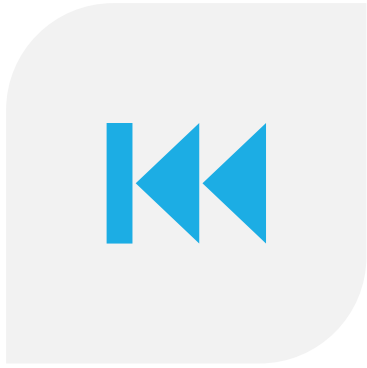


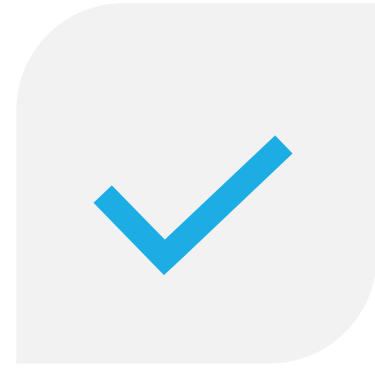
COMPUTER TECHNOLOGY

Dr. Amr Elkholy

Lecture 9: Databases and Decision Making (Part1)



PREVIOUS



TODAY

✓ Ch1: Intro to Computer Fundamentals

✓ Ch2: Operating System

✓ Ch3: Computer Networking

✓ Ch4: Programming Language

✓ Ch5: Databases and Decision Making



CH5: DATABASES AND DECISION MAKING (PART1)

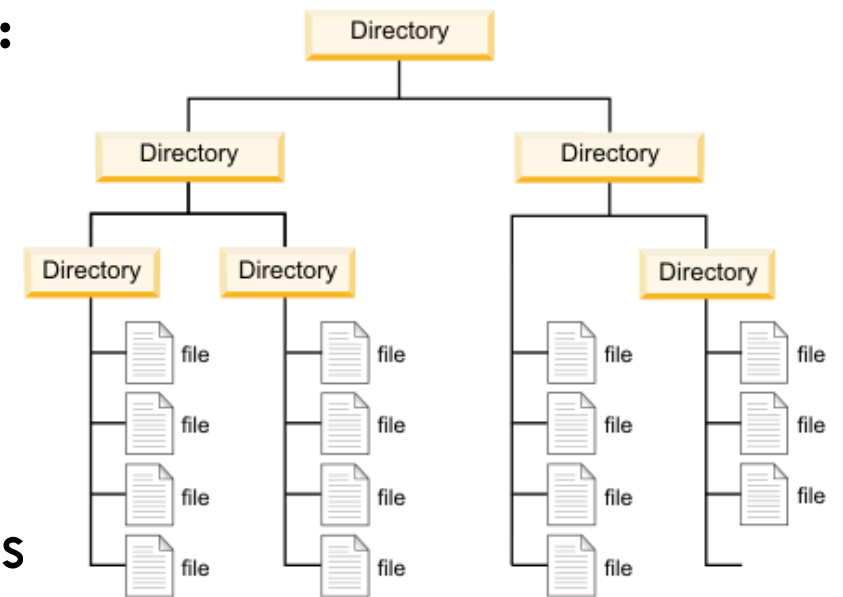
FILE SYSTEM



❑ In the early days, database applications were built on top of file systems

❑ Drawbacks of using file systems to store data:

- Data redundancy and inconsistency
 - Multiple file formats, duplication of information in different files
- Difficulty in accessing data
 - Need to write a new program to carry out each new task
- Data isolation — multiple files and formats
- Integrity problems
 - Integrity constraints (e.g. account balance > 0) become part of program code
 - Hard to add new constraints or change existing ones



DATABASE



□ A database is a collection of related, logically coherent data which can be used alone or combined to provide answers to the user's question.

<i>StudentNr</i>	<i>StudentName</i>
101	Ann Jones
102	John Smith
103	John Smith

<i>CourseCode</i>	<i>CourseTitle</i>
CS100	Introduction to Computer Science
CS102	Programming Basics
CS200	Operating Systems
CS400	MetaInformatics

<i>StudentNr</i>	<i>CourseCode</i>	<i>Grade</i>
101	CS100	A
101	CS102	A
101	CS200	B
102	CS100	

DATABASE



□ Database Applications:

- Banking: all transactions
- Airlines: reservations, schedules
- Universities: registration, grades
- Sales: customers, products, purchases
- Manufacturing: production, inventory, orders, supply chain
- Human resources: employee records, salaries, tax deductions

DATABASE



Database Advantage:

- Less Redundancy
- Inconsistency avoidance
- Efficiency
- Data Integrity
- Confidentiality

<i>StudentNr</i>	<i>StudentName</i>
101	Ann Jones
102	John Smith
103	John Smith

<i>CourseCode</i>	<i>CourseTitle</i>
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<i>StudentNr</i>	<i>CourseCode</i>	<i>Grade</i>
101	CS100	A
101	CS102	A
101	CS200	B
102	CS100	

DBMS

□ A DBMS is a combination of five components:

Hardware

- The physical computer system that allows access t

Software

- Actual program that allows users to access, maintain, and update data.

