CS105.3 Database Management Systems

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Outline of the Lesson

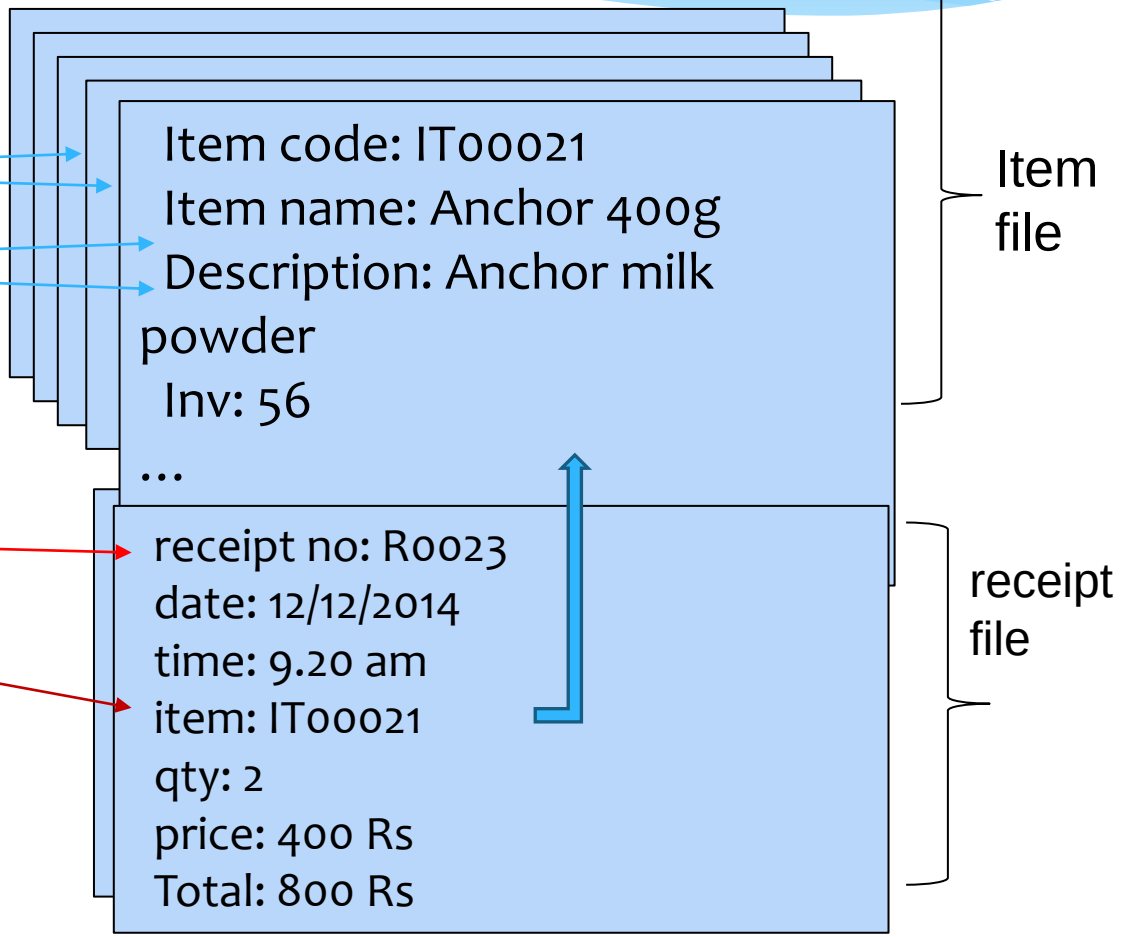
* Data Hierarchy
* Review of database models
* Properties of Relational Model
* The relational model - major components
* Relational Objects
* Relational model terminology
* Characteristics of relations
* Relational constraints

