



# **Manipulating Data**

# Objectives

After completing this lesson, you should be able to do the following:

- Describe each data manipulation language (DML) statement
- Insert rows into a table
- Update rows in a table
- Delete rows from a table
- Control transactions

# Lesson Agenda

- Adding new rows in a table
  - INSERT statement
- Changing data in a table
  - UPDATE statement
- Removing rows from a table:
  - DELETE statement
  - TRUNCATE statement
- Database transactions control using COMMIT, ROLLBACK, and SAVEPOINT
- Read consistency
- FOR UPDATE clause in a SELECT statement

# Data Manipulation Language

- A DML statement is executed when you:
  - Add new rows to a table
  - Modify existing rows in a table
  - Remove existing rows from a table
- A *transaction* consists of a collection of DML statements that form a logical unit of work.

# Adding a New Row to a Table

## DEPARTMENTS

	DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
1	10	Administration	200	1700
2	20	Marketing	201	1800
3	50	Shipping	124	1500
4	60	IT	103	1400
5	80	Sales	149	2500
6	90	Executive	100	1700
7	110	Accounting	205	1700
8	190	Contracting	(null)	1700

70	Public Relations	100	1700
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**New  
row**

**Insert new row  
into the  
DEPARTMENTS table.**

	DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
1	10	Administration	200	1700
2	20	Marketing	201	1800
3	50	Shipping	124	1500
4	60	IT	103	1400
5	80	Sales	149	2500
6	90	Executive	100	1700
7	110	Accounting	205	1700
8	190	Contracting	(null)	1700

9	70	Public Relations	100	1700
---	----	------------------	-----	------

# INSERT Statement Syntax

- Add new rows to a table by using the `INSERT` statement:

```
INSERT INTO  table [(column [, column...])]  
VALUES      (value [, value...]);
```

- With this syntax, only one row is inserted at a time.

# Inserting New Rows

- Insert a new row containing values for each column.
- List values in the default order of the columns in the table.
- Optionally, list the columns in the `INSERT` clause.

```
INSERT INTO departments (department_id,  
                        department_name, manager_id, location_id)  
VALUES (70, 'Public Relations', 100, 1700);
```

```
1 rows inserted
```

- Enclose character and date values within single quotation marks.

# Inserting Rows with Null Values

- Implicit method: Omit the column from the column list.

```
INSERT INTO departments (department_id,  
                          department_name)  
VALUES (30, 'Purchasing');
```

```
1 rows inserted
```

- Explicit method: Specify the NULL keyword in the VALUES clause.

```
INSERT INTO departments  
VALUES (100, 'Finance', NULL, NULL);
```

```
1 rows inserted
```



# Inserting Special Values

The SYSDATE function records the current date and time.

```
INSERT INTO employees (employee_id,  
                        first_name, last_name,  
                        email, phone_number,  
                        hire_date, job_id, salary,  
                        commission_pct, manager_id,  
                        department_id)  
VALUES  
      (113,  
       'Louis', 'Popp',  
       'LPOPP', '515.124.4567',  
       SYSDATE, 'AC_ACCOUNT', 6900,  
       NULL, 205, 110);
```

1 rows inserted

# Inserting Specific Date and Time Values

- Add a new employee.

```
INSERT INTO employees
VALUES      (114,
            'Den', 'Raphealy',
            'DRAPHEAL', '515.127.4561',
            TO_DATE('FEB 3, 1999', 'MON DD, YYYY'),
            'SA_REP', 11000, 0.2, 100, 60);
```

1 rows inserted

- Verify your addition.

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID	SALARY	COMMISSION_PCT
114	Den	Raphealy	DRAPHEAL	515.127.4561	03-FEB-99	SA_REP	11000	0.2

# Creating a Script

- Use & substitution in a SQL statement to prompt for values.
- & is a placeholder for the variable value.

```
INSERT INTO departments
      (department_id, department_name, location_id)
VALUES (&department_id, '&department_name', &location);
```

The image shows three overlapping dialog boxes titled "Enter Substitution Variable". The first dialog box in the background is for "DEPARTMENT\_ID:" with the value "40" entered and an "OK" button. The second dialog box in the middle is for "DEPARTMENT\_NAME:" with the value "Human Resources" entered and an "OK" button. The third dialog box in the foreground is for "LOCATION:" with the value "2500" entered, and both "OK" and "Cancel" buttons.

