KB금융그룹 | 국민의 평생 금융파트너

2024년 상반기 K-디지털 트레이닝

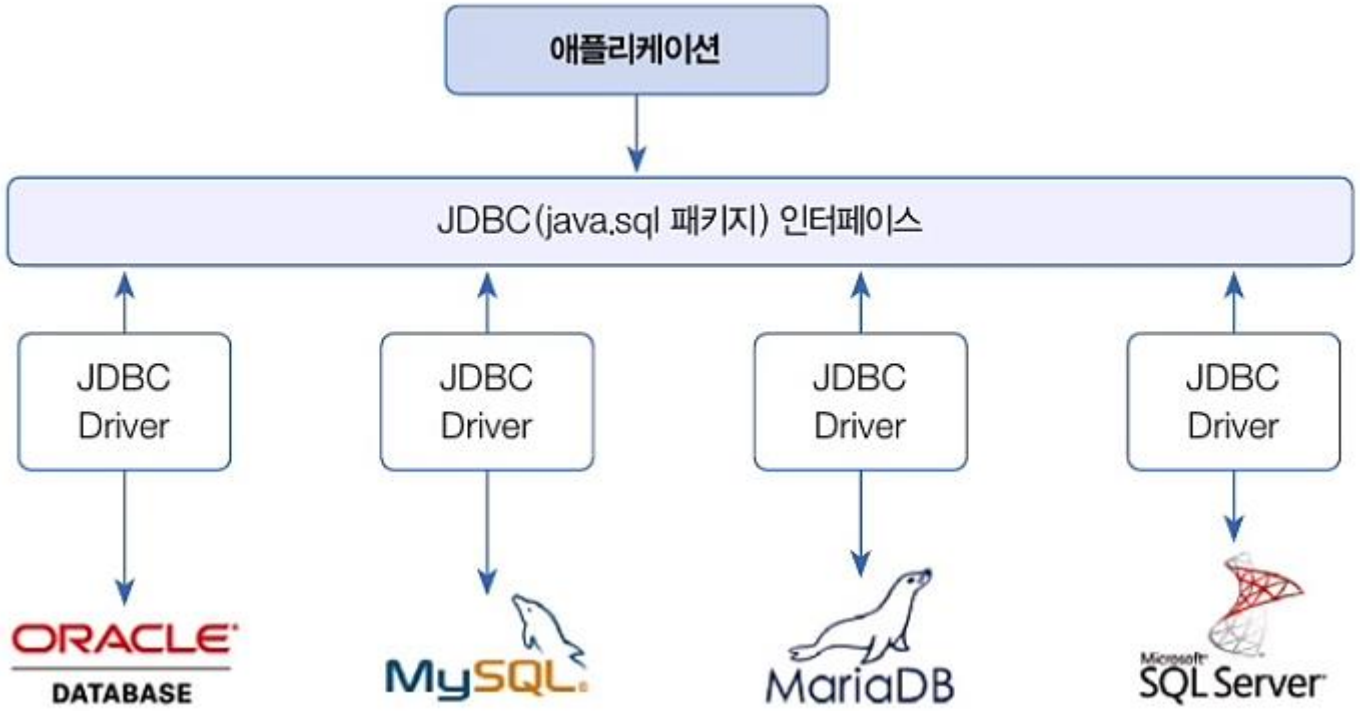
JDBC 프로그래밍

[KB] IT's Your Life

KB 국민은행

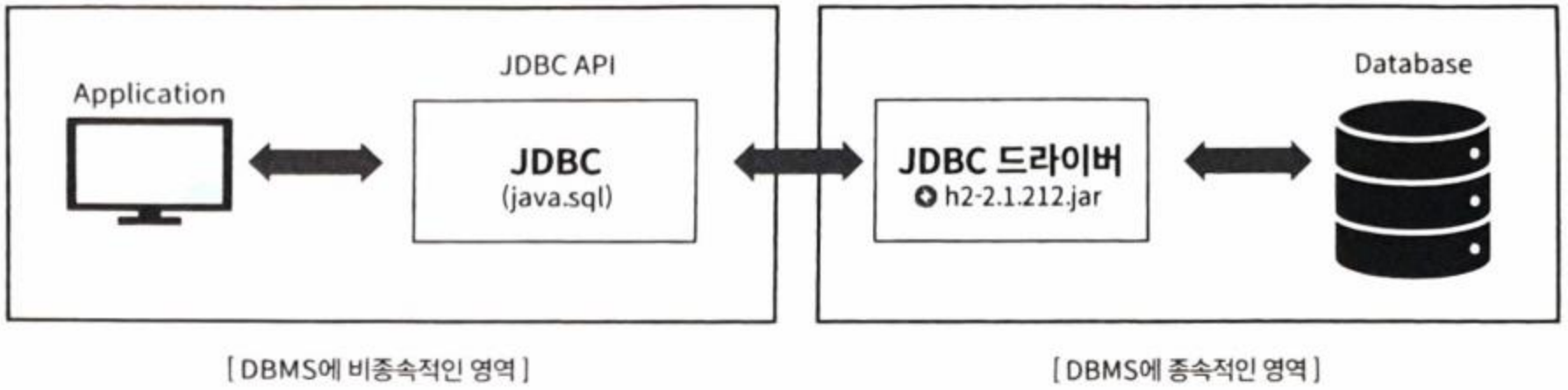
JDBC Java Database Connectivity

- 데이터베이스와 연결해서 입출력을 지원
- 데이터베이스 관리시스템(DBMS)의 종류와 상관없이 동일하게 사용할 수 있는 클래스와 인터페이스로 구성



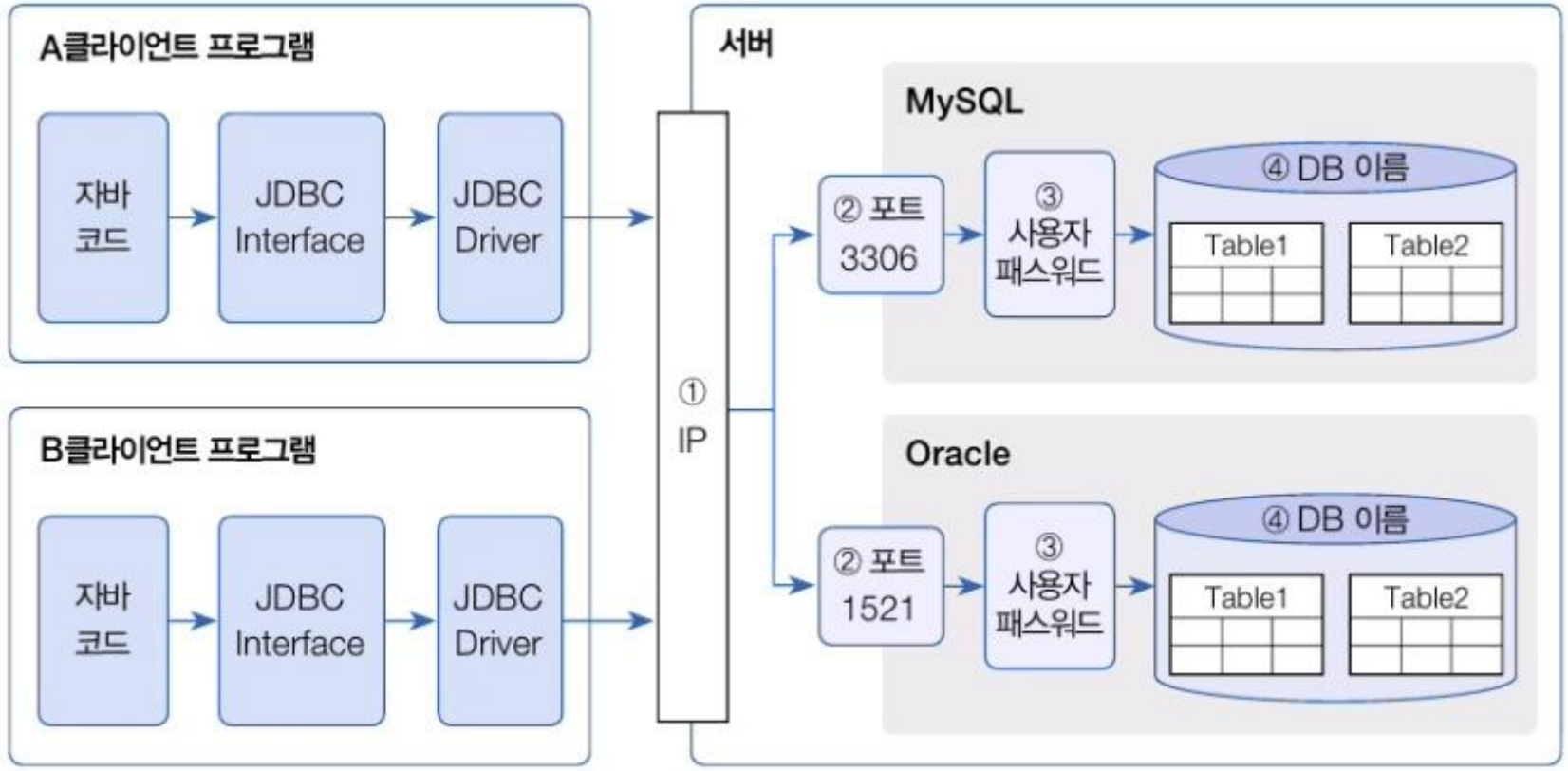
JDBC

JDBC 개념


Application
JDBC API
JDBC
(java.sql)
JDBC 드라이버
h2-2.1.212.jar
Database
[DBMS에 비종속적인 영역]
[DBMS에 종속적인 영역]

