SC2002 OBJECT ORIENTED DESIGN & PROGRAMMING

CAMP APPLICATION AND MANAGEMENT SYSTEM

Report of Project Structure Design & Functionality

AY23/24 Sem 1 | SCEC, Group 3

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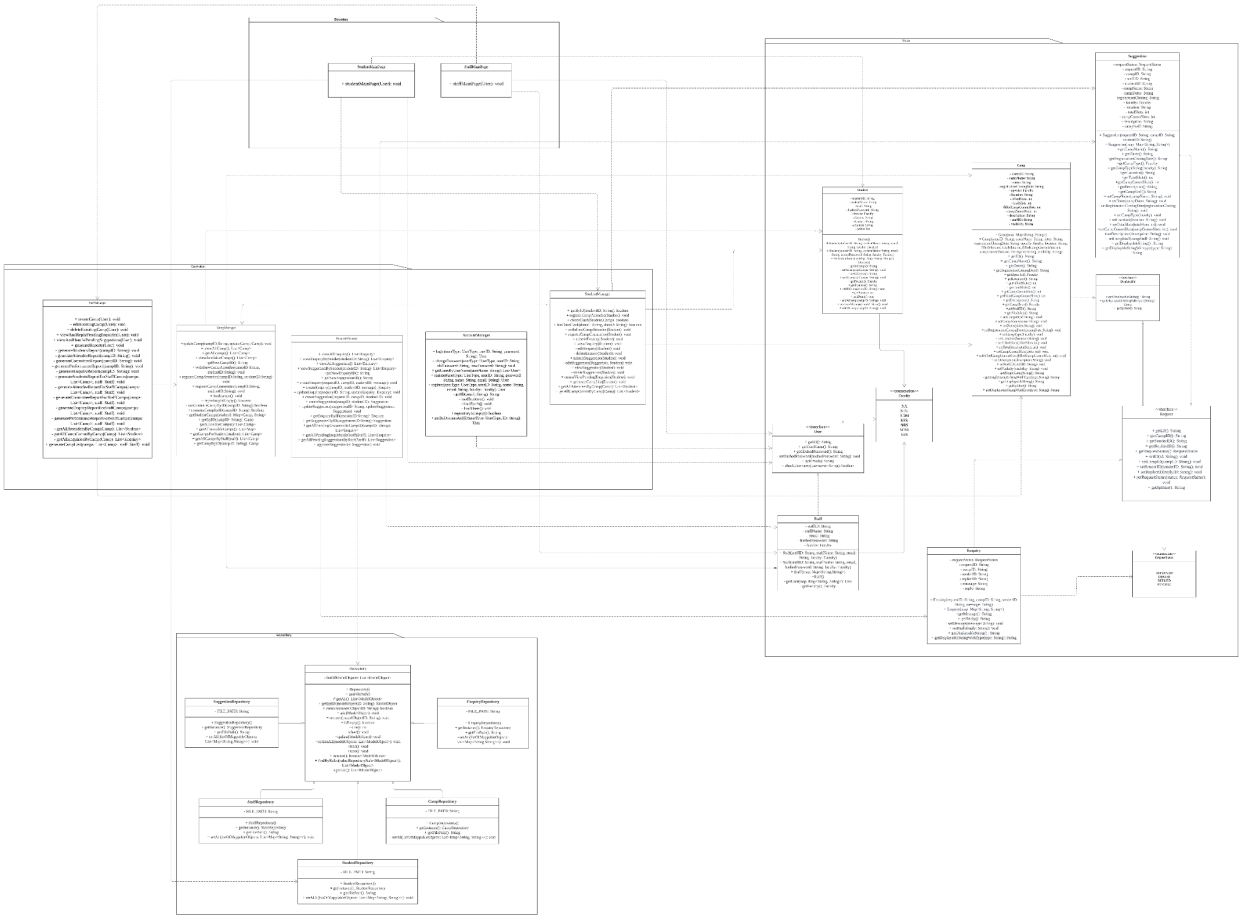
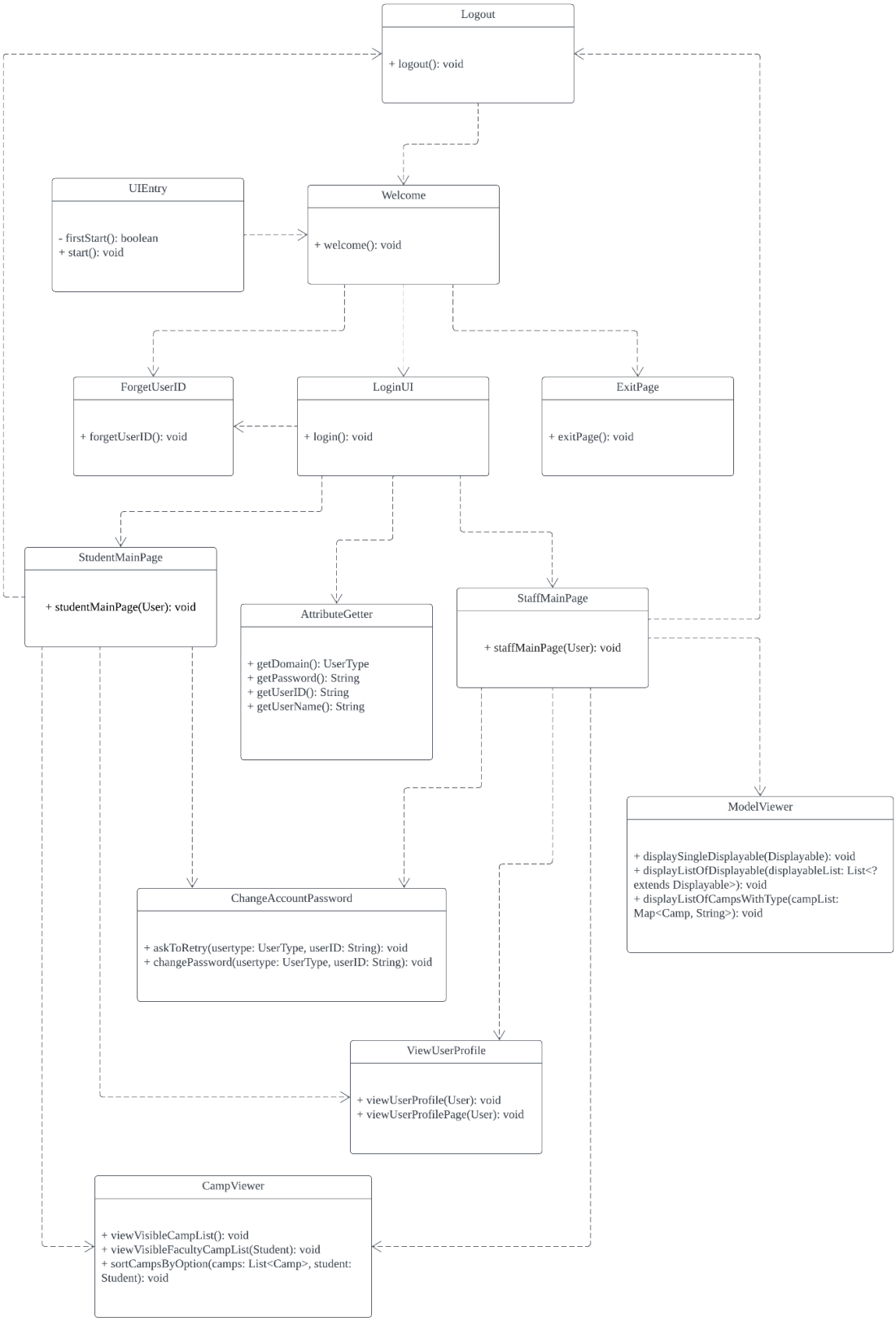
1 UML CLASS DIAGRAM

