# Software Requirements Specification - *SRS*

# Project Course in Software Engineering

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*Semester:* VT 2020
*Area:* Computer Science
*Course Code:* 2DV609

# Contents

# 1 Introduction

## 1.1 Purpose of the requirements document

The purpose of the requirements document is to produce complete, precise, and formal specifications from the needs of the stakeholders. The report is written and structured such that a variety of different stakeholders can understand the contents of the document.

The document contains precise requirements of the Exam Management System. Hence the text serves as a pivot for the architectural design and the implementation of the plan.

## 1.2 Scope of the product

The scope of the process is to define the stakeholders, conduct requirements elicitation, requirement analysis, and requirements validation. Write test cases for the final precise set of requirements. Moreover, the scope includes designing and implementing the last accurate set of requirements.

## 1.3 Business goals

The business goals of the application are to provide Exam Management System that provides educators with features that allow them to create and manage exams that can be performed by students remotely and to allow flexibility in terms of correcting exams and setting grades.

## 1.4 Definitions, Acronyms, And Abbreviations

| Acronyms and abbreviation | Definition |
|---|---|
| SRS | Software Requirements Specification. |
| GDPR | European Union General Data Protection Regulation. |
| CRUD | Create, Retrieve, Update and Delete. |
| UI | User Interface. |
| GUI | Graphical User Interface. |
| SSL | Secure Sockets Layer. |

Table 1: Acronyms, abbreviation and definitions

## 1.5   How to use the document

| User | Use |
|---|---|
| Developers, Designers, and Testers | They can use this document to design, develop the system, and structure test cases for it. |
| Data Inspection Board | They can use this document to understand how the personal information of the students is being handled in the system. |
| Project Maintenance Team | They can use it to understand and decide how they can maintain the system. |
| Teachers and Teacher Assistants | They can use it to understand how the system works in terms of creating exams, adding questions and setting grades. |
| Students | They can use it to understand how the exam management system works. |

Table 2: The Use Of The Requirements Document

## 1.6   Stakeholders

| Stakeholders |
|---|
| Product Owner |
| End-Users: Students |
| Software Developers |
| Software Designers |
| IT Security Team |
| Networking Team |
| University President |
| Teachers |
| Teacher Assistants |
| Academic Faculty |
| Non-government organizations: Student Union |
| University Administrators |
| University Support Service |
| Software Testers |
| Database Team |
| Project Maintenance Team |
| The Education Authority |
| Data Inspection Board |

Table 3: Stakeholders

## 1.7 Security and Privacy

When it comes to the security aspect, the system will handle and manage sensitive information that belongs to the users of the applications, such as personal information, addresses, and grades. The SSL technology will be adapted to protect and secure the information during the communications and the transmissions between the Client and the Sever and vice versa.

As for the privacy aspect, the system will provide privacy by processing and managing the data of the users in accordance and compliance with the GDPR. These aspects are essential for the system to make it a secure and reliable application.

## 2 Requirements

This section contains the functional and the non-functional requirements for the application MyExam Management application.

### 2.1 Functional Requirements

The functional requirements divided into three categories, Admin, Teacher, and Student. The following subsections will describe them according to their categories:

#### 2.1.1 Admin Requirements

| Identifier | ADMN-EXAM-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to create an exam for any teacher. | |
| **Input:** | |
| The name of the exam, the publication date and time, the deadline date and time and the duration time. | |
| **Output:** | |
| An online exam. | |
| **Process:** | |
| The system will create an online exam, and save the information in the database. | |

| Identifier | ADMN-EXAM-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to review all exams. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| The exam corresponding to the name. | |
| **Process:** | |
| The system will retrieve the information of the target exam from the database and view it for the user. | |

| Identifier | ADMN-EXAM-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to edit all existing exams. | |
| **Input:** | |
| The name of the exam and exam data to update. | |
| **Output:** | |
| Updated exam. | |
| **Process:** | |
| The system will update the target exam and save and update the information in the database. | |

| Identifier | ADMN-EXAM-004 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to delete any exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| The exam removed from the system. | |
| **Process:** | |
| The system will delete the target exam and delete the information from the database. | |

| Identifier | ADMN-QUES-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to add question[s] to any exam that requires textual answers from students. | |
| **Input:** | |
| Question[s]. | |
| **Output:** | |
| Question[s] added to the exam. | |
| **Process:** | |
| The system will add the question[s] to the target exam and save the information in the database. | |

| Identifier | ADMN-QUES-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to add question[s] to any exam with multiple-choice answer[s] that requires students to check the answers to an exam. | |
| **Input:** | |
| Question[s] and multiple-choice answer[s]. | |
| **Output:** | |
| Question[s] with multiple-choice answer[s] added to the exam. | |
| **Process:** | |
| The system will add the question[s] and the multiple-choice answer[s] to the target exam and save the information in the database. | |

| Identifier | ADMN-QUES-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to read textual question[s] in any exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| The given exam with its question[s]. | |
| **Process:** | |
| The system will retrieve the information of the target exam from the database and view the exam along with its question[s] for the user. | |

| Identifier | ADMN-QUES-004 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to view existing question[s] with multiple-choice in any exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| The given exam with its question[s]. | |
| **Process:** | |
| The system will retrieve the information of the target exam from the database and view the exam along with its question[s] and answer[s] for the user. | |

| Identifier | ADMN-QUES-005 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to edit textual question[s] in any existing exam. | |
| **Input:** | |
| Name of the exam. | |
| **Output:** | |
| Question[s] updated in the exam. | |
| **Process:** | |
| The system will update the question[s] in the target exam and save and update the information in the database. | |

| Identifier | ADMN-QUES-006 |
|---|---|
| **Priority** | Essential |
| **Description:** ||
| An admin shall be able to edit question[s] with multiple-choice answer[s] in any existing exam. ||
| **Input:** ||
| Name of the exam. ||
| **Output:** ||
| Question[s] and answer[s] updated in the exam. ||
| **Process:** ||
| The system will update the question[s] and the answer[s] in the target exam and save and update the information in the database. ||

| Identifier | ADMN-QUES-007 |
|---|---|
| **Priority** | Essential |
| **Description:** ||
| An admin shall be able to delete textual question[s] from any exam. ||
| **Input:** ||
| Name of the exam. ||
| **Output:** ||
| Question[s] deleted from the exam. ||
| **Process:** ||
| The system will delete the question[s] from the target exam and delete the information from the database. ||

| Identifier | ADMN-QUES-008 |
|---|---|
| **Priority** | Essential |
| **Description:** ||
| An admin shall be able to delete question[s] with multiple-choice answer[s] from any exam. ||
| **Input:** ||
| Name of the exam. ||
| **Output:** ||
| Question[s] and answer[s] deleted from the exam. ||
| **Process:** ||
| The system will delete the question[s] and its answer[s] from the target exam and delete the information from the database. ||

| Identifier | ADMN-QUES-009 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to add an image to any question in any exam in the system. | |
| **Input:** | |
| The name of the exam, the target question and an image. | |
| **Output:** | |
| An Image added to the question in the given exam. | |
| **Process:** | |
| The system will add an image to the question in the target exam and save the information in the database. | |

