Database Design

9-2
Basic Mapping: The Transformation Process

Objectives

This lesson covers the following objectives:

- Distinguish between a conceptual model and a physical model

- Apply terminology mapping between the two models

- Understand and apply the Oracle naming conventions for tables and columns used in physical models

- Transform an entity into a table diagram

Purpose

- When you design a house, you eventually would like to see the house built.

- Even if you don't do the actual construction, you will need to understand the terms used by the builders in order to help them take your conceptual design and make it a physical reality.

- The initial database design can be used for further discussion between designers, database administrators, and application developers.

Review of Relational Tables

- A table is a simple structure in which data is organized and stored.

- In the example below, the EMPLOYEES table is used to store employees' information.

Columns

Table: EMPLOYEES

EMPLOYEE_ID	LAST_NAME	FIRST_NAME	DEPARTMENT_ID	PAYROLL_ID	NICKNAME
100	SMITH	DANA	10	21215	Dana
310	ADAMS	TYLER	15	59877	Ty
210	CHEN	LAWRENCE	10	1101	Larry
405	GOMEZ	CARLOS	10	52	Chaz
378	LOUNGANI	NEIL	22	90386	Neil

Rows

Primary Key Column (PK)

Foreign Key Column (FK)

Unique Key Column (UK)

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Review of Relational Tables

- Tables have columns and rows.
- In the example, each row describes an occurrence of an employee.

Columns

Table: EMPLOYEES

EMPLOYEE_ID	LAST_NAME	FIRST_NAME	DEPARTMENT_ID	PAYROLL_ID	NICKNAME
100	SMITH	DANA	10	21215	Dana
310	ADAMS	TYLER	15	59877	Ty
210	CHEN	LAWRENCE	10	1101	Larry
405	GOMEZ	CARLOS	10	52	Chaz
378	LOUNGANI	NEIL	22	90386	Neil

Rows

Primary Key Column (PK)

Foreign Key Column (FK)

Unique Key Column (UK)

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Review of Relational Tables

- Each column is used to store a specific type of value, such as employee number, last name, and first name.

- The employee_id column is a primary key.

Columns

Table: EMPLOYEES

EMPLOYEE_ID	LAST_NAME	FIRST_NAME	DEPARTMENT_ID	PAYROLL_ID	NICKNAME
100	SMITH	DANA	10	21215	Dana
310	ADAMS	TYLER	15	59877	Ty
210	CHEN	LAWRENCE	10	1101	Larry
405	GOMEZ	CARLOS	10	52	Chaz
378	LOUNGANI	NEIL	22	90386	Neil

Rows

Primary Key Column (PK)

Foreign Key Column (FK)

Unique Key Column (UK)

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Review of Relational Tables

- Every employee has a unique identification number in this table.

- The value in the primary key column distinguishes each individual row.

Columns

Table: EMPLOYEES

EMPLOYEE_ID	LAST_NAME	FIRST_NAME	DEPARTMENT_ID	PAYROLL_ID	NICKNAME
100	SMITH	DANA	10	21215	Dana
310	ADAMS	TYLER	15	59877	Ty
210	CHEN	LAWRENCE	10	1101	Larry
405	GOMEZ	CARLOS	10	52	Chaz
378	LOUNGANI	NEIL	22	90386	Neil

Rows

Primary Key Column (PK)

Foreign Key Column (FK)

Unique Key Column (UK)

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Review of Relational Tables

- The payroll_id is a unique key.
- This means that the system does not allow two rows with the same payroll_id.

Columns

Table: EMPLOYEES

EMPLOYEE_ID	LAST_NAME	FIRST_NAME	DEPARTMENT_ID	PAYROLL_ID	NICKNAME
100	SMITH	DANA	10	21215	Dana
310	ADAMS	TYLER	15	59877	Ty
210	CHEN	LAWRENCE	10	1101	Larry
405	GOMEZ	CARLOS	10	52	Chaz
378	LOUNGANI	NEIL	22	90386	Neil

Rows

Primary Key Column (PK)

Foreign Key Column (FK)

Unique Key Column (UK)

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Review of Relational Tables

- The foreign key column refers to a column in another table.

