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LECTURE 14: Introduction to DataBase Systems

INFORMATION ORGANIZATION WITH COMPUTERS

Filter people who are:

<input type="checkbox"/> Male	<input checked="" type="checkbox"/> Single
<input checked="" type="checkbox"/> Female	<input type="checkbox"/> In a Relationship
<input type="checkbox"/> Unknown gender	<input type="checkbox"/> Married
	<input type="checkbox"/> Open Marriage
	<input type="checkbox"/> Unknown status

Database Systems: Today

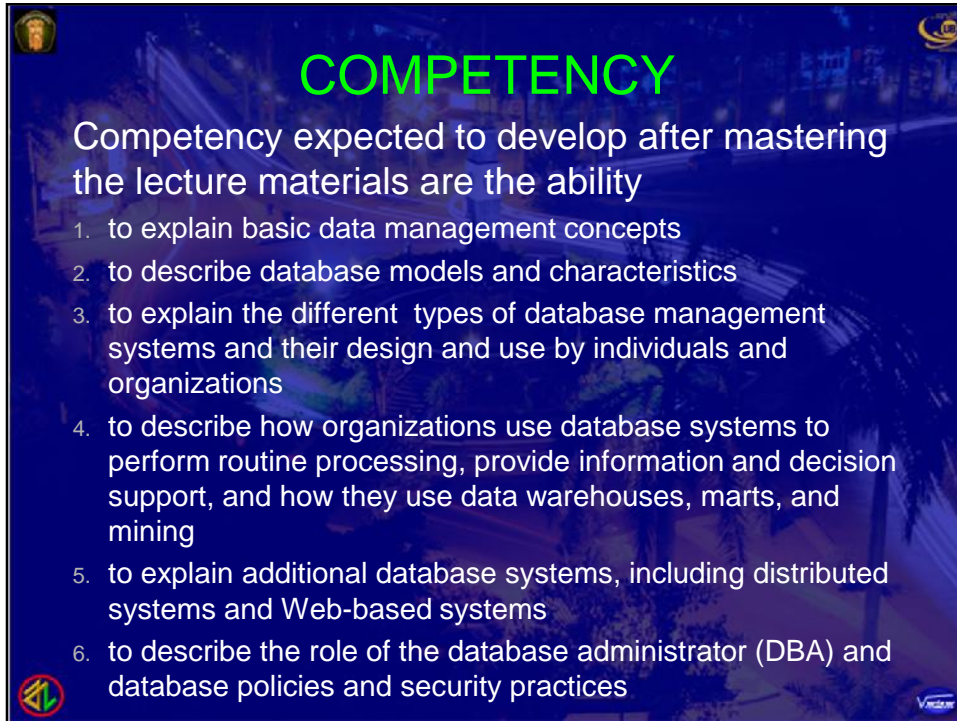
People matches: 1 - 20 of 209 1 2 3 4 5 6 7 ... 11 Next

Wendy	Brandi	Melissa	<p>From: Jonathan</p> <p>You are connected to Jonathan through: You ## Melissa ## Jonathan.</p> <p>Date: September 1, 2002 3:30 PM</p> <p>Subject: Hello!</p> <p>Hi Cindy, I'm a friend of Melissa's, and I like your profile.</p> <p>Message: What kind of teaching do you do? Maybe we can play tennis sometime... Jonathan.</p>
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LECTURE LAY-OUT

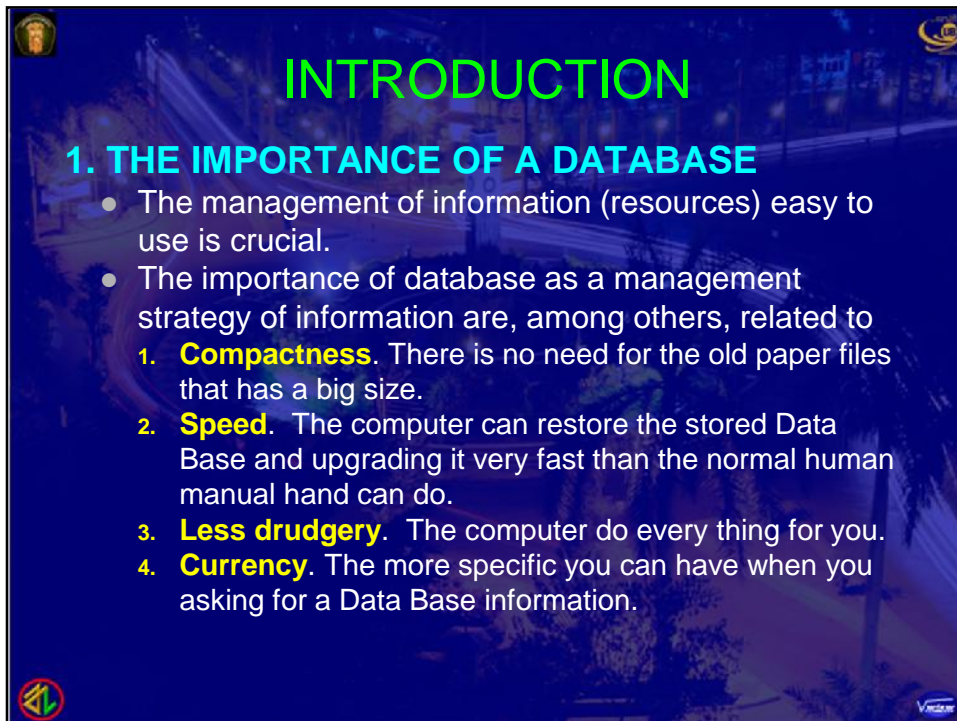
- COMPETENCY
- INTRODUCTION
 - THE IMPORTANCE OF A DATABASE
 - BASIC DATA MANAGEMENT CONCEPTS
- DEFINITION
- DATABASE
- EXCEL EXERCISES



