



Database systems



Databases. Main definitions.

- **This are resources** to which the users having the corresponding access rights have to have access.
- **The database** is the coordinated (consistent) data set which is falling into to a specific objective (tasks) together with logical communications between data.
- **Logical communications (schemes)** define how one data correspond to others according to the DB logical model. In it the main difference of a DB from the file of data in which data are organized on physical sign in the form of a serial set of records consists.
- **The database management system** represents a set of tools, and is more often - the realized programs intended for storage of the database, change of its contents, ensuring its safety and interaction with the user.



Databases. Trial functions.

- Providing quick access to a DB.
- Protection of a wholeness of a DB at hardware failures and program mistakes.
- Differentiation of access rights and protection against unauthorized access to a DB.
- Support of collaboration of several users from the common DB.
- Data management in external memory;
- Control of buffers of random access memory;
- Management of transactions (operating sequences over a DB);
- Journalizing and restoration of a DB after failures;
- Maintaining of the DB languages.



Logical organization of databases.

The logical organization of databases is the logical model of subject domain reflecting three types of information about objects of subject domain:

- data on objects of subject domain;
- their properties;
- their relations.

Objects on the scheme are defined by types of records, properties of objects - fields of records, the relations - define communications between types of records and fields.

Types of the DB logical models:

- hierarchical;
- network;
- relational.



Data model definition

- Data structure
- Operations
- Integrity constraints

schema – data description

instance – data value

data structure = schema + instance

data algebra = data structure + operations

data model = data algebra + integrity constraints



Field and Segment

Data field – elementary named data. Its instance is a data value.

Segment – is a named set of field names:

TEACHER (Name, Post, Address)

Graphic notation:

TEACHER

Name

Post

Address

Segment instance – ordered set of fields instances:

TEACHER

Johnson

professor

Kiev



Hierarchy Data Schema

FACULTY

Name	Dean	Fund
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DEPARTMENT

Name	Head	Building
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TEACHER

Name	Post	Address
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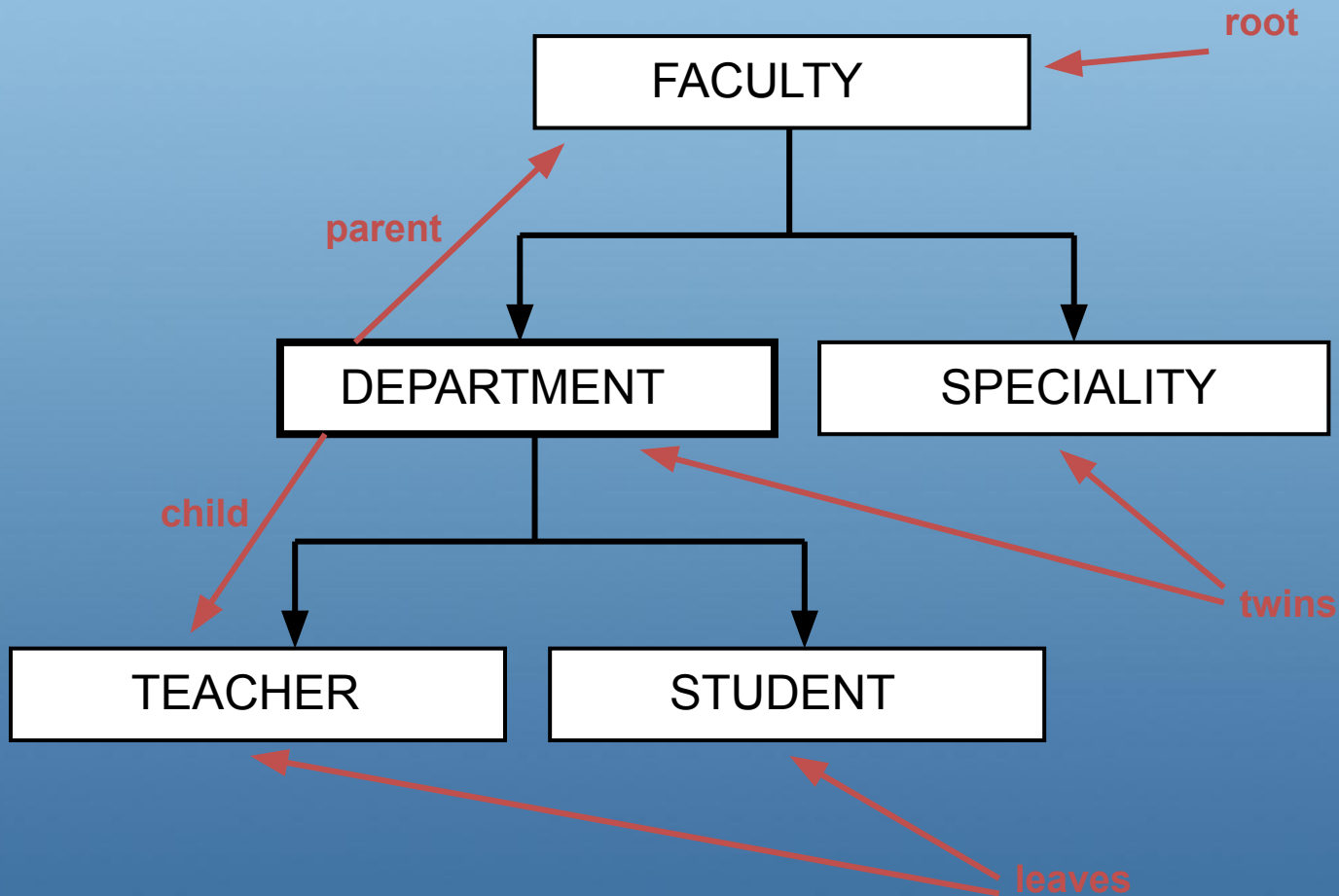
FACULTY

