



Stored Procedures and Triggers in SQL

Learning Objectives

By the end of this lesson, you will be able to:

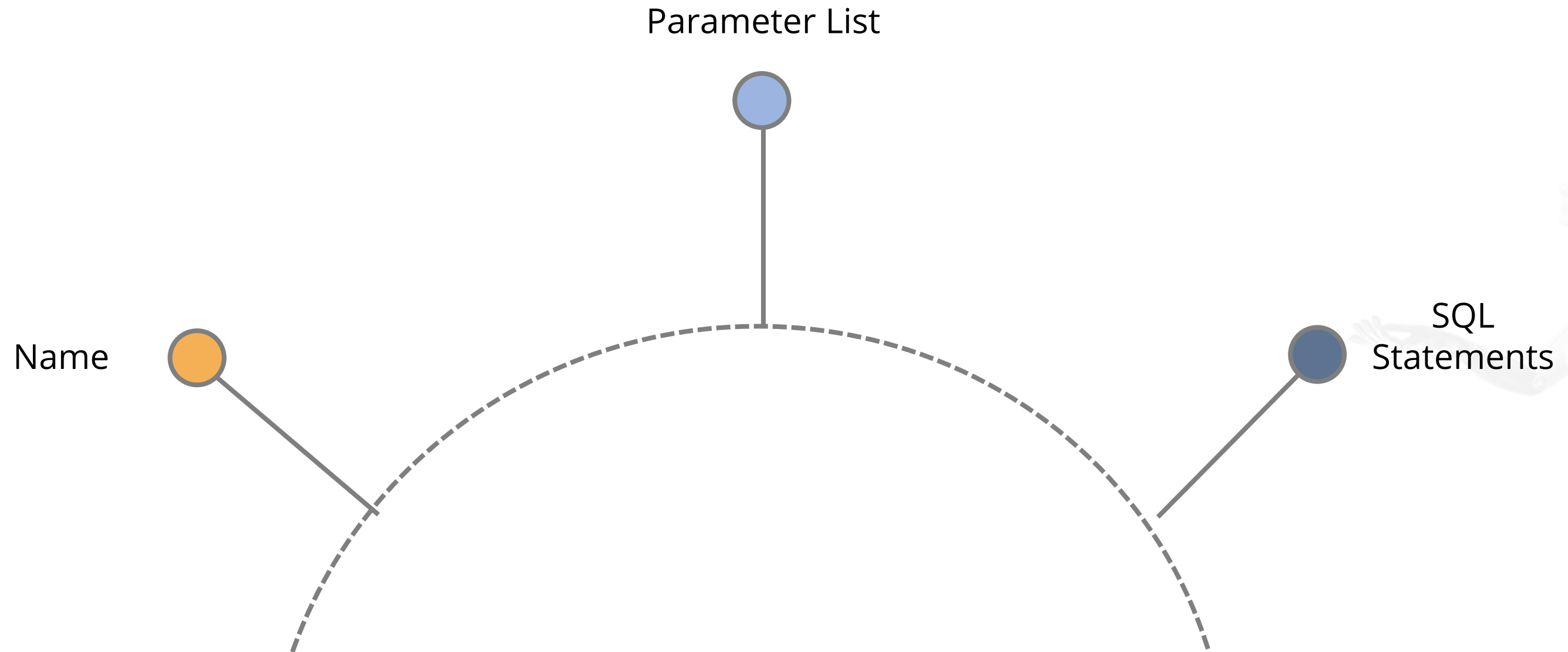
- 🕒 List the advantages of stored procedures
- 🕒 Interpret the various aspects of stored procedures
- 🕒 Outline the different types of error handlers
- 🕒 Analyze SQL triggers



Introduction to Stored Procedures

Stored Procedures

A stored procedure is a collection of precompiled SQL commands in a database.



When a procedure calls itself, then it is called a recursive stored procedure.

Stored Procedures

The explanation of each parameter in the stored procedure syntax is given below:

Procedure Name

- Refers to the name of the stored procedure

Declaration Section

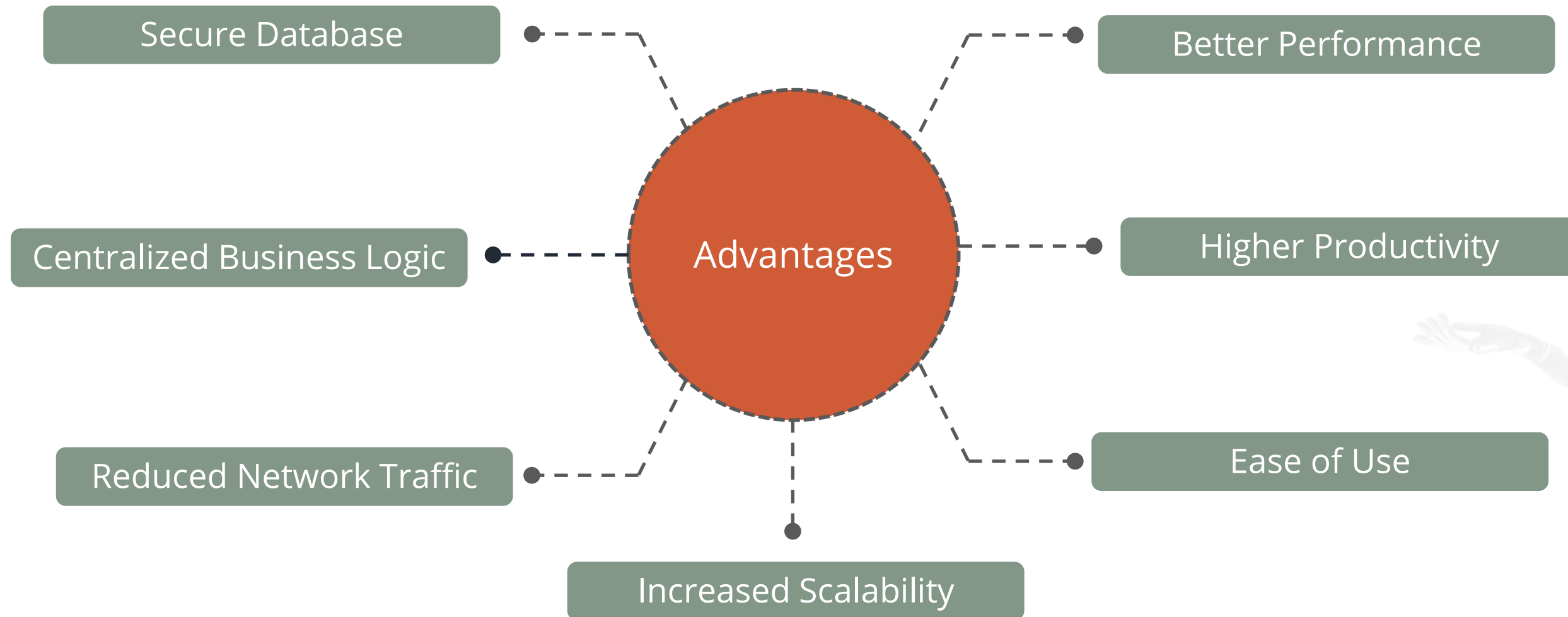
- Refers to the declarations of all variables

Executable Section

- Refers to the section of code that is executable

Advantages of Stored Procedures

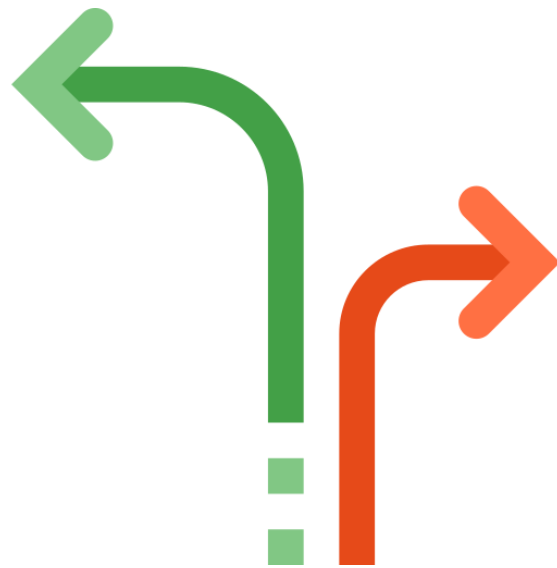
Advantages of Stored Procedures



Working with Stored Procedures

Changing the Default Delimiter

MySQL Workbench uses the delimiter (;) to separate statements and execute each statement distinctly.



- If MySQL Workbench is used to define a stored procedure with semicolon characters, then it considers the whole stored procedure as multiple statements.
- To tackle this, redefine the delimiter temporarily. This will pass the whole stored procedure to the MySQL workbench as a single statement.
- The command to redefine delimiter is **DELIMITER delimiter_character**.

Note: Backslash (\) is an escape character, and it must be avoided in MySQL.

Creating Stored Procedures

CREATE PROCEDURE keywords are used to create stored procedures.

SYNTAX

```
CREATE PROCEDURE procedure_name (parameter_list)
BEGIN
    statements;
END
```

In MySQL, code is written between the BEGIN and END keywords. The delimiter character is placed after END to conclude the procedure statement.

Executing Stored Procedures

To execute the stored procedure, you can use the following syntax with

CALL [Procedure Name] ([Parameters])

SYNTAX

```
CALL [Procedure Name] ([Parameters])
```

If the procedure has parameters, then the parameter values must be specified in the parenthesis.

Removing Stored Procedures

DROP PROCEDURE statement is used to delete stored procedures.

SYNTAX

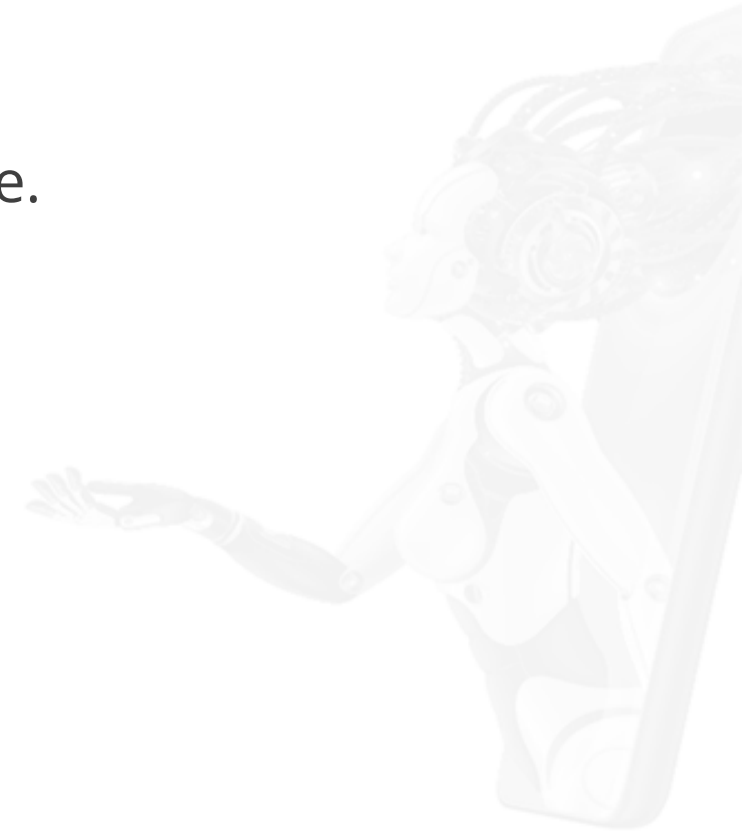
```
DROP PROCEDURE [IF EXISTS] stored_procedure_name;
```

- If you drop a procedure that does not exist without using the IF EXISTS option, MySQL shows an error.
- If you use the IF EXISTS option for the same condition, then MySQL shows a warning.

Stored Procedures: Example

Problem Statement: You are a junior DB administrator in your company. Your manager has asked you to retrieve data on employees with more than five years of experience, using a single command.

Objective: Use a stored procedure to retrieve the required data anytime.



Stored Procedures: Example

Step 1: You have a table on employees with details, such as employee ID, first name, last name, gender, role name, department, experience, country, and continent.

	Emp_ID	Emp_Name	Role_name	Dept	Experience
▶	260	Roy	Senior Data Scientist	Retail	7
	620	Katrina	Junior Data Scientist	Retail	2
	430	Steve	Associate Data Scientist	Finance	4
	160	William	Lead Data Scientist	Automotive	12
	52	Diana	Senior Data Scientist	Healthcare	6
	366	Clair	Associate Data Scientist	Automotive	3
	403	John	Lead Data Scientist	Finance	10



Stored Procedures: Example

Step 2: Create a stored procedure that displays the employees with more than five years of experience using the following command.

QUERY

```
DELIMITER &&  
CREATE PROCEDURE get_mid_experience()  
BEGIN  
SELECT * FROM Emp_Table WHERE experience > 5;  
END &&
```

Stored Procedures: Example

Step 3: Call for the stored procedure to return the results based on the specified condition.

QUERY

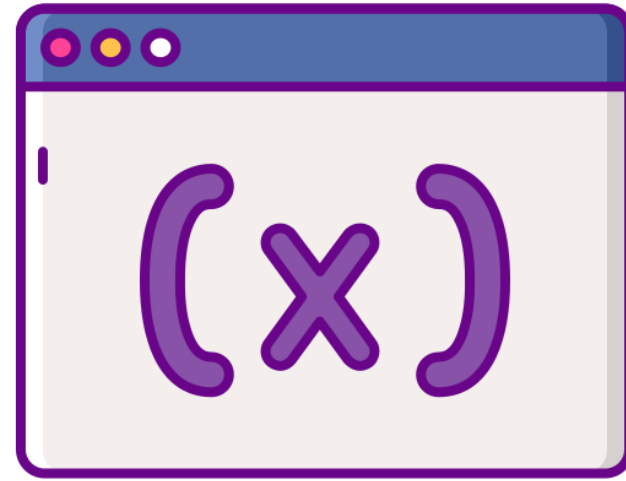
```
CALL get_mid_experience();
```

Output:

	Emp_ID	Emp_Name	Role_name	Dept	Experience
▶	260	Roy	Senior Data Scientist	Retail	7
	160	William	Lead Data Scientist	Automotive	12
	52	Diana	Senior Data Scientist	Healthcare	6
	403	John	Lead Data Scientist	Finance	10

Using Variables in Stored Procedures

Variable is a named data object whose value can be changed during stored procedure execution.



They are used to store immediate results and are local to the stored procedure.

Declaring and Assigning Variables

DECLARE and SET keywords are used to declare and set variables.

Declaring Variables

```
DECLARE variable_name  
datatype(size) [DEFAULT  
default_value];
```

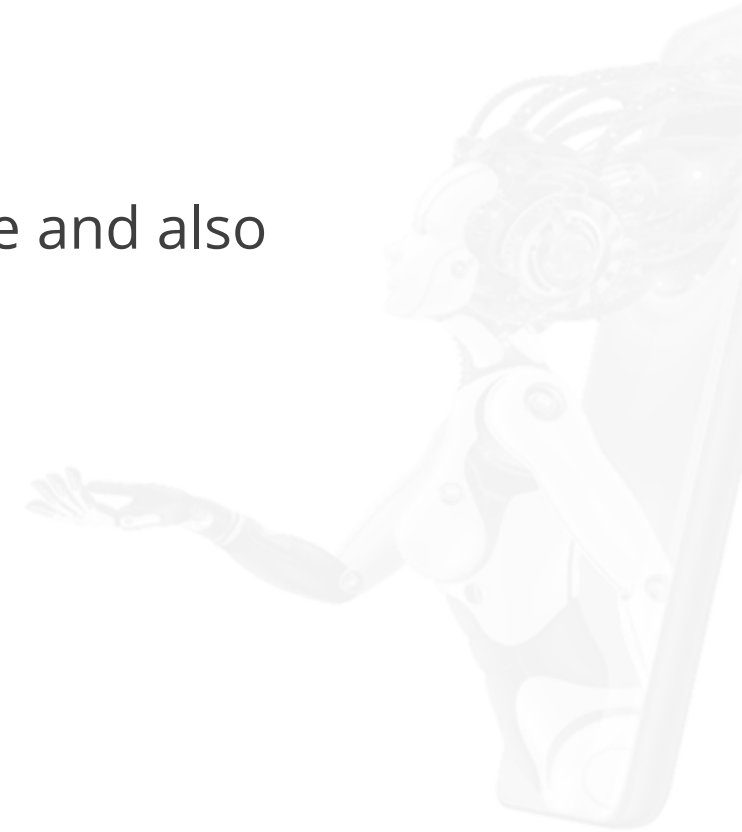
Assigning Variables

```
SET variable_name = value;
```

Declaring and Assigning Variables: Example

Problem statement: You are a junior DB administrator, and your manager has asked you to identify the total number of employees in the employee table created earlier.

Objectives: Use the stored procedure to view the number of employees anytime and also declare a variable for total employees.



Declaring and Assigning Variables: Example

Step 1: Using the same employee table as earlier, create a stored procedure and declare a default variable 0.

QUERY

```
DELIMITER &&
CREATE PROCEDURE get_total_employees()
BEGIN
DECLARE totalemployee INT DEFAULT 0;
SELECT COUNT (*)
INTO totalemployee
FROM Emp_Table;
SELECT totalemployee;
END &&
DELIMITER ;
```


Declaring and Assigning Variables: Example

Step 2: Use the CALL function to view the stored procedure results.

QUERY

```
CALL get_total_employees()
```

Output:

	totalemployee
▶	7



Scope of Variables

Scope of a variable refers to the lifetime of a variable.

A variable declared inside the stored procedure will be out of scope when it reaches END.

A variable declared inside the block BEGIN END will be out of scope at END.

Two or more variables with the same name can be declared in MySQL.

Note: A variable that begins with @ is called a session variable. It is accessible until the session ends.

Stored Procedures That Return Multiple Values

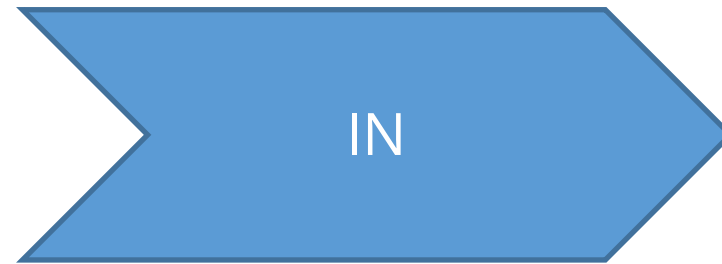
Parameter refers to a placeholder for a variable to store a value of a data type.



Generally, MySQL stored functions return a single value. To obtain multiple values, use stored procedures with INOUT or OUT parameters.

Stored Procedures That Return Multiple Values (IN)

This is the default mode, and parameter is the input here. The calling program must pass an argument to the stored procedure when it is defined.

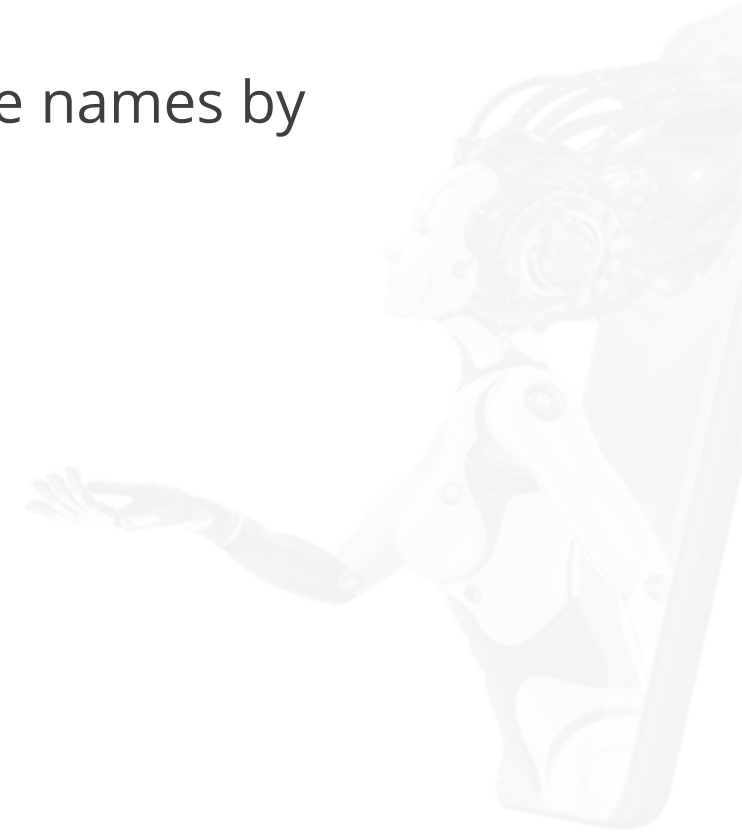


- Values are protected in an IN parameter.
- When the values in the parameter are changed, the original value remains unchanged after the stored procedure ends.

Stored Procedures That Return Multiple Values: Example (IN)

Problem Statement: You are a junior DB administrator in your organization. Your manager has asked you to list the employee names in the automotive department.

Objective: Create a stored procedure with an IN parameter to extract employee names by specifying the department name.



Stored Procedures That Return Multiple Values: Example (IN)

Step 1: Create a procedure names employee of auto. Keep the department as the IN parameter.

QUERY

```
CREATE PROCEDURE Employee_of_Auto(  
    IN Automotive VARCHAR(255)  
)  
BEGIN  
    SELECT Emp_Name, Dept  
    FROM Emp_Table  
    WHERE Dept = "Automotive";  
END
```


Stored Procedures That Return Multiple Values: Example (IN)

Step 2: Call the procedure with the mentioned department.

QUERY

```
CALL Emp_of_Auto("Automotive");
```

Output:

	Emp_Name	Dept
▶	William	Automotive
	Clair	Automotive



Stored Procedures That Return Multiple Values (OUT)

This parameter is used to pass a parameter as an output. Its value can be changed inside the stored procedure.