COMPETENCY

Competency expected to develop after mastering the lecture materials are the ability

1. to explain basic data management concepts
2. to describe database models and characteristics
3. to explain the different types of database management systems and their design and use by individuals and organizations
4. to describe how organizations use database systems to perform routine processing, provide information and decision support, and how they use data warehouses, marts, and mining
5. to explain additional database systems, including distributed systems and Web-based systems
6. to describe the role of the database administrator (DBA) and database policies and security practices



INTRODUCTION

1. THE IMPORTANCE OF A DATABASE

- The management of information (resources) easy to use is crucial.
- The importance of database as a management strategy of information are, among others, related to
 1. **Compactness**. There is no need for the old paper files that has a big size.
 2. **Speed**. The computer can restore the stored Data Base and upgrading it very fast than the normal human manual hand can do.
 3. **Less drudgery**. The computer do every thing for you.
 4. **Currency**. The more specific you can have when you asking for a Data Base information.

2. BASIC DATA MANAGEMENT CONCEPTS

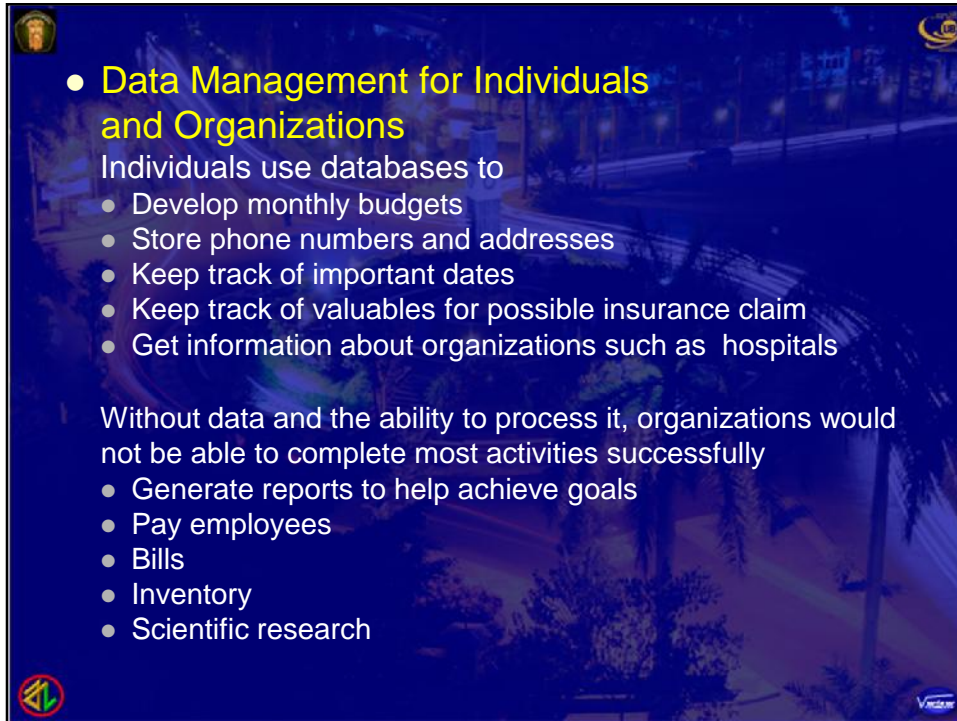
- **General Aspects**
 - **Database**
 - A collection of data organized to meet users' needs
 - **Database management system (DBMS)**
 - Software used to access database
 - **Database system**
 - Comprised of database, DBMS, and application programs
- **Some functions of a DBMS**
 - Store important data such as phone numbers, addresses, text, images, audio signals
 - Perform routine tasks such as preparing income tax forms or produce paychecks for employees

- Make better decisions by using information gathered from databases and creating reports
- Protect data from attacks and unauthorized access

FIGURE 7.1 ■ Door to door

UPS uses state-of-the-art databases to help keep track of millions of packages a day. Customers can use the Web and software that links to these databases to see exactly where their packages are.

