Databases

(Basic concepts)

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LAB no. 1 - 2

1. *Definition and features of databases*
2. *Database scheme*
3. *Database users*
4. *DataBase Management System*
5. *Designing of databases*

Definition and characteristic of databases

- *Database*:

  a specialized computer system enables storing the informations in the form of data records/rows. Basic functionalities include:
  - searching of the required informations/data,
  - adding, modyfing and deleting information within individual records and/or in a set of records,

- *Features*:
  - storing the data in a persistent way,
  - possibility of on-line access to data,
  - data consistency (integrity),
  - the security of stored data..

Database scheme

- **Database contains three main modules, including:**
  - ***data*,**
  - ***hardware*, and**
  - ***software*.**

- **The *Data* stored in the database as:**
  - **persistent,**
  - **integrated, and**
  - **data can be shared,**

- ***Hardware*, including:**
  - **storage devices(e.g., magnetic and/or optical hard discs),**
  - **processors and memory, where applications are executed.**

Database scheme (*cont.*)

- ***Software*:**
  - **the interfaces between the end-users and the (a) physical structure and (b) storage of data,**
  - **so-called as *DBMS* (*DataBase Management System*),**
  - **relieving the user out from the technical details of the database.**

Database's users

- There are 3 main groups of users, i.e., including:
  - *End-users*, including:

    - users who search (and insert/modify) the content of the database by using the specialized *UI* (e.g., form/report),

    - „advanced" users, who're able to use of the database query language(s) (for instance *QBE* and/or *SQL*),

  - *Application's developers*, who're implementing the database applications,

  - *Administrators* with the division into:

    - *administrators of data* (*DA*), i.e., persons responsible for defining the data (persons who knows the specifity of data from the given domain),

    - *database administrators* (*DBA*), i.e., IT specialists. The database administrator is responsible for (a) supervision of the database with regards to its technical perspective and/or (b) deciding how the data structures are (should be) implemented.

Database components

Query language

DBMS (Database Management System)

External memory/storage

External memory

- ***Persistent*:**
  data should be kept as long as required by users,

- ***Reliable*:**
  maximum limitation of the occurence of failures, e.g., by:
  - **Multiplication of memory devices (e.g., disk array(s)),**
  - **Checking of the recording correcteness,**
  - **Entry of codes for error detection and/or correction.**

DBMS (DataBase Management System)

- **Operations of access to data on a physical level, e.g.:**
  ***drivers, algorithms iof access, data structures,* etc.**

- **Data integrity:**
  - **Transactional processing,**
  - **Control of restrictions onto data, etc.**

- **Co-processing:**
  manage of conflicts over access to the same data,

- **Data protecion:**
  control of access rights for a specyfic users.

DBMS – DataBase Management System (cont.)

- **Restart after breakdowns (*back-up's*),**
- **Processing of distributed data,**
- **Parallel processing *(multi-processor processing)*.**

