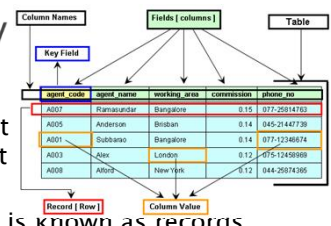# Basic Introduction

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Terminology

Data:
- Data means fact that have implicit

Records:
- Interrelated data is known as records

Database:
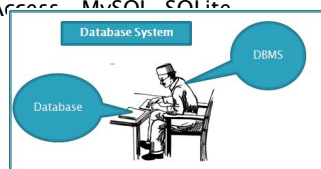- Collection of records (related data) is known as database

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DBMS:
- DATABASE MANAGEMENT SYSTEMS(DBMS) general purpose software system Collection of inter related data programs to manage the data.
  Ex: Well known DBMS Oracle ,IBM(DB2), Microsoft SQLServer, Microsoft Access, MySQL, SQLite

Database System:
  Database + DBMS

Schema:
- The description of a database is called database schema, A database schema is specified during database design and is not expected change frequently

Instance:
- The data in the database at a particular moment in time is called database state or snapshot. It is also called current set of occurrence or instance in the database

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- Instance For The Family 1991 to 2000

Meta Data:
- Meta data is a data about data it is also called system catalog or data dictionary, dbms stores the descriptions of schema and constraint in meta data

DBA: a person or S/W or H/W ???
- A person who has central control over the system is called DBA

Functions of DBA

1) Schema definition
2) Storage structure and access method definition
3) Granting user authority to access the database
4) Specifying integrity constraints

Database Systems versus File Systems:

▸ **Data redundancy and inconsistency**
  This is the major problem of file System. the same information may be duplicated in several places (files).
▸ **Difficulty in accessing data**
  File processing system not allowed the convenient way of data retrieval.
▸ **Data isolation**
  In file processing system writing new application is very difficult because here data is scattered in different file.
▸ **Integrity problems**
  Sometime constraint are require on the data item, example balance of account should be greater than 5000.

Database Systems versus File Systems: Conti....

▸ **Atomicity problems**
  In file processing system it is very difficult to maintain the atomicity.
  Atomicity ??

  Atomicity means if transaction fails because of some reason all the file must be consistence.
▸ **Security problems**
  In the file system every user have the access to other user file. So one user can easily delete or see the details of other user.
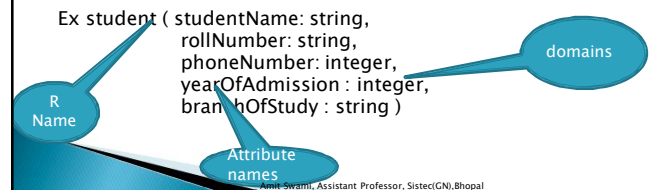
Relational Model

▸ Proposed by Codd(1923-2003) in the early seventies.
▸ Most of the modern DBMS are relational.
▸ RM Model is a mathematical based model

Relation Scheme
▸ Consists of relation name, and a set of attributes or field names or column names. Each attribute has an associated domain.

Ex student (studentName: string,
  rollNumber: string,
  phoneNumber: integer,
  yearOfAdmission : integer,
  branchOfStudy : string)

R Name

domains

Attribute names

Domain
▸ set of atomic(or indivisible) values data type

Relation Instance
▸ A finite set of tuples constitute a relation instance.
▸ A tuple of relation with scheme $R = (A_1, A_2, ..., A_m)$ is an ordered sequence of values$(v_1, v_2, ..., v_m)$ such that $v_i \in$ domain (A_i), $1 \leq i \leq m$

▸ Student

Student Name	Roll Number	Year Of Admission	Phone Number	Branch Of Study
Ravi Teja	CS05B015	2005	9840110489	CS
Rajesh	CS04B125	2004	9840110490	EC

▸ No duplicate tuples (or rows) in a relation instance
▸ In SQL, duplicate rows would be allowed in tables

Keys for a Relation

Key:
- A set of attributes K, whose values uniquely identify a tuple in any instance. And none of the proper subsets of K has this property
  Ex {*rollNumber*} *is a key for student relation*
- {*rollNumber, name*} *–values can uniquely identify a tuple Y/N?*

Note:
- A key can not be determined from any particular instance data
- It can only be determined from the meaning of attributes

Keys Conti...

- A relation can have more than one key (Y/N)
  book (isbnNo, authorName, title, publisher, year)
  Assumption : books have only one author
  Keys: {isbnNo}, {authorName, title}

Super key :
- A set of attributes that contains any key as a subset.
  Ex: *{isbnNo}, {isbnNo,author}, {authorName, title}*

Candidate key:
- The set of all attributes, in case no proper subset is a key.
  Ex: *{isbnNo}, {authorName, title}*

Keys Conti...

Primary Key
- One of the candidate keys chosen for _____ purposes
  Ex: *{isbnNo}*

Integrity constraints

- Necessary conditions to be satisfied by the data values in the relational instances so that the set of data values constitute a meaningful database
  ◦ domain constraints
  ◦ key constraints
  ◦ referential integrity constraints

Domain Constraints :
- Attributes have associated domains

Domain
- *set of atomic data values of a specific type.*

Constraint
- *Actual values of an* attribute in any tuple must belong to the declared domain.

