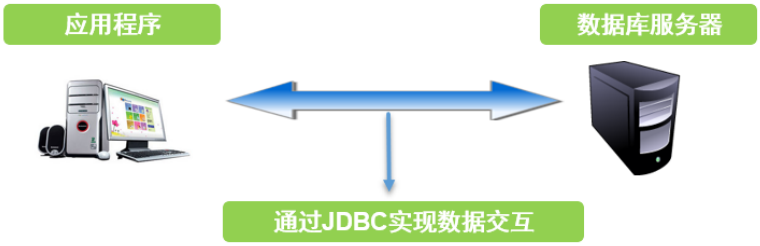
JDBC介绍

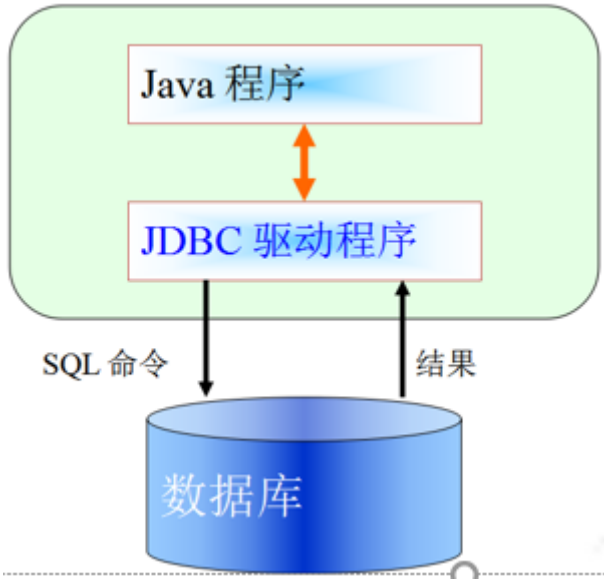
提问

- 在之前的程序中，数据都是预先写好的，如何实现数据的动态变化?

- JDBC
  - Java数据库连接技术(Java DataBase Connectivity)



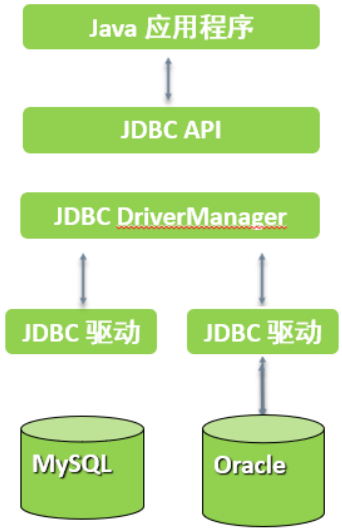
- 数据库访问技术简介:
  - JDBC（Java DataBase Connectivity）是由Sun Microsystem公司提供的API（Application Programming Interface应用程序编程接口）；它为Java应用程序提供了一系列的类，使其能够快速高效地访问数据库；这些功能是由一系列的类和对象来完成的，我们只需使用相关的对象，即可完成对数据库的操作



JDBC的工作原理

JDBC的工作原理

- JDBC的内容
  - JDBC API
    - 定义了一系列的接口和类，集成在java.sql和javax.sql包中
  - DriverManager
    - 管理各种不同的JDBC驱动
  - JDBC 驱动
    - 负责连接不同类型的数据库



JDBC访问数据库步骤

JDBC访问数据库的步骤

- JDBC访问数据库步骤

步骤1：加载驱动

- 使用Class类的forName方法，将驱动程序类加载到JVM（Java虚拟机）中；

方 法 原 型	说　　明
static Class forName(String className) throws ClassNotFoundException	将由className指定完整名称的类加载到JVM中，如果加载失败，将抛出异常，必须捕捉

语法　Class.forName("JDBC驱动类名称");

示例：Class.forName("com.mysql.jdbc.Driver");

