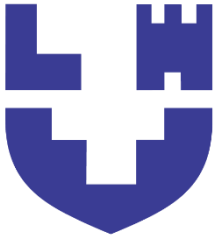
Міністерство освіти і науки України

Луцький національний технічний університет



Методичні вказівки до практичних занять та самостійної роботи для здобувачів першого (бакалаврського) рівня вищої освіти освітньої програми Штучний інтелект та аналіз масивів даних галузі знань F Інформаційні технології спеціальності F1 Прикладна математика денної та заочної форм навчання

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До друку

Голова вченої ради факультету цифрових, освітніх та соціальних технологій _____ Г.А. Герасимчук

Затверджено вченою радою факультету цифрових, освітніх та соціальних технологій ЛНТУ, протокол № _____ від «_____»_____2026 р.

Електронна копія друкованого видання передана для внесення в репозиторій ЛНТУ

Директор бібліотеки _____ Н. Поліщук

Рекомендовано до видання на засіданні кафедри іноземної філології та прикладної лінгвістики ЛНТУ, протокол № _____ від «_____»_____2026 р.

В.о. завідувача кафедри іноземної філології та прикладної лінгвістики ЛНТУ

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І -76 Методичні вказівки до практичних занять та самостійної роботи для здобувачів першого (бакалаврського) рівня вищої освіти ОСВІТНЬОЇ ПРОГРАМИ Штучний інтелект та аналіз масивів даних ГАЛУЗІ ЗНАНЬ F Інформаційні технології СПЕЦІАЛЬНОСТІ F1 Прикладна математика денної та заочної форм навчання / уклад. Ю.В. Літкович, Луцьк. ЛНТУ, 2026. 26 с.

SECTION 1. THE FOUNDATIONS OF SMART TECHNOLOGY AND DATA CONCEPTS

1.1. Reading and Comprehension (Texts)

Text 1. Computers: Smaller and Smarter The ability of tiny computing devices to control complex operations has transformed the way many tasks are performed, ranging from scientific research to producing consumer products. Not only is computing equipment getting smaller, it is getting more **sophisticated**. Today, computers in security systems result in safer environments, and computers in cars improve energy efficiency. These **smart machines** are designed to take over some of the basic tasks previously performed by people, making life easier and more pleasant. **Smart cards** store vital information such as health records and bank balances, while **smart houses** have built-in monitoring systems to operate lights, ovens, and windows. Ultimately, the integration of hardware and software allows people to spend more time being creative.

Text 2. Introduction to Data Mining Data mining is the process of filtering through large amounts of raw data for useful information that gives businesses a **competitive edge**. This information consists of meaningful patterns and trends that were previously unseen. The most popular tool used when mining is **artificial intelligence (AI)**. AI technologies attempt to work the way the human brain works by making intelligent guesses, learning by example, and using deductive reasoning. Popular AI methods in data mining include:

- **Neural networks:** Software that compares factors repeatedly until it finds emerging patterns, known as **rules**.
- **Clustering:** Dividing data into groups based on similar features when data isn't labeled.

- **Decision trees:** Separating data into subsets and analyzing them at multiple levels to find relationships.

1.2. Practical Exercises

Exercise 1. Reading Comprehension Questions Answer the following questions based on Text 1 and Text 2:

1. How has the size of computing devices affected their application in daily life?
2. What are the main functions of a "smart house" monitoring system?
3. What is the definition of "Data Mining"?
4. How do AI technologies simulate human brain functions in data analysis?
5. What is the difference between "clustering" and "decision trees" in data processing?

Exercise 2. Terminology Matching Match the terms with their correct definitions:

1. **Expert system** — a) A process of filtering through large amounts of raw data for useful information.
2. **Data Mining** — b) Software that enables computers to 'think' like experts.
3. **Multimedia** — c) Storage method of archiving large amounts of data to make it easy to access.
4. **Data warehouse** — d) A combination of text with sound, video, animation, and graphics.
5. **AI** — e) A computing tool that tries to operate in a way similar to the human brain.

