

# Unit 10

## INFORMATION SYSTEMS AND DATABASES

### 1.1. Read and translate the following words and word-combinations.

Highly dependent, computer-based information systems, take advantage, application software, the strategic value of information, provide up-to-date access, update the data, major trends, enhance, span a broad range, answer specific questions, decision making, a major concern, provide the means, a query optimizer, specific applications, an ad hoc fashion, large-scale transaction-processing systems, entities called objects.

### 1.2. Learn key-words and word-combinations.

attribute(n) – ознака; атрибут  
condense (v) – ущільнювати  
data independence – незалежність від даних  
database management system (DBMS) – система керування базою даних (СКБД)  
data model – модель даних  
directed graph – орієнтований граф  
encapsulated (adj) – герметизований  
filter (v) – фільтрувати  
handle complex data – опрацьовувати складні дані  
hierarchical database – ієрархічна база даних  
information technology – інформаційна технологія  
linked list – ланцюговий список; список з вказівниками  
management information system (MIS) – інформаційно-керівна система  
manipulation (n) – опрацювання; маніпулювання  
network model – мережева модель  
one-to-many relationship – відношення “один до багатьох”

optimizer (n) – оптимізатор  
occurrence record – екземпляр запису (у базі даних)  
parent (n) – твірний елемент (вузол)  
pointer (n) – вказівник  
provide up-to-date access – забезпечити сучасний доступ  
relation (n) – відношення; стосунок; залежність  
query language – мова запитів  
relational model – реляційна модель  
root record – кореневий запис  
tree structure – деревоподібна структура  
tuple (n) – запис

### 1.3. Read and translate the text.

## Management Information Systems

Computers and information systems play critical roles in the operation of most organizations. All organizations are highly dependent on information for their day-to-day operations. The vast quantity of information that large corporations and government agencies need to operate, and the speed with which that information is created and used, makes computer-based information systems critical to such operations.

A **management information system**, or MIS, refers to a system that gathers, condenses, and filters data until it becomes information, and then makes it available on time, and in a useful form, for use in decision making at various levels of management within an organization. Finding the ways to manage these data, provide up-to-date access to them, and develop new applications around them has become a major concern of MIS organizations for the last two decades.

A database management system (DBMS) is composed of three major parts: (1) a storage subsystem that stores and retrieves data in files; (2) a modelling and manipulation subsystem that provides the means with which to organize the data and to add, delete, maintain, and update the data; and (3) an interface between the DBMS and its users.

Database management spans a broad range of information systems and needs. Some are based on a single personal computer and are used in an ad hoc fashion to support decision making. Others are based on several distrib-

uted mainframe or minicomputers and are used to support large-scale transaction-processing systems. A DBMS need not be confined to storing words and numbers. Manufacturing organizations use a DBMS to store engineering drawings, sometimes storing millions of drawings on optical disk systems that resemble jukeboxes. Also, some applications may require quite specialized databases. For example, a text database is a collection of words such as articles in the Wall Street Journal or a series of legal abstracts. Such databases are either stored on-line or on CD-ROM optical disks and include the means to search through massive amounts of data to answer specific questions.

**Types of Databases.** A **data model** describes a way to structure and manipulate the data in a database. The structural part of the model specifies how data should be represented (e.g., tree, tables, and so on). The manipulative part of the model specifies the operations with which to add, delete, display, maintain, print, search, select, sort, and update the data. A query language provides the means to formulate commands that permits the user to perform such data manipulation. Because it is a language like a programming language, commands must be translated into a sequence of machine-language instructions that the storage subsystem uses to manipulate the data.

The first database management systems used a **hierarchical model** – that is – they arranged records into a tree structure. Some records are **root records** and all others have unique **parent** records. The structure of the tree is designed to reflect the order in which the data will be used – that is – the record at the root of a tree will be accessed first, then records one level below the root, and so on. The hierarchical model was developed because hierarchical relationships are commonly found in business applications. Hierarchical models are characterized by **one-to-many relationship** among data.

The next major approach to database management systems was called the **network model**, which arranged records into a **linked list** called a **directed graph**. Unlike the hierarchical database, each record in the network model can have more than one parent.

The network model has had a performance advantage over other database models, and it is used in high-volume, high-speed transaction processing such as ATM networks. Both hierarchical and network data-bases are application specific. If a new application is developed, a new database must be developed, though the data are the same.

A major breakthrough in database research occurred in 1970 when E. F. Cod proposed a fundamentally different approach to database management called the relational model, which uses a table as its data structure. A table, like a spreadsheet, consists of rows and columns. Each row identifies a record and each column corresponds to a field. (In relational language, a table is called a relation, a row is called a **tuple**, and a column is called an **attribute**).

**Structured query language** (SQL), is a query language for manipulating data in a relational database. It is nonprocedural or declarative, in that the user need only specify an Englishlike description that specifies the operation and the desired record or combination of records. A **query optimizer** translates the description into a procedure to perform the database manipulation. Relational databases do not have to be application specific. They can solve most of the problems when developing new applications by providing data independence, the ability of database to exist independently of specific applications.