- In this example, the department_id refers to a column in the DEPARTMENTS table.

Columns

Table: EMPLOYEES

EMPLOYEE_ID	LAST_NAME	FIRST_NAME	DEPARTMENT_ID	PAYROLL_ID	NICKNAME
100	SMITH	DANA	10	21215	Dana
310	ADAMS	TYLER	15	59877	Ty
210	CHEN	LAWRENCE	10	1101	Larry
405	GOMEZ	CARLOS	10	52	Chaz
378	LOUNGANI	NEIL	22	90386	Neil

Rows

Primary Key Column (PK)

Foreign Key Column (FK)

Unique Key Column (UK)

Review of Relational Tables

- We know that Dana Smith works in department 10.
- If we wanted to know more about Dana Smith's department, we would look for the row in the DEPARTMENTS table that has department_id = 10.

Columns

Table: EMPLOYEES

EMPLOYEE_ID	LAST_NAME	FIRST_NAME	DEPARTMENT_ID	PAYROLL_ID	NICKNAME
100	SMITH	DANA	10	21215	Dana
310	ADAMS	TYLER	15	59877	Ty
210	CHEN	LAWRENCE	10	1101	Larry
405	GOMEZ	CARLOS	10	52	Chaz
378	LOUNGANI	NEIL	22	90386	Neil

Rows

Primary Key Column (PK)

Foreign Key Column (FK)

Unique Key Column (UK)

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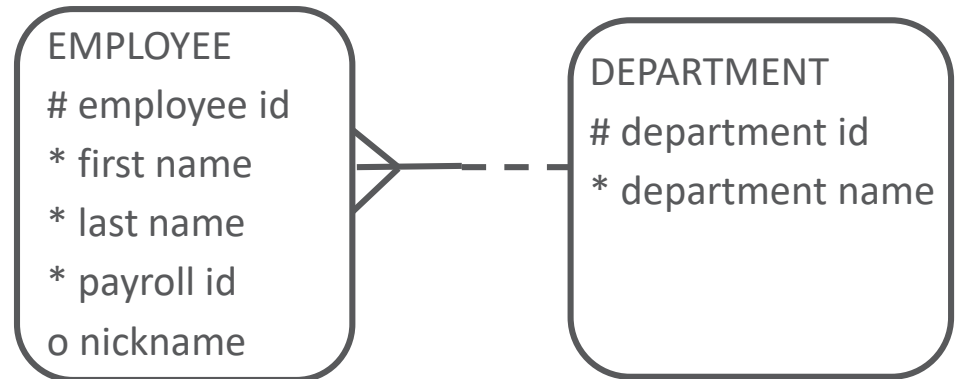
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Transforming Conceptual To Physical

- The conceptual model (ER diagram) is transformed into a physical model.

- The physical implementation will be a relational database.

Transforming Conceptual To Physical

Conceptual Model (ERD)

Transformation process

EMPLOYEE
employee id
* first name
* last name
* payroll id
o nickname

DEPARTMENT
department id
* department name

Physical Implementation: Relational Database

EMPLOYEES (EPE)

Key type	Optionality	Column name
pk	*	employee_id
uk	*	payroll_id
	*	last_name
	*	first_name
	o	nickname
fk	*	department_id

DEPARTMENTS (DPT)

Key type	Optionality	Column name
pk	*	department_id
	*	department_name

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Terminology Mapping

- Changing from analysis (conceptual model) to implementation (physical model) also means changing terminology:
  - An entity becomes a table.
  - An instance becomes a row.
  - An attribute becomes a column.
  - A primary unique identifier becomes a primary key.
  - A secondary unique identifier becomes a unique key.
  - A relationship is transformed into a foreign-key column and a foreign key constraint.