| Identifier | ADMN-QUES-010 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to review any image in any question of any exam in the system. | |
| **Input:** | |
| The name of the exam and the target question. | |
| **Output:** | |
| Image viewed. | |
| **Process:** | |
| The system will retrieve the information of the target exam from the database and view the exam along with its answer[s] and images for the user. | |

| Identifier | ADMN-QUES-011 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to edit any existing image in any question of any exam. | |
| **Input:** | |
| The name of the exam, the target question and the new image. | |
| **Output:** | |
| Image updated. | |
| **Process:** | |
| The system will update the new image to the question of the target exam in the database and save and update the information in the database. | |

| Identifier | ADMN-QUES-012 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to delete any existing image of any exam. | |
| **Input:** | |
| The name of the exam and the target question. | |
| **Output:** | |
| Image deleted. | |
| **Process:** | |
| The system will delete the image to the target question[s] and delete the image from the database. | |

| Identifier | ADMN-ANSW-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to add a multiple-choice answer[s] to any question. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| Answer[s] added to the question. | |
| **Process:** | |
| The system will add the multiple-choice answer[s] to a question of the target exam and save the information in the database. | |

| Identifier | ADMN-ANSW-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to change the answer[s] on any multiple-choice question. | |
| **Input:** | |
| Name of the exam. | |
| **Output:** | |
| Answer[s] updated for a question. | |
| **Process:** | |
| The system will update the answer[s] to a question in the target exam and save and update the information in the database. | |

| Identifier | ADMN-ANSW-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to delete an answer from any multiple-choice question. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| Answer deleted from the question. | |
| **Process:** | |
| The system will delete the answer to the target question and delete the information from the database. | |

| Identifier | ADMN-USER-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to request a statistic report from a particular perspective. | |
| **Input:** | |
| The perspective. | |
| **Output:** | |
| Charts and tables. | |
| **Process:** | |
| The system will generate a statistic report according to the perspective.. | |

| Identifier | ADMN-USER-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to create user accounts. | |
| **Input:** | |
| User data. | |
| **Output:** | |
| User account registered. | |
| **Process:** | |
| The system will create an account for the user and save the information in the database. | |

| Identifier | ADMN-USER-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to delete user accounts. | |
| **Input:** | |
| User information. | |
| **Output:** | |
| User account deleted. | |
| **Process:** | |
| The system will delete the user and delete the information from the database. | |

| Identifier | ADMN-USER-004 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to update the information of user accounts. | |
| **Input:** | |
| User Information. | |
| **Output:** | |
| User account updated. | |
| **Process:** | |
| The system will update the user account and save and update the information in the database. | |

| Identifier | ADMN-USER-005 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to read user data. | |
| **Input:** | |
| User Information. | |
| **Output:** | |
| Users data. | |
| **Process:** | |
| The system will retrieve the information of the user from the database and view the information. | |

| Identifier | ADMN-USER-006 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| An admin shall be able to read user[s] by search. | |
| **Input:** | |
| Keywords. | |
| **Output:** | |
| User data matching the search keywords. | |
| **Process:** | |
| The system will retrieve the information that is related to the keyword from the database and view the user[s]. | |

| Identifier | ADMN-USER-007 |
|---|---|
| **Priority** | Essential |
| **Description:** ||
| An admin shall be able to filter the user data. ||
| **Input:** ||
| User data. ||
| **Output:** ||
| User[s]. ||
| **Process:** ||
| The system will retrieve the information that is related to the filter data from the database and view it. ||

| Identifier | ADMN-USER-008 |
|---|---|
| **Priority** | Essential |
| **Description:** ||
| An admin shall be able to change the role of a user. ||
| **Input:** ||
| The user data. ||
| **Output:** ||
| User role updated and permissions changed. ||
| **Process:** ||
| The system will update the role and the permission of the user and save the information in the database. ||

### 2.1.2  Teach Requirements

| Identifier | TCHR-EXAM-001 |
|---|---|
| **Priority** | Essential |
| **Description:** ||
| A teacher shall be able to create an exam. ||
| **Input:** ||
| The name of the exam, the publication date and time, the deadline date and time and the duration time. ||
| **Output:** ||
| An online exam. ||
| **Process:** ||
| The system will create an online exam, and save the information in the database. ||

| Identifier | TCHR-EXAM-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to review an existing exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| The existing exam. | |
| **Process:** | |
| The system will retrieve the information of the target exam from the database and view it for the user. | |

| Identifier | TCHR-EXAM-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to edit an existing exam. | |
| **Input:** | |
| The name of the exam and the information that need to be updated. | |
| **Output:** | |
| An updated online exam. | |
| **Process:** | |
| The system will update the target exam and save and update the information in the database. | |

| Identifier | TCHR-EXAM-004 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to delete an existing exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| The exam removed from the system. | |
| **Process:** | |
| The system will delete the target exam and delete the information from the database. | |

| Identifier | TCHR-QUES-001 |
| --- | --- |
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to add textual question[s] to an exam that requires textual answer[s] from students. | |
| **Input:** | |
| Question[s]. | |
| **Output:** | |
| Question[s] added to the given exam. | |
| **Process:** | |
| The system will add the question[s] to the target exam and save the information in the database. | |

| Identifier | TCHR-QUES-002 |
| --- | --- |
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to add question[s] with multiple-choice answer[s] to an exam that requires students to check the correct answer[s]. | |
| **Input:** | |
| Question[s] and answer[s]. | |
| **Output:** | |
| Question[s] with multiple-choice answer[s] added to the given exam. | |
| **Process:** | |
| The system will add the question[s] and the multiple-choice answer[s] to the target exam and save the information in the database. | |

| Identifier | TCHR-QUES-003 |
| --- | --- |
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to review existing textual question[s] in a existing exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| The given exam with its question[s]. | |
| **Process:** | |
| The system will retrieve the information of the target exam from the database and view the exam along with its question[s] for the user. | |

| Identifier | TCHR-QUES-004 |
|---|---|
| **Priority** | Essential |
| **Description:**<br>A teacher shall be able to view existing question[s] with multiple-choice answer[s] in a existing exam. ||
| **Input:**<br>The name of the exam. ||
| **Output:**<br>The given exam with its question[s]. ||
| **Process:**<br>The system will retrieve the information of the target exam from the database and view the exam along with its question[s] and answer[s] for the user. ||

| Identifier | TCHR-QUES-005 |
|---|---|
| **Priority** | Essential |
| **Description:**<br>A teacher shall be able to edit textual question[s] in existing exam. ||
| **Input:**<br>The name of the exam and the question[s]. ||
| **Output:**<br>Question[s] updated in the given exam. ||
| **Process:**<br>The system will update the question[s] in the target exam and save and update the information in the database. ||

