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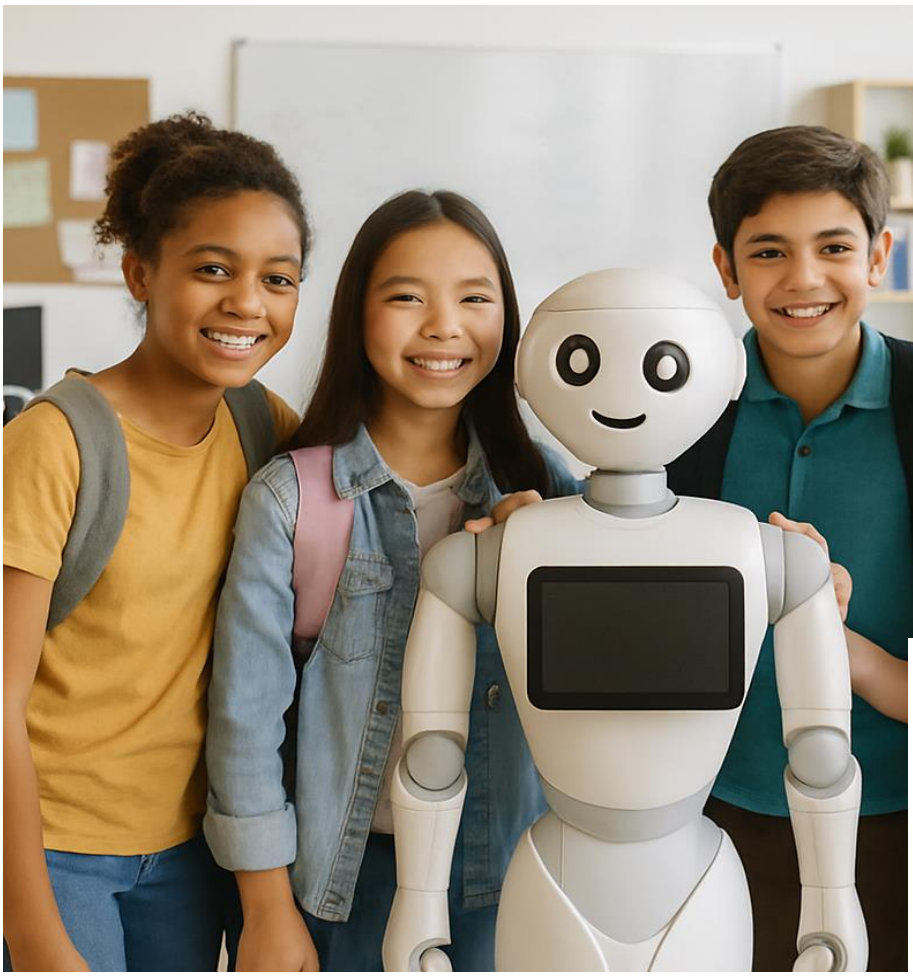
Computer World

Prep 2 _ Second Term 2026



Mr/ Ebrahim Elkomy

Tel_No _ 01096169792

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📕 Unit Three: Artificial Intelligence

Lesson One: The Historical Development of Artificial Intelligence

🌟 **Have you ever wondered** how our smartphones became so smart that they understand what we say?
How can cars drive themselves without a human driver?
🤔 **All of this is thanks to the amazing technology called Artificial Intelligence (AI).**
But did you know that AI is **not a completely modern idea**?
In fact, it has developed over a **very long period of history**.
📜 In this lesson, we will travel through time to discover the **roots of this great dream**.

🎯 What Will We Learn?

1. **The Human Dream of Thinking Machines:**
   How did people's interest in automation begin in ancient times?
2. **The Modern Age of Artificial Intelligence:**
   The key historical milestones that shaped today's AI world.

🏛️ First: Ancient Roots (Before Computers)

📜 Long before computers were invented, humans dreamed of machines that could **think and act like people**.
✨ Ancient civilizations made early efforts that can be considered the **first roots of machine thinking**.
These efforts appeared in:

- 🏺 Myths and legends
- 🏛️ Philosophy
- ⚙️🏺 Early mechanical inventions

🚀 Second: Major Historical Milestones

🏛️ A. Alan Turing – The Father of Artificial Intelligence (1950)

The British mathematician **Alan Turing** laid the foundation of AI by asking his famous question:
"Can machines think?"

🔍 The Turing Test:

A machine passes the test if it can convince a human, through text conversation, that it is also human.

📢 B. Dartmouth Conference – The Official Birth (1956)

☀️ In the summer of 1956, scientists met at **Dartmouth College** in the USA.

📌 During this meeting, the term **"Artificial Intelligence"** was officially introduced.

🎚️ C. Years of Enthusiasm and Big Dreams (1956 – 1970)

🌱 Promising beginnings:

Early programs appeared, such as:

- **Logic Theorist:** Solved logical and mathematical problems.
- **General Problem Solver:** Solved problems step by step.

⚠️ Early challenges:

Computers were very slow and had limited memory.

🧠 D. Expert Systems (1970 – 1980)

Instead of copying human thinking, scientists taught machines the **knowledge of experts**.

👨‍⚕️ Example – MYCIN:

An expert system that helped doctors diagnose infectious diseases with accuracy close to human experts.

❄️ E. AI Winter (1980 – 1990)

Dreams faded for a while due to:

1. Over-promising results
2. High costs and technical limitations

💡 Positive Message:

Sometimes failure helps us learn and become stronger! 💪

🌱 F. The Renaissance Era (1990 – 2010)

A major revival happened thanks to:

- 🌐 The Internet
- 📊 Big Data

🤖 Machine Learning:

Instead of programming every step, machines learn patterns from data (e.g., recognizing cats and dogs in images).

♟ Deep Blue:

A historic moment when a computer defeated the world chess champion **Garry Kasparov**.

🔥 G. The Modern Revolution (2010 – Present)

Deep Learning:

An advanced type of machine learning inspired by the neural networks of the human brain.

🏆 AlphaGo:

A stunning victory over the world champion in the complex Chinese game **Go**.

✓ Model 1

A. True or False (8 Questions)

1. Artificial Intelligence is a very recent idea. ( )
2. Ancient civilizations dreamed of thinking machines. ( )
3. Alan Turing asked if machines can think. ( )
4. The Turing Test uses voice communication. ( )
5. The Dartmouth Conference was held in 1956. ( )
6. Early computers were fast and powerful. ( )
7. Expert systems depended on expert knowledge. ( )
8. AlphaGo is related to chess. ( )

B. Complete the Sentence (7 Questions)

1. Artificial Intelligence is often called _____.
   a) IT b) AI c) CPU d) RAM
2. Alan Turing was a famous _____.
   a) Doctor b) Engineer c) Mathematician d) Pilot
3. The term “Artificial Intelligence” appeared in _____.
   a) 1950 b) 1956 c) 1960 d) 1970
4. MYCIN helped doctors in _____ diseases.
   a) Heart b) Genetic c) Infectious d) Mental
5. AI Winter happened between _____.
   a) 1960–1970 b) 1970–1980 c) 1980–1990 d) 1990–2000
6. Machine Learning depends on _____.
   a) Rules only b) Data patterns c) Human feelings d) Manual control
7. AlphaGo is an example of _____.
   a) Expert systems b) Deep learning c) AI winter d) Logic programs

✓ Model 2

A. True or False (8 Questions)

1. Artificial Intelligence aims to make machines think like humans. ( )
2. Ancient myths were part of early ideas about intelligent machines. ( )
3. Alan Turing introduced the term “Artificial Intelligence”. ( )
4. The Turing Test depends on text-based communication. ( )
5. Early AI programs faced problems due to limited computer memory. ( )
6. Expert systems were designed to learn like children. ( )
7. Machine Learning allows machines to learn from data. ( )
8. AlphaGo defeated the world champion in chess. ( )

B. Complete the Sentence (7 Questions)

1. The main goal of Artificial Intelligence is to build _____ machines.
   a) weak b) thinking c) broken d) manual
2. Philosophers contributed to AI through _____.
   a) philosophy b) programming c) networking d) gaming
3. The Dartmouth Conference was held in the year _____.
   a) 1950 b) 1956 c) 1965 d) 1975
4. MYCIN is an example of a(n) _____ system.
   a) operating b) expert c) gaming d) learning
5. AI Winter occurred because of _____ promises.
   a) realistic b) limited c) overestimated d) successful
6. Machine Learning works mainly by analyzing _____.
   a) commands b) emotions c) patterns d) mistakes
7. Deep Learning is inspired by the _____.
   a) computer screen b) neural networks of the brain
   c) keyboard d) database

✓ Model 3

A. True or False (8 Questions)

1. The idea of intelligent machines appeared only after computers. ( )
2. Early mechanical inventions supported the idea of automation. ( )
3. Alan Turing asked whether machines can think. ( )
4. The Dartmouth Conference took place in Europe. ( )
5. Logic Theorist was an early AI program. ( )
6. Expert systems depend on random learning. ( )
7. The Internet helped the growth of Artificial Intelligence. ( )
8. AlphaGo is an example of Deep Learning. ( )

B. Complete the Sentence (7 Questions)

1. Artificial Intelligence developed over a long period of _____.
   a) weeks b) history c) experiments d) devices
2. The Turing Test checks if a machine can act like a _____.
   a) robot b) animal c) human d) computer
3. Early AI systems were limited because computers were _____.
   a) fast b) powerful c) slow d) modern
4. MYCIN was used in the field of _____.
   a) engineering b) education c) medicine d) agriculture
5. Machine Learning reduces the need for detailed _____.
   a) hardware b) programming c) electricity d) storage
6. Deep Blue became famous after defeating a _____ champion.
   a) tennis b) chess c) football d) boxing
7. AlphaGo uses advanced _____ techniques.
   a) manual b) deep learning c) simple logic d) typing

Unit Three: Artificial Intelligence

Lesson Two: How Do Machines Think and Change Our World?

Have you ever noticed that your phone suggests a song without you asking?
Or that an educational app knows exactly which topics you need help with?
This is not magic — it is the **power of Artificial Intelligence (AI)**, the amazing technology that enables machines to **act, respond, and interact intelligently**, in ways that simulate human intelligence.

Where Do We Find Artificial Intelligence?

On Your Phone

Voice assistants, face recognition, and text prediction.