Terminology Mapping

ANALYSIS ➡ IMPLEMENTATION

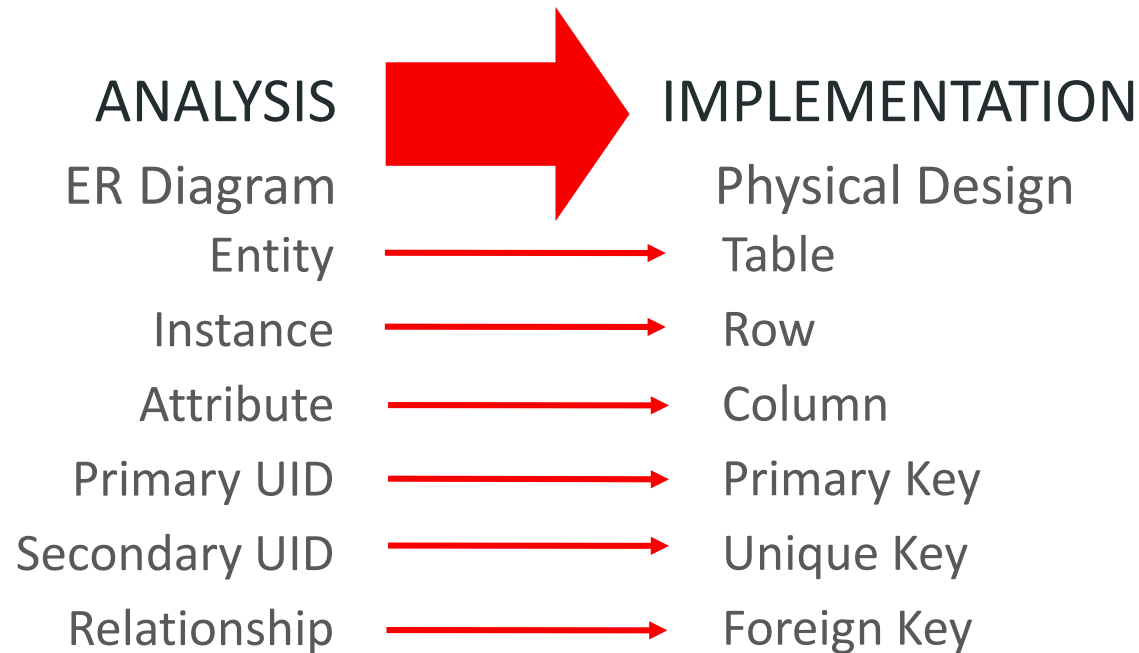| ANALYSIS	IMPLEMENTATION
ER Diagram	Physical Design
Entity	Table
Instance	Row
Attribute	Column
Primary UID	Primary Key
Secondary UID	Unique Key
Relationship	Foreign Key

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Table Diagram Notations

- The first row of the table diagram contains the table name and the short name.

- The Key Type column should contain values of "pk" for the primary key, "uk" for the unique key, and "fk" for the foreign-key column.

