



Computer and Information Technology



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Unit 4: Python

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Unit three

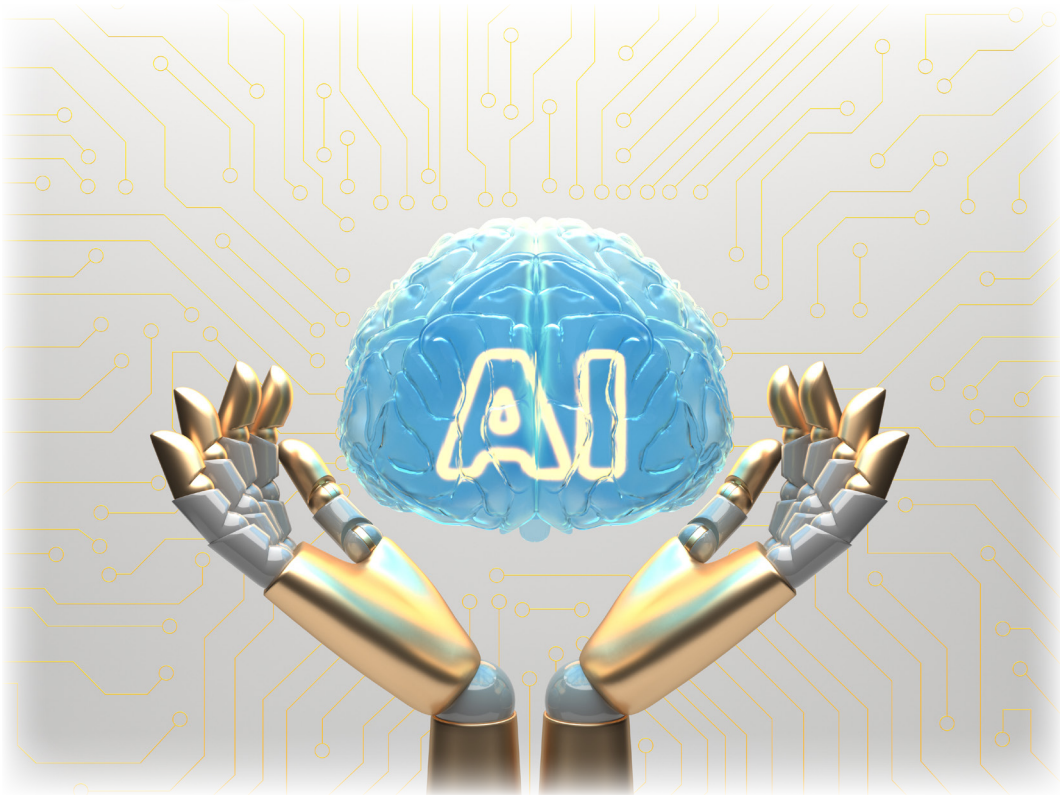
Programming and Artificial Intelligence





Lesson one

The Historical Development of Artificial Intelligence



Objectives :

By the end of this lesson, the students will be able to:

- Distinguish between the way traditional programs work and artificial intelligence.
- Recognize the historical development of artificial intelligence.
- State the importance of artificial intelligence in solving problems in olives.

Engage :

How has artificial intelligence technologies evolved in our lives?

Learn:

Dear student... Have you ever wondered how our phones became so smart that they understand what we say? And how cars can drive themselves – self-driving cars? All of this is thanks to the amazing technology of Artificial Intelligence (AI).

But did you know that artificial intelligence is not a completely new concept? It has evolved throughout history for a very long time. In this lesson, we will embark on an adventure through time to discover how humanity's dreams of autonomous machines began, leading to the current state of artificial intelligence. We will explore the most important stages of its development, how AI has become an essential part of our lives today, and what the future holds.

1-Humanity's dream of a thinking, self-operating machine

Long before computers were invented, humans dreamed of machines capable of thinking and acting like them. Humans have been creating thinking machines since ancient times, and ancient civilizations witnessed efforts that can be considered the earliest roots of mechanical thinking and automation systems. These efforts were not, of course, in the modern technical sense of artificial intelligence, but rather manifested in myths, philosophy, early mechanics, and self-operating machines.

Activity:

Dear student... with the help of your teacher and in cooperation with your classmates, participate in the «Guess the Intelligence» game and discuss:

- After both «Human» and «Machine» wrote an answer to the same question, can you guess who the human is and who the machine is?
- What did this game teach us about machine intelligence?

2-The Modern Era of Artificial Intelligence

Now, let's move on to the actual stages that paved the way for the emergence of artificial intelligence as we know it.

A-Alan Turing: The Father of Artificial Intelligence

In 1950, the British mathematician Alan Turing laid the foundations for modern artificial intelligence. Turing proposed a crucial question: «Can machines think?»



Turing Test - A Simple Example

Imagine you are texting someone and you don't know if they are a human or a computer program. If you can't tell the difference, then the program has passed the Turing Test.

Activity:

Dear student... In collaboration with your classmates, think of at least three examples to determine whether the messages you send to another party are from a machine or a human.

B- The Dartmouth Conference: The Beginning of the Term

In the summer of 1956, a group of the brightest scientists gathered at Dartmouth College in America. Their goal was ambitious: to create machines capable of learning and thinking like humans!

At this conference, the term «**artificial intelligence**» was officially born.

C- Years of enthusiasm and great hopes (1956-1970)

Promising Beginnings

Following the Dartmouth conference, scientists began creating the first artificial intelligence programs. These programs were very simple compared to what we see today, but they were amazing for their time!

The first challenges

But scientists soon faced a major problem: computers were very slow and had limited memory! Imagine that a computer at that time needed hours to solve a simple math problem that a child could solve in minutes!

Examples of early programs:

- **Logic Theorist:** A program that can solve logical mathematical problems
- **General Problem Solver:** A program that attempts to solve general problems step by step.

D-Expert Systems – Machines Learn from Experts (1970-1980)

A brilliant idea:

Why not teach machines from experts? In the 1970s, scientists had a brilliant idea: Instead of trying to make machines think like humans, why not teach them specialized knowledge from experts?

MYCIN:

The Robotic Doctor: One of the most famous expert systems was **MYCIN**

a program that helped doctors diagnose infectious diseases. It asked questions like:

«Does the patient have a fever?»

«What are the other symptoms?»

Then it suggested the appropriate treatment! Amazingly, its accuracy rivaled that of expert human doctors.

E-The winter of Artificial Intelligence - When Dreams Faded (1980-1990)

Major Challenges

In the 1980s, artificial intelligence faced a real crisis. The initial enthusiasm turned to disappointment! Why?

Exaggerated Promises : Scientists promised more than they could deliver.

Technological Limitations: Computers were still slow and had limited memory.

High Cost : Developing these systems was very expensive.

Limited Results : The programs only worked in very narrow fields.

Lessons Learned from These Challenges:

This period wasn't entirely bad! Scientists learned an important lesson: artificial intelligence is more difficult than they thought, and they needed patience and better development.

A positive message: Sometimes we need to face failure to learn and become stronger!

F-The Renaissance - The Return of Hope (1990-2010)

The Internet and Data Revolution

In the 1990s, something amazing happened: the internet appeared! Suddenly, scientists had enormous amounts of data to work with.

Machine Learning: A New Approach

Instead of programming machines with knowledge, scientists decided to teach them how to learn from data! This is called «**Machine Learning**.»

A simple example:

Imagine you want to teach a computer to distinguish between pictures of cats and dogs. Instead of describing what a cat looks like («It has pointed ears and whiskers»), you feed the computer thousands of labeled images and let it discover the patterns on its own!

Amazing Victories:

For the first time in history, a computer defeated the world chess champion! It was an incredible event watched by millions of people around the world.

Activity:

Research the Deep Blue vs. Kasparov match. What made this victory so important?

G-The modern revolution-deep learning is changing everything (2010-Now)

What is Deep Learning?

Deep learning is an advanced type of machine learning that mimics the way the human brain works! It uses what are called «artificial neural networks.»

Illustrative example:

Think of your brain as a network of interconnected neurons. Each neuron receives signals and sends signals back. Deep learning mimics this process!

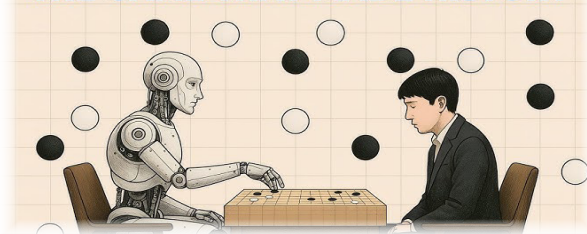


Computer defeats world champion in the Chinese game

«AlphaGo»

- a game much harder than chess!

THE GAME THAT MADE HISTORY



Learn By Doing

First: Choose the correct answer from the following options:

1. What is the best description of artificial intelligence?

- a. Making machines faster and stronger
- b. Making machines think and learn like humans
- c. Making machines bigger
- d. Making machines smaller

2. Which scientist created a famous test to determine if a machine is intelligent?

- a. Isaac Newton
- b. Albert Einstein
- c. Alan Turing
- d. Al-Khwarizmi

3. Why is learning artificial intelligence important for your future?

- a. Because it will soon disappear
- b. Because it will become an essential part of our jobs and daily lives.
- c. Because it is a difficult and complex subject only for scientists
- d. Because it is a form of entertainment

3. A computer learning to play chess and beat the best players is an early example of:

- a. Machine learning
- b. The internet
- c. 3D printing
- d. Using office software

5. How can artificial intelligence help solve the problem of traffic congestion

- a. By manufacturing more cars
- b. By analyzing data and intelligently managing traffic flow
- c. By eliminating traffic lights
- d. By disabling cars

6. The statement «Artificial intelligence is a powerful tool» means that:

- a. We should fear and avoid it
- b. We should understand its impact and direct it to serve humanity
- c. No one can control it
- d. It should be used irresponsibly

Second: Put a check mark (✓) in front of the correct sentence
and a check mark (✗) in front of the incorrect sentence.

- 1. The idea of artificial intelligence is a very recent one that emerged in the last few years. ()
- 2. The idea of artificial intelligence faced many challenges in its early stages. ()
- 3. The Turing test is a method to determine whether a machine can successfully simulate human thought. ()
- 4. Machine learning is a branch of artificial intelligence that allows a computer to learn from experience. ()
- 5. Artificial intelligence is used only in games and entertainment. ()
- 6. Deep learning is an advanced type of machine learning. ()
- 7. Artificial intelligence will be a helpful tool in many future jobs. ()



Lesson two

How Do Machines Think and Change Our World?



Objectives :

By the end of this lesson, the students will be able to:

- Compare human thinking and machine thinking.
- List some examples of artificial intelligence applications in our lives.
- Suggest some future applications of artificial intelligence.

Engage :

How does a machine think? Explain with examples.

