CE208-Database Management Systems

Intro

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0.1.1 Week-1 (Intro)

0.1.1.1 Spring Semester, 2021-2022

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0.1.2 Outline

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- Database
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0.1.3 Outline

- Hierarchical databases
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  - Relational databases
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[1] 1_veri_tabani_giris_week_1.pdf
[2] week-1.en.md_slide.pdf
[3] week-1.en.md_slide.pptx
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0.1.4 Outline

- Database Structure
- Table
- Data Types
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- Database Design

0.2 What is Database?

- It is an information repository where data that is related to each other is kept.
- The collection of data arranged in accordance with the purpose of use
- They are information stores with their logical and physical definitions.

0.3 Database Examples

- University - Student Affairs Information System
- Hospital - Patient, doctor, treatment, equipment, financial information
- A commercial company - Customer, Product, Sales, Payment, Delivery information
- Bank - Customer, deposit, credit card, credit information

0.4 Database

- The database concept was first introduced in the 1980s.
- It is used in everywhere from a simple web application up to large and complex data of international organizations
- Database applications are needed in many areas.

0.5 What is Database Management System?

It is a software system in which various complex following operations are performed.

- Creating a new database,
- Editing the database
- To use,
- Develop
- to take care of (maintanance)

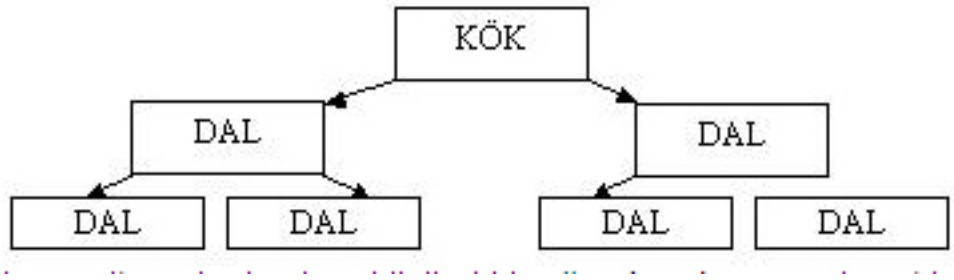
0.6 Classification of Database Management Systems

- By Data Model
  - Hierarchical
  - Network
  - relational
  - Object Oriented

- By Number of Users
  - single user
  - multi-user

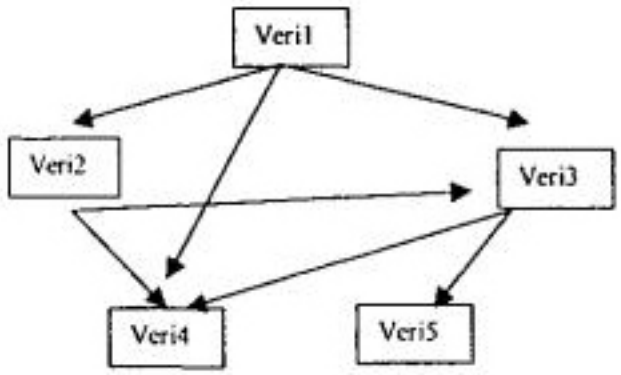
0.6.1 Hierarchical databases

- It is the first model used for databases.
- Hierarchical databases store information in a tree structure.



