SECJ2013 DSA - MINI PROJECT SPECIFICATION

OBJECTIVES FOR STUDENTS

1. Construct or develop a medium to complex size program by applying a number of data structure concepts in C++ programming language.
2. Solve problems in groups in which the group are required to prepare a report to document the project output and present the output in the class.

INSTRUCTION

a. Solve this project in a group of **3-4 members**.
b. Each group is required to select a software application in the domain to be determined by the lecturer. For examples: application to be used at UTM University Health Centre or UTM e-learning application.
c. The software applications must be developed based on the given data structure concepts which the group must apply in their application. The specified concepts are minimum concepts for each group, they can add more data structure concepts to their application.
d. Group's submission details:

Submission	Date
Problem Analysis	15/1/2024
Class Design in class diagram and algorithm design in pseudo code or flowchart	17/1/2024
Presentation & Demo (15 minutes presentation and 5 minutes Q & A) ● Use power point to describe the data structure and the system being developed. ● System – Describe flow of the system. The system need to be user friendliness and creativity in the solution approach. ● Presentation skill and collaboration in group work. ● Answering question during demo.	19/1/2024
A complete source codes Submit both hardcopy and softcopy. Data structure concept must be applied correctly using C++ language.	19/1/2024

e. Mark Distribution

Description	Mark
i. Project Report ● System analysis ● Design ● Program code	10 15 25
ii. Presentation & Demo	25
iii. System Prototype	25

TOTAL	100

f. Documentation of the project output must follow the report template given to the students.

FACULTY OF COMPUTING

UNIVERSITI TEKNOLOGI MALAYSIA

**DATA STRUCTURE & ALGORITHM
(SECJ2013)**

SEMESTER 1 2023/2024

**Mini Project Documentation
Vehicle Sticker Registration System**

**By
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Denies Wong Ke Ying (030516011788)
Lim Xiao Xuan (031105011470)**

SECTION 13

**Lecturer:
Dr Pang Yee Yong**

18/1/2024

For lecturer use:

Description	Mark Distribution	Mark
Project Report ● System analysis ● Design ● Program code	10 15 25	
Presentation & Demo	25	
System Prototype	25	
TOTAL	**100**	

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PART 1: INTRODUCTION

1.1.Synopsis Project:

The Vehicle Sticker Registration system is a system that aims to keep track of students' vehicles and ensure road safety in UTM. Every student who brings a vehicle whether it be a car, or a motorcycle, is required to register it using the Vehicle Sticker Registration system. After registration is done and approved by the system, students will receive an official vehicle sticker. They must put the sticker on their vehicle's windshield to prove that their vehicle has obtained authorization from the system. As a result, when students approach the main gate, security clearance is expedited, ensuring a smooth passage without any delays or unnecessary holdups.

Type of data structure:
1. Queue. Applied during the workflow process for approval. System administrators receive registrations and handle them one at a time from the queue. System administrators must obey the rule of first-in-first-out (FIFO). For example, administrators must approve students who apply first.
2. Linked list. The System can save students' records dynamically. It means no limitation of the quantity of students.

System functionality:
1. Vehicle registration. Students are required to register their vehicles using this system. This involves providing the necessary details. For example, vehicle type, plate number, owner information, engine code, insurance information, and other necessary information.
2. Approval Process. The system likely has an approval workflow where submitted registrations are reviewed and approved by the system administrators. This step ensures that only authorized vehicles receive a sticker.
3. Record Keeping. By keeping track of registered cars, the system makes it simple to audit, monitor, and manage the total number of vehicles on campus.
4. Sticker Renewal. A feature that lets students renew their expired car stickers, making sure their authorization is up-to-date and meets with university guidelines.
5. Status Checking. An interface that allows students to monitor the authorization status of their vehicle on the UTM premises.

1.2.Objective of the project

The objective of implementing the Vehicle Sticker Registration System is:
1. To allow students to apply for vehicle stickers.
2. To allow students to renew their expired vehicle stickers.
3. To allow students to check the status of the vehicle.
4. To allow students to check the approval process of vehicle stickers.
5. To allow admin to handle the registration

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PART 2: SYSTEM ANALYSIS AND DESIGN (USE CASE, FLOWCHART AND CLASS DIAGRAM)

In this section, you have to identify the requirements and the design of the system. Provide a use case diagram, class diagram, algorithm/flowchart for every module in the system. Every algorithm/flowchart for each module must be described in detail.

2.1.System Requirements
Use case diagram – Describe the user of the system and detailed descriptions of each use case.

Use Case Description for Vehicle Sticker Registration System

The system users are students and admin.

Actor	Task
Student	Log in
	Apply vehicle sticker
	Check registration status
	Renew vehicle sticker
	Log out
Admin	Log in
	Handle registration
	Log out

Detail Description for Each Use Cases

The system has main use cases.

Use Case	Purpose
Log in	Students or administrators log in to the system using their credentials
Check Vehicle Status (Student)	Allows students to see the authorization status of their vehicle and the status of vehicle stickers like expiry date.
Apply Vehicle Sticker (Student)	Enable students to start the vehicle registration process and apply for an official vehicle sticker.
Renew Vehicle Sticker (Student)	Allow students to renew expired vehicle stickers.
Handle Registration (Admin)	Allow administrators approve/reject vehicle registration applications of students.
Log out	Students or administrators log out of the system when they have completed their tasks

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2.2.System Design
– Document the class diagram and algorithm design in pseudocode or flowchart.

