S&C project by E. S. Gribaldo and F. Rosa

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Requirement Analysis and Specification Document

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1 Introduction

1.1 Purpose

In today's job market, when looking for a job, having a previous work experience has become an important criteria of evaluation, therefore, more and more students try to find an internship. On the other hand, many companies are willing to invest in young talents in order to build a skilled workforce that can help them drive innovation and secure a competitive edge in the future.
Student&Companies is a platform that offers to students the opportunity to search for internships and to companies the opportunity to advertise. The matchmaking process of student and companies is enabled through a (proprietary) recommendation algorithm that creates the most suited matches, through the collection of statistics and feedback.
Moreover Students&Companies allows for the management of the selection process and the monitoring of the execution of the internships. The goal is to provide a platform for both students and companies to make the process of finding, offering, and tracking internships easier and more efficient for both parties.

1.1.1 Goals

[G1] **Internship Lookup for Students**: Help students in their search for an internship by connecting their profiles with well-suited internship offers from companies.

[G2] **Visibility for Internship Positions of the Companies**: Allow companies to promote their internship positions to students and inform them about the availability of eligible candidates.

[G3] **Selection Process Management**: Support the interaction and selection by providing a platform to companies to set up and conduct interviews, gather structured information about students and finalize the selections.

[G4] **Data Collection for Recommendation System**: Collect statistics in order to allow the efficiency of the matchmaking process of the recommendation system

[G5] **Enhance Communication**: Enhance communication between students and companies, through a shared space where they can exchange information, raise problems and collect complaints about the internships

[G6] **Monitoring of Internships by Universities**: Allow universities to see the situation of the internships of their students, including the complaints about them.

1.2 Scope

The platform S&C has three major stakeholders: students, companies and universities. On one hand, students upload their CV and indicate their skills and domain of interest on the platform. Then they can proactively look out for internships or they can get suggestions from the platform, when new positions become available. On the other hand, companies can open internship positions, with the related domain and required skills, advertise those positions but also get notified when profiles of students, aligned with the requirements of one of their open positions, appear on the platform. Once both parties express interest on the platform, a contact between the two is established. Then the management of the set up and the conduct of interview starts. When a candidate is selected, the platform tracks the conduction of the internship through feedback, complaints and exchange of information by both parties. Indeed a specific space of the website is devoted to communication between a student and a company that are involved an internship together. The system run analytics on statistics collected by the platform itself on both students and companies to guarantee the best match possible between the two. Finally, the universities can look into the list of their students who are carrying or carried out an internship and see its details.

1.2.1   World phenomena

[WP1] Companies need interns for a position

[WP2] Students write their own CVs

[WP3] Students acquire new skills

[WP4] Companies and students carry out internships on which they agreed upon

[WP5] Students enroll to a university

1.2.2   Shared phenomena

- World controlled

[SPWC1] Companies create an internship position
[SPWC2] Companies carry out the selection process
[SPWC3] Companies select some students among the candidates
[SPWC4] Companies write complaints
[SPWC5] Companies communicate problems
[SPWC6] Students fill their profile with their personal information
[SPWC7] Students look out for an internship
[SPWC8] Students undertake assessments to test their skills on the platform
[SPWC9] Companies publish news about an internship
[SPWC10] Companies provide feedback
[SPWC11] Students provide feedback
[SPWC12] Students communicate problems
[SPWC13] Universities look into the list of internships done by their students

- Machine controlled

[SPMC1] The system notifies students of a newly available internship
[SPMC2] The system notifies the company of a newly available student that fits an internship role
[SPMC3] Contact between a student and a company is established

1.3   Definitions, Acronyms, Abbreviations

1.3.1   Definitions

- **Platform**: The Students & Companies (S&C) web application

- **Feedback**: The reviews and ratings provided by students or companies after internship

- **Application**: A submission made by a student to an internship position posted by a company through the S&C platform

- **Contact**: A connection that S&C creates between a student who applied for an internship position of a company and the company itself. It precedes the phase of confirmation by the student.

- **Communication**: Any exchange of information between a company and a student regarding an internship (e.g. news, complaints, announcements, private notes)

1.3.2 Acronyms

- S&C: Students & Companies

- UI: User Interface

- UML: Unified Modeling Language

- RASD: Requirement Analysis and Specification Document

- DD: Design Document

1.3.3 Abbreviations

- G*: Goal

- WP*: World Phenomena

- SPWC*: Shared Phenomena World Controlled

- SPMC*: Shared Phenomena Machine Controlled

- R*: Requirement

- US*: Use Case

- D*: Domain Assumption

1.4 Revision History

- December 22, 2024: Version 1.0 (first release)

1.5 Reference Documents

This document is based on the following reference documents:

- The document of the 2024/2025 assignment for RASD and DD

- The slides of the course found on WeBeep

1.6 Document Structure

1. **Introduction**
   The introduction identifies the purpose and the scope of the project, defines the goals, lists the related world and shared phenomena, explains acronyms, abbreviations that will be used in the document, specifies the version of the document and the reference document on which the current version it is based.

2. **Overall Description**
   The overall description points out and explains the various scenarios, including their class diagrams. It also includes product functions, user characteristics plus assumptions for the specific domain of the application and constraints.

3. **Specific Requirements**
   The specific requirements section outlines all the functional requirements, alongside with all the possible use cases.

4. **Formal Analysis**
   The part about formal analysis uses Alloy to formally verify the most involved parts of the project

5. **Effort Spent**
   The effort spent is described by a simple table

6. **References**
   It has pointers to all the resources used or cited in this project

2 Overall Description

2.1 Product perspective

2.1.1 Scenarios

In this section when we refer to users we mean "active" users therefore only students and companies, since the universities are considered "passive" because they cannot create interaction with the other users.

1. **A student wants to start using the Students&Companies website**:
   Bob is a university student that is looking for an internship and he decides to exploit a website to facilitate the research, so he connects to S&C. After entering to the platform for the first time he must register himself on the web application; therefore, he selects the option *"Register as student"* and he fills out sign-up form beginning the registration process providing his email, creating a password and filling all the necessary information (such as *Basic Information*, *Academic Information*, *Skills*, *CV* and *Languages Spoken*). After sending the data through the appropriate button the registration is done. Bob will be able to navigate his homepage and profile page.

2. **A company wants to start using the Students&Companies website**:
   Bridgenix is a company that is looking for interns and it decides to exploit a website to facilitate the research, so it connects to S&C. After entering to the platform for the first time it must register itself on the web application; therefore, it selects the option *"Register as company"* and it fills out sign-up form beginning the registration process providing its company email, its name, creating a password and filling out all the needed information (such as *Location*, *Description*, *Logo*. After sending the data through the appropriate button the registration is done. At this point Bridgenix will be able to navigate on the homepage and to access to its personal profile.

3. **A university wants to start using the Students&Companies website**: Mordor Institute of Technology is a university that would like to monitor the internships of its students, connects to S&C. After entering to the platform for the first time it must register itself on the web application; therefore, it selects the option *"Register as university"* and it fills out sign-up form beginning the registration process providing its university email, its name, its main address, its university mail, the link to the institutional website, and creating a password. After sending the data through the appropriate button the registration is done.

4. **A student changes his personal information**:
   Jack has finished some new projects, updated his CV and took a new certification. He logs into S&C to update his personal information. He navigates to his profile page. There he can modify many fields and save the changes.

5. **A company changes his personal information**:
   The company WeInnovate decides to update his profile on S&C. It connects and logs into S&C, navigates to the profile page, it can make changes on the company information.

6. **A university changes his personal information**:
   The Horizon University decides to update his profile on S&C. It connects and logs into S&C, navigates to the profile page, it can make changes about its information.

7. **A company wants to post a new internship and review student applications**:
   Bridgenix can post available internship positions by navigating to the internship positions creation section. Here, the company can specify details such as the *Role Title*, *Program Name*, *Location*, *Compensation* etc.) . It can also provide *Description*, to guide students on what is epected from them or give extra information. Once the company has fully set up the internship details, it can publish the opportunity on the platform. Every time a student applies for the position, Bridgenix will receive a notification, allowing the company to review the application submitted. For each candidate, the enterprise can access complete details about the application and about the student.

8. **A student proactively searches for an internship**:
   Anita is a student registered to S&C. Once she is logged into the platform, she can easily find the *Available job search* button. By clicking it, the student will be redirected to another page of the website where she can type into the search bar specific keywords or she can apply specific filters on the search. After issuing the search, Anita will see a list of all the suitable internship positions with synthetic details about the company which is offering it. If she clicks one of them, she will be able to see more details on it. The recommendation system will list the positions accordingly to the information which she uploaded on her profile page and with the details of the internship positions.

9. **A student applies to an internship position**
   Once the student Leah finds an internship position that might interest her, she can see its preview, which will redirect her to the internship position's page where she can submit an application to that position.

10. **A company gets notified for a match**
    The company WorkInc is registered to the platform and has some open positions for internships. The person who is logged in for the company can navigate to the page of a specific internship positions and see in the section *"Matching Candidates"* where there is a list of all the suitable candidates for the positions based on the recommendation. When new matching candidates appear the company will receive a notification on their profile page.

11. **Universities monitor the internships of their students**
    The university of Erewhon has a list of all the students enrolled to it that are doing an internship. The university can further look into the internship and getting to know the details of it (the company, the duration, location, role title, etc.). However, the university can look the status of an internship only once it is started, it cannot look to applications.

12. **Users interact in the application process**
    The company JobCo can reject, accept or further evaluate some selected students who applied to one of his internship positions. In the latter case, JobCo will schedule an interview providing the meeting link along with the specified date and time. Based on the decisions taken by JobCo, if the application will be accepted the student has to confirm to make the internship start.

13. **Users keep track of the internship**
    The company JobCo can leave private notes to the student, including suggestions, criticisms but also news about the internship. On the other hand, Tony, the student who is carrying out the internship, can communicate problems. Both JobCo and Tony can see the status of the internship and read information regarding the internship, that either one of the two has written on the platform.

14. **Users keep track of the internship**
    The company JobCo can leave private notes to the student, including suggestions, criticisms but also news about the internship. On the other hand, Tony, the student who is carrying out the internship, can communicate problems. Both JobCo and Tony can see the status of the internship and read information regarding the internship, that either one of the two has written on the platform.

15. **Users leave feedback**

    After an internship is finished, both the company Workly and the student Jeff can leave a feedback to each other including a rating and a comment. These feedback will be fed to the recommendation system to enhance the matchmaking process.

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2.1.2 Domain Class Diagram

To capture the different classes, their methods and their interactions we drew the following domain class diagram
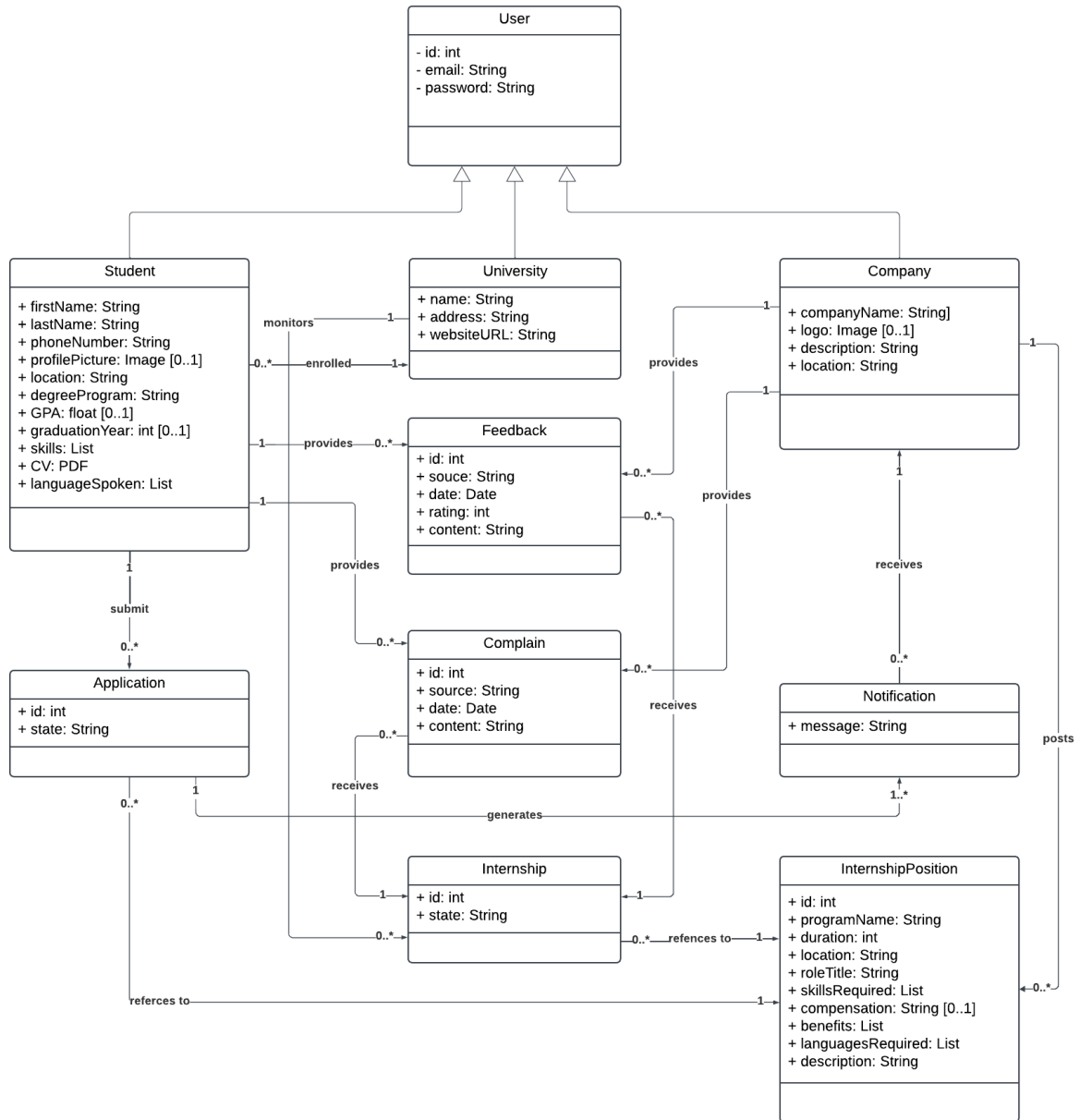

Figure 1: Class Diagram

2.1.3 State Diagrams

The most crucial aspect of the application is the creation and evolution of the internship positions and internships on the platform. Not to leave any room for doubts, we explain the point of view of the company and the one of the student.

