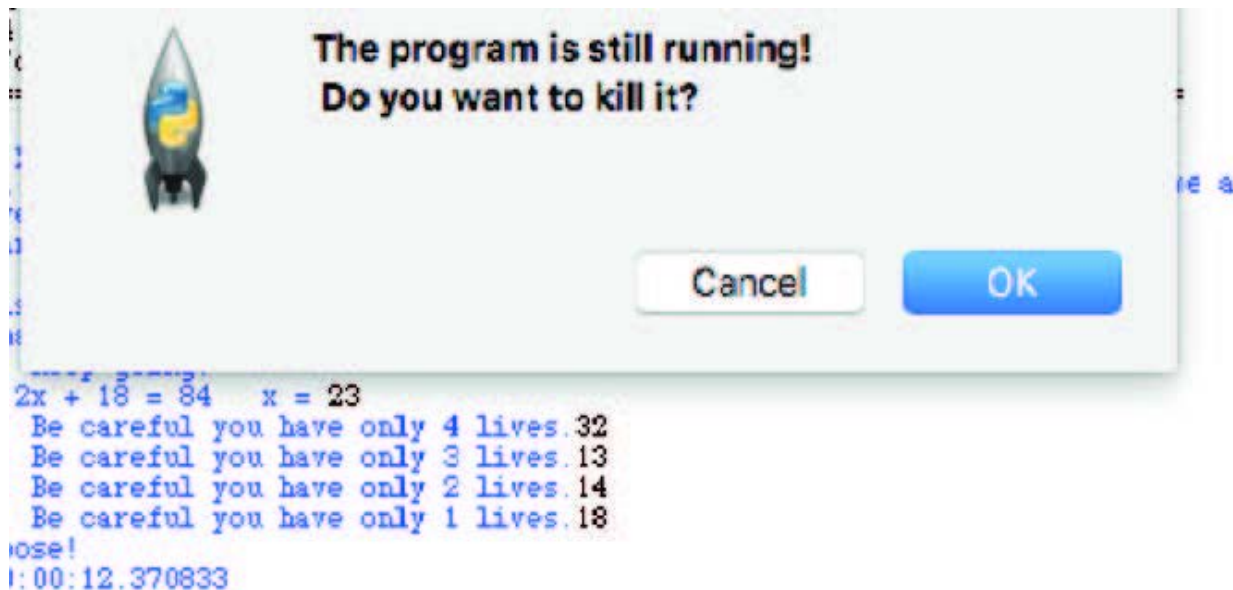
Right. Keep going!

Math: $2x + 18 = 84$ $x = 32$

Wrong. Be careful you have only 4 lives. 23

Wrong. Be careful you have only 3 lives.

If user has lost all his lives print:



To calculate time use datetime library:

st = datetime.now() #after user started the game (*st* - started time)

t = st - datetime.now() #before exiting the program (*t* - time spend)

To exit the program type “*exit()*” function:

```

if lives <= 1:
    now = datetime.now() - st
    print("You lose!")
    print("Time {0}".format(now))
    exit()

```

Step 4 - Winning the Game

In this step we check if the user responds to all questions correctly and then wins the game. Also he must save all his

lives and the program must show total time spent at the end.

>>>

Enter your name: Arman

Hello, Arman! You are here to solve the quiz. Your goal is to spend less time and save your all 5 lives!

Each wrong answer will reduce your live.

To start the game type GO. GOOD LUCK!!!

GO

Informatics: What is the brain of computer? cpu

Right. Keep going!

Math: $2x + 18 = 84$ $x = 32$

Wrong. Be careful you have only 4 lives. 23

Wrong. Be careful you have only 3 lives. 33

Right. Keep going!

physics: Who explored the Gravitation Law? Newton

You won! Great job!!! Your time is 0:00:22.121225 and you still have 3 lives.

>>>

Additional tasks for the project

1. Add scoring system. For example: each correct answer gives 10 points and each wrong answer subtracts 5 points. You can add points according to difficulty of questions.
2. A player can earn extra lives if he has 3 correct answers in a row.

