Ministry of Public Health of Ukraine
"Ukrainian Medical Stomatological Academy"

"APPROVED"
at the meeting of the Department
of Medical Informatics, Medical Biophysics
«27» august 2020
Minutes №. 1 «27» august 2020
Head of department _____ O.V.Silkova

METHODICAL GUIDANCE

for students' self-directed work when preparing and during the practical session

Academic Subject	Medical Information Science
Module No 1	Fundamentals of Information Technology in the Health Care System. Treatment and analysis of medical and biological data.
Topic	Computer data: types of data processing and management
Year of study	2
Speciality	Foreign Student Training (Medcine/Stomatology)
Number of academic hours	2

Poltava – 2020

1. **Relevance of the topic**:

Data is a set of values of qualitative or quantitative variables. An example of qualitative data would be an anthropologist's handwritten notes about his or her interviews with indigenous people. Pieces of data are individual pieces of information. While the concept of data is commonly associated with scientific research, data is collected by a huge range of organizations and institutions, including businesses (e.g., sales data, revenue, profits, stock price), governments (e.g., crime rates, unemployment rates, literacy rates) and non-governmental organizations (e.g., censuses of the number of homeless people by non-profit organizations).

2. **The specific aims**:

To know the definition of data;
To know data types;
To have general knowledge of the topic studied;
To understand, to remember and to use the knowledge received;
To form the professional experience by reviewing, training and authorizing it;
To be able to carry out laboratory and experimental work.

3. **Basic knowledge and skills necessary to study the topic (inter-disciplinary integration).**

Previous (providing disciplines)	**Obtainable skills**
Computer Science	distinguish types of information; explain the properties of the dates.

4. **The tasks for students' individual work**

4.1. The list of basic term, parameters, characteristics, which student should master while preparin for the class.

Term	Definition
Data	A set of values of qualitative or quantitative variables.
Qualitative data	Subjective in nature and cannot be measured objectively. It can be ranked or ordered. Quantitative data is objective in nature and can be measured
Quantitative data	Objective in nature and can be measured.
A database	An organized collection of data
A database-management system	A computer-software application that interacts with end-users, other applications, and the database itself to capture and analyze data.

4.2 Theoretical questions for the class (to the topic):

1. Types of computer data.
2. Elements of the databases theory.
3. Common logical data models for databases.
4. Main types of user interface.

4.3 Practical work performing in class:

Test

1.THE ROWS OF A TABLE CORRESPOND TO

a) Fields
b) Records
c) Reports
d) Files
e) Tables

2.A TABLE CONTAINS

a) Records but no fields
b) Fields but no records
c) Both records and fields, and further, every record contains the same fields
d) Both records and fields, and further, every field contains the same records
e) There is not right answer here

3.WHICH OF THE FOLLOWING ARE OBJECTS IN AN ACCESS DATABASE?

a) Tables, forms, queries, reports, macros, and modules
b) Database, Datasheet, and Form views
c) Folders and Tools
d) All of the above
e) None of above

4.THE COLUMNS OF A TABLE CORRESPOND TO

a) Fields
b) Records
c) Folders
d) Reports
e) Tables

5.IN WHICH OF THE FOLLOWING OBJECTS DOES ACCESS STORE DATA?

a) Datasheets
b) Forms
c) Tables
d) Reports
e) Queries

Content of the topic:

Data is a set of values of qualitative or quantitative variables.

There are two types of Data – Qualitative and Quantitative.

Qualitative data is subjective in nature and cannot be measured objectively. It can be ranked or ordered. Quantitative data is objective in nature and can be measured. Qualitative data is further bifurcated as Nominal, Ordinal and Binary whereas Quantitative data is either Discrete or Continuous (Fig. 3.1).

