

CS307 Project 2 - Report

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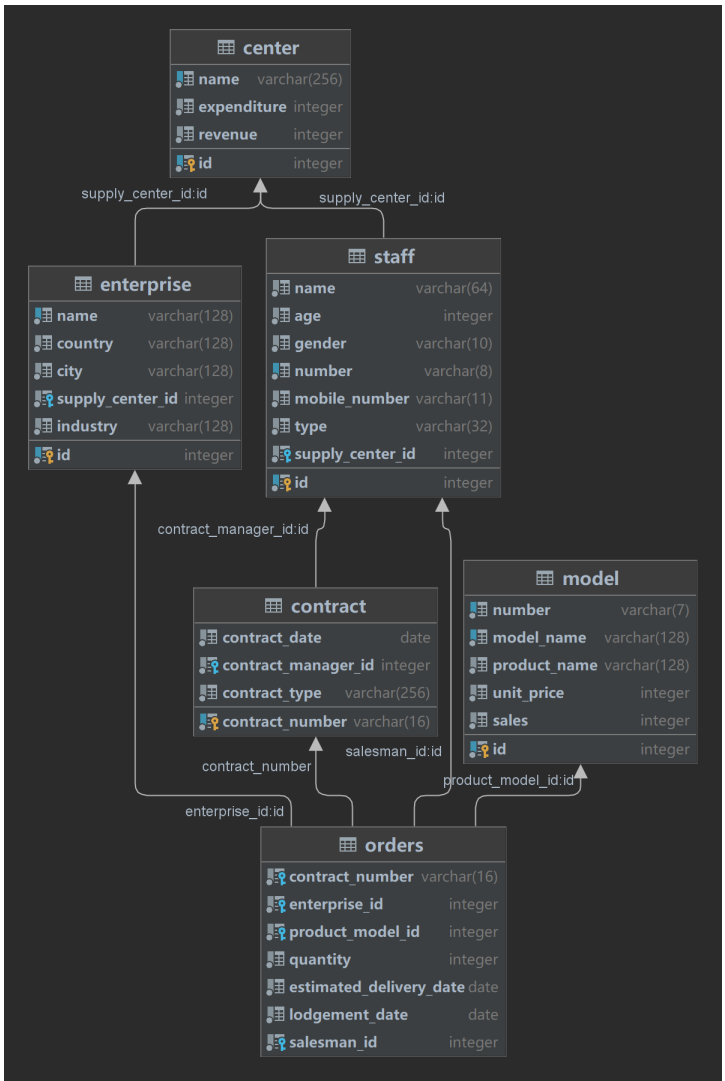
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1. Database Design



1.1 center

center table has two original property: id, name.

We add expenditure and revenue to update the pay and the profit of each center when we import task1_in_stoke_test_data_publish.csv, task2_test_data_publish.csv, task34_update_test_data_publish.tsv, task34_delete_test_data_publish.tsv.

1.2 enterprise

enterprise table has 6 original property: id, name, country, city, supply_center, industry. We use foreign key to connect it with center:

```
1 constraint enterprise_supply_center_fk foreign key (supply_center_id) references center (id) on delete cascade
```

1.3 model

model table has 5 original property: id, number, model_name, product_name, unit_price

We add sales to update the number of sales model of each model when we import task1_in_stoke_test_data_publish.csv, task2_test_data_publish.csv, task34_update_test_data_publish.tsv, task34_delete_test_data_publish.tsv.

1.4 staff

staff table has 5 original property: id, name, age, gender, number, mobile_number, type, supply_center. We use foreign key to connect it with center.

```
1 constraint center_staff_fk foreign key (supply_center_id) references center (id) on delete cascade
```

1.5 contract

contract table is a new table and used to record the information of contract in task2_test_data_publish.csv. We use foreign key to connect it with staff

```
1 constraint contract_staff_fk foreign key (contract_manager_id) references staff (id) on delete cascade
```

1.6 inventory

inventory table is a new table and used to record the information of stock in task1_in_stoke_test_data_publish.csv, and update it in task2_test_data_publish.csv, task34_update_test_data_publish.tsv, task34_delete_test_data_publish.tsv. We use foreign key to connect it with model and center

```
1 constraint stock_center_fk foreign key (supply_center_id) references center (id) on delete cascade
2 constraint stock_model_fk foreign key (product_model_id) references model (id) on delete cascade
```