| Identifier | TCHR-QUES-006 |
|---|---|
| **Priority** | Essential |
| **Description:**<br>A teacher shall be able to edit question[s] with multiple-choice answer[s] in an existing exam. ||
| **Input:**<br>The name of the exam. ||
| **Output:**<br>Question[s] and answer[s] updated in the given exam. ||
| **Process:**<br>The system will update the question[s] and the answer[s] in the target exam and save and update the information in the database. ||

| Identifier | TCHR-QUES-007 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to delete textual question[s] from an existing exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| Question[s] removed from the given exam. | |
| **Process:** | |
| The system will delete the question[s] from the target exam and delete the information from the database. | |

| Identifier | TCHR-QUES-008 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to delete question[s] with multiple-choice answer[s] from an existing exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| Question[s] and answer[s] removed from the given exam. | |
| **Process:** | |
| The system will delete the question[s] and the answer[s] from the target exam and delete the information from the database. | |

| Identifier | TCHR-QUES-009 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to add an image to a question in an exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| An image added to the question in the given exam. | |
| **Process:** | |
| The system will add an image to the question in the target exam and save information in the database. | |

| Identifier | TCHR-QUES-010 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to review an added image to a question in an exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| Image viewed. | |
| **Process:** | |
| The system will retrieve the information of the target exam from the database and view the exam along with its answer[s] and images for the user. | |

| Identifier | TCHR-QUES-011 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to edit an existing image that was added to a question in an exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| Image updated. | |
| **Process:** | |
| The system will update the new image to the question of the target exam in the database and save and update the information in the database. | |

| Identifier | TCHR-QUES-012 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to delete an existing image that was added to a question in an exam. | |
| **Input:** | |
| The name of the exam and the target question. | |
| **Output:** | |
| Image deleted. | |
| **Process:** | |
| The system will delete the image to the question[s] of the target exam and delete the image from the database. | |

| Identifier | TCHR-STUD-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to register a student in a exam. | |
| **Input:** | |
| The name of the exam and the student identification number. | |
| **Output:** | |
| Student registered to a given exam. | |
| **Process:** | |
| The system will register the student the the exam. | |

| Identifier | TCHR-STUD-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to un-register a student from a exam. | |
| **Input:** | |
| The name of the exam and the student identification number. | |
| **Output:** | |
| Student unregistered from a given exam. | |
| **Process:** | |
| The system will un-register the student from exam. | |

| Identifier | TCHR-GRAD-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to edit a grade. | |
| **Input:** | |
| The student identification number. | |
| **Output:** | |
| An updated grade. | |
| **Process:** | |
| The system will update the grade and save the information in the data base. | |

| Identifier | TCHR-GRAD-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to correct a exam and set the grade. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| A graded exam. | |
| **Process:** | |
| The system will set the grade of the student and save the information in the database. | |

| Identifier | TCHR-GRAD-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| A teacher shall be able to edit a grade that was set automatically by the system. | |
| **Input:** | |
| The student identification number. | |
| **Output:** | |
| An updated grade. | |
| **Process:** | |
| The system will update the grade and save the information in the database. | |

| Identifier | TCHR-STAT-001 |
|---|---|
| **Priority** | Useful |
| **Description:** | |
| A teacher shall be able to retrieve a statistic report about the average number of students passed in a given exam. | |
| **Input:** | |
| Choosing the statistical perspective that is related to the average grade. | |
| **Output:** | |
| Report. | |
| **Process:** | |
| The system will generate a statistic report about the average grade. | |

| Identifier | TCHR-STAT-002 |
|---|---|
| **Priority** | Useful |
| **Description:** | |
| A teacher shall be able to retrieve a statistic report about the number of participants in a given exam. | |
| **Input:** | |
| Choosing the statistical perspective that is related to the participants. | |
| **Output:** | |
| Report. | |
| **Process:** | |
| The system will generate a statistic report about the number of participants in a given exam. | |

| Identifier | TCHR-STAT-003 |
|---|---|
| **Priority** | Useful |
| **Description:** | |
| A teacher shall be able to retrieve a statistic report about the common difficult question[s] in a given exam, where the majority of the participated students failed to answer the question[s] correctly. | |
| **Input:** | |
| Choosing the statistical perspective that is related to the difficult questions. | |
| **Output:** | |
| Report. | |
| **Process:** | |
| The system will generate a statistic report about the common difficult question[s] in a given exam. | |

| Identifier | TCHR-STAT-004 |
|---|---|
| **Priority** | Useful |
| **Description:** | |
| A teacher shall be able to retrieve a statistic report about the distribution of the grades in a given exam. | |
| **Input:** | |
| Choosing the statistical perspective that is related to the distribution of the grades. | |
| **Output:** | |
| Report. | |
| **Process:** | |
| The system will generate a statistic report about the distribution of the grades. | |

### 2.1.3 Student Requirements

| Identifier | STUD-EXAM-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view a list of the available exams after the student has logged in. | |
| **Input:** | |
| | |
| **Output:** | |
| List of the available exams. | |
| **Process:** | |
| The system will retrieve the exam[s] from the data base and view them for the student. | |

| Identifier | STUD-EXAM-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view a list of the submitted exams after the student has logged in. | |
| **Input:** | |
| **Output:** | |
| List of the submitted exams. | |
| **Process:** | |
| The system will retrieve the submitted exams from the database and view them for the student | |

| Identifier | STUD-EXAM-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view the exam instructions before taking the exam. | |
| **Input:** | |
| The given exam. | |
| **Output:** | |
| Exam instructions. | |
| **Process:** | |
| The system will view the instructions of the exam before starting the exam. | |

| Identifier | STUD-EXAM-004 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to start an examination from the list of the available exams. | |
| **Input:** | |
| List of available exams. | |
| **Output:** | |
| Started the given exam. | |
| **Process:** | |
| The system will start the selected exam, if the exam is allowed to be conducted at the given moment. | |

| Identifier | STUD-EXAM-005 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view the time taken to finish an exam directly after the submission of the exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| The duration of the conduct of the exam. | |
| **Process:** | |
| The system will view the information of the exam. | |

| Identifier | STUD-EXAM-006 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view the remaining time of the exam during the exam period. | |
| **Input:** | |
| A started exam. | |
| **Output:** | |
| The remaining time of the exam. | |
| **Process:** | |
| The system will view the remaining time of the exam. | |

| Identifier | STUD-EXAM-007 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to submit an exam during the exam period. | |
| **Input:** | |
| A started exam. | |
| **Output:** | |
| A submitted exam. | |
| **Process:** | |
| The system will accept the submission and save the information in the database | |

| Identifier | STUD-EXAM-008 |
| --- | --- |
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to submit an examination without answering one or more questions. | |
| **Input:** | |
| A started exam. | |
| **Output:** | |
| A submitted exam. | |
| **Process:** | |
| The system will accept the submission and save the information in the database, | |

| Identifier | STUD-QUES-001 |
| --- | --- |
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view the question and any image[s] belong to the question. | |
| **Input:** | |
| A started exam. | |
| **Output:** | |
| Question description with image[s] -if available. | |
| **Process:** | |
| The system will retrieve the exam from the database and view the exam and its information to the student. | |