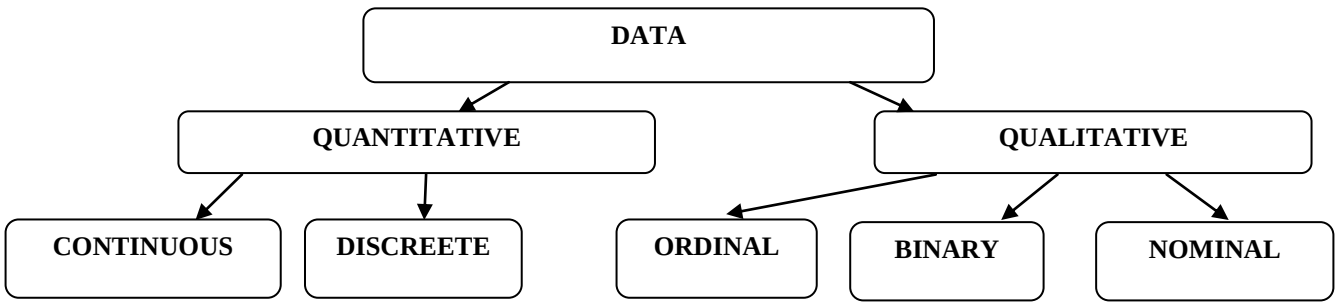

Fig. 3.1 Types of clinical data

The quantitative data:

1) *Continuous data* is information that can be measured on a continuum or scale. Continuous data can have almost any numeric value and can be meaningfully subdivided into finer and finer increments, depending upon the precision of the measurement system. E.g.: length, size, width.

2) *Discrete data* is information that can be categorized into a classification. Discrete Data can only take certain values. E.g.: the number of students in a class (you can't have half a student).

The qualitative data:

1) *Nominal data* are variables with no inherent order or ranking sequence. E.g.: gender, race, etc.
2) *Ordinal data* are variables with an ordered series. E.g.: blood group, performance, etc.
3) *Binary data* are variables with only two options. E.g.: pass/fail, yes/no, etc.

ELEMENTS OF THE DATABASES THEORY

The basis of any computing system is an information store, which includes a set of different related data from a particular subject area. Such data, which is stored in a computer, is called a **database**. A **database** is an organized collection of data. It is a collection of schemas, tables, queries, reports, views, and other objects. Examples of databases are: library catalogs, notebook, success journals, medical history.

In all modern automated medical records management systems there are database technologies that allow you to manage large information arrays - databases. To use or modify this data by one or more users, you need DBMS database management systems). A **database-management system** (DBMS) is a computer-software application that interacts with end-users, other applications, and the database itself to capture and analyze data. A general-purpose DBMS allows the definition, creation, querying, update, and administration of databases. Well-known DBMSs include MySQL, PostgreSQL, MongoDB, MariaDB, Microsoft SQL Server, Oracle, Sybase, SAP HANA, MemSQL, FoxBase and FoxPro.

Main functions of DBMS

- Storage and data manipulation in a DB.
- Re-structuring of a DB without loss of the information.
- Simulation of data logical structures.
- Processing of the big text datafields.
- Sorting (ordering) or codeindexing of the data on several keys.
- Creation and output of reports.
- Calculations with using of set arithmetical and logical expressions.

The data base management system is a special software package which provides creation, support and usage of databases by many users.

The DBMS is based on the use of a certain data model. The data model displays the relationship between the objects in the domain. Most modern DBMS uses a relational data model. The data in the relational model is represented in the form of two-dimensional tables (Fig.4.1).

Such tables in the terminology of databases are called **relationships**. Each column of the table called an **attribute**, and lines called **records**.

The main operations by which the database modified are the inclusion of a certain record, destruction and modification. Such operations are called transactions.

Code	Last name	First name	Sex	Age	Rhesus factor	Blood type
235	Smith	John	male	58	+	0 (I)
118	Petrov	Pol	male	33	+	A(II)
328	Kin	Kira	female	45	-	B(III)

135	Torens	Anna	female	23	-	AB(IV)

Fig. 3.2 Table database of the hospital

For information retrieval operations use a set of special commands, which allows you to build a number of queries, which is necessary to obtain the necessary data from the database.