Data

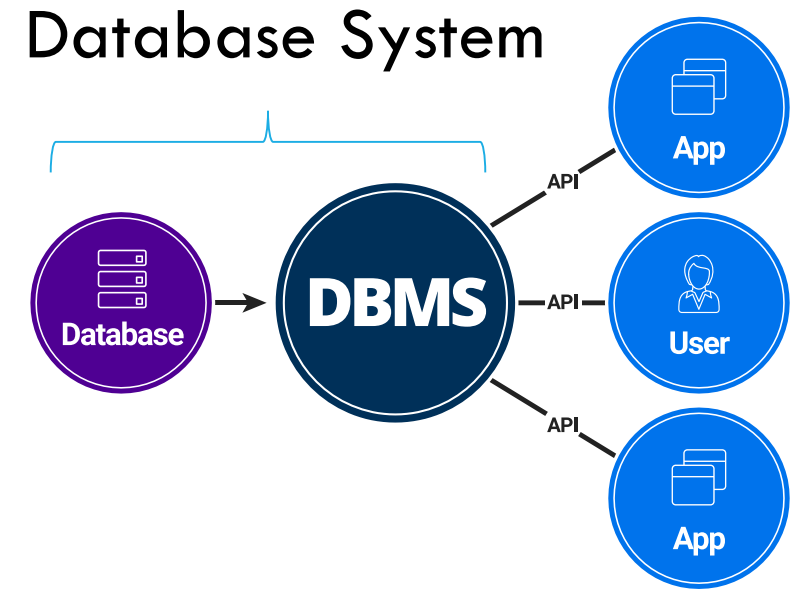
- Schema, subschema, table, attribute

Users

- Data administrator & database administrator
- Database designer: logical & physical
- Application programmer
- End-user: naive & sophisticated

Procedure

- The set of rules that should be clearly defined and followed by the users of the database.

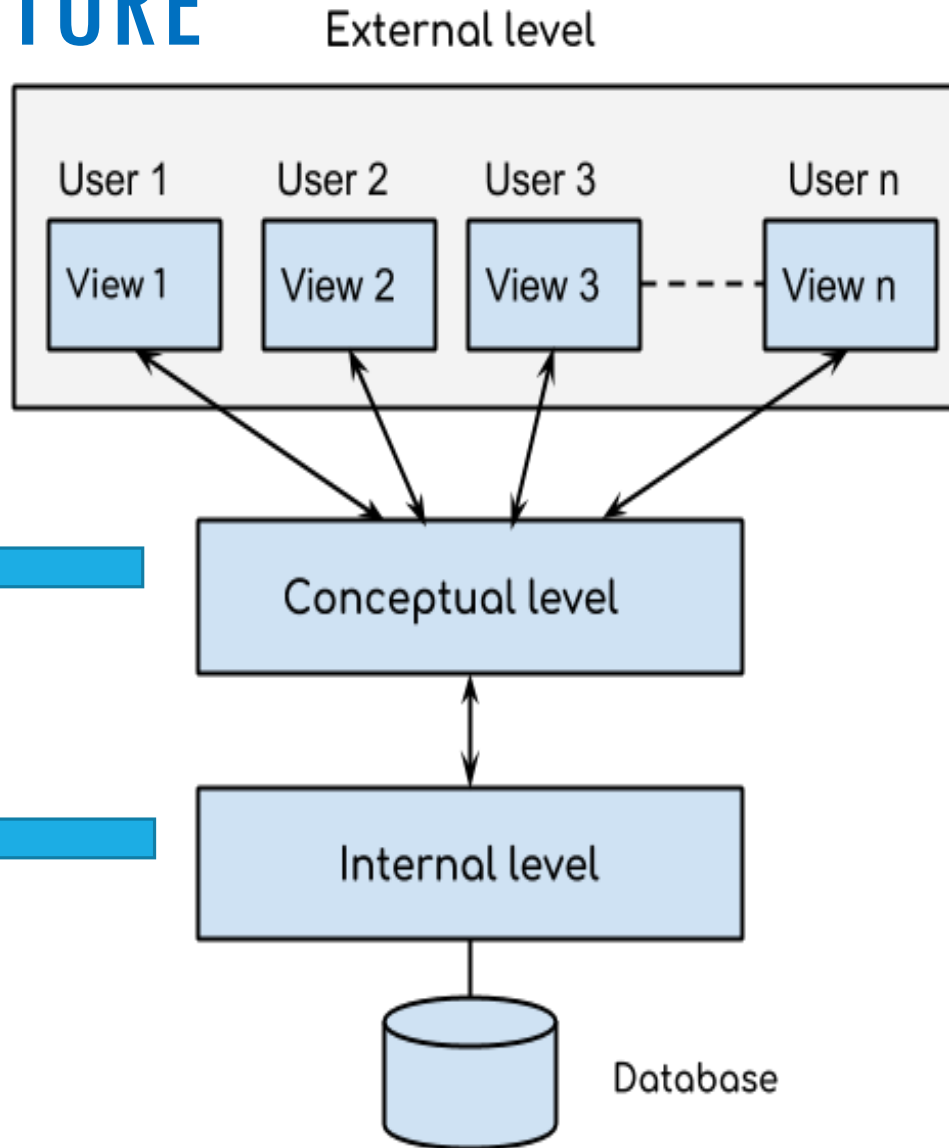


DATABASE ARCHITECTURE

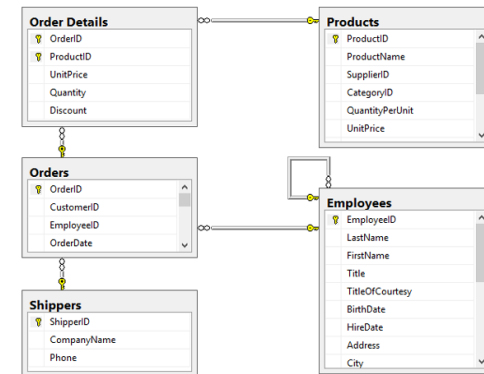
Interacts directly with the user.