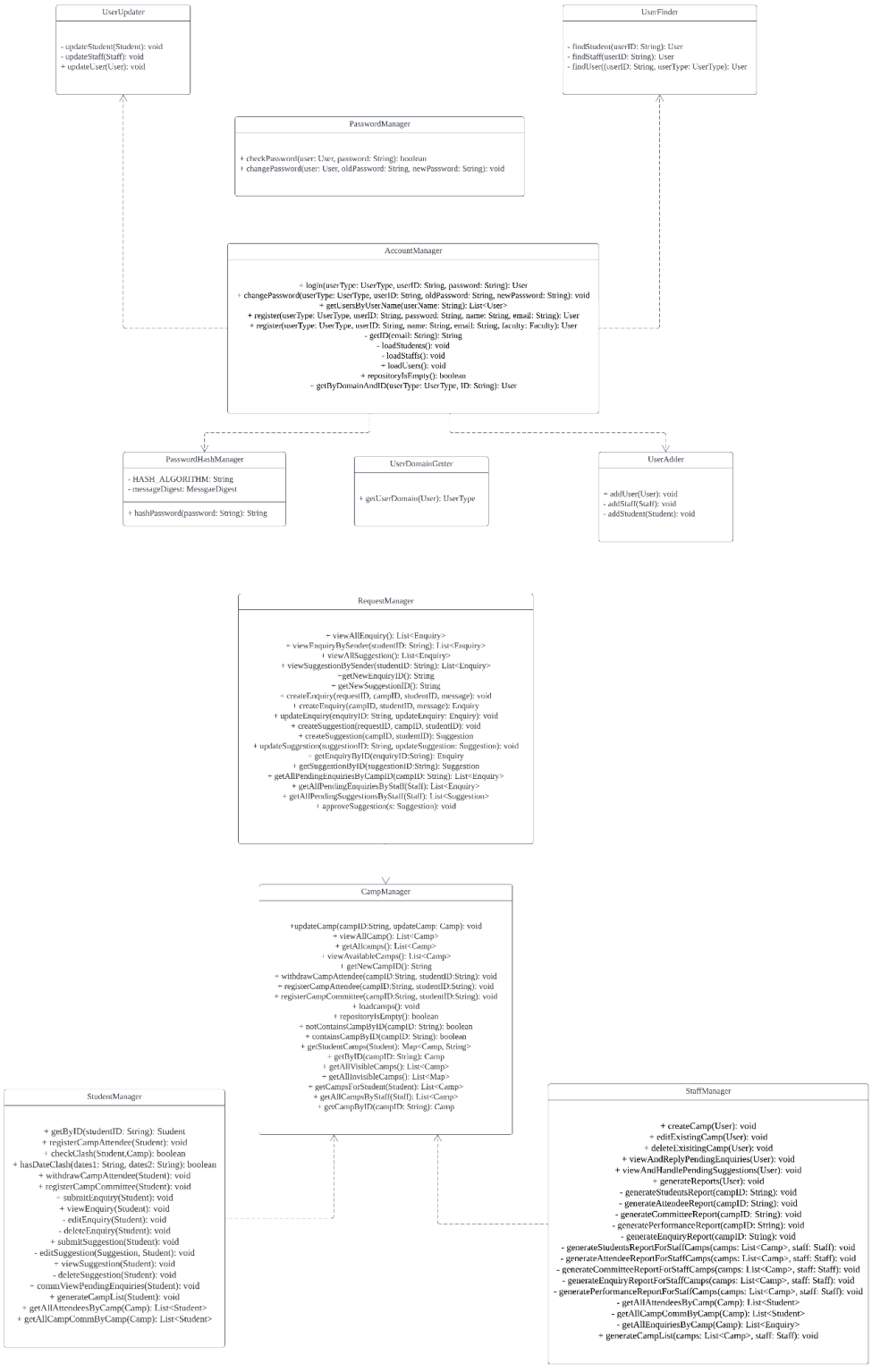
Higher resolution diagrams can be found in project directory/documentation/UML_diagrams/



