Murach Chapter 4

How to Retrieve Data From Two or More Tables

Week 3, Lecture 5, Part 1

Knowledge Points in this lecture

- Basics about JOIN
- CROSS JOIN
- INNER JOIN
- Table Alias
- Column qualification
- Search condition and join condition
- Schema
- Ad hoc query
- Multiple JOIN conditions
- Explicit syntax of INNER JOIN
- Join 3 tables

Basics About JOIN

- Join
  - Combine columns from 2 or more tables into the same result set based on join conditions
  - Typically combine data based on primary key – foreign key relationship
- Join conditions
  - Typically use operator =
  - But can use any operator
- Explicit syntax of JOIN
  - Explicitly use keyword JOIN in the FROM clause of a SELECT statement

CROSS JOIN

- CROSS JOIN
  - Cartesian product of multiple tables listed in the FROM clause
  - FROM t1 CROSS JOIN t2
    - Combine each row in table t1 with each row in table t2
    - Generates |t1| x |t2| number of combined rows in the query result, where |t1|, |t2| are number of rows in t1, t2
- Given T1 = {2, 3}, T2 = {3, 5}, the Cartesian product of T1 and T2:

  T1 x T2 = {(2,3), (2, 5), (3, 3), (3, 5)}

CROSS JOIN

- Examples – Print all information about any combination of any vendor with any invoice

```
SELECT vendors.*, invoices.*
FROM vendors CROSS JOIN invoices;

SELECT *
FROM vendors CROSS JOIN invoices;
```

INNER JOIN

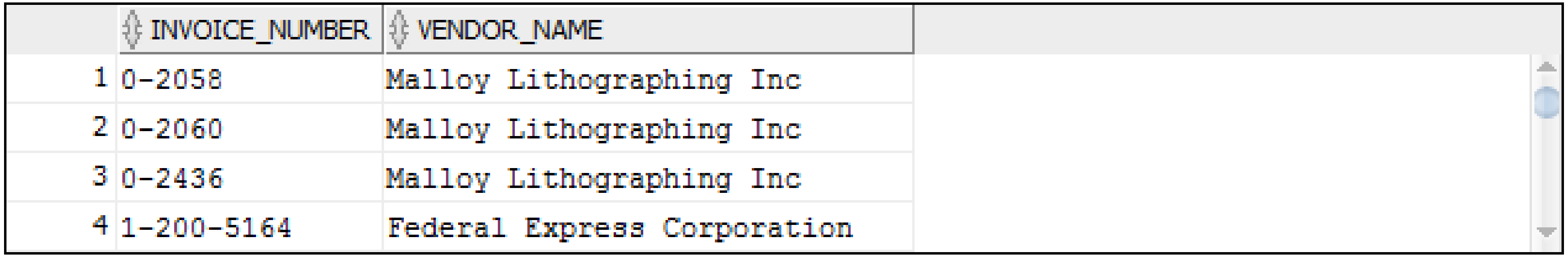
join based on matching condition

- INNER JOIN
  - Only combined rows that satisfy the join condition are included in the query result (i.e. result set)
  - INNER keyword is optional and typically omitted

A SELECT statement that joins two tables

```
SELECT invoice_number, vendor_name
FROM vendors INNER JOIN invoices
    ON vendors.vendor_id = invoices.vendor_id
ORDER BY invoice_numbe
```

The result set



	INVOICE_NUMBER	VENDOR_NAME
1	0-2058	Malloy Lithographing Inc
2	0-2060	Malloy Lithographing Inc
3	0-2436	Malloy Lithographing Inc
4	1-200-5164	Federal Express Corporation

(114 rows selected)

Table Alias, Column Qualification

Table Alias

- Alternative table name assigned to tables listed in FROM clause
- Used to shorten long names, and/or qualify column names
- Can not use the original table name once the table is assigned an alias

