NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

Declaration of Original Work for CE/CZ2002 Assignment

We hereby declare that the attached group assignment has been researched, undertaken, completed, and submitted as a collective effort by the group members listed below.

We have honored the principles of academic integrity and have upheld Student Code of Academic Conduct in the completion of this work.

We understand that if plagiarism is found in the assignment, then lower marks or no marks will be awarded for the assessed work. In addition, disciplinary actions may be taken.

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Design Considerations and Use of OO Concepts

Since **CAMs** is an application that allows the storage of data to and from text files, a pseudo database would be used that would load and store data back to the text files, through serialization and deserialization of object data. Hence, the database forms the core of the program, and the database should be easily extendable and closed for modification. Also, since there are limitless operations that a camp can do, patterns such as the **Strategy Pattern** must be used, to fully utilize the benefits of polymorphism.

CAMs must also be written to fully maximize **dependency injection**, by working through interfaces and abstract classes as far as possible to increase extensibility and maintainability. Also, to ensure the code is as loosely coupled as possible, as many classes as possible should follow the **Single Responsibility Principle** such that an entity class is not taking on too many functions.

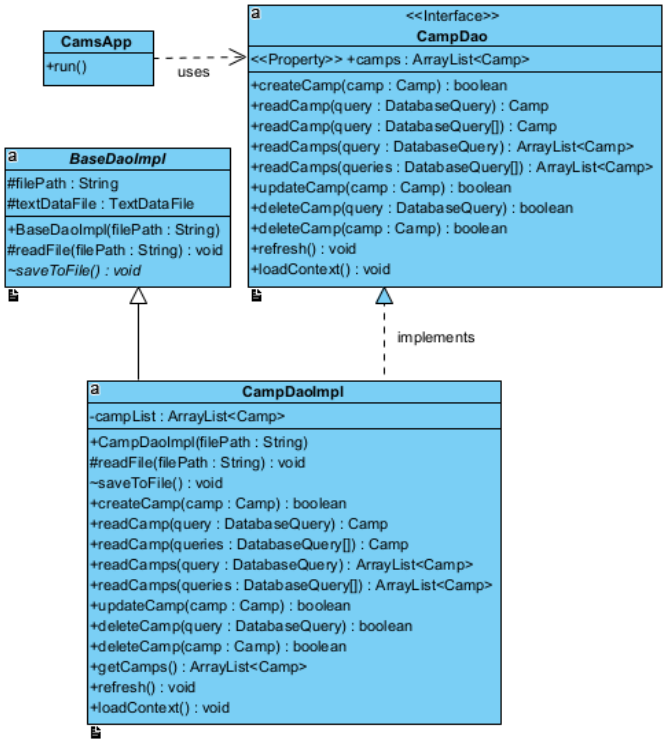
Hence, we have written CAMs to adhere to the SOLID principles as much as possible. For example, an important controller class works through abstractions and interfaces, following the **Dependency Injection Principle** and **Open Closed Principle.** The code is as follows (CampManager):

```
/**
* A function to use a particular camp service
*
* @param campOperations camp operation to use
*/
public boolean operate(CampOperations campOperations) {
   return campOperations.execute();
}
```

Hence, the operations that our camp manager can do to camps is easily extensible by creating a new class for each operation, reducing the coupling of classes and allowing easy extension, while ensuring the CampManager works through abstractions and interfaces. This is a key part of any manager, as not doing this would cause a lot of code to be in that file, creating a giant class.

Furthermore, the CampManager class does not need to know the operations it is performing, and any changes to any operations that are created would not affect the CampManager class. This method is also known as the **Strategy Pattern**. This pattern is also used for the filtering and sorting methods to sort camps, which can be found in a subfolder called "diagrams/".

Another key principle used was the usage of **Data Access Object Pattern** to handle enquiries to our database.



This provides an abstract interface to our database, which is a persistence mechanism. Since we map database calls to the persistence layer, the Data Access Object (DAO) provides data implementations without exposing the database details, and can refine those database details. This supports the **Single Responsibility Principle** as well. Also, since the DAO layer is written according to the typical **CRUD (Create, Read, Update, Delete)** operations, the database layer is easy to use and allows convenience. More specifically, any updates to our database would only use the **CampDao**, while the **CampDaoImpl** provides the implementation for that interface.