1.7 center_record

center_record table is a new table and used to record the information of stock in task1_in_stoke_test_data_publish.csv. We use foreign key to connect it with model, center and staff

1.8 orders

orders table is a new table and used to record the information of each order in task1_in_stoke_test_data_publish.csv, and update it in task2_test_data_publish.csv, task34_update_test_data_publish.tsv, task34_delete_test_data_publish.tsv. We use foreign key to connect it with model, center, staff and contract.

```
1 constraint orders_product_model_fk foreign key (product_model_id) references model (id) on delete cascade,
2 constraint orders_salesman_fk foreign key (salesman_id) references staff (id) on delete cascade,
3 constraint orders_enterprise_fk foreign key (enterprise_id) references enterprise (id) on delete cascade,
4 constraint orders_contract_fk foreign key (contract_number) references contract (contract_number) on delete casc
```

2. API Design

2.1 stockIn

According to `task1_in_stoke_test_data_publish.csv`, put the information into `inventory` table and `record` table.

And we should notice that:

- (1) select the center of the salesman and it must be same as the information of the staff table
- (2) select the type of the staff and it must be salesman
- (3) select the information of center, staff and product to make sure they exist

2.2 placeOrder

According to `task2_test_data_publish.csv`, put the information into `orders` table and `contract` table.

And we should notice that:

- (1) select the inventory of the model and compare it with the quantity in the order, we should make sure inventory is more than quantity
- (2) select the type of salesman to check it whether is salesman in staff table
- (3) update the quantity in inventory and sales in model table

2.3 updateOrder

According to `task34_update_test_data_publish.tsv`, put the information into `orders` table and `inventory` table

And we should notice that:

- (1) select the staff in order to check whether it is the same person
- (2) update the quantity in inventory and sales in model table
- (3) check the updated quantity whether is 0

2.4 deleteOrder

According to `task34_delete_test_data_publish.tsv`, put the information into `orders` table and `inventory` table

And we should notice that:

- (1) select the staff in order to check whether it is the same person
- (2) update the quantity in inventory and sales in model table
- (3) make sure contract table does not delete contract

2.5 getAllStaffCount

Use simple **SQL** language to get it.

```
1 <select id="getAllStaffCount" resultMap="staffTypeToStaffCntMap">
2     select type as type, count(*) as count
3     from staff
4     group by type
5 </select>
```

2.6 getContractCount

Use simple **SQL** language to get it.

```
1 <select id="getContractCount" resultMap="contractCountMap">
2     select count(*) as count from contract
3 </select>
```

2.7 getOrderCount

Use simple **SQL** language to get it.

```
1 <select id="getOrderCount" resultMap="orderCountMap">
2   select count(*) as count from orders
3 </select>
```

2.8 getNeverSoldProductCount

Find the model which sales is 0 then count the number of them.

```
1 <select id="getNeverSoldProductCount" resultMap="neverSoldProductCountMap">
2   select count(*) as count
3   from (select model.model_name
4   from model
5   join center_record cr on model.id = cr.product_model_id
6   where model.sales = 0
7   and cr.quantity != 0
8   group by model.model_name) as sub
9 </select>
```

2.9 getFavoriteProductModel

Find the model which has the highest sales, first count number of each product, then select the max.

```
1 <select id="getFavoriteProductModel" resultMap="favoriteProductModelMap">
2   select model_name, sales
3   from model
4   where sales = (select max(sales) from model)
5 </select>
```

2.10 getAvgStockByCenter

Count the number of products for each center and then divide the types of model. Notice that we should round the result and divide the types which number more than 0

```
1 <select id="getAvgStockByCenter" resultMap="avgStockInByCenterMap">
2   select c.name as centerName, round(sum(count) / count(product_model_id)::numeric, 1) as avg
3   from inventory
4   join center c on c.id = inventory.supply_center_id
5   group by c.name
6   order by c.name
7 </select>
```

2.11 getProductByNumber

Input the number of product and then select the relevant information by it. We should count number for each center

```

1 <select id="getProductByNumber" resultMap="productByNumberMap">
2     select center.name as centerName, m.model_name as modelName, i.count as count
3     from center
4     join inventory i on center.id = i.supply_center_id
5     join model m on m.id = i.product_model_id
6     where product_name = #{productName}
7     group by center.name, m.product_name, m.model_name, i.count
8 </select>

