MoonBird

系統需求規格書
Software Requirements Specification (SRS)
Version: 1.0

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Section 1 簡介 (Introduction)

1.1 目的 (Purpose)

Due to COVID-19, E-commerce development between retail stores and online stores is necessary. Therefore, a consistent database system is important for E-commerce development to avoid data redundancy and data inconsistency. Through this course, we have the opportunity to develop an online e-commerce system to learn database architecture. Our project team would deploy the concept of Enterprise Resource Planning (ERP) which integrates systems across the whole company and retail store including financial resources, human resources, Inventory management, Point of sale (POS), and E-commerce.

Concerning the Point of sale (POS), the web-based system in retail stores would be created to develop the synchronous data transfer between successful transactions and update sale records. All data will connect to the database server. There are 2 types of users with the following privileges:

Staff: manage the data of products, such as querying and updating products, processing product orders.

Administrators: have basic privileges of the staff but also can create and manage user accounts.

Regarding E-commerce, the Web Interface would be created to develop a B2C drop-shipping online store and provide some additional functions such as online product checking, online purchase. The necessary data such as product state, the valid user state will connect with the database server. There is 1 type of user with the following privileges:

Customers: search and purchase products

1.2 系統名稱 (Identification)

Our project will implement a Web-based E-commerce System in which users will be divided into three; which are: different identities, system administrators, staff and customers. These three identities will use different functions in the store, so each identity will also have a different table to store the corresponding information. If you want to obtain information between different identities, it will be executed through a relational database.

1.3 概觀 (Overview)

The system consists of the main system and several subsystems that are described as follows:

Main system:

Web-based E-commerce System(WECS)

Subsystem:

Member Management Subsystem, MMS

Product Management Subsystem, PMS

Discount Management Subsystem, DMS

Order Management Subsystem, OMS

Logistics Management Subsystem, LMS

Financial Management Subsystem, FMS

Shopping Cart Management Subsystem, SCMS

Comment and Score Management Subsystem, CSMS

1.4符號描述 (Notation Description) (if any)

Notation	Description
WECS 1.0.0	Web-based E-commerce System will be labeled with the number 1.0.0
MMS 1.1.n	Member Management Subsystem will be labeled with the number 1.1.n
PMS 1.2.n	Product Management Subsystem will be labeled with the number 1.2.n
DMS 1.3.n	Discount Management Subsystem will be labeled with the number 1.3.n
OMS 1.4.n	Order Management Subsystem will be labeled with the number 1.4.n
LMS 1.5.n	Logistics Management Subsystem will be labeled with the number 1.5.n
FMS 1.6.n	Financial Management Subsystem will be labeled with the number 1.6.n
SCMS 1.7.n	Shopping Cart Management Subsystem will be labeled with the number 1.7.n
CSMS 1.8.n	Comment and Score Management Subsystem will be labeled with the number 1.8.n

Notation	Description
FR-n	Functional Requirements
DR-n	Data Requirements
PR-n	Performance Requirements
SR-n	Security Requirements
UIR-n	User Interface Requirements
XIR-n	External Interface Requirements
IIR-n	Internal Interface Requirements
ER-n	Environment Requirements
IR-n	Installation Requirements
TR-n	Test Requirements
BR-n	Business Rule and Integrity Constraints

Section 2　系統(System)

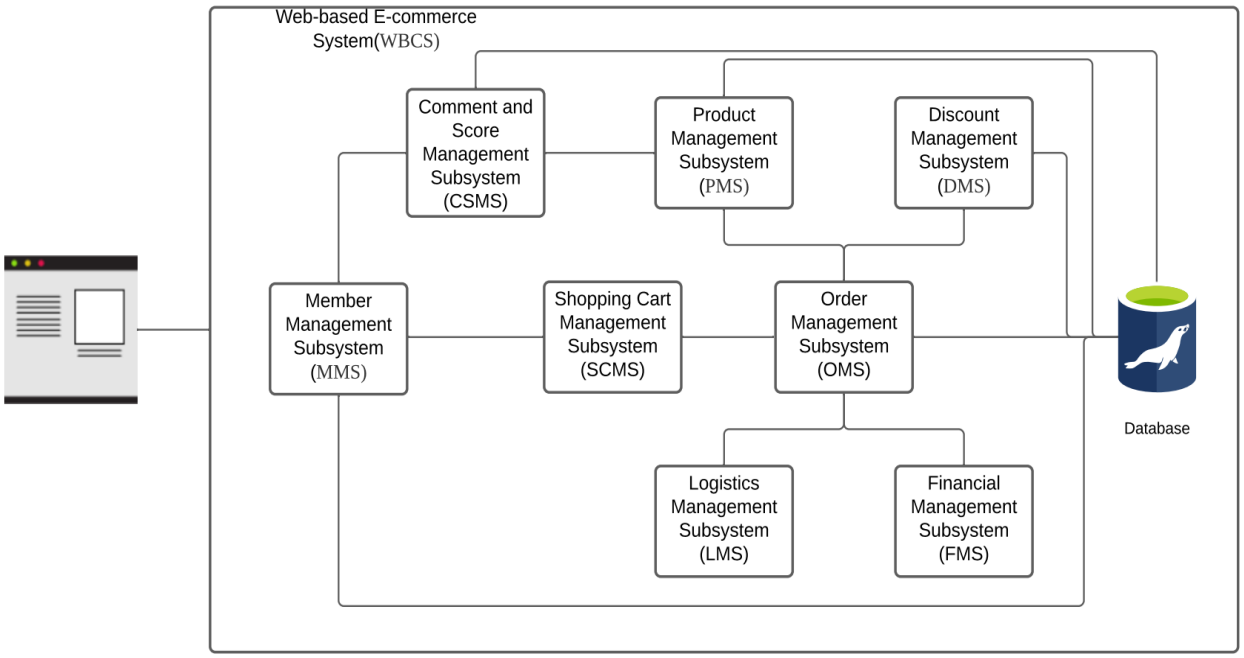
2.1 系統描述 (System Description)

The System Architecture will be divided into the main system and multiple subsystems. The main system is the Web-based E-commerce System(WECS). Also, there are many subsystems in the main system, which are divided into Member Management Subsystem (MMS), Product Management Subsystem (PMS), Discount Management Subsystem (DMS), Order Management Subsystem (OMS), Logistics Management Subsystem (LMS), Financial Management Subsystem (FMS), Shopping Cart Management Subsystem (SCMS), Comment and Score Management Subsystem (CSMS).

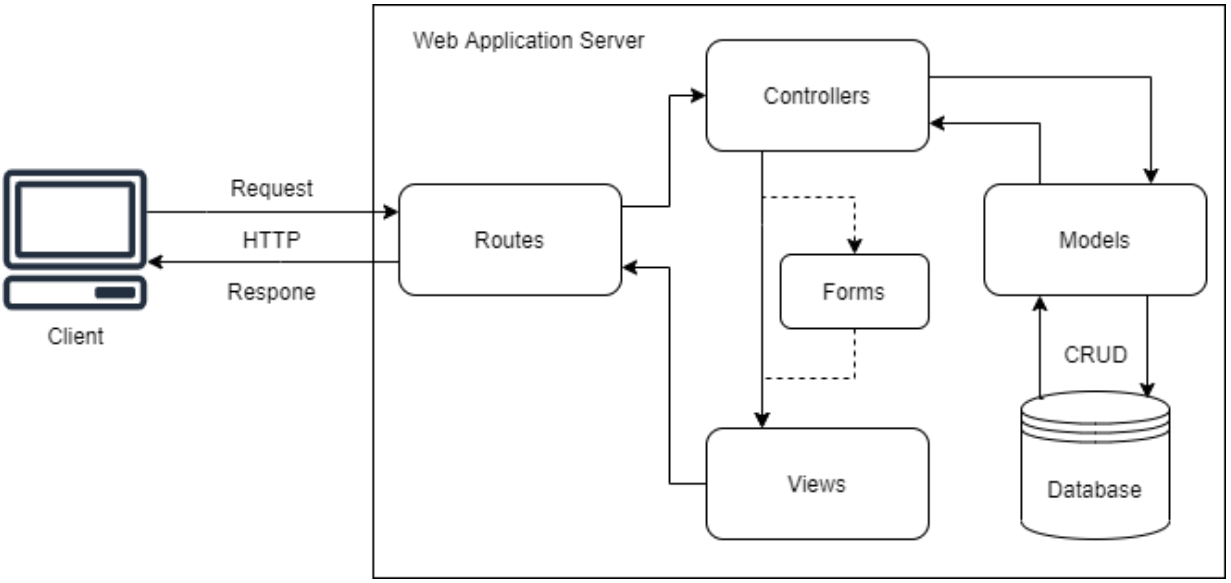
For the Application Architecture, it will be implemented as a Model–View–Controller (MVC) structure. The model is responsible for managing the data of the application. It receives user input from the controller. The view renders the presentation of the model in a particular format. The controller responds to the user input and performs interactions on the data model objects. The controller receives the input, optionally validates it, and then passes the input to the model.