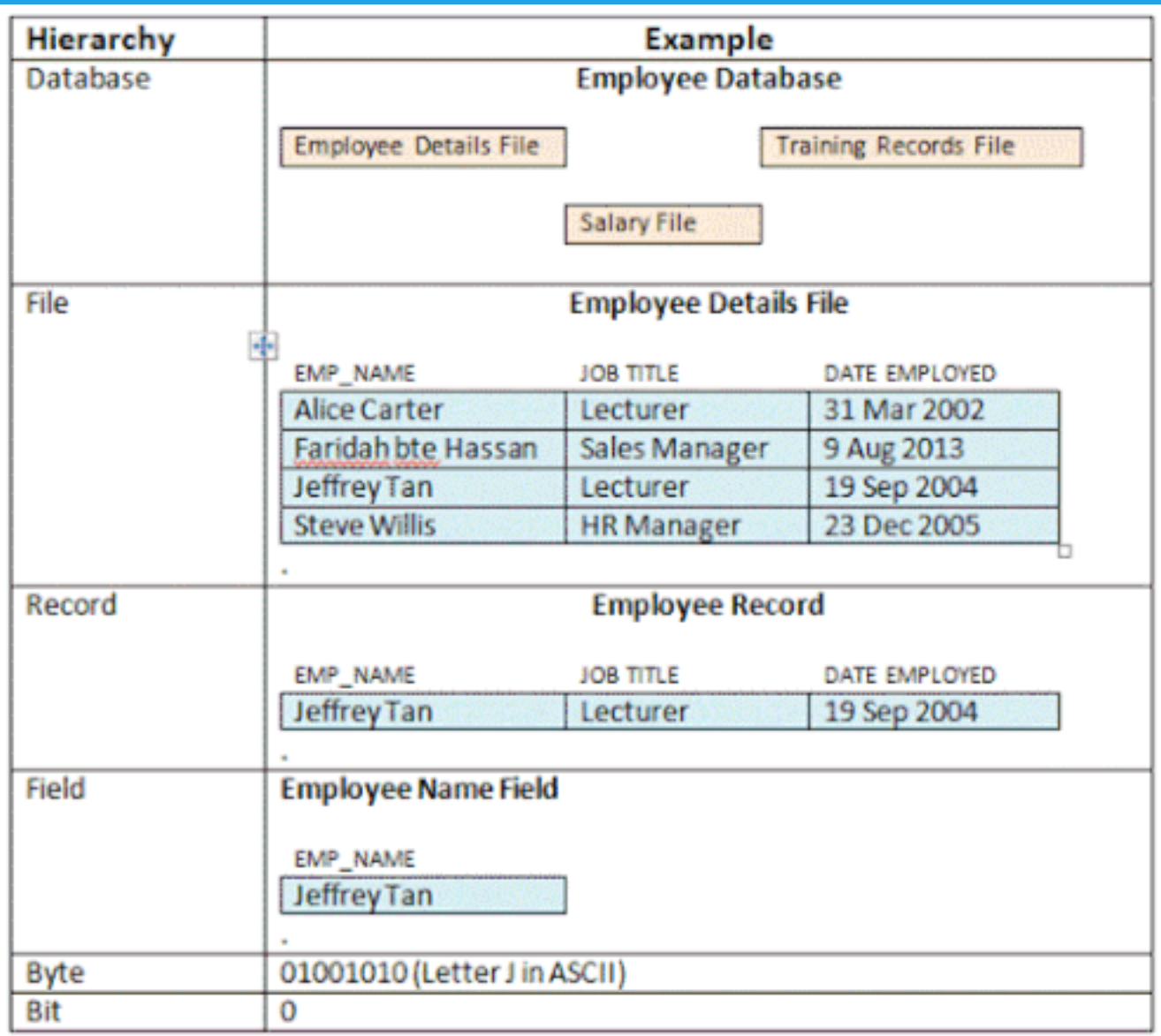
Data Hierarchy

* Database
* Files
* Records
* Fields
* Characters (Bytes)
* Bits

Some Terminology

* File(s)
* Records
* Fields
* Keys
* Foreign keys





Data Hierarchy Diagram – with Employee Database example

Activity… How do you generate an item category-wise daily sales report? What are the steps?