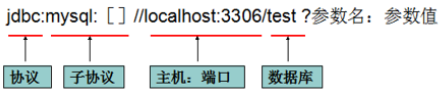
步骤2：获取数据库连接

- 成功加载驱动后，必须使用DriverManager类的静态方法getConnection来获得连接对象；

方 法 原 型	说　　明
static Connection getConnection (String url, String user, String password) throws SQLException	参数url是连接字符串，参数user是数据库用户名，参数password是登录口令，成功连接到数据库返回Connection对象，连接失败则抛出SQLException异常，必须捕捉

语法
- 示例：Co

Connection conn=DriverManager.getConnection(数据库URL,数据库用户名,密码)
注意：在加载驱动及获取连接过程中，可能会出现异常，因此需要注意进行异常处理



步骤3：创建Statement执行SQL语句

- 通过Connection对象创建

方 法 原 型	说　　明
Statement createStatement() throws SQLException	成功创建返回Statement对象，否则抛出SQLException异常，必须捕捉

语法　Statement stmt=conn.createStatement();

- 用于执行SQL语句

方法	说明
ResultSet executeQuery(String sql)	执行SQL查询并获取到ResultSet对象
int executeUpdate(String sql)	可以执行插入、删除、更新等操作，返回值是执行该操作所影响的行数
void close()	关闭Statement对象

步骤4：处理ResultSet结果集

- 用于存储查询结果
  - 只在执行select语句时返回

方法	说明
boolean next()	将光标从当前位置向下移动一行
void close()	关闭ResultSet 对象
String getString(String colLabel)	根据列名称对应的值
String getString(int colIndex))	根据列的位置获取对应的值
int getInt(int colIndex)	根据列的位置获取对应值
int getInt(String colLabel)	根据列的名称获取对应的值

步骤5：释放资源 close();

案例

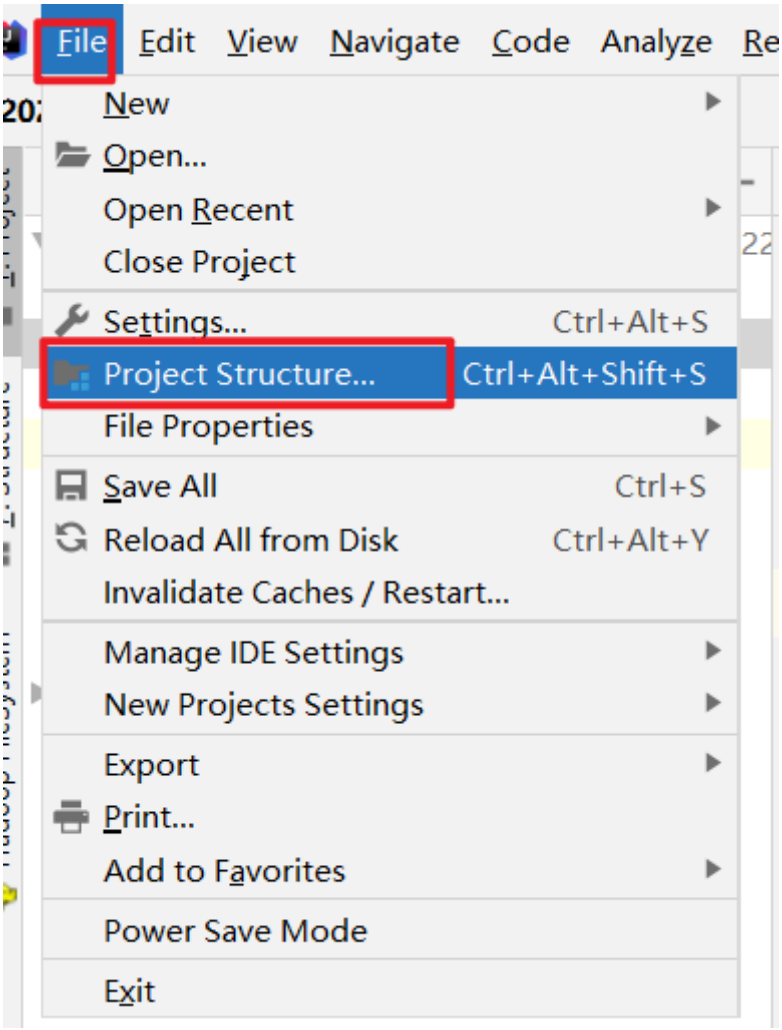
User定义

```
DROP TABLE IF EXISTS `user`;
CREATE TABLE `user` (
  `id` bigint NOT NULL AUTO_INCREMENT,
  `username` varchar(255) NOT NULL,
  `password` varchar(255) NOT NULL,
  PRIMARY KEY (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=6 DEFAULT CHARSET=utf8;

-- ----------------------------
-- Records of user
-- ----------------------------
INSERT INTO `user` VALUES ('1', 'jim', '11111');
INSERT INTO `user` VALUES ('2', 'tom', '22222');
INSERT INTO `user` VALUES ('3', 'lucy', '3333');
INSERT INTO `user` VALUES ('4', 'laowang', '4444');
INSERT INTO `user` VALUES ('5', 'laoli', '5555');
```

