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CSC 409

THE DEFINITION AND PROPERTIES OF A RELATION

A relation, or table, in a relational database has certain properties. First off, its name must be unique in the database, i.e. a database cannot contain multiple tables of the same name. Next, each relation must have a set of columns, or attributes, and it must have a set of rows to contain the data. As with the table names, no attributes can have the same name.

Next, no tuple (or row) can be a duplicate. In practice, a database might actually contain duplicate rows, but there should be practices in place to avoid this, such as the use of unique primary keys (next up).

Given that a tuple cannot be a duplicate, it follows that a relation must contain at least one attribute (or column) that identifies each tuple (or row) uniquely. This is usually the primary key. This primary key cannot be duplicated.

This means that no tuple can have the same unique, primary key. The key cannot have a [NULL](https://www.thoughtco.com/all-about-null-values-1019266) value, which simply means that the value must be known.

Further, each cell, or field, must contain a single value. For example, you cannot enter something like "Tom Smith" and expect the database to understand that you have a first and last name; rather, the database will understand that the value of that cell is exactly what has been entered.

Finally, all attributes — or columns — must be of the same domain, meaning that they must have the same data type. You cannot mix a string and a number in a single cell.

Properties of Relational Tables

Relational tables have six properties:

1.      Values are atomic.

2.      Column values are of the same kind.

3.      Each row is unique.

4.      The sequence of columns is insignificant.

5.      The sequence of rows is insignificant.

6.      Each column must have a unique name.

Values Are Atomic

This property implies that columns in a relational table are not repeating group or arrays. Such tables are referred to as being in the "first normal form" (1NF). The atomic value property of relational tables is important because it is one of the cornerstones of the relational model.

The key benefit of the one value property is that it simplifies data manipulation logic.

Column Values Are of the Same Kind

In relational terms this means that all values in a column come from the same domain. A domain is a set of values which a column may have. For example, a Monthly\_Salary column contains only specific monthly salaries. It never contains other information such as comments, status flags, or even weekly salary.

This property simplifies data access because developers and users can be certain of the type of data contained in a given column. It also simplifies data validation. Because all values are from the same domain, the domain can be defined and enforced with the Data Definition Language (DDL) of the database software.

Each Row is Unique

This property ensures that no two rows in a relational table are identical; there is at least one column, or set of columns, the values of which uniquely identify each row in the table. Such columns are called primary keys and are discussed in more detail in [Relationships and Keys](https://www.cs.wcupa.edu/~zjiang/RDB_keys.htm).

This property guarantees that every row in a relational table is meaningful and that a specific row can be identified by specifying the primary key value.

The Sequence of Columns is Insignificant

This property states that the ordering of the columns in the relational table has no meaning. Columns can be retrieved in any order and in various sequences. The benefit of this property is that it enables many users to share the same table without concern of how the table is organized. It also permits the physical structure of the database to change without affecting the relational tables.

The Sequence of Rows is Insignificant

This property is analogous the one above but applies to rows instead of columns. The main benefit is that the rows of a relational table can be retrieved in different order and sequences. Adding information to a relational table is simplified and does not affect existing queries.

Each Column Has a Unique Name

Because the sequence of columns is insignificant, columns must be referenced by name and not by position. In general, a column name need not be unique within an entire database but only within the table to which it belongs.