PUN street Universal Access (PUA)

系統需求規格書

Software Requirements Specification (SRS)

Version: 1.0

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目錄 (Table of Contents)

1 簡介 (Introduction)

1.1 目的 (Purpose)

光華商場旁的美食街道，俗稱「潘（p'un）街」，是北科學生平日不可或缺的食物來源。每到用餐時段，街道上總是充滿著排隊人潮。為了讓學生們能夠更方便的取得潘街的食物，我們將藉由在資料庫系統課程及過往程式語言及網路通訊的基礎知識，分工合作開發一個美食訂購及外送系統–「PUN street Universal Access」，簡稱 PUA。此系統可以讓使用者在網頁上瀏覽、搜尋、並訂購餐點，讓所有人都能夠方便、迅速的享用潘街上的美食。

本系統主要目標為：

1. 顧客可以瀏覽、搜索店家並訂購餐點
2. 顧客可以查詢購物車、訂單狀況
3. 顧客可以為商店評分
4. 顧客可以註冊商店成為商店管理者
5. 商店管理者可以管理、更新餐點品項
6. 商店管理者可以計算月份總銷量、餐點銷售統計資料
7. 商店管理者可以更新訂單狀況
8. 商店管理者可以更新、查詢和刪除各種折扣政策

1.2 系統名稱 (Identification)

本專案範圍包含建置下面主系統與各項子系統，主系統為：

- 線上訂餐系統 (Web-based Ordering system, WOS)

子系統為：

- 帳號管理子系統 (Account Management Subsystem,AMS)
- 商店註冊子系統 (Shop Register Subsystem, SRS)
- 商品管理子系統 (Commodity Management Subsystem, CMS)
- 折扣管理子系統 (Discount Management Subsystem, DMS)
- 訂單配送管理子系統 (Order and Logistics Management Subsystem, OLMS)
- 銷售分析子系統 (Sales Analysis System, SAS)
- 購物車子系統 (Shopping Cart Management Subsystem, SCMS)
- 商店評價管理子系統 (Comment and Score Management Subsystem, CSMS)
- 商品搜尋推薦管理子系統 (Search and Recommend Management Subsystem, SRMS)
- 歷史訂單子系統 (Historical Order Subsystem, HOS)
- 資料庫子系統 (Database Subsystem, DBS)

1.3 概觀 (Overview)

本系統採用前後端分離架構開發，以便團隊成員分工。我們採用 svelte 作為前端框架，後端利用 golang 撰寫，資料庫管理系統則使用 postgreSQL。

1.4 符號描述 (Notation Description)

Notation	Description
WOS 1.0.0	The WOS components will be labeled with the number 1.0.0
AMS 1.1.n	The AMS components will be labeled with the number 1.1.n
SRS 1.2.1.n	The SRS components will be labeled with the number 1.2.n
CMS 1.3.n	The CMS components will be labeled with the number 1.3.n
DMS 1.4.n	The DMS components will be labeled with the number 1.4.n
OLMS 1.5.n	The OLMS components will be labeled with the number 1.5.n
SAS 1.6.n	The SAS components will be labeled with the number 1.6.n
SCMS 1.7.n	The SCMS components will be labeled with the number 1.7.n
CSMS 1.8.n	The CSMS components will be labeled with the number 1.8.n
SRMS 1.9.n	The SRMS components will be labeled with the number 1.9.n
HOS 1.10.n	The HOS components will be labeled with the number 1.10.n
DBS 1.11.n	The DBS components will be labeled with the number 1.11.n

Notation	Description
WOS-I-nnn	WOS 介面需求 (Interface Requirements)
WOS-F-nnn	WOS 功能性需求 (Functional Requirements)
WOS-D-nnn	WOS 資料需求 (Data Requirements)
WOS-N-nnn	WOS 非功能性需求 (Non-Functional Requirements)
WOS-O-nnn	WOS 其他需求 (Other Requirements)
WOS-B-nnn	WOS 商業規則或約束 (Business Rules or Constraints)

2 系統 (System)

2.1 系統描述 (System Description)

2.1.1 系統架構圖 (System Architecture Diagram)

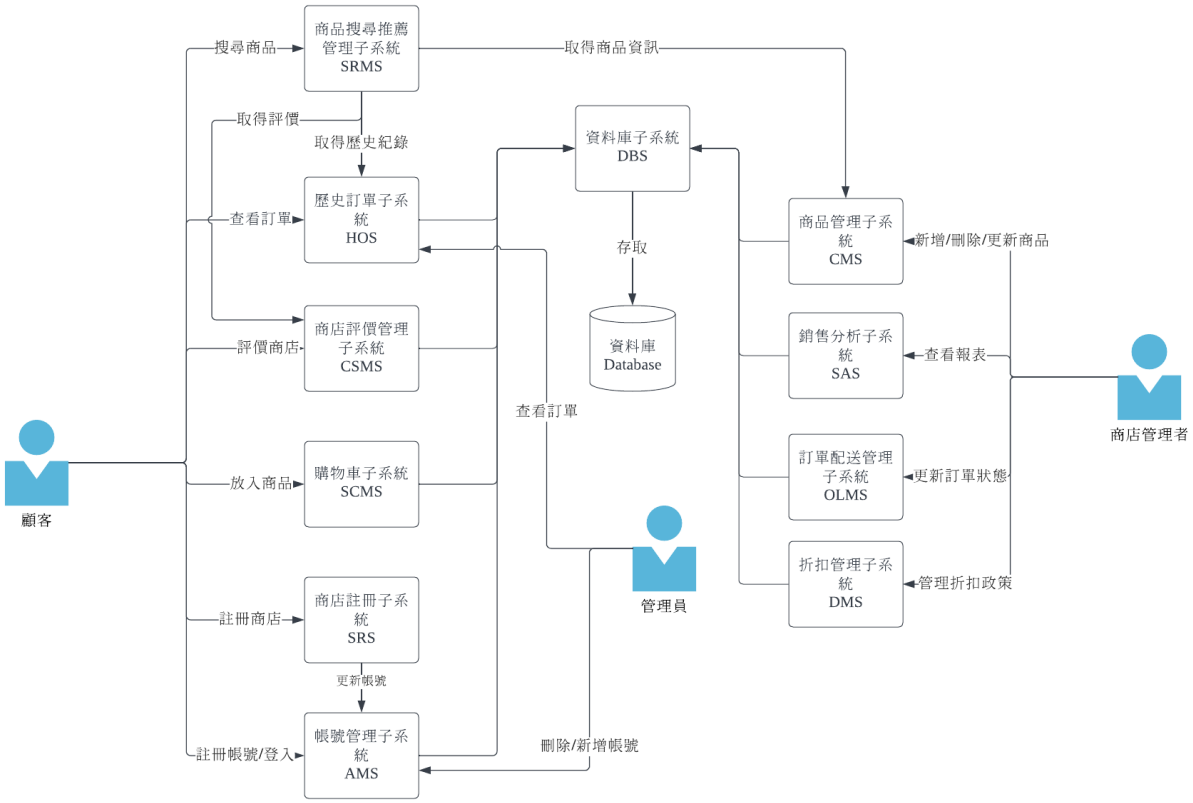


Figure 1: 系統架構圖

2.2 操作概念 (Operational Concepts or User Stories)

- 顧客操作概念：
  使用者可以透過帳號管理子系統 (AMS) 進行註冊，用商品搜尋推薦管理子系統 (SRMS) 尋找自己想要的商品，透過歷史訂單子系統 (HOS) 查詢自己的訂單歷史紀錄，並透過購物車子系統 (SCMS) 將商品放入購物車並購買商品。
- 商店管理者操作概念：
  顧客可以透過商店註冊系統 (SRS) 進行註冊成為商店管理者，用商品管理子系統 (CMS) 管理商品，用銷售分析子系統 (SAS) 產生財務報表，並透過訂單配送管理子系統 (OLMS) 管理顧客訂單。
- 管理員操作概念：
  管理員可以透過帳號管理子系統 (AMS) 管理所有帳號，透過歷史訂單子系統 (HOS) 查看所有訂單紀錄。

2.3 功能性需求 (Functional Requirements)

Notation	Description
WOS-F-001	顧客可以註冊帳號。
WOS-F-002	顧客可以搜尋商店及商品。
WOS-F-003	顧客可以將商品加入購物車。
WOS-F-004	顧客可以結帳購物車內的商品。
WOS-F-005	顧客可以查詢訂單狀態。
WOS-F-006	顧客可以在訂單完成後為商店或商品評分。
WOS-F-007	顧客可以查詢訂購歷史。
WOS-F-008	顧客可以註冊商店成為商店管理員。
WOS-F-009	商店管理者可以增加、刪減商品品項及數量。
WOS-F-010	商店管理者可以查詢日、周、月銷售量及金額。
WOS-F-011	商店管理者可以更新訂單狀況。
WOS-F-012	商店管理者可以查詢、增加及刪減各項折扣方案。
WOS-F-013	管理員可以新增、刪除、更新帳號。
WOS-F-014	管理員可以查看所有訂單。

2.4 資料需求 (Data Requirements)

需求編號	需求描述
WOS-D-001	系統需儲存使用者的相關資訊：登入 ID、姓名、密碼、電子郵件、地址
WOS-D-002	系統需儲存產品的相關資訊：產品 ID、名稱描述、其他屬性、產品圖片、價格、庫存產品數量、標籤
WOS-D-003	系統需儲存商店的相關資訊：商店 ID、名稱、地址、聯絡電子郵件、電話
WOS-D-004	系統需儲存訂單的相關資訊：訂單 ID、時間、客戶、每個採購項目的名稱和價格、每個採購項目的數量、採購總額、訂單的當前狀態（已接收、處理、運輸、關閉）
WOS-D-005	系統需儲存銷售報告的相關資訊：日期、商店名稱、訂單數量、銷售總額

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

2.5.1 效能需求 (Performance Requirements)

需求編號	需求描述
WOS-N-001	網頁載入時間需不超過五秒
WOS-N-002	用戶搜尋時間需不超過五秒
WOS-N-003	商店管理員更新訂單及商店狀況至用戶端反映需不超過三十秒

2.5.2 資安需求 (Security Requirements)

需求編號	需求描述
WOS-N-004	註冊密碼必須符合複雜度需求
WOS-N-005	管理員應遵守隱私權保護政策，不可隨意檢視個人資料

2.6 介面需求 (Interface Requirements)

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

買家介面

需求編號	需求描述
WOS-I-001	搜尋食物 or 店家種類介面。
WOS-I-002	購物清單介面
WOS-I-003	點餐介面。
WOS-I-004	訂單配送管理界面。

商家介面

需求編號	需求描述
WOS-I-005	刊登商品資訊。
WOS-I-006	檢視買家訂單
WOS-I-007	管理刊登商品介面。
WOS-I-008	折扣管理介面。
WOS-I-009	檢視銷售報表介面。

2.6.2 內部介面需求 (Internal Interface Requirements)

需求編號	需求描述
WOS-I-010	SRMS 能向 CMS 接收商品資訊需求。
WOS-I-011	SRMS 能向 HOS 接收歷史訂單需求。
WOS-I-012	SRMS 能向 CSMS 接收評價需求。
WOS-I-013	HOS 與 DBS 需有傳送與接收歷史訂單需求。
WOS-I-014	CSMS 與 DBS 需有傳送與接收商店評價需求。
WOS-I-015	SCMS 與 DBS 需有傳送與接收購物車相關資訊需求。
WOS-I-016	SRS 能向 AMS 傳送更新帳號的需求。
WOS-I-017	AMS 與 DBS 需有傳送與接收帳號資訊需求。
WOS-I-018	CMS 與 DBS 需有傳送與接收商品資訊的需求。
WOS-I-019	SAS 能向 DBS 傳送取得銷售分析需求。
WOS-I-020	OLMS 能向 DBS 傳送更新訂單需求。
WOS-I-021	DMS 與 DBS 需有傳送與接收優惠資訊需求。

2.7 其他需求 (Other Requirements)

2.7.1 環境需求 (Environmental Requirement)

需求編號	需求說明
WOS-O-001	需要網路
WOS-O-002	docker
WOS-O-003	中子
WOS-O-004	電子
WOS-O-005	質子 (不會離開原子)

2.7.2 安裝需求 (Installation Requirement)

需求編號	需求說明
WOS-O-006	使用 docker compose 自動建置

2.7.3 測試需求 (Test Requirements)

需求編號	需求說明
WOS-O-007	所有子系統都應經過測試且無問題

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

需求編號	需求說明
WOS-B-001	同一次購買可以應用三種類型的折扣，包括運費季節和特別活動折扣。
WOS-B-002	一種產品不能與多種特殊活動類型的折扣相關聯
WOS-B-003	產品的同一特殊活動折扣期間不能重疊。
WOS-B-004	購買的產品的數量必須是大於零的整數。
WOS-B-005	採購數量必須小於或等於該產品的當前庫存數量
WOS-B-006	使用者可以有多個身份
WOS-B-007	資料庫初始狀態要有所有員工和系統管理員的資訊