Learn:

Dear student... Have you ever noticed that your phone suggests a song without you asking for it, or that an educational app knows exactly which topics you need help with? This isn't magic; it's the incredible power of artificial intelligence—that amazing technology that makes machines act as if they think and interact with us intelligently, mimicking human intelligence.

On your phone

Voice assistants, facial recognition, and text prediction

In games

Intelligent characters that interact with you and adapt to your gameplay

Online

Smart search engines and personalized content suggestions

Activity: Dear student... With the help of your teacher and in collaboration with your classmates, Think about and discuss the electronic devices you use daily (such as your smartphone, tablet, smart TV, or even your favorite video game). Are there any apps or features on these devices that use artificial intelligence?

1 - What is Artificial Intelligence?

Artificial intelligence is the ability of machines to «think,» make decisions, and solve problems.

It can also be defined as the ability of computer systems to mimic some human cognitive abilities, such as:

- Learning from data
- Making decisions
- Solving problems
- Understanding natural language
- Recognizing patterns in images and sounds

A deeper understanding of artificial intelligence:

Imagine that we are building a «digital brain» for a machine. This brain doesn't have feelings or self-awareness like a human brain, but it is designed to be adept at processing massive amounts of information at incredible speeds, searching for relationships and patterns to make logical and accurate decisions.

Examples from your daily life of AI uses:

- **Video games:**

Non-player characters use artificial intelligence to make complex decisions, such as choosing the best strategy to attack or flee and to learn from your gameplay to become more challenging.

- **Voice Assistants**

Siri, Alexa, and Google Assistant use natural language processing technologies to understand your speech, convert it to text, and analyze the meaning to fulfill your requests or answer your questions.

Comparison between Human Intelligence and Artificial Intelligence:

Artificial intelligence is powerful and amazing; it mimics human intelligence but is not a perfect replica.

Human Intelligence is characterized by:	Artificial Intelligence is characterized by:
Emotions and Awareness We experience complex emotions such as joy, sadness, love, and empathy, and possess self-awareness.	Pure Data Processing It doesn't feel or understand emotions, has no self-awareness, and processes only information and data.
Creativity and Authentic Innovation We generate entirely new ideas and solve problems in unconventional ways.	Ultimate Speed and Accuracy It processes trillions of data points in seconds and executes complex tasks with pinpoint precision
Deep Understanding and Context We understand jokes, sarcasm, and hidden meanings, and comprehend complex social situations.	Pure Logic and Data Decisions are based on data and programmed rules, without intuition or moral conscience

To illustrate:

Imagine showing a painting to an artificial intelligence. It will analyze the painting with great precision, identifying the colors used, the line patterns, and the number of people depicted. However, it will not be able to perceive the beauty of the painting, the sadness or joy the artist is expressing, or the deeper message conveyed by the artwork. This capacity for profound emotional and aesthetic understanding is a uniquely human ability



Activity: Dear student...in collaboration with your teacher, you and your classmates should propose a set of tasks and abilities. Then, discuss and determine

Who is best at performing each of these tasks? Human intelligence, artificial intelligence, or both? What are your reasons for choosing this?

Why is artificial intelligence important to us today?

Imagine having a robotic assistant that can learn, think, and make decisions just like humans. This is the essence of artificial intelligence. It's everywhere around us: when Google searches for your answer, when Facebook suggests a new product, or when you and your friends play video games. Artificial intelligence is a tremendous force. It's not just a technology; it's a tool that can help us solve big problems, make our lives easier, and even open doors we never imagined!

GPT and the Language Model Revolution:

Programs like ChatGPT can now have natural conversations and help you with homework!

Image Recognition: Your smartphone can now recognize your face to unlock it!

Self-Driving Cars : Cars that drive themselves!

Artificial Intelligence in Our Daily Lives

Examples from Our Daily Lives

Artificial intelligence is all around us:

In mobile phones

- Voice assistants (Siri, Google Assistant)
- Phone cameras that automatically enhance photos
- Apps that translate text instantly

In games

- Intelligent opponents in video games
- Personalized tips to improve your performance

In entertainment

- Watch IT suggests suitable movies
- Spotify discovers songs you'll love

At home

- Smart devices that control lighting
- Smart vacuum cleaners

Activity: Dear student... In collaboration with your classmates, discuss the future services that artificial intelligence can provide in the future.

Learn By Doing

First: Choose the correct answer from the following options:

1. Artificial intelligence is:

- a. The machine's ability to feel
- b. The machine's ability to «think» and make decisions
- c. The human's ability to control a computer
- d. A program for displaying images

2. An example of using artificial intelligence in mobile phones is:

- a. Writing messages only
- b. Playing songs
- c. Facial recognition
- d. Manually opening the camera

3. Which of the following is a human intelligence ability and not an artificial one?

- a. Pattern recognition
- b. Data processing speed
- c. Creativity and innovation
- d. Analyzing millions of data points

4. Games use artificial intelligence to:

- a. Display backgrounds
- b. Move the character in a fixed manner
- c. Make characters adapt to the player's style
- d. Increase the number of players

5. An example of using artificial intelligence on the internet is:

- a. Change the screen color
- b. Suggest appropriate content
- c. Block the internet
- d. Increase browser speed

6. Artificial intelligence is characterized by:

- a. Having feelings
- b. Understanding sarcasm humans
- c. Possessing self-awareness
- d. It processes data at lightning speed

7. Siri is an example of:

- a. Image processing
- b. An AI-powered voice assistant
- c. A drawing program
- d. An internet browser

8. What can't AI do yet?

- a. Image analysis
- b. Learning from data
- c. Appreciating the beauty of a painting
- d. Voice recognition

9. Some of the capabilities of AI include:

- a. Understanding deep social relationships
- b. Making decisions based on data
- c. Experiencing sadness and joy
- d. Free artistic creativity

10. Self-driving cars are an example of:

- a. AI in homes
- b. AI in education
- c. AI in transportation
- d. AI in medicine

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

1. Artificial intelligence can feel human emotions. ()
2. Artificial intelligence relies on data processing only without self-awareness. ()
3. Characters in video games can learn from the user's playing style. ()
4. Human intelligence possesses creativity, while artificial intelligence imitates and does not innovate. ()
5. A smartphone camera that automatically improves photos uses artificial intelligence. ()
6. Intelligent search engines such as Google do not rely on artificial intelligence. ()
7. Artificial intelligence can understand sarcasm and emotions with the same accuracy as humans. ()
8. Robots can be programmed to make decisions based on data. ()
9. Smart home devices such as smart vacuum cleaners rely on artificial intelligence. ()



Lesson three

Artificial Intelligence All Around Us



Objectives:

By the end of the lesson, the student will be able to:

- Identify ethical responsibility in the uses of artificial intelligence.
- Suggest the greatest possible number of ideas for using artificial intelligence technology in responsible ways.
- Suggest some simple projects that employ artificial intelligence responsibly.

Engage

What is meant by ethical responsibility in the uses of artificial intelligence?

Learn

Dear student... in the previous lesson you studied some examples of artificial intelligence in our daily lives. In this lesson, we will continue what we have learned and become familiar with many applications that rely on artificial intelligence in our lives..

Ethical Responsibility in Using Artificial Intelligence

With great power comes great responsibility.

Artificial intelligence is a force with enormous capabilities that can change the world for the better, but it must be used wisely and with ethical responsibility to ensure benefit, safety, and security for all.

◀ **Justice and Transparency**

Artificial intelligence systems must be designed in a fair and equitable manner for all individuals, without discrimination based on race, gender, or religion.

Golden rule: Justice for all.

◀ **Privacy and Data Protection**

Your personal information must remain safe and protected. No one has the right to use your data without your approval.

Advice: Always read the privacy settings of any application or program you will use.

◀ **Human Oversight and Control**

- Artificial intelligence is a powerful tool, but it is still a tool controlled and guided by humans. Humans set its goals and design its algorithms.
- Critical decisions that affect people's lives (such as a decisive medical decision, a judicial ruling, or a decision related to national security) must always be made by humans. Why? Because humans possess

awareness, ethics, empathy, and the ability to understand complex social and cultural contexts that artificial intelligence does not possess.

- Humans establish the values and principles that artificial intelligence must follow.
- Important decisions must always be made by humans.

Remember: The human is the leader and the final decision-maker.

◀ The Problem of Bias in Artificial Intelligence:

If an artificial intelligence system is trained on incomplete, unfair, or biased data, it may “learn” this bias and make unfair decisions.



For example, if a facial recognition system is trained on data that mainly contains faces of people from one race; it may struggle to accurately recognize faces of people from other races. This is what we call “bias” in AI. Therefore, we must be very careful about the quality, integrity, and diversity of the data used to train AI to ensure fairness and equity in its outputs..

How to Use Artificial Intelligence Technology Responsibly

Your role as a smart user

Use technology responsibly

Use technology to improve your life and the lives of others

Verify information

Learn how to ensure the accuracy of information

Think critically

Do not automatically trust everything produced by artificial intelligence

Activity ...The “Young AI Innovator” Project

With the help of your teacher and in cooperation with your classmates:

Think of a simple problem you face at school or at home, and imagine how an artificial intelligence system could solve it. Follow the guiding steps below:

(What – How – Where – Why – When)

What is the problem? What data is required?

How will the system work?

Where.....?

Why.....?

When ?

Dear student... remember that artificial intelligence is not something frightening; rather, it is a great power that can improve the world if it is guided correctly.

Learn By Doing

First: Choose the correct answer from the following options:

1. What is meant by justice in artificial intelligence systems?

- a. Designing systems that work faster
- b. Designing systems that operate without human intervention
- c. Designing systems that are fair and equitable to all individuals
- d. Designing systems that monitor all data

2. An example of protecting privacy is:

- a. Sharing your data with any application without review
- b. Reading privacy settings before using a new application
- c. Publishing all your information online
- d. Giving your password to a friend

3. Who makes critical decisions in systems that rely on artificial intelligence?

- a. Artificial intelligence alone
- b. The voice assistant
- c. Humans
- d. The robot

4. Why should humans make important decisions?

- a. Because artificial intelligence is slower
- b. Because humans possess awareness, ethics, and empathy
- c. Because humans do not make mistakes
- d. Because artificial intelligence cannot analyze data

5. When does bias occur in artificial intelligence?

- a. When data are diverse
- b. When data are limited or unfair
- c. When data are abundant
- d. When data are recent

6. The result of training a facial recognition system on data from one race is that it:

- a. Works efficiently for everyone
- b. Becomes faster
- c. May fail to recognize other races
- d. Improves translation

7. One role of the smart user when dealing with artificial intelligence is:

- a. Believing everything presented
- b. Neglecting to verify information
- c. Critical thinking and verification of information
- d. Using technology for entertainment only

8. Which of the following is an example of responsible use of artificial intelligence?

- a. Using it to harm others
- b. Using it to improve people's lives
- c. Using it to spread rumors
- d. Using it without reviewing data

9. What element does artificial intelligence lack but humans possess

- a. The ability to store data
- b. The ability to learn.
- c. The ability to feel and understand values
- d. The ability to analyze numbers

10. The goal of the "Young AI Innovator" project is to:

- a. Design games only
- b. Think of artificial intelligence solutions to simple problems
- c. Write difficult code
- d. Use artificial intelligence in everything without constraints

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

- 1. Artificial intelligence should be designed to be fair and equitable for everyone. ()
- 2. No entity has the right to use your personal data without your approval. ()
- 3. Artificial intelligence can make critical decisions better than humans. ()
- 4. Humans are the final decision-makers because they possess ethics and awareness. ()
- 5. Bias in artificial intelligence may occur due to incomplete or unfair data. ()
- 6. It is safe to trust all artificial intelligence results without verification. ()
- 7. Using artificial intelligence to improve others' lives is a responsible use. ()
- 8. Facial recognition is not affected by the quality of training data. ()
- 9. Part of the smart user's role is critical thinking and verifying information accuracy. ()
- 10. The proposed student project encourages finding solutions using artificial intelligence for real-world problems. ()



Lesson four

The Artificial Neuron



Objectives:

By the end of the lesson, the student will be able to:

- Explain the concept of the artificial neuron.
- Identify the components of the artificial neuron and their role in artificial intelligence.
- Infer how an artificial neuron is built and operates.
- Relate real-life applications to the techniques used in artificial intelligence.