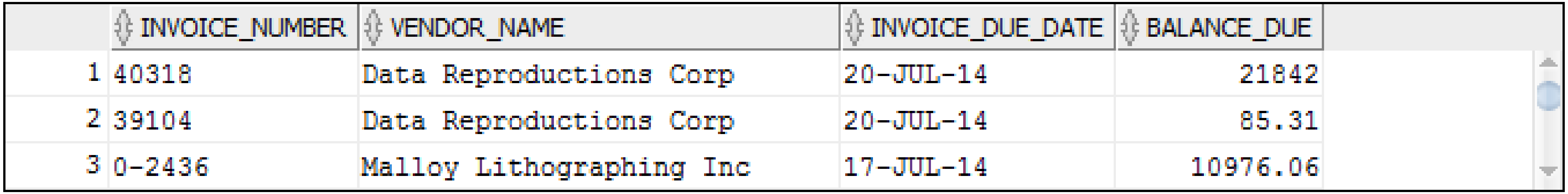
Column Qualification

- Use a table name or table alias and a dot operator to indicate where the column come from
- E.g. vendors.vendor_id, v.vendor_id

An inner join with aliases for all tables

```
SELECT invoice_number, vendor_name, invoice_due_date,
    (invoice_total - payment_total - credit_total)
        AS balance_due
FROM vendors v JOIN invoices i
    ON v.vendor_id = i.vendor_id
WHERE (invoice_total - payment_total - credit_total) > 0
ORDER BY invoice_due_date DESC
```

The result set



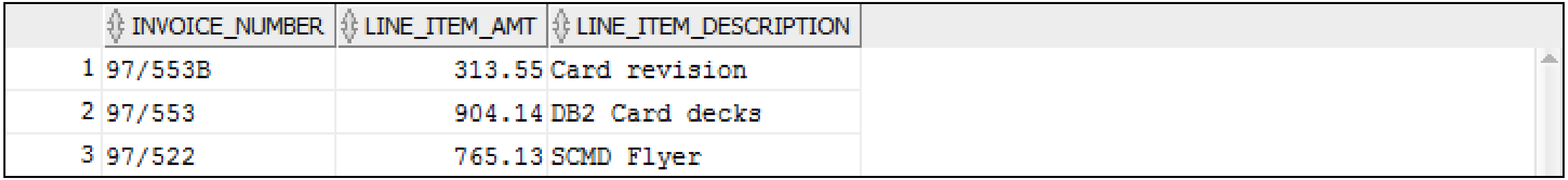
	INVOICE_NUMBER	VENDOR_NAME	INVOICE_DUE_DATE	BALANCE_DUE
1	40318	Data Reproductions Corp	20-JUL-14	21842
2	39104	Data Reproductions Corp	20-JUL-14	85.31
3	0-2436	Malloy Lithographing Inc	17-JUL-14	10976.06

```
(40 rows selected)
```

An inner join with an alias for only one table

```
SELECT invoice_number, line_item_amt,
    line_item_description
FROM invoices JOIN invoice_line_items line_items
    ON invoices.invoice_id = line_items.invoice_id
WHERE account_number = 540
ORDER BY invoice_date
```

The result set



	INVOICE_NUMBER	LINE_ITEM_AMT	LINE_ITEM_DESCRIPTION
1	97/553B	313.55	Card revision
2	97/553	904.14	DB2 Card decks
3	97/522	765.13	SCMD Flyer

(8 rows selected)

Join Condition and Search Condition

- Search Condition
  - Condition that involves columns from one table
  - Typically in a WHERE clause
- Join condition
  - Condition that compares columns from two different tables
  - Typically in a FROM clause:
    - FROM table1 JOIN table2 ON (join-condition)
- See examples in next slide