6



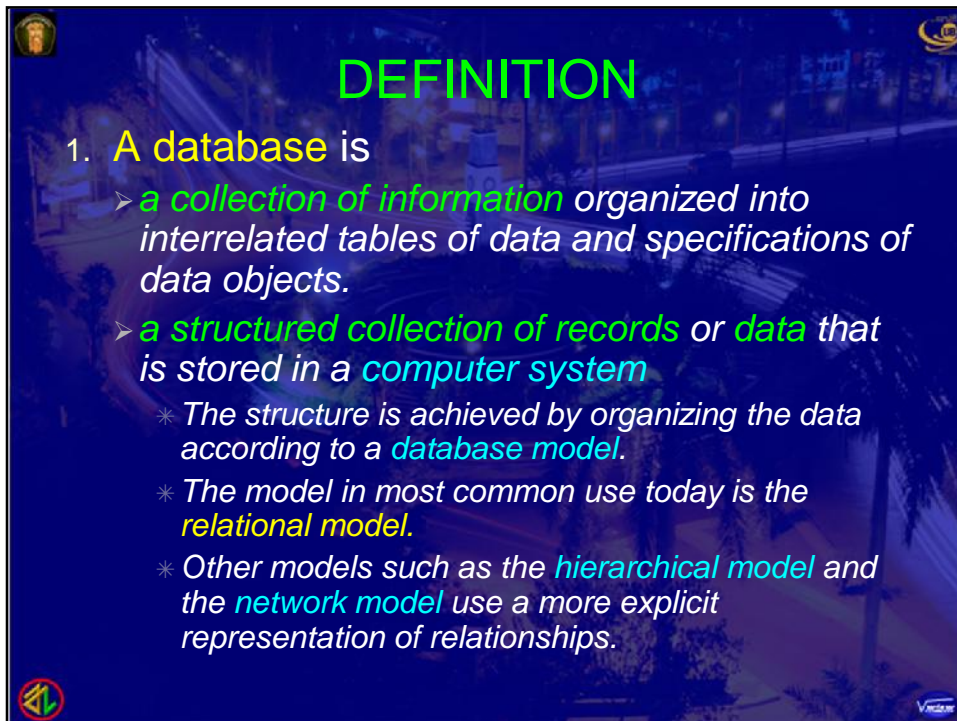
- **Data Management for Individuals and Organizations**

Individuals use databases to

- Develop monthly budgets
- Store phone numbers and addresses
- Keep track of important dates
- Keep track of valuables for possible insurance claim
- Get information about organizations such as hospitals

Without data and the ability to process it, organizations would not be able to complete most activities successfully

- Generate reports to help achieve goals
- Pay employees
- Bills
- Inventory
- Scientific research



DEFINITION

1. **A database is**
 - *a collection of information organized into interrelated tables of data and specifications of data objects.*
 - *a structured collection of records or data that is stored in a computer system*
 - * *The structure is achieved by organizing the data according to a database model.*
 - * *The model in most common use today is the relational model.*
 - * *Other models such as the hierarchical model and the network model use a more explicit representation of relationships.*

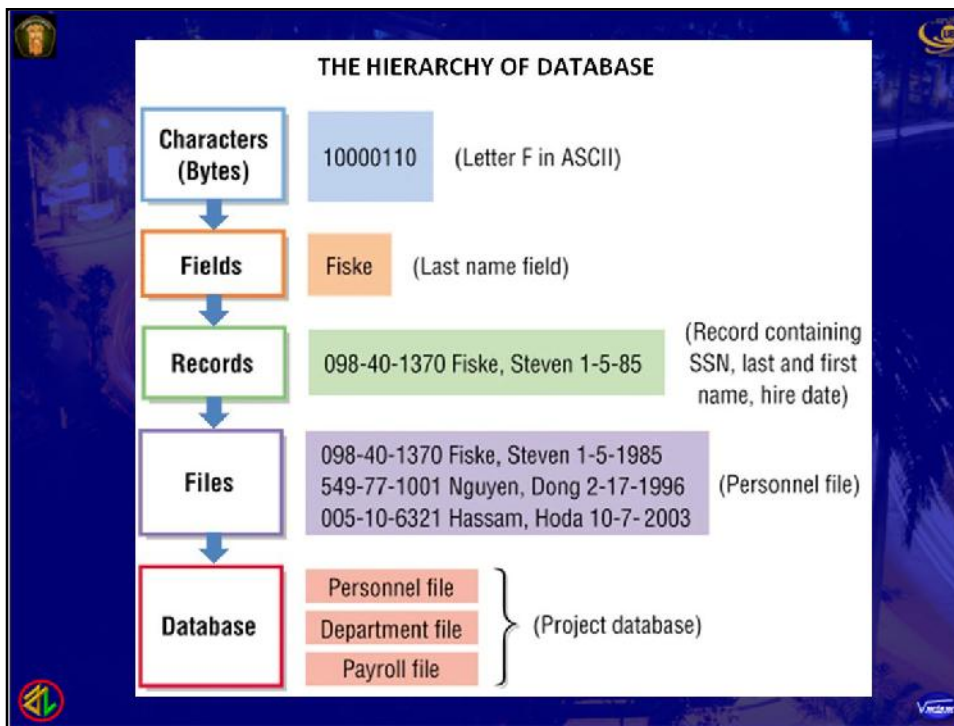
- **Data refers to**
*information or facts usually collected as the result of **experience, observation or experiment**, or processes within a computer system, or **premises***
- **Data may consist of**
***numbers, words or images** particularly as **measurements** or observations of a set of variables. Data are often viewed as a lowest level of abstraction from which **information** and **knowledge** are derived.*
- **A database model is**
*the structure or format of a **database**, described in a formal language supported by the **database management system**. Data base models or schemas are generally stored in a **data dictionary***