	A	B	C	D	E
3	**Emp Id**	**First Name**	**Last Name**	**Department**	**Location**
4	101	Donald	Patrick	Finance	Banglore
5	102	Samuel	Samson	Marketing	Hyderabad
6	103	Ian	Jacob	Finance	Hyderabad
7	104	David	Johnson	Marketing	Pune
8	105	Ian	Smith	Marketing	Banglore
9	106	Henry	Madrid	IT	Pune
10	107	Ronica	Brave	Finance	Hyderabad
11	108	Christine	Salvi	Marketing	Banglore
12	109	Andrew	Baisley	IT	Hyderabad
13	110	Erica	Irons	IT	Pune
14					

Sales-Person File

Sales File

3	**Date**	**Item ID**	**Quntity**	**Sales person**
4	11/3/2018	1001	20	102
5	11/3/2018	1003	15	101
6	11/3/2018	1004	25	103
7	12/3/2018	1002	30	104
8	12/3/2018	1003	40	102
9	15/3/2018	1006	20	106
10	16/3/2018	1007	10	101

Item File

	A	B	C	D	E
1	**ID**	**Item**	**Category**	**No. of items**	**Visibility**
2	1001	Carrot	vegetables	200	1
3	1002	Apple	fruits	150	1
4	1003	Cherry	fruits	112	1
5	1004	Garlic	vegetables	130	1
6	1005	Onion	vegetables	180	1
7	1006	Grapefruit	fruits	360	1
8	1007	Lemon	fruits	140	1
9	1008	Cabbage	vegetables	450	1
10	1009	Orange	fruits	320	1
11	1010	Peach	fruits	250	1

What are the different data items that need to be stored?

* Sale details
  *
* Item details and inventory
  *
* Employee details
  * ???
* Departments
  * ??
* Who supplies what ??
* What about loyalty cards? – Why? and where they fit in?

Steps to generate category-wise daily sales report

1. Open Sales file and filter the records corresponding to the required date.

2. For each filtered sales record in step 1,
   a. Read the item ID of the sales record.
   b. Open the item file.
   c. Locate the item record for the item ID in step a.
   d. Read the Category from the item record of step b.
   e. Add the total sales value in the current sales record to a sum maintained for the Category.

3. Print date, item category and resultant sum for each category.

Exercise 1…

How do you generate salesperson-wise daily sales report?
What are the steps?

	A	B	C	D	E
3	**Emp Id**	**First Name**	**Last Name**	**Department**	**Location**
4	101	Donald	Patrick	Finance	Banglore
5	102	Samuel	Samson	Marketing	Hyderabad
6	103	Ian	Jacob	Finance	Hyderabad
7	104	David	Johnson	Marketing	Pune
8	105	Ian	Smith	Marketing	Banglore
9	106	Henry	Madrid	IT	Pune
10	107	Ronica	Brave	Finance	Hyderabad
11	108	Christine	Salvi	Marketing	Banglore
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Sales-Person File

Item File

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6	1005	Onion	vegetables	180	1
7	1006	Grapefruit	fruits	360	1
8	1007	Lemon	fruits	140	1
9	1008	Cabbage	vegetables	450	1
10	1009	Orange	fruits	320	1
11	1010	Peach	fruits	250	1

3	Date	Item ID	Quntity	Sales person
4	11/3/2018	1001	20	102
5	11/3/2018	1003	15	101
6	11/3/2018	1004	25	103
7	12/3/2018	1002	30	104
8	12/3/2018	1003	40	102
9	15/3/2018	1006	20	106
10	16/3/2018	1007	10	101

Sales File

Database models

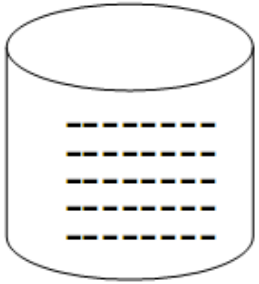
* A database model is the theoretical foundation of a database and fundamentally determines in which manner data can be stored, organized, and manipulated in a database system.

