1. 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 honored 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 (SC2002/CE2002 CZ2002)**	**Lab Group**	**Signature / Date**
ADRIAN CHAN FENG JUN (U2422146E)	SC2002	SCE3	 18/11/2025
DARREN EE DAI EN (U2422987H)	SC2002	SCE3	 18/11/2025
LEE YONG LIANG (U2422741K)	SC2002	SCE3	 18/11/2025
NICODEMUS NOEL LEE (U2423002L)	SC2002	SCE3	 18/11/2025
RYAN LEE RUI YUAN (U2421709J)	SC2002	SCE3	 18/11/2025

Important notes:

1. Name must EXACTLY MATCH the one printed on your Matriculation Card.
2. Student Code of Academic Conduct includes the latest guidelines on the usage of Generative AI and any other guidelines as released by NTU.

2. Design Considerations / Approach

The Internship **Placement Management System**(IPMS) is a Java application designed to provide a common medium for companies, students, employers, and career center staff to efficiently manage the process of internship placements.

2.1 Design Approach

Our design for the IPMS revolves around having **loose coupling** and **high cohesion**, and our application is modelled after the **MVC**(Model-View-Control) pattern. Separating classes in this manner abides by the focus on designing with **Reusability**, **Extensibility**, and **Maintainability** in mind, allowing our software to be changed easily. When a user is using the application, they interact directly with the Boundary class, which then calls the corresponding Control classes to perform the appropriate operations and retrieves or updates data within the Entity classes.

2.3.1 Single Responsibility Principle (SRP)

According to the SRP, each class should have a **single well-defined job**, and unrelated jobs should belong in a different class. By following this principle, it enforces **cohesiveness** within the application, ensures smooth updates as **changes** will stay **localised** and will not affect existing & unrelated modules and functions, **simplifies testability** as single-purpose classes require lesser dependencies and test scenarios, and **simplifies scalability and extension**. For example, the Student class only has relevant student-specific attributes and methods, and CareerCenterStaff class mainly processes approval of internship opportunities and withdrawal requests of internship placements.

2.3.2 Open-Closed Principle (OCP)

The OCP states that classes should be **open for extension** and **closed for modification**, which means classes should be able to add new features without changing the existing code. In our application, we achieved this by defining the User class as an abstract superclass containing shared attributes and common operations and once defined, will not need future modification. The 3 concrete subclasses Student, CompanyRepresentative, and CareerCenterStaff extends User and each adds its own

attributes and its own role-specific methods. If we want to support a new user type eg. Professor, the User class does not need to be modified and a new subclass “Professor” can be created instead.

2.3.3 Liskov Substitution Principle (LSP)

According to the LSP, a subclass must be **substitutable** for its parent class **without affecting the correctness of the program**. Using the same abstract User parent class, the subclasses Student, CompanyRepresentative, and CareerCenterStaff inherit from the User class and they provide consistent implementations of the methods inherited from the User parent class. The subclasses **do not violate** any **expected behaviour** and any instance of the subclasses can be referenced as User safely without causing incorrect behaviour, thereby satisfying the LSP.

2.3.4 Interface Segregation Principle (ISP)

ISP states that classes **shouldn’t** be forced to **implement methods** that **they don’t use**. Instead of creating a large interface, separate them into **multiple**, **small**, **role-specific interfaces**. Our application uses small repository interfaces which keeps them specific, rather than implementing one large interface. By separating UserRepository, InternshipRepository and InternshipAppRepository, each controller only depends on the exact methods they need. Providing smaller interfaces like such increases clarity, reduces coupling, and prevents bloated interfaces. Hence our design aligns with the ISP.

2.3.5 Dependency Injection Principle (DIP)

DIP states that high level modules **should not depend** on **concrete implementations** and instead depend on abstractions. In our application, when a company representative approves of a student’s internship application, the **CompanyRepController** doesn’t interact directly with a concrete entity class, but rather **performs operations** through the **InternshipAppRepository interface**. Since the controller depends on an abstraction rather than a specific repository implementation, it allows the system to be loosely coupled, meaning different repository implementations can be substituted without changing the controller’s logic, thereby satisfying the DIP.

3. UML Class Diagram

The class diagrams are split into 3 sub-diagrams for easy viewing. They consist of entity classes (for storing of actual data), repository classes (for reading the CSV file), and controller classes (for implementing the logic of the application).