| Identifier | STUD-QUES-002 |
| --- | --- |
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view the instructions of every question, i.e. multiple-choice answer[s] or textual answers. | |
| **Input:** | |
| A started online exam. | |
| **Output:** | |
| Question instructions. | |
| **Process:** | |
| The system will retrieve the exam from the database and view the exam and its information to the student. | |

| Identifier | STUD-QUES-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view the list of question[s] marked with a flag. | |
| **Input:** | |
| A started exam. | |
| **Output:** | |
| A list of questions marked with a flag. | |
| **Process:** | |
| The system will view the flagged question[s]. | |

| Identifier | STUD-QUES-004 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view the answered and the unanswered question[s] differently. | |
| **Input:** | |
| A started exam. | |
| **Output:** | |
| Two different views for the answered and the unanswered question[s]. | |
| **Process:** | |
| The system will view the question[s] in two different perspectives; answered and unanswered. | |

| Identifier | STUD-QUES-005 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to mark a question with a flag for a specific reason. | |
| **Input:** | |
| A started exam. | |
| **Output:** | |
| A question marked with a flag | |
| **Process:** | |
| The system will mark the given question with a flag. | |

| Identifier | STUD-ANSW-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to choose answer[s] from multiple-choice question[s]. | |
| **Input:** | |
| A started online exam. | |
| **Output:** | |
| One or more answer[s] are chosen. | |
| **Process:** | |
| The system will check the chosen answer[s]. | |

| Identifier | STUD-ANSW-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to change choice[s] on multiple-choice question[s] during the exam period. | |
| **Input:** | |
| An answered multiple-choice question. | |
| **Output:** | |
| An updated multiple-choice answer. | |
| **Process:** | |
| The system will update and check the new answer[s]. | |

| Identifier | STUD-ANSW-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to add answer[s] to textual question[s]. | |
| **Input:** | |
| Text. | |
| **Output:** | |
| An updated textual question[s]. | |
| **Process:** | |
| The system will add the given text as the answer for the question. | |

| Identifier | STUD-ANSW-004 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to edit answer[s] to the textual question[s] during the exam period. | |
| **Input:** | |
| An answered textual question[s]. | |
| **Output:** | |
| Text. | |
| **Process:** | |
| The system will set the new text as the answer to the question. | |

| Identifier | STUD-ANSW-005 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to remove choice[s] on multiple-choices question[s] during the exam period. | |
| **Input:** | |
| An answered multiple-choices question. | |
| **Output:** | |
| An updated multiple-choice question. | |
| **Process:** | |
| The system will uncheck the question[s]. | |


| Identifier | STUD-ANSW-006 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to remove answer[s] to the textual question[s] during the exam period. | |
| **Input:** | |
| An answered textual question[s]. | |
| **Output:** | |
| An unanswered textual question[s]. | |
| **Process:** | |
| The system will remove the answer of the question. | |


| Identifier | STUD-CMNT-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to add comments to every question during the exam period. | |
| **Input:** | |
| Textual or multiple-choice question[s]. | |
| **Output:** | |
| Textual or multiple-choice question[s] with student comments. | |
| **Process:** | |
| The system will add the comment to the given question. | |

| Identifier | STUD-CMNT-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to edit comments on every question during the exam period. | |
| **Input:** | |
| Textual or multiple-choice question[s] with comments. | |
| **Output:** | |
| An updated textual or multiple-choice question[s] with student comments. | |
| **Process:** | |
| The system will update the comment for the given question. | |

| Identifier | STUD-CMNT-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to remove comments from every question on the exam. | |
| **Input:** | |
| Textual or multiple-choice question[s] with comments. | |
| **Output:** | |
| An updated textual or multiple-choice question[s] with no comments. | |
| **Process:** | |
| The system will remove the comment from the given question. | |

| Identifier | STUD-GRAD-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view the grade automatically after the submission of an only multiple-choice exam. | |
| **Input:** | |
| The name of the exam. | |
| **Output:** | |
| Result of the exam. | |
| **Process:** | |
| The system will view the grade. | |

| Identifier | STUD-FDBK-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The student shall be able to view a list of available feedbacks from the teachers. | |
| **Input:** | |
| | |
| **Output:** | |
| List of available feedbacks. | |
| **Process:** | |
| The system will view the feedbacks of the teachers. | |

### 2.1.4 User Requirements

| Identifier | USER-AUTH-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The user shall be able to login to the system. | |
| **Input:** | |
| E-mail and password. | |
| **Output:** | |
| Login. | |
| **Process:** | |
| The system will log the user to the system in after authentication. | |

| Identifier | USER-AUTH-002 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The user shall be able to logout from their account. | |
| **Input:** | |
| Logout. | |
| **Output:** | |
| Logging out is done successfully. | |
| **Process:** | |
| The system will log the user out from the account. | |

| Identifier | USER-AUTH-003 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The user shall be able to reset their password. | |
| **Input:** | |
| E-mail. | |
| **Output:** | |
| The user receives an email contains a link to reset its password. | |
| **Process:** | |
| The system will send a link to the user that can enable them to reset the password. | |

| Identifier | USER-AUTH-004 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The user shall be able to edit its profile. | |
| **Input:** | |
| User profile. | |
| **Output:** | |
| Updated user profile. | |
| **Process:** | |
| The system will update the profile after authentication. | |

## 2.2 Non-functional Requirements

The following subsections will describe the non-functional requirements and divide them into three categories.

### 2.2.1 Privacy

| Identifier | NFRQ-PRVC-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The system shall conform the GDPR. | |

### 2.2.2 Security

| Identifier | NFRQ-SECU-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The system shall use strong security measures by applying the SSL certificate. | |

### 2.2.3 Performance

| Identifier | NFRQ-PERF-001 |
|---|---|
| **Priority** | Essential |
| **Description:** | |
| The home page shall be loaded in less than two seconds. | |

# 3 Systematic Requirements Analysis

This section shows the requirements analysis and the checklist that is the basis for the review.

## 3.1 Checklist

The following checklist is used for the analysis.

| ID | Name | Description |
|----|------|-------------|
| A1 | Premature design | Does the requirement include premature design or implementation information? |
| A2 | Combined requirements | Could the description of a requirement be broken down into several different requirements? |
| A3 | Unnecessary requirements | Is the requirement 'gold plating'? That is, a cosmetic addition to the system which is not really necessary. |
| A4 | Use of non-standard hardware | Does the requirement mean that non-standard hardware or software must be used? |
| A5 | Conformance with business goals | Is the requirement consistent with the business goals defined in the introduction to the requirements document? |
| A6 | Requirements ambiguity | Is the requirement ambiguous, i.e., could it be read in different ways by different people? |
| A7 | Requirements realism | Is the requirement realistic given the technology which will be used to implement the system? |
| A8 | Requirements testability | Is the requirement testable, that is, is it stated in such a way that test engineers can derive a test which can show if the system meets that requirement? |

## 3.2  Results

The following table shows the result of requirements analysis based on the checklist. The character "X" reflects that there is an issue with the requirements.

