Chapter 4

Basic SQL

Company Database Schema

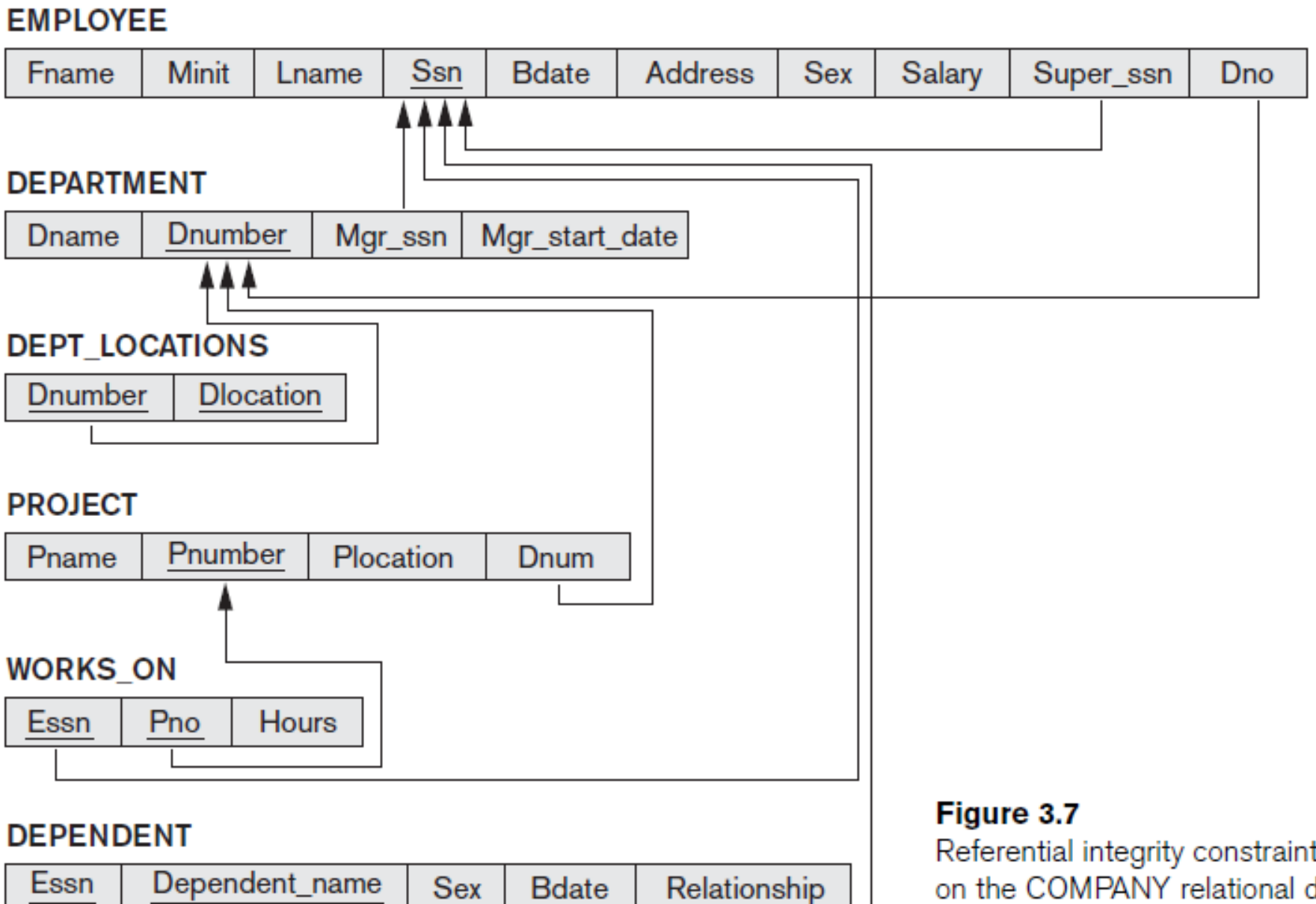


Figure 3.7
Referential integrity constraints displayed on the COMPANY relational database

SQL Overview

- It was originally developed by IBM in 1970
- It is the standard relational database language
- It stands for Standard Query Language
- It is non-procedural language, you specify what information needed rather than how to get it
- **It has two types:**
  - **Data Definition Language (DDL):** Used it to define the structure of the database. Define database, tables, attributes, datatypes, constraints… Keywords: create, alter and drop
  - **Data Manipulation Language (DML):** Used to manipulate data in the database. Keywords: select, update, delete and insert

