Databases, DBMS and SQL

IICT Lecture 06

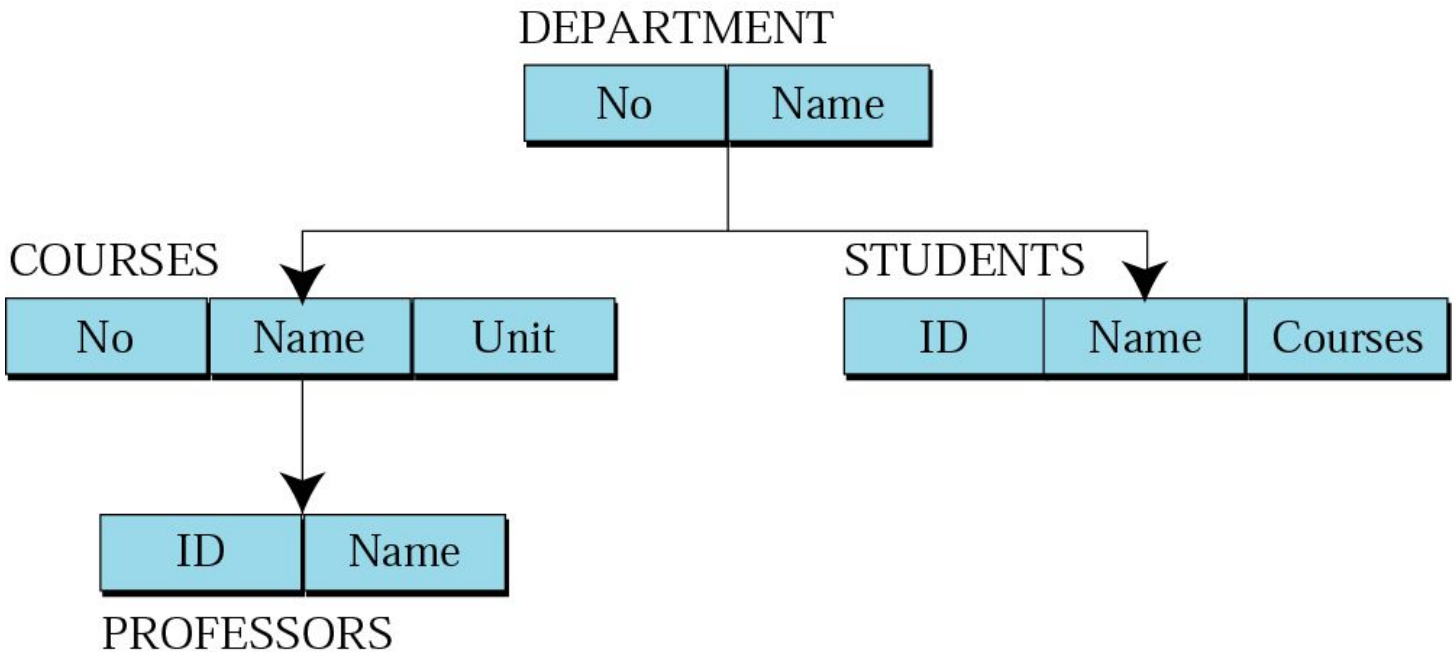
What is a Database?

- An organized collection of Data
- A comprehensive collection of related data organized for convenient access, generally in a computer

Database Model

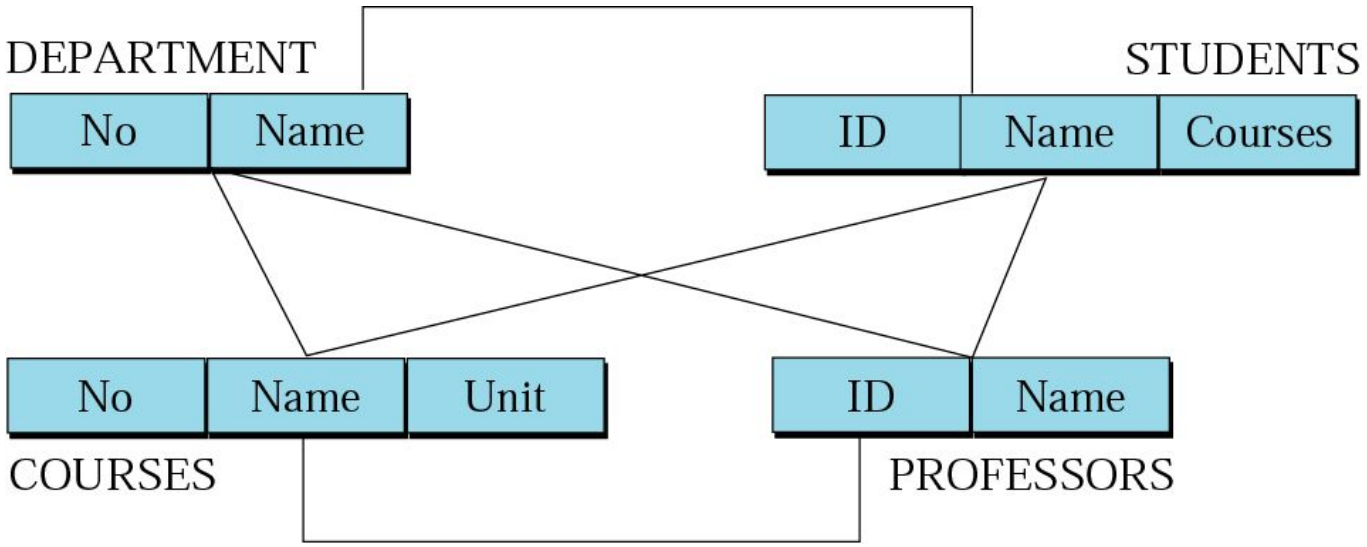
- Database model defines the logical design of data.
- Database model describes the relation between different parts of data.
- There are three database models:
    1. Hierarchical Model
    2. Network Model
    3. Relational Model