0.6.2 Network databases

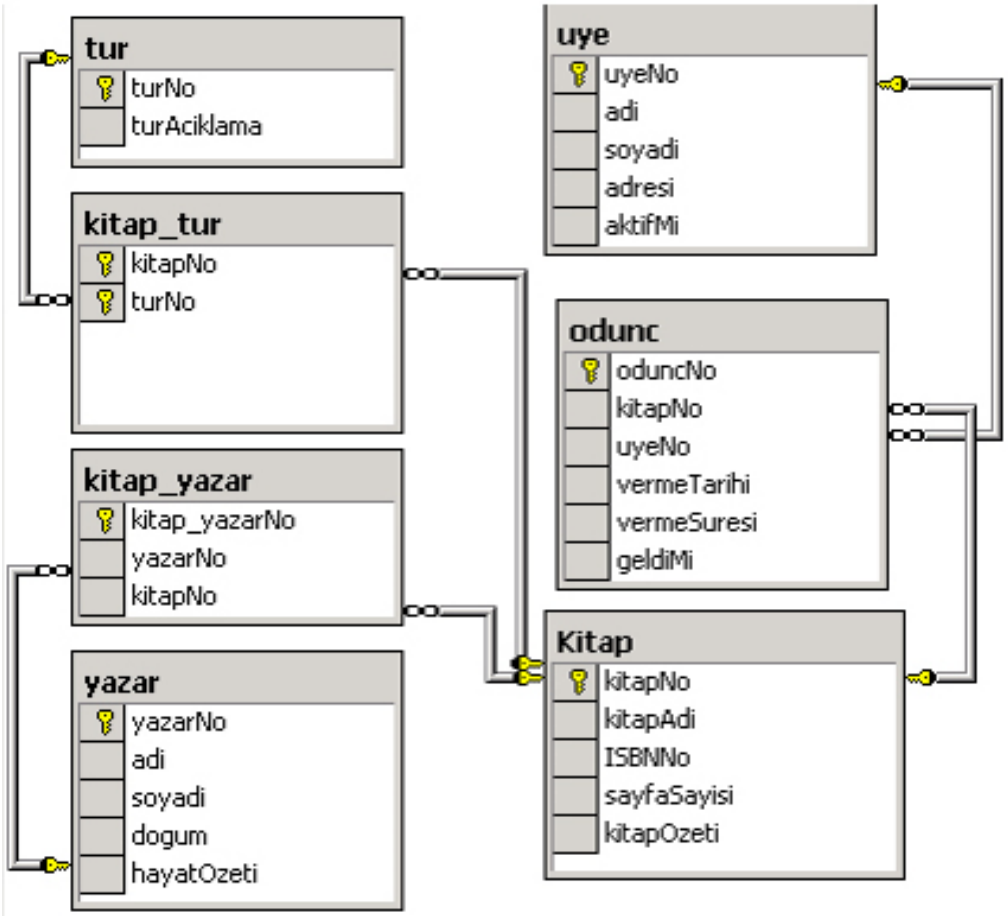
- When hierarchical databases were insufficient, a structure in which data was stored in the form of graphs, which is a more advanced version of trees, emerged at the end of the 1960s.



0.6.3 Relational databases

- It was developed in the early 1970s.
- In this system, data is stored in tabular form.
- Connections between tables are represented by mathematical relationships.
- Almost all database programs today have this structure.

0.6.4 Relational databases



0.6.5 Object Oriented databases

- Objects used in many word processor and spreadsheet programs today are also used in databases.
- Object-oriented database means a database created and used in an object-oriented language such as
  - `C++`,
  - `C#`,
  - `java`,
  - `Visual Basic`.

0.7 Why use a database?

- The traditional approach to holding, storing and accessing data uses the approach of grouping data into separate files.
- With the increase in data and the need to access and edit data at the same time, the traditional approach has been inadequate.

0.8 Advantages of the Database Approach

- Preventing duplication of common data;
- Ensuring centralized control and consistency of data

- Ensuring data sharing
- Hiding physical structure and access method complexities from the user with multi-layered architectures,
- Presenting only the data that is of interest to each user in easy, understandable structures

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0.9 Advantages of the Database Approach

- Ease of application software development with the analysis, design and development tools provided.
- Providing the necessary facilities for data integrity,
- Ensuring the desired level of security and confidentiality
- Solving operational problems such as backup, reboot, repair

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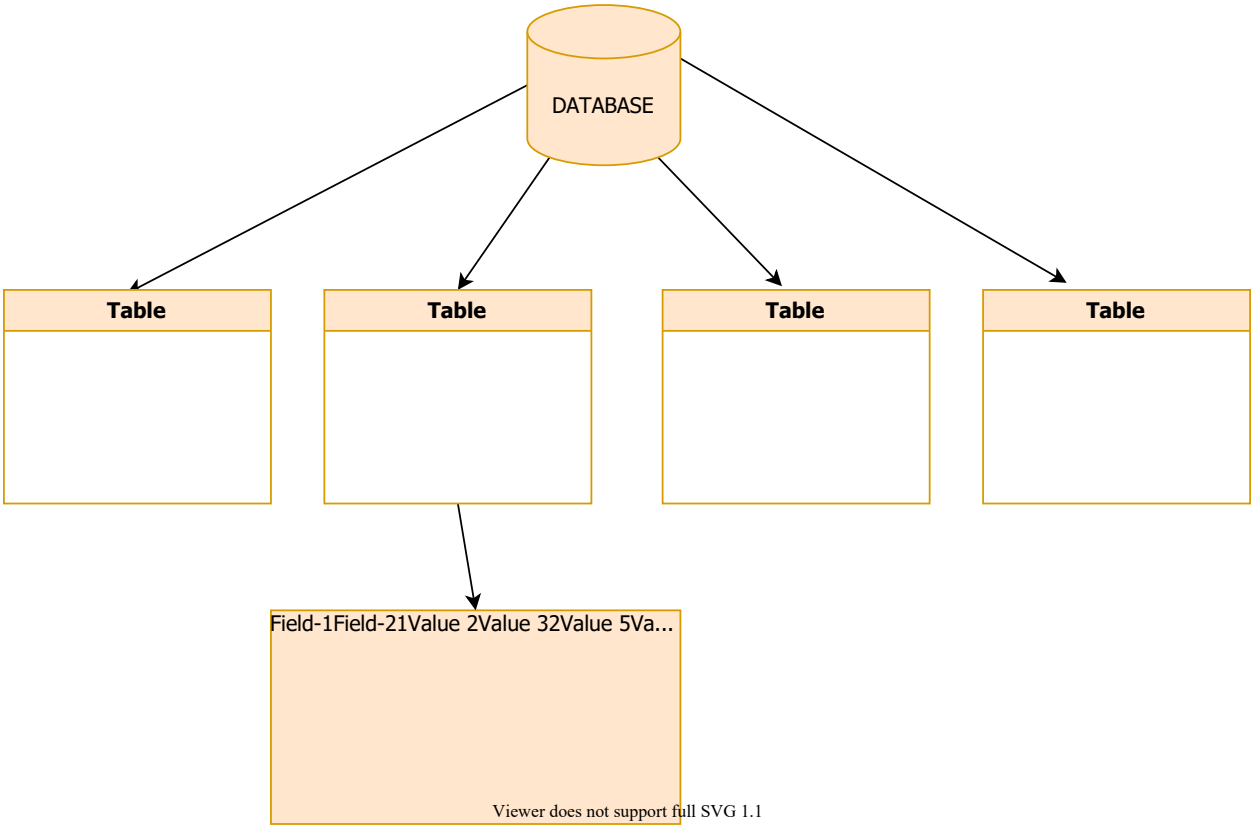
0.10 Database Management Systems