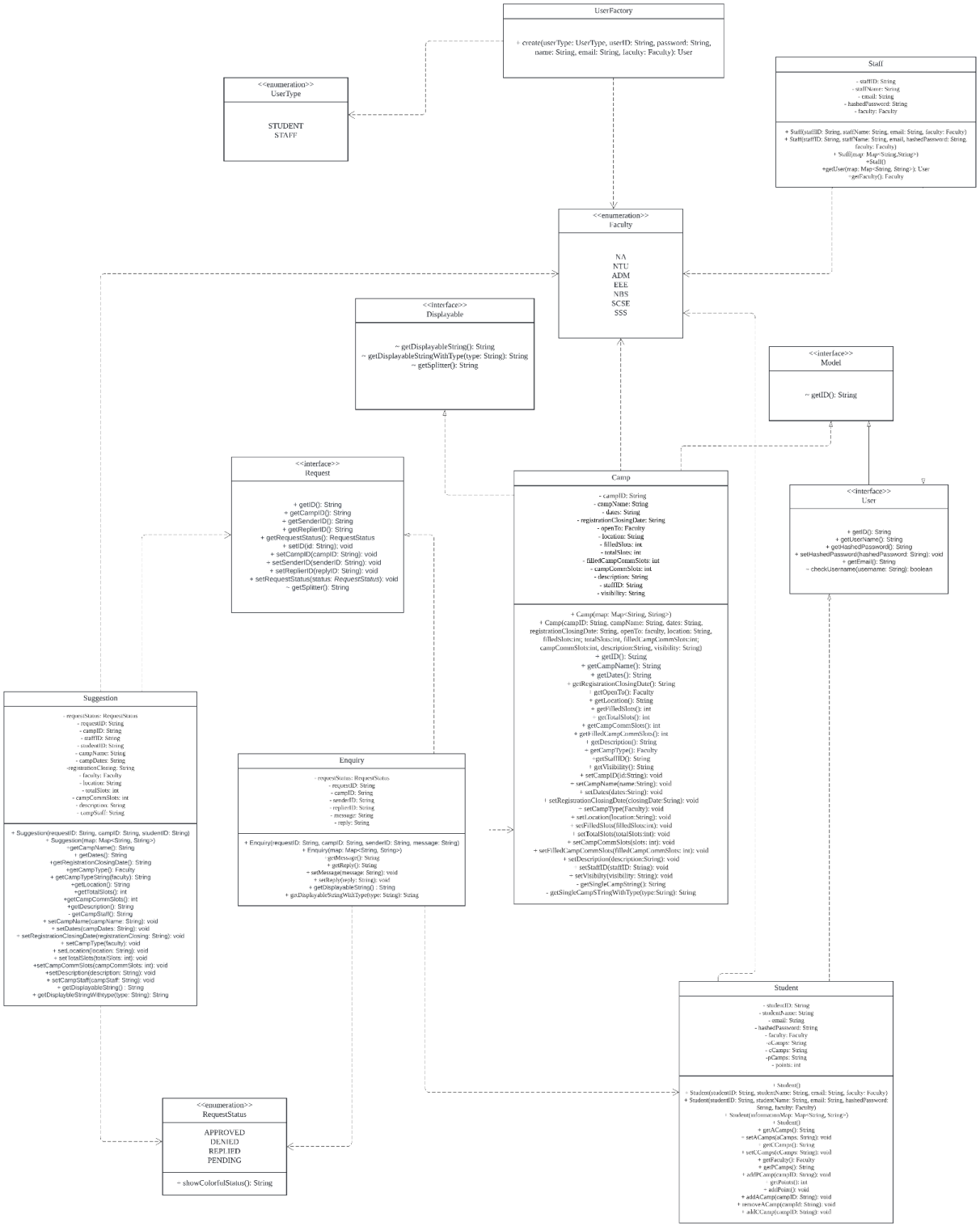
1.1 BOUNDARY


Logout
+ logout(): void
UIEntry
- firstStart(): boolean
+ start(): void
Welcome
+ welcome(): void
ForgetUserID
+ forgetUserID(): void
LoginUI
+ login(): void
ExitPage
+ exitPage(): void
StudentMainPage
+ studentMainPage(User): void
AttributeGetter
+ getDomain(): UserType
+ getPassword(): String
+ getUserID(): String
+ getUserName(): String
StaffMainPage
+ staffMainPage(User): void
ModelViewer
+ displaySingleDisplayable(Displayable): void
+ displayListOfDisplayable(displayableList: List<? extends Displayable>): void
+ displayListOfCampsWithType(campList: Map<Camp, String>): void
ChangeAccountPassword
+ askToRetry(usertype: UserType, userID: String): void
+ changePassword(usertype: UserType, userID: String): void
ViewUserProfile
+ viewUserProfile(User): void
+ viewUserProfilePage(User): void
CampViewer
+ viewVisibleCampList(): void
+ viewVisibleFacultyCampList(Student): void
+ sortCampsByOption(camps: List<Camp>, student: Student): void