# Copying Rows from Another Table

- Write your `INSERT` statement with a subquery:

```
INSERT INTO sales_reps(id, name, salary, commission_pct)
  SELECT employee_id, last_name, salary, commission_pct
 FROM   employees
WHERE  job_id LIKE '%REP%';
```

4 rows inserted

- Do not use the `VALUES` clause.
- Match the number of columns in the `INSERT` clause to those in the subquery.
- Inserts all the rows returned by the subquery in the table, `sales_reps`.

# Lesson Agenda

- Adding new rows in a table
  - INSERT statement
- Changing data in a table
  - UPDATE statement
- Removing rows from a table:
  - DELETE statement
  - TRUNCATE statement
- Database transactions control using COMMIT, ROLLBACK, and SAVEPOINT
- Read consistency
- FOR UPDATE clause in a SELECT statement

# Changing Data in a Table

## EMPLOYEES

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	SALARY	MANAGER_ID	COMMISSION_PCT	DEPARTMENT_ID
100	Steven	King	24000	(null)	(null)	90
101	Neena	Kochhar	17000	100	(null)	90
102	Lex	De Haan	17000	100	(null)	90
103	Alexander	Hunold	9000	102	(null)	60
104	Bruce	Ernst	6000	103	(null)	60
107	Diana	Lorentz	4200	103	(null)	60
124	Kevin	Mourgos	5800	100	(null)	50

Update rows in the EMPLOYEES table:

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	SALARY	MANAGER_ID	COMMISSION_PCT	DEPARTMENT_ID
100	Steven	King	24000	(null)	(null)	90
101	Neena	Kochhar	17000	100	(null)	90
102	Lex	De Haan	17000	100	(null)	90
103	Alexander	Hunold	9000	102	(null)	80
104	Bruce	Ernst	6000	103	(null)	80
107	Diana	Lorentz	4200	103	(null)	80
124	Kevin	Mourgos	5800	100	(null)	50

# UPDATE Statement Syntax

- Modify existing values in a table with the `UPDATE` statement:

```
UPDATE      table  
SET         column = value [, column = value, ...]  
[WHERE      condition];
```

- Update more than one row at a time (if required).

# Updating Rows in a Table

- Values for a specific row or rows are modified if you specify the `WHERE` clause:

```
UPDATE employees
SET    department_id = 50
WHERE  employee_id = 113;
```

1 rows updated

- Values for all the rows in the table are modified if you omit the `WHERE` clause:

```
UPDATE    copy_emp
SET       department_id = 110;
```

22 rows updated

- Specify `SET column_name= NULL` to update a column value to `NULL`.



# Updating Two Columns with a Subquery

Update employee 113's job and salary to match those of employee 205.

```
UPDATE employees
SET   job_id = (SELECT job_id
                FROM   employees
                WHERE  employee_id = 205),
      salary = (SELECT salary
                FROM   employees
                WHERE  employee_id = 205)
WHERE employee_id = 113;
```

```
1 rows updated
```

# Updating Rows Based on Another Table

Use the subqueries in the `UPDATE` statements to update row values in a table based on values from another table:

```
UPDATE copy_emp
SET    department_id = (SELECT department_id
                        FROM employees
                        WHERE employee_id = 100)
WHERE  job_id        = (SELECT job_id
                        FROM employees
                        WHERE employee_id = 200);
```

1 rows updated

# Lesson Agenda

- Adding new rows in a table
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- Removing rows from a table:
  - DELETE statement
  - TRUNCATE statement
- Database transactions control using COMMIT, ROLLBACK, and SAVEPOINT
- Read consistency
- FOR UPDATE clause in a SELECT statement

# Removing a Row from a Table

## DEPARTMENTS

	DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
1	10	Administration	200	1700
2	20	Marketing	201	1800
3	50	Shipping	124	1500
4	60	IT	103	1400
5	80	Sales	149	2500
6	90	Executive	100	1700
7	110	Accounting	205	1700
8	190	Contracting	(null)	1700

**Delete a row from the DEPARTMENTS table:**

	DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
1	10	Administration	200	1700
2	20	Marketing	201	1800
3	50	Shipping	124	1500
4	60	IT	103	1400
5	80	Sales	149	2500
6	90	Executive	100	1700
7	110	Accounting	205	1700

# DELETE Statement

You can remove existing rows from a table by using the DELETE statement:

```
DELETE [FROM]    table  
[WHERE          condition] ;
```