Database models

* Flat
* Hierarchical
* Network
* Relational
* Object Oriented

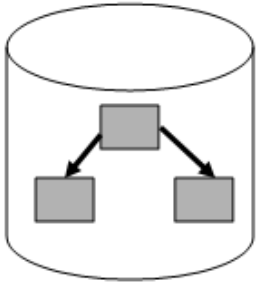
Types of Database Models

Traditional Files



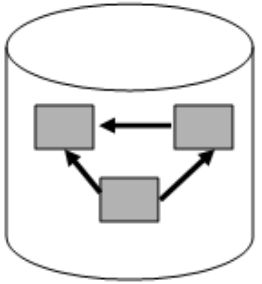
60s

Hierarchical Database Model



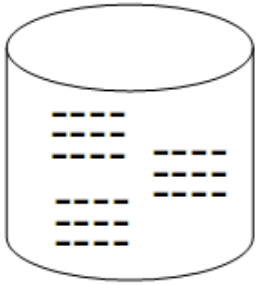
70s

Network Database Model



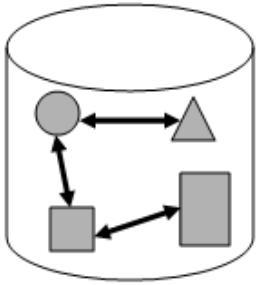
70s

Relational Database Model



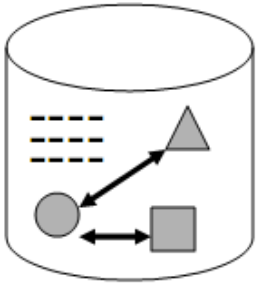
80s

Object-oriented Database Model



90s

Object-relational Database Model



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Flat model

* The flat 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.

* Columns of the table often have a type associated with them, defining them as character data, date or time information, integers, or floating point numbers.

Flat model

Flat File Model

	Route No.	Miles	Activity
Record 1	I-95	12	Overlay
Record 2	I-495	05	Patching
Record 3	SR-301	33	Crack seal