3 Conceptual Design of the Database

3.1 Entity Relationship ER Model

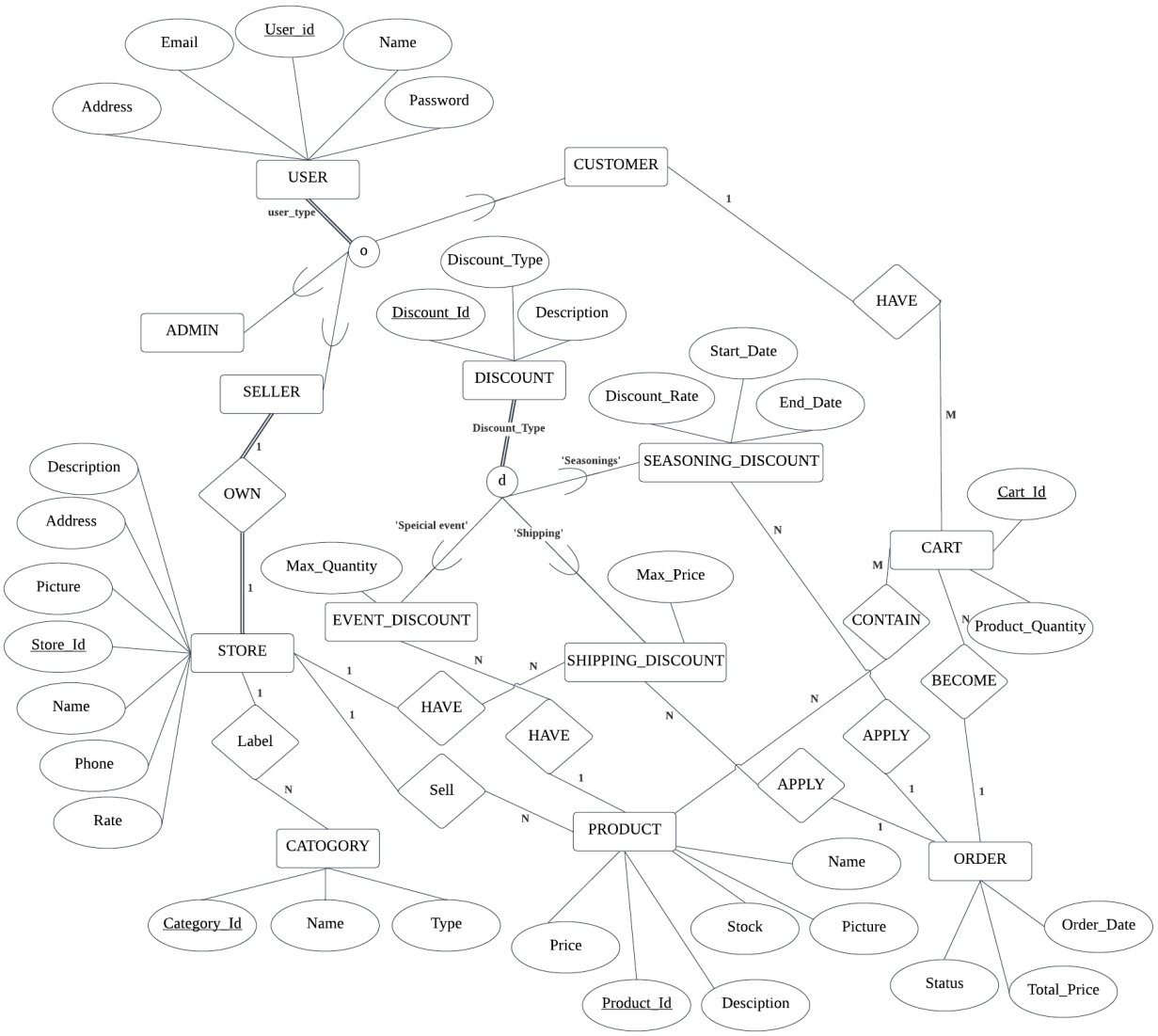


Figure 2: ER diagram

4 Logical Database Schema

4.1 Schema of the Database

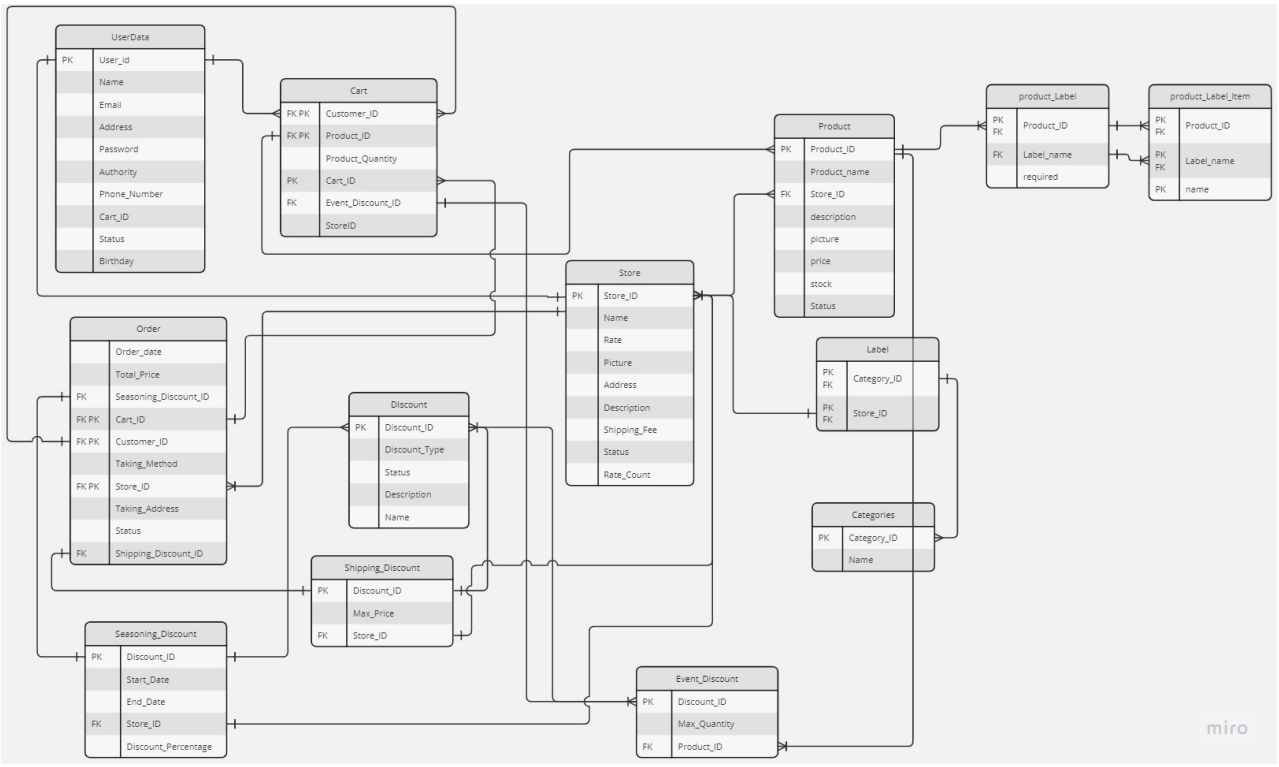


Figure 3: database schema

4.2 Data Dictionary

USER_DATA				
Description: 使用者相關資料				
Attribute	Type	Key	Nullable	Description
user_id	SERIAL	Primary	Not Null	使用者 ID
name	VARCHAR		Not Null	使用者名稱
email	VARCHAR		Not Null	使用者信箱
address	VARCHAR		Not Null	使用者地址
password	VARCHAR		Not Null	使用者密碼
authority	INTEGER		Not Null	使用者權限 (admin, seller, user)
phone_number	VARCHAR		Not Null	使用者電話號碼
current_cart_id	INTEGER		Not Null	使用者目前購物車
status	INTEGER		Not Null	使用者狀態 (0= 停用, 1= 啟用)
birthday	DATE		Not Null	使用者生日

CARTS				
Description: 購物車相關資料				
Attribute	Type	Key	Nullable	Description
customer_id	SERIAL	Primary Foreign	Not Null	使用者 ID
product_id	SERIAL	Primary Foreign	Not Null	商品 ID
cart_id	INTEGER	Primary	Not Null	購物車 ID
product_quantity	INTEGER		Not Null	商品數量
event_discount_id	SERIAL	Foreign	Not Null	折價券 ID
store_id	SERIAL	Primary Foreign	Not Null	購買商店 ID

PRODUCTS				
Description: 商品相關資料				
Attribute	Type	Key	Nullable	Description
product_id	SERIAL	Primary Foreign	Not Null	商品 ID
name	VARCHAR		Not Null	商品名字
description	TEXT		Not Null	商品資訊
store_id	SERIAL	Foreign	Not Null	商店 ID
picture	STRING		Not Null	商品照片
price	INTEGER		Not Null	商品價錢
stock	INTEGER		Not Null	商品庫存
status	INTEGER		Not Null	商品狀態 (0= 停用, 1= 啟用, 2= 已售完)

STORES				
Description: 商店相關資料				
Attribute	Type	Key	Nullable	Description
store_id	SERIAL	Primary	Not Null	商品 ID
name	VARCHAR		Not Null	商店名字
rate	FLOAT		Not Null	商店評價
picture	STRING		Not Null	商店照片
address	VARCHAR		Not Null	商店地址
description	TEXT		Not Null	商店描述
shipping_fee	INTEGER		Not Null	運費
status	INTEGER		Not Null	商店狀態 (0= 停用, 1= 啟用)
rate_count	INTEGER		Not Null	評價數量

LABEL				
Description: 商店標籤資料				
Attribute	Type	Key	Nullable	Description
store_id	SERIAL	Primary Foreign	Not Null	商店 ID
category_id	SERIAL	Primary Foreign	Not Null	目錄 ID

CATEGORIES				
Description: 類別資料				
Attribute	Type	Key	Nullable	Description
category_id	SERIAL	Primary	Not Null	類別 ID
name	VARCHAR		Not Null	類別名稱

EVENT_DISCOUNT				
Description: 事件折扣資料				
Attribute	Type	Key	Nullable	Description
discount_id	SERIAL	Primary	Not Null	折扣 ID
max_quantity	INTEGER		Not Null	買 x 送一
product_id	SERIAL	Foreign	Not Null	商品 ID

SHIPPING_DISCOUNT				
Description: 運費折扣資料				
Attribute	Type	Key	Nullable	Description
discount_id	SERIAL	Primary	Not Null	折扣 ID
max_price	INTEGER		Not Null	免運金額
store_id	SERIAL	Foreign	Not Null	商店 ID

DISCOUNTS				
Description: 折扣資料				
Attribute	Type	Key	Nullable	Description
discount_id	SERIAL	Primary	Not Null	折扣 ID 1= 無折扣
discount_type	INTEGER		Not Null	折扣種類 0= 無折扣 1= 運費折扣 2= 季節性折扣 3= 事件折扣
status	INTEGER		Not Null	狀態
description	VARCHAR		Not Null	折價資訊
name	VARCHAR		Not Null	折扣名稱

ORDER				
Description: 訂單				
Attribute	Type	Key	Nullable	Description
order_date	DATE		Not Null	訂單日期
total_price	INTEGER		Not Null	總金額
seasoning_discount_id	SERIAL	Foreign	Not Null	季節折扣 ID
shipping_discount_id	SERIAL	Foreign	Not Null	運費折扣 ID
cart_id	SERIAL	Primary Foreign	Not Null	購物車 ID
customer_id	SERIAL	Primary Foreign	Not Null	顧客 ID
taking_method	INTEGER		Not Null	0= 自取 1= 外送
store_id	SERIAL	Primary Foreign	Not Null	商店 ID
taking_address	VARCHAR		Not Null	運送地址
status	INTEGER		Not Null	訂單狀態 0= 未結帳 1= 已結帳 2= 接受訂單 3= 製作訂單 4= 運送中 5= 已送達 6 =確認訂單 7= 已評分

SEASONING_DISCOUNT				
Description: 季節折扣資料				
Attribute	Type	Key	Nullable	Description
discount_id	SERIAL	Primary	Not Null	折扣 ID
start_date	DATE		Not Null	開始日期
end_date	DATE		Not Null	結束日期
store_id	SERIAL	Foreign	Not Null	商店 ID
discount_percentage	INTEGER		Not Null	折扣比例 (70=30%off)

PRODUCT_LABEL				
Description: 商品標籤				
Attribute	Type	Key	Nullable	Description
product_id	SERIAL	Primary Foreign	Not Null	商品 ID
label_name	VARCHAR	Primary Foreign	Not Null	類別名稱
required	BOOLEAN		Not Null	是否為必填

PRODUCT_LABEL_ITEM				
Description: 商品標籤選項				
Attribute	Type	Key	Nullable	Description
product_id	SERIAL	Primary Foreign	Not Null	商品 ID
label_name	VARCHAR	Primary Foreign	Not Null	類別名稱
name	VARCHAR	Primary	Not Null	選項名稱

4.3 Snapshot of Tables

user_data

Search results | Cost: 8ms | 1 | Total 8

	user_id integer	* name varchar(32)	* password varchar(32)	* email varchar(64)	* address varchar(64)	* phone_numbe varchar(16)	* birthday date	* authority integer	* current_cart_id integer	* status integer
1	1	admin	admin	admin@gmail.com	address_admin	0900-0000	2021-10-10	111	1	1
2	2	alice	pwd1	a@gmail.com	address_1	0900-1111	2021-10-10	1	1	1
3	3	bob	pwd2	b@gmail.com	address_2	0900-2222	2022-11-11	10	2	1
4	4	tcp	pwd3	c@gmail.com	address_3	0900-3333	2023-12-12	1	1	1
5	5	udp	pwd4	d@gmail.com	address_4	0900-4444	2024-01-01	11	1	1
6	6	icmp	pwd5	e@gmail.com	address_5	0900-5555	2025-02-02	1	1	1
7	7	dns	pwd6	f@gmail.com	address_6	0900-6666	2026-03-03	1	1	1
8	8	dhcp	pwd7	g@gmail.com	address_7	0900-7777	2027-04-04	1	1	1