使用Statement查询User

引入MySql驱动jar


File
Edit
View
Navigate
Code
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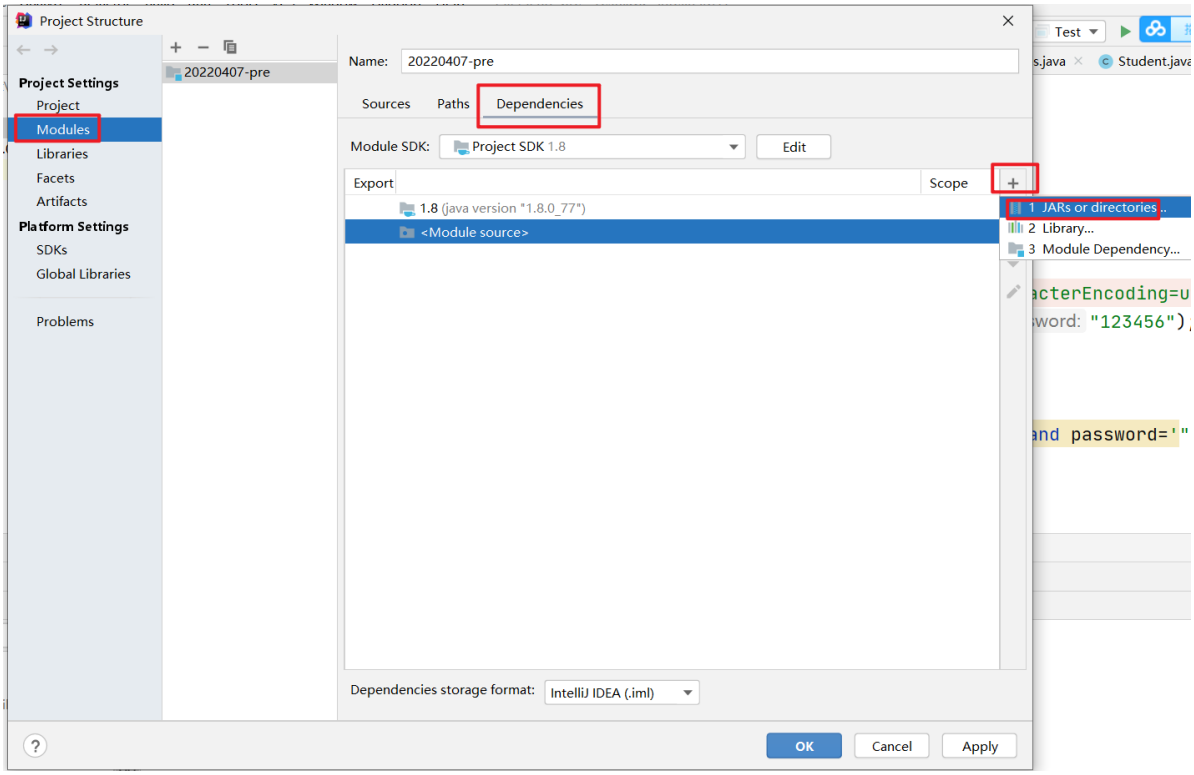
New
Open...
Open Recent
Close Project
Settings... Ctrl+Alt+S
Project Structure... Ctrl+Alt+Shift+S
File Properties
Save All Ctrl+S
Reload All from Disk Ctrl+Alt+Y
Invalidate Caches / Restart...
Manage IDE Settings
New Projects Settings
Export
Print...
Add to Favorites
Power Save Mode
Exit