Basic SQL Retrieval Queries Structure

Select <Attribute list>

From <Table list>

Where <Condition>

Example:

Select SSN, Fname, DOB

From Employee

Where salary > 100,000

Retrieve all Attributes, all Rows

- Retrieve all the attributes and rows from the table:
- Select * from employee
- Retrieve some attributes for all employees:
- Select SSN, Fname, Lname, Salary from employee
- Retrieve some attributes for some employees:
- Select SSN, Fname, Dnumber from employee where salary=2000
- Select SSN, Fname, DOB from employee where salary=2000 and dnumber=3

Aliases for tables and attributes

- **Alias for attributes:**
- Select Fname as First_Name, Lname as Last_Name from Employee
- **Alias for Tables:**
- Select Fname as First_Name from employee as Emp
- **Attribute reference by table name:**
- Select employee.fname as First_name from employee
- Select emp.fname from employee as emp

Ordering of the retrieved tuples

- **Order of resulted rows without condition**
- Select * from employee order by SSN
- **Order of resulted rows with condition**
- Select * from employee where salary<3000 order by SSN
- **Order the resulted rows with different attributes**
- Select SSN, Fname, address from employee order by salary, Dno
- **Default ordering is ascending if descending then:**
- Select * from employee order by salary desc
- Select * from employee order by salary desc, dno asc

Retrieve Distinct Values

- Select salary from employee (Query 1)
- Select distinct (salary) from employee (Query 2)

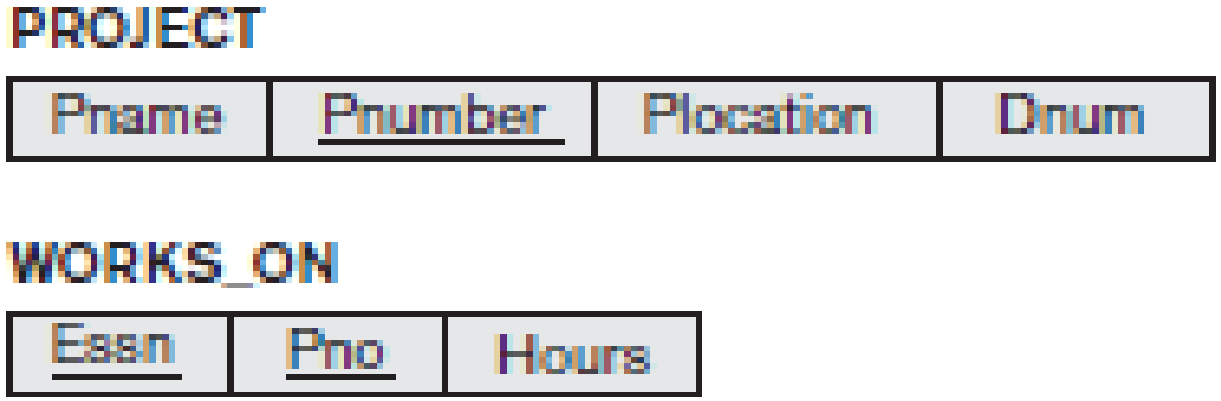
Query 1

Salary
3000
2500
3000
3000
2500
1200

Query 2

Salary
3000
2500
1200

Exercises:



- Retrieve project data for projects in department 10
- Select * from project where dnum=10
- Retrieve SSN for employees working in project number 1 with hours greater than 10 hours
- Select ESSN from works_on where Pno=1 and hours> 10
- Retrieve SSN and Pno for employees working in either project number 1 or 2 ordered by hours in descending way
- Select ESSN, Pno from works_on where pno=1 or pno=2 order by hours desc

Select from Two Relations

- Retrieve project name and number along with the department name controlling it

Select Pname, Pnumber,Dname from project join Department On dnumber=dnum

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

PROJECT

Pname	Pnumber	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

Select from Two Relations

- Retrieve project name and SSN of employee working more than 10 hours in this project
- Select Pname, ESSN from works_on join project on project.Pnumber=works_on.Pno where hours >10

PROJECT

Pname	Pnumber	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

WORKS_ON

Essn	Pno	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0

Try it Yourself .....