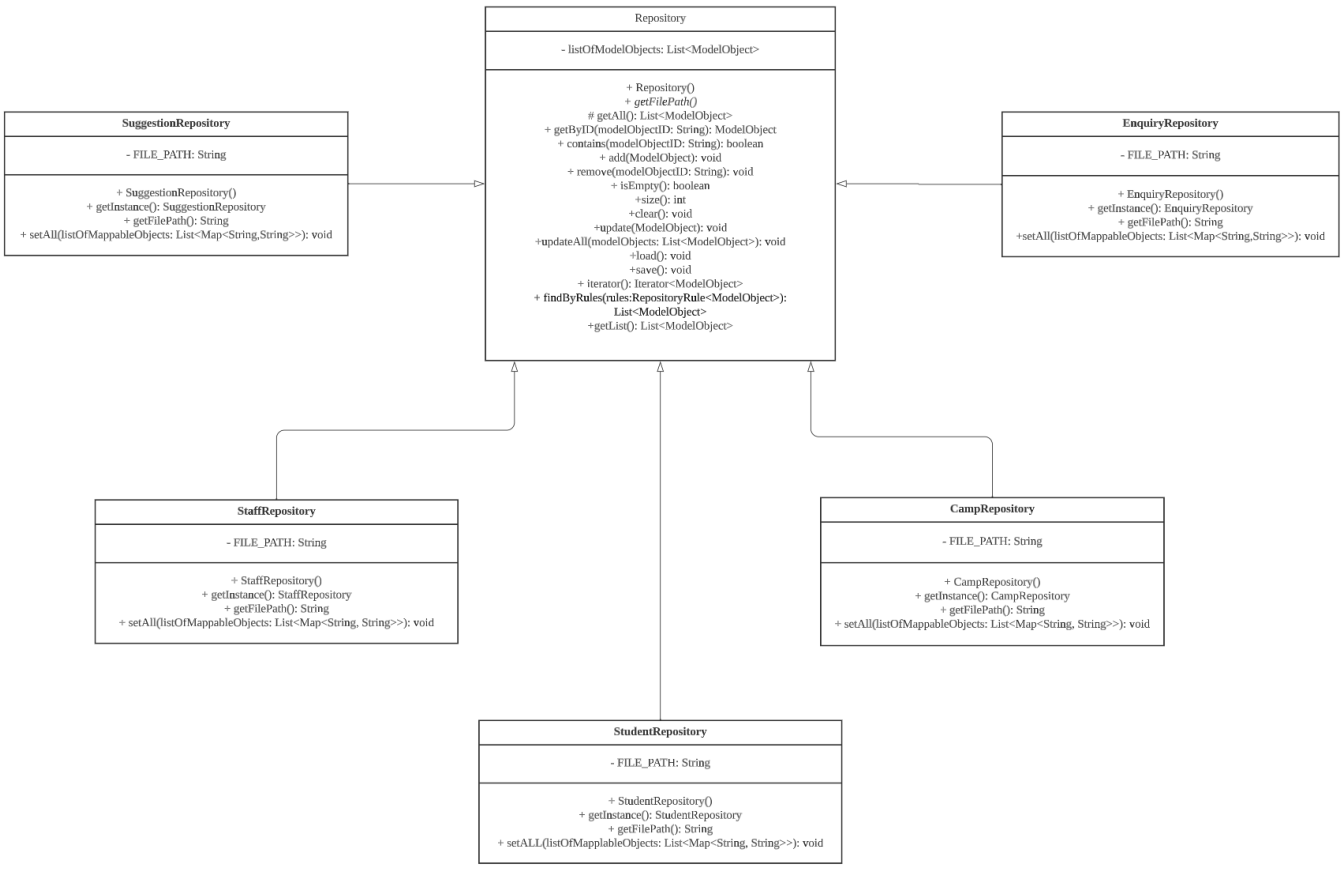
1.2 CONTROLLER



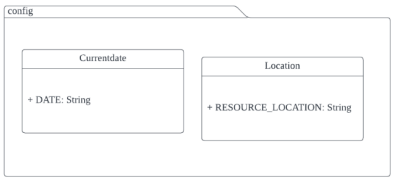
1.3 MODEL

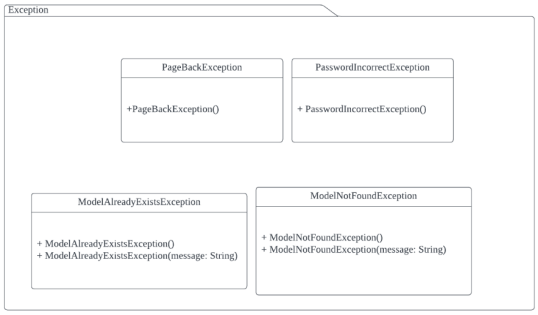

UserFactory
+ create(userType: UserType, userID: String, password: String, name: String, email: String, faculty: Faculty): User
<<enumeration>>
UserType
STUDENT
STAFF
Staff
- staffID: String
- staffName: String
- email: String
- hashedPassword: String
- faculty: Faculty
+ Staff(staffID: String, staffName: String, email: String, faculty: Faculty)
+ Staff(staffID: String, staffName: String, email, hashedPassword: String, faculty: Faculty)
+ Staff(map: Map<String,String>)
+Staff()
+getUser(map: Map<String, String>): User
+getFaculty(): Faculty
<<enumeration>>
Faculty
NA
NTU
ADM
EEE
NBS
SCSE
SSS
<<interface>>
Displayable
~ getDisplayableString(): String
~ getDisplayableStringWithType(type: String): String
~ getSplitter(): String
<<interface>>
Model
~ getID(): String
<<interface>>
Request
+ getID(): String
+ getCampID(): String
+ getSenderID(): String
+ getReplierID(): String
+ getRequestStatus(): RequestStatus
+ setID(id: String): void
+ setCampID(campID: String): void
+ setSenderID(senderID: String): void
+ setReplierID(replyID: String): void
+ setRequestStatus(status: RequestStatus): void
~ getSplitter(): String
Camp
- campID: String
- campName: String
- dates: String
- registrationClosingDate: String
- openTo: Faculty
- location: String
- filledSlots: int
- totalSlots: int
- filledCampCommSlots: int
- campCommSlots: int
- description: String
- staffID: String
- visibility: String
+ Camp(map: Map<String, String>)
+ Camp(campID: String, campName: String, dates: String, registrationClosingDate: String, openTo: faculty, location: String, filledSlots:int, totalSlots:int, filledCampCommSlots:int, campCommSlots:int, description:String, visibility: String)
~ getID(): String
+ getCampName(): String
+ getDates(): String
+ getRegistrationClosingDate(): String
+ getOpenTo(): Faculty
+ getLocation(): String
+ getFilledSlots(): int
+ getTotalSlots(): int
+ getCampCommSlots(): int
+ getFilledCampCommSlots(): int
+ getDescription(): String
+ getCampType(): Faculty
+getStaffID(): String
+ getVisibility(): String
+ setCampID(id:String): void
~ setCampName(name:String): void
+ setDates(dates:String): void
+ setRegistrationClosingDate(closingDate:String): void
~ setCampType(Faculty): void
+ setLocation(location:String): void
+ setFilledSlots(filledSlots:int): void
+ setTotalSlots(totalSlots:int): void
+ setCampCommSlots(slots: int): void
+ setFilledCampCommSlots(filledCampCommSlots: int): void
+ setDescription(description:String): void
setStaffID(staffID: String): void
~ setVisibility(visibility: String): void
- getSingleCampString(): String
- getSingleCampSTringWithType(type:String): String
<<interface>>
User
+ getID(): String
+ getUserName(): String
+ getHashedPassword(): String
+ setHashedPassword(hashedPassword: String): void
+ getEmail(): String
~ checkUsername(username: String): boolean