For the Network Architecture, Nginx can improve the performance of Web Server and using Nginx has lots of advantages such as Caching and Load balance. Caching can reduce the waiting time of response. If there are a large number of static files on the web service, setting Cache will allow the browser to cache these files, saving network traffic costs, and allowing users to visit the website more quickly. Load balance refers to the process of distributing a set of tasks over a set of resources (computing units), with the aim of making their overall processing more efficient. Load balancing can optimize the response time and avoid unevenly overloading some compute nodes while other compute nodes are left idle.

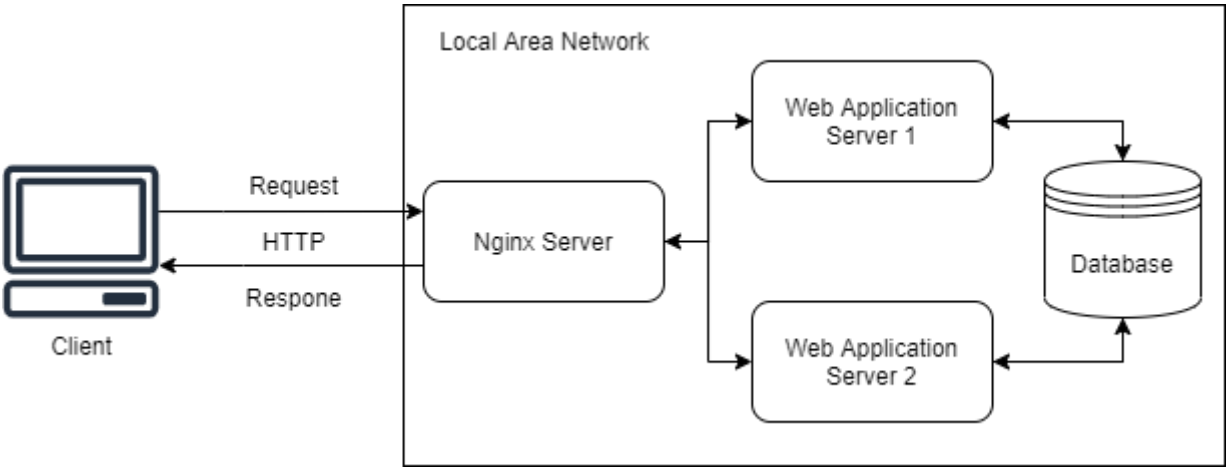
2.1.1　系統架構圖 (System Architecture Diagram)



2.1.2　應用程式架構圖 (Application Architecture Diagram)



2.1.3　網路架構圖 (Network Architecture Diagram)



2.2 操作概念 **(Operational Concepts or User Stories)**

Scenario 1:**Guest Operational Concepts**

Guests can view product details via a Web-based E-commerce System(WECS). Guests also can search products and view suggested products on "The Customers Who Bought This Product Also Bought" Suggestion through the Product Management Subsystem(PMS). After selecting products, Guests can add items to the Shopping Cart Management Subsystem(SCMS). If guests want to check-in, guests must register as a customer on Member Management Subsystem(MMS).

Scenario 2：**Customer Operational Concepts**

After customers log in with a valid user ID on Member Management Subsystem(MMS), customers can search products and view suggested products through the Product Management Subsystem(PMS). After selecting products, customers can add items to the Shopping Cart Management Subsystem(SCMS).

In Shopping Cart Management Subsystem(SCMS), customers can add/remove product items into/from the shopping cart, insert discounts code, and check-out. The total purchase amount will be calculated automatically. After the order transaction is received, customers can track the order's status and query the order history via Order Management Subsystem(OMS). Logistics Management Subsystem(LMS) updates orders' status automatically depending on the order tracking. After the order transaction is completed, customers can write review comments and rates for the store on the Comment and Score Management Subsystem(CSMS).

Scenario 3：**Staff Operational Concepts**

After staff logs in with a valid user ID on Member Management Subsystem(MMS), staff can manage the products, including insert, update, query, and delete products on Product Management Subsystem(PMS). Staff can also manage the discount policy, including insert, update, query, and delete discount policies on Discount Management Subsystem(DMS), the discount is divided into 3 types, which are shipping, seasoning, and special event discount. In addition, staff can process and update the status of customers' orders on the Order Management Subsystem(OMS). Logistics Management Subsystem(LMS) will update the order's status automatically after the order's status is changed.

In the Financial Management Subsystem(FMS), staff can view statistical reports about the product sales including daily, weekly, monthly sales reports, best-selling product reports for each store. Staff also can select a special period to view purchase statistics reports for each product or each store.

Scenario 4：**Administrator Operational Concepts**

After administrators log in with a valid user ID on Member Management Subsystem(MMS), administrators have all privileges of the staff.

In Member Management Subsystem(MMS), administrators can search user account information through some searching attributes such as userID, user's type. Administrators also can create and manage user accounts including staff account and customer account.

2.3 功能性需求 (Functional Requirements)

No.	Description
FR-01	The customers can search and purchase products.
FR-02	The staff can manage the data of products, such as query and update products and process product orders.
FR-03	The administrator can create and manage user accounts.
FR-04	The system shall allow users to log in and log out.
FR-05	The system shall authenticate users with *username* and *password.*
FR-06	The system should allow a user to register himself/herself as a customer.
FR-07	The system shall allow staff to manage the discount policy, including insert, update, query and delete discount policies.
FR-08	The system shall allow customers to add or remove product items from the shopping cart.
FR-09	The system shall calculate the total purchase amount of each customer's order when the customer checks out their shopping carts.
FR-10	The order transaction is completed when the customers confirm the payment of the purchase after checking out the shopping carts.
FR-11	The system shall allow customers to query the history of their orders
FR-12	The system should automatically email an order confirmation message to the customers who place an order
FR-13	The system shall support online payment and cash on delivery.
FR-14	The system shall provide the statistic report about the product sales, such as the daily, weekly, monthly sales reports
FR-15	The system should provide the report about the best-selling product for each store
FR-16	The system should provide the purchase statistic reports for each product or each store for a given period.
FR-17	The system shall allow customers to rate and/or comment on what they bought.
FR-18	The system shall provide some suggested products for the customers.
FR-19	The system shall keep tracking the status of the orders.

2.4 資料需求 (Data Requirements)

No.	Description
DR-01	The system shall contain information about each valid user of the system: email, username, password(hash), name, address, date of birth.
DR-02	The system shall contain information about each product: category, name, description, price, quantity, picture.
DR-03	The system shall contain information about each category: name, description
DR-04	The system shall contain information about each discount: name, description, code, status, discount rate
DR-05	The system shall contain information about each comment: user, content, rate

2.5 非功能性需求 (Non-Functional Requirements)

2.5.1 效能需求 (Performance Requirements)

No.	Description
PR-01	Page response should be less than 3 seconds.
PR-02	Searching time should be less than 3 seconds.
PR-03	When an error occurs in the system, an error message should be displayed and the user should return to the previous page.

2.5.2 資安需求 (Security Requirements) (if any)

No.	Description
SR-01	All users must be authenticated and data access is only allowed to authorized users.
SR-02	All user passwords must meet the complexity requirements.
SR-03	Verify there are no default passwords in use for the application framework or any components used by the application.
SR-04	All passwords are stored in the database in the ciphertext.

2.6 介面需求 **(Interface Requirements)**

2.6.1 使用者介面需求 (User Interfaces Requirements)

No.	Description
UIR-01	After the user logs in, the website will provide different pages for users of different identities.
UIR-02	Can’t use any real money to buy or sell.
UIR-03	Login page for all user roles
UIR-04	Register page for user role of customer
UIR-05	Forgot Password page for user role of customer
UIR-06	MMS page for user role of admin
UIR-07	PMS page for user role of staff
UIR-08	DMS page for user role of staff
UIR-09	OMS page for user role of staff
UIR-10	LMS page for user role of staff
UIR-11	FMS page for user role of staff
UIR-12	SCMS page for user role of customer
UIR-13	CSMS page for user role of customer

2.6.2 外部介面需求 (External Interface Requirements) (if any)

No.	Description
XIR-01	The user browses the web through the browser using HTTP communication.

2.6.3 內部介面需求 (Internal Interface Requirements) (if any)

No.	Description
IIR-01	MMS manages all users.
IIR-02	PMS manages all products.
IIR-03	DMS manages all discounts.
IIR-04	OMS manages all orders.