- Oracle database
- IBM DB/2
- Adaptive Server Enterprise
- Informix
- Microsoft Access
- Microsoft SQL Server
- Microsoft Visual FoxPro
- MySQL

0.11 Database Management Systems

- PostgreSQL
- Progress
- SQLite
- Teradata
- CSQL
- OpenLink Virtuoso

0.12 Database Structure



0.13 Table

- A database consists of data stored in tables.
- Tables are a group of data that is formed by arranging data in rows and columns.
- For example, 2 tables are created to store the course content and student information in the database:
  - Student information
  - contents

0.14 Table

- Each piece of information in the table is called a **record** , and the columns are called **a field** .
- For example, in the student information table, following information is included.
  - Student number,
  - Name and surname,
  - date of birth,
  - Place of birth,
  - E mail address

0.15 Table

Ogr_no	Ad_soyad	d_tarih	d_yeri	e-mail
1	Ayşe Öztürk	01.11.1979	Konya	ayse@gazi.edu.tr

Ogr_no	Ad_soyad	d_tarih	d_yeri	e-mail
2	Sema Özdemir	24.05.1975	Ankara	sema@gazi.edu.tr
3	Serdar Gülpınar	06.06.1983	Adana	serdar@gazi.edu.tr
4	Mehmet Efe	11.02.1978	Niğde	mehmet@gazi.edu.tr
5	Zerrin Polat	22.08.1980	Antalya	zerrin@gazi.edu.tr
6	Ulviye Kubalı	12.12.1984	İstanbul	ulviye@gazi.edu.tr

0.16 Table

Fields

Ogr_no	Ad_soyad	d_tarih	d_yeri	e-mail

Record

1	Ayşe Öztürk	01.11.1979	Konya	ayse@gazi.edu.tr
2	Sema Özdemir	24.05.1975	Ankara	sema@gazi.edu.tr

0.17 Data Types

- In order to have information about the structure of the records kept in the database, some properties of the fields must be defined beforehand.
- *For example*, the personnel registration number must be made up of integers, names and surnames must be words.

0.17.1 MYSQL Data Types

- **Numeric**
- **Date and Time**
- **Textual (String)**
- **Spatial**

0.17.2 MYSQL Data Types

0.17.2.1 TINYINT :

- For very small integer values
- When Signed is defined, the values are between `-128` and `127`.
- Unsigned defined range is between `0` and `255`.

0.17.3 MYSQL Data Types

0.17.3.1 SMALLINT :

- For small integer values
- When Signed is defined, the values are between `-32768` and 32767.
- Unsigned defined range is `0` to `65535`.

0.17.4 MYSQL Data Types

0.17.4.1 MEDIUMINT :

- For medium-sized integer values.
- When Signed is defined, the values are between `-8388608` and `8388607`.
- Unsigned defined range is between 0 and `16777215`.

0.17.5 MYSQL Data Types

0.17.5.1 INT(n):Interger

- For normal-sized integer values.
- When Signed is defined, the values are between `-2147483648` and `2147483647`.
- Unsigned defined range is between `0` and `4294967295`.