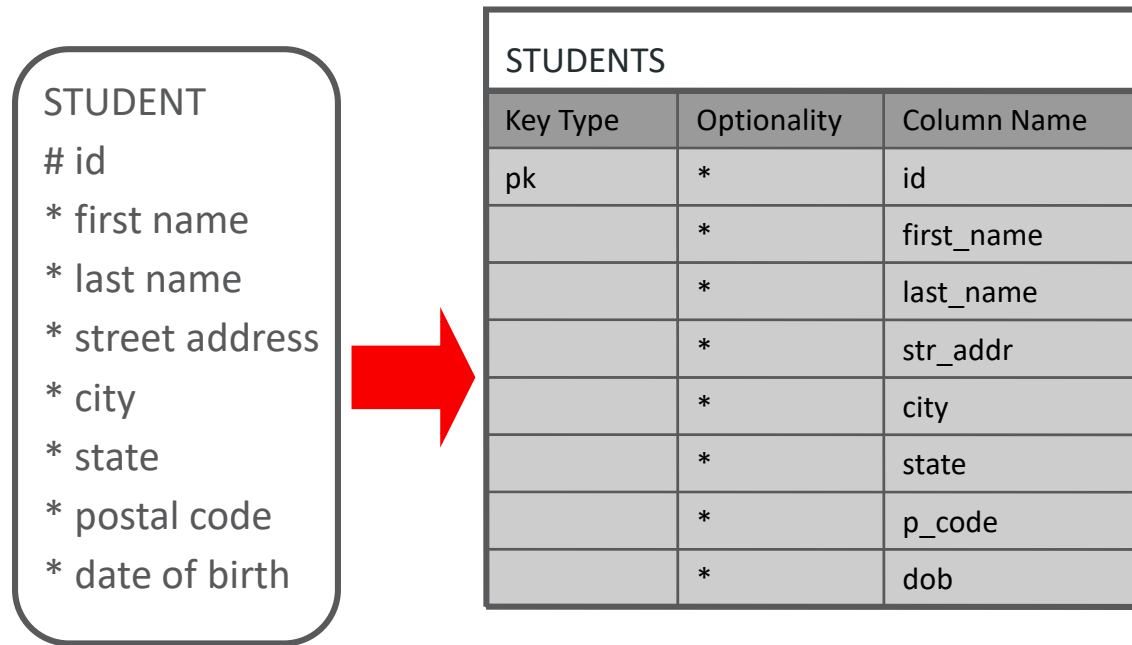| TABLE NAME (short name)		
Key Type (pk, uk, fk)	Optionality ("*", "o")	Column Name

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Table Diagram Notations

- It will be blank if the column is not a part of any key.

- The Optionality column must contain "*" if the column is mandatory and "o" if it is optional. This is similar to the entity diagram. The third column is for the column name.

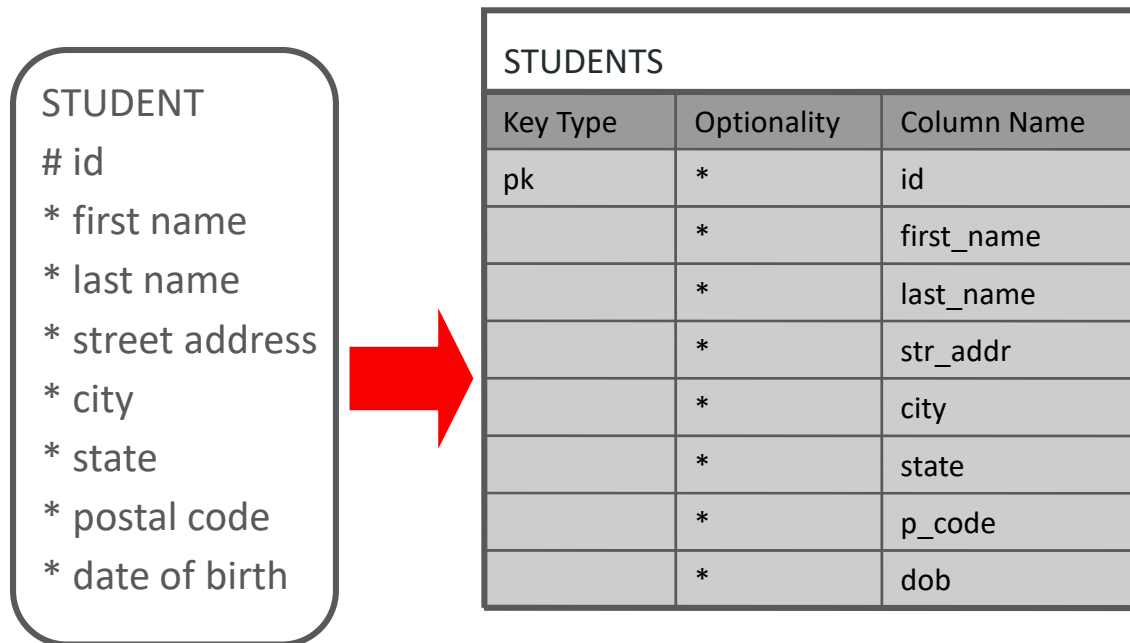| TABLE NAME (short name)		
Key Type (pk, uk, fk)	Optionality ("*", "o")	Column Name

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Naming Conventions for Tables and Columns

- The table name is the plural of the entity name.

