

# BBM105 - Databases

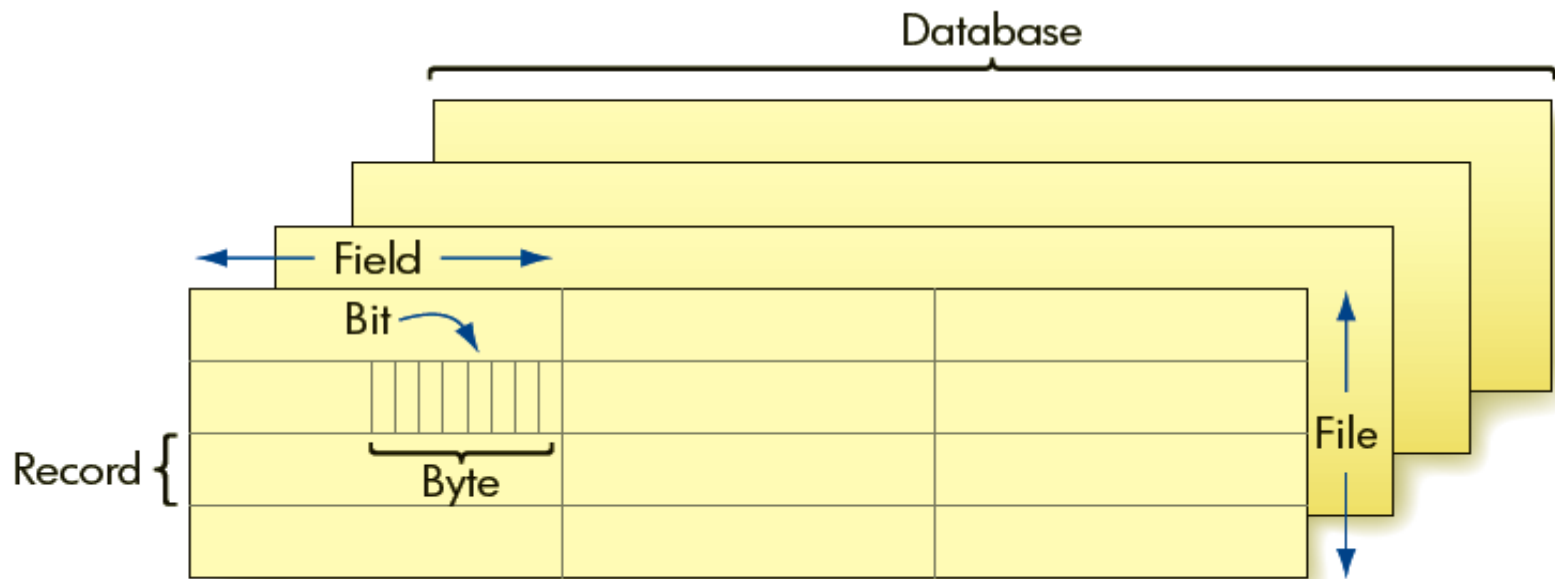
Slides: Invitation to Computer Science 5<sup>th</sup> Edition (Chapter 14)

# Databases

- Bit
  - Most basic unit of data
  - Combined into groups of eight called bytes
- Fields
  - Group of bytes
- Record
  - Collection of related fields

# Databases (continued)

- Data file
  - Stores related records
- Database
  - Made up of related files



**Figure 14.3** Data Organization Hierarchy

	Field 1	Field 2	Field 3
Record 1			
Record 2			
Record 3			
Record 4			
Record 5			

**Figure 14.4** Records and Fields in a Single File

ID	LASTNAME	FIRSTNAME	BIRTHDATE	PAYRATE	HOURSWORKED
149	Takasano	Frederick	5/23/1966	\$12.35	250

**Figure 14.5** One Record in the Rugs-For-You Employees File

# Database Management Systems

- Manage the files in a database
- Entity
  - Fundamental distinguishable component
- Attribute
  - Category of information
- Primary key
  - Attribute or combination of attributes that uniquely identifies a **tuple**

### EMPLOYEES

<u>ID</u>	LASTNAME	FIRSTNAME	BIRTHDATE	PAYRATE	HOURSWORKED
116	Kay	Janet	3/29/1956	\$16.60	94
123	Perreira	Francine	8/15/1987	\$ 8.50	185
149	Takasano	Frederick	5/23/1966	\$12.35	250
171	Kay	John	11/17/1954	\$17.80	245
165	Honou	Morris	6/9/1988	\$ 6.70	53

**Figure 14.6** Employees Table for Rugs-For-You



# Database Management Systems (continued)

- Query languages
  - Enable user or another application program to **query** the database, in order to retrieve information
- Composite primary key
  - Needed to identify a tuple uniquely
- Foreign key
  - Key from another table that refers to a specific key, usually the primary key