Figure 4: user_data

stores

Search results | Cost: 11ms | 1 | Total 4

	store_id integer	* name varchar(255)	* rate double precis	* rate_count integer	* address varchar(255	* picture varchar(255)	* description text	* shipping_fee integer	* status integer
1	1	im pasta	4	100	pun street	https://i.imgur.com/3i3tyXJ.	you are not pasta	35	1
2	3	number five	3.5	5	pun street	https://i.imgur.com/3i3tyXJ.	special meal	15	1
3	2	mos burger	4	123	NTUT	https://i.imgur.com/3i3tyXJ.	moooooooooooooos	55	1
4	7	trash noodle	4.9	9876	pun street	https://i.imgur.com/3i3tyXJ.	trash	192	1

Figure 5: stores

carts

Search results | Cost: 7ms | 1 | Total 5

	customer_i integer	product_id integer	store_id integer	cart_id integer	* product_quantity integer	* event_discount_id integer
1	1	2	1	1	100	8
2	1	1	1	1	100	9
3	1	2	1	2	33	10
4	3	3	2	1	100	1
5	1	1	1	3	7	1

Figure 6: carts

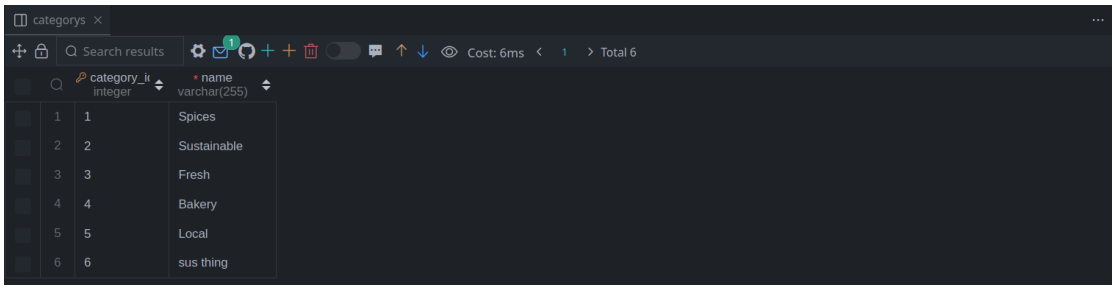


Figure 7: categories

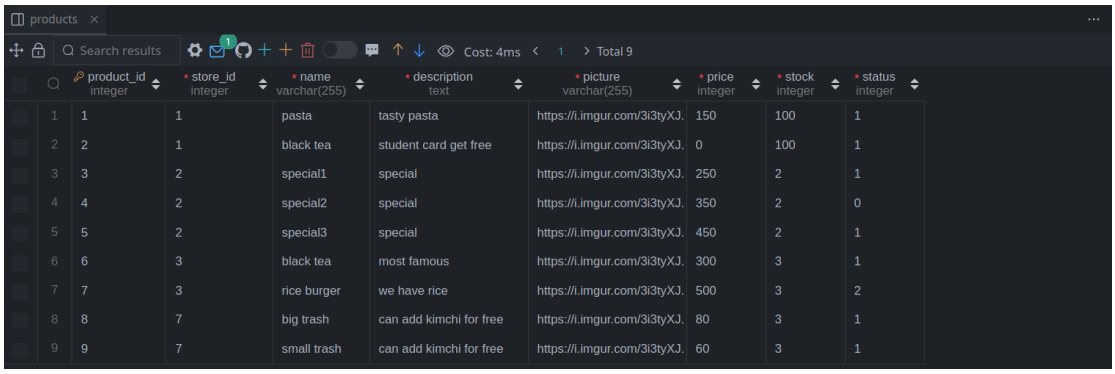


Figure 8: products

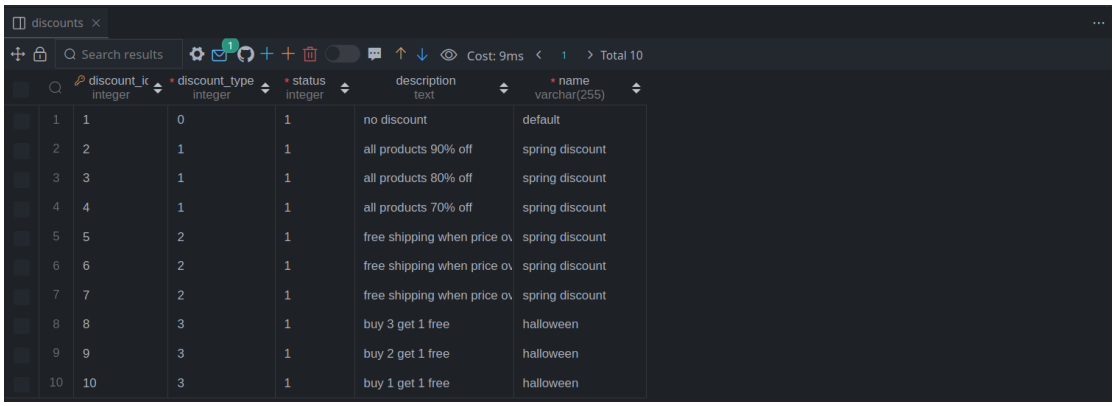


Figure 9: discounts

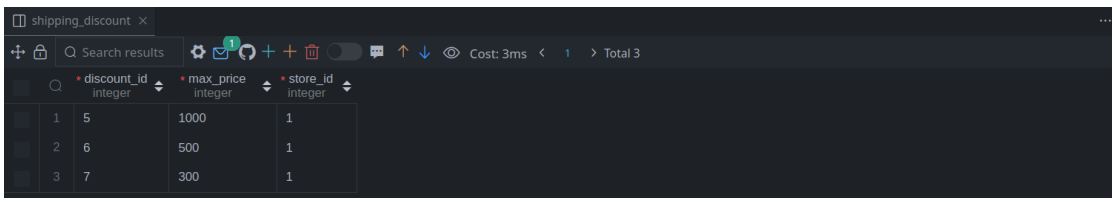


Figure 10: shipping_discount

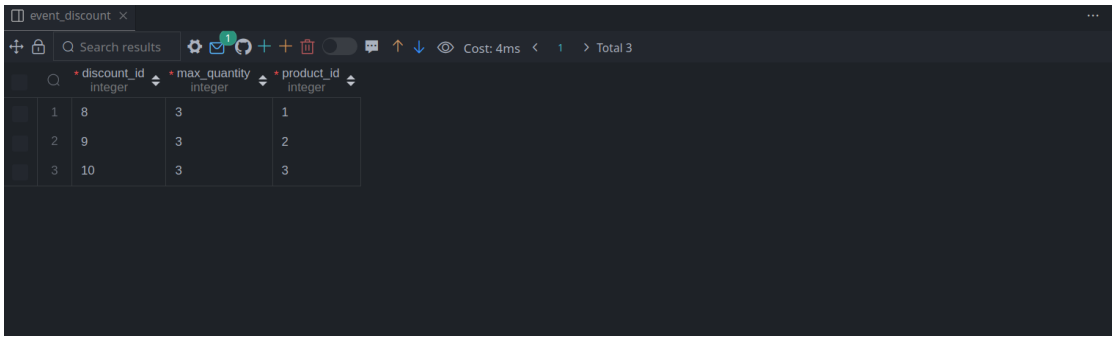


Figure 11: event_discount

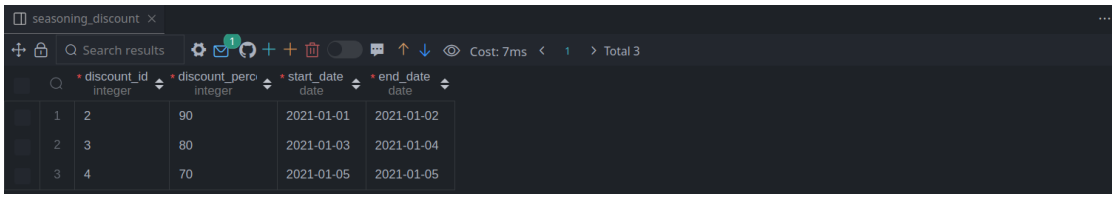


Figure 12: seasoning_discount

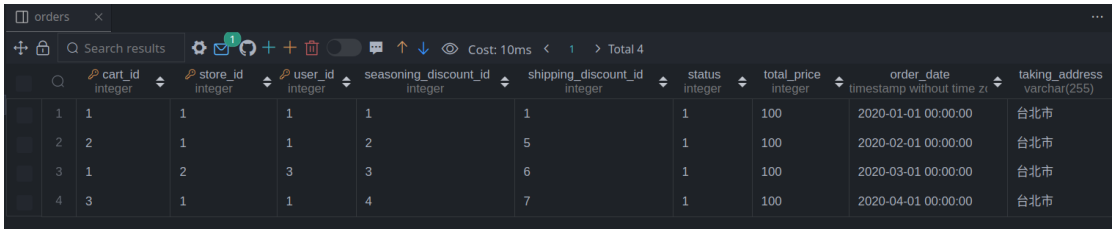


Figure 13: orders

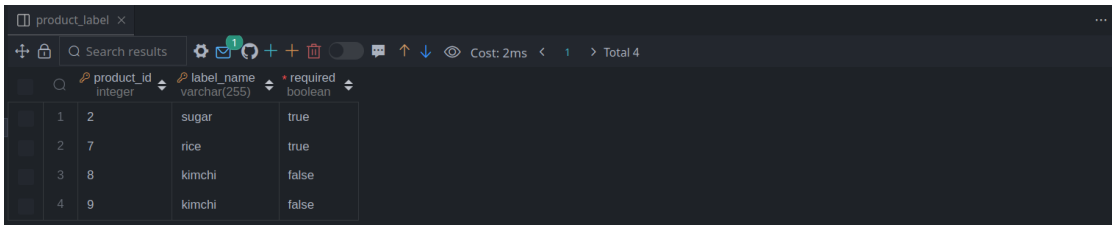


Figure 14: product_label

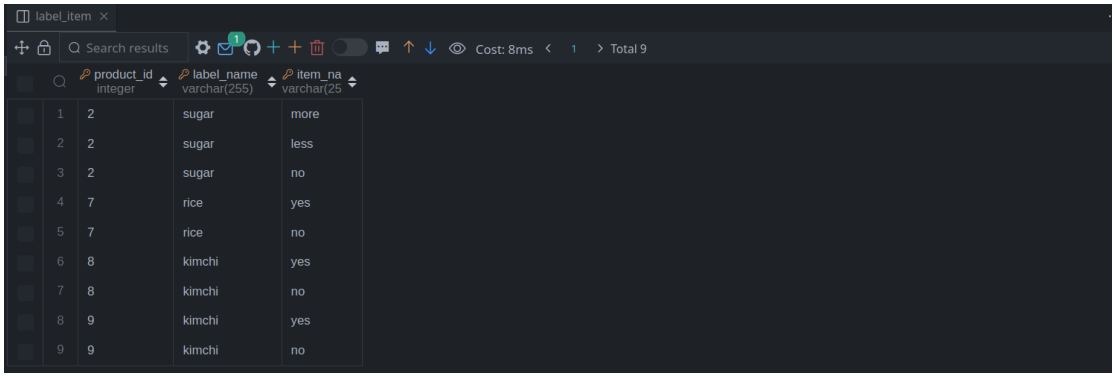


Figure 15: label_item

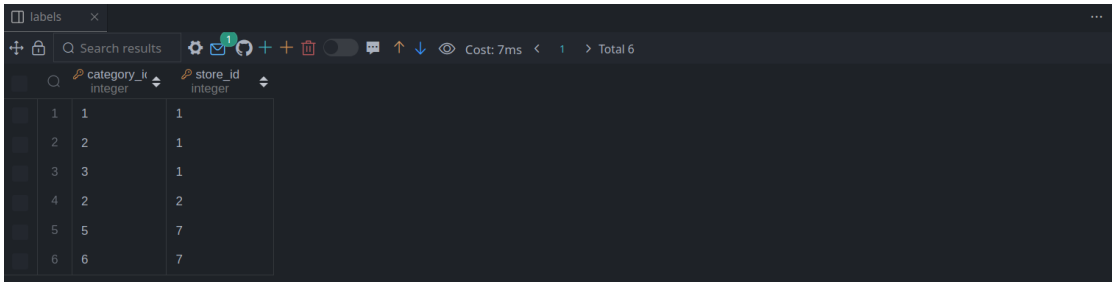


Figure 16: labels

4.4 SQL Statements for Database Construction

4.4.1 Create Table

```
-- user_data
CREATE TABLE
    IF NOT EXISTS user_data(
        user_id SERIAL PRIMARY KEY,
        name VARCHAR(32) NOT NULL,
        password VARCHAR(32) NOT NULL,
        email VARCHAR(64) UNIQUE NOT NULL,
        address VARCHAR(64) NOT NULL,
        phone_number VARCHAR(16) NOT NULL,
        birthday DATE NOT NULL,
        authority INTEGER NOT NULL,
        current_cart_id INTEGER NOT NULL,
        status INTEGER NOT NULL
    );
```

```
-- stores
CREATE TABLE
    IF NOT EXISTS stores (
        store_id SERIAL PRIMARY KEY REFERENCES user_data(user_id),
        name VARCHAR(255) NOT NULL,
        rate FLOAT NOT NULL,
        rate_count INTEGER NOT NULL,
        address VARCHAR(255) NOT NULL,
        picture VARCHAR(255) NOT NULL,
        description TEXT NOT NULL,
        shipping_fee INTEGER NOT NULL,
        status INTEGER NOT NULL
    );
```

```
-- products
CREATE TABLE
    IF NOT EXISTS products (
        product_id SERIAL PRIMARY KEY,
        store_id SERIAL REFERENCES stores(store_id),
        name VARCHAR(255) NOT NULL,
        description TEXT NOT NULL,
        picture VARCHAR(255) NOT NULL,
        price INTEGER NOT NULL,
        stock INTEGER NOT NULL,
        status INTEGER NOT NULL
    );
```

```
-- discounts
CREATE TABLE
    IF NOT EXISTS discounts (
        discount_id SERIAL PRIMARY KEY UNIQUE,
```

```
    discount_type INT NOT NULL,
    status INT NOT NULL,
    description TEXT,
    name VARCHAR(255) NOT NULL
);
```

```
-- seasoning_discount
CREATE TABLE
    IF NOT EXISTS seasoning_discount (
        discount_id SERIAL UNIQUE REFERENCES discounts(discount_id),
        discount_percentage INT NOT NULL,
        start_date DATE NOT NULL,
        end_date DATE NOT NULL
    );
```

```
-- shopping_discount
CREATE TABLE
    IF NOT EXISTS shipping_discount (
        discount_id SERIAL UNIQUE REFERENCES discounts(discount_id),
        max_price INT NOT NULL,
        store_id SERIAL REFERENCES stores(store_id)
    );
```

```
-- event_discount
CREATE TABLE
    IF NOT EXISTS event_discount (
        discount_id SERIAL UNIQUE REFERENCES discounts(discount_id),
        max_quantity INT NOT NULL,
        product_id SERIAL REFERENCES products(product_id)
    );
```

```
-- carts
CREATE TABLE
    IF NOT EXISTS carts (
        customer_id SERIAL REFERENCES user_data(user_id),
        product_id SERIAL REFERENCES products(product_id),
        store_id SERIAL REFERENCES stores(store_id),
        cart_id INTEGER NOT NULL,
        product_quantity INT NOT NULL,
        event_discount_id SERIAL REFERENCES discounts(discount_id),
        PRIMARY KEY (
            customer_id,
            product_id,
            store_id,
            cart_id
        )
    );
```

```sql
-- orders
CREATE TABLE
    orders (
        cart_id INTEGER,
        store_id INTEGER REFERENCES stores(store_id),
        user_id INTEGER REFERENCES user_data(user_id),
        seasoning_discount_id INTEGER REFERENCES discounts(discount_id),
        shipping_discount_id INTEGER REFERENCES discounts(discount_id),
        status INTEGER,
        total_price INTEGER,
        Order_date TIMESTAMP,
        taking_address VARCHAR(255),
        taking_method INTEGER,
        PRIMARY KEY (cart_id, store_id, user_id)
    );
```

```sql
-- categories
CREATE TABLE
    IF NOT EXISTS categories (
        category_id SERIAL PRIMARY KEY,
        name VARCHAR(255) UNIQUE NOT NULL
    );
```

```sql
-- product_label
CREATE TABLE
    IF NOT EXISTS product_label (
        product_id SERIAL REFERENCES products(product_id),
        label_name VARCHAR(255) NOT NULL,
        required BOOLEAN NOT NULL,
        PRIMARY KEY (product_id, label_name)
    );
```

```sql
-- label_item
CREATE TABLE
    IF NOT EXISTS label_item (
        product_id SERIAL NOT NULL,
        label_name VARCHAR(255) NOT NULL,
        item_name VARCHAR(255) NOT NULL,
        FOREIGN KEY (product_id, label_name) REFERENCES
            product_label(product_id, label_name),
        PRIMARY KEY (product_id, label_name, item_name)
    );
```

4.4.2 Insert Data

```sql
-- user_data
INSERT INTO user_data (name, password, email, address, phone_number,
    birthday, authority, current_cart_id, status) VALUES
```

```
    ('admin', 'admin', 'admin@gmail.com', 'address_admin', '0900-0000',
        '2021-10-10 11:30:30', 111, 1, 1),
    ('alice', 'pwd1', 'a@gmail.com', 'address_1', '0900-1111',
        '2021-10-10 11:30:30', 001, 1, 1),
    ('bob', 'pwd2', 'b@gmail.com', 'address_2', '0900-2222', '2022-11-11
        11:30:30', 010, 2, 1),
    ('tcp', 'pwd3', 'c@gmail.com', 'address_3', '0900-3333', '2023-12-12
        11:30:30', 001, 1, 1),
    ('udp', 'pwd4', 'd@gmail.com', 'address_4', '0900-4444', '2024-01-01
        11:30:30', 011, 1, 1),
    ('icmp', 'pwd5', 'e@gmail.com', 'address_5', '0900-5555',
        '2025-02-02 11:30:30', 001, 1, 1),
    ('dns', 'pwd6', 'f@gmail.com', 'address_6', '0900-6666', '2026-03-03
        11:30:30', 001, 1, 1),
    ('dhcp', 'pwd7', 'g@gmail.com', 'address_7', '0900-7777',
        '2027-04-04 11:30:30', 001, 1, 1);
```

```
-- stores
INSERT INTO stores (store_id, name, rate, rate_count, address, picture,
    description, shipping_fee, status) VALUES
    (1, 'im pasta', 4, 100, 'pun street',
        'https://i.imgur.com/3i3tyXJ.gif', 'you are not pasta', 35, 1),
    (3, 'number five',3.5, 5, 'pun street',
        'https://i.imgur.com/3i3tyXJ.gif', 'special meal', 15, 1),
    (2, 'mos burger',4, 123, 'NTUT', 'https://i.imgur.com/3i3tyXJ.gif',
        'moooooooooooooos', 55, 1),
    (7, 'trash noodle',4.9, 9876, 'pun street',
        'https://i.imgur.com/3i3tyXJ.gif', 'trash', 192, 1);
```

```
-- products
INSERT INTO products (store_id, name, description, picture, price,
    stock, status) VALUES
    (1, 'pasta', 'tasty pasta', 'https://i.imgur.com/3i3tyXJ.gif', 150,
        100, 1),
    (1, 'black tea', 'student card get free',
        'https://i.imgur.com/3i3tyXJ.gif', 0, 100, 1),
    (2, 'special1', 'special', 'https://i.imgur.com/3i3tyXJ.gif', 250,
        2, 1),
    (2, 'special2', 'special', 'https://i.imgur.com/3i3tyXJ.gif', 350,
        2, 0),
    (2, 'special3', 'special', 'https://i.imgur.com/3i3tyXJ.gif', 450,
        2, 1),
    (3, 'black tea', 'most famous', 'https://i.imgur.com/3i3tyXJ.gif',
        300, 3, 1),
    (3, 'rice burger', 'we have rice',
        'https://i.imgur.com/3i3tyXJ.gif', 500, 3, 2),
    (7, 'big trash', 'can add kimchi for free',
        'https://i.imgur.com/3i3tyXJ.gif', 80, 3, 1),
    (7, 'small trash', 'can add kimchi for free',
        'https://i.imgur.com/3i3tyXJ.gif', 60, 3, 1);
```

```sql
-- discounts
INSERT INTO discounts (discount_type, description, name, status) VALUES
(0, 'no discount', 'default', 1),
(1, 'all products 90% off', 'spring discount', 1),
(1, 'all products 80% off', 'spring discount', 1),
(1, 'all products 70% off', 'spring discount', 1),
(2, 'free shipping when price over 1000', 'spring discount', 1),
(2, 'free shipping when price over 500', 'spring discount', 1),
(2, 'free shipping when price over 300', 'spring discount', 1),
(3, 'buy 3 get 1 free', 'halloween', 1),
(3, 'buy 2 get 1 free', 'halloween', 1),
(3, 'buy 1 get 1 free', 'halloween', 1);
```

```sql
-- seasoning_discount
INSERT INTO seasoning_discount (discount_id, discount_percentage,
    start_date, end_date) VALUES
    (2,90,'2021-01-01 00:00:00','2021-01-02 00:00:00'),
    (3,80,'2021-01-03 00:00:00','2021-01-04 00:00:00'),
    (4,70,'2021-01-05 00:00:00','2021-01-05 00:00:00');
```

```sql
-- shipping_discount
INSERT INTO shipping_discount (discount_id, max_price, store_id) VALUES
  (5,1000,1),
  (6,500,1),
  (7,300,1);
```

```sql
-- event_discount
INSERT INTO event_discount (discount_id, max_quantity, product_id)
    VALUES
    (8,3,1),
    (9,3,2),
    (10,3,3);
```

```sql
-- carts
INSERT INTO carts (customer_id, cart_id, store_id, product_id,
    product_quantity, event_discount_id) VALUES
    (1, 1, 1, 2, 100, 8),
    (1, 1, 1, 1, 100, 9),
    (1, 2, 1, 2, 33, 10),
    (3, 1, 2, 3, 100, 1),
    (1, 3, 1, 1, 7, 1);
```

```sql
-- orders
INSERT INTO orders (user_id, cart_id, store_id, seasoning_discount_id,
    shipping_discount_id, status, total_price, Order_date,
    taking_address, taking_method) VALUES
    (1, 1, 1, 1, 1, 1, 100, '2020-01-01 00:00:00', '台北市', 1),
```

```
    (1, 2, 1, 2, 5, 1, 100, '2020-02-01 00:00:00', '台北市', 1),
    (3, 1, 2, 3, 6, 1, 100, '2020-03-01 00:00:00', '台北市', 1),
    (1, 3, 1, 4, 7, 1, 100, '2020-04-01 00:00:00', '台北市', 1);
```

```
-- categories
INSERT INTO categories (name) VALUES
    ('Spices'),
    ('Sustainable'),
    ('Fresh'),
    ('Bakery'),
    ('Local'),
    ('sus thing');
```

```
-- labels
INSERT INTO labels (category_id, store_id) VALUES
    (1, 1),
    (2, 1),
    (3, 1),
    (2, 2),
    (5, 7),
    (6, 7);
```

```
-- product_label
INSERT INTO product_label (product_id, label_name, required) VALUES
    (2,'sugar', true),
    (7,'rice', true),
    (8, 'kimchi', false),
    (9, 'kimchi', false);
```

```
-- label_item
INSERT INTO label_item (product_id, label_name, item_name) VALUES
    (2, 'sugar', 'more'),
    (2, 'sugar', 'less'),
    (2, 'sugar', 'no'),
    (7, 'rice', 'yes'),
    (7, 'rice', 'no'),
    (8, 'kimchi', 'yes'),
    (8, 'kimchi', 'no'),
    (9, 'kimchi', 'yes'),
    (9, 'kimchi', 'no');
```

4.5 Size of Each table

Table	Tuple Size (bytes)	Average Tuple Count	Estimate Size (kb)
user_data	92	300	27.6
stores	120	30	3.6
products	110	600	66
carts	50	4000	200
discounts	70	250	17.5
seasoning_discount	40	20	0.8
shipping_discount	40	30	1.2
event_discount	40	200	8
orders	80	1500	120
categories	40	10	0.4
labels	35	120	42
product_label	35	400	14
label_item	40	1200	48