0.17.6 MYSQL Data Types

0.17.6.1 BIGINT :

- For large integer values.
- Can take integer value `-9223372036854775808` to `9223372036854775807`

0.17.7 MYSQL Data Types

0.17.7.1 FLOAT :

- Keeps numbers with their fractions.
- Max. character width is taken as a parameter. (`up to 23 digits`)

0.17.8 MYSQL Data Types

0.17.8.1 DOUBLE:

- Keeps numbers with their fractions.
- Max. character width is taken as a parameter. (`24 to 53 digits`)

0.17.9 MYSQL Data Types

0.17.9.1 DECIMAL:

- Keeps numbers with their fractions.
- The integer part can have a maximum `64 digits`, and the fractional part a maximum `30 digits`.

0.17.10 MYSQL Data Types

0.17.10.1 DATETIME:

- Datetime information in `Year+Month+Day+Hour+Minute+Second` format

```
YYYY-MM-DD HH:MM:SS
```

0.17.11 MYSQL Data Types

0.17.11.1 TIMESTAMP:

- Time information from `January 1, 1970` to `January 18, 2038`, in the format `Year+Month+Day+Hour+Minute+Second`.

```
YYYYMMDDHHMMSS
```

0.17.12 MYSQL Data Types

0.17.12.1 DATE:

- Date field that can change from `1000-01-01` to `9999-12-31`.

```
YYYY-MM-DD
```

0.17.13 MYSQL Data Types

0.17.13.1 CHAR(n):

- Fixed-length data with n characters.

0.17.14 MYSQL Data Types

0.17.14.1 TEXT:

- A text field that can hold up to `65535` characters.

0.17.15 MYSQL Data Types

0.17.15.1 MEDIUMTEXT:

- Text field up to `16777215` characters

0.17.16 MYSQL Data Types

0.17.16.1 VARCHAR(n):

- Characters of varying size, not exceeding n

0.17.17 MYSQL Data Types

0.17.17.1 BOOL:

- A data type that takes the value `0` or `1`. or `True/ False`

0.18 Key

- A key forces one or more fields to be entered as qualifiers for a row.
- There are 2 types of keys:
  - Primary Key
  - Foreign Key

0.19 Primary key

- It is the key data that will enable access to a record.
- For example, there are two Ahmet among the students. Each student must have a unique number in order to find the Ahmet we want while searching.
- For example student number could be a primary key
- Multiple fields can have primary keys together

0.20 Foreign key

- A foreign key is a set of attributes in a table that refers to the primary key of another table. The foreign key links these two tables.

0.21 Foreign key

Persons Table

PersonID	LastName	FirstName	Age
1	Hansen	Ola	30
2	Svendson	Tove	23
3	Pettersen	Kari	20

0.22 Foreign key

Orders Table

OrderID	OrderNumber	PersonID
1	77895	3

OrderID	OrderNumber	PersonID
2	44678	3
3	22456	2
4	24562	1

0.23 Foreign key

- Notice that the "PersonID" column in the "Orders" table points to the "PersonID" column in the "Persons" table.
- The "PersonID" column in the "Persons" table is the **PRIMARY KEY** in the "Persons" table.
- The "PersonID" column in the "Orders" table is a **FOREIGN KEY** in the "Orders" table.
- The **FOREIGN KEY** constraint prevents invalid data from being inserted into the foreign key column, because it has to be one of he values contained in the parent table.

0.24 Database Design

- Objects are defined
  - **Library system:** books, members, types, loan movements

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0.25 Designing a database

- A table is created for each object:
  - book,
  - members,
  - types,
  - woodc_movements

0.26 Designing a database

- A key field is selected for each table
  - **book table:** *book no*
  - **Members table:** *Userno*

0.27 Designing a database

- A column is added to the table for each property of the objects
  - **Book table:** book number, year, author, name, related field

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0.28 Designing a database

- Additional tables are created for recurring object properties.
  - **request table:**

userno	request_date	Book_name	Book_date	Book_author	Related_field
.	.	.	.	.	.
.	.	.	.	.	.

0.29 Designing a database

- Fields that are not directly related to the table are determined.
  - The address of the member who borrowed the book in the loan transactions table is not directly related to this table.
  - This data should be included in the **members table** where member information is kept.

0.30 Designing a database

- Relationships between tables should be defined.
  - The relationship between the **fields** in a **table** is defined.
  - For example, the **userno** field in the **members table** should be associated with the **userno** field in the **request table**.

0.31 Resources

- Köseoğlu, K. (2005). Veri Tabanı Mantığı. Şefik Matbaası. İstanbul
- Alokoç Burma, Z. (2005). Veritabanı Yönetim Sistemleri ve SQL / PL - SQL / T – SQL. Seçkin Yayıncılık. Ankara

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$End - Of - Week - 1 - Module$