The newest approach to database management uses an object model, in which records are represented by entities called objects that can both store data and provide methods or procedures to perform specific tasks. Like an engineering “black box,” the inner workings of an object are hidden or encapsulated. Each object belongs to a family or class of similar objects. The class is a template that describes the common characteristics of a set of objects. Although objects can be simple, the object model is used to handle complex data.

#### **1.4. Give the definition of the following terms in English.**

Object model, query language, SQL, table, data independence, relational model.

#### **1.5. Translate the following word-combinations into English.**

Деревоподібна структура, формулювати команди, маніпулювання даними, забезпечувати доступ, існувати незалежно, твірний елемент, поновлювати дані, опис, кореневий запис, маніпуляційна частина, послідовність команд, на фізичному рівні, на логічному рівні, оптимізатор запитів, реляційна база даних.

#### **1.6. Translate the following sentences into English.**

1. Кожна база даних містить інформацію про певний клас об'єктів.
2. Основу реляційної моделі становлять двовимірні таблиці.

3. Дані таблиць можна зберігати, доповнювати, вилучати, переглядати, редагувати, сортувати або фільтрувати за досить складними критеріями.
4. З допомогою запитів можуть бути виконані обчислення, відновлені дані в таблицях, додані або вилучені записи.
5. Зв'язок "один до багатьох" є найзагальнішим.
6. Застосовуючи мережеву модель, можна зв'язувати екземпляри запису з допомогою вказівника з іншими екземплярами у базі даних.

**1.7. Fill in the blanks with the words from the box.**

query language	natural-user interface	database
data independence	data	query language

1. There are specialized ... that perform specific functions.
2. A ... allows the user to question the database in a free-form language such as English.
3. If a new application is developed, a new ... must be developed.
4. Relational databases can solve most of the problems when developing new applications by providing
5. All databases include some kind of ... to perform data manipulation.
6. ... are the raw material from which information is produced.

**1.8. Answer the questions.**

1. What is the role of computers and information systems in the operation of businesses, government agencies and other organizations?
2. What functions does MIS perform?
3. What are the major parts of MIS?
4. What models does MIS use?
5. What is the most popular database model today?
6. What language is used for manipulating data in a relational model?
7. Give examples of an object-oriented database.

**2.1. Translate the following words and word-combinations.**

Physically separate computers, without regard to, bridge the gap, incompatible data formats, formulate a query, download the requested data, access, "behind-the-scenes" details, partially, spread the files, duplicate files, request a record, eliminate, read a record, centralized control, transfer the data, a slave.

### 2.2. Learn key-words and word-combinations.

authorized (adj) – дозволений  
database server – сервер бази даних  
data security – захист даних  
database integrity – цілісність даних  
distributed database – розподілена база даних  
distributed processing – розподілене опрацювання  
file server – файловий процесор  
incompatible data format – несумісний формат даних  
record locking – блокування запису  
reside (v) – (постійно) перебувати  
slave (adj) – підлеглий, підпорядкований  
terminate a link – завершувати зв'язок

### 2.3. Read and translate the text.

## Distributed Database

Distributed database is one in which different parts of the database reside on physically separate computers.

One goal of distributed databases is the access of information without regard to where the data might be stored. Distributed databases require software that resides partially in the personal computer and partially in the larger computer. This software bridges the gap between personal and larger computers and resolves the problems of incompatible data formats. Ideally, it would make the mainframe databases appear to be large libraries of information, with most of the processing accomplished on the personal computer. As an example, suppose a person wants to obtain some financial data from a corporate database to use in a spreadsheet program. Software would allow the user to formulate a query by example. Then the program establishes contact with the database, translates the user's request into SQL, downloads the requested data to the personal computer, terminates the link to the database, and transfers the data directly into the format needed by a spreadsheet program. All this is accomplished without the user having to understand the "behind-the-scenes" details of the process involved.

A drawback to some distributed systems is that they are often based on what is often called a mainframe-centric model, in which the larger **host**

**computer** is seen as the master and the **terminal** or personal computer is seen as a slave. There are some advantages to this approach. With databases under centralized control, many of the problems of data integrity and security are solved. But today's personal computers, departmental computers, and distributed processing require computers and their applications to communicate with each other on a more equal or peer-to-peer basis. In a database, the client/server model provides the framework for distributing databases.

A file server is software that provides access to files across a network. A dedicated file server is a single computer dedicated to being a file server. This is useful if the files are large and require fast access. In such cases, a minicomputer or a mainframe would be used as a file server. A distributed file server spreads the files around on individual computers instead of placing them on one dedicated computer.

Advantages of the latter server include the ability to store and retrieve files on other computers and the elimination of duplicate files at each computer. A major disadvantage, however, is that individual read/write requests are moved across the network and problems can arise when updating files. Suppose one user requests a record from a file and changes it while another user requests the same record and changes it too. The solution to this problem is called **record locking**, which means that the first request for a record locks the record to other users, making them wait until the first request is satisfied. Other users may be able to read the record, but they will not be able to change it.