2. Hierarchy of Data

The hierarchy of data represents the idea that

- **characters** are combined to make **a field**,
- **fields** are combined to make **a record**,
- **records** are combined to make **a file**, and
- **the files** are combined to make a **data base**


1. **Field**
 - Name, number, or combination of characters that describes some aspect of an object
2. **Record**
 - Collection of related fields
3. **File or table**
 - Collection of related records
4. **Database**
 - Collection of integrated and related files or tables



Record Field

	A	B	C	D	E
1	NO.	NAMA MAHASISWA	NO. INDUK	FAKULTAS	PS
2	1	Andik Aris S.	0410110017	Hukum	Ilmu Hukum
3	2	Gustian Juanda	0410110102	Hukum	Ilmu Hukum
4	3	Ika Arlina P.	0410110120	Hukum	Ilmu Hukum
5	4	Muhammad Yusuf Z	0510110123	Hukum	Ilmu Hukum
6	5	Nurita Shalihati	0510110128	Hukum	Ilmu Hukum
7	6	Pinastika Prajna P.	0510110134	Hukum	Ilmu Hukum
8	7	Prawatyda Ido N.	0510110135	Hukum	Ilmu Hukum
9	8	Tatipato Naomi Y.	0510110183	Hukum	Ilmu Hukum
10	9	Wineka S.	0510113237	Hukum	Ilmu Hukum
11	10	Rudy Subi	0610110180	Hukum	Ilmu Hukum
12	11	Susi Ira Wati	0610110194	Hukum	Ilmu Hukum
13	12	ling Dwi Y.	0610113116	Hukum	Ilmu Hukum
14	13	Gladys Riyandini Santoso	0710233004	Ekonomi	Akuntansi
15	14	Aifin Nur Afni	0710233012	Ekonomi	Akuntansi
16	15	Rizki Febrianto	0510233142	Ekonomi	Akuntansi
17	16	Lestari Wijayanti	0610220130	Ekonomi	Manajemen
18	17	Aziz Muhaldlori Ridwan	0610220045	Ekonomi	Manajemen
19	18	Handari Pramita Sari	0610210058	Ekonomi	IESP
20	19	Narutta Pratiwi	0610210092	Ekonomi	IESP
21	20	Thalitha Alphasasti G.	0610210122	Ekonomi	IESP

	A	B	C		
1	College Enrollment 2005 - 2006				
2					
3	Student ID	Last Name	Initial	Age	Program
4	ST348-245	Smith	B.	21	Drafting
5	ST348-246	Wilson	C.	19	Science
6	ST348-247	Thompson	S.	18	Business
7	ST348-248	James	D.	23	Nursing
8	ST348-249	Ramirez	A.	37	Science
9	ST348-250	Graham	T.	20	Arts
10	ST348-251	Rosen	O.	26	Business
11	ST348-252	Hirsch	W.	22	Arts
12	ST348-253	Russell	E.	20	Nursing
13	ST348-254	Robitaille	K.	19	Drafting

Field names 

3. Data Entities, Attributes, and Keys

1. **Entity**
 - Generalized class of people, places, or things for which data is collected, stored, and maintained
2. **Attribute**
 - Characteristic of an entity
 - For example, employee number or last name
 - The specific value of an attribute is called a data item
3. **Key**
 - Field in a record used to identify the record
 - Primary key
 - Uniquely identifies the record

ATTRIBUTES AND KEYS

The attributes in this entity include employee number, last name, first name, hire date, and department number. **Employee number** is the primary key in this entity because it uniquely identifies each employee

Employee number	Last name	First name	Hire date	Dept. number
005-10-6321	Hassam	Hoda	10-7-2003	257
549-77-1001	Nguyen	Dong	2-17-1996	650
098-40-1370	Fiske	Steven	1-5-1985	598