A company can close an internship position whenever it wants to. Once it closes the internship position, the applications who were accepted but not confirmed or not refused, the pending applications, and the applications needing further assessment are automatically rejected. Instead, for those who confirmed, we consider the moment of the closing of the internship position by the company as the moment from which the internship starts.

- **Company's Perspective**
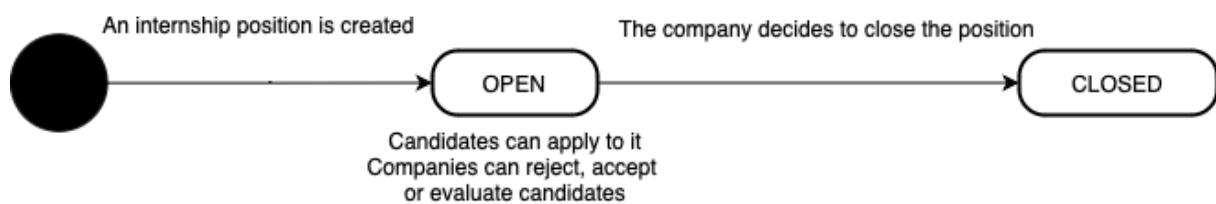 The following is the point of view of the company:

Figure 2: The evolution of an internship position on the platform from the point of view of a company

- **Student's Perspective**
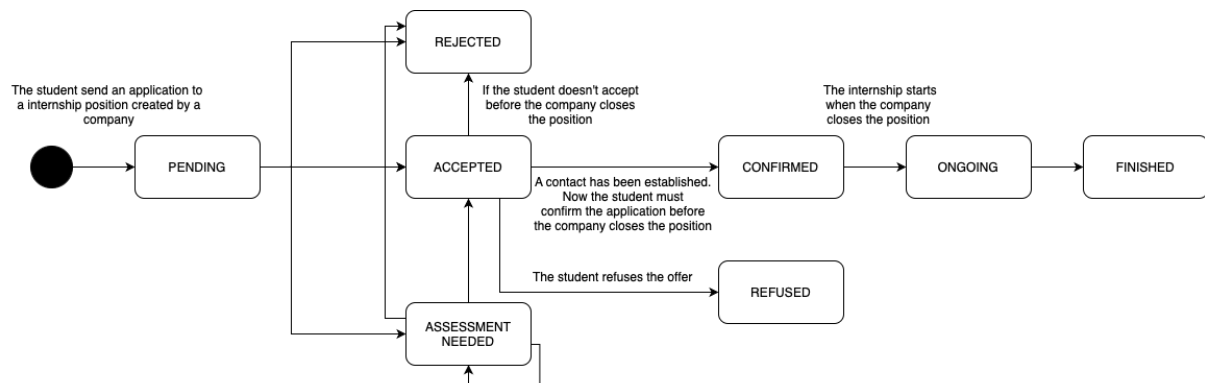 The following one, instead, is the point of view of a student:

Figure 3: The evolution of an internship position into an internship on the platform from the point of view of a student

2.2   Product Functions

1. **Sign Up and Log In**
   The users sign up to the platform by providing an email, a password and all the needed information. A registered user logs in to the platform by providing the email and the password. At the moment of sign up it is necessary to indicate whether the account is related to a company, to a university or to a student, since the three types of account are treated differently inside the platform.

2. **Profile Information Update**
   The users can update their profile information. Users can modify any kind of information they inserted in the application, so that information stays up to date.

3. **Internship Position Creation**
   Companies can create new internships positions by establishing the duration, the work place, the role title, the required skills, languages required, and the salary range and benefits.

4. **Internship Search**
   Students can search for internship opportunities using various filters based on their preferences, such as location, role, required skills, and salary range. Once the filters are applied, the platform presents a list of relevant internship positions. Students can also search internship through textual search. In both cases the recommendation system will suggest the most suited internship positions based on the information it has on the student and the internship positions relative to the search. Students can browse the list and click on each position to view detailed information.

5. **Internship Application**
   After reviewing the available internship positions, students can apply to one or more internships that align with their interests. By clicking the "Apply" button, the student sends an application to the company, expressing their interest in the position. The company will then review the application as part of their selection process.

6. **Management of the Selection Process**
   Companies see the profiles of students who applied to an internship. They can reject students who applied to an internship position after checking their qualifications on their profiles; they can directly accept one or more of them. Companies can propose an online interview to assess the preparation of students who applied for an internship position and finalize the decisions after it or requesting another one.

7. **Situation Monitoring by University**
   Universities can monitor the status of internships their students are participating in. They can track the progress of the internship. This monitoring function allows universities to stay informed about their students' experiences, without being able to directly modify or communicate within the internship process.

8. **Communication Space**
   After an internship is started, both the students and companies have dedicated sections of the website to exchange information, communicate problems, indicate suggestions, make announcements (all regarding the internship) such that both of the interested parties can benefit from the sharing of information.

9. **Feedback Management**
   After the internship is finished the platform asks both the company and the student to rate and review each other. Moreover it asks both parties for suggestions. Collecting this kind of information is particularly important to feed and improve the recommendation system.

2.3 User Characteristics

Users of S&C are divided into three distinct categories, each with specific roles and responsibilities that reflect their interaction with the internship process:

2.3.1 Students

Students are the main beneficiaries of the S&C platform, using it to find internship opportunities and develop their professional skills. Their responsibilities and capacities include:

- **Internship Search**
  Students can search through the available internships by applying various filters such as location, role, required skills, and salary range to find positions that match their career goals.

- **Application for Internship Positions**
  Students can apply for internships directly through the platform.

- **Participation in the Selection Process**
  Once a student has applied, it may be necessary to go through a selection process set up by the company offering the internship. This could include interviews to determine their suitability for the position.

- **Accepting or Refusing Offers**
  Once a company makes an internship offer, students can review the details and choose to accept or refuse the offer. This ensures that students have control over their internship decisions.

- **Communicating with the Company**
  During the internship, students can use the platform to communicate directly with the company, facilitating the exchange of information, addressing requests or providing updates on their progress.

- **Providing Feedback**
  After completing an internship, students can provide feedback on their experience, helping future applicants and companies to assess the quality of internships. This feedback can be used to improve the platform and the internship experience itself.

2.3.2 Companies

Companies use the platform to find talented students for internship opportunities and to manage the selection and monitoring process. Their main features include:

- **Creating Internship Positions**
  Companies can create and publish internship opportunities on the platform. They provide details such as the role, skills required and other relevant information to attract suitable candidates.

- **Definition of the selection process**
  Companies are responsible for defining the stages of selection of trainees. This includes the scheduling of interviews to ensure that the best candidates possible are selected for the role.

- **Tracking Internship Progress**
  During the internship, companies can monitor the status of internship stages, providing continuous mentoring and addressing any problems that arise.

- **Provide feedback on students**
  After completion of the internship, companies are able to provide feedback on student performance which can influence future internship opportunities or job offers for the student.

2.3.3 Universities

Universities have a limited role within the S&C platform, focusing exclusively on monitoring the internships undertaken by their students. Their functionality includes:

- **Monitoring Student Internships**
  Universities can track the internships their students are participating in through the platform. This allows them to stay informed about the progress and status of these experiences without directly intervening or influencing the process.

2.4 Assumptions, Dependencies and Constraints

2.4.1 Regulatory Policies

Personal information will be processed in compliance with GDPR rules and the recommendation system if enhanced with AI will be compliant of the AI act.

2.4.2 Domain Assumptions

[D1] Students insert correct information about their skills and experience.

[D2] Students apply to jobs in countries where they have a work permit.

[D3] Students provide valuable feedback when asked for it.

[D4] Companies offer existing and legal contracts for the internships.

[D5] Companies insert correct information about the internships.

[D6] Companies periodically review information about the internship candidates.

[D7] Companies provide valuable feedback when asked for it.

[D8] Students raise problems through the platform.

[D9] Companies use the platform as principal mean of communication regarding the internships.

[D10] Universities must register on the platform before their students can create accounts, as students are required to link their profiles to their university.

3 Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

We prefer not to tie our design to any guidelines so early in the project, so we will probably give some snippets of the user interfaces in the DD. However, the principles that will guide our design will be clarity and minimalism. We believe that at the basis of a well working web application there must be a nice user interface. We are also convinced that being minimal and simple looking is a plus for a web application since a confusing user interface is one of the biggest reasons why users dislike a certain website and prefer another to it.

3.1.2 Hardware Interfaces

Being our project a web application there are not many hardware requirements. From the client side perspective the only request is about the size of the monitor. Indeed the website is going to be developed for desktop view exclusively. Apart of that, any laptop with a stable internet access will suffice. On the server side, any kind of setup is acceptable since our website does not have specific requirements for special computing power or similar capabilities.

3.1.3 Software Interfaces

From the perspective of software interfaces, there is only one standard requirement: the platform must be compatible with all the latest stable versions of the major web browsers

3.1.4 Communication Interfaces

S&C communicates important information to users through notifications on the website.

1. **Push Notifications**: notifications created when a company posted an internship or a student with the right skill set for an internship position becomes available on the platform

2. **Real Time Notifications**: notifications created when an action is performed by a user to let him/her know that it has been successful or not

3.2 Functional Requirements

The listed requirements are in the form suggested by IEEE[1]:

[Condition][Subject][Action][Object][Constraints on the Action]

Users:

R1 S&C shall allow users to sign up.

R2 S&C shall allow users to fill in their profile information when signing up.

R3 S&C shall allow users to log in.

R4 S&C shall allow users to log out.

R5 S&C shall allow users to update their profile information.

R6 S&C shall allow users to examine their own internships.

Students:

R7 S&C shall allow students to examine open internship positions.

R8 S&C shall allow students to examine their own applications.

R9 S&C shall allow students to search for a specific kind of internship position.

R10 S&C shall allow students to apply for an internship position.

R11 If an internship position suitable for a student is opened, S&C shall notify the student.

R12 When a student searches for an internship, S&C shall list the different positions aligned with the student's profile.

Applications:

R13 If an application has been accepted by a company, S&C shall allow the student who made the application to confirm or refuse the internship.

R14 If a company signals that it needs an assessment of the students' skills, S&C shall allow the company to schedule an interview.

R15 After an interview has been scheduled, S&C shall allow the student to access the link and see the date of the meeting.

R16 S&C shall allow the students to see the status of their applications.

Companies:

R17 S&C shall allow companies to open and examine its internship positions.

R18 S&C shall allow companies to accept or reject applications for their internship positions.

R19 S&C shall allow companies to close internship positions.

R20 If a new profile of a student who could interest a company becomes available on the platform, S&C shall notify the company.

Communication during the internship:

R21 S&C shall allow companies to leave private notes to students who are doing an internship with it.

R22 S&C shall allow companies to send news about the internship to the students who participate in it.

R23 S&C shall allow both parties to communicate problems in a specific space of the website.

Feedback and Suggestions:

R24 S&C shall allow students who took an internship with a company to rate the internship and vice versa.

R25 S&C shall allow students who took an internship with a company to give suggestions to the company and vice versa.

R26 S&C shall allow companies to send news about the internship to students who are carrying it out.

R27 S&C shall allow both parties involved in an internship to make complaints in a dedicated space.

Universities:

R28 S&C shall allow universities to monitor the status of the internship of their students.

R29 S&C shall allow universities to see details of the internships of their students.