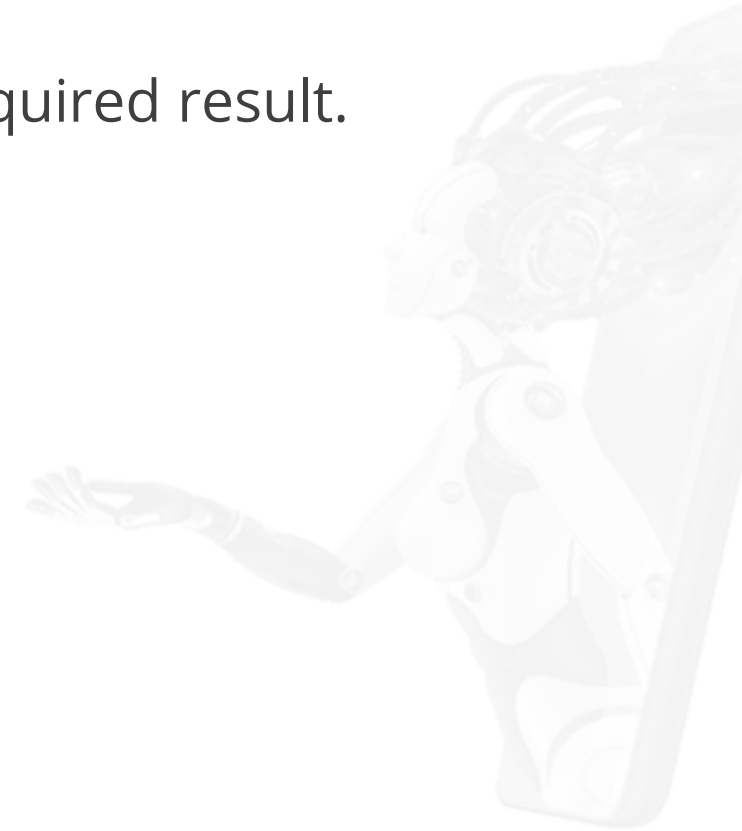


The initial value of the OUT parameter cannot be accessed by the stored procedure when it starts.

Stored Procedures That Return Multiple Values: Example (OUT)

Problem Statement: You are a junior DB administrator in your organization. Your manager has asked you to count the employees in the retail department.

Objective: Create a stored procedure with an OUT parameter and extract the required result.



Stored Procedures That Return Multiple Values: Example (OUT)

Step 1: Create a procedure called employee count in retail with the OUT parameter to count the employees in the retail department.

QUERY

```
CREATE PROCEDURE Emp_Count_in_Retail ( OUT total_Emp INT)
BEGIN
SELECT count(Emp_ID) INTO total_Emp FROM Emp_Table WHERE Dept
= "Retail";
END &&
```



Stored Procedures That Return Multiple Values: Example (OUT)

Step 2: Call the created procedure. To store the returned value, pass a session variable named @Retail_Employees. Select values from these in a separate value called employee retail.

QUERY

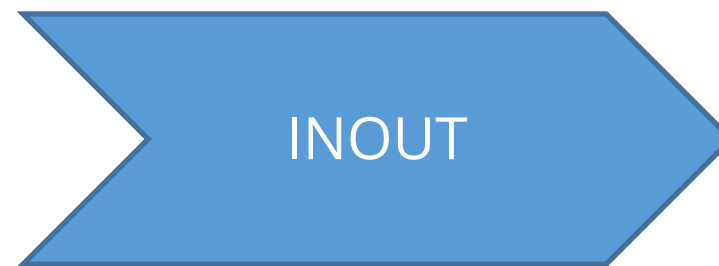
```
CALL Emp_Count_in_Retail (@Reatil_Employees);  
Select @Retail_Employees AS EmployeeRetail;
```

Output:

	EmployeeRetail
▶	2

Stored Procedures That Return Multiple Values (IN OUT)

This is a combination of IN and OUT parameters.

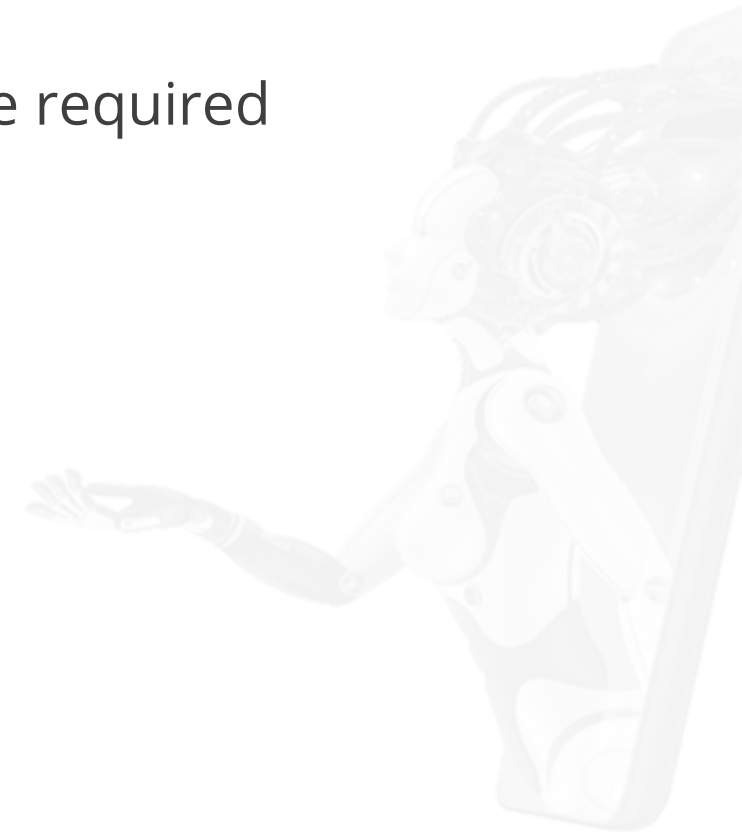


This specifies that the calling program can pass the argument and the stored procedure can modify the INOUT parameter.

Stored Procedures That Return Multiple Values (IN OUT)

Problem Statement: You are a junior DB administrator in your organization. Your manager wants to track total number of changes made each time when there is a new addition to an existing database.

Objective: Create a stored procedure with an IN OUT parameter to display the required count.



Stored Procedures That Return Multiple Values (IN OUT)

Step 1: Create a procedure iteration with count as the IN OUT parameter and increment as the IN parameter.

QUERY

```
CREATE PROCEDURE
Iterations (INOUT count int, IN increment int)
BEGIN
SET count = count + increment;
END
```



Stored Procedures That Return Multiple Values (IN OUT)

Step 2: Set Iterations to zero. Call the procedure with the variable when there is one change; repeat the process when there are five changes.

QUERY

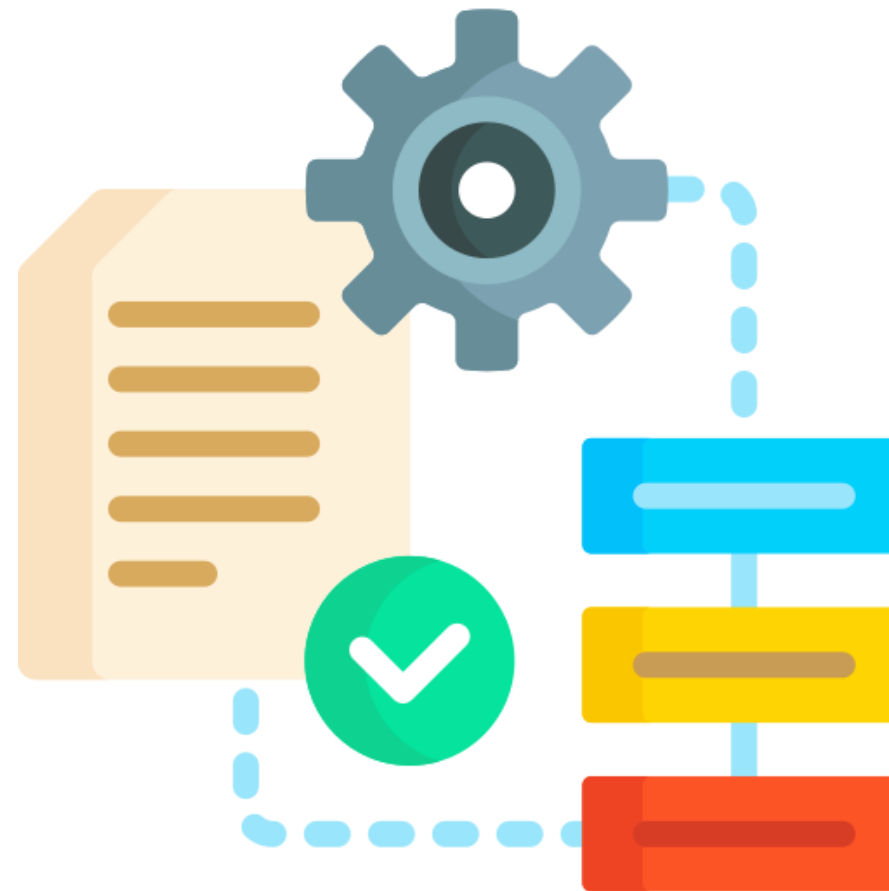
```
SET @Iterations = 0;  
CALL Iterations (@Iterations, 1);  
select @Iterations;  
CALL Iterations (@Iterations, 5);  
select @Iterations;
```

Output:

	@Iterations
▶	6

Stored Procedures with One and Multiple Parameters

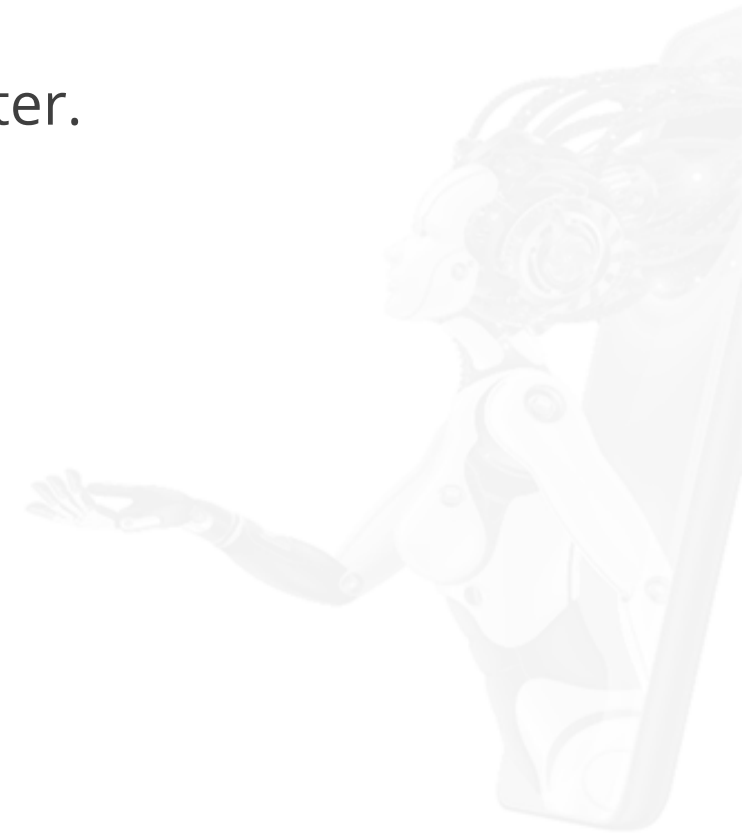
Stored procedures can have one or more parameters, and these parameters are separated by commas.



Stored Procedures with One Parameter: Example

Problem Statement: You are a junior DB administrator in your organization. Your manager wants to identify an employee's experience based on just the employee ID and decide whether to give them a hike or not.

Objective: Create a stored procedure with employee ID as the parameter.



Stored Procedures with One Parameter: Example

Step 1: Create a stored procedure with the relevant employee details and keep employee ID as the parameter.

QUERY

```
CREATE PROCEDURE GetEmpExp(eid int)
BEGIN
    SELECT Emp_ID, Emp_Name
    Role_name, Dept, Experience
    FROM Emp_Table
    WHERE Emp_ID = eid;
END $$
```



Stored Procedures with One Parameter: Example

Step 2: Call the stored procedure.

QUERY

```
CALL GetEmpExp(620);
```

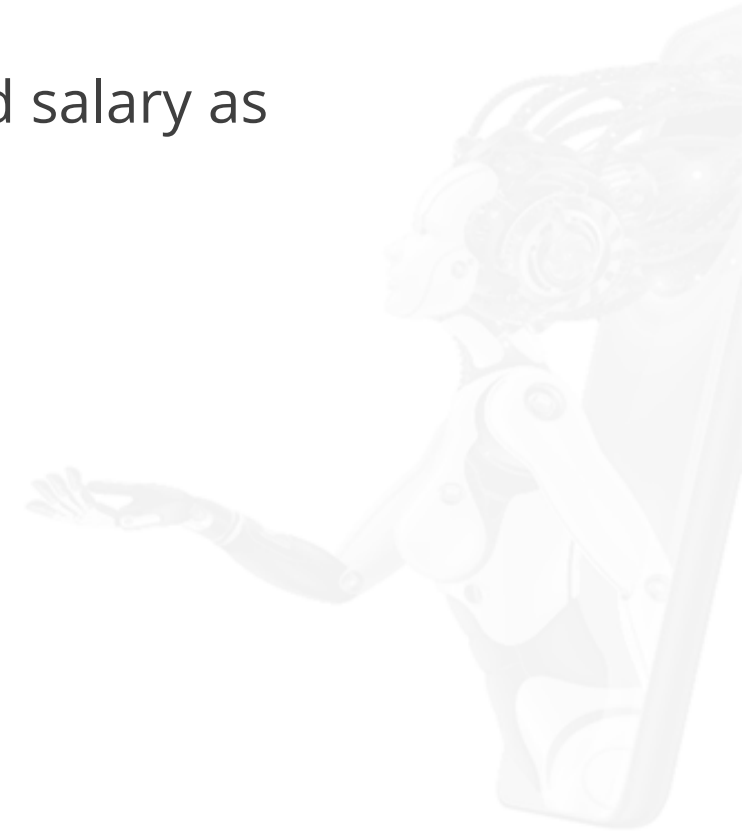
Output:

	Emp_ID	Role_name	Dept	Experience
▶	620	Katrina	Retail	2

Stored Procedures with Two Parameter: Example

Problem Statement: You are a junior DB administrator in your organization. Your manager wants to identify employees with less than 3 years of experience and salaries less than 30000.

Objective: Create a stored procedure that takes the employee experience and salary as parameters.



Stored Procedures with Two Parameter: Example

Step 1: Create a stored procedure with the relevant employee details and keep employee experience and employee salary as the parameters.

QUERY

```
DELIMITER $$
CREATE PROCEDURE GetEmpHike(exp int, sal int)
BEGIN
    SELECT *
    FROM Emp_Table
    WHERE Experience <= exp
    AND Salary <= sal;
END $$
```



Stored Procedures with Two Parameter: Example

Step 2: Call the stored procedure.

QUERY

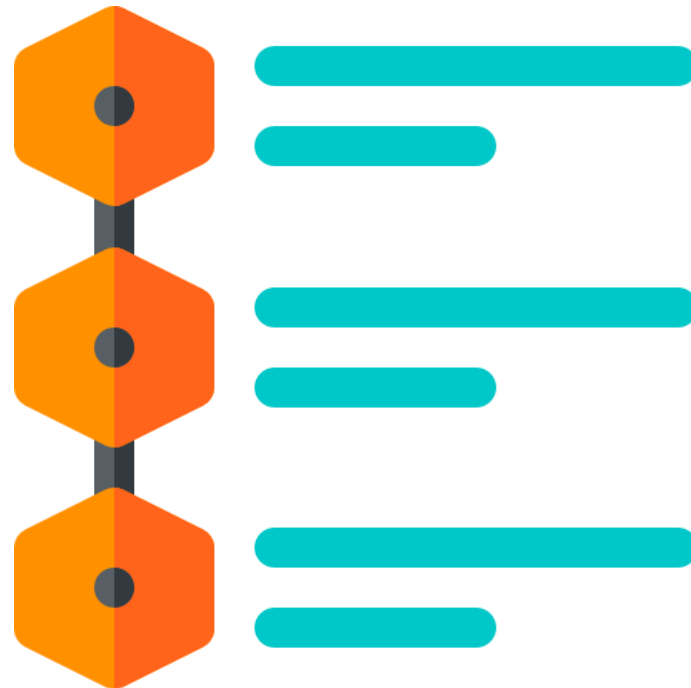
```
CALL GetEmpHike(3,30000);
```

Output:

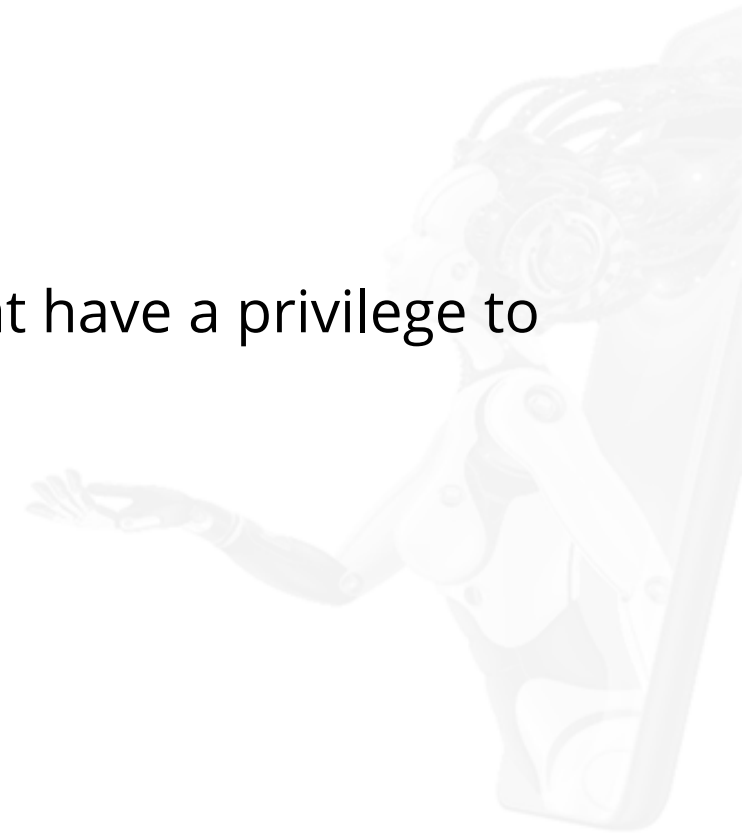
	Emp_ID	Emp_Name	Role_name	Dept	Experience	Salary
▶	620	Katrina	Junior Data Scientist	Retail	2	21500
	366	Clair	Associate Data Scientist	Automotive	3	28000

Listing Stored Procedures

SHOW PROCEDURE STATUS statement displays all the characteristics of stored procedures.



- Returns stored procedures that have a privilege to access
- Stores stored names



Use Case: Employee Data Analysis by HR

Use Case: Employee Data Analysis by HR

Problem Statement: You work as a junior analyst at your organization. You must assist the HR department with the development of an employee information table in one of the databases so that the HR can track and retrieve their data anytime they need it.

Objective: Build the appropriate database and table for storing the HR specific data.

Download the **HR_EMP_TABLE.csv** file from the course resources section.

Use Case: Employee Data Analysis by HR

The HR department has provided a detailed description of the required table given below.

Column Name	Value Type
EMP_ID	A unique ID assigned to each employee while joining the organization
MANAGER_ID	EMP_ID of the reporting manager for the project
FIRST_NAME	First name of the employee
LAST_NAME	Last name of the employee
SALARY	Monthly salary of the employee in dollars
GENDER	Gender of the employee abbreviated as M (male), F (female), and O (others)
EXP	Overall work experience of the employee
ROLE	Employee job designation
CONTINENT	Location of the branch
COUNTRY	Country of the branch
DEPT	Department of the employee

Use Case: Employee Data Analysis by HR

Step 1: Create a database named **HR_DB** with the **CREATE DATABASE** statement.

SQL Query

```
CREATE DATABASE IF NOT EXISTS HR_DB;
```



Use Case: Employee Data Analysis by HR

Step 2: Set **HR_DB** as the default database in MySQL with the **USE** statement.

SQL Query

```
USE HR_DB;
```



Use Case: Employee Data Analysis by HR

Step 3: Set **INNODB** as the default storage engine for HR_DB database in MySQL with the **SET** statement.

SQL Query

```
SET default_storage_engine = INNODB;
```



Use Case: Employee Data Analysis by HR

Step 4: Create the required **EMP_RECORDS** table in the **HR_DB** database with the **CREATE TABLE** statement as given below.

SQL Query

```
CREATE TABLE IF NOT EXISTS HR_DB.EMP_RECORDS (  
    EMP_ID VARCHAR(4) NOT NULL PRIMARY KEY CHECK(SUBSTR(EMP_ID,1,1) = 'E'),  
    FIRST_NAME VARCHAR(100) NOT NULL,  
    LAST_NAME VARCHAR(100) NOT NULL,  
    GENDER VARCHAR(1) NOT NULL CHECK(GENDER IN ('M', 'F', 'O')),  
    ROLE VARCHAR(100) NOT NULL,  
    DEPT VARCHAR(100) NOT NULL,  
    EXP INTEGER NOT NULL CHECK (EXP >= 0),  
    COUNTRY VARCHAR(80) NOT NULL,  
    CONTINENT VARCHAR(50) NOT NULL,  
    SALARY DECIMAL(7,2) NOT NULL DEFAULT '2000.00' CHECK(SALARY >= 2000.00),  
    EMP_RATING INTEGER NOT NULL DEFAULT 1 CHECK (EMP_RATING IN (1,2,3,4,5)),  
    MANAGER_ID VARCHAR(100) NOT NULL CHECK(SUBSTR(MANAGER_ID,1,1) = 'E'),  
    ) ENGINE=INNODB;
```

Use Case: Employee Data Analysis by HR

Step 5: Analyze the structure of the **EMP_RECORDS** table with the **DESCRIBE** statement.