Engage:

How do artificial intelligence technique work ? Explain with examples.

Learn

Dear student... in previous grades you studied the concept of artificial intelligence and some concepts related to virtual reality and augmented reality. In this lesson, we will shed light on how artificial intelligence techniques work and how simple models can be designed for some of the processes that artificial intelligence understands

First: What Is an Artificial Neuron?

An artificial neuron is a small unit in the computer that attempts to imitate the way humans think. Just as there are neurons in our brains that help us learn and think, each neuron receives information from a group of other neurons, processes this information, and then sends signals to other neurons. In this way, your brain understands and perceives the world around it, makes decisions, and acts. Scientists have created similar cells inside computers that help them “think” and make decisions.

Second: Components of the Artificial Neuron

The artificial neuron consists of five main parts:

1-Inputs

These are the pieces of information that enter the neuron (such as an image, sound, or number).

2- Weights

These are numbers that help the neuron determine the importance of each piece of information.

3- Bias

A number added to the total to adjust the neuron's operation.

Example: Imagine that a student needs **50** marks to pass but was ill during the exam, so the school gave them **5** extra marks as assistance. These extra marks are

similar to the bias; they are added to help the artificial neuron reach the correct decision.

But what is the benefit of bias?

- It makes the neuron more flexible.
- It allows the neuron to produce outputs even when the inputs are zero.
- It resembles a “personal inclination” that may influence our decisions as humans.

4-Activation Function:

This is the part of the artificial neuron that makes the final decision: should the neuron send a signal or remain silent? This depends on the result of the calculations performed by the neuron (inputs $\times$ weights + bias).

The activation function is like a switch that turns the neuron on or off. It determines whether the neuron will send a signal or not. Without it, the neuron would not know what to do with the calculations.

Common types of activation functions

Name	Simplified Function	Practical Example
Threshold	A simple function that tells the neuron: if the value is greater than a certain number (e.g., 0.5), the result = 1; if it is less than or equal, the result = 0	An exam out of 100, with 50 as the passing mark. If you score 60 $\rightarrow$ pass; if 40 $\rightarrow$ fail (yes or no).
Sigmoid	Gives a probability between 0 and 1	The computer analyzes an image and says: “The probability that this is a cat = 0.85” (85%)
ReLU	Activates positive values only	A microphone records strong sounds, while very weak sounds are ignored
Positive	A negative or zero gives zero	(Positive values only)

5-Output

Example: Dear student, today we will learn how your results in school subjects (science, mathematics, computer studies) can be calculated using a simple artificial neuron like those used in artificial intelligence!

Simple steps to calculate your result:

Inputs	Weights	Bias	Calculation method	Activation Function
Your grades in each subject (out of 10, for example): Science : your grade Mathematics : your grade Computer : your grade	Each subject has a different importance: Science weight = 0.4 Mathematics weight = 0.3 Computer weight = 0.3	A constant number (such as 1) added to improve the result, similar to attendance or coursework	Multiply each grade by its weight, then add them together with the bias: Result = (Science × 0.4) + (Mathematics × 0.3) + (Computer × 0.3) + 1	To determine whether the student is “weak” or “excellent”: - If the result is greater than 5 → “Excellent!” - If it is less → “Keep studying!”

Example:

If your grades are:

Science : 8

Mathematics: 7

Computer : 6

Calculation:

$$(8 \times 0.4) + (7 \times 0.3) + (6 \times 0.3) + 1 = 3.2 + 2.1 + 1.8 + 1 = 8.1$$

Final result: 8.1 → “Excellent!”

Now it's your turn!

Try calculating the result if your grades are (5, 6, 7)

Remember: artificial intelligence learns just like you— the more you work, the better your results become!

Learn By Doing

First: Choose the correct answer from the following options:

1. What is an artificial neuron?

- a. A program for running games
- b. A unit that attempts to imitate the way humans think
- c. A part of computer memory
- d. A real biological cell

2. What is the function of inputs in the artificial neuron?

- a. Storing results
- b. Sending decisions
- c. Receiving information
- d. Deleting data

3. Weights are used to:

- a. Decorate data
- b. Determine the importance of each piece of information .
- c. Store sound
- d. Run the activation function

4. Bias resembles:

- a. Deleting a grade
- b. Adding a small number to help the neuron
- c. Doubling the data
- d. Reducing the weights

5. One function of bias is to:

- a. Reduce the neuron's accuracy
- b. Prevent the neuron from working
- c. Make the neuron more flexible
- d. Cancel the use of inputs

6. What is the function of the activation function?

- a. Managing memory
- b. Making the final decision
- c. Calculating weights
- d. Storing data

7. The Threshold function works as:

- a. A probability
- b. An on/off switch based on a specific threshold
- c. A color scale
- d. A sound system

8. The Sigmoid function gives:

- a. A negative number
- b. A number between 0 and 1(probability)
- c. A random number
- d. A number greater than 100

9. Which part of the neuron helps it make a decision even when inputs are zero?

- a. Inputs
- b. Weights
- c. Bias
- d. Input function

10. In the artificial neuron, what happens after calculating (inputs $\times$ weights + bias)?

- a. The data are erased
- b. They are sent directly to the user
- c. They are passed to the activation function
- d. The neuron stopsworking

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

1. The artificial neuron attempts to imitate the function of neurons in the human brain. ()
2. Weights in the artificial neuron do not affect the final decision. ()
3. Bias helps the neuron produce outputs even when inputs are absent. ()
4. The activation function is responsible for executing the neuron's final decision. ()
5. The Threshold function gives values between 0 and 1 only. ()
6. The Sigmoid function is used to give a probability or percentage. ()
7. Without an activation function, the neuron will not be able to make a decision. ()
8. Weights are always fixed values that do not change. ()
9. Bias has no role in adjusting the performance of the neuron. ()
10. Bias has no role in adjusting the performance of the neuron. ()



Lesson five

The Role of the Artificial Neuron in Artificial Intelligence



Objectives:

By the end of the lesson, the learner is expected to be able to:

- Identify the concept of artificial neural networks.
- Explain the components of the artificial neuron.
- Mention the largest possible number of ideas for applications of the artificial neuron in our daily lives.

Engage

What is an artificial neuron?

How can it be built?

Learn

Dear student ... the previous lesson we studied the components of the artificial neuron and the activation function, along with its most common types. In this lesson, we will learn more about artificial neural networks.

The artificial neuron is the basic building block of what is known as artificial neural networks, which are used in:

- Image recognition.
- Language translation.
- Communicating with humans (such as smart assistants).
- Weather or price prediction.

1- How Do We Build an Artificial Neuron?

To build an artificial neuron, we need to:

- Determine the type of data that will be input (such as numbers or images)
- Assign a weight to each input.
- Sum the inputs after multiplying them by their weights.
- Pass the result to the activation function.
- Obtain the final output (decision or prediction).

2- How Does an Artificial Neuron Work?

Imagine you want to know whether an image contains a cat or not:

- The image is entered as an input.
- The neuron analyzes the image using weights.
- The activation function decides: Is this a cat? Yes or no?
- The result is sent to other neurons or given directly as an answer.

3- How Are Neurons Utilized in Artificial Intelligence?

When we connect thousands of artificial neurons together, we obtain a powerful neural network that can:

- Learn from experience.
- Improve itself over time.
- Solve complex problems such as driving cars or diagnosing diseases

4- Real-Life Applications of the Artificial Neuron

- Smart assistants such as Siri and Alexa.
- Smart cameras that recognize faces.
- Self-driving cars.
- Instant language translation.
- Disease diagnosis in hospitals.
- Movie recommendations on platforms such as Netflix and YouTube

Activity: Dear student... Imagine that you are designing an artificial neuron that helps determine whether a student needs assistance in a particular subject..

- What inputs would you use? (For example: student grades, number of absences)
- What decision would the neuron make? (For example: needs assistance or does not need assistance)

Learn By Doing

First: Choose the correct answer from the following options:

- 1. What is the basic building of artificial neural networks?**
 - a. Complex algorithms
 - b. Artificial neuron
 - c. Smart assistants
 - d. Translation functions
- 2. What happens after inputs are given weights?**
 - a. Final output appears
 - b. Result goes to the activation function
 - c. Weighted inputs are added together
 - d. Image is analyzed
- 3. What is the main job of the activation function?**
 - a. Set input weights
 - b. Add weighted inputs.
 - c. Make the final decision (yes/no)
 - d. Enter the image
- 4. Connecting many neurons creates a network that can solve complicated problems like:**

a. Write simple programs	b. Store data
c. Drive cars or diagnose diseases	d. Read text only
- 5. One of the practical applications of the artificial neural cell mentioned, which relates to content suggestion, is:**
 - a. Intelligent assistants
 - b. Face-recognition cameras
 - c. Movie suggestions on Netflix
 - d. Self-driving cars

- 6. Artificial neural cells are considered technologies that are used in:**
- a. Fix product prices
 - b. Set prices manually
 - c. Predict weather or prices
 - d. Show old prices
- 7. What is the ability that a strong neural network acquires over time as a result of learning from experiences?**
- a. Weights never change
 - b. Neurons increase automatically
 - c. It improves itself
 - d. No activation function is needed
- 8. If the neural cell is analyzing an image (for example, a cat), what is the input that enters the cell?**
- a. Decision
 - b. Output.
 - c. Image
 - d. Activation function
- 9. Which of the following applications is an example of smart assistants that rely on artificial neural cells?**
- a. Smart air conditioners
 - b. Siri and Alexa
 - c. Operating systems
 - d. Cameras
- 10. After the activation function determines the result (e.g., Is this a cat? Yes or No?), what is the next step mentioned?**
- a. Data type is chosen again
 - b. Inputs are added
 - c. Weights are assigned
 - d. Result is sent to other neurons or given as output

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

1. The artificial neuron is the basic unit of artificial neural networks. ()
2. Artificial neurons are used only in translation and weather prediction, not in image recognition. ()
3. Identifying the type of input data (numbers or images) is a necessary first step in building an artificial neuron. ()
4. Each input is given a weight before the result is passed to the activation function.()
5. The main goal of an artificial neuron is to produce an output such as a decision or prediction. ()
6. The activation function analyzes the image using weights in the cat recognition example. ()
7. Artificial neurons are used in hospitals to help diagnose diseases. ()
8. Connecting thousands of neurons makes the network unable to learn or improve over time. ()
9. Self-driving cars are not complex problems for neural networks. ()
10. Face-recognition cameras are a real-life application of artificial neurons. ()



Lesson six

Introduction to Data Analysis Using Python



Objectives:

By the end of this lesson, the student will be able to:

- Understand why Python is a suitable language for data analysis.
- Identify basic data analysis concepts (arithmetic mean, and extrema).
- Recognize different types of data that can be analyzed (numbers, text, dates).