```

2.12 getContractInfo

Input the number of contract, and select in contract table and orders table to get the information. If there is no orders in contract, we should still show the information of the contract

```

1 <select id="getContractInfo" resultMap="contractInfoMap">
2     select distinct c2.contract_number as contract_number,s2.name as staffName,e.name as
    enterpriseName ,c.name as centerName
3     from orders
4     join model m on m.id = orders.product_model_id
5     join enterprise e on e.id = orders.enterprise_id
6     join center c on c.id = e.supply_center_id
7     join staff s on s.id = orders.salesman_id
8     join contract c2 on orders.contract_number = c2.contract_number
9     join staff s2 on s2.id=c2.contract_manager_id
10    where c2.contract_number = #{contract_number}
11 </select>

```

```

1 <select id="getOrderInfo" resultMap="orderInfoMap">
2     select distinct m.model_name as modelName,s.name as salesmanName,quantity,unit_price as
    unitPrice,estimated_delivery_date,lodgement_date
3     from orders
4     join model m on m.id = orders.product_model_id
5     join enterprise e on e.id = orders.enterprise_id
6     join center c on c.id = e.supply_center_id
7     join staff s on s.id = orders.salesman_id
8     join contract c2 on orders.contract_number = c2.contract_number
9     join staff s2 on s2.id=c2.contract_manager_id
10    where c2.contract_number = #{contract_number}
11 </select>

```

3. Advanced Part

3.1 Enhanced Usability of API

(1) Query the order list based on multiple parameters, and the parameters can be null or not.

```

1 <select id="getOrder" resultMap="orderMap">
2     select distinct c2.contract_number as contract_number,s2.name as staffName,e.name as
enterpriseName ,c.name as centerName, m.model_name as modelName,s.name as
salesmanName,quantity,unit_price as unitPrice,estimated_delivery_date,lodgement_date
3     from orders
4     join model m on m.id = orders.product_model_id
5     join enterprise e on e.id = orders.enterprise_id
6     join center c on c.id = e.supply_center_id
7     join staff s on s.id = orders.salesman_id
8     join contract c2 on orders.contract_number = c2.contract_number
9     join staff s2 on s2.id=c2.contract_manager_id
10    where c2.contract_number like #{contract_number} and e.name like #{enterpriseName} and
c.name like #{centerName} and m.model_name like #{modelName}
11 </select>

```

use like "?....." to query the order list based on multiple parameters, and the parameters can be null or not.

(2) Design the Bill Module

add and update the expenditure and revenue in the center table

(3) Design a mechanism to change order status according to time and date.

```

1 @Update("update contract set contract_type = 'Processed' where contract_date > #{contract_date}
")
2 void updateDate(@Param("contract_date") LocalDate contract_date);

```

set the contract later than date to "processed", and earlier than date to 'finished'

3.2 Design Pattern

DAO (Data Access Objects) is applied into this project to implement enable access to persistent data between business logic and persistent data and wrap all database operations. This design pattern mainly divides the **Java** classes into the following layers:

- **entity**: Used to store and transfer object data.
- **service**: Define all operations on the database as abstract methods, which can provide multiple implementations.
- **impl**: Give a concrete implementation of the **service** interface definition method for different databases.

Besides, since we use **Mybatis-Plus** to implement manipulate and operate **CRUD** of the database in **Java**, and communication and interaction between front and back-end, another layers will be added:

- **mapper**: Composed of **Java** interfaces and **XML** files. It has functions of:
 - a. Define the parameter type
 - b. Configuration Cache
 - c. Provide SQL statements and dynamic SQL
 - d. Define the mapping relationship between query results and **POJO**
- **controller**: Responsible for front-end and back-end interaction, accepting front-end requests, calling the service layer, receiving data returned from the service layer, and finally returning the specific page and data to the client.