SQL Query

DESCRIBE HR_DB.EMP_RECORDS;

Output:

	Field	Type	Null	Key	Default	Extra
▶	EMP_ID	varchar(4)	NO	PRI	NULL	
	FIRST_NAME	varchar(100)	NO		NULL	
	LAST_NAME	varchar(100)	NO		NULL	
	GENDER	varchar(1)	NO		NULL	
	ROLE	varchar(100)	NO		NULL	
	DEPT	varchar(100)	NO		NULL	
	EXP	int	NO		NULL	
	COUNTRY	varchar(80)	NO		NULL	
	CONTINENT	varchar(50)	NO		NULL	
	SALARY	decimal(7,2)	NO		2000.00	
	EMP_RATING	int	NO		1	
	MANAGER_ID	varchar(100)	NO		NULL	

Use Case: Employee Data Analysis by HR

Step 6: Insert the required data from the downloaded **HR_EMP_TABLE.csv** file into the **EMP_RECORDS** table as shown below.

SQL Query

```
INSERT INTO  
HR_DB.EMP_RECORDS (EMP_ID, FIRST_NAME, LAST_NAME, GENDER, ROLE, DEPT, EXP, COUNTRY, CONTINENT, SALARY, E  
MP_RATING, MANAGER_ID)  
VALUES  
  
("E083", "Patrick", "Voltz", "M", "MANAGER", "HEALTHCARE", 15, "USA", "NORTH  
AMERICA", "9500", 5, "E002"),  
  
...  
  
...  
  
("E403", "Steve", "Hoffman", "M", "ASSOCIATE DATA SCIENTIST", "FINANCE", 4, "USA", "NORTH  
AMERICA", "5000", 3, "E103");
```

Use Case: Employee Data Analysis by HR

Step 7: Analyze the data entered into the **EMP_RECORDS** table with the **SELECT** statement.

SQL Query

```
SELECT * FROM HR_DB.EMP_RECORDS;
```

Output:

	EMP_ID	FIRST_NAME	LAST_NAME	GENDER	ROLE	DEPT	EXP	COUNTRY	CONTINENT	SALARY	EMP_RATING	MANAGER_ID
▶	E001	Arthur	Black	M	CEO	ALL	20	USA	NORTH AMERICA	16500.00	5	E001
	E002	Cynthia	Brooks	F	PRESIDENT	ALL	17	CANADA	NORTH AMERICA	14500.00	5	E001
	E005	Eric	Hoffman	M	LEAD DATA SCIENTIST	FINANCE	11	USA	NORTH AMERICA	8500.00	3	E103
	E052	Dianna	Wilson	F	SENIOR DATA SCIENTIST	HEALTHCARE	6	CANADA	NORTH AMERICA	5500.00	5	E083
	E057	Dorothy	Wilson	F	SENIOR DATA SCIENTIST	HEALTHCARE	9	USA	NORTH AMERICA	7700.00	1	E083
	E083	Patrick	Voltz	M	MANAGER	HEALTHCARE	15	USA	NORTH AMERICA	9500.00	5	E002
	E103	Emily	Grove	F	MANAGER	FINANCE	14	CANADA	NORTH AMERICA	10500.00	4	E002
	E245	Nian	Zhen	M	SENIOR DATA SCIENTIST	RETAIL	6	CHINA	ASIA	6500.00	2	E583
	E260	Roy	Collins	M	SENIOR DATA SCIENTIST	RETAIL	7	INDIA	ASIA	7000.00	3	E583
	E403	Steve	Hoffman	M	ASSOCIATE DATA SCIENTIST	FINANCE	4	USA	NORTH AMERICA	5000.00	3	E103
	E428	Pete	Allen	M	MANAGER	AUTOMOTIVE	14	GERMANY	EUROPE	11000.00	4	E002
	E505	Chad	Wilson	M	ASSOCIATE DATA SCIENTIST	HEALTHCARE	5	CANADA	NORTH AMERICA	5000.00	2	E083
	E532	Claire	Brennan	F	ASSOCIATE DATA SCIENTIST	AUTOMOTIVE	3	GERMANY	EUROPE	4300.00	1	E428
	E583	Janet	Hale	F	MANAGER	RETAIL	14	COLOMBIA	SOUTH AMERICA	10000.00	2	E002
	E612	Tracy	Norris	F	MANAGER	RETAIL	13	INDIA	ASIA	8500.00	4	E002
	E620	Katrina	Allen	F	JUNIOR DATA SCIENTIST	RETAIL	2	INDIA	ASIA	3000.00	1	E583
	E640	Jenifer	Jhones	F	JUNIOR DATA SCIENTIST	RETAIL	1	COLOMBIA	SOUTH AMERICA	2800.00	4	E583

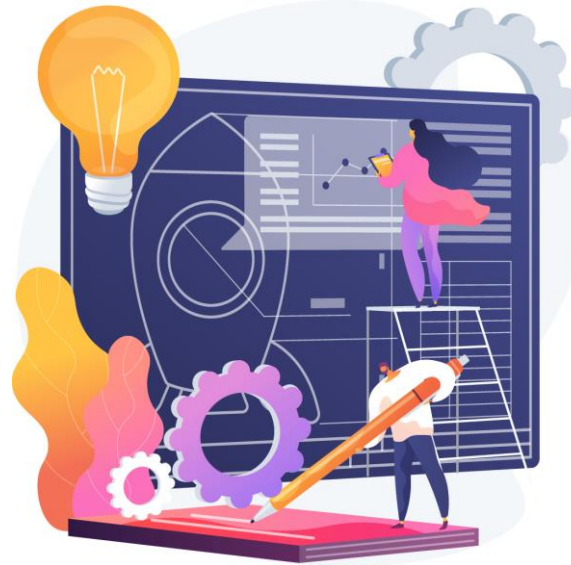
Compound Statement

Compound Statement

Compound statement is a block that contains declarations of variables, condition handlers, cursors, loops, and conditional tests.



Functionality



Structure



Application



Compound Statement

The compound statements are enclosed within a BEGIN...END block.

Syntax

```
[begin_label:] BEGIN  
    [statement_list]  
END [end_label]
```



Compound Statement: Example

Problem Statement: The HR department wants to extract the manager's details along with the number of employees reporting to the manager by using the manager's employee ID.

Objective: Create a stored procedure that takes the manager's employee ID as input and returns the manager's basic information as well as the number of employees reporting to the manager.

Compound Statement: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 1

```
DROP PROCEDURE IF EXISTS GetEmpCount;
DELIMITER $$
CREATE PROCEDURE GetEmpCount(mid VARCHAR(4))
BEGIN
    SELECT m.EMP_ID, m.FIRST_NAME, m.LAST_NAME,
           m.ROLE, m.DEPT, COUNT(e.EMP_ID) AS `EMP_COUNT`
    FROM EMP_RECORDS m
    LEFT JOIN EMP_RECORDS e
        ON m.EMP_ID = e.MANAGER_ID
```

SQL Query – Par 2

```
WHERE m.ROLE IN ("MANAGER", "PRESIDENT", "CEO")
AND m.EMP_ID = mid
GROUP BY m.EMP_ID
ORDER BY m.EMP_ID;
END $$
```

Compound Statement: Example

Step 2: Execute this stored procedure with the EMP_ID of the manager and check the output.

SQL Query

```
CALL GetEmpCount("E083");
```

Output:

	EMP_ID	FIRST_NAME	LAST_NAME	ROLE	DEPT	EMP_COUNT
▶	E083	Patrick	Voltz	MANAGER	HEALTHCARE	3



Conditional Statements

Conditional Statements

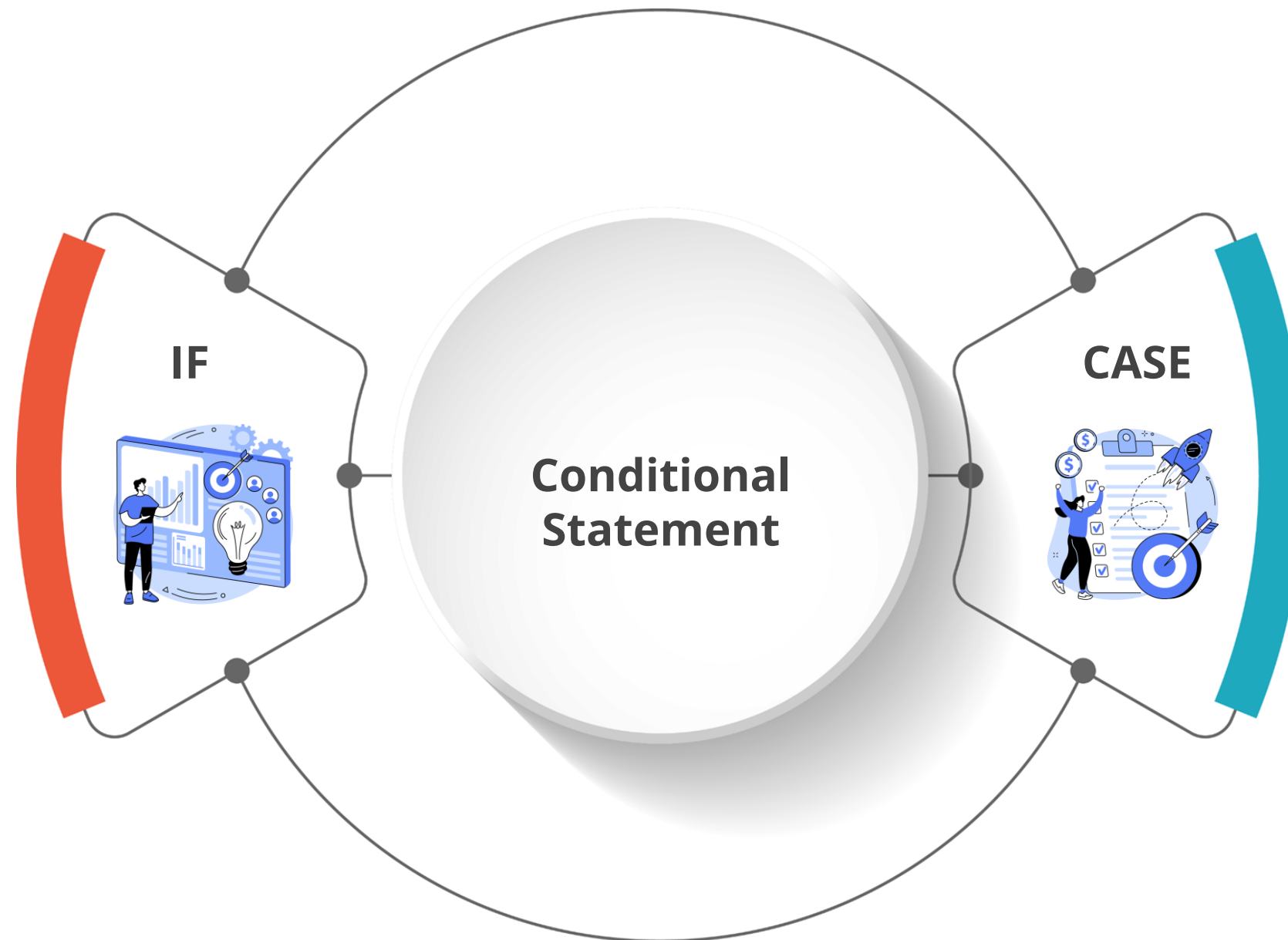


Conditional statements are used to regulate the flow of an SQL query's execution by describing the logic that will be executed if a condition is satisfied.



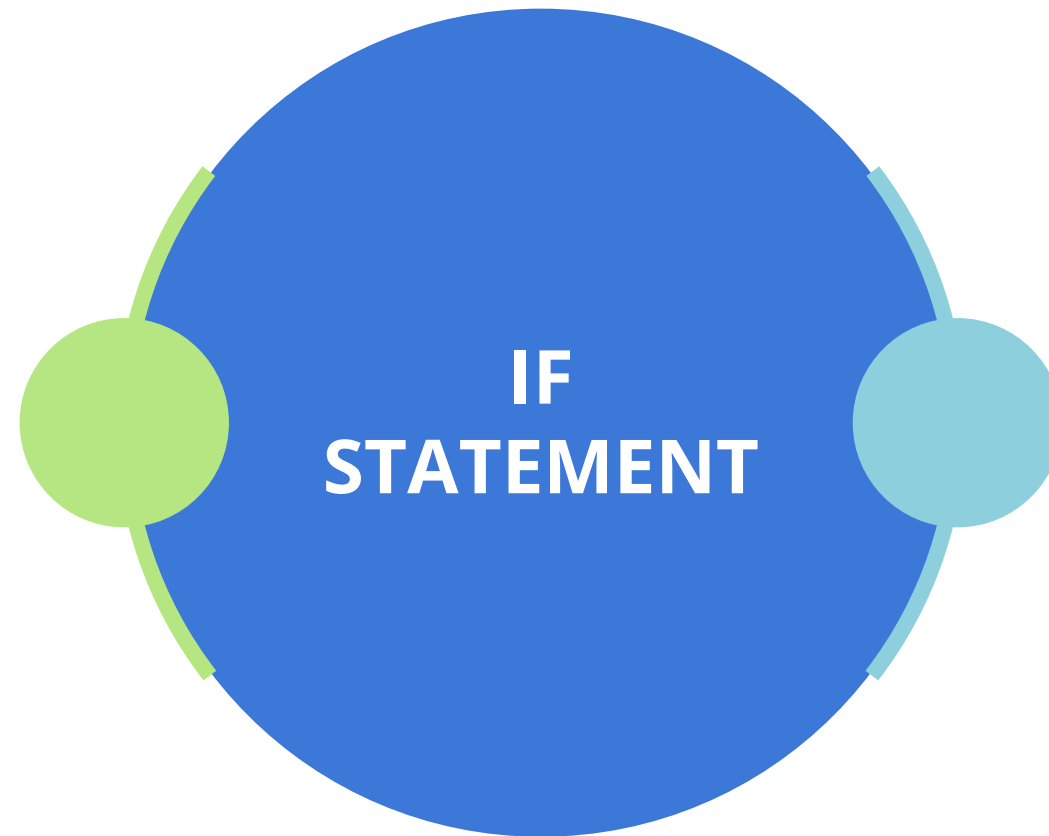
Types of Conditional Statements

There are two types of conditional statements supported by MySQL.



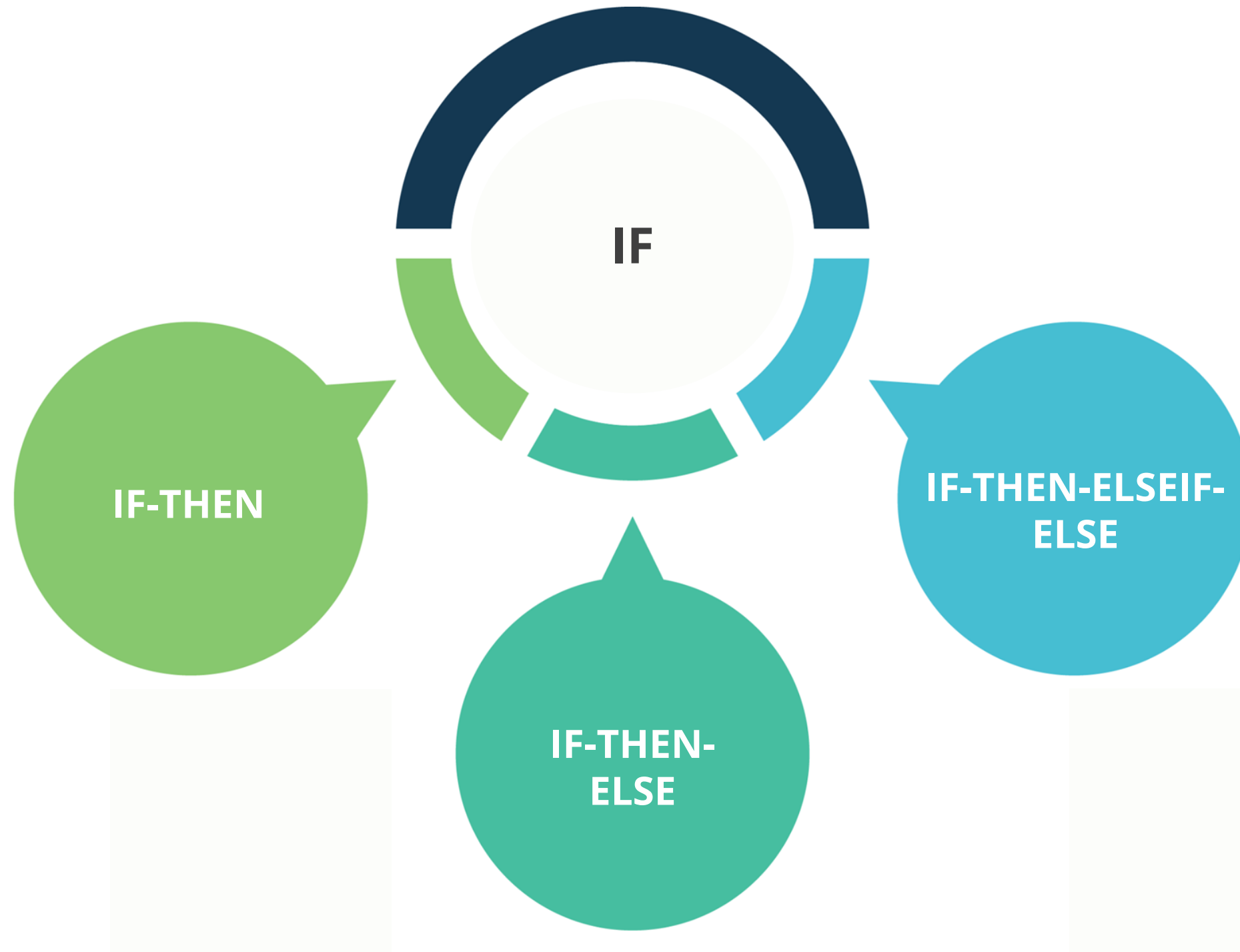
IF Statement

It is a type of control-flow statement that determines whether to execute a block of SQL code based on a specified condition.



In the IF condition, a block of SQL code is specified between the IF and END IF keywords.

Types of IF Statements



IF-THEN Statement

The IF-THEN statement executes a set of SQL statements based on a specified condition.

Syntax

```
IF condition THEN  
    statement_list;  
END IF;
```

IF-THEN Statement: Example

Problem Statement: The HR department wants to identify the employees who have a rating below three and are not performing well.

Objective: Create a stored procedure to determine if an employee's performance is bad depending on the rating, where a rating below three indicates bad performance.

IF-THEN Statement: Example

Step 1: Create a stored procedure as shown below.

SQL Query – Par 1

```
DROP PROCEDURE IF EXISTS getEmpScore1;
DELIMITER $$
CREATE PROCEDURE getEmpScore1(
    IN eid VARCHAR(4),
    OUT performance VARCHAR(50))
BEGIN
    DECLARE score INT DEFAULT 1;
    SELECT EMP_RATING INTO score
    FROM EMP_RECORDS WHERE EMP_ID = eid;
```

SQL Query – Par 2

```
    IF score < 3 THEN
        SET performance = "BAD";
    END IF;
END$$
```

IF-THEN Statement: Example

Step 2: Use the **EMP_ID** and a temporary global variable **@performance** to run this stored procedure, and then use this variable to examine the result.

SQL Query

```
CALL getEmpScore1("E505", @performance);
```

SQL Query

```
SELECT @performance;
```

Output:

	@performance
▶	BAD



IF-THEN-ELSE Statement

The IF-THEN-ELSE statement executes another set of SQL statements when the condition in the IF branch does not evaluate to TRUE.

Syntax

```
IF condition THEN  
    statement_list;  
  
ELSE  
    statement_list;  
  
END IF;
```



IF-THEN-ELSE Statement

Problem Statement: The HR department needs to know the employees who have a rating below three and are not doing well as well as the ones with a rating of three or more and are performing well.

Objective: Create a stored procedure to determine if an employee's performance is good or bad depending on the rating, where a rating below three indicates bad performance and three or above indicates good performance.

IF-THEN-ELSE Statement

Step 1: Create a stored procedure as shown below.

SQL Query – Par 1

```
DROP PROCEDURE IF EXISTS getEmpScore2;

DELIMITER $$

CREATE PROCEDURE getEmpScore2 (
    IN eid VARCHAR(4), OUT performance VARCHAR(50))
BEGIN
    DECLARE score INT DEFAULT 1;
    SELECT EMP_RATING INTO score
    FROM EMP_RECORDS
    WHERE EMP_ID = eid;
```

SQL Query – Par 2

```
    IF score < 3 THEN
        SET performance = "BAD";
    ELSE
        SET performance = "GOOD";
    END IF;
END$$
```

IF-THEN-ELSE Statement

Step 2: Use the **EMP_ID** and a temporary global variable **@performance** to run this stored procedure, and then use this variable to examine the result.

SQL Query

```
CALL getEmpScore2("E005", @performance);
```

SQL Query

```
SELECT @performance;
```

Output:

	@performance
▶	GOOD



IF-THEN-ELSEIF-ELSE Statement

The IF-THEN-ELSEIF-ELSE statement conditionally executes a set of SQL statements based on multiple conditions.

Syntax

```
IF condition THEN  
    statement_list;  
  
ELSEIF elseif_condition THEN  
    statement_list;  
  
...  
  
ELSE  
    statement_list;  
  
END IF;
```

It can have multiple ELSEIF branches.

IF-THEN-ELSEIF-ELSE Statement: Example

Problem Statement: The HR department needs to know how each employee is performing by categorizing them based on their ratings, which vary from one to five. They want to grade each employee's performance as Overachiever, Excellent Performance, Meeting Expectations, Below Expectations, and Not Achieving Any Goals.

Objective: Create a stored procedure to determine the performance of an employee based on the employee rating with an additional criteria for identifying an invalid rating using the IF-THEN-ELSEIF-ELSE statement.

IF-THEN-ELSEIF-ELSE Statement: Example

Step 1: Create a stored procedure as shown below.