Main Chart
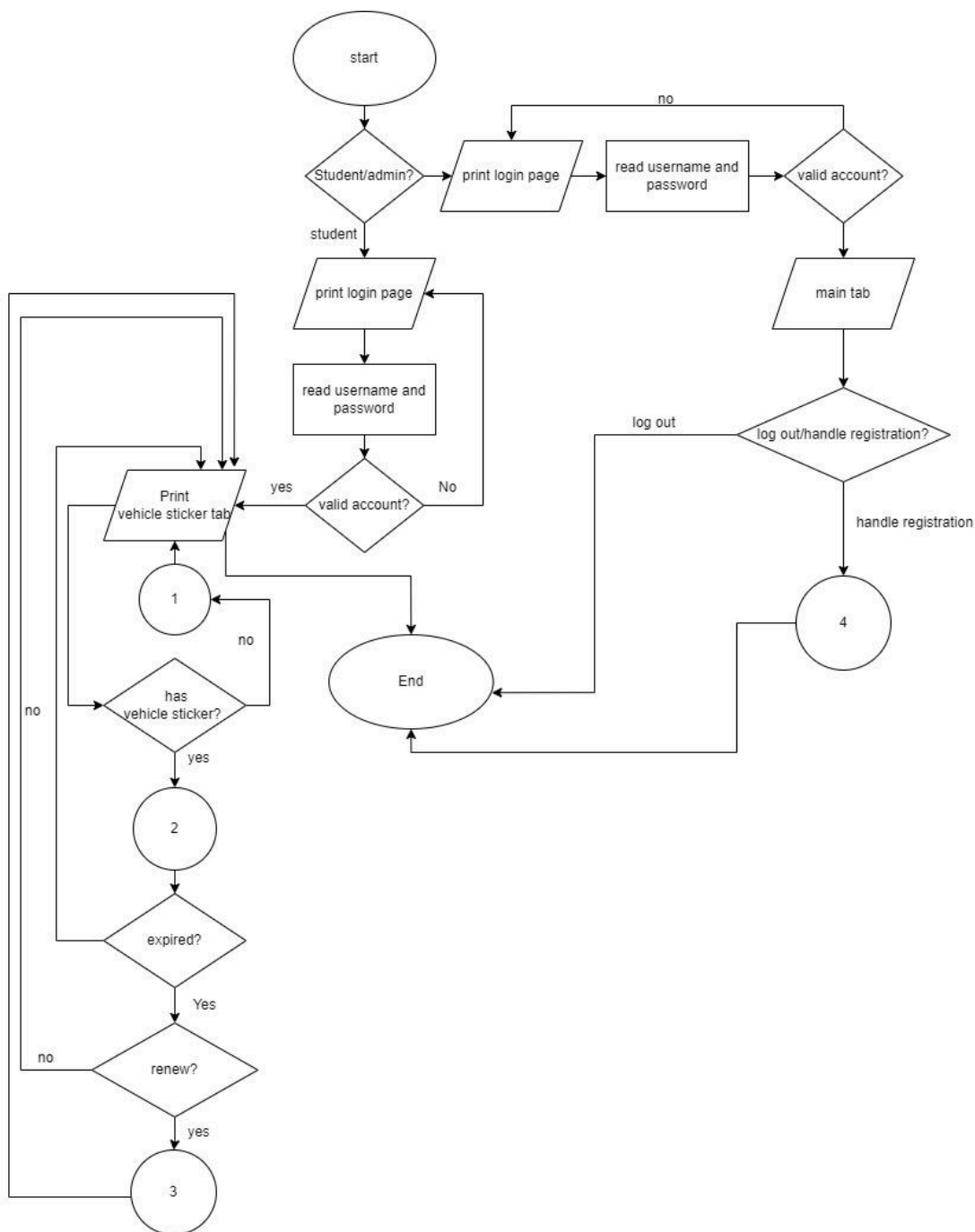
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Subroutines Flowchart 1: Apply Vehicle Sticker
Prepared By: Lim Xiao Xuan

```
  ┌──────┐      ┌─────────┐
  │  1   │───▶  │  Apply  │
  └──────┘      └─────────┘
                     │
                     ▼
            ┌──────────────────┐      ┌──────────────────┐
            │ fill in vehicle  │───▶  │ fill in owner    │
            │ owner            │      │ name             │
            └──────────────────┘      └──────────────────┘
                                               │
                                               ▼
            ┌──────────────────┐      ┌──────────────────┐
            │ fill in vehicle  │◀───  │ fill in ic       │
            │ type             │      │ number           │
            └──────────────────┘      └──────────────────┘
                     │
                     ▼
            ┌──────────────────┐      ┌──────────────────┐
            │ fill in plate    │───▶  │ fill in engine   │
            │ number           │      │ number           │
            └──────────────────┘      └──────────────────┘
                                               │
                                               ▼
            ┌──────────────────┐      ┌──────────────────┐
            │ fill in license  │◀───  │ fill in license  │
            │ expiry date      │      │ number           │
            └──────────────────┘      └──────────────────┘
                     │                         │
                     ▼                         ▼
            ┌──────────────────┐      ┌──────────────────┐
            │ fill in insuranse│───▶  │ fill in polisi   │
            │ company          │      │ number           │
            └──────────────────┘      └──────────────────┘
                                               │
                                               ▼
            ┌──────────────────┐      ┌──────────────────┐
            │     submit       │◀───  │ fill in insuranse│
            │                  │      │ expiry date      │
            └──────────────────┘      └──────────────────┘
                     │
                     ▼