Suggestion
- requestStatus: RequestStatus
- requestID: String
- campID: String
- staffID: String
- studentID: String
- campName: String
- campDates: String
-registrationClosing: String
- faculty: Faculty
- location: String
- totalSlots: int
- campCommSlots: int
- description: String
- campStaff: String
+ Suggestion(requestID: String, campID: String, studentID: String)
+ Suggestion(map: Map<String, String>)
+getCampName(): String
+ getDates(): String
+getRegistrationClosingDate(): String
+getCampType(): Faculty
+ getCampTypeString(faculty): String
+getLocation(): String
+getTotalSlots(): int
+getCampCommSlots(): int
+getDescription(): String
+ getCampStaff(): String
+ setCampName(campName: String): void
+ setDates(campDates: String): void
+ setRegistrationClosingDate(registrationClosing: String): void
+ setCampType(faculty): void
+ setLocation(location: String): void
+ setTotalSlots(totalSlots: int): void
+setCampCommSlots(campCommSlots: int): void
+setDescription(description: String): void
+ setCampStaff(campStaff: String): void
+ getDisplayableString() : String
+ getDisplayableStringWithtype(type: String): String
Enquiry
- requestStatus: RequestStatus
- requestID: String
- campID: String
- senderID: String
- replierID: String
- message: String
- reply: String
+ Enquiry(requestID: String, campID: String, senderID: String, message: String)
+ Enquiry(map: Map<String, String>)
getMessage(): String
+ getReply(): String
+ setMessage(message: String): void
+ setReply(reply: String): void
+ getDisplayableString() : String
+ getDisplayableStringWithType(type: String): String
Student
- studentID: String
- studentName: String
- email: String
- hashedPassword: String
- faculty: Faculty
-oCamps: String
- cCamps: String
-pCamps: String
- points: int
+ Student()
+ Student(studentID: String, studentName: String, email: String, faculty: Faculty)
+ Student(studentID: String, studentName: String, email: String, hashedPassword: String, faculty: Faculty)
+ Student(informationMap: Map<String, String>)
+ Student()
+ getACamps(): String
~ setACamps(aCamps: String): void
getCCamps(): String
+ setCCamps(cCamps: String): void
+ getFaculty(): Faculty
+ getPCamps(): String
+ addPCamp(campID: String): void
getPoints(): int
~ addPoint(): void
+ addACamp(campID: String): void
+ removeACamp(campId: String): void
+ addCCamp(campID: String): void
<<enumeration>>
RequestStatus
APPROVED
DENIED
REPLIED
PENDING
~ showColorfulStatus(): String

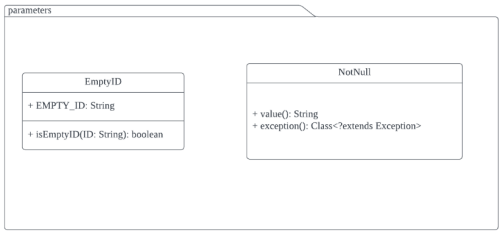
1.4 REPOSITORY

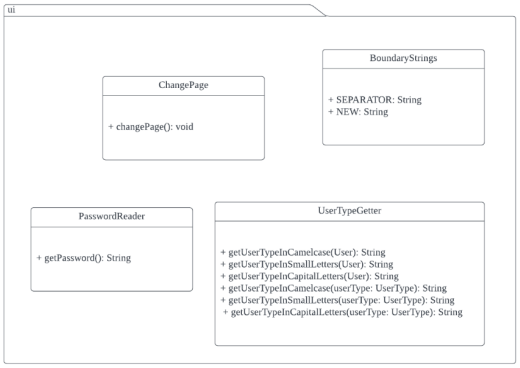


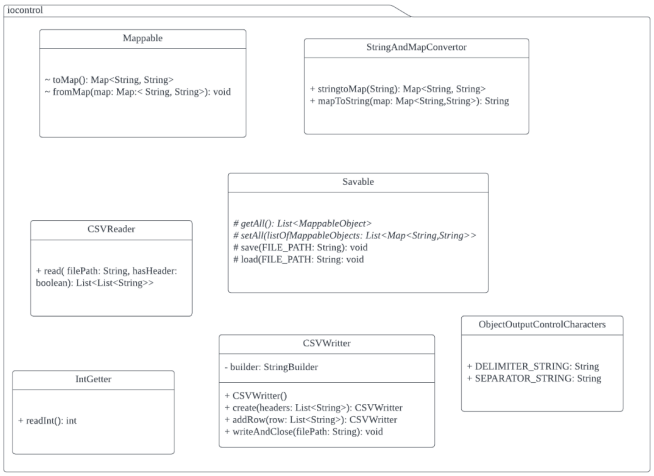
1.5 UTILS


config
Currentdate
+ DATE: String
Location
+ RESOURCE_LOCATION: String


Exception
PageBackException
+PageBackException()
PasswordIncorrectException
+ PasswordIncorrectException()
ModelAlreadyExistsException
+ ModelAlreadyExistsException()
+ ModelAlreadyExistsException(message: String)
ModelNotFoundException
+ ModelNotFoundException()
+ ModelNotFoundException(message: String)