In Games

Smart characters that interact with you and adapt to your playing style.

On the Internet

Intelligent search engines and personalized content recommendations.

What Is Artificial Intelligence?

Artificial Intelligence is the ability of machines to **think**, make decisions, and solve problems.
Scientifically, AI is defined as the ability of computer systems to **simulate human cognitive abilities**, such as:

- Learning from data
- Decision-making
- Problem-solving
- Understanding natural language
- Recognizing patterns in images and sounds

A Deeper Understanding of AI

Imagine that we are building a **digital brain** for a machine.
This brain has **no emotions or self-awareness** like the human brain, but it is designed to **process huge amounts of information at incredible speed**.

🌍 Examples from Daily Life

🎮 1. Video Games

Non-Playable Characters (NPCs) use AI to choose the best strategy for attack or escape,
and they **learn from your playing style** to become more challenging.

🎙️ 2. Voice Assistants

Such as **Siri, Alexa, and Google Assistant**.
They use **Natural Language Processing (NLP)** to understand your speech, convert it into text, analyze meaning, and perform your request.

⚖️ Comparison: Human Intelligence vs Artificial Intelligence

Aspect	Human Intelligence 👩‍🎓	Artificial Intelligence 🤖
Emotions & Awareness	Has emotions and self-awareness	No emotions or awareness, processes data only
Creativity	Creates new and original ideas	Extremely fast and accurate in data processing
Understanding Context	Understands humor and hidden meanings	Relies on logic and programmed rules

🖼️ Example:

If you show a painting to an AI, it can identify colors, lines, and people accurately,
but it **cannot feel the beauty or emotion** expressed by the artist.

🚀 Why Is AI Important Today?

Because it is a powerful force that opens doors we never imagined:

- 💬 **Language Models Revolution:** Tools like ChatGPT help with conversations and homework.
- 📸 **Image Recognition:** Unlocking phones using face recognition.
- 🚗 **Self-Driving Cars:** Vehicles that drive safely on their own.

✓ Model 1

A. True or False (8)

1. Artificial Intelligence is a form of magic. ( )
2. AI allows machines to make decisions. ( )
3. AI can recognize patterns in images. ( )
4. Voice assistants do not use AI. ( )
5. AI has emotions like humans. ( )
6. NPCs can adapt to the player's style. ( )
7. AI can process large amounts of data quickly. ( )
8. AI understands feelings naturally. ( )

B. Complete the Sentence (7)

Choose the correct answer:

1. Artificial Intelligence enables machines to _____.
   a) sleep b) think c) feel d) dream
2. Face recognition is an example of _____.
   a) gaming b) image recognition c) emotions d) art
3. Voice assistants use _____ to understand speech.
   a) hardware b) NLP c) RAM d) cables
4. AI characters in games are called _____.
   a) CPUs b) NPCs c) URLs d) APIs
5. AI systems learn mainly from _____.
   a) guesses b) data c) feelings d) luck
6. AI processes information with high _____.
   a) fear b) speed c) noise d) delay
7. ChatGPT is an example of a _____ model.
   a) language b) image c) hardware d) storage

✓ Model 2

A. True or False (8)

1. AI can suggest content based on user behavior. ( )
2. Educational apps never use AI. ( )
3. AI simulates human cognitive abilities. ( )
4. AI systems can learn from data. ( )
5. AI understands emotions better than humans. ( )
6. AI is used in internet search engines. ( )
7. AI has self-awareness. ( )
8. AI can analyze language. ( )

B. Complete the Sentence (7)

1. Artificial Intelligence helps machines _____ problems.
   a) ignore b) solve c) hide d) forget
2. Learning from data is a key feature of _____.
   a) AI b) art c) music d) hardware
3. NPCs are commonly found in _____.
   a) phones b) games c) cars d) books
4. AI decisions depend mainly on _____.
   a) emotions b) logic c) dreams d) fear
5. NLP helps machines understand _____.
   a) numbers b) language c) images d) speed
6. AI can analyze _____ amounts of information.
   a) tiny b) huge c) random d) weak
7. Self-driving cars depend on _____.
   a) AI b) paint c) fuel only d) drivers

✓ Model 3

A. True or False (8)

1. AI is used in smartphones. ( )
2. AI can predict text. ( )
3. AI has emotions like humans. ( )
4. AI can recognize faces. ( )
5. AI works without data. ( )
6. AI helps personalize content. ( )
7. AI understands sarcasm perfectly. ( )
8. AI supports decision-making. ( )

B. Complete the Sentence (7)

1. AI systems rely mainly on _____.
   a) feelings b) data c) opinions d) luck
2. Text prediction is found in _____.
   a) notebooks b) smartphones c) paintings d) radios
3. AI does not have _____.
   a) speed b) accuracy c) emotions d) memory
4. Voice assistants convert speech into _____.
   a) images b) text c) video d) signals
5. AI can help in _____ learning.
   a) random b) personalized c) slow d) manual
6. AI characters become stronger by _____.
   a) copying b) learning c) resting d) guessing
7. Image recognition is used to unlock _____.
   a) doors b) phones c) books d) bags

✓ Model 4

A. True or False (8)

1. AI can interact intelligently with humans. ( )
2. AI thinks exactly like humans. ( )
3. AI is used in games and phones. ( )
4. AI cannot solve problems. ( )
5. AI processes data very quickly. ( )
6. AI understands hidden emotions. ( )
7. AI supports self-driving cars. ( )
8. AI depends on programmed rules and data. ( )

B. Complete the Sentence (7)

1. AI allows machines to make _____.
   a) mistakes b) decisions c) jokes d) feelings
2. Personalized content is powered by _____.
   a) AI b) paper c) electricity d) art
3. AI assistants respond to _____ commands.
   a) visual b) voice c) touch only d) random
4. AI does not possess _____.
   a) speed b) logic c) awareness d) accuracy
5. AI processes data at _____ speed.
   a) slow b) human c) incredible d) weak
6. Image recognition helps identify _____.
   a) faces b) sounds c) feelings d) smells
7. Self-driving cars are an example of _____.
   a) AI applications b) games c) art d) myths

🛡️ Unit Three: Artificial Intelligence

Lesson Three: Artificial Intelligence All Around Us

Ethical Responsibility and Safe Use

🏫 With Great Power Comes Great Responsibility

🌍 Artificial Intelligence is a powerful force that can change the world for the better,
but it must be used **wisely and responsibly** to ensure **safety and benefit for everyone**.

📜 Core Ethical Principles

⚖️ 1. Fairness and Transparency

AI systems should be designed in a **fair and unbiased way**, treating all individuals equally without discrimination.

🔒 2. Privacy and Data Protection

Your personal information must remain **safe and protected**.

💡 *Tip:* Always read privacy settings before using any application.

🕹️✈️ 3. Human Oversight and Control

AI is a **tool**, not a decision-maker by itself.
Humans set the goals, design the algorithms, and remain responsible for outcomes.

⚠️ The Problem of Bias in Artificial Intelligence

🧠 If an AI system is trained on **incomplete or unfair data**, it may **learn bias**.

🔎 Example:

If a system is trained mainly on faces from one ethnic group,
it may fail to recognize faces from other groups accurately.

✅ Solution:

High-quality, fair, and diverse data is the key to **justice and equality**.

👩‍💻 Your Role as a Smart User

✓ **Think critically:** Do not automatically trust everything AI produces.

✓ **Verify information:** Always check reliable sources.

✓ **Use responsibly:** Guide technology to improve your life and the lives of others.

✓ Model 1

A. True or False (8)

1. Artificial Intelligence must always be used responsibly. ( )
2. AI systems should treat all people equally. ( )
3. Privacy is not important when using AI applications. ( )
4. Humans control and supervise AI systems. ( )
5. Bias can appear due to poor data. ( )
6. AI systems always make fair decisions. ( )
7. Users should verify AI information. ( )
8. AI can change the world positively. ( )

B. Complete the Sentence (7)

1. Ethical AI systems must be _____.
   a) secret b) fair c) random d) weak
2. Personal data should be kept _____.
   a) public b) open c) safe d) ignored
3. Bias occurs when data is _____.
   a) diverse b) fair c) limited d) balanced
4. Humans are responsible for _____ AI systems.
   a) designing b) obeying c) ignoring d) copying
5. Reading privacy settings helps protect _____.
   a) devices b) batteries c) personal information d) screens
6. AI decisions depend mainly on _____.
   a) emotions b) algorithms c) dreams d) luck
7. Responsible AI use improves _____.
   a) problems b) harm c) life d) bias

✓ Model 2

A. True or False (8)

1. AI systems must be transparent. ( )
2. Privacy protection is optional. ( )
3. Bias can affect AI results. ( )
4. AI replaces human responsibility completely. ( )
5. Data quality affects AI fairness. ( )
6. Users should think critically about AI outputs. ( )
7. AI should be used safely. ( )
8. AI tools cannot make mistakes. ( )

B. Complete the Sentence (7)

1. Ethical AI focuses on fairness and _____.
   a) speed b) transparency c) power d) cost
2. AI bias is learned from _____ data.
   a) diverse b) unfair c) rich d) complete
3. Humans must _____ AI systems.
   a) supervise b) fear c) avoid d) forget
4. Personal information must be _____.
   a) deleted b) protected c) shared d) lost
5. AI should improve the lives of _____.
   a) machines b) developers c) people d) robots
6. A smart user always _____ information.
   a) ignores b) trusts c) verifies d) deletes
7. Diverse data leads to more _____ AI systems.
   a) biased b) accurate c) unfair d) weak

✓ Model 3

A. True or False (8)

1. AI is a powerful technology. ( )
2. AI can be used without rules. ( )
3. Bias reduces AI accuracy. ( )
4. Human oversight is necessary. ( )
5. AI systems can reflect data problems. ( )
6. Privacy protects personal data. ( )
7. AI is always neutral. ( )
8. Responsible use benefits society. ( )

B. Complete the Sentence (7)

1. AI systems must follow _____ principles.
   a) ethical b) electrical c) mechanical d) visual
2. Poor data can cause AI _____.
   a) balance b) bias c) speed d) safety
3. Human control keeps AI _____.
   a) dangerous b) safe c) hidden d) slow
4. Personal data should not be _____.
   a) protected b) secured c) exposed d) encrypted
5. A smart user does not blindly _____ AI.
   a) question b) trust c) design d) improve
6. AI fairness depends on data _____.
   a) quantity b) diversity c) color d) size
7. Ethical AI helps build a _____ society.
   a) weak b) harmful c) better d) biased

✓ Model 4

A. True or False (8)

1. AI must be used wisely. ( )
2. Fairness is an ethical AI principle. ( )
3. AI bias comes from diverse data. ( )
4. Humans design AI algorithms. ( )
5. Privacy settings are important. ( )
6. AI systems are independent of humans. ( )
7. Users should guide AI positively. ( )
8. Ethical AI protects everyone. ( )

B. Complete the Sentence (7)

1. Ethical responsibility ensures AI _____.
   a) harm b) safety c) chaos d) bias
2. AI should not discriminate against _____.
   a) data b) individuals c) machines d) systems
3. Bias occurs when data is not _____.
   a) fair b) slow c) small d) encrypted
4. Humans remain _____ for AI decisions.
   a) absent b) responsible c) replaced d) silent
5. Protecting data ensures user _____.
   a) speed b) comfort c) privacy d) cost
6. Responsible users always _____ information.
   a) ignore b) verify c) delete d) hide
7. AI projects should aim to _____ problems.
   a) create b) solve c) increase d) repeat

🤖 Unit Three: Artificial Intelligence

Lesson Four: The Artificial Neuron

How Does a Machine Imitate the Human Mind?