Defined the logical view of the data (i.e., data model, queries).

Determines where the data is actually stored on the storage devices.



Emp_Id	Last_Name	First_Name	Gender	Title
1000	Torbati	Yolanda	F	Programmer
1001	Kleinn	Joel	M	Programmer
1002	Ginsburg	Laura	F	President
1003	Cox	Jennifer	F	Programmer
1005	Zada	Mauri	M	Product Designer
1006	Keyser	Cara	F	Account Executive
1010	Smith	Roxe	M	Programmer
1011	Nelson	Robert	M	Programmer
1012	Sachsen	Lars	M	Support Technician
1013	Shannon	Don	M	Product Designer

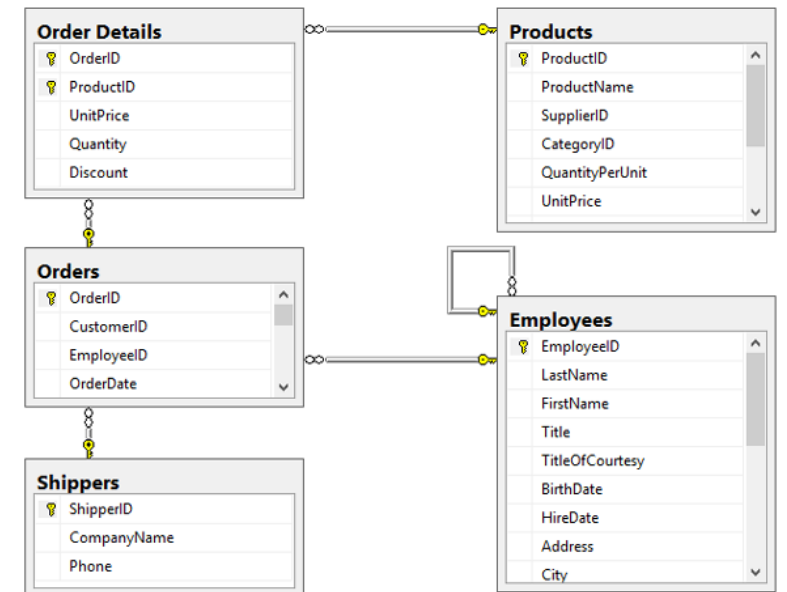


DATABASE MODELS

- ✓ Defines the logical design of the data
- ✓ Describes the relationships between different parts of the data.

□ Database Models:

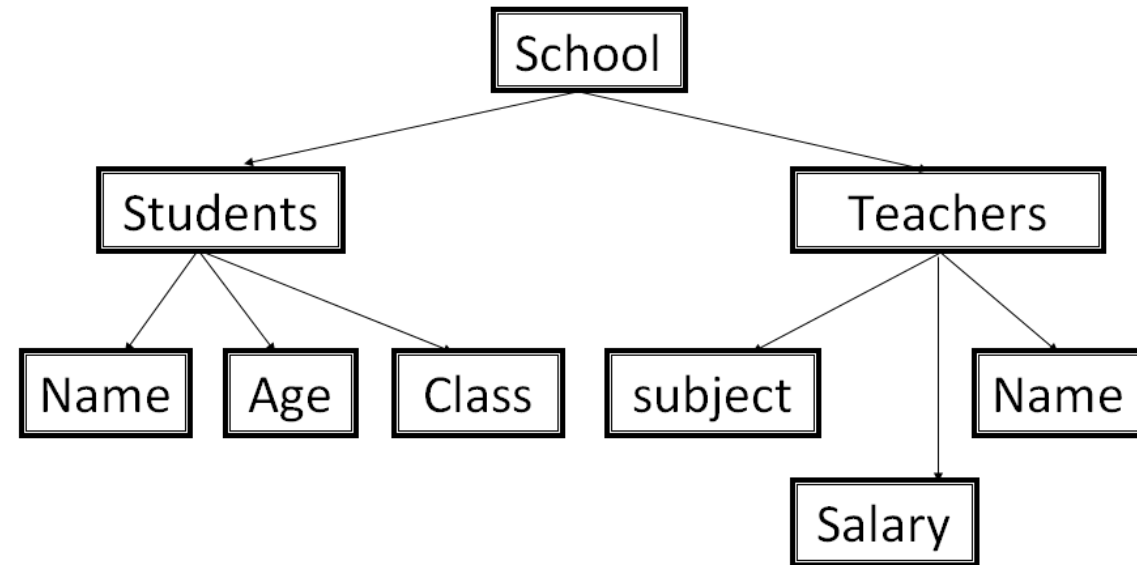
- Hierarchical database model
- Network database model
- Relational database model