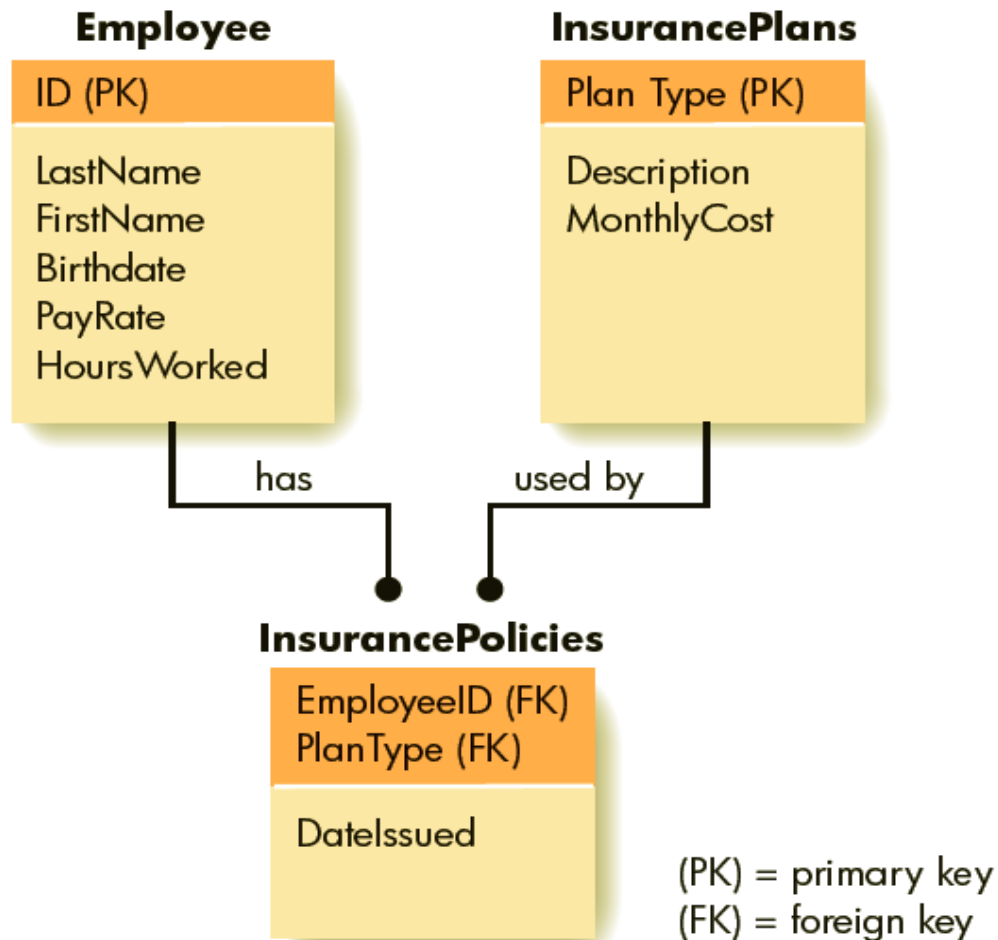
# Database Systems

- The big commercial database vendors:
  - Oracle
  - IBM (with DB2)
  - Microsoft (SQL Server)
  - Sybase
- Some free database systems:
  - Postgres
  - MySQL
  - Predator

## INSURANCEPOLICIES

<u>EMPLOYEEID</u>	<u>PLANTYPE</u>	<u>DATEISSUED</u>
171	B2	10/18/1974
171	C1	6/21/1982
149	B2	8/16/1990
149	A1	5/23/1995
149	C2	12/18/1999

**Figure 14.7** Insurance Policies Table for Rugs-For-You



**Figure 14.8** Three Entities in the Rugs-For-You Database

# Functionality of a DBMS

The programmer sees SQL, which has two components:

- Data Definition Language - DDL
- Data Manipulation Language - DML
  - query language

Behind the scenes the DBMS has:

- Query engine
- Query optimizer
- Storage management
- Transaction Management (concurrency, recovery)

# How the Programmer Sees the DBMS

- Tables:

SSN	Name	Category
123-45-6789	Charles	undergrad
234-56-7890	Dan	grad
	...	...

SSN	CID
123-45-6789	CSE444
123-45-6789	CSE444
234-56-7890	CSE142
	...

CID	Name	Quarter
CSE444	Databases	fall
CSE541	Operating systems	winter

- Still implemented as files, but behind the scenes can be quite complex

# Queries

- Find all courses that “Mary” takes
  - ```
SELECT C.name
FROM   Students S, Takes T, Courses C
WHERE  S.name="Mary" and
       S.ssn = T.ssn and T.cid = C.cid
```
- What happens behind the scene ?
  - Query processor figures out how to answer the query efficiently.

# Transactions

- A *transaction* = sequence of statements that either all succeed, or all fail
- Transactions have the ACID properties:
  - A = atomicity (a transaction should be done or undone completely )
  - C = consistency (a transaction should transform a system from one consistent state to another consistent state)
  - I = isolation (each transaction should happen independently of other transactions )
  - D = durability (completed transactions should remain permanent)



# Other Considerations

- Performance issues
  - Affect the user's satisfaction with a database management system
- To significantly reduce access time:
  - Create additional records to be stored along with the file
- Distributed databases
  - Allow the physical data to reside at separate and independent locations that are electronically networked together

# Summary

- E-business
  - Every part of a financial transaction is handled electronically
- Opening an online store
  - Requires a significant amount of planning
- Database
  - Allows data items to be stored, extracted, sorted, and manipulated
- Relational database model
  - Conceptual model of a file as a two-dimensional table