IIR-05	LMS manages all logistics information.
IIR-06	FMS manages all financial reports.
IIR-07	SCMS manages all shopping carts.
IIR-08	CSMS manages all comments and ratings.

2.7 其他需求 (Other Requirements)

2.7.1 環境需求 (Environmental Requirement)

No.	Description
ER-01	Linux(Ubuntu/Debian) or Windows with WSL.
ER-02	64-bit dual-core 2.0GHz processor.
ER-03	100GB or more storage space.
ER-04	4GB or more memory.
ER-05	100Mbps full-duplex NIC.

2.7.2 安裝需求 (Installation Requirement)

No.	Description
IR-01	Python 3.6 up
IR-02	Relational DBMS (MySQL/MariaDB)
IR-03	Coding IDE (VS Code/Atom)

2.7.3 測試需求 (Test Requirements) (if any)

No.	Description
TR-01	All modules should pass unit tests.
TR-02	The system should pass vulnerability testing.
TR-03	The system should pass penetration testing.
TR-04	The system should pass the stress testing.
TR-05	All UIs should pass the functional testing

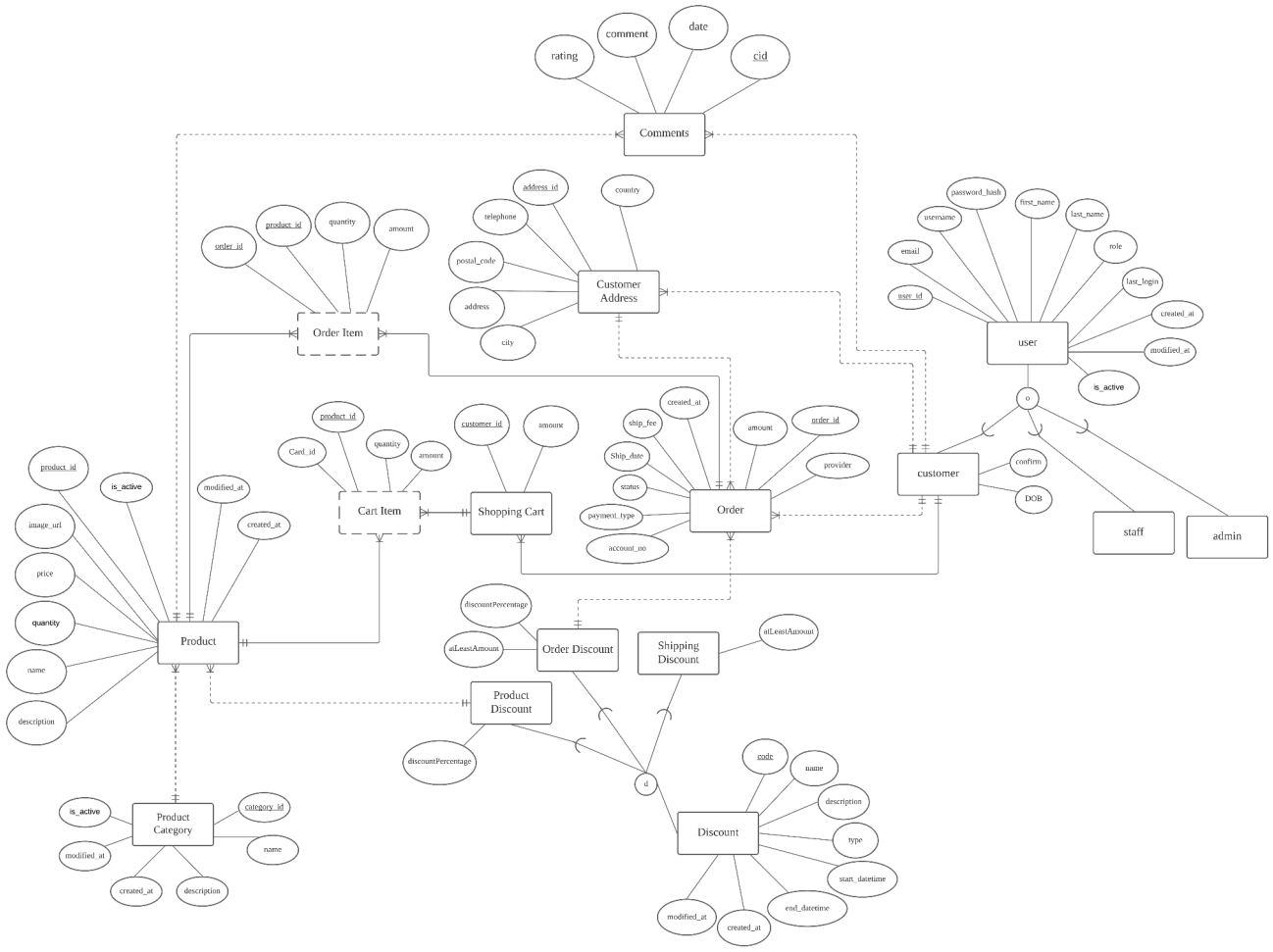
TR-06	The system should work on different platforms

2.8 商業規則與限制 **(Business Rules and Integrity Constraints)**

No.	Description
BR-01	Discount periods for special events for a specific product cannot overlap.
BR-02	The quantity of each product purchased must be an integer greater than zero.
BR-03	The purchase quantity for a product must be less than or equal to the current stock quantity for this product.

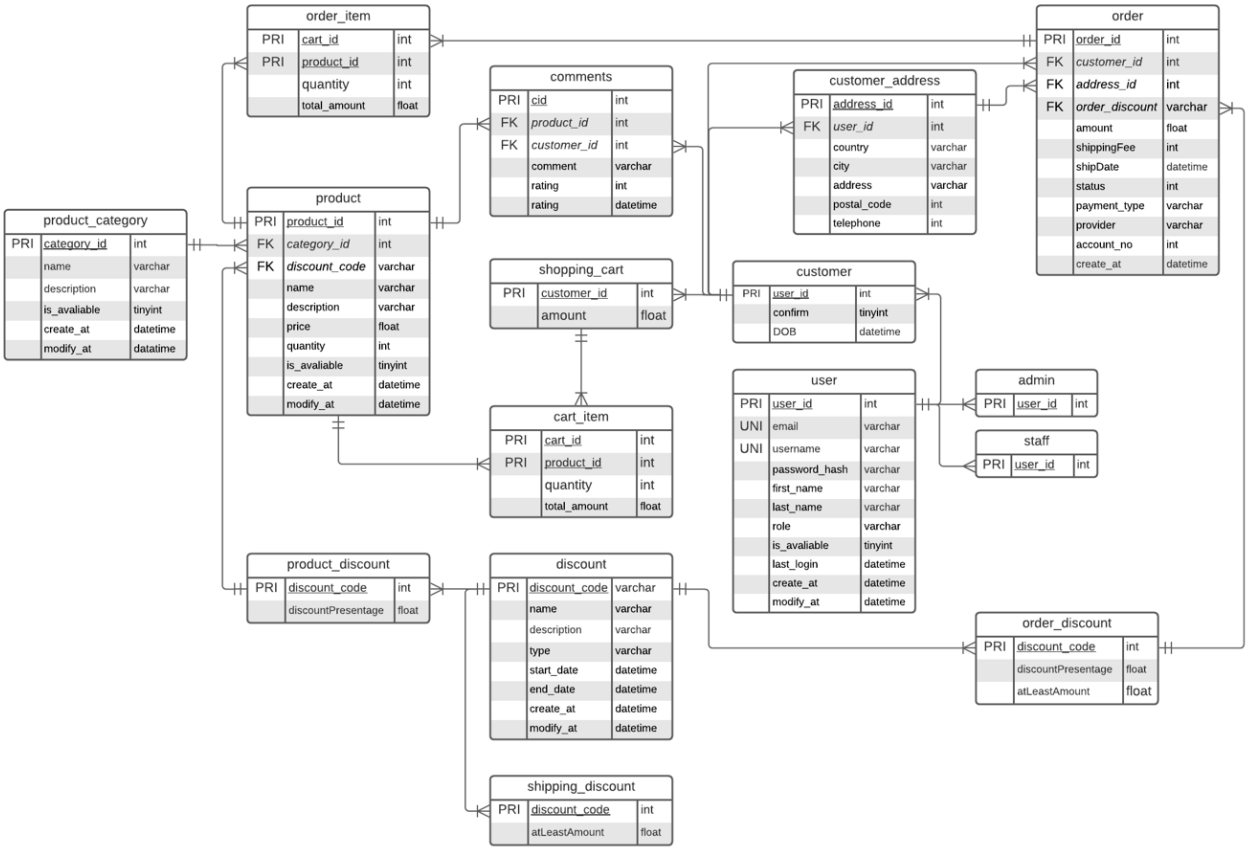
Section 3　資料庫概念設計（Conceptual Design of the Database）