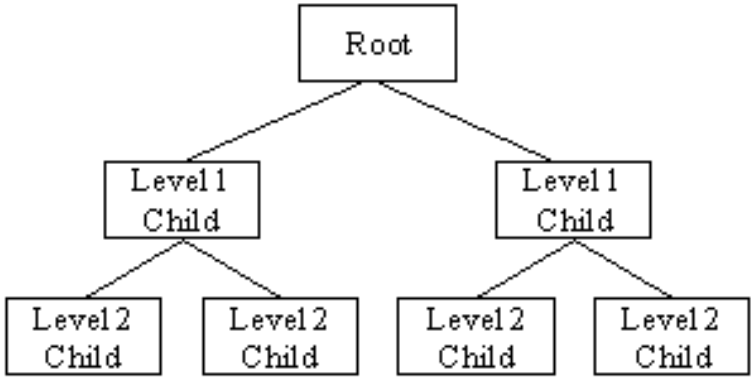
Hierarchical model

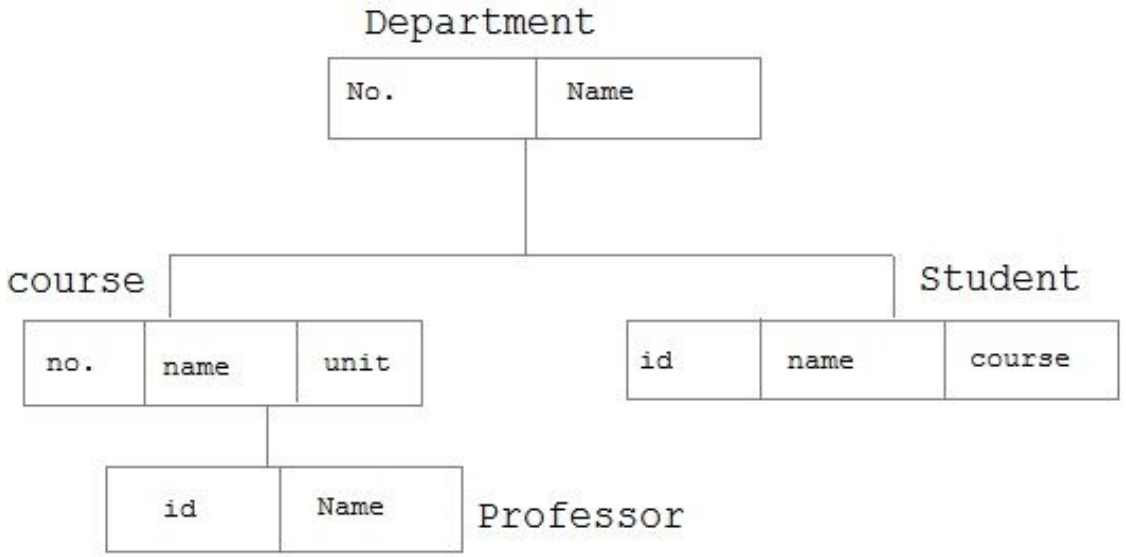
* Data is organized into a tree-like structure, implying a single upward link in each record to describe the nesting, and a sort field to keep the records in a particular order in each same-level list

* Hierarchical structures were widely used in the early mainframe database management systems,

* This structure allows one 1:M relationship between two types of data. This structure is very efficient to describe many relationships in the real world.