Exercise 3. Vocabulary: True or False Mark the following statements as **True (T)** or **False (F)**:

1. Computers are sometimes used to monitor systems that previously needed human supervision.
2. The use of computers prevents people from being creative.
3. Data mining is only useful for a limited range of scientific problems.
4. "Cleansing" data means freeing it from duplicate information and errors.
5. Neural networks look for patterns known as "rules".

1.3. Independent Work (Self-Study)

Task 1. Technical Abbreviations Research and explain the meaning of the following IT abbreviations used in storage and data processing: **CD-ROM, MB, GHz, SVGA, SDRAM**.

Task 2. Data Processing Flowchart Complete the description of the data mining process using the words: cleansed, analyst, patterns, warehouse, decisions. "Large amounts of data stored in a data **(1)____** are often used for mining. The data is first **(2)____** to remove errors. The data is analyzed until **(3)____** emerge. A report is then reviewed by an **(4)____** who passes results to the **(5)____** makers."

Task 3. Short Essay Write a paragraph (50-80 words) in English about a "Smart Device" you use daily. Describe how it uses technology to make your life "smaller and smarter"

SECTION 2. OPERATING SYSTEMS AND SYSTEM ARCHITECTURE

2.1. Reading and Comprehension (Texts)

Text 1. Operating Systems: The Hidden Interface When a brand-new computer comes off the assembly line, it can do nothing. The hardware needs software to make it work. While we often think of applications like word processing, these programs do not communicate directly with the hardware. Between the applications software and the hardware is a software interface known as the **operating system (OS)**. An operating system is essentially a set of programs that acts as a bridge between the user's applications and the computer's physical components.

Text 2. Main Functions and the Supervisor Program The most critical part of an OS is the **supervisor program**, which manages the entire system. Most of it remains in the computer's memory and is called **resident**. Other parts are loaded from the disk only when needed and are called **non-resident**. An operating system has three primary roles:

1. **Resource Management:** It handles the CPU, memory, disk drives, and printers.
2. **User Interface:** It establishes how the user interacts with the machine.
3. **Application Support:** It executes applications and provides them with necessary services. Interestingly, much of this work is hidden; for example, all input and output operations are actually performed by the OS, even if they are started by an application.

Text 3. Linux and Open Source Linux began in 1992 as a student project by Linus Torvalds. It was designed as a near-clone of **Unix**, which was the standard operating system for engineering and scientific computing in the 70s and 80s. A key feature of Linux is that it is **Open Source**, meaning anyone can access, modify, and improve the **source code**. Because it is free and highly adaptable, Linux has become the most widely ported operating system in existence.

2.2. Practical Exercises

Exercise 1. Comprehension Check Answer the following questions based on the texts:

1. What is the main difference between application software and an operating system?
2. Why is the supervisor program considered the most important part of the OS?
3. Explain the difference between "resident" and "non-resident" programs.
4. What was the original motivation for Linus Torvalds to create Linux?
5. Why is access to "source code" important for programmers?

Exercise 2. Vocabulary and Logic Complete the gaps in this summary using the following linking words: although, because, therefore, such as, in addition.

The user sees the effects of applications, (1)____ operating systems are invisible. They lie between hardware and programs (2)____ spreadsheets. The supervisor remains in memory, (3)____ it is resident. Others are non-resident (4)____ they are loaded only when needed. (5)____, the OS establishes the user interface and handles all input/output tasks.

Exercise 3. Terminology Matching Match the Linux-related terms with their descriptions:

1. **Kernel** — a) The original program text from which compiled programs are made.
2. **Source code** — b) A complete OS kit with utilities and applications.

3. **Distribution** — c) The core of an OS that handles memory and hardware.
4. **X (Windowing System)** — d) A standard for implementing graphical interfaces.