Engage

How can data be analyzed using Python?

Learn

Dear student... in the first preparatory grade we studied the concept of big data and some examples of data analysis, and we also learned the Python programming language. In this lesson, we will learn how to analyze data using Python.

Concept of Data Analysis and Its Importance

Data analysis is the process of examining, cleaning, and transforming data in order to extract useful information and make fact-based decisions.

1- Why do we use Python for data analysis?

Python is one of the best programming languages for data analysis because it offers:

- Ease of learning and use : Its simple syntax makes it suitable for beginners.
- Powerful libraries, such as:
 - **Pandas** for data processing and manipulation.
 - **NumPy** for numerical and scientific calculations.
 - **Matplotlib** and **Seaborn** for data visualization.
 - A large support community with many educational resources.
 - Compatibility with artificial intelligence and machine learning.

Basic Concepts in Data Analysis

A. Mean (Average)

The mean is the sum of values divided by their count..

Example in Python:

```
python
import numpy as np
data = [10, 20, 30, 40, 50]
mean = np.mean(data)
print("Mean:", mean) # Output: 30.0
```

Dear student, here is a simple explanation of the code:

```
import numpy as np
```

- **Function:** Calling the NumPy library which is used for scientific calculations in Python.
- **'as np'** : An abbreviation for the library name so we can use 'np' instead of writing 'numpy' in full.

Example without the abbreviation:

```
import numpy
mean = numpy.mean(data) #Longer to write
data = [10, 20, 30, 40, 50]
```

Function: Creating a list containing the numbers for which we want to calculate the mean.

Note : The list can contain any numbers (doesn't need to be sorted).

Another example:

```
python
data = [5, 15, 25, 35, 45]
mean = np.mean(data)
'np.mean()': A built-in function in NumPy to calculate the mean.
```

How does the mean work?

- $\text{Mean} = (\text{Sum of numbers}) \div (\text{Count of numbers})$
- Here: $(10 + 20 + 30 + 40 + 50) / 5 = 150 / 5 = 30.0$

• Manual example without NumPy:

```
python
sum_data = sum(data) # 150
count = len(data) # 5
mean = sum_data / count # 30.0
print("Mean:", mean)
```

Function: Displaying the result on the screen.

Output :

Mean : 30.0

Note: The result is of type 'float' (decimal) even if it is a whole number.

B. Maximum & Minimum Values (Max & Min)

• **Maximum value (Max):** The largest value in a data set.

• **Minimum value (Min):** The smallest value in a data set.

Example:

```
maximum = np.max(data)
minimum = np.min(data)
print(«Maximum value:», maximum) # 50
print(«Minimum value:», minimum) # 10
```

2-Types of Data that Can Be Analyzed**A. Numerical Data**

- Integer numbers like: ages, number of products
- Decimal numbers like: weights, prices

B. Text Data

- Text like: customer reviews, articles
- Can be analyzed using Natural Language Processing (NLP)

C. DateTime Data

- Dates like: purchase date, event dates
- Can be analyzed using `pandas.to\_datetime()`

Example:

```
python
import pandas as pd
dates = ["2023-01-01", "2023-01-02", "2023-01-03"]
date_series = pd.to_datetime(dates)
print(date_series)
```

Explanation of the Code

Importing the Pandas library:

```
import pandas as pd
python
import pandas as pd
```

We use `import pandas as pd` to call the library and give it the abbreviation `pd` for convenience

Creating a list containing dates as strings

```
python
dates = ["2023-01-01", "2023-01-02", "2023-01-03"]
```

Here, we define the variable `dates`, which contains 3 dates in the format “YYYY-MM-DD” (Year-Month-Day)

Converting the dates to DateTime objects:

```
python
date_series = pd.to_datetime(dates)
```

We use the `pd.to\_datetime()` function to convert the list `dates` into a DateTime Series

• The result will be a `DatetimeIndex` object on which you can perform time operations such as:

- Extracting the day, month, or year.
- Calculating time differences.
- Filtering
- Printing the result:

```
python
print(date_series)
```

The output will be:

```
DatetimeIndex(['2023-01-01', '2023-01-02', '2023-01-03'], dtype='datetime64[ns]', freq=None)
```

This means that the data is now ready to be treated as dates rather than strings.

Why Use `pd.to\_datetime()`

Enables time-based operations like:

- Calculating the period between two dates.
- Extracting parts of the date (day, month, year).
- Grouping by date, such as summing sales monthly.
- Validating dates (e.g., rejecting invalid dates like “2023-01-03”).

Dear student... remember that:

- Data analysis is crucial for extracting insights and making better decisions.
- Python is an ideal language due to its simplicity and specialized libraries.

Learn By Doing

First: Choose the correct answer from the following options:

1. What is the definition of data analysis?

- a. The process of deleting data only
- b. The process of storing data in files
- c. The process of examining, cleaning, and transforming data to extract useful information
- d. Converting data into images

2. Why is Python considered suitable for data analysis?

- a. Because it is difficult to learn
- b. Because it has no libraries
- c. Because it has powerful libraries such as Pandas and NumPy
- d. Because it works only on mobile phones

3. What is the function of the NumPy library?

- a. Drawing charts
- b. Handling text.
- c. Scientific calculations
- d. Image analysis

4. The function `np.mean()` is used to calculate:

- a. The largest number
- b. The smallest number
- c. The arithmetic mean
- d. Adding two lists

5. In the code `import numpy as np`, what does `as np` mean?

- a. Deleting the library
- b. Changing the Python language
- c. An abbreviation of the library name to make it easier to use
- d. Running the library automatically

6. The maximum value is:

- a. The smallest value in the data
- b. The largest value in the data
- c. The average of the values
- d. The result of multiplying the values

7. Which type of data can be analyzed using NLP?

- a. Numerical data
- b. Images
- c. Text
- d. Dates only

8. What is the benefit of `pd.to_datetime()`?

- a. Converting text to numbers
- b. Converting text-based dates into a date-time format
- c. Deleting dates
- d. Sorting data automatically

9. What type of data is in the list:

`data = [10, 20, 30, 40, 50]`

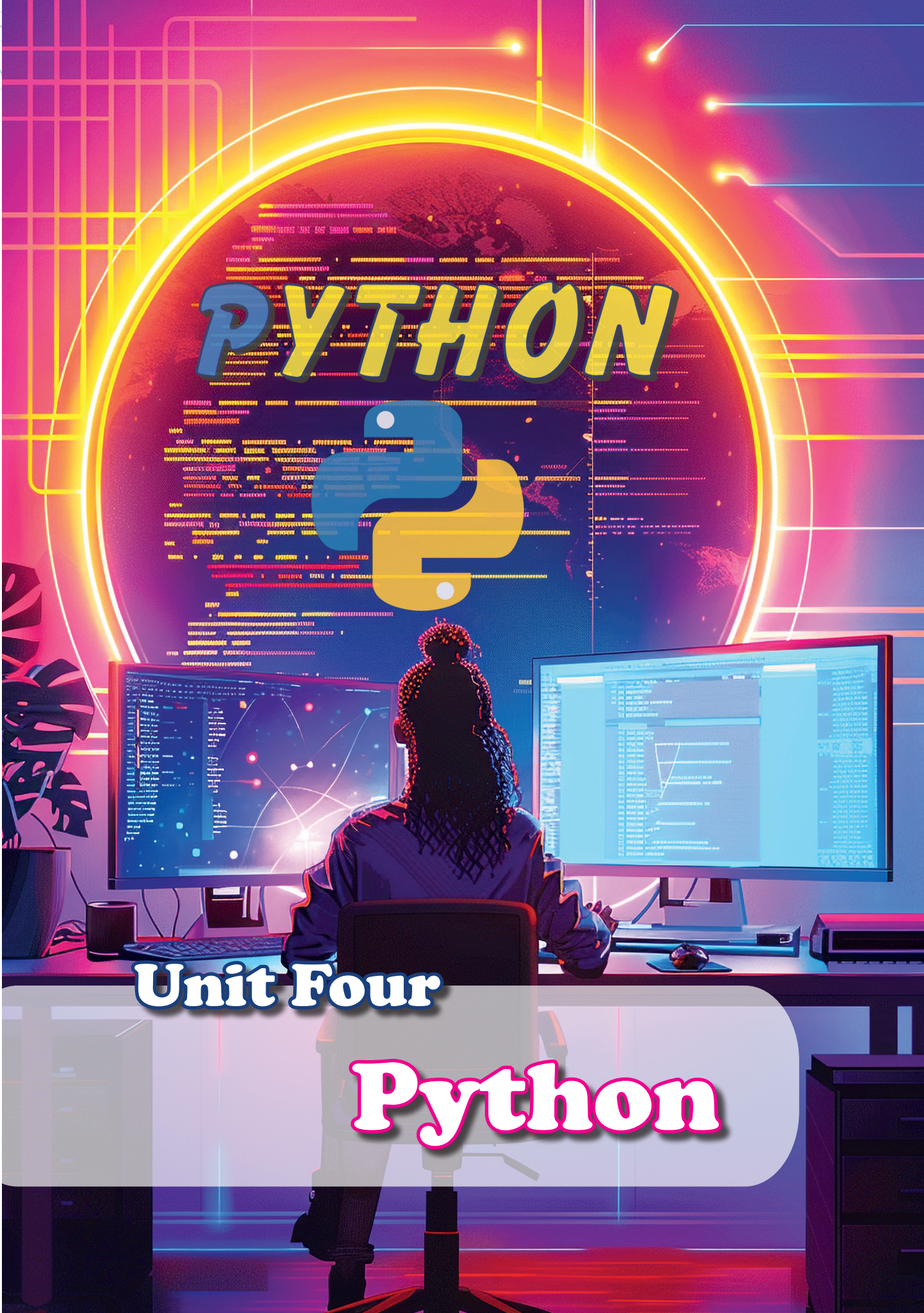
- a. Text data
- b. Date data
- c. Numerical data
- d. Audio data