3.1 Entity Relationship ER Model



Section 4　邏輯資料庫綱要(Logic Database Schema)

4.1 Schema of the Database



4.2 Domain of the Database

user				
Description: Base table of user role				
Attribute	Domain Type	Key	Nullable	Description
user_id	int(11)	Primary	Not null	user's ID
email	varchar(64)	Unique	Not null	user's email
username	varchar(32)	Unique	Not null	user's login account
password_hash	varchar(1024)		Not null	user's password
first_name	varchar(32)		Not null	user's first name
last_name	varchar(32)		Not null	user's last name
role	varchar(16)		Not null	classify the role of customer, admin, staff
is_active	tinyint(1)		Not null	default=true
last_login	datetime			the date and time for user last login
create_at	datetime		Not null	default=current datetime
modified_at	datetime		Not null	default=current datetime on update=current datetime

admin				
Description: Inherited from User table				
Attribute	Domain Type	Key	Nullable	Description
user_id	int(11)	Primary	Not null	admin.user_id refers to user.user_id

staff				
Description: Inherited from User table				
Attribute	Domain Type	Key	Nullable	Description
user_id	int(11)	Primary	Not null	staff.user_id refers to user.user_id

customer				
Description: Inherited from User table				
Attribute	Domain Type	Key	Nullable	Description
user_id	int(11)	Primary	Not null	customer.user_id refers to user.user_id
confirm	tinyint(1)		Not null	default=false
DOB	datetime		Not null	customer's date of birth

customer_address				
Description: Table of customer address				
Attribute	Domain Type	Key	Nullable	Description
address_id	int(11)	Primary	Not null	address's ID
user_id	int(11)	Foreign	Not null	customer_address.user_id refers to customer.user_id
country	varchar(8)		Not null	user's current country
city	varchar(32)		Not null	user's current city
address	varchar(255)		Not null	user's delivery address
postal_code	varchar(8)		Not null	user's postal code
telephone	varchar(16)		Not null	user's telephone number

product				
Description: product table				
Attribute	Domain Type	Key	Nullable	Description
product_id	int(11)	Primary	Not null	product ID
category_id	int(11)	Foreign	Not null	products.category_id refers to product_category.category_id
discount_code	varchar(8)	Foreign		discount code
name	varchar(64)	Unique	Not null	Product's name

description	varchar(255)			Product’s description
image_url	varchar(255)		Not null	The picture of a product
price	float		Not null	Product’s price
quantity	int(11)		Not null	Product’s stock quantity
is_active	tinyint(1)		Not null	default=true true=available,false=unavailable
create_at	datetime		Not null	default=current datetime
modified_at	datetime		Not null	default=current datetime on update=current datetime

product_categories				
Description: category table				
Attribute	Domain Type	Key	Nullable	Description
category_id	int(11)	Primary	Not null	category ID
name	varchar(64)	Unique	Not null	category’s name
description	varchar(255)			category’s description
is_active	tinyint(1)		Not null	default=true true=available,false=unavailable
create_at	datetime		Not null	default=current datetime
modified_at	datetime		Not null	default=current datetime on update=current datetime

order				
Description: Order table				
Attribute	Domain Type	Key	Nullable	Description
order_id	int(11)	Primary	Not null	order ID
customer_id	int(11)	Foreign	Not null	order.customer_id refers to customer.user_id

address_id	int(11)	Foreign	Not null	order.address_id refers to customer_address.address_id
order_discount	varchar(8)	Foreign		order.order_dicount refers to order_discount.discount_code
amont	int(11)		Not null	The total amount of transaction
shippingFee	int(11)		Not null	The shipping fee of transaction
shipDate	datetime			The shipping date of transaction
status	int(11)		Not null	0=received, 1=processing, 2=shipping, 3=closed
payment_type	varchar(8)		Not null	payment type (VISA/MASTER/UNIONPAY)
provider	varchar(64)		Not null	the provider of credit card
account_no	int(11)		Not null	customer's credit card no.
created_at	datetime		Not null	The date of creating transaction

order_item				
Description: order item table				
Attribute	Domain Type	Key	Nullable	Description
product_id	int(11)	Primary	Not null	order_item.product_id refers to product.product_id
order_id	int(11)	Primary	Not null	order_item.order_id refers to order.order_id
quantity	int(11)		Not null	the quantity of product
amount	float		Not null	the total amount of product

shopping_cart				
Description: shopping cart table				
Attribute	Domain Type	Key	Nullable	Description
customer_id	int(11)	Primary	Not null	shopping_cart.customer_id refers to customer.customer_id
amount	float		Not null	

cart_item				
Description: cartitem table				
Attribute	Domain Type	Key	Nullable	Description
product_id	int(11)	Primary	Not null	cart_item.product_id refers to product.product_id
cart_id	int(11)	Primary	Not null	cart_item.cart_id refers to shopping_cart.cart_id
quantity	int(11)		Not null	the quantity of product
amount	float		Not null	the total amount of product

discount				
Description: discount table				
Attribute	Domain Type	Key	Nullable	Description
discount_code	varchar(8)	Primary	Not null	discount code
name	varchar(64)	Unique	Not null	
type	varchar(255)		Not null	3 types of discounts
description	varchar(255)			The description of discount
start_datetime	datetime		Not null	the start date of discount period
end_datetime	datetime		Not null	the end date of discount period
created_at	datetime		Not null	the date of creating discount

modified_at	datetime		Not null	the date of modifying discount

product_discount				
Description: product matching special event discount table				
Attribute	Domain Type	Key	Nullable	Description
discount_code	varchar(8)	Primary	Not null	an extra benefit given to a customer
discountPercentage	float		Not null	a discount that is given to a product or service that is given as an amount per hundred

shipping_discount				
Description: product matching special event discount table				
Attribute	Domain Type	Key	Nullable	Description
discount_code	varchar(8)	Primary	Not null	a code for reducing price or an extra benefit given to a customer
atLeastAmount	float		Not null	a minimum amount that can be ordered

order_discount				
Description: order discount table				
Attribute	Domain Type	Key	Nullable	Description
discount_code	varchar(8)	Primary	Not null	an extra benefit given to a customer
discountPercentage	float		Not null	a discount that is given to a product or service that is given as an amount per hundred
atLeastAmount	float		Not null	a minimum amount that can be ordered

comments				
Description: customer comment table				
Attribute	Domain Type	Key	Nullable	Description
cid	int(11)	Primary	Not null	The comment ID
product_id	int(11)	Foreign	Not null	comments.product_id refers to produuct.product_id
customer_id	int(11)	Foreign	Not null	comments.customer_id refer to customer.user_id
comment	varchar(255)			The comment
rating	int(11)		Not null	1-5 rating for product
create_date	datetime		Not null	default=current datetime