3.3 HTTP/RESTful Web Services

In this project, we use **Springboot** to encapsulate and implement the backend API. To implement request back-end data and operations through web services, all we need is to add annotations in **controller** layer:

- `@RestController`: provide **Restful** style interface return values, or **json** objects.
- `@GetMapping`: Handle **get** requests, which correspond to `select` operation in the database.
- `@PostMapping`: Handle **post** requests (usually to add data), which correspond to `insert` operation in database.
- `@PutMapping`: Handle **post** requests (usually to modify data), which corsepond to `update` operation in database.
- `@DeleteMapping`: Delete URL mapping, which corsepond to `delete` operation in database.
- `@RequestParam`: Specify the Request parameter in the HTTP protocol.
- `@RequestBody`: Used to receive data in a **json** string passed from the front-end to the back-end

3.4 Frontend Design

In this project, we also implement the front and back-end separation. We mainly use **vue** and **element-plus** to build the user interface (web page).

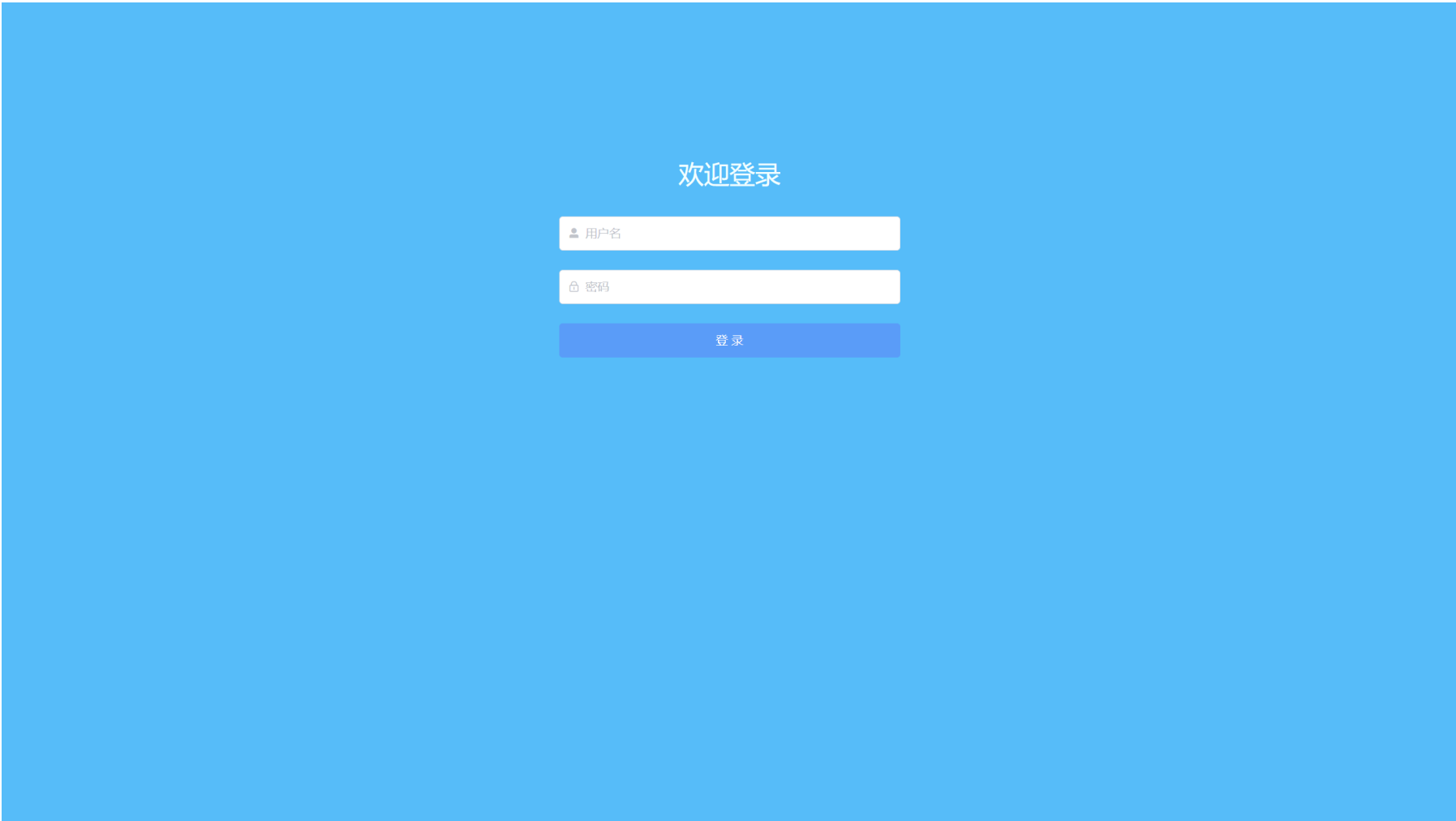


Figure 1. Login page

User need to enter his or her username and password to login the system.