💡 First: What Is an Artificial Neuron?

🤖 An **artificial neuron** is a small unit inside a computer that tries to **imitate the way humans think**.

🧠 Just as our brains contain neurons that help us learn and make decisions,

scientists created **programmed neurons** that help computers *"think"* and decide.

🏭🤖 Second: Components of the Artificial Neuron

An artificial neuron consists of **five main parts**:

1️⃣ Inputs

📥 The information entering the neuron (image, sound, or number).

2️⃣ Weights

⚖️🤖 Numbers that determine the **importance** of each input.

3️⃣ Bias

➕ An additional value added to adjust the neuron's behavior and make it more flexible.

💡 **Example:** Extra marks or "class activities" added to help a student pass.

4️⃣ Activation Function

🔔 The decision-maker:

Should the neuron send a signal or stay silent?

🔍 Types of Activation Functions (The Magic Key)

Function	Simple Role	Practical Example
Threshold	Gives only (0 or 1)	Pass (1) or Fail (0)
Sigmoid	Gives a value between 0 and 1	85% chance the image is a cat
ReLU	Passes positive values, removes negative ones	Ignoring very weak sounds

5 Output

📤 The final result and decision made by the neuron.

🔢 Practical Example: Calculating Your School Result

🎓 Imagine an artificial neuron calculating your result based on **three subjects**:

(Science – Math – Computer)

🔹 Inputs : Your grades in the subjects.

🔹 Weights : Science (0.4) – Math (0.3) – Computer (0.3)

🔹 Bias : +1 attendance mark

Step 1: Weighted Score

Weighted Score =

(Science × 0.4) + (Math × 0.3) + (Computer × 0.3)

Step 2: Add Bias

Final Result = Weighted Score + 1

➖ Example Calculation

Grades:

Science = 85, Math = 90, Computer = 80

Weighted Score =

(85 × 0.4) + (90 × 0.3) + (80 × 0.3)

= 34 + 27 + 24 = **85**

Final Result =

85 + 1 = **86**

✅ Just like an artificial neuron makes decisions!

✓ Model 1

A. True or False (8)

1. An artificial neuron imitates human thinking. ( )
2. Inputs can be images, sounds, or numbers. ( )
3. Weights show the importance of inputs. ( )
4. Bias reduces flexibility of the neuron. ( )
5. Activation functions make decisions. ( )
6. Output is the final result. ( )
7. ReLU passes negative values only. ( )
8. Artificial neurons exist inside computers. ( )

B. Complete the Sentence (7)

1. An artificial neuron is a _____ unit.
   a) biological b) software c) mechanical d) electrical
2. Weights determine the _____ of each input.
   a) color b) importance c) size d) speed
3. Bias makes the neuron more _____.
   a) rigid b) flexible c) slow d) noisy
4. The activation function decides whether to _____ a signal.
   a) store b) ignore c) send d) delete
5. Threshold function outputs _____.
   a) values only b) 0 or 1 c) text d) images
6. Sigmoid outputs a value between _____.
   a) 1 and 10 b) 0 and 1 c) –1 and 1 d) 0 and 100
7. Output represents the _____ decision.
   a) first b) final c) random d) partial

✓ Model 2

A. True or False (8)

1. Artificial neurons are inspired by the human brain. ( )
2. Inputs must always be numbers. ( )
3. Bias is added to the total value. ( )
4. Activation functions control neuron behavior. ( )
5. ReLU removes negative values. ( )
6. Output comes before activation. ( )
7. Weights affect calculations. ( )
8. Artificial neurons cannot make decisions. ( )

B. Complete the Sentence (7)

1. Artificial neurons help computers _____.
   a) sleep b) think c) feel d) dream
2. Inputs enter the neuron through _____.
   a) outputs b) signals c) data d) rules
3. Bias is similar to extra _____ for students.
   a) exams b) marks c) books d) lessons
4. ReLU ignores _____ values.
   a) positive b) negative c) large d) correct
5. Activation functions are the neuron's _____.
   a) memory b) brain c) decision tool d) storage
6. The final result is called the _____.
   a) input b) output c) bias d) weight
7. Weighted score depends on _____ and inputs.
   a) time b) weights c) colors d) screens

✓ Model 3

A. True or False (8)

1. Artificial neurons copy biological neurons exactly. ( )
2. Inputs provide data to the neuron. ( )
3. Weights can change the result. ( )
4. Bias always decreases the score. ( )
5. Sigmoid gives probabilities. ( )
6. ReLU is an activation function. ( )
7. Output is the neuron’s decision. ( )
8. Artificial neurons cannot learn. ( )

B. Complete the Sentence (7)

1. Artificial neurons are part of _____ systems.
   a) AI b) biology c) chemistry d) physics
2. Inputs can be _____.
   a) grades b) images c) sounds d) all of these
3. Weights are represented by _____.
   a) words b) numbers c) colors d) signals
4. Bias is added to the _____.
   a) output b) input c) total d) memory
5. Threshold function gives _____ result.
   a) many b) continuous c) binary d) random
6. ReLU passes only _____ values.
   a) negative b) positive c) equal d) small
7. The neuron’s final answer is called _____.
   a) weight b) bias c) output d) input

✓ Model 4

A. True or False (8)

1. Artificial neurons are used in AI systems. ( )
2. Bias increases neuron flexibility. ( )
3. Weights are optional in neurons. ( )
4. Activation functions help in decision-making. ( )
5. Output comes after activation. ( )
6. Sigmoid produces values above 1. ( )
7. ReLU removes negative inputs. ( )
8. Artificial neurons help machines decide. ( )

B. Complete the Sentence (7)

1. Artificial neurons imitate the _____ brain.
   a) animal b) human c) robot d) digital
2. Inputs enter the neuron before _____.
   a) output b) activation c) decision d) memory
3. Weights control the _____ of inputs.
   a) order b) importance c) color d) type
4. Bias is added to adjust the _____.
   a) speed b) behavior c) screen d) size
5. Activation functions decide whether to _____.
   a) send a signal b) stop learning c) store data d) erase memory
6. Sigmoid outputs a _____ value.
   a) binary b) fixed c) probability d) random
7. The final neuron decision is the _____.
   a) input b) output c) weight d) bias

Lesson Five: The Role of the Artificial Neuron in Artificial Intelligence

From a Single Neuron to Giant Networks

How Do We Build an Artificial Neuron?

The artificial neuron is the basic building block of Artificial Neural Networks (ANNs).

To build it, we follow organized steps:

1. **Identifying the type of data:** such as numbers, images, or text.
2. **Assigning weights:** giving each piece of information a certain importance.
3. **Summation and processing:** adding the inputs after multiplying them by their weights.
4. **Activation:** passing the result through an activation function to make a decision.
5. **Final output:** obtaining a prediction (for example: “This is a cat image”).

How Does the Neuron Work? (The Cat Example)

Imagine you are designing a system to recognize cat images:

- **Input:** the image is entered into the system.
- **Analysis:** the neuron analyzes image features using weights.
- **Decision:** the activation function decides whether the features match a cat (Yes / No).
- **Communication:** the result is sent to other neurons in the network to confirm the decision.

When thousands of neurons are connected together, we get a powerful neural network that can:

1. Learn from experience.
2. Improve itself over time.
3. Solve complex problems such as self-driving cars or medical diagnosis.

Amazing Real-Life Applications

- **Smart assistants:** such as Siri and Alexa to understand speech.
- **Face recognition:** in smartphone cameras.
- **Self-driving cars:** to make driving decisions instead of humans.
- **Instant translation:** converting languages in seconds.
- **Medicine:** diagnosing diseases accurately in hospitals.
- **Entertainment:** recommending movies you like on YouTube or Netflix.