JDBC

JDBC 개념


A클라이언트 프로그램
자바 코드
JDBC Interface
JDBC Driver
B클라이언트 프로그램
자바 코드
JDBC Interface
JDBC Driver
① IP
서버
MySQL
② 포트 3306
③ 사용자 패스워드
④ DB 이름
Table1
Table2
Oracle
② 포트 1521
③ 사용자 패스워드
④ DB 이름
Table1
Table2

데이터베이스 준비

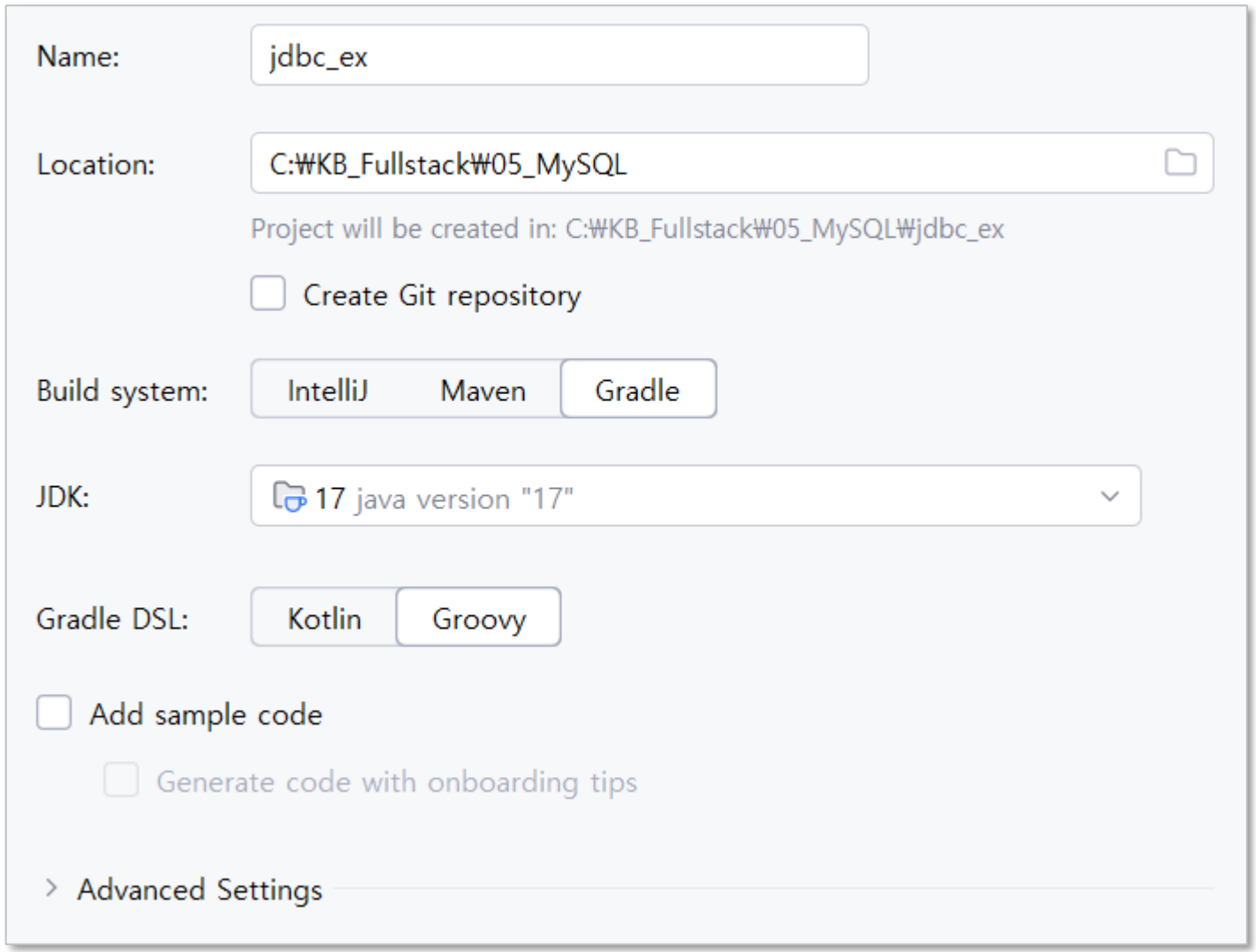
```
CREATE DATABASE jdbc_ex;
```

사용자 준비

```
CREATE USER 'jdbc_ex'@'%' IDENTIFIED BY 'jdbc_ex';
GRANT ALL PRIVILEGES ON jdbc_ex.* TO 'jdbc_ex'@'%';
FLUSH PRIVILEGES;
```