parameters
EmptyID
+ EMPTY_ID: String
+ isEmptyID(ID: String): boolean
NotNull
+ value(): String
+ exception(): Class<?extends Exception>


ui
ChangePage
+ changePage(): void
BoundaryStrings
+ SEPARATOR: String
+ NEW: String
PasswordReader
+ getPassword(): String
UserTypeGetter
+ getUserTypeInCamelcase(User): String
+ getUserTypeInSmallLetters(User): String
+ getUserTypeInCapitalLetters(User): String
+ getUserTypeInCamelcase(userType: UserType): String
+ getUserTypeInSmallLetters(userType: UserType): String
+ getUserTypeInCapitalLetters(userType: UserType): String


iocontrol
Mappable
~ toMap(): Map<String, String>
~ fromMap(map: Map:< String, String>): void
StringAndMapConvertor
+ stringtoMap(String): Map<String, String>
+ mapToString(map: Map<String,String>): String
Savable
getAll(): List<MappableObject>
setAll(listOfMappableObjects: List<Map<String,String>>
save(FILE_PATH: String): void
load(FILE_PATH: String: void
CSVReader
+ read(filePath: String, hasHeader: boolean): List<List<String>>
CSVWritter
- builder: StringBuilder
+ CSVWritter()
+ create(headers: List<String>): CSVWritter
+ addRow(row: List<String>): CSVWritter
+ writeAndClose(filePath: String): void
ObjectOutputControlCharacters
+ DELIMITER_STRING: String
+ SEPARATOR_STRING: String
IntGetter
+ readInt(): int

2 DESIGN CONSIDERATIONS

Camp Application and Management System (CAMS) is a Java console application designed with reusability, extensibility and maintainability in mind. It manages camps and tailors to the specific requirements of different types of users, allowing future developments to be easier.

2.1 DESIGN APPROACH

Our design of CAMS focuses on high cohesion and loose coupling. The classes are separated mainly into three categories, controllers, boundaries and entities.

Controllers include all the manager classes, including *CampManager, StudentManager, StaffManager, RequestManager.* Boundaries include main page classes like *StudentMainPage* and *StaffMainPage.* Entities include classes under the model folder like *Camp, Enquiry, Suggestion, Staff, Student.*

When a user uses the application, he/she interacts with the boundaries(main pages) which calls the controllers(managers) to perform requested operations such as creating, editing, deleting entities or to retrieve information from an entity to be displayed. The three categories work together to run the application, while also minimising the dependency on one another. Introducing new features and functionality will be easy since the system is extendable and modifying class files will not create ‘snowball’ effects. Hence, our system is flexible to modify, extend and easy to maintain.

2.2 APPLIED DESIGN PRINCIPLE

2.2.1 SINGLE RESPONSIBILITY PRINCIPLE (SRP)

Single Responsibility Principle (SRP) states that each class should have a single and clear responsibility, without being coupled to another responsibility. By adhering to SRP, we can minimise the ‘snowball’ effect of changes in each class, hence we streamline the process of modifying, testing and reusing code, leading to more maintainable software.

In our design of CAMS, our main pages of the application, such as *StaffMainPage* and *StudentMainPage* have the singular responsibility of displaying the main page of each user and none of the methods are defined in those classes. Hence modifying code in those classes will not lead to the ‘snowball’ effect.

2.2.2 OPEN/CLOSED PRINCIPLE (OCP)

Open/Closed Principle (OCP) states “A module should be open for extension but closed for modification”. We should be able to add new functionality to classes, without changing the existing code of the classes. This can be implemented by abstraction, inheritance and polymorphism.

In our design of CAMS, we adopt the OCP by creating an abstract class *Repository* that can be extended to create different types of Repositories such as *ProjectRepository, CampRepository, SuggestionRepository.* Each subclass overrides *getFilePath()* method in the superclass which allows for easy extension of the Repository abstract class.

We also adopted OCP in the case of requests in our system (Figure 1), specifically for enquiries and suggestions. Firstly, we created an interface *Request* to be implemented in the classes *Enquiry* and *Suggestion.* Each subclass defines the method body of the *get* methods and defines new methods related to their requirements. Hence, new types of request can be added without changing the existing code in the Request interface.

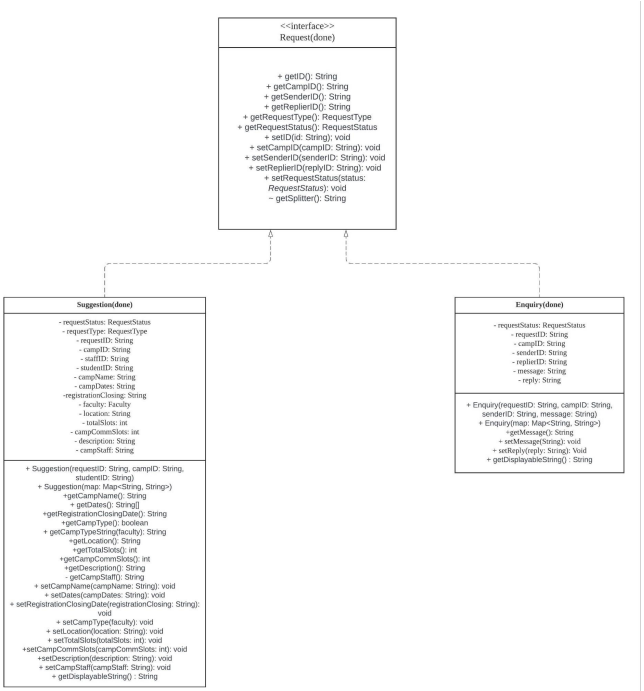


Figure 1: OCP

2.2.3 LISKOV SUBSTITUTION PRINCIPLE (LSP)

Liskov Substitution Principle (LSP), in layman terms, suggests that a derived class must be substitutable for its base class. This happens when the derived class's pre-conditions are no stronger than the base class method and its post-conditions are no weaker than the base class method.

