SQL Course

The Relational Model

The **R**elational **M**odel **D**atabases
Objectives

- To introduce **the basic notion** of the Relational Data Model.
- Describe the **key concepts and theory** which supports this data model.

- The notion of Relational Modelling for Databases originally arose from work done by E.F. Codd at IBM research laboratories.
- The idea is to organise all data items into a number of relations. Informally, each relation resembles a table. The data can thus be inserted, modified, deleted and queried based on these data tables.
- Thus if a database organises its data in accordance with the relational data model, it is termed a **Relational Database**.

Relational Database Table

aircraft name	*model*	*club seats*	*econ seats*	*call sign*
Eagle Flyer	ATR42	22	40	N410C
(NULL)	Boeing 707-320C	50	102	9J-AEB
(NULL)	Boeing 727-200	34	100	N7255U
Finians Dream	Boeing 737-200	22	96	DQ-FDM
(NULL)	Boeing 737-200	8	120	N301SW

Value

The smallest update-able portion of a table. A value is specified by the intersection of a column and a row.

Columns

A column is a set of values which may vary over time. All values of a column are of the same data-type.
A column specification includes its type and integrity constraints on the values it may hold.
Column names are also called **attribute** names.

Rows

A row is a non empty set of values. Rows are also called **tuples**.

- In Relational databases a table is termed a **relation**, a row in a table is termed a **tuple** and a column in a table is termed an **attribute**.
- The fact that the information is presented in tables does not constrain the actual underlying storage mechanism of a relational database system. The data may be stored in files and records on disk but the storage formats are hidden from the user.
- Since all data in a relational database is organised into data tables, all operations in the

database are in fact operations on the data tables themselves e.g. database queries are merely retrieval operations performed across one or more of these tables
- The relational data model is based on the mathematics of set theory Relational algebra.

The notion of a Relational data model is based on the mathematical foundations of set theory. A relation is a special type of set, where:

- A set is a collection of values of the same type.
- A set has no implied ordering.
- A set has no duplicate elements.

Therefore the operations supported by a relational database are set oriented and NOT record oriented. Therefore unlike third generation programming languages like C and PASCAL which store and operate on information in 'a record at a time' fashion, a single relational query can operate over a set of values.
For example consider a table containing information describing different types of aircraft e.g. aircraft name, manufacturer, number of seats in economy class, number of seats in business class. The relational query to retrieve 'all information about aircraft where there are more than 100 economy seats' would be a single relational query.

However, if a user tried to retrieve the same information using PASCAL or C, it would involve writing a small program which looped through the entire table checking the economy value in each row and returning all row values where the economy attribute value is greater than 100.

Further Reading

For further reading into the theoretical basis and mathematics of Relational database the reader is referred to the following references.

- "'Database Systems: Models, Languages, Design and Application Programming', R. Elmasri, S. Navathe, 6th edition, published by Pearson Education, 2010 (ISBN-10: 0132144980 | ISBN-13: 9780132144988).
- "'An Introduction to Database Systems' Vol. 1, C.J. Date, published by Addison Wesley,1990.