Hierarchical model





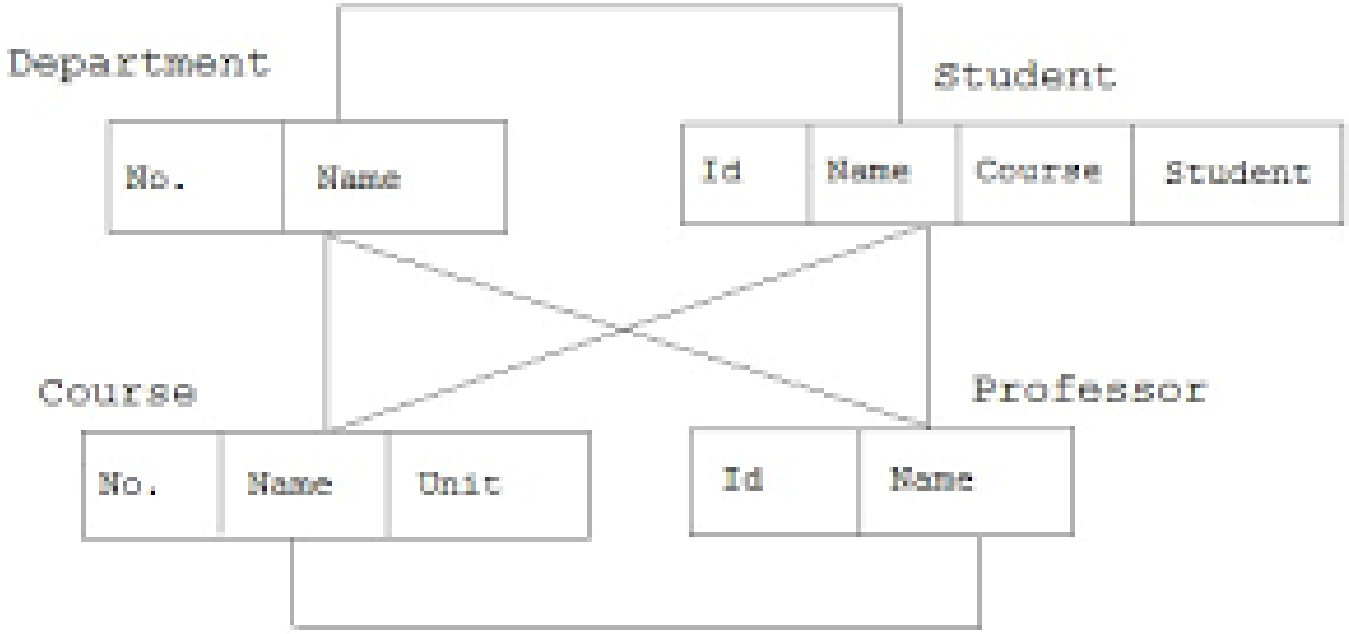
Network Model

* The network model organizes data using two fundamental constructs, called *records* and *sets*.

* Records contain fields. Sets define one-to-many relationships between records: one owner, many members.

* A record may be an owner in any number of sets, and a member in any number of sets.

Network Model



Object oriented model

* The object-oriented paradigm has been applied to database technology, creating a new programming model known as object databases.

* These databases attempt to bring the database world and the application programming world closer together, in particular by ensuring that the database uses the same type system as the application program

* Object databases attempt to introduce the key ideas of object programming, such as encapsulation and polymorphism, into the world of databases