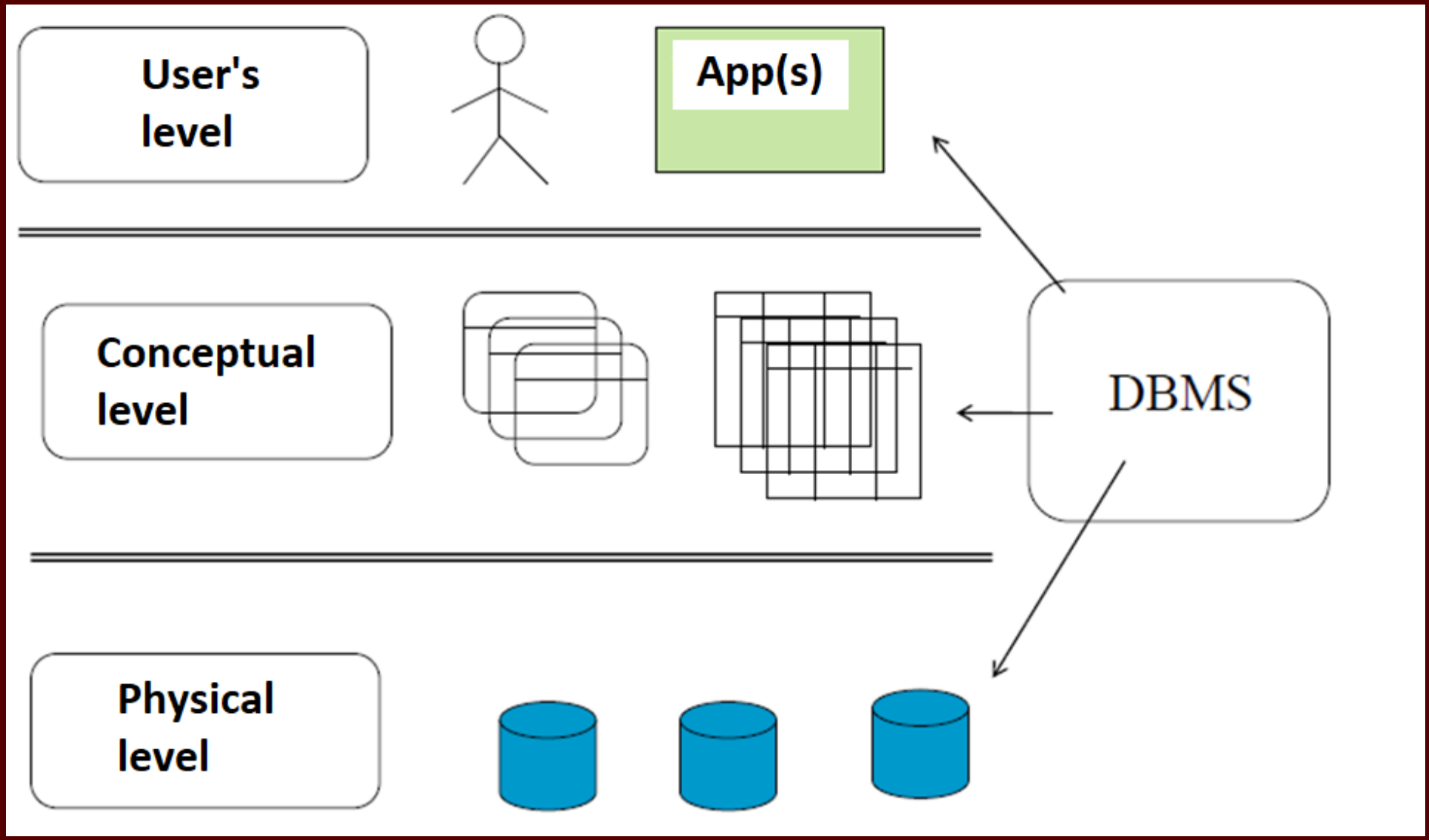
Query language

- ***End-users*:**
  - **Options selected from menu, and/or**
  - **Instructions entered from the command line,**

- ***Developers*:**
  - **Specialized database's programming language (4GL), or**
  - **3rd generation language (e.g., C++), extended with database handling functions,**

- **3 (or 4) categories of SQL language:**
  - ***DDL* (i.e., *Data Definition Language*),**
  - ***DML* (i.e.. *Data Manipulation Language*),**
  - ***DCL* (i.e., *Data Control Language*), and/or**
  - ***TCL* (i.e., *Transaction Control Language*).**

Architecture of the database system



Independence from the perspective of data type(s)

- Separating the user level from the physical database level makes the application independent out of the data structure.

- Advantages – without any changes in app's code such solution allows to perform:
  - changes within storage/memory devices,
  - modification of existed data structures (and/or creation of new ones),
  - change of phisical-type data representation.

External (*user's*) level

- **Database view from the individual user's perspective:**
  - **abstract vs the „real" physical storage of data,**
- **Access restrictions and transparency:**
  - **„unawareness" of existence of data other than those required by the user.**

Conceptual level

- **The conceptual data model means:**
  representation of the database's content,

- **The data are presented in the form:**
  in which they've been saved rather than in the form viewed by the user,

- **The conceptual data model is:**
  the „way" in which an entire content of database can be viewed.