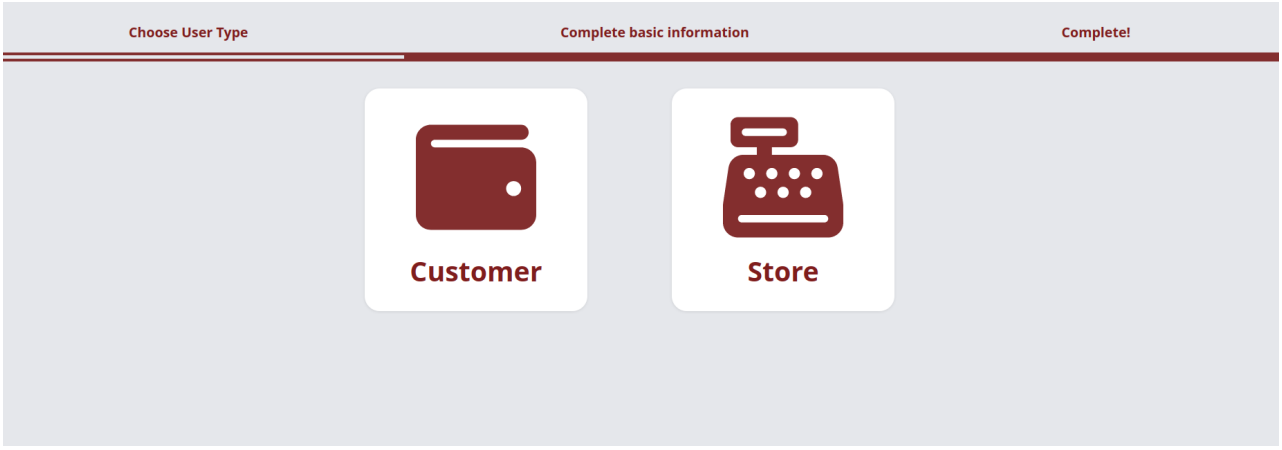
4.6 Expected Database Operation

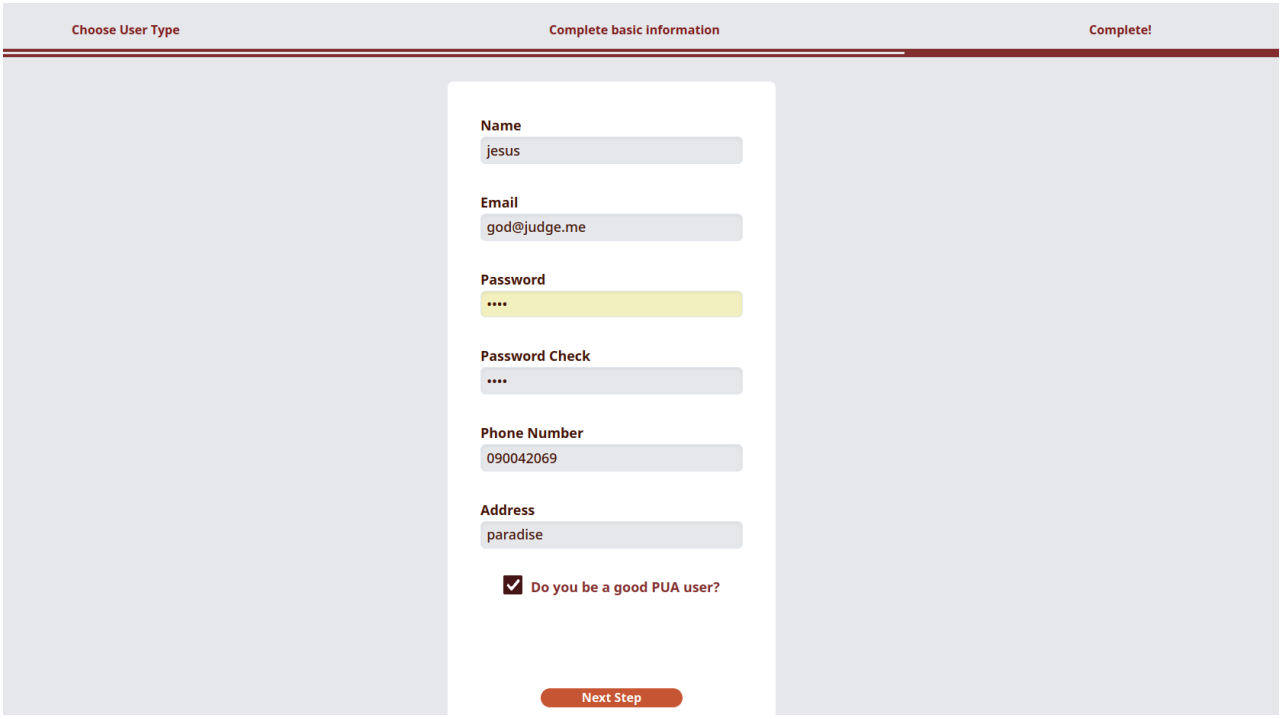
Table	可能操作	頻率（次數/天)
user_data	登入	150
	註冊	5
stores	新增商店	2
	查看商店資料	200
	為商店評分	20
	編輯商店	2
products	新增商品	2
	查看商品資料	60
	編輯商品	10
carts	加入購物車	250
	結帳	90
	查看購物車	100
discounts	新增折扣	9
	編輯折扣	3
	查看折扣	100
seasoning_discounts	新增折扣	3
	編輯折扣	1
shipping_discount	新增折扣	3
	編輯折扣	1
event_discount	新增折扣	3
	編輯折扣	1
orders	查看訂單	100
	更新訂單	400
categories	查看類別	50
labels	編輯店家類別	2
product_label	新增商品類別	10
	編輯商品類別	2
label_item	新增商品類別品項	30
	編輯商品類別品項	10

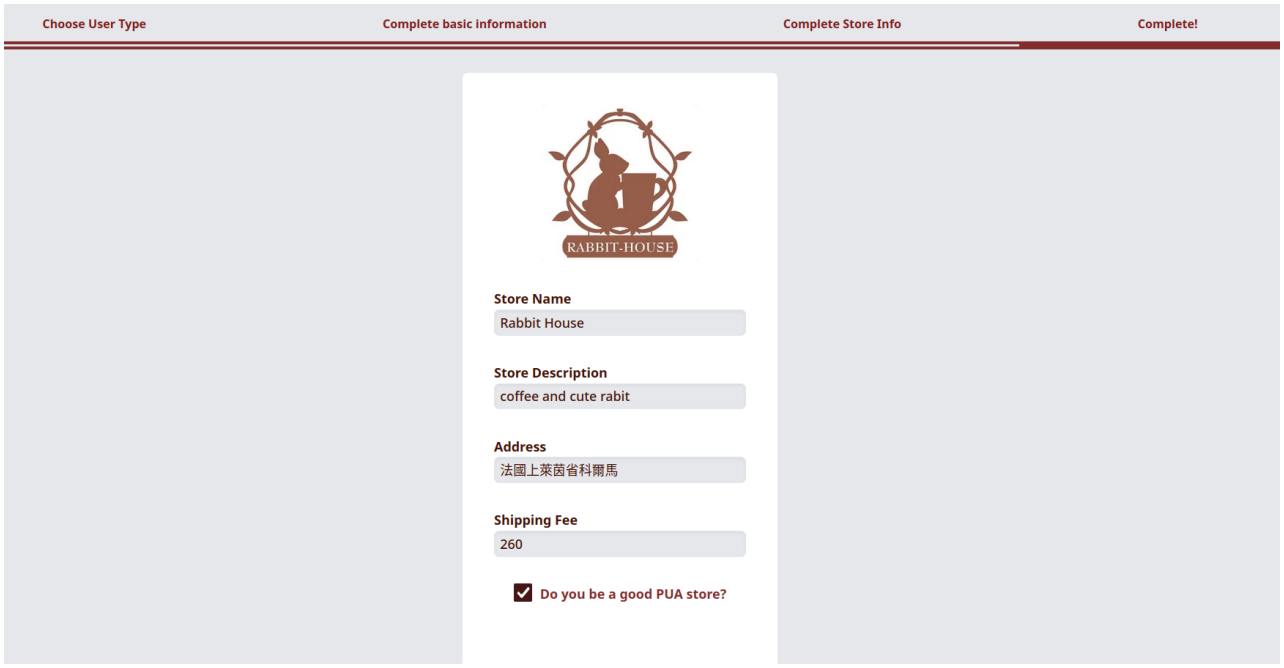
5 The User Guide of the System

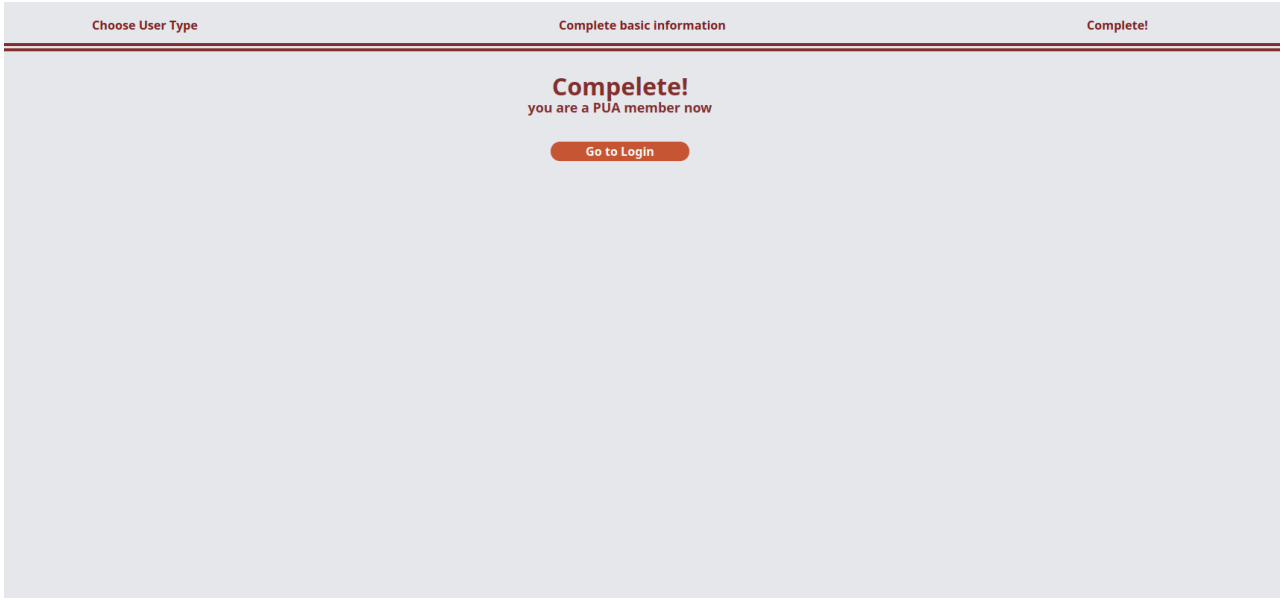
5.1 user

user can register seller or customer

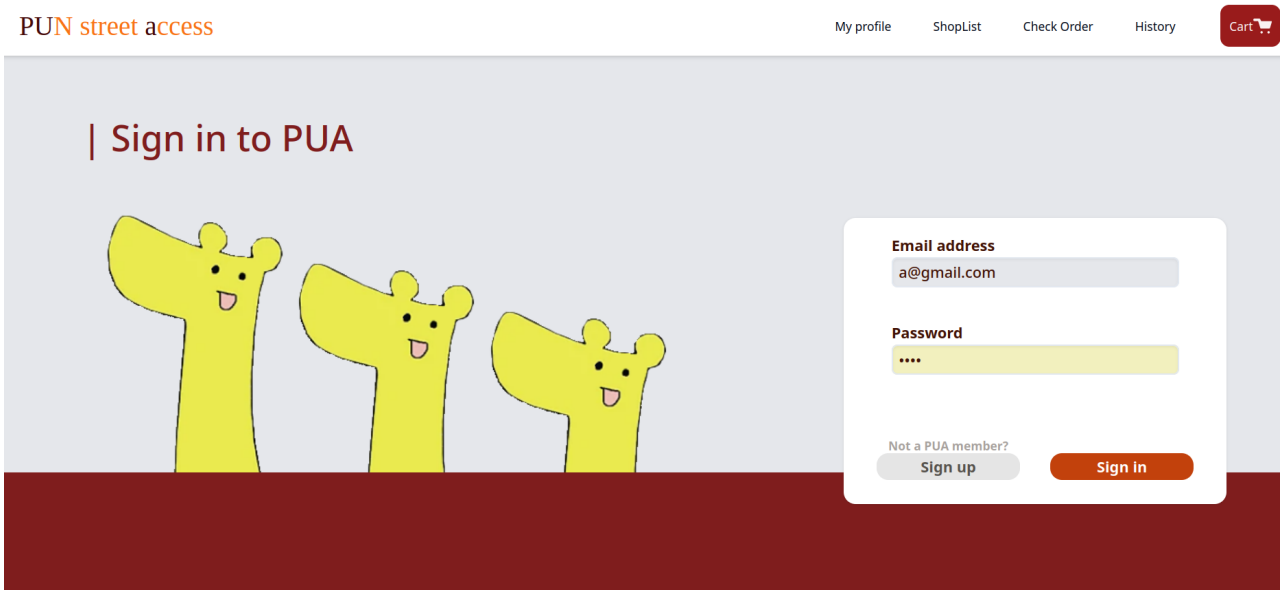





Choose User Type
Complete basic information
Complete Store Info
Complete!
RABBIT-HOUSE
Store Name
Rabbit House
Store Description
coffee and cute rabit
Address
法國上萊茵省科爾馬
Shipping Fee
260
Do you be a good PUA store?