后台管理

用户

系统管理

供应中心成员管理

公司管理

供应中心管理

产品管理

信息查询

新增

请输入人员编号

查询

姓名	年龄	性别	编号	电话号码	类型	所属供应中心	操作
Steven Edwards	38	Male	12211522	15673757797	Supply Staff	America	<div>编辑</div> <div>删除</div>
Jiang Shengxiang	40	Male	12012116	15639234045	Supply Staff	America	<div>编辑</div> <div>删除</div>
Yang Penglong	48	Male	11210418	18690429590	Supply Staff	America	<div>编辑</div> <div>删除</div>
Al Evans	41	Male	11910017	15639548357	Supply Staff	America	<div>编辑</div> <div>删除</div>
Xu Shiyun	49	Female	11110325	13990824090	Supply Staff	America	<div>编辑</div> <div>删除</div>
Gene Jackson	41	Male	11911118	18658431890	Supply Staff	America	<div>编辑</div> <div>删除</div>
Tao Yibo	38	Female	12210416	13866742389	Supply Staff	America	<div>编辑</div> <div>删除</div>
Chen Yueqi	45	Male	11512800	15696096714	Supply Staff	America	<div>编辑</div> <div>删除</div>
Xu Zhuyu	44	Male	11610802	18903294883	Supply Staff	America	<div>编辑</div> <div>删除</div>
You Taian	47	Male	11310827	18936275779	Supply Staff	America	<div>编辑</div> <div>删除</div>

Total 1000

10/page

<123456...100>

Go to1

Figure 2. Basic web page

The data are mainly demonstrated by the form of table. To make the interface moew beautiful, we implement the pagination function of tables by using the **Pagination InnerInterceptor** of **Mybatis-Plus**. For the basic four information tables (`staff`, `center`, `enterprise`, `product`), user can execute **CRUD** operations in web page.

