CS5373 – Model and Software Architecture **Fall 2020**

Term Project: Phase I

You are required to develop an Analysis model of the **Supermarket Checkout System (SCOUTS),** which includes:

a) Develop a System Context Class Model depicted on a class diagram showing how the system interfaces to the external environment. (3 pts)

b) Develop a static model showing the entity classes in the system, attributes of the classes, and the relationships between them. (3 pts)

c) Develop sequence (or communication) diagrams (one for each use case), depicting the sequence of interactions among the objects participating in each use case. Identify the object structuring criteria used. (7 pts)

d) For the checkout, and payment use cases (e.g., by credit/debit, pay by check, and pay by cash use cases), show the statechart for each use case. In addition, show the alternative paths on both the sequence diagrams and statecharts. Make sure that each statechart is consistent with the appropriate sequence diagram. (6 pts)

e) Develop message sequence descriptions, describing the object interactions on each sequence diagram depicted in (1c) above. (3 pts)

f) Based on the statecharts developed in 1(d), develop a complete statechart. (3 pts)

State any assumptions you make.

Term Project: Phase II

For Phase II of the project, you are required to develop a Design Model for the **Supermarket Checkout System**. In particular:

a) Develop an integrated (consolidated) communication diagram(s) showing all the objects and message interfaces in the system. (4 pts)

b) Define the subsystem architecture, (depicted on a concurrent communication diagram), showing the clients and server of the Scouts System. Define the message communication interfaces between the clients and server. (4 pts)

c) Define the task architecture (depicted on concurrent communication diagrams) showing the concurrent tasks in each subsystem and the interfaces between them. Describe the criteria used for task structuring. (Define the message communication interfaces.) (6 pts)

d) Define the information hiding classes in the system. Define the operations of each class. (5 pts)

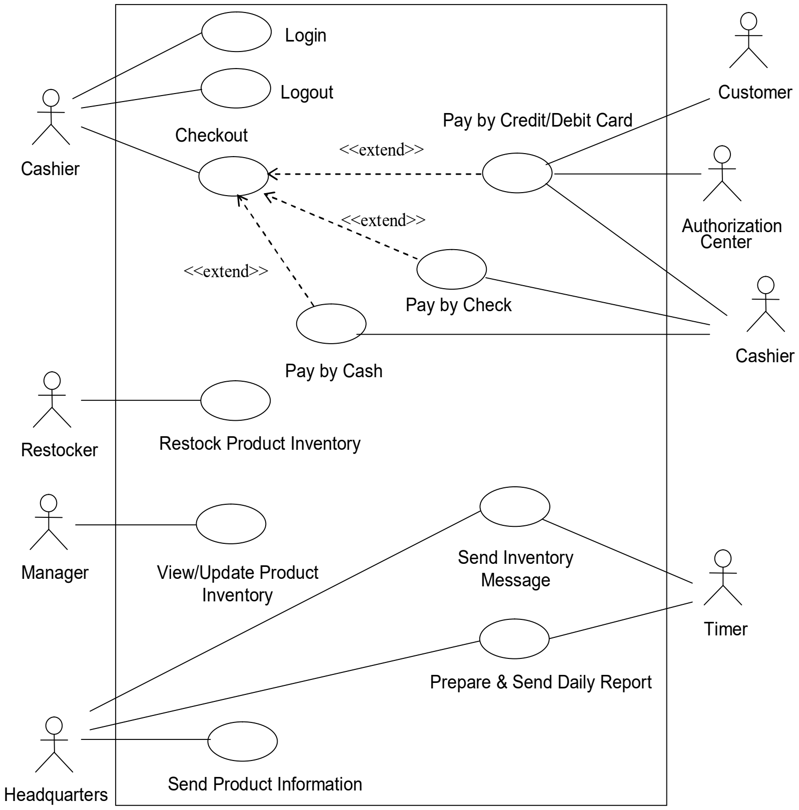
~~e) Define the detailed software design (depicted on more detailed concurrent communication diagrams) showing the internal structure of composite tasks (active objects).~~

f) Develop a task behavior specification for each concurrent task in the system, showing how each task responds to the inputs it receives. (6 pts)

State any assumptions you make.

