

# Lesson 4 : Relational Models

# Where We Are

- Now you know about:
  - What Database Management Systems are.
  - What Entity Relationship Models are.
  - Represent the Entity Relationship models using Entity Relationship Diagrams by Crow's Foot Notation.
- Entity Relationship Models are **conceptual** models.
- We need to convert ERDs to Relational Models so we are able to implement them as **physical** Databases.

# Learning Objectives

- Finishing this module, you will be able to:
  - Understand and explain what are **Relational Models**
  - Explain the **properties** of Relational Models
  - Explain and select appropriate **keys** for Relational Models
  - Represent Relational Models with a set of **Relational Schemas**
  - **Convert** ERADs to Relational Models.

# Relational Models

- Why are Relational Models?
  - Relational Model **organizes** data in two-dimensional **tables**: columns and rows.
  - Relational Model includes: Relations, Tuples, Attributes, keys and foreign keys.
  - Relational Models are represented by a set of **Relational Schemas**.

# Relational Examples

Stores

StoreID	Street	City	Zip
#1506	1200 W Dillon Rd	Louisville	80027
#1546	1600 29th Street	Boulder	80301
#1524	1271 Sheridan Blvd	Broomfield	80020
#1517	7125 W 88th Ave	Westminster	80021
#1548	16420 Washington Street	Thornton	80023
#1503	10003 Grant Street	Thornton	80229
#1502	5215 Wadsworth Blvd	Arvada	8002

Cardinality

Degree



# Relational Examples

Employees

EmpID	FirstName	LastName	DoB	Position	Departme	StoreID
#20399	John	Ford	1998/2/12	Manager	HR	#1506
#30123	Anne	Brand	2001/3/12	Intern	Marketing	#1546
#12524	David	Biden	2000/2/20	Assistant	Sales	#1524
#14517	William	Potter	2001/9/12	Senior Manager	HR	#1506
#15214	Mary	Alexander	2001/9/12	Assistant	IT	#1524
#11032	Rose	Smith	1999/1/21	Intern	IT	#1503
#02012	Julie	Smith	1977/12/1	Senior Manager	IT	#1503
#78123	Angela	White	1967/4/4	Senior Manager	HR	#1546
#21342	John	Ford	1983/11/11	Manager	IT	#1546

↑  
Cardinality  
↓

← Degree →

# Terminologies

- A **relation** is a table with columns and rows.
  - **Attribute** is a named column of a relation.
  - **Domain** is the set of allowable values for one or more attributes.
  - **Tuple** is a row of a relation.
  - **Degree** is the number of attributes in a relation.
  - **Cardinality** is the number of tuples in a relation.
- Relational Database is a collection of normalized relations with distinct relation names.

# Relational Keys

- Superkey

- An attribute, or a set of attributes, that uniquely identifies a tuple within a relation.

- Candidate Key

- Superkey (K) such that no proper subset is a superkey within the relation.
  - In each tuple of R, values of K uniquely identify that tuple (uniqueness).
  - No proper subset of K has the uniqueness property (irreducibility).



# Relational Keys

- Primary Key

- Candidate key selected to identify tuples uniquely within relation.

- Alternate Keys

- Candidate keys that are not selected to be primary key.

- Foreign Key

- Attribute, or set of attributes, within one relation that matches candidate key of some (possibly same) relation.

# Relational Keys

Primary Key						StoreID	Street	City	Zip
						#1506	1200 W Dillon Rd	Louisville	80027
						#1546	1600 29th Street	Boulder	80301
						#1524	1271 Sheridan Blvd	Broomfield	80020
						#1517	7125 W 88th Ave	Westminster	80021
						#1548	16420 Washington Street	Thornton	80023
						#1503	10003 Grant Street	Thornton	80229
						#1502	5215 Wadsworth Blvd	Arvada	8002
EmpID	FirstName	LastName	DoB	Position	Department	StoreID	Foreign Key		
#20399	John	Ford	1998/2/12	Manager	HR	#1506			
#30123	Anne	Brand	2001/3/12	Intern	Marketing	#1546			
#12524	David	Biden	2000/2/20	Assistant	Sales	#1524			
#14517	William	Potter	2001/9/12	Senior Manager	HR	#1506			
#15214	Mary	Alexander	2001/9/12	Assistant	IT	#1524			
#11032	Rose	Smith	1999/1/21	Intern	IT	#1503			
#02012	Julie	Smith	1977/12/1	Senior Manager	IT	#1503			
#78123	Angela	White	1967/4/4	Senior Manager	HR	#1546			
#21342	John	Ford	1983/11/11	Manager	IT	#1546			



# Lab 3

Welcome to lab 3, do well to consider it before proceeding



# Relational Schema

# Database Relations

- Relation schema
  - Defines a relation by a set of attributes (and their domain).
- Relational database schema
  - Set of relation schemas, each with a distinct name.
- General format:
  - Name(Attribute<sub>1</sub>, Attribute<sub>2</sub>, ..., Attribute<sub>x</sub>(fk), ... , Attribute<sub>N</sub>)
  - The attribute(s) with underline as key
  - The attribute(s) with (fk) as foreign key(s)



# Relational Schema Example

Stores

StoreID	Street	City	Zip
#1506	1200 W Dillon Rd	Louisville	80027
#1546	1600 29th Street	Boulder	80301
#1524	1271 Sheridan Blvd	Broomfield	80020
#1517	7125 W 88th Ave	Westminster	80021
#1548	16420 Washington Street	Thornton	80023
#1503	10003 Grant Street	Thornton	80229
#1502	5215 Wadsworth Blvd	Arvada	8002

● Stores(StoreID, Street, City, Zip)

# Relational Schema Example

Employees

EmpID	FirstName	LastName	DoB	Position	Departme	StoreID
#20399	John	Ford	1998/2/12	Manager	HR	#1506
#30123	Anne	Brand	2001/3/12	Intern	Marketing	#1546
#12524	David	Biden	2000/2/20	Assistant	Sales	#1524
#14517	William	Potter	2001/9/12	Senior Manager	HR	#1506
#15214	Mary	Alexander	2001/9/12	Assistant	IT	#1524
#11032	Rose	Smith	1999/1/21	Intern	IT	#1503
#02012	Julie	Smith	1977/12/1	Senior Manager	IT	#1503
#78123	Angela	White	1967/4/4	Senior Manager	HR	#1546
#21342	John	Ford	1983/11/11	Manager	IT	#1546

- Employees (EmpID, FirstName, LastName, DoB, Position, Department, StoreID(fk) )

# Properties of a Relation

- Each tuple is distinct; there are no duplicate tuples.
- Order of attributes has no significance.
- Order of tuples has no significance, theoretically.
- Each cell of relation contains exactly one value.
- Each attribute has a distinct name.
- Values of an attribute are all from the same domain.
- Relation name is distinct from all other relation names in a Relational Model.



# Lab 4

Welcome to lab 4, do well to consider it before proceeding

