# Chapter 1
# Introduction to Databases



## Objectives

- What is a database?
- What does database design do?
- What is database management system (DBMS)?

- What is database?
- What does database design do?
- What is Database Management System (DBMS)?

# Database

- A database is a single, large, organized collection of data that can be used simultaneously by many departments and users.
- It is the collection of data that contains information relevant to an enterprise.
- Databases allow for data to be stored quickly and easily and are used in many aspects of your daily life.
- Your school, grocery store, bank, and clothing store all use databases to keep track of customer, inventory, employee and accounting information.



- What is database?
- What does database design do?
- What is Database Management System (DBMS)?

# Database Design

- **Database design** is the organisation of data according to a database model.
- The designer determines what data must be stored and how the data elements interrelate.
- In the case of relational model, data are represented in the form of tables. Each table has multiple columns, and each column has a unique name. Each row of the table represents one piece of information.
- In an Object model, the storage objects correspond directly to the objects used by the Object-oriented programming language used to write the applications that will manage and access the data.

# Database Design – Relational Model

- What is database?
- What does database design do?
- What is Database Management System (DBMS

Additional tasks for Relational Model:

- ER diagram (entity-relationship model)
- Normalization
  - *normalization* is a systematic way of ensuring that a database structure is suitable for general-purpose querying and free of certain undesirable characteristics — insertion, update, and deletion anomalies that could lead to loss of data integrity.



# Database Management System (DBMS)

- What is database?
- What does database design do?
- What is Database Management System (DBMS)?

- A database management system (DBMS) provides the software tools needed to organize that data in a flexible manner.
- It includes tools to add, modify or delete data from the database, ask questions (or queries) about the data stored in the database and produce reports summarizing selected contents.
- We use SQL (Structured Query Language) statements
  - DML (data manipulation language) to access, modify, retrieve data from the database
  - DDL (data definition language) to specify the database structure
- Recall that a database is a single, large, organized collection of data used simultaneously by many departments and users.
- Assume that two students are trying to register for a course in which there is only one open seat. Concurrency control of DBMS prevents both students from being given that last seat.

# RDBMS: Examples

- Examples of relational database management system (RDBMS) include
  - Microsoft Access
  - Microsoft SQL server
  - Oracle Database: has extended the relational model to an **object-relational** model, that implements object-oriented features such as user-defined types, inheritance, and polymorphism
- Examples of open-source RDBMS:
  - **MySQL** (developed by Oracle Corporation), pronounced as "My Ess Que Ell"
  - **PostgreSQL**, also known as **Postgres**

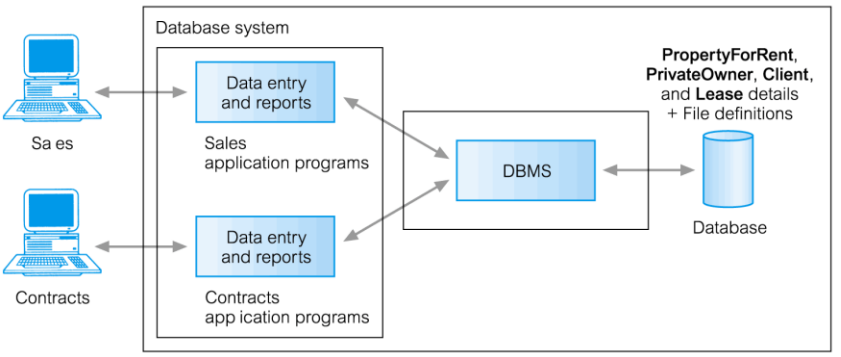


# How to pronounce SQL properly? S-Q-L or Sequel?


https://medium.com/tableplus/how-to-pronounce-sql-properly-s-q-l-or-sequel-7203a5185676

*SQL was initially developed at IBM. This version was initially called SEQUEL (Structured English Query Language). SEQUEL was later changed to SQL because "SEQUEL" was a trademark of the UK-based Hawker Siddeley aircraft company.*

# Database Processing (Fig 1.7)




**PropertyForRent** (propertyNo, street, city, postcode, type, rooms, rent, ownerNo)
**PrivateOwner** (ownerNo, fName, lName, address, telNo)
**Client** (clientNo, fName, lName, address, telNo, prefType, maxRent)
**Lease** (leaseNo, propertyNo, clientNo, paymentMethod, deposit, paid, rentStart, rentF nish)



# ODBC, JDBC

- To access the database, DML statements need to be sent from the host to the database where they will be executed.
- This is most commonly done by using an application-program interface (set of procedures) that can be used to send DML and DDL statements to the database and retrieve the results.
- The Open Database Connectivity (ODBC) standard defines application program interfaces for use with C and several other languages.
- The Java Database Connectivity (JDBC) standard defines a corresponding interface for the Java language.

# Accessing SQL from a Programming Language: **example of JDBC code**

```
public static void JDBCexample(String userid, String passwd)
{
    try (
        Connection conn = DriverManager.getConnection(
                "jdbc:oracle:thin:@db.yale.edu:1521:univdb",
                userid, passwd);
        Statement stmt = conn.createStatement();
    ) {
        try {
            stmt.executeUpdate(
                "insert into instructor values('77987','Kim','Physics',98000)");
        }
        catch (SQLException sqle) {
            System.out.println("Could not insert tuple. " + sqle);
        }
        ResultSet rset = stmt.executeQuery(
                "select dept_name, avg (salary) "+
                " from instructor "+
                " group by dept_name");
        while (rset.next()) {
            System.out.println(rset.getString("dept_name") + " " +
                    rset.getFloat(2));
        }
    }
    catch (Exception sqle)
    {
        System.out.println("Exception : " + sqle);
    }
}
```

An example of JDBC code.



# Examples of applications

List four applications you have used that most likely employed a database system to store persistent data.

- Banking: For account information, transfer of funds, banking transactions.
- Universities: For student information, online assignment submissions, course registrations, and grades.
- Airlines: For reservation of tickets and schedule information.
- Online news sites: For updating news and maintaining archives.
- Online-trade: For product data, availability and pricing information, order-tracking facilities, and generating recommendation lists.

# Summary

**We have covered the following:**

- **Difference between a database and Database Management System (DBMS)**
- What does database design do.
- Examples of RDBMS.