2.3. Independent Work (Self-Study)

1. **Comparative Analysis:** Research the difference between a "Command Line Interface" (like MS-DOS) and a "Graphical User Interface" (GUI). Write a short comparison (100 words) explaining which is more efficient for data analysis tasks.
2. **OS Identification Task:** Identify which of the following are Operating Systems and which are Applications: Windows 7, MS Word, Linux, Adobe Photoshop, Mac OS X, Unix.
3. **Future Trends:** Read about "The Future of IT" in Text 23. Write a brief prediction on how user interfaces might change by 2030, specifically mentioning "voice and language recognition"

SECTION 3. DATA MINING AND PATTERN RECOGNITION

3.1. Reading and Comprehension (Texts)

Text 1. Definition of Data Mining Data mining is the process of filtering through large amounts of raw data for useful information that gives businesses a competitive edge. This information consists of meaningful patterns and trends that are already present in the data but were previously unseen. Artificial Intelligence (AI) is the most popular tool used during the mining process. AI technologies attempt to mimic the human brain by making intelligent guesses, learning by example, and using deductive reasoning to find these hidden relationships.

Text 2. Popular AI Methods in Data Analysis There are several key AI methods used in data mining:

- **Neural networks:** This software looks at the rules of using data based on connections found in sample sets. It compares factors repeatedly until patterns, known as **rules**, emerge.
- **Clustering:** This method divides data into groups based on similar features. It is especially useful when data is not labeled. For example, insurance companies use clustering to find patterns that point to fraudulent claims.
- **Decision trees:** This technique separates data into subsets and then analyzes those subsets to divide them even further. This multi-level analysis continues until the subsets are small enough to reveal interesting relationships.

Text 3. Data Cleansing and Storage Before data can be mined, it must be **cleansed**. Cleansing involves freeing the data from duplicate information and erroneous entries. After cleansing, data is stored in a uniform format within relevant fields. Large-scale storage methods include **data warehouses** and **data marts**, which archive massive amounts of data to make them easy to access for analysis. Once the process is complete, an analyst reviews the software-generated report to decide if the results are usable or if the parameters need refinement.

3.2. Practical Exercises

Exercise 1. Reading Comprehension Questions Answer the following questions based on the texts:

1. What is the primary purpose of data mining for a business?
2. Which AI method uses "rules" to describe emerging patterns?
3. In what situation is "clustering" more favorable than other mining methods?
4. How does the "decision tree" method reach a level where relationships become visible?

5. What are the two main things removed during the data cleansing process?
6. What is the difference between a data warehouse and a standard desktop database?

Exercise 2. Terminology Matching Match the terms with their descriptions based on the source:

1. **AI** - a) Data free from duplicate and erroneous information.
2. **Data mining** - b) A storage method for archiving large amounts of data for easy access.
3. **Cleansed data** - c) A computing tool that tries to operate in a way similar to the human brain.
4. **Data warehouse** - d) A process of filtering through raw data for useful patterns.

Exercise 3. Vocabulary: True or False Mark the statements as **True (T)** or **False (F)**:

1. Data mining is the process of analyzing patterns that are already well-known.
2. Neural networks compare factors repeatedly to find rules.
3. Clustering can be used to detect false insurance claims.
4. An analyst is only involved at the very beginning of the data mining process.
5. Data mining is beneficial for almost any area of study, including genetic research.

3.3. Independent Work (Self-Study)

Task 1. Fill in the Blanks Complete the description of the data mining process using words from the text:

"Large amounts of data stored in data **(1)____** are often used for data mining. The data is first **(2)____** to remove **(3)____** information and errors. The data is then analyzed using a tool such as **(4)____**. An analysis report is reviewed by an **(5)____** who passes the final results to the **(6)____** makers."

Task 2. Case Study Research Data mining is used in various fields, such as analyzing Supreme Court decisions, discovering healthcare patterns, and resolving production bottlenecks. Research one real-world example of how AI-driven data mining has improved a specific industry (e.g., Finance, Medicine, or E-commerce) and write a 100-word summary in English.