               ┌─────────┐
               │   End   │
               └─────────┘
```
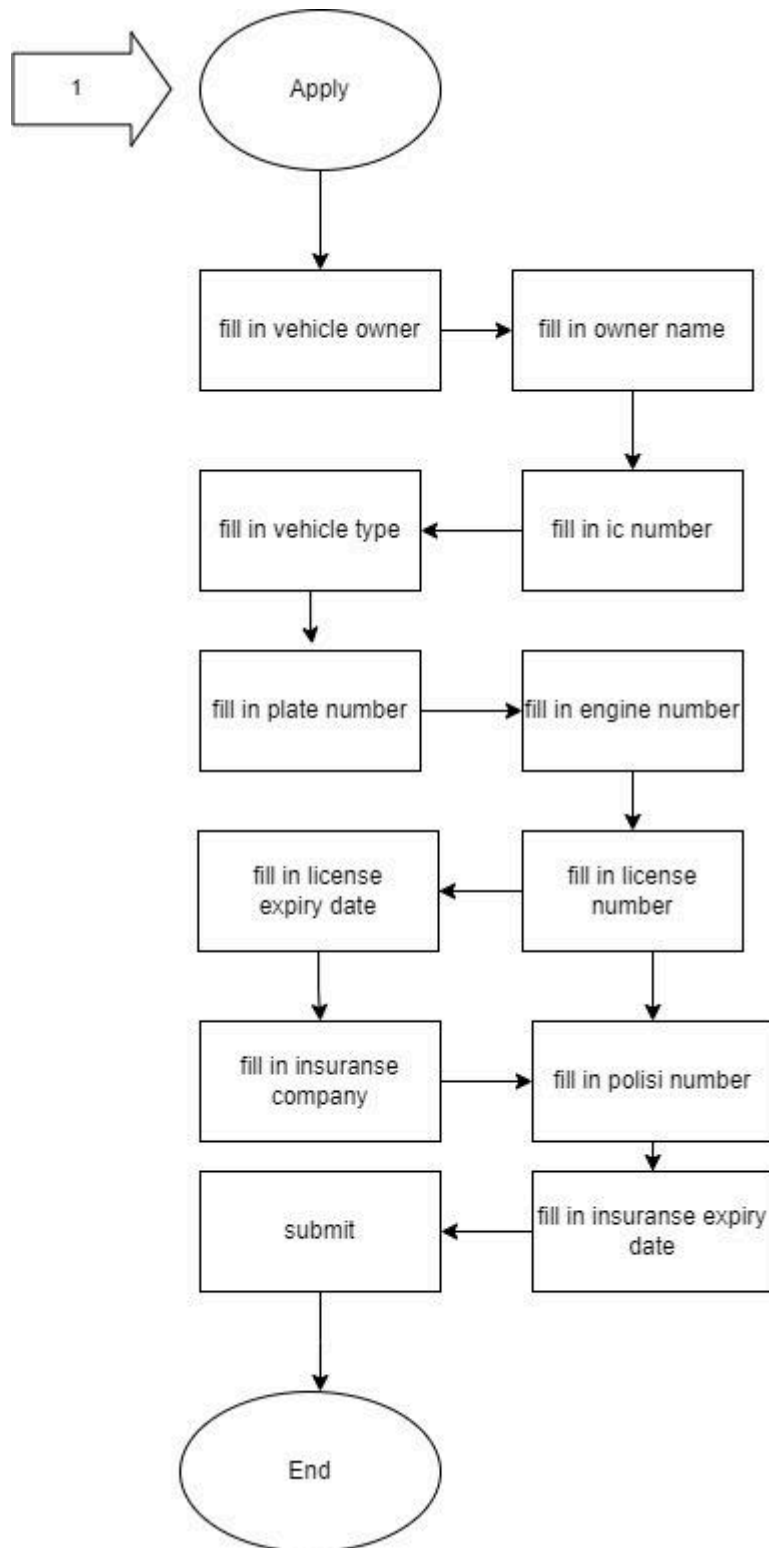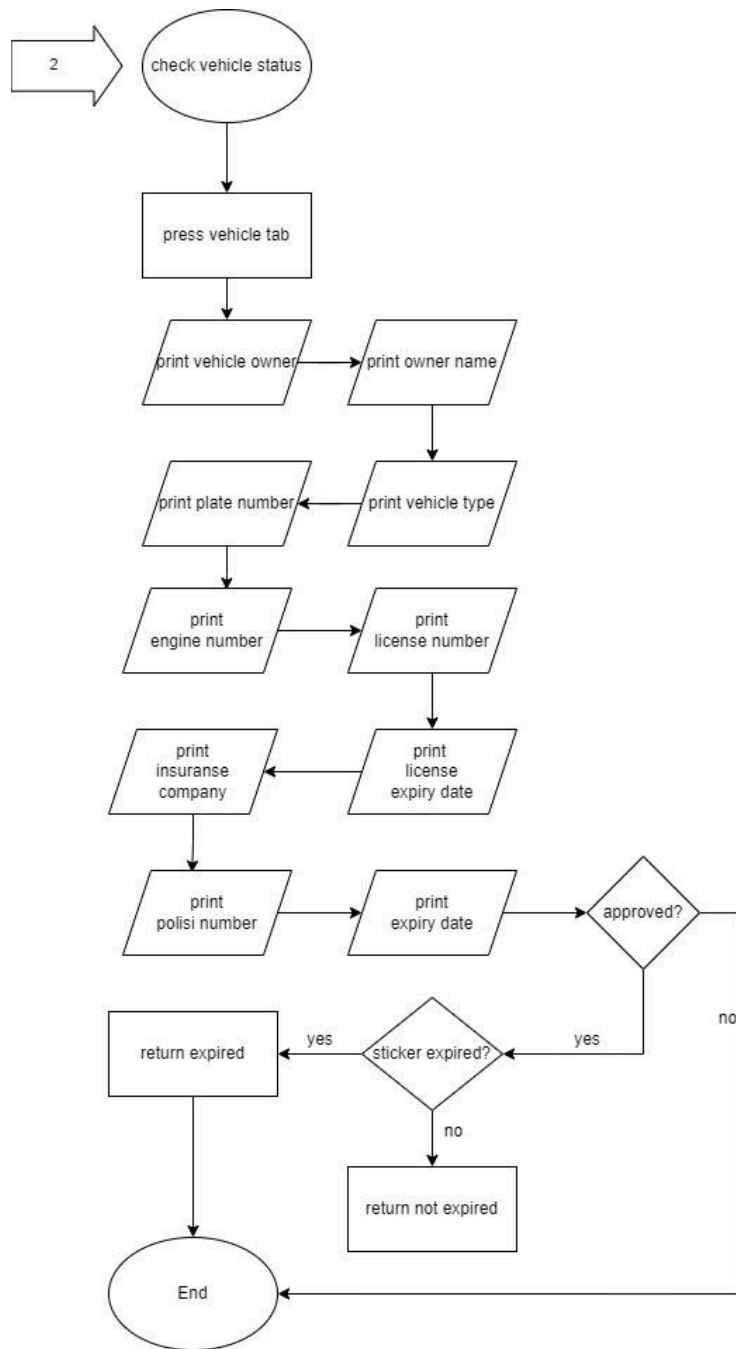
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Subroutines Flowchart 2: Check vehicle status
Prepared By: Denies Wong Ke Ying

```
        ┌──2──┐        ( check vehicle status )
                              │
                              ▼
                    ┌──────────────────┐
                    │ press vehicle tab │
                    └──────────────────┘
                              │
                              ▼
          /print vehicle owner/ ──────▶ /print owner name/
                                                │
                                                ▼
          /print plate number/ ◀────── /print vehicle type/
                    │
                    ▼
          /print engine number/ ──────▶ /print license number/
                                                │
                                                ▼
          /print insuranse company/ ◀── /print license expiry date/
                    │
                    ▼
          /print polisi number/ ──────▶ /print expiry date/ ──────▶ <approved?>
                                                                         │  │
                                                                      yes│  │no
                                                                         ▼  │
    ┌───────────────┐   yes                                              │  │
    │ return expired │◀─────── <sticker expired?> ◀────── yes ──────────┘  │
    └───────────────┘               │                                      │
            │                      no│                                      │
            │                        ▼                                      │
            │               ┌───────────────────┐                          │
            │               │ return not expired │                         │
            │               └───────────────────┘                          │
            ▼                                                               │
        ( End ) ◀───────────────────────────────────────────────────────────┘
```