Refer to the Github Repository for the full diagrams.

https://github.com/rlry72/SC2002-Assignment-2025S1/tree/main/diagrams/Class%20Diagrams

4. UML Sequence Diagram

The sequence diagram models the end-to-end process for a Company Representative (CR) to review and decide on whether to approve or reject an Internship Application within the system.

The core process is shown in one comprehensive diagram (main.png).

However, due to the complexity of the main diagram, I have broken it down into six smaller, interconnected diagrams for clarity and maintainability.

Refer to the Github Repository for the full diagrams.

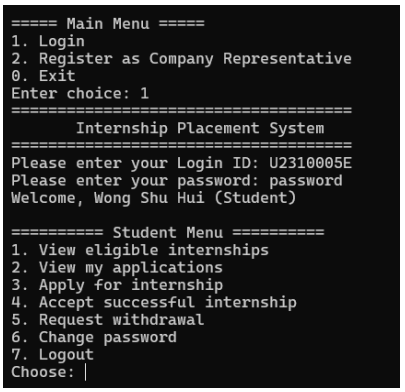
https://github.com/rlry72/SC2002-Assignment-2025S1/tree/main/diagrams/Sequence%20Diagrams

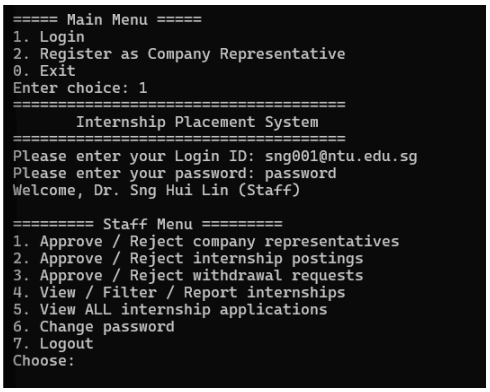
5. Test Cases and Results

5.1 Welcome Page

5.1.1 Login page

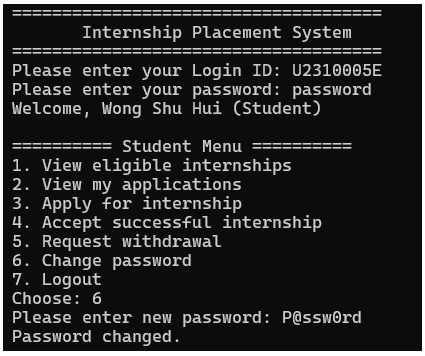
When the application is first run, there are 3 options available for choosing.





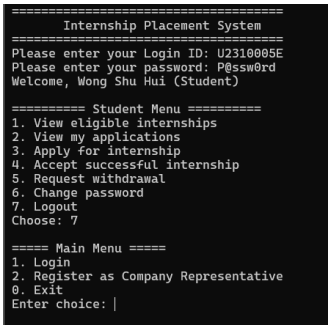
For this example, we can login with pre-existing staff "sng001@ntu.edu.sg" and student "U2310005E". Students are to login with their ID, and staff with their email. All passwords are defaulted to "password" at the start.

5.1.2 Change password function



All users can change their password as and when they want.

5.1.3 Logout



A user can choose as and when they want to logout as well.

5.2 Creating new rep account and new internship opportunity

5.2.1 Creation of rep account

```
===== Company Representative Registration =====
Enter your full name: test
Enter your company email (used as login ID): test@tes
Invalid email format. Try again (example: user@company.com).
Enter your company email (used as login ID): test@test.com
Enter company name: test
Enter department: test
Enter position: test

Registration submitted successfully!
Your account is pending approval by staff.
```