3.3   Use Cases and Use Case Diagrams

This section is dedicated to use cases and use case diagrams. In order to be as clear as possible here is the general schema of the use cases and their links with the actors.
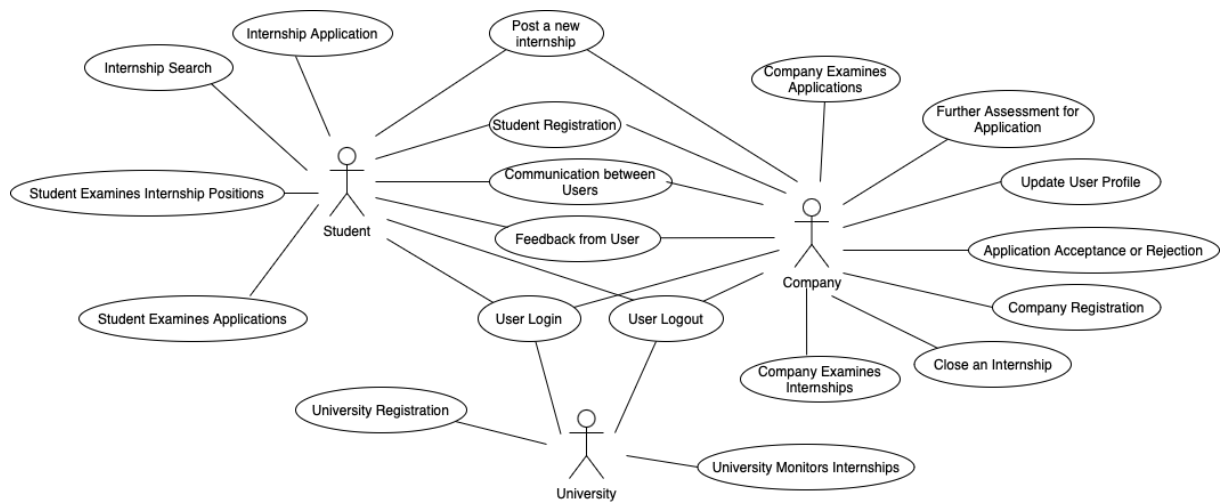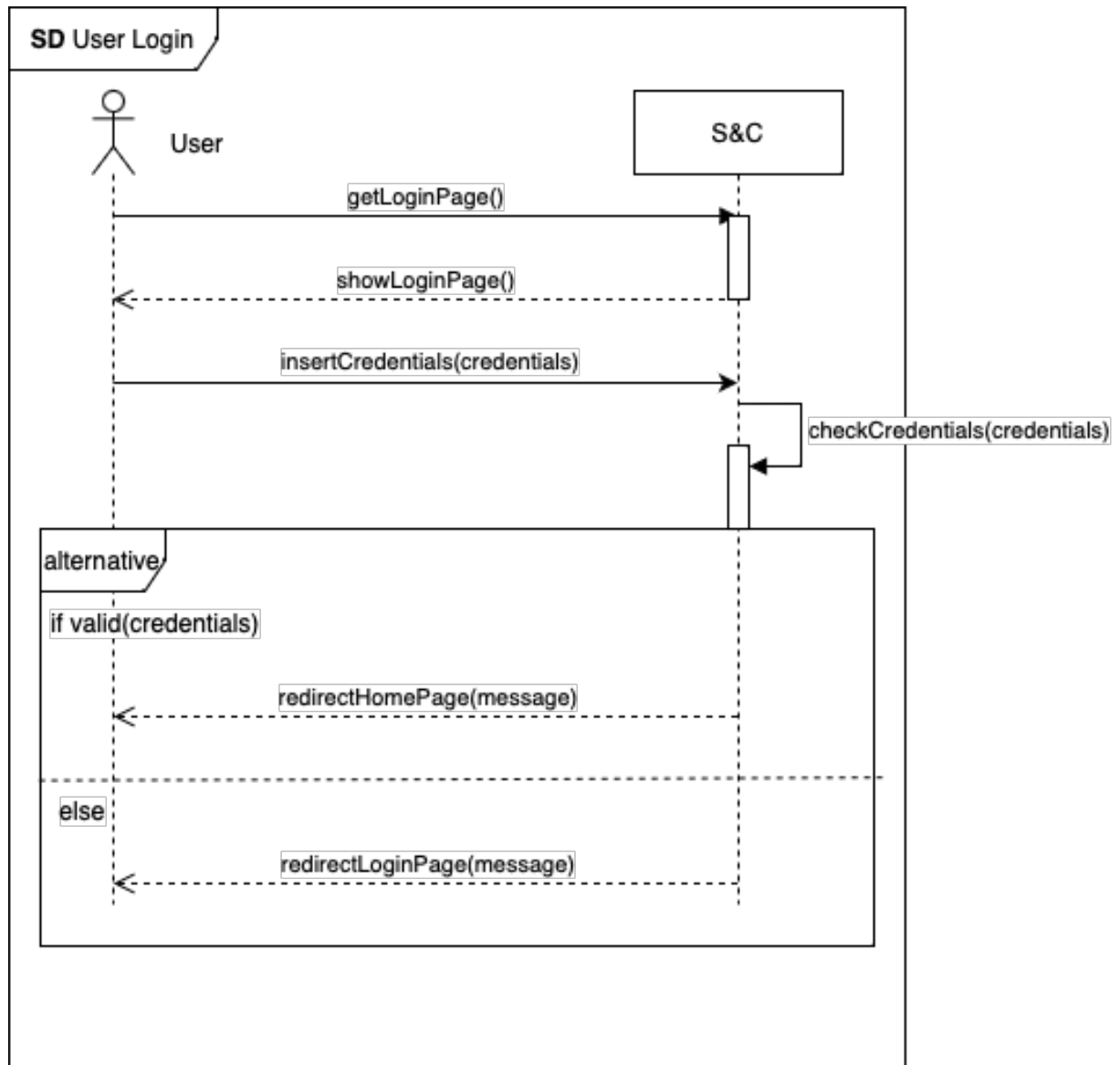

In the following pages all the use cases along with their diagrams are listed.
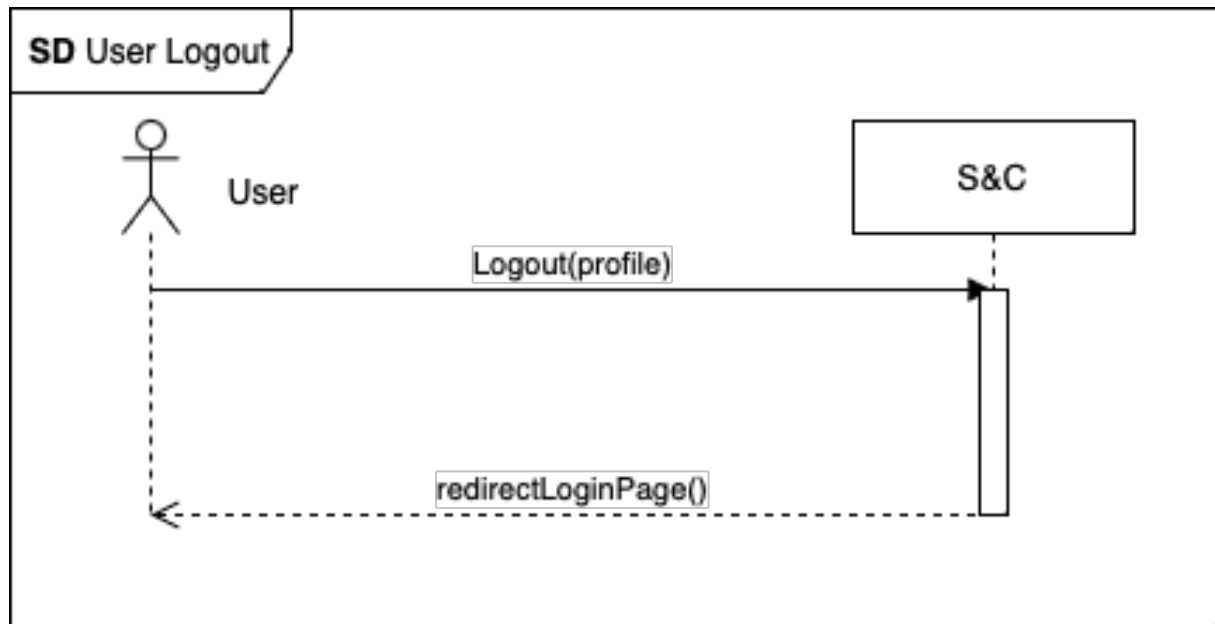
3.3.1 User Use Cases

[US1] User Login

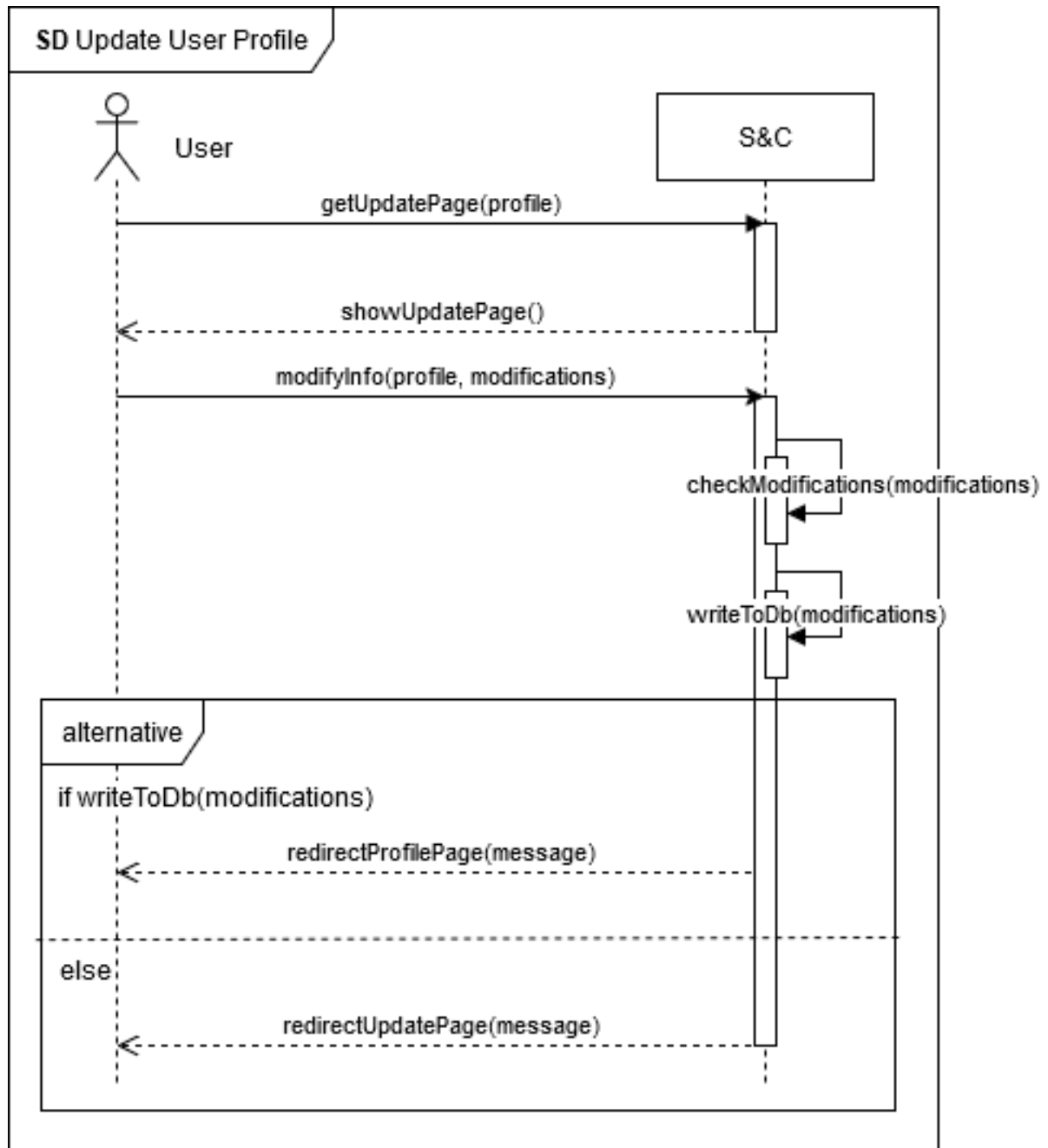| Name	User Login
Actors	• User
Entry Condition	• The user wants to log in; • The user has an account and is on the main page of S&C.
Event Flow	1. The user presses the "Login" button; 2. S&C redirects the user to the login page; 3. The user types the email in the corresponding form field; 4. The user types the password in the corresponding form field; 5. The user presses the "Log in" button; 6. S&C validates the data; 7. S&C redirects the user to the homepage of S&C.
Exit Condition	The user logs into his/her profile.

Exceptions	1. A user with the entered email doesn't exists.
	    • In that case, S&C will display an error message on the screen.
	2. The entered password and the stored password do not match.
	    • In that case, S&C will display an error message on the screen.

[US2] User Logout

Name	User Logout
Actors	• User
Entry Condition	• The user wants to log out; • The user has an account, is logged in, and is on his/her homepage.
Event Flow	1. The user presses the "Logout" button; 2. S&C redirects the user to the login page and displays a Success Message;
Exit Condition	The user logs out his/her profile.
Exceptions	1. The user doesn't have an account. • In that case, S&C will display an error message on the screen.

[US3] Update User Profile

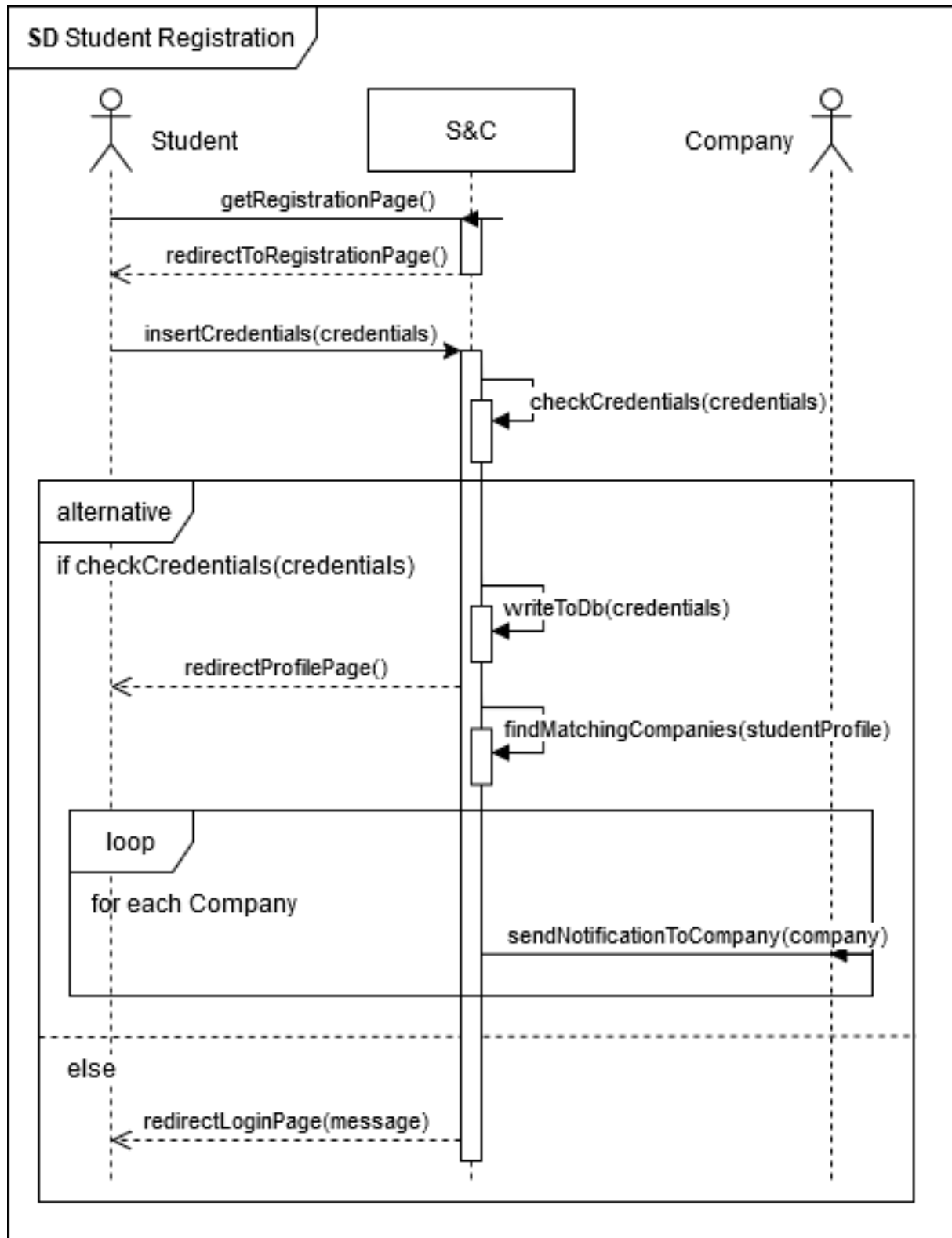| Name	Update User Profile
Actors	• User
Entry Condition	• The user decides to modify his/her profile; • The user has an account, is logged in, and is on his homepage.
Event Flow	1. The user presses the "Edit Profile" button; 2. S&C redirects the user to the personal profile page; 3. The user choose which information modify; 4. The user presses the "Modify" button on the right of the desired category; 5. The user modifies the data; 6. The user presses the "Apply Changes" button; 7. S&C validates the data; 8. S&C redirects the user to the homepage of S&C.
Exit Condition	The user's profile is successfully updated and saved in the system.

