

Relational Algebra: Gives an evaluation plan for executing SQL queries

1. Selection

Q: Find the details of employees

SQL: select
 *
 From emp;

RA: σ (emp)

2. Projection

Q: Find the salary of employees

SQL: select
 Empno, salary
 From emp;

RA: $\pi_{\text{empno,salary}}$ (emp)

3. Selection with a condition

Q: Find the details of employees whose salary is greater than 2000

SQL: select
 *
 From emp
 Where salary>2000;

RA: $\sigma_{\text{salary} > 2000}(\text{emp})$

4. Selection and projection with a condition

Q: Find the hiredate of employees who are salesmen

SQL: select
Empno, hiredate
From emp
Where job='Salesmen';

RA1: $\pi_{\text{empno}, \text{hiredate}}(\sigma_{\text{job}='Salesmen'}(\text{emp}))$

RA2: $\sigma_{\text{job}='Salesmen'}(\pi_{\text{empno}, \text{hiredate}}(\text{emp}))$

5. Cartesian Product

SQL: select
*
From emp, dept

RA: $\sigma(\text{emp} \bowtie \text{dept})$

6. Join (Join is a subset to Cartesian Product)

SQL: select

*

From emp, dept

Where emp.deptno=dept.deptno

RA1: σ (emp \bowtie dept)

RA2: $\sigma_{\text{emp.deptno}=\text{dept.deptno}}$ (emp X dept)

7. Join with aliases

SQL: select

*

From emp e, dept d

Where e.deptno=d.deptno

RA: $\sigma_{\text{e.deptno}=\text{d.deptno}}$ ($\rho_e(\text{emp})$ X $\rho_d(\text{dept})$)

8. Join with projection

SQL: select

Empno, e.deptno,dname

From emp e, dept d

Where e.deptno=d.deptno

RA: $\pi_{\text{empno, e.deptno, dname}}$ ($\sigma_{\text{e.deptno}=\text{d.deptno}}$ ($\rho_e(\text{emp})$ X $\rho_d(\text{dept})$))

9. Nested Query

Q: Find the names of departments of managers

SQL:

Query a: select
deptno
From emp
Where job='Manager'

Query b: select
dname
From dept
Where deptno in (query a)

Query c: substitute query a in query b

RA:
$$r \leftarrow \pi_{\text{deptno}} (\sigma_{\text{job}='Manager'} (\text{emp}))$$
$$\pi_{\text{dname}} (\sigma_{\text{deptno in } r} (\text{dept}))$$

10. Left outer join

SQL: select
*
From emp e, dept d
Where e.deptno=d.deptno(+);

RA:
$$\sigma_{e.\text{deptno}=d.\text{deptno}(+)} (\rho_e(\text{emp}) \bowtie \rho_d(\text{dept}))$$
$$\sigma (\rho_e(\text{emp}) \Join \rho_d(\text{dept}))$$

11. Right outer join

SQL: select

*

From emp e, dept d

Where e.deptno(+) = d.deptno;

RA: $\sigma_{e.deptno(+) = d.deptno} (\rho_e(emp) \bowtie \rho_d(dept))$

$\sigma (\rho_e(emp) \Join \rho_d(dept))$

12. Full outer join

SQL: select

*

From emp e, dept d

Where e.deptno(+) = d.deptno(+);

RA: $\sigma_{e.deptno(+) = d.deptno(+)} (\rho_e(emp) \bowtie \rho_d(dept))$

$\sigma (\rho_e(emp) \Join \rho_d(dept))$

13. Group functions

SQL:

```
Select  
Count(*)  
From emp;
```

RA: $\pi_{\text{count}(*)}(\text{emp})$

14. Group function with group by clause

SQL:

```
Select  
Deptno, max(salary)  
From emp  
Group by deptno;
```

RA: $\pi_{\text{deptno}, \text{count}(*)}(\rho_{\text{deptno}}(\text{emp}))$

15. Group function with group by and having clauses

Q: Find the deptno with atleast one manager

SQL:

```
Select
Deptno, count(*)
From emp
Where job='Manager'
Group by deptno
Having count(*)>=1
```

RA: $\pi_{\text{deptno}, \text{count}(*)}(\sigma_{\text{count}(*)\geq 1}(\rho_{\text{deptno}}(\sigma_{\text{job}='Manager'}(\text{emp}))))$

Set Operations

16. Union

SQL:

```
select prof1 from programmer  
union  
select prof2 from programmer
```

RA: $\pi_{\text{prof1}}(\text{programmer}) \cup \pi_{\text{prof2}}(\text{programmer})$

17. Intersection

SQL:

```
Select pname from programmer  
Intersect  
Select pname from software
```

RA: $\pi_{\text{pname}}(\text{programmer}) \cap \pi_{\text{pname}}(\text{software})$

18. Difference

Q: Find the programmer who haven't done any project

SQL:

```
Select pname from programmer  
minus  
Select pname from software
```


RA: π_{pname} (programmer) - π_{pname} (software)

Update operations

19. Insert

SQL:

Insert into sailor values('S1','Hari','Vskp',7)

RA: sailor \leftarrow sailor \cup ('S1','Hari','Vskp',7)

20. Delete

SQL:

Delete sailor where sid='S10'

RA: sailor \leftarrow sailor $- \sigma_{sid='S10'}(\text{sailor})$

21. Update

SQL:

Update sailor set city='Guntur' where sid='S2'

RA: sailor $\leftarrow \pi_{city='Guntur'} (\sigma_{sid='S2'} (\text{sailor}))$

$\pi, \sigma, \rho, \bowtie, X, \bowtie, \bowtie, \bowtie, X, \bowtie, \bowtie, \bowtie, \mathcal{G}$