DATABASE MODELS

❑ Hierarchical database model

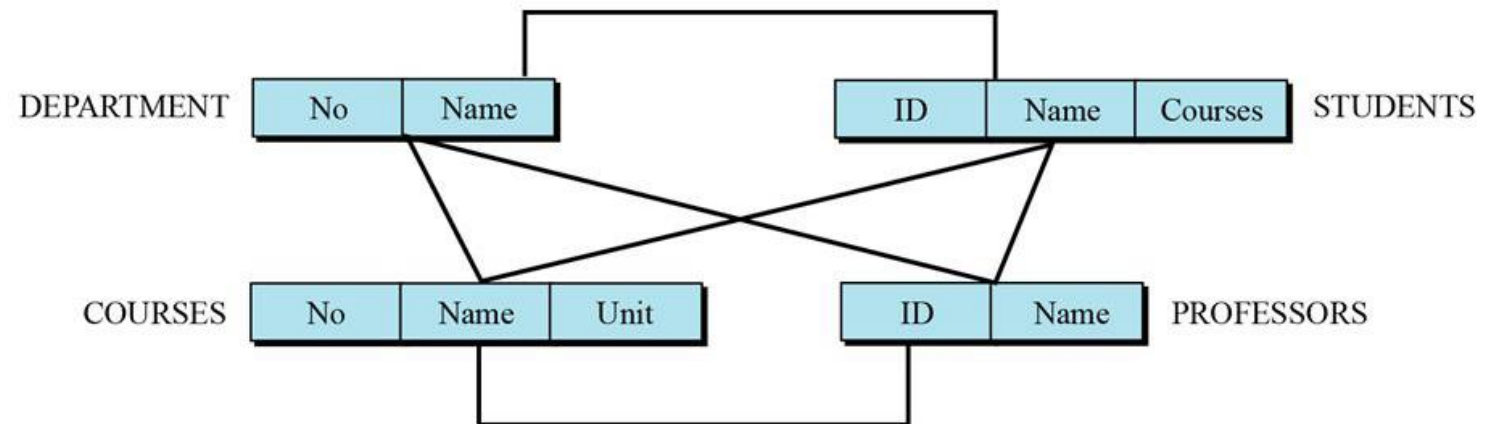
- ✓ Data is organized as an upside-down tree
- ✓ Each entity has only one parent
- ✓ At the top, there is one entity (Root)



DATABASE MODELS

❑ Network database model

- ✓ Entities are organized in a graph
- ✓ Some entities can be accessed through several paths.



DATABASE MODELS

❑ Relational database model

- ✓ Data is organized in two-dimensional tables called **“Relations”**
- ✓ Tables are related to each other.

EMPLOYEE

Employee_ID	First_Name	Last_Name	Hire_Date	Manager	Department_ID
37	Frances	Newton	14-SEP-2005		
1234	Donald	Newton	24-SEP-2006	28	10
7895	Matthew	Michaels	16-MAY-2007	28	10

DEPARTMENT

Department_ID	Name
10	Accounting
20	Payroll

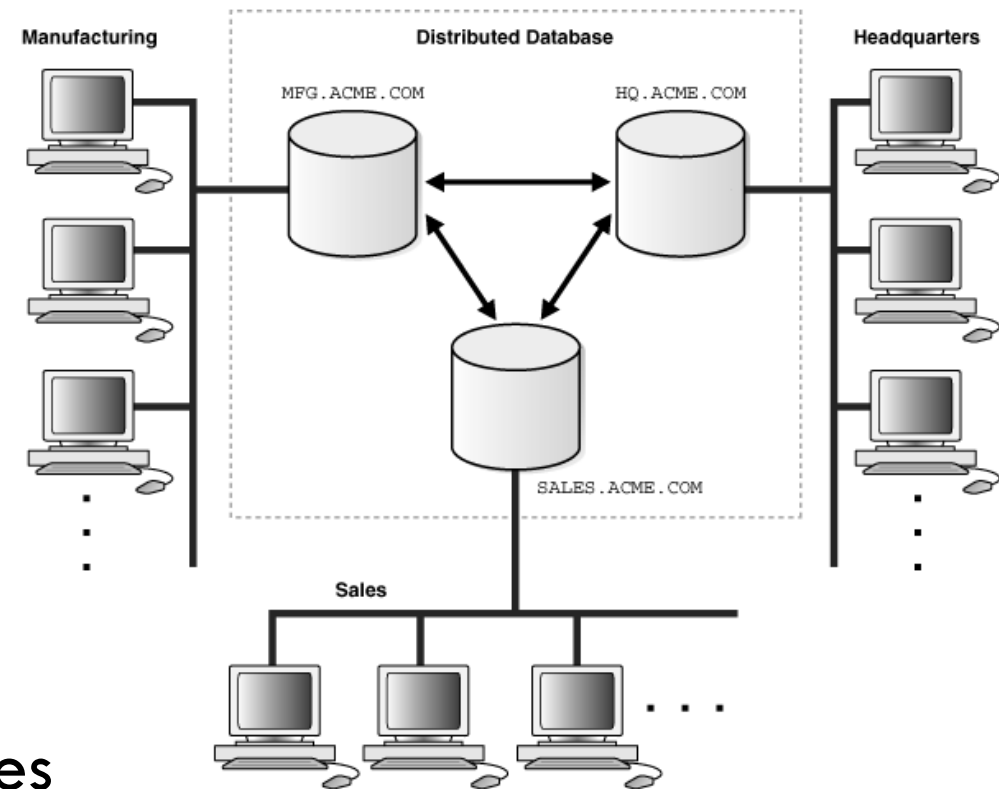
(1)