Hierarchical model



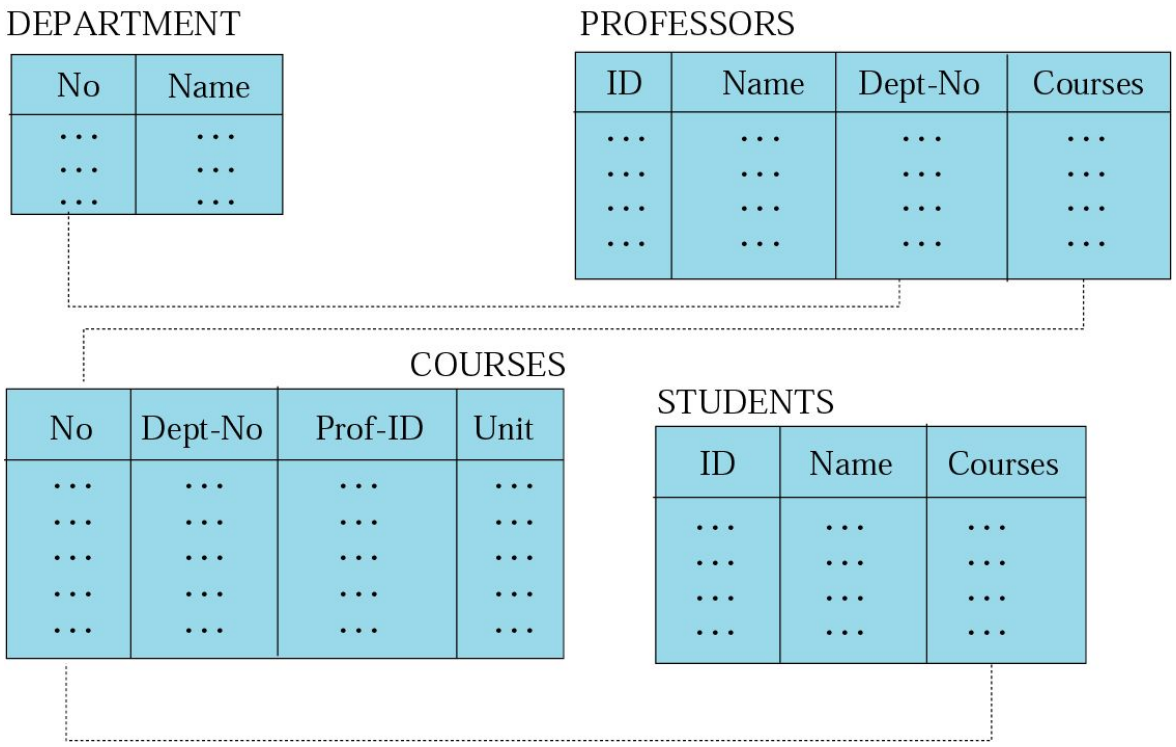
- Data are organized in an upside down tree
- Each entity has one parent and many children
- Old and not used now

Network model



- Entities are organized in a graph
- Entities can be accessed through several paths
- Old and not used

Relational model



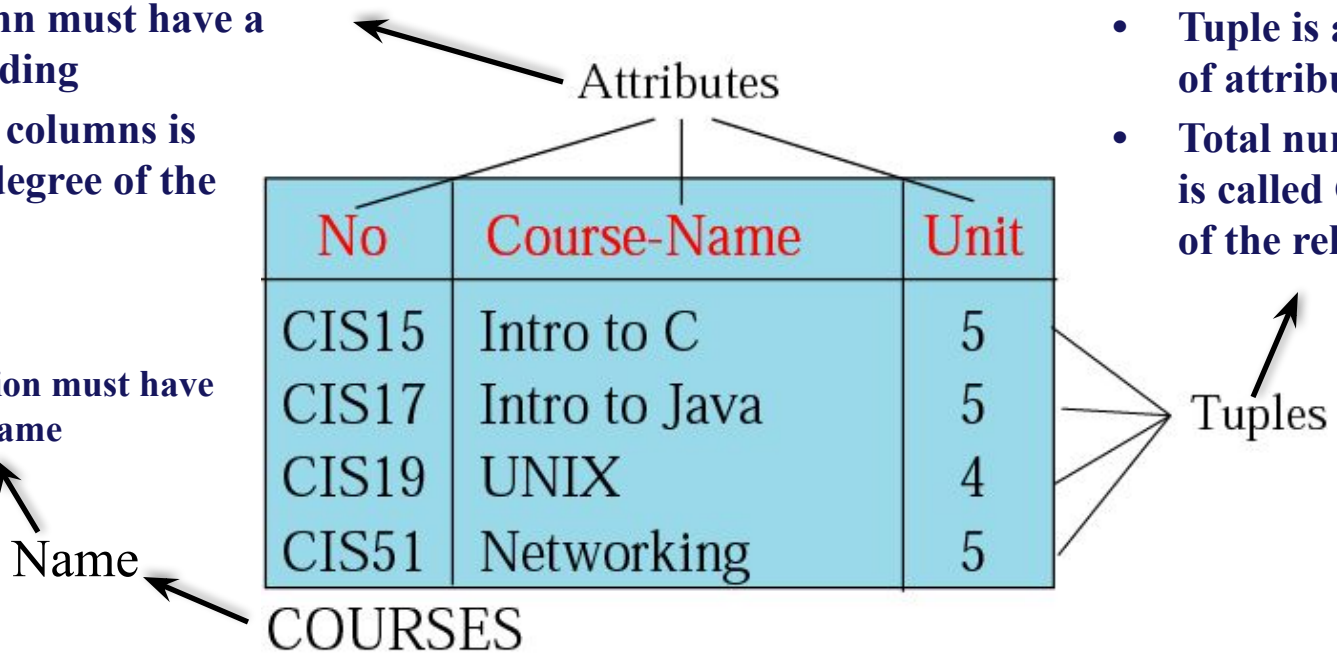
- **Data are organized in two dimensional tables (relations)**
- **Tables re related to each other**
- **Relational Database Management System (RDBMS) are more common model used today**

Relation (Name, Attributes, Tuples)

- **Attributes are the column heading**
- **Each column must have a unique heading**
- **Number of columns is called the degree of the relation**

- **Tuple is a collection of attribute value**
- **Total number of rows is called Cardinality of the relation**

- **Each relation must have a unique name**



- Relation appears in 2 dimensional table
- That doesn't mean data stored as table; the physical storage of data is independent of the logical organization of data