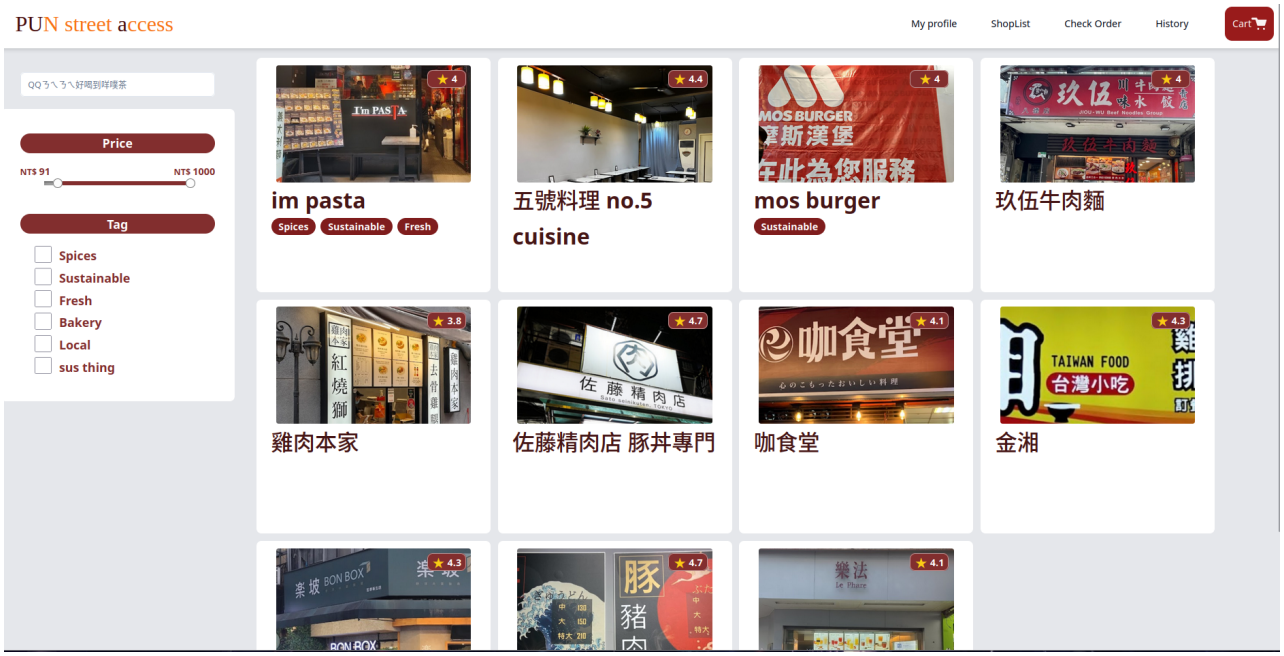

Choose User Type
Complete basic information
Complete!
Compelete!
you are a PUA member now
Go to Login