Exceptions	1. Missing Required Fields:
	  • If any mandatory fields are left empty, S&C will display an error message.
	2. Invalid Data Format:
	  • If at least one data is invalid, an error message is displayed;

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3.3.2 Student Use Cases
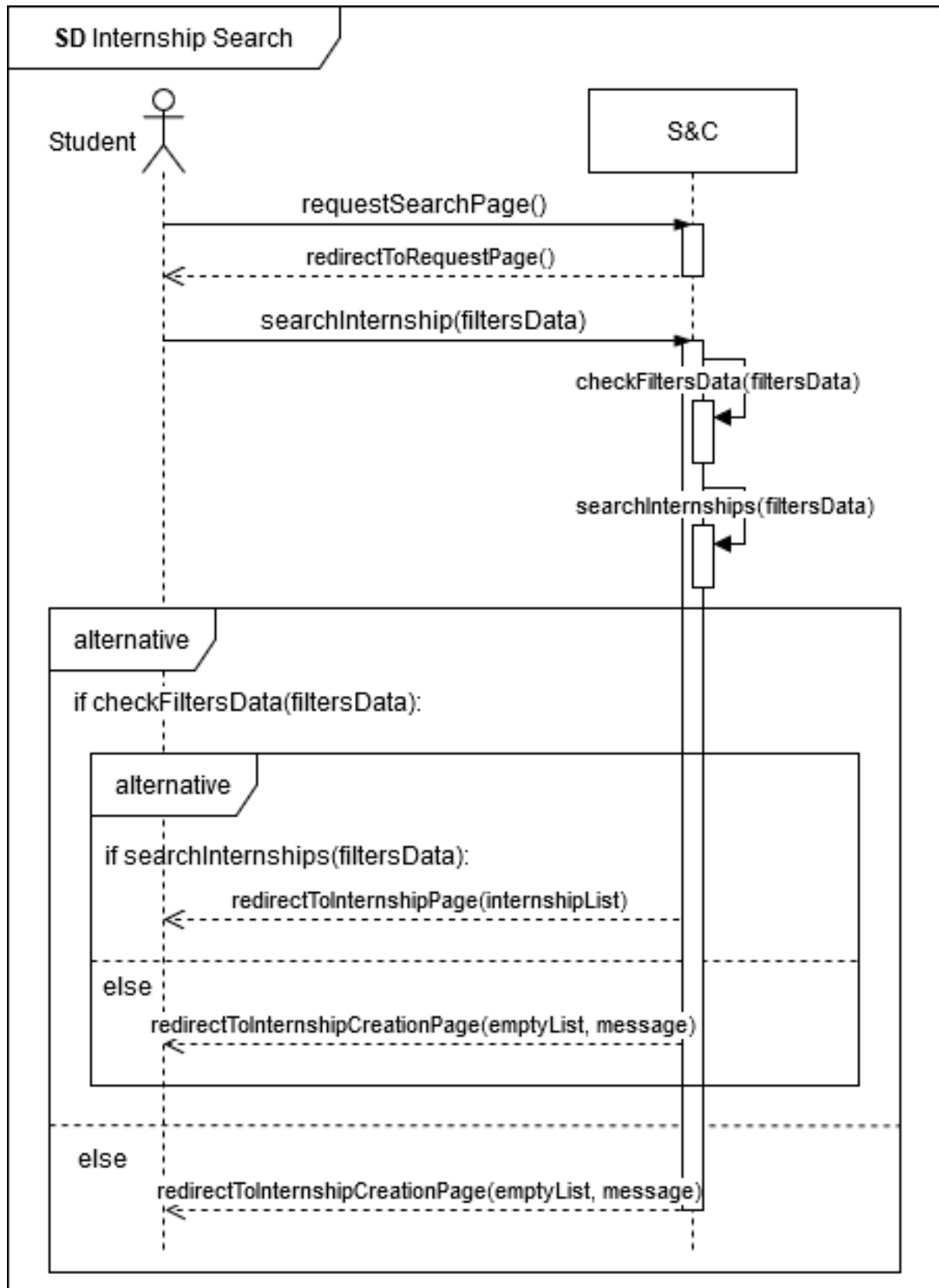
[US4] Student Registration

Name	Student Registration
Actors	• Student; • Company.
Entry Condition	The student does not have an account and is on the main page of S&C.

Event Flow	1. The student presses the "Register as Student" button;
	
	2. S&C redirects the student to the register page;
	
	3. The student types the Email in the corresponding form field;
	
	4. The student types the password in the corresponding form field;
	
	5. The student types the confirm password in the corresponding form field;
	
	6. The student enters the *Basic Information* in the corresponding form field:
	  • Full name;
	  • Phone number;
	  • Profile picture (not mandatory);
	  • Location for location-based internships.
	
	7. The student enters the *Academic Information*:
	  • University name;
	  • Degree program;
	  • GPA (not mandatory);
	  • Graduation year (not mandatory).
	
	8. The student types the Skills;
	
	9. The student uploads the *CV*;
	
	10. The student types the *Languages Spoken*.
	
	11. The student presses the "Subscribe" button;
	
	12. S&C validates the data;
	
	13. S&C creates the student's account;
	
	14. S&C redirects the student to the homepage of S&C.
	
	15. S&C identifies the internships that match the student's profile based on skills, academic background, and location;
	
	16. S&C sends notifications to companies offering internships that match the student's profile.

Exit Condition	The student's account is created, and they are logged in.

Exceptions	1. The student provides invalid data (e.g., invalid email format, duplicate email address, mismatched passwords). • S&C validates the input and detects the invalid data. • S&C displays an error message explaining the specific validation errors. • The student must correct the errors and resubmit the form

SD Student Registration

Student · S&C · Company

getRegistrationPage()

redirectToRegistrationPage()

insertCredentials(credentials)

checkCredentials(credentials)

alternative

if checkCredentials(credentials)

writeToDb(credentials)

redirectProfilePage()

findMatchingCompanies(studentProfile)

loop

for each Company

sendNotificationToCompany(company)

else

redirectLoginPage(message)

[US5] Internship Search
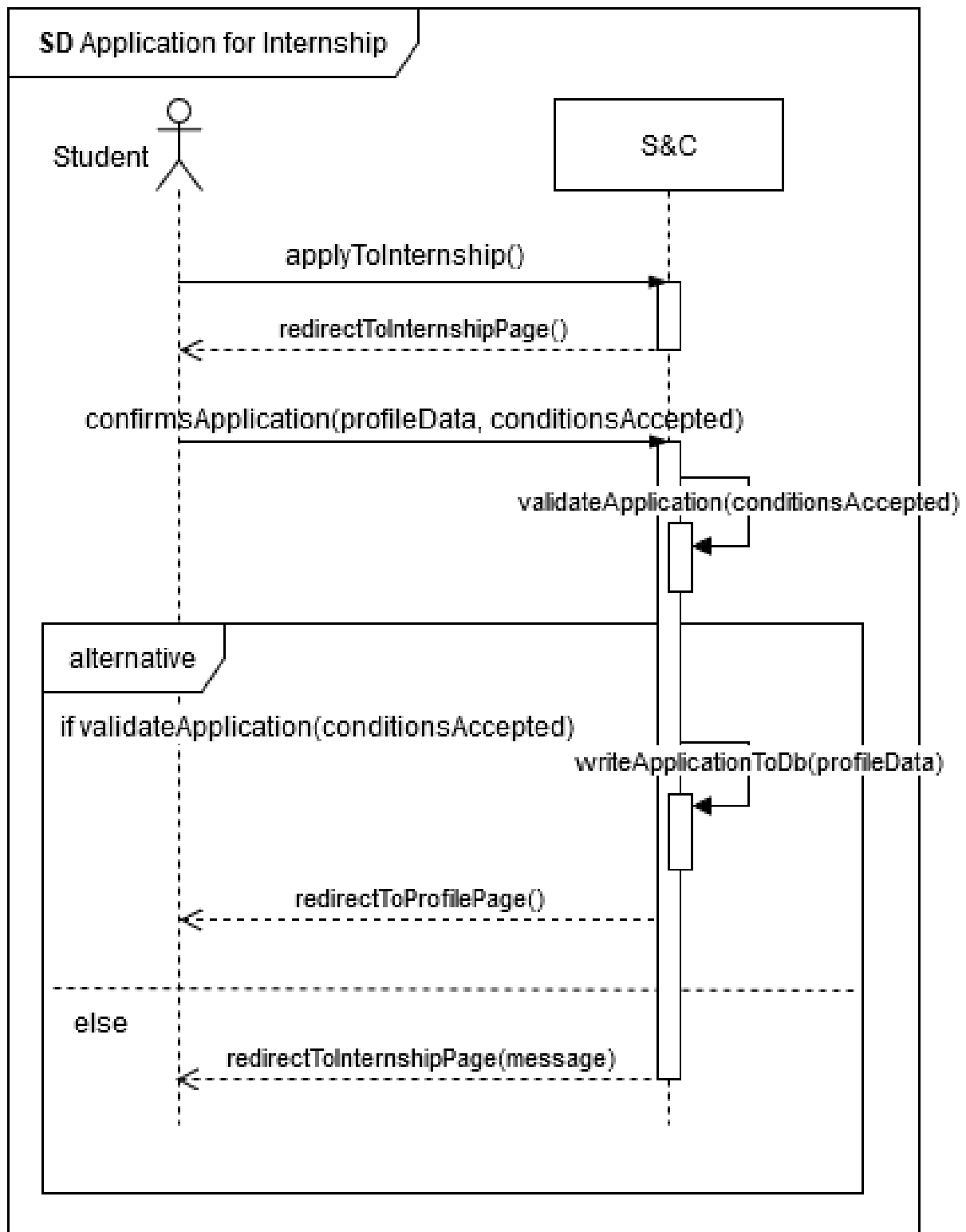
Name	Internship Search
Actors	• Student
Entry Condition	• The student knows the search criteria; • The student has an account and is logged in.
Event Flow	1. The student clicks on the "Search" button 2. S&C redirects the student to the search page; 3. The student searches for keyword or compiles some filters options; 4. The student issues the search 5. S&C looks for the results and shows them with a preview for each internship; 6. The student can now scroll the list of internships that match the search criteria; 7. If the student is interested in any of the shown positions can click to discover more about it;
Exit Condition	The user leaves the search page by clicking any button redirecting him or her to another page of the website

Exceptions	1. The criteria do not match any open position
	    • In that case, S&C will show a notification on the screen saying that no open position matched the search criteria
	 2. One or more keywords entered are not valid.
	    • In that case, S&C will display an empty list and a warning message on the screen saying that the input keywords don't exist.

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[US6] Application for internship

Name	Application for Internship
Actors	• Student
Entry Condition	• The student decides to apply to an internship; • The student has an account and is logged in; • The student searched an internship and he/she is on the dedicated page.
Event Flow	1. The student presses the "Apply" button; 2. S&C redirects the student to the page of the internship position; 3. The student can see all the information 4. The student has to accept terms and condition of the application 5. The student presses the "Confirm" button
Exit Condition	The user sent the application and gets redirected to his own profile page
Exceptions	1. The application is made to an internship position who closed in the meanwhile but the front end has not yet rendered the change. • In that case, S&C will display warning message on the screen saying that the internship is not available.

SD Application for Internship

Student

S&C

applyToInternship()

redirectToInternshipPage()

confirmsApplication(profileData, conditionsAccepted)

validateApplication(conditionsAccepted)

alternative

if validateApplication(conditionsAccepted)

writeApplicationToDb(profileData)

redirectToProfilePage()

else

redirectToInternshipPage(message)

[US7] Student Examines Applications

Name	Student Examines Applications
Actors	• Student
Entry Condition	• The student decides to examine its applications; • The student has an account and is logged in; • The student is on its profile page.
Event Flow	1. The student presses the "Applications" button; 2. S&C redirects the student to the page of the applications; 3. The student can click on any of them to get more details
Exit Condition	The student exits his own profile page or confirms an application
Exceptions	1. The student doesn't have any applications • In that case, S&C will display an empty list and a warning message on the screen saying that the student has not made any applications yet.
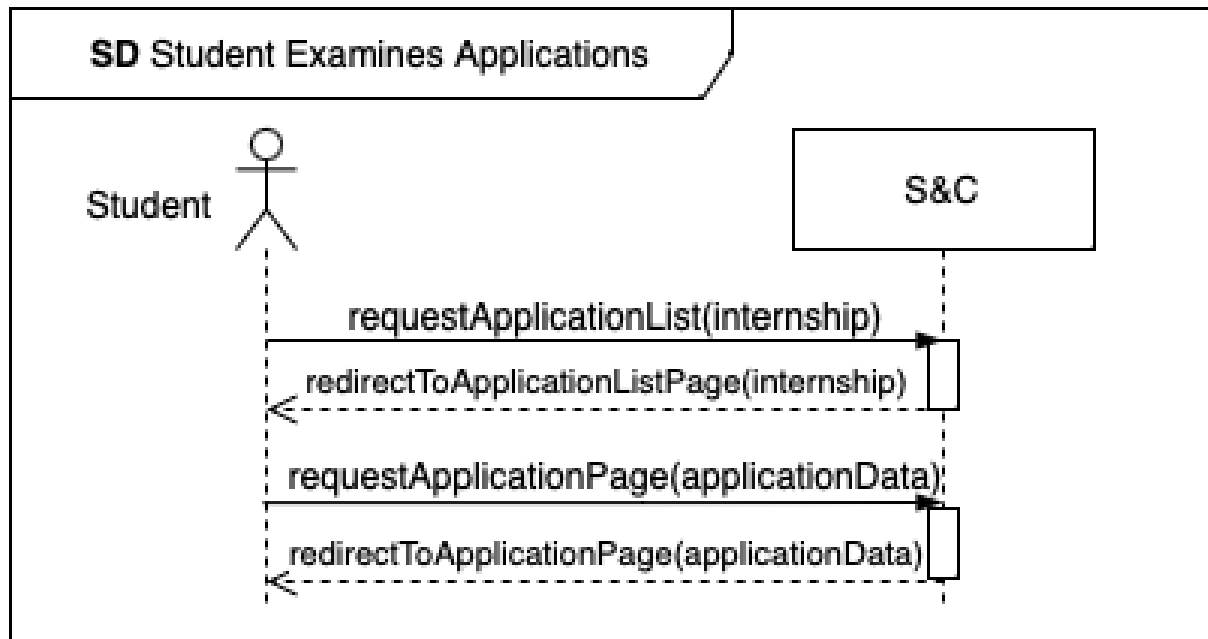
3.3.3 Company Use Cases

[US8] Company Registration

Name	Company Registration
Actors	• Company
Entry Condition	The company does not have an account and is on the main page of S&C.