OPERATIONS ON RELATIONS

Insert operation

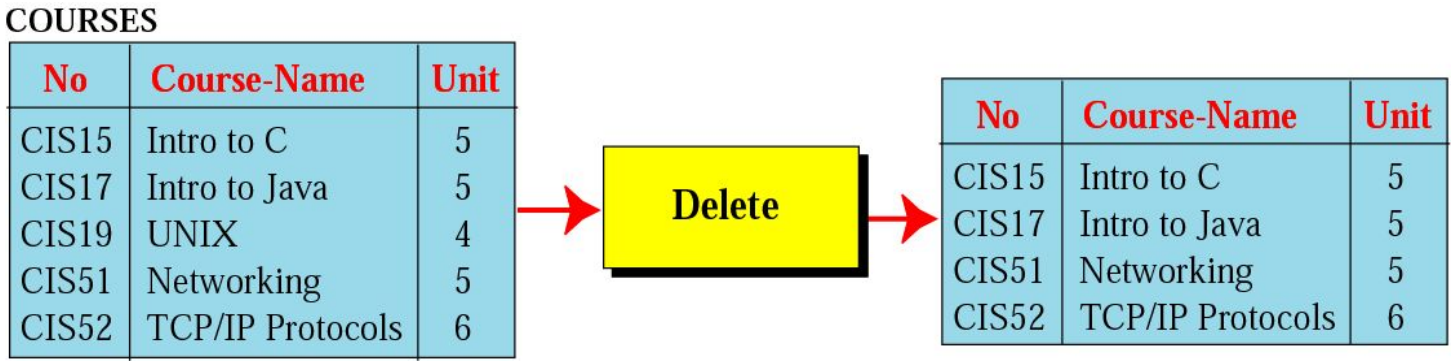
COURSES

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	5

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	5
CIS52	*TCP/IP Protocols*	*6*

- **Unary operation**
- **Insert Operation: Inserts new tuple into the relation**

Delete operation



- **Unary operation**
- **Delete Operation: Deletes tuple from the relation**

Update operation

COURSES

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	5
CIS52	TCP/IP Protocols	6

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	**6**
CIS52	TCP/IP Protocols	6

- **Unary operation**
- **Update Operation: Changes the values of some attributes of a tuple**

Select operation

COURSES

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	5
CIS52	TCP/IP Protocols	6

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS51	Networking	5

- **Unary operation**
- **Select Operation: Uses some criteria to select some tuples from the original relation**

