Murach Chapter 1

An Introduction to Relational Databases and SQL

Week 1, Lec 2

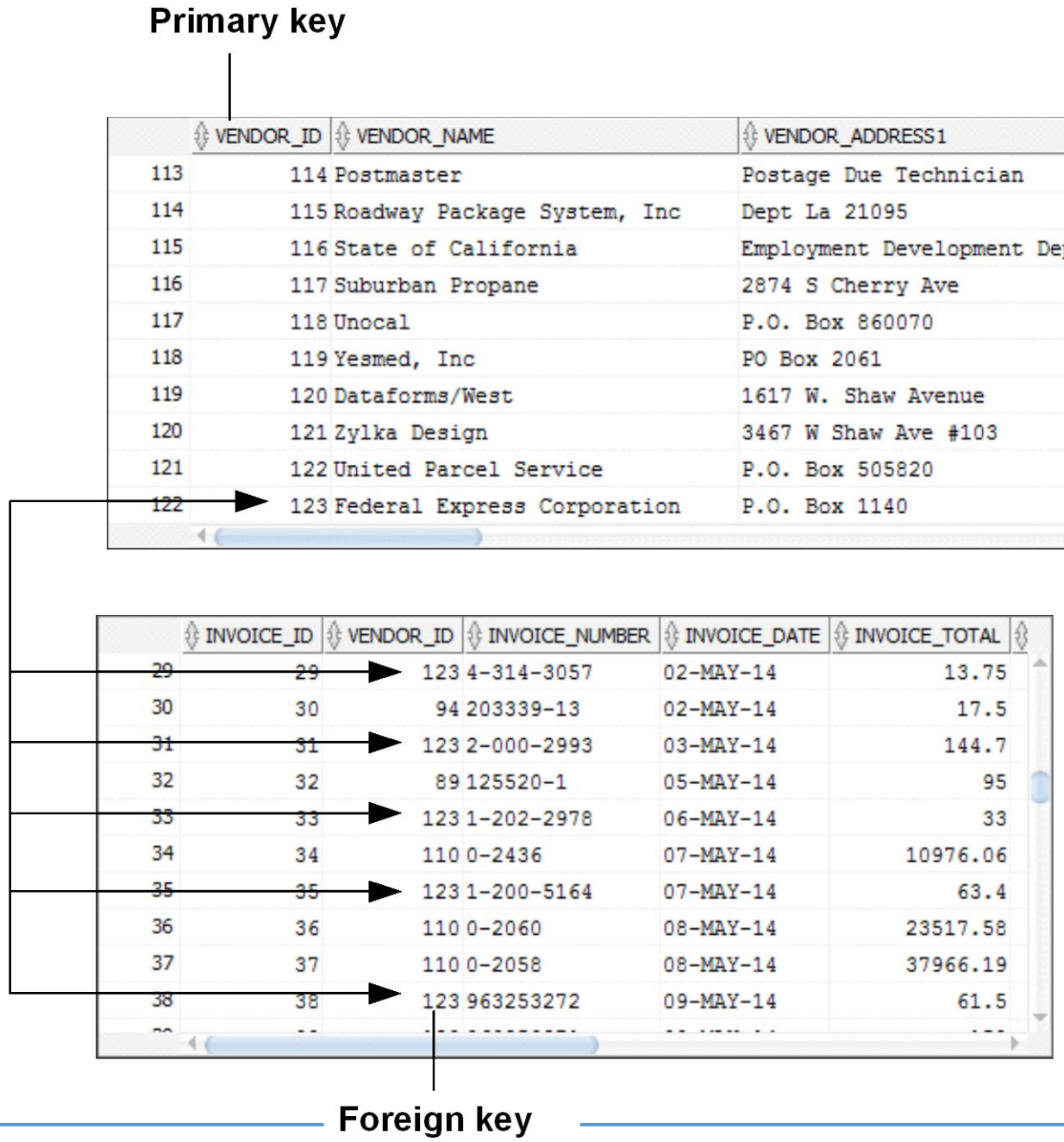
Key Topics

- Basic Terms
  - Primary Key, Foreign Key
  - Null, Default values
  - Query, Action Query, Result Set, Clause, SQL Script
- Common Data Type in Oracle Database
- SQL History
- SQL Standard and Variants
- SQL Statements Overview
- SQL Programming Style Guide
- SQL Examples
- PL/SQL and Embedded SQL

Basic Terms

- Foreign Key
  - Used to relate tables in a relational database
  - Consists of one or multiple columns in a table that refer to the primary key in another table
    - Refer means that values match
- Relationships between tables
  - One-to-Many
    - Most common
  - One-to-one
  - Many-to-many