Project Structure
Project Settings
Project
Modules
Libraries
Facets
Artifacts
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Global Libraries
Problems
20220407-pre
Name: 20220407-pre
Sources
Paths
Dependencies
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Edit
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Scope
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Dependencies storage format: IntelliJ IDEA (.iml)
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2 Library...
3 Module Dependency...
Test
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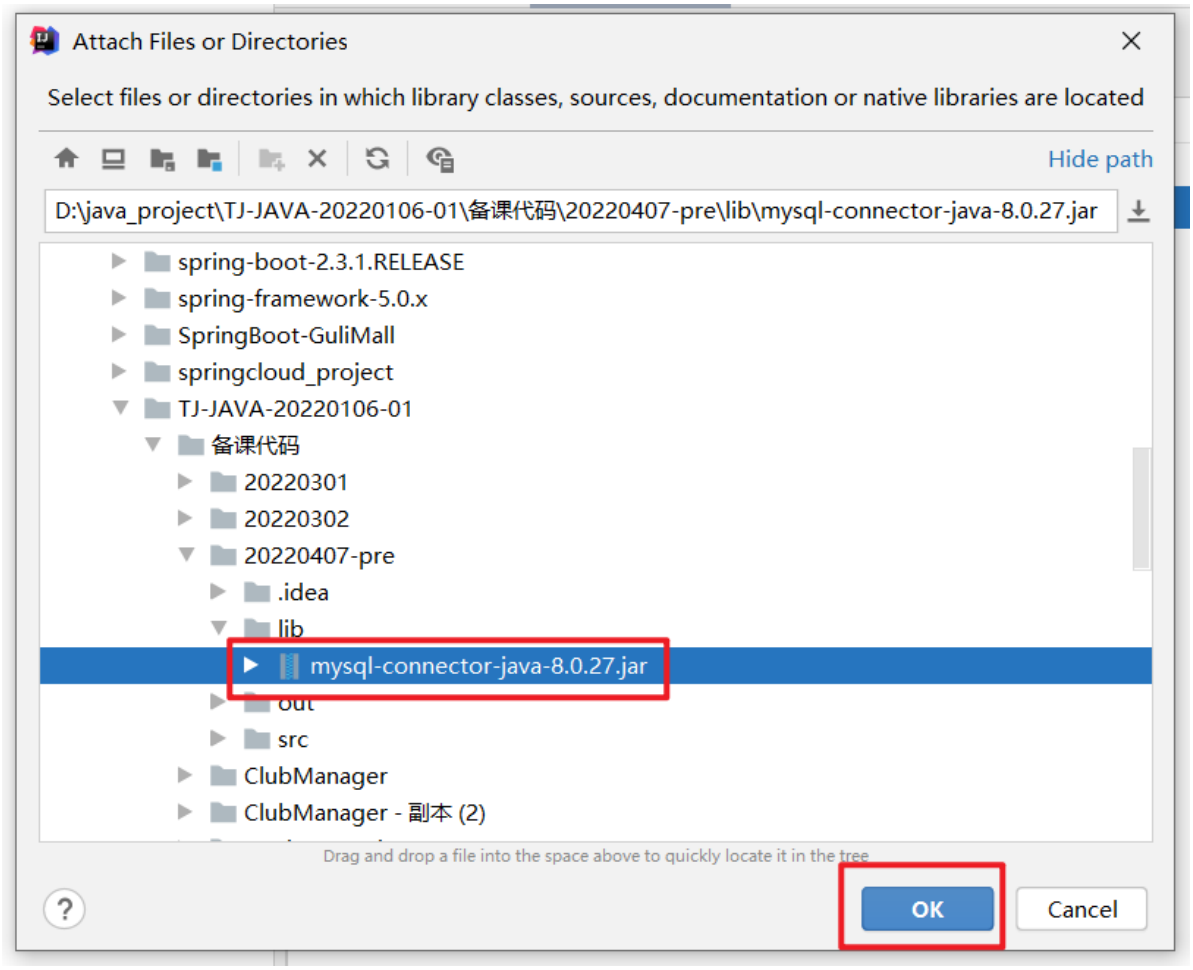



```java
/**
 * user表的实体类
 */
public class User {
    /**
     * 主键
     */
    private Long id;
    /**
     * 用户名
     */
    private String username;
    /**
     * 密码
     */
    private String password;

    public User() {
    }

    public User(String username, String password) {
        this.username = username;
        this.password = password;
    }

    public int getId() {
        return id;
    }
```

```
    public void setId(int id) {
        this.id = id;
    }

    public String getUsername() {
        return username;
    }

    public void setUsername(String username) {
        this.username = username;
    }

    public String getPassword() {
        return password;
    }

    public void setPassword(String password) {
        this.password = password;
    }

    @Override
    public String toString() {
        return "User{" +
                "id=" + id +
                ", username='" + username + '\'' +
                ", password='" + password + '\'' +
                '}';
    }
}
```