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Subroutines Flowchart 3: Renew Vehicle Sticker
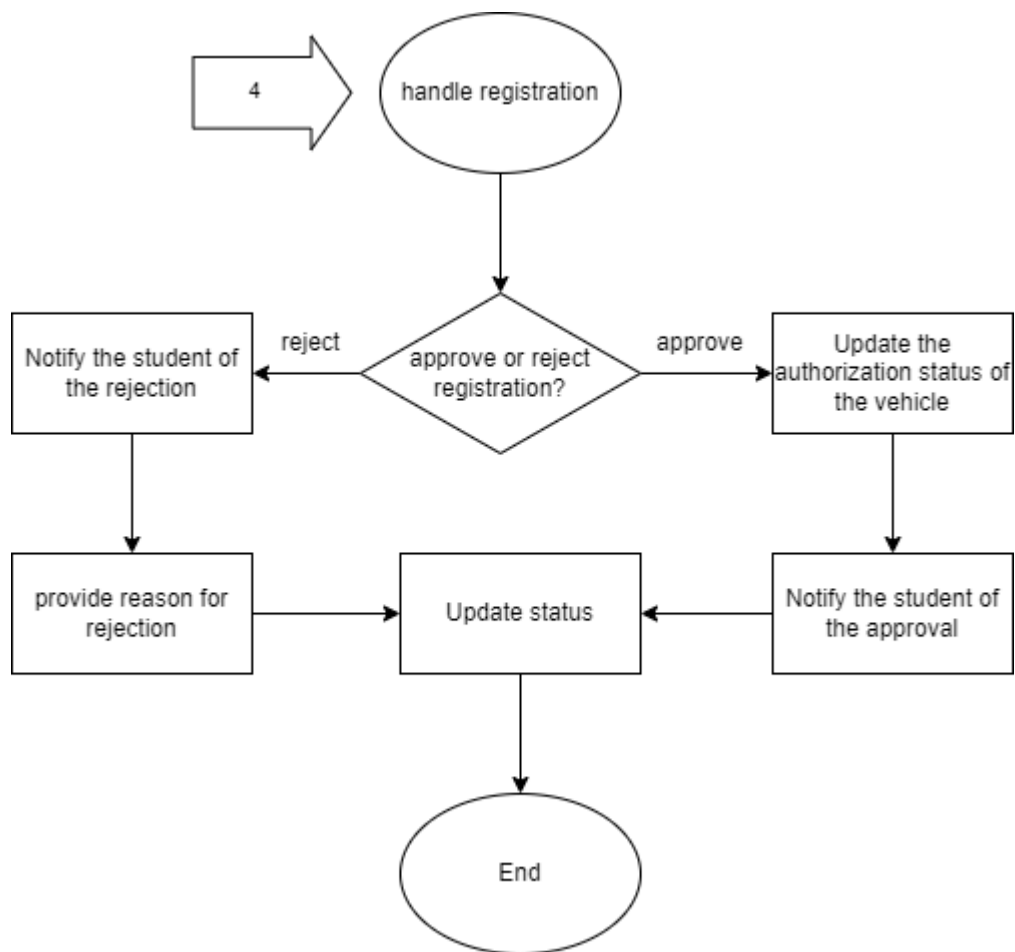**Prepared By**: Liow Zhi Heng