Event Flow	1. The company presses the "Register as Company" button;
	
	 2. S&C redirects the company to the register page;
	
	 3. The company enters the following information in the corresponding form field:
	
	   • Company mail;
	   • Password;
	   • Confirm password
	   • Company name;
	   • Logo (not mandatory);
	   • Short description of the company;
	   • Location.
	
	 4. The company presses the "Subscribe" button;
	
	 5. S&C validates the data;
	
	 6. S&C creates the company's account;
	
	 7. S&C redirects the company to the homepage of S&C.

Exit Condition	The company's account is created, and it's logged in.

Exceptions	1. The company provides invalid data (e.g., invalid email format, duplicate email address, mismatched passwords).
	
	   • S&C validates the input and detects the invalid data.
	   • S&C displays an error message explaining the specific validation errors.
	   • The company must correct the errors and resubmit the form.

[US9] Post a new Internship

| Name	Post a new internship
Actors	• Company; • Student.
Entry Condition	The company has an account and is logged in.
Event Flow	1. The company presses the "Add New Internship" button; 2. S&C displays a form that the company have to fill; 3. The company fills the form; 4. The company presses the "Publish" button; 5. S&C validates the data; 6. S&C displays a Success Message; 7. S&C redirects the company to the main page; 8. S&C identifies the students' profiles that match the internship based on skills, academic background, and location; 9. S&C sends notifications to students that match offering the internship.
Exit Condition	The company posts a new internship.

Exceptions	1. The company leaves one or more mandatory fields empty.
	   • S&C displays an error message indicating the missing fields.
	   • S&C highlights the empty fields in the form.
	   • The company is prompted to complete the form before resubmitting.
	
	2. The company provides invalid data (e.g., incorrect date formats, non-numeric salary inputs).
	   • S&C validates the input and detects the invalid data.
	   • S&C displays an error message explaining the specific validation errors.
	   • The company must correct the errors and resubmit the form
	
	3. The company is not logged in.
	   • S&C denies access and displays an error message: "You must be logged in with a company account to perform this action."
	   • S&C redirects the user to the login page.
	
	4. The company attempts to post an internship with identical details to an already existing one.
	   • S&C detects the duplicate entry and displays a warning: "An internship with similar details already exists. Please review your submission."

[US10] Close an internship

Name	Close an internship
Actors	• Company
Entry Condition	• The company has an account and is logged in; • The company has at least one open internship.
Event Flow	1. The company enters the open internship section; 2. The company chooses the internship they want to close; 3. The company presses the "Close" button; 4. S&C validates the data; 5. S&C displays a Success Message; 6. S&C redirects the company to the main page;
Exit Condition	The company posts a new internship.

Exceptions	1. The company is not logged in.
	   • S&C denies access and displays an error message: "You must be logged in with a company account to perform this action."
	   • S&C redirects the user to the login page.
	2. The company provides invalid data (e.g., already closed internship, nonexistent internship).
	   • S&C validates the input and detects the invalid data.
	   • S&C displays an error message explaining the specific validation errors.
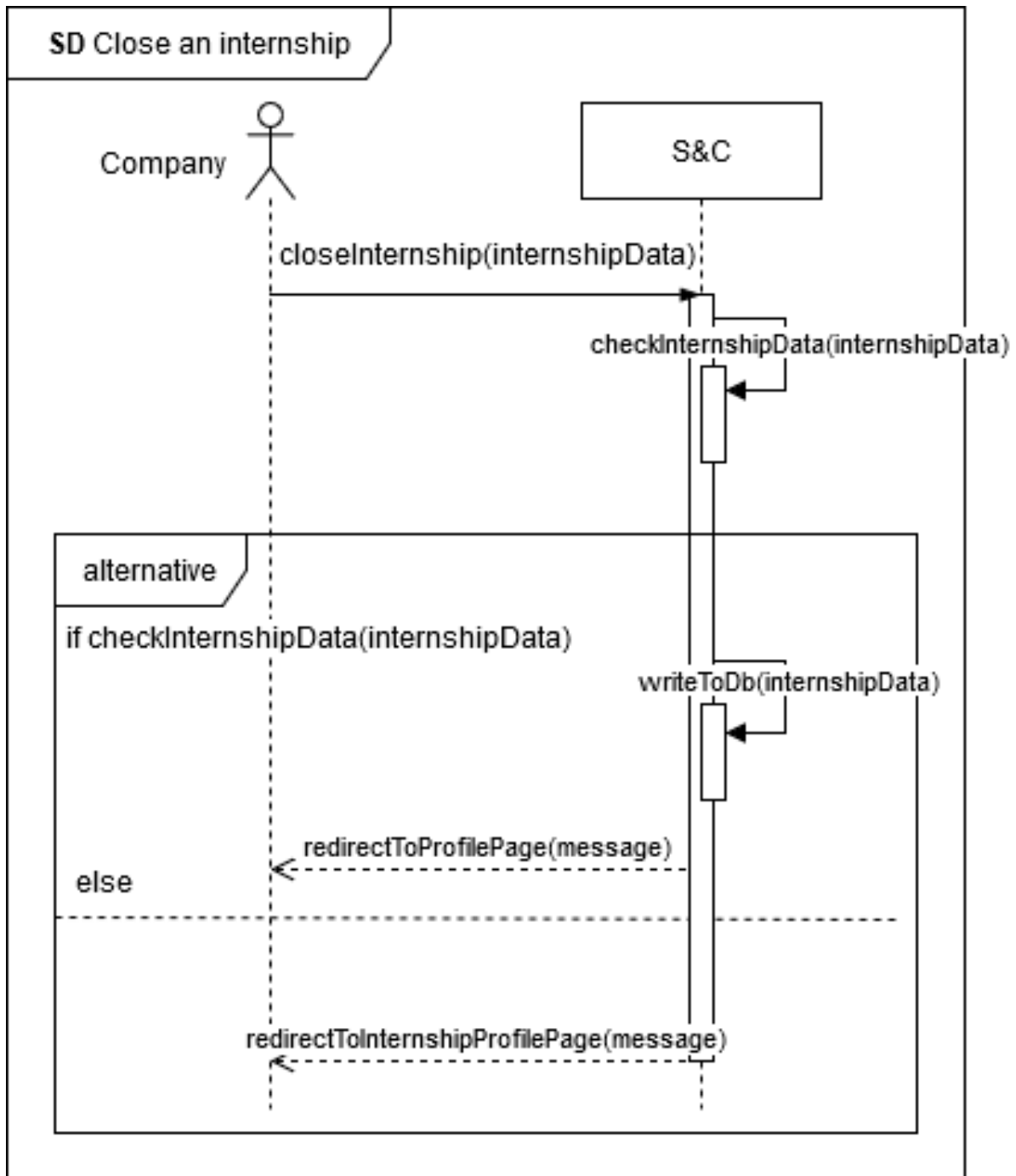
[US11] Company Examines Internship Positions

Name	Company Examines Internship Positions
Actors	• Company
Entry Condition	• The company decides to examine its internship positions; • The company has an account and is logged in; • The company is on its profile page.
Event Flow	1. The company presses the "Internships Positions" button; 2. S&C redirects the company to the page of the internship positions; 3. The company can click on any of them to get more details; 4. For each internship position, the company can click on the "Candidate Matching" button; 5. S&C displays a list of candidates who match the internship requirements; 6. The company can examine the list of candidates and review their profiles.
Exit Condition	The company exits his own profile page or goes checking out some applications
Exceptions	1. The company doesn't have any internship positions • In that case, S&C will display an empty list and a warning message on the screen saying that the company has not any internship positions yet.

SD Company Examines Internship Positions

Company → S&C: requestInternshipPositionList(profileData)

S&C --> Company: redirectToInternshipPositionListPage(profileData)

Company → S&C: getInternshipPositionPage(internshipPosition)

S&C --> Company: redirectToInternshipPositionPage(internshipPosition)

Company → S&C: requestMatchedCandidatesList(internshipPosition)

S&C --> Company: redirectMatchedCandidatesList(internshipPosition)

[US12] Company Examines Internships

Name	Company Examines Internships
Actors	• Company
Entry Condition	• The company decides to examine its internships; • The company has an account and is logged in; • The company is on its profile page.
Event Flow	1. The company presses the "Internships" button; 2. S&C redirects the company to the page of the internships; 3. The company can click on any of them to get more details
Exit Condition	The company exits his own profile page
Exceptions	1. The company doesn't have any internships • In that case, S&C will display an empty list and a warning message on the screen saying that the company has not any internships yet.

SD Company Examines Internships

Company

S&C

requestInternshipList(profileData)

redirectToInternshipListPage(profileData)

getInternshipPage(internship)

redirectToInternshipPage(internship)
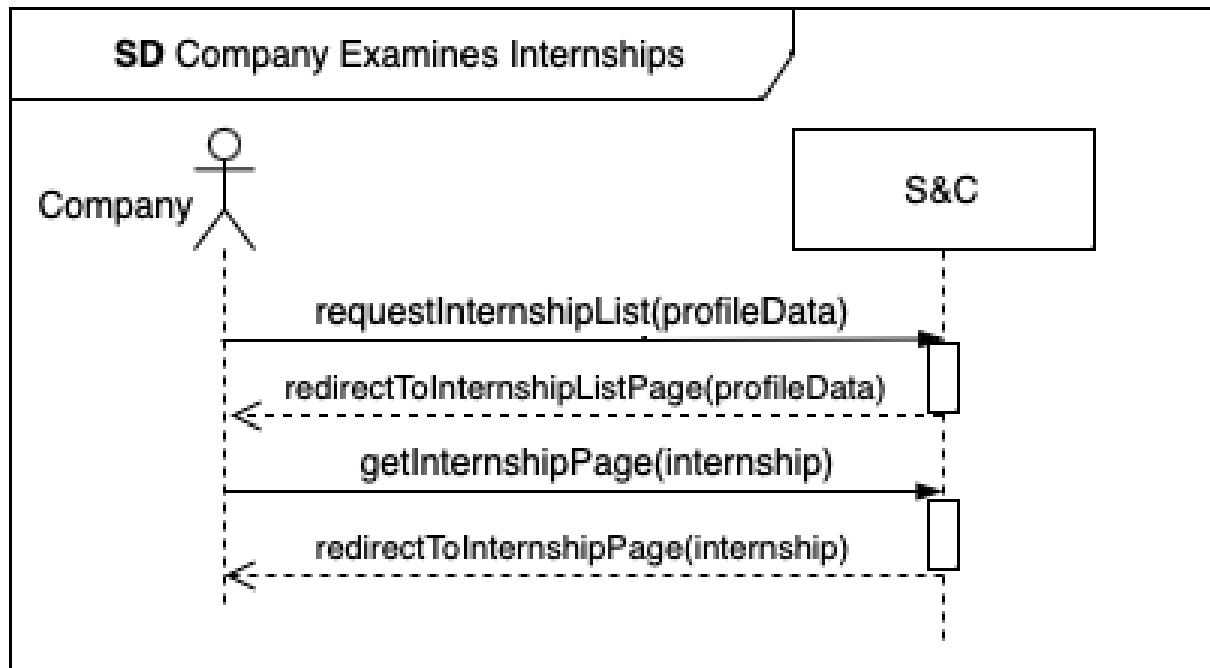
[US13] Company Examines Applications

Name	Company Examines Applications
Actors	• Company
Entry Condition	• The company decides to examine its applications; • The company has an account and is logged in; • The company is on its profile page.
Event Flow	1. Included use case: Company Examines Internship Positions 2. The company presses the "Applications" button; 3. S&C redirects the company to the page of the applications; 4. The company can click on any of them to get more details
Exit Condition	The company exits his own profile page or accept, refuse or request an assessment an application
Exceptions	1. The company doesn't have any applications for an internship position • In that case, S&C will display an empty list and a warning message on the screen saying that the company has not any applications for that internship yet.