Task 3. Glossary Expansion Using the glossary at the end of the book, find and write down the definitions for: **Neural network**, **Data warehouse**, **Algorithm**, and **Cleansing.**

SECTION 4. NETWORK COMMUNICATIONS AND PROTOCOLS

4.1. Reading and Comprehension (Texts)

Text 1. The Layered Communication Process Network communication is a complex, layered process where each layer performs a specific task to prepare data for transmission. The **application layer** is the only part a user sees; it converts human-readable data into bits and attaches a header with routing information. Below it, the **presentation layer** ensures the message is in a language the receiving computer can interpret, handling compression and encryption. The **session layer** manages the connection between nodes, while the **transport layer** subdivides data into segments and creates **checksums**—mathematical sums used to verify data integrity. The **network layer** selects the best route and forms data into packets, and

the **physical layer** finally encodes these packets into a medium, such as an analogue signal for telephone lines.

Text 2. TCP/IP: Linking Dissimilar Machines At the core of the Internet is the **TCP/IP** suite. The **Internet Protocol (IP)** uses a 32-bit coding system to assign a unique address to every node on a network, allowing **gateways** to route information between different systems. Working alongside IP is the **User Datagram Protocol (UDP)**, which identifies which specific application a data block should contact. The **Transmission Control Protocol (TCP)** ensures "reliable stream service" by managing communication exchanges, checking for responses, and replacing any missing data blocks. Standard high-level protocols like **FTP** (File Transfer) and **SMTP** (Simple Mail Transfer) rely on TCP to move data across diverse types of computers.

Text 3. Email Retrieval: POP vs. IMAP While SMTP is used to send messages between servers, different protocols are used for retrieval. The **Post Office Protocol (POP)** works in "pull" mode, downloading all messages in a mailbox at once. However, the **Internet Mail Access Protocol (IMAP)** is more flexible; it initially retrieves only message headers, allowing the user to choose which messages to download or delete from the server. This makes IMAP especially useful when bandwidth is limited or expensive.

4.2. Practical Exercises

Exercise 1. Identifying the Communication Layers Match the function with the correct network layer based on Text 1:

1. **Transport Layer** — a) Encodes packets into the transmission medium.
2. **Presentation Layer** — b) Protects data by subdividing it into segments and creating checksums.

3. **Physical Layer** — c) Selects a route and counts data packets.
4. **Network Layer** — d) Handles data encryption and language translation.
5. **Application Layer** — e) The part of the process visible to the user.

Exercise 2. Technical Vocabulary Quiz Complete the sentences with the appropriate terms: Gateway, Checksum, Bandwidth, Packet, 32-bit.

1. A(n) _____ is a fixed-size unit of data prepared for transmission.
2. The IP address system is a(n) _____ coding system.
3. A(n) _____ is a device used to connect and route data between dissimilar networks.
4. To determine if data was scrambled during transit, the system uses a(n) _____.
5. IMAP is preferred over POP when _____ is limited or expensive.

Exercise 3. True or False Mark the statements as **True (T)** or **False (F)**:

1. TCP is responsible for recovering packets that are not successfully delivered.
2. UDP software provides the final routing for data within the receiving system.
3. SMTP can be used to recall a message after it has been delivered.
4. The physical layer is responsible for reassembling message segments at the receiving node.
5. POP3 allows you to download only the headers of your emails.

4.3. Independent Work (Self-Study)

Task 1. Protocol Comparison Research and write a brief comparison (120 words) between **TCP** and **UDP**. Explain why TCP is called a "reliable stream service" and in what scenarios a developer might prefer the faster but less reliable UDP (e.g., video streaming vs. file transfer).

Task 2. Diagram Analysis Draw a flowchart representing the "path of an email" from the sender's PC to the recipient's inbox. Include the roles of **SMTP**, the **Mail Server**, and **POP3/IMAP** in your diagram.