Model (1)

A) True or False (8)

1. The artificial neuron is the basic unit of neural networks. ( )
2. Inputs can be numbers, images, or text. ( )
3. Weights give importance to input data. ( )
4. The activation function is not needed in AI systems. ( )
5. The output is the final prediction of the neuron. ( )
6. Neural networks consist of only one neuron. ( )
7. Artificial neurons can communicate with other neurons. ( )
8. Neural networks can learn from experience. ( )

B) Choose the correct answer (7)

1. The step that decides Yes or No is:
   (a) Input (b) Weight (c) Activation (d) Output
2. Which is an example of input data?
   (a) Decision (b) Image (c) Prediction (d) Output
3. Many connected neurons form a:
   (a) File (b) Neural network (c) Website (d) Folder
4. Siri and Alexa are examples of:
   (a) Games (b) Smart assistants (c) Cameras (d) Cars
5. The process of adding inputs after weights is called:
   (a) Activation (b) Summation (c) Output (d) Storage
6. Neural networks improve themselves through:
   (a) Forgetting (b) Experience (c) Deleting data (d) Errors
7. Recognizing cat images is an example of:
   (a) Programming only (b) Image recognition (c) Translation (d) Encryption

Model (2)

A) True or False (8)

1. Artificial neurons analyze data using weights. ( )
2. All inputs have the same importance. ( )
3. The activation function helps in decision making. ( )
4. Neural networks cannot solve complex problems. ( )
5. Thousands of neurons can be connected together. ( )
6. AI is used in face recognition systems. ( )
7. Self-driving cars depend on neural networks. ( )
8. Artificial intelligence has no medical uses. ( )

B) Choose the correct answer (7)

1. The final result of a neuron is called:
   (a) Input (b) Weight (c) Output (d) Data
2. Which application uses AI in hospitals?
   (a) Gaming (b) Translation (c) Medical diagnosis (d) Music
3. The importance given to data is called:
   (a) Input (b) Weight (c) Output (d) Network
4. Passing the result to make a decision is called:
   (a) Summation (b) Activation (c) Storage (d) Input
5. Netflix movie suggestions are related to:
   (a) Medicine (b) Entertainment (c) Driving (d) Security
6. A neural network becomes stronger when it:
   (a) Stops learning (b) Learns from data
   (c) Deletes neurons (d) Ignores input
7. The lesson explains neuron work using a:
   (a) Car example (b) Cat image example
   (c) Phone example (d) Robot example

Model (3)

A) True or False (8)

1. Artificial neurons are inspired by the human brain. ( )
2. Data must pass through weights before processing. ( )
3. The activation function gives random results. ( )
4. Neural networks can be used in translation apps. ( )
5. The output can be a prediction or decision. ( )
6. AI systems cannot improve over time. ( )
7. Face recognition uses artificial neurons. ( )
8. Neural networks help solve complex problems. ( )

B) Choose the correct answer (7)

1. Which is NOT an input type?
   (a) Image (b) Text (c) Number (d) Decision
2. The basic building block of neural networks is:
   (a) Program (b) Artificial neuron (c) Website (d) File
3. Making driving decisions without humans relates to:
   (a) Smart assistants (b) Self-driving cars (c) Translation (d) Gaming
4. The step after summation is:
   (a) Input (b) Activation (c) Storage (d) Deletion
5. AI translation converts languages in:
   (a) Days (b) Weeks (c) Seconds (d) Months
6. Improving performance over time is called:
   (a) Forgetting (b) Learning (c) Deleting (d) Stopping
7. YouTube recommendations depend on:
   (a) Artificial intelligence (b) Manual work
   (c) Paper data (d) Human guessing

Lesson Six: Introduction to Data Analysis 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?

Python is considered one of the best languages for data analysis for the following reasons:

- **Easy to learn:** Its syntax is simple and close to the English language.
- **Powerful libraries:**
  - **Pandas:** for data processing and cleaning.
  - **NumPy:** for scientific and mathematical calculations.
  - **Matplotlib and Seaborn:** for data visualization (charts and graphs).
- **Large community support:** many tutorials and learning resources are available.
- **Artificial Intelligence:** fully compatible with AI and Machine Learning techniques.

Basic Concepts in Data Analysis

A. Mean (Average)

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

Python Example:

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

First: Importing the NumPy Library

```
import numpy as np
```

Function:

- Imports the NumPy library, which is used for scientific and mathematical calculations in Python.

Note:

- as np is a shortcut name so we can use np instead of writing numpy every time.

Example without shortcut:

```
import numpy
mean = numpy.mean(data)
```

📌 Second: Creating the Data List

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

Function:

- Creates a list containing the values we want to analyze.

Note:

- The list can contain any numbers and does not need to be ordered.

📌 Third: Calculating the Mean Using NumPy

```
mean = np.mean(data)
```

Function:

- np.mean() is a built-in function in NumPy used to calculate the mean.

How Does the Mean Work?

Mean = Sum of values ÷ Number of values

Example:

(10 + 20 + 30 + 40 + 50) ÷ 5 = 150 ÷ 5 = 30.0

📌 Manual Example Without NumPy

```
sum_data = sum(data)
count = len(data)
mean = sum_data / count
```

📌 Fourth: Printing the Result

```
print("Mean:", mean)
```

Output:

```
Mean: 30.0
```

Important Note:

- The result is of type **float**, even if the value is a whole number.

B. Maximum and Minimum Values (Max & Min)

- **Maximum (Max):** the largest value in the data set.
- **Minimum (Min):** the smallest value in the data set.

Example:

```
maximum = np.max(data)
minimum = np.min(data)
print("Maximum value:", maximum)
print("Minimum value:", minimum)
```

📂 Types of Data That Can Be Analyzed

1. **Numerical Data:** integers (age) or decimals (price).
2. **Text Data:** such as customer reviews, analyzed using NLP techniques.
3. **Date and Time Data:** purchase dates or event times.

📅 Working with Dates Using Pandas

We use pd.to_datetime() to convert text into real date objects.

Example:

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

🔍 Code Explanation

Importing Pandas

```
import pandas as pd
```

- pd is a shortcut for the Pandas library.

Creating a List of Dates

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

- Dates are written as text using the format: **YYYY-MM-DD**

Converting Text to DateTime

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

- Converts text dates into real DateTime objects.
- Allows:
  - Extracting day, month, and year
  - Calculating time differences
  - Filtering by date

Printing the Result

```
print(date_series)
```

Expected Output:

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

❓ Why Do We Use pd.to_datetime()?

Because it allows us to:

- Calculate time differences between dates
- Extract date parts (day, month, year)
- Group data by date
- Validate date formats

⭐ Important Note

Data analysis helps extract insights and make better decisions.

Python is an ideal language for data analysis because of:

- Its simplicity
- Its specialized libraries like **Pandas** and **NumPy**

Model (1)

A) True or False (8)

1. Data analysis helps in making fact-based decisions. ( )
2. Python is difficult to learn for beginners. ( )
3. NumPy is used for mathematical calculations. ( )
4. Pandas is used for data cleaning. ( )
5. The mean is the largest value in data. ( )
6. The result of np.mean() is usually a float. ( )
7. Dates cannot be analyzed in Python. ( )
8. pd.to_datetime() converts text to dates. ( )

B) Choose the correct answer (7)

1. The library used for averages is:
   (a) Pandas (b) NumPy (c) Seaborn (d) Matplotlib
2. Mean equals:
   (a) Max ÷ Min (b) Sum ÷ Count (c) Count ÷ Sum (d) Max + Min
3. Which data type represents age?
   (a) Text (b) Numerical (c) Date (d) Image
4. np.max() returns the:
   (a) Smallest value (b) Average (c) Largest value (d) Count
5. pd is a shortcut for:
   (a) NumPy (b) Pandas (c) Python (d) Data
6. Date format YYYY-MM-DD represents:
   (a) Day-Month-Year (b) Year-Month-Day
   (c) Month-Day-Year (d) Random
7. Data visualization means:
   (a) Cleaning data (b) Drawing charts
   (c) Deleting data (d) Encrypting data

Model (2)

A) True or False (8)

1. Python supports AI and machine learning. ( )
2. Lists must be ordered to calculate the mean. ( )
3. Matplotlib is used for charts. ( )
4. Mean can be calculated manually. ( )
5. Text data cannot be analyzed. ( )
6. NumPy uses ready-made functions. ( )
7. DateTime data helps in time analysis. ( )
8. Pandas has no role in data analysis. ( )

B) Choose the correct answer (7)

1. Which library handles dates?
   (a) NumPy (b) Pandas (c) Seaborn (d) Math
2. The smallest value is called:
   (a) Max (b) Mean (c) Min (d) Sum
3. AI compatibility is a feature of:
   (a) Java (b) Python (c) HTML (d) CSS
4. sum(data) returns the:
   (a) Count (b) Average (c) Total (d) Max
5. Customer reviews are:
   (a) Numerical data (b) Text data (c) Date data (d) Image data
6. to_datetime() is used to:
   (a) Delete dates (b) Convert text to dates
   (c) Draw charts (d) Count values
7. Data analysis extracts:
   (a) Errors (b) Games (c) Insights (d) Viruses

Model (3)

A) True or False (8)

1. Python syntax is similar to English. ( )
2. Mean is always an integer. ( )
3. NumPy is imported using np. ( )
4. DateTime objects allow time calculations. ( )
5. Data analysis is useless without Python. ( )
6. Pandas is powerful for handling data. ( )
7. Min represents the lowest value. ( )
8. Visualization helps understand data. ( )

B) Choose the correct answer (7)

1. Which is NOT a Python library?
   (a) NumPy (b) Pandas (c) Seaborn (d) Excel
2. Mean is calculated using:
   (a) np.mean() (b) np.max() (c) np.min() (d) len()
3. Which data uses NLP?
   (a) Numbers (b) Images (c) Text (d) Dates
4. Date data example:
   (a) Price (b) Age (c) Purchase date (d) Name
5. The output of mean(10,20,30) is:
   (a) 20 (b) 30 (c) 10 (d) 15
6. Pandas shortcut is:
   (a) np (b) pd (c) py (d) ds
7. Data analysis supports:
   (a) Guessing (b) Random decisions
   (c) Fact-based decisions (d) Ignoring data

Model (4)

A) True or False (8)

1. Data can be numbers, text, or dates. ( )
2. NumPy cannot calculate max values. ( )
3. Python is widely used in data science. ( )
4. Mean equals total divided by count. ( )
5. DateTime data cannot be filtered. ( )
6. Pandas helps handle time data. ( )
7. Float numbers contain decimals. ( )
8. Python has strong community support. ( )

B) Choose the correct answer (7)

1. Which function finds the minimum value?
   (a) np.mean() (b) np.min() (c) np.max() (d) sum()
2. The result type of mean is usually:
   (a) int (b) str (c) float (d) bool
3. Charts are created using:
   (a) NumPy (b) Pandas (c) Matplotlib (d) Math
4. Which is numerical data?
   (a) Comment (b) Name (c) Age (d) Date
5. Python libraries make data analysis:
   (a) Harder (b) Slower (c) Easier (d) Impossible
6. Dates written as text are called:
   (a) Numbers (b) Strings (c) Floats (d) Lists
7. Data analysis goal is to:
   (a) Hide information (b) Extract useful information
   (c) Delete data (d) Encrypt data

Unit Two

Lesson One: Practical Application on Data Analysis from an Excel File

Operating Environment Requirements

Before starting, we need to install the following Python libraries:

Library	Installation Command (Terminal)	Library Function
pandas	pip install pandas	For data analysis and reading Excel files
matplotlib	pip install matplotlib	For creating charts and visual graphs

Note:

An Excel file named **grades.xlsx** must be located in the same folder as the Python program for the code to work correctly.