### 3.2.1  Admin Requirements

| Requirement ID | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| ADMN-EXAM-001 | | | | | | X | | |
| ADMN-EXAM-002 | | | | | | | | |
| ADMN-EXAM-003 | | | | | | | | |
| ADMN-EXAM-004 | | | | | | | | |
| ADMN-QUES-001 | | | | | | | | |
| ADMN-QUES-002 | | | | | | | | |
| ADMN-QUES-003 | | | | | | | | |
| ADMN-QUES-004 | | | | | | | | |
| ADMN-QUES-005 | | | | | | | | |
| ADMN-QUES-006 | | | | | | | | |
| ADMN-QUES-007 | | | | | | | | |
| ADMN-QUES-008 | | | | | | | | |
| ADMN-QUES-009 | | | | | | | | |
| ADMN-QUES-010 | | | | | | | | |
| ADMN-QUES-011 | | | | | | | | |
| ADMN-QUES-012 | | | | | | | | |
| ADMN-USER-001 | | | | | | | | |
| ADMN-USER-002 | | | | | | | | |
| ADMN-USER-003 | | | | | | | | |
| ADMN-USER-004 | | | | | | | | |
| ADMN-USER-005 | | | | | | | | |
| ADMN-USER-006 | | | | | | | | |
| ADMN-USER-007 | | | | | | | | |
| ADMN-USER-008 | | | | | | | | |
| ADMN-ANSW-001 | | | | | | | | |
| ADMN-ANSW-002 | | | | | | | | |
| ADMN-ANSW-003 | | | | | | | | |

### 3.2.2 Teacher Requirements

| Requirement ID | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| TCHR-EXAM-001 | | | | | | | | |
| TCHR-EXAM-002 | | | | | | | | |
| TCHR-EXAM-003 | | | | | | | | |
| TCHR-EXAM-004 | | | | | | | | |
| TCHR-QUES-001 | | | | | | | | |
| TCHR-QUES-002 | | | | | | | | |
| TCHR-QUES-003 | | | | | | | | |
| TCHR-QUES-004 | | | | | | | | |
| TCHR-QUES-005 | | | | | | | | |
| TCHR-QUES-006 | | | | | | | | |
| TCHR-QUES-007 | | | | | | | | |
| TCHR-QUES-008 | | | | | | | | |
| TCHR-QUES-009 | | | | | | | | |
| TCHR-QUES-010 | | | | | | | | |
| TCHR-QUES-011 | | | | | | | | |
| TCHR-QUES-012 | | | | | | | | |
| TCHR-STAT-001 | | | | | | | | |
| TCHR-STAT-002 | | | | | | | | |
| TCHR-STAT-003 | | | | | | X | | |
| TCHR-STAT-004 | | | | | | | | |
| TCHR-GRAD-001 | | | | | | | | |
| TCHR-GRAD-002 | | | | | | | | |
| TCHR-GRAD-003 | | | | | | | | |
| TCHR-STUD-001 | | | | | | | | |
| TCHR-STUD-002 | | | | | | | | |

### 3.2.3 Student Requirements

| Requirement ID | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| STUD-EXAM-001 | | | | | | | | |
| STUD-EXAM-002 | | | | | | | | |
| STUD-EXAM-003 | | | | | | | | |
| STUD-EXAM-004 | | | | | | | | |
| STUD-EXAM-005 | | | | | | | | |
| STUD-EXAM-006 | | | | | | | | |
| STUD-EXAM-007 | | | | | | | | |
| STUD-EXAM-008 | | | | | | | | |
| STUD-QUES-001 | | | | | | | | |
| STUD-QUES-002 | | | | | | | | |
| STUD-QUES-003 | | | | | | | | |
| STUD-QUES-004 | | | | | | | | |
| STUD-QUES-005 | | | | | | | | |
| STUD-ANSW-001 | | | | | | | | |
| STUD-ANSW-002 | | | | | | | | |
| STUD-ANSW-003 | | | | | | | | |
| STUD-ANSW-004 | | | | | | | | |
| STUD-ANSW-005 | | | | | | | | |
| STUD-ANSW-006 | | | | | | | | |
| STUD-CMNT-001 | | | | | | | | |
| STUD-CMNT-002 | | | | | | | | |
| STUD-CMNT-003 | | | | | | | | |
| STUD-GRAD-001 | | | | | | | | |
| STUD-FDBK-001 | | | | | | X | | |

### 3.2.4 User Requirements

| Requirement ID | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| USER-AUTH-001 | | | | | | X | | |
| USER-AUTH-002 | | | | | | | | |
| USER-AUTH-003 | | | | | | | | |
| USER-AUTH-004 | | | | | | | | |

### 3.2.5 Non-functional Requirements

| Requirement ID | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| NFRQ-PRVC-001 | | | | | | | | |
| NFRQ-SECU-001 | | | | | | | | |
| NFRQ-PERF-001 | | | | | | | | |

## 3.3 Analysis and Amendments

| Requirement | ADMN-EXAM-001 |
|---|---|
| Problem | Ambiguous. |
| New | An admin shall create an exam. |
| New | An admin shall create an exam for any teacher. |
| Solution | The statement should be specific and unambiguous. |

| Requirement | TCHR-STAT-003 |
|---|---|
| Problem | Ambiguous. |
| Old | A teacher shall be able to retrieve a statistic report about the common difficult questions. |
| New | A teacher shall be able to retrieve a statistic report about the common difficult question[s] in a given exam, where the majority of the participated students failed to answer the question[s] correctly. |
| Solution | The statement should be specific and unambiguous. |

| Requirement | STUD-FDBK-001 |
|---|---|
| Problem | Ambiguous. |
| Old | The student shall be able to view feedbacks. |
| New | The student shall be able to view a list of available feedbacks from the teachers. |
| Solution | The statement should be specific and unambiguous. |

| Requirement | USER-AUTH-001 |
|---|---|
| Problem | Ambiguous. |
| Old | The user can login. |
| New | The user shall be able to login to the system. |
| Solution | The statement should be specific and unambiguous. |

# 4 Classification using faceted approach

The facets are used to classify the requirements are: System, User Interface, Database, Communication, and Security. The following table presents the classification according the facets.