Task 3. Glossary Extension Define the following terms using the glossary in the book: **Header, Node, Full-duplex, Hub, and Topology.**

SECTION 5. DATA SECURITY AND CRYPTOGRAPHY

5.1. Reading and Comprehension (Texts)

Text 1. The Three Goals of Secure Transactions Secure transactions across the Internet have three primary goals. First, **privacy**: the two parties involved in a transaction (such as an email or business purchase) do not want a third party to be able to read their transmission. This is prevented through data encryption. Second, **integrity**: the receiver should be able to detect whether someone has tampered with the message in transit. This is achieved through a message-integrity scheme. Finally, **authentication**: both parties must know they are communicating with each other and not an impostor. This is verified through user authentication systems.

Text 2. Public-Key Cryptography Modern data encryption relies on a technique called **public-key cryptography**. In this system, everyone has a **public key** and a **private key**. A message encrypted with a public key can only be decrypted by a system that knows the corresponding private key. For a secure transaction, two parties must exchange public keys while keeping their private keys as closely guarded secrets. For example, if Person A wants to send an encrypted message to Person B, they use

Person B's public key to turn the message into "gibberish" (meaningless data), knowing that only Person B can decipher it using their private key.

Text 3. Message Integrity and MAC To make a message "tamper-proof," the sender runs the message through a **message-digest function**. This application produces a unique number called a **message-authentication code (MAC)**. It is nearly impossible for an altered message to have the same MAC as the original. The software produces a MAC for a message before it is encrypted, encrypts the MAC with the sender's private key, and then encrypts both the message and the MAC with the recipient's public key. Upon receipt, the recipient creates their own MAC and compares it with the decrypted MAC from the sender; if they match, the message is intact.

Text 4. Digital Certificates Authentication on the Web is often performed using **digital certificates**. A server identifies itself to a client by sending an unencrypted ASCII-based certificate. This certificate contains information about the company and the server's public key. Crucially, it is "signed" by a **trusted digital certificate issuer** who has investigated the company's legitimacy. The issuer signs the certificate by generating a MAC and encrypting it with the issuer's private key.

5.2. Practical Exercises

Exercise 1. Reading Comprehension Questions Answer the following questions based on the source texts:

1. What are the three main goals of secure Internet transactions?
2. What is the difference between a public key and a private key?
3. How is a message turned into "gibberish" for security?
4. What is the function of a "message-digest"?
5. How does a recipient verify that a message has not been tampered with?

6. What information is typically contained in a digital certificate?

Exercise 2. Terminology Matching Match the terms (1-6) with their definitions (a-f) based on the texts:

1. **Gibberish** — a) A person pretending to be someone else.
2. **Impostor** — b) To make unauthorized changes to data.
3. **Decipher** — c) Meaningless data produced by encryption.
4. **MAC** — d) Principal features or principles.
5. **Tenets** — e) Message-authentication code.
6. **Tamper** — f) To convert coded data into meaningful information.

Exercise 3. Key Functions Quiz Identify the correct key used for each action:

1. To encrypt a message for sending: a) Sender's private key; b) Recipient's public key.
2. To decrypt a received message: a) Sender's public key; b) Recipient's private key.
3. To encrypt the MAC of a digital signature: a) Trusted issuer's private key; b) Recipient's public key.

5.3. Independent Work (Self-Study)

Task 1. Cryptography Workflow Using the information in Text 3, draw a simple logic diagram showing the steps of sending a "tamper-proof" message. Include the stages of MAC generation, encryption, and decryption.

Task 2. Vocabulary Search Find and write down the definitions for the following terms using the glossary at the end of the book: **Encryption**, **Authentication**, **Digital Certificate**, **Private Key**, and **Decryption**.

Task 3. Short Research Essay Research the concept of a "Man-in-the-Middle" attack mentioned in the hi-tech crime glossary. Write a 100-word explanation of how this attack works and how the "Authentication" goal discussed in Section 5 helps prevent it.