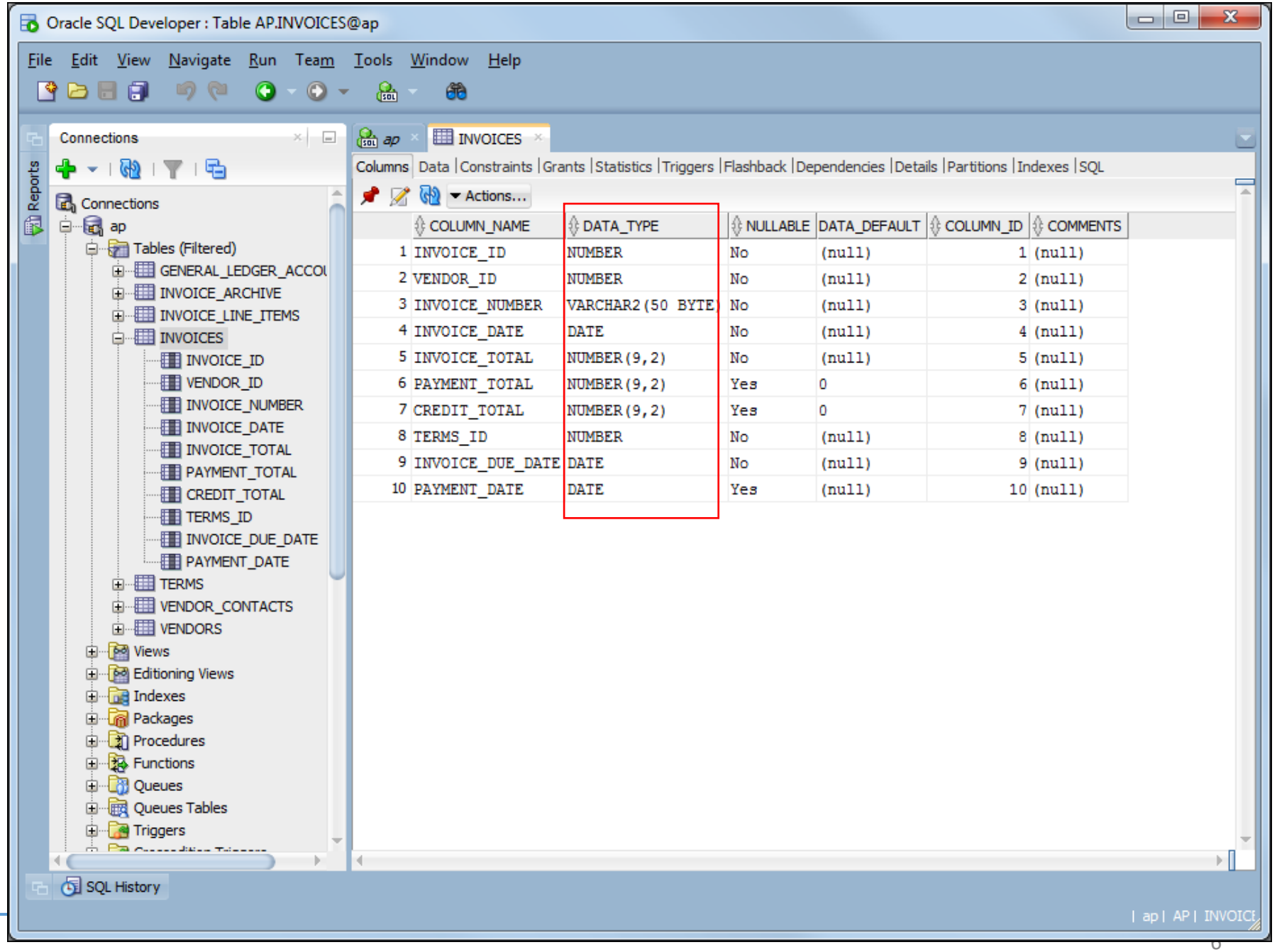
Relationship between tables Vendors & Invoices



Common Oracle BuiltIn Data Types

- VARCHAR2(n)
  - Variable-length sequence of ASCII characters
  - E.g. VARCHAR2(20)
- NUMBER(p,s) s - #s of decimals
  - Integer and decimal numbers that contain an exact value
  - E.g. NUMBER(5), NUMBER(10, 2)
- DATE internally time included
  - Date and time values
- CHAR(n) exact #s of chars
  - Fixed-length sequence of ASCII characters, e.g. CHAR(2)
- FLOAT(p)
  - Floating-point numbers that contain an approximate value
  - For very large, very small numbers

Columns in table Invoices



Basic Terms

- Null value true, false, null
  - A value in a cell that means unknown or inapplicable
- Default value
  - The value used when a value is not provided for a column during row insertion.
  - Default values are defined during table creation.

Important Events in SQL History

Year	Event
1970	Dr. E. F. Codd develops the relational database model.
1979	Relational Software, Inc. (later renamed Oracle) releases the first relational DBMS, Oracle.
1982	IBM releases their first RDBMS, SQL/DS (SQL/Data System).
1985	IBM released DB2 (Database 2).
1987	Microsoft releases SQL Server.
1989	ANSI publishes first SQL standards (ANSI/ISO SQL-89, or SQL1).
2003	ANSI publishes SQL4 (ANSI/ISO SQL:2003).
2008	Sun Microsystems acquired by MySQL.
2010	Oracle acquired Sun Microsystems and MySQL.