## 4.1 Admin Requirements Classification

| Requirement ID | System | UI | Database | Communication | Security |
|---|---|---|---|---|---|
| ADMN-EXAM-001 | X | X | X | | X |
| ADMN-EXAM-002 | X | X | X | | X |
| ADMN-EXAM-003 | X | X | X | | X |
| ADMN-QUES-001 | X | X | X | | |
| ADMN-QUES-002 | X | X | X | | |
| ADMN-QUES-003 | X | X | X | | |
| ADMN-QUES-004 | X | X | X | | |
| ADMN-QUES-005 | X | X | X | | |
| ADMN-QUES-006 | X | X | X | | |
| ADMN-QUES-007 | X | X | X | | |
| ADMN-QUES-008 | X | X | X | | |
| ADMN-QUES-009 | X | X | X | | X |
| ADMN-QUES-010 | X | X | X | | X |
| ADMN-QUES-011 | X | X | X | | X |
| ADMN-QUES-012 | X | X | X | | X |
| ADMN-USER-001 | X | X | | | |
| ADMN-USER-002 | X | X | X | | X |
| ADMN-USER-003 | X | X | X | | X |
| ADMN-USER-004 | X | X | X | | X |
| ADMN-USER-005 | X | | X | | X |
| ADMN-USER-006 | X | X | X | | X |
| ADMN-USER-007 | X | X | | | X |
| ADMN-USER-008 | X | X | X | | X |
| ADMN-ANSW-001 | X | X | X | | X |
| ADMN-ANSW-002 | X | X | X | | X |
| ADMN-ANSW-003 | X | X | X | | X |

## 4.2 Teacher Requirements Classification

| Requirement ID | System | UI | Database | Communication | Security |
|---|---|---|---|---|---|
| TCHR-EXAM-001 | X | X | X | | X |
| TCHR-EXAM-002 | X | X | X | | X |
| TCHR-EXAM-003 | X | X | X | | X |
| TCHR-EXAM-004 | X | X | X | | X |
| TCHR-EXAM-004 | X | X | X | | X |
| TCHR-QUES-001 | X | X | X | | |
| TCHR-QUES-002 | X | X | X | | |
| TCHR-QUES-003 | X | X | X | | |
| TCHR-QUES-004 | X | X | X | | |
| TCHR-QUES-005 | X | X | X | | |
| TCHR-QUES-006 | X | X | X | | |
| TCHR-QUES-007 | X | X | X | | |
| TCHR-QUES-008 | X | X | X | | |
| TCHR-STAT-001 | X | X | X | X | |
| TCHR-STAT-002 | X | | X | X | |
| TCHR-STAT-003 | X | | X | X | |
| TCHR-STAT-004 | X | | X | X | |
| TCHR-GRAD-002 | X | X | X | X | |
| TCHR-GRAD-001 | X | X | X | X | |
| TCHR-GRAD-003 | X | X | X | X | |
| TCHR-QUES-009 | X | X | X | | |
| TCHR-QUES-010 | X | X | X | | |
| TCHR-QUES-011 | X | X | X | | |
| TCHR-QUES-012 | X | X | X | | |
| TCHR-STUD-001 | X | X | X | X | X |
| TCHR-STUD-002 | X | X | X | X | X |

### 4.3 Student Requirements Classification

| Requirement ID | System | UI | Database | Communication | Security |
|---|---|---|---|---|---|
| STUD-EXAM-001 | X | X | X | | X |
| STUD-EXAM-002 | X | X | X | | X |
| STUD-EXAM-003 | X | X | X | | X |
| STUD-EXAM-004 | X | | X | X | X |
| STUD-EXAM-005 | X | X | X | | |
| STUD-EXAM-006 | X | X | X | | |
| STUD-EXAM-007 | X | X | X | | X |
| STUD-EXAM-008 | X | X | X | | X |
| STUD-QUES-001 | X | X | | | |
| STUD-QUES-002 | X | X | X | | |
| STUD-QUES-003 | X | X | X | | |
| STUD-QUES-004 | X | X | | | |
| STUD-QUES-005 | X | X | X | | |
| STUD-ANSW-001 | X | X | X | | |
| STUD-ANSW-002 | X | X | X | | |
| STUD-ANSW-003 | X | X | X | | |
| STUD-ANSW-004 | X | X | X | | |
| STUD-ANSW-005 | X | X | X | | |
| STUD-ANSW-006 | X | X | X | X | |
| STUD-CMNT-001 | X | X | X | | |
| STUD-CMNT-002 | X | X | X | | |
| STUD-CMNT-003 | X | X | X | | |
| STUD-GRAD-001 | X | X | X | X | X |
| STUD-FDBK-001 | X | X | X | X | |

### 4.4 User Requirements Classification

| Requirement ID | System | UI | Database | Communication | Security |
|---|---|---|---|---|---|
| USER-AUTH-001 | X | X | X | | X |
| USER-AUTH-002 | X | X | X | | X |
| USER-AUTH-003 | X | X | X | | X |
| USER-AUTH-004 | X | X | X | | X |

### 4.5 Non-functional Requirements Classification

| Requirement ID | System | UI | Database | Communication | Security |
|---|---|---|---|---|---|
| NFRQ-PRVC-001 | X | | X | | |
| NFRQ-SECU-001 | X | | X | X | X |
| NFRQ-PERF-001 | X | | | X | |

# 5 Risk assessment

This section shows the risk types, levels and assessment for the requirements.

## 5.1 Types

| ID | Name | Description |
|----|------|-------------|
| R1 | Performance | May affect the overall performance of the system. |
| R2 | Safety and security | May cause problems in meeting overall system requirements for safety and security. |
| R3 | Process | May require changes to the normal development process. |
| R4 | Implementation technology | May require the use of unfamiliar implementation technology, such as AI techniques, the use of N-version programming for fault tolerance, etc. |
| R5 | Database | May involve non-standard data which is not available in an existing system database. |
| R6 | Schedule | May be technically difficult and may threaten the planned development schedule for the system. |
| R7 | External | Involves external contractors. |
| R8 | Stability | Requirement may be volatile and subject to evolution during the development process. |

## 5.2 Levels

| ID | Name | Description |
|----|------|-------------|
| H | High | High risk |
| M | Medium | Medium risk. |
| L | Low | Low risk |
| N | None | No risk |

## 5.3 Assessment

This section describes the requirements risk assessment.

### 5.3.1 Admin Requirements

| Requirement ID | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
|---|---|---|---|---|---|---|---|---|
| ADMN-EXAM-001 | | X | X | | | | | |
| ADMN-EXAM-002 | | X | X | | | | | |
| ADMN-EXAM-003 | | X | X | | | | | |
| ADMN-EXAM-004 | | X | X | | | | | |
| ADMN-QUES-001 | | X | | | | | | |
| ADMN-QUES-002 | | X | | | | | | |
| ADMN-QUES-003 | | X | | | | | | |
| ADMN-QUES-004 | | X | | | | | | |
| ADMN-QUES-005 | | X | | | | | | |
| ADMN-QUES-006 | | X | | | | | | |
| ADMN-QUES-007 | | X | | | | | | |
| ADMN-QUES-008 | | X | | | | | | |
| ADMN-USER-001 | | X | X | | | X | | X |
| ADMN-USER-002 | | X | | | | | | |
| ADMN-USER-003 | | X | | | | | | |
| ADMN-USER-004 | | X | | | | | | |
| ADMN-USER-005 | | X | | | | | | |
| ADMN-USER-006 | | X | | | | | | |
| ADMN-USER-007 | | X | | | | | | |
| ADMN-USER-008 | | X | | | | X | | X |
| ADMN-ANS-001 | | X | | | | | | |
| ADMN-ANS-002 | | X | | | | | | |
| ADMN-ANS-003 | | X | | | | | | |