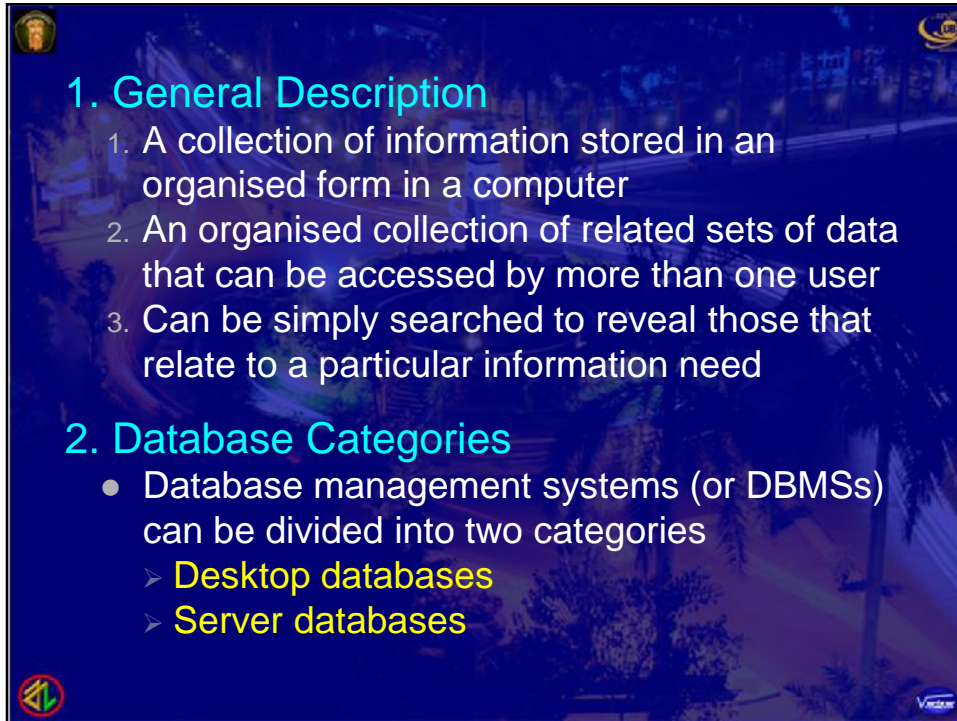
Primary key field

Attributes (fields)

Entities (Records)

DATABASE

- A **Database** looks like a **spreadsheet** (Table, Columns, Rows, Cells), but is actually **much more powerful** than a **spreadsheet** in the way you're able to manipulate data.
- The following actions easily performed on a database, but difficult if not impossible to perform on a spreadsheet:
 1. Retrieve all records that match certain criteria
 2. Update records in bulk
 3. Cross-reference records in different tables
 4. Perform complex aggregate calculations

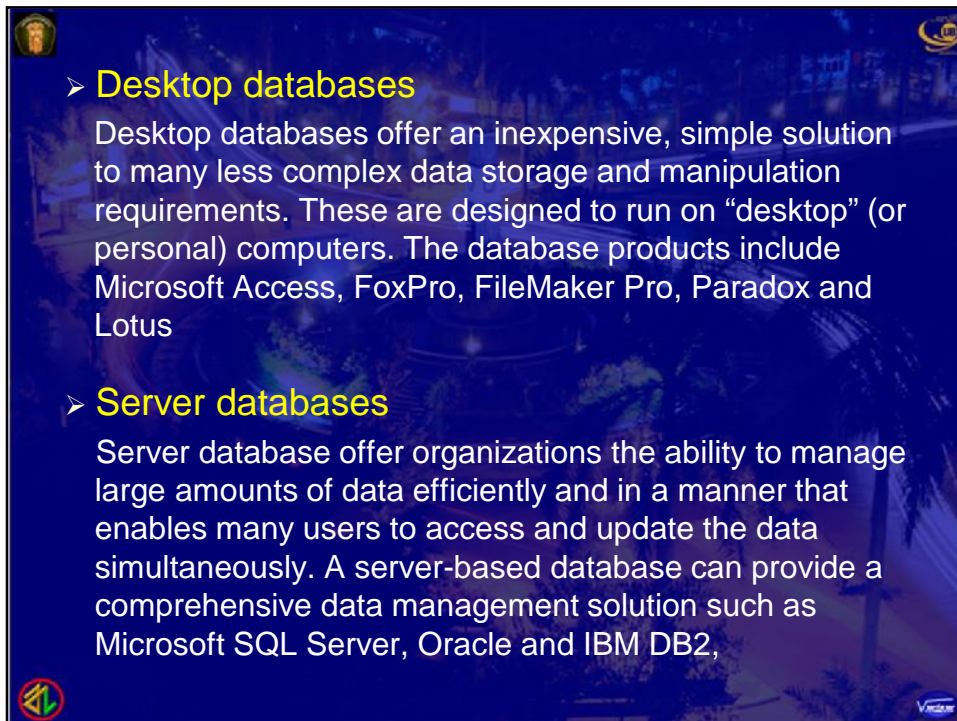


1. General Description

1. A collection of information stored in an organised form in a computer
2. An organised collection of related sets of data that can be accessed by more than one user
3. Can be simply searched to reveal those that relate to a particular information need

2. Database Categories

- Database management systems (or DBMSs) can be divided into two categories
 - Desktop databases
 - Server databases



