University of Essex

Computing Department - MSc Computer Science programme

Object-Oriented Information Systems

Mid-Module Assignment:

**System Design**

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Contents

[List of Classes 2](#_Toc92564779)

[Customer 2](#_Toc92564780)

[Member 2](#_Toc92564781)

[NonMember 2](#_Toc92564782)

[Staff 2](#_Toc92564783)

[Payment 2](#_Toc92564784)

[LoyaltyCard 3](#_Toc92564785)

[Cash 3](#_Toc92564786)

[BankCard 3](#_Toc92564787)

[Product 3](#_Toc92564788)

[Inventory 3](#_Toc92564789)

[ShoppingBasket 3](#_Toc92564790)

[ShoppingItem 4](#_Toc92564791)

[Status 4](#_Toc92564792)

[List of Relationships 5](#_Toc92564793)

[Class Diagram 6](#_Toc92564794)

[Rationale and Key Choices Made 7](#_Toc92564795)

[The main transaction 7](#_Toc92564796)

[Payment 7](#_Toc92564797)

[People who operate the self-service machine 7](#_Toc92564798)

[Loyalty Card 7](#_Toc92564799)

[Relationships 8](#_Toc92564800)

[Reference 8](#_Toc92564801)

# List of Classes

## Customer

The Customer represents all the customers who operate the self-server checkout by scanning the product to add them in the shopping basket.

The customers can scan the barcode of the product, weight the products, and search the products.

The customers can also scan their loyalty card to identify them as a member.

## Member

The member represents the customers who own the loyalty card and identify themselves by scanning the loyalty card. The member has its own member name and id.

The members can update the member information such as email and address.

## NonMember

NonMember represents those customers who do not own the loyalty card, or the customers who own the loyalty card but do not scan it.

A non-member can become a member by registering a loyalty card.

## Staff

The Staff represent the staff work near the self-checkout machine who can provide help to the customers. Each staff has name, id, and password.

The staff can assist the customers to override the shopping basket. For instance, if the customer wants to cancel the items that have already being scanned, the staff can override the basket by removing the unwanted items.

The same logic, the staff can help the customers to override/cancel their transaction. For example, if the discount of the items is not correctly applied and the payment is completed, the staff can override the transaction to correct the amount that the customers need to pay.

The staff can also scan, weight, and search the products in case if the customers do not know how to operate these actions correctly.

Some restricted products like alcohol are not allowed to be purchased by under-age customers. In the case, the staff will need to verify the customers’ age by checking their identity card.

## Payment

The Payment represent the payment method. After the shopping basket is confirmed, the payment will take place.

The payment includes the amount that need to be paid. Once the payment process is completed, it will update the Status to “paid”.

## LoyaltyCard

The LoyaltyCard represents the loyalty card, and it can store the loyalty point.

The loyalty card can apply certain discount to certain items in the shopping basket.

The loyalty card can show the balance of the loyalty point, and the member can use the loyalty point as a payment method.

## Cash

Cash represents the tangible money that the customers can use as a payment method.

## BankCard

BankCard represents the bank card; the card type can be credit card or debit card.

The bank card should include the information like card number and expiration date, and pin code. Before using the bank card as a payment method, the customer needs to authorize the card by enter the correct pin code.

## Product

Product represents as all the products that the customers can purchase from the supermarket. All the product has its price value, and the price type of the product can be price per unit (chips, wine…etc.) and price per kg (apple, banana…etc.).

The product is classified as restricted and non-restricted product. Once the restricted product is scanned and added into the shopping basket, it will trigger the restricted alert as a pop-up notice to remind the staff to verify the customers’ age.

## Inventory

Inventory represents the warehouse where the products are stored. It includes the product’s name, id, quantity, and weight.

The stock (product) in the inventory can be added and updated. When the product in the inventory is less than certain amount, it would trigger the alert to avoid stockout.

## ShoppingBasket

ShoppingBasket represents the shopping basket that list all the items that the customer will buy. The shopping basket will be created automatically once the first product is scanned.

Each shopping basket has its own id. The shopping basket can have the items detail (ShoppingItem) and payment status (Status). After the shopping basket is confirmed, it will be direct to the Payment process.

The shopping basket can calculate the total price, and calculate the total amount saved from the discount.

After the status of the shopping basket is set to “paid”, the shopping basket will calculate the earning bonus point and add it to the loyalty card in the case if the loyalty card was scanned.

## ShoppingItem

ShoppingItem represents the listed items which are added to the shopping basket. The items include the information of the quantity or the weight of the product, and it would calculate the total price of each product (product price multiply by quantity/weight.) It would also update the discount price if there is any.

Once the status of the shopping basket is updated to “paid”, the items will update the information to the Inventory by deducting the quantity or weight of the corresponding product.

## Status

The Status represents the payment status of the shopping basket. It can be “paid”, “unpaid”, “processing”, “error” etc.