SQL Query – Par 1

```
DROP PROCEDURE IF EXISTS getEmpScore3;
DELIMITER $$
CREATE PROCEDURE getEmpScore3(
    IN eid VARCHAR(4),
    OUT performance VARCHAR(50))
BEGIN
    DECLARE score INT DEFAULT 1;
    SELECT EMP_RATING INTO score FROM EMP_RECORDS WHERE
EMP_ID = eid;
    IF score = 5 THEN
        SET performance = "Over Achiever";
```

SQL Query – Par 2

```
        ELSEIF score = 4 THEN
            SET performance = "Excellent Performance";
        ELSEIF score = 3 THEN
            SET performance = "Meeting Expectation";
        ELSEIF score = 2 THEN
            SET performance = "Below Expectation";
        ELSEIF score = 1 THEN
            SET performance = "Not Achieving Any Goals";
        ELSE
            SET performance = "Invalid Rating";
    END IF;
END$$
```

IF-THEN-ELSEIF-ELSE Statement: Example

Step 2: Use the **EMP_ID** and a temporary global variable **@performance** to run this stored procedure, and then use this variable to examine the result.

SQL Query

```
CALL getEmpScore3("E005", @performance);
```

SQL Query

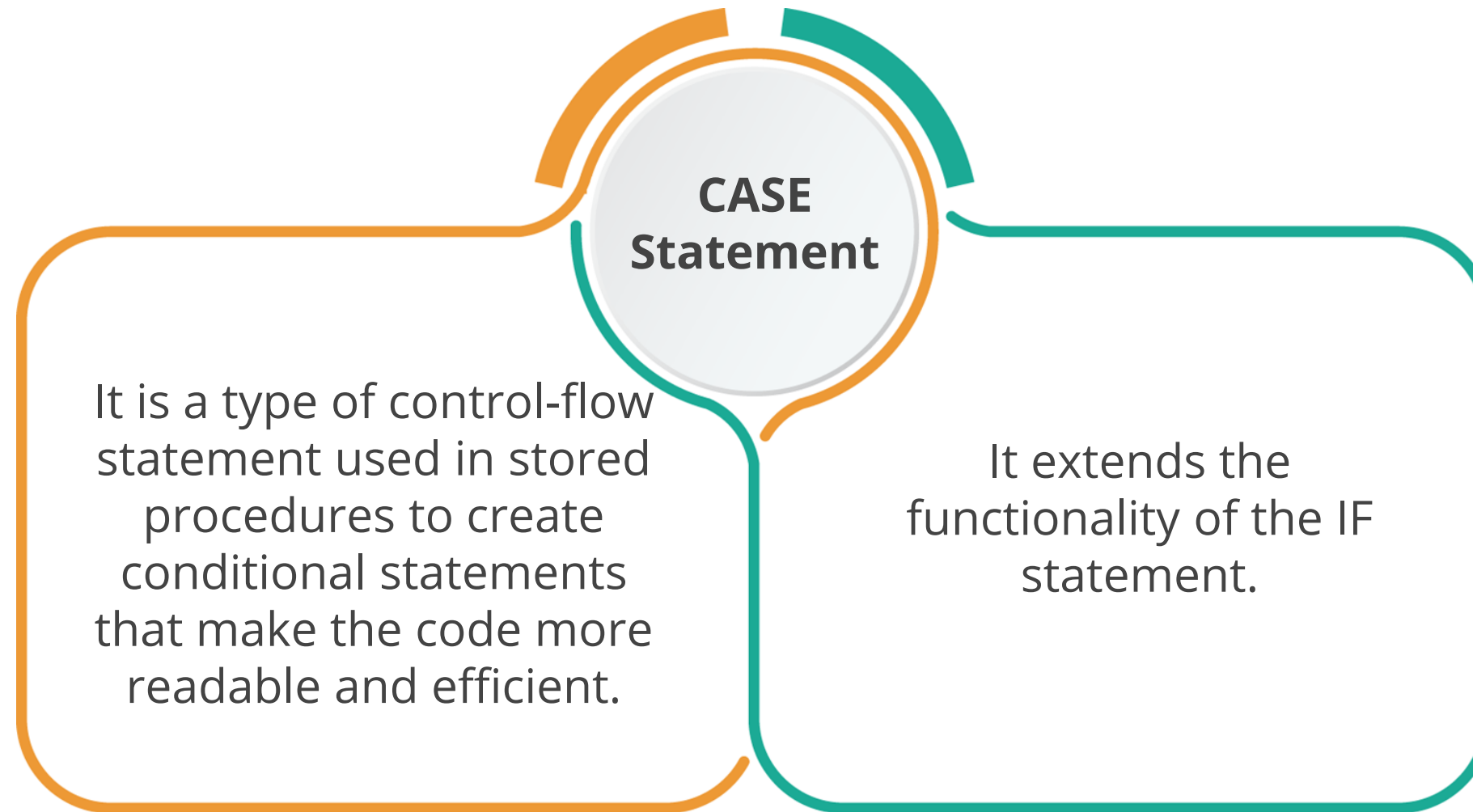
```
SELECT @performance;
```

Output:

	@performance
▶	Meeting Expectation



CASE Statement



Types of CASE Statements



Simple CASE Statement

It checks for equality; however, it cannot be used to check for equality with NULL because NULL returns FALSE.

Syntax

```
CASE case_value
  WHEN when_value1 THEN statements
  WHEN when_value2 THEN statements
  ELSE
    [ELSE else_statements]

    Or,

  BEGIN
  END;
END CASE;
```

It only allows a value to be compared to a set of distinct values.

Simple CASE Statement

MySQL raises an error in absence of the ELSE clause if no conditions are satisfied.

Error

```
Case not found for CASE statement
```

The ELSE clause utilizes an empty BEGIN...END block to prevent any errors.

Simple CASE Statement: Example

Problem Statement: The HR department needs to know how each employee is performing by categorizing them based on their ratings, which vary from one to five. They want to grade each employee's performance as Overachiever, Excellent Performance, Meeting Expectations, Below Expectations, and Not Achieving Any Goals.

Objective: Create a stored procedure to determine the performance of an employee based on the employee rating with an additional criteria for identifying an invalid rating using the Simple CASE statement.

Simple CASE Statement: Example

Step 1: Create a stored procedure as shown below.

SQL Query – Par 1

```
DROP PROCEDURE IF EXISTS getEmpScore4;
DELIMITER $$
CREATE PROCEDURE getEmpScore4(
    IN eid VARCHAR(4),
    OUT performance VARCHAR(50))
BEGIN
    DECLARE score INT DEFAULT 1;
    SELECT EMP_RATING INTO score
    FROM EMP_RECORDS WHERE EMP_ID = eid;
```

SQL Query – Par 2

```
CASE score
    WHEN 5 THEN
        SET performance = "Over Achiever";
    WHEN 4 THEN
        SET performance = "Excellent Performance";
    WHEN 3 THEN
        SET performance = "Meeting Expectation";
    WHEN 2 THEN
        SET performance = "Below Expectation";
```

Simple CASE Statement: Example

Step 1: Create a stored procedure as shown below.

SQL Query – Par 3

```
WHEN 1 THEN
    SET performance = "Not Achieving Any Goals";
ELSE
    BEGIN
        SET performance = "Invalid Rating";
    END;
END CASE;
END$$
```



Simple CASE Statement: Example

Step 2: Use the **EMP_ID** and a temporary global variable **@performance** to run this stored procedure, and then use this variable to examine the result.

SQL Query

```
CALL getEmpScore4("E005", @performance);
```

SQL Query

```
SELECT @performance;
```

Output:

	@performance
▶	Below Expectation



Searched CASE Statement

It is similar to the IF statement; however, it is considerably more readable.

Syntax

```
CASE
  WHEN search_condition1 THEN statements
  WHEN search_condition1 THEN statements
  ...
  [ELSE else_statements]

Or,

BEGIN
  END;
END CASE;
```

It is used for performing more complex matching such as ranges.

Searched CASE Statement

MySQL raises an error in absence of the ELSE clause if no condition evaluates to TRUE.

Error

```
Case not found for CASE statement
```

The ELSE clause utilizes an empty BEGIN...END block to prevent errors.

Searched CASE Statement: Example

Problem Statement: The HR department needs to know how each employee is performing by categorizing them based on their ratings, which vary from one to five. They want to grade each employee's performance as Overachiever, Excellent Performance, Meeting Expectations, Below Expectations, and Not Achieving Any Goals.

Objective: Create a stored procedure to determine the performance of an employee based on the employee rating with an additional criteria for identifying an invalid rating using the Searched CASE statement.

Searched CASE Statement: Example

Step 1: Create a stored procedure as shown below.

SQL Query – Par 1

```
DROP PROCEDURE IF EXISTS getEmpScore5;
DELIMITER $$
CREATE PROCEDURE getEmpScore6(
    IN eid VARCHAR(4),
    OUT performance VARCHAR(50))
BEGIN
    DECLARE score INT DEFAULT 1;
    SELECT EMP_RATING INTO score
    FROM EMP_RECORDS WHERE EMP_ID = eid;
```

SQL Query – Par 2

```
CASE
    WHEN score = 5 THEN
        SET performance = "Over Achiever";
    WHEN score = 4 THEN
        SET performance = "Excellent Performance";
    WHEN score = 3 THEN
        SET performance = "Meeting Expectation";
    WHEN score = 2 THEN
        SET performance = "Below Expectation";
```


Searched CASE Statement: Example

Step 1: Create a stored procedure as shown below.

SQL Query – Par 3

```
WHEN score = 1 THEN
    SET performance = "Not Achieving Any Goals";
ELSE
    BEGIN
        SET performance = "Invalid Rating";
    END;
END CASE;
END$$
```



Searched CASE Statement: Example

Step 2: Use the **EMP_ID** and a temporary global variable **@performance** to run this stored procedure, and then use this variable to examine the result.

SQL Query

```
CALL getEmpScore5("E005", @performance);
```

SQL Query

```
SELECT @performance;
```

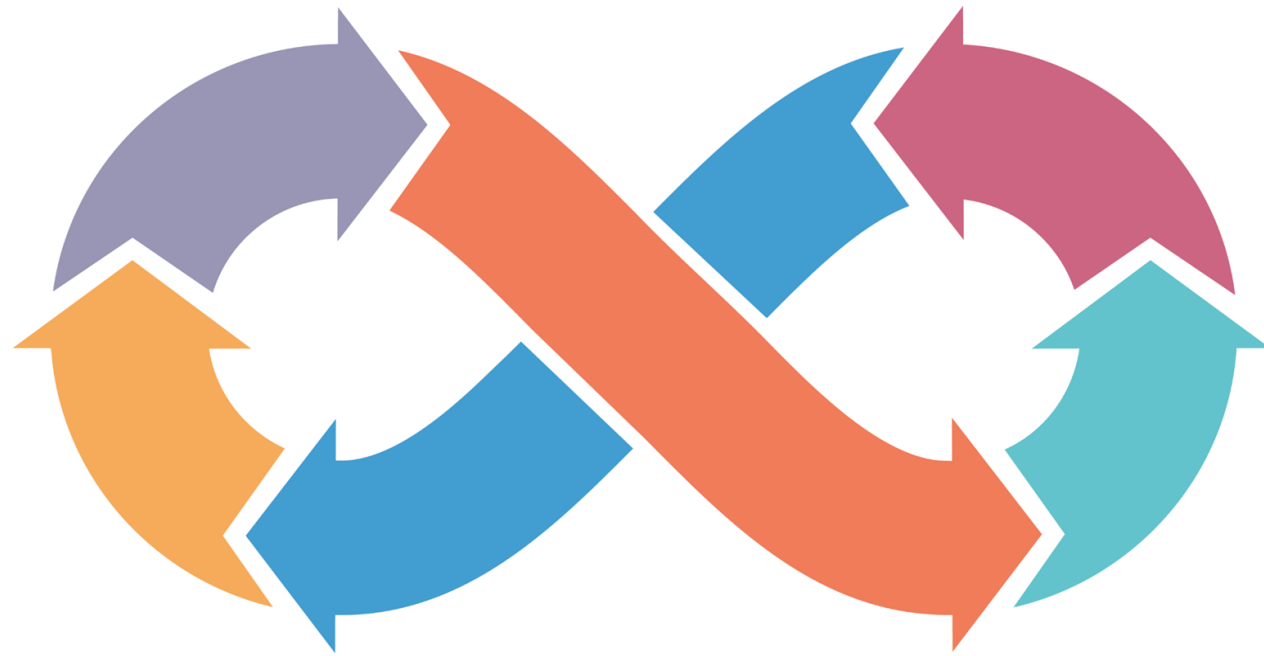
Output:

	@performance
▶	Over Achiever



Loops in Stored Procedures

Loops in Stored Procedures



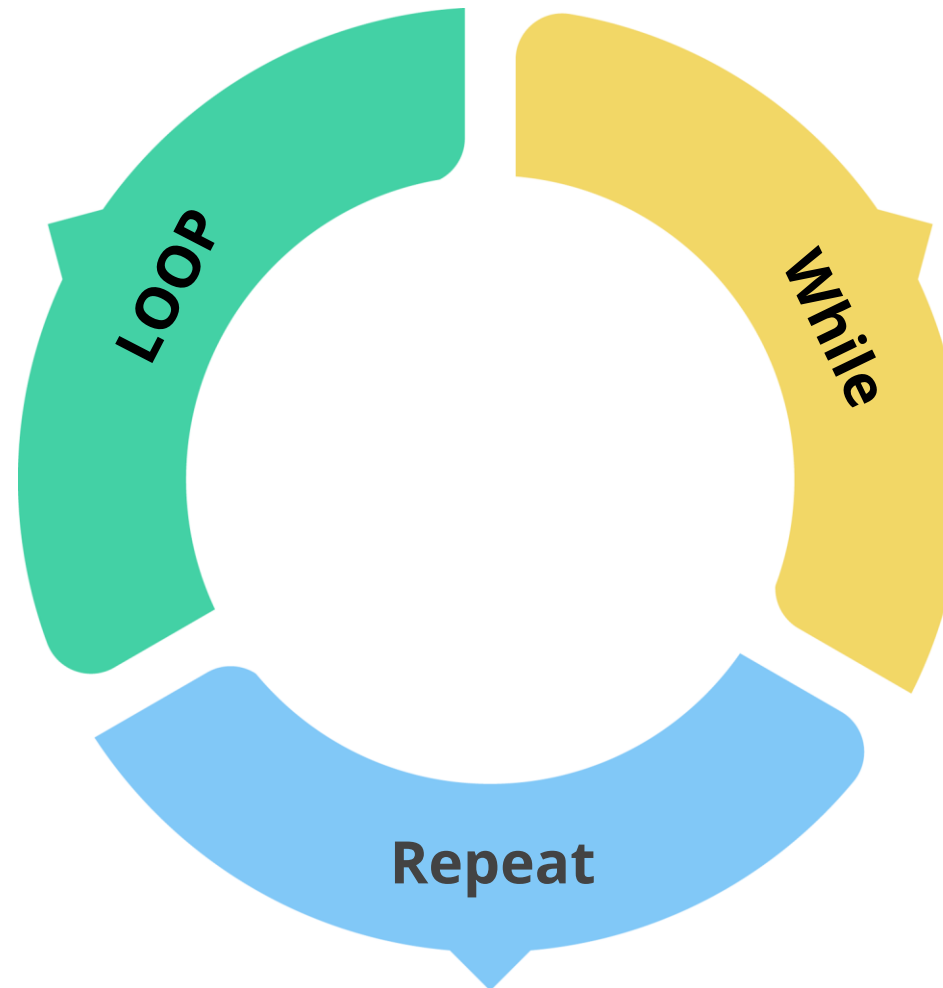
Loops, also known as iterative control statements, are a programming structure that repeats a set of instructions until a specific condition is satisfied.

They are crucial for saving time and reducing errors.

Types of Loops

There are three types of loops supported by MySQL.

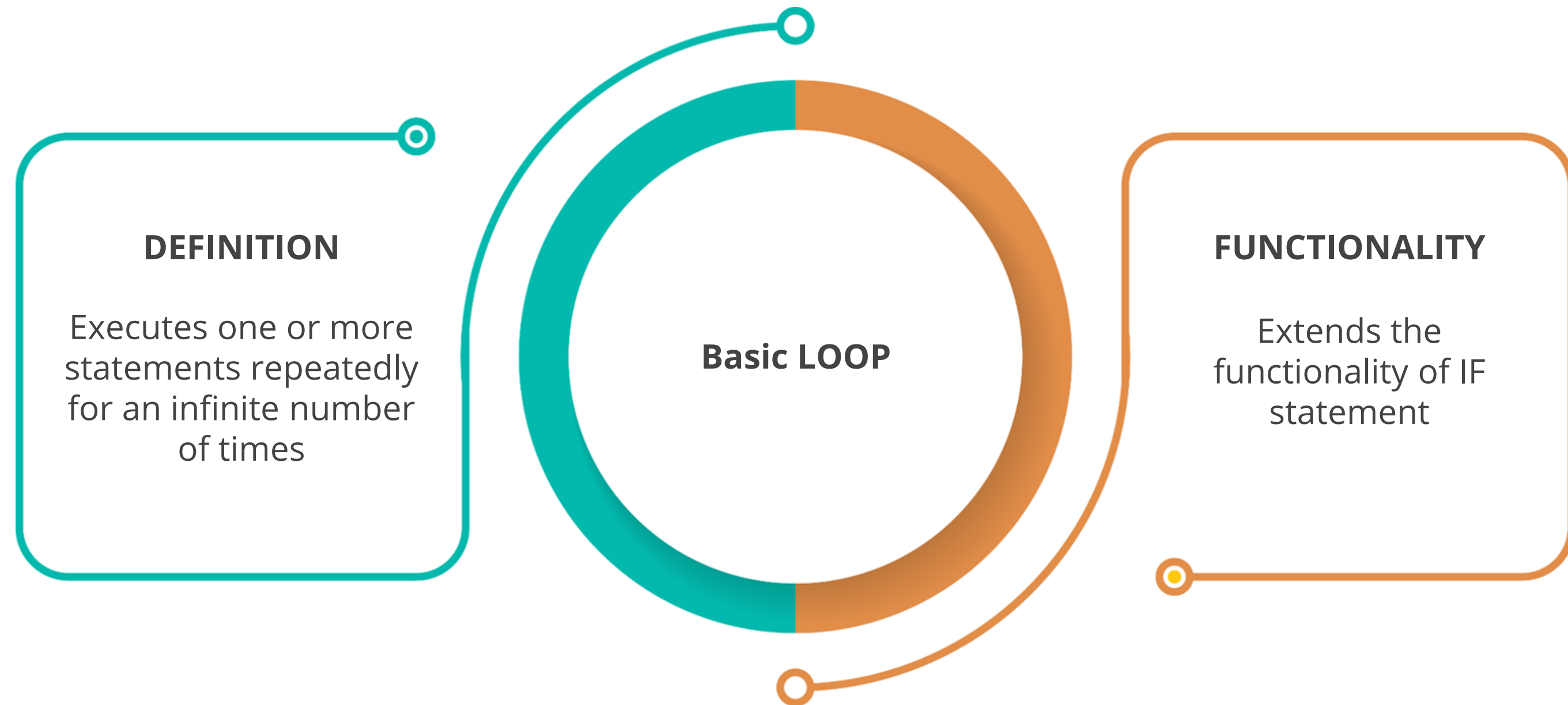
Executes one or more statements repeatedly for an infinite number of times



Executes one or more statements repeatedly as long as a condition is TRUE

Executes one or more statements repeatedly until a condition is satisfied

LOOP Statement

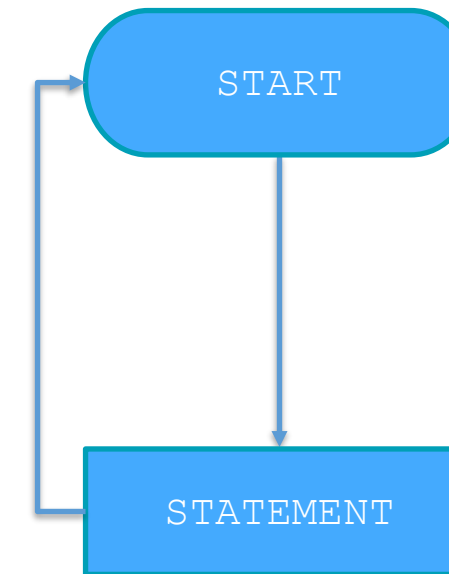


LOOP Statement

Syntax

```
[begin_label]: LOOP  
    statement_list  
END LOOP [end_label];
```

Flowchart



LOOP Statement: Example

Problem Statement: Your manager expects you to write a simple infinite loop in MySQL that counts even integers and adds them one after the other in a string separated by a comma.

Objective: Create a stored procedure with a simple infinite loop in MySQL that counts even integers from 1 and adds them one after the other in a string separated by a comma.

LOOP Statement: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 1

```
DROP PROCEDURE InfiniteEvenLoop;

DELIMITER $$

CREATE PROCEDURE InfiniteEvenLoop()
BEGIN
    DECLARE num INT;
    DECLARE msg VARCHAR(300);
    SET num = 1;
    SET msg = '';
```

SQL Query – Par 2

```
    loop_label: LOOP
        SET num = num + 1;
        IF (num mod 2) THEN
            ITERATE loop_label;
        ELSE
            SET msg = CONCAT(msg,num,',');
        END IF;
    END LOOP;
    SELECT msg;
END$$
```

LOOP Statement: Example

Step 2: Execute this stored procedure with the **CALL** statement, and analyze the warning produced by MySQL as the loop is infinite.