- **Desktop databases**
 Desktop databases offer an inexpensive, simple solution to many less complex data storage and manipulation requirements. These are designed to run on “desktop” (or personal) computers. The database products include Microsoft Access, FoxPro, FileMaker Pro, Paradox and Lotus
- **Server databases**
 Server database offer organizations the ability to manage large amounts of data efficiently and in a manner that enables many users to access and update the data simultaneously. A server-based database can provide a comprehensive data management solution such as Microsoft SQL Server, Oracle and IBM DB2,

3. Database Models

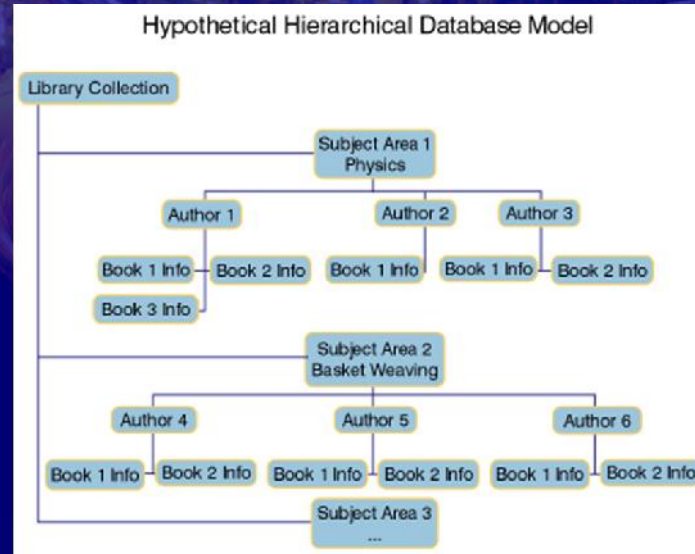
- **A database model** is a theory or specification describing how a database is **structured** and **used**.
 - **Flat model**: This may not strictly qualify as a data model. The flat (or table) model consists of a single, two-dimensional array of data elements, where all members of a given column are assumed to be similar values, and all members of a row are assumed to be related to one another.
 - **Hierarchical model**: In this model data is organized into a tree-like structure, implying a single upward link in each record to describe the nesting, and a sort field to keep the records in a particular order in each same-level list.

Flat (Table) model

Flat File

Name	Group #	Occupation
Watts	1000	Model
Shelton	1000	Chef
Weber	1000	Chef
Tubbs	1001	Musician
Jones	1001	Musician
Carson	1001	Librarian

Hierarchical model

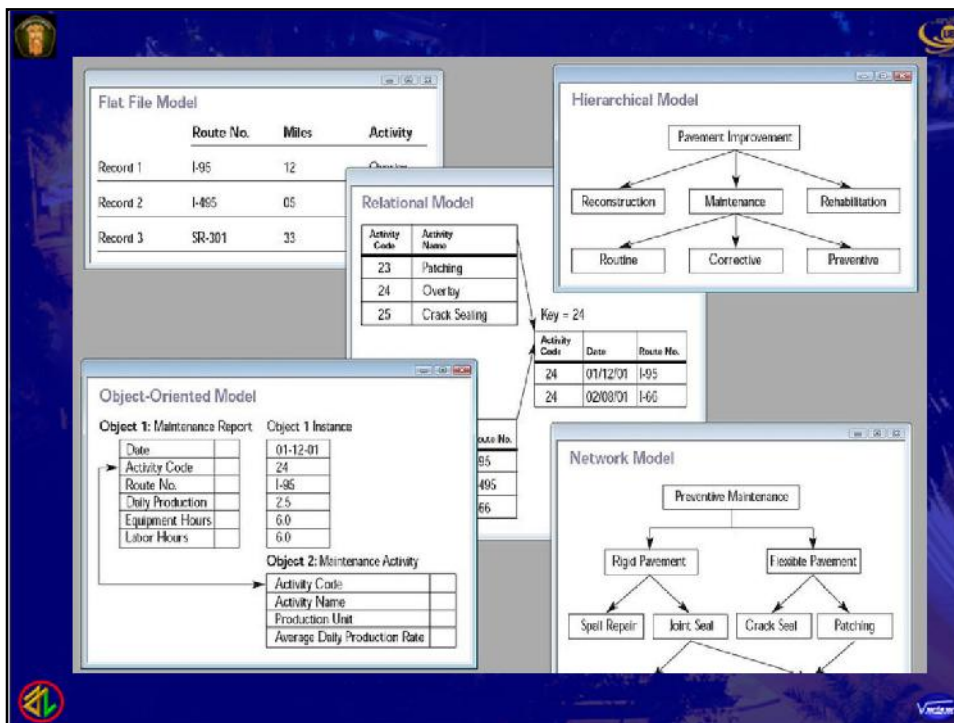
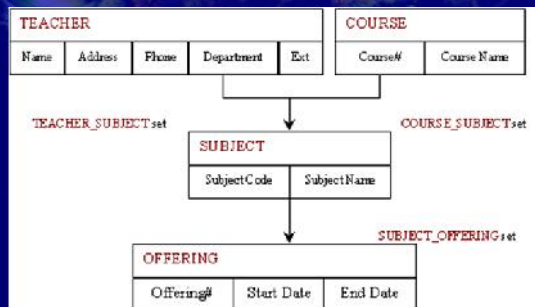


- Relational model:** is a database model based on first-order predicate logic. Its core idea is to describe a database as a collection of predicates over a finite set of predicate variables, describing constraints on the possible values and combinations of values.