# Deleting Rows from a Table

- Specific rows are deleted if you specify the `WHERE` clause:

```
DELETE FROM departments  
WHERE department_name = 'Finance';
```

```
1 rows deleted
```

- All rows in the table are deleted if you omit the `WHERE` clause:

```
DELETE FROM copy_emp;
```

```
22 rows deleted
```

# Deleting Rows Based on Another Table

Use the subqueries in the `DELETE` statements to remove rows from a table based on values from another table:

```
DELETE FROM employees
WHERE  department_id =
      (SELECT department_id
       FROM   departments
       WHERE  department_name
              LIKE '%Public%');
```

1 rows deleted

# TRUNCATE Statement

- Removes all rows from a table, leaving the table empty and the table structure intact
- Is a data definition language (DDL) statement rather than a DML statement; cannot easily be undone
- Syntax:

```
TRUNCATE TABLE table_name;
```

- Example:

```
TRUNCATE TABLE copy_emp;
```



# Lesson Agenda

- Adding new rows in a table
  - INSERT statement
- Changing data in a table
  - UPDATE statement
- Removing rows from a table:
  - DELETE statement
  - TRUNCATE statement
- **Database transactions control using COMMIT, ROLLBACK, and SAVEPOINT**
- Read consistency
- FOR UPDATE clause in a SELECT statement

# Database Transactions

A database transaction consists of one of the following:

- DML statements that constitute one consistent change to the data
- One DDL statement
- One data control language (DCL) statement

# Database Transactions: Start and End

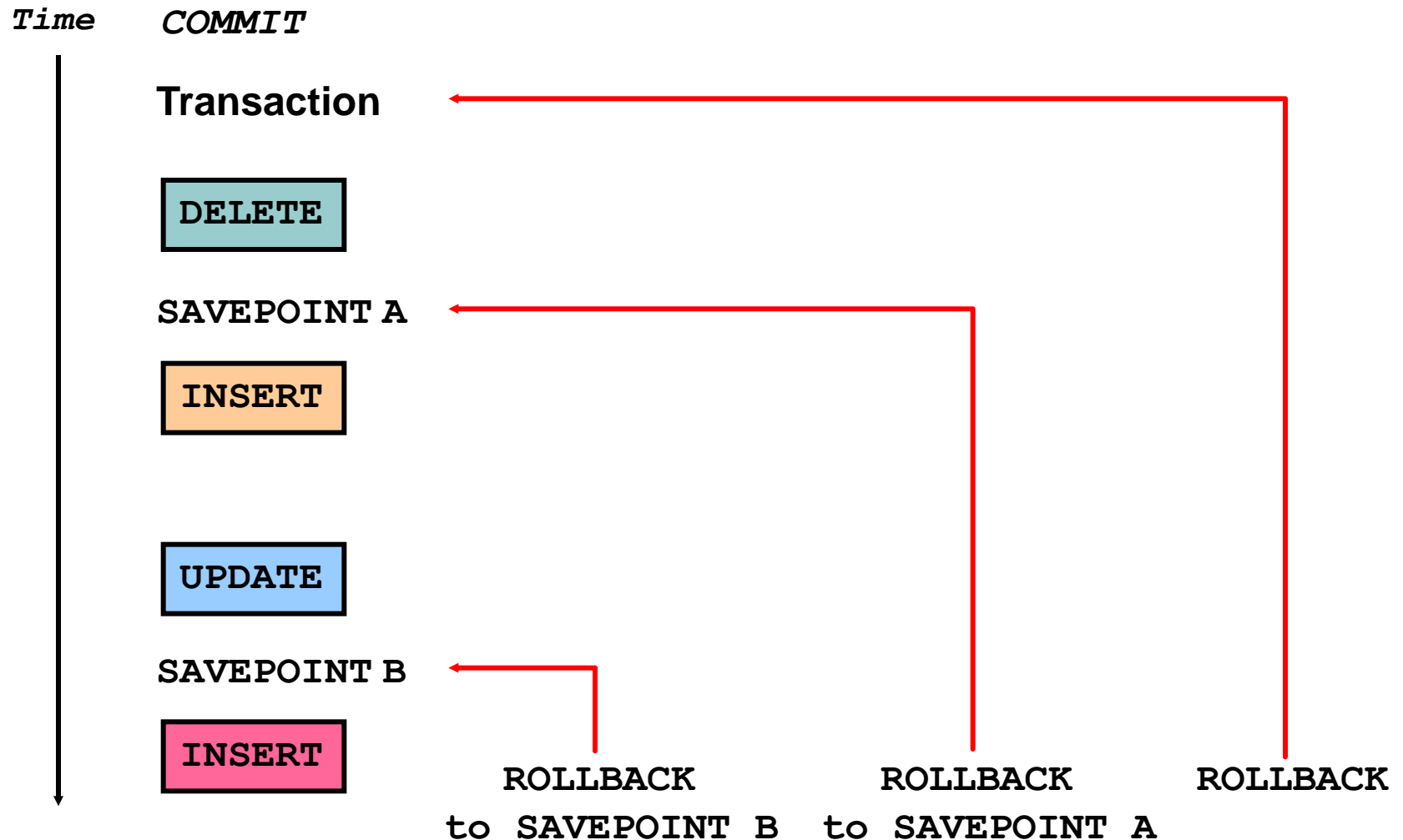
- Begin when the first DML SQL statement is executed.
- End with one of the following events:
  - A `COMMIT` or `ROLLBACK` statement is issued.
  - A DDL or DCL statement executes (automatic commit).
  - The user exits SQL Developer or SQL\*Plus.
  - The system crashes.