Project operation

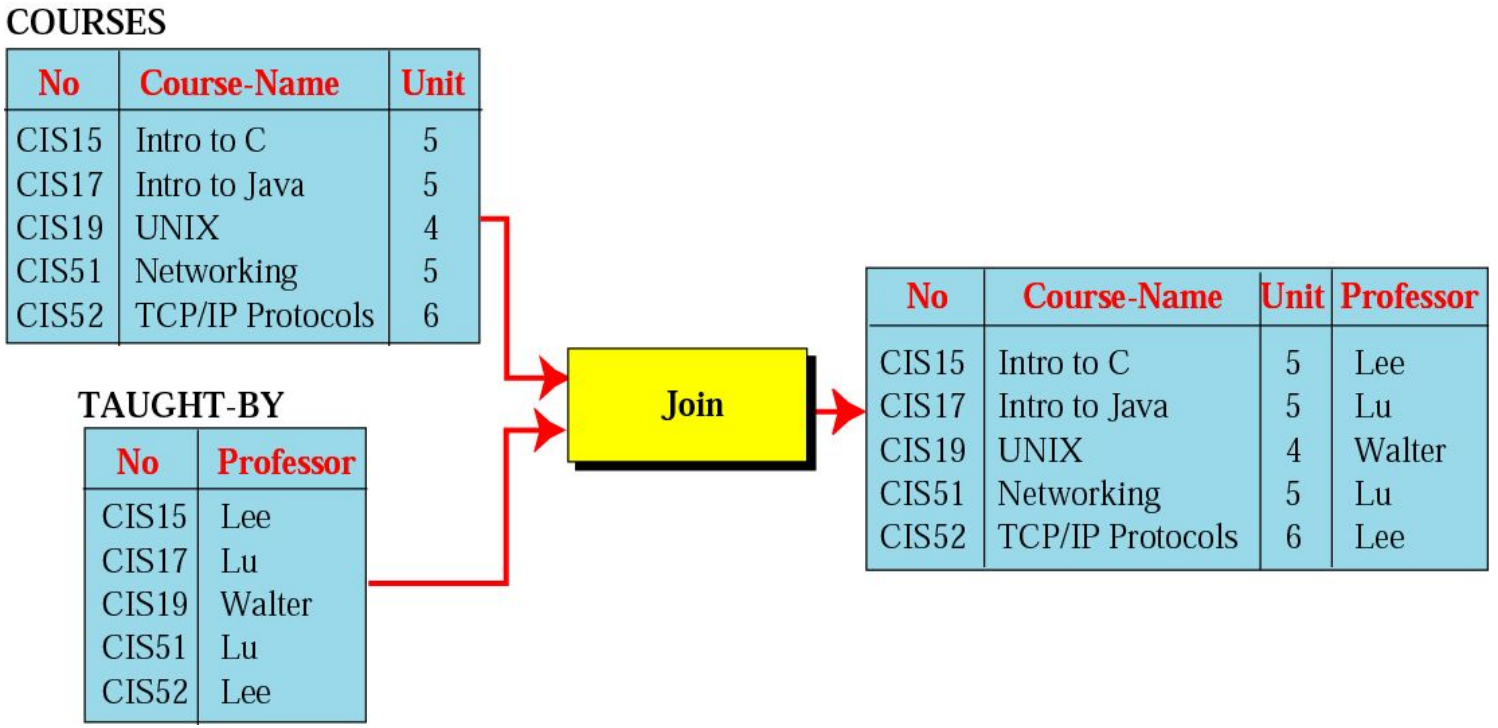
COURSES

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	5
CIS52	TCP/IP Protocols	6

No	Unit
CIS15	5
CIS17	5
CIS19	4
CIS51	5
CIS52	6

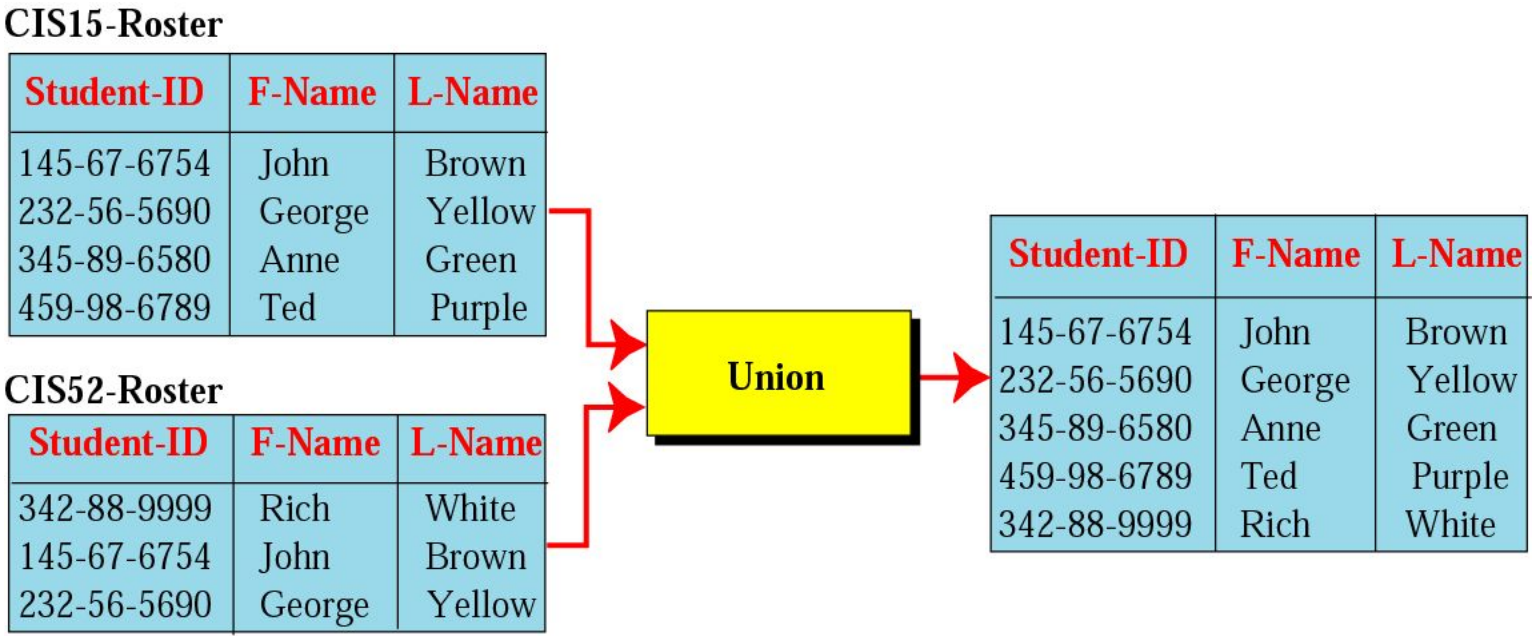
- **Unary operation**
- **Project Operation: Creates relation in which each tuple has fewer attributes**

Join operation



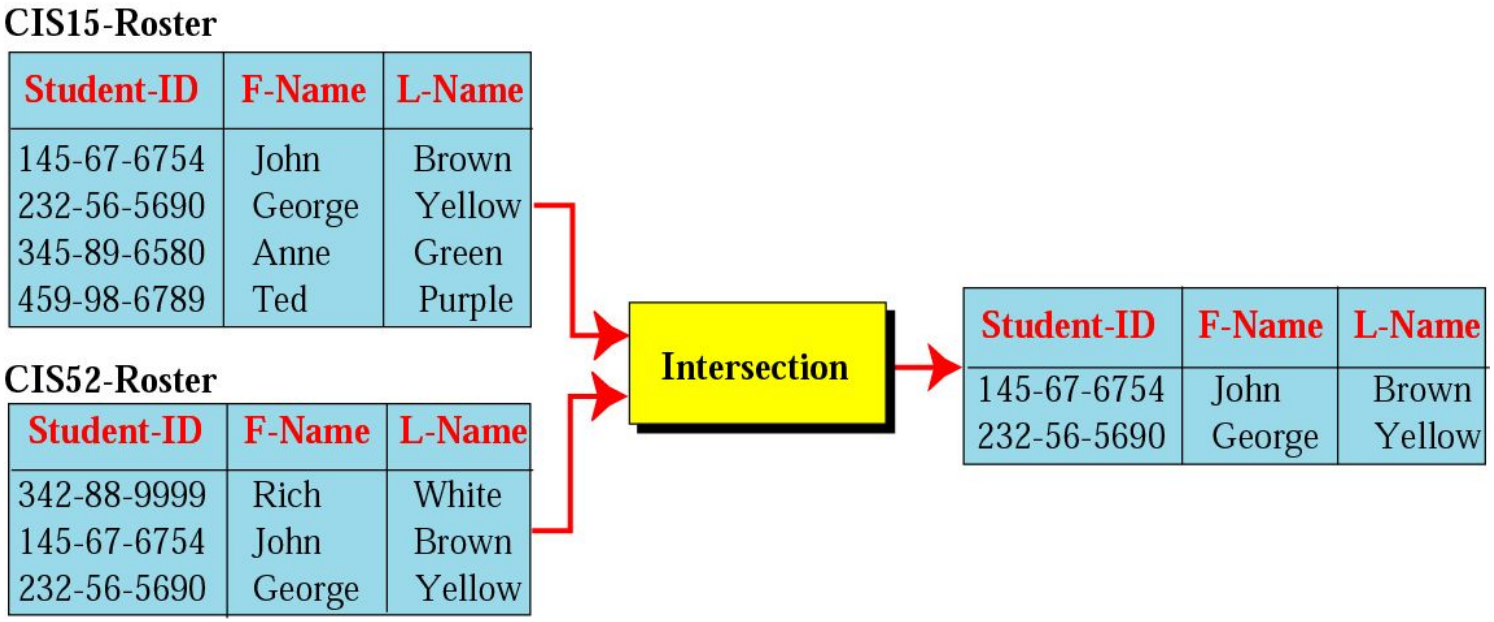
- **Binary operation**
- **Join Operation: Takes two relation and combine them based on common attribute**

