
ORACLE
Academy

Database Design

9-1
Introduction to Relational Database Concepts

ORACLE Academy

Objectives

This lesson covers the following objectives:

- Define a primary key
- Define a foreign key
- Define a column-integrity rule
- Identify row, column, primary key, unique key, and foreign key elements given a diagram of a table containing these elements
- Identify violations of data-integrity rules

Purpose

- The conceptual data model will be transformed into a relational database design.
- This means that our entities, attributes, relationships, and unique identifiers will be translated into objects in a relational database.
- Compare this to a clothing designer who is taking his design from paper and implementing it with fabric.
- The designer needs to understand how to sew the designs just like you will need to understand the structure of relational database objects.

Relational Database Illustrated

- A relational database is a database that is seen by the user as a collection of two-dimensional tables, each containing rows and columns.
- The table below contains employee data.

EMPLOYEES (table name)

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	DEPARTMENT_ID
100	Steven	King	90
101	Neena	Kochhar	90
102	Lex	De Haan	90
200	Jennifer	Whalen	10
205	Shelley	Higgins	110

Language to Access Data

- Structured query language (SQL) allows us to access data in relational databases in an efficient way.
- Instead of manually searching through each row to find the record for employee number 200, we use the following SQL statement:

```
SELECT last_name, department_id
FROM employees
WHERE employee_id = 200;
```

- You can see the result of this statement on the next slide.

SQL Query Illustrated

EMPLOYEES (table name)

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	DEPARTMENT_ID
100	Steven	King	90
101	Neena	Kochhar	90
102	Lex	De Haan	90
200	Jennifer	Whalen	10
205	Shelley	Higgins	110

```
SELECT last_name, department_id
FROM employees
WHERE employee_id = 200;
```

LAST_NAME	DEPARTMENT_ID
Whalen	10

Specific SQL Query

- To find all the employees in department number 90, we write a different SQL statement:

```
SELECT *
FROM employees
WHERE department_id = 90;
```

- Again, you can see the result on the next slide.

Specific SQL Query

EMPLOYEES (table name)

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	...	DEPARTMENT_ID
100	Steven	King	...	90
101	Neena	Kochhar	...	90
102	Lex	De Haan	...	90
200	Jennifer	Whalen	...	10
205	Shelley	Higgins	...	110

```
SELECT  *
FROM employees
WHERE department_id = 90;
```

EMPLOYEES (table name)

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	...	DEPARTMENT_ID
100	Steven	King	...	90
101	Neena	Kochhar		90
102	Lex	De Haan	... ...	90

Primary Key

- A primary key (PK) is a column or set of columns that uniquely identifies each row in a table.

ACCOUNTS

BANK_NO	ACCT_NO	BALANCE	DATE_OPENED
104	75760	12,0050.00	21-OCT-89
104	77956	100.10	
105	89570	55,775.00	15-JAN-85
103	55890	15,001.85	10-MAR-91
105	75760	5.00	22-SEP-03

Multiple Column Primary Key

EMPLOYEES

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	...	DEPARTMENT_ID
100	Steven	King	...	90
101	Neena	Kochhar	...	90
102	Lex	De Haan	...	90
200	Jennifer	Whalen	...	10
205	Shelley	Higgins	...	110

Single Column Primary Key

Primary Key

- Each table should have a primary key, and a primary key must be unique.

ACCOUNTS

BANK_NO	ACCT_NO	BALANCE	DATE_OPENED
104	75760	12,0050.00	21-OCT-89
104	77956	100.10	
105	89570	55,775.00	15-JAN-85
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Multiple Column Primary Key

EMPLOYEES

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	...	DEPARTMENT_ID
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101	Neena	Kochhar	...	90
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200	Jennifer	Whalen	...	10
205	Shelley	Higgins	...	110

Single Column Primary Key

Primary Key

- No part of the primary key can be null.

ACCOUNTS

BANK_NO	ACCT_NO	BALANCE	DATE_OPENED
104	75760	12,0050.00	21-OCT-89
104	77956	100.10	
105	89570	55,775.00	15-JAN-85
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Multiple Column Primary Key

EMPLOYEES

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	...	DEPARTMENT_ID
100	Steven	King	...	90
101	Neena	Kochhar	...	90
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200	Jennifer	Whalen	...	10
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Single Column Primary Key

Primary Key Candidates

- A table can have more than one column, or combinations of columns, that could serve as the table's primary key.
- Each column, or combination of columns, is called a "candidate" key because it could be selected for use as the primary key.

MEMBERS

MEMBER_ID	LAST_NAME	FIRST_NAME	PAYROLL_ID
100	SMITH	DANA	21215
310	ADAMS	TYLER	59877
210	CHEN	LAWRENCE	1101
405	GOMEZ	CARLOS	52
378	LOUNGANI	NEIL	90386

Candidate Key

Candidate Key

Choose a Candidate Key

- Select one candidate key to be the primary key for the table.
- The other candidates become alternate keys (or unique keys).