SECTION 6. PRINCIPLES OF OBJECT-ORIENTED PROGRAMMING (OOP)

6.1. Reading and Comprehension (Texts)

Text 1. Motivations for OOP One of the principal motivations for using Object-Oriented Programming (OOP) is to handle complex multimedia applications where diverse data types, such as sound and video, can be packaged together into executable modules. Another goal is to write program code that is more intuitive and reusable, which significantly shortens the time required for program development.

Text 2. Encapsulation: Bundling Data The key feature of OOP is **encapsulation**, which involves bundling data and program instructions into modules called "objects". For instance, an icon representing a shape (like a triangle) on a screen is an object that contains both the properties of the shape and the instructions on how to display or modify it. This allows developers to integrate complex data, such as speech or moving images, without manually synchronizing every separate type of data into a working whole.

Text 3. Inheritance: Reusing Properties A second fundamental feature is **inheritance**, which allows developers to define a general class of objects and then create specific instances that "inherit" all properties of that class. For example, if a class "Rectangles" is defined as having four sides and four right angles, a specific instance called "Squares" will automatically possess these same properties. This property is highly useful for rapidly processing business data, such as employee records where specific roles inherit general company benefits.

Text 4. Polymorphism and Reusability The third principle of OOP is **polymorphism**, meaning that different objects can receive the same instruction but process it in different ways. For instance, clicking on a "Right Triangle" object might trigger one explanation, while clicking on an "Equilateral Triangle" object triggers a different response, even though the instruction (the mouse click) was the same. The combination of encapsulation, inheritance, and polymorphism leads to **code reusability**, allowing new programs to be constructed efficiently from libraries of existing objects.

6.2. Practical Exercises

Exercise 1. Reading Comprehension Questions Answer the following questions based on the source texts:

1. What are the two primary reasons for using OOP mentioned in the text?
2. What are the three key features of OOP?
3. How does encapsulation help developers handle multimedia data?
4. Explain the concept of inheritance using the "Rectangles" and "Squares" example.
5. What is the definition of polymorphism in the context of program instructions?
6. How does code reusability impact program maintenance?

Exercise 2. Terminology Matching Match the terms with their correct descriptions:

1. **Encapsulation** — a) A property that enables different objects to deal with the same instruction in different ways.
2. **Inheritance** — b) A module containing both data and program instructions.

3. **Polymorphism** — c) A property that allows data and program instructions to be bundled into an object.
4. **Object** — d) A property that allows a specific instance of a class to receive the properties of that class.
5. **Library** — e) A reusable collection of objects.

Exercise 3. Fill in the Blanks Complete the summary using the words: reusable, instances, instructions, maintenance, polymorphism, objects.

Encapsulation, inheritance, and **(1)____** are the key features of OOP. Encapsulation allows data and program **(2)____** to be bundled together in modules called **(3)____**. Inheritance means that specific **(4)____** of a class inherit its properties. These features make code **(5)____**, which speeds up the development and **(6)____** of programs.

6.3. Independent Work (Self-Study)

1. **Case Study Analysis:** Think of a real-world system (e.g., a Library Management System or a Banking App). Identify one "Class" and three "Objects" (instances) that could belong to it. List at least two properties that would be "inherited".
2. **Glossary Task:** Using the glossary at the end of the book, write down the definitions for: **C++**, **Java**, **Class**, and **Module**.
3. **Short Essay:** Write a short paragraph (60-100 words) explaining why code reusability is particularly important for large-scale AI projects that involve processing massive data arrays.

SECTION 7. THE FUTURE OF IT AND EMERGING COMPUTING PARADIGMS

7.1. Reading and Comprehension (Texts)

Text 1. The Convergence and Human-Machine Equivalence We are currently in the midst of convergence, where hardware (computers,

phones) and applications (commerce, education, entertainment) are merging into a single ecosystem. By approximately 2015–2020, researchers expected **human-machine equivalence** in terms of processing capability. Beyond this point, a "positive feedback loop" occurs: each generation of improved computers assists in designing the next, leading to systems created with little to no human involvement. This rapid advancement will solve the "interface problem" through voice and language recognition, making technology accessible to anyone who can speak a major language.

