Database System

Lecture 14

Lecture-14- Overview of Database Normalization

Prepared By

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Database Constraints

Primary key

- The primary key value must be unique and not null.
- Multiple UNIQUE constraints and only one Primary key in a Table .

Foreign key

- FOREIGN KEY in one table points to a PRIMARY KEY in another table.
- prevents that invalid data form being inserted into the foreign key column

Unique Constraints

- every value in a column or set of columns must be unique.
- **Example**
  - no two employees can have the same phone number

Check Constraints

- used to limit the value range that can be placed in a column.
- Example :
  - A column must only include integers greater than 0

Not null Constraints

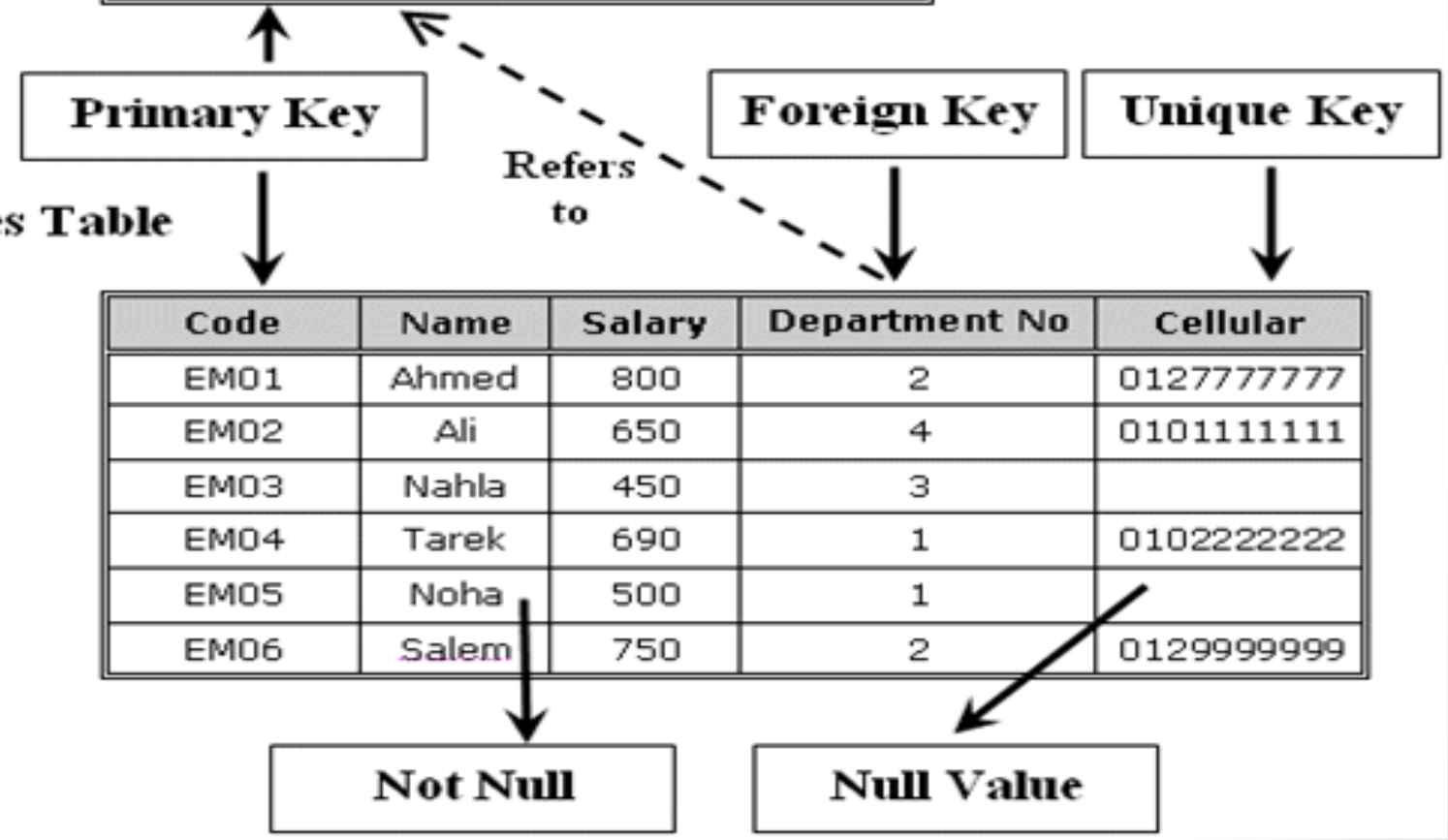
- A null value is an unknown
- Null value is not as zero or space.