2016 ANSI publishes Standard SQL 2016.

SQL Standard and Variant need to use notation same as the textbook

- SQL Variant
  - The implementation of a specific database vendor
  - May have extensions to standard SQL
- Most basic SQL statements are same in all SQL products.
  - Learning one product helps learning another product
- Porting a non-trivial application from one SQL database to another require code modification.

Relational Database Products

Database Product	First Database Releases	Primary Platforms	Typical Usage
ORACLE	1979	Unix, OS/390, Windows, Mac OS	Large, mission critical system
DB2	1985	Unix, OS/390, Windows, Mac OS	Large, mission critical system
SQL SERVER	1987	Windows	Small to medium size systems
MY SQL	2000	Unix, Windows, Mac OS	Web applications

SQL Statements

DML (Data Manipulation)	DDL (Data Definition Language)	DCL (Data Control Language)	Transaction Control Language
INSERT DELETE UPDATE SELECT	CREATE TABLE, USER, etc ALTER TABLE, USER, etc DROP TABLE, USER, etc	GRANT REVOKE	COMMIT ROLLBACK

DROP - drop definition of a table/user eg: DROP USER avatar CASCADE; = remove def of this user from db (all objects created under this user, pw, username, etc) depends on authority to drop user (might work if run under system)

DEFAULT TABLESPACE users; = users created and move to TABLESPACE by default

grant system privilege: GRANT CREATE SESSION TO avatar; or GRANT ALL PRIVILEGES TO avatar;
grant object privilege: GRANT SELECT ON ap.terms TO avatar; = avatar can use select query in ap.terms table.

DROP then CREATE TABLE eg: CREATE TABLE friends (columnName DataType,…) - only def is created, db is still empty
for Data Manipulation: INSERT INTO friends VALUES (…);
if insertion fail: alter the table def = ALTER TABLE friends; MODIFY phone VARCHAR(12);
if modify data: UPDATE table SET phone = sth WHERE name = sth;

ROLLBACK - cancel the changes in current transaction (not needed just for query, depends on which transaction we're working with)
COMMIT - to save the current transaction permanently
DDL is a separate transaction

Basic Terms

- Query
  - SELECT statement that does not modify user data
- Action Query
  - INSERT, DELETE, UPDATE
- Result set
  - What is returned from a SELECT statement
  - Include a set of selected rows and columns
- Clause
  - Part of a SQL statement, e.g. SELECT clause, FROM clause, etc
- SQL Script comments start with at least 2 dashes
  - Text file that contains a number of SQL statements
  - In Oracle, the default extension name is .sql

SQL Examples

- See details in file Wk1-MurachCh1-SQLExamples.sql

Comments in SQL Script

SELECT statement with a block comment

```
/*
Author: Joel Murach
Date: 8/22/2014
*/
SELECT invoice_number, invoice_date, invoice_total,
    invoice_total - payment_total - credit_total
        AS balance_due
FROM invoices
```

AS - rename columns, if no keyword then use space

A SELECT statement with a single-line comment

```
-- The fourth column calculates the balance due
SELECT invoice_number, invoice_date, invoice_total,
    invoice_total - payment_total - credit_total
        AS balance_due
FROM invoices
```

SQL Programming Style Guideline

A SELECT statement that's difficult to read

```
select invoice_number, invoice_date, invoice_total,
payment_total, credit_total, invoice_total - payment_total -
credit_total as balance_due from invoices where invoice_total
- payment_total - credit_total > 0 order by invoice_date
```

A SELECT statement with a readable style

```
SELECT invoice_number, invoice_date, invoice_total,
    payment_total, credit_total,
    invoice_total - payment_total - credit_total
        AS balance_due
FROM invoices
WHERE invoice_total - payment_total - credit_total > 0
ORDER BY invoice_date
```

SQL Coding Style Guideline

- Capitalize all keywords.
- Use lowercase for the other code.
- Separate the words in names with underscores.
- Start each clause on a new line.
- Break long clauses into multiple lines.
- Indent continued lines.
- Use comments only for code that is hard to understand.
- Make sure that the comments are correct and up-to-date.

SQL DDL

To be covered later:

- Can use ALTER TABLE to add/drop columns in a table
- Can also create other relational database objects
  - Views, Indices, Sequences, etc

Views - virtual table
Sequences - to use Sequence generator

Other SQL-Related Terms

- PL/SQL
  - Procedural Language extension to SQL
  - Extensions
    - Control structures, error handling etc.
  - Sample code in next slide
- Embedded SQL
  - SQL commands embedded inside a programing language like Java

Sample PL/SQL Code

A CREATE PROCEDURE statement

```
CREATE OR REPLACE PROCEDURE update_invoices_credit_total
(
  invoice_number_param VARCHAR2,
  credit_total_param NUMBER
)
AS
BEGIN
  UPDATE invoices
  SET credit_total = credit_total_param
  WHERE invoice_number = invoice_number_param;

  COMMIT;
EXCEPTION
  WHEN OTHERS THEN
    ROLLBACK;
END;
/
```

PL/SQL block

error handling exception

OTHERS = type of error