DEPARTMENT

TEACHER

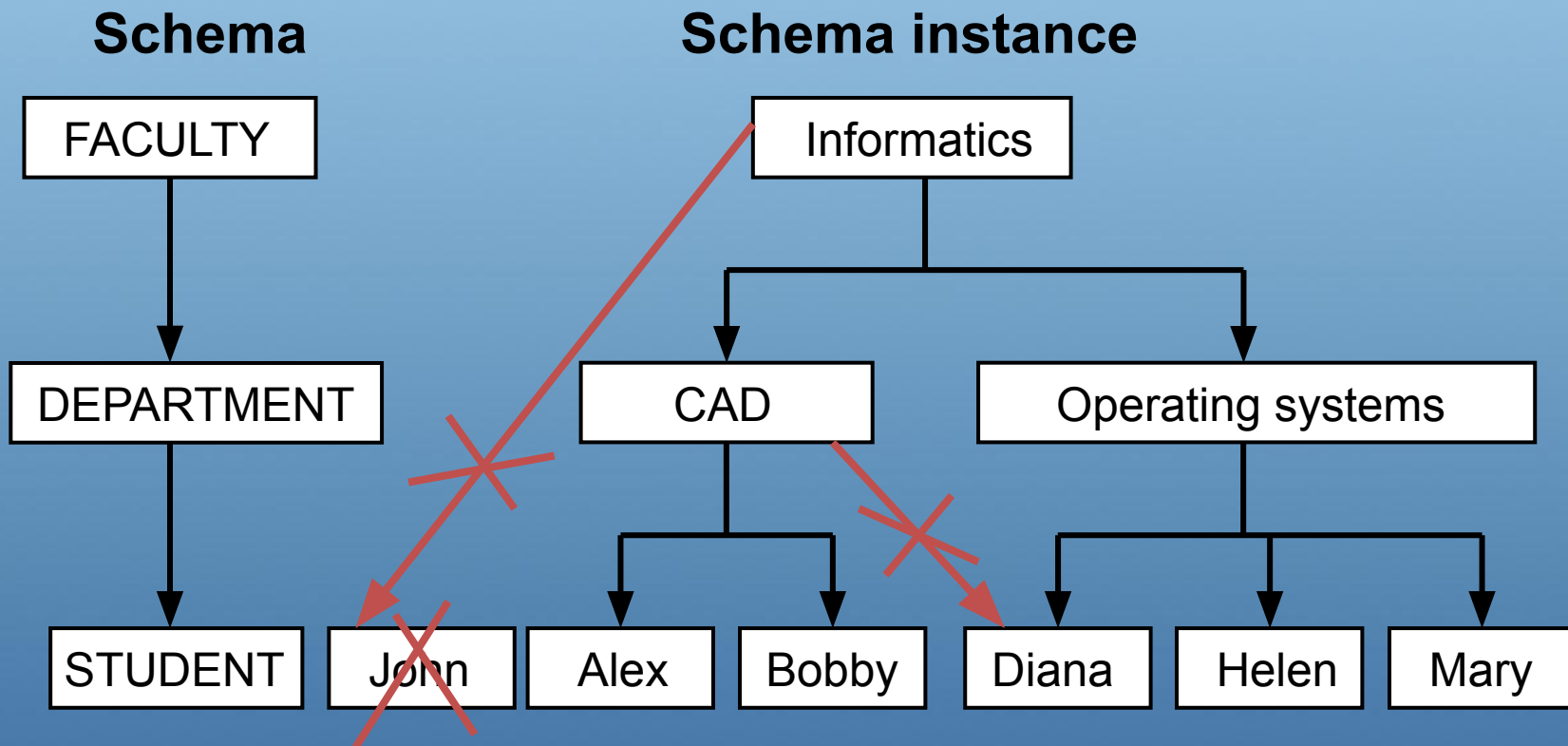


Hierarchy Data Schema





Hierarchy Schema Instance





Fields and record types

Data field (item) – elementary named data. Its instance (occurrence) is a data value.