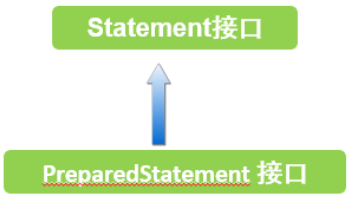
```
 /*
    * statement 只能拼接sql语句，可能会出现sql注入的风险（例如sql注入 用户名输入    ' or
1=1 #  密码随便输入，就会查出数据），不推荐用，
    * */
    public User query(String username, String password) {

        try {
            //1、加载驱动
            //加载mysql8.0+的驱动
            Class.forName("com.mysql.cj.jdbc.Driver");
            //Class.forName("com.mysql.jdbc.Driver");
            //2、获取连接
            String url = "jdbc:mysql://localhost:3306/test?
useUnicode=true&characterEncoding=utf8&useSSL=false&serverTimezone=Asia/Shanghai"
;
            Connection conn = DriverManager.getConnection(url, "root",
"123456");
            //3、获取Statement对象
            Statement statement = conn.createStatement();
            //4、执行sql返回ResultSet
            String sql = "select * from user where username='" + username + "'
and password='" + password + "'";
            ResultSet rs = statement.executeQuery(sql);
```

```
            User user=null;
            if (rs.next()) {
                int id = (Integer) rs.getObject(1);
                String username1 = (String) rs.getObject(2);
                String password1 = (String) rs.getObject(3);

                user = new User();
                user.setId(id);
                user.setUsername(username1);
                user.setPassword(password1);
            }

            //5、关闭资源
            rs.close();
            statement.close();
            conn.close();
            return user;
        } catch (ClassNotFoundException e) {
            e.printStackTrace();
        } catch (SQLException e) {
            e.printStackTrace();
        }
        return null;
    }
```

JDBC的PreparedStatement

PreparedStatement概述

- PreparedStatement概述
  - 继承自Statement接口
  - 能够对SQL语句进行预编译
- PreparedStatement的优势
  - 提高SQL语句执行效率
  - 提高安全性