(M)

DATABASE MODELS

❑ Distributed database model

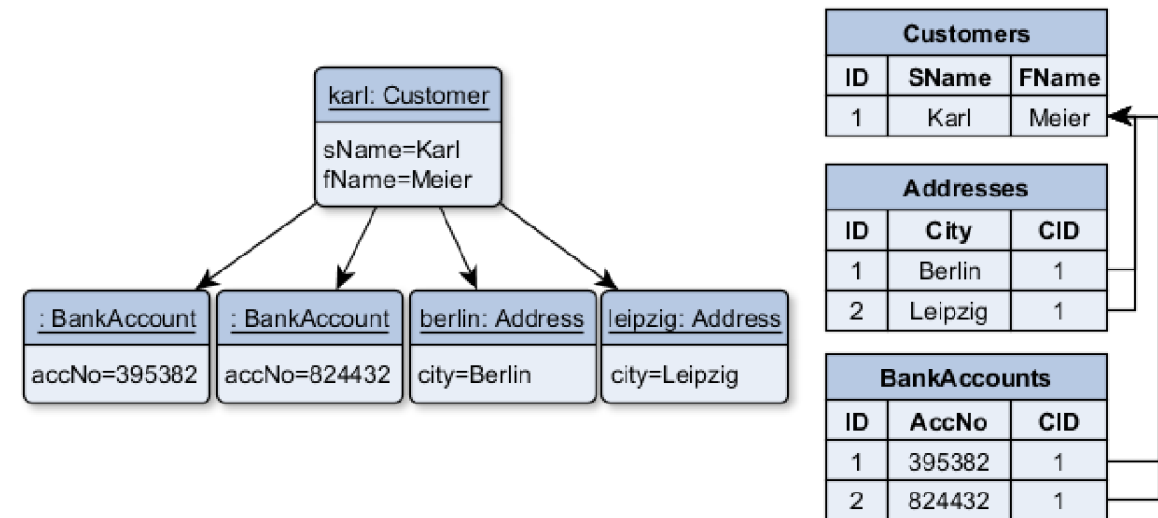
- ✓ It is based on the relational model.
- ✓ The data are stored on several computers that communicate through the Internet or some private Network.
 - Fragmented distributed databases
 - Replicated distributed databases



DATABASE MODELS

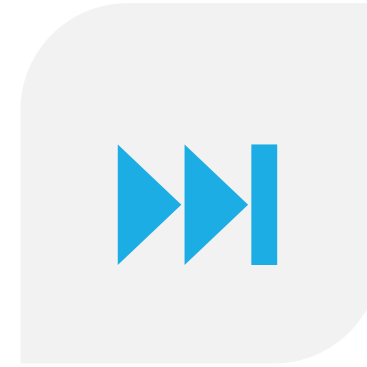
❑ Object Oriented database model

- ✓ Data as a structure.
- ✓ Tries to keep the adv. Of the relational model and allows applications to access structured data.
- ✓ Objects and their relations are defined, and each object can have attributes.





SUMMARY



NEXT

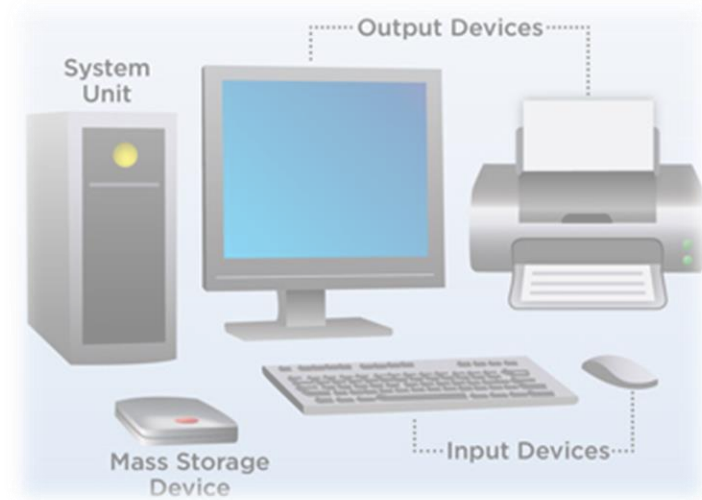
✓ Ch5: Databases and Decision Making
(Part1)

- File Systems
- Database
- DBMS
- DB Architecture
- DB Models

✓ Ch5: Databases and Decision Making
(Part2)