Union operation



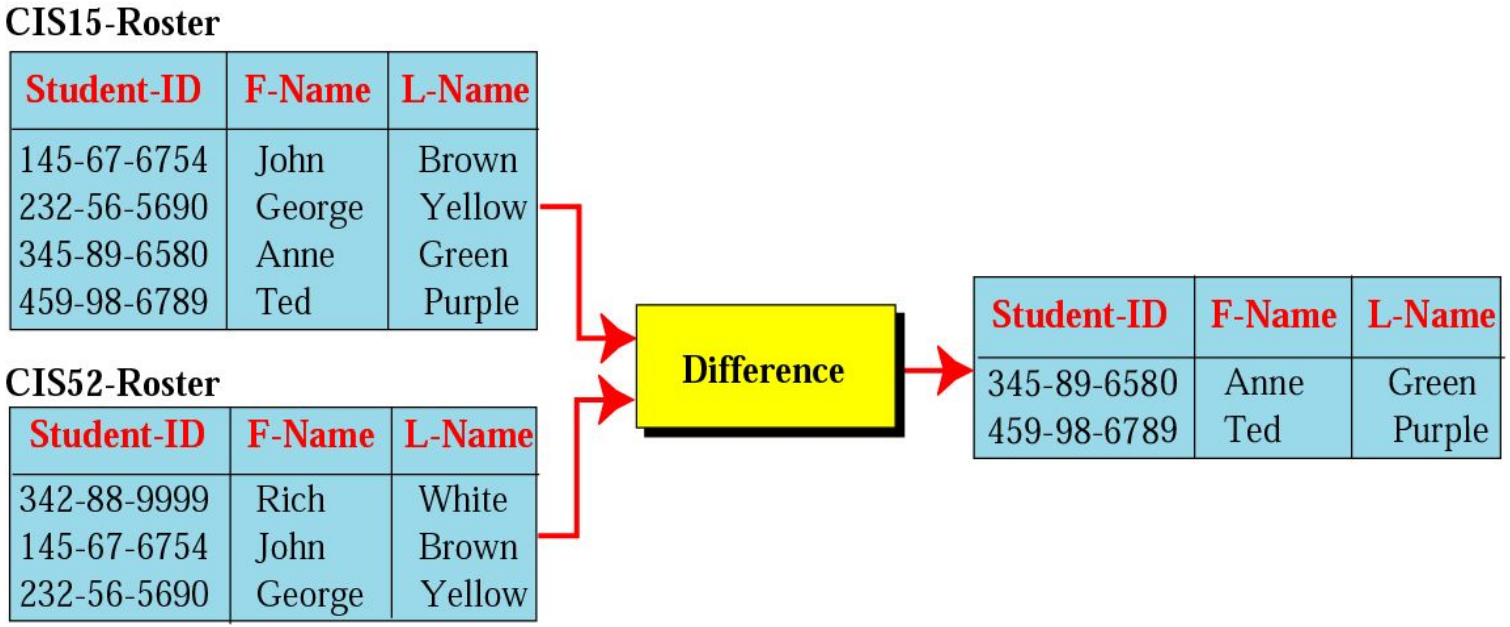
- **Binary operation**
- **Union Operation: Creates new relation in which each tuple is either in the first relation, the second relation or in both**

Intersection operation



- **Binary operation**
- **Intersection Operation: Creates new relation in which each tuple is in both relations.**

Difference operation



- **Binary Operation**
- **Difference Operation: Creates new relation where the new tuples are in the first relation but not in the second.**

Database Management System

- A database management system (DBMS) is system software for creating and managing Database.
- The DBMS provides users and programmers with a systematic way to create, retrieve, update and manage data.
- DBMS allow all the operations on database discussed in previous slides
  - Inserte, Delete, retrieve, Union, Join etc…

STRUCTURED QUERY LANGUAGE

SQL

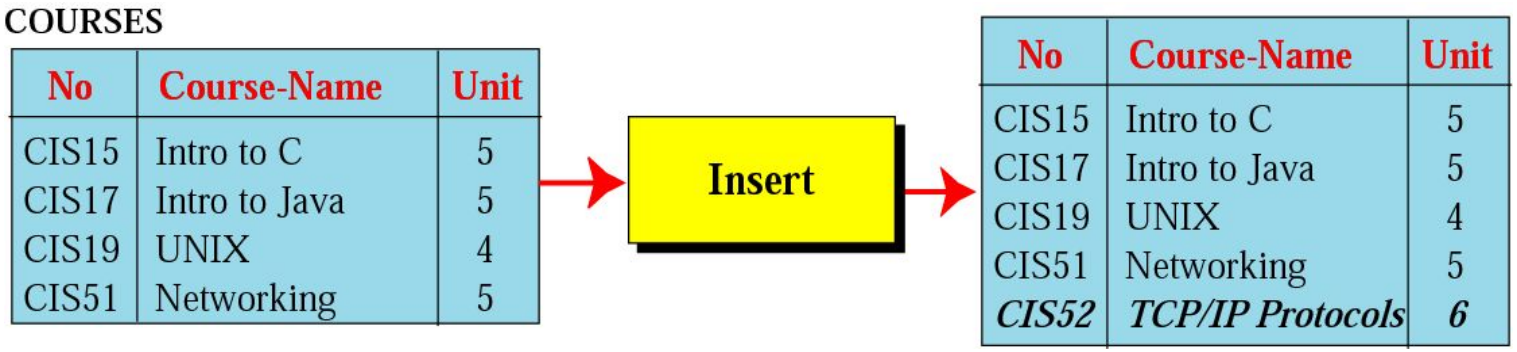
- SQL is the standard language used for relational databases.
- It is declarative language where users declare what they want without having to write a step by stem procedure.
- It was first implemented by Oracle Corporation

1. Insert

- SQL Insert Operation format

insert into RELATION-NAME
values (…, …, …)

Insert (Example)



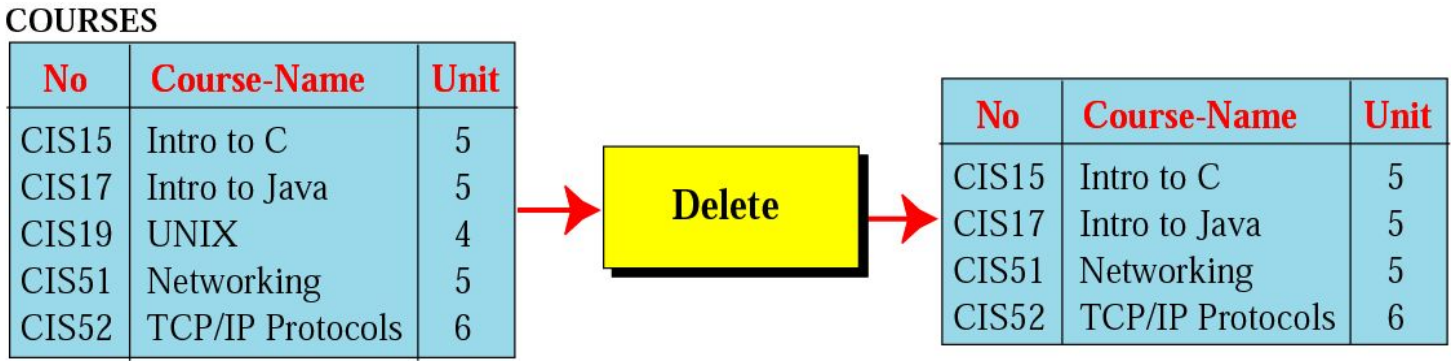
insert into COURSES
values (“CIS52”, “TCP/IP Protocols”, 6)