Company Representatives can request for their account creation on the base landing page. If the email is invalid, it would be flagged out accordingly

```
===== Main Menu =====
1. Login
2. Register as Company Representative
0. Exit
Enter choice: 1
=====================================
      Internship Placement System
=====================================
Please enter your Login ID: sng001@ntu.edu.sg
Please enter your password: password
Welcome, Dr. Sng Hui Lin (Staff)

========= Staff Menu =========
1. Approve / Reject company representatives
2. Approve / Reject internship postings
3. Approve / Reject withdrawal requests
4. View / Filter / Report internships
5. View ALL internship applications
6. Change password
7. Logout
Choose: 1
No.  ID              Name                Company
1    test@test.com   test                test
Select index of Company Representative to manage, 0 to cancel: 1
1 = Approve, 2 = Reject
Choose: 1
Approved Company Representative.
```

```
========= Staff Menu =========
1. Approve / Reject company representatives
2. Approve / Reject internship postings
3. Approve / Reject withdrawal requests
4. View / Filter / Report internships
5. View ALL internship applications
6. Change password
7. Logout
Choose: 2

================ Pending Internships ================
No.  Title                Company             Level      Major
   Open          Close       Slots
1    CS-level-1            test                BASIC      Computer Science
   2024-12-30    2025-12-30  1/1
Select internship to inspect (0 to cancel): 1
------------------------------------------------------------------------------
|                              CS-level-1                                    |
------------------------------------------------------------------------------
| Description : CS-level-1                                                   |
| Level : BASIC                                                              |
| Preferred Major : Computer Science                                         |
| Opening Date : 2024-12-30                                                  |
| Closing Date : 2025-12-30                                                  |
| Company Name : test                                                        |
| Representative : test                                                      |
| Slots : 1/1                                                                |
| Status : PENDING                                                           |
| Visibility : Hidden                                                        |
------------------------------------------------------------------------------

1 = Approve, 2 = Reject, 3 = Back: 1
Internship approved.
```

Company representatives can only log in after the staff has approved their request.

5.2.2 Creation of internship request

```
--- Create Internship Opportunity ---
Enter Internship title: CS-level-1
Enter Internship description: CS-level-1
Enter Internship preferred major: Computer Science
Internship Levels:
1. Basic
2. Intermediate
3. Advanced
Enter Internship level (1, 2, 3): 1
Enter Internship Application opening date (yyyy-MM-dd): 2024-12-30
Enter Internship Application closing date (yyyy-MM-dd): 2025-12-30
Enter number of slots available for Internship (1-10): 1
Internship created with ID: bdda3655-3277-4a45-861f-5922b431cace (PENDING APPROVAL)
------------------------------------------------------------------------------
|                              CS-level-1                                    |
------------------------------------------------------------------------------
| Description : CS-level-1                                                   |
| Level : BASIC                                                              |
| Preferred Major : Computer Science                                         |
| Opening Date : 2024-12-30                                                  |
| Closing Date : 2025-12-30                                                  |
| Company Name : test                                                        |
| Representative : test                                                      |
| Slots : 1/1                                                                |
| Status : PENDING                                                           |
| Visibility : Hidden                                                        |
------------------------------------------------------------------------------
```

```
========= Staff Menu =========
1. Approve/Reject company representatives
2. Approve/Reject internship postings
3. Approve/Reject withdrawal requests
4. Generate Internship Opportunities reports
5. Change password
6. Logout
Choose: 2
No.  ID                                   Title               Company         Level
1    8d289843-1f5e-4868-8ba5-407aa99191b3 CS-level-1          test            BASIC
Select index of Internship to manage, 0 to cancel: 1
1 = Approve, 2 = Reject
Choose: 1
Approved internship.
```

Internship opportunities can only be created once the company rep has created it, and the staff has approved it.

```
======== Compnay Representative Menu ========
1. Create internship opportunity
2. View / Filter my internships
3. Edit internship
4. Delete internship
5. Toggle internship visibility
6. View applications
7. Approve / Reject applications
8. Change password
9. Logout
Choose: 5

================== Your Internship Listings ==================
No.  Title                Major                Level       Company          Representative    Open Date    Close Date   Status      Visibility Slots
1    CS-level-1           Computer Science     BASIC       test             test              2024-12-30   2025-12-30   APPROVED    Hidden     0/1
Select internship index, 0 to cancel: 1
Internship visibility toggled to: true
```

```
--------------------------------------------------------------------------------
|                                  CS-level-1                                  |
--------------------------------------------------------------------------------
| Description : CS-level-1                                                     |
| Level : BASIC                                                                |
| Preferred Major : Computer Science                                           |
| Opening Date : 2024-12-30                                                    |
| Closing Date : 2025-12-30                                                    |
| Company Name : test                                                          |
| Representative : test                                                        |
| Slots : 1/1                                                                  |
| Status : APPROVED                                                            |
| Visibility : Visible                                                         |
--------------------------------------------------------------------------------
```