user can login

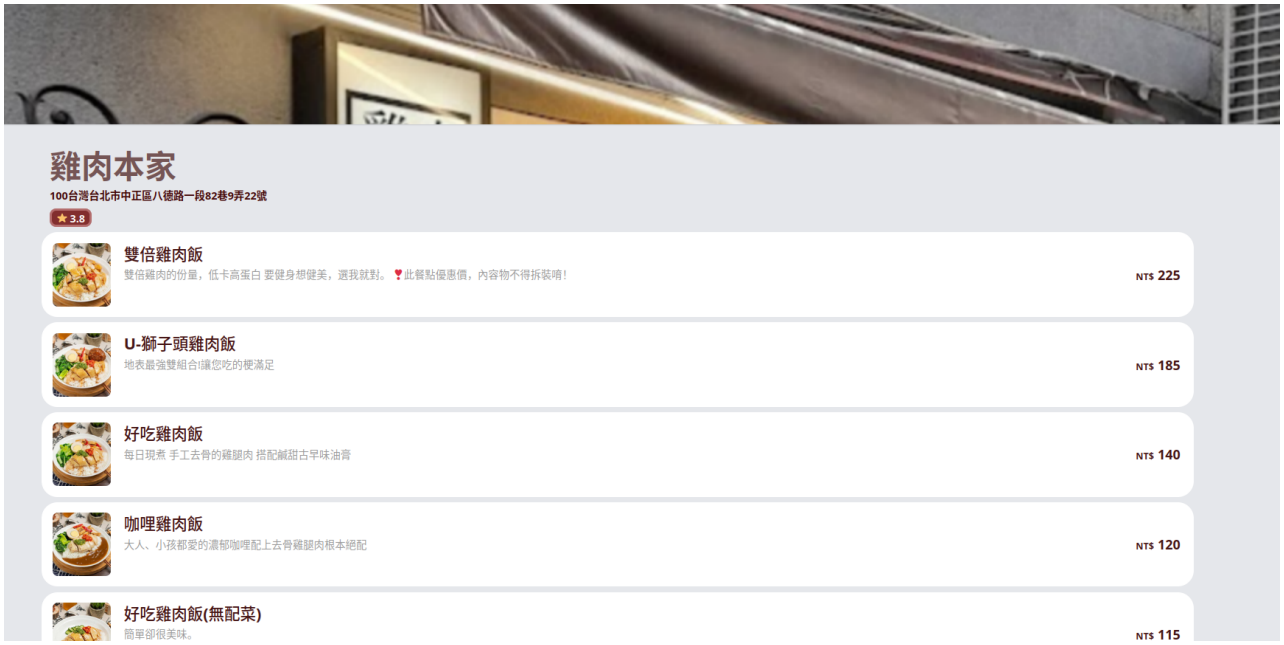


5.2 customer

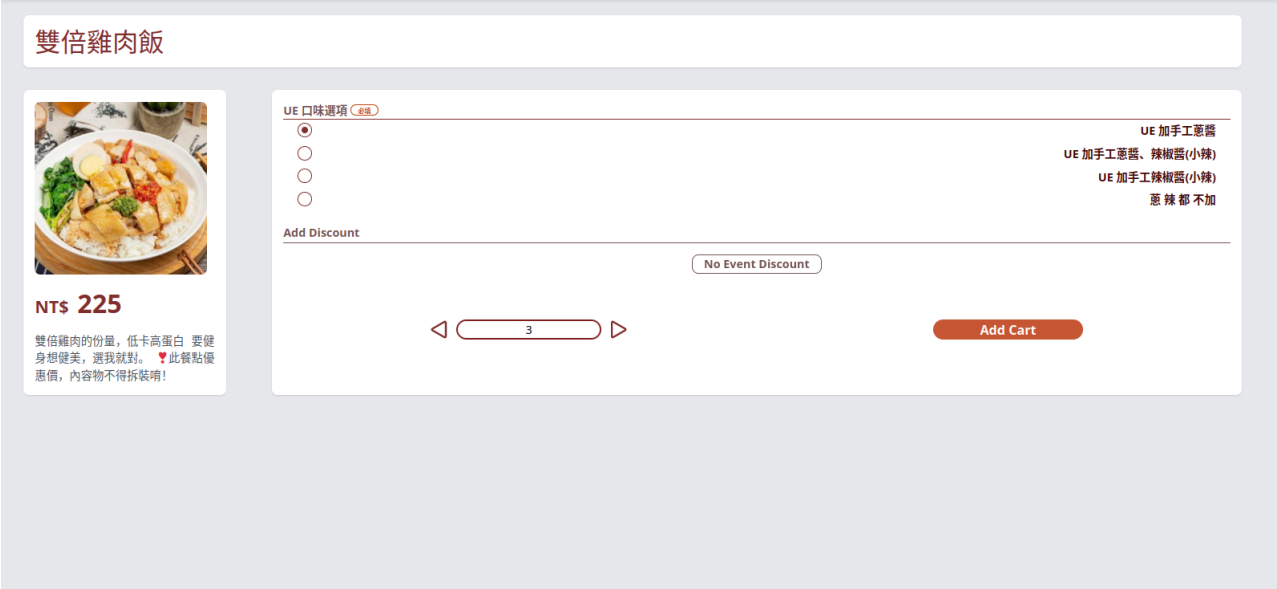
customer can browse and search shops



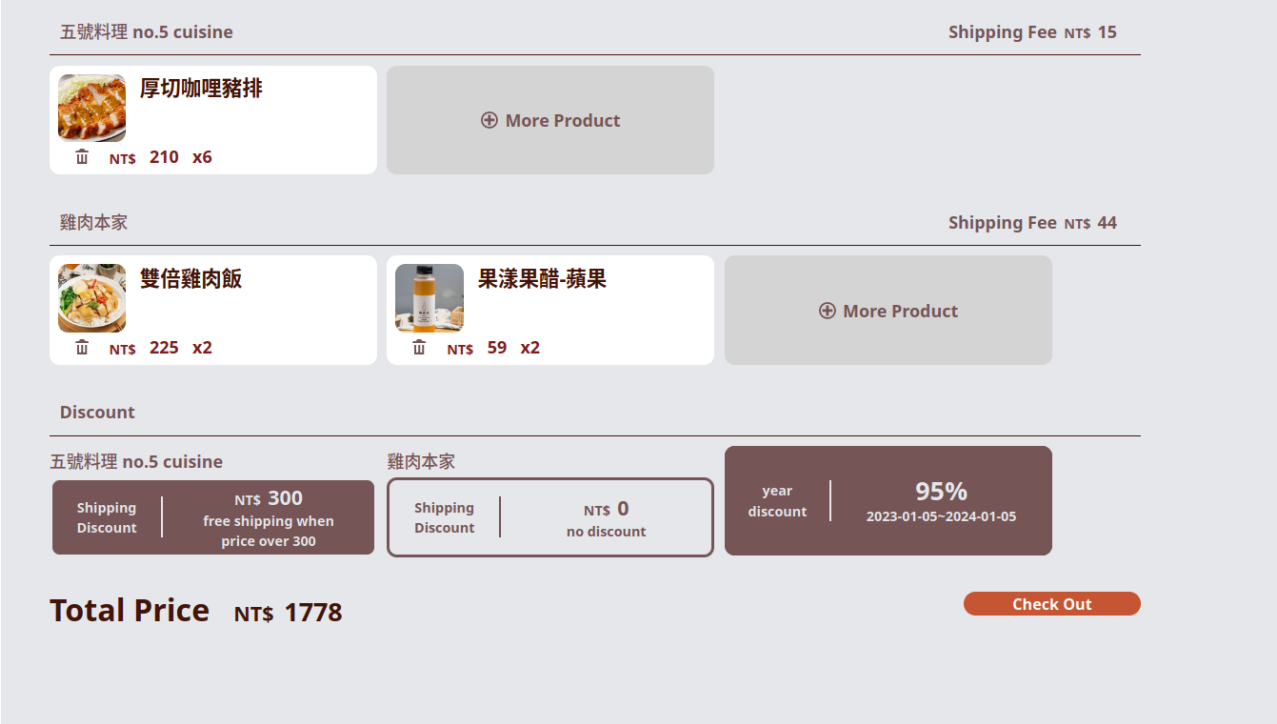
customer can browse products



customer can buy products

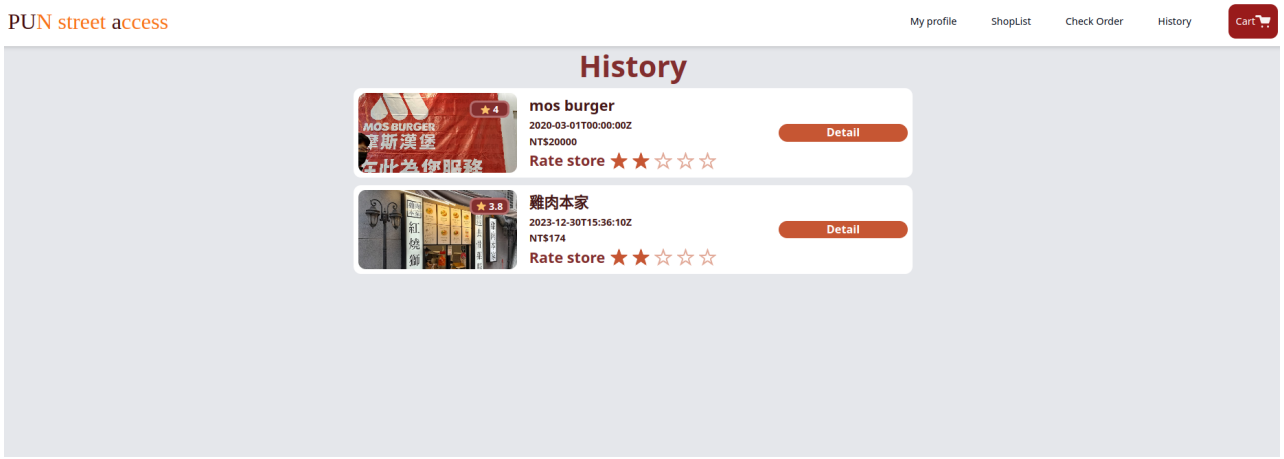


customer can view cart



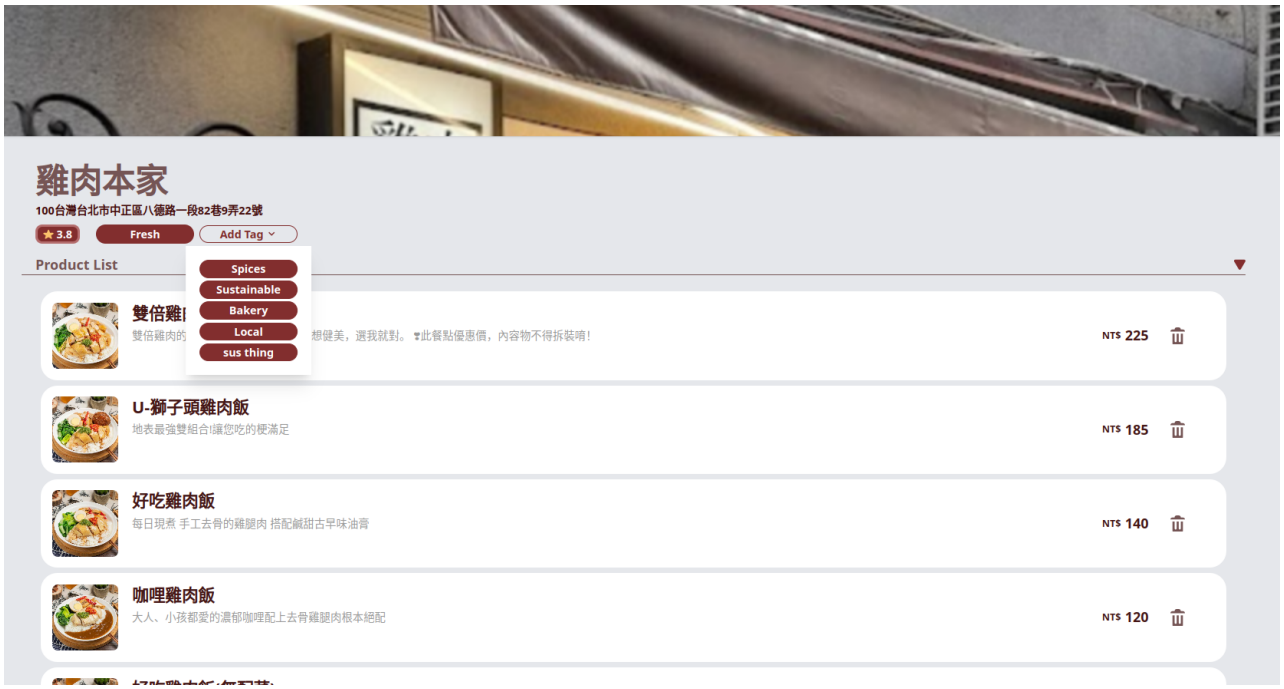
customer can view order

customer can view history

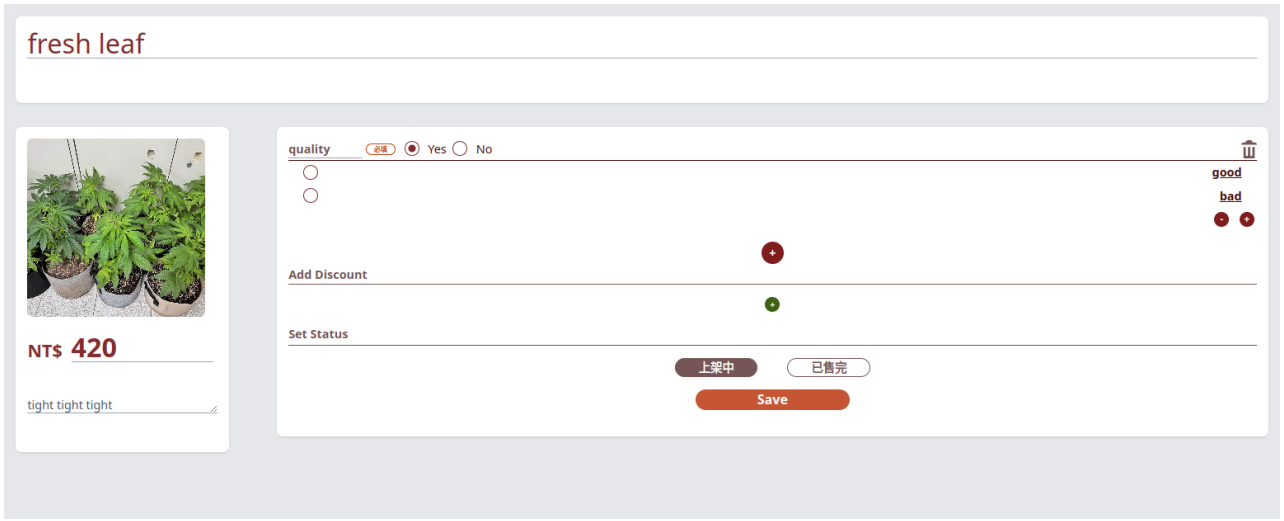


5.3 seller

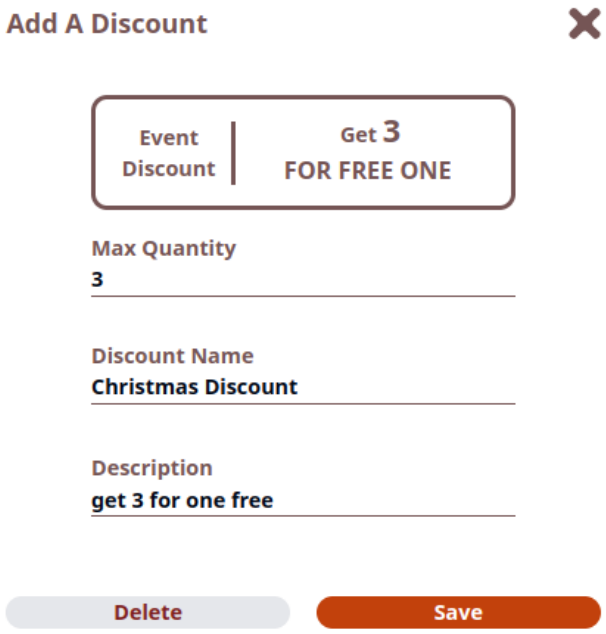
seller can edit shop (edit tag)