Finally, we adopted a **Model-view-ViewModel (MVVM) architecture**, such that the display of the user interface is separated from the application logic as much as possible. Hence, all our views are not dependent on any specific model, and all logic is separated, allowing lesser coupling between our application logic instead of messy switch statements throughout the program. The swapping between views is done through a ViewManager, which does the state handling and abstracts away all the messy handling of states.

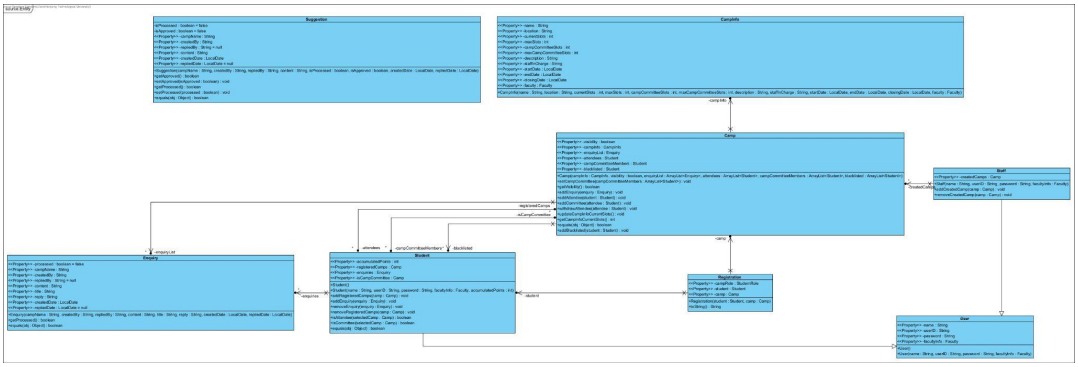
```
/**
* Changes the current view to the new view. Calls cleanup on the current view
and initialises the new view
*
* @param newView the new view model to be run
*/
public void changeView(IViewModel newView) {
   if (newView == null)
       return;

   //Cleanup current view
   currentView.cleanup();
   //Add current view into the stack
   viewModelStack.push(currentView);
   //Update with new view
   currentView = newView;
   //Initialize the new view
   currentView.init(this);
}
```

However, although we have added potential support for other types of files, our database mainly revolves around the handling of text data, which can be a concern for the future. We assume that the main form of the database would be in the csv format.

