CS - 571

Database Systems

for BS (DS)

Lecture 1-2: Introduction

Dr. Khurram Shahzad
khurram@pucit.edu.pk

Agenda

- Introduction
- Course Material
- Course Evaluation
- Course Contents

Course Evaluation

- Sessional (25)
- Mid Term (35 marks)
- Final Term (40 marks)

Rules of Business!

- Please
  - Ringing Phone
  - Attendance Problem
  - Sessional Problems
  - Class Timing

Introduction to the course

Areas to be covered

- Database design and application development
- Concurrency and robustness
- Efficiency and scalability
- Tools for manipulating database
- Using AI for DB Development

Have you ever designed a software?

Have you ever implemented a software?

Have you ever seen the backend of a software?

File System Critique

- **File System Data Management**
  - Requires extensive programming
  - Time consuming
  - Makes ad hoc queries impossible
  - Data Redundancy (Unnecessary Duplication of data)

Database

- ***Def 1:*** A shared collection of logically related data, designed to meet the information needs of multiple users in an organization
- Database is shared, integrated computer structure that stores a collection of data:
  - End user data (raw data)
  - Metadata (data about data, it contains data characteristics and relationships)

Database Management System

- DBMS on the other hand is the software or tool that is used to manage the database and its users

A software or application providing operations on the data like, adding new files, inserting new data, retrieving existing data, updating and deleting data,removing files etc.

- DBMS is an application, which holds user data permanently and then provide different operations on this data e.g., retrieval of data, insertion of data, updation of data etc.

Database Management

- Database Management System (DBMS): software system (collect of software) help to manage the data contents
  - Manages Database structure
  - Controls access to data
  - Contains query language

Importance of DBMS

- Makes data management more efficient and effective
- Query language allows quick answers to *ad hoc* queries
- Provides better access to more and better-managed data
- Reduces the probability of inconsistent data
- Improved data sharing
- Improved data security

DBMS vs DBs

- Database is a collection of data
- DBMS is tool to manage this data
- Jointly they are called database system

Jobs of DBA

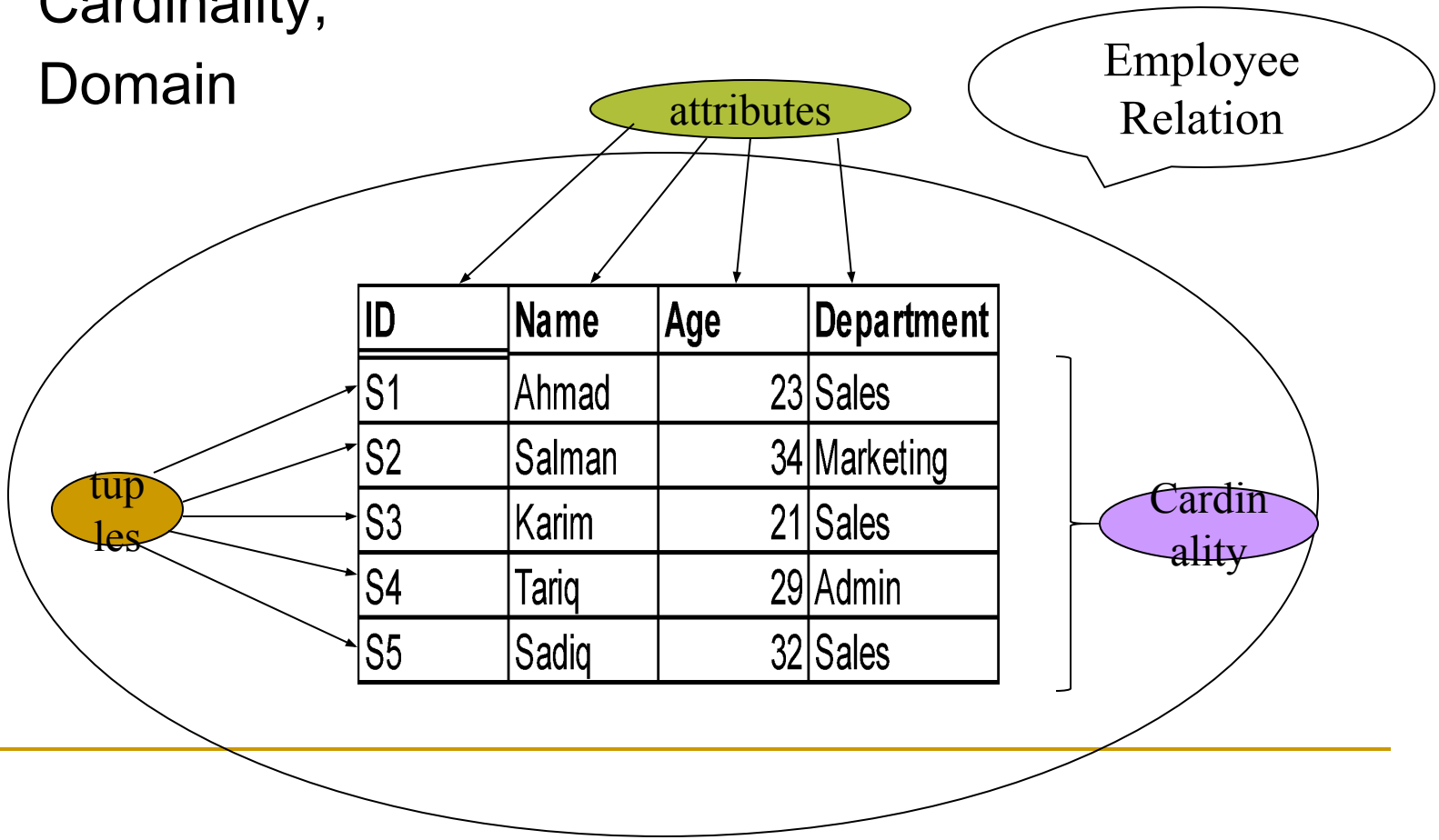
- Defining logical Schema
- Defining Internal Schema
- Liaising with users
- Defining Security and Integrity rules
- Defining Backup and Recovery procedures
- Monitoring performance and responding to changing requirements