MEMBERS

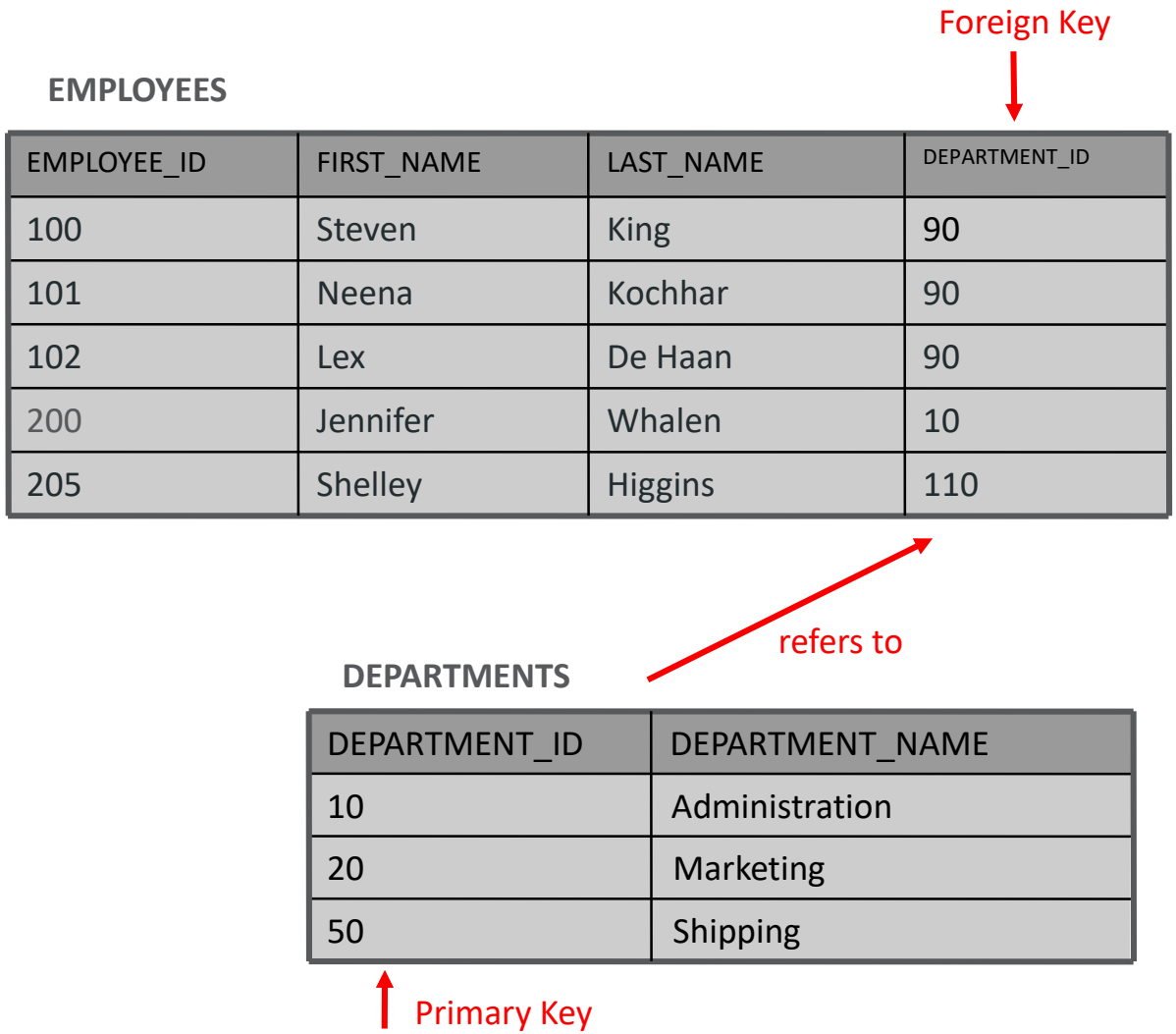
MEMBER_ID	LAST_NAME	FIRST_NAME	PAYROLL_ID
100	SMITH	DANA	21215
310	ADAMS	TYLER	59877
210	CHEN	LAWRENCE	1101
405	GOMEZ	CARLOS	52
378	LOUNGANI	NEIL	90386

Primary Key

Alternate or Unique Key (UK)