The company rep must then toggle the visibility to allow students to view the internship opportunity

```
========== Student Menu ==========
1. View eligible internships
2. View my applications
3. Apply for internship
4. Accept successful internship
5. Request withdrawal
6. Change password
7. Logout
Choose: 1
View Eligible internships
No eligible internships!
```

```
========== Student Menu ==========
1. View eligible internships
2. View my applications
3. Apply for internship
4. Accept successful internship
5. Request withdrawal
6. Change password
7. Logout
Choose: 1
View Eligible internships
No.  Title                Company          Level       Open          Close
1    CS-level-1           test             BASIC       2024-12-30    2025-12-30
```

On the left shows before visibility was turned on, and on the right it shows after it's turned on. Students can also only view internships based on their respective level's requirements.

5.3 Internship Application

5.3.1 Student sends request to register for internship

```
========== Student Menu ==========
1. View eligible internships
2. View my applications
3. Apply for internship
4. Accept successful internship
5. Request withdrawal
6. Change password
7. Logout
Choose: 3
#    Title                Company          Level       Major                          Remaining
1    CS-level-1           test             BASIC       Computer Science               1/1
Select internship index, 0 = cancel: 1
--------------------------------------------------------------------------------
|                                  CS-level-1                                  |
--------------------------------------------------------------------------------
| Description : CS-level-1                                                     |
| Level : BASIC                                                                |
| Preferred Major : Computer Science                                           |
| Opening Date : 2024-12-30                                                    |
| Closing Date : 2025-12-30                                                    |
| Company Name : test                                                          |
| Representative : test                                                        |
| Slots : 1/1                                                                  |
--------------------------------------------------------------------------------
Confirm APPLY for this internship? (Y/N): y
Application submitted successfully.
```

Students can choose to apply for these internships, and see their applications at a glance.

```
================== Your Internship Listings ==================
No.  Title                     Major                   Level       Company          Representative    Open Date    Close Date   Status      Visibility Slots
1    CS-level-1                Computer Science        BASIC       test             test              2024-12-30   2025-12-30   APPROVED    Visible    0/1
Select internship index, 0 to cancel: 1
No.  Internship Title                Company          Student ID      Student Name       Status
1    CS-level-1                      test             U2310005E       Wong Shu Hui       PENDING
Select application index, 0 to cancel: 1
1 = Approve, 2 = Reject
Choose: 1
Application approved.
```

Company rep then can choose if they want to approve or drop the application

```
No.  Internship Title                Company          Student ID      Student Name       Status
1    CS-level-2                      test             U2310005E       Wong Shu Hui       PENDING
2    CS-level-1                      test             U2310005E       Wong Shu Hui       SUCCESSFUL
```

And the student can see if the application is pending, successful, or unsuccessful.

```
No.  Internship Title                Company          Student ID      Student Name       Status
1    CS-level-1                      test             U2310005E       Wong Shu Hui       SUCCESSFUL
Select index, 0 = cancel: 1
--------------------------------------------------------------------------------
|                                  CS-level-1                                  |
--------------------------------------------------------------------------------
| Description : CS-level-1                                                     |
| Level : BASIC                                                                |
| Preferred Major : Computer Science                                           |
| Opening Date : 2024-12-30                                                    |
| Closing Date : 2025-12-30                                                    |
| Company Name : test                                                          |
| Representative : test                                                        |
| Slots : 1/1                                                                  |
--------------------------------------------------------------------------------
Confirm ACCEPT this internship offer? (Y/N): y
Internship accepted. All other applications withdrawn.

========== Student Menu ==========
1. View eligible internships
2. View my applications
3. Apply for internship
4. Accept successful internship
5. Request withdrawal
6. Change password
7. Logout
Choose: 2
No.  Internship Title                Company          Student ID      Student Name       Status
1    CS-level-2                      test             U2310005E       Wong Shu Hui       WITHDRAWN
2    CS-level-1                      test             U2310005E       Wong Shu Hui       SUCCESSFUL
```