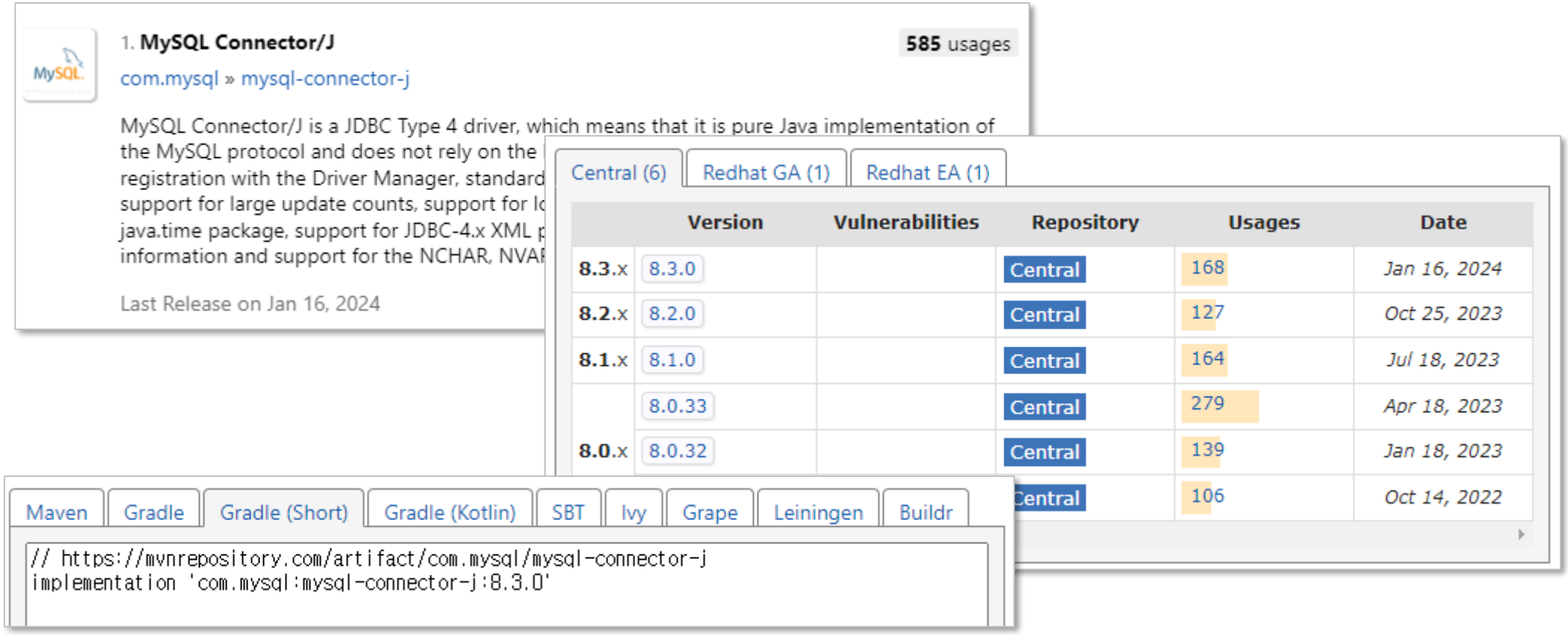
프로젝트 생성

- Name: jdbc_ex
- Build System : gradle
- Group Id: org.scoula



MySQL Connector

- https://mvnrepository.com/
- MySQL 검색



- Lombok도 추가

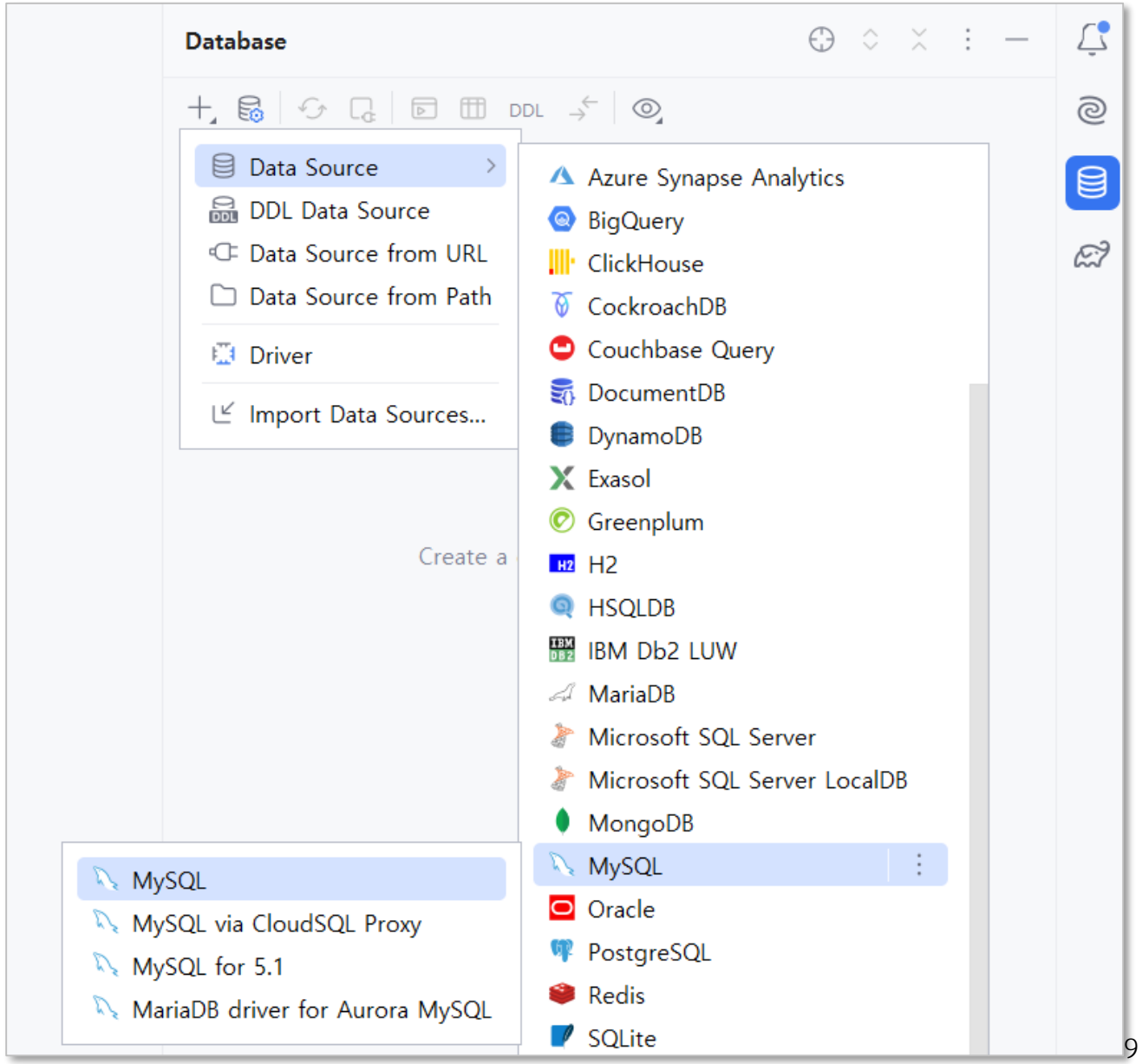
build.gradle

```
…
dependencies {
    implementation 'com.mysql:mysql-connector-j:8.3.0'
    compileOnly 'org.projectlombok:lombok:1.18.30'
    annotationProcessor 'org.projectlombok:lombok:1.18.30'

    testCompileOnly 'org.projectlombok:lombok:1.18.30'
    testAnnotationProcessor 'org.projectlombok:lombok:1.18.30'

    testImplementation platform('org.junit:junit-bom:5.9.1')
    testImplementation 'org.junit.jupiter:junit-jupiter'
}
…
```