The Relational Database (Model)

- It is a prescription for a way of representing **data by means of tables** and a prescription for **a way of manipulating** such a representation using some operators.

Terms in Relational Model

- Relation
- Tuple, Attribute
- Cardinality,
- Domain



Properties of Relations

- There are no duplicate Tuples
- All attributes have atomic values
- Tuples are unordered
- Attributes are unordered

Terms in Relational Model

- Candidate key
  - **General definition:**
    - **A set of attributes which can uniquely identify each row in the table**
  - **Relational Model Definition:**
    - **Let *R* be a relation. Then candidate key for *R* is a subset of the set of attributes of *R* say *K*, such that:**

1. **Uniqueness Property:**

   no two distinct tuples of *R* have the same value for *K*.

2. **Irreducibility property:**

   no proper subset of *K* has the uniqueness property

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

Terms in Relational Model

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

Possible Candidate Keys:

- **ID**
- **NIC**

Terms in Relational Model

- Primary key
  - **is a unique identifier for the table, that is , a column or column combination with the property that, at any given time, no two rows of the table contain same value in that column or column combination.**
  - **One of the candidate keys**
- Alternate Keys
  - **All candidate keys other than primary key are called alternate keys**

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

Terms in Relational Model

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

Primary Key: ID

Alternate Key: NIC

Terms in Relational Model

- Foreign key
  - **General definition:**
    - **A set of attributes in a table whose values are taken from the values of candidate key of some other table**

ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

Department	Location
Sales	Floor 1
Marketing	Floor 3
Admin	Floor 5

Same values

Terms in Relational Model

- **Relational Model Definition:**
  - **Let *R2* be a relation. Then a foreign key in *R2* is a subset is a subset of the set of attributes of *R2,* say *FK*, such that:**
  1. **there exists a base relation *R1* (*R1* and *R2* not necessarily distinct) with a candidate key *CK* and**
  2. **for all time, each value of *FK* in the current value of *R2* is identical to the value of *CK* in some tuple in the current value of *R1***