Internal level

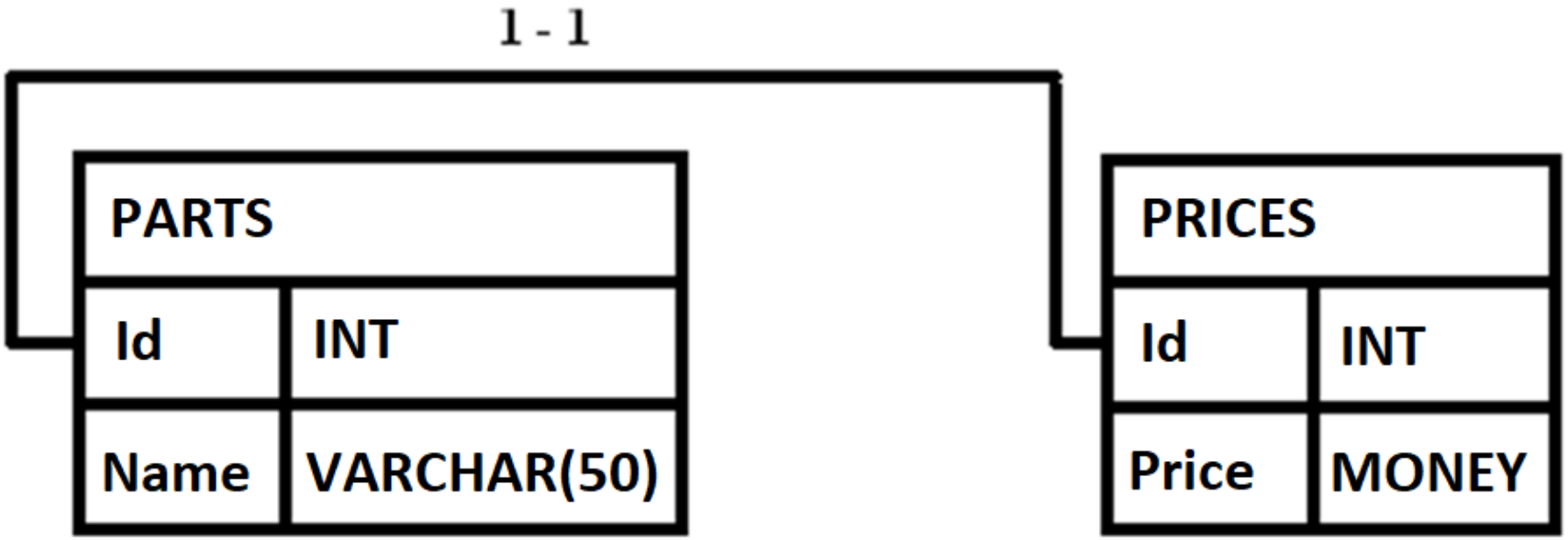
- **The internal data model is described by using the internal scheme, which defines:**
  - **type of saved records,**
  - **type of indexes,**
  - **the representation of row/record's fields,**
  - **the order in which records are saved, etc.**
- **The physical level does not include the physical level of the base (files, disks, cylinders, etc.).**

Basic concepts (*objects*)

- Table / Relation,
- Perspective / View,
- PK (Primary Key) and/or FK (Foreign Key),
- Cursor,
- Stored procedure (and/or function),
- Relationship(s).

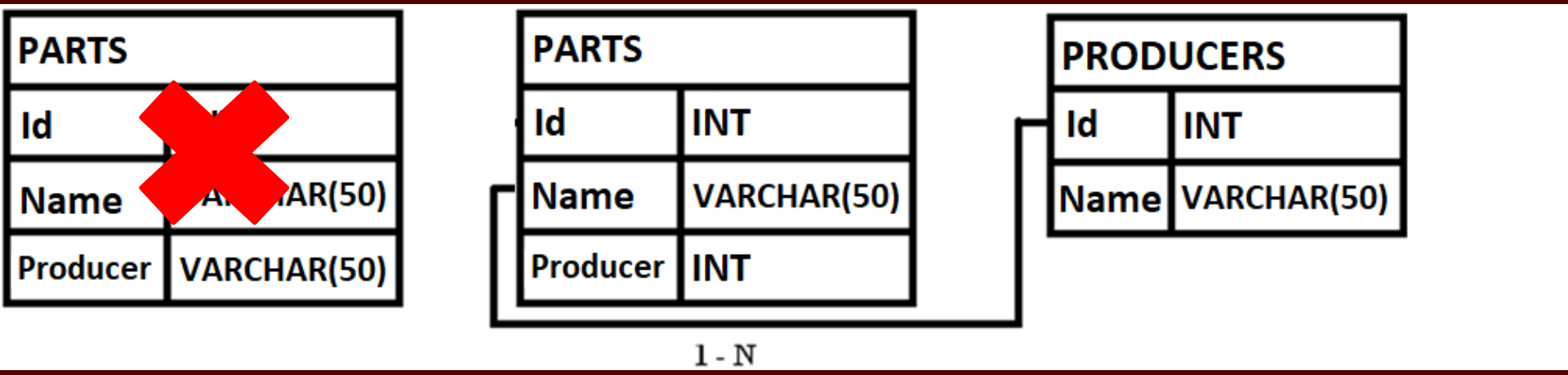
Basic concepts (*relations/relationships*)