SD Company Examines Applications

Company

S&C

requestInternshipPositionsList(profileData)

redirectToInternshipPositionListPage(profileData)

requestApplicationList(internship)

redirectToApplicationListPage(internship)

requestApplicationPage(applicationData)

redirectToApplicationPage(applicationData)
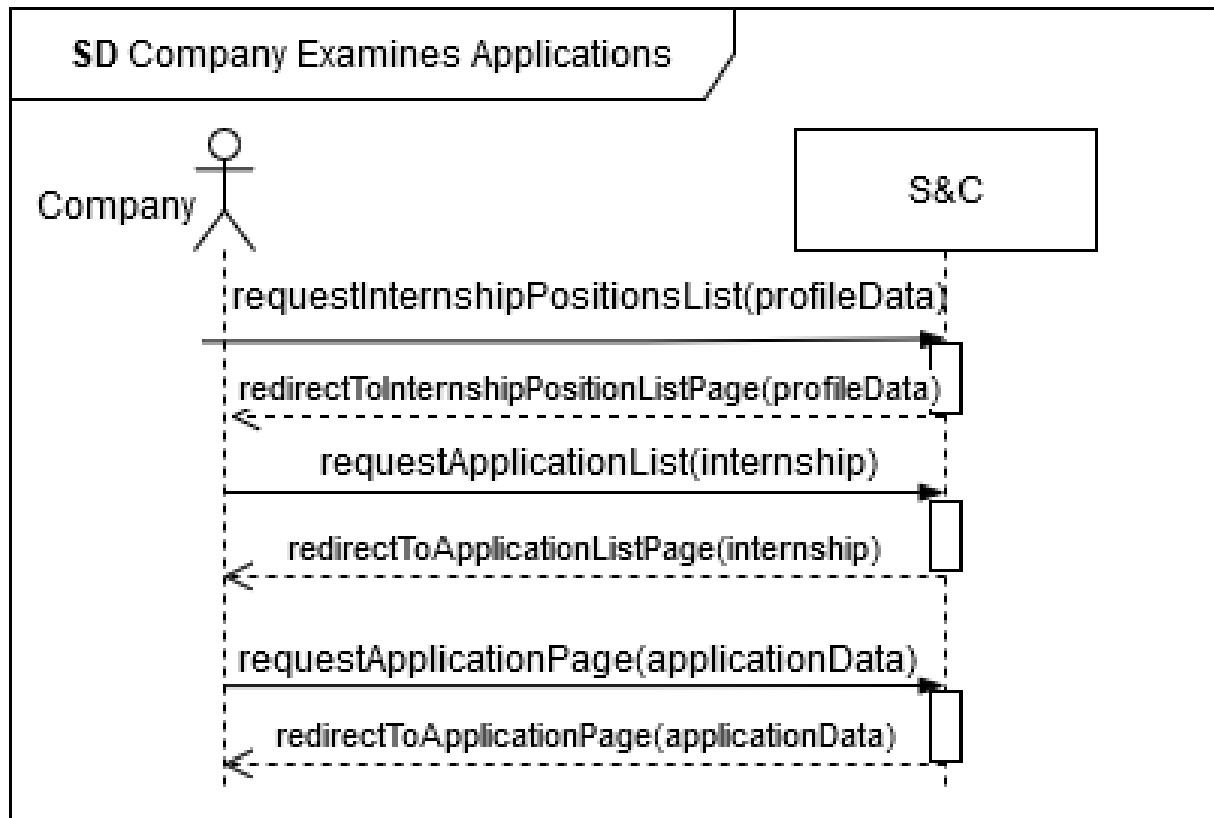
[US14] Application Acceptance or Rejection

Name	Application Acceptance or Rejection
Actors	• Company
Entry Condition	• The company has an account and is logged in; • The company knows which candidate to accept or reject; • The company is in the dedicate page of an open internship that it has.
Event Flow	1. The company clicks on the button to see the list of candidates; 2. The company can click on each item of the list to visit the profile page of the candidate; 3. The company clicks on the "Accept" or "Reject" button in correspondence with the candidate 4. S&C displays a Success Message;
Exit Condition	The candidate is accepted or rejected.
Exceptions	1. The company has no candidates for an open internship. • In that case, S&C will show an empty list an display a notification which says no applications were found for that position.

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SD Application Acceptance or Rejection

Company — S&C

requestApplicationList(internship)

redirectToApplicationListPage(internship)

requestApplicationPage(applicationData)

redirectToApplicationPage(applicationData)

alternative

acceptApplication(applicationData)

writeToDb(applicationData)

redirectToApplicationListPage(internship)

else

rejectApplication(applicationData)

writeToDb(applicationData)

redirectToApplicationListPage(internship)

[US15] Further Assessment for Application

Name	Further Assessment for Application
Actors	• Company
Entry Condition	• The company has an account and is logged in; • The company knows which candidates have to undergo more assessment before being accepted or rejected; • The company is in the dedicate page of an open internship that it has.
Event Flow	1. The company clicks on the button to see the list of candidates; 2. The company can click on each item of the list to visit the profile page of the candidate; 3. The company clicks the "Assess Further" button in correspondence with the candidate; 4. The company is prompted a calendar to choose when to schedule the interview and an input field to put the link of the online room; 5. The company confirms the date; 6. S&C displays a Success Message.
Exit Condition	The company has scheduled a new interview.

Exceptions	1. The company has no candidates for an open internship.
	  • In that case, S&C will show an empty list and display a notification which says no applications were found for that position.
	2. The company inserted an invalid link.
	  • S&C validates the input and detects the invalid data.
	  • S&C displays an error message explaining the specific validation error.

SD Further Assesment for Application

Company

S&C

requestApplicationList(internship)

redirectToApplicationListPage(internship)

requestApplicationPage(applicationData)

redirectToApplicationPage(applicationData)

furtherAssess(applicationData)

redirectToScheduleInterview(applicationData)

scheduleInterview(interviewData)

checkInterviewData(interviewData)

alternative

if checkInterviewData(interviewData)

writeToDb(interviewData)

redirectToApplicationListPage(internship)

else

redirectToScheduleInterview(applicationData, message)

3.3.4 Users (Company and Student) Use Cases

Notice that in this subsection when we refer to users we intend students and companies only.

[US16] Feedback from User

Name	Feedback from User
Actors	• User
Entry Condition	• The user has an account and is logged in; • The user has participated in the internship; • The internship has finished.
Event Flow	1. The user navigates to the page of the just finished internship; 2. The user clicks the button to create a feedback; 3. The user inserts a rating and a comment; 4. The user sends it by clicking "Send"; 5. S&C validates the data; 6. S&C displays a Success Message.
Exit Condition	The feedback is sent and the user is redirected to the application page

Exceptions	1. The user provides invalid data (e.g., rating outside the range).
	   • S&C validates the input and detects the invalid data.
	   • S&C displays an error message explaining the specific validation errors.

[US17] Communication between Users

Name	Communication between Users
Actors	• User
Entry Condition	• The user has an account and is logged in; • The user is participating in the internship; • A user has to communicate something while an internship is on-going.
Event Flow	1. The user navigates to the page of the ongoing internship; 2. The user clicks the button to create a new complaint or a new suggestion; 3. The user inserts a message and sends it;
Exit Condition	The suggestion/complaint is sent and the student/company is redirected to the application page

SD Communication between Users

User

S&C

requestApplicationPage()

redirectToApplicationPage()

requestCommunicationPage()

redirectToCommunicationPage()

sendMessage(message)

writeToDb(message)

redirectToApplicationPage()
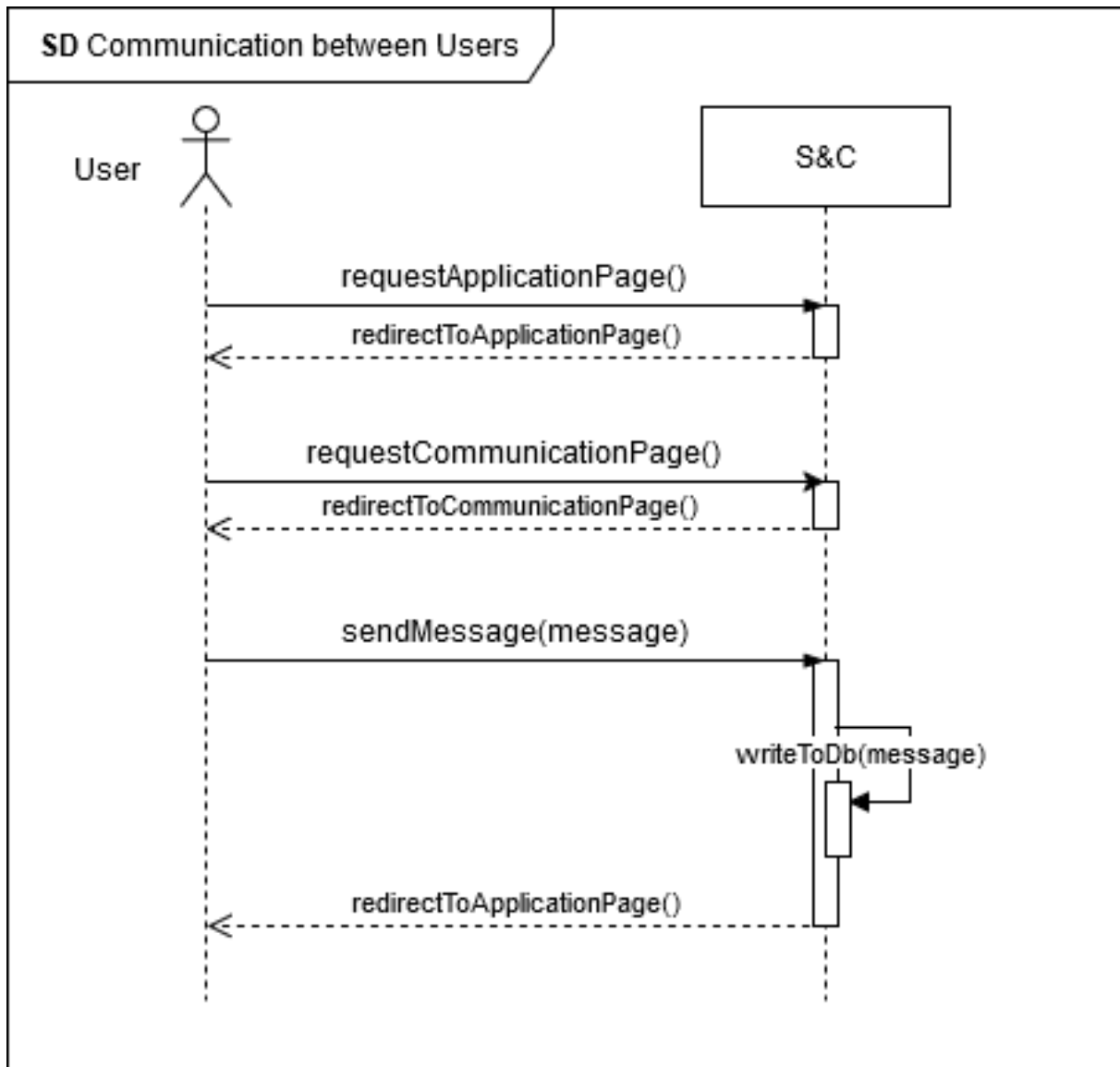
3.3.5 Universities Use Cases

[US18] University Registration

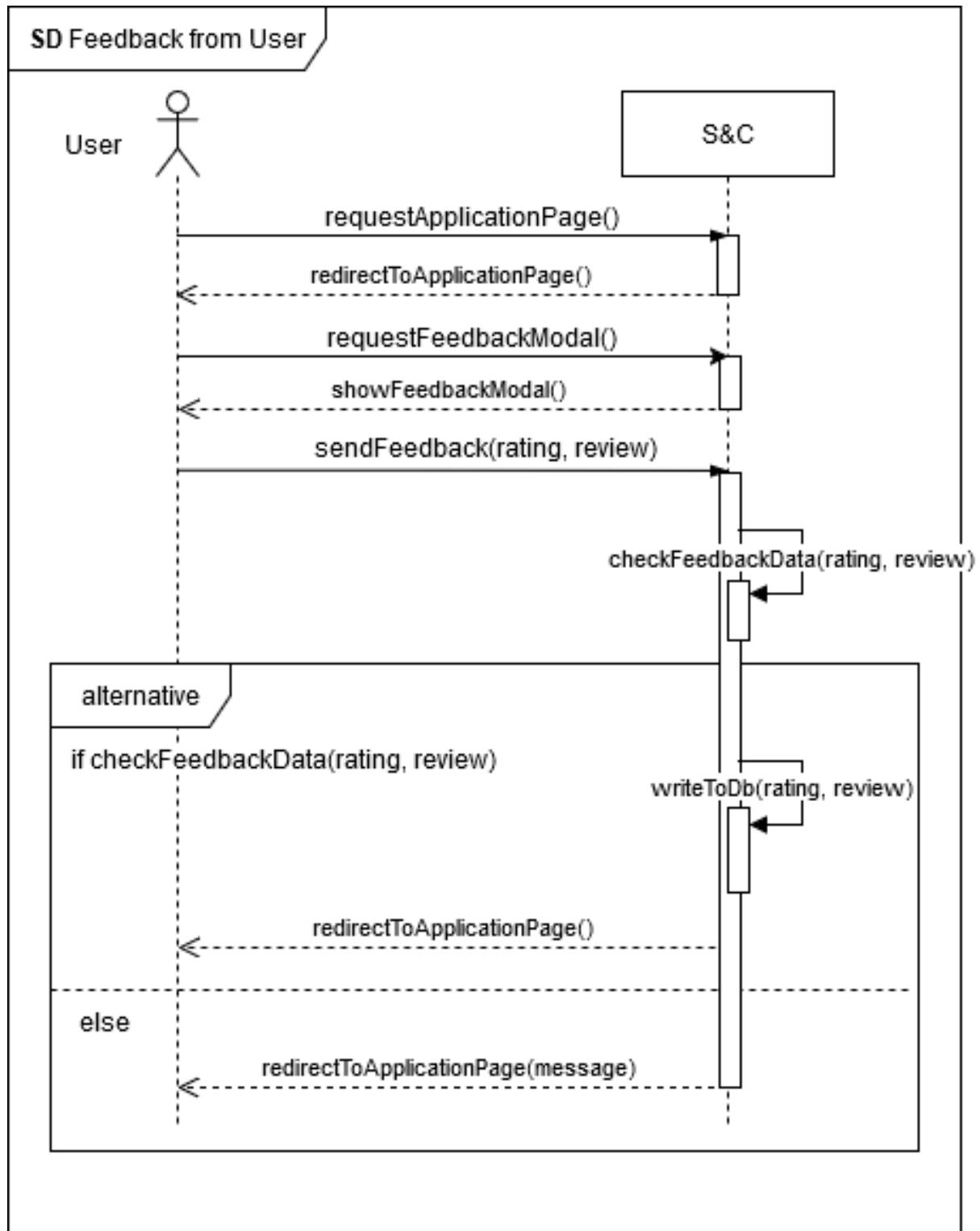| Name	University Registration
Actors	• University
Entry Condition	The university does not have an account and is on the main page of S&C.