Data Table 1: Project Table			Data Table 2: Department Table		
Project number	Description	Dept. number	Dept. number	Dept. name	Manager SSN
155	Payroll	257	257	Accounting	421-55-9993
498	Widgets	632	632	Manufacturing	765-00-3192
226	Sales Manual	598	598	Marketing	098-40-1370

Data Table 3: Manager Table				
SSN	Last name	First name	Hire date	Dept. number
005-10-6321	Hassam	Hoda	10-7-2003	257
549-77-1001	Nguyen	Dong	2-17-1996	650
098-40-1370	Fiske	Steven	1-5-1985	598

- **Network model:** This model organizes data using two fundamental constructs, called **records** and **sets**. Records contain **fields**, and sets define **one-to-many relationships** between records: one owner, many members.
- **For example (University):** SUBJECT has two owners, **TEACHER** and **COURSE**. **TEACHER** is the owner of the **TEACHER_SUBJECT set** and **COURSE** is the owner of the **COURSE_SUBJECT set**.



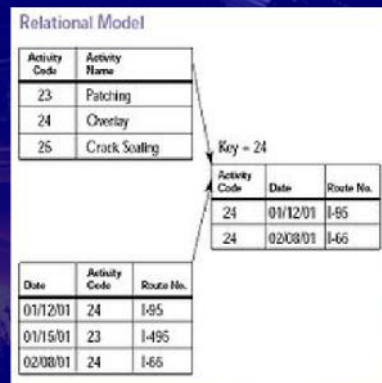
4. Type of Database Models

- **Conceptual Model**
 - Focuses on the logical nature of the data representation
 - Concerned with what is represented in the database rather than with how it is represented
 - (example Entity-Relationship model)
- **Implementation Model**
 - Emphasizes on how the data is represented in the database or how the data structures are implemented to represent what is modelled
 - (example Relational or Object-oriented model)

5. Relational Model

Relational DBMS are so called because the data that they can manipulate are stored as “relations”; *these relations are in the form of data tables in which the information is stored in rows and columns*

- The relational model is **entity-based**
- A relation is a set of tuples



• “Relations”

- Relations are represented as tables in which rows represent “tuples” and columns represent attributes
- A relation may be described by its name and the related attributes, e.g.
 - Employee_info (Emp_No, Emp_Name, Age, Start_Date, Address,)

CustomerID	Surname	Initials	Title	Address1	Address2	Address3	PostCode	Country
1	Jones	SL	Mr	Kingston-Upon	Surrey		KT1	UK
2	Sloan	MK	Mr	London			WC1N	UK
3	Sloan	RH	Dr	University of La	Bedford Way	London	WC1H	UK
4	Sloan	S	Mr	67B Kingsway	London		WC2B	UK
5	Smith	B	Dr	123 Rottenrow	Glasgow		G4 0	UK
6	Zhadani	Z	Mrs	789 Holborn Ter	Woodhouse	Leeds	LS6	UK
7	Rob	RP	Mr	Eagle Way	Exeter		EX2	UK
8	Doonhy	D	Miss	Redhill	Surrey		RH1	UK
9	Smith	K	Mr	Nottingham Tr	Burton Street	Nottingham	NG1	UK
10	Clive	A	Mrs	Hemel Hill	London		SE24	UK
11	Smith	E	Mr	Penny	Middlesex		HA6	UK
12	Jones	N	Mrs	Weybridge	Surrey		KT13	UK
13	Smith	W T	Mr	Golders Green	London		NY11	UK
14	Smith	U	Mr	Middle Street	Islip	Oxford	OX5	UK
15	Clive	O	Mr	Yarnon Way	Southmere	London	SE2	UK
16	Brandt	B	Mr	St Albans	Herts		AL1	UK
17	Smith	S	Mr	Westbury Park	Bristol		BS6	UK
18	White	S	Mr	Bournemouth			BH6	UK
19	Smith	C	Dr	London			NW2	UK
20	Smith	S	Mr	Twickenham	Middlesex		TW2	UK

• Features of Relational DBMS

- 2-D tables (rows and columns representing records/tuples and fields/attributes)
- Dynamic links among entities
- Easy and flexible to design and use
- Data independence
- Generic manipulation language – Structured Query language (SQL)

• Widely used RDBMS

- Microsoft Access (is it a DBMS?)
- Microsoft SQL Server
- IBM's DB2
- Oracle



Oracle RDBMS

The diagram illustrates the Oracle RDBMS architecture. On the left, a 'Web Browser' is connected to an 'iSQL*Plus Server (OC4J)' via 'HTTP(S) TCP/IP'. The 'iSQL*Plus Server (OC4J)' is connected to an 'Oracle RDBMS' via 'Oracle Net'. Below these components are three red boxes labeled 'Client tier', 'Middle tier', and 'Database tier' respectively.