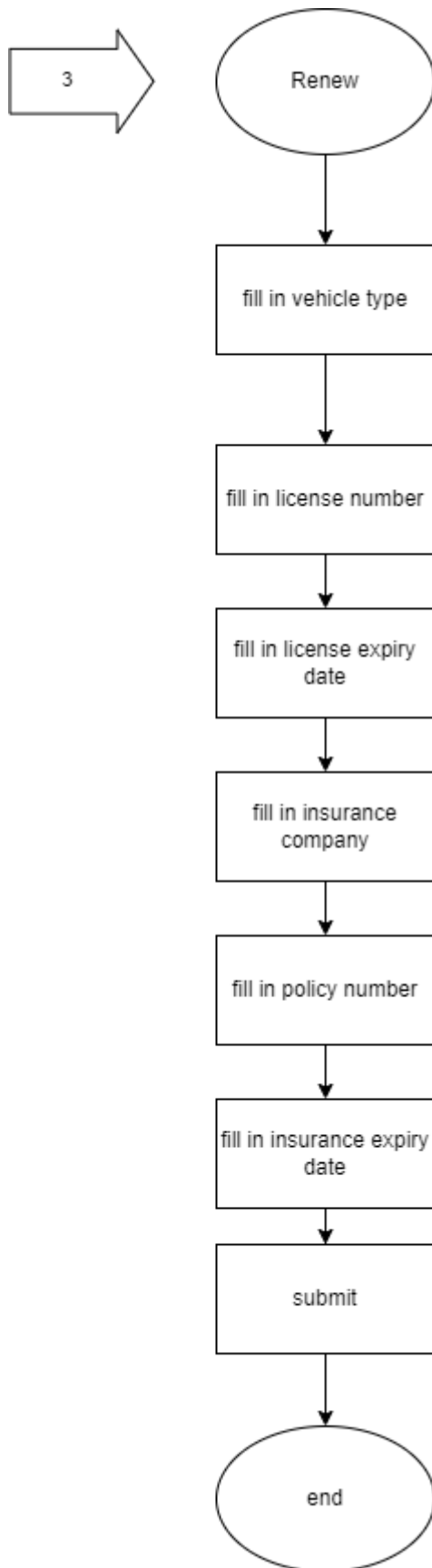
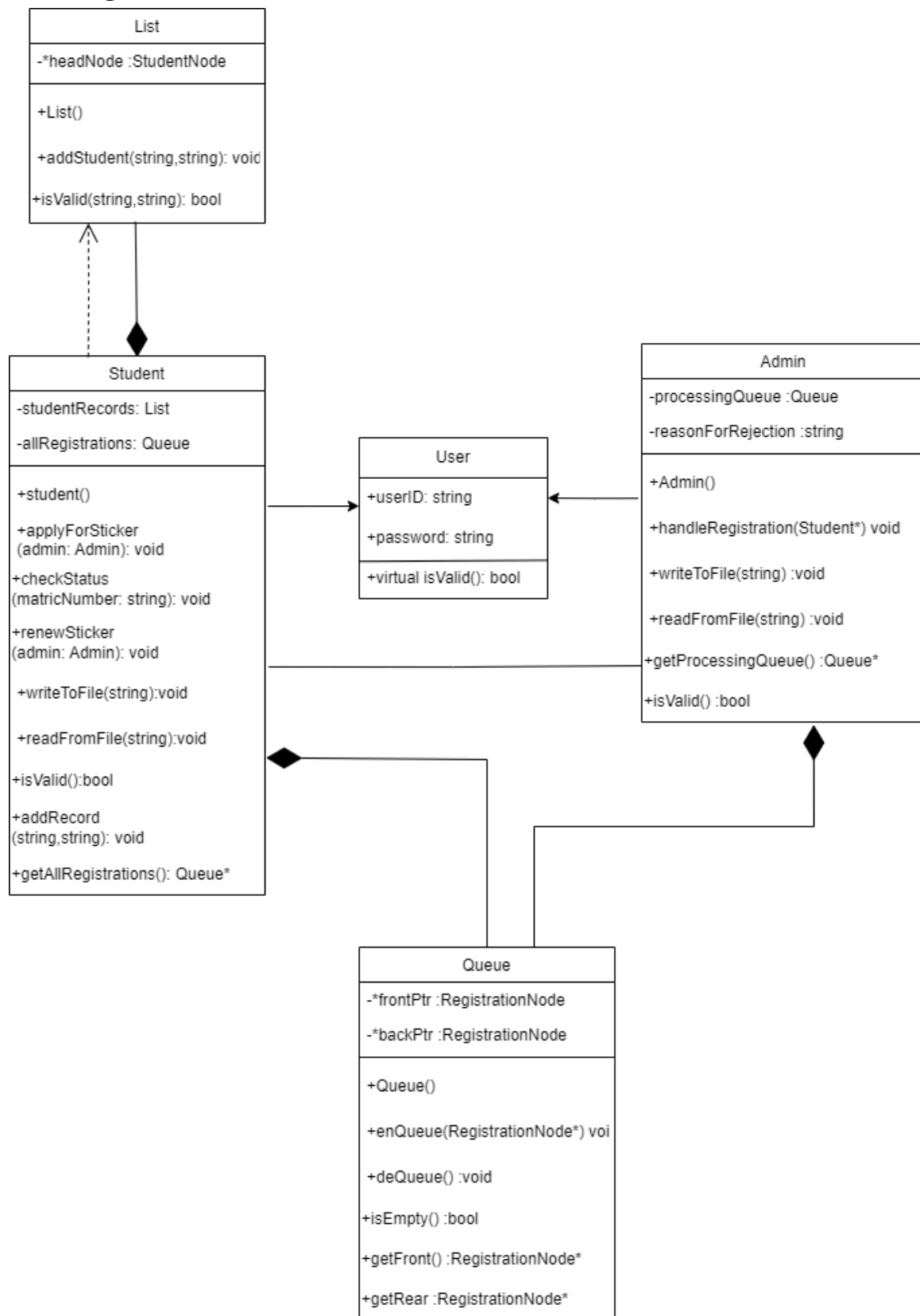**SECJ2013 DSA - MINI PROJECT SPECIFICATION**