Event Flow	1. The university presses the "Register as University" button;
	
	2. S&C redirects the university to the register page;
	
	3. The university enters the following information in the corresponding form field:
	  • University mail;
	  • Password;
	  • Confirm password
	  • University name;
	  • Address;
	  • URL of it's website.
	
	4. The university presses the "Subscribe" button;
	
	5. S&C validates the data;
	
	6. S&C creates the university's account;
	
	7. S&C redirects the university to the homepage of S&C.

Exit Condition	The university's account is created, and it's logged in.

Exceptions	1. The university provides invalid data (e.g., invalid email format, duplicate email address, mismatched passwords).
	  • S&C validates the input and detects the invalid data.
	  • S&C displays an error message explaining the specific validation errors.
	  • The university must correct the errors and resubmit the form.
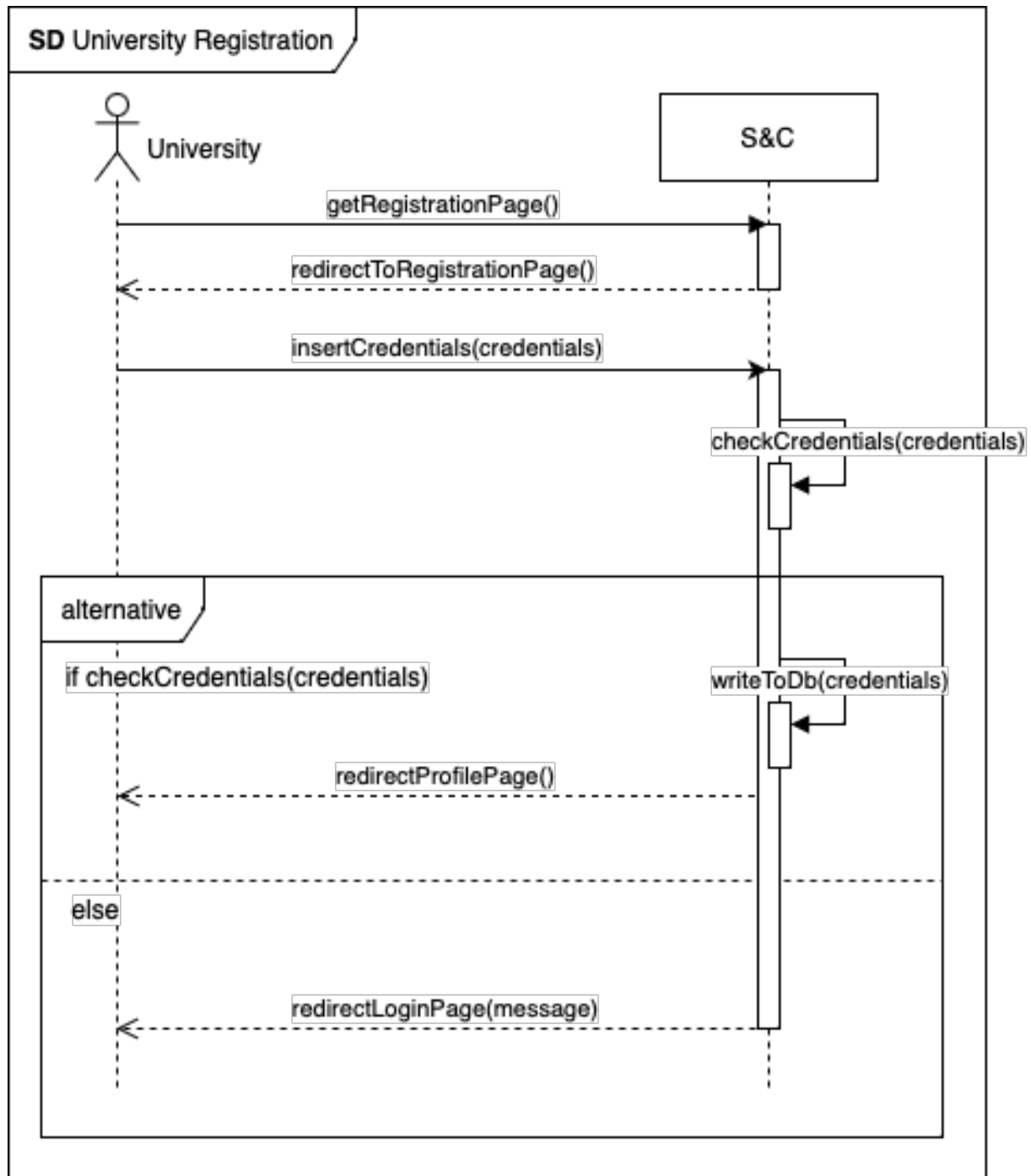
[US19] University Monitors Internships

Name	University Monitors Internships
Actors	University
Entry Condition	The university is logged in
Event Flow	1. The university has a list of internships done by its students on its home page; 2. The university can click on any of them to get more details;
Exit Condition	The university stops scrolling the list of hits students who got an internship profile.
Exceptions	1. The universities has no students who got an internship. • In that case, S&C will display a message on the screen saying that no enrolled student got any internship.

SD University Monitors Internships

University

S&C

requestInternshipList()

showInternshipList()

requestInternshipPage()

redirectToInternshipPage()
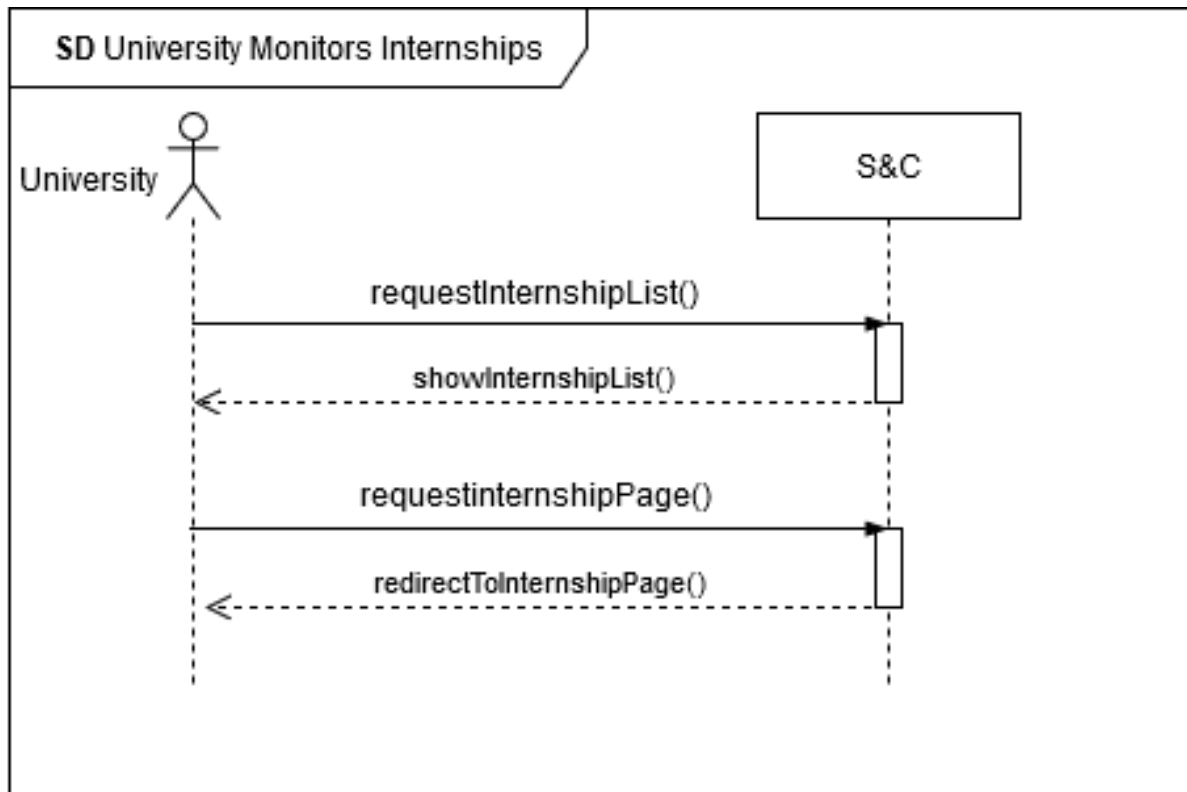
3.4 Requirement Mapping

[G1] **Internship Lookup for Students**: Help students in their search for an internship by connecting their profiles with well-suited internship offers from companies.

Requirements	Mapped To
R1 S&C shall allow users to sign up.	D1 Students insert correct information about their skills and experience
R2 S&C shall allow users to fill their profile information on sign up	D2 Students apply to jobs in countries where they have a work permit
R3 S&C shall allow users to log in.	D3 Companies offer existing and legal contracts for the internships
R4 S&C shall allow users to log out.	D4 Companies insert correct information about the internships
R5 S&C shall allow users to update their profile information.	D5 Companies periodically review information about the internship candidates
R7 S&C shall allow users to examine open internship positions.	
R9 S&C shall allow students to search for a specific kind of internship.	
R10 S&C shall allow students to apply for an internship.	
R11 If an internship position suited to a student is opened, S&C shall notify the student	
R12 When a student issues a search for an internship, S&C shall list the different positions aligned with the student's profile.	

[G2] **Visibility for Internship Positions of the Companies**: Allow companies to promote their internship positions to students and inform them about the availability of eligible candidates.

Requirements	Mapped To
R1 S&C shall allow users to sign up.	D1 Students insert correct information about their skills and experience
R2 S&C shall allow users to fill their profile information on sign up	D2 Students apply to jobs in countries where they have a work permit
R3 S&C shall allow users to log in.	D3 Companies offer existing and legal contracts for the internships
R4 S&C shall allow users to log out.	D4 Companies insert correct information about the internships
R5 S&C shall allow users to update their profile information.	D5 Companies periodically review information about the internship candidates
R7 S&C shall allow users to examine open internship positions.	
R9 S&C shall allow students to search for a specific kind of internship.	
R10 S&C shall allow students to apply for an internship.	
R11 If an internship position suited to a student is opened, S&C shall notify the student	
R12 When a student issues a search for an internship, S&C shall list the different positions aligned with the student's profile.	
R18 S&C shall allow companies to open and examine its internship positions.	

[G3] **Selection Process Management**: Support the interaction and selection by providing a platform to companies to set up and conduct interviews, gather structured information about students and finalize the selections.

Requirements	Mapped To
R1 S&C shall allow users to sign up.	D1 Students insert correct information about their skills and experience
R2 S&C shall allow users to fill their profile information on sign up	D2 Students apply to jobs in countries where they have a work permit
R3 S&C shall allow users to log in.	D3 Companies offer existing and legal contracts for the internships
R4 S&C shall allow users to log out.	D4 Companies insert correct information about the internships
R5 S&C shall allow users to update their profile information.	D5 Companies periodically review information about the internship candidates
R8 S&C shall allow users to examine their own applications.	
R10 S&C shall allow students to apply for an internship.	
R13 If an application has been accepted by a company, S&C shall allow the student who made the application to confirm or refuse the internship	
R14 If a company signals that it needs an assessment of the students' skills, S&C shall allow the student to schedule the quiz	
R15 After an assessment has been scheduled, S&C shall allow the student to access the link and see the date of the assessment	
R16 S&C shall allow the student to see the status of its applications	
R17 S&C shall allow companies to accept or reject applications to their internship positions	
R18 S&C shall allow companies to open and examine its internship positions.	
R19 S&C shall allow companies to close internship positions.	

[G4] **Data Collection for Recommendation System**: Collect statistics in order to allow the efficiency of the matchmaking process of the recommendation system

Requirements	Mapped To
R1 S&C shall allow users to sign up.	D1 Students insert correct information about their skills and experience
R2 S&C shall allow users to fill their profile information on sign up	D2 Companies insert correct information about the internships
R3 S&C shall allow users to log in.	D3 Students provide valuable feedback when asked for it
R4 S&C shall allow users to log out.	
R5 S&C shall allow users to update their profile information.	
R21 S&C shall allow companies to leave private notes to students who are carrying out an internship with it	
R22 S&C shall allow companies to send news about the internship to students who are carrying it out	
R23 S&C shall allow both parties to communicate problems in a specific space of the website	
R24 S&C shall allow students who took an internship with a company to rate the internship and vice versa	
R25 S&C shall allow students who took an internship with a company to give suggestions to the company and vice versa	
R26 S&C shall allow companies to send news about the internship to students who are carrying it out	
R27 S&C shall allow both parties involved in an internship to communicate problems in a dedicated space	

[G5] **Enhance Communication**: Enhance communication between students and companies, through a shared space where they can exchange information, raise problems and collect complaints about the internships

Requirements	Mapped To
R1 S&C shall allow users to sign up.	D5 Students provide valuable feedback when asked for it
R2 S&C shall allow users to fill their profile information on sign up	D7 Companies provide valuable feedback when asked for it
R3 S&C shall allow users to log in.	D8 Students raise problems through the platform
R4 S&C shall allow users to log out.	D9 Companies use the platform as principal mean of communication regarding the internships
R21 S&C shall allow companies to leave private notes to students who are carrying out an internship with it	
R22 S&C shall allow companies to send news about the internship to students who are carrying it out	
R23 S&C shall allow both parties to make complaints in a specific space of the website	
R24 S&C shall allow students who took an internship with a company to rate the internship and vice versa	
R25 S&C shall allow students who took an internship with a company to give suggestions to the company and vice versa	
R26 S&C shall allow companies to send news about the internship to students who are carrying it out	
R27 S&C shall allow both parties involved in an internship to communicate problems in a dedicated space	

[G6] **Monitoring of Internships by Universities**: Allow universities to see the situation of the internships of their students, including the complaints about them.