- Retrieve each department and its location
- Select Dname, Dlocation from department join dept_locations on department.dnumber=dept_locations.dnumber
- Retrieve each department and its location with manager SSN= 333445555
- Select Dname, Dlocation from department join dept_locations on department.dnumber=dept_locations.dnumber where mgr_ssn=333445555

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

DEPT_LOCATIONS

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

Try it Yourself .....

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse

- Retrieve employee name with his/her son or daughter data

- Select Fname,Lname, dependent_name, sex, bdate, relationship from employee join dependent on ssn=essn where relationship='son' or relationship='daughter'

Try it Yourself .....

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

- Retrieve employee name and salary with his/her department name

- Select Fname, Lname, salary, dname from employee join department on dno=dnumber

Select from Different Relations

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01

DEPT_LOCATIONS

Dnumber	Dlocation
1	Houston
4	Stafford

- Retrieve department name and its locations and the name of its manager with salary greater than 40000

Select Dname, dlocation,Fname+lname as manager_name from employee join department on ssn=mgr_ssn join dept_locations on department.dnumber =dept_locations.dnumber where salary> 40000

- Retrieve each department name and its location along with the project name and location they manage

- Select dname, dloaction, pname, plocation from department join dept_locations on department.dnumber= dept_locations.dnumber join project on department.dnumber=project.dnum

- Retrieve each department name and its location along with the project name and location they manage provided that the department and project are in the same location

- Select dname, dloaction, pname, plocation from department join dept_locations on department.dnumber= dept_locations.dnumber join project on department.dnumber=project.dnum Where dlocation=plocation