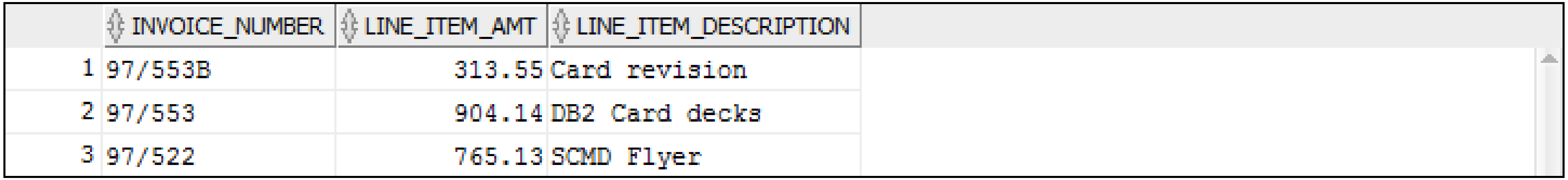
A Query with Search Condition and Join Condition

```
SELECT invoice_number, line_item_amt,
    line_item_description
FROM invoices JOIN invoice_line_items line_items
    ON invoices.invoice_id = line_items.invoice_id
WHERE account_number = 540
ORDER BY invoice_date
```

Join condition

Search condition

The result set



	INVOICE_NUMBER	LINE_ITEM_AMT	LINE_ITEM_DESCRIPTION
1	97/553B	313.55	Card revision
2	97/553	904.14	DB2 Card decks
3	97/522	765.13	SCMD Flyer

```
(8 rows selected)
```

Schema

- A DB user and the collection of DB objects owned by that user
  - schema = DB user
  - schema name = DB user name
- More technically, a set of metadata for all DB objects belonging to a DB user
- Examples -- schemas used in Murach book chapters
  - AP (Account Payable)
  - OM (Order Management)
  - EX (Examples)
- Created by DDL (Data Definition Language) statements

Schema and Database Objects

- Must log into the DB server as a DB user before accessing any DB object like a table
- Do NOT need schema name (i.e. user name) when accessing your own data
- Must use schema name (i.e. user name) for accessing objects in other schemas

The syntax of a table name that's qualified with a schema name

```
schema_name.table_name
```

A SQL statement that grants the SELECT permission in the OM schema to the AP schema