Subroutines Flowchart 4:Approve or reject registration
Prepared By: Liow Zhi Heng

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Class diagram

List

-*headNode :StudentNode

+List()

+addStudent(string,string): void

+isValid(string,string): bool

Student

-studentRecords: List

-allRegistrations: Queue

+student()

+applyForSticker
(admin: Admin): void

+checkStatus
(matricNumber: string): void

+renewSticker
(admin: Admin): void

+writeToFile(string):void

+readFromFile(string):void

+isValid():bool

+addRecord
(string,string): void

+getAllRegistrations(): Queue*

User

+userID: string

+password: string

+virtual isValid(): bool

Admin

-processingQueue :Queue

-reasonForRejection :string

+Admin()

+handleRegistration(Student*) void

+writeToFile(string) :void

+readFromFile(string) :void

+getProcessingQueue() :Queue*

+isValid() :bool

Queue

-*frontPtr :RegistrationNode

-*backPtr :RegistrationNode

+Queue()

+enQueue(RegistrationNode*) voi

+deQueue() :void

+isEmpty() :bool

+getFront() :RegistrationNode*

+getRear :RegistrationNode*

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PART 3: SYSTEM PROTOTYPE

```
Welcome to the Vehicle Registration System!

1. Student
2. Admin
3. Exit
Please enter your choice:
```
Screen 1: User menu

Screen 1:The system prompts the user to enter their choice. The user should enter an integer value between 1 and 3. If the user enters a number outside this range, the system will display an error message and show the menu again.

Prepared By: Denies Wong

```
== Student Login Menu ==
Please enter your matric number:
Please enter your password:
```
Screen 2: **Student login menu**

Screen 2: This is the Student Login Menu in the Vehicle Registration System. Students enter their Matric Number and Password to access the system and go to student menu. If the credentials don't match the system's student records, an error message is displayed and will go back to the user menu.

Prepared By: Denies Wong

```
== Student Menu ==
1. Apply for sticker
2. Check status
3. Renew sticker
4. Logout
```
Screen 3: **Student Menu**

Screen 3: This screen displays the Student Menu of the Vehicle Registration System. It offers four options to the student. The first option allows students to apply for a new vehicle sticker. The second option enables students to check the status of their application. The third option is for renewing their vehicle stickers. The final option is for logging out of the system. Students can access these features by entering the number corresponding to each option. If the user enters a number that is not within the range of the options provided in the menu, the system will likely display an error message indicating that the input is out of range. The menu will then be displayed again.