DEFAULT Constraint

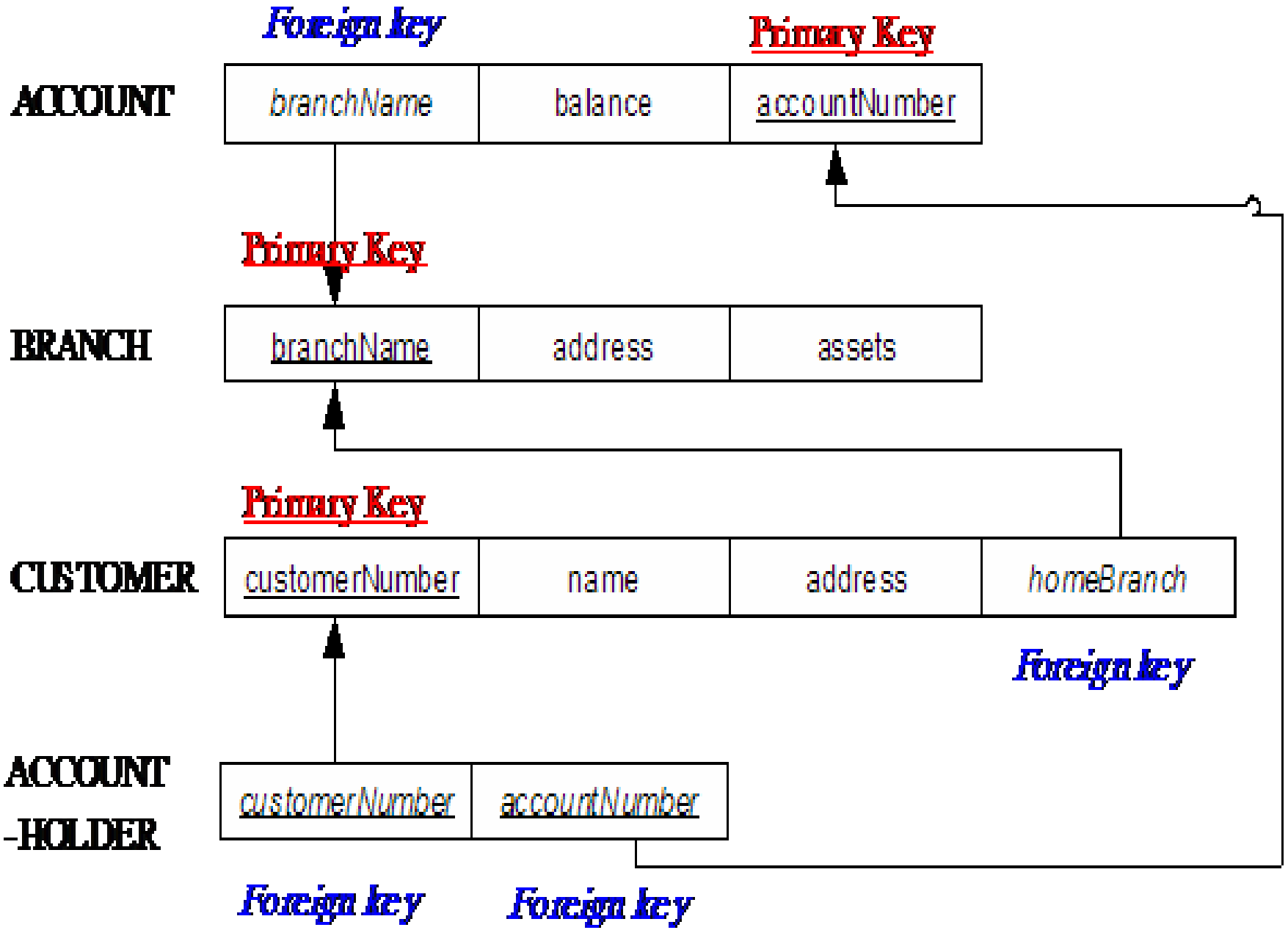
- used to insert a default value into a column

Departments Table

Department ID	Department Name
1	Training
2	Development
3	Human Resources
4	Sales



Code	Name	Salary	Department No	Cellular
EM01	Ahmed	800	2	0127777777
EM02	Ali	650	4	0101111111
EM03	Nahla	450	3	
EM04	Tarek	690	1	0102222222
EM05	Noha	500	1	
EM06	Salem	750	2	0129999999


Foreign key
Primary Key
ACCOUNT
branchName
balance
accountNumber
Primary Key
BRANCH
branchName
address
assets
Primary Key
CUSTOMER
customerNumber
name
address
homeBranch
Foreign key
ACCOUNT
-HOLDER
customerNumber
accountNumber
Foreign key
Foreign key

