Parul® University

Relational Database Management System

Prof. Manish Kumar Joshi, Assistant Professor,
Prof. Nishant P Khatri, Assistant Professor
Parul Institute Of Computer Application.

Parul®
University

DIGITAL LEARNING CONTENT

CHAPTER-5

Relational Algebra and calculus

Relational Algebra

Relational database systems are to be equipped with a query language that can assist its users to query the database instances. There are two types of query languages – relational algebra and relational calculus.

Relational algebra is a procedural query language, which are takes instances of relations as input and instances of relations as output. It uses operators to perform queries. An operator can be either **unary** or **binary**. They accept relations as their input and relations as it is their output. it performed recursively on a relation and intermediate results are also considered relations.

Relational Algebra

The fundamental operations of relational algebra are as shown below −

- Select
- Project
- Union
- Set different
- Cartesian product
- Rename

Select Operation (σ)

It selects rows that satisfy the given predicate from a relation.

Notation – $\sigma_p(r)$

Where **σ** for selection predicate and **r** for relation. *p* is prepositional logic formula which may use connect like **and, or,** and **not**. terms use relational operators like – =, ≠, ≥, < , >, ≤.

For example –

$\sigma_{subject = "data"}$(Books) **Output** – Selects rows from books where subject is 'data'.

$\sigma_{subject = "data" \text{ and } price = "450"}$(Books) **Output** – Selects tuples from books where subject is 'data' and 'price' is 450.

$\sigma_{subject = "data" \text{ and } price = "450" \text{ or } year > "2010"}$ (Books) **Output** – Selects rows from books where subject is 'data' and 'price' is 450 or those books published after 2010.

Project Operation (∏)

- It projects column(s) that satisfied a given predicate.
- Notation – $\prod_{A1, A2, An} (r)$
- Where A_1, A_2 , A_n are attribute of relation **r**.
- Duplicate tuples are automatically eliminated, as relation is a set.
- **For example** –
- $\prod_{subject, author}$ (Books) Selects and projects columns named as subject and author from the relation Books.

Union Operation (∪)

- It performs binary union within two given relations and is defined as −r ∪ s = { t | t ∈ r or t ∈ s} **Notation** − r U s
- Where **r** and **s** are database relations or relation result set temporary relation.
- For a union operation can be valid, the following conditions must hold −**r**, and **s** must have the same number of attributes.
- domains attributes must be compatible .
- Duplicate rows are automatically eliminated.
- $\prod_{author}$ (Books) ∪ $\prod_{author}$ (Articles) **Output** −names of the authors who have written a book or an article or both.

Set Difference (–)

- The result of set difference operation is rows, which are present in one relation but are not in the second relation.
- **Notation** – **r** – **s**
- all the rows are present in **r** but not in **s**.
- $\prod_{author}$ (Books) – $\prod_{author}$ (Articles)
- **Output** – Provides the name of authors who have written books but not written articles.

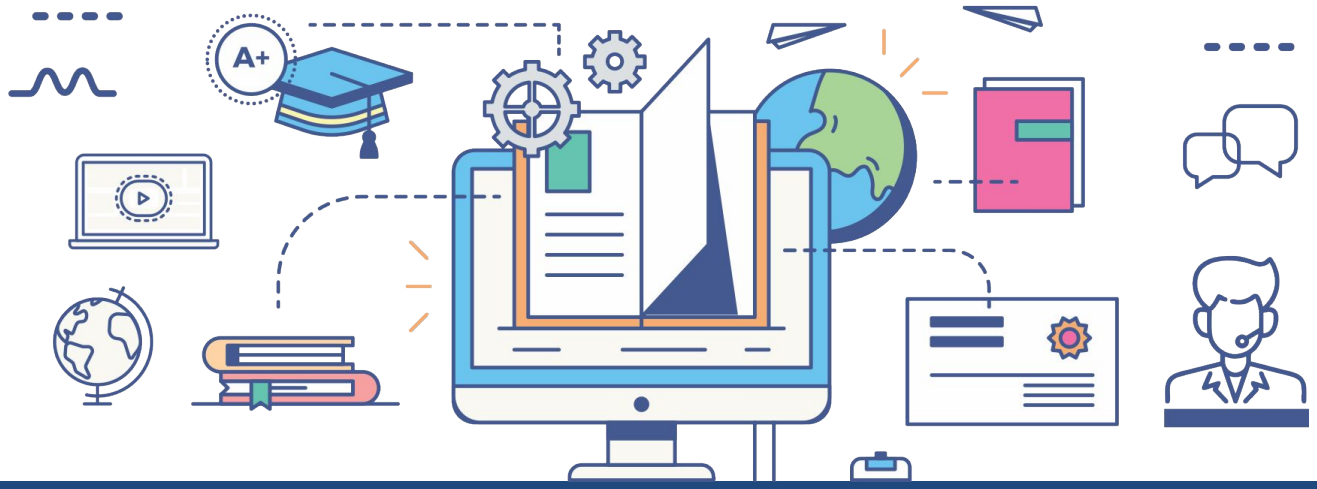
Cartesian Product (X)

- Combines information of different relations into one.
- **Notation** – r X s
- Where **r** and **s** are relations and their output will be shows as –r X s = { q t | q ∈ r and t ∈ s}
- $\sigma_{author = 'tutorialspoint'}$(Books X Articles) **Output** – a relation, which shows all the books and articles written by tutorialspoint.

Rename Operation (ρ)

- The results of relational algebra are relations but without any name. The rename operation allowed us to rename the output relation. 'rename' operation is denoted by small Greek **rho** *ρ*.
- **Notation** – ρ_x (E)
- Where the result of expression **E** is showed with name of **x**.
- Additional operations are –
- Set intersection
- Assignment
- Natural join

DIGITAL LEARNING CONTENT



Parul® University

www.paruluniversity.ac.in