# List of Relationships

|  |  |  |  |
| --- | --- | --- | --- |
| Relationship | Class A | Class B | Comment |
| Association | Customer | ShoppingBasket | Once the first product is scanned, the shopping basket will be automatically created by the customer, and each scanned product will be updated into the shopping basket.  One customer can own 0 to unlimited shopping baskets. |
| Association | Customer | Product | A customer can scan, weight, and search the product. |
| Inheritance | Customer | Member  Nonmember | Both member and non-member are customers. |
| Association | Customer | LoyaltyCard | The customers can also scan the loyalty card to identify them as a member. |
| Association | Member | LoyaltyCard | One member can only own one loyalty card. |
| Association | Nonmember | LoyaltyCard | The non-member can register for a loyalty card. |
| Association | Staff | Customer | The staff can verify the customer’s age. |
| Association | Staff | Product | A Staff can scan, weight, and search the product. |
| Association | Staff | ShoppingBasket | A Staff can override the shopping basket. |
| Association | Staff | Payment | A Staff can override the Payment. |
| Inheritance | Payment | LoyaltyCard  Cash  BankCard | There are three types of payments: loyalty card, cash, and bank card. |
| Association | Payment | ShoppingBasket | The payment is used to pay for the shopping basket.  In general, one basket should be paid with one payment method, but in certain case one basket can be paid with two method. (loyalty card payment can be combined with cash or bank card payment if the loyalty point balance is not enough to cover the payment amount.) |
| Association | Payment | Status | The payment can update the latest status to the status class |
| Association | LoyaltyCard | ShoppingBasket | As there are some discounts are available exclusively to the loyalty card holder, the loyalty card can apply these discounts to the shopping basket. |
| Association | Product | Staff | The product can generate an alert to the staff when a restricted product is scanned. |
| Aggregation | Inventory | Product | The product is part of the inventory. The inventory can store many products. |
| Composition | ShoppingBasket | Status | The shopping basket includes status as detail information to show if the basket is paid or not. |
| Composition | ShoppingBasket | ShoppingItem | One shopping basket can have many shopping items. |
| Association | ShoppingBasket | LoyaltyCard | Once the status of the shopping basket is set to “paid”, the calculated earning bonus point will be added to the loyalty card. |
| Association | ShoppingItem | Inventory | Once the status of the shopping basket is set to “paid”, the deducted quantity or weight of the product will be updated to the inventory. |

# Class Diagram

Diagram

Description automatically generated

# Rationale and Key Choices Made

The main idea of the self-checkout system is for the customer to scan the product and make the payment by themselves.

## The main transaction

The customer can access the product’s information and add them to the shopping basket by scanning the products. Each product will be added to the shopping basket as shopping items with the detail such as price, quantity, or weight. When the first product is scanned by the customer, the system will automatically create a new shopping basket for the customer.

A customer can have several shopping baskets because he/she can start a new purchase several times. A shopping basket can have several shopping items added before proceeding the payment.

I decided to separate the shopping basket and the shopping item because there is some calculation need to make for each item before they are added to the basket. For example, the banana weights 2 kg and prices 0.99 euro/kg, the shopping item will calculate the total item price first (1.98 euro), and then add it to the basket where all the items’ total price will be summed up.

## Payment

The payment process will take place after the shopping basket is confirmed. In the system, it will allow the customer to choose different payment methods from cash, bank card, and loyalty card. Therefore, these three types of payment methods are the children of payment, and they are in an inheritance relationship.

If the loyalty card is chosen to be the payment method but the loyalty point balance is not enough to cover the payment amount, the remain amount can be paid by cash or bank card. Therefore, one shopping basket can be paid by at least one payment method and can also be paid by two method maximin when one of the payments is loyalty card.

## People who operate the self-service machine

The customer can use the self-service machine to scan the product. Both member and non-member are customer, there for they are in an inheritance relationship that member and non-member are both customer’s children. Scanning the loyalty card can identify the customer as a member.

Other than the customer, the staff have the same ability as the customer to scan the products. Moreover, the staff can override the shopping basket and the payment for the customer when the product is not scanned correctly, or the transaction has error.

## Loyalty Card

The loyalty card can apply the discount to the basket. When the basket is paid, certain amount of the bonus point will be added to the loyalty card.

The verify age action cannot be omit even the member not underage. There might be the chance that the member card is borrowed.

## Relationships

‘In an aggregation relationship, the child class instance can outlive its parent class.’ (Donald, 2003). Therefore, the product is using the aggregation relationship with the inventory as the product can exist without the inventory. In another hand, the shopping basket is in a composition relationship with its child classes. Once the shopping basket is removed, the shopping item and the status will no longer exist.

# Reference

Donald, MB (2003). UML basics Part III: The class diagram. Available from: http://kursinfo.himolde.no/in-kurs/in140/diverse/modelinguml\_classes.pdf [Accessed 08 January 2022].