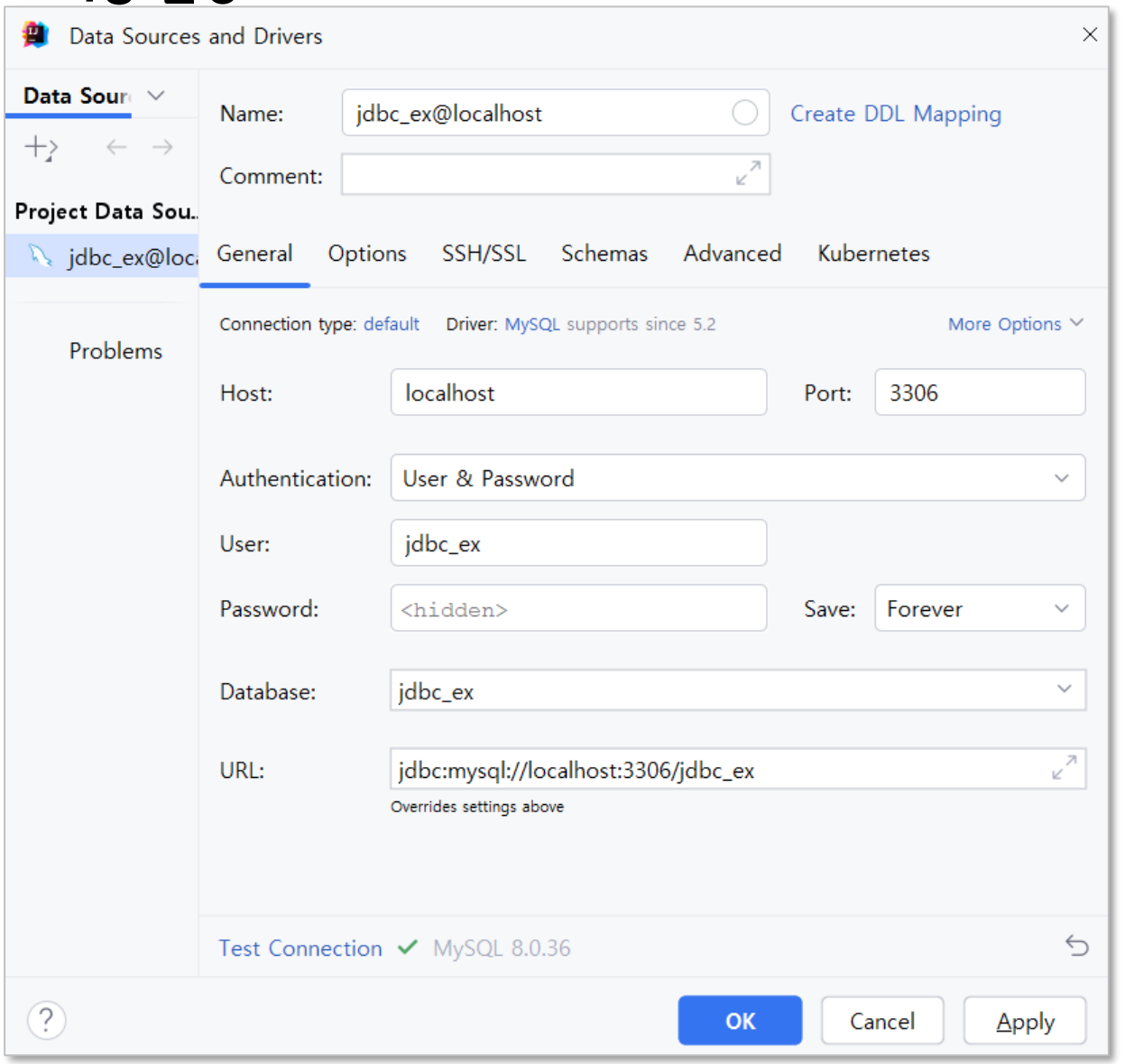
- 수정 후 Sync 실행

- 프로젝트 설정
  - Annotation Processing 활성화

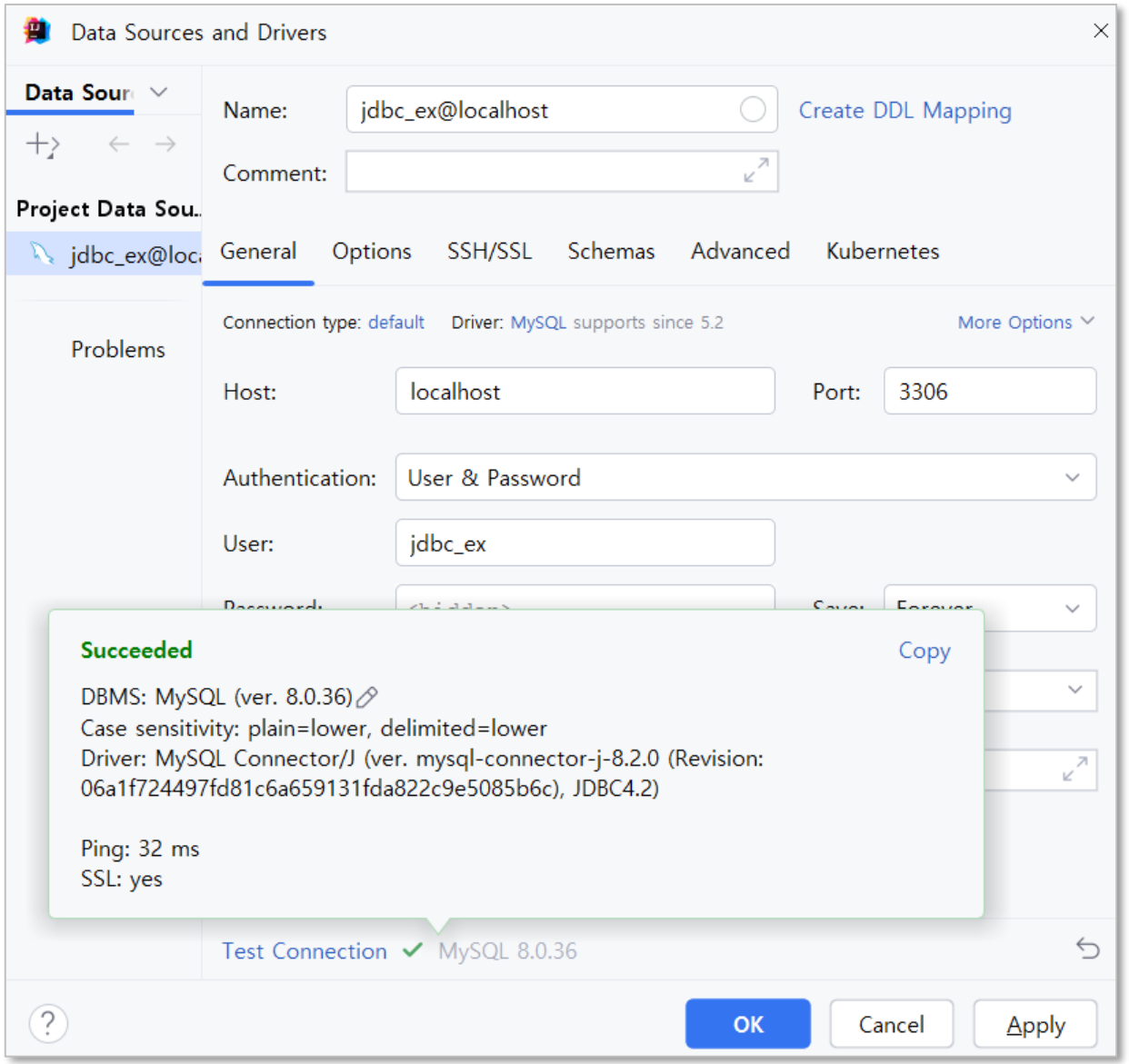
Intellij Datasource 기능 설정



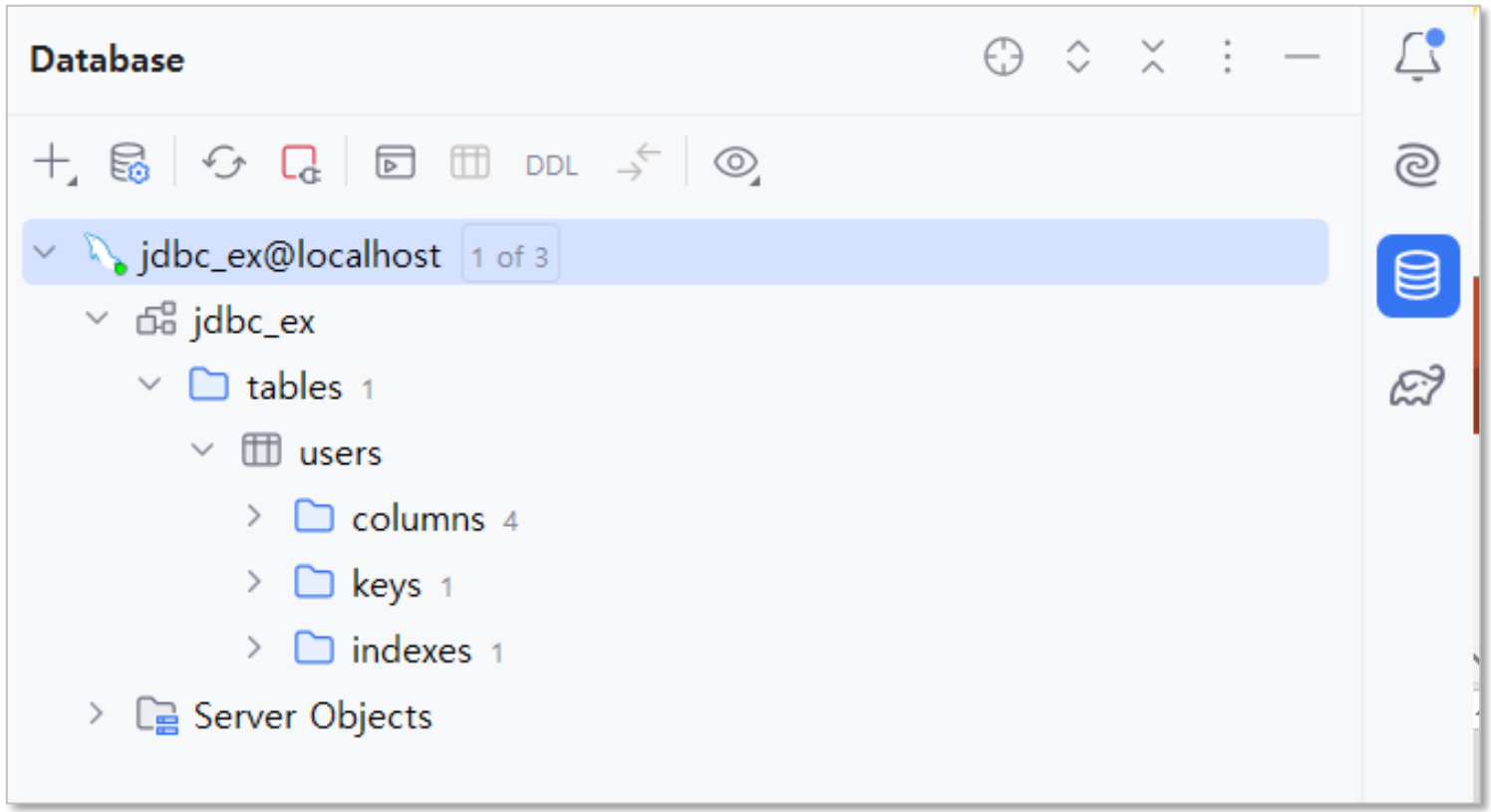
Intellij Datasource 기능 설정



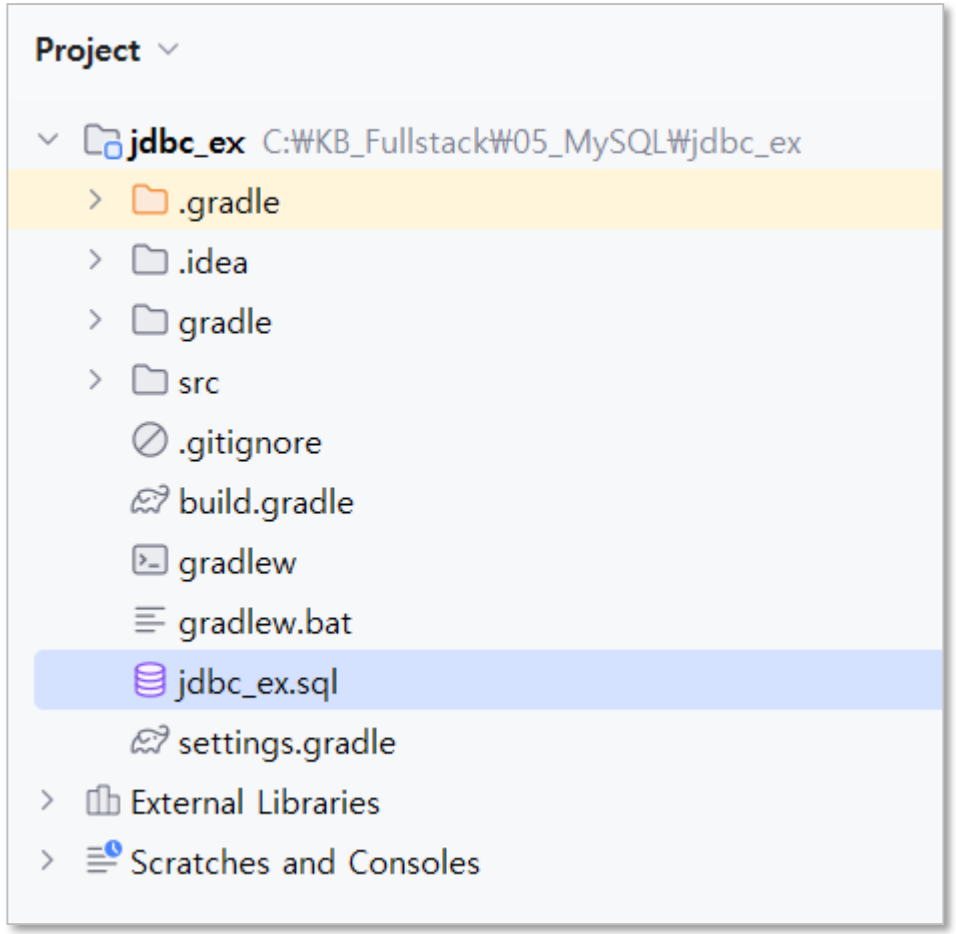
Intellij Datasource 기능 설정



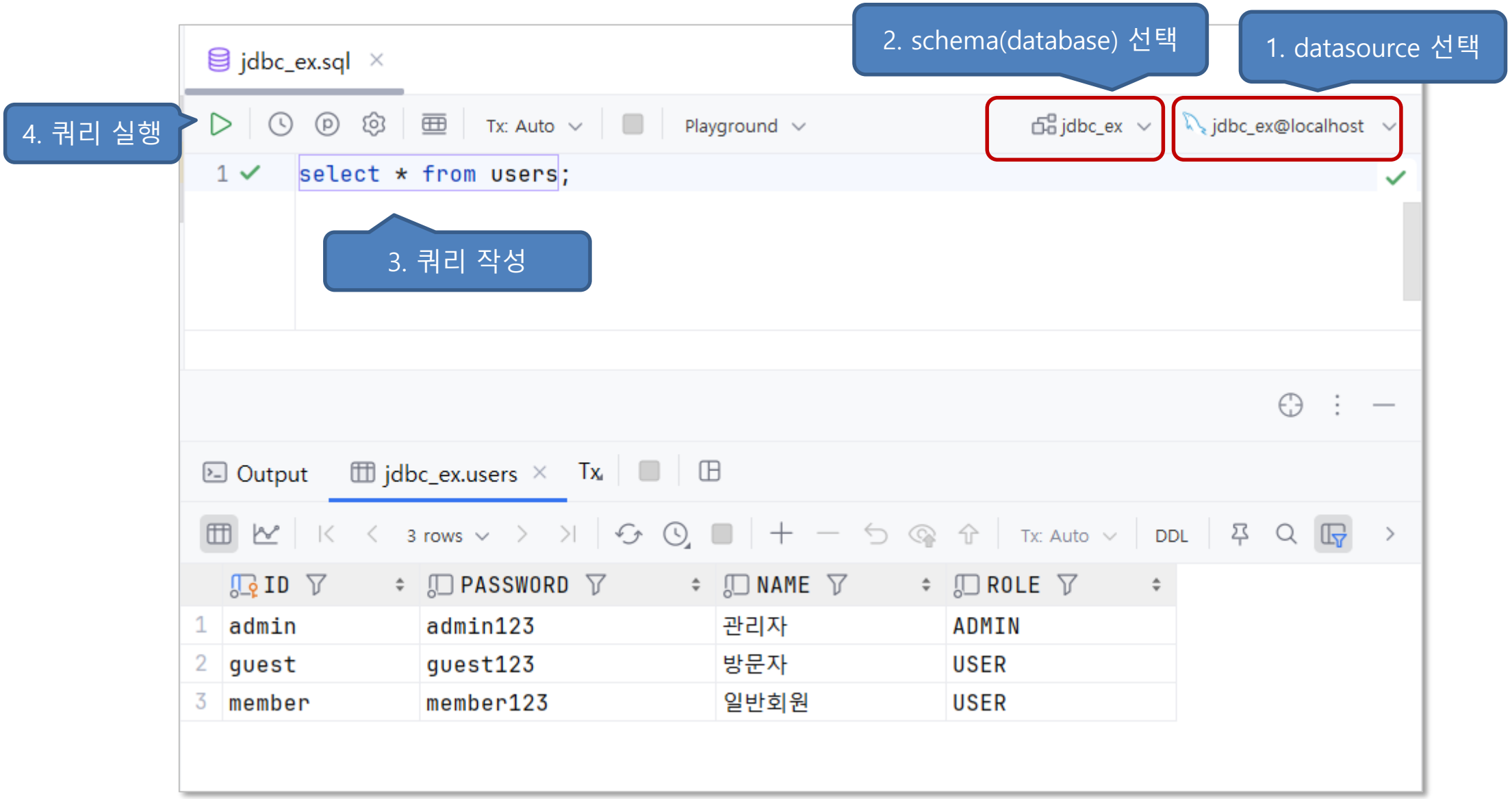
datasource 목록



sql 파일 만들기


Project
jdbc_ex C:₩KB_Fullstack₩05_MySQL₩jdbc_ex
.gradle
.idea
gradle
src
.gitignore
build.gradle
gradlew
gradlew.bat
jdbc_ex.sql
settings.gradle
External Libraries
Scratches and Consoles

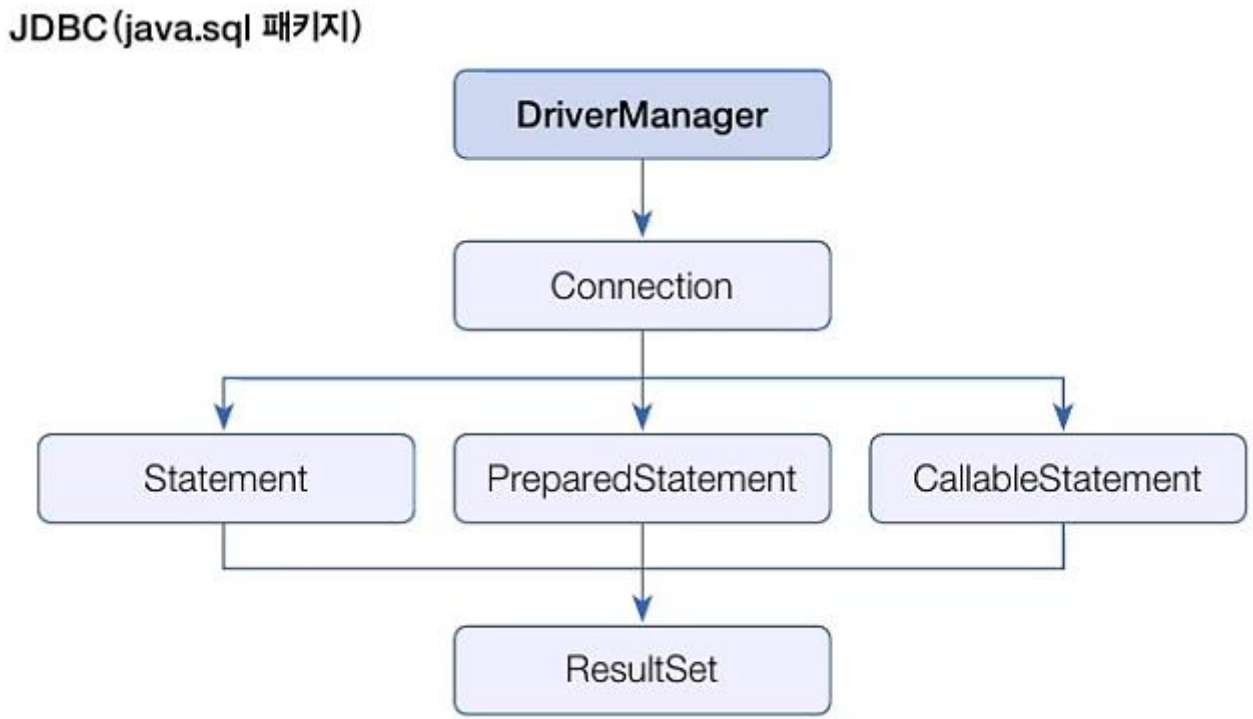
쿼리 실행


2. schema(database) 선택
1. datasource 선택
4. 쿼리 실행
jdbc_ex.sql
Tx: Auto
Playground
jdbc_ex