Prepared By: Denies Wong

```
Please enter the vehicle owner's name:
Please enter the IC number:
Please enter the vehicle type:
Please enter the plate number:
Please enter the engine number:
Please enter the license number:
Please enter the license expiry date:
Please enter the insurance company:
Please enter the policy number:
Please enter the insurance expiry date:


Sticker application submitted successfully.
```

Screen 4: Possible outcome 1 of Choice 1 of student menu

Screen 4: This screen is a vehicle sticker registration form for students who haven't registered a vehicle sticker before. It asks for details about the vehicle owner, the vehicle itself, and other necessary details. After filling out the form, it will be submitted. If successful, students will see a message confirming the submission.

Prepared By: Denies Wong

```
You already have a registration record. You cannot apply for a new sticker.
```

Screen 5: Possible outcome 2 of Choice 1 of student menu

Screen 5: The screen displays the message "You already have a registration record. You cannot apply for a new sticker." This suggests that students cannot apply for a new sticker if they already have an active, non-rejected registration. This screen likely comes up if a student tries to register a new sticker while their previous registration is still valid.

Prepared By: Denies Wong

```
Your previous application was rejected. Please fill in the information again.
Please enter the vehicle owner's name:
Please enter the IC number:
Please enter the vehicle type:
Please enter the plate number:
Please enter the engine number:
Please enter the license number:
Please enter the license expiry date:
Please enter the insurance company:
Please enter the policy number:
Please enter the insurance expiry date:


Sticker application submitted successfully.
```

Screen 6: Possible outcome 3 of Choice 1 of student menu

Screen 6: The screen starts with a notification: "Your previous application was rejected. Please fill in the information again." This indicates that the student's previous application was

not successful and they are allowed to apply again. The form fields are the same as the initial application form, asking for details about the vehicle owner, the vehicle, and other details. After filling out the form, it will be submitted and display the message "Sticker application submitted successfully."

Prepared By: Denies Wong

No record.

Screen 7: Possible outcome 1 of Choice 2 of student menu

Screen 7: This screen shows no record for students who haven't registered a vehicle sticker before.

Prepared By: Denies Wong

Vehicle Owner　　　　　: IC Number　　　　　　: Vehicle Type　　　　　: Plate Number　　　　　: Engine Number　　　　: License Number　　　　: License Expiry Date　　: Insurance Company　　: Policy Number　　　　: Insurance Expiry Date　: Registration Status　　　: processing Sticker Expiry Date　　　: registration in process

Screen 8: Possible outcome 2 of Choice 2 of student menu

Screen 8: The screen displays the details of the student's application, including information about the vehicle owner, the vehicle, and other details. Two key fields on this screen are registration status and sticker expiry date. Registration Status shows the current status of the application. If the application hasn't been handled by an administrator yet, this field will display "processing". Sticker Expiry Date shows the expiry date of the vehicle sticker. If the application is still being processed, this field will display "registration in process".

Prepared By: Denies Wong

Vehicle Owner　　　　: IC Number　　　　　　: Vehicle Type　　　　　: Plate Number　　　　　: Engine Number　　　　: License Number　　　　: License Expiry Date　　: Insurance Company　　:

```
Policy Number         :
Insurance Expiry Date :
Registration Status   : approved
Sticker Expiry Date   : 2024-12-31
```
Screen 9: Possible outcome 3 of Choice 2 of student menu

Screen 9: The screen displays the details of the student's application, including information about the vehicle owner, the vehicle, and other details. Two key fields on this screen are registration status and sticker expiry date. Registration Status shows the current status of the application. If the application has been approved by an administrator, this field will display "approved". Sticker expiry date shows the expiry date of the vehicle sticker. If the application has been approved, this field will display the expiry date of the sticker, in this case, "2024-12-31".

Prepared By: Denies Wong

```
Vehicle Owner         :
IC Number             :
Vehicle Type          :
Plate Number          :
Engine Number         :
License Number        :
License Expiry Date   :
Insurance Company     :
Policy Number         :
Insurance Expiry Date :
Registration Status   : rejected
Reason for Rejection  : incomplete
Sticker Expiry Date   : registration is rejected
```
Screen 10: Possible outcome 4 of Choice 2 of student menu

Screen 10: The screen displays the details of the student's application, including information about the vehicle owner, the vehicle, and other details. Three key fields on this screen are registration status, reason for rejection and sticker expiry date. Registration Status shows the current status of the application. If the application has been rejected by an administrator, this field will display "rejected". Reason for Rejection provides the reason why the application was rejected. In this case, the reason given is "incomplete", suggesting that the student did not provide all the necessary information in their application. Sticker Expiry Date shows the expiry date of the vehicle sticker. If the application has been rejected, this field will display "registration is rejected".

Prepared By: Denies Wong

> No record.

Screen 11: Possible outcome 1 of Choice 3 of student menu

Screen 11: This screen shows no record for students who haven't registered a vehicle sticker before.