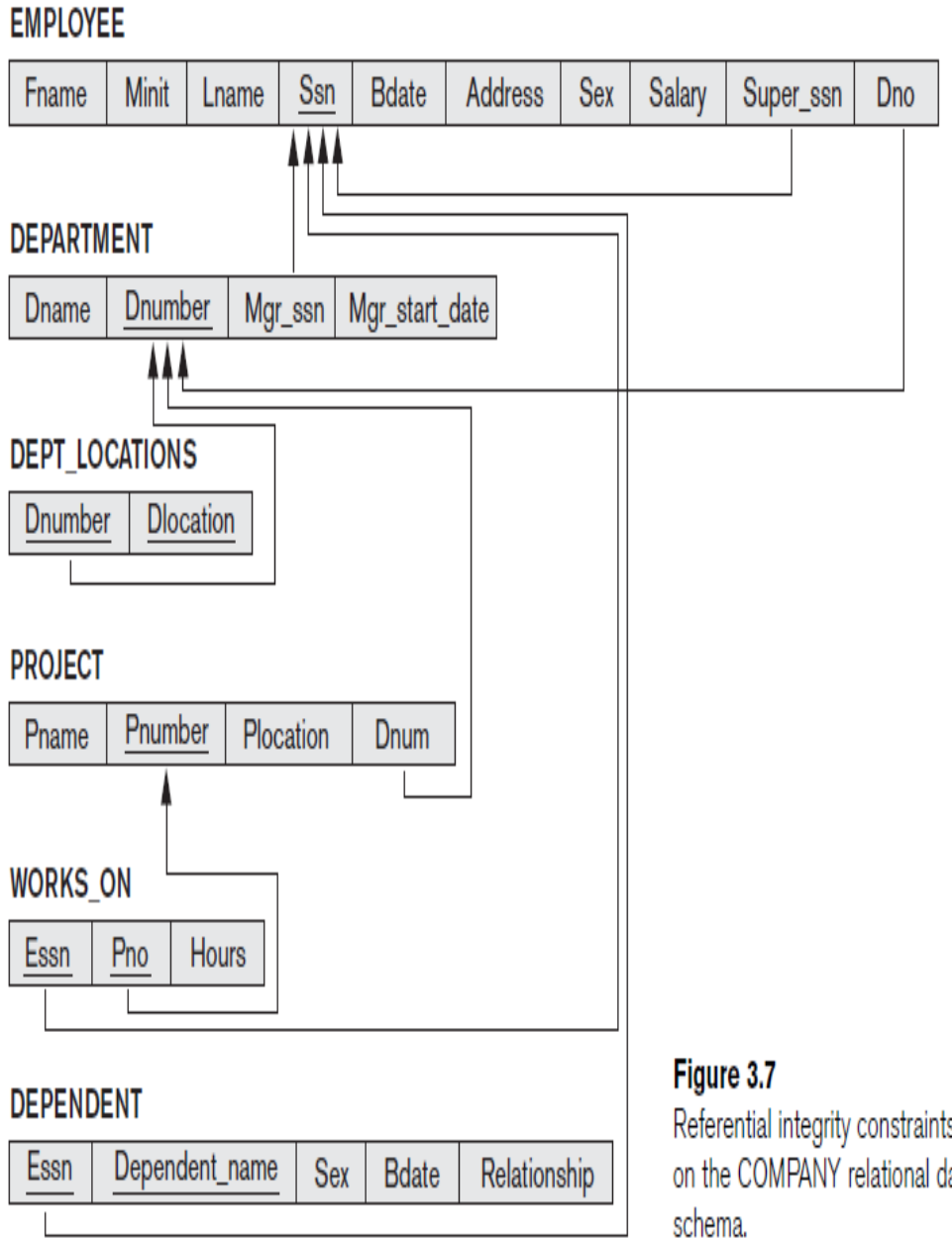


Figure 3.7
Referential integrity constraints displayed on the COMPANY relational database schema.

- Retrieve employee name who have dependents and are working in Administration department

Select fname, lname

from employee join dependent on ssn=essn

join department on dnumber=dno

where dname=‘ Administration’