Text 2. Quantum Computing: A New Paradigm Silicon electronics are approaching their physical limits, leading researchers to explore **Quantum Computing**. Unlike a conventional bit (which is either 0 or 1), a **qubit** can represent both states simultaneously through a phenomenon called **superposition**. This allows quantum computers to perform massively parallel processing within a single piece of hardware, solving complex problems with vast amounts of data in seconds—tasks that would take classical computers an almost infinite amount of time.

Text 3. Biomolecular and Chemical Computing Future computing might not be electronic at all. **DNA computing** (biomolecular computing) uses DNA and biochemistry to perform tasks that traditional silicon cannot, such as "smart drugs" that sense a biochemical environment and release medication only when cancer cells are detected. Similarly, **chemical computing** uses different concentrations of chemicals in a "soup" to represent data. These reaction-diffusion processors are incredibly robust; because they are amorphous, a chemical computer could literally be cut in half and both parts would continue to function independently.

Text 4. Spintronics: Beyond the Movement of Electrons Traditional electronics rely on the movement and accumulation of electrons, which

generates significant heat. **Spintronics** (magnetoelectronics) instead harnesses the **spin** of particles (up or down) to represent bits. Spintronic devices require much less power and should be significantly faster than conventional electronics. One promising material for these devices is **Cobalt green**, an 18th-century pigment that exhibits magnetic properties at room temperature.

7.2. Practical Exercises

Exercise 1. Reading Comprehension Questions Answer the following questions based on the source texts:

1. What is meant by a "positive feedback loop" in technology development?
2. How will voice and language recognition change the way people interact with IT?
3. What is the fundamental difference between a bit and a qubit?
4. Why is superposition considered a "killer application" for large-scale data analysis?
5. What are the potential medical applications of DNA computing?
6. Why are spintronic devices more energy-efficient than traditional silicon chips?

Exercise 2. Terminology Matching Match the term with its correct description:

1. **Superposition** — a) Using the "spin" of an electron to store or transmit data.
2. **Qubit** — b) The ability of a quantum bit to be in two states at once.
3. **Spintronics** — c) A system where data is represented by chemical concentrations.

4. **Chemical computer** — d) The basic unit of information in quantum computing.
5. **Amorphous** — e) Lacking a fixed or rigid shape (characteristic of gel-based robots).

Exercise 3. Vocabulary: Synonyms and Context Find words in the texts that mean:

1. Merging together (Text 1)
2. Extremely difficult to deal with or solve (Text 2)
3. Strong and healthy; hardy (Text 3)
4. To utilize or control a natural source of energy (Text 4)

7.3. Independent Work (Self-Study)

1. **Comparative Research:** Research the concept of **"Data Drift"** versus the **"Positive Feedback Loop"** mentioned in the text. Write a short explanation (100 words) on how AI systems designing themselves might either solve or accelerate the problem of model degradation.
2. **Ethical Reflection:** Professor Cochrane suggests that we must build rules to hold human life "sacrosanct" before letting loose powerful AI. Write a short argumentative essay (150 words) on whether you believe current AI regulations (like those in Appendix A) are sufficient for a future of "human-machine equivalence."
3. **Future Hardware Report:** Choose one "Future Direction" (Quantum, Light, Spin, or DNA) and prepare a 2-minute presentation outline explaining how this technology could specifically improve **Data Array Analysis** (e.g., faster searching of vast databases or better encryption).