SQL Query

```
CALL InfiniteEvenLoop();
```

Output:

#	Time	Action	Message	Duration / Fetch
1	16:25:51	CALL InfiniteEvenLoop()	Error Code: 1406. Data too long for column 'msg' at r...	0.000 sec

WHILE Loop

DEFINITION

Executes one or more statements repeatedly as long as a condition is TRUE

WHILE Loop

FUNCTIONALITY

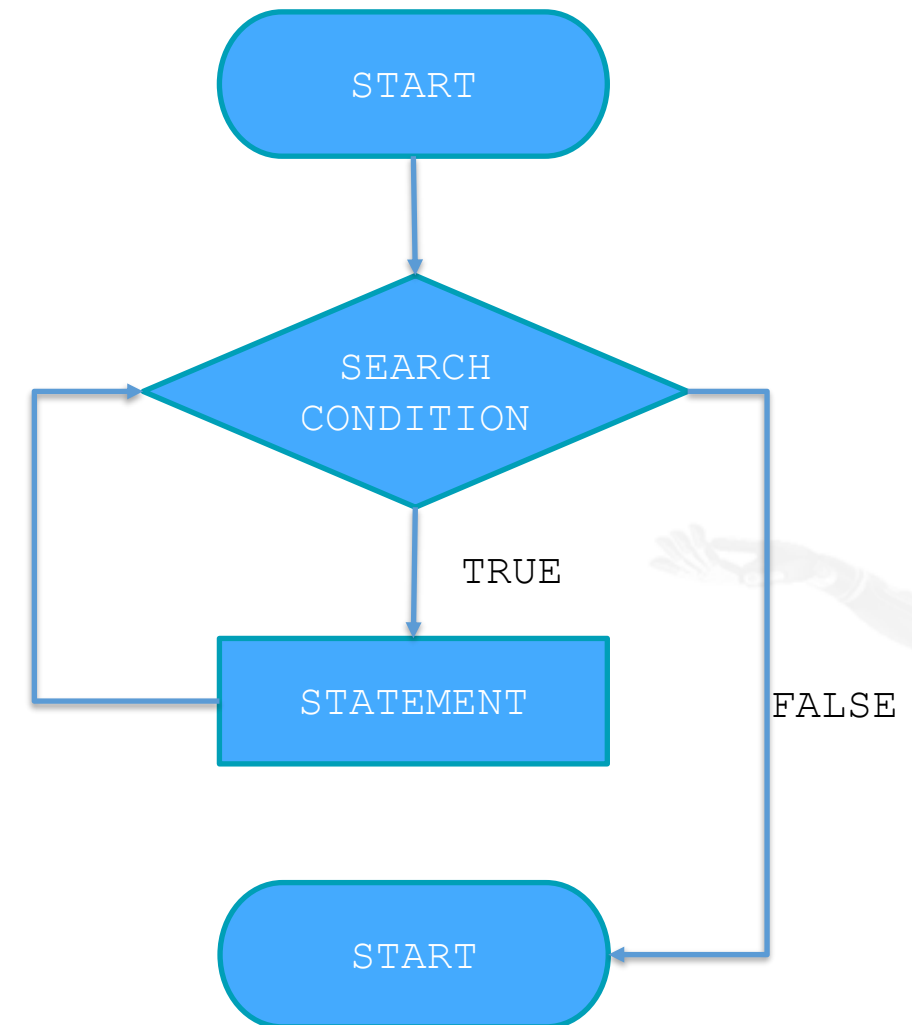
Also known as a pretest loop because it checks the search condition before executing the statement(s)

WHILE Loop

Syntax

```
[begin_label]: LOOP  
    statement_list  
END LOOP [end_label];
```

Flowchart



WHILE Loop: Example

Problem Statement: Your manager expects you to write a loop in MySQL that counts integers till 10 and adds them one after the other in a string separated by a comma.

Objective: Create a stored procedure with a while loop in MySQL that counts integers till 10 and adds them one after the other in a string separated by a comma.

WHILE Loop: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 1

```
DROP PROCEDURE InfiniteEvenLoop;

DELIMITER $$

CREATE PROCEDURE InfiniteEvenLoop()
BEGIN
    DECLARE num INT;
    DECLARE msg VARCHAR(300);

    SET num = 1;
    SET msg = '';
```

SQL Query – Par 2

```
    WHILE num <=10 DO
        SET msg = CONCAT(msg,num,',');
        SET num = num + 1;
    END WHILE;

    SELECT msg;

END $$
```

WHILE Loop: Example

Step 2: Execute this stored procedure with **CALL** statement and check the output.

SQL Query

```
CALL EvenWhileLoop();
```

Output:

	msg
▶	1,2,3,4,5,6,7,8,9,10,

REPEAT Loop

DEFINITION

Executes one or more statements repeatedly until a condition is satisfied

REPEAT Loop

FUNCTIONALITY

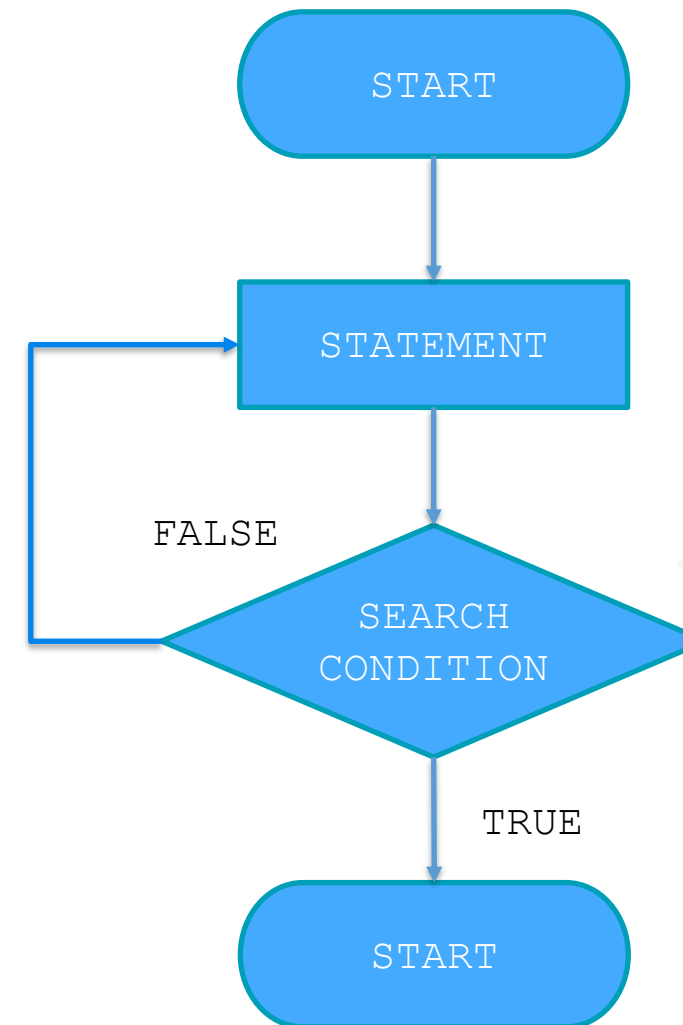
Also known as a post-test loop because it checks the search condition after the execution of the statement(s)

REPEAT Loop

Syntax

```
[begin_label]: LOOP  
    statement_list  
END LOOP [end_label];
```

Flowchart



REPEAT Loop: Example

Problem Statement: Your manager expects you to write a loop in MySQL that counts integers till 10 and adds them one after the other in a string separated by a comma.

Objective: Create a stored procedure with a repeat loop in MySQL that counts integers till 10 and adds them one after the other in a string separated by a comma.

REPEAT Loop: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 1

```
DROP PROCEDURE EvenRepeatLoop;

Delimiter $$

CREATE PROCEDURE EvenRepeatLoop()

BEGIN

    DECLARE num INT DEFAULT 1;

    DECLARE msg Varchar(300) DEFAULT '';
```

SQL Query – Par 2

```
REPEAT

    SET msg = CONCAT(msg,num,', ');

    SET num = num + 1;

UNTIL num > 10

END REPEAT;

SELECT msg;

END $$
```

REPEAT Loop: Example

Step 2: Execute this stored procedure with **CALL** statement and check the output.

SQL Query

```
CALL EvenRepeatLoop();
```

Output:

	msg
▶	1,2,3,4,5,6,7,8,9,10,

Terminating Stored Procedures and Loops

LEAVE Statement

The LEAVE statement is used to exit a flow control which has a specific label, such as stored programs or loops.

Syntax

```
LEAVE label;
```



Using LEAVE With Stored Procedure

A LEAVE statement is used to terminate a stored procedure or function.

Syntax

```
DELIMITER //
```

```
CREATE PROCEDURE  
procedure_name(parameter_list)  
[label]: BEGIN  
    statement_list;  
    ...  
    IF condition THEN  
        LEAVE [label];  
    END IF;  
    ...  
    -- other statements  
END //
```

```
DELIMITER;
```



Using LEAVE With Stored Procedure: Example

Problem Statement: The HR department wants to find the employees with a rating above 3 along with their basic information.

Objective: Create a stored procedure for the basic information of an employee only if the rating is above 3.

Using LEAVE With Stored Procedure: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 1

```
DROP PROCEDURE GoodEmployeeRecord;

Delimiter $$

CREATE PROCEDURE GoodEmployeeRecord(eid VARCHAR(4))

sp: BEGIN

    DECLARE rating INT DEFAULT 0;

    SELECT EMP_RATING INTO rating

    FROM EMP_RECORDS WHERE EMP_ID = eid;
```

SQL Query – Par 2

```
        IF rating < 3 THEN

            LEAVE sp;

        END IF;

        SELECT EMP_ID, FIRST_NAME, LAST_NAME, DEPT, SALARY

        FROM EMP_RECORDS WHERE EMP_ID = eid;

END$$
```

Using LEAVE With Stored Procedure: Example

Step 2: Execute this stored procedure with the **EMP_ID** of the employee and check the output.

SQL Query

```
CALL GoodEmployeeRecord("E083");
```

Output:

	EMP_ID	FIRST_NAME	LAST_NAME	DEPT	SALARY
▶	E083	Patrick	Voltz	HEALTHCARE	9500.00



Using LEAVE With LOOP Statement

The LEAVE statement is used in a LOOP statement when a set of statements needs to be executed at least once before the termination of the loop.

Syntax

```
[label]: LOOP
    statement_list
    ...
    -- terminate the loop
    IF condition THEN
        LEAVE [label];
    END IF;
    ...
    -- other statements
END LOOP [label];
```



Using LEAVE With LOOP Statement: Example

Problem Statement: Your manager expects you to write a simple infinite loop in MySQL that counts even integers to add them one after the other in a string separated by a comma and terminate when the integer exceeds 10.

Objective: Create a stored procedure with a simple infinite **LOOP** in MySQL that counts even integers till 10 and adds them one after the other in a string separated by a comma, terminating the loop when the integer count exceeds 10.

Using LEAVE With LOOP Statement: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 1

```
DROP PROCEDURE EvenLoop;

DELIMITER $$

CREATE PROCEDURE EvenLoop()
BEGIN
    DECLARE num INT;
    DECLARE msg VARCHAR(300);
    SET num = 1;
    SET msg = '';
```

SQL Query – Par 2

```
loop_label: LOOP
    IF num > 10 THEN
        LEAVE loop_label;
    END IF;
    SET num = num + 1;
    IF (num mod 2) THEN
        ITERATE loop_label;
```

Using LEAVE With LOOP Statement: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 3

```
ELSE
    SET msg = CONCAT(msg,num,',');
END IF;
END LOOP loop_label;
SELECT msg;
END$$
```



Using LEAVE With LOOP Statement: Example

Step 2: Execute this stored procedure with the **CALL** statement, and analyze the warning produced by MySQL as the loop is infinite.

SQL Query

```
CALL EvenLoop ( ) ;
```

Output:

	msg
▶	2,4,6,8,10,



Using LEAVE With WHILE Loop

A LEAVE statement is used to terminate a WHILE loop when a specific condition is satisfied before its loop condition becomes FALSE.

Syntax

```
[label:] WHILE search_condition DO
    statement_list
    ...
    -- terminate the loop
    IF condition THEN
        LEAVE [label];
    END IF;
    ...
    -- other statements
END WHILE [label];
```



Using LEAVE With WHILE Loop: Example

Problem Statement: Your manager expects you to write a loop in MySQL that produces the sum of first 20 even integers.

Objective: Create a stored procedure with a **WHILE Loop** in MySQL that counts first 20 even integers and adds them one by one, terminating the loop when the integer count exceeds the 20th even integer and return the sum.

Using LEAVE With WHILE Loop: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 1

```
DROP PROCEDURE LeaveWhileLoop;

Delimiter $$

CREATE PROCEDURE LeaveWhileLoop()
BEGIN
    DECLARE num INT;
    DECLARE sum INT;
    SET num = 1;
    SET sum = 0;
```

SQL Query – Par 2

```
while_label: WHILE num < 200 DO
    IF num > 20 THEN
        LEAVE while_label;
    END IF;
    SET sum = sum + 2;
    SET num = num + 1;
END WHILE while_label;

SELECT sum;

END $$
```

Using LEAVE With WHILE Loop: Example

Step 2: Execute this stored procedure with **CALL** statement and check the output.

SQL Query

```
CALL LeaveWhileLoop();
```

Output:

	SUM
▶	40



Using LEAVE With REPEAT Loop

A LEAVE statement is used to terminate a REPEAT loop when a specific condition is satisfied before its loop condition becomes TRUE.

Syntax

```
[label:] REPEAT
    statement_list
    ...
    -- terminate the loop
    IF condition THEN
        LEAVE [label];
    END IF;
    ...
    -- other statements
UNTIL search_condition
END REPEAT [label];
```



Using LEAVE With WHILE Loop: Example

Problem Statement: Your manager expects you to write a loop in MySQL that produces the sum of first 20 even integers.

Objective: Create a stored procedure with a **REPEAT Loop** in MySQL that counts first 20 even integers and adds them one by one, terminating the loop when the integer count exceeds the 20th even integer and return the sum.

Using LEAVE With REPEAT Loop: Example

Step 1: Create a stored procedure as given below.

SQL Query – Par 1

```
DROP PROCEDURE LeaveRepeatLoop;

Delimiter $$

CREATE PROCEDURE LeaveRepeatLoop()
BEGIN
    DECLARE num INT;
    DECLARE sum INT;
    SET num = 1;
    SET sum = 0;
```

SQL Query – Par 2

```
repeat_label: REPEAT
    SET sum = sum + 2;
    SET num = num + 1;
    IF num > 20 THEN
        LEAVE repeat_label;
    END IF;
UNTIL num > 200
END REPEAT repeat_label;

SELECT sum;

END$$
```

Using LEAVE With REPEAT Loop: Example

Step 2: Execute this stored procedure with **CALL** statement and check the output.

SQL Query

```
CALL LeaveRepeatLoop();
```

Output:

	SUM
▶	40

Error Handling in Stored Procedures

Error Handling

Modifying the flow of code is known as error handling.



- When an error occurs, you either continue or exit the current execution.
- When an error occurs, you must ensure that there is an error message displayed.

Handlers refer to code that performs specified actions when an error occurs.

Error Handling

Syntax for a handler is shown below:

SYNTAX

```
DECLARE handler_action HANDLER FOR  
condition_value ... statement
```

CONTINUE

- Code continues to execute after error instance.

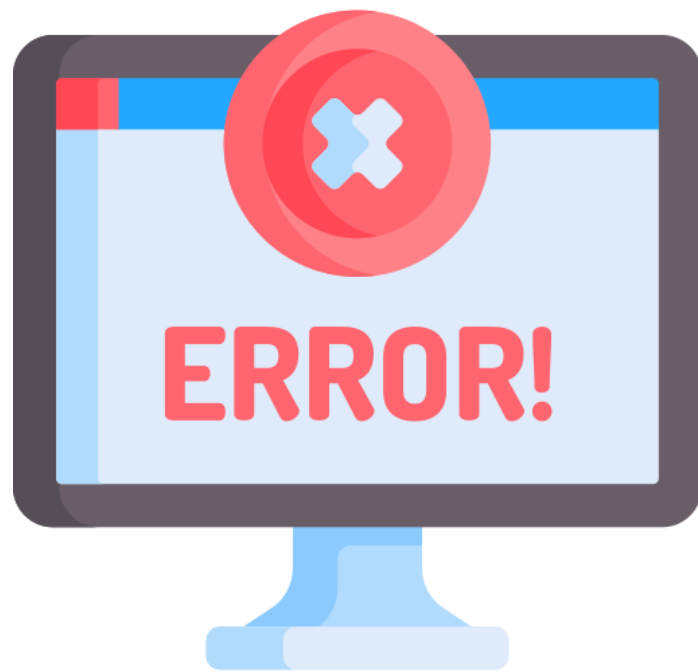
EXIT

- Code terminates execution from the point of error.

Condition_value specifies the type of error that activates the error handler.

Error Handling

All errors in MySQL are mapped to a specific code.



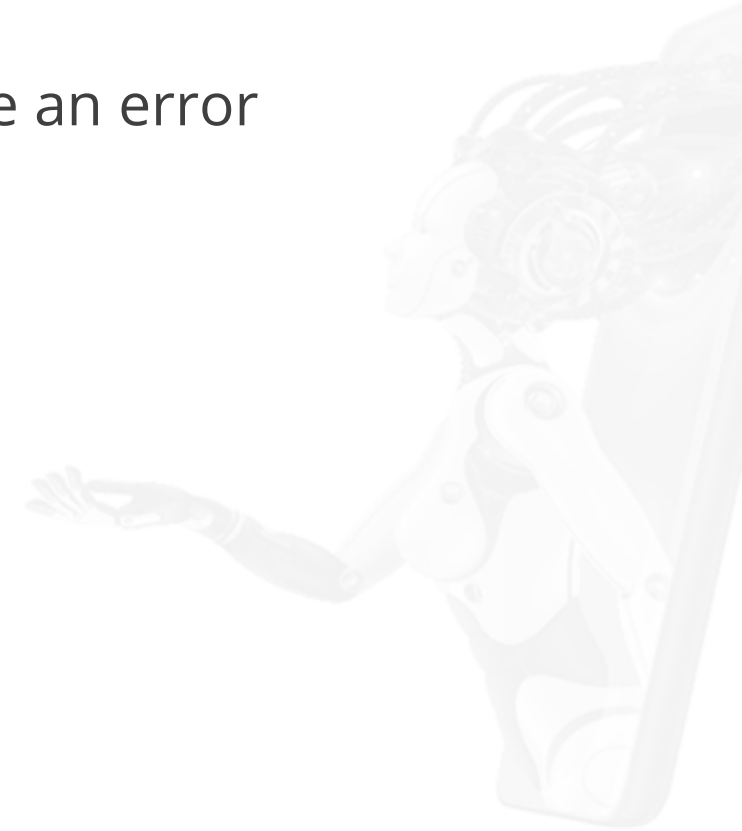
- SQLSTATE can correspond to multiple error code
- SQLEXCEPTION with SQLWARNING refer to a group of values of similar types.

MySQL error code handler, SQLSTATE error handler, and SQLEXCEPTION handler are ranked first, second, and third.

Error Handling (Continue): Example

Problem Statement: You are a junior DB administrator in your organization. The HR wants to extract distinct employee data that is ordered by department and employee ID. HR also wants to extract distinct department names.

Objective: Create a stored procedure to extract these requirements. Also, create an error handler that continues to execute in case of any wrong data input.



Error Handling (Continue): Example

Step 1: Create a stored procedure to extract the employee data ordered by the department with continue error handler.

SQL QUERY 1

```
DELIMITER &&
CREATE PROCEDURE GetTable()
BEGIN
DECLARE CONTINUE HANDLER FOR SQLSTATE '42S02'
SELECT 'SQLSTATE Handler - Table Not Found' AS msg;
DECLARE CONTINUE HANDLER FOR SQLEXCEPTION BEGIN
```

SQL QUERY 2

```
GET DIAGNOSTICS CONDITION 1 @sqlstate =
RETURNED_SQLSTATE, @errno = MYSQL_ERRNO,
@text = MESSAGE_TEXT;
SET @full_error = CONCAT("SQLEXCEPTION Handler - ERROR
", @errno, " (", @sqlstate, "): ", @text); SELECT
@full_error AS msg; END;
```

Error Handling (Continue): Example

SQL QUERY 3

```
SELECT DISTINCT ROLE FROM EMP_RECORDORDER BY DEPT,  
EMP_ID;  
  
-- Incorrect Table Name (EMP_RECORDS) SELECT DISTINCT  
DEPT FROM EMP_RECORDS;  
  
END &&
```



Error Handling (Continue): Example

Step 2: Call the stored procedure.

SYNTAX

```
CALL GetTable();
```

	msg
▶	SQLSTATE Handler - Table Not Found

Result 21 × Result 22

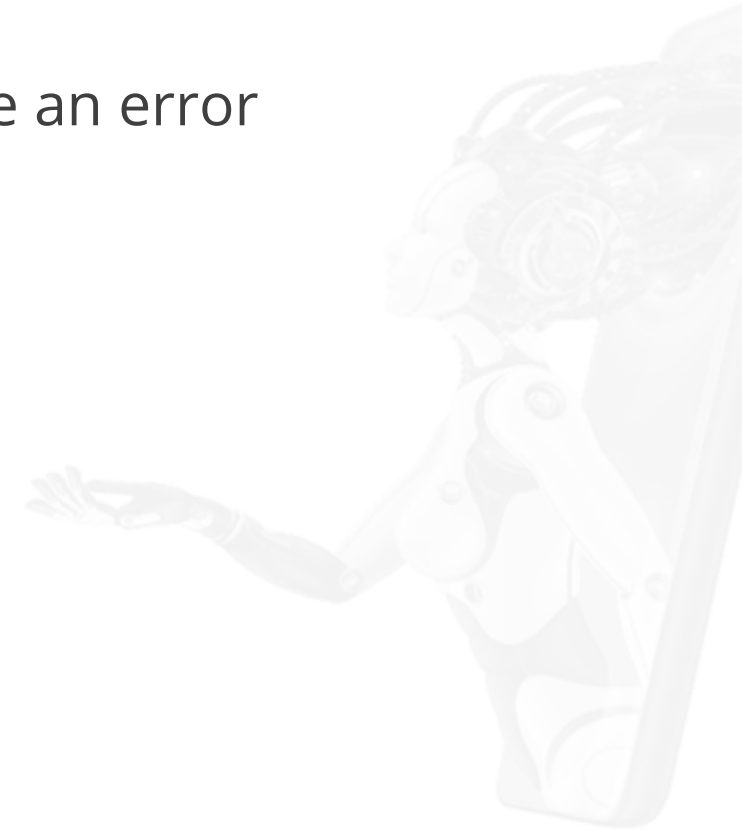
	DEPT
▶	Retail
	Finance
	Automotive
	Healthcare

Result 21 Result 22 ×

Error Handling (Exit): Example

Problem Statement: You are a junior DB administrator in your organization. The HR wants to extract distinct employee data that is ordered by department and employee ID. HR also wants to extract distinct department names.