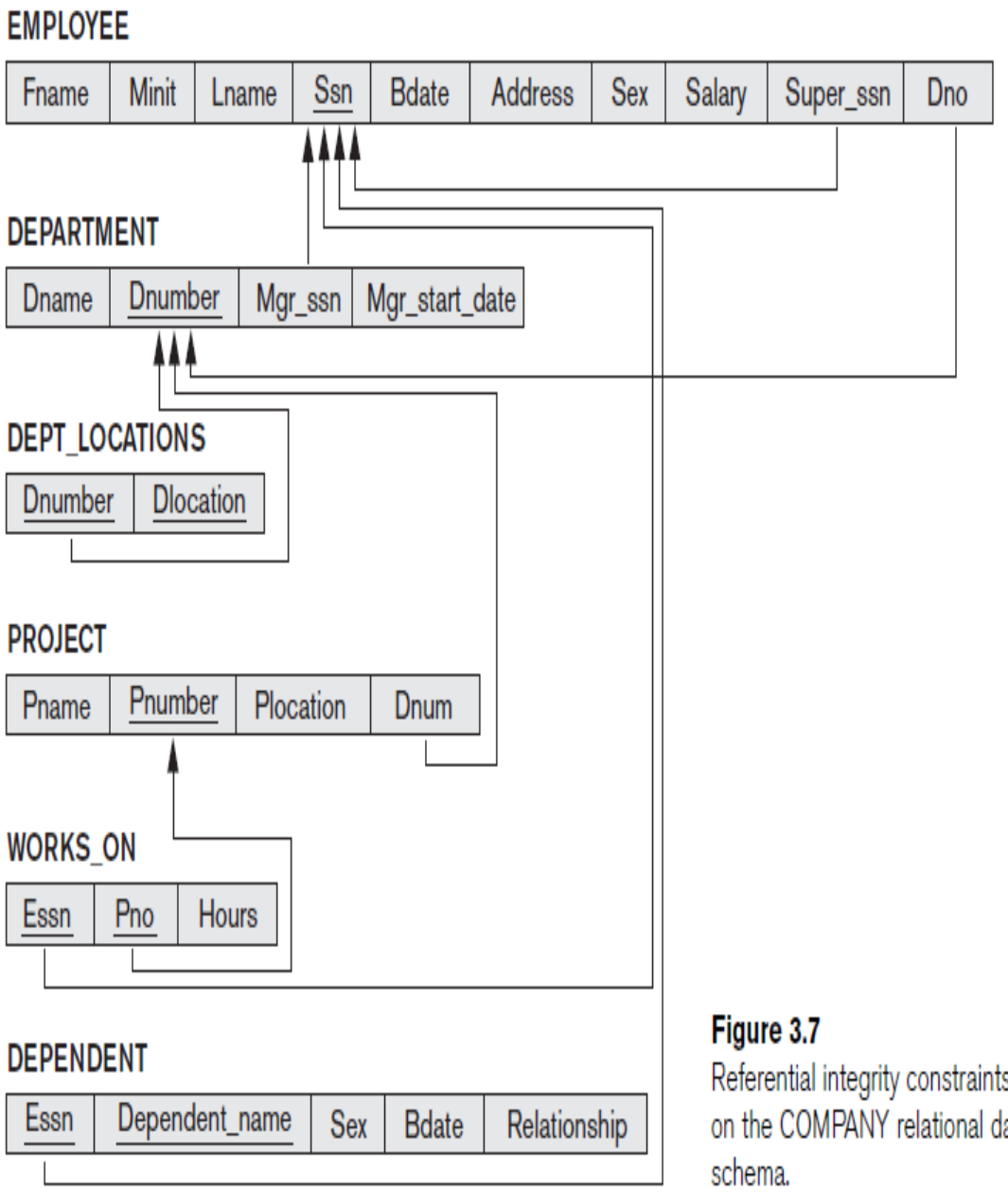


Figure 3.7
Referential integrity constraints displayed on the COMPANY relational database schema.

Left and Right outer join

- Left outer join includes all rows even unmatched rows from the left table written in the join clause
- Right outer join includes all rows even unmatched rows from the right table written in the join clause

Dept_no	Dept_name
1	IS
2	CS
3	IT

Student_ID	St_name	Dept_no
100	Noha	1
200	Bashayer	1
300	Shahd	2

Left and Right outer join

Dept_no	Dept_name
1	IS
2	CS
3	IT

Student_ID	St_name	Dept_no
100	Noha	1
200	Bashayer	1
300	Shahd	2

- Select Dept_name, st_name from department left join student on department.dept_no=student.dept_no

St_name	Dept_no
Noha	IS
Bashayer	IS
Shahd	CS
NULL	IT

Left and Right outer join

Dept_no	Dept_name
1	IS
2	CS
3	IT

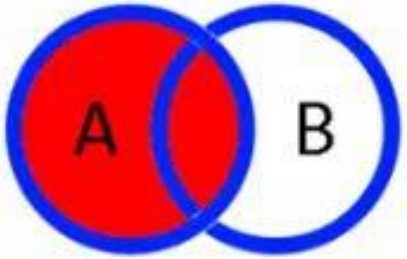
Student_ID	St_name	Dept_no
100	Noha	1
200	Bashayer	1
300	Shahd	NULL

- Select Dept_name, st_name from department right join student on department.dept_no=student.dept_no

St_name	Dept_no
Noha	IS
Bashayer	IS
Shahd	NULL

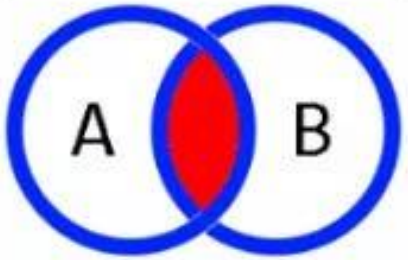
SQL JOINS

LEFT OUTER JOIN



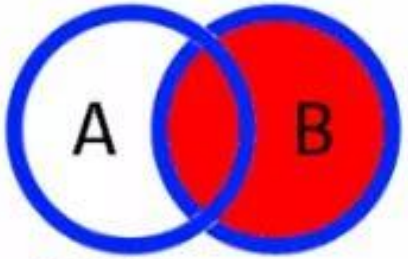

```
SELECT *
FROM TableA a
LEFT JOIN TableB b
    ON a.KEY = b.KEY
```

INNER JOIN




```
SELECT *
FROM TableA a
INNER JOIN TableB b
    ON a.KEY = b.KEY
```

RIGHT OUTER JOIN




```
SELECT *
FROM TableA a
RIGHT JOIN TableB b
    ON a.KEY = b.KEY
```

Cross Join or Cartesian Product

- In this type of join you don't specify a join condition
- Unlike Inner, left, right outer join, cross join doesn't have On clause
- The number of rows resulted from cross join R1 and R2 is R1x R2
- **Syntax**
  - Select * from R1 cross join R2

Cross Join or Cartesian Product

Department

Dept_no	Dept_name
1	IS
2	CS

Student

Student_ID	St_name	Dept_no
100	Noha	1
200	Bashayer	1
300	Shahd	2

Result of the cross join of the following query:

Select st_name, Dept_name from student cross join department

St_name	Dept_name
Noha	IS
Noha	CS
Bashayer	IS
Bashayer	CS
Shahd	IS
Shahd	CS

Self Join

EMPLOYEE as Emp

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

Employee as manager

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

Retrieve each employee name and his/her supervisor name

Select emp.fname as employee_name, manager.fname as manager_name from employee as emp join employee as manager On emp.super_ssn = manager.ssn