The use case diagram of SCOUTS and descriptions of each use case

1. Use Case Diagram



2. Use Cases Descriptions

Use Case Name: Login
Summary: The cashier logs onto the SCOUTS system at the cash register.
Dependency:
Actor: Cashier
Precondition: A cash register is operating properly and is connected to the Store Computer.
Description:

1. Cashier places a till in cash register till drawer.
2. System locks the till.
3. Cashier presses the "Logon" function key on the cash register keypad.
4. System prompts for User ID.

5. Cashier enters ID number on the keypad.
6. System prompts for password.
7. Cashier enters the password on the keypad.
8. System checks if the login ID and password are correct.
9. System displays “Welcome” on the cash register display.

Alternatives:

- If the login ID and password are not correct, the system displays an “Invalid Login” for 10 seconds after step 8 and then returns to idle.

Postcondition: Cashier has logged onto the cash register.

Use Case Name: Logout

Summary: The cashier logs out the SCOUTS system at the cash register.

Dependency:

Actor: Cashier

Precondition:

1. Cashier has logged onto the SCOUT system at the cash register.
2. Till must be locked cash register till drawer.
3. Cashier is not currently processing a transaction.

Description:

1. Cashier presses the “Log Out” function key on the cash register keypad.
2. The system prompts the cashier to verify log off.
3. Cashier verifies log off by pressing the “Log Out” function key again.
4. The system logs off the cashier and releases till.

Alternatives:

- If Cashier presses the “Cancel” function key on the keypad when the system prompts to verify logout, Cashier is not logged off.

Postcondition: Cashier has logged out from the system at the cash register.

Use Case Name: Checkout

Summary: Cashier checks out items.

Actors: Cashier

Precondition: A cash register is ready and displaying welcome message.

Description:

1. Customer brings his items to Cashier to check out.
2. Cashier enters the identification number of each item. He scans the item over the bar-code scanner or manually from the keypad. In the latter case, Cashier enters the number by keypad, followed by the function key ITEM-ID.
3. System displays item price and description, and prints them on the customer order receipt.
4. Cashier presses TOTAL button.
5. System outputs the total price including tax on the display and the customer order receipt printer.
6. System opens the till.
7. *extend* Pay by Credit/Debit, Pay by Cash, or Pay by Check use case.
8. If there is no error message, Cashier presses ENTER key.

9. System decreases items on the customer order list from product inventory.
10. System appends transaction data to transaction log.
11. Cashier closes the till.
12. System displays Welcome Message.

Alternatives:

- If an item is a bulk item, the weight is calculated when the cashier presses the SCALE button. The weight and price are displayed and printed on the receipt.
- If the item triggers a store coupon for some related product, system prints the store coupon on the store coupon printer.
- If Customer has discount coupons, the cashier scans each coupon across the bar-code scanner or enters the amount manually and pressed the COUPON function key after all the item identification numbers have been entered. If a coupon is scanned by the bar-code scanner, system verifies its expiration date and whether the discounted item has actually been bought. If a discount coupon is expired, the system displays coupon expired message on the display.
- If a discount coupon is not related with any item on the customer order list, system displays coupon invalid on the display.
- If an item identification number is invalid, the system displays invalid item message on the display.
- If Cashier presses SUBTOTAL key while scanning items, the total price and tax are computed then displayed and printed.
- If Cashier presses CANCEL CHECKOUT key at any time, the entire transaction is canceled.
- If Cashier presses the CANCEL PAYMENT key, then the current payment method is canceled and the system prompts for a payment method.
- If number of items goes below specified threshold, then send inventory message to supermarket printer and to system message buffer.

Postcondition: Customer has been checked out.

Use Case Name: Pay by Credit/Debit Card
Summary: Customer pays with credit/debit card authorized by Authorization Center.
Dependency: Extension of Checkout use case.
Actor: Cashier, Customer, Authorization Center
Precondition: Total has been computed.
Description:

1. Cashier presses the CREDIT/DEBIT function key on the keypad.
2. Customer scan the card.
3. System reads the card.
4. If the card is a debit card, the system prompts for PIN. Customer enters a PIN on keyboard.
5. System sends a message containing customer information to the appropriate Authorization Center.
6. If accepted, the Authorization Center returns an authorization code.
7. System prints last four digits of card number and authorization code on the customer receipt.
8. System prints two copies of a receipt on the card receipt printer.
9. Customer signs one receipt and leaves the supermarket with it.

