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**SECJ2013 – SECTION 08**  
**DATA STRUCTURE AND**  
**ALGORITHM**

“Swab Test Kit Vending Machine using Queue”

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**GROUP MEMBERS :**

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**Mini Project Demo Video:** <https://youtu.be/NyxhE9aOVBI>

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## **1.0 Synopsis**

In this project we are trying to implement a vendor machine in which the seller is able to load the test kits with a certain sequence number. This vendor machine dispenses swab test kits when the user gives an input. The user can also view the next swab test kit to be dispensed and also be able to display all the available swab test kits. This implementation is done using queue methodology for the ease of management.

## **2.0 Objectives**

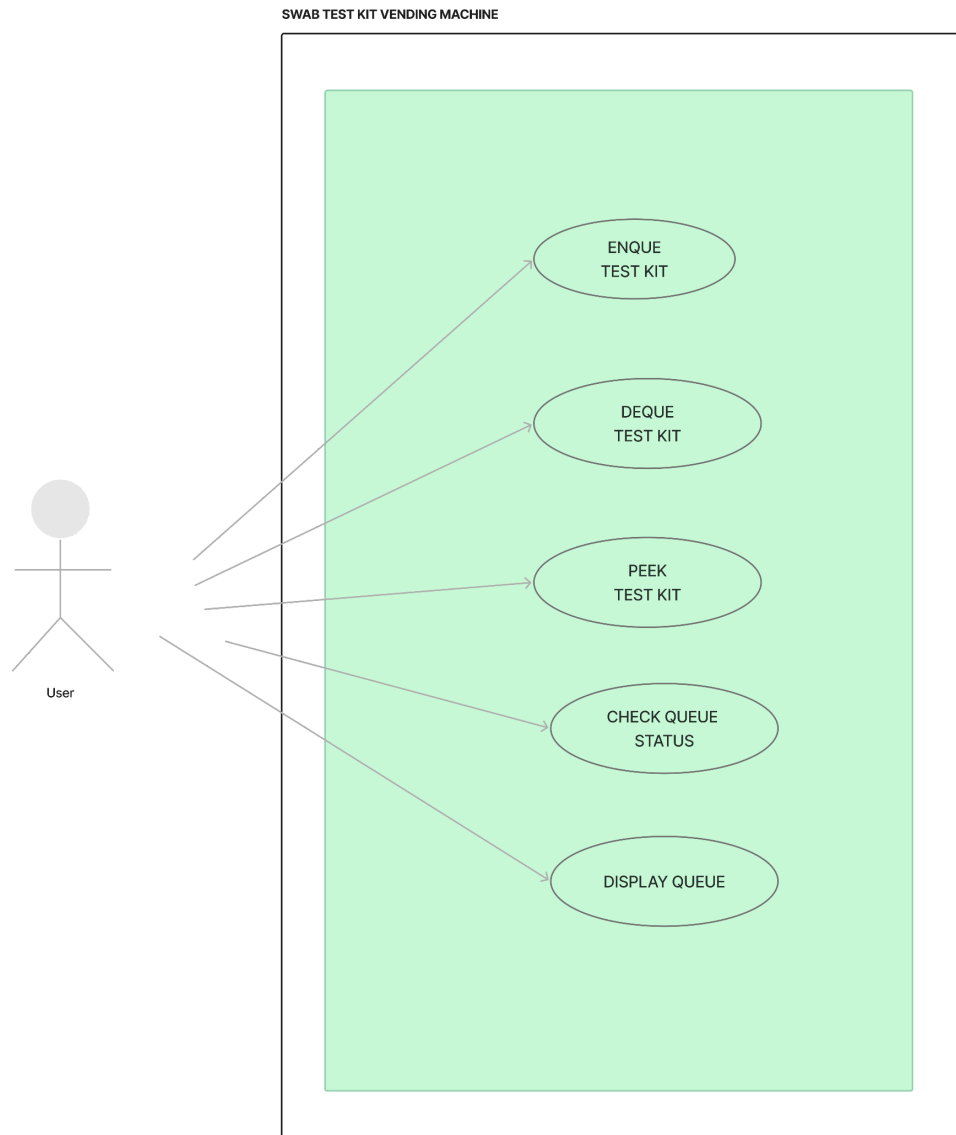
The Swab Test Vending Machine system was created to meet the increasing demand for contactless, automated distribution of medical supplies, particularly swab test kits, in the event of a pandemic or other public health emergency. The system guarantees that test kits are dispensed in the order that requests are received by utilising the queue data structure to ensure that the distribution process follows the FIFO (First-In-First-Out) principle. This method ensures justice and order throughout the process by removing any possible delays or inefficiencies.

The project primarily aims to streamline the distribution of test kits, reducing human interaction, which is vital for minimizing the risk of transmission in such high-demand, public-health scenarios. By automating the dispensing process, the system ensures that users receive their kits quickly and without the need for face-to-face interaction with medical staff or vending personnel. This fosters a safer, more efficient method of resource allocation, particularly during periods of high demand.

In the end, this project not only demonstrates how the queue data structure can be used practically in a real-world setting, but it also emphasises how crucial these structures are for streamlining processes and guaranteeing efficient resource management. The project highlights how theoretical knowledge can be applied to solve concrete problems effectively and fairly by modelling a real-world need.