4.3 SQL Statements For Database Construction

```
CREATE TABLE `discount` (
  `discount_code` varchar(8) NOT NULL,
  `name` varchar(64) NOT NULL,
  `description` varchar(255) DEFAULT NULL,
  `type` varchar(255) NOT NULL,
  `start_at` datetime DEFAULT NULL,
  `end_at` datetime DEFAULT NULL,
  `create_at` datetime DEFAULT NULL,
  `modified_at` datetime DEFAULT NULL,
  PRIMARY KEY (`discount_code`)
);
```

```
CREATE TABLE `user` (
  `user_id` int(11) NOT NULL AUTO_INCREMENT,
  `email` varchar(64) NOT NULL,
  `username` varchar(32) NOT NULL,
  `password_hash` varchar(1024) NOT NULL,
  `first_name` varchar(32) NOT NULL,
  `last_name` varchar(32) NOT NULL,
  `role` varchar(16) NOT NULL,
  `is_active` tinyint(1) NOT NULL,
  `last_login` datetime DEFAULT NULL,
  `create_at` datetime NOT NULL,
  `modified_at` datetime NOT NULL,
  PRIMARY KEY (`user_id`),
  UNIQUE KEY `email` (`email`),
  UNIQUE KEY `username` (`username`)
);
```

```
CREATE TABLE `product_category` (
  `category_id` int(11) NOT NULL AUTO_INCREMENT,
  `name` varchar(63) NOT NULL,
  `description` varchar(255) DEFAULT NULL,
  `is_active` tinyint(1) NOT NULL,
  `create_at` datetime NOT NULL,
  `modified_at` datetime NOT NULL,
  PRIMARY KEY (`category_id`),
  UNIQUE KEY `name` (`name`)
);
```

```
CREATE TABLE `staff` (
  `user_id` int(11) NOT NULL,
  PRIMARY KEY (`user_id`),
  CONSTRAINT `staff_ibfk_1` FOREIGN KEY (`user_id`) REFERENCES `user` (`user_id`)
);
```

```
CREATE TABLE `customer` (
  `user_id` int(11) NOT NULL,
  `confirm` tinyint(1) NOT NULL,
  `DOB` date NOT NULL,
  PRIMARY KEY (`user_id`),
  CONSTRAINT `customer_ibfk_1` FOREIGN KEY (`user_id`) REFERENCES `user` (`user_id`)
);
```

```
CREATE TABLE `admin` (
  `user_id` int(11) NOT NULL,
  PRIMARY KEY (`user_id`),
  CONSTRAINT `admin_ibfk_1` FOREIGN KEY (`user_id`) REFERENCES `user` (`user_id`)
);
```

```sql
CREATE TABLE `product` (
  `product_id` int(11) NOT NULL AUTO_INCREMENT,
  `category_id` int(11) NOT NULL,
  `discount_code` varchar(8) DEFAULT NULL,
  `name` varchar(63) NOT NULL,
  `description` varchar(255) DEFAULT NULL,
  `image_url` varchar(255) NOT NULL,
  `price` float NOT NULL,
  `quantity` int(11) NOT NULL,
  `is_active` tinyint(1) NOT NULL,
  `create_at` datetime NOT NULL,
  `modified_at` datetime NOT NULL,
  PRIMARY KEY (`product_id`),
  KEY `category_id` (`category_id`),
  KEY `discount_code` (`discount_code`),
  CONSTRAINT `product_ibfk_1` FOREIGN KEY (`category_id`) REFERENCES `product_category`
(`category_id`),
  CONSTRAINT `product_ibfk_2` FOREIGN KEY (`discount_code`) REFERENCES `product_discount`
(`discount_code`)
);
```

```sql
CREATE TABLE `customer_address` (
  `address_id` int(11) NOT NULL AUTO_INCREMENT,
  `user_id` int(11) NOT NULL,
  `country` varchar(8) NOT NULL,
  `city` varchar(32) NOT NULL,
  `address` varchar(255) NOT NULL,
  `postal_code` varchar(8) NOT NULL,
  `telephone` varchar(16) NOT NULL,
  PRIMARY KEY (`address_id`),
  KEY `user_id` (`user_id`),
  CONSTRAINT `customer_address_ibfk_1` FOREIGN KEY (`user_id`) REFERENCES `customer` (`user_id`)
);
```

```sql
CREATE TABLE `shopping_cart` (
  `customer_id` int(11) NOT NULL,
  `amount` float NOT NULL,
  PRIMARY KEY (`customer_id`),
  CONSTRAINT `shopping_cart_ibfk_1` FOREIGN KEY (`customer_id`) REFERENCES `customer` (`user_id`)
);
```

```sql
CREATE TABLE `cart_item` (
  `cart_id` int(11) NOT NULL,
  `product_id` int(11) NOT NULL,
  `quantity` int(11) NOT NULL,
  `amount` float NOT NULL,
  PRIMARY KEY (`cart_id`,`product_id`),
  KEY `product_id` (`product_id`),
  CONSTRAINT `cart_item_ibfk_1` FOREIGN KEY (`cart_id`) REFERENCES `shopping_cart` (`customer_id`),
  CONSTRAINT `cart_item_ibfk_2` FOREIGN KEY (`product_id`) REFERENCES `product` (`product_id`)
);
```

```sql
CREATE TABLE `product_discount` (
  `discount_code` varchar(8) NOT NULL,
  `discountPercentage` float NOT NULL,
  PRIMARY KEY (`discount_code`),
  CONSTRAINT `product_discount_ibfk_1` FOREIGN KEY (`discount_code`) REFERENCES `discount`
(`discount_code`)
);
```

```
CREATE TABLE `order_discount` (
  `discount_code` varchar(8) NOT NULL,
  `discountPercentage` float NOT NULL,
  `atLeastAmount` float NOT NULL,
  PRIMARY KEY (`discount_code`),
  CONSTRAINT `order_discount_ibfk_1` FOREIGN KEY (`discount_code`) REFERENCES `discount`
(`discount_code`)
);
```

```
CREATE TABLE `shipping_discount` (
  `discount_code` varchar(8) NOT NULL,
  `atLeastAmount` float NOT NULL,
  PRIMARY KEY (`discount_code`),
  CONSTRAINT `shipping_discount_ibfk_1` FOREIGN KEY (`discount_code`) REFERENCES `discount`
(`discount_code`)
);
```

```
CREATE TABLE `order_item` (
  `order_id` int(11) NOT NULL,
  `product_id` int(11) NOT NULL,
  `quantity` int(11) NOT NULL,
  `amount` float NOT NULL,
  PRIMARY KEY (`order_id`,`product_id`),
  KEY `product_id` (`product_id`),
  CONSTRAINT `order_item_ibfk_1` FOREIGN KEY (`order_id`) REFERENCES `order` (`order_id`),
  CONSTRAINT `order_item_ibfk_2` FOREIGN KEY (`product_id`) REFERENCES `product` (`product_id`)
);
```

```
CREATE TABLE `order` (
  `order_id` int(11) NOT NULL AUTO_INCREMENT,
  `customer_id` int(11) NOT NULL,
  `address_id` int(11) NOT NULL,
  `order_discount` varchar(8) DEFAULT NULL,
  `amount` float NOT NULL,
  `shippingFee` int(11) NOT NULL,
  `shipDate` datetime DEFAULT NULL,
  `status` int(11) NOT NULL,
  `payment_type` varchar(8) DEFAULT NULL,
  `provider` varchar(64) DEFAULT NULL,
  `account_no` int(11) DEFAULT NULL,
  `create_at` datetime DEFAULT NULL,
  PRIMARY KEY (`order_id`),
  KEY `customer_id` (`customer_id`),
  KEY `address_id` (`address_id`),
  KEY `order_discount` (`order_discount`),
  CONSTRAINT `order_ibfk_1` FOREIGN KEY (`customer_id`) REFERENCES `customer` (`user_id`),
  CONSTRAINT `order_ibfk_2` FOREIGN KEY (`address_id`) REFERENCES `customer_address` (`address_id`),
  CONSTRAINT `order_ibfk_3` FOREIGN KEY (`order_discount`) REFERENCES `order_discount`
(`discount_code`)
);
```

```
CREATE TABLE `comments` (
  `cid` int(11) NOT NULL AUTO_INCREMENT,
  `product_id` int(11) NOT NULL,
  `user_id` int(11) NOT NULL,
  `comment` varchar(256) DEFAULT NULL,
  `rating` int(11) NOT NULL,
  `date` datetime NOT NULL,
  PRIMARY KEY (`cid`),
  KEY `product_id` (`product_id`),
  KEY `user_id` (`user_id`),
  CONSTRAINT `comments_ibfk_1` FOREIGN KEY (`product_id`) REFERENCES `product` (`product_id`),
  CONSTRAINT `comments_ibfk_2` FOREIGN KEY (`user_id`) REFERENCES `customer` (`user_id`)
);
```

4.4 SQL Statements For Database Population

```
LOCK TABLES `customer` WRITE;
INSERT INTO `customer` VALUES (1,0,'2021-12-14');
UNLOCK TABLES;
```

```
LOCK TABLES `admin` WRITE;
INSERT INTO `admin` VALUES (3);
UNLOCK TABLES;
```