- SQL语句使用"?"作为数据占位符
- 在创建时对SQL语句进行预编译
- 使用setXxx()方法设置数据

使用PreparedStatement查询

```
public User query(String username, String password) {
    try {
        //1、加载驱动
```

```
        //加载mysql8.0+的驱动
        Class.forName("com.mysql.cj.jdbc.Driver");
        //Class.forName("com.mysql.jdbc.Driver");
        //2、获取连接
        String url = "jdbc:mysql://localhost:3306/test?
useUnicode=true&characterEncoding=utf8&useSSL=false&serverTimezone=Asia/Shanghai"
;
        Connection conn = DriverManager.getConnection(url, "root", "123456");
        //3、获取PreparedStatement
        String sql = "select * from user where username= ? and password= ?";
        PreparedStatement ps = conn.prepareStatement(sql);
        ps.setObject(1,username);
        ps.setObject(2,password);
        //4、执行sql返回ResultSet
        ResultSet rs = ps.executeQuery();
        User user =null;
        if (rs.next()) {
            int id = (Integer) rs.getObject(1);
            String username1 = (String) rs.getObject(2);
            String password1 = (String) rs.getObject(3);

            user = new User();
            user.setId(id);
            user.setUsername(username1);
            user.setPassword(password1);
        }

        //5、关闭资源
        rs.close();
        ps.close();
        conn.close();
        return user;
    } catch (ClassNotFoundException e) {
        e.printStackTrace();
    } catch (SQLException e) {
        e.printStackTrace();
    }
    return null;
}
```

新增

```
/**
 * 新增
 *
 * @throws ClassNotFoundException
 * @throws SQLException
 */
private static void insert() throws ClassNotFoundException, SQLException {
    //1、加载jdbc驱动
    Class.forName("com.mysql.cj.jdbc.Driver");
    //2、获取连接
    //在mysql8.0的数据库 serverTimezone=Asia/shanghai是必须的参数
```

```
    String url = "jdbc:mysql://localhost:3306/db1?
useUnicode=true&characterEncoding=utf8&useSSL=false&serverTimezone=Asia/Shanghai"
;
    Connection conn = DriverManager.getConnection(url, "root", "123456");
    //3、获取PreparedStatement对象
    //注意点：sql语句中使用？作为参数的占位符
    String sql = "insert into `user`(username,password) values(?,?)";
    PreparedStatement ps =
conn.prepareStatement(sql,Statement.RETURN_GENERATED_KEYS);
    //把问号替换成参数
    ps.setObject(1, "jim");
    ps.setObject(2, 30);
    //4、执行sql，新增 要使用executeUpdate()
    ps.executeUpdate();
    // 执行此 Statement 对象而创建的所有自动生成的键
    ResultSet rs = ps.getGeneratedKeys();
    if (rs.next()) {
        // 指定返回生成的主键
        Object id = rs.getObject(1);
        System.out.println("新增的主键为："+id);
    }
    //5、关闭资源
    ps.close();
    conn.close();
}
```

修改和删除

```
/**
 * 更新
 *
 * @throws ClassNotFoundException
 * @throws SQLException
 */
private static void update() throws ClassNotFoundException, SQLException {
    //1、加载jdbc驱动
    Class.forName("com.mysql.cj.jdbc.Driver");
    //2、获取连接
    //在mysql8.0的数据库 serverTimezone=Asia/shanghai是必须的参数
    String url = "jdbc:mysql://localhost:3306/db1?
useUnicode=true&characterEncoding=utf8&useSSL=false&serverTimezone=Asia/Shanghai"
;
    Connection conn = DriverManager.getConnection(url, "root", "123456");
    //3、获取PreparedStatement对象
    //注意点：sql语句中使用？作为参数的占位符
    String sql = "update user set password=? where id = ?";
    PreparedStatement ps = conn.prepareStatement(sql);
    //把问号替换成参数
    ps.setObject(1, "888");
    ps.setObject(2, 1);
    //4、执行sql，更新或者删除 要使用executeUpdate()，处理返回值，返回值代表的含义：影响的行
数
    int result = ps.executeUpdate();
    if (result > 0) {
```

```
            System.out.println("更新密码成功");
        } else {
            System.out.println("更新密码失败");
        }
        //5、关闭资源
        ps.close();
        conn.close();
    }
```