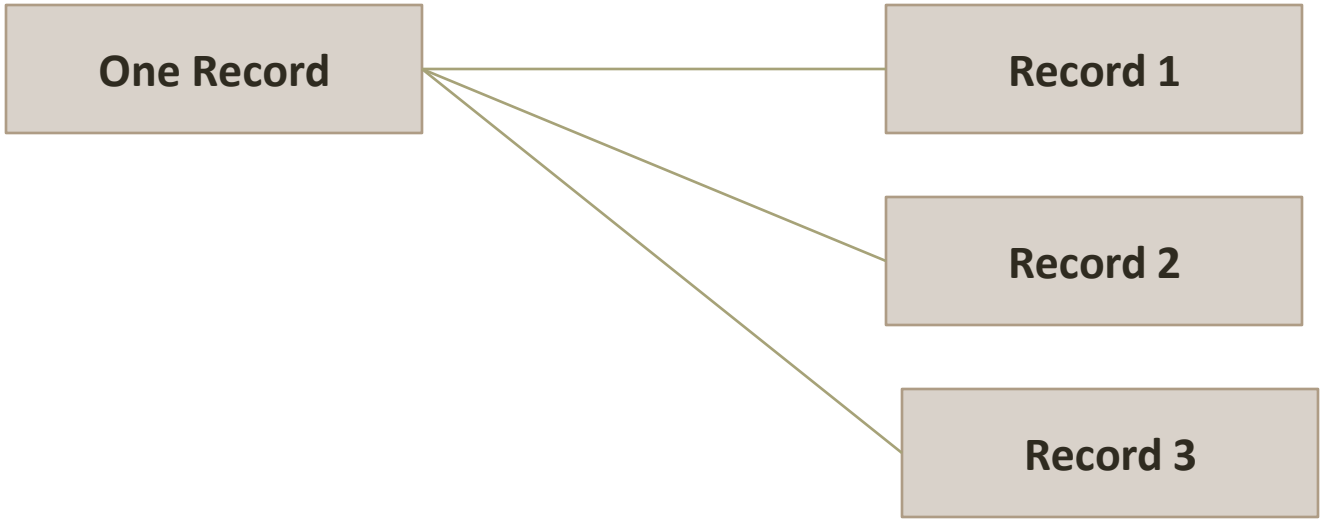
Database Relationships

Relationship Types

- One-to-one relationship
- One-to-many relationship
- Many-to-many relationship
- Recursive relationship
- Referential integrity

