**Objective 1: Demonstrate Implementation of Query Methods in Spring Data JPA**

Spring Data JPA makes it possible to declare query methods in your repository interfaces just by following specific method naming rules. Spring generates the query implementations behind the scenes at runtime, so you don’t need to manually write SQL or JPQL.

**Common Query Method Use Cases:**

1. **Search by Containing Text**

List<Employee> findByNameContaining(String keyword);

Fetches employees whose name contains the given keyword (case sensitive by default).

1. **Filter with Starting Text**

List<Employee> findByDepartmentStartingWith(String prefix);

Useful when searching names or departments that begin with a specific string.

1. **Sorting Results**

List<Employee> findByDepartmentOrderByNameAsc(String department);

Sorts employees by name within the given department.

1. **Fetch Between Dates**

List<Employee> findByJoiningDateBetween(LocalDate start, LocalDate end);

Useful to fetch records within a specific range of time, e.g., monthly reports.

1. **Greater Than / Less Than**

List<Employee> findBySalaryGreaterThan(Double minSalary);

List<Employee> findBySalaryLessThanEqual(Double maxSalary);

Filters based on numeric comparisons.

1. **Top / First Records**

List<Employee> findTop3ByOrderBySalaryDesc();

Fetches top N records with the highest salary, useful for leaderboards or insights.

These query methods are highly composable, allowing you to build complex queries by combining method keywords without writing boilerplate code.

**Objective 2: Demonstrate Implementation of Object-Relational Mapping (O/R Mapping)**

In Spring Data JPA, annotations are used to specify how Java classes and fields are linked to database tables and columns. This is essential for modeling real-world relationships such as employees, departments, and projects.

**Common Relationship Annotations:**

1. **@ManyToOne**

@ManyToOne(fetch = FetchType.LAZY)

@JoinColumn(name = "department\_id")

private Department department;

Many employees can belong to one department.

@JoinColumn specifies the foreign key column.

FetchType.LAZY means the department will be loaded only when accessed.

1. **@OneToMany**

@OneToMany(mappedBy = "department", fetch = FetchType.LAZY)

private List<Employee> employees;

A department has many employees.

mappedBy refers to the field in the Employee entity that owns the relationship.

1. **@ManyToMany**

@ManyToMany

@JoinTable(

name = "employee\_project",

joinColumns = @JoinColumn(name = "employee\_id"),

inverseJoinColumns = @JoinColumn(name = "project\_id")

)

private Set<Project> projects;

An employee can be assigned to multiple projects, and a project can have multiple employees.

@JoinTable defines the linking (junction) table and its foreign keys.

1. **EAGER vs LAZY Fetching**

FetchType.LAZY: Data is loaded only when explicitly accessed. Better performance.

FetchType.EAGER: Data is loaded immediately with the entity. May cause overhead if not used carefully.