- **1-1 relation:**



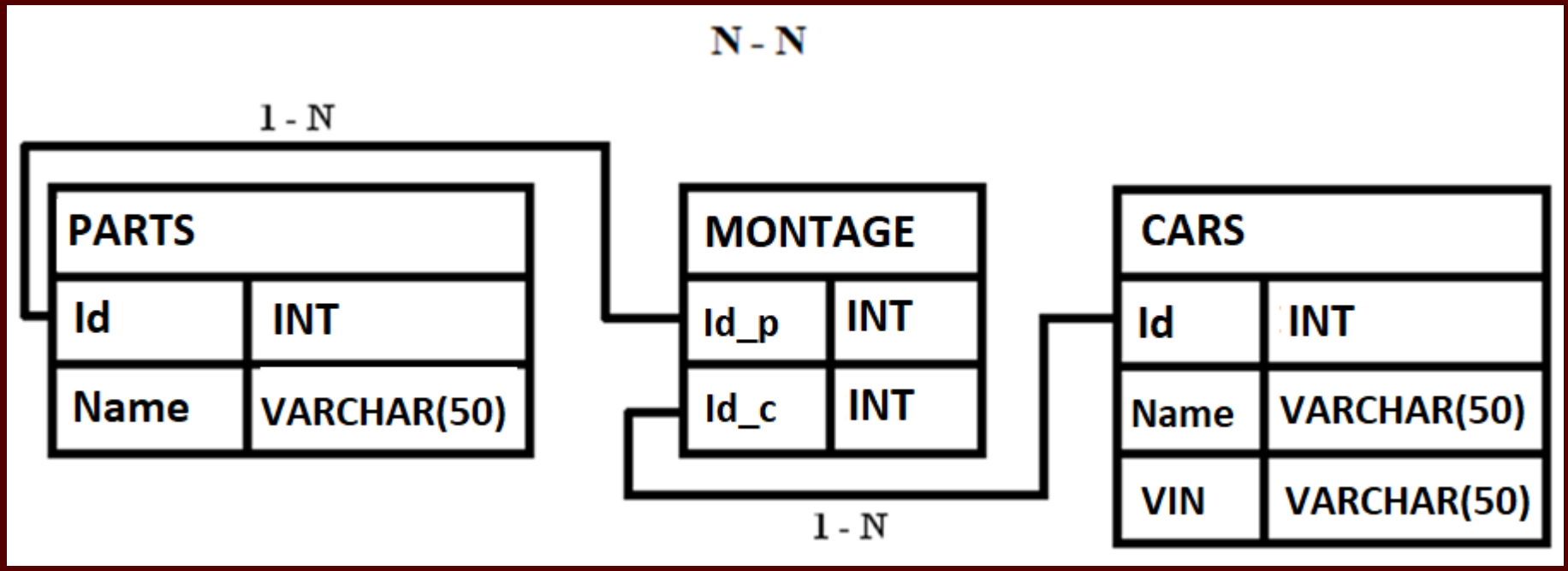
Basic concepts (*relations/relationships*)

- **1-N type relation:**



Basic concepts (*relations/relationships*)

- **N-N (many-to-many) relation:**



Designing of the databases (*examples*)

- **TASK no.1**

  Design an example database's scheme for the *Library*.
  The database should contains informations about:
  - ***Persons* who borrowing the books,**
  - **Collection of owned *books*, and**
  - **Completed *loans*.**

- **TASK no.2**

  Design an example database's scheme for the *University*.

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Thx for attention…