Key Constraint
- Relation scheme –associated keys
- **Constraint:** if K is supposed to be a key for scheme R
- None of the key attributes can have null value

Foreign Keys

- Tuples in one relation, say $r_1(R_1)$, often need to refer to tuples in another relation, say $r_2(R_2)$
- Why?
- To capture relationships between entities
- Primary Key of R_2: $K= \{B_1, B_2, ..., B_j\}$
- A set of attributes F= $\{A_1, A_2, ..., A_j\}$ of R_1 such that dom(A_i) = dom(B_i), $1 \le i \le j$ and whose values are used to refer to tuples in r_2 is called a foreign key in R_1 referring to R_2.

Slide 1

Course					Department			
courseId	name	credits	deptNo		deptId	name	hod	phone
CS635	ALGORITHMS	3	1		1	COMPUTER SCIENCE	CS01	22576235
CS636	A.I	4	1		2	ELECTRICAL ENGG	ES01	22576234
ES456	D.S.P	3	2		3	MECHANICAL ENGG	ME01	22576233
ME650	AERO DYNAMIC	3	3					

➢There can be more than one foreign key in a relation?

➢It is possible for a foreign key in a relation to refer to the primary key of the relation itself ?

Slide 2

Ex:
univEmployee (empNo, name, salary, dept, reportsTo)

▸ reportsTo is a foreign key referring to empNo of the same relation
▸ Relation every employee in the university reports to some other employee for administrative purposes

Slide 3

Referential Integrity Constraint (RIC)

▸ Let F be a foreign key in scheme R_1 referring to scheme R_2 and let K be the primary key of R_2
▸ **RIC:** any relational instance r_1 on R_1, r_2 on R_2 must be
▸ for any tuple t in r_1, either its F–attribute values are null or they are identical to the K attribute values of some tuple in r_2

Slide 4

COURSE					DEPARTMENT			
courseId	name	credits	deptNo		deptId	name	hod	phone
CS635	ALGORITHMS	3	1		1	COMPUTER SCIENCE	CS01	22576235
CS636	A.I	4	1		2	ELECTRICAL ENGG.	ES01	22576234
ES456	D.S.P	3	2		3	MECHANICAL ENGG.	ME01	22576233
ME650	AERO DYNAMIC	3	3					
CE751	MASS TRANSFER	3	4					

Slide 5

Communicating with an RDBMS Using SQL

SQL statement is entered.   Statement is sent to Oracle server.

```
SELECT department_name
FROM   departments;
```

DEPARTMENT_NAME
Administration
Marketing
Shipping
IT
Sales
Executive
Accounting
Contracting

Oracle server

Slide 6

SQL Statements

Statements	Category
SELECT INSERT UPDATE DELETE MERGE	Data manipulation language (DML)
CREATE ALTER DROP RENAME TRUNCATE COMMENT	Data definition language (DDL)
GRANT REVOKE	Data control language (DCL)
COMMIT ROLLBACK SAVEPOINT	Transaction control

Tables Used

- The following main tables are :
  - EMPLOYEES table: Gives details of all the employees
    - EMP(EID, FN, LN,EMAIL, Ph.NO, HDATE, JOBID…….)
  - DEPARTMENTS table: Gives details of all the departments
    - DEPT(DID,DNAME,MID,LOC……..)
  - JOB_GRADES table: Gives details of salaries for various grades
    - JOBGRA(GRA,LSAL,HSAL………)

Tables

EMPLOYEES

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID	SALA
100	Steven	King	SKING	515.123.4567	17-JUN-87	AD_PRES	240
101	Neena	Kochhar	NKOCHHAR	515.123.4568	21-SEP-89	AD_VP	170
102	Lex	De Haan	LDEHAAN	515.123.4569	13-JAN-93	AD_VP	170
103	Alexander	Hunold	AHUNOLD	590.423.4567	03-JAN-90	IT_PROG	90
104	Bruce	Ernst	BERNST	590.423.4568	21-MAY-91	IT_PROG	60
107	Diana	Lorentz	DLORENTZ	590.423.5567	07-FEB-99	IT_PROG	42
124	Kevin	Mourgos	KMOURGOS	650.123.5234	16-NOV-99	ST_MAN	58
141	Trenna	Rajs	TRAJS	650.121.8009	17-OCT-95	ST_CLERK	35
142	Curtis	Davies	CDAVIES	650.121.2994	29-JAN-97	ST_CLERK	31
1.2674					15-MAR-98	ST_CLERK	26
1.2004					09-JUL-98	ST_CLERK	25

DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
10	Administration	200	1700
20	Marketing	201	1800
50	Shipping	124	1500
60	IT	103	1400
80	Sales	149	2500
90	Executive	100	1700
110	Accounting	205	1700
190	Contracting		1700

GRA	LOWEST_SAL	HIGHEST_SAL
A	1000	2999
B	3000	5999
C	6000	9999
D	10000	14999
E	15000	24999
F	25000	40000

DEPARTMENTS   JOB_GRADES