2.2.4 INTERFACE SEGREGATION PRINCIPLE (ISP)

Interface Segregation Principle (ISP) states that "Many client specific interfaces are better than one general purpose interface". This means that classes should not depend on interfaces that they do not use, hence "fat" interfaces should be avoided.

In our design of CAMS, we further divided the interface *Model* into separate interfaces such as *User*, *Camp* and *Request* so that different entities can extend the interfaces accordingly. (Figure 2) In doing so, we ensure that entity classes do not depend on interfaces that contain methods not related to the classes, reducing the "snowball" effect when modifying our system.

We have also adopted the ISP in our design of CAMS by creating the 'Displayable' interface, which only implements the methods *getSplitter()* and *getDisplayableString()* for formatting and displaying objects. Thus, it is a very specific interface as it is not a general and 'fat' interface.

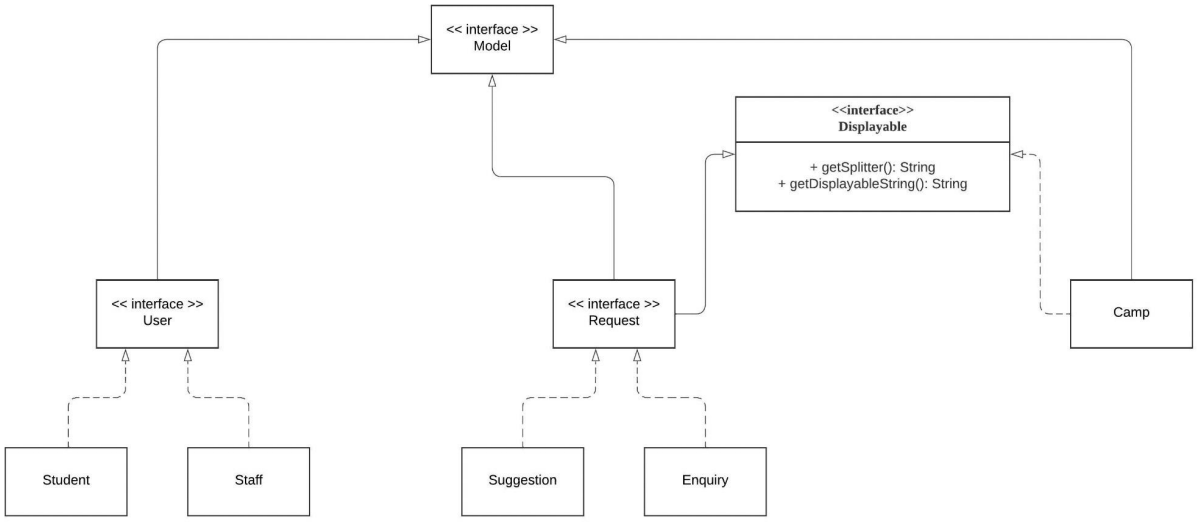


Figure 2: ISP

2.2.5 DEPENDENCY INJECTION PRINCIPLE (DIP)

Dependency Injection Principle (DIP) suggests two things. First is that high level modules should not depend upon low level modules, both should depend upon abstractions. Second is that abstractions should not depend upon details, details should depend upon abstractions.

In our design of CAMS, we focused on this principle. For example, when obtaining the ID of a student user, instead of depending on the *Student* concrete class, we depend on the <*User*> interface. This allows for further extensibility of the system as we can add more users with the least effort needed.

2.3 HIGHLIGHTS IN DESIGN

SHA-3 Password Encryption: Use of SHA-3 algorithm in encryption of user passwords.

CSV Data Import: CAMS application supports importing of CSV files for initial data, making it convenient to process large datasets.

Java Field Reflection: *Model* interface uses reflection to convert between classes and strings, enabling dynamic handling of model data without manual mapping.

Database real-time synchronisation: CAMS application allows multiple users to be logged in and run the program to CRUD(Create, Read, Update and Delete) data simultaneously.

2.4 FURTHER ENHANCEMENT

In terms of further development of our application, we have considered the situation in which a student can be both a camp committee member and a non-camp committee member. Hence we designed separate pages according to the status of a student. (Figure 3 & 4) On top of checks to prevent a non-camp committee member from accessing features of a camp committee member, we created a separate page to ensure integrity of the application.