Record type – is a uniquely named collection of field names:

TEACHER (Name, Post, Address)

Graphic notation:

TEACHER

Name

Post

Address

Record type instance – ordered collection of fields instances:

TEACHER

Johnson

professor

Kiev



Keys

Two or more different records within a network data base may have duplicate values of all data items.

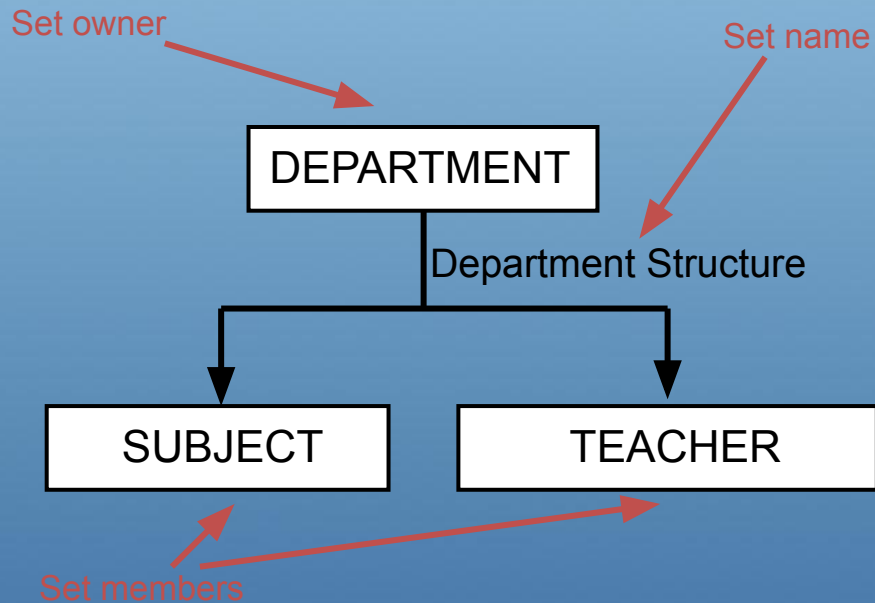
The Data Base Key (DBK) is a unique internal identifier of any record. DBK is automatically assigned to any record when it is stored in DB and do not changed when a record is updated.

CALC key is an internal identifier of any record, that assigned to a record on the base of values of a specified record fields.