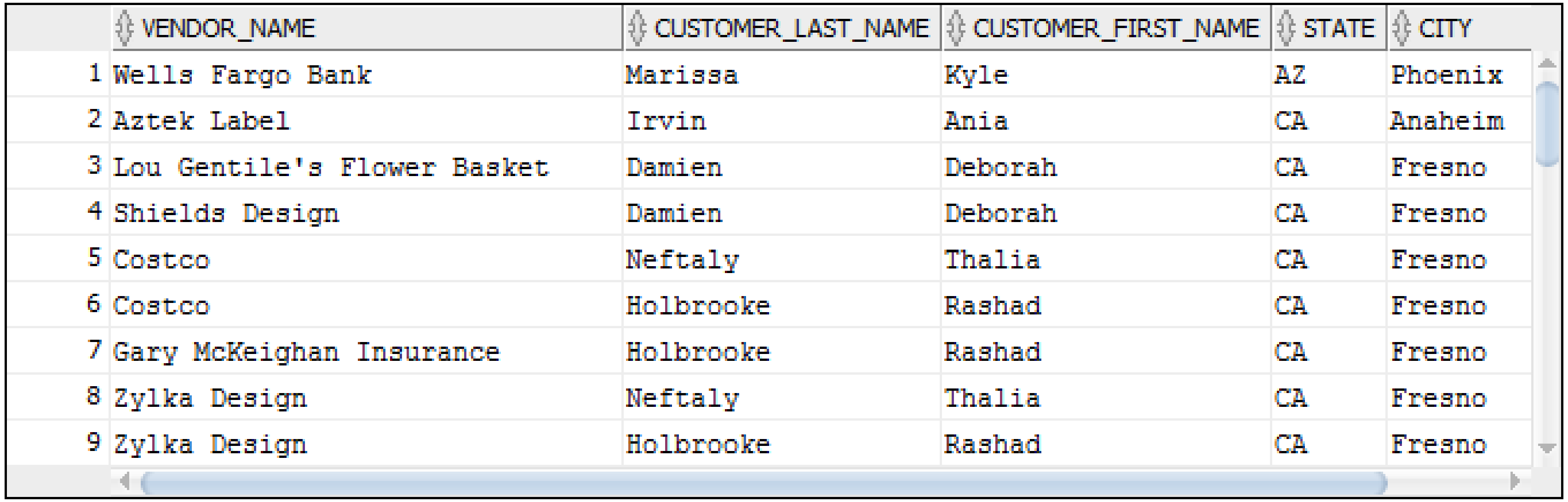
```
GRANT SELECT ON customers TO ap
```

A join with a table from another schema

```
SELECT vendor_name, customer_last_name,
    customer_first_name, vendor_state AS state,
    vendor_city AS city
FROM vendors v
    JOIN om.customers c
    ON v.vendor_zip_code = c.customer_zip
ORDER BY state, city
```

Join ap’s vendors to customers in om user
(Run it as user ap)

The result set



	VENDOR_NAME	CUSTOMER_LAST_NAME	CUSTOMER_FIRST_NAME	STATE	CITY
1	Wells Fargo Bank	Marissa	Kyle	AZ	Phoenix
2	Aztek Label	Irvin	Ania	CA	Anaheim
3	Lou Gentile's Flower Basket	Damien	Deborah	CA	Fresno
4	Shields Design	Damien	Deborah	CA	Fresno
5	Costco	Neftaly	Thalia	CA	Fresno
6	Costco	Holbrooke	Rashad	CA	Fresno
7	Gary McKeighan Insurance	Holbrooke	Rashad	CA	Fresno
8	Zylka Design	Neftaly	Thalia	CA	Fresno
9	Zylka Design	Holbrooke	Rashad	CA	Fresno

(37 rows)

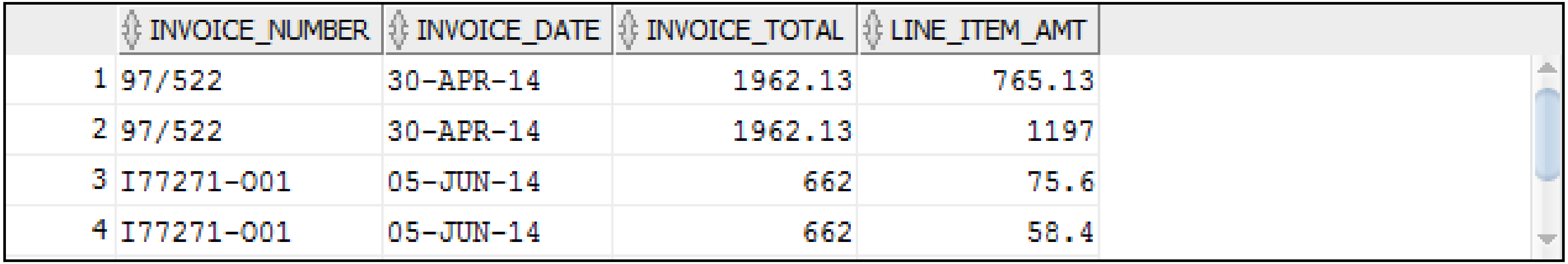
Ad Hoc Query

- Join data from multiple tables based on relationships that are not stored in the database
- Do not join data from multiple tables based on primary key and foreign key relationships.
- Example in the previous slide is an Ad Hoc query

An inner join with two conditions

```
SELECT invoice_number, invoice_date,
    invoice_total, line_item_amt
FROM invoices i JOIN invoice_line_items li
    ON (i.invoice_id = li.invoice_id) AND
       (i.invoice_total > li.line_item_amt)
ORDER BY invoice_number
```

The result set



	INVOICE_NUMBER	INVOICE_DATE	INVOICE_TOTAL	LINE_ITEM_AMT
1	97/522	30-APR-14	1962.13	765.13
2	97/522	30-APR-14	1962.13	1197
3	I77271-O01	05-JUN-14	662	75.6
4	I77271-O01	05-JUN-14	662	58.4