# Advantages of COMMIT and ROLLBACK Statements

With COMMIT and ROLLBACK statements, you can:

- Ensure data consistency
- Preview data changes before making changes permanent
- Group logically-related operations

# Explicit Transaction Control Statements



# Rolling Back Changes to a Marker

- Create a marker in the current transaction by using the `SAVEPOINT` statement.
- Roll back to that marker by using the `ROLLBACK TO SAVEPOINT` statement.

```
UPDATE...
```

```
SAVEPOINT update_done;
```

```
SAVEPOINT update_done succeeded.
```

```
INSERT...
```

```
ROLLBACK TO update_done;
```

```
ROLLBACK TO succeeded.
```

# Implicit Transaction Processing

- An automatic commit occurs in the following circumstances:
  - A DDL statement is issued
  - A DCL statement is issued
  - Normal exit from SQL Developer or SQL\*Plus, without explicitly issuing `COMMIT` or `ROLLBACK` statements
- An automatic rollback occurs when there is an abnormal termination of SQL Developer or SQL\*Plus or a system failure.

# State of the Data Before COMMIT or ROLLBACK

- The previous state of the data can be recovered.
- The current user can review the results of the DML operations by using the `SELECT` statement.
- Other users *cannot* view the results of the DML statements issued by the current user.
- The affected rows are *locked*; other users cannot change the data in the affected rows.



# State of the Data After COMMIT

- Data changes are saved in the database.
- The previous state of the data is overwritten.
- All users can view the results.
- Locks on the affected rows are released; those rows are available for other users to manipulate.
- All savepoints are erased.

# Committing Data

- Make the changes:

```
DELETE FROM employees  
WHERE  employee_id = 99999;
```

```
1 rows deleted
```

```
INSERT INTO departments  
VALUES (290, 'Corporate Tax', NULL, 1700);
```

```
1 rows inserted
```

- Commit the changes:

```
COMMIT;
```

```
COMMIT succeeded.
```

# State of the Data After ROLLBACK

Discard all pending changes by using the `ROLLBACK` statement:

- Data changes are undone.
- Previous state of the data is restored.
- Locks on the affected rows are released.

```
DELETE FROM copy_emp;  
ROLLBACK ;
```

# State of the Data After ROLLBACK: Example

```
DELETE FROM test;  
25,000 rows deleted.
```

```
ROLLBACK;  
Rollback complete.
```

```
DELETE FROM test WHERE id = 100;  
1 row deleted.
```

```
SELECT * FROM test WHERE id = 100;  
No rows selected.
```

```
COMMIT;  
Commit complete.
```

# Statement-Level Rollback

- If a single DML statement fails during execution, only that statement is rolled back.
- The Oracle server implements an implicit savepoint.
- All other changes are retained.
- The user should terminate transactions explicitly by executing a `COMMIT` or `ROLLBACK` statement.