10. If the neural cell is analyzing an image (for example, a cat), what is the input that enters the cell?

- a. Pandas
- b. NumPy
- c. Matplotlib
- d. datetime

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

1. Data analysis helps in making fact-based decisions. ()
2. Python does not contain libraries that support data analysis. ()
3. The Pandas library is used for cleaning and processing data. ()
4. The function `np.mean()` is used to find the smallest value in a list. ()
5. The arithmetic mean can be calculated manually without NumPy. ()
6. Text data can never be analyzed. ()
7. `pd.to_datetime()` can reject invalid dates such as "2023-13-01". ()
8. The maximum value (Max) is the smallest value in the data. ()
9. The arithmetic mean results in a decimal number even if the values are whole numbers. ()
10. Python can be used to analyze date and time data. ()



PYTHON



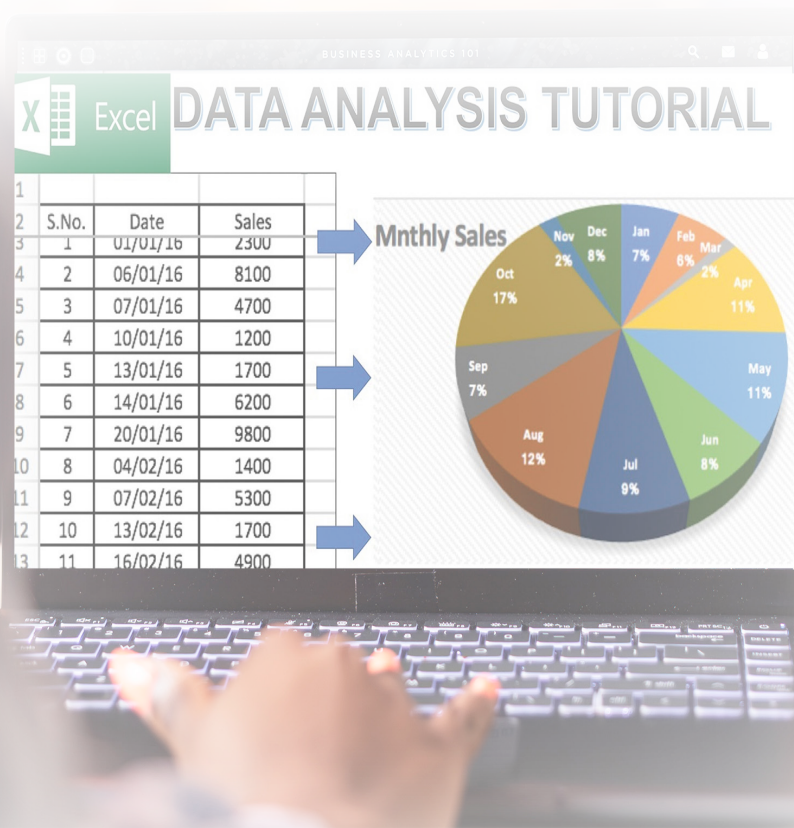
Unit Four

Python



Lesson one

Practical Application of Data Analysis Using Excel



Objectives:

By the end of this lesson, the student will be able to:

- Learn how to import an Excel file that contains students' grades and display the basic data.
- Perform basic calculations (calculating averages, finding the highest and lowest grades in each subject, and determining the number of successful students).
- Analyze the relationships between different subject grades using results and charts.

Engage:

What is Excel? What is the idea behind representing data using Excel? Explain.

Lesson1: Practical Application of Data Analysis Using Excel

Learn:

Dear student ... there are several requirements that must be available in the working environment:

Required Libraries (Python Packages)	pip install pandas	pip install matplotlib
Function of Each Library	pandas	Used for data analysis and for reading Excel files. pandas
	matplotlib	Used to create charts and graphs

An Excel file named **grades.xlsx** must be available in the same folder as the program.

File contents

Name	Math	Science	English
Ali	12	11	15
Khaled	14	14	12
Mohammed	13	15	13
Sabah	11	12	14
Mustafa	10	13	15
Yousef	15	13	12

Loading and Displaying Data Using the Following Code:

```
import pandas as pd
df = pd.read_excel('grades.xlsx') #Load the Excel file
print(df.head()) # Display the first 5 rows
```

Dear student ... here is a simple explanation of the code:

Importing the library:

```
import pandas as pd
```

Here, we import the pandas library, which helps us work with data and tables.

Reading the Excel file:

```
df = pd.read_excel('grades.xlsx')
```

This line reads the data from a file called **grades.xlsx** and stores it in a variable named **df**.

Displaying the first 5 rows:

```
print (df.head)
```

Here, the first five rows of the file are printed so you can see what the data looks like at the beginning.

In this way, you can understand how to read data from an Excel file and display some basic information about it.

Basic Data Analysis:

```
grades = df[['Math', 'Science', 'English']]
```

- Selects the columns Math, Science, and English from the data and stores them in grades.

```
print(«Average»)
```

```
print(grades.mean().to_dict()) # Average grade for each subject
```

- Calculates and displays the average grade for each subject.

```
print(«Maximum value»)
```

```
print(grades.max().to_dict()) # Highest grade in each subject
```

- Finds and displays the highest grade in each subject.

```
print(«Number of successful students»)
```

```
print((grades > 13).sum().to_dict()) # Number of students who passed in each subject
```

- Counts how many students scored above 13 in each subject and displays the result.

Code	Explanation
<code>grades = df[['Math', 'Science', 'English']]</code>	Selects the columns Math, Science, and English from the data and stores them in grades.
<code>print ("Average")</code> <code>print(grades.mean().to_dict())</code>	Calculates and displays the average grade for each subject..
<code>print ("Maximum value")</code> <code>print(grades.max().to_dict())</code>	Finds and displays the highest grade in each subject.
<code>print ("Number of successful students")</code> <code>print((grades > 13).sum().to_dict())</code>	Counts how many students scored above 13 in each subject and displays the result.

Explanation:

We print "Number of successful students", then calculate how many students scored more than 13 in each subject (that is, who passed), and display the count.

In other words:

This code performs a basic statistical analysis of the data in the table and shows:

The average grade for each subject.

The highest grade in each subject.

How many students passed in each subject.

Data Representation

Code	Explanation
<pre>import matplotlib.pyplot as plt df.mean().plot(kind='bar') # Plot the average of subjects plt.show() # Display the chart</pre>	Dear students, the code in front of you draws a bar chart for the average grades of the subjects
<pre>import matplotlib.pyplot as plt</pre>	This line means we are using a library called matplotlib, which helps us create charts and graphs.
<pre>"as plt"</pre>	means we use the short name plt instead of the full library name, which makes writing easier and faster.
<pre>grades.mean().plot(kind='pie')</pre>	Here we tell the program to: Calculate the average grade for each subject using grades.mean(). Draw the results as a pie chart using plot(kind='pie'). plt.show()
Finally: We ask the program to display the chart. Result: A chart appears showing the average grades of the subjects. Each bar (or slice, in the pie chart) represents the average grade of a subject. This makes it easy to compare grades quickly and in a clear, visual way.	

Explanation:

```
print(df.corr())# Calculate the correlation between subjects
```

It calculates the relationship between the subjects in the data table.

What does this mean?

It means checking whether one subject affects another. For example, if a student is good at Math, are they usually good at Science?

What is the result of the code?

It shows numbers between -1 and 1:

- Close to 1 → Strong positive relationship (both subjects increase together).
- Close to 0 → No clear relationship.
- Close to -1 → Negative relationship (when one increases, the other decreases).

Example:

If the correlation between Math and Science is 0.9, this means students who are good at Math are usually also good at Science.

This helps us understand how subjects affect each other.

Learn By Doing

First: Choose the correct answer from the following options:

1. What is the main function of the pandas library?

- a. Drawing charts
- b. Playing audio files
- c. Data analysis and reading Excel files
- d. Creating websites

2. Which library is responsible for creating charts in Python?

- a. numpy
- b. pandas
- c. tkinter
- d. matplotlib

3. Which command is used to load an Excel file?

- a. `pd.load_file()`
- b. `pd.read_excel()`
- c. `pd.open()`
- d. `df.read()`

4. What does the command `df.head()` do?

- a. Deletes the first 5 rows
- b. Displays the first 5 rows
- c. Displays the last 5 rows
- d. Displays the number of columns

5. What type of chart is produced by: `grades.mean().plot(kind='bar')`

- a. Pie chart
- b. Scatter plot
- c. Line chart
- d. Bar chart

6. What does the code `grades.mean()` do?

- a. Calculates the highest grade
- b. Calculates the lowest grade
- c. Calculates the average grade for each subject
- d. Deletes columns

7. What is the function of the following code: `grades.max()`?

- a. Finds the lowest grade
- b. Finds the highest grade
- c. Calculates the total grades
- d. Counts the number of students

Lesson 1: Learn By Doing

8. What does the code `(grades > 13).sum()` do?

- a. Calculates students' grades
- b. Counts the number of students who scored above 13
- c. Compares students with each other
- d. Reorders the grades

9. What does `df.corr()` mean?

- a. Shows the number of rows
- b. Calculates the correlation between subjects
- c. Removes data
- d. Calculates the average

10. Which of the following is used to display the chart?

- a. `plt.show()`
- b. `plt.start()`
- c. `plt.run()`
- d. `plt.open()`

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

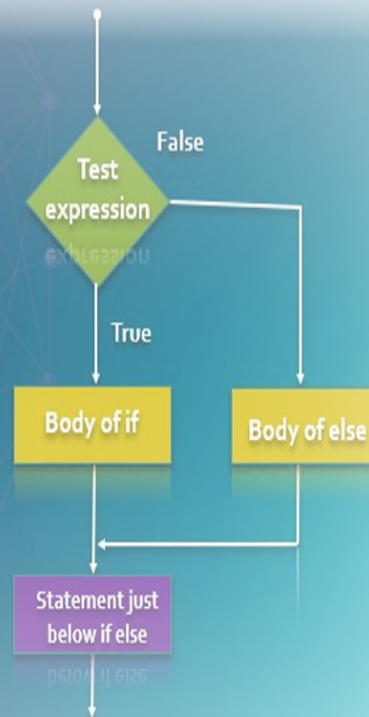
1. The pandas library is used to read Excel files and analyze data. ()
2. The `head()` function displays all the data in the table. ()
3. The matplotlib library can create bar, pie, and line charts. ()
4. The command `grades.max()` calculates the average grades of students. ()
5. `df.corr()` helps identify the relationship between different subjects. ()
6. `plt.show()` does not display the chart. ()
7. Using `(grades > 13)` gives true or false results for each student. ()
8. The code `grades.mean()` returns the highest grade, not the average. ()
9. The file `grades.xlsx` must be in the same folder as the Python program for the code to work correctly. ()
10. Pandas can be used to create charts without the need for the matplotlib library. ()



Lesson two

Conditional Statements in Python

if else
Statement
in Python



Objectives:

By the end of this lesson, the student will be able to:

- Understand the concept of conditional statements and how to use them to make decisions in programs.
- Explain how to use loops to repeat commands efficiently.
- Apply examples of functions, including how to create and call them to organize code effectively

Engage:

What are conditional statements?