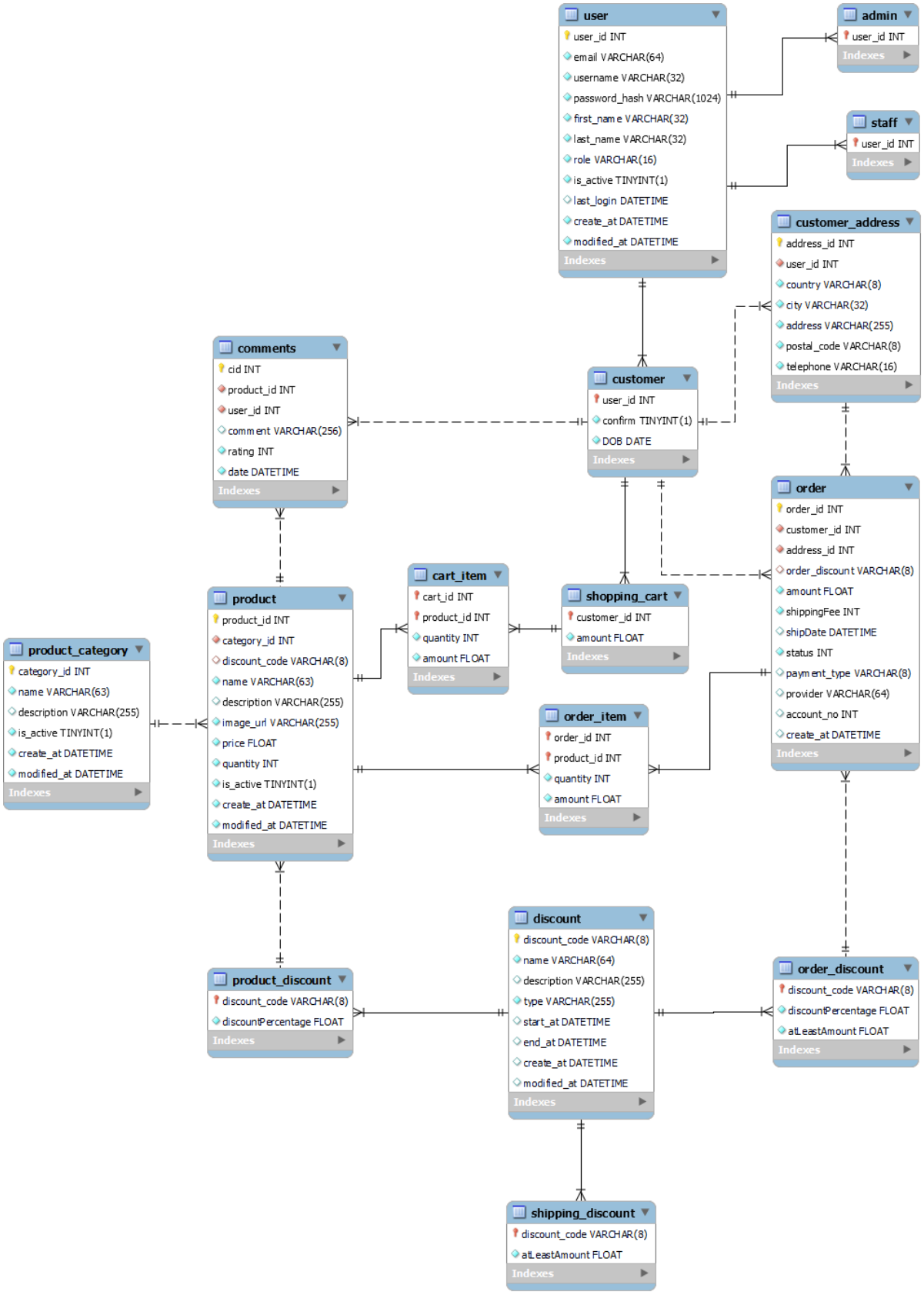
```
LOCK TABLES `staff` WRITE;
INSERT INTO `staff` VALUES (2);
UNLOCK TABLES;
```

```
LOCK TABLES `product_category` WRITE;
INSERT INTO `product_category` VALUES
(1,'Shoes','Shoes',1,'2021-12-14 23:57:42','2021-12-14 23:57:42'),
(2,'Watch','Watch',1,'2021-12-14 23:57:42','2021-12-14 23:57:42');
UNLOCK TABLES;
```

```
LOCK TABLES `user` WRITE;
INSERT INTO `user` VALUES
(1,'customer@domain.com','customer','$2b$12$hSu5Xm71JZd/jhWakN8w8ujUbFEuzqd2jH79OjhYta3zkauBiZ6/W','customer','customer','customer',1,NULL,'2021-12-14 23:57:41','2021-12-14 23:57:41'),
(2,'staff@domain.com','staff','$2b$12$ea5zB2g8/qrZNRERuaUhhO66ZLLEje.aj/351xNR7Be.rBUKIx63O','staff','staff','staff',1,NULL,'2021-12-14 23:57:41','2021-12-14 23:57:41'),
(3,'admin@domain.com','admin','$2b$12$o/NmA4l/tv8sreaCp2D8JenIcNsHpw0d.2MFsK5QY9CbqWe3ipUOW','admin','admin','admin',1,NULL,'2021-12-14 23:57:42','2021-12-14 23:57:42');
UNLOCK TABLES;
```

```
LOCK TABLES `product` WRITE;
INSERT INTO `product` VALUES
(1,1,NULL,'Shoe','Shoe description','https://api.lorem.space/image/shoes?w=304&h=225',100,1,1,'2021-12-15 20:28:56','2021-12-15 20:28:56'),
(2,2,NULL,'Watch','Watch description','https://api.lorem.space/image/watch?w=304&h=225',100,1,1,'2021-12-15 20:28:56','2021-12-15 20:28:56');
UNLOCK TABLES;
```

4.5 The Implementation Of Tables In Target DBMS



```
MariaDB [ecProject]> SHOW TABLES;
+---------------------+
| Tables_in_ecProject |
+---------------------+
| admin               |
| cart_item           |
| comments            |
| customer            |
| customer_address    |
| discount            |
| order               |
| order_discount      |
| order_item          |
| product             |
| product_category    |
| product_discount    |
| shipping_discount   |
| shopping_cart       |
| staff               |
| user                |
+---------------------+
16 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC staff;
+---------+---------+------+-----+---------+-------+
| Field   | Type    | Null | Key | Default | Extra |
+---------+---------+------+-----+---------+-------+
| user_id | int(11) | NO   | PRI | NULL    |       |
+---------+---------+------+-----+---------+-------+
1 row in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC admin;
+---------+---------+------+-----+---------+-------+
| Field   | Type    | Null | Key | Default | Extra |
+---------+---------+------+-----+---------+-------+
| user_id | int(11) | NO   | PRI | NULL    |       |
+---------+---------+------+-----+---------+-------+
1 row in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC order_item;
+------------+---------+------+-----+---------+-------+
| Field      | Type    | Null | Key | Default | Extra |
+------------+---------+------+-----+---------+-------+
| order_id   | int(11) | NO   | PRI | NULL    |       |
| product_id | int(11) | NO   | PRI | NULL    |       |
| quantity   | int(11) | NO   |     | NULL    |       |
| amount     | float   | NO   |     | NULL    |       |
+------------+---------+------+-----+---------+-------+
4 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC cart_item;
+------------+---------+------+-----+---------+-------+
| Field      | Type    | Null | Key | Default | Extra |
+------------+---------+------+-----+---------+-------+
| cart_id    | int(11) | NO   | PRI | NULL    |       |
| product_id | int(11) | NO   | PRI | NULL    |       |
| quantity   | int(11) | NO   |     | NULL    |       |
| amount     | float   | NO   |     | NULL    |       |
+------------+---------+------+-----+---------+-------+
4 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC customer;
+---------+------------+------+-----+---------+-------+
| Field   | Type       | Null | Key | Default | Extra |
+---------+------------+------+-----+---------+-------+
| user_id | int(11)    | NO   | PRI | NULL    |       |
| confirm | tinyint(1) | NO   |     | NULL    |       |
| DOB     | date       | NO   |     | NULL    |       |
+---------+------------+------+-----+---------+-------+
3 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC shopping_cart;
+-------------+---------+------+-----+---------+-------+
| Field       | Type    | Null | Key | Default | Extra |
+-------------+---------+------+-----+---------+-------+
| customer_id | int(11) | NO   | PRI | NULL    |       |
| amount      | float   | NO   |     | NULL    |       |
+-------------+---------+------+-----+---------+-------+
2 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC shipping_discount;
+---------------+------------+------+-----+---------+-------+
| Field         | Type       | Null | Key | Default | Extra |
+---------------+------------+------+-----+---------+-------+
| discount_code | varchar(8) | NO   | PRI | NULL    |       |
| atLeastAmount | float      | NO   |     | NULL    |       |
+---------------+------------+------+-----+---------+-------+
2 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC discount;
+---------------+--------------+------+-----+---------+-------+
| Field         | Type         | Null | Key | Default | Extra |
+---------------+--------------+------+-----+---------+-------+
| discount_code | varchar(8)   | NO   | PRI | NULL    |       |
| name          | varchar(64)  | NO   |     | NULL    |       |
| description   | varchar(255) | YES  |     | NULL    |       |
| type          | varchar(255) | NO   |     | NULL    |       |
| start_at      | datetime     | YES  |     | NULL    |       |
| end_at        | datetime     | YES  |     | NULL    |       |
| create_at     | datetime     | YES  |     | NULL    |       |
| modified_at   | datetime     | YES  |     | NULL    |       |
+---------------+--------------+------+-----+---------+-------+
8 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC order_discount;
+--------------------+------------+------+-----+---------+-------+
| Field              | Type       | Null | Key | Default | Extra |
+--------------------+------------+------+-----+---------+-------+
| discount_code      | varchar(8) | NO   | PRI | NULL    |       |
| discountPercentage | float      | NO   |     | NULL    |       |
| atLeastAmount      | float      | NO   |     | NULL    |       |
+--------------------+------------+------+-----+---------+-------+
3 rows in set (0.01 sec)
```

```
MariaDB [ecProject]> DESC product_discount;
+--------------------+------------+------+-----+---------+-------+
| Field              | Type       | Null | Key | Default | Extra |
+--------------------+------------+------+-----+---------+-------+
| discount_code      | varchar(8) | NO   | PRI | NULL    |       |
| discountPercentage | float      | NO   |     | NULL    |       |
+--------------------+------------+------+-----+---------+-------+
2 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC customer_address;
+-------------+--------------+------+-----+---------+----------------+
| Field       | Type         | Null | Key | Default | Extra          |
+-------------+--------------+------+-----+---------+----------------+
| address_id  | int(11)      | NO   | PRI | NULL    | auto_increment |
| user_id     | int(11)      | NO   | MUL | NULL    |                |
| country     | varchar(8)   | NO   |     | NULL    |                |
| city        | varchar(32)  | NO   |     | NULL    |                |
| address     | varchar(255) | NO   |     | NULL    |                |
| postal_code | varchar(8)   | NO   |     | NULL    |                |
| telephone   | varchar(16)  | NO   |     | NULL    |                |
+-------------+--------------+------+-----+---------+----------------+
7 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC comments;
+------------+--------------+------+-----+---------+----------------+
| Field      | Type         | Null | Key | Default | Extra          |
+------------+--------------+------+-----+---------+----------------+
| cid        | int(11)      | NO   | PRI | NULL    | auto_increment |
| product_id | int(11)      | NO   | MUL | NULL    |                |
| user_id    | int(11)      | NO   | MUL | NULL    |                |
| comment    | varchar(256) | YES  |     | NULL    |                |
| rating     | int(11)      | NO   |     | NULL    |                |
| date       | datetime     | NO   |     | NULL    |                |
+------------+--------------+------+-----+---------+----------------+
6 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC `order`;
+----------------+-------------+------+-----+---------+----------------+
| Field          | Type        | Null | Key | Default | Extra          |
+----------------+-------------+------+-----+---------+----------------+
| order_id       | int(11)     | NO   | PRI | NULL    | auto_increment |
| customer_id    | int(11)     | NO   | MUL | NULL    |                |
| address_id     | int(11)     | NO   | MUL | NULL    |                |
| order_discount | varchar(8)  | YES  | MUL | NULL    |                |
| amount         | float       | NO   |     | NULL    |                |
| shippingFee    | int(11)     | NO   |     | NULL    |                |
| shipDate       | datetime    | YES  |     | NULL    |                |
| status         | int(11)     | NO   |     | NULL    |                |
| payment_type   | varchar(8)  | YES  |     | NULL    |                |
| provider       | varchar(64) | YES  |     | NULL    |                |
| account_no     | int(11)     | YES  |     | NULL    |                |
| create_at      | datetime    | YES  |     | NULL    |                |
+----------------+-------------+------+-----+---------+----------------+
12 rows in set (0.01 sec)
```