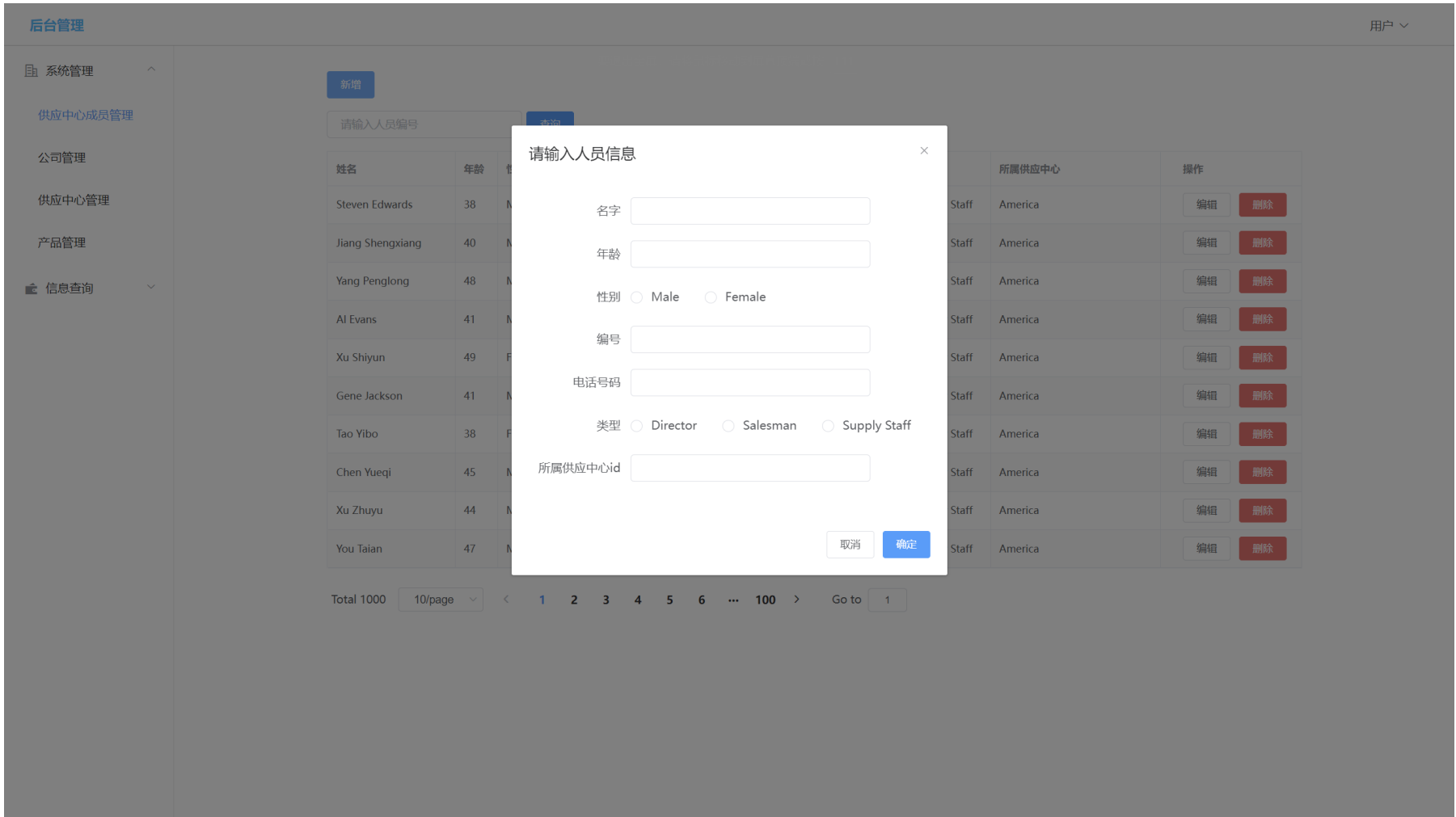
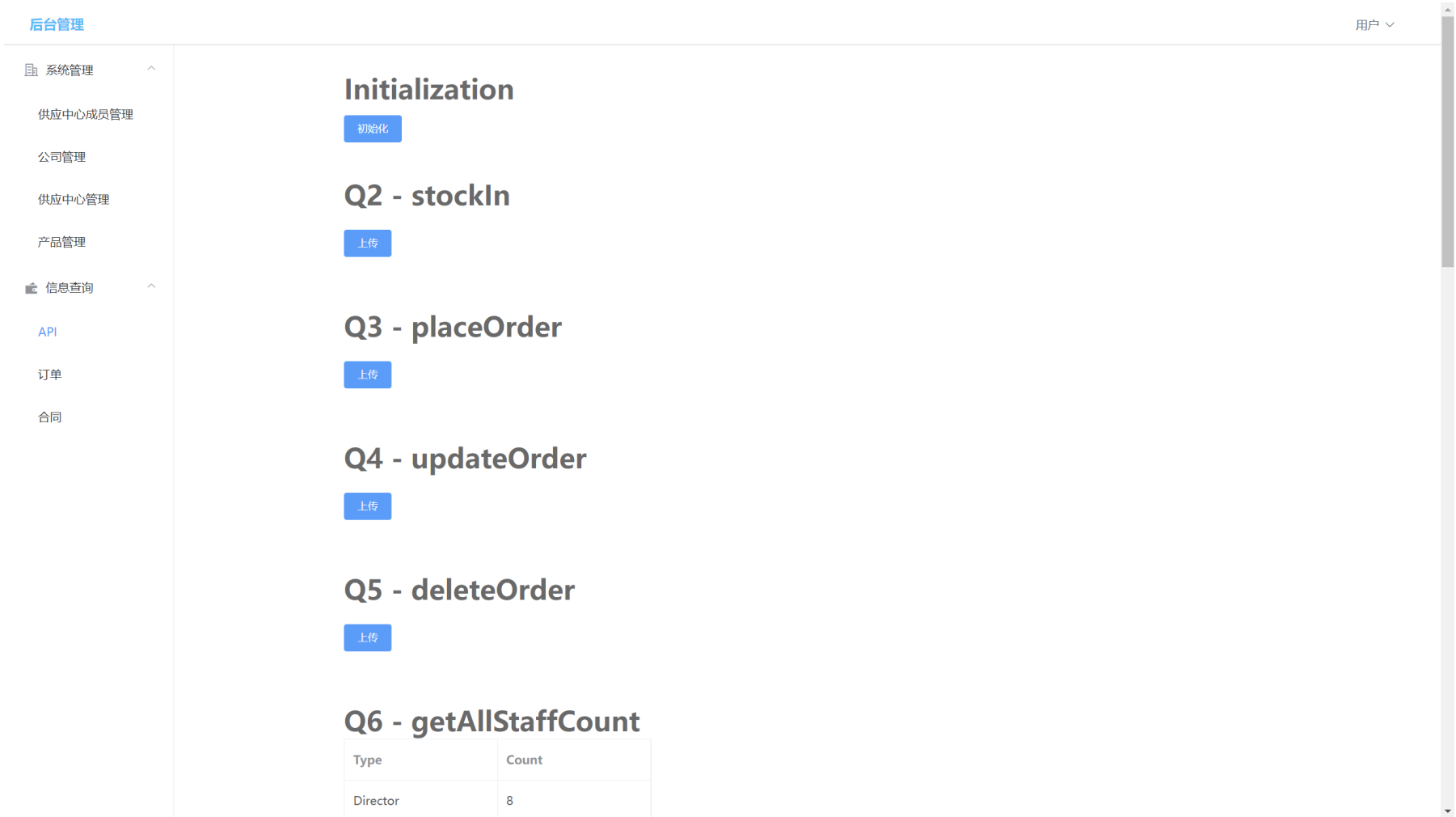