Alternatives:

- If the card is not accepted and no other payment is offered, the order is canceled.

- If the system does not recognize the card, the card is ejected.

Postcondition: Payment has been made with a credit/debit card.

Use Case Name: Pay by Cash
Summary: Customer pays by cash.
Dependency: Extension of Checkout use case.
Actor: Cashier
Precondition: Total has been computed.
Description:

1. Cashier presses the CASH, FOOD-STAMP, or MONEY-ORDER function key on the keypad.
2. System prompts cashier to enter the amount being paid by the customer
3. Cashier enters the amount of cash received to the system using the keypad.
4. System outputs the amount of cash paid by the customer on the display.
5. If the system determines sufficient payment is made by cash, it displays the change if necessary. The system prints the amount of cash paid by the customer and the change on the customer receipt.
6. System displays welcome menu.

Alternatives:

- If the customer cannot pay full payment, the system displays an error message.

Postcondition: Payment has been made with cash.

Use Case Name: Pay by Check
Summary: Customer pays by check.
Dependency: Extension of Checkout use case.
Actor: Cashier
Precondition: Total has been computed.
Description:

1. Cashier presses the CHECK function key on the keypad.
2. A check is scanned by the check reader.
3. System verifies the check.
4. If the system accepts the check, the system prompts Cashier to enter the amount paid by the customer.
5. Cashier enters the amount paid by the customer.
6. If the amount is sufficient, the system prompts the cashier to place the check in the customer order receipt printer.
7. System prints a line containing date, time, store identity, cashier identity, and order number on the check.
8. System outputs the amount of cash paid by the customer on the display.

Alternatives:

- If the system rejects the check, the system displays an error message.
- If the customer cannot pay full payment, the system displays an error message.

Postcondition: Payment has been made with check.

Use Case Name: Restock Product Inventory
Summary: Restocker restocks inventory into system. Information about each product being restocked is entered into the system.
Actor: Restocker
Precondition: Menu is displayed to restocker.
Description:

1. Restocker selects Restock from menu.
2. The system prompts restocker to enter items.
3. Restocker scans items to be restocked.
4. The system prompts for the quantity.
5. The restocker enters the quantity to be restocked.
6. The system displays the quantity.

Alternatives:

- If the scanned item is new then the system prompts and the restocker enters the item description, price, discount information, and quantity.

Postcondition: Inventory has been restocked.

Use Case Name: View/Update Product Inventory
Summary: Information about a product is viewed/updated including price, descriptions, and discount information.
Actor: Manager
Precondition: Menu is displayed to manager.
Description:

1. Manager selects View/Update from menu.
2. System prompts and manager selects an item to view/update.
3. System displays the price, description, and discount information of the item.
4. Manager updates any information by typing over if necessary and enters when done (OK, SUBMIT, ENTER key or graphical user interface button).
5. System updates information if necessary and displays new values.

Postcondition: Product inventory is viewed/updated.

Use Case Name: Prepare & Send Daily Report
Summary: Daily Reports are provided periodically. They are sent to a printer for the manager and to headquarters.
Actor: Timer, Headquarters
Precondition: The transaction log is stored.
Description:

1. Timer signals to the system to prepare daily reports at midnight.
2. System reads transaction log to compute the number of items sold for each product and the total revenue for the day.
3. System prints report on supermarket printer.
4. System sends report to supermarket headquarters.

Postcondition: The daily reports have been completed

Use Case Name: Send Inventory Message
Summary: Buffered inventory messages are sent to headquarters periodically.
Actor: Timer, Headquarters
Precondition: Inventory messages have been stored by system.
Description:

1. Timer signals to the system to prepare daily inventory report at midnight.
2. System sends inventory messages to Headquarters.

Postcondition: Inventory messages have been sent to headquarters.

Use Case Name: Send Product Information
Summary: Information about a product including price, descriptions, and discount information is sent and product inventory is updated.
Actor: Headquarters
Precondition: Headquarters is connected to system.
Description:

1. Headquarters sends new message with product information.
2. System updates product inventory.

Postcondition: Product inventory has been updated.