jdbc_ex@localhost
1
select * from users;
3. 쿼리 작성
Output
jdbc_ex.users
Tx
3 rows
Tx: Auto
DDL
ID
PASSWORD
NAME
ROLE
1 admin admin123 관리자 ADMIN
2 guest guest123 방문자 USER
3 member member123 일반회원 USER

데이터 준비

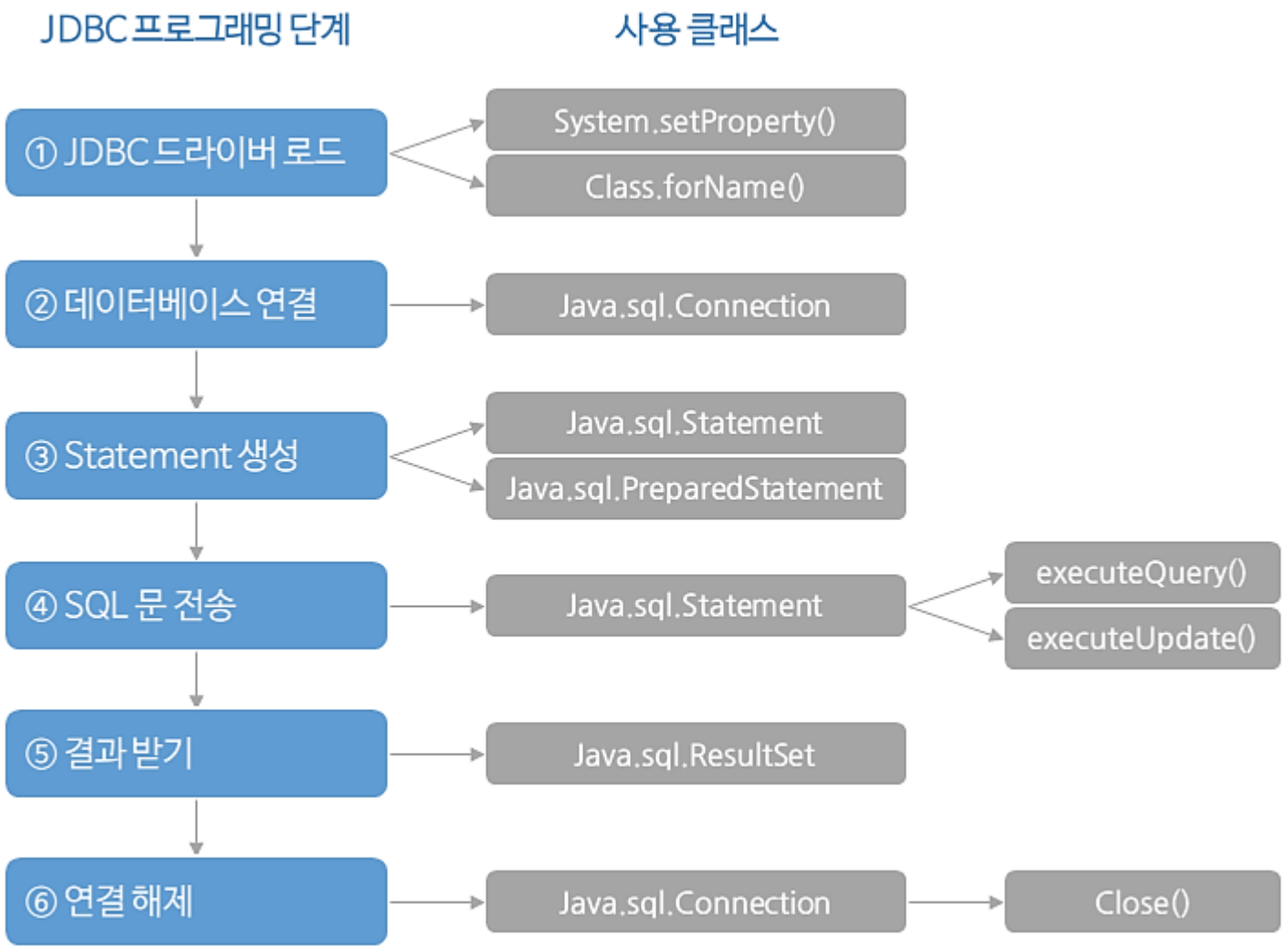
```
use jdbc_ex;

CREATE TABLE USERS (
  ID VARCHAR(12) NOT NULL PRIMARY KEY,
  PASSWORD VARCHAR(12) NOT NULL,
  NAME VARCHAR(30) NOT NULL,
  ROLE VARCHAR(6) NOT NULL
);

INSERT INTO USERS(ID, PASSWORD, NAME, ROLE)
VALUES('guest', 'guest123', '방문자', 'USER');

INSERT INTO USERS(ID, PASSWORD, NAME, ROLE)
VALUES('admin', 'admin123', '관리자', 'ADMIN');

INSERT INTO USERS(ID, PASSWORD, NAME, ROLE)
VALUES('member', 'member123', '일반회원', 'USER');

SELECT * FROM USERS;
```