Excel File Contents

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

First: Loading and Displaying the Data

Use the following code to start:

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

Simple Code Explanation:

- import pandas as pd : imports the library responsible for tables and data handling.
- pd.read_excel() : opens the Excel file and stores it in a variable called df.
- df.head() : displays only the first 5 rows to preview the data.

Second: Basic Data Analysis

Now we want to extract useful statistics for **Math, Science, and English** grades:

```
grades = df[['Math', 'Science', 'English']]
print("Average")
print(grades.mean().to_dict())
print("Maximum value")
print(grades.max().to_dict())
print("Number of successful students")
print((grades > 13).sum().to_dict())
```

Tool Explanation:

- grades.mean() : calculates the average (sum ÷ number of students).
- grades.max() : finds the highest score in each subject.
- (grades > 13).sum() : counts how many students scored more than 13 (passing grade).

Third: Data Visualization

To convert numbers into easy-to-understand charts:

```
import matplotlib.pyplot as plt
# Bar chart for subject averages
grades.mean().plot(kind='bar')
plt.show()
# Pie chart for subject averages
grades.mean().plot(kind='pie')
plt.show()
```

What Do These Commands Mean?

- kind='bar' : draws vertical bars to compare subjects.
- kind='pie' : draws a circular chart showing each subject's share.
- plt.show() : displays the chart on the screen.

Fourth: Interpreting Results (Correlation)

Is there a relationship between students' performance in Math and Science?

print(df.corr())

Result Meaning:

- Value close to **1** → strong positive relationship.
- Value close to **0** → no clear relationship.
- Value close to **-1** → inverse relationship.

Model (1)

A) True or False (8)

1. Pandas is used to read Excel files. ( )
2. The Excel file must be in the same folder as the program. ( )
3. df.head() shows all rows in the file. ( )
4. grades.mean() calculates averages. ( )
5. Matplotlib is used for data visualization. ( )
6. A bar chart compares values visually. ( )
7. Correlation measures relationships between data. ( )
8. grades.max() finds the lowest value. ( )

B) Choose the correct answer (7)

1. The command used to read Excel files is:
   (a) pd.read_csv (b) pd.read_excel (c) pd.open (d) pd.load
2. The passing grade is:
   (a) >10 (b) >11 (c) >12 (d) >13
3. Which library draws charts?
   (a) NumPy (b) Pandas (c) Matplotlib (d) Math
4. df represents:
   (a) A list (b) A DataFrame (c) A loop (d) A chart
5. grades.max() returns:
   (a) Average (b) Minimum (c) Maximum (d) Count
6. kind='pie' creates:
   (a) Bars (b) Lines (c) Circle chart (d) Table
7. Correlation value near 1 means:
   (a) No relation (b) Weak relation (c) Strong relation (d) Random data

Model (2)

A) True or False (8)

1. Matplotlib must be installed before use. ( )
2. pd is a shortcut for Pandas. ( )
3. grades > 13 checks for successful students. ( )
4. Pie charts show comparisons clearly. ( )
5. df.corr() checks relationships between subjects. ( )
6. Excel data cannot be analyzed in Python. ( )
7. grades.mean() works on numeric columns. ( )
8. Bar charts use kind='bar'. ( )

B) Choose the correct answer (7)

1. Which file name is required?
   (a) data.xlsx (b) marks.xlsx (c) grades.xlsx (d) sheet.xlsx
2. The highest grade is found using:
   (a) mean (b) max (c) min (d) sum
3. DataFrame is created by:
   (a) read_excel (b) show (c) plot (d) corr
4. Correlation close to 0 means:
   (a) Strong relation (b) Weak relation
   (c) Inverse relation (d) Perfect relation
5. Which subject is NOT analyzed?
   (a) Math (b) Science (c) English (d) History
6. grades is an example of:
   (a) Dictionary (b) DataFrame (c) Loop (d) Function
7. Visualization helps to:
   (a) Hide data (b) Delete data (c) Understand data (d) Encrypt data

Model (3)

A) True or False (8)

1. Python can analyze Excel files. ( )
2. df.head() displays sample data. ( )
3. grades.mean() calculates the sum only. ( )
4. Matplotlib uses plt.show() to display charts. ( )
5. Correlation can be positive or negative. ( )
6. Pie charts use kind='bar'. ( )
7. Pandas handles tabular data. ( )
8. grades.max() returns highest scores. ( )

B) Choose the correct answer (7)

1. Which library handles tables?
   (a) Pandas (b) Matplotlib (c) NumPy (d) OS
2. Successful students scored:
   (a) <13 (b) =13 (c) >13 (d) <10
3. df.corr() measures:
   (a) Average (b) Maximum (c) Relationship (d) Count
4. plt.show() is used to:
   (a) Save file (b) Display chart (c) Delete data (d) Load Excel
5. grades.mean() returns:
   (a) Numbers (b) Charts (c) Averages (d) Text
6. Which is a visual chart?
   (a) Pie (b) Loop (c) List (d) Variable
7. Excel file contains:
   (a) Code (b) Images (c) Grades (d) Videos

Model (4)

A) True or False (8)

1. Pandas reads Excel files. ( )
2. grades is a subset of df. ( )
3. Bar charts compare subjects. ( )
4. Correlation value -1 means inverse relation. ( )
5. Matplotlib is optional for visualization. ( )
6. df.head() shows last rows only. ( )
7. grades.max() finds highest values. ( )
8. Python supports data analysis. ( )

B) Choose the correct answer (7)

1. Which command installs Pandas?

   (a) install pandas (b) pip pandas (c) pip install pandas (d) get pandas

2. The function that calculates average is:

   (a) mean (b) max (c) min (d) corr

3. Which chart shows proportions?

   (a) Bar (b) Pie (c) Line (d) Table

4. grades > 13 checks:

   (a) Failed students (b) All students
   (c) Successful students (d) Absent students

5. df is short for:

   (a) Data File (b) Data Frame (c) Data Form (d) Data Field

6. Correlation close to -1 means:

   (a) Strong positive (b) No relation (c) Strong negative (d) Random

7. Data visualization purpose is to:

   (a) Confuse users (b) Simplify understanding
   (c) Delete data (d) Hide results

⚖️ Unit Two

📕 Lesson Two: Conditional Statements in Python

🧠 Concept of Conditional Statements

In Python, **conditional statements** are used to make logical decisions based on whether a certain condition is true.

They tell the program to execute a specific part of the code **only if the condition is met**.

📝 General Syntax of Conditional Statements

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

🎛️ Types of Conditional Statements in Python

1️⃣ Simple if Statement

Executes the code **only if the condition is true**.

```
age = 18
if age >= 18:
    print("You are allowed to enter")
```

2️⃣ if ... else Statement

Executes **one of the two branches**: the first if the condition is true, the second if it is false.

```
age = 16
if age >= 18:
    print("You are allowed to enter")
else:
    print("Sorry, you cannot enter")
```

3 if ... elif ... else Statement

Used to test **multiple consecutive conditions**.

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

🛠 Practical Example

A code that asks the user to input a number and determines its type:

```
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")
```

Model (1)

A) True or False (8)

1. Conditional statements decide which code to execute. ( )
2. if executes code only if the condition is false. ( )
3. else runs when the if condition is not met. ( )
4. elif allows testing multiple conditions. ( )
5. Python uses indentation to define code blocks. ( )
6. input() is used to get user input. ( )
7. Conditional statements cannot handle numbers. ( )
8. if number > 0: checks if the number is positive. ( )

B) Choose the correct answer (7)

1. What executes if the condition in if is false?

   (a) if (b) elif (c) else (d) input

2. Which statement tests multiple conditions?

   (a) if ... else (b) if ... elif ... else (c) input (d) print

3. int(input()) does what?

   (a) Prints a number (b) Converts input to integer
   (c) Creates a list (d) Checks condition

4. If mark = 80, which branch runs?

   (a) Excellent (b) Very Good (c) Good (d) Fail

5. The : symbol in Python:

   (a) Ends a statement (b) Starts a block
   (c) Prints text (d) Comments code

6. What is the output if number = 0?

   (a) Positive (b) Negative (c) Zero (d) Error

7. Conditional statements are used to:

   (a) Repeat code (b) Make decisions (c) Store data (d) Draw charts

Model (2)

A) True or False (8)

1. if runs code only when the condition is true. ( )
2. elif comes before if. ( )
3. else runs if no previous condition is true. ( )
4. Python ignores indentation in conditional statements. ( )
5. You can have multiple elif statements. ( )
6. input() returns a string by default. ( )
7. print() displays output. ( )
8. number < 0 checks for negative numbers. ( )

B) Choose the correct answer (7)

1. Which is correct syntax?
   (a) if condition: (b) if condition {} (c) if condition () (d) if condition ;
2. To check if a number is negative:
   (a) number > 0 (b) number < 0 (c) number = 0 (d) number >= 0
3. If age = 16, which prints?
   (a) You can enter (b) Sorry, you cannot enter
   (c) Age is valid (d) Input required
4. How do you test several marks?
   (a) if only (b) if ... else (c) if ... elif ... else (d) input
5. What data type does int(input()) return?
   (a) String (b) Integer (c) List (d) Boolean
6. Which statement handles the default case?
   (a) if (b) elif (c) else (d) input
7. Indentation in Python is:
   (a) Optional (b) Required (c) Random (d) Forbidden

Model (3)

A) True or False (8)

1. if statement is mandatory for all code. ( )
2. elif is short for "else if". ( )
3. else can appear without if. ( )
4. Conditional statements guide code execution. ( )
5. Python uses : to start code blocks. ( )
6. You can nest if statements inside each other. ( )
7. int(input()) converts user input to integer. ( )
8. if number == 0: checks for zero. ( )

B) Choose the correct answer (7)