PROFESSIONAL VOCABULARY LIST

Section 1 & 2: Computing Foundations & Operating Systems

- **Handheld computing device** — портативний обчислювальний пристрій, який використовується для збору даних, контролю інвентарю або як органайзер.
- **Smart card** — пластикова картка з вбудованим процесором і пам'яттю, що зберігає важливу інформацію (медичні записи, банківські баланси).
- **Expert system** — програмне забезпечення, що дозволяє комп'ютеру «думати» як експерт, наприклад, для встановлення медичного діагнозу.
- **Edutainment** — система, що поєднує освітню та розважальну цінність.
- **Supervisor program** — найважливіша частина операційної системи, яка постійно знаходиться в пам'яті (resident) і керує всією системою.
- **Kernel** — ядро операційної системи, що відповідає за розподіл пам'яті, взаємодію з обладнанням та стабільність роботи.
- **Open Source** — модель розробки ПЗ, за якої будь-хто має доступ до вихідного коду (source code) і може його змінювати або виправляти помилки.
- **Multimodal input** — концепція інтерфейсу майбутнього, що пропонує комбінацію різних типів введення: голос, жести, рукописне введення тощо.

Section 3: Data Mining & Analysis

- **Data mining** — процес фільтрації великих обсягів сирих даних для пошуку корисних закономірностей і трендів.

- **Neural networks** — програмне забезпечення, що імітує роботу мозку, аналізуючи значення та порівнюючи фактори, поки не виникнуть патерни, відомі як «правила».
- **Clustering** — метод аналізу, що розділяє дані на групи за подібними ознаками, особливо коли дані не мають міток.
- **Decision trees** — техніка ШІ, яка багаторівнево розділяє дані на підмножини для виявлення прихованих взаємозв'язків.
- **Data cleansing** — процес очищення даних від дублікатів та помилкової інформації перед початком аналізу.
- **Data warehouse** — метод зберігання, що передбачає архівування величезних обсягів даних для легкого доступу до них.

Section 4 & 5: Networking & Security

- **TCP/IP** — офіційний набір стандартів для визначення форми сигналів, що використовуються для передачі даних в Інтернеті.
- **Gateway** — пристрій (шлюз) для з'єднання несхожих мереж та маршрутизації інформації.
- **Checksum** — розраховане математичне значення, що додається до даних для виявлення помилок під час їх копіювання або передачі.
- **Bandwidth** — пропускна здатність; діапазон частот, які можуть бути передані через канал зв'язку.
- **Encryption** — перетворення даних у закодовану форму для забезпечення приватності та безпеки.
- **Public-key cryptography** — метод кодування повідомлень за допомогою публічних та приватних ключів.

- **Digital certificate** — електронне повідомлення, що підтверджує надійність транзакції та містить публічний ключ компанії.
- **MAC (Message Authentication Code)** — код автентифікації повідомлення, що робить його захищеним від несанкціонованого втручання (tamper-proof).

Section 6 & 7: Programming & Future Trends

- **Encapsulation** — об'єднання даних та програмних інструкцій у модулі, що називаються «об'єктами».
- **Inheritance** — властивість ООП, що дозволяє специфічним екземплярам класу успадковувати всі його властивості.
- **Polymorphism** — здатність різних об'єктів отримувати однакові інструкції, але обробляти їх у різний спосіб.
- **Qubit** — квантовий біт; одиниця інформації в квантовому комп'ютері, яка може бути одночасно і «1», і «0» завдяки явищу суперпозиції (superposition).
- **Spintronics** — технологія, що використовує спін частинок (магнітну силу) замість руху заряду для передачі та зберігання даних.

І-76 Методичні вказівки до практичних занять та самостійної роботи для здобувачів першого (бакалаврського) рівня вищої освіти ОСВІТНЬОЇ ПРОГРАМИ Штучний інтелект та аналіз масивів даних ГАЛУЗІ ЗНАНЬ F Інформаційні технології СПЕЦІАЛЬНОСТІ F1 Прикладна математика денної та заочної форм навчання / уклад. Ю.В. Літкович, Луцьк. ЛНТУ, 2026. 26 с.

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