JDBC의 핵심 인터페이스/클래스



JDBC

JDBC 개발 절차



DB 연결

드라이버 확인

Class.forName("com.mysql.cj.jdbc.Driver");

→ 없으면 ClassNotFoundException 발생

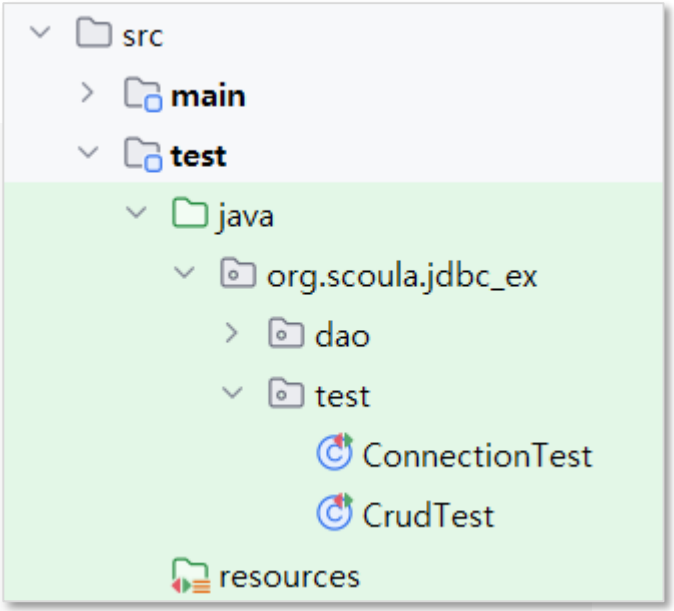
Connection 객체

- 데이터베이스에 연결 세션을 만듦
- Connection conn = DriverManager.getConnection(
  "연결 문자열", "사용자", "비밀번호")

- 연결 문자열
  "jdbc:mysql://[host]:[포트]/[db이름]
  → jdbc:mysql://127.0.0.1:3306/jdbc_ex

- String url = "jdbc:mysql://127.0.0.1:3306/jdbc_ex";
- Connection conn = DriverManager.getConnection(url, "jdbc_ex", "jdbc_ex");

ConnectionTest.java




```
package org.scoula.jdbc_ex.test;

import org.junit.jupiter.api.DisplayName;
import org.junit.jupiter.api.Test;
import org.scoula.jdbc_ex.common.JDBCUtil;

import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.SQLException;

public class ConnectionTest {

    @Test
    @DisplayName("jdbc_ex 데이터베이스에 접속한다.")
    public void testConnection() throws SQLException, ClassNotFoundException {
        Class.forName("com.mysql.cj.jdbc.Driver");
        String url = "jdbc:mysql://127.0.0.1:3306/jdbc_ex";
        String id = "jdbc_ex";
        String password = "jdbc_ex";
        Connection conn = DriverManager.getConnection(url, id, password);
        System.out.println("DB 연결 성공");
        conn.close();
    }
}
```

DB 연결 성공

모듈화해야 할 코드

- 데이터베이스 연결 및 닫기 작업은 항상 필요함

→ common.JDBCUtil

resource::/application.properties

```
driver=com.mysql.cj.jdbc.Driver
url=jdbc:mysql://127.0.0.1:3306/jdbc_ex
id=jdbc_ex
password=jdbc_ex
```

JDBCUtil.java

```
package org.scoula.jdbc_ex.common;

import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.SQLException;
import java.util.Properties;

public class JDBCUtil {
    static Connection conn = null;
    static {
        try {
            Properties properties = new Properties();
            properties.load(JDBCUtil.class.getResourceAsStream("/application.properties"));
            String driver = properties.getProperty("driver");
            String url = properties.getProperty("url");
            String id = properties.getProperty("id");
            String password = properties.getProperty("password");

            Class.forName(driver);
            conn = DriverManager.getConnection(url, id, password);
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
```

JDBCUtil.java

```
  public static Connection getConnection() {
    return conn;
  }

  public static void close() {
    try {
      if (conn != null) {
        conn.close();
        conn = null;
      }
    } catch (SQLException e) {
      e.printStackTrace();
    }
  }

}
```

ConnectionTest.java

```
package org.scoula.jdbc_ex.test;
…

public class ConnectionTest {

    …
    @Test
    @DisplayName("jdbc_ex에 접속한다.(자동 닫기)")
    public void testConnection2() throws SQLException {
        try(Connection conn = JDBCUtil.getConnection()) {
            System.out.println("DB 연결 성공");
        }
    }
}
```

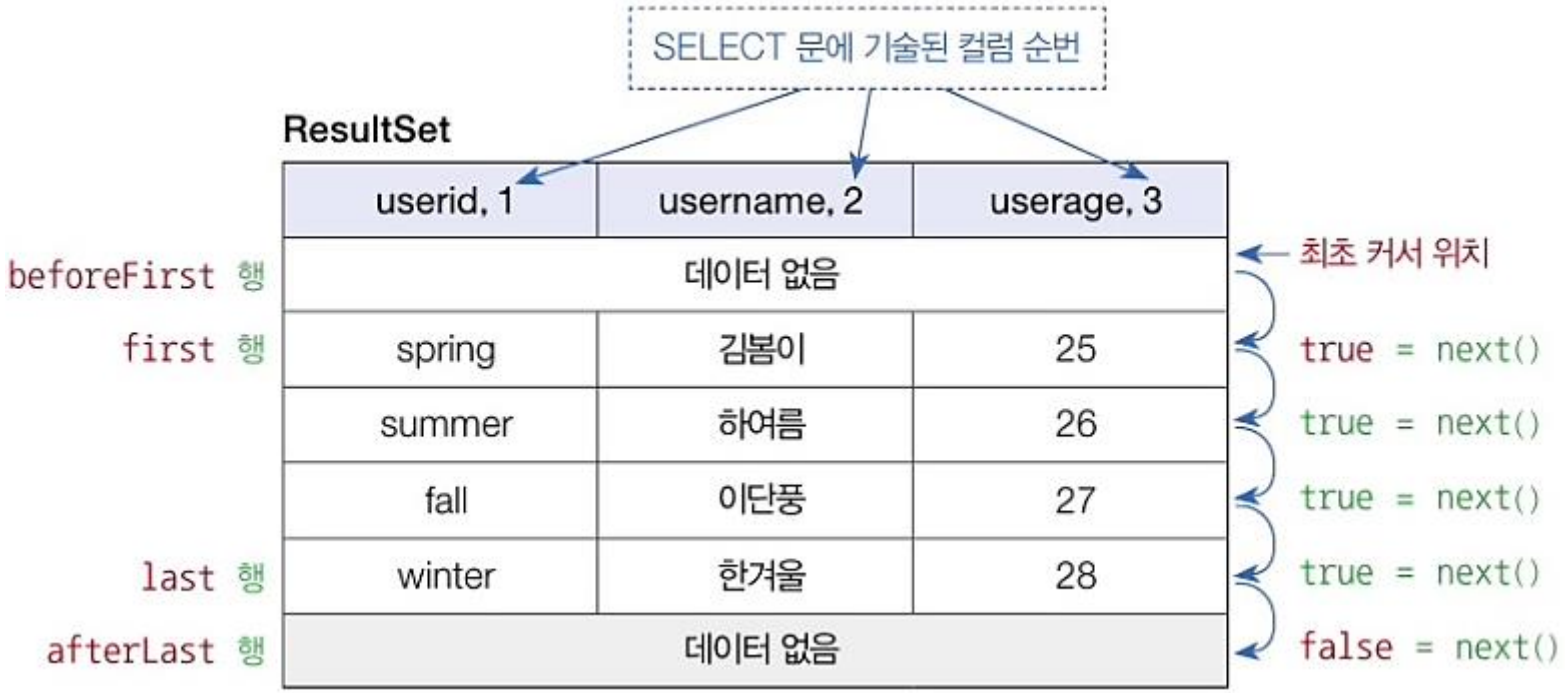
Statement

- SQL 문 실행 클래스
- Connection 객체를 통해 생성

  Statement stmt = conn.createStatement();

- SQL 실행 메서드
  - ResultSet executeQuery(SQL문) : select문 실행
  - int executeUpdate(SQL문): insert, update, delete 문 실행

ResultSet



- **컬럼 값 추출**
  - getXxxx("컬러명)
    - Xxx : 추출하고자하는 데이터 타입명
    - getString(), getInt(), getLong(), getDouble()

PreparedStatement

- SQL문에 값을 넣을 때 파라미터화 해서 처리

```
String sql ="INSERT INTO USERS(ID, PASSWORD, NAME, ROLE) " +
                    "VALUES(?, ?, ?, ?)";
```

- Connection 객체를 통해 생성

```
PreparedStatement pstmt = conn.prepareStatement(sql);
```

- 파라미터 설정
  - pstmt.setXxxx(파라미터번호, 값)
    - setString(), setInt(), setLong(), setDouble()

- SQL문 실행

```
int count = pstmt.executeUpdate();
```

Statement로 Insert 문 실행하기

```
String sql ="INSERT INTO USERS(ID, PASSWORD, NAME, ROLE)" +
                "VALUES('member2', 'member123', '일반회원', 'USER')";

int count = stmt.executeUpdate(sql);
```