Objective: Create a stored procedure to extract these requirements. Also, create an error handler that will exit to execute in case of any wrong data input.



Error Handling (Exit): Example

Step 1: Create a stored procedure to extract the employee data ordered by the department with exit error handler.

SQL QUERY 1

```
DELIMITER &&
CREATE PROCEDURE GetTableOrExit()
BEGIN
DECLARE EXIT HANDLER FOR SQLEXCEPTION
    BEGIN
GET DIAGNOSTICS CONDITION 1
```

SQL QUERY 2

```
@sqlstate = RETURNED_SQLSTATE,
    @errno = MYSQL_ERRNO,
    @text = MESSAGE_TEXT;
SET @full_error = CONCAT("SQLEXCEPTION Handler -
ERROR ", @errno, " (", @sqlstate, "): ", @text);
SELECT @full_error AS msg;
END;
```

Error Handling (Exit): Example

SQL QUERY 3

```
-- MySQL Query 1
SELECT DISTINCT ROLE FROM EMP_RECORD
ORDER BY DEPT, EMP_ID; -- Incorrect Table Name
(EMP_RECORDS)

-- MySQL Query 2
SELECT DISTINCT DEPT FROM EMP_RECORDS;

END &&
```



Error Handling (Exit): Example

Step 2: Call the stored procedure.

SYNTAX

```
CALL GetTableOrExit();
```

	msg
▶	SQLExceptionHandler - ERROR 1146 (42S02): Table 'sql_course.emp_record' doesn't exist

Result 23 ✕

Error Handling

SIGNAL and RESIGNAL statements are used to raise error conditions inside stored procedures.

Signal Statement

- Used to return an error or warning to the caller from a stored program

Resignal Statement

- Used to raise a warning or error in terms of functionality and syntax

SIGNAL Statement

SIGNAL statement provides control over information for returning value and message SQLSTATE.

SQLSTATE is a code that identifies SQL error conditions.

SYNTAX

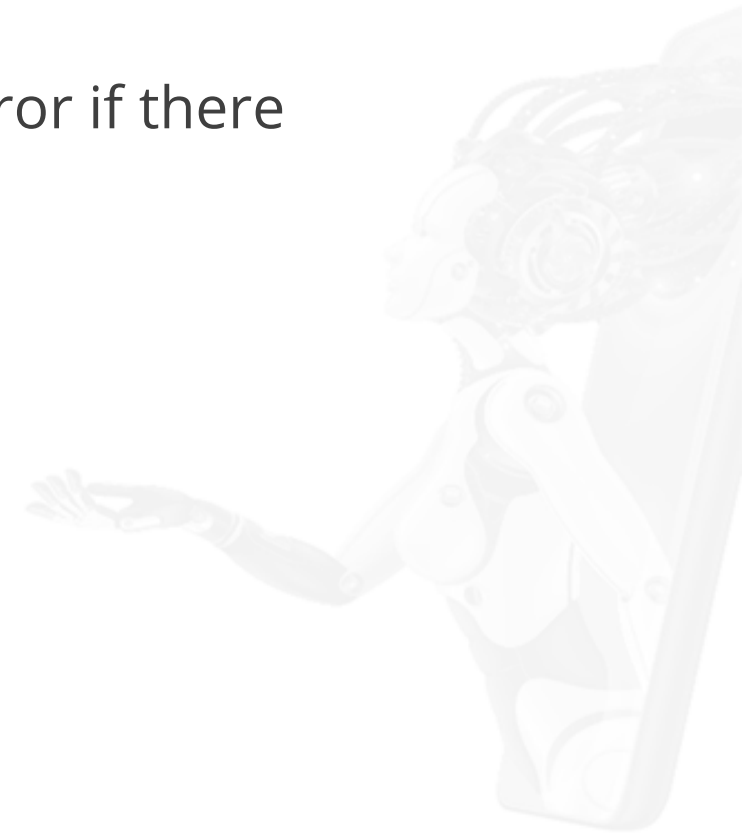
```
SIGNAL SQLSTATE | condition_name; SET condition_information_item_name_1 = value_1,  
condition_information_item_name_1 = value_2, etc; DECLARE handler_action HANDLER FOR  
condition_value ... statement
```

The condition_information_item_name can be MESSAGE_TEXT, MYSQL_ERRORNO, or CURSOR_NAME.

Error Handling (Signal): Example

Problem Statement: You are a junior DB administrator in your organization. The HR wants to extract the employees reporting to a manager.

Objective: Create a stored procedure to extract this requirement and indicate error if there are no employees reporting.



Error Handling (Signal): Example

Step 1: Create a stored procedure to extract list of employees reporting to the manager ID that is entered in the CALL function.

SQL QUERY 1

```
DELIMITER $$
CREATE PROCEDURE GetEmpRecords (mid VARCHAR(4))
BEGIN
    DECLARE ecount INT;
    SELECT COUNT(EMP_ID) INTO ecount
    FROM EMP_RECORDS
    WHERE MANAGER_ID = mid;
```

SQL QUERY 2

```
-- check if orderNumber exists
    IF(ecount < 1) THEN
        SIGNAL SQLSTATE '45000'
        SET MESSAGE_TEXT = 'No Reporting Employees
Found!!';
    END IF;
```

Error Handling (Signal): Example

SQL QUERY 3

```
-- more code below  
      SELECT EMP_ID, FIRST_NAME, LAST_NAME, GENDER, DEPT  
FROM EMP_RECORDS  
      WHERE MANAGER_ID = mid;  
END $$
```



Error Handling (Signal): Example

Step 2: Use the CALL function for the given manager ID.

```
SQL QUERY 3
CALL GetEmpRecords('E428');
```

	EMP_ID	FIRST_NAME	LAST_NAME	GENDER	DEPT
▶	E532	Claire	Brennan	F	AUTOMOTIVE

```
SQL QUERY 3
CALL GetEmpRecords('E612');
```

Action Output					
	#	Time	Action	Message	Duration / Fetch
✖	1	13:39:52	CALL GetEmpRecords('E612')	Error Code: 1644. No Reporting Employees Found!!	0.000 sec

RESIGNAL Statement

RESIGNAL is similar to the SIGNAL statement, in terms of functionality and syntax.



- It must be used within an error handler; else you will receive an error message **RESIGNAL when the handler is not active.**
- All the attributes of the RESIGNAL statement can be omitted.

Error Handling (Resignal): Example

Problem Statement: You are a junior DB administrator in your organization. The HR wants to extract the employees reporting to a manager.

Objective: Create a stored procedure to extract this requirement and indicate an error if no employees are reporting and customize the error using resignal.



Error Handling (Resignal): Example

Step 1: Create a stored procedure to extract the employees data reporting to the manager ID that is entered in the CALL function and customize the error name.

SQL QUERY 1

```
DELIMITER $$  
CREATE PROCEDURE GetEmpRecords2 (mid VARCHAR(4))  
BEGIN  
    DECLARE ecounT INT;  
    DECLARE Manager_Without_Team CONDITION FOR SQLSTATE  
        '45000';  
    DECLARE CONTINUE HANDLER FOR Manager_Without_Team
```

SQL QUERY 2

```
RESIGNAL SET MESSAGE_TEXT = 'No Reporting Employees  
Found!!';  
SELECT COUNT (EMP_ID) INTO ecounT  
    FROM EMP_RECORDS  
    WHERE MANAGER_ID = mid;  
-- check if orderNumber exists  
IF (ecounT < 1) THEN  
    SIGNAL Manager_Without_Team;  
ELSE
```

Error Handling (Resignal): Example

SQL QUERY 3

```
SELECT EMP_ID, FIRST_NAME, LAST_NAME, GENDER, DEPT
FROM EMP_RECORDS
      WHERE MANAGER_ID = mid;
      END IF;
END $$
```



Error Handling (Resignal): Example

Step 2: Use the CALL function for the given Manager ID.

SQL QUERY

CALL GetEmpRecords ('E083');

	EMP_ID	FIRST_NAME	LAST_NAME	GENDER	DEPT
▶	E052	Dianna	Wilson	F	HEALTHCARE
	E057	Dorothy	Wilson	F	HEALTHCARE
	E505	Chad	Wilson	M	HEALTHCARE

SQL QUERY

CALL GetEmpRecords ('E612');

Action Output					
	#	Time	Action	Message	Duration / Fetch
✖	1	13:58:31	CALL GetEmpRecords2('E612')	Error Code: 1644. No Reporting Employees Found!!	0.094 sec

Assisted Practice: Error Handling



Duration: 15 minutes

Problem Statement: Declare an error handler in MySQL to handle errors encountered in stored procedures due to duplication of primary keys.

ASSISTED PRACTICE

Assisted Practice: Error Handling



Steps to be performed:

1. Create a table named **dataproject** with columns named **emp_id** and **project_id**.

TABLE CREATION:

```
CREATE TABLE `sys`.`dataproject`  
(`project_id` INT NOT NULL,  
`emp_id` INT NOT NULL, PRIMARY KEY  
(`emp_id`));
```


Assisted Practice: Error Handling



2. Insert values in the **dataproject** table.

VALUE INSERTION:

```
INSERT INTO `sys`.`dataproject` (`project_id`, `emp_id`) VALUES ('90', '1');INSERT  
INTO `sys`.`dataproject` (`project_id`, `emp_id`) VALUES ('91', '2');INSERT INTO  
`sys`.`dataproject` (`project_id`, `emp_id`) VALUES ('92', '3');INSERT INTO  
`sys`.`dataproject` (`project_id`, `emp_id`) VALUES ('93', '4');INSERT INTO  
`sys`.`dataproject` (`project_id`, `emp_id`) VALUES ('94', '5');INSERT INTO  
`sys`.`dataproject` (`project_id`, `emp_id`) VALUES ('95', '6');
```

ASSISTED PRACTICE

Assisted Practice: Error Handling



3. Create a stored procedure named **product**, and declare the EXIT handler for MySQL.

STORED PROCEDURE AND EXIT HANDLER CREATION:

```
DROP PROCEDURE IF EXISTS Product;
DELIMITER $$
CREATE PROCEDURE Product( IN inproject_id INT, IN inemp_id INT) BEGIN
DECLARE EXIT HANDLER FOR 1062 SELECT 'Duplicate keys error
encountered' Message;
INSERT INTO dataproject(project_id,emp_id)
VALUES(inproject_id,inemp_id);    SELECT COUNT(*)
FROM dataproject WHERE project_id = inproject_id;
END$$ DELIMITER ;
CALL Product(95,6);
```



Assisted Practice: Lab Output

Table: product

	project_id	emp_id
	90	1
	91	2
	92	3
	93	4
	94	5
▶	95	6

Output:

	Message
▶	Duplicate keys error encountered

ASSISTED PRACTICE

Cursors in Stored Procedures

Cursors in Stored Procedures



- A database cursor is a control structure that allows users to access records in a database.
- Database programmers utilize cursors to process individual rows returned by database system queries.

Cursors in Stored Procedures

Functions of cursors:



Enabling
manipulation

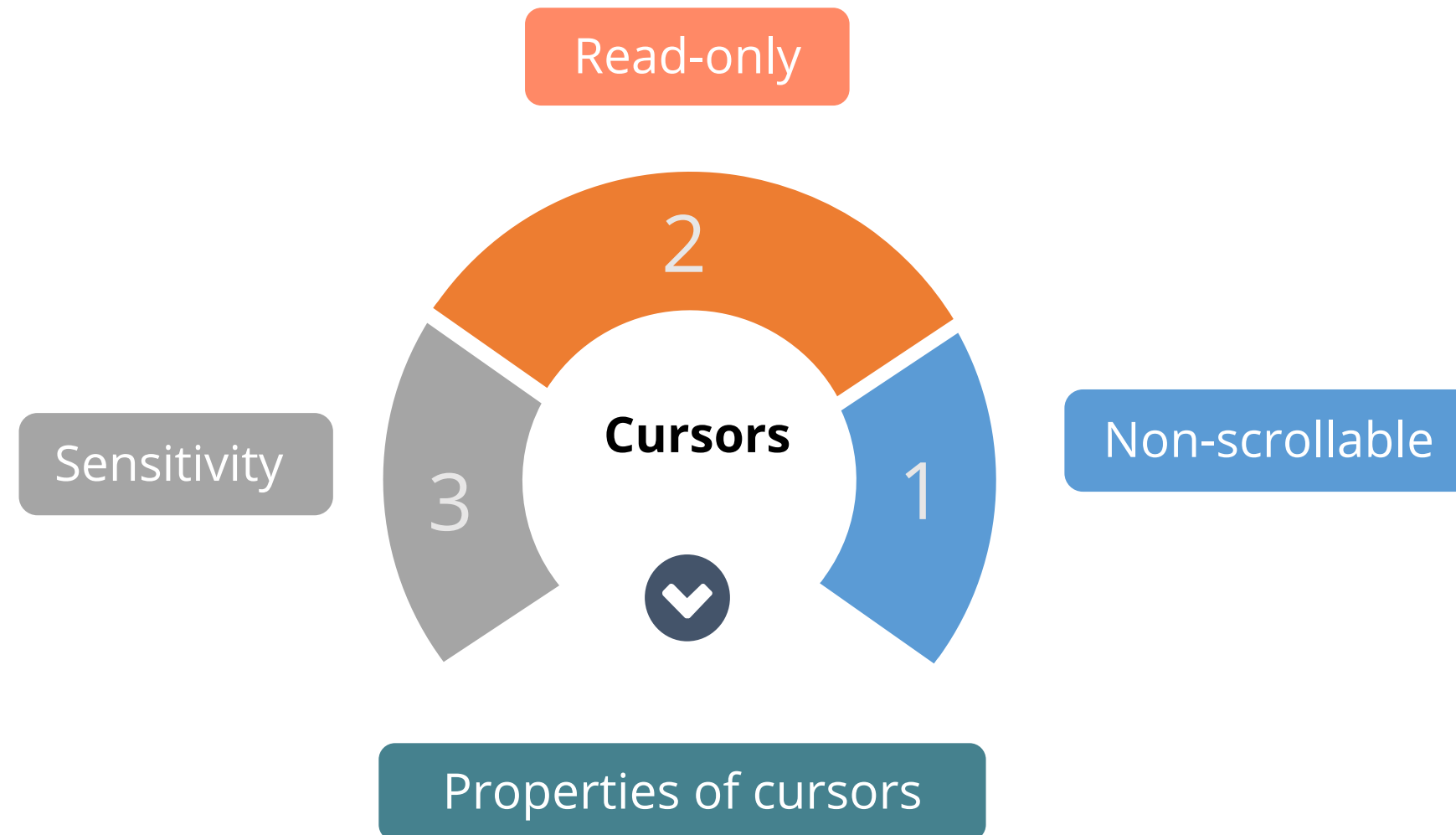


Performing complex
operations



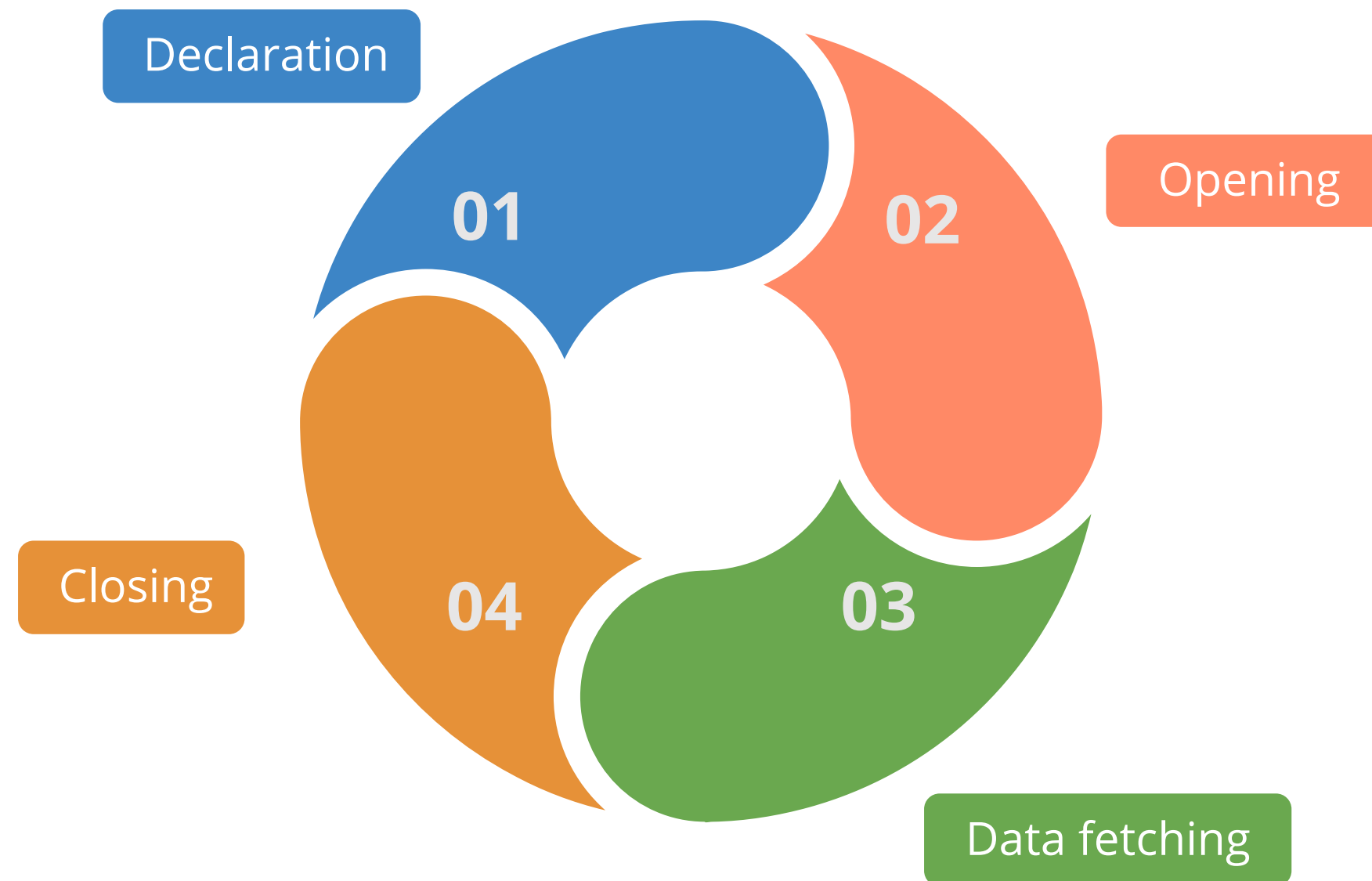
Returning to client
application

Cursors in Stored Procedures



Cursors in Stored Procedures

Steps to use cursors:



Cursors in Stored Procedures

Declaring a cursor:

```
DECLARE cursor_name  
CURSOR FOR select_statement
```

Cursors in Stored Procedures

Opening a cursor:

```
OPEN cursor_name
```

Cursors in Stored Procedures

Fetching data from cursor:

```
FETCH [[NEXT] FROM] cursor_name  
INTO var_name [, var_name]
```

Cursors in Stored Procedures

Closing:

```
CLOSE cursor_name
```

Cursors in Stored Procedures

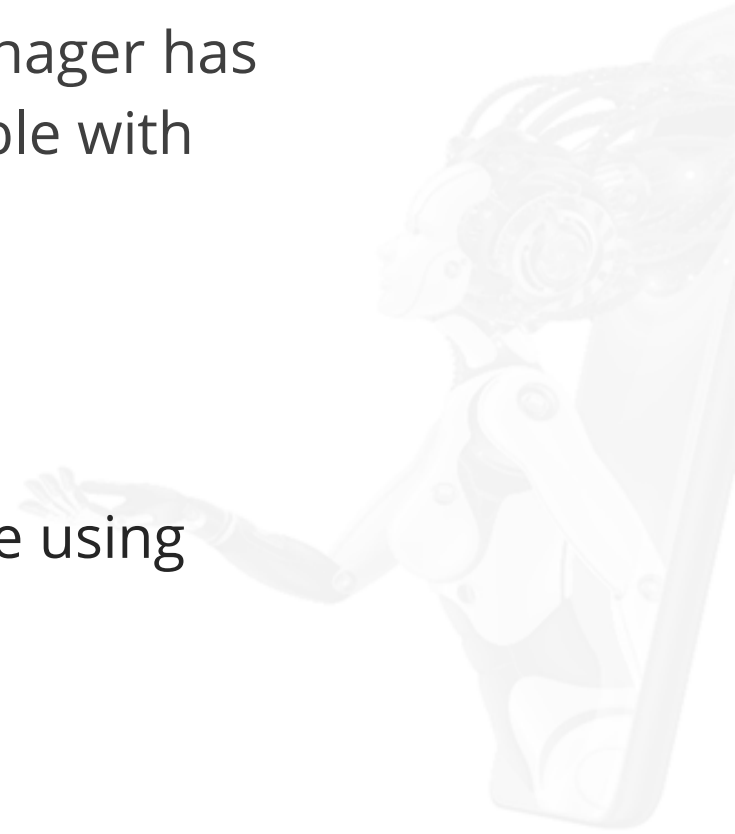
Example:

```
DELIMITER $$
CREATE PROCEDURE my_procedure_cursors(INOUT return_val INT)
BEGIN
DECLARE a,b INT;
DECLARE cursor_1 CURSOR FOR
SELECT max_bonus FROM payscale;
DECLARE CONTINUE HANDLER FOR NOT FOUND SET b = 1;
OPEN cursor_1;
REPEAT FETCH cur_1 INTO a;
UNTIL b = 1 END REPEAT;
CLOSE cursor_1;
SET return_val = a;
END;
$$
```

Problem Statement

Problem Scenario: You are working as a junior database administrator. Your manager has asked you to perform different operations using cubes on the **project_details** table with the schema named as **sys**.