Prepared By: Denies Wong

> Sticker is expired. Please fill in the information again.
>
> Please enter the vehicle owner's name:
> Please enter the IC number:
> Please enter the vehicle type:
> Please enter the plate number:
> Please enter the engine number:
> Please enter the license number:
> Please enter the license expiry date:
> Please enter the insurance company:
> Please enter the policy number:
> Please enter the insurance expiry date:
>
>
> Sticker application submitted successfully.

Screen 12: Possible outcome 2 of Choice 3 of student menu

Screen 12: This is a renewal form for students whose vehicle sticker has expired and haven't renewed it yet. The screen starts with a notification: "Sticker is expired. Please fill in the information again." This indicates that the student's vehicle sticker has expired and they need to renew it.

Prepared By: Denies Wong

> Registration is processing.

Screen 13: Possible outcome 3 of Choice 3 of student menu

Screen 13: The screen displays a simple message: "Registration is processing." This indicates that the student's application is still under review by an administrator and hasn't been approved or rejected yet.

Prepared By: Denies Wong

> Sticker is not expired.

Screen 14: Possible outcome 4 of Choice 3 of student menu

Screen 14: The screen displays a simple message: "Sticker is not expired." This indicates that the student's vehicle sticker is still valid and doesn't need to be renewed at this time.

Prepared By: Denies Wong

```
== Admin Login Menu ==
Please enter your admin ID:
Please enter your password:
```

Screen 15: **Admin login menu**

Screen 15: This is the Admin Login Menu in the Vehicle Registration System. Admin enter the admin ID and Password to access the system and go to the admin menu. If the credentials don't match the system's admin records, an error message is displayed and will go back to the user menu.

Prepared By: Denies Wong

```
== Admin Menu ==
1. Handle registration
2. Logout
```

Screen 16: **Admin Menu**

Screen 3: This screen displays the Admin Menu of the Vehicle Registration System. It offers two options to the admin. The first option allows admin to handle vehicle sticker registration of students. The second option is for logging out of the system. Admin can access these features by entering the number corresponding to each option. If the admin enters a number that is not within the range of the options provided in the menu, the system will likely display an error message indicating that the input is out of range. The menu will then be displayed again.

Prepared By: Denies Wong

```
Matric Number       :
Vehicle Owner       :
IC Number           :
Vehicle Type        :
Plate Number        :
Engine Number       :
License Number      :
License Expiry Date :
Insurance Company   :
Policy Number       :
Insurance Expiry Date :
Registration Status :
Sticker Expiry Date :


1. Approve
2. Reject
Please enter your choice: 1

Registration approved.
```

Screen 17: Possible outcome 1 of Choice 1 of admin menu

Screen 17: The screen displays the details of the student's application, including information about the vehicle owner, the vehicle, and other details. The administrator is given two options which are approve and reject. If the administrator chooses to approve, the registration status will be updated to "approved", and a message "Registration approved" will be displayed.

Prepared By: Denies Wong

```
Matric Number        :
Vehicle Owner        :
IC Number            :
Vehicle Type         :
Plate Number         :
Engine Number        :
License Number       :
License Expiry Date  :
Insurance Company    :
Policy Number        :
Insurance Expiry Date :
Registration Status  :
Sticker Expiry Date  :


1. Approve
2. Reject
Please enter your choice: 2
Enter reason for rejection: incomplete

Registration rejected.
```
Screen 18: Possible outcome 2 of Choice 1 of admin menu

Screen 18: The screen displays the details of the student's application, including information about the vehicle owner, the vehicle, and other details. The administrator is given two options which are approve and reject. If the administrator chooses to reject, the administrator should provide a reason for the rejection. This helps the student understand why their application was not successful and what they can do to improve their chances of approval in the future. The registration status will be updated to "rejected", and a message "Registration rejected" will be displayed.

Prepared By: Denies Wong

```
No registrations to process.
```
Screen 19: Possible outcome 3 of Choice 1 of admin menu

Screen 19: The screen displays a simple message: "No registrations to process." This indicates that all student registrations have been handled, and there are currently no new or pending applications for the administrator to review.

Prepared By: Denies Wong

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PART 4: DEVELOPMENT ACTIVITIES

Shows every meeting conducted, meeting activity, task being assigned and whether task achieved or not.

Meeting Date	Members Participate in the meeting	Activity	Task for each member	Task Achieved (Yes/No)
8/1/2024	Liow Zhi Heng	Discuss what system we want to do Discuss what data structure needed to be applied to the system	Suggest the system	Yes
	Denies Wong Ke Ying		Suggest data structure	Yes
	Lim Xiao Xuan			Yes
10/1/2024	Liow Zhi Heng	Discuss the concept of the system design and implementation of program code Distribution of task	System analysis and design	Yes
	Denies Wong Ke Ying		System prototype and program code	Yes
	Lim Xiao Xuan		Introduction, development activities, appendix, assist in program code	Yes

PART 5: APPENDIX

1. processingQueue.txt
   - This file stores the details of student registrations that have not yet been handled by an administrator. It serves as a queue for pending applications, allowing administrators to review and process them in an organized manner.

2. registrationFile.txt
   - This file stores all registration records, including those that have been handled (approved or rejected) by an administrator. It serves as a comprehensive record of all vehicle sticker registrations, and it's updated whenever a new registration is processed.

--- END OF DOCUMENTATION ---