2. Delete

- SQL Delete Operation format

delete from RELATION-NAME
where criteria

Delete (Example)



Delete from COURSES
where No = “CIS19”

3. Update

- SQL Update Operation format

update RELATION-NAME
set attribute1 = value1 attribute 2 = value2 …
where criteria

Update (Example)

COURSES

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	5
CIS52	TCP/IP Protocols	6

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	**6**
CIS52	TCP/IP Protocols	6

update COURSES
set unit = 6
where No = “CIS51”

4. Select

- SQL Select Operation format

```
select          *
from    RELATION-NAME
where   criteria
```

Select (Example)

COURSES

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	5
CIS52	TCP/IP Protocols	6

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS51	Networking	5

```
select   *
from     COURSES
where    Unit = 5
```

5. Project

- SQL Project Operation format

select attribute-list
from RELATION-NAME

Project (Example)

COURSES

No	Course-Name	Unit
CIS15	Intro to C	5
CIS17	Intro to Java	5
CIS19	UNIX	4
CIS51	Networking	5
CIS52	TCP/IP Protocols	6

No	Unit
CIS15	5
CIS17	5
CIS19	4
CIS51	5
CIS52	6

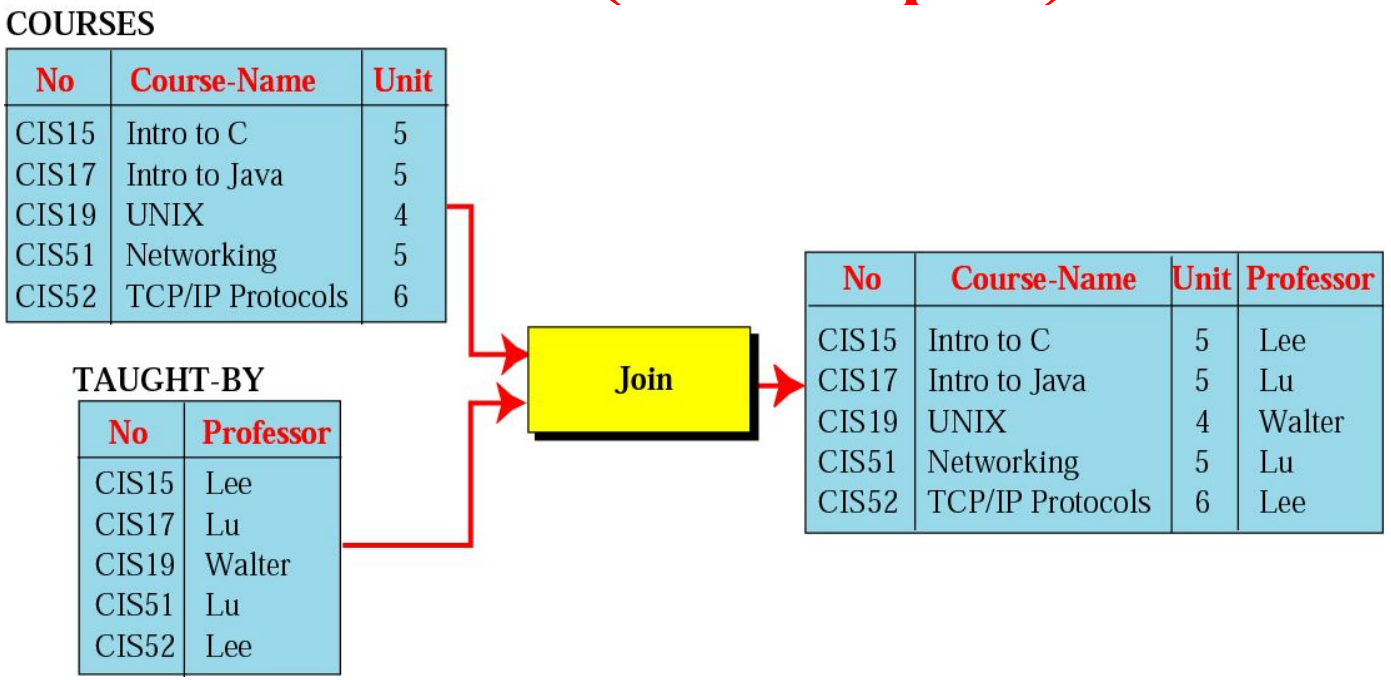
select No, Unit
from COURSES

6. Join

- SQL Join Operation format

```
select    attribute-list
from      RELATION NO1, RELATION NO2
where     criteria
```

Join (Example)