Object Oriented model

Maintenance Report

Activities	
Activity code	
Production rate	
Labor hours	
Daily production	

Object 1-values

02-11-2011
30
45
60
200

Object2-Activities

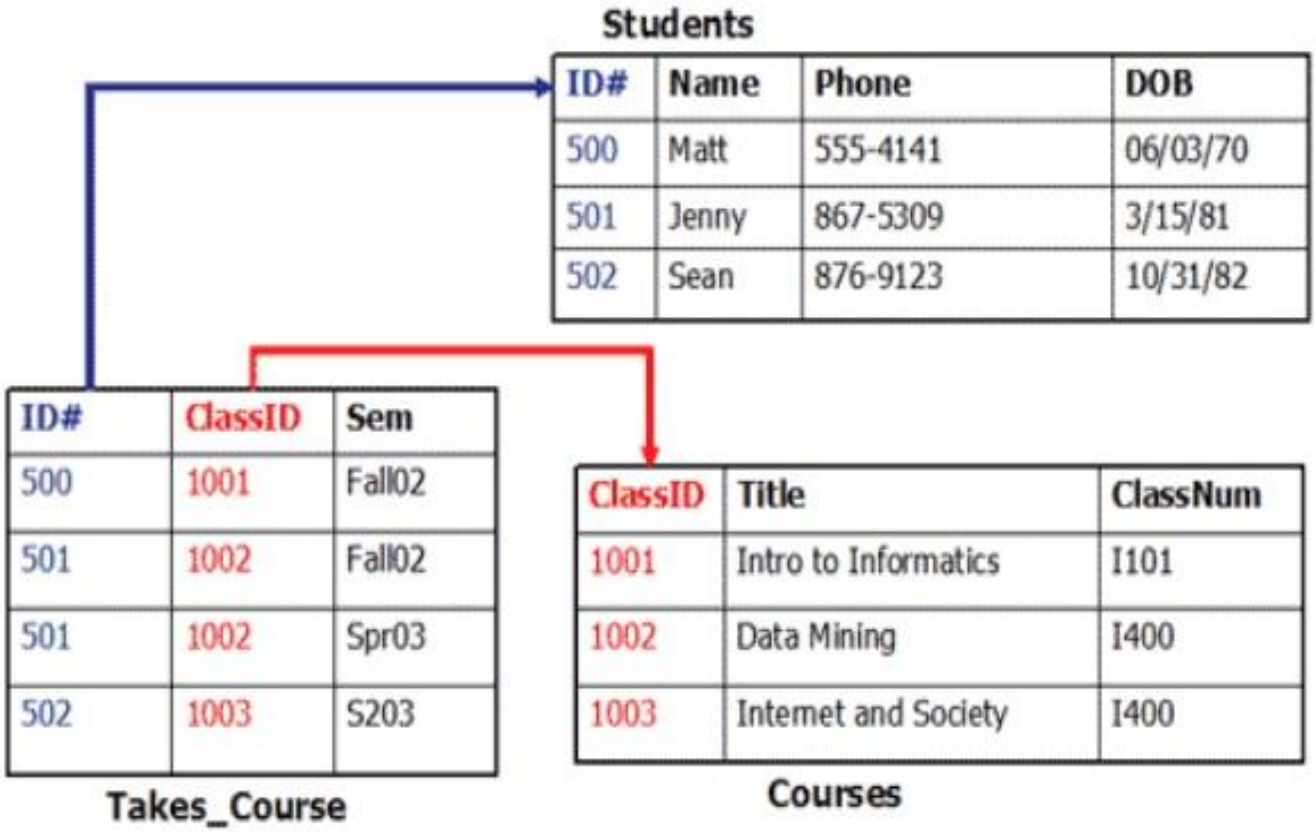
Activity code	
Labor hours	

Relational Model

* It is a mathematical model defined in terms of predicate logic and set theory.

* The products that are generally referred to as relational databases in fact implement a model that is only an approximation to the mathematical model.

* Three key terms are used extensively in relational database models: *relations*, *attributes*, and *domains*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ID# Name Phone DOB
500 Matt 555-4141 06/03/70
501 Jenny 867-5309 3/15/81
502 Sean 876-9123 10/31/82
ID# ClassID Sem
500 1001 Fall02
501 1002 Fall02
501 1002 Spr03
502 1003 S203
Takes_Course
ClassID Title ClassNum
1001 Intro to Informatics I101
1002 Data Mining I400
1003 Internet and Society I400
Courses

The relational model – major components

* Relational database objects

  allows to define data structures

* Relational operators

  allows manipulation of stored data

* Relational integrity constraints

  allows to defines business rules and ensure data integrity

The Relational Objects

* Relation
  * A named, two dimensional table of data
* Database
  * A collection of databases, tables and related objects organized in a structured fashion

Relational Model [Properties]

* Each relation (or table) in a database has a unique name
* An entry at the intersection of each row and column is atomic (or single-valued)
* Each row is unique; No two rows in a relation are identical
* Each attribute (or column) within a table has a unique name

Relational Objects

* Tables are comprised of rows and a fixed number of named columns.
* Data is presented to the user as tables:

	Column 1	Column 2	Column 3
Row 1			
Row 2			
Row 3			

Relational Objects

* Columns are attributes describing an entity. Each column must have an unique name and a data type.

Structure of a relation (e.g. Employee)

Employee(Name, Designation, Department)

Employee

Name	Designation	Department

Relational Objects

Rows are records that present information about a particular entity occurrence

Employee

Name	Designation	Department
Jason	Software Engineer	SE
Shavantha	DA Engineer	DA
Roshni	Solution Engineer	BS

Relational model terminology

* Row is called a ‘tuple’
* Column header is called an ‘attribute’
* Table is called a ‘relation’
* The data type describing the type of values that can appear in each column is called a ‘domain’

E.g.

Employee ages: value between 15 & 80 years old

The above is called ‘logical definitions of domains’.

A data type or format can also be specified for each domain.

e.g. The employee age is an integer between 15 and 80

Relational Model [Properties]

* The sequence of columns (left to right) is insignificant;
* The columns of a relation can be interchanged without changing the meaning or use of the relation
* The sequence of rows (top to bottom) is insignificant;
* Rows of a relation may be interchanged or stored in any sequence

Relational constraints

* **Domain constraints**
  * specifies that the value of each attribute ‘A 'must be an atomic value. And from the specified domain

* **Key constraints**
  * There is a sub set of attributes of a relational schema with the property that no two tuples should have the same combination of values for the attributes.

Thank You