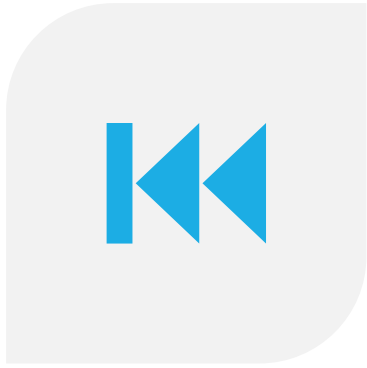
**THE
END**



COMPUTER TECHNOLOGY

Dr. Amr Elkholy

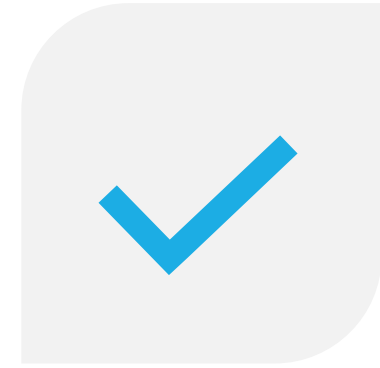
Lecture 9: Databases and Decision Making (Part2)



PREVIOUS

✓ Ch5: Databases and Decision Making
(Part1)

- File Systems
- Database
- DBMS
- DB Architecture
- DB Models



TODAY

✓ Ch5: Databases and Decision Making
(Part2)

- Relational Database Model
- SQL
- Decision Making

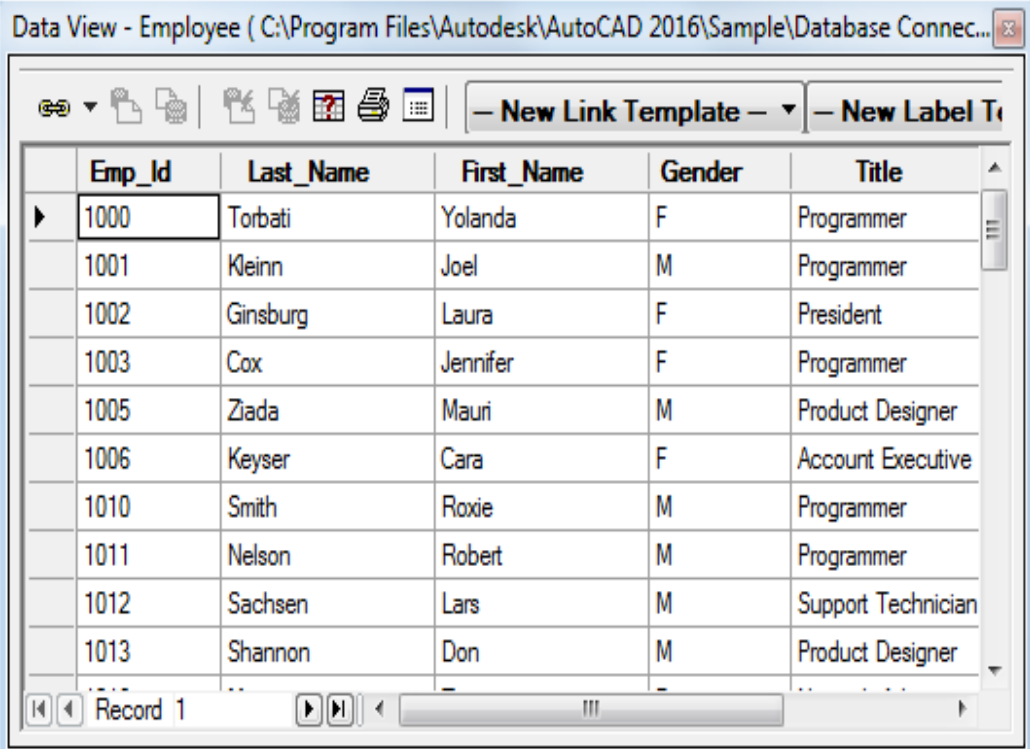


CH5: DATABASES AND DECISION MAKING (PART2)

RELATIONAL DATABASE MODEL

□ In **Relational DataBase Management System** (RDBMS), the data is represented as a set of **relations**.

- Relation is a two-dimensional table.



Data View - Employee (C:\Program Files\Autodesk\AutoCAD 2016\Sample\Database Connec...

Emp_Id	Last_Name	First_Name	Gender	Title
1000	Torbati	Yolanda	F	Programmer
1001	Kleinn	Joel	M	Programmer
1002	Ginsburg	Laura	F	President
1003	Cox	Jennifer	F	Programmer
1005	Ziada	Mauri	M	Product Designer
1006	Keyser	Cara	F	Account Executive
1010	Smith	Roxie	M	Programmer
1011	Nelson	Robert	M	Programmer
1012	Sachsen	Lars	M	Support Technician
1013	Shannon	Don	M	Product Designer

Record 1

RELATION

□ A relation in an RDBMS has the following features:

- **Name**

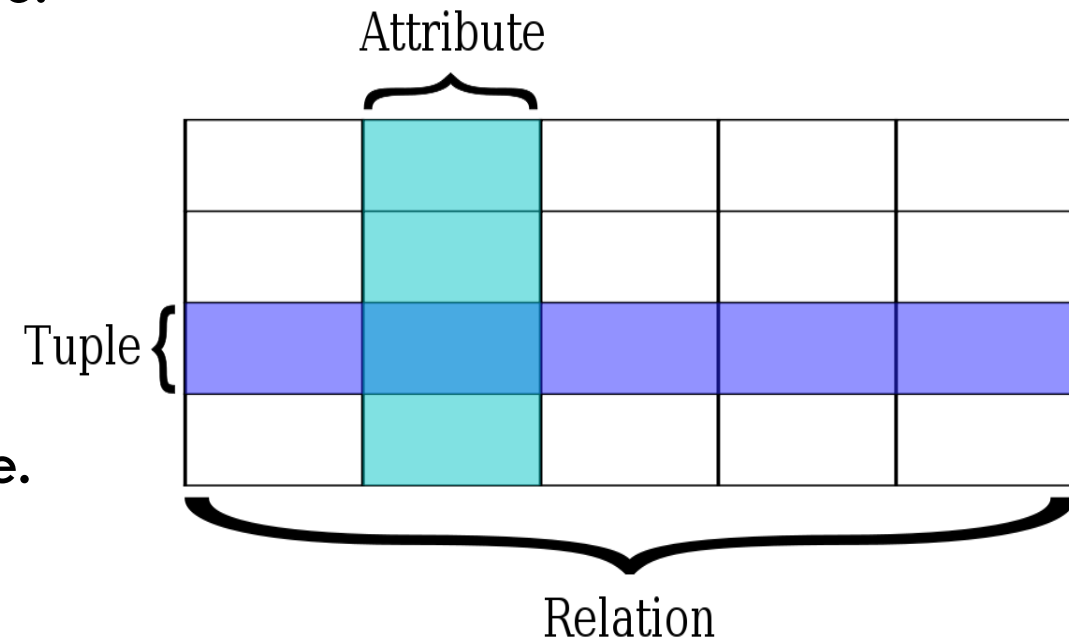
- Each relation has a name that is unique.

- **Attributes**

- Each column in a relation is called an attribute.

- **Tuples**

- Each row in a relation is called a tuple.



OPERATIONS ON RELATIONS

□ We can define several operations that can be applied to relations.

- **Insert**
- **Delete**
- **Update**
- **Select**
- **Project**
- **Join**
- **Union**
- **Intersect**
- **Difference**

✓ Each operation is described as defined in the database query language

SQL (Structured Query Language)

SQL

- ❑ SQL is a standard language that can be used on relational databases.
- ❑ It is a declarative rather than procedural language.



SQL



1. Insert Operation

- This operation inserts a new tuple into the relations.
- It is a unary operation (i.e., it is applied to a single relation)

Insert into **RELATION-NAME**
Values (**.....,.....,**)

SQL



1. Insert Operation

Insert into **Courses**
Values (**“CIS52”, “Programming”, 6**)

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	2
CIS19	UNIX	4
CIS51	Networking	5



ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	2
CIS19	UNIX	4
CIS51	Networking	5
CIS52	Programming	6

SQL



2. Delete Operation

- This operation deletes a tuple defined by a criterion from the relations.
- It is a unary operation (i.e., it is applied to a single relation)

Delete from **RELATION-NAME**
Where **Criteria**

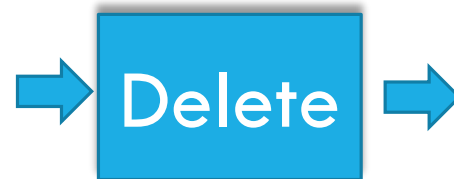
SQL



2. Delete Operation

Delete from **Courses**
Values **ID = "CIS52"**

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	2
CIS19	UNIX	4
CIS51	Networking	5
CIS52	Programming	6



ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	2
CIS19	UNIX	4
CIS51	Networking	5

SQL



3. Update Operation

- This operation changes the value of some attributes of a tuple.
- It is a unary operation (i.e., it is applied to a single relation)

Update **RELATION-NAME**

Set **attribute1 = value1,**

attribute2 = value2, ...

Where **Criteria**

SQL



3. Update Operation

Update **Courses**

Set Credit_Hours = 3

Where **ID = "CIS52"**

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	2
CIS19	UNIX	4
CIS51	Networking	5
CIS52	Programming	6



ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	2
CIS19	UNIX	4
CIS51	Networking	5
CIS52	Programming	3

SQL



4. Select Operation

- This tuples in the resulting relation are a subset of the tuples in the original relation.
- It is a unary operation (i.e., it is applied to a single relation)

Select *

From **RELATION-NAME**

Where **Criteria**

SQL



4. Select Operation

Select *
From **Courses**
Where **Credit_Hours = 3**

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	3
CIS19	UNIX	4
CIS51	Networking	5
CIS52	Programming	6



ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	3

SQL



5. Project Operation

- The attributes (columns) in the resulting relation are a subset of the attributes in the original relation.
- It is a unary operation and creates another relation.

Select **Attribute-List**
From **RELATION-NAME**

SQL



5. Project Operation

Select **ID, Course_Name**
From **Courses**

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	3
CIS19	UNIX	4
CIS51	Networking	5
CIS52	Programming	6



ID	Course_Name
CIS15	Intro to C
CIS17	Intro to Java
CIS19	UNIX
CIS51	Networking
CIS52	Programming

SQL



6. Join Operation

- It is a binary operation that combines two relations on common attributes.