- Example: STUDENT becomes STUDENTS

STUDENT
id
* first name
* last name
* street address
* city
* state
* postal code
* date of birth

STUDENTS		
Key Type	Optionality	Column Name
pk	*	id
	*	first_name
	*	last_name
	*	str_addr
	*	city
	*	state
	*	p_code
	*	dob

Naming Conventions for Tables and Columns

- Column names are identical to the attribute names except that special characters and spaces are replaced with underscores.

STUDENT

id

* first name

* last name

* street address

* city

* state

* postal code

* date of birth

STUDENTS		
Key Type	Optionality	Column Name
pk	*	id
	*	first_name
	*	last_name
	*	str_addr
	*	city
	*	state
	*	p_code
	*	dob

Naming Conventions for Tables and Columns

- Column names often use more abbreviations than attribute names. Example: first name becomes first_name, or fname

STUDENT

id

* first name

* last name

* street address

* city

* state

* postal code

* date of birth

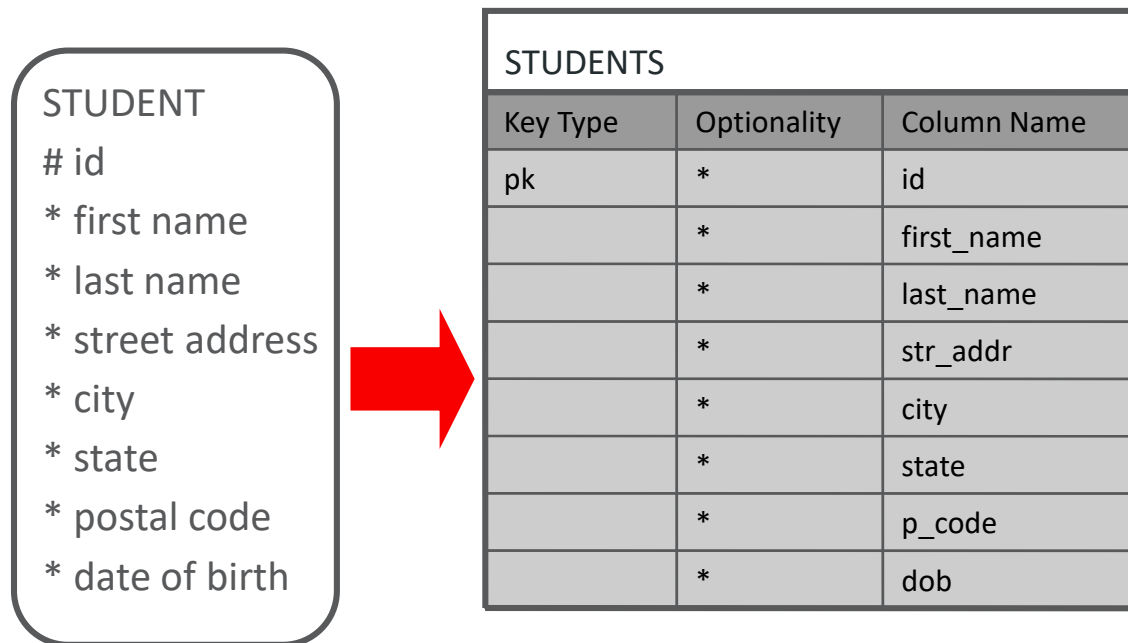| STUDENTS		
Key Type	Optionality	Column Name
pk	*	id
	*	first_name
	*	last_name
	*	str_addr
	*	city
	*	state
	*	p_code
	*	dob

Table Short Names

- A unique short name for every table is useful in the naming of foreign-key columns.