To create a database, you must specify the following:

- database name – certain of characters, under which this database will be stored on disk;
- number of fields – number of columns;
- name of each field is an arbitrary sequence of characters, under which there will be formed some column of the table;
- type of each field – indicates the data properties that are stored in the field. There are following basic types of fields: *Number* - for the preservation of digital data, *Text* - for the preservation of text data, *Date/Time* - for the preservation of dates or time, *Memo* - for the preservation of arbitrary information of unlimited size, *Yes/No* - to preserve the logical replaceable "and", "or", "not", *Attachment* - attached images, spreadsheet files, documents, charts, and other types of supported files to the records in your database, similar to attaching files to e-mail messages;
- length of each field (applies to fields of type numeric, character) - specifies the maximum number of characters that can be stored in a field of this type.

DATABASE MODELS

Common logical data models for databases include:

1. Hierarchical database model

In a hierarchical model, data is organized into a tree-like structure, implying a single parent for each record. A sort field keeps sibling records in a particular order. Hierarchical structures were widely used in the early mainframe database management systems.

2. Network model

The network model expands upon the hierarchical structure, allowing many-to-many relationships in a tree-like structure that allows multiple parents. Network model organizes data using two fundamental concepts, called records and sets. Records contain fields. Sets define one-to-many relationships between records: one owner, many members. A record may be an owner in any number of sets, and a member in any number of sets.

3. Relational model

The relational model was introduced by E.F. Codd in 1970 as a way to make database management systems more independent of any particular application. It is a mathematical model defined in terms of predicate logic and set theory, and systems implementing it have been used by mainframe, midrange and microcomputer systems.

In the theory of relational databases of line name as tuples (record), and columns – attributes (fields).

In each table one attribute is selected. It name key attribute, or simply – key. The key attribute is necessary unique, that is it should uniquely, unambiguously determine (to identify) tuples. *For example,* key field can be *Code of card*.

Key attribute (key field) is used for identification (recognition, discrimination) of different tuples and for associating them to the certain, fixed objects.

4. Entity–relationship model

This model captures the relationships between real-world entities much like the network model, but it isn't as directly tied to the physical structure of the database. Instead, it's often used for designing a

database conceptually.

5. Object-oriented database

Items created using object-oriented programming languages are often stored in relational databases, but object-oriented databases are well-suited for those items.

An object-oriented database is organized around objects rather than actions, and data rather than logic. For example, a multimedia record in a relational database can be a definable data object, as opposed to an alphanumeric value.

6. Graph database

A graph-oriented database, or graph database, is a type of NoSQL database that uses graph theory to store, map and query relationships. Graph databases are basically collections of nodes and edges, where each node represents an entity, and each edge represents a connection between nodes.

Graph databases are growing in popularity for analyzing interconnections. For example, companies might use a graph database to mine data about customers from social media.