Select **Attribute-List**

From **RELATION1, RELATION2**

Where **Criteria**

SQL



6. Join Operation

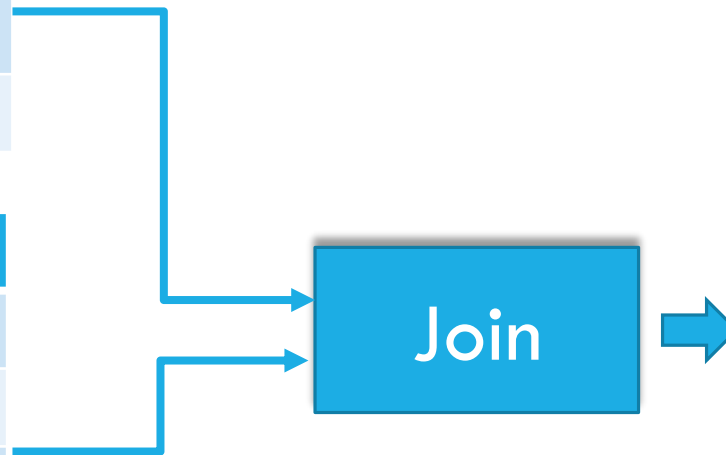
Courses

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	3
CIS19	UNIX	4
CIS51	Networking	5

Professors

ID	Professor	Course_ID
1	Ahmed	CIS19
2	Mohamed	CIS17
3	Mostafa	CIS51
4	Amin	CIS15

Select **Course_Name, Professor**
From **Courses, Professors**
Where **Courses.ID = Professors.Course_ID**



Course_Name	Professor
Intro to C	Amin
Intro to Java	Mohamed
UNIX	Ahmed
Networking	Mostafa

SQL



7. Union Operation

- Union operation takes two relations with the same set of attributes.

Select *

From **RELATION1**

Union

Select *

From **RELATION2**



SQL

7. Union Operation

```
Select *  
From Courses1  
Union  
Select *  
From Courses2
```

Courses1

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	3

Courses2

ID	Course_Name	Credit_Hours
CIS19	UNIX	4
CIS51	Networking	5



ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	3
CIS19	UNIX	4
CIS51	Networking	5



8. Intersection Operation

- Intersection operation takes two relations and creates a new relation which is the intersection of the two.

Select *

From **RELATION1**

Intersection

Select *

From **RELATION2**

SQL



8. Intersection Operation

```
Select *  
From Courses1  
Union  
Select *  
From Courses2
```

Courses1

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	3
CIS51	Networking	5

Courses2

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS19	UNIX	4
CIS51	Networking	5

Intersection

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS51	Networking	5

SQL



9. Difference Operation

- Difference operation is applied to two relations with the same attributes.
- The tuples in the resulting relation are those that are in the first relation but not in the second.

```
Select *  
From RELATION1  
Minus  
Select *  
From RELATION2
```

SQL



9. Difference Operation

Select *
From **Courses1**
Minus
Select *
From **Courses2**

Courses1

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS17	Intro to Java	3
CIS51	Networking	5

Courses2

ID	Course_Name	Credit_Hours
CIS15	Intro to C	3
CIS19	UNIX	4
CIS51	Networking	5

Difference

ID	Course_Name	Credit_Hours
CIS17	Intro to Java	3

DECISION MAKING

☐ Computers are everywhere.

☐ What can the computer offer to the users and how can it support their work when dealing with **decision-making** problems?



DECISION MAKING

□ **Decision making** is usually defined as a mental process, which involves judging multiple options or alternatives, in order to select one, so as to best achieve the goals.

□ There are two main components involved in decision making:

- ✓ The set of alternatives.
- ✓ The goals to be satisfied with the choice of one alternative.

Decision Making



DECISION MAKING



❑ The output of this process can be an action or an opinion of choice.

❑ Decision making is a process, involving several activities, such as:

- ✓ Identification of the decision problem.
- ✓ Collecting and verifying relevant information.
- ✓ Identifying decision alternatives.
- ✓ Anticipating the consequences of decisions.
- ✓ Making the decision.

DECISION MAKING



Decision Making



□ When decisions are made in a computer program, they are simply the result of a computation in which the final result is either **TRUE** or **FALSE**.

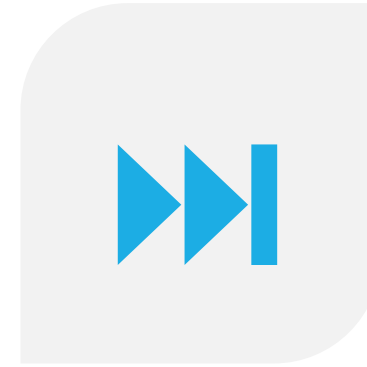
□ Examples of Decision making programming statements.

- ✓ If statement
- ✓ Switch statement
- ✓ ? Conditional operator system
- ✓ Goto statement



SUMMARY

✓ Ch5: Databases and Decision Making
(Part2)



NEXT

✓ Ch6: Computer Graphics
and Multimedia



**THE
END**