1. Which branch runs when all conditions fail?
   (a) if (b) elif (c) else (d) input
2. Which statement allows testing multiple conditions?
   (a) if ... else (b) if ... elif ... else (c) input (d) print
3. If mark = 95, which prints?
   (a) Excellent (b) Very Good (c) Good (d) Fail
4. print() is used to:
   (a) Input data (b) Display output
   (c) Run condition (d) Assign variables
5. In if number > 0:, the > symbol means:
   (a) Less than (b) Greater than (c) Equals (d) Not equals
6. Python conditional blocks use:
   (a) Curly braces (b) Parentheses (c) Indentation (d) Semicolons
7. The default branch in multiple conditions is:
   (a) if (b) elif (c) else (d) input

Model (4)

A) True or False (8)

1. if checks a condition. ( )
2. else executes when if fails. ( )
3. elif allows multiple checks. ( )
4. Python ignores colons : in syntax. ( )
5. Indentation defines code blocks. ( )
6. number > 0 is a valid condition. ( )
7. Conditional statements cannot take input from users. ( )
8. print() outputs results. ( )

B) Choose the correct answer (7)

1. To take input from user:
   (a) input() (b) print() (c) int() (d) if
2. To convert input to integer:
   (a) int(input()) (b) str(input()) (c) float(input()) (d) list(input())
3. If age >= 18, which prints?
   (a) Access denied (b) You are allowed (c) Invalid (d) None
4. Which is used to test multiple conditions?
   (a) if only (b) if ... else (c) if ... elif ... else (d) print
5. else runs when:
   (a) Condition is True (b) Condition is False
   (c) Condition is None (d) All
6. Colon : in Python marks:
   (a) Comment (b) Start of block (c) Variable (d) End of line
7. Nested conditions are:
   (a) Not allowed (b) Allowed (c) Optional (d) Forbidden

🔄 Unit Two

📕 Lesson Three: Loops and Functions

🔁 Part One: Loops

Loops help you **execute a specific command multiple times** without rewriting it repeatedly.

1️⃣ for Loop — For a known number of repetitions

Used when you **know in advance how many times** you want to repeat the code.

General Syntax:

```
for item in sequence:
    # code to repeat
    print(item)  # print each element
```

Example:

```
for i in range(5):
    print("Hello!")  # Prints "Hello!" 5 times
```

💡 **Note:** range(5) starts counting from 0 and stops before 5 (0, 1, 2, 3, 4).

2️⃣ while Loop — Repeating based on a condition

Continues running **as long as the condition is true**, and stops immediately when it becomes false.

```
x = 0
while x < 3:
    print("I am learning")
    x += 1  # Increment x to avoid an infinite loop
```

⚠️ **Warning:** Forgetting to increment x inside the loop causes an **infinite loop** that never stops!

🔁 Examples of for Loops

Example 1: Printing numbers 1 to 5

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

Notes:

- range(1,6) means start at 1 and end before 6.
- Output: 1, 2, 3, 4, 5

Example 2: Summing numbers in a list

```
numbers = [10, 20, 30]
sum = 0
for n in numbers:
    sum += n
print("Sum =", sum)  # Output: 60
```

Notes:

- n takes the value of each element in the list in order (10 → 20 → 30).
- Each value is added to sum.

⭐ **Remember:**

- ✅ Use for → when the number of repetitions is known.
- ✅ Use while → when repetition depends on a condition.

🎁 Part Two: Functions

Imagine a function as a **small machine or template** containing code for a specific task.

Instead of writing the code 10 times, you write it **once** inside a function and **call it** whenever you need.

🔹 What is a Function?

- **Purpose:** Execute a specific task (e.g., sum two numbers, print a message).
- **Benefit:** Makes code organized, readable, and easier to modify.

🏭 How to Create a Function

```
def greet():  # Define the function
    print("Hello! I am a beginner function")
greet()  # Call the function
```

Code Explanation:

- def → keyword to define a function.
- greet → function name, can be any descriptive name.
- () → parentheses for passing input values (parameters).
- : → indicates the start of the function body.
- Indentation → required for all code inside the function.

Output:

```
Hello! I am a beginner function
```

⚡ **Note:** A function only works when called; defining it alone does not execute code.

🔹 Function with Parameters (Input)

```
def add(a, b):  # a and b are inputs
    result = a + b
    print(f"The sum is: {result}")
add(3, 5)  # Pass numbers 3 and 5 to the function
```

Output:

```
The sum is: 8
```

Explanation:

- a, b → values passed to the function.
- result → stores the sum.
- f-string → displays text with variable values: f"The sum is: {result}".

🔹 Function with Return Value

```
def multiply(x, y):
    return x * y  # Returns the result instead of printing
product = multiply(4, 6)  # Save the result in a variable
print("The product is:", product)
```

Output:

```
The product is: 24
```

Difference Between print and return:

- print → only displays the value; cannot use in further calculations.
- return → gives back the value; can store in a variable and use it later.

⭐ Remember:

Functions make your programs **faster, cleaner, and easier to modify**.

Model (1)

A) True or False (8)

1. Loops help repeat code multiple times. ( )
2. for loop is used when repetition depends on a condition. ( )
3. while loop stops when the condition becomes false. ( )
4. Forgetting to increment a variable in while causes an infinite loop. ( )
5. Functions execute automatically without being called. ( )
6. def is used to define a function. ( )
7. Parameters are inputs to a function. ( )
8. return allows storing a value for later use. ( )

B) Multiple Choice (7)

1. Which loop is used when the number of repetitions is known?
   (a) for (b) while (c) if (d) def
2. Which statement continues as long as the condition is true?
   (a) for (b) while (c) function (d) print
3. sum += n inside a loop does what?
   (a) multiplies (b) adds to total (c) subtracts (d) prints
4. How do you call a function?
   (a) def (b) print (c) greet() (d) return
5. f"The sum is: {result}" is an example of:
   (a) Variable (b) f-string (c) Loop (d) Function
6. return differs from print because:
   (a) only displays (b) returns value (c) ignores code (d) ends program
7. Infinite loops occur if:
   (a) for used (b) while never ends (c) function called (d) def used

Model (2)

A) True or False (8)

1. for i in range(5) prints "Hello!" 5 times. ( )
2. while x < 3 stops when x >= 3. ( )
3. x += 1 prevents infinite loops. ( )
4. Function body must be indented. ( )
5. Parameters cannot be changed per function call. ( )
6. print() displays output. ( )
7. return allows the value to be stored. ( )
8. A function runs automatically after definition. ( )

B) Multiple Choice (7)

1. Which defines a function?
   (a) def (b) while (c) for (d) if
2. How to pass numbers to a function?
   (a) greet() (b) add(3,5) (c) print() (d) return
3. How do you sum list elements in Python?
   (a) for loop (b) while loop (c) if statement (d) def
4. Which returns a value from function?
   (a) print (b) return (c) input (d) f-string
5. while x < 5: means:
   (a) loop forever (b) repeat until x < 5 is false
   (c) define x (d) call function
6. sum = 0 inside a loop does what?
   (a) stores total (b) prints (c) defines function (d) ends loop
7. multiply(x,y) returns:
   (a) x+y (b) x*y (c) x/y (d) prints value

Model (3)

A) True or False (8)

1. Loops avoid rewriting the same code. ( )
2. for loop iterates based on condition. ( )
3. while needs a condition. ( )
4. Forgetting increment in while creates infinite loop. ( )
5. Functions are called using parentheses (). ( )
6. def keyword defines a function. ( )
7. return allows saving a result. ( )
8. print() stores a result in a variable. ( )

B) Multiple Choice (7)

1. To print each item in a list:
   (a) for (b) while (c) def (d) return
2. To stop while loop:
   (a) condition becomes false (b) def (c) return (d) print
3. x += 1 is used for:
   (a) addition (b) subtraction (c) increment (d) return
4. Function with no input:
   (a) greet() (b) add(a,b) (c) multiply(x,y) (d) return
5. sum += n inside for does:
   (a) subtract (b) add (c) multiply (d) return
6. def multiply(x,y): return x*y → product stored in:
   (a) variable (b) loop (c) print (d) list
7. Indentation defines:
   (a) block of code (b) loop (c) variable (d) parameter

Model (4)

A) True or False (8)

1. for loop runs for a known number of iterations. ( )
2. while loop depends on a condition. ( )
3. Functions require calling to execute. ( )
4. Parameters are inputs for functions. ( )
5. return lets you reuse the result. ( )
6. print() can only display, not store. ( )
7. Loops save time and reduce code repetition. ( )
8. Forgetting increment in while causes infinite loop. ( )

B) Multiple Choice (7)

1. Which is correct function call?
   (a) greet() (b) def greet (c) while greet (d) for greet
2. What does x += 1 do?
   (a) Decreases (b) Increments (c) Multiplies (d) Prints
3. sum = 0 is used to:
   (a) store total (b) print (c) define function (d) return
4. Which prints output?
   (a) print() (b) return (c) def (d) input
5. Loop through list items:
   (a) for (b) while (c) def (d) return
6. Function that returns value:
   (a) multiply(x,y) (b) greet() (c) print() (d) input
7. Infinite loop occurs when:
   (a) while condition never false (b) for loop ends
   (c) function returns (d) print()

Unit Two

Lesson Four: Data Structures (Collections)

What are Data Structures?

Data structures are **ways to organize data in a program** to make it easier to handle.

Real-life examples:

- **List** → like a shopping list, you can add or remove items.
- **Tuple** → like a school timetable, fixed and unchangeable.
- **Dictionary** → like a language dictionary, a key has a corresponding value.

1 Lists

A **list** is mutable (can be changed: add, remove, sort) and uses square brackets [].

Main operations:

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

Example:

```
grades = [85, 90, 78, 92]
average = sum(grades) / len(grades)
print("Average is:", average)
```

2 Tuples

A **tuple** is immutable (cannot be changed) and uses parentheses (). Used for data that should never change, like days of the week or GPS coordinates.

Example:

```
days = ("Saturday", "Sunday", "Monday", "Tuesday")
print("The third day is:", days[2])  # Indexing starts at 0
```

3 Dictionaries

A **dictionary** stores data in **key: value pairs** using curly braces {}.

Features:

- Fast access using the key.
- Keys must be unique.
- Perfect for organized data like student info.