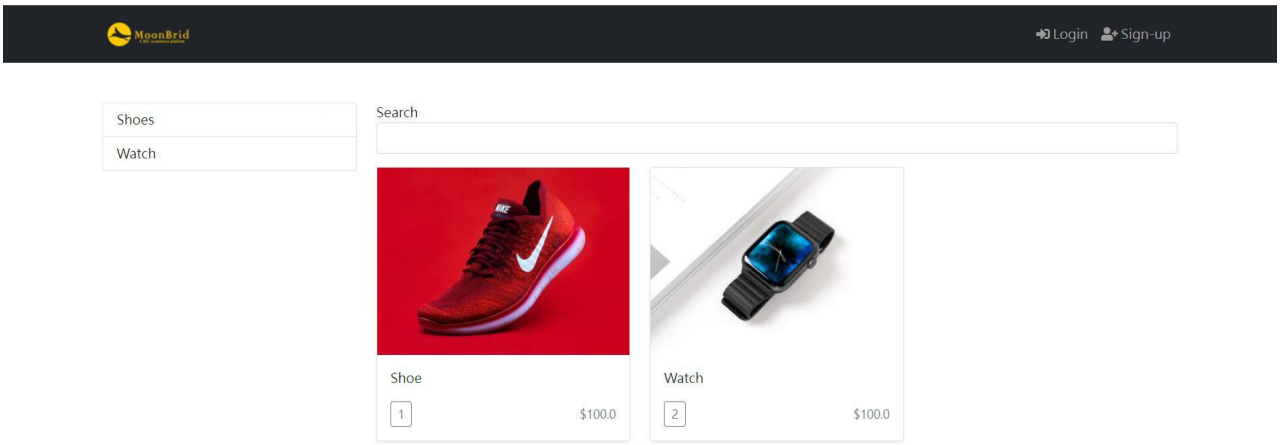
```
MariaDB [ecProject]> desc product;
+---------------+--------------+------+-----+---------+----------------+
| Field         | Type         | Null | Key | Default | Extra          |
+---------------+--------------+------+-----+---------+----------------+
| product_id    | int(11)      | NO   | PRI | NULL    | auto_increment |
| category_id   | int(11)      | NO   | MUL | NULL    |                |
| discount_code | varchar(8)   | YES  | MUL | NULL    |                |
| name          | varchar(63)  | NO   |     | NULL    |                |
| description   | varchar(255) | YES  |     | NULL    |                |
| image_url     | varchar(255) | NO   |     | NULL    |                |
| price         | float        | NO   |     | NULL    |                |
| quantity      | int(11)      | NO   |     | NULL    |                |
| is_active     | tinyint(1)   | NO   |     | NULL    |                |
| create_at     | datetime     | NO   |     | NULL    |                |
| modified_at   | datetime     | NO   |     | NULL    |                |
+---------------+--------------+------+-----+---------+----------------+
11 rows in set (0.00 sec)
```

```
MariaDB [ecProject]> DESC product_category;
+-------------+--------------+------+-----+---------+----------------+
| Field       | Type         | Null | Key | Default | Extra          |
+-------------+--------------+------+-----+---------+----------------+
| category_id | int(11)      | NO   | PRI | NULL    | auto_increment |
| name        | varchar(63)  | NO   | UNI | NULL    |                |
| description | varchar(255) | YES  |     | NULL    |                |
| is_active   | tinyint(1)   | NO   |     | NULL    |                |
| create_at   | datetime     | NO   |     | NULL    |                |
| modified_at | datetime     | NO   |     | NULL    |                |
+-------------+--------------+------+-----+---------+----------------+
6 rows in set (0.00 sec)
```

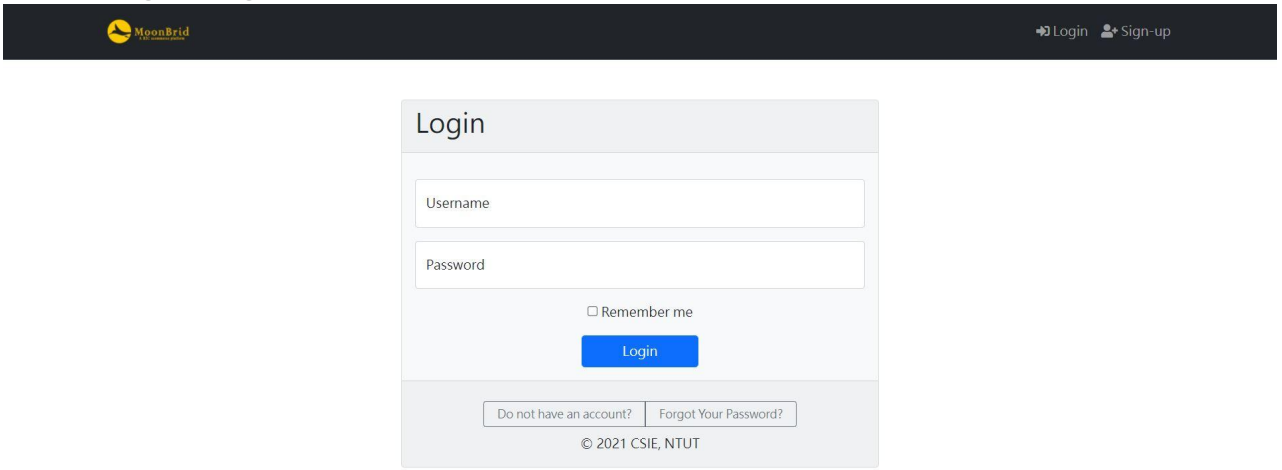
```
MariaDB [ecProject]> DESC user;
+---------------+---------------+------+-----+---------+----------------+
| Field         | Type          | Null | Key | Default | Extra          |
+---------------+---------------+------+-----+---------+----------------+
| user_id       | int(11)       | NO   | PRI | NULL    | auto_increment |
| email         | varchar(64)   | NO   | UNI | NULL    |                |
| username      | varchar(32)   | NO   | UNI | NULL    |                |
| password_hash | varchar(1024) | NO   |     | NULL    |                |
| first_name    | varchar(32)   | NO   |     | NULL    |                |
| last_name     | varchar(32)   | NO   |     | NULL    |                |
| role          | varchar(16)   | NO   |     | NULL    |                |
| is_active     | tinyint(1)    | NO   |     | NULL    |                |
| last_login    | datetime      | YES  |     | NULL    |                |
| create_at     | datetime      | NO   |     | NULL    |                |
| modified_at   | datetime      | NO   |     | NULL    |                |
+---------------+---------------+------+-----+---------+----------------+
11 rows in set (0.00 sec)
```

