

Introduction to Relational Databases:

- Database **schema** (name of a relations with set of attributes)
- **Key** is an attribute (or set of attributes) that uniquely defines the characteristics of each row (underlined)
- example:
Movies (mID, title, year, length, genre)
- **Relation** is a 2-dimensional table:

Movies

mID	title	year	length	genre	→ attributes
0001	Title1	1939	120	drama	
0002	Title2	2002	243	comedy	→ tuple
0003	Title3	1987	156	sci-fi	

- **Projection** operation extracts only the specified attributes from table (picks certain columns columns from table)
- **Selection** operation allows us to select tuples (table rows) that satisfy certain conditions.

Join operation

Join operation is used for answering queries that combine data that reside in several tables. Two tables are joinable by their common attributes.

Natural Join: The result of the natural join on two tables is the set of all combinations of tuples in two tables that are equal on their common attribute names.

Theta Join: Natural join on a conditions (instead of returning all combinations of tuples that are equal on common attribute names)

SQL

SQL is used for:

- Data definition (declaring database schemas)
 - table declarations (create table, drop table, alter table)
- Data manipulation (querying and modifying database)
 - select, insert, delete, update
- Other commands
 - indexes, constraints, views, triggers, transactions, authorization...

Relations in SQL:

- stored relations (tables)
- Views (constructed on fly, not stored)
- temporary tables (constructed by SQL processor when executing queries, not stored)

Basic Query:

```
SELECT    A1, A2,...,An
FROM      R1, R2,...Rn
WHERE     condition
GROUP BY  columns
HAVING    condition
```

Set operators:

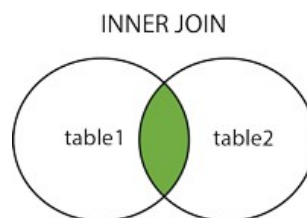
- Union, Intersect, Except

Aggregation functions:

- min, max, sum, average, count

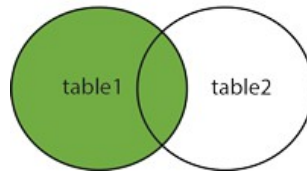
SQL join expressions

- Inner Join (Join) on condition
 - taking cross-product, applying condition and keeping tuples that satisfy condition



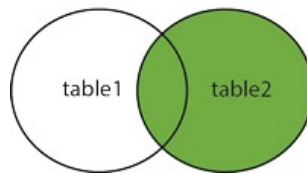
- Natural Join
 - The result of the natural join on two tables is the set of all combinations of tuples in two tables that are equal on their common attribute names.
- Inner Join Using Attributes
 - Like natural join, only you explicitly list arguments that you want equated.
- Left / Right / Full Outer Join
 - Like natural join, only when tuples don't match the condition they are still added to result and padded with null values
 - **Left Join** returns all rows from the left table (table1), with the matching rows in the right table (table2). The result is NULL in the right side when there is no match.

LEFT JOIN



- **Right Join** returns all rows from the right table (table2), with the matching rows in the left table (table1). The result is NULL in the left side when there is no match.

RIGHT JOIN



- **Full Outer Join** returns all rows from the left table (table1) and from the right table (table2).

FULL OUTER JOIN