### 5.3.2 Teacher Requirements

| Requirement ID | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
|---|---|---|---|---|---|---|---|---|
| TCHR-EXAM-001 | | X | X | | | | | |
| TCHR-EXAM-002 | | X | X | | | | | |
| TCHR-EXAM-003 | | X | X | | | | | |
| TCHR-EXAM-004 | | X | X | | | | | |
| TCHR-QUES-001 | | X | | | | | | |
| TCHR-QUES-002 | | X | | | | | | |
| TCHR-QUES-003 | | X | | | | | | |
| TCHR-QUES-004 | | X | | | | | | |
| TCHR-QUES-005 | | X | | | | | | |
| TCHR-QUES-006 | | X | | | | | | |
| TCHR-QUES-007 | | X | | | | | | |
| TCHR-QUES-008 | | X | | | | | | |
| TCHR-STAT-001 | | X | X | | | X | | |
| TCHR-STAT-002 | | X | X | | | X | | |
| TCHR-STAT-003 | | X | X | | | X | | |
| TCHR-STAT-004 | | X | X | | | X | | |
| TCHR-GRAD-002 | | X | X | | | X | | |
| TCHR-GRAD-001 | | X | X | | | X | | |
| TCHR-GRAD-003 | | X | X | | | X | | |
| TCHR-QUES-009 | | | X | | | | | |
| TCHR-QUES-010 | | | X | | | | | |
| TCHR-QUES-011 | | | X | | | | | |
| TCHR-QUES-012 | | | X | | | | | |
| TCHR-STUD-001 | | | | | | X | | |
| TCHR-STUD-002 | | | | | | X | | |

### 5.3.3 Student Requirements

| Requirement ID | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
|---|---|---|---|---|---|---|---|---|
| STUD-EXAM-001 | | | X | | | | | |
| STUD-EXAM-002 | | | X | | | | | |
| STUD-EXAM-003 | | | | | X | | | |
| STUD-EXAM-004 | | | X | | X | | | |
| STUD-EXAM-005 | | | X | | | | | |
| STUD-EXAM-006 | | | X | | | | | |
| STUD-EXAM-007 | | X | | | X | X | | X |
| STUD-EXAM-008 | | X | | | X | X | | X |
| STUD-QUES-001 | | | X | | | | | |
| STUD-QUES-002 | | | X | | | | | |
| STUD-QUES-003 | | | X | | | | | |
| STUD-QUES-004 | | | X | | | | | |
| STUD-QUES-005 | | | X | | | | | |
| STUD-ANSW-001 | | | X | | | | | |
| STUD-ANSW-002 | | | X | | | | | |
| STUD-ANSW-003 | | | X | | | | | |
| STUD-ANSW-004 | | | X | | | | | |
| STUD-ANSW-005 | | | X | | | | | |
| STUD-ANSW-006 | | | X | | | | | |
| STUD-CMNT-001 | | | X | | | | | |
| STUD-CMNT-002 | | | X | | | | | |
| STUD-CMNT-003 | | | X | | | | | |
| STUD-GRAD-001 | | | X | X | | | | |
| STUD-FDBK-001 | | | | | | | | |

### 5.3.4 User Requirements

| Requirement ID | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
|---|---|---|---|---|---|---|---|---|
| USER-AUTH-001 | | X | | | | | | |
| USER-AUTH-002 | | | | | | | | |
| USER-AUTH-003 | | X | X | | | X | X | |
| USER-AUTH-004 | | X | | | | | | |

### 5.3.5 Non-functional Requirements

| Requirement ID | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
|---|---|---|---|---|---|---|---|---|
| NFRQ-PRVC-001 | | | | | | | X | |
| NFRQ-SECU-001 | X | X | | X | | | | |
| NFRQ-PERF-001 | X | | | | | | | X |

## 5.4 Risk Level

This section describes the requirements risk level.

### 5.4.1 Admin Requirements

| Requirement Identifier | Risk Level |
|---|---|
| ADMN-EXAM-001 | Low |
| ADMN-EXAM-002 | Low |
| ADMN-EXAM-003 | Low |
| ADMN-EXAM-004 | Low |
| ADMN-QUES-001 | Low |
| ADMN-QUES-002 | Low |
| ADMN-QUES-003 | Low |
| ADMN-QUES-004 | Low |
| ADMN-QUES-005 | Low |
| ADMN-QUES-006 | Low |
| ADMN-QUES-007 | Low |
| ADMN-QUES-008 | Low |
| ADMN-QUES-009 | Low |
| ADMN-QUES-010 | Low |
| ADMN-QUES-011 | Low |
| ADMN-QUES-012 | Low |
| ADMN-USER-001 | Medium |
| ADMN-USER-002 | Low |
| ADMN-USER-003 | Low |
| ADMN-USER-004 | Low |
| ADMN-USER-005 | Low |
| ADMN-USER-006 | Low |
| ADMN-USER-007 | Medium |
| ADMN-USER-008 | Medium |
| ADMN-ANSW-001 | Low |
| ADMN-ANSW-002 | Low |
| ADMN-ANSW-003 | Low |

### 5.4.2 Teacher Requirements

| Requirement Identifier | Risk Level |
| --- | --- |
| TCHR-EXAM-001 | Low |
| TCHR-EXAM-002 | Low |
| TCHR-EXAM-003 | Low |
| TCHR-EXAM-004 | Low |
| TCHR-QUES-001 | Low |
| TCHR-QUES-002 | Low |
| TCHR-QUES-003 | Low |
| TCHR-QUES-004 | Low |
| TCHR-QUES-005 | Low |
| TCHR-QUES-006 | Low |
| TCHR-QUES-007 | Low |
| TCHR-QUES-008 | Low |
| TCHR-QUES-009 | Low |
| TCHR-QUES-010 | Low |
| TCHR-QUES-011 | Low |
| TCHR-QUES-012 | Low |
| TCHR-STAT-001 | Medium |
| TCHR-STAT-002 | Medium |
| TCHR-STAT-003 | Medium |
| TCHR-STAT-004 | Medium |
| TCHR-GRAD-002 | Medium |
| TCHR-GRAD-001 | Medium |
| TCHR-GRAD-003 | Medium |
| TCHR-STUD-001 | Low |
| TCHR-STUD-002 | Low |

### 5.4.3 Student Requirements

| Requirement Identifier | Risk Level |
| --- | --- |
| STUD-EXAM-001 | Low |
| STUD-EXAM-002 | Low |
| STUD-EXAM-003 | Low |
| STUD-EXAM-004 | Medium |
| STUD-EXAM-005 | Low |
| STUD-EXAM-006 | Medium |
| STUD-EXAM-007 | Medium |
| STUD-EXAM-008 | Medium |
| STUD-QUES-001 | Low |
| STUD-QUES-002 | Low |
| STUD-QUES-003 | Low |
| STUD-QUES-004 | Low |
| STUD-QUES-005 | Low |
| STUD-ANSW-001 | Low |
| STUD-ANSW-002 | Low |
| STUD-ANSW-003 | Low |
| STUD-ANSW-004 | Low |
| STUD-ANSW-005 | Low |
| STUD-ANSW-006 | Low |
| STUD-CMNT-001 | Low |
| STUD-CMNT-002 | Low |
| STUD-CMNT-003 | Low |
| STUD-GRAD-001 | Medium |
| STUD-FDBK-001 | Low |

### 5.4.4 User Requirements

| Requirement Identifier | Risk Level |
| --- | --- |
| USER-AUTH-001 | High |
| USER-AUTH-002 | Low |
| USER-AUTH-003 | High |
| USER-AUTH-004 | Medium |

### 5.4.5 Non-functional Requirements

| Requirement Identifier | Risk Level |
| --- | --- |
| NFRQ-PRVC-001 | High |
| NFRQ-SECU-001 | High |
| NFRQ-PERF-001 | High |

# 6 Systematic Validation

A pre-defined checklist is used to check the identified requirements and discover possible problems with them.