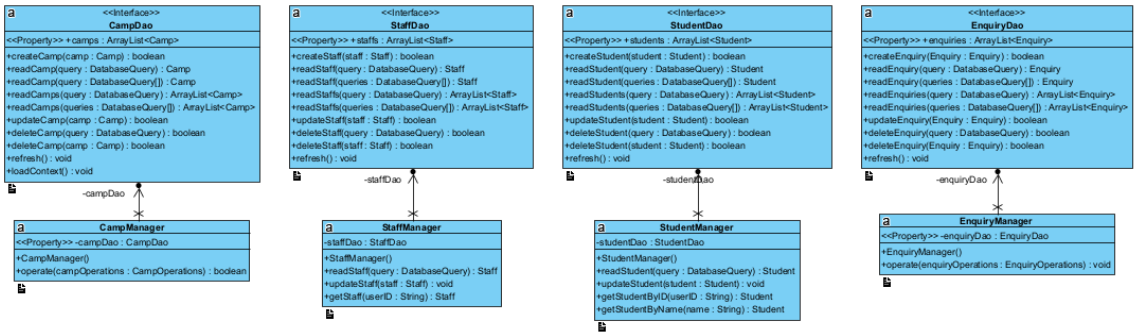
UML Diagrams

NOTE: Due to page limit on document, refer to diagrams in report/diagrams/

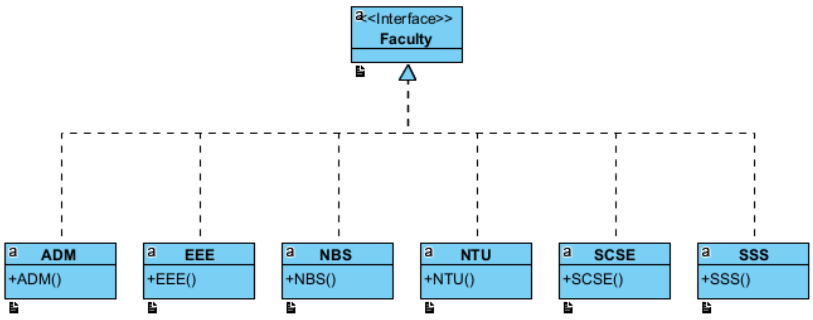
1. **Class Diagram - Entity classes**
    - These are the entity classes and their relationships, they control logic of the main flow such as suggestions, enquiries and camps storage of students and staff. All explanations of entity classes and their usages are in **Design Considerations**



2. **Class Diagrams - Camp Manager/Staff Manager/Student Manager/Enquiry Manager**
    - These classes interact with the data access object and provides additional functions related to the database through the abstraction layer. There is a data access object for each type.

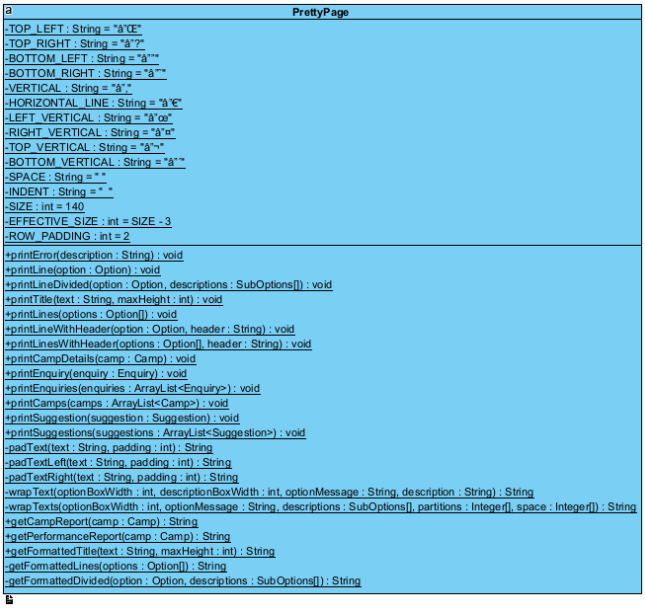


3. **Class Diagram - Faculty**
    - A simple interface for future extension of faculty functions, to show **Open Closed Principle**



4. Class Diagram - “PrettyPage” Command-line GUI

- A static utility class that handles printing of GUI with dynamic console sizes and printing of lists with headers



Test Cases and Results

For our testing strategy, the team equally conducts black box testing and updates a separate document for our test cases and results. The team does testing on the parts that they do not know the implementation about, and updates each other about any discrepancies in output as we navigate through the application. An excerpt is found below on the login feature of CAMs:

Test Case 1: Login Feature of CAMs (Black Box Testing)

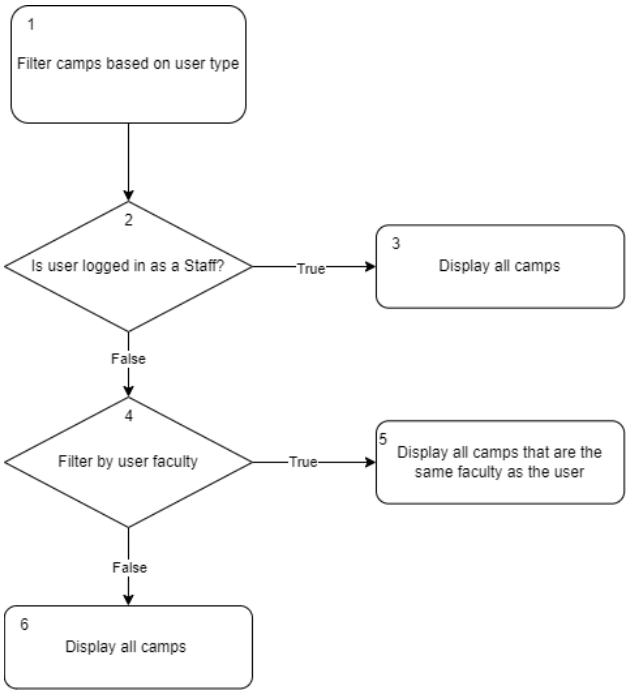
Test Input (Valid Input)		**Expected Output**	**Actual Output**
email	**password**		
FANGKAI@e.ntu.edu.sg	password	User needs to change password	User needs to change password
FANGKAI@e.ntu.edu.sg	Fangkai123!	User successfully login	User successfully login
Test Input (Invalid Input)		**Expected Output**	**Actual Output**
email	**password**		
N/A	Fangkai123!	Show email cannot be blank	Show email cannot be blank
FANGKAI	Fangkai123!	Show invalid ntu email input	Show invalid ntu email input
FANGKAI@hotmail.com	Fangkai123!	Show invalid ntu email input	Show invalid ntu email input
FANGKAI@e.ntu.edu.sg	N/A	Show password cannot be blank	Show password cannot be blank