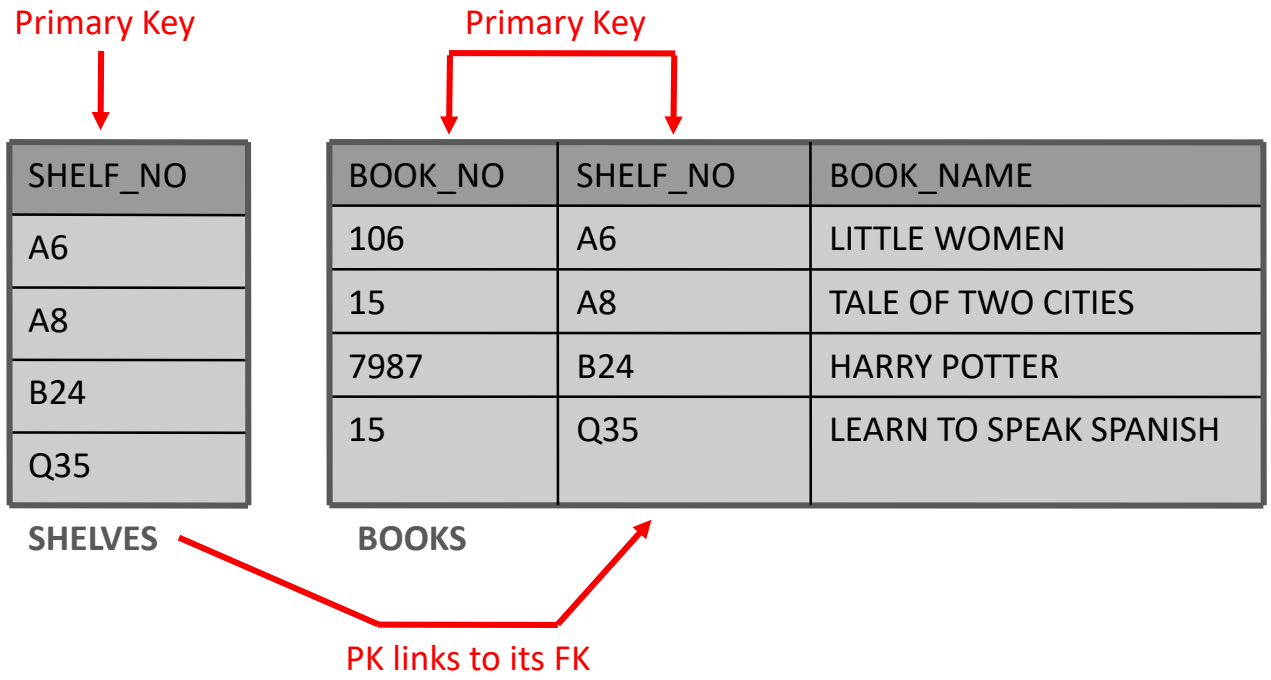
Foreign Key

- A foreign key (FK) is a column, or combination of columns, in one table that contains values that match the primary key value in another table.



Foreign Key Rules

- If a primary key is composed of one or more foreign keys, the FK value cannot be NULL.



Column Integrity

- A column must contain only values that are consistent with the defined data format of the column.

ACCOUNTS

BANK_NO	ACCT_NO	BALANCE	DATE_OPENED
104	75760	12,0050.00	21-OCT-1989
104	77956	100.10	
105	89570	55,775.00	15-JAN-1985
103	55890	15,001.85	10-MAR-1991
105	75760	5.00	22-SEP-2003

ACCOUNTS Table Definition

Column Name	Data Type	Optionality
BANK_NO	Number (5)	Not null
ACCT_NO	Number (8)	Not null
BALANCE	Number (12,2)	Not null
DATE_OPENED	Date	

Summary of Data-Integrity Rules

- Data-integrity rules (also known as constraints) define the relationally correct state for a database.
- Data-integrity rules ensure that users can perform only those operations that leave the database in a correct, consistent state.

Summary of Data-Integrity Rules

Constraint Type	Explanation	Example
Entity Integrity	A primary key must be unique, and no part of the primary key can be null	The column emp_no in the EMPLOYEES table cannot be null
Referential Integrity	A foreign key must match an existing primary key value (or else be null if nulls are allowed)	The value in the dept_no column of the EMPLOYEES table must match a value in the dept_no column in the DEPARTMENTS table
Column Integrity	A column must contain only values consistent with the defined data format of the column	The value in the balance column of the ACCOUNTS table must be numeric
User-Defined Integrity	The data stored in a database must comply with the rules of the business	If the value in the balance column of the ACCOUNTS table is below 1.00, we must send a letter to the account owner (this will need additional programming to enforce)

Terminology

Key terms used in this lesson included:

- Candidate key
- Column
- Foreign key
- Primary key
- Relational database
- Row
- Unique key

Summary

In this lesson, you should have learned how to:

- Define a primary key
- Define a foreign key
- Define a column-integrity rule
- Identify row, column, primary key, unique key, and foreign key elements given a diagram of a table containing these elements
- Identify violations of data-integrity rules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