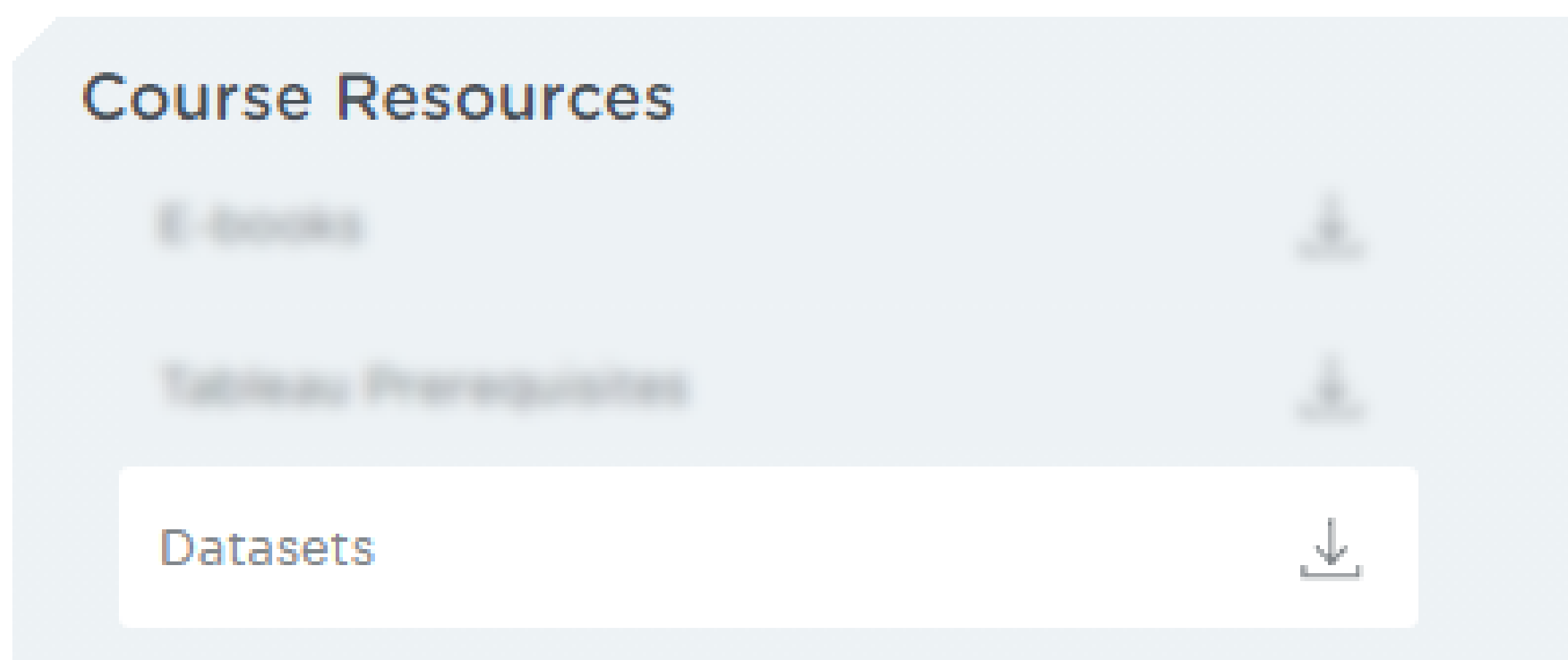
Objective: You are required to extract the first record of the **project_details** table using **CUBES**, where status is marked as **DONE**.



Problem Statement

Steps to be performed:

1. Download the **emp_details** and **project_details** table from the course resources, and import it to MySQL Workbench.



Solution

Query for FIRST record

```
DELIMITER $$
CREATE PROCEDURE abcd ()
BEGIN DECLARE a VARCHAR(255);
DECLARE b VARCHAR(255);DECLARE cursor_1 CURSOR FOR SELECT
status, project_name FROM project_details
WHERE status = 'DONE';
OPEN cursor_1;
REPEAT FETCH cursor_1 INTO a,b;
UNTIL b = 0 END REPEAT;SELECT a as status, b as name;
CLOSE cursor_1;END;
$$ DELIMITER ; call abcd();
```


Output

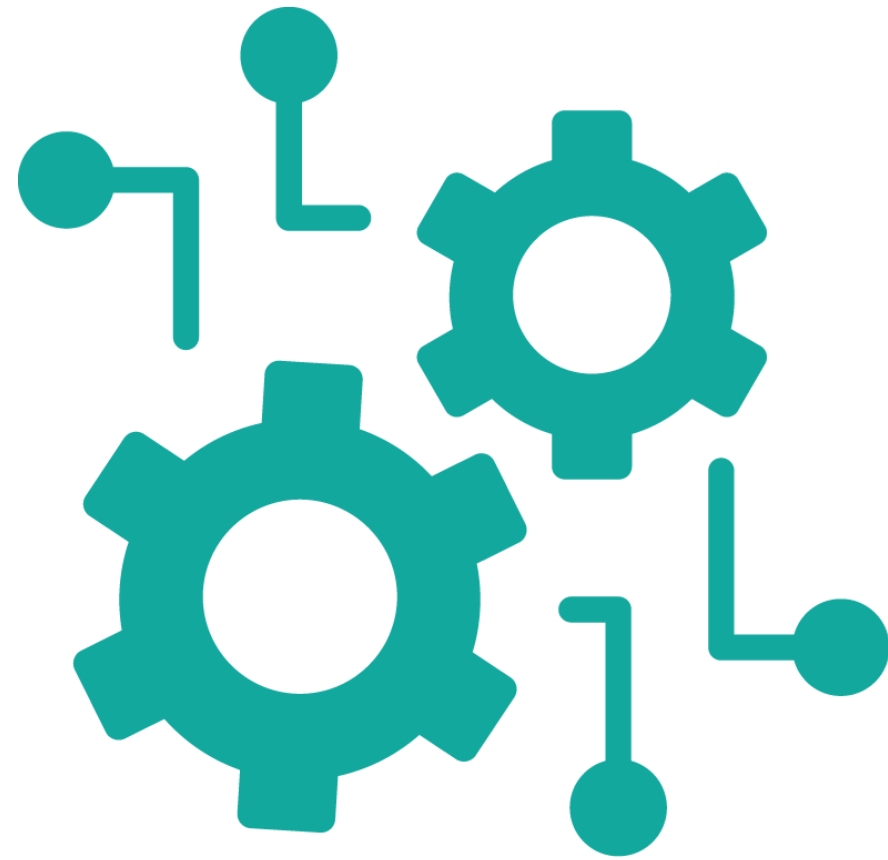
After executing the query, we get the first project which has the status as DONE.

	status	name
▶	DONE	Drug Discovery



Stored Functions in Stored Procedures

Stored Functions in Stored Procedures



A stored function is a stored program that returns a single value.

It is a subroutine that may be accessed by programs that use a relational database management system.

Stored Functions in Stored Procedures



The CREATE FUNCTION statement is used for creating a stored function and user-defined functions.

Stored Functions in Stored Procedures

Syntax for creating a stored function:

```
DELIMITER $$
```

```
CREATE FUNCTION fun_name(fun_parameter(s))
```

```
RETURNS datatype
```

```
[NOT] {Characteristics}
```

```
fun_body;
```

Stored Functions in Stored Procedures

Parameters	Description
fun_name	The name of the stored function that the user wants to create
fun_parameter	The list of parameters used by the function body
datatype	The data type that returns value of the function
fun_body	The set of SQL statements that performs the operations

Stored Functions in Stored Procedures

Example:

```
DELIMITER //
```

```
CREATE FUNCTION no_of_years(date1  
date) RETURNS int DETERMINISTIC  
BEGIN  
    DECLARE date2 DATE;  
    Select current_date() into date2;  
    RETURN year(date2)-year(date1);  
END
```

```
//
```

```
DELIMITER ;
```

EMP_ID	Fname	Lname	Start_Data
1	Ravi	Kumar	2000-01-09
2	Slim	Shady	2005-09-11
3	Michael	Scott	2002-04-12
4	Travis	Baker	2004-06-11

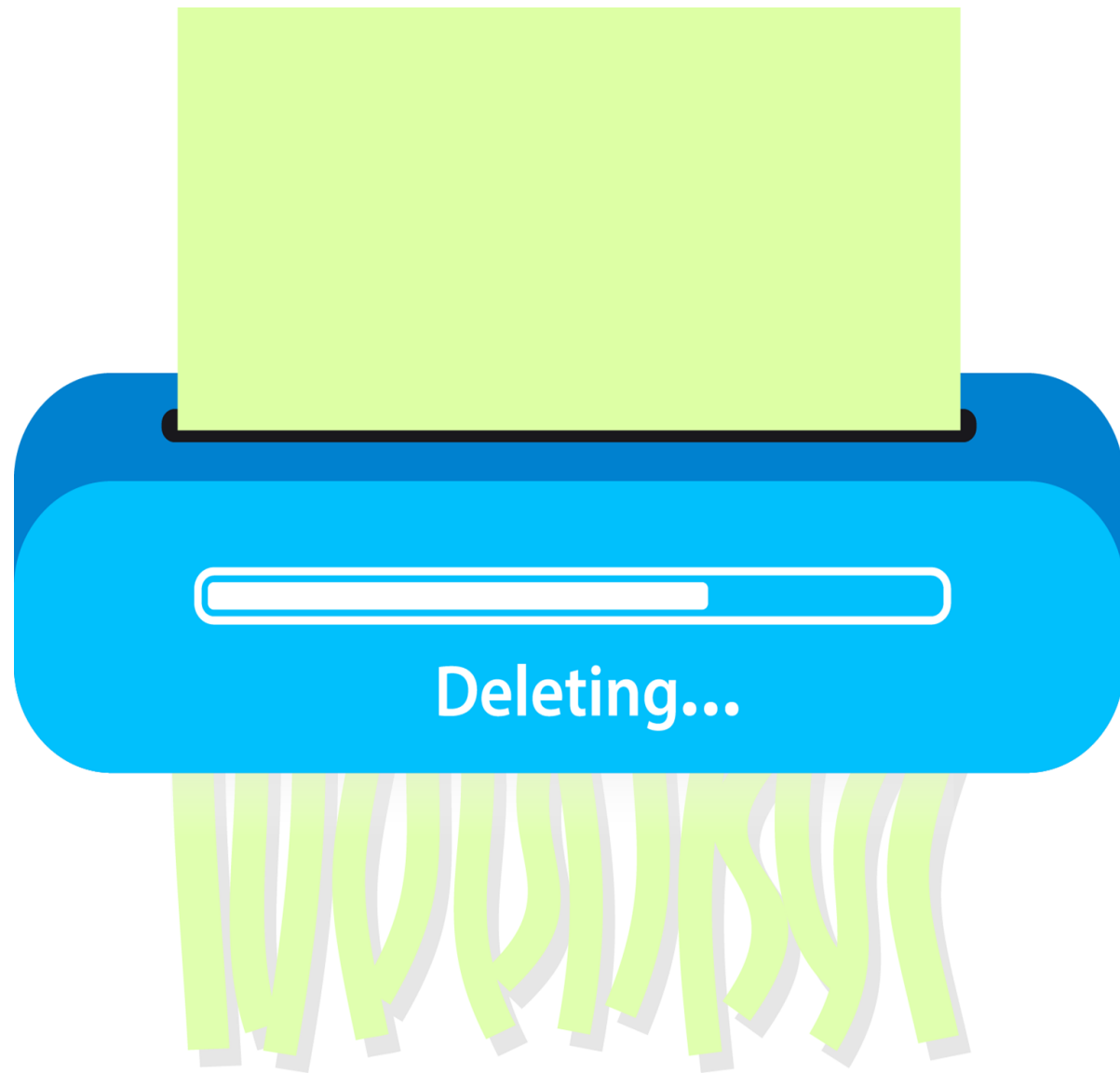
Stored Functions in Stored Procedures

Output:

EMP_ID	Fname	Lname	Years
1	Ravi	Kumar	21
2	Slim	Shady	16
3	Michael	Scott	19
4	Travis	Baker	17



Stored Functions in Stored Procedures



To remove a stored function, we use the DROP FUNCTION.

Syntax for removing a stored function:

```
DROP FUNCTION [IF EXISTS] function_name;
```

Stored Functions in Stored Procedures



The list of all stored functions from databases can be accessed by using `SHOW FUNCTION STATUS`.

Stored Functions in Stored Procedures

Syntax for listing stored function:

```
SHOW FUNCTION STATUS  
[LIKE 'pattern' | WHERE search_condition];
```

Stored Functions in Stored Procedures

Syntax for listing stored function using the data dictionary:

```
SELECT
    routine_name
FROM
    information_schema.routines
WHERE
    routine_type = 'FUNCTION'
    AND routine_schema = '<database_name>;'
```

Stored Functions in Stored Procedures

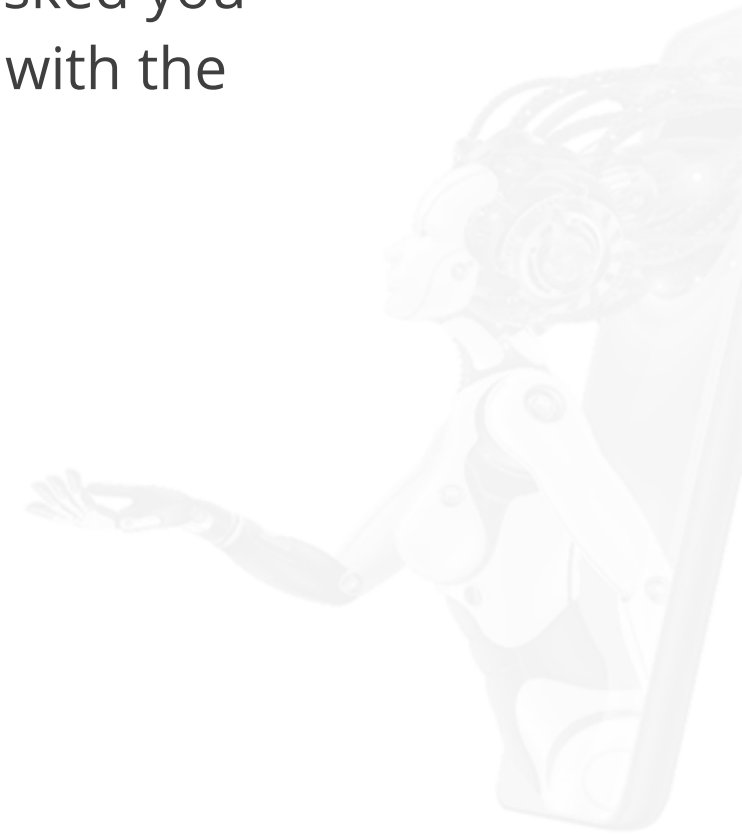
Example:

```
SELECT
    routine_name
FROM
    information_schema.routines
WHERE
    routine_type = 'FUNCTION'
    AND routine_schema = 'classicmodels';
```

Problem Statement

Problem Scenario: You are a junior database administrator. Your manager has asked you to perform different operations using **stored function** on the **emp_details** table with the schema named as **sys**.

Objective: You are required to extract the first and last names, department, and designation based on the experience of the employees.



Solution

Query for designation

```
DELIMITER $$

drop function sys.Customer_details1;

CREATE FUNCTION Customer_details1(experience int)
RETURNS VARCHAR(2255) DETERMINISTIC
BEGIN DECLARE customer_details1 VARCHAR(2255);
IF experience <= 2 THEN SET customer_details1 = 'JUNIOR DATA SCIENTIST';
ELSEIF experience <= 5 THEN SET customer_details1 = 'ASSOCIATE DATA SCIENTIST';
ELSEIF experience <= 10 THEN SET customer_details1 = 'SENIOR DATA SCIENTIST';
ELSEIF experience <= 12 THEN SET customer_details1 = 'LEAD DATA SCIENTIST';
ELSEIF experience > 12 THEN SET customer_details1 = 'MANAGER'
END IF; RETURN (customer_details1); END$$ DELIMITER $$;

SELECT first_name, last_name, department, Customer_details1(experience) as designation FROM
sys.emp_details ORDER BY experience;
```

Output

After executing the query, the list of names, department, experience, and designation are shown as the following output:

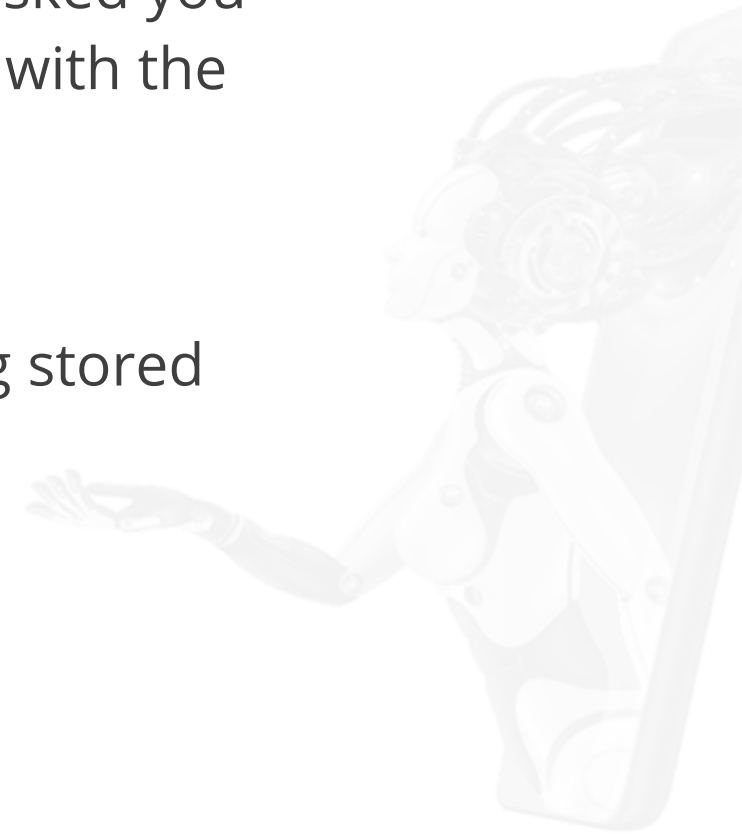
	first_name	last_name	department	designation	experience
▶	Jenifer	Jhones	RETAIL	JUNIOR DATA SCIENTIST	1
	Katrina	Allen	RETAIL	JUNIOR DATA SCIENTIST	2
	David	Smith	RETAIL	ASSOCIATE DATA SCIENTIST	3
	Claire	Brennan	AUTOMOTIVE	ASSOCIATE DATA SCIENTIST	3
	Steve	Hoffman	FINANCE	ASSOCIATE DATA SCIENTIST	4
	Chad	Wilson	HEALTHCARE	ASSOCIATE DATA SCIENTIST	5
	Dianna	Wilson	HEALTHCARE	SENIOR DATA SCIENTIST	6
	Nian	Zhen	RETAIL	SENIOR DATA SCIENTIST	6
	Karene	Nowak	AUTOMOTIVE	SENIOR DATA SCIENTIST	8
	Dorothy	Wilson	HEALTHCARE	SENIOR DATA SCIENTIST	9
	Eric	Hoffman	FINANCE	LEAD DATA SCIENTIST	11
	Slim	Shady	FINANCE	LEAD DATA SCIENTIST	11
	William	Butler	AUTOMOTIVE	LEAD DATA SCIENTIST	12
	Tracy	Norris	RETAIL	MANAGER	13
	Emily	Grove	FINANCE	MANAGER	14



Problem Statement

Problem Scenario: You are a junior database administrator. Your manager has asked you to perform different operations using **stored function** on the **emp_details** table with the schema named as **sys**.

Objective: You are required to extract the names and status of the projects using stored procedure with stored functions.



Solution

Query for stored function

```
DELIMITER $$
CREATE FUNCTION Customer_details1(project_id VARCHAR(225))
RETURNS VARCHAR(2255) DETERMINISTIC
BEGIN DECLARE customer_details1 VARCHAR(2255);
IF project_id = 'P103' THEN SET customer_details1 = 'Drug Discovery';
ELSEIF project_id = 'P105' THEN SET customer_details1 = 'Fraud Detection';
ELSEIF project_id = 'P109' THEN SET customer_details1 = 'Market Basket Analysis';
ELSEIF project_id = 'P201' THEN SET customer_details1 = 'Self Driving Cars';
ELSEIF project_id = 'P204' THEN SET customer_details1 = 'Supply Chain Management';
ELSEIF project_id = 'P208' THEN SET customer_details1 = 'Algorithmic Trading';
ELSEIF project_id = 'P302' THEN SET customer_details1 = 'Early Detection of Lung Cancer';
ELSEIF project_id = 'P406' THEN SET customer_details1 = 'Customer Sentiment Analysis';
END IF; RETURN (customer_details1); END$$
DELIMITER $$;
```

Solution

Query for using stored procedure

```
DELIMITER $$  
  
CREATE PROCEDURE GetCustomerDetail() BEGIN  
  
SELECT project_id, status , Customer_details1(project_id) as  
project_name FROM sys.project_details ORDER BY project_id;  
  
END$$ DELIMITER ; call GetCustomerDetail();
```



Output

After executing the query, the list of **project_id**, **project_name**, and **status** are shown as the following output:

	project_id	project_name	status
▶	P103	Drug Discovery	DONE
	P105	Fraud Detection	DONE
	P109	Market Basket Analysis	DELAYED
	P201	Self Driving Cars	YTS
	P204	Supply Chain Management	WIP
	P208	Algorithmic Trading	YTS
	P302	Early Detection of Lung Cancer	YTS
	P406	Customer Sentiment Analysis	WIP



Difference Between Stored Functions and Stored Procedures

Stored Functions

- A function has a return type and returns a value.
- Functions cannot be used with data manipulation queries. Only select queries are allowed in functions.
- A function does not allow output parameters.
- Stored procedures cannot be called from a function.