### 3.0 System Requirement, Analysis & Design

#### 3.1 Use Case Diagram



**Figure 1: Use Case Diagram**

### 3.2 UML Class Diagram

Figure 2 UML Class Diagram below, represents two primary classes which are TestKit and Queue. The TestKit class models an individual test kit with a single private attribute, id, representing its unique identifier. It provides a constructor to initialize the ID, a getId() method to access the ID, and a display() method to output the ID value. The Queue class implements a linear array-based queue to manage TestKit objects. It maintains an array kits to store test kits, along with attributes front, rear, and count to manage the queue's state. The class provides methods for checking if the queue is full or empty (isFull() and isEmpty()), adding a test kit (enqueue()), removing a test kit (dequeue()), viewing the front test kit (peek()), and displaying all test kits in the queue (display()). The Queue class demonstrates composition by using an array of TestKit objects as part of its internal implementation. Together, the classes form a robust system for managing test kits in a vending machine simulation.

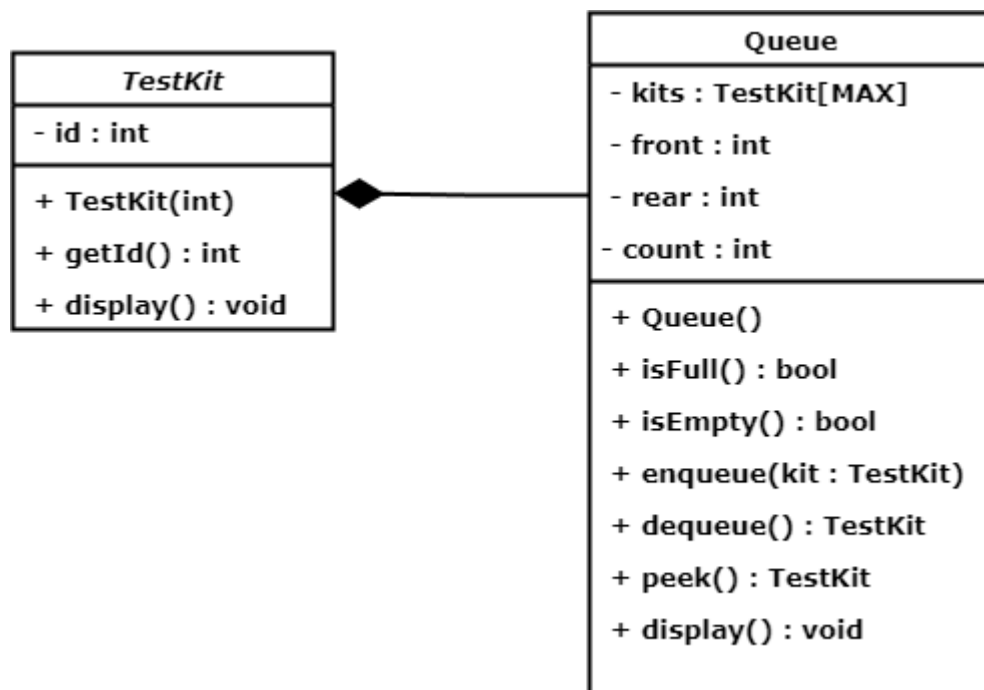


Figure 2: UML Class Diagram

## 4.0 Development Activities

Date	Member Involved	Activity	Activity Done By
24/12/24	Aidil, Habib, Chong, Anjum	Initial brainstorming above the project	Aidil
26/12/24	Aidil, Habib	Draw the use case diagram for the code.	Habib, Aidil
28/12/24	Aidil, Habib	Completed the UML class diagram for the code.	Habil, Aidil
2/1/25	Anjum	Coded the Testkit class in C++	Anjum
4/1/25	Chong	Implemented Queue class in C++	Chong
6/1/25	Habib, Anjum	Tested and fixed a bug in the enqueue() logic.	Habib, Anjum
13/1/25	Aidil, Habib, Chong, Anjum	Finalized the code and conducted reviews.	Aidil, Habib, Chong, Anjum

*Table 1: Development Activities Log Journal*

## 5.0 Task Distribution

### Group meeting details

**Date:** 24/12/24

**Time:** 9:30 AM

**Mode:** Online via Zoom

Member	Tasks Assigned during the meeting	Contributions
<i>Habib</i>	- Divide the task among group members	- Created system requirements, analysis, and design. - Actively participated in group discussions.
<i>Chong</i>	- Complete the code successfully	- Conducted thorough testing and validation to ensure code quality and adherence to project requirements. - Overcome challenges related to debugging.
<i>Aidil</i>	- Contribute to project ideas during brainstorming sessions. - Conduct research to define project objectives.	- Defined and clarified the project's objectives to align with the project's goals and scope. - Prepared a section of the project report. - Conducted thorough testing of the program.
<i>Anjum</i>	- Assist teammates in modifying and completing the code.	- Modified the code to meet the system requirement - Prepared the presentation slides. - Prepared the Task distribution and Development activities table for the report

***Table 2: Task Distribution***