# Homework: Database Systems Overview

## What database models do you know?

Databases have different models: hierarchical, network, object-orientated and relation, the most common one.

In the hierarchical database model the data is organized in a tree structure. There is one main node from which other branches go down. A node can contain from none to numerous child elements. Nodes are connected with links.

## Which are the main functions performed by a RDBMS?

Some of the main functions performed by RDBMS are data organization, data integration, physical/logical level of separation of data, data control, data protection, data storage, and other.

## Define what is “table” in database terms.

A table is a collection of data, which is connected in some way. A database usually has numerous tables, each with a specific collection of data. Tables are made of columns and rows. The columns are used to set the structure of the table e.g. First Name, Last Name, and the purpose of the rows is to store the given data e.g. Ivan Todorov. Tables are types of relations that allow duplication.

## Explain the difference between a primary and foreign key.

Primary key is a string/number that is used to make a row unique. The purpose of the primary key is to give a distinctive identifier for each row so that the given row could be modified/used more easily. Foreign keys are used to make a connection between tables. Their purpose is to link data from one table to data from another table. There are a few differences between primary and foreign keys. Foreign key don’t have to be unique (in the tables that they are used). They have different purposes; one is used for uniqueness and the other for connection. Also, primary keys can be referenced by foreign ones. Primary keys can’t be NULL; however, foreign can.

## Explain the different kinds of relationships between tables in relational databases.

There are 3 main types of relationships between tables:  
- one to many: row from table A can have many matching rows in table B, but a row of table B can have only one matching row in A. For instance, directors and movies: one director can have many movies, but each movie can have only one director (there are movies with more than one but for the sake of the example lets assume that there could be only one).

- many to many: row from table A can have many matching rows in table B, and vice versa. For example, game developers and games: One game can be developed by more than one developer and one developer could have developed more than one game.

- one to one: row from table A can have no more than one matching row in table B, and vice versa. The relationship can be used to create a hierarchy between employees: CEO -> Manager -> Developer

## What is a certain database schema normalized?

Database normalization is the process of organizing tables in relational databases with the goal of reducing data redundancy. Normalization is achieved by making new tables that are connected with foreign key to the previous table.

## What are the advantages of normalized databases?

Normalized databases don’t have redundant data and thus take less disc space. Not having redundant data also makes is easier and faster for updating/changing the value of mistaken data (A lot faster to change one row and not one million). Normalized databases allow for faster queries (depends on the project and query).

## What are database integrity constraints and when are they used?

Integrity constraints are rules that are set during the creation of a database and have the purpose of preserving data integrity. The constraints can forbid the column Age in a certain table to be negative, or forbid the value to be NULL, or set the value to be a specific data type – INT, etc.

## Point out the pros and cons of using indexed in a database?

Indexing allows to sort a number of records on multiple fields. When the user creates an index, a data structure is created, which holds the field value and a pointer to field. The indexes are then sorted and thus allow for binary search. The pros are that they allow for a substantial increase in performance. The main downside is that indexes take extra disc space.

## What’s the main purpose of the SQL language?

SQL is a standardized declarative language that is used for manipulating data held in databases.

Simple query: select \* from students

## What are transactions used for? Give an example.

Transactions are a sequence of database operations that are executed as a single operation. Either the whole operation passes or none of the sub steps are executed. Transactions can be used in almost every operation but are especially useful for working with money.

## What is a NoSQL database?

NoSQL databases are databases that store data on a non-table relation. The reasons for the creation of NoSQL databases include simplicity of design, horizontal scaling, finer control over availability, etc. One of the main advantages of NoSQL is performance.

Examples of NoSQL databases: Couchbase, MongoDB, Cassandra, Redis, ect.