4.7 PROJECT WORK 3: "ROCK, SCISSORS AND PAPER" GAME

You will:

- make a project.

Need to know

- Input and output
- Random
- While loop
- If / else statement
- Variables

Code:

Here is a code for 3 questions. Now your task is to write 10 questions and complete the game.

Note: If you are using python 2.7 or earlier versions use `raw_input()` instead of `input()`.

```
from datetime import datetime
lives = 5
name = input("Enter your name: ")
print("Hello, {0}! You are here to solve the quest. Your goal is
to spend less time and save your all 5 lives!
Each wrong answer will reduce your live.\n
To start the game type GO. GOOD LUCK!!!".format(name))
```

```
s = input()
if s == "GO":
    print("Time is started!")
    st = datetime.now()
    ans = input("informatics: What is the brain of
computer?")
    while ans.upper() != "CPU" and lives > 1:
        lives -= 1
        ans = input("Wrong. Be careful you have only
{0} lives.".format(lives))
    if lives <= 1:
        now = datetime.now() - st
        print("You lose!")
        print("Time {0}".format(now))
        exit()
    print("Right. Keep going!")
    ans = int(input("math: 2x + 18 = 84 x = "))
    while ans != 33 and lives > 1:
        lives -= 1
        ans = int(input("Wrong. Be careful you have only
{0} lives.".format(lives)))
    if lives <= 1:
        now = datetime.now() - st
        print("You lose!")
        print("Time {0}".format(now))
        exit()
    print("Right. Keep going!")
    ans = input("physics: Who explored the Gravitation
Law?")
    while ans.upper() != "NEWTON" and lives > 1:
        lives -= 1
        ans = input("Wrong. Be careful you have only
{0} lives.".format(lives))
    if lives <= 1:
        now = datetime.now() - st
        print("You lose!")
```

```

        print("Time {0}".format(now))
    else:
        now = datetime.now() - st
        print("You win! Great job!!! Your time is {0} and
you still have {1} lives".format(now, lives))

```

“Rock, Scissors and Paper” game

Sometimes to determine a turn order we use “Rock, Scissors and Paper” game. Each player randomly forms one of three shapes with a hand. These shapes are "rock", "paper", and "scissors". Paper beats rock, scissors beats paper and rock beats scissors. If the shapes are same, the result will be a draw.

Now, try to code it in Python. Player must play with computer. Computer generates one of the hand positions randomly.

Code:

```

import random
print("This is 'Rock, Scissors and Paper' game! You will play
with computer. Computer generates randomly what to
choose. Game continue until one of you get 3 wins!")
computer_score = 0
player_score = 0
while computer_score < 3 and player_score < 3:
    a = int(input("choose: 1)paper 2) rock 3) scissors "))
    b = random.randint(1, 3)
    print ("computer chose {0}".format(b))
    if a == b:
        print ("draw")
    elif ((a == 1 and b == 2) or (a == 2 and b == 3) or (a == 3
and b == 1):
        print ("you won")
        player_score += 1

```

```
elif (b == 1 and a == 2) or (b == 2 and a == 3) or (b == 3
and a == 1):
```

```
    print ("computer won")
```

```
    computer_score += 1
```

```
if player_score > computer_score:
```

```
    print ("CONGRATULATIONS, YOU WON THE GAME!")
```

```
else:
```

```
    print ("Sorry, computer won the game!")
```

```
>>>
This is su-li-fa game! You will play with computer. Computer
what to choose. Game continue until one of you get 3 wins!
choose: 1)paper 2) rock 3) scissors 2
computer chose 3
you won
choose: 1)paper 2) rock 3) scissors 3
computer chose 3
draw
choose: 1)paper 2) rock 3) scissors 2
computer chose 1
computer won
choose: 1)paper 2) rock 3) scissors 1
computer chose 2
you won
choose: 1)paper 2) rock 3) scissors 2
computer chose 3
you won
CONGRATULATIONS, YOU WON THE GAME!
>>> |
```

CHECK YOURSELF

1. Write a Python program that will use a 'FOR' loop to print your name 10 times, and then the word 'Done' at the end.
2. Write a Python program that uses a 'FOR' loop to print 'Red' and then 'Gold' 20 times all on separate lines.