Give examples of how conditional statements are used in Python.

Learn:

Dear student ... in the first year of preparatory stage, we studied Python programming, variables, and their types.

In this lesson, we will learn the concept of conditional statements and how to use them in Python.

The Concept of Conditional Statements and How to Use Them?

In Python, conditional statements are used to make logical decisions based on whether a certain condition is true. These statements tell the program to execute a specific part of the code only if the condition is met.

What is a conditional statement?

A conditional statement is a programming structure that allows the program to choose between multiple paths of execution depending on specified conditions.

General Syntax:

```
if condition:  # if the condition is true
    # execute this code
else:          # otherwise
    # execute this code instead
```

Types of Conditional Statements in Python

1. if Statement

The code executes only if the condition is true.

```
age = 18
if age >= 18:
    print(«You are allowed to enter») # This line will be executed
```

2. if ... else Statement

Executes one of two branches: if the condition is true, the first code runs; otherwise, the alternative code runs.

```
age = 16
if age >= 18:
    print(«You are allowed to enter»)
else:
    print(«Sorry, you cannot enter») # This line will be executed
```

3. if ... elif ... else Statement

Used to test multiple different conditions. If one condition is true, the program stops checking the others and executes its code.

```
mark = 85
if mark >= 90:
    print(«Excellent»)
elif mark >= 75:
    print(«Very Good»)
elif mark >= 60:
    print(«Good»)
else:
    print(«Fail»)
```

Practical Example:

```
number = int(input("Enter a number: "))
if number > 0:
    print("The number is positive")
elif number < 0:
    print("The number is negative")
else:
    print("The number is zero")
```

Learn By Doing

First: Choose the correct answer from the following options:

1. What is the purpose of conditional statements in Python?
 - a. To repeat code only
 - b. To execute specific code when a condition is true
 - c. To define functions
 - d. To create variables
2. What is the correct syntax for writing an if statement?
 - a. if: condition
 - b. if condition:
 - c. condition if
 - d. if (condition) then
3. What happens if the condition in an if statement is false?
 - a. The if code executes
 - b. The program stops completely
 - c. The if statement is ignored and the program continues
 - d. A runtime error occurs

Lesson 2 : Learn By Doing

4. The else statement is used when...

- a. The condition is always true
- b. The condition does not exist
- c. We want to execute alternative code if the condition is false
- d. We want to define a variable

5. Which of the following is a correct example of if...else?

- a. if x > 10 else:
- b. if x > 10: else x:
- c. if x > 10: print(«OK») else:
- d. print(«NO») if x > 10: else:

6. What does the keyword elif mean?

- a. End of the program
- b. A loop
- c. An additional branch between if and else
- d. A built-in function

7. Which statement is used to test multiple consecutive conditions?

- a. if only
- b. else only
- c. if...elif...else
- d. print

8. What happens if the first condition in an if...elif...else chain is true?

- a. All conditions are executed
- b. Only the elif condition executes
- c. The rest of the conditions are ignored
- d. A warning appears

9. Which of the following is a correct condition in Python?

- a. if x = 5
- b. if x == 5
- c. if x => 5
- d. if x <= 5

10. When writing:

```
age = 18
```

```
if age >= 18:
```

```
    print(«Allowed»)
```

What is the result?

- a. Nothing will be printed
- b. An error will appear
- c. «Allowed» will be printed
- d. «Not allowed» will be printed

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

- 1. The if statement is used to make a decision based on a condition. ()
- 2. The else statement can be written without an if statement before it. ()
- 3. More than one elif can be used in the same conditional statement. ()
- 4. A condition in Python must end with a semicolon (;). ()
- 5. An if statement can execute more than one line of code inside it. ()
- 6. The elif statement is short for else if. ()
- 7. The condition inside if must be only a mathematical operation. ()
- 8. A conditional statement can contain an if without an else. ()
- 9. The code inside if must be indented by only one space. ()
- 10. if...elif...else helps the program choose only one execution path. ()



Lesson three

Loops and Functions



Objectives:

By the end of this lesson, the student will be able to:

- Identify the concept of loops and functions.
- Explain the while loop as a conditional repetition loop.
- Write simple code using loops and functions.

Engage:

What are loops and
functions?

Learn:**Loops**

Dear student ... loops help you execute a specific command multiple times without writing it more than once.

The for loop (repetition with a known number of times)**General syntax:**

for item in sequence:

the code you want to repeat

print(item) # example: printing each item

Example:

for i in range(5): # repeat the command 5 times

print("Hello!") # this command will be printed 5 times

Notes:

- range(5) means from 0 to 4 (5 times).
- Every instruction under the for loop is executed in each iteration.

The while loop (conditional repetition)**General syntax:****while condition:**

the code that repeats as long as the condition is true.

(there must be something that changes the condition,

otherwise the loop will continue forever!)

Example:

x = 0

while x < 3: # repeat while x is less than 3.

print("I am learning!") # will be printed 3 times.

x += 1 # increase x by 1 in each iteration.

Notes:

- The loop continues as long as the condition (x < 3) is true.
- Beware of infinite loops: if you forget to increase x, the loop will continue forever.

Examples:

Printing numbers from 1 to 5:

```
for num in range (1, 6): # from 1 to 5  
    print(num)
```

Notes:

range (1, 6) means from 1 to 5 (6 is not included).

Summing numbers in a list:

```
numbers = [10, 20, 30]  
sum = 0  
for n in numbers: # for each number in the list  
    sum += n # add it to the total  
print ("Sum =", sum) # output: 60
```

Notes:

n takes the value of each element in the list in order.

Remember:

1. Use **for** when you know the number of repetitions.
2. Use **while** when the repetition depends on a condition.

Functions:

Dear student... imagine that a function is like a small machine that performs a specific task when you ask it to do it.

What is a function?

- **Its task:** To perform a specific action (such as calculating the sum of two numbers, printing a message, etc.).
- **Its benefit:** It makes the code more organized and easier to understand and modify.

How to create a function?

```
def greet(): # we use def to create a function  
    print("Hello! I am a beginner function") # code inside the function
```

Note: The function does not run until we call it!

Code explanation:

- **def:** short for define, used to create a function.
- **greet():** the function name (you can choose any name).
- **:** placed after the function name.
- **Indentation:** required for all code inside the function.

How to call a function?

greet () # calling the function to execute its code

Output:

Hello! I am a beginner function

Function with parameters (Input):

```
def add (a, b): # a and b are function inputs
```

```
    result = a + b
```

```
    print (f"The sum is: {result}")
```

```
add (3, 5) # passing the numbers 3 and 5 to the function
```

Output:

The sum is: 8

Parameter explanation:

- **(a, b):** values passed to the function to work with.
- **{result}:** we use an f-string to display the result.

Function that returns a value (Return):

```
def multiply (x, y):
```

```
    return x * y # returns the result instead of printing it
```

```
product = multiply (4, 6) # store the result in a variable
```

```
print ("The product is:", product)
```

Output:

The product is: 24

Difference between print and return:

- **print:** displays the result on the screen only.
- **return:** sends the result back to be used later in the program.

Remember:

- Functions make your programs faster and easier to modify.
- The more you practice, the more skilled a programmer you become!

Learn By Doing

First: Choose the correct answer from the following options:

1. A for loop is used when:

- a. The repetition depends on a condition
- b. The number of repetitions is unknown
- c. We want to run the code only once
- d. The number of repetitions is known

2. In programming, a function means:

- a. Repeating code
- b. A tool to perform a specific task
- c. Storing data
- d. Creating new variables

3. The code inside a function must be:

- a. Without indentation
- b. Written after a semicolon (;)
- c. Written with indentation
- d. Inside parentheses

4. The key word def is used for:

- a. Creating a variable
- b. Creating a loop
- c. Defining a function
- d. Printing text

5. A while loop continues to execute as long as:

- a. The number of repetitions is known
- b. The condition is true
- c. The number of repetitions = 0
- d. The condition is false

6. If we do not change the condition inside a while loop, it may cause:

- a. Immediate stop
- b. System error
- c. An infinite loop
- d. Only one iteration

7. The correct way to call a function is:

- a. Writing def only
- b. Writing the function name followed by parentheses
- c. Writing the variables inside print
- d. Writing the file name

Lesson 3 : Learn By Doing

8. Parameters in a function are:

- a. The values returned by the function
- b. The values we pass to the function to work with
- c. The commands inside the function
- d. The function name

9- The difference between return and print is that return:

- a. Displays the result on the screen
- b. Stores the result for later use
- c. Repeats the code
- d. Creates a new function

10- The main purpose of functions is:

- a. To make the code longer
- b. To write the same code multiple times
- c. To make the program more organized
- d. To eliminate the need for variables

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

1. A for loop is suitable when you know the number of repetitions in advance. ()
2. A while loop can work without a condition. ()
3. Forgetting to change the condition inside a while loop may cause an infinite loop. ()
4. A function only works when it is called. ()
5. A function cannot have parameters. ()
6. The code inside a function must be indented (Indentation). ()
7. A return function is used only to display the result on the screen. ()
8. Functions help organize code and reduce repetition. ()
9. A for loop always depends only on a logical condition. ()
10. A function can be called multiple times within the same program. ()



Lesson four

Data Structures or Collections



Objectives :

By the end of this lesson, the student will be able to:

- Identify data structures in Python and understand why we use them.
- Compare the uses of List, Tuple, and Dictionary.
- Write simple code using Python data structures.

Engage :

What are data structures?

What do we mean by

Data Structures in

Python?

Learn:**Data Structures in Python**

Dear student ... Data structures are ways to store data in a program in an organized way.

Examples :

- **Shopping list (List)** → We write down the items we want to buy.
- **School timetable (Tuple)** → fixed and unchanging throughout the week.
- **Glossary (Dictionary)** → A data structure that stores data as pairs of “keys” and “values”.

Lists :

- A list is mutable, meaning you can add or remove items.
- Lists use square brackets [].

Example (data Analyzing) :

Let's assume we have the math grades of students in a class and want to calculate the average:

```
grades = [85, 90, 78, 92, 88] # list of grades.
```

```
average = sum(grades) / len(grades) # sum of grades ÷ number of grades.
```

```
print ("The average is:", average)
```

Output:

The average is: 86.6

Important List Operations

Operation	Code	Explanation
Add	grades. append (95)	Add a new grade
Remove	grades. remove (78)	Remove a specific grade
Sort	grades. sort ()	Sort the grades in ascending order

Tuple :

- A tuple is immutable (fixed).
- Tuples use round brackets ().