# Lesson Agenda

- Adding new rows in a table
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- FOR UPDATE clause in a SELECT statement

# Read Consistency

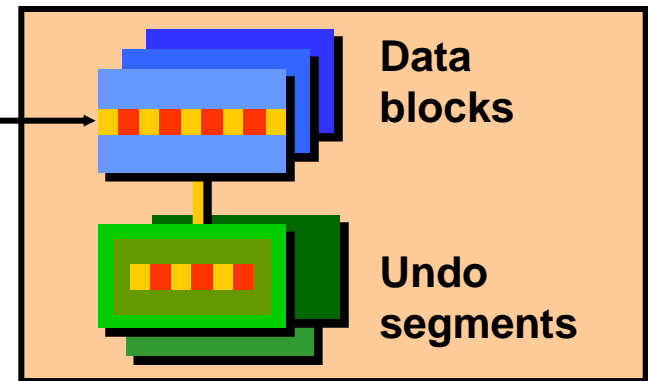
- Read consistency guarantees a consistent view of the data at all times.
- Changes made by one user do not conflict with the changes made by another user.
- Read consistency ensures that, on the same data:
  - Readers do not wait for writers
  - Writers do not wait for readers
  - Writers wait for writers

# Implementing Read Consistency

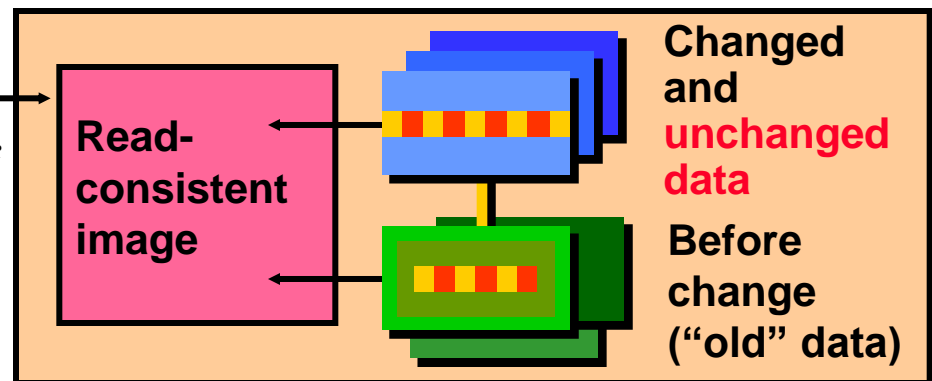
User A



```
UPDATE employees  
SET    salary = 7000  
WHERE  last_name = 'Grant';
```



```
SELECT *  
FROM userA.employees;
```



User B



# Lesson Agenda

- Adding new rows in a table
  - INSERT statement
- Changing data in a table
  - UPDATE statement
- Removing rows from a table:
  - DELETE statement
  - TRUNCATE statement
- Database transactions control using COMMIT, ROLLBACK, and SAVEPOINT
- Read consistency
- FOR UPDATE **clause** in a SELECT **statement**

# FOR UPDATE Clause in a SELECT Statement

- Locks the rows in the EMPLOYEES table where job\_id is SA\_REP.

```
SELECT employee_id, salary, commission_pct, job_id
FROM employees
WHERE job_id = 'SA_REP'
FOR UPDATE
ORDER BY employee_id;
```

- Lock is released only when you issue a ROLLBACK or a COMMIT.
- If the SELECT statement attempts to lock a row that is locked by another user, then the database waits until the row is available, and then returns the results of the SELECT statement.

# FOR UPDATE Clause: Examples

- You can use the `FOR UPDATE` clause in a `SELECT` statement against multiple tables.

```
SELECT e.employee_id, e.salary, e.commission_pct
FROM employees e JOIN departments d
USING (department_id)
WHERE job_id = 'ST_CLERK'
AND location_id = 1500
FOR UPDATE
ORDER BY e.employee_id;
```

- Rows from both the `EMPLOYEES` and `DEPARTMENTS` tables are locked.
- Use `FOR UPDATE OF column_name` to qualify the column you intend to change, then only the rows from that specific table are locked.

# Summary

In this lesson, you should have learned how to use the following statements:

Function	Description
INSERT	Adds a new row to the table
UPDATE	Modifies existing rows in the table
DELETE	Removes existing rows from the table
TRUNCATE	Removes all rows from a table
COMMIT	Makes all pending changes permanent
SAVEPOINT	Is used to roll back to the savepoint marker
ROLLBACK	Discards all pending data changes
FOR UPDATE clause in SELECT	Locks rows identified by the SELECT query

# Practice 9: Overview

This practice covers the following topics:

- Inserting rows into the tables
- Updating and deleting rows in the table
- Controlling transactions