One To One Relationships

One To Many Relationships



One To Many Relationships

Departments Table

Department ID	Department Name
1	Training
2	Development
3	Human Resources
4	Sales

Primary Key

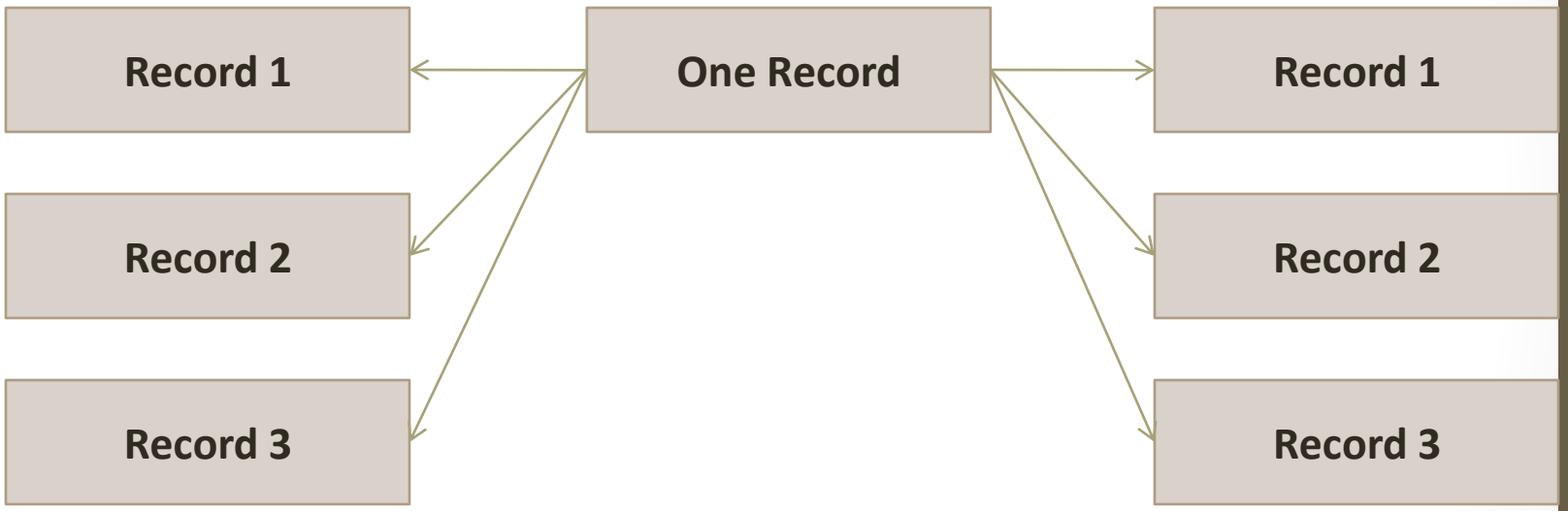
Foreign Key

Refers to

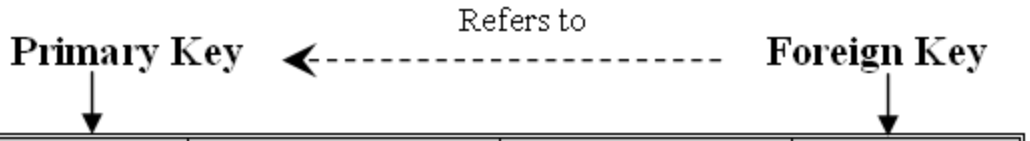
Employees Table

Code	Name	Salary	Department No	Cellular
EM01	Ahmed	800	2	0127777777
EM02	Ali	650	4	0101111111
EM03	Nahla	450	3	
EM04	Tarek	690	1	0102222222
EM05	Noha	500	1	
EM06	Salem	750	2	0129999999

Many To Many Relationships



Recursive relationship



No	Name	Title	Manager
1	Ahmed	GM	
2	Ali	Assistant	1
3	Sami	BM	1
4	Hassan	Coordinator	3
5	Sally	Secretary	3
6	Bahaa	Sales Rep.	3
7	Diaa	BM	1
8	Sabrv	Coordinator	7
9	Mona	Secretary	7
10	Gamal	Sales Rep.	7

Referential Integrity

- You cannot add a value in a foreign key without a matching value in a primary key.
- it prevents deleting a primary key that there is a foreign key related to it

Database Normalization

Normalization Overview

- Definition
  - the process of organizing data to minimize redundancy
  - the process of decomposing large, inefficiently structured tables into smaller, more efficiently structured tables without losing any data in the process .
  - the process of reducing tables to a set of columns where all the non-key columns depend on the primary key column

First Normal form

- rules
  - Table must describe only a single object.
  - A single field must not contain multiple data values.
  - Table must not include repeated fields in the same column.
  - Repeated fields must be removed to a related table.
  - Create separate tables for each group of related data.
  - Identify each row with a unique identifier (primary key).

Example : First Normal Form

ID	CourseName	CourseCategory	CourseInfo
1	Excel	Office	Start Date: 15/2/2004, Branch: Heliopolis
2	Word	Office	Start Date: 10/2/2004, Branch: Maadi
3	Access	Office	Start Date: 5/3/2004, Branch: Heliopolis
4	Oracle	Database	Start Date: 25/2/2004, Branch: Mohandessen
5	Photo Shop	Graphics	Start Date: 10/2/2004, Branch: Maadi
6	Outlook	Office	Start Date: 15/2/2004, Branch: Heliopolis
7	SQL Server	Database	Start Date: 5/3/2004, Branch: Heliopolis
8	Free Hand	Graphics	Start Date: 25/2/2004, Branch: Mohandessen
9	Power Builder	Database	Start Date: 5/3/2004, Branch: Heliopolis
10	Power Point	Office	Start Date: 25/2/2004, Branch: Mohandessen
11	Corel Draw	Graphics	Start Date: 10/2/2004, Branch: Maadi
12	Project	Office	Start Date: 15/2/2004, Branch: Heliopolis

First Normal Form

- Problem
  - The CourseCategory column contains repeated values for the rows.
  - The CourseInfo column contains multiple data values in each field
- Solution
  - CourseCategory > to separate table (Categories)
    - One-Many relationships (Category to Course)
  - CourseInfo > to two columns(start date , branch)
    - You need to create branches Tables .

Second Normal Form

- rules
  - Meet all the requirements of the first normal form.
  - Data in all non-key columns must fully depend on the value of the primary key column or the composite primary key columns.

Second Normal Form: Example

Customer	Course	CoursePrice
Ahmed	Access	15.00
Bahaa	Access	15.00
Ahmed	Excel	13.00
Mohsen	Word	10.00
Neveen	Oracle	25.00
Zainab	Photo Shop	22.00
Hany	SQL Server	18.00
Hany	Access	15.00
Ahmed	Outlook	9.00
Zainab	Access	15.00
Ayman	Photo Shop	22.00
Rania	Corel Draw	19.00
Rania	SQL Server	18.00
Rania	Access	15.00
Rania	Excel	13.00

Second Normal Form :Example

- **Problem**
  - CoursePrice depending only on the course column

- **Solution**
  - CoursePrice column > Course Table

Denormalization

- **Definition**
  - the opposite of normalization
- **Why**
  - to optimize the performance of a database
    - if many relations are joined, it may be too slow then to retrieve information