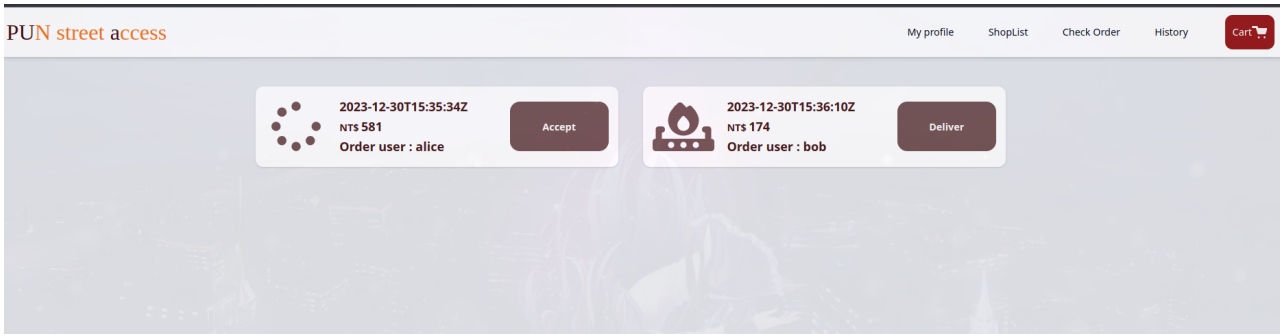
seller can edit (create) products



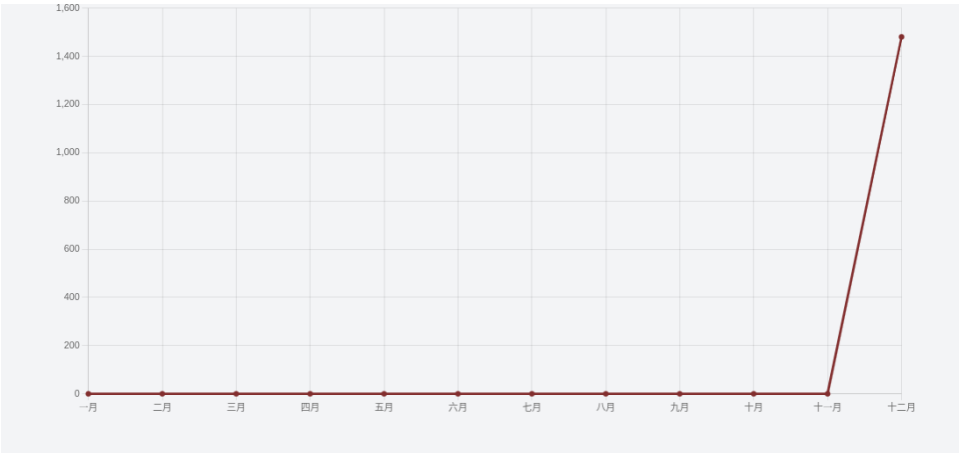
seller can edit (create) discounts



seller can view and update order

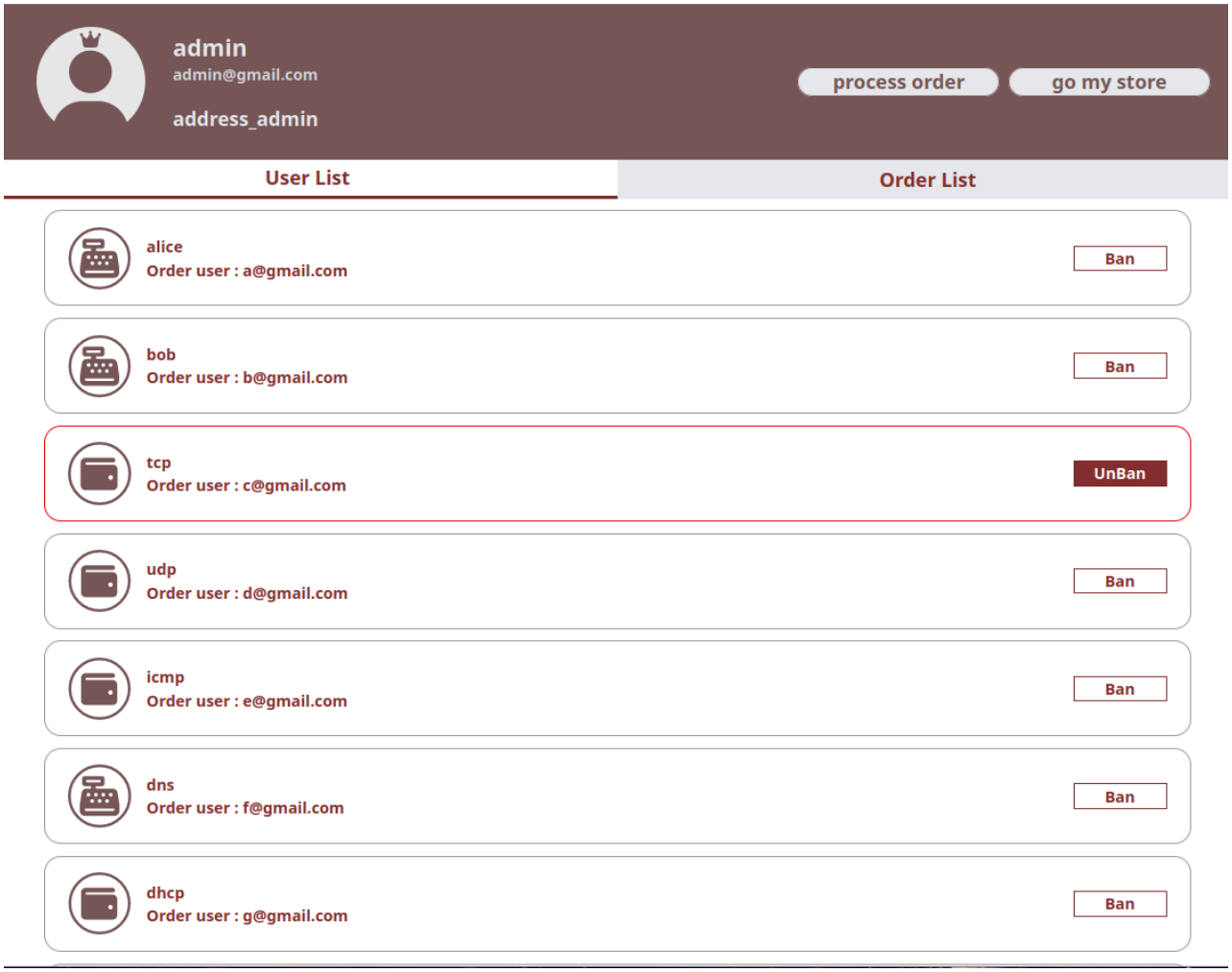


seller can get statistics of the shop

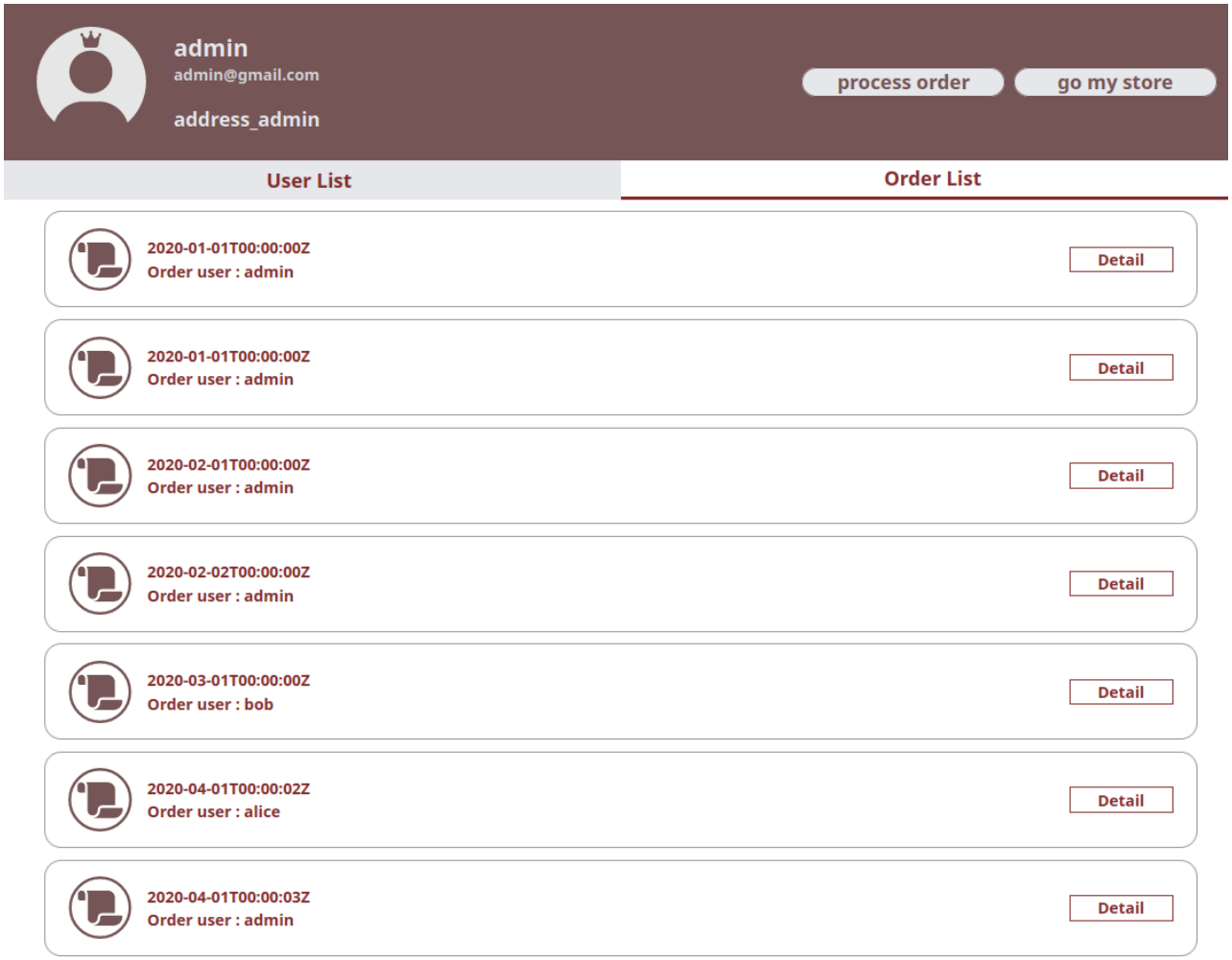


5.4 admin

admin can ban/unban users



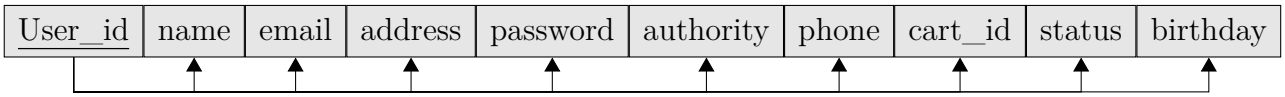
admin can view all orders



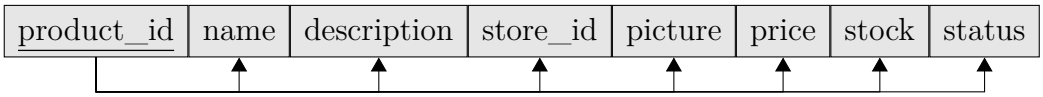
6 Functional Dependencies and Database Normalization