Section 5 Additional Queries and Views

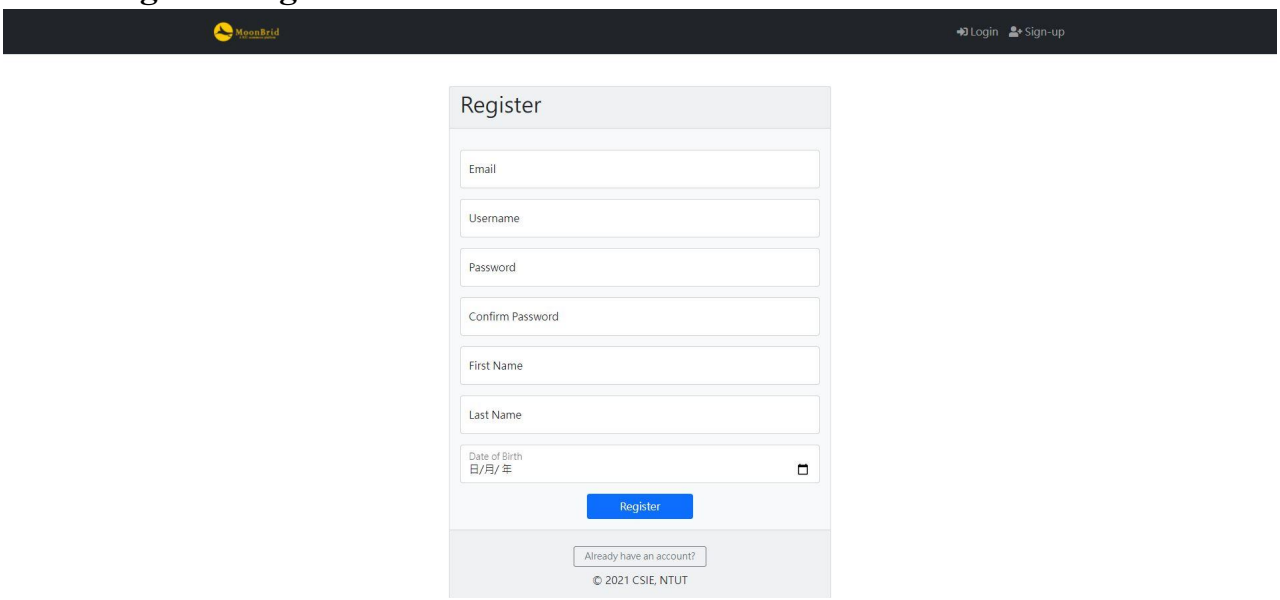
1. Index



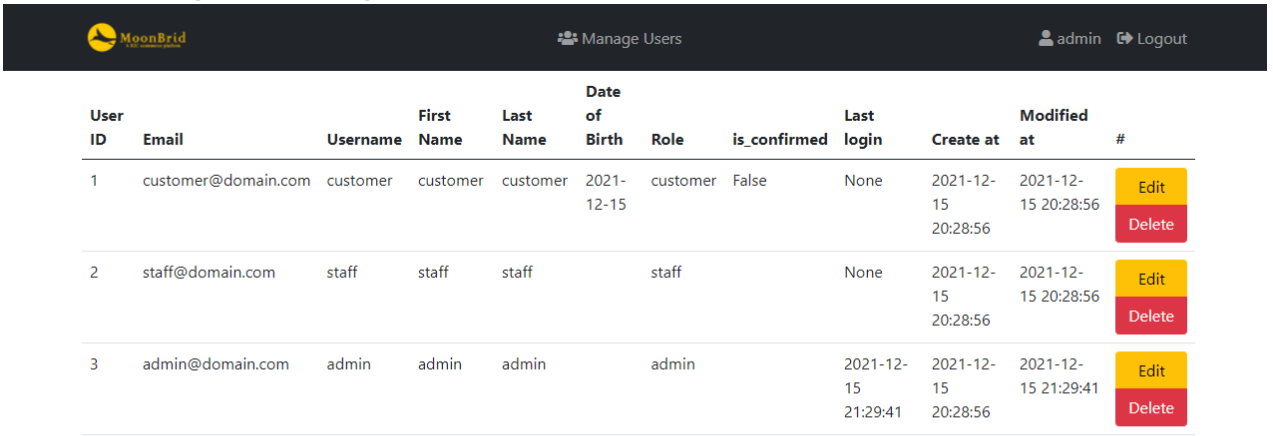
2. Login Page



3. Register Page



4. Manage User Page



Section 6

Glossary

Enterprise resource planning (ERP) is the integrated management of main business processes, often in real-time and mediated by software and technology. ERP is usually referred to as a category of business management software—typically a suite of integrated applications—that an organization can use to collect, store, manage and interpret data from many business activities. ERP Systems can be local-based or Cloud-based. Cloud-based applications have grown in recent years due to information being readily available from any location with internet access.

Point of sale (POS) or **point of purchase** (**POP**) is the time and place where a retail transaction is completed. At the point of sale, the merchant calculates the amount owed by the customer, indicates that amount, may prepare an invoice for the customer (which may be a cash register printout), and indicates the options for the customer to make payment. It is also the point at which a customer makes a payment to the merchant in exchange for goods or after the provision of a service. After receiving payment, the merchant may issue a receipt for the transaction, which is usually printed but can also be dispensed with or sent electronically.

Business-to-consumer (B2C) refers to businesses selling products directly to customers, bypassing any third-party retailers, wholesalers, or any other middlemen. B2C brands are usually sold online only and specialize in a specific product category: Casper, Warby Parker, Everlane, Harry's, Outdoor Voices, AWAY, and Dollar Shave Club. Some direct-to-consumer brands have opened a limited number of physical retail spaces in addition to their main e-commerce platform in a clicks-and-mortar business model.

Drop shipping is a form of retail business wherein the seller accepts customer orders but does not keep goods sold in stock. Instead, in a form of supply chain management, it transfers the orders and their shipment details to either the manufacturer, wholesalers, other retailers, or a fulfillment house, which then ships the goods directly to the customer. As such, the retailer is responsible for marketing and selling a product, but has little or no control over product quality, storage, inventory management, or shipping. This eliminates the costs of maintaining a warehouse – or even a brick and mortar storefront, purchasing and storing inventory, and employing necessary staff for such functions. As in any other form of retail, the seller makes their profit on the difference between an item's wholesale and retail price, less any pertinent selling, merchant, or shipping fees accruing to them.

Model–view–controller (MVC) is a software design pattern commonly used for developing user interfaces that divide the related program logic into three interconnected elements. This is done to separate internal representations of information from the ways information is presented to and accepted by the user.

Windows Subsystem for Linux (WSL) is a compatibility layer for running Linux binary executables (in ELF format) natively on Windows 10, Windows 11, and Windows Server 2019.

Network interface controller (**NIC**, also known as a **network interface card**, **network adapter**, **LAN adapter,** or **physical network interface**, and by similar terms) is a computer hardware component that connects a computer to a computer network.

References

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https://flask.palletsprojects.com/en/2.0.x/

HackMD @shaoeChen

https://hackmd.io/@shaoeChen?tags=%5B"flask"%5D

What's an Example of Good E-Commerce Database Design?

https://resources.fabric.inc/blog/answers/ecommerce-database-design-example

How Do You Design a Shopping Cart Database for E-Commerce?

https://resources.fabric.inc/blog/answers/shopping-cart-database-design

YouTube @Jamal Bugti

https://www.youtube.com/playlist?list=PLYPlvTh05MsxJja9bzQCSTDu4hnEv5N_u

產品經理電商規劃實錄，解構綜合性電商全維度規劃心法

https://medium.com/begonia-design/產品經理電商規劃實錄-解構綜合性電商全維度規劃心法-c2bead911bfa

電子商務是什麼？做電商前的3大思考關鍵和成功要素

https://transbiz.com.tw/電子商務是什麼？ecommerce-sucess/

Appendix