Example (data Analyzing) :

Let's assume we have the days of the week, which cannot be changed:

```
days = ("Saturday", "Sunday", "Monday", "Tuesday", "Wednesday", "Thursday", "Friday")
```

```
print ("The third day is:", days [2]) # counting starts from 0
```

Output:

The third day is: Monday

When to use a tuple?

- o When you need fixed data, such as:
 - Days of the week
 - Coordinates of a location (longitude and latitude)

Dictionary :

1. A dictionary is a collection of items stored in pairs as key → value.
2. Dictionaries are written with curly braces {}, and keys and values are separated by a colon:.
3. It is used for fast access to data using keys instead of indexes like in lists.
4. Keys must be unique and cannot be duplicated; they can be text or numbers.
5. You can easily add new items or modify existing values.
6. Dictionaries are often used to store structured data, such as student or employee information.

Exercise 1:

```

student = {"name": "Ali", "age": 15, "grade": "A"} # create a dictionary for a student

print(student["name"])      # print the student's name

student["age"] = 16         # modify the student's age

student["city"] = "Cairo"   # add a new city to the dictionary

print(student)              # print the full dictionary after modification

```

Practical Exercises :**Looping Through the List****Exercise 1:**

You have a list of students' ages. Write a program to count how many students are older than 15.

```

ages = [14, 16, 15, 17, 14, 16] # list of students' ages

count = 0                        # Variable starting from zero to count the number of stu-
                                # dents greater than 15

for age in ages:                # loop through each age in the list

    if age > 15:                 # condition: is the current age greater than 15?

        count += 1              # if true, increase the counter by 1

print ("The number of students older than 15 is:", count) # print the result

```

Learn By Doing

First: Choose the correct answer from the following options:

1. What is meant by Data Structures?

- a. Ways to beautify program shape
- b. Ways to execute loops only
- c. Ways to store data in program in an organized manner
- d. Commands to print texts

2. Lists are characterized by being:

- a. Fixed and immutable
- b. Written with parentheses ()
- c. Mutable (adding and deleting items)
- d. Cannot store more than one data type

3. Which of the following uses square brackets?

- a. Tuple
- b. Set
- c. Dictionary
- d. List

4. Method append() is used to:

- a. Delete item from list
- b. Add new item to list
- c. Sort items
- d. Change list type

5. Tuple is characterized by being:

- a. Mutable
- b. Items change automatically
- c. Immutable (Fixed)
- d. Written with braces {}

6. We use Tuple when we want data that:

- a. Changes constantly
- b. Fixed and does not change
- c. Is deleted automatically
- d. Depends on keys and values

7. Dictionary stores data in the form of:

- a. List inside list
- b. Key → Value
- c. Values only without keys
- d. Unordered items

8. Which of the following is used to write a Dictionary?

- a. []
- b. ()
- c. {}
- d. <>

Lesson 4 : Learn By Doing

9. One characteristic of dictionary keys is that they:

- | | |
|--------------------|-------------------------|
| a. Can be repeated | b. Must be unique |
| c. Cannot be texts | d. Must be numbers only |

10. Dictionary is useful in storing:

- | | |
|------------------------|-------------------------------------|
| a. Fixed data only | b. Organized data like student data |
| c. Unique numbers only | d. Unordered items |

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

- | | |
|---|----------|
| 1. Lists in Python are mutable. | () |
| 2. Tuple items can be changed after definition. | () |
| 3. Dictionary relies on using keys to access values. | () |
| 4. Keys in Dictionary can be repeated without problem. | () |
| 5. List is written using square brackets []. | () |
| 6. Tuple uses braces {}. | () |
| 7. Dictionary is suitable for storing student data because it is organized and clear. | () |
| 8. List cannot contain more than one data type. | () |
| 9. Tuple is suitable for storing fixed data like days of the week. | () |
| 10. Dictionaries do not allow adding new items after creation. | () |



Lesson five

Introduction to Encryption Using «Python»

```
32 self.file = open('fingerprint.log', 'a')
33 self.fingerprints = {}
34 self.logdupes = True
35 self.debug = debug
36 self.logger = logging.getLogger(__name__)
37 if path:
38     self.file = open(os.path.join(path, 'requests.log'), 'a')
39     self.file.seek(0)
40     self.fingerprints.update({request: fingerprint})
41
42
43 settings.getboolean('fingerprint', 'logdupes')
44 ls(job_dir(settings))
45
46 seen(self, request)
47 self.request_fingerprint(request)
48 if fp in self.fingerprints:
49     return True
50 self.fingerprints.add(fp)
51 if self.file:
52     self.file.write(fp + os.linesep)
53
54 def request_fingerprint(self, request):
55     return request_fingerprint(request)
```



Objectives :

By the end of this lesson, the student will be able to:

- Use «Python» functions to convert letters to numbers and vice versa.
- Perform some operations (encrypt / decrypt a single character by adding and subtracting a fixed number).
- Explain the importance of encryption in protecting data and information.

Engage :

What is meant by encryption? How can encryption be performed using Python language?

Learn:

Have you ever wondered: How can you send a secret «encrypted» message that no one understands except the person it is addressed to?

Today, we will learn how to do that using «Python», in an easy and fun way.

What is Cryptography?

Encryption:

It is the art of converting information from its original, clear, understandable form called “Plaintext” to another form that is unintelligible called “Ciphertext”, so that no one can read it except the person who possesses the secret key to decrypt this encryption. Think of it as a secret box with a lock and key!

1. Correct and Incorrect Uses of Encryption

Type of Use	Examples	Explanation
Correct Use	(Security)	Protecting messages (WhatsApp), securing passwords, Secure sites: (https://)
Incorrect Use	(Harmful)	Ransomware viruses.

2. Encryption Methods

Encryption Type	Explanation (Basic Idea)	Example
Simple Encryption	Fixed and easy rules, like shifting every letter by a specific number (This is what we will learn)	Caesar Cipher
Complex Encryption	Complex mathematical equations and very long keys (Used by banks and companies)	AES Algorithm

Our Magical Tools in “Python”: The functions ord() and chr()

Because the computer does not understand letters but understands numbers, we must learn how to convert between them.

Function	Functionality	Example
ord()	Converting the character to its corresponding secret number according to the system used like "UNICODE".	ord('A') → 65
chr()	Converting the secret number to the corresponding character.	chr(65) → 'A'

Simple examples on using both functions:**1-To know the secret number for letter ‘S’:**

Python

```
print(ord('S'))
```

Output: 83

2-To know the letter corresponding to number 72:

Python

```
print(chr(72))
```

Output: H

3-Trying Shifting on letter ‘D’ (+1):

Python

```
code_D = ord('D') # ..... (1)
```

```
shifted_code = code_D + 1 # ..... (2)
```

```
print(chr(shifted_code)) # ..... (3)
```

```
# Output: E # ..... (4)
```

Lesson 5 : Introduction to Encryption Using «Python»

Explanation:

1. Converts letter 'D' to its number in UNICODE table and stores it in variable code_D using ord('D').
2. Increases the resulting number by 1 to get the number of the next letter in order.
3. Converts the new number to a letter using function chr() and prints it on screen.
4. Final output is Letter E.

Note: Letters used in code are Capital letters.

Applying Encryption and Decryption in «Python»

We will now use the shifting method (Caesar Cipher) which relies on:

- **Encryption:** Original Character Code + Encryption Key = Encrypted Code
- **Decryption:** Encrypted Character Code - Encryption Key = Original Character Code

Summary of Main Points

Point	Summary
Concept of Encryption	Converting Plaintext to Ciphertext using a Key.
Function ord()	Converts character to corresponding number in (Unicode) table.
Function chr()	Converts numeric value in parentheses to corresponding character.
Shift Encryption	Done by adding a fixed numeric value "Encryption Key" to the number corresponding to original character.
Decryption	Done by subtracting the fixed number previously added from the number corresponding to the new character to get the number of the original character before encryption.

Learn By Doing

First: Choose the correct answer from the following options:

1. What is meant by Plaintext?

- a. Encrypted text
- b. Unreadable text
- c. Original clear text
- d. Text protected by key

2. Ciphertext is:

- a. Original text
- b. Text understood by everyone
- c. Text after converting it to become unintelligible
- d. Text containing no key

3. Which of the following is considered a correct use of encryption?

- a. Spreading viruses
- b. Asking for ransom
- c. Protecting messages and passwords
- d. Deleting data

4. Which of the following is considered an incorrect use of encryption?

- a. Securing accounts
- b. Encrypting data for protection
- c. Securing sites
- d. Ransomware viruses

5. Simple encryption relies on:

- a. Complex equations
- b. Very long keys
- c. Fixed rules like shifting
- d. Artificial Intelligence

6. Which of the following types is used in banks and companies to ensure maximum security?

- a. Simple encryption
- b. Complex encryption
- c. Manual encryption
- d. Shift encryption

7. Function ord() is used to:

- a. Convert text to sentence
- b. Convert number to letter
- c. Convert letter to its number in Unicode
- d. Decrypt only

Lesson 5 : Learn By Doing

8. Function chr() functionality:

- | | |
|-----------------------------|-----------------------------|
| a. Delete letters | b. Convert letter to number |
| c. Convert number to letter | d. Encrypt texts |

9. Shift encryption relies on:

- | | |
|--|----------------------------|
| a. Subtracting random number | b. Swapping words |
| c. Adding fixed value to letter number | d. Changing sentence order |

10. Shift decryption is done through:

- | | |
|---|-----------------------------------|
| a. Adding encryption key | b. Deleting first letter |
| c. Subtracting key from encrypted letter number | d. Swapping letters automatically |

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

1. Encryption is a method to protect information from unauthorized access. ()
2. Anyone can read encrypted text easily without encryption key. ()
3. Incorrect use of encryption includes encrypting files and asking for money to unlock them. ()
4. Simple encryption like Caesar cipher is still used in protecting major banks. ()
5. Function ord() converts letter to number. ()
6. Function chr() converts number to corresponding letter. ()
7. Complex encryption relies on long keys and mathematical equations ()
8. In shift encryption, a fixed value is subtracted to produce encrypted text. ()
9. Shift decryption is done using subtraction operation. ()
10. Encryption is not used in daily apps like WhatsApp or Banks. ()



Lesson six

Encryption in «Python»

How to Turn Messages into Secrets Using the XOR Operator?



Objectives :

By the end of this lesson, the student will be able to:

- Explain (concept / function) of Bitwise Operations.
- Use XOR operation in encrypting/decrypting simple messages.
- Write a simple program in «Python» to «encrypt / decrypt» text using a secret key

Engage :

How can you perform encryption with Python language?

Learn:

Introduction: From Fixed Code to Smart Code

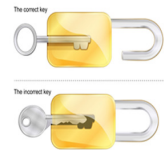
Dear Student... In the previous lesson, you learned a simple method for encryption, which is adding a fixed number to the number corresponding to any letter.