6.1 Functional Dependencies of the Database Schema

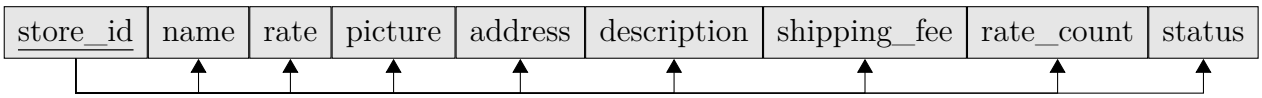
User_data



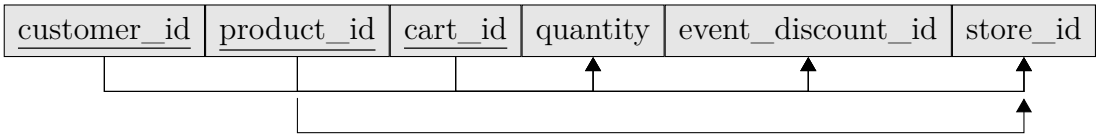
Products



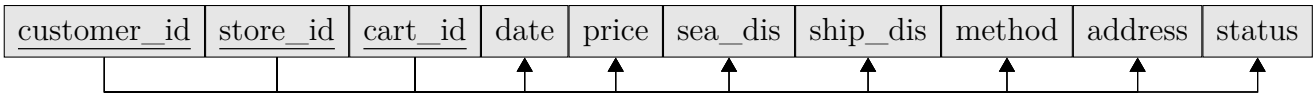
Stores



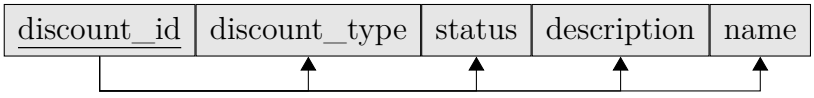
Carts



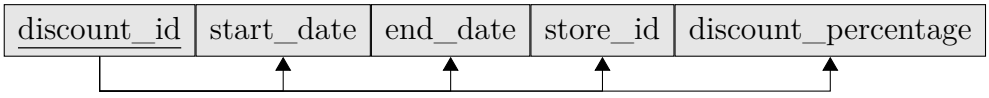
Order



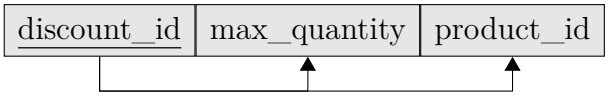
Discounts



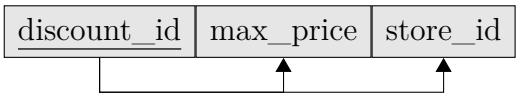
Seasoning_discount



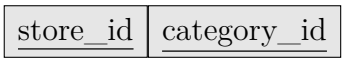
Event_discount



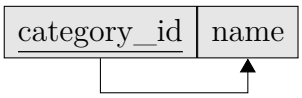
Shipping_discount



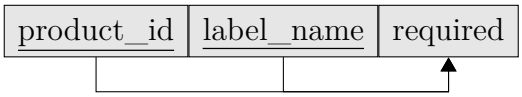
Label



Categories



Product_label



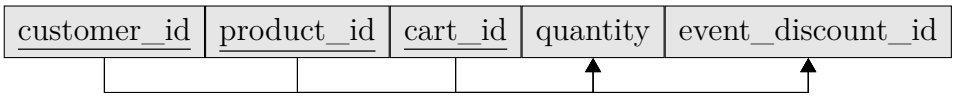
Product_label_item

6.2 Database Normalization

In the cart relation, the store_id partially depends on the product_id, thereby violating the 2NF. All other relations comply with BCNF.

6.2.1 Updated Schema

Carts



6.2.2 Updated SQL Statement

```
-- carts
CREATE TABLE
    IF NOT EXISTS carts (
        customer_id SERIAL REFERENCES user_data(user_id),
        product_id SERIAL REFERENCES products(product_id),
        cart_id INTEGER NOT NULL,
        product_quantity INT NOT NULL,
        event_discount_id SERIAL REFERENCES discounts(discount_id),
        PRIMARY KEY (
            customer_id,
            product_id,
            cart_id
        )
    );
```

After updating, all relations are in BCNF.

7 Suggestions on Database Turning

7.1 View

在取得商店或商品資料時，常常需要 join 許多不同的表格，若建立良好的 view，可使得開發人員不需寫過於複雜的 query，同時也增加資料可讀性。

7.2 Index

在做搜尋功能時，其中有用到 store 中的 category 欄位，若能將 category 做為 index，就可以避免線性搜尋所造成的效能損失。

7.3 Database

當初設計資料庫時，將 store_id 紀錄進購物車內，但後來發現由 product_id 就可以推算出 store_id，造成 2NF 的違反，經過正規化後將 store_id 移除。

8 Additional Queries and Views

8.1 First Query

Get shops by search string: use nest queries, aggregate functions, order by clause

```
SELECT
store_id,
name,
rate,
picture,
category_array
FROM (
    SELECT
        store_id,
        name,
        rate,
        picture, (
            SELECT
                jsonb_agg(
                    jsonb_build_object(
                        'category_id',
                        categories.category_id,
                        'category_name',
                        categories.name
                    )
                ) as categories_item
            FROM categories
                NATURAL JOIN (
                    SELECT labels.category_id
                    FROM labels
                    WHERE
                        labels.store_id = stores.store_id
                ) AS labels
        ) AS category_array, (
            SELECT COUNT(*) > 0
            FROM products
                LEFT JOIN stores as s ON products.store_id =
                    stores.store_id
            WHERE
                products.store_id = stores.store_id
                AND(
                    products.name LIKE '%' || '飯' || '%'
                    OR stores.name LIKE '%' || '飯' || '%'
                    OR products.description LIKE '%' || '飯' || '%'
                )
        ) AS is_string_exits
    FROM stores
) as store
WHERE is_string_exits = true
ORDER BY store.rate DESC
```

query result

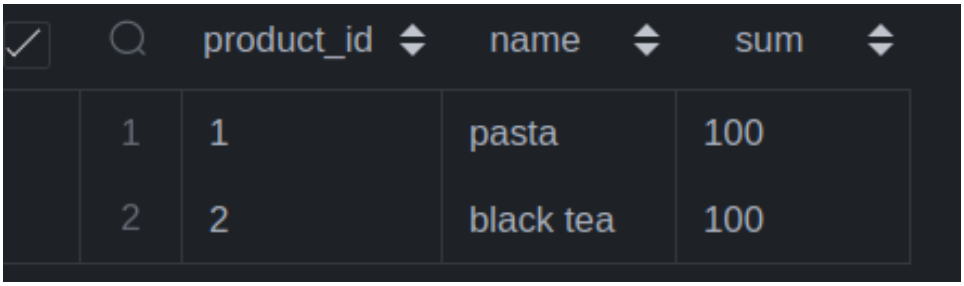
	store_id	name	rate	picture	category_array
1	11	佐藤精肉店 豚丼専門	4.7	https://cdn.discordapp.com	(NULL)
2	15	山本軒YAMAMOTOKEN丼	4.7	https://cdn.discordapp.com	(NULL)
3	3	五號料理 no.5 cuisine	4.4	https://cdn.discordapp.com	(NULL)
4	13	金湘	4.3	https://cdn.discordapp.com	(NULL)
5	14	楽坡BonBox	4.3	https://cdn.discordapp.com	(NULL)
6	12	咖食堂	4.1	https://cdn.discordapp.com	(NULL)
7	2	mos burger	4	https://cdn.discordapp.com	[{"category_id": 2, "category
8	9	雞肉本家	3.8	https://ilili.io/JADCTGt.png	[{"category_id": 3, "category

8.2 Second Query

Get products selling statistics by date: use group by clause

```
SELECT
    carts.product_id,
    products.name,
    SUM(carts.product_quantity)
FROM carts
    LEFT JOIN products ON carts.product_id = products.product_id
    LEFT JOIN orders ON carts.store_id = orders.store_id AND
        carts.cart_id = orders.cart_id AND carts.customer_id =
        orders.user_id
WHERE
    orders.store_id = 1
    AND orders.status >= 6
    AND EXTRACT(
        year
        FROM
            order_date
    ) = 2020
    AND EXTRACT(
        month
        FROM order_date
    ) = 1
GROUP BY
    carts.product_id,
    products.name
```

query result



	product_id	name	sum
1	1	pasta	100
2	2	black tea	100

8.3 Third Query

Get all Product's information: use nest query, order by clause

```
SELECT
    product_id,
    store_id,
    name,
    description,
    picture,
    stock,
    price,
    status, (
        SELECT
            coalesce(
                jsonb_agg(
                    jsonb_build_object(
                        'discount_max_quantity',
                        max_quantity,
                        'product_id',
                        product_id,
                        'discount_name',
                        name,
                        'discount_description',
                        description,
                        'discount_id',
                        discount_id,
                        'status',
                        status
                    )
                ),
                '[]'
            ) AS event_discount
        FROM discounts
            NATURAL JOIN (
                SELECT
                    event_discount.discount_id,
                    event_discount.max_quantity,
                    event_discount.product_id
                FROM event_discount
                WHERE
                    event_discount.product_id = products.product_id
            ) AS discountInfo
    ) AS event_discount_array, (
        SELECT
            coalesce(
                jsonb_agg(
                    jsonb_build_object(
                        'product_id',
                        product_id,
                        'label_name',
                        label_name,
```

```
                    'required',
                    required,
                    'item_array', (
                        SELECT (
                                jsonb_agg(
                                    jsonb_build_object('name',
                                        label_item.item_name)
                                )
                            ) AS item_array
                        FROM label_item
                        WHERE
                            label_item.label_name =
                                product_label.label_name
                            AND label_item.product_id =
                                product_label.product_id
                    )
                )
            ),
            '[]'
        ) AS product_label_array
    FROM product_label
    WHERE
        product_label.product_id = products.product_id
)
FROM products
WHERE store_id = 1 AND status != 0
ORDER BY product_id;
```

query result

	product_id	store_id	name	description	picture	stock	price	status	event_discount_array	product_label_array
1	1	1	pasta	tasty pasta	https://i.imgur.com/3i3tyXJ.	100	150	1	[{"status": 1, "product_id": 1	[]
2	2	1	black tea	student card get free	https://i.imgur.com/3i3tyXJ.	100	0	1	[{"status": 1, "product_id": 2	[{"required": true, "item_arra
3	25	1	義式肉醬焗烤	義式肉醬、高級起司絲、美	https://tb-static.uber.com/pr	100	155	1	[]	[{"required": true, "item_arra
4	26	1	奶油青醬雞肉	獨家特製青醬奶油、香炒蘑	https://tb-static.uber.com/pr	100	150	1	[]	[{"required": true, "item_arra
5	27	1	香蒜白酒蛤蜊	自製蒜醬加濃醇高湯與特級	https://tb-static.uber.com/pr	100	155	1	[]	[{"required": true, "item_arra
6	28	1	佛羅倫斯奶油	香濃義式白醬、蒜醬、奶油	https://tb-static.uber.com/pr	100	175	1	[]	[{"required": true, "item_arra
7	29	1	義式肉醬麵	義式肉醬、高級起司粉	https://tb-static.uber.com/pr	100	130	1	[]	[{"required": true, "item_arra
8	30	1	墨魚醬海鮮麵	濃郁墨魚墨囊熬煮黑醬、新	https://tb-static.uber.com/pr	100	175	1	[]	[{"required": true, "item_arra

9 Conclusions and Future Work

10 Glossary

11 References

12 Appendix