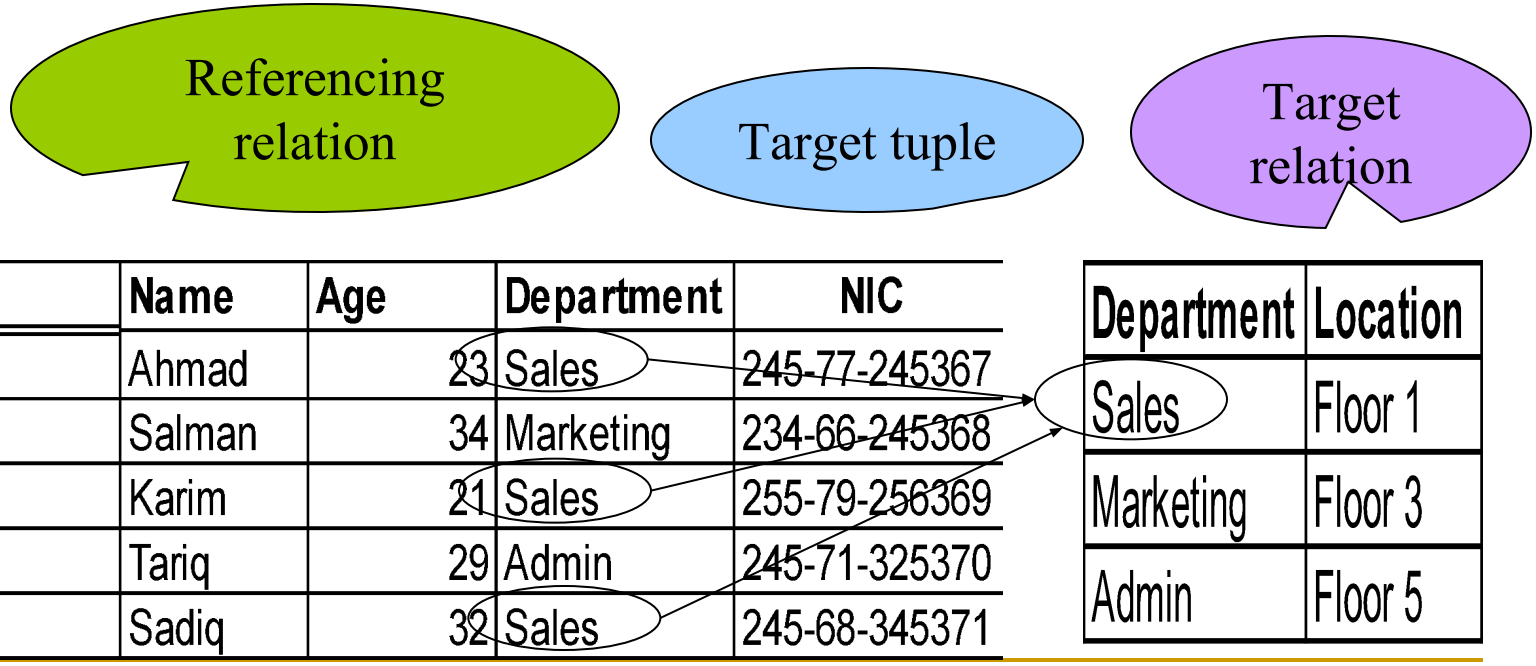
ID	Name	Age	Department	NIC
S1	Ahmad	23	Sales	245-77-245367
S2	Salman	34	Marketing	234-66-245368
S3	Karim	21	Sales	255-79-256369
S4	Tariq	29	Admin	245-71-325370
S5	Sadiq	32	Sales	245-68-345371

Department	Location
Sales	Floor 1
Marketing	Floor 3
Admin	Floor 5

Same values

Terms in Relational Model

- Referenced tuple or Target tuple
- Referencing relation
- Referenced relation or Target relation
- Simple key vs Composite key



Terms in Relational Model

- Foreign key rules
  - **Restricted**
  - **Cascade**
  - **possible cases: update, delete**

- Referential integrity

  database must not contain any unmatched foreign key values

- Nulls
  - **candidate keys shouldn't have null values**

TASK

- Consider the relations given below. Provide following information for each of them:

  name of relation, heading of relation, cardinality, degree, domain of each attribute.
- What would be the maximum number of elements in the domain of an attribute in a relation if its cardinality is 13.

Parts

P#	P.Name	Color	Weight	City
P1	Nut	Red	12	Lahore
P2	Bolt	Green	17	Karachi
P3	Screw	Blue	17	Multan
P4	Screw	Red	14	Lahore
P5	Cam	Blue	12	Karachi
P6	Cog	Red	19	Lahore

Supplies

S#	P#	Qty
S1	P1	300
S1	P2	200
S1	P3	400
S1	P4	200
S1	P5	100
S1	P6	100
S2	P1	300
S2	P2	400
S3	P2	200
S4	P2	200
S4	P4	300
S4	P5	400