SQL in Oracle

The circular diagram shows 'SQL' at the center, with 'RDBMS' below it. The circle is divided into four quadrants: 'APPLICATIONS' (top), 'O.A. & TEXT' (left), 'CASE' (right), and 'END USER' (bottom-left). 'APPLICATIONS' includes Oracle Financials and Oracle Office. 'O.A. & TEXT' includes Oracle*Mail, All-In-One, and SQL*ConText. 'CASE' includes CASE*Method, CASE*Designer, and CASE*Dictionary. 'END USER' includes Oracle Card, SQL*QIMX, Easy*SQL, and SQL*Graph. 'CASE' also includes SQL*Load, SQL*DBA, and SQL*Net. 'UTILITIES' includes SQL*Plus, SQL*Forms, SQL*Report, SQL*Menu, and SQL Interfaces. 'DEVELOPMENT' is listed at the bottom.

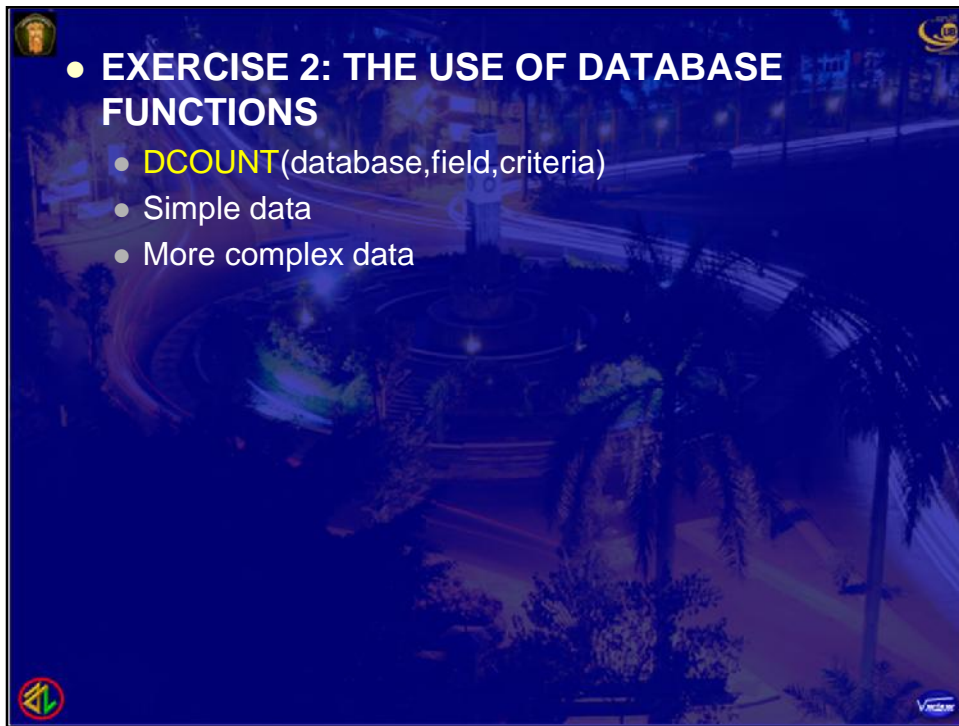
Excel as Database

- Excel is a perfect tool to build database for small businesses and average users
- Excel is the cheapest and the simplest database program
- However there are two limits to using Excel as a database
 - The first one is that only one person at a time can enter data into the database.
 - The second limit is a matter of quantity of data. Each sheet in an Excel workbook comprises **1,048,576 rows** and **16,364 columns** in Excel 2010 and 2013.
 - An Excel workbook can comprise up to 256 sheet. We are talking about 4,292,608,000 cells.

- As a general rule of thumb, **databases** should be used for data storage and **spreadsheets** should be used to analyze data
- Database tables, just like Excel tables, consist of **columns** and **rows**.
 - Each column contains a different type of **attribute** and each row corresponds to a single **record**.
 - For example, a database **table** that contained
 - **Names**
 - **Telephone numbers**
 - Columns are named probably
 - "FirstName",
 - "LastName" and
 - "Telephone Number."

GO TO EXERCISES

- **EXERCISE 1: DATA**
 1. **Entering the Data** - How data is stored
 2. **Entering Data Correctly** - How to avoid common errors
 3. **Rows are Records** - Organizing your data
 4. **Columns are Fields**- Organizing your data (con't)
 5. **Creating the Table** - Create the database (*Format as Table* option)
 6. **Using the Database Tools** - Sorting and filtering data (Drop down arrow, *Sort A to Z*)
 7. **Expanding the Database** - Adding new records (Use small dot in the bottom right)
 8. **Completing the Database Formatting** - Formatting the title and cell color



● **EXERCISE 2: THE USE OF DATABASE FUNCTIONS**

- **DCOUNT**(database,field,criteria)
- Simple data
- More complex data

