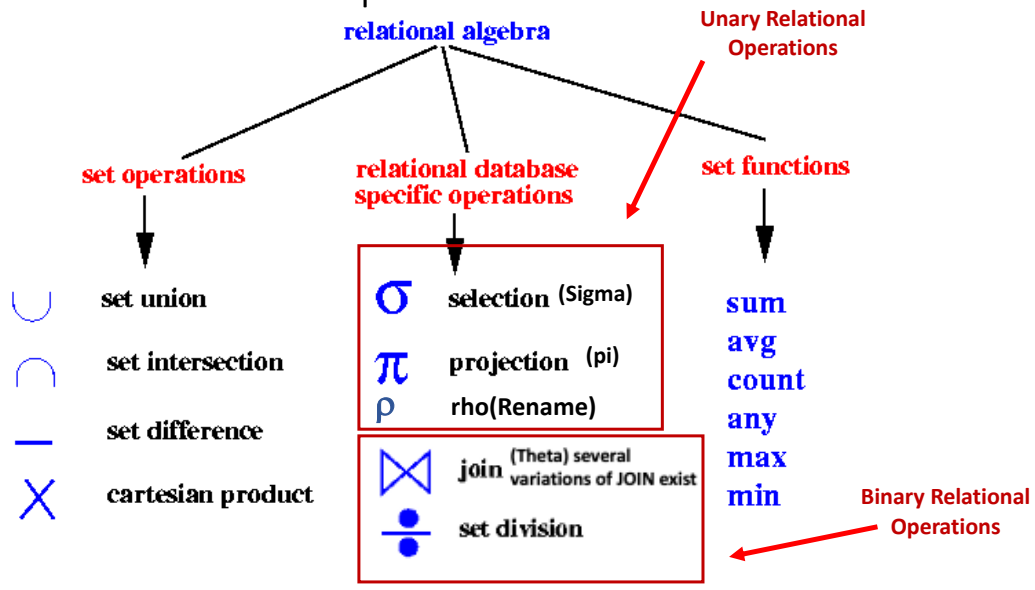
JOIN
Binary Relational Operations:

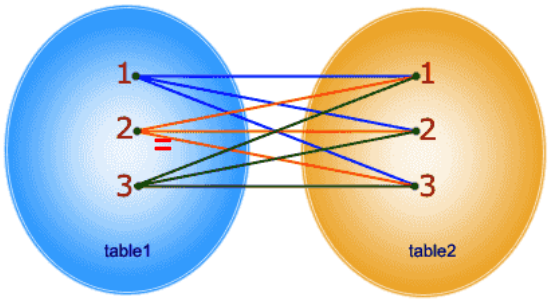
1

Relational Algebra consists of several groups of operations



2

Cross Join



In CROSS JOIN, each row from 1st table joins with all the rows of another table.
If 1st table contain x rows and y rows in 2nd one the result set will be x * y rows.

```
SELECT *
FROM table1
 CROSS JOIN table2;
```

=

```
SELECT *
FROM table1, table2;
```

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Join

- JOIN Operation (denoted by ⋈)
  - The sequence of CARTESIAN PRODECT followed by SELECT is used quite commonly to identify and select related tuples from two relations
  - A special operation, called JOIN combines this sequence into a single operation
  - This operation is very important for any relational database with more than a single relation, because it allows us *combine related tuples* from various relations
  - The general form of a join operation on two relations R(A1, A2, . . ., An) and S(B1, B2, . . ., Bm) is:

$$R \bowtie_{\text{<join condition>}} S$$

  - where R and S can be any relations that result from general *relational algebra expressions*.

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Join

SELECT *
FROM table1 JOIN table2
[**ON** (join_condition)]

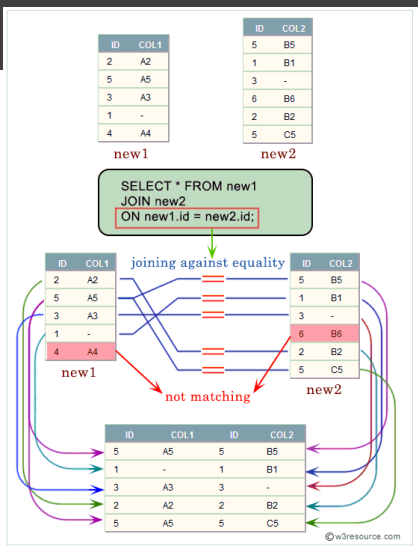
OR
SELECT *
FROM table1 JOIN table2
[**Using** (Column name)]

$R \bowtie_{\text{<join condition>}} S$

=

$T = \sigma_{condition}(R \times S)$

SELECT column_list
FROM table1, table2....
WHERE table1.column_name = table2.column_name;



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Binary Relational Operations: JOIN (cont.)

- Example: Suppose that we want to retrieve the name of the manager of each department.
  - To get the manager's name, we need to combine each DEPARTMENT tuple with the EMPLOYEE tuple whose SSN value matches the MGRSSN value in the department tuple.
  - We do this by using the join $\bowtie$ operation.
  - DEPT_MGR $\leftarrow$ DEPARTMENT $\bowtie_{\text{MGRSSN=SSN}}$ EMPLOYEE
- MGRSSN=SSN is the join condition
  - Combines each department record with the employee who manages the department
  - The join condition can also be specified as DEPARTMENT.MGRSSN= EMPLOYEE.SSN

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Some properties of JOIN

- Consider the following JOIN operation:
  - R(A1, A2, . . ., An) $\bowtie_{R.Ai=S.Bj}$ S(B1, B2, . . ., Bm)
  - Result is a relation Q with degree n + m attributes:
    - Q(A1, A2, . . ., An, B1, B2, . . ., Bm), in that order.
  - The resulting relation state has one tuple for each combination of tuples—r from R and s from S, but *only if they satisfy the join condition* r[Ai]=s[Bj]
  - Hence, if R has n_R tuples, and S has n_S tuples, then the join result will generally have *less than* $n_R * n_S$ tuples.
  - Only related tuples (based on the join condition) will appear in the result

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Some properties of JOIN

- The general case of JOIN operation is called a Theta-join: R $\bowtie_{theta}$ S
- The join condition is called *theta*
- *Theta* can be any general boolean expression on the attributes of R and S; for example:
  - R.Ai<S.Bj AND (R.Ak=S.Bl OR R.Ap<S.Bq)
- Most join conditions involve one or more equality conditions “AND”ed together; for example:
  - R.Ai=S.Bj AND R.Ak=S.Bl AND R.Ap=S.Bq

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Specifying Joined Tables in the FROM Clause of SQL

- **Joined table**
  - Permits users to specify a table resulting from a join operation in the FROM clause of a query
- The FROM clause in Q1A
  - Contains a single joined table. JOIN may also be called INNER JOIN

SQL

```
Q1A:  SELECT  Fname, Lname, Address
      FROM    (EMPLOYEE JOIN DEPARTMENT ON Dno=Dnumber)
      WHERE   Dname='Research';
```

Relational Algebra

$$RESEARCH\_DEPT \longleftarrow \sigma_{DNAME='Research'}(DEPARTMENT)$$

$$RESEARCH\_EMPS \longleftarrow (RESEARCH\_DEPT \bowtie_{DNUMBER=DNO} (EMPLOYEE))$$

$$RESULT \longleftarrow \pi_{FNAME,LNAME,ADDRESS}(RESEARCH\_EMPS)$$

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