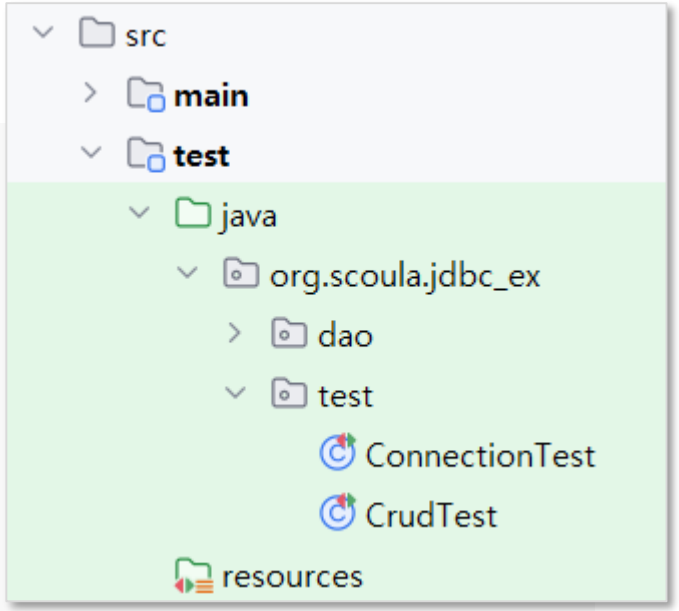
- 값을 변수로 대체한다면 ?

```
String userId = "member2";
String password = "member123";
String name = "일반회원";
String role = "USER";

String sql ="INSERT INTO USERS(ID, PASSWORD, NAME, ROLE)" +
                "VALUES('" + userId + "', '" + password + "', '" +
          name + "', '" + role + "')";
```

→ PreparementStatement로 처리

CrudTest.java

```
package org.scoula.jdbc_ex.test;

import org.junit.jupiter.api.*;
import org.scoula.jdbc_ex.common.JDBCUtil;

import java.sql.*;

@TestMethodOrder(MethodOrderer.OrderAnnotation.class)
public class CrudTest {
    Connection conn = JDBCUtil.getConnection();

    @AfterAll
    static void tearDown() {
        JDBCUtil.close();
    }
```



CrudTest.java

```
@Test
@DisplayName("새로운 user를 등록한다.")
@Order(1)
public void insertUser()  throws SQLException {
    String sql = "insert into users(id, password, name, role) values(?, ?, ?, ?)";
    try (PreparedStatement pstmt = conn.prepareStatement(sql)) {
        pstmt.setString(1, "scoula");
        pstmt.setString(2, "scoula3");
        pstmt.setString(3, "스콜라");
        pstmt.setString(4, "USER");

        int count = pstmt.executeUpdate();
        Assertions.assertEquals(1, count);
    }
}
```

CrudTest.java

```
@Test
@DisplayName("user 목록을 추출한다.")
@Order(2)
public void selectUser() throws SQLException {
    String sql ="select * from users";
    try(Statement stmt = conn.createStatement();
        ResultSet rs = stmt.executeQuery(sql);
        ) {
        while(rs.next()) {
            System.out.println(rs.getString("name"));
        }
    }
}
```

CrudTest.java

```
@Test
@DisplayName("특정 user 검색한다.")
@Order(3)
public void selectUserById() throws SQLException {
    String userid = "scoula";
    String sql ="select * from users where id = ?";
    try(PreparedStatement stmt = conn.prepareStatement(sql)){
        stmt.setString(1, userid);
        try(ResultSet rs = stmt.executeQuery()) {
            if(rs.next()) {
                System.out.println(rs.getString("name"));
            } else {
                throw new SQLException("scoula not found");
            }
        }
    }
}
```

CrudTest.java

```
@Test
@DisplayName("특정 user 수정한다.")
@Order(4)
public void updateUser() throws SQLException {
    String userid = "scoula";
    String sql ="update users set name= ?  where id = ?";
    try(PreparedStatement stmt = conn.prepareStatement(sql)){
        stmt.setString(1, "스콜라 수정");
        stmt.setString(2, userid);
        int count = stmt.executeUpdate();
        Assertions.assertEquals(1, count);
    }
}
```

CrudTest.java

```
    @Test
    @DisplayName("지정한 사용자를 삭제한다.")
    @Order(5)
    public void deleteUser() throws SQLException {
        String userid = "scoula";
        String sql ="delete from users where id = ?";
        try(PreparedStatement stmt = conn.prepareStatement(sql)){
            stmt.setString(1, userid);
            int count = stmt.executeUpdate();
            Assertions.assertEquals(1, count);
        }
    }
}
```

VO 패턴

VO 객체

- Value Object
- 특정 테이블의 한 행을 매핑하는 클래스

클래스 정의 → 테이블
필드들 → 컬럼들
인스턴스 → 한 행

UserVO.java

```
package org.scoula.jdbc_ex.domain;

import lombok.AllArgsConstructor;
import lombok.Data;
import lombok.NoArgsConstructor;

@Data
@NoArgsConstructor
@AllArgsConstructor
public class UserVO {
    private String id;
    private String password;
    private String name;
    private String role;
}
```

DAO 패턴 적용

DAO 클래스

- Data Access Object
- 데이터베이스에 접근하여 실질적인 데이터베이스 연동 작업을 담당하는 클래스

- 테이블에 대한 CRUD 연산을 처리

인터페이스 정의 후 구현 클래스 작성

UserDao.java

```
package org.scoula.jdbc_ex.dao;

import org.scoula.jdbc_ex.domain.UserVO;

import java.sql.SQLException;
import java.util.List;
import java.util.Optional;

public interface UserDao {
    // 회원 등록
    int create(UserVO user) throws SQLException;

    // 회원 목록 조회
    List<UserVO> getList() throws SQLException;

    // 회원 정보 조회
    Optional<UserVO> get(String id) throws SQLException;

    // 회원 수정
    int update(UserVO user) throws SQLException;

    // 회원 삭제
    int delete(String id) throws SQLException;
}
```

UserDaoImpl.java

```
package org.scoula.jdbc_ex.dao;

import org.scoula.jdbc_ex.common.JDBCUtil;
import org.scoula.jdbc_ex.domain.UserVO;

import java.sql.Connection;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.util.ArrayList;
import java.util.List;
import java.util.Optional;

public class UserDaoImpl implements UserDao {
    Connection conn = JDBCUtil.getConnection();

    // USERS 테이블 관련 SQL 명령어
    private String USER_LIST   = "select * from users";
    private String USER_GET    = "select * from users where id = ?";
    private String USER_INSERT = "insert into users values(?, ?, ?, ?)";
    private String USER_UPDATE = "update users set name = ?, role = ? where id = ?";
    private String USER_DELETE = "delete from users where id = ?";
```

UserDaoImpl.java

```
private String USER_INSERT = "insert into users values(?, ?, ?, ?)";
```

```
// 회원 등록
@Override
public int create(UserVO user) throws SQLException {
    try (PreparedStatement stmt = conn.prepareStatement(USER_INSERT)) {
        stmt.setString(1, user.getId());
        stmt.setString(2, user.getPassword());
        stmt.setString(3, user.getName());
        stmt.setString(4, user.getRole());
        return stmt.executeUpdate();
    }
}
```

UserDaoImpl.java

```
private UserVO map(ResultSet rs) throws SQLException {
    UserVO user = new UserVO();
    user.setId(rs.getString("ID"));
    user.setPassword(rs.getString("PASSWORD"));
    user.setName(rs.getString("NAME"));
    user.setRole(rs.getString("ROLE"));
    return user;
}

// 회원 목록 조회
@Override
public List<UserVO> getList() throws SQLException{
    List<UserVO> userList = new ArrayList<UserVO>();
    Connection conn = JDBCUtil.getConnection();
    try (PreparedStatement stmt = conn.prepareStatement(USER_LIST);
         ResultSet rs = stmt.executeQuery()) {
        while(rs.next()) {
            UserVO user = map(rs);
            userList.add(user);
        }
    }
    return userList;
}
```

```
private String USER_LIST   = "select * from users";
```

UserDaoImpl.java

```
private String USER_GET    = "select * from users where id = ?";
```

```
// 회원 정보 조회
@Override
public Optional<UserVO> get(String id) throws SQLException{
    try (PreparedStatement stmt = conn.prepareStatement(USER_GET)) {
        stmt.setString(1, id);
        try(ResultSet rs = stmt.executeQuery()) {
            if(rs.next()) {
                return Optional.of(map(rs));
            }
        }
    }
    return Optional.empty();
}
```