封装DbUtils工具类

```
package com.tjetc.jdbc;

import java.io.IOException;
import java.io.InputStream;
import java.sql.*;
import java.util.*;

public class DbUtils {
    private static String driverName;
    private static String url;
    private static String username;
    private static String password;

    static {
        InputStream inputStream = null;
        try {
            //创建db.properties的流
            inputStream =
DbUtils.class.getClassLoader().getResourceAsStream("db.properties");
            //创建Properties对象
            Properties p = new Properties();
            //把数据流读入Properties对象中
            p.load(inputStream);
            //从Properties对象中获取配置数据
            url = p.getProperty("url");
            username = p.getProperty("username");
            password = p.getProperty("password");
            driverName = p.getProperty("driverName");
        } catch (IOException e) {
            e.printStackTrace();
        } finally {
            try {
                if (inputStream != null) {
                    inputStream.close();
                }
            } catch (IOException e) {
                e.printStackTrace();
            }
        }
    }

    /**
     * insert语句使用，返回新增数据的自增主键。
```

```
     *
     * @param sql
     * @return
     */
    public static Object insert(Connection connection, String sql, Object[]
params) throws SQLException {
        PreparedStatement ps = null;
        Object id = null;
        try {
            //创建PreparedStatement
            ps = connection.prepareStatement(sql,
Statement.RETURN_GENERATED_KEYS);
            //设置参数
            setPreparedStatementParam(ps, params);
            //执行sql
            ps.executeUpdate();
            // 执行此 Statement 对象而创建的所有自动生成的键
            ResultSet rs = ps.getGeneratedKeys();
            if (rs.next()) {
                // 指定返回生成的主键
                id = rs.getObject(1);
            }
        } finally {
            close(ps);
        }
        return id;
    }

    /**
     * insert语句使用，返回新增数据的自增主键。
     *
     * @param sql
     * @return
     */
    public static Object insert(String sql, Object[] params) throws
SQLException, ClassNotFoundException {
        Connection conn = null;
        Object id;
        try {
            //创建连接
            conn = getConnection();
            id = insert(conn, sql, params);
        } finally {
            close(conn);
        }
        return id;
    }

    /**
     * 更新、删除
     *
     * @param sql
     * @param params
     * @return
     * @throws SQLException
```

```
     */
    public static boolean update(Connection connection, String sql, Object[]
params) throws SQLException {
        PreparedStatement ps = null;
        try {
            //步骤2：设置SQL语句以及对应的参数
            ps = connection.prepareStatement(sql);
            setPreparedStatementParam(ps, params);
            //步骤3：执行update
            int result = ps.executeUpdate();
            //返回执行的结果
            return result > 0 ? true : false;
        } finally {
            //步骤4：关闭资源
            close(ps);
        }
    }

    /**
     * 更新、删除
     *
     * @param sql
     * @param params
     * @return
     * @throws SQLException
     */
    public static boolean update(String sql, Object[] params) throws
SQLException, ClassNotFoundException {
        Connection connection = null;
        try {
            //步骤1：获取链接
            connection = getConnection();
            return update(connection, sql, params);
        } finally {
            //步骤2：关闭连接资源
            close(connection);
        }
    }

    /**
     * 查询一个
     *
     * @param sql
     * @param params
     * @return
     * @throws SQLException
     */
    public static Map<String, Object> selectOne(Connection connection, String
sql, Object[] params) throws SQLException {
        PreparedStatement ps = null;
        ResultSet rs = null;
        try {
            //步骤2：设置SQL语句以及对应的参数
            ps = connection.prepareStatement(sql);
            setPreparedStatementParam(ps, params);
```

```
            //步骤3：执行查询，把查询结果的列作为key，列对应的值作为value，保存到Map中
            rs = ps.executeQuery();

            if (rs.next()) {
                return getResultMap(rs);
            }
        } finally {
            //步骤4：关闭资源
            close(rs, ps);
        }
        return null;
    }

    /**
     * 获取ResultMap
     *
     * @param rs
     * @return
     * @throws SQLException
     */
    private static Map<String, Object> getResultMap(ResultSet rs) throws
SQLException {
        //获取到result的元数据，包含了列的信息
        ResultSetMetaData metaData = rs.getMetaData();

        //获取到当前表的所有的列的列数