This method is good for starting, but it is easy to break! In this lesson, we will move to a smarter and stronger method that uses the magic of computers themselves: Bitwise operations, specifically the XOR operator.

You can consider this the first real step into the world of cryptography!

1. Encryption Basics: Bitwise Operations

Imagine your computer is a big box of small light bulbs, each bulb is either Lit (represented by value 1) or Off (represented by value 0).



This is the Bit, the smallest unit of data storage in a computer.

So, how does the computer speak?

Instead of exchanging words or complex numbers, it speaks in the language of lights: 0 and 1. Here comes the magic of Bitwise Operations:

If these bulbs express words and substitute their use in the computer, then Bitwise Operations are the grammar rules!

They are mathematical and logical operations performed directly on the state of these bulbs (i.e., on zeros and ones).

These operations allow the computer to “read” the state of bulbs and change them at super speed to make decisions and perform complex calculations. In other words, those bulbs are the basic components, and these operations are the engine that moves everything the computer executes!

What are Bitwise Operations?

They are a method to process numbers based on their internal representation consisting of zeros and ones.

Function and Uses:

- **Processing Speed:** It is the fastest way to perform many arithmetic and logical operations.
- **Encryption:** And this is our exciting use today! It is considered a basis for building encryption algorithms.

2. The Secret Star: XOR (Exclusive OR) Operation

Now, let's get to know the most important operation in our lesson: The XOR operator, read as "Exclusive OR", and symbolized in "Python" by the symbol $\wedge$.

XOR Operator Rule:

Imagine you study the state of two bulbs (2 bits), the result is Lit (1) if the state of the two bulbs is different (one lit and other off), whereas if the state of the two bulbs is similar (both lit or both off), the result is Off (0).

Using XOR Operator in Encryption "The Secret of the Reversible Operation":

The magical feature of XOR that makes it ideal for encryption is that it is Reversible!

- If you combine the Message with the Secret Key using XOR, you get the Encrypted Message.
- If you take the Encrypted Message and combine it with the Same Secret Key using XOR again, you will get the Original Message!

3. Encryption and Decryption in «Python»

In "Python", text can be handled, where we need to convert every letter in it to a number (Bit-wise) so we can apply the XOR operator on it.

Helper Tools:

- **ord(char):** Converts Letter to Number corresponding to this letter in "Unicode" table.
- **chr(number):** Converts Number to Letter corresponding to it in "Unicode" table.
- **Fixed Secret Key:** We will use key `secret_key = 10` for example in all examples.

Encryption Process

Encrypting one letter (A)

Explanation: Letter "A" is encrypted directly without a loop, where it is converted to a number, XOR is applied with key 10, then converted to an encrypted letter through the following code in "Python":

```
Python
secret_key = 10                                # ..... (1)
original_char = "A"                            # ..... (2)
encrypted_char_num = ord(original_char) ^ secret_key # ..... (3)
cipher_text = chr(encrypted_char_num)          # ..... (4)
print(f"Cipher: {cipher_text}")                # ..... (5)
```

Lesson 6 : Encryption in «Python» How to Turn Messages into Secrets Using the XOR Operator?**Explanation:**

1. Variable `secret_key` represents encryption key, here value is 10 and is used in encryption process.
2. Variable `original_char` contains the original letter to be encrypted which is "A".
3. Letter 'A' is converted to its number in UNICODE table using `ord()`, then XOR (^) operation is performed on it with `secret_key` to encrypt it.
4. The numerical result from XOR operation is converted to Encrypted Letter using function `chr()`.
5. Final encrypted letter is displayed on screen using Text Formatting (f-string).

Dear Student... Remember some of the following concepts

Concept	Explanation
Bit	Refers to smallest storage unit, either 1 (lit) or 0 (off).
Bitwise Operations	Fast mathematical movements performed directly on zeros and ones.
XOR (^)	Encryption operator. Result is 1 if inputs are different, and 0 if similar.
Secret Key	A number that must be used itself or same number in both encryption and decryption.
Reversible Property	Applying XOR twice: once at encryption and once at decryption with same secret key value restores original message.

Decryption Code for Previous Code:

Python

```
secret_key = 10                                # Same encryption key used previously
cipher_text = "K"                             # Cipher text (Example: Result from line (4) in encryption)
encrypted_char_num = ord(cipher_text)          # Convert cipher letter to number (Unicode value)
original_char_num = encrypted_char_num ^ secret_key # Apply XOR again to restore original number
decrypted_char = chr(original_char_num)         # Convert restored number to letter
print(f"Decrypted: {decrypted_char}")          # Print decrypted letter
```

Learn By Doing

First: Choose the correct answer from the following options:

1. Bit is:

- a. Largest measurement unit in data
- b. Complex electrical circuit
- c. Smallest storage unit and represents 0 or 1
- d. Decimal number

2. Bitwise operations are used because they are:

- a. Very slow
- b. Complex and computer cannot execute them
- c. Fastest way to process data
- d. Irrelevant to encryption

3. XOR operation works such that result is 1 when:

- a. Two values are similar
- b. Two values are different
- c. Two values are zero only
- d. Two values are one only

4. One of XOR features making it suitable for encryption:

- a. It changes data shape completely
- b. It is an irreversible operation
- c. It is a reversible operation that can be used for encryption and decryption
- d. It works only on texts

5. Bitwise operations are:

- a. Operations performed on words directly
- b. Operations performed on images only
- c. Operations performed on zeros and ones inside computer
- d. Slow and complex operations

6. ord() is a function in Python whose function is:

- a. Convert text to random numbers
- b. Convert text to list
- c. Convert letter to its number in Unicode
- d. Convert number to letter

7. XOR operation in Python is executed using symbol:

- a. +
- b. *
- c. &
- d. ^

Lesson 6 : Learn By Doing

8. Reversible property of XOR means:

- a. Operation executes once only
- b. XOR cannot be used for decryption
- c. Performing XOR twice with same key restores original value
- d. Operation changes data always

9. Secret key used in encryption must:

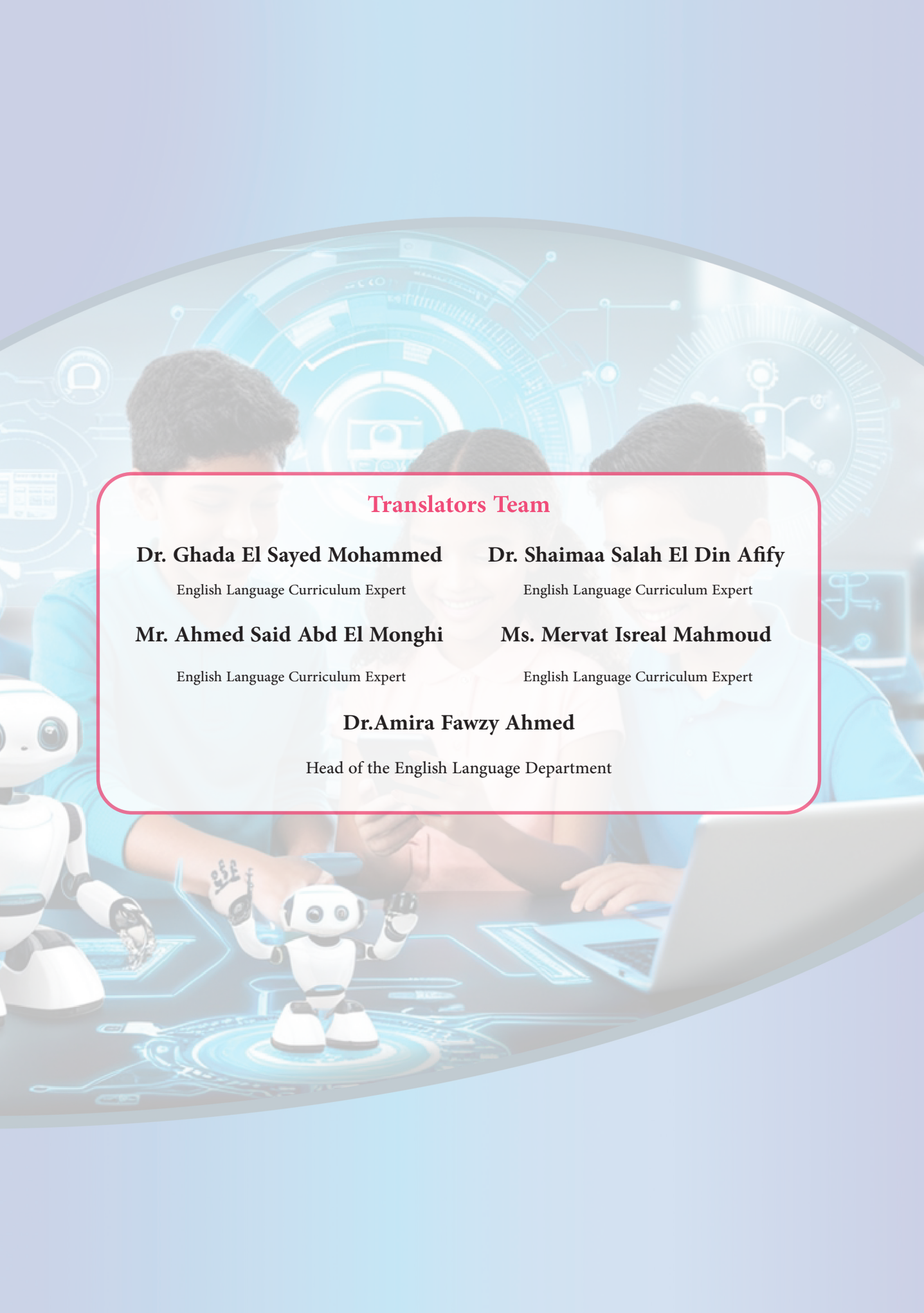
- a. Change in every step
- b. Be the same in both encryption and decryption operations
- c. Not be used in decryption
- d. Be a letter only

10. Bitwise operations are considered important because they are:

- a. Working on words only
- b. Essential part of computer execution of decisions and operations
- c. Not used in modern apps
- d. Limited to games only

Second: Put a check mark (✓) in front of the correct sentence and a check mark (✗) in front of the incorrect sentence.

1. Bit is the smallest storage unit in computer. ()
2. XOR operation gives result 1 only when values are equal. ()
3. XOR operator can be used in encryption because it possesses reversible property. ()
4. Bitwise operations are slow compared to normal arithmetic operations. ()
5. chr function in Python converts number to corresponding letter in Unicode table. ()
6. One of XOR characteristics is that it is unsuitable for encryption because it cannot be reversed. ()
7. Computer deals internally with data in form of 0 and 1. ()
8. Secret key must not be the same when decrypting. ()
9. Bitwise operations are the basis of encryption work and pattern discovery inside computer. ()
10. XOR operation is used only in texts and does not work on numbers. ()



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