Test Case 1: Results in CAMS (Valid Test Case Results)

Test Case 1: Results in CAMS (Invalid Test Case Results)

Test Case 2: Filtering of Camps (White Box Testing)

Secondly, white box testing was also done to ensure correctness of the code and that it produces the expected result. An excerpt of a diagram and table below shows the white box testing for filtering camps based on faculty. This is part of the feature where students are not able to see camps outside of their faculty.

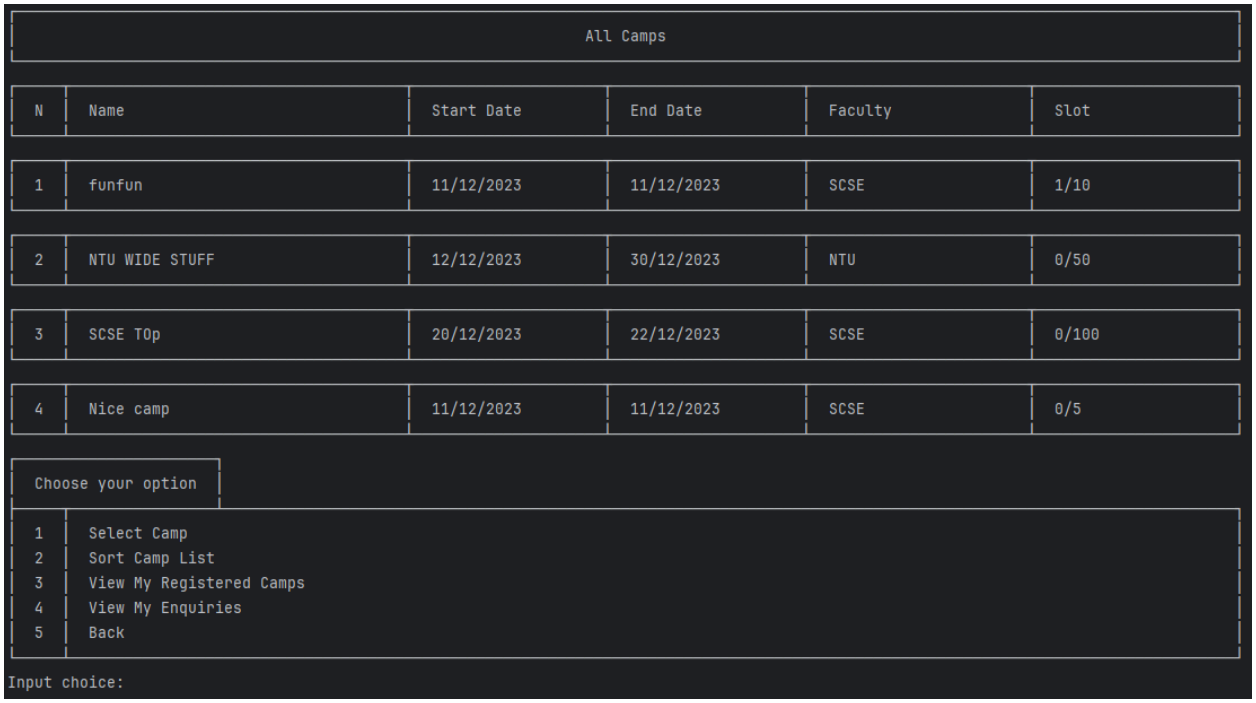


Cyclomatic Complexity = 2 decision points + 1 = 3 basic paths to test

Test ID	Basis Path	Input after logging in		Expected Output	Actual Output
		isUserStaff?	Filter		
1	1,2,3	True	N/A	All the camps in the system are shown	All the camps in the system are shown