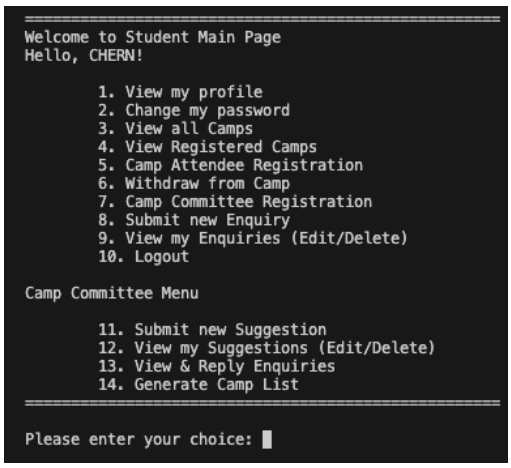


Figure 3: Camp Committee Page

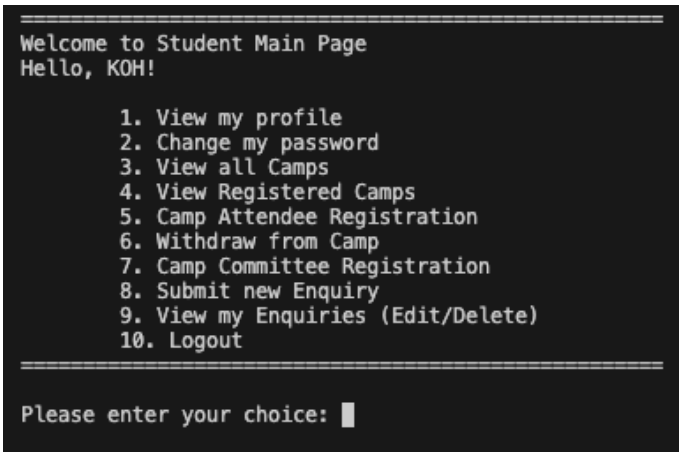


Figure 4: Non-Camp Committee Page

We have also improved the application to be more user friendly when viewing camps, including a sort by function for viewing camps. This will allow users to easily view a large number of camps by sorting the view according to parameters such as camp ID, camp name, camp dates, camp registration closing date.

3 REFLECTION

While working on this assignment, we have come to appreciate the significance of the SOLID design principles in designing real life applications. Drawing upon the concepts taught in lectures, we applied them throughout our coding process. Initially, we created a draft of the UML diagram in Visual Paradigm and used it to generate our initial code base. In the early stages of our assignment, we encountered challenges whereby every minor modification in the code for each class file would 'break' the application. Subsequently, we referenced the SOLID design principles from then on to improve the system design of our application, allowing it to be more flexible.

We also recognised that coding applications demands meticulous attention to detail. This involves thorough consideration of every possible scenario in our test cases, ensuring that there are no conflicts or overlaps among code files. Throughout the coding process, we found ourselves revisiting numerous features due to the omission of error checking when the application prompts the user for an input. This lack of attention to error checking led to frequent instances of our application 'breaking'. Hence, we have learnt that error checking is paramount in preserving the integrity of data being fed into the application.

This assignment also marked our introduction to using GitHub to coordinate our code directory. This is important because acquiring proficiency in Git is crucial as it is an essential skill needed in the industry. It has streamlined the process of deconflicting code during the coding phase of our assignment.

Ultimately, this assignment has given us the invaluable experience of working as a team to code our first Java based real-word application.

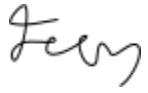
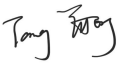
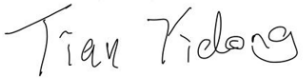
APPENDIX B:

Declaration of Original Work for SC2002 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 honoured the principles of academic integrity and have upheld the 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.

NAME	COURSE	LAB GROUP	SIGNATURE
CHOW EN YAO	SC2002	SCEC	
CUI NAN	SC2002	SCEC	
RIDHWAN HAKIM BIN KUSNI	SC2002	SCEC	
TANG YUTONG	SC2002	SCEC	
TIAN YIDONG	SC2002	SCEC	

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, **Chow En Yao** (student name), **CHOW0167@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: **Li Fang**
4. Title of Assignment/Project Submission: **SC2002 ASSIGNMENT**

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

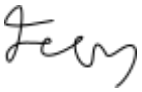
iv. As it is not permitted: Not used GAI assistance in any way in the development or generation of this assignment or project. ☑

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.

Chow En Yao  26 November 2023

Student Name & Signature **Date**

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, **Cui Nan** (student name), **c220133@e.ntu.edu.sg** (NTU email) honestly and sincerely make the following declaration in relation to the following course submission:

5. Name of course: **OBJECT ORIENTED DES & PROG**
6. Course Code: **SC2002**
7. Instructor: **Li Fang**
8. Title of Assignment/Project Submission: **SC2002 ASSIGNMENT**

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 :

c. Fully and honestly submitted the digital paper trail required under the assignment/project instructions; and that

d. 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.

CuiNan  26 November 2023

Student Name & Signature **Date**

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, **Ridhwan Hakim Bin Kusni** (student name), **RIDH0003@e.ntu.edu.sg** (NTU email) honestly and sincerely make the following declaration in relation to the following course submission:

9. Name of course: **OBJECT ORIENTED DES & PROG**
10. Course Code: **SC2002**
11. Instructor: **Li Fang**
12. Title of Assignment/Project Submission: **SC2002 ASSIGNMENT**

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 :

e. Fully and honestly submitted the digital paper trail required under the assignment/project instructions; and that

f. 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.

Ridhwan Hakim Bin Kusni  26 November 2023

Student Name & Signature **Date**

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, **Tang Yutong** (student name), **Tang0513@e.ntu.edu.sg** (NTU email) honestly and sincerely make the following declaration in relation to the following course submission:

13. Name of course: **OBJECT ORIENTED DES & PROG**
14. Course Code: **SC2002**
15. Instructor: **Li Fang**
16. Title of Assignment/Project Submission: **SC2002 ASSIGNMENT**

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 :

g. Fully and honestly submitted the digital paper trail required under the assignment/project instructions; and that

h. 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.

Tang Yutong — 26 November 2023

Student Name & Signature — **Date**

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, **Tian Yidong** (student name), **YTIAN006@e.ntu.edu.sg** (NTU email) honestly and sincerely make the following declaration in relation to the following course submission:

17. Name of course: **OBJECT ORIENTED DES & PROG**
18. Course Code: **SC2002**
19. Instructor: **Li Fang**
20. Title of Assignment/Project Submission: **SC2002 ASSIGNMENT**

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

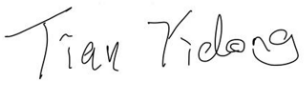
iv. As it is not permitted: Not used GAI assistance in any way in the development or generation of this assignment or project. ☑

I also declare that I have :

i. Fully and honestly submitted the digital paper trail required under the assignment/project instructions; and that

j. 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.

Tian Yidong  26 November 2023

Student Name & Signature **Date**