Example:

```
student = {"name": "Ali", "age": 15, "grade": "A"}
print(student["name"])  # Output: Ali
```

Exercise (1): Working with Dictionaries

```
# Create a student dictionary
student = {"name": "Ali", "age": 15, "grade": "A"}
# Print student name
print(student["name"])
# Modify age
student["age"] = 16
# Add new city
student["city"] = "Cairo"
# Print full dictionary
print(student)
```

Expected Output:

```
{'name': 'Ali', 'age': 16, 'grade': 'A', 'city': 'Cairo'}
```

Important Notes:

- Dictionary uses key: value.
- Access values by their key.
- Values can be modified easily.
- New items can be added without creating a new dictionary.

✍ Exercise (1): Count Students Older than 15

```
ages = [14, 16, 15, 17, 14, 16]  # List of student ages
count = 0  # Counter
for age in ages:  # Loop over all ages
    if age > 15:  # Check condition
        count += 1
print("Number of students older than 15:", count)
```

Expected Output:

```
Number of students older than 15: 3
```

Notes:

- for loops over each element.
- age takes each value in order.
- if checks the condition.
- count stores the total.

✍ Exercise (2): Loop Over Names

```
names = ["Mohamed", "Mona", "Haba", "Asmaa"]  # List of names
for name in names:
    print(name)
```

Expected Output:

Mohamed
Mona
Haba
Asmaa

Remember:

- ✅ Use for to iterate over a list.
- ✅ Variable name inside the loop can be any valid name.
- ✅ Each loop iteration represents one element of the list.

Model 1

True/False (8 questions)

1. The pandas library is used to read Excel files. ( )
2. The file grades.xlsx must be in the same folder as the program. ( )
3. df.head() prints the last 5 rows of the data. ( )
4. The command grades.mean() calculates the average of each column. ( )
5. grades.max() shows the highest value in each subject. ( )
6. (grades > 13).sum() counts the number of students with grades greater than 13. ( )
7. plt.show() is used to display charts on the screen. ( )
8. df.corr() checks the relationship between columns. ( )

Fill in the blanks (8 questions)

1. The library used to handle Excel files in Python is _____.

   a) pandas b) matplotlib c) numpy d) seaborn

2. To create bar charts, we use _____.

   a) matplotlib b) pandas c) numpy d) seaborn

3. grades.max() gives the _____ grade in each subject.

   a) highest b) lowest c) average d) total

4. (grades > 13).sum() counts students who are _____.

   a) successful b) failing c) absent d) late

5. The method df.head() shows the first _____ rows of data.

   a) 5 b) 10 c) 3 d) all

6. grades.mean() calculates the _____ grade for each column.

   a) average b) maximum c) minimum d) sum

7. The command to check correlation between columns is _____.

   a) df.corr() b) df.mean() c) df.max() d) df.sum()

Model 2

True/False (8 questions)

1. The if statement executes code only if a condition is true. ( )
2. else is executed when the if condition is false. ( )
3. elif is used to check multiple conditions sequentially. ( )
4. A conditional statement cannot have more than one elif. ( )
5. if age >= 18: checks if age is at least 18. ( )
6. if number > 0: checks if the number is negative. ( )
7. else runs code when all previous conditions are false. ( )
8. Conditional statements are only used in loops. ( )

Fill in the blanks (8 questions)

1. The Python statement to execute code if a condition is true is _____. a) if b) else c) elif d) for
2. To provide an alternative when the condition is false, we use _____. a) else b) if c) elif d) while
3. To test multiple conditions sequentially, we use _____.
   a) elif b) if c) else d) def
4. The if statement checks if a condition is _____.
   a) true b) false c) numeric d) string
5. elif mark >= 75: tests if the mark is _____.
   a) between 75 and 89 b) less than 75 c) above 90 d) zero
6. Conditional statements control the _____ flow of a program.
   a) logical b) numerical c) text d) file
7. If none of the conditions are true, the _____ block executes.
   a) else b) if c) elif d) for
8. if number > 0: checks if a number is _____.
   a) positive b) negative c) zero d) imaginary

Model 3

True/False (8 questions)

1. A for loop is used when the number of iterations is known. ( )
2. A while loop continues as long as a condition is true. ( )
3. Forgetting to increment the counter in a while loop can cause an infinite loop. ( )
4. range(1, 6) generates numbers 1 through 5. ( )
5. Functions make code more organized and reusable. ( )
6. return in a function allows storing the result in a variable. ( )
7. print displays the result but cannot store it in a variable. ( )
8. Functions do not need to be called to execute. ( )

Fill in the blanks (8 questions)

1. A loop used when the number of repetitions is known is called _____. a) for b) while c) if d) def
2. A loop that depends on a condition is a _____ loop.
   a) while b) for c) if d) def
3. Forgetting to increment a counter in a while loop may cause a _____. a) infinite loop b) error c) break d) skip
4. A function is defined using the keyword _____.
   a) def b) func c) function d) loop
5. To pass values into a function, we use _____.
   a) parameters b) return c) print d) variables
6. The return statement allows a function to _____.
   a) output a value b) print c) stop d) loop
7. print() only _____ the result.
   a) displays b) returns c) stores d) saves
8. Calling a function executes the _____ inside it.
   a) code b) loop c) print d) variable

Model 4

True/False (8 questions)

1. Lists are mutable collections. ( )
2. Tuples are immutable collections. ( )
3. Dictionaries store data as key-value pairs. ( )
4. Dictionary keys must be unique. ( )
5. grades.append(95) adds a grade to the list. ( )
6. grades.sort() arranges the list in ascending order. ( )
7. student["age"] = 16 modifies a value in a dictionary. ( )
8. Tuples can be modified after creation. ( )

Fill in the blanks (8 questions)

1. A collection that can be modified is called a _____.
   a) list b) tuple c) dictionary d) set
2. A collection that cannot be changed is a _____.
   a) tuple b) list c) dictionary d) set
3. Dictionaries store data in _____ pairs.
   a) key-value b) item-index c) key-item d) value-index
4. To add an item to a list, we use _____.
   a) append b) remove c) sort d) insert
5. To arrange a list in ascending order, we use _____.
   a) sort b) append c) pop d) insert
6. To access a value in a dictionary, we use _____.
   a) the key b) the index c) the value d) a number
7. To loop through a list, we use a _____ loop.
   a) for b) while c) if d) def
8. To count students older than 15, we use a loop with a _____ condition. a) if b) for c) while d) def

Lesson 5: Introduction to Cryptography with Python

What is Cryptography?

Cryptography is the art of transforming information from its original readable form (Plaintext) into an unreadable form (Ciphertext), so that only someone with the secret key can read it.

Correct and Incorrect Uses of Cryptography

Type	Examples
Correct (Secure)	Protecting WhatsApp messages, securing passwords, and HTTPS websites.
Incorrect (Malicious)	Ransomware encrypting files to demand money.

Encryption Methods

1. **Simple encryption**: Uses fixed rules, e.g., shifting letters (Caesar Cipher).
2. **Complex encryption**: Uses mathematical formulas and long keys, e.g., AES used in banks.

Python Tools: ord() and chr()

Computers understand numbers, not letters.

Function	Purpose	Example
ord()	Converts a character to its numeric Unicode code	ord('A') ➜ 65
chr()	Converts a numeric code to its character	chr(65) ➜ 'A'

Examples

1. Get the Unicode code of a letter

```
print(ord('S'))  # Output: 83
```

2. Get the letter for a numeric code

```
print(chr(72))  # Output: H
```

3. Character Shift

Shift D by 1:

```
code_D = ord('D')
shifted_code = code_D + 1
print(chr(shifted_code))  # Output: E
```

Caesar Cipher (Shift Cipher)

Encryption

encrypted_code = ord(char) + key
encrypted_char = chr(encrypted_code)

Decryption

original_code = ord(encrypted_char) - key
original_char = chr(original_code)

Example

```
char = 'S'
key = 2
encrypted = chr(ord(char) + key)
print("Encrypted:", encrypted)
decrypted = chr(ord(encrypted) - key)
print("Decrypted:", decrypted)
# Output: Encrypted: U, Decrypted: S
```

Summary

Concept	Explanation
Cryptography	Transform plaintext into ciphertext using a key
ord()	Converts letter to numeric Unicode
chr()	Converts numeric code to letter
Shift Encryption	Add key to original letter code
Decryption	Subtract key from encrypted letter code

Notes

- Examples use **capital letters**.
- The **same key** must be used for encryption and decryption.
- This method is **educational only** and not secure for real use.

Model 1

True/False (8 questions)

1. Cryptography changes readable text into unreadable text. ( )
2. Only someone with the secret key can read the ciphertext. ( )
3. Caesar Cipher is an example of complex encryption. ( )
4. ord() converts a letter to its numeric code. ( )
5. chr() converts a number to a letter. ( )
6. Using different keys for encryption and decryption works correctly. ()
7. Encryption with a shift key adds the key to the letter code. ( )
8. Decryption subtracts the key from the encrypted letter code. ( )

Fill in the blanks (8 questions)

1. The Python function used to convert a letter to a number is _____.
   a) ord b) chr c) int d) str
2. To convert a number back to a letter, we use _____.
   a) chr b) ord c) print d) input
3. A simple encryption method that shifts letters is called _____.
   a) Caesar Cipher b) AES c) RSA d) MD5
4. The result of encryption is called _____.
   a) ciphertext b) plaintext c) key d) code
5. To decrypt a message, we _____ the key from the letter code.
   a) subtract b) add c) multiply d) divide
6. The key used for encryption must be the _____ for decryption.
   a) same b) different c) larger d) smaller
7. This encryption method is _____ for real security.
   a) educational b) safe c) unbreakable d) advanced
8. Capital letters in examples are important because their numeric codes are _____ from lowercase.
   a) different b) same c) random d) negative

Model 2

True/False (8 questions)

1. Cryptography can protect passwords. ( )
2. Ransomware uses cryptography maliciously. ( )
3. ord('A') outputs 65. ( )
4. chr(65) outputs 'B'. ( )
5. Adding the key to the letter code encrypts the letter. ( )
6. Subtracting the key from the letter code decrypts it. ( )
7. Complex encryption is used in banks and companies. ( )
8. Shift encryption is secure for sensitive financial data. ( )

Fill in the blanks (8 questions)

1. The numeric representation of letters in Python uses the ____ table.
   a) Unicode b) ASCII c) HTML d) UTF-8
2. The letter 'D' shifted by 1 becomes _____.
   a) E b) F c) C d) D
3. The type of ciphertext produced by Caesar Cipher is _____.
   a) encrypted b) plaintext c) key d) number
4. To encrypt in Caesar Cipher, we _____ the key to the numeric code. a) add b) subtract c) multiply d) divide
5. To decrypt, we _____ the key from the encrypted code.
   a) subtract b) add c) divide d) multiply
6. Python functions ord() and chr() are examples of _____ tools.
   a) simple b) complex c) built-in d) external
7. The letter code changes when shifting because letters are represented by _____.
   a) numbers b) symbols c) text d) formulas

Model 3

True/False (8 questions)

1. Cryptography can be used correctly for secure communication. ( )
2. Ransomware encrypts files for malicious purposes. ( )
3. Caesar Cipher adds a fixed key to each letter's numeric code. ( )
4. Decryption in Caesar Cipher involves adding the key. ( )
5. ord('S') outputs 83. ( )
6. chr(72) outputs 'H'. ( )
7. Shift encryption example: 'D' becomes 'E' with key=1. ( )
8. This Caesar Cipher method is not secure for real-life use.