2	1,2,4,5	False	True	Displays the camps that are in the same faculty as the user and the global camps	Displays the camps that are in the same faculty as the user and the global camps.
3	1,2,4,6	False	False	A student can see all the camps (although this is not intended!)	A student can see all the camps (although this is not intended!)

Test Case 2: Results in CAMS (Filtering when logged in as Student)

Note: Students can only see camps in his own faculty or in NTU. The logged in student is in the SCSE faculty.



All Camps

N	Name	Start Date	End Date	Faculty	Slot
1	funfun	11/12/2023	11/12/2023	SCSE	1/10
2	NTU WIDE STUFF	12/12/2023	30/12/2023	NTU	0/50
3	SCSE TOp	20/12/2023	22/12/2023	SCSE	0/100
4	Nice camp	11/12/2023	11/12/2023	SCSE	0/5

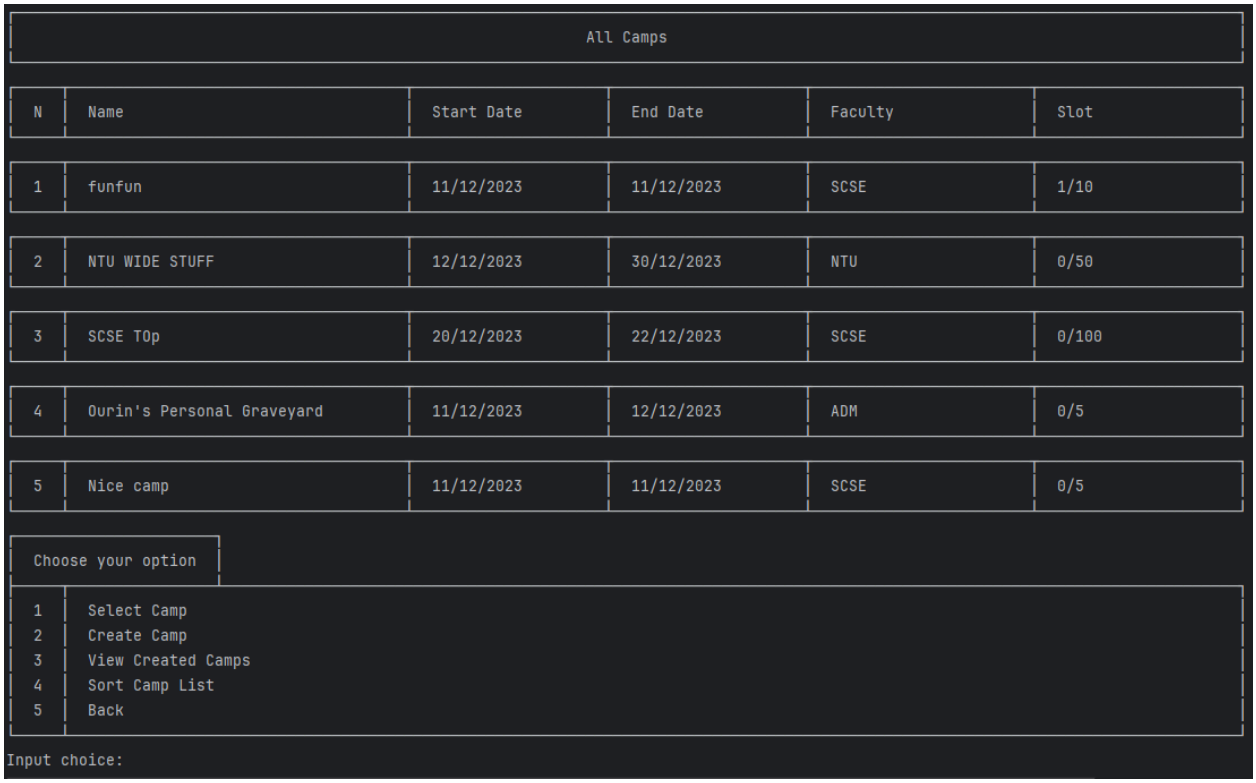
Choose your option

1	Select Camp
2	Sort Camp List
3	View My Registered Camps
4	View My Enquiries
5	Back

Input choice:

Test Case 2: Results in CAMS (Filtering when logged in as Staff)

Note: Staff can see every camp, so we can see a new camp at entry 4



All Camps

N	Name	Start Date	End Date	Faculty	Slot
1	funfun	11/12/2023	11/12/2023	SCSE	1/10
2	NTU WIDE STUFF	12/12/2023	30/12/2023	NTU	0/50
3	SCSE TOp	20/12/2023	22/12/2023	SCSE	0/100
4	Ourin's Personal Graveyard	11/12/2023	12/12/2023	ADM	0/5
5	Nice camp	11/12/2023	11/12/2023	SCSE	0/5

Choose your option

1	Select Camp
2	Create Camp
3	View Created Camps
4	Sort Camp List
5	Back

Input choice:

Reflections

In hindsight, maintaining clean and maintainable code was an iterative process. As the complexity of the application increases, it becomes harder to ensure a clean code base. Working on a single application as a team can be a rewarding but a challenging experience. In the early stages of developments, we failed to discuss the overall system design and architecture we want to achieve for **CAMs**. This coordination issue snowballed and without a shared understanding of the overall application flow, each of us started adopting different development approaches. On top of that, our team was prioritizing quick solutions over long term considerations when writing code, this resulted in increased difficulty when we had to implement new features in the later stage. Even though this was largely resolved in the later stages, the time taken to refactor architecture could have been spent on building the system architecture.

Also, it was hard to realize **SOLID principles**, always leading to doubts about what would be the best way to implement a particular piece of the application. However, using the knowledge and examples from the lecture slides, the team now has a better grasp on how to better apply SOLID principles and create maintainable and extensible code.

For the future, ensuring that everyone is on the same page on the system architecture would be greatly helpful in reducing downtime.

Appendix I: Declaration on Use of GAI (Generative Artificial Intelligence) Assistance in relation to Assignment/Project (to be submitted individually even for group projects)

I Pan Haolun (student name),
HPAN004@e.ntu.edu.sg (NTU email) honestly and sincerely make the following declaration in relation to the following course submission:

1. Name of course: Object Oriented Des&Prog
2. Course Code: SC2002
3. Instructor: Jiao FangKai
4. Title of Assignment/Project Submission: Camp Application and Management Systems (CAMs)

In relation to the foregoing I hereby declare that, fully and properly in accordance with the Assignment/Project Instructions I have (check where appropriate):

i. Used GAI as permitted to assist in generating key ideas only. ☐

ii. Used GAI as permitted to assist in generating a first text only. ☐

And/or

iii. Used GAI to refine syntax and grammar for correct language submission only. ☐

Or

iv. As it is not permitted: Not used GAI assistance in any way in the development or generation of this assignment or project. ☑

I also declare that I have :

a. Fully and honestly submitted the digital paper trail required under the assignment/project instructions; and that
b. Wherever GAI assistance has been employed in the submission in word or paraphrase or inclusion of a significant idea or fact suggested by the GAI assistant, I have acknowledged this by a footnote; and that,
c. Apart from the foregoing notices, the submission is wholly my own work.

Pan Haolun 

Student Name & Signature

26/11/2023

Date

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I J'sen Ong Jia Xuan (student name),
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1. Name of course: Object Oriented Des&Prog
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J'sen Ong Jia Xuan 
Student Name & Signature

26/11/2023
Date

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Ho Jian Feng 26/11/2023

Student Name & Signature Date

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I Isaac Chun Jun Heng (student name),
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Isaac Chun Jun Heng Isaac

Student Name & Signature

26/11/2023

Date

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I Edwin Lim Hong Wee (student name),
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2. Course Code: SC2002
3. Instructor: Jiao FangKai
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Edwin Lim Hong Wee  26/11/2023

Student Name & Signature Date