Requirements	Mapped To
R1 S&C shall allow users to sign up.	D10 Universities must register on the platform before their students can create accounts, as students are required to link their profiles to their university
R2 S&C shall allow users to fill their profile information on sign up	
R3 S&C shall allow users to log in.	
R4 S&C shall allow users to log out.	
R5 S&C shall allow users to update their profile information.	
R28 S&C shall allow universities to monitor the status of the internship of their students	
R29 S&C shall allow universities to see details of the internships of their students	

3.5 Performance Requirements

S&C has to guarantee certain performance requirements in order to fulfill the goals for which it has been designed.

- **Up-time**: it has to be at least 99.5%, which is pretty standard.

- **Response time**: it has to be reasonable. Here we tend not to quantify too much the response time because it also depends on the type of connection the user has not only on how the platform is built. We would like the system to reflect changes in almost real-time.

- **Notifications**: they have to be delivered in a reasonable time. Again as above.

- **Scalability**: the platform must support busy periods as well as periods with less interactions.

3.6 Design Constraints

3.6.1 Standard Compliance

S&C should be perfectly compliant with data regulations present in the countries in which it operates. Since it is supposed to work mainly in the EU, it should be compliant with GDPR rules and the recommendation system used to match students and companies if enhanced by AI should be compliant with the AI Act. Privacy is of paramount importance to the platform, therefore a series of legal contracts regulate the information that the users store into the platform and users have to accept the privacy policy before registering to the website. Moreover, the infrastructure of the website is designed to be secure and avoid any kind of data breach that could harm the privacy of the users registered to the platform.

3.6.2 Hardware Limitations

The hardware necessary for this kind of applications is barely minimum, indeed any computing device with internet access on the market can navigate the web and visit the website page of S&C. However, the only important hardware limitation is having a big screen. Indeed the application will be available only for desktop view. Therefore a mobile phone (even with internet access) won't be capable of seeing the platform and interact with it.

3.6.3 Any Other Constraint

As long as inclusive support is concerned, S&C has not already support for blind people, but it does not use any kind of audio support therefore it can be used by hearing-impaired people.

3.7 Software System Attributes

The software system attributes along with the design choices we made to enforce those attributes will be more documented in the DD in the corresponding section. In this section our goal is to give a general idea of their scope within our platform.

3.7.1 Reliability

S&C must be reliable at all times. It has to be up and running continuously to provide users with a nice and fluid experience. The system should enforce data consistency which is a key component of reliability.

3.7.2 Availability

Availability is of crucial importance to the platform. Indeed crashes and service interruptions should be avoided as much as possible. Maintenance must be scheduled and users must be alerted in advance when the website will not be available due to it.

3.7.3 Security

S&C should be strongly secure. Requests should be validated on both the back-end and on the front-end side to ensure no malicious code will reach the data stored. Password encryption will keep securely stored the password of the users. The website will be protected by using specific libraries from cross-site request forgery attacks. User session should be managed in order to guarantee an adequate level of security.

3.7.4 Maintainability

The software of S&C shall be as easy as possible to maintain. The code should be commented extensively for making new programmers who contribute to the development of the project aware of how all the function and components work. When possible, writing reusable code is preferred and, of course, modular programming is preferred over a monolithic style. Other techniques that will be used to make sure the system is going to be maintainable is to define clear boundaries between modules and apply as much decoupling among them as possible. The software of S&C must be linked to a versioning control software to keep track of the changes made and by who they were made.

4 Formal Analysis Using Alloy

In this Alloy section we focused mainly on the two most critical point of S&C: the opening and closing of an internship position and the application by a student to an open position. At the end there are also some screenshot from the Alloy analyzer that proved our predicates to be consistent or say that assertion may be valid since no counterexample were found (which is equivalent to say that the assertions made were fine since Alloy does bounded verification). In order to improve the readability of the Alloy part we decided to divide the code into different sections, namely Signatures, Internship Positions, Applications, Internships and Feedback and Universities.

```
-------------------------------------------------------------------------------
Signatures:
-------------------------------------------------------------------------------
enum ApplicationStatus {Accepted, Rejected, Pending, ToBeAssessed, Confirmed, Refused}

enum InternshipStatus {Ongoing, Finished}

enum InternshipPositionStatus { Open, Closed }

abstract sig User {
    id: String,
    email:  String,
    password:  String,
}

sig Student extends User {
    firstName: String,
    lastName: String,
    phoneNumber: String,
    location: String,
    degreeProgram: String,
    GPA: Int,
    graduationYear: Int,
    var applications: set Application,
    var university: one University
}

sig Company extends User {
    name: String
}

sig University {
    id: String,
    name: String,
    var internship: set Internship,
    address: String,
    website: String
}

sig Internship {
    application: one Application,
```

```
    var status: InternshipStatus
}

sig InternshipPosition {
    id: String,
    programName: String,
    location: String,
    roleTitle: String,
    compensation: Int,

    var applications: set Application,
    var status: InternshipPositionStatus
}

sig Application {
    id: String,
    company: one Company,
    internshipPosition: one InternshipPosition,
    student: one Student,
    var status: ApplicationStatus,
}

abstract sig Feedback{
    id: String,
    rating: Int,
    review: String,
    internship: one Internship
}

sig FeedbackByStudent extends Feedback {
    giver: one Student
}

sig FeedbackByCompany extends Feedback{
    giver: one Company
}

abstract sig Complaint {
    id: String,
    content: String,
    internship: one Internship
}

sig ComplaintByStudent extends Complaint {
    giver: one Student
}

sig ComplaintByCompany extends Complaint{
    giver: one Company
}
```

Internship Positions

```
// All internship positions are open at the beginning
fact DefaultOpenInternshipPosition {
    all i: InternshipPosition | i.status = Open
}

// Closed internship positions will not reopen
fact InternshipPositionClosedWontReopen {
 all i: InternshipPosition |
  always (i.status = Closed implies
     after always i.status = Closed)
}

// If an internship position is open, it will eventually be closed
fact NotAlwaysOpenInternshipPosition {
    all i: InternshipPosition |
        always ( i.status = Open
                implies
                    eventually i.status = Closed )
}

// If an internship position is open it has been open since the beginning
fact NowOpenPreviouslyOpenInternshipPosition {
    all i: InternshipPosition |
        always ( i.status = Open
                    implies
                        historically i.status = Open )
}

// If an internship position is closed now it has been closed in an instant in the past
fact IfClosedDidCloseInternshipPosition {
all i: InternshipPosition |
    always (i.status = Closed
        implies
            once close[i])
}

// If I applied to an internship position it must have been open in the past
assert OnlyApplyToOpenInternshipPosition {
    all a: Application |
        always (once a.internshipPosition.status = Open)

}

check OnlyApplyToOpenInternshipPosition for 20 steps
```

```
pred close[i: InternshipPosition] {
    i.status = Open
    i.status' = Closed
}
```

```
run close for 15 but 4 InternshipPosition, 2 Company, 2 Student, 2 Application,
2 University, 6 Internship, 4 steps
```

```
pred showThatInternshipCloses{
InternshipPosition.status = Open
after eventually Closed in InternshipPosition.status
}
```

```
run showThatInternshipCloses
```

The results of the instructions above:

Executing "Check OnlyApplyToOpenInternshipPosition for 20 steps"
Solver=sat4j Steps=1..20 Bitwidth=4 MaxSeq=4 SkolemDepth=1 Symmetry=20 Mode=batch
1..20 steps. 478527 vars. 19730 primary vars. 1415995 clauses. 10785ms.
No counterexample found. Assertion may be valid. 13ms.

Executing "Run close for 25 but 4 steps, 4 InternshipPosition, 2 Company, 2 Student, 2 Application,
Solver=sat4j Steps=1..4 Bitwidth=4 MaxSeq=7 SkolemDepth=1 Symmetry=20 Mode=batch
1..2 steps. 33836 vars. 3528 primary vars. 59866 clauses. 343ms.
Instance found. Predicate is consistent. 28ms.

Executing "Run showThatInternshipCloses"
Solver=sat4j Steps=1..10 Bitwidth=4 MaxSeq=4 SkolemDepth=1 Symmetry=20 Mode=batch
1..2 steps. 5636 vars. 507 primary vars. 9452 clauses. 144ms.
Instance found. Predicate is consistent. 70ms.

```
--------------------------------------------------------------------------------
Applications
--------------------------------------------------------------------------------


// All applications are done to open positions
fact ApplicationsOnlyForOpenPositions {
    all a: Application | a.internshipPosition.status = Open
}

// All applications are pending at the beginning
fact DefaultPendingApplication {
    all a: Application | a.status = Pending
}

// If an application is pending or to be assessed, it will eventually be either rejected or
fact EventualStatusOfPendingApplication {
    all a: Application |
        always ( a.status = Pending or a.status = ToBeAssessed
                 implies
                     eventually a.status = Rejected or
                     a.status = Confirmed or a.status = Refused )
}

// Pending applications are referred only to open internship positions
assert PendingApplicationReferToOpenPositions {
    all a: Application |
        a.status = Pending implies a.internshipPosition.status = Open
}

// Applications which request further assessment are referred only to open internship positi
assert TobeAssessedApplicationReferToOpenPositions {
    all a: Application |
        a.status = ToBeAssessed implies a.internshipPosition.status = Open
}
```

The results of the instructions above:

Executing "Check PendingApplicationReferToOpenPositions for 15"
Solver=sat4j Steps=1..10 Bitwidth=4 MaxSeq=7 SkolemDepth=1 Symmetry=20 Mode=batch
1..10 steps. 615060 vars. 89825 primary vars. 1124587 clauses. 8442ms.
No counterexample found. Assertion may be valid. 11ms.

Executing "Check TobeAssessedApplicationReferToOpenPositions for 15"
Solver=sat4j Steps=1..10 Bitwidth=4 MaxSeq=7 SkolemDepth=1 Symmetry=20 Mode=batch
1..10 steps. 615060 vars. 89825 primary vars. 1124587 clauses. 8124ms.
No counterexample found. Assertion may be valid. 10ms.

```
--------------------------------------------------------------------------------
Internships
--------------------------------------------------------------------------------


// All internships are ongoing at the beginning
fact DefaultInternship {
    all i: Internship | i.status = Ongoing
}

// All internships refer to confirmed application
fact AllInternshipReferToConfirmedApplication {
    all i: Internship | i.application.status = Confirmed
}

// If an internship is ongoing, it will eventually be finished
fact NotAlwaysOngoingInternship {
    all i: Internship |
        always ( i.status = Ongoing
                implies
                    eventually i.status = Finished )
}

// If an internship is nongoing it has been ongoing since the beginning
fact NowOpenPreviouslyOpenInternship {
    all i: Internship |
        always ( i.status = Ongoing
                    implies
                        historically i.status = Ongoing )
}

// If an internship is finished now it has been finished in an instant in the past
fact IfClosedDidCloseInternship {
all i: Internship |
    always (i.status = Finished
        implies
            once finish[i])
}

pred finish[i: Internship] {
    i.status = Ongoing
    i.status' = Finished
}

run finish for 15 but 4 InternshipPosition, 2 Company, 2 Student, 2 Application,
6 Internship, 2 University, 4 steps
```

The results of the instructions above:

```
--------------------------------------------------------------------------------
Feedback
--------------------------------------------------------------------------------


// All feedbacks given by student are given after an internship is finished
assert FeedbackStudentGivenOnFinishedInternship {
    all f: FeedbackByStudent | f.internship.status = Finished
}

// All feedbacks given by companies are given after an internship is finished
assert FeedbackCompanyGivenOnFinishedInternship {
    all f: FeedbackByCompany | f.internship.status = Finished
}

// A student can only give feedback for an internship he has taken
fact StudentFeedbackOnlyTheirInternship {
    all f: FeedbackByStudent |
        f.giver in f.internship.application.student
}

// A company can only give feedback for an internship he has offered
fact CompanyFeedbackOnlyTheirInternship {
    all f: FeedbackByCompany |
        f.giver in f.internship.application.company
}

check FeedbackCompanyGivenOnFinishedInternship for 10
```

The results of the instructions above:

Executing "Check FeedbackStudentGivenOnFinishedInternship for 10"
Solver=sat4j Steps=1..10 Bitwidth=4 MaxSeq=7 SkolemDepth=1 Symmetry=20 Mode=batch
1..10 steps. 359810 vars. 42700 primary vars. 671172 clauses. 6841ms.
No counterexample found. Assertion may be valid. 13ms.

```
--------------------------------------------------------------------------------
Complaints
--------------------------------------------------------------------------------


// All complaints given by student are given during an internship
fact ComplaintByStudentDuringInternship {
    all f: ComplaintByStudent | f.internship.status = Ongoing
}


// All complaints given by companies are given during an internship
fact ComplaintByCompanyDuringInternship {
    all f: ComplaintByCompany | f.internship.status = Ongoing
}


// A student can only complain about an internship he is taking
fact StudentComplainsOnlyTheirInternship {
    all f: ComplaintByStudent |
        f.giver in f.internship.application.student
}


// A company can only complain about an internship it is offering
fact CompanyComplainsOnlyTheirInternship {
    all f: ComplaintByCompany |
        f.giver in f.internship.application.company
}


--------------------------------------------------------------------------------
Universities
--------------------------------------------------------------------------------


// University sees the applications of its own students
fact UniversityMonitorsItsStudentsInternship {
    all u: University, i: Internship |
        i in u.internship implies i.application.student.university = u
}
```

Executing "Check FeedbackCompanyGivenOnFinishedInternship for 10"
  Solver=sat4j Steps=1..10 Bitwidth=4 MaxSeq=7 SkolemDepth=1 Symmetry=20 Mode=batch
  1..10 steps. 359810 vars. 42700 primary vars. 671172 clauses. 4184ms.
  No counterexample found. Assertion may be valid. 3ms.

5   Effort Spent

Project Working Hours

Project Section	Gribaldo (hours)	Rosa (hours)	Total Hours
1) Introduction	4:00	4:30	8:30
2) Overall Description	4:00	14:00	18:00
3) Specific Requirements	22:00	21:00	43:00
4) Formal Analysis using Alloy	10:00	2:00	12:00
Reading and Checking	4:30	3:00	7:30
Brainstorming (together)	8:00	8:00	16:00
Total Hours	52:30	52:30	105:00

Table 26: Working Hours per Project Section

References

[1] Ieee guide for developing system requirements specifications. *IEEE Std 1233-1996*, pages 1–30, 1996.