If the student accepts the application, all other applications will be automatically withdrawn

```
================= Internship Reporting Menu =================
1. View All Internships
2. Filter By Status
3. Filter By Preferred Major
4. Filter By Internship Level
5. Filter By Company Name
6. Filter By Company Representative
7. Filter By Date Range
8. Sort By Remaining Slots (Descending)
9. View Most Popular Internships
0. Back
=============================================================
Enter option: 1

===== Filter / Report Result =====
ID       Title               Company         Level        Major    Remain     Status
4739ab64-5077-4914-8a45-72837d7fea96 CS-level-1          test            BASIC        Computer Science 1/1        APPROVED
b76873b4-122c-489e-bac3-e4d77e1da2aa CS-level-3          test            ADVANCED     Computer Science 0/1        FILLED
```

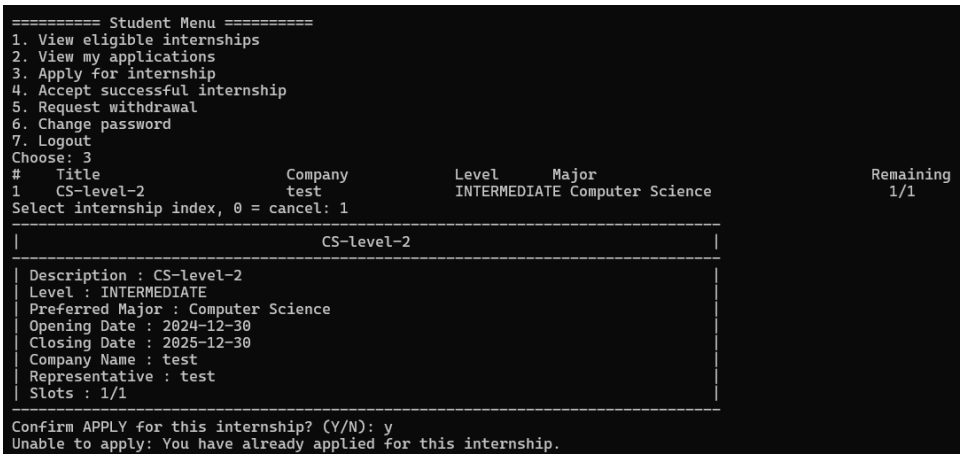
The staff can also have a comprehensive review of all the applications details, via a filter/report function

```
====================== ALL INTERNSHIPS ======================
No.  Title                     Major                   Level       Company                   Open         Close        Status     Slots
1    CS-level-2                Computer Science        INTERMEDIATE test                     2024-12-30   2025-12-30   APPROVED   0/1
2    CS-level-1                Computer Science        BASIC       test                      2024-12-30   2025-12-30   FILLED     1/1

Select internship to view applications (0 to cancel): 2

================ Applications for: CS-level-1 ================
No.  Student ID      Student Name          Email                    Status         Accepted     App ID(Short)
1    U2310005E       Wong Shu Hui          wong005@e.ntu.edu.sg     SUCCESSFUL     YES          f24670db
```

Above shows a filtered perspective of the output from the perspective of a staff



If a user wishes to withdraw a successful application, they are once again allowed to apply for internships, but not those that they have tried for before.

Above is an example of a user who withdrew a successful application (CS-level-1) and withdrew a (CS-level-2) case. We can see that CS-level-1 is no longer visible, and CS-level-2 cannot be taken up again, as the student has previously applied for it and withdrawn from it.

6. Reflection

Given the somewhat vague and ambiguous specifics of the assignment, generating an idea of the application was very abstract, which made it hard to even get started. Luckily, the hands-on nature of the Lab Exercises (e.g., Lab 3: Classes & Objects, Lab 4: Inheritance & Polymorphism) provided the practical understanding necessary for us to model complex entities and implement the required object relationships accurately in the class diagram. Thereafter, we moved on to drawing sequence diagrams, which enable us to visualise the flows of specific use cases in our application. With all the diagrams done, we have a clear, tangible framework to start writing our application. However, due to core concepts like Design Principles (SOLID) not being taught until Week 10 (Lecture) and Week 11 (Tutorial 8, e-learning), our team faced hiccups in our development process. This late introduction meant our initial design did not follow best practices, leading to tightly coupled and low cohesion code. After learning how to implement the SOLID principles in our application, we greatly reduced the effort to update and modify our application, and the trajectory of our progress wouldn't be a series of sprints followed by long halts caused by extensive debugging, but rather a smooth one. Our current manual testing is time-consuming. We could improve by implementing automated unit testing to ensure the testing process is more reliable.

7. GitHub Repo: https://github.com/rlry72/SC2002-Assignment-2025S1