Figure 3. Insert data example

To simplify the operations of user, we add the `Initialization` button to intialize the four baisc tables at one single button. Besides, user can upload the testcase files directly in frontend page.



3.5 Database Connection Pool

In this project, we use connection pool [HikaiCP](#), which is the default connection pool applied by **SpringBoot**. Below is some configuration of our connection pool.

```

1 spring:
2     type: com.zaxxer.hikari.HikariDataSource
3     hikari:
4         maximum-pool-size: 16
5         auto-commit: false

```

3.6 Manipulation to Database

In this project, we use **Mybatis-Plus** to implement manipulate the database using **Java**, since it can simplify development.

Mybatis-Plus use the form of **XML** or **Annotation** to customize the **SQL** statement. Besides, it can automatically encapsulate the selected data into **Java** objects, such as `List`, `Map` or just the corresponding `entity` classes. **Mybatis-Plus** also some **Java** methods to implement the simple **CRUD** operations so that you do not need to write **SQL** again.

```

1 @Mapper
2 public interface CenterMapper extends BaseMapper<Center> {
3     @Update("update center set expenditure = expenditure + #{expenditure} where id = #{id}")
4     void updateExpenditure(@Param("expenditure") int expenditure, @Param("id") int id);
5
6     @Select("select * from center where name = #{name}")
7     Center selectByName(@Param("name") String name);
8 }

```

For the first function above, it use annotation `@Update` to define **update** operation, and use annotation `@Param` to define the parameters in **SQL** statement. For the **select** operation whose format is like `select * from ...` to a certain table, **Mybatis-Plus** will automatically encapsulate the data into corresponding `entity` class according to the column name.

For the complex query to a certain table that you just need certain columns of query result instead of all columns of the table, the return value need to by `java.util.Map`. Each `Map` object corresponds to one row of query results, and **key** of `Map` is the column name of results, and the **value** is the column value of corresponding column name.

```

1 <resultMap id="listPageMap" type="java.util.Map">
2     <result property="staffName" column="staffName" javaType="java.lang.String"/>
3     <result property="age" column="age" javaType="java.lang.Integer"/>
4     <result property="gender" column="gender" javaType="java.lang.String"/>
5     <result property="number" column="number" javaType="java.lang.String"/>
6     <result property="mobileNumber" column="mobileNumber" javaType="java.lang.String"/>
7     <result property="type" column="type" javaType="java.lang.String"/>
8     <result property="supplyCenterName" column="supplyCenterName" javaType="java.lang.String"/>
9 </resultMap>
10
11 <select id="listPage" resultMap="listPageMap">
12     select staff.name    as staffName,
13     age,
14     gender,
15     number,
16     mobile_number as mobileNumber,
17     type,
18     c.name          as supplyCenterName
19     from staff
20     join center c on c.id = staff.supply_center_id
21 </select>

```