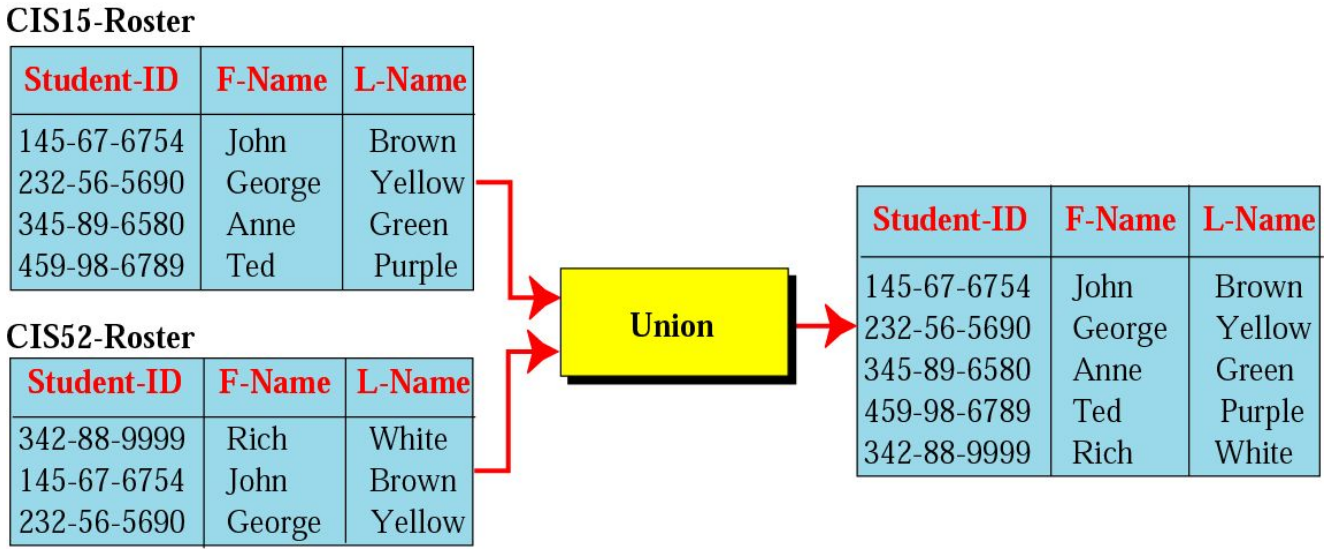
select No, Course-Name, Unit, Professor
from COURSES, TAUGHT-BY
where COURSES.No = TAUGHT-BY.No;

7. Union

- SQL Union Operation format

```
select   *
from     RELATION NO1
union
select   *
from     RELATION NO2
```

Union (Example)



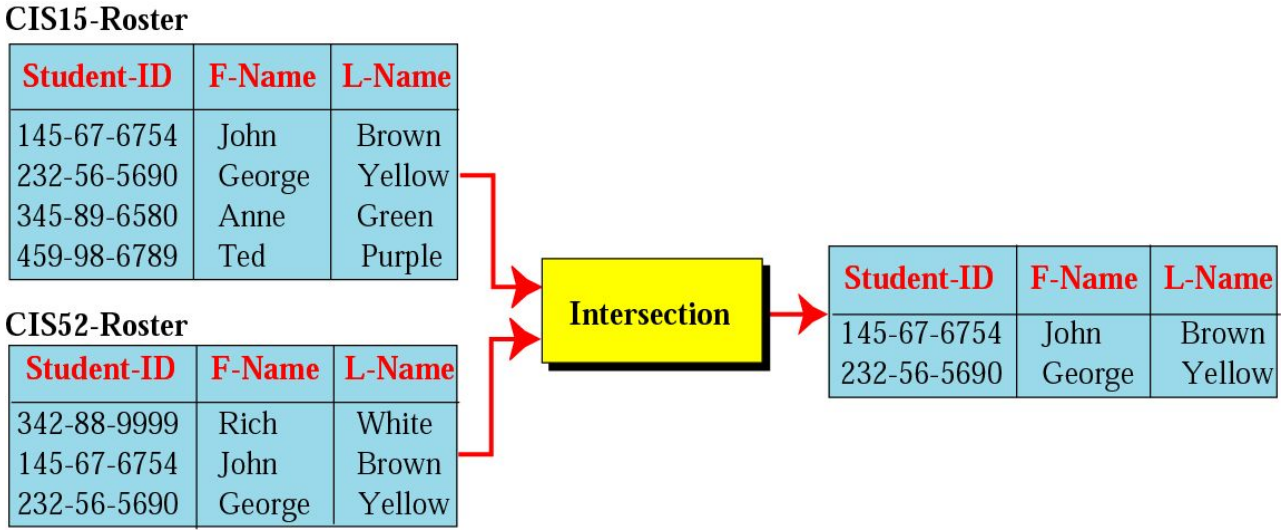

```
select   *
from     CIS15-Roster
union
select   *
from     CIS52-Roster;
```

8. Intersection

- SQL Intersection Operation format

```
select    *
from      RELATION NO1
intersection
select    *
from      RELATION NO2
```

Intersection (Example)



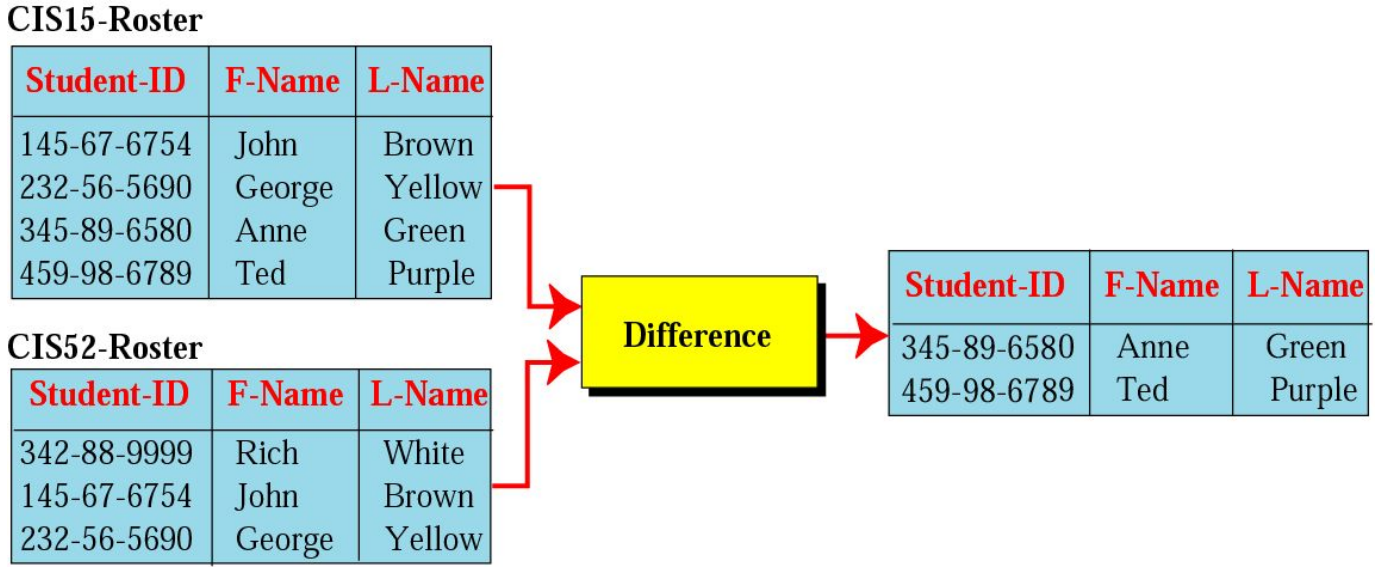

```
select    *
from      CIS15-Roster
intersection
select    *
from      CIS52-Roster;
```