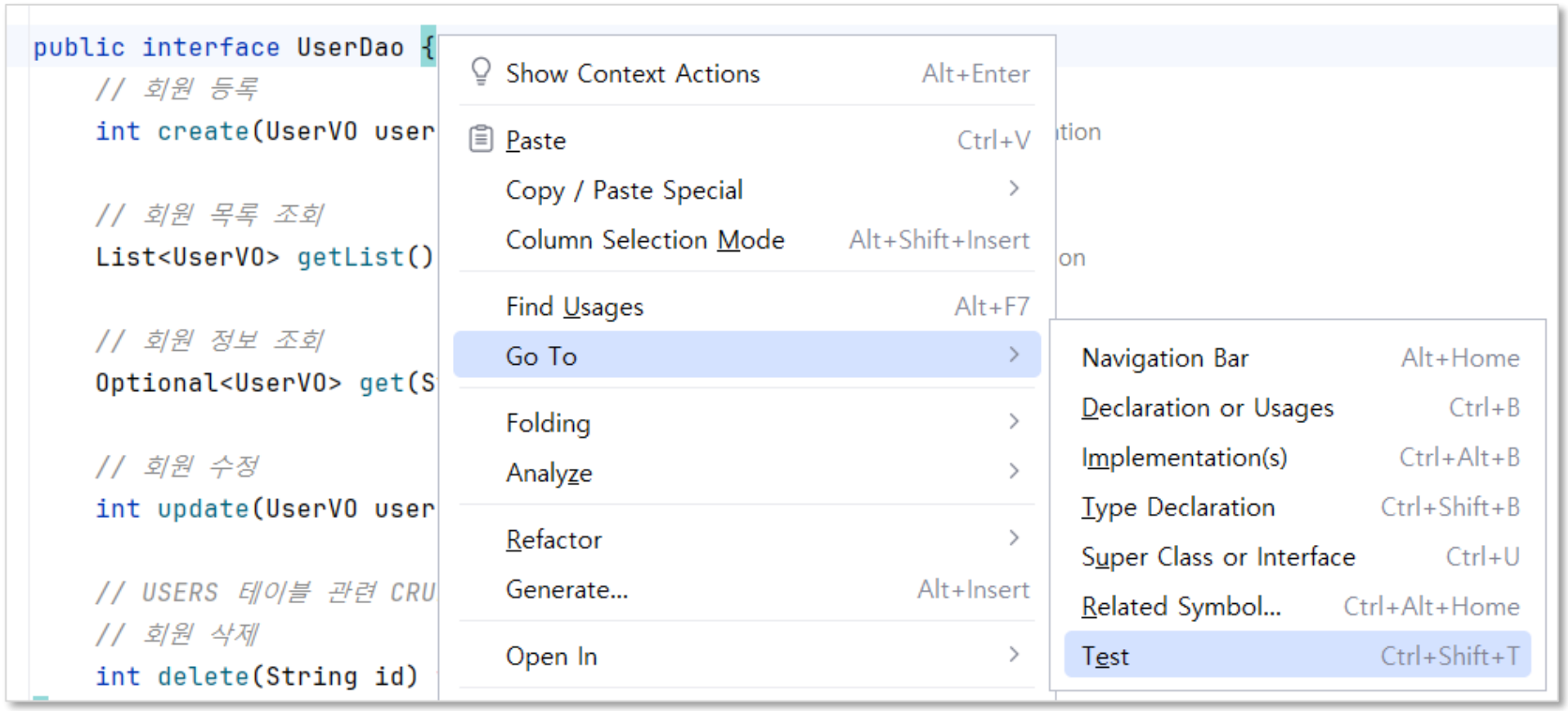
UserDaoImpl.java

```
private String USER_UPDATE = "update users set name = ?, role = ? where id = ?";
```

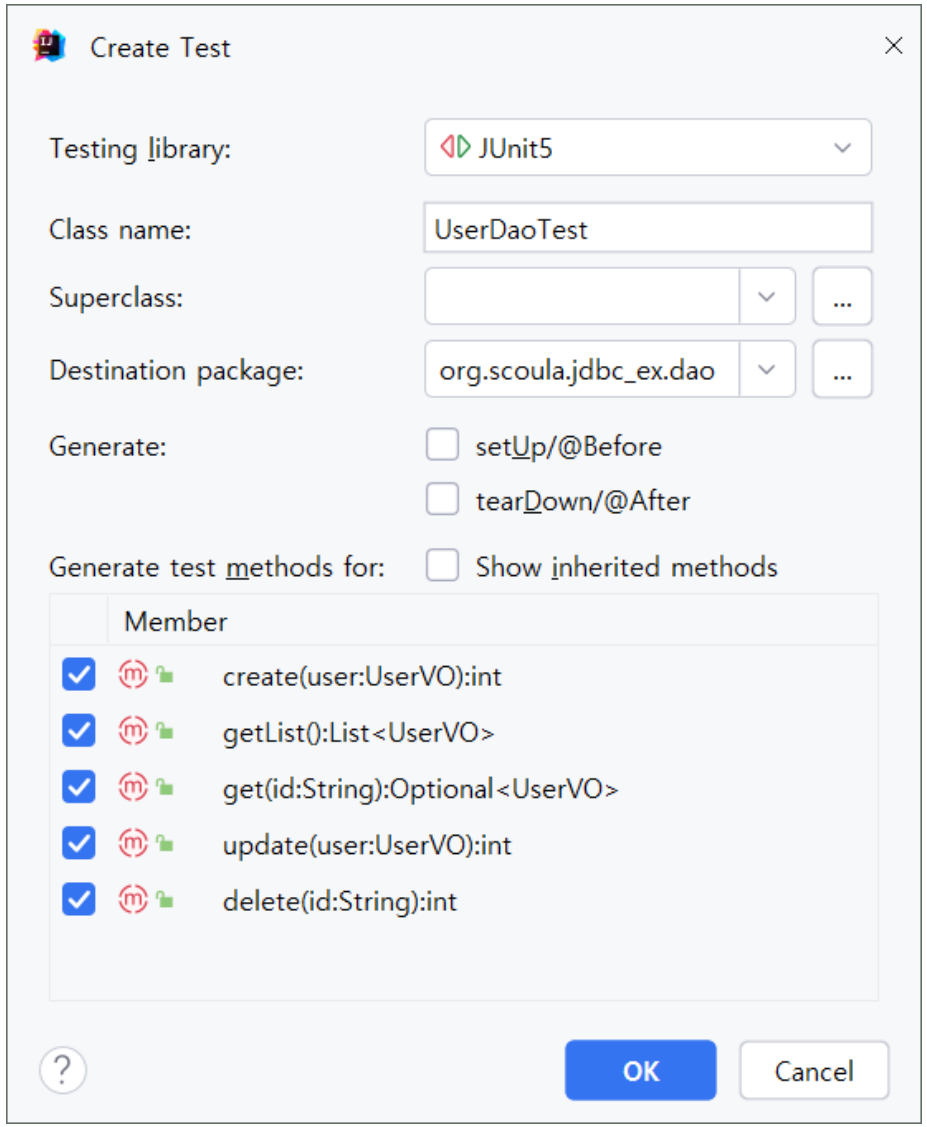
```
    // 회원 수정
    @Override
    public int update(UserVO user) throws SQLException{
        Connection conn = JDBCUtil.getConnection();
        try ( PreparedStatement stmt = conn.prepareStatement(USER_UPDATE)) {
            stmt.setString(1, user.getName());
            stmt.setString(2, user.getRole());
            stmt.setString(3, user.getId());
            return stmt.executeUpdate();
        }
    }

    // USERS 테이블 관련 CRUD 메소드
    // 회원 삭제
    @Override
    public int delete(String id) throws SQLException{
        try(PreparedStatement stmt = conn.prepareStatement(USER_DELETE)) {
            stmt.setString(1, id);
            return stmt.executeUpdate();
        }
    }
}
```

```
private String USER_DELETE = "delete from users where id = ?";
```

UserDao 테스트 클래스

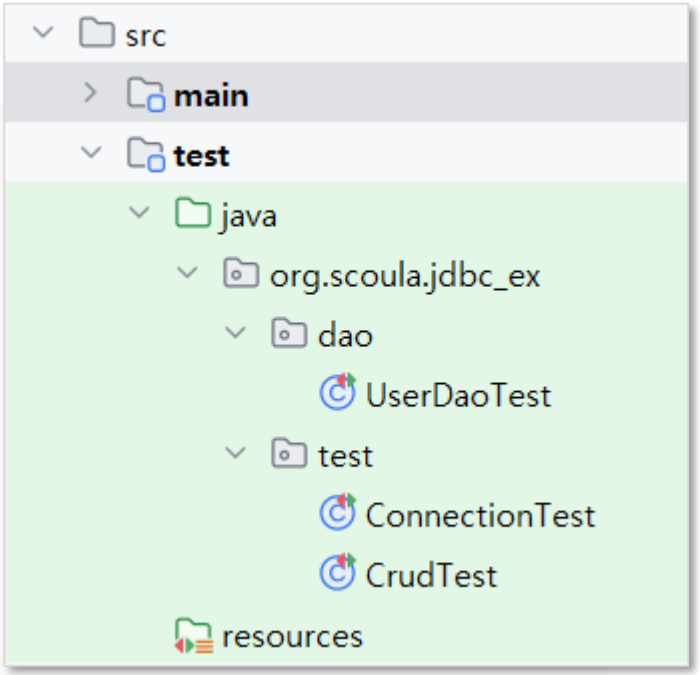


UserDao 테스트 클래스



UserDaoTest.java

```
package org.scoula.jdbc_ex.dao;

import org.junit.jupiter.api.*;
import org.scoula.jdbc_ex.common.JDBCUtil;
import org.scoula.jdbc_ex.domain.UserVO;

import java.sql.SQLException;
import java.util.List;
import java.util.NoSuchElementException;

@TestMethodOrder(MethodOrderer.OrderAnnotation.class)
class UserDaoTest {
    UserDao dao = new UserDaoImpl();

    @AfterAll
    static void tearDown() {
        JDBCUtil.close();
    }
```



UserDaoTest.java

```
@Test
@DisplayName("user를 등록합니다.")
@Order(1)
void create() throws SQLException {
    UserVO user = new UserVO("ssamz3", "ssamz123", "쌤즈", "ADMIN");
    int count = dao.create(user);
    Assertions.assertEquals(1, count);
}

@Test
@DisplayName("UserDao User 목록을 추출합니다.")
@Order(2)
void getList() throws SQLException {
    List<UserVO> list = dao.getList();
    for(UserVO vo: list) {
        System.out.println(vo);
    }
}
```

UserDaoTest.java

```
    @Test
    @DisplayName("특정 user 1건을 추출합니다.")
    @Order(3)
    void get() throws SQLException {
        UserVO user = dao.get("ssamz3").orElseThrow(NoSuchElementException::new);
        Assertions.assertNotNull(user);
    }

    @Test
    @DisplayName("user의 정보를 수정합니다.")
    @Order(4)
    void update() throws SQLException {
        UserVO user = dao.get("ssamz3").orElseThrow(NoSuchElementException::new);
        user.setName("쌤즈3");
        int count = dao.update(user);
        Assertions.assertEquals(1, count);
    }

    @Test
    @DisplayName("user를 삭제합니다.")
    @Order(5)
    void delete() throws SQLException {
        int count = dao.delete("ssamz3");
        Assertions.assertEquals(1, count);
    }
}
```