Stored Procedures

- A procedure does not have a return type. It returns values using the OUT parameters.
- DML queries such as insert, update, and select can be used with procedures.
- A procedure allows both input and output parameters.
- Functions can be called from a stored procedure.

Stored Program Security

Stored Program Security

The body of each stored program is made up of SQL statements. These could be compound statements with numerous statements separated by semicolon (;) characters.



In the realm of databases and stored programs, security has always been of paramount importance.



Stored Program Security

Stored programs can be executed with permission of the user who created the program rather than that of the user who is executing the stored program.



A user must have specific and distinct permissions to both create and execute a stored program.



Stored Object Access Control

Stored Object Access Control



- MySQL uses DEFINER and SQL SECURITY characteristics to control the privileges that apply to the execution of a stored object.

Stored Object Access Control

Syntax

```
CREATE [DEFINER=user] PROCEDURE spName(parameter_list)
```

```
...
```

```
CREATE [DEFINER=user] FUNCTION sfName()
```

```
...
```

- You can specify the DEFINER attribute, which is the name of a MySQL account, when defining a stored routine such as a stored procedure or function.



Stored Object Access Control

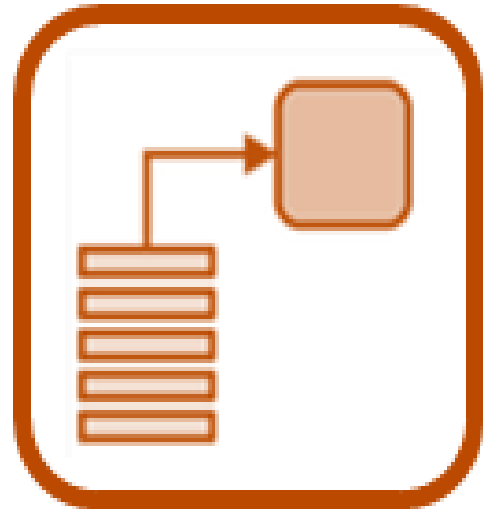
Syntax

```
CREATE [DEFINER=user] PROCEDURE spName(parameter_list)
SQL SECURITY [DEFINER | INVOKER]
...
CREATE [DEFINER=user] FUNCTION sfName(parameter_list)
SQL SECURITY [DEFINER | INVOKER]
...
```

- An SQL SECURITY clause with a value of DEFINER or INVOKER can be used in stored routines (stored procedures and functions) and views.



Stored Object Access Control



The object definition can include an SQL SECURITY characteristic with a value of DEFINER or INVOKER to specify whether the object executes in definer or invoker context.

Stored Object Access Control

SQL SECURITY DEFINER

Syntax

```
DELIMITER $$  
CREATE DEFINER = 'admin'@'localhost' PROCEDURE p1()  
SQL SECURITY DEFINER  
BEGIN  
UPDATE t1 SET counter = counter + 1;  
END$$
```



Stored Object Access Control

SQL SECURITY INVOKER

Syntax

```
DELIMITER $$  
CREATE DEFINER = 'admin'@'localhost' PROCEDURE p2()  
SQL SECURITY INVOKER  
BEGIN  
UPDATE t1 SET counter = counter + 1;  
END$$
```



Use Case for Stored Object Access Control

Problem Scenario:

Consider a senior DBA wants to create a stored procedure and a new user named junior DBA with access to perform operations on the securitydb database.

Objective:

The senior DBA is required to create a stored procedure, a new user named junior DBA, and grant access to the junior DBA with the help of DEFINER and INVOKER.

Instructions:

Create a new **securitydb** database and a new **projectdetails** table to perform the above objectives.

Table Description

Field Name	Description
ID	Serial number
messages	A textual description



Use Case for Stored Object Access Control

Solution

```
# create securitydb

CREATE DATABASE securitydb;

# create table projectdetails

CREATE TABLE projectdetails (    id
INT AUTO_INCREMENT,    message
VARCHAR(100) NOT NULL,    PRIMARY KEY
(id));
```

By executing this query, you can create a database and a table.

Solution

```
# create stored procedure using definer

DELIMITER $$
CREATE DEFINER = root@localhost PROCEDURE
InsertsMessages( msg VARCHAR(100))
SQL SECURITY DEFINER
BEGIN
INSERT INTO projectdetails(message)
VALUES(msg);
END$$
DELIMITER ;
```

By executing this query, you can create a stored procedure using DEFINER.

Use Case for Stored Object Access Control

Solution

```
# create new user junior

CREATE USER junior@localhost
IDENTIFIED BY 'junior123';

# grant access for new user

GRANT EXECUTE ON securitydb.* TO
junior@localhost;
```

By executing this query, you can create a new user and grant access.

Solution

```
# create stored procedure using invoker

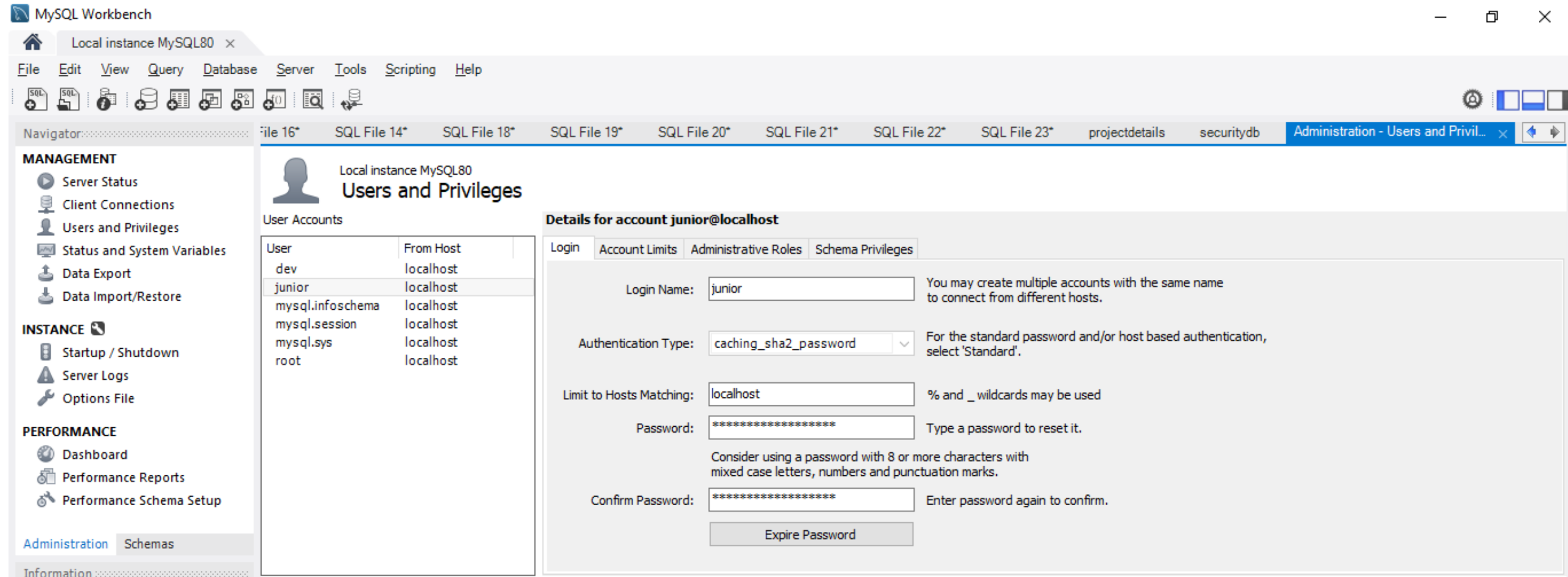
DELIMITER $$
CREATE DEFINER=root@localhost PROCEDURE
UpdateMessages(msgId INT,msg VARCHAR(100))
SQL SECURITY INVOKER
BEGIN
UPDATE projectdetails
SET message = msg
WHERE id = msgId;
END$$
DELIMITER ;
```

By executing this query, you can create a stored procedure using INVOKER.

Use Case for Stored Object Access Control

Output:

You can view the new user and privileges under Administration tab -> Users and privileges tab.



The screenshot shows the MySQL Workbench interface with the 'Administration - Users and Privileges' window open. The 'Users and Privileges' tab is selected, displaying a list of user accounts and the details for the 'junior@localhost' account.

Local instance MySQL80
Users and Privileges

User Accounts

User	From Host
dev	localhost
junior	localhost
mysql.infoschema	localhost
mysql.session	localhost
mysql.sys	localhost
root	localhost

Details for account junior@localhost

Login | Account Limits | Administrative Roles | Schema Privileges

Login Name: You may create multiple accounts with the same name to connect from different hosts.

Authentication Type: For the standard password and/or host based authentication, select 'Standard'.

Limit to Hosts Matching: % and _ wildcards may be used

Password: Type a password to reset it.

Consider using a password with 8 or more characters with mixed case letters, numbers and punctuation marks.

Confirm Password: Enter password again to confirm.

SQL Triggers

SQL Triggers



When a specific change operation (SQL INSERT, UPDATE, or DELETE statement) is done on a specific table, a trigger is executed automatically. It is a collection of actions.



SQL Triggers

Syntax to create a trigger

Syntax

```
create trigger [trigger_name] [before | after]
{insert | update | delete} on [table_name] [for
each row] [trigger_body]
```



SQL Triggers

Data Definition Language (DDL) command events that begin with Create, Alter, or Drop, such as Create table, Create view, Drop table, Drop view, and Alter table, fire the DDL triggers.

There are two types of triggers:

DML triggers are activated when Data Manipulation Language (DML) command events begin with Insert, Update, or Delete. Insert table, Update view, and Delete table are examples of such functions.

SQL Triggers

DDL Trigger

Syntax

```
create trigger saftey on database for  
create_table,alter_table,drop_table as print'you  
can not create ,drop and alter table in this  
database' rollback;
```

DML Trigger

Syntax

```
create trigger deep on emp for  
insert,update,delete as print'you can  
not insert,update and delete this table i'  
rollback;
```

SQL Triggers

Triggers can be used to:

1

Enforce business rules

2

Validate input data

3

Create a unique value for a newly entered row in another file

4

Write to additional files for auditing

5

Perform a cross-reference query from other files

6

Achieve data consistency, putting duplicate data to separate files

Use Case for Triggers

Problem Scenario:

Consider an HR of a company wants to update the salary of employees based on their experience using triggers.

Objective:

You are required to retrieve the employee ID, first name, role, experience, and salary by creating a trigger to update the salary of the employee to 20000 if the years of experience are greater than 15.

Instructions:

Refer to the payroll dataset given in the course resource section in LMS to create a payroll table using fields mentioned in the dataset and insert the values accordingly to perform the above objectives.

Table Description

Field Name	Description
EMP_ID	Employee ID
FIRST_NAME	First name of the employee
LAST_NAME	Last name of the employee
GENDER	Gender of the employee (M/F)
ROLE	Designation of the employee (Junior, Senior, Lead and Associate Data Scientist)
DEPT	Name of the department (Retail, Finance, Automotive, and Healthcare)

Table Description

Field Name	Description
EXP	Experience of the employee
COUNTRY	Country where the employee live
CONTINENT	Continent based on the country
SALARY	Salary of the employee per month in Dollars
EMP_RATING	Rating for the employee (1: Not Achieved Any Goals, 2: Below Expectation, 3: Meeting Expectation, 4: Excellent Performance, 5: Over Achiever
MANAGER_ID	Employee ID for the manager

Use Case for Triggers

Solution:

```
# create a trigger salary to update the salary if the experience is greater than 15

delimiter //
CREATE TRIGGER salary
BEFORE INSERT ON payroll_table
FOR EACH ROW
  IF NEW.EXP>15 THEN SET NEW.salary = 20000;
END IF; //
```

By executing this query, the HR can identify the updated salary of the employee as 20000 if the experience is greater than 15.

Use Case for Triggers

Output:

Values in the dataset before trigger

	EMP_ID	FIRST_NAME	LAST_NAME	GENDER	ROLE	DEPT	EXP	COUNTRY	CONTINENT	SALARY	EMP_RATING	MANAGER_ID
▶	E001	Arthur	Black	M	CEO	ALL	20	USA	NORTH AMERICA	16500	5	E001
	E002	Cynthia	Brooks	F	PRESIDENT	ALL	17	CANADA	NORTH AMERICA	14500	5	E001
	E005	Eric	Hoffman	M	LEAD DATA SCIENTIST	FINANCE	11	USA	NORTH AMERICA	8500	3	E103
	E010	William	Butler	M	LEAD DATA SCIENTIST	AUTOMOTIVE	12	FRANCE	EUROPE	9000	2	E428
	E052	Dianna	Wilson	F	SENIOR DATA SCIENTIST	HEALTHCARE	6	CANADA	NORTH AMERICA	5500	5	E083
	E057	Dorothy	Wilson	F	SENIOR DATA SCIENTIST	HEALTHCARE	9	USA	NORTH AMERICA	7700	1	E083
	E083	Patrick	Voltz	M	MANAGER	HEALTHCARE	15	USA	NORTH AMERICA	9500	5	E002
	E103	Emily	Grove	F	MANAGER	FINANCE	14	CANADA	NORTH AMERICA	10500	4	E002
	E204	Karene	Nowak	F	SENIOR DATA SCIENTIST	AUTOMOTIVE	8	GERMANY	EUROPE	7500	5	E428
	E245	Nian	Zhen	M	SENIOR DATA SCIENTIST	RETAIL	6	CHINA	ASIA	6500	2	E583
	E260	Roy	Collins	M	SENIOR DATA SCIENTIST	RETAIL	7	INDIA	ASIA	7000	3	E583
	E403	Steve	Hoffman	M	ASSOCIATE DATA SCIENTIST	FINANCE	4	USA	NORTH AMERICA	5000	3	E103
	E428	Pete	Allen	M	MANAGER	AUTOMOTIVE	14	GERMANY	EUROPE	11000	4	E002
	E478	David	Smith	M	ASSOCIATE DATA SCIENTIST	RETAIL	3	COLOMBIA	SOUTH AMERICA	4000	4	E583
	E505	Chad	Wilson	M	ASSOCIATE DATA SCIENTIST	HEALTHCARE	5	CANADA	NORTH AMERICA	5000	2	E083
	E532	Clarie	Brennan	F	ASSOCIATE DATA SCIENTIST	AUTOMOTIVE	3	GERMANY	EUROPE	4300	1	E428
	E583	Janet	Hale	F	MANAGER	RETAIL	14	COLOMBIA	SOUTH AMERICA	10000	2	E002
	E612	Tracy	Norris	F	MANAGER	RETAIL	13	INDIA	ASIA	8500	4	E002
	E620	Katrina	Allen	F	JUNIOR DATA SCIENTIST	RETAIL	2	INDIA	ASIA	3000	1	E612
	E640	Jenifer	Jhones	F	JUNIOR DATA SCIENTIST	RETAIL	1	COLOMBIA	SOUTH AMERICA	2800	4	E612

Use Case for Triggers

Output:

Values in the dataset after trigger

EMP_ID	FIRST_NAME	LAST_NAME	GENDER	ROLE	DEPT	EXP	COUNTRY	CONTINENT	SALARY	EMP_RATING	MANAGER_ID
E001	Arthur	Black	M	CEO	ALL	20	USA	NORTH AMERICA	20000	5	E001
E002	Cynthia	Brooks	F	PRESIDENT	ALL	17	CANADA	NORTH AMERICA	20000	5	E001
E005	Eric	Hoffman	M	LEAD DATA SCIENTIST	FINANCE	11	USA	NORTH AMERICA	8500	3	E103
E010	William	Butler	M	LEAD DATA SCIENTIST	AUTOMOTIVE	12	FRANCE	EUROPE	9000	2	E428
E052	Dianna	Wilson	F	SENIOR DATA SCIENTIST	HEALTHCARE	6	CANADA	NORTH AMERICA	5500	5	E083
E057	Dorothy	Wilson	F	SENIOR DATA SCIENTIST	HEALTHCARE	9	USA	NORTH AMERICA	7700	1	E083
E083	Patrick	Voltz	M	MANAGER	HEALTHCARE	15	USA	NORTH AMERICA	9500	5	E002
E103	Emily	Grove	F	MANAGER	FINANCE	14	CANADA	NORTH AMERICA	10500	4	E002
E204	Karene	Nowak	F	SENIOR DATA SCIENTIST	AUTOMOTIVE	8	GERMANY	EUROPE	7500	5	E428
E245	Nian	Zhen	M	SENIOR DATA SCIENTIST	RETAIL	6	CHINA	ASIA	6500	2	E583
E260	Roy	Collins	M	SENIOR DATA SCIENTIST	RETAIL	7	INDIA	ASIA	7000	3	E583
E403	Steve	Hoffman	M	ASSOCIATE DATA SCIENTIST	FINANCE	4	USA	NORTH AMERICA	5000	3	E103
E428	Pete	Allen	M	MANAGER	AUTOMOTIVE	14	GERMANY	EUROPE	11000	4	E002
E478	David	Smith	M	ASSOCIATE DATA SCIENTIST	RETAIL	3	COLOMBIA	SOUTH AMERICA	4000	4	E583
E505	Chad	Wilson	M	ASSOCIATE DATA SCIENTIST	HEALTHCARE	5	CANADA	NORTH AMERICA	5000	2	E083
E532	Claire	Brennan	F	ASSOCIATE DATA SCIENTIST	AUTOMOTIVE	3	GERMANY	EUROPE	4300	1	E428
E583	Janet	Hale	F	MANAGER	RETAIL	14	COLOMBIA	SOUTH AMERICA	10000	2	E002
E612	Tracy	Norris	F	MANAGER	RETAIL	13	INDIA	ASIA	8500	4	E002
E620	Katrina	Allen	F	JUNIOR DATA SCIENTIST	RETAIL	2	INDIA	ASIA	3000	1	E612
E640	Jenifer	Jhones	F	JUNIOR DATA SCIENTIST	RETAIL	1	COLOMBIA	SOUTH AMERICA	2800	4	E612

Key Takeaways

- A stored procedure is executed using the CALL keyword.
- The CREATE PROCEDURE keyword is used to create stored procedures, which can contain one or more comma-separated parameters.
- IF and CASE are the two types of conditional statements that govern the execution of a SQL query.
- A trigger is a set of actions that are executed automatically when a specific change operation is performed on a specific table.





Knowledge Check

Knowledge Check

1

Which of the following defines a stored procedure in SQL?

- A. Block of functions
- B. Group of SQL statements
- C. Collection of views
- D. None of the above



Knowledge Check

1

Which of the following defines a stored procedure in SQL?

- A. Block of functions
- B. Group of SQL statements
- C. Collection of views
- D. None of the above



The correct answer is **B**

A stored procedure is a logical unit in a database that groups one or more precompiled SQL statements contained within the BEGIN and END keywords in the stored procedure's body.

Knowledge Check

2

Which of the following is a component of a stored procedure?

- A. SQL statements
- B. Tables
- C. Views
- D. Database



Knowledge Check

2

Which of the following is a component of a stored procedure?

- A. SQL statements
- B. Tables
- C. Views
- D. Database



The correct answer is **A**

SQL statement is one of the components of a stored procedure.

Knowledge Check

3

Which of the following is an escape character in SQL?

- A. Period
- B. Comma
- C. Colon
- D. Backslash



Knowledge Check

3

Which of the following is an escape character in SQL?

- A. Period
- B. Comma
- C. Colon
- D. Backslash



The correct answer is **D**

Backslash is the escape character in MySQL.

Knowledge Check

4

What is the keyword used to create a stored procedure?

- A. DECLARE PROCEDURE
- B. SET PROCEDURE
- C. CREATE PROCEDURE
- D. ASSIGN PROCEDURE



Knowledge
Check

4

What is the keyword used to create a stored procedure?

- A. DECLARE PROCEDURE
- B. SET PROCEDURE
- C. CREATE PROCEDURE
- D. ASSIGN PROCEDURE



The correct answer is **C**

CREATE PROCEDURE is the keyword used to create stored procedure in MySQL.

**Knowledge
Check**

5

Which of the following performs a specified action when an error occurs?

- A. Procedure
- B. Handlers
- C. Loops
- D. Conditional statements



Knowledge
Check

5

Which of the following performs a specified action when an error occurs?

- A. Procedure
- B. Handlers
- C. Loops
- D. Conditional statements



The correct answer is **B**

Handlers perform a specified action when an error occurs.

Knowledge Check

6

Which of the following is used to access records in a database?

- A. Compound statement
- B. Loops
- C. Cursors
- D. Stored procedures



Knowledge Check

6

Which of the following is used to access records in a database?

- A. Compound statement
- B. Loops
- C. Cursors
- D. Stored procedures



The correct answer is **C**

Cursors are control structures used to access records in a database.

**Knowledge
Check**
7

Which of the following repeats a set of instructions until a specific condition is reached?

- A. Loops
- B. Control structures
- C. Repeat statement
- D. Stored procedures



**Knowledge
Check**
7

Which of the following repeats a set of instructions until a specific condition is reached?

- A. Loops
- B. Control structures
- C. Repeat statement
- D. Stored procedures



The correct answer is **A**

Loops are used to repeat a set of instructions until a specific condition is met.

**Knowledge
Check**

8

Which characteristics are used to control the privileges of execution of a stored object?

- A. DEFINER
- B. SET
- C. SQL SECURITY
- D. DECLARE



Knowledge
Check

8

Which characteristics are used to control the privileges of execution of a stored object?

- A. DEFINER
- B. SET
- C. SQL SECURITY
- D. DECLARE



The correct answers are **A, C**

DEFINER and SQL SECURITY characteristics are used to control the privileges of execution of a stored object.