9. Difference

- SQL Difference Operation format

```
select   *
from     RELATION NO1
minus
select   *
from     RELATION NO2
```

Intersection (Example)




```
select   *
from     CIS15-Roster
minus
select   *
from     CIS52-Roster;
```

OTHER DATABASE MODELS

The levels of Data

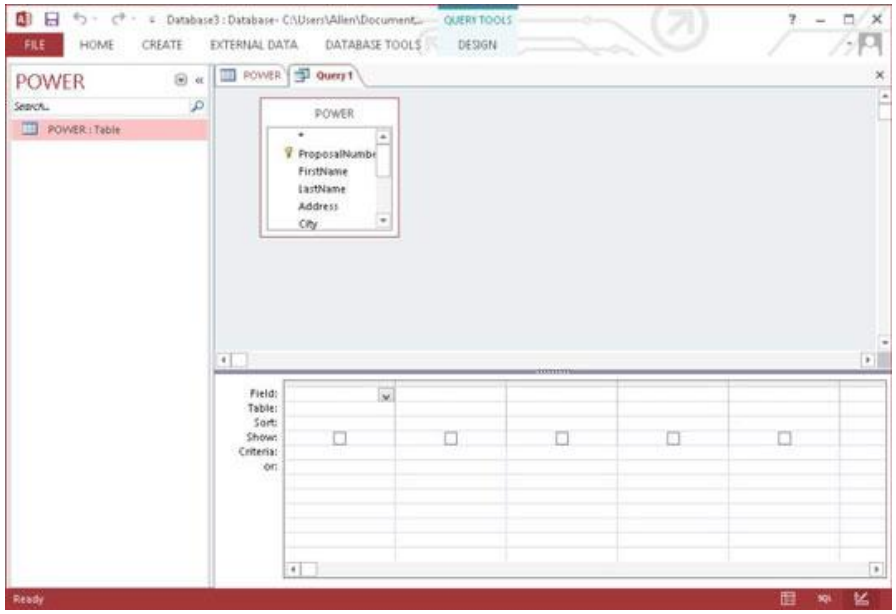
Database	**One or more tables**
Table (relation)	**A collection of Records**
Record/Tuple	**A group of related fields**
Field	**One or more character**
Character	**At least 8 bits**
Bit	**0 or 1**

5 characteristics of Good Database

Data Integrity	Ensuring data is valid
Data Independence	Data is separated from software
Avoiding data Redundancy	Repetition of input data is avoided
Data Security	Data is not accessible to unauthorized users
Data Maintenance	Set procedures for adding ,deleting … records for the purpose of optimization

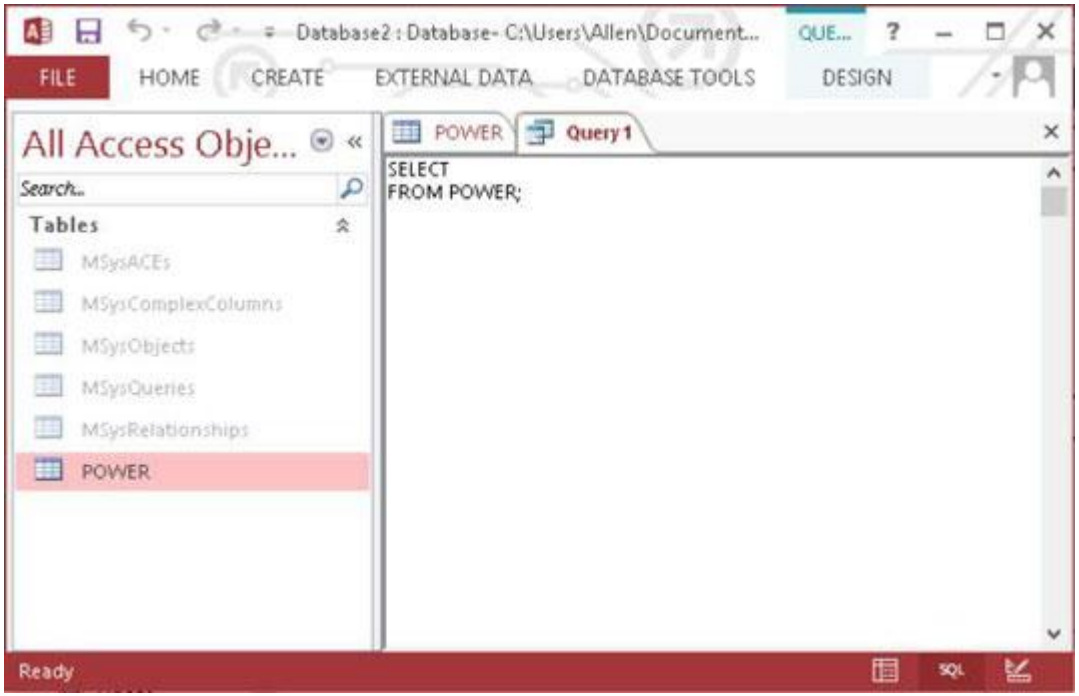
How To Write And Run SQL Query

- **Open your database and click the CREATE tab.**
  - This will display the ribbon across the top of the window.
- **Click Query Design in the Queries section.**
  - The Show Table dialog box appears.
- **Select the POWER table. Click the Add button and then click the Close button to close the dialog box.**



How To Write And Run SQL Query

- **Click the Home tab and then the View icon in the left corner of the Ribbon.**
  - A menu drops down, displaying the different views available to you in query mode. One of those views is SQL View.
- **Click SQL View to display the SQL View Object tab.**



How To Write And Run SQL Query

- **Fill in an asterisk (*) in the blank area in the first line and add a WHERE clause after the FROM line.**
  - If you had already entered some data into the POWER table, you could make a retrieval with something like:
  - SELECT * FROM POWER WHERE LastName = 'Marx' ;
- **Enter a name and then click OK.**
  - Your statement is saved and can be executed as a query later.