(6 rows selected)

The explicit syntax for an inner join

```
SELECT select_list
FROM table_1
    [INNER] JOIN table_2
        ON join_condition_1
   [[INNER] JOIN table_3
        ON join_condition_2]...
```

- [ ]: Optional
  - You don’t have to use INNER keyword in a JOIN.
  - Optionally, an inner join can include 3 or more tables in FROM clause.
- Explicit syntax
  - Explicitly use the keyword JOIN or INNER JOIN

The explicit syntax for an inner join that uses table aliases

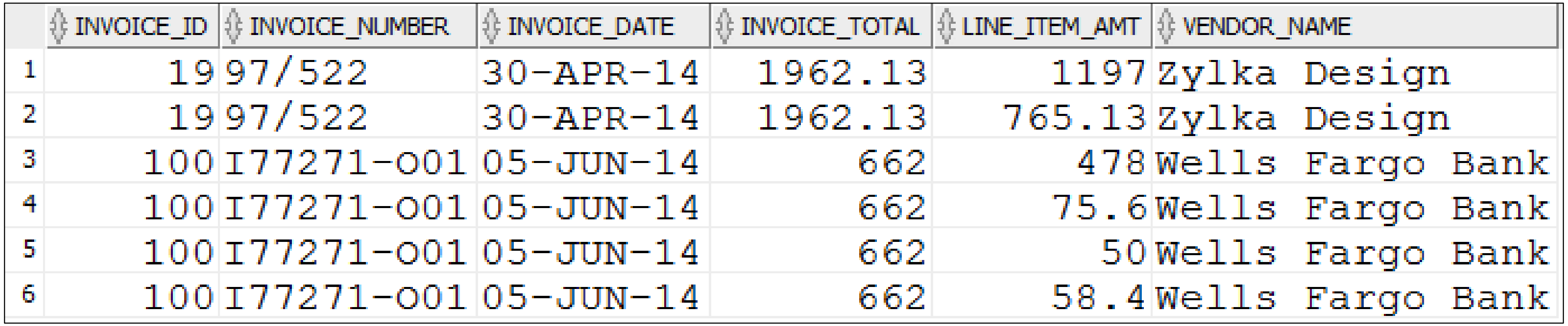
```
SELECT select_list
FROM table_1 n1
    [INNER] JOIN table_2 n2
        ON n1.column_name operator n2.column_name
   [[INNER] JOIN table_3 n3
        ON n2.column_name operator n3.column_name]...
```

- [ ]: Optional
  - You don’t have to use INNER keyword in a JOIN.
  - Optionally, an inner join can include 3 or more tables in FROM clause.
- Explicit syntax
  - Explicitly use the keyword JOIN or INNER JOIN

A SELECT statement that joins three tables

```
SELECT vendor_name, i.invoice_id, invoice_number,
       invoice_date, invoice_total, line_item_amt
FROM vendors v
    JOIN invoices i ON (v.vendor_id = i.vendor_id)
    JOIN invoice_line_items li
        ON (i.invoice_id = li.invoice_id) AND
           (i.invoice_total > li.line_item_amt)
ORDER BY invoice_number
```

The result set



	INVOICE_ID	INVOICE_NUMBER	INVOICE_DATE	INVOICE_TOTAL	LINE_ITEM_AMT	VENDOR_NAME
1	19	97/522	30-APR-14	1962.13	1197	Zylka Design
2	19	97/522	30-APR-14	1962.13	765.13	Zylka Design
3	100	I77271-O01	05-JUN-14	662	478	Wells Fargo Bank
4	100	I77271-O01	05-JUN-14	662	75.6	Wells Fargo Bank
5	100	I77271-O01	05-JUN-14	662	50	Wells Fargo Bank
6	100	I77271-O01	05-JUN-14	662	58.4	Wells Fargo Bank

```
(6 rows selected)
```