A **database server** is software that services requests to a database across a network. For example, suppose a user types in a query for data on his or her personal computer. If the application is designed with the client/server model in mind, the query-language part on the personal computer simply sends the query across the network to the database server and requests to be notified when the data are found.

Distributing databases is an evolutionary step because it is logical that data should exist at the location at which they are being used. Departmental computers within a large corporation, for example, should have data reside locally, yet those data should be accessible by authorized corporate management when they want to consolidate departmental data. DBMS software protects the **security** and **integrity** of the database, and the distributed database appears to its users as no different from the nondistributed database.

**2.4. Give the definition of the following terms in English.**

Database server, query, record locking, distributed file server, host computer, client/server model.

**2.5. Translate the following words and phrases into English.**

Забезпечувати доступ до файлів, запит, блокувати запис, встановлювати зв'язок з базою даних, електронна таблиця, головний комп'ютер, підлеглий комп'ютер, вирішувати проблему, несумісний формат даних, одержати дані, цілісність даних, посилати дані, структурувати дані.

**2.6. Answer the questions.**

1. What is the goal of distributed database?
2. What the software do distributed databases require?
3. What are the advantages of distributed databases?
4. What are the advantages and drawbacks of a mainframe-centric model?
5. Explain the difference between dedicated and distributed file servers. Speak on their advantages and disadvantages.
6. What are the effects of information technology on people?

**2.7. Write a brief report on.**

1. The Computerization of Society.
2. The Computerless Society.
3. Computer Crimes.
4. Computers and Security.
5. Software Piracy.

**Test Yourself****Match the following key terms to the appropriate definition:****A.**

1. Management information system (MIS)
2. Information technology
3. Hierarchical model
4. Network model
5. Query language
6. Database management system (DBMS)
7. Data model

- a. A system that gathers, condenses, and filters data until it becomes information, and then makes it available on time, and in a useful form, for use in decision making at various levels of management within an organization.
- b. A description of a way to structure and manipulate the data in a database.
- c. A collective term for computer and communication hardware and system-and-application software.
- d. The means to question the database in free-form English.
- e. Arranging records into a tree structure.
- f. Arranging records into a linked list called a directed graph.
- g. A storage subsystem, a modelling and manipulation sub-system, and an interface between the DBMS and its users.

**B.**

- 1. Relational model
  - 2. Table
  - 3. Structured query language (SQL)
  - 4. Data independence
  - 5. Object model
  - 6. Key field
  - 7. Form
  - 8. Sorting
  - 9. Distributed database
  - 10. File server
  - 11. Database server
- a. A set of rows and columns.
  - b. The ability of a database to exist independently of specific applications.
  - c. Arranging records into entities that can store both data and procedures.
  - d. A database in which different parts of the database reside on physically separate computers.
  - e. The means to identify the names and characteristics of the fields within a record.
  - f. Arranging records into table structure.
  - g. Software that services requests to a database across a network.
  - h. Software that provides access to files across a network.
  - i. Rearranging the records in a database according to a set of predefined criteria.

- j. A field that eliminates the problem of duplicate records.
- k. A query language for manipulating data in a relational database.

**True/False:**

- 12. Historically, the role of MIS has been to use information in strategic ways.
- 13. Relational databases were developed before hierarchical databases.
- 14. In theory, databases should exist independently of the specific applications.
- 15. A DBMS is confined to storing words and numbers.
- 16. The structural part of a data model specifies how data should be represented.
- 17. A query language is similar to a programming language.
- 18. Maintaining the consistency of hierarchical databases in different applications is a simple matter.
- 19. A goal of distributing databases is accessing information without regard to where the information is stored.

**Multiple Choice:**

- 20. Which of the following is not a part of a database management system
  - a. A storage subsystem.
  - b. A modelling and manipulation subsystem.
  - c. A communications subsystem.
  - d. An interface.
- 21. The hierarchical model creates relationships among data by
  - a. Creating linked lists with pointers.
  - b. Creating two-dimensional tables.
  - c. Structuring data into rows and columns.
  - d. Structuring data into an inverted tree.
- 22. The most popular database model today is
  - a. Relational.
  - b. Hierarchical.
  - c. Network.
  - d. Object-oriented.
- 23. In the relational model, fields are represented by
  - a. Linked lists.
  - b. Pointers.
  - c. Vertical columns.
  - d. Horizontal rows.
- 24. Which of the following is not a basic data-manipulation operation.
  - a. Retrieving information.

- b. Modifying the database.
  - c. Deleting old information from the database.
  - d. Sorting the database.
25. Distributing databases is an evolutionary step because
- a. Client/server computing is no longer in use.
  - b. Data should exist at the location at which they are being used.
  - c. They are often based on a mainframe-centric model.
  - d. They cannot replace one central computing facility.