Fill in the blanks (8 questions)

1. The original readable text is called _____.
   a) plaintext b) ciphertext c) key d) code
2. The encrypted text is called _____.
   a) ciphertext b) plaintext c) code d) number
3. chr(65) returns the letter _____.
   a) A b) B c) C d) D
4. ord('H') returns the numeric code _____.
   a) 72 b) 65 c) 83 d) 75
5. The encryption key is added to the letter code to produce _____.
   a) encrypted letter b) original letter c) key d) number
6. To decrypt, the key is _____ from the code.
   a) subtracted b) added c) multiplied d) divided
7. This method of encryption is best for _____ learning.
   a) educational b) real c) secure d) advanced

Model 4

True/False (8 questions)

1. Only someone with the correct key can decrypt the message. ( )
2. Caesar Cipher is an example of simple encryption. ( )
3. ord() converts letters to numeric codes. ( )
4. chr() converts numeric codes to letters. ( )
5. The numeric code for 'D' plus 1 gives 'E'. ( )
6. Key value must match for encryption and decryption. ( )
7. Shift encryption adds key to encrypt and subtracts key to decrypt. ( )
8. This lesson uses lowercase letters for all examples. ( )

Fill in the blanks (8 questions)

1. A simple encryption method in Python is _____.
   a) Caesar Cipher b) AES c) RSA d) SHA
2. To convert letters to numbers, we use _____.
   a) ord b) chr c) int d) str
3. To convert numbers back to letters, we use _____.
   a) chr b) ord c) print d) input
4. Encryption adds a _____ to the original code.
   a) key b) number c) letter d) symbol
5. Decryption _____ the key from the encrypted code.
   a) subtracts b) adds c) multiplies d) divides
6. Encrypted text that cannot be read without a key is called _____.
   a) ciphertext b) plaintext c) code d) input
7. The output of ord('S') is _____.
   a) 83 b) 72 c) 65 d) 90
8. For correct decryption, we must use the _____ key.
   a) same b) different c) random d) new

Lesson 6: Cryptography with Python – Bitwise Operations

1. Basics: Bit-Level Operations

Think of a computer as a big box of tiny lights; each light is either **on (1)** or **off (0)**.

This is a **Bit**, the smallest storage unit.

Bitwise operations are rules for manipulating these 0s and 1s.

Advantages:

- **Speed**: Fastest way to do arithmetic and logical operations.
- **Foundation of encryption**: Strongest data protection algorithms use bitwise operations.

2. The Secret Star: XOR Operation

XOR (Exclusive OR) is represented in Python as ^ and works on the "difference rule":

Condition	Result
Bits are different (0 & 1)	1 (on)
Bits are the same (0 & 0 or 1 & 1)	0 (off)

Reversible property:

- Encrypt: Original message XOR secret key ➜ encrypted message
- Decrypt: Encrypted message XOR same secret key ➜ original message

✓ Same operation works for **encryption** and **decryption**.

3. How to Encrypt Characters Using XOR in Python

Python cannot apply bitwise operations directly on letters, so we:

1. Convert the character to its **Unicode number**.
2. Apply **XOR** with a secret key.
3. Convert the result back to a **character**.

Tools:

- ord() ➜ convert a character to a number
- chr() ➜ convert a number to a character

Secret Key Example:

secret_key = 10

Encryption Example (Letter A):

```
secret_key = 10
original_char = "A"
encrypted_char_num = ord(original_char) ^ secret_key
cipher_text = chr(encrypted_char_num)
print(f"Cipher: {cipher_text}")
```

Step-by-step explanation:

1. secret_key = 10
2. original_char = "A"
3. ord(original_char) ^ secret_key = convert 'A' to number, then XOR with key
4. chr(encrypted_char_num) = convert result back to letter
5. print(f"...") = display encrypted character

4. Key Concepts

Concept	Explanation
Bit	Smallest unit of storage: 0 (off) or 1 (on)
Bitwise operations	Math operations done directly on 0 and 1
XOR (^)	Result = 1 if values differ, 0 if the same
Secret key	Fixed number used for both encryption and decryption
Reversible property	Applying XOR twice with the same key restores the original message

5. Decryption Example

```
secret_key = 10
cipher_text = "K"  # encrypted letter
encrypted_char_num = ord(cipher_text)
original_char_num = encrypted_char_num ^ secret_key
decrypted_char = chr(original_char_num)
print(f"Decrypted: {decrypted_char}")
```

✓ Result: Original letter is successfully restored thanks to XOR's reversible property.

Model 1

True/False (8 questions)

1. A bit can be either 0 or 1. ( )
2. Bitwise operations are fast. ( )
3. XOR returns 1 if the bits are the same. ( )
4. XOR is reversible. ( )
5. The same key can be used for encryption and decryption. ( )
6. Python can directly apply XOR to letters without conversion. ( )
7. ord() converts letters to numbers. ( )
8. chr() converts numbers to letters. ( )

Fill in the blanks (8 questions)

1. The smallest storage unit in computing is called a _____.
   a) bit b) byte c) pixel d) code
2. XOR in Python is represented by _____.
   a) ^ b) & c) | d) %
3. Applying XOR twice with the same key _____ the original message. a) restores b) deletes c) encrypts d) changes
4. The function used to convert a letter to a number is _____.
   a) ord b) chr c) int d) str
5. The function used to convert a number to a letter is _____.
   a) chr b) ord c) print d) input
6. The secret key must be _____ for encryption and decryption.
   a) same b) different c) random d) new
7. Bitwise operations work on _____.
   a) 0 and 1 b) letters c) words d) strings
8. XOR returns 0 if the bits are _____. a) same b) different c) random d) negative

Model 2

True/False (8 questions)

1. Bitwise operations are the basis of strong encryption algorithms. ( )
2. A bit can store multiple letters at once. ( )
3. XOR returns 1 if the bits are different. ( )
4. The encrypted message can be decrypted using the same XOR operation and key. ( )
5. Python uses ord() and chr() for bitwise encryption on letters. ( )
6. The key can be changed for decryption independently of encryption. ( )
7. XOR encryption is suitable for learning. ( )
8. Bitwise operations are slower than normal arithmetic operations. ( )

Fill in the blanks (8 questions)

1. Bitwise operations are performed on _____.

   a) bits b) letters c) strings d) pixels

2. XOR stands for _____.

   a) Exclusive OR b) Inclusive OR c) AND d) NOT

3. Converting a letter to a numeric code uses the _____ function.

   a) ord b) chr c) int d) str

4. Converting a numeric code back to a letter uses the _____ function.

   a) chr b) ord c) print d) input

5. The secret number used in encryption is called a _____.

   a) key b) code c) password d) cipher

6. Applying XOR twice with the same key _____ the original data.

   a) restores b) deletes c) encrypts d) changes

7. A bit can be either _____.

   a) 0 or 1 b) 1 or 2 c) letter or number d) true or false

8. Bitwise XOR is performed using the symbol _____.

   a) ^ b) & c) | d) %

Model 3

True/False (8 questions)

1. XOR can encrypt and decrypt messages. ( )
2. The same secret key must be used for both encryption and decryption. ( )
3. ord('A') ^ key produces a number. ( )
4. chr() converts numbers to letters. ( )
5. Bitwise operations are performed on letters directly. ( )
6. XOR is not reversible. ( )
7. Bitwise operations are faster than normal arithmetic operations. ( )
8. XOR encryption is only suitable for learning, not real security. ( )

Fill in the blanks (8 questions)

1. A bit is represented by either _____.

   a) 0 or 1 b) letters c) numbers d) symbols

2. XOR is reversible, which means applying it twice with the same key .

   a) restores the original b) encrypts c) deletes d) changes

3. The encrypted letter is called _____.

   a) cipher b) plaintext c) key d) number

4. To decrypt a message, we apply XOR with the _____.

   a) same key b) new key c) different key d) random key

5. The function that converts letters to numbers is _____.

   a) ord b) chr c) int d) str

6. The function that converts numbers back to letters is _____.

   a) chr b) ord c) input d) print

7. The key used in examples is _____.

   a) 10 b) 5 c) 1 d) 100

Model 4

True/False (8 questions)

1. XOR works on bit-level operations. ( )
2. The secret key is fixed for both encryption and decryption. ( )
3. ord('A') converts the letter to a numeric code. ( )
4. chr() converts the numeric code back to a letter. ( )
5. Bitwise operations are suitable for fast encryption. ( )
6. XOR cannot encrypt letters without conversion.
7. The reversible property makes XOR ideal for simple encryption. ( )
8. XOR encryption in this lesson is safe for real-world security. ( )

Fill in the blanks (8 questions)

1. Bitwise operations manipulate _____.
   a) bits b) letters c) words d) pixels
2. XOR produces 1 if the bits are _____.
   a) different b) same c) negative d) random
3. XOR produces 0 if the bits are _____.
   a) same b) different c) negative d) random
4. The secret key in the examples is _____.
   a) 10 b) 5 c) 1 d) 100
5. To encrypt a letter, we first convert it using _____.
   a) ord b) chr c) int d) str
6. To decrypt a letter, we convert the number back using _____.
   a) chr b) ord c) input d) print
7. The reversible property allows _____ encryption and decryption using XOR. a) same key b) different key c) random key d) new key
8. XOR encryption is mainly used for _____.
   a) learning b) advanced security c) banking d) real-world protection