Red
Gold
Red
Gold
Red
Gold
Red
Gold
...

3. Write a Python program that uses a 'FOR' loop to print even numbers from 2 to 100, inclusively.
4. Write a Python program that uses a 'WHILE' loop to count from 10 down to 0 inclusively. Then print the words 'Blast off!' Use a 'WHILE' loop instead of 'FOR' loop.

...
2
1
0
Blast off!

5. There are three errors in this code. Find and fix them.

```
print("This program takes three numbers and returns the
sum.")
total = 0
for i in range(3):
x = input("Enter a number: ")
total = total + i
print("The total is:", x)
```

6. Fix the following code:

```
x = 10
while x < 0:
print(x)
x - 1
print("Blast-off ")
```

7. What is the output of the following code?

```
for i in range(10):
j = 10
while (j > 0):
print(i,"*",j,"=",i*j)
j -= 1
```

8. Explain the difference of printed x values:

Sample 1

```
x = 0
for i in range(10):
x += 1
for j in range(10):
x += 1
print(x)
```

Sample 2


```
x = 0
for i in range(10):
    x += 1
    for j in range(10):
        x += 1
        print(x)
```

9. What is the output of the following code?

```
x = 5
while x >= 0:
    print(x)
    if x == "1":
        print("Blast off !")
    x = x - 1
```

10. What is the output of the following code?

```
x = 0
while x < 10:
    print(x)
    x = x + 2
```

GLOSSARY

4G – fourth-generation: pertaining to or being a mobile device or communications technology that supports much faster data-transfer speeds than the previous version.

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 finite 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

Bandwidth – the transmission capacity of an electronic communications device or system; the speed of data transfer.

Binary number – number, expressed as 0 or 1.

Bit – also called binary digit. a single, basic unit of information, used in connection 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 a computer system and then propagates itself to other computers via networks or disks.

Core – one of several processing units working in parallel in a computer.

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

Customize – to modify or build according to individual or personal specifications or preference.

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 system by 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

Feature - something offered as a special attraction.

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 for recording the information.

Formatting – the arrangement of text on printed output or a display screen, or a coded description of such an arrangement.

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

Freezing Columns and/or Rows – freezing is a technique that can be used in larger spreadsheets to assist in viewing the information on the screen. If a spreadsheet contains many rows, you can freeze the rows containing your heading labels so that as you scroll down in the sheet the headings stay at the top and line up with the appropriate data.

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 identifies 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 battery-powered, 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, performed repeatedly 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 file extension for MPEG Audio Layer-3, a set of standards for compressing and downloading audio files from the Internet.

N

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

O

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

Operating system – the collection of software that directs a computer’s operations, controlling and scheduling the

execution of other programs, and managing storage, input/output, and communication resources.

Operator – a symbol for expressing a mathematical operation.

Output – the information produced by a computer.

P

Personal Computer – a compact computer that uses a microprocessor and is designed for individual use, as by a person in an office or at home or school, for such applications as word processing, data management, financial analysis, or computer games.

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

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

Satellite – a device designed to be launched into orbit around the earth, another planet, the sun, etc.

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

Smartphone – category of mobile devices with computerlike functionality.

Socket – a hollow part or piece for receiving and holding some part or thing.

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

Spreadsheet – table of data arranged in columns and rows often used in business and financial applications. spreadsheet software programs are widely used computer applications that allow the user to organize large amounts of data.

T

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

Transmission – the act or process of sending a message, picture, or other information from 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

Vacuum tube - also called, especially British, vacuum valve. an electron tube from which almost all air or gas has been evacuated: formerly used extensively in radio and electronics.

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

W

Web page - a single, usually hypertext document on the World Wide Web that can incorporate text, graphics, sounds, etc.

Website - a connected group of pages on the World Wide Web regarded as a single entity, usually maintained by one person or organization and devoted to a single topic or several closely related topics.

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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INFORMATICS

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