- One possible way to make these short names is based on the following rules:

- For entity names of more than one word, take the:
  - First character of the first word
  - First character of the second word
  - Last character of the last word

- Example: JOB ASSIGNMENT gets a short name of JAT

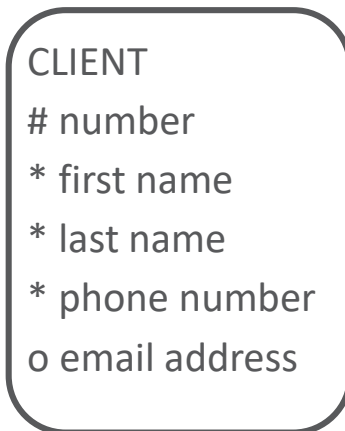# Table Short Names

PRIVATE HOME

id

* address

o comments

PRIVATE HOMES (PHE)		
Key Type	Optionality	Column Name
pk	*	id
	*	address
	o	comments

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Table Short Names

- For entity names of one word but more than one syllable, take the:
  - First character of the first syllable
  - First character of the second syllable
  - Last character of the last syllable

- Example: EMPLOYEE gets a short name of EPE and CLIENT gets a short name of CET
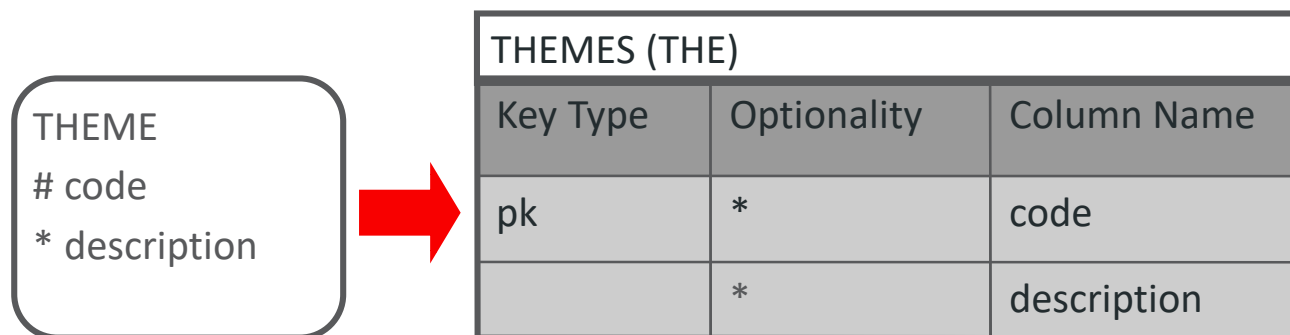
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Table Short Names

CLIENT
number
* first name
* last name
* phone number
o email address

→

CLIENTS (CET)		
Key Type	Optionality	Column Name
pk	*	client_num
	*	first_name
	*	last_name
	*	phone_num
	o	email_addr

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Table Short Names

- For entity names of one syllable but more than one character:
  - First character
  - Second character
  - Last character

- Example: FLIGHT gets a short name of FLT

| THEME
code
* description | → |

THEMES (THE)		
Key Type	Optionality	Column Name
pk	*	code
	*	description

Naming Restrictions with Oracle

- Table and column names:

- Must start with a letter

- Can contain up to 30 alphanumeric characters

- Cannot contain spaces or special characters such as "!," but "$," "#," and "_" are permitted.

- Table names must be unique within one user account in the Oracle database.

- Column names must be unique within a table.

Naming Restrictions with Oracle

- Some words have a special meaning in the Oracle database and in the SQL programming language.

- These are called "reserved" words.

- It is best to avoid using these as names for your tables and columns.

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Naming Restrictions with Oracle

- Some common examples of Oracle reserved words are:
  - TABLE
  - NUMBER
  - SEQUENCE
  - ORDER
  - VALUES
  - LEVEL
  - TYPE
- A complete list can be found on otn.oracle.com.

Terminology

Key terms used in this lesson included:

- Map
- Reserved word
- Transform

Summary

In this lesson, you should have learned how to:

- Distinguish between a conceptual model and a physical model

- Apply terminology mapping between the two models

- Understand and apply the Oracle naming conventions for tables and columns used in physical models

- Transform an entity into a table diagram