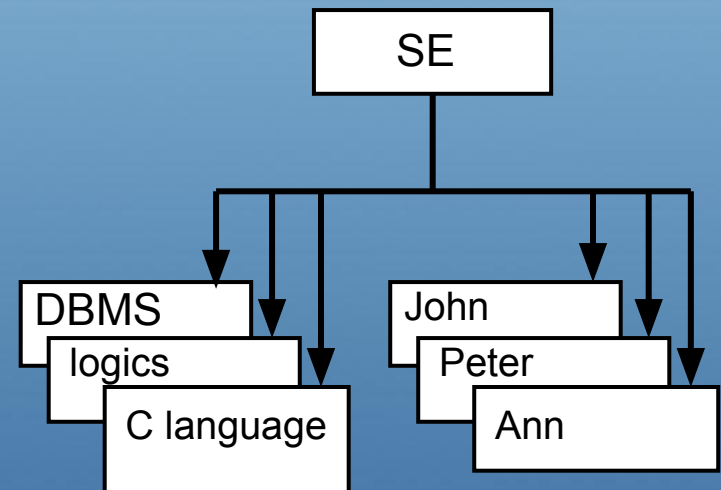


Example of the set type and instance

Set type

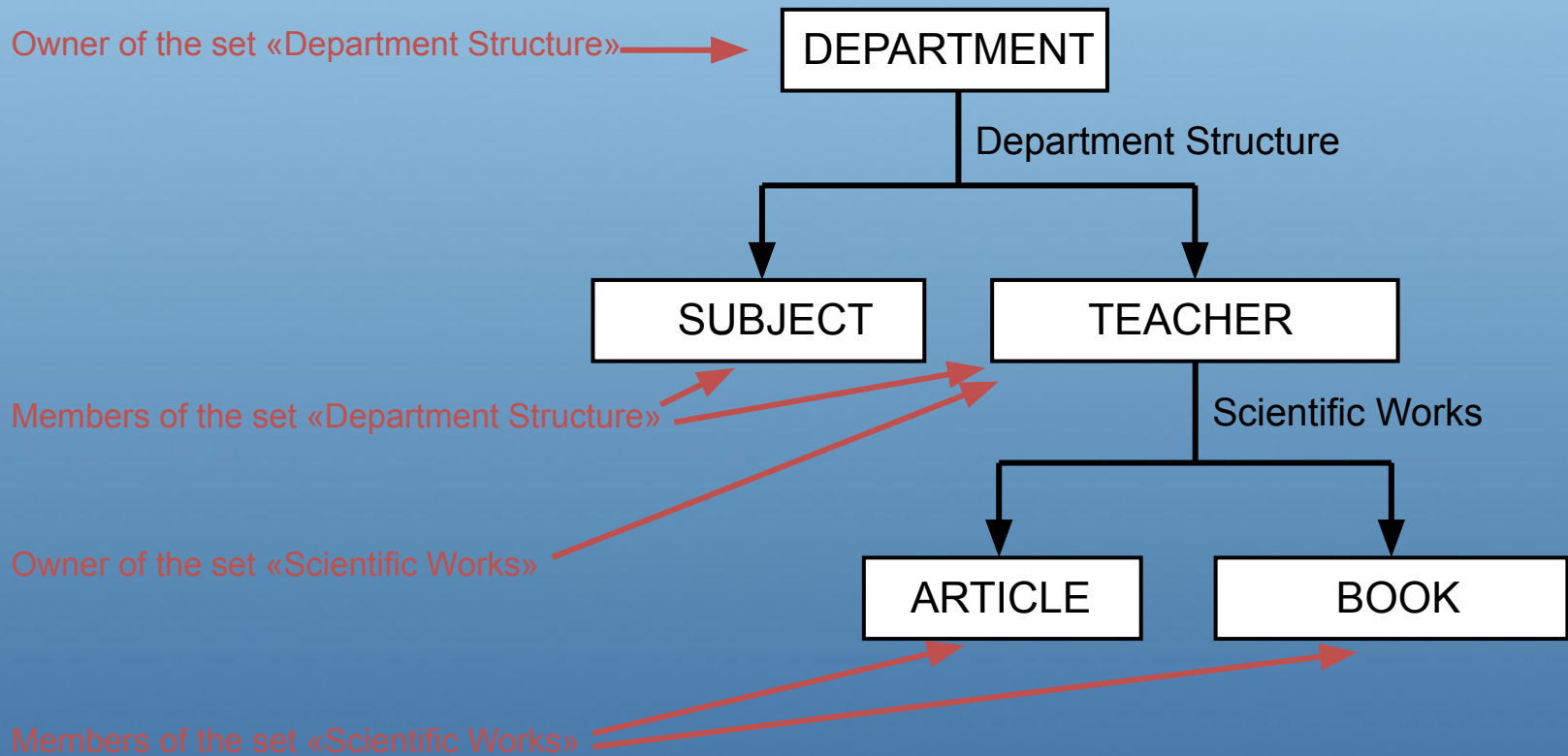


Set instance



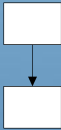
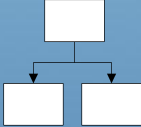

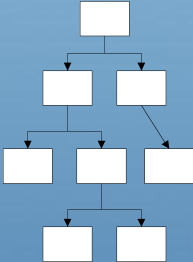
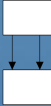
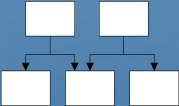

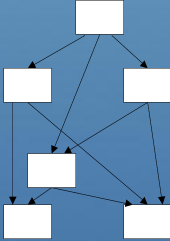
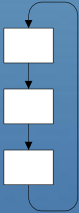



Multilevel Hierarchy





Possible categories of network schemas

	Two level schemas		Multilevel schemas		Schema with cycles
	Without branches	With branches	Without branches	With branches	
Hierarchical structures					
Network structures					
Loops (one level cycles)					



Nonformal introduction to relations

Relation is an association between any number of entities.

Like subject				Is more			Supply	
Who	What	First	Second	Who	Whom	What	Q-ty	
John	DBMS	5	3	П1	K7	table	200	
Peter	C	17	5	П3	K14	door	150	
Ann XML	2	1	П18	K9	window	1000		

Form of representation:

- As a table
- By using a condition



Property of attributes and schemas

Properties of the relation attributes:

- Each attribute of a relation has a name.
- The set of allowed values for each attribute is called the domain of the attribute.
- Different attributes may have the same domain.
- Attribute values are required to be atomic, that is, indivisible.

Properties of the relation schema:

- Every schema has a name.
- Attribute names in schema must be unique.
- Order of attributes in schema is not fixed