INTRODUCTION TO THE *ACCESS* DATABASE

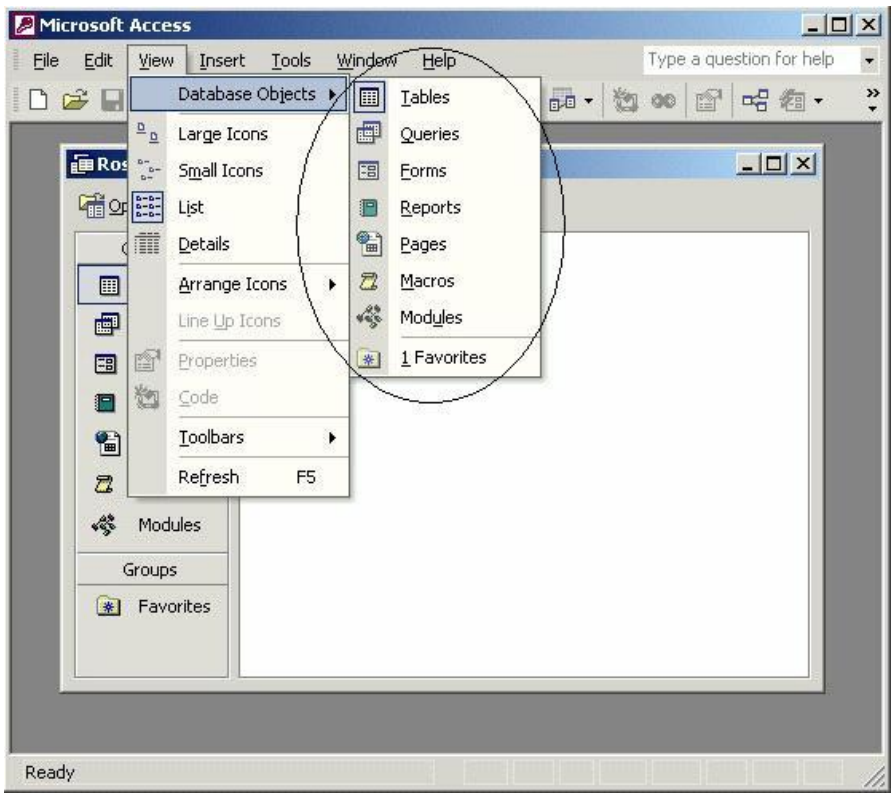

Fig. 3.3 The Access database objects

Access is an object-oriented relational database management system. The objects that make up any particular database that you create using *Access* are illustrated in Fig. 3.3.

- A **Table** is an object which represents the data in rows and columns, rather like a spreadsheet. For this reason, when you view a table in an *Access* database, you are in what *Access* refers to as a *Datasheet View*. You will learn about Tables in this lesson.
- A **Query** is an object which makes a request to the database to find some set of data that is stored in the database.
- A **Form** is an object which gives the user another view of the data in the database. Whereas a Table allows the user to view multiples records at once, a Form displays the contents of just one record at a time.
- A **Report** is an object which is designed based on the data in the database and which is used to inform the user of the selected contents of the database.
- A **Page** is a special type of web page designed for viewing and working with data from the Internet. This *Access* feature is beyond the scope of these tutorials.
- A **Macro** is a sequence of instructions which can be carried out with a single click of the mouse button on a button in a toolbar or by pressing a key or combination of keys on the keyboard.
- Finally, a **Module** is a collection of programming procedures designed to give programmer control over the *Access* database look and feel.

INTERFACE

A **user interface** is a combination of means by which a user interacts with the computer system. It allows the end user to communicate with the operating system so they can load programs, access files, and accomplish other tasks. The three main types of user interfaces are:

1. Command drive
2. Menu drive
3. Graphical User Interface (GUI)

The most popular graphical user interface is that provided by Windows. Database management packages facilitate the storage, maintenance, and utilization of data in a database that is shared by many users. Microcomputer DBMs enables the users to:

1. Create and maintain a database
2. Query a database with a query language
3. Prepare formatted reports

In addition, packages offer security features, network connectivity, and the ability to present graphical output, as well as to perform spreadsheet-type computations.

Tasks for self-check:

Task 1:

1.A DATABASE MAY CONTAIN

a) Only one table
b) At most two tables
c) At most three tables
d) All of the above
e) None of the above

2.WHICH OF THE FOLLOWING IS USED TO ANSWER A QUESTION ABOUT A DATABASE?

a) Form
b) Module
c) Query
d) Table
e) Report

3.WHICH OF THE FOLLOWING IS USED IN ACCESS TO AUTOMATE A SERIES OF COMMANDS?

a) Report
b) Table
c) Macro
d) Query
e) Form

4.AN ACCESS DATABASE YOU ARE WORKING ON CONTAINS A TABLE, FORM, QUERY, AND REPORT. HOW MANY FILES ARE NEEDED TO STORE THESE ELEMENTS?

a) One
b) Two
c) Three
d) Four
e) Many

5.WHICH OF THE FOLLOWING VIEWS WOULD YOU USE TO DEFINE A TABLE AND SPECIFY THE FIELDS IT WILL CONTAIN?

a) Define view
b) Datasheet view
c) Design view
d) Edit view
e) None of above

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Additional.

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3. www.ncbi.nlm.nih.gov (Національна бібліотека медицини США)
4. www.cochrane.ru (Розділ Кохранівського співтовариства)

The methodical guidance has been completed by **S.Y. Olenets**