        int columnCount = metaData.getColumnCount();

        //存储数据库列与值的map
        Map<String, Object> map = new HashMap<>();

        //根据列的数量，获取到每一个列的列名以及对应的值
        for (int i = 0; i < columnCount; i++) {
            //能够获取到每一个列的名称，参数是每个列的序号值
            String columnLabel = metaData.getColumnLabel(i + 1);
            Object columnValue = rs.getObject(columnLabel);
            map.put(columnLabel, columnValue);

        }
        return map;
    }

    /**
     * 查询一个
     *
     * @param sql
     * @param params
     * @return
     * @throws SQLException
     */
    public static Map<String, Object> selectOne(String sql, Object[] params)
throws SQLException, ClassNotFoundException {
        Connection connection = null;
        try {
```

```
            //步骤1：获取链接
            connection = getConnection();
            return selectOne(connection, sql, params);
        } finally {
            //步骤4：关闭资源
            close(connection);
        }
    }

    /**
     * 查询集合
     *
     * @param sql
     * @param params
     * @return
     */
    public static List<Map<String, Object>> selectList(Connection connection,
String sql, Object[] params) throws SQLException {
        PreparedStatement ps = null;
        ResultSet rs = null;
        List<Map<String, Object>> list;
        try {
            //步骤2：设置SQL语句以及对应的参数
            ps = connection.prepareStatement(sql);
            setPreparedStatementParam(ps, params);

            //步骤3：执行查询，把查询结果的列作为key，列对应的值作为value，保存到Map中
            rs = ps.executeQuery();
            list = new ArrayList<>();

            while (rs.next()) {
                list.add(getResultMap(rs));
            }
        } finally {
            //步骤4：关闭资源
            close(rs, ps);
        }
        return list;
    }

    /**
     * 查询集合
     *
     * @param sql
     * @param params
     * @return
     */
    public static List<Map<String, Object>> selectList(String sql, Object[]
params) throws SQLException, ClassNotFoundException {
        Connection connection = null;
        try {
            connection = getConnection();
            return selectList(connection, sql, params);
        } finally {
            close(connection);
```

```
        }
    }

    /**
     * 设置参数
     *
     * @param ps
     * @param params
     * @throws SQLException
     */
    private static void setPreparedStatementParam(PreparedStatement ps, Object[]
params) throws SQLException {
        if (params != null && params.length > 0) {
            for (int i = 0; i < params.length; i++) {
                ps.setObject(i + 1, params[i]);
            }
        }
    }

    /**
     * 获取连接
     *
     * @return
     * @throws SQLException
     */
    public static Connection getConnection() throws ClassNotFoundException,
SQLException {
        //加载数据库驱动
        Class.forName(driverName);
        return DriverManager.getConnection(url, username, password);
    }

    //开启事务
    public static void beginTransaction(Connection conn) throws SQLException {
        conn.setAutoCommit(false);
    }

    //提交事务
    public static void commit(Connection conn) throws SQLException {
        conn.commit();
    }

    //回滚事务
    public static void rollback(Connection conn) throws SQLException {
        conn.rollback();
    }

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

```
    }


    /**
     * 释放PreparedStatement,Connection
     */
    private static void close(PreparedStatement ps, Connection connection) {
        close(ps);
        close(connection);
    }

    /**
     * 释放ResultSet,PreparedStatement
     */
    private static void close(ResultSet rs, PreparedStatement ps) {
        close(rs);
        close(ps);
    }

    /**
     * 释放ResultSet,PreparedStatement,Connection
     */
    private static void close(ResultSet rs, PreparedStatement ps, Connection
conn) {
        close(rs);
        close(ps);
        close(conn);
    }


    private static void close(Statement statement) {
        if (statement != null) {
            try {
                statement.close();
            } catch (SQLException e) {
                e.printStackTrace();
            }
        }
    }

    private static void close(PreparedStatement statement) {
        if (statement != null) {
            try {
                statement.close();
            } catch (SQLException e) {
                e.printStackTrace();
            }
        }
    }

    private static void close(ResultSet rs) {
        if (rs != null) {
            try {
                rs.close();
            } catch (SQLException e) {
```

```
                e.printStackTrace();
            }
        }
    }
}
```