## 6.1 Checklist

| ID | Keyword | Description |
|----|---------|-------------|
| V1 | complete | Are the requirements **complete** – does the checker know of any missing requirements or is there any information missing from individual requirement descriptions? |
| V2 | consistent | Are the requirements **consistent** – do the descriptions of different requirements include contradictions? |
| V3 | comprehensible | Are the requirements **comprehensible** – can readers of the document understand what the requirements mean? |
| V4 | ambiguous | Are the requirements **ambiguous** – are there different possible interpretations of the requirements? |
| V5 | structured | Is the requirements document **structured** – are the descriptions of requirements organized so that related requirements are grouped? |
| V6 | traceable | Are the requirements **traceable** – do the requirements include links to related requirements and to the reasons why these requirements have been included? |
| V7 | standards | Does the requirements document as a whole, or do the individual requirements conform to defined **standards**? |

## 6.2 Results

This section describes the results of the requirements validation.

### 6.2.1 Admin Requirements

| Requirement ID | V1 | V2 | V3 | V4 | V5 | V6 | V7 |
|---|---|---|---|---|---|---|---|
| ADMN-EXAM-001 | | | | | | | |
| ADMN-EXAM-002 | | | | | | | |
| ADMN-EXAM-003 | | | | | | | |
| ADMN-EXAM-004 | | | | | | | |
| ADMN-QUES-001 | | | | | | | |
| ADMN-QUES-002 | | | | | | | |
| ADMN-QUES-003 | | | | | | | |
| ADMN-QUES-004 | | | | | | | |
| ADMN-QUES-005 | | | | | | | |
| ADMN-QUES-006 | | | | | | | |
| ADMN-QUES-007 | | | | | | | |
| ADMN-QUES-008 | | | | | | | |
| ADMN-USER-001 | | | | | | | |
| ADMN-USER-002 | | | | | | | |
| ADMN-USER-003 | | | | | | | |
| ADMN-USER-004 | | | | | | | |
| ADMN-USER-005 | | | | | | | |
| ADMN-USER-006 | | | | | | | |
| ADMN-USER-007 | | | | | | | |
| ADMN-USER-008 | | | | | | | |
| ADMN-ANSW-001 | | | | | | | |
| ADMN-ANSW-002 | | | | | | | |
| ADMN-ANSW-003 | | | | | | | |

### 6.2.2 Teacher Requirements

| Requirement ID | V1 | V2 | V3 | V4 | V5 | V6 | V7 |
|---|---|---|---|---|---|---|---|
| TCHR-EXAM-001 | | | | | | | |
| TCHR-EXAM-002 | | | | | | | |
| TCHR-EXAM-003 | | | | | | | |
| TCHR-EXAM-004 | | | | | | | |
| TCHR-QUES-001 | | | | | | | |
| TCHR-QUES-002 | | | | | | | |
| TCHR-QUES-003 | | | | | | | |
| TCHR-QUES-004 | | | | | | | |
| TCHR-QUES-005 | | | | | | | |
| TCHR-QUES-006 | | | | | | | |
| TCHR-QUES-007 | | | | | | | |
| TCHR-QUES-008 | | | | | | | |
| TCHR-QUES-009 | | | | | | | |
| TCHR-QUES-010 | | | | | | | |
| TCHR-QUES-011 | | | | | | | |
| TCHR-QUES-012 | | | | | | | |
| TCHR-STAT-001 | | | | | | | |
| TCHR-STAT-002 | | | | | | | |
| TCHR-STAT-003 | | | | | | | |
| TCHR-STAT-004 | | | | | | | |
| TCHR-GRAD-002 | | | | | | | |
| TCHR-GRAD-001 | | | | | | | |
| TCHR-GRAD-003 | | | | | | | |
| TCHR-STUD-001 | | | | | | | |
| TCHR-STUD-002 | | | | | | | |

### 6.2.3  Student Requirements

| Requirement ID | V1 | V2 | V3 | V4 | V5 | V6 | V7 |
|---|---|---|---|---|---|---|---|
| STUD-EXAM-001 | | | | | | | |
| STUD-EXAM-002 | | | | | | | |
| STUD-EXAM-003 | | | | | | | |
| STUD-EXAM-004 | | | | | | | |
| STUD-EXAM-005 | | | | | | | |
| STUD-EXAM-006 | | | | | | | |
| STUD-EXAM-007 | | | | | | | |
| STUD-EXAM-008 | | | | | | | |
| STUD-QUES-001 | | | | | | | |
| STUD-QUES-002 | | | | | | | |
| STUD-QUES-003 | | | | | | | |
| STUD-QUES-004 | | | | | | | |
| STUD-QUES-005 | | | | | | | |
| STUD-ANSW-001 | | | | | | | |
| STUD-ANSW-002 | | | | | | | |
| STUD-ANSW-003 | | | | | | | |
| STUD-ANSW-004 | | | | | | | |
| STUD-ANSW-005 | | | | | | | |
| STUD-ANSW-006 | | | | | | | |
| STUD-CMNT-001 | | | | | | | |
| STUD-CMNT-002 | | | | | | | |
| STUD-CMNT-003 | | | | | | | |
| STUD-GRAD-001 | | | | | | | |
| STUD-FDBK-001 | | | | | | | |

### 6.2.4  User Requirements

| Requirement ID | V1 | V2 | V3 | V4 | V5 | V6 | V7 |
|---|---|---|---|---|---|---|---|
| USER-AUTH-001 | | | | | | | |
| USER-AUTH-002 | | | | | | | |
| USER-AUTH-003 | | | | | | | |
| USER-AUTH-004 | | | | | | | |

### 6.2.5  Non-functional Requirements

| Requirement ID | V1 | V2 | V3 | V4 | V5 | V6 | V7 |
|---|---|---|---|---|---|---|---|
| NFRQ-PRVC-001 | | | | | | | |
| NFRQ-SECU-001 | | | | | | | |
| NFRQ-PERF-001 | | | | | | | |

## 6.3  Observations and modifications

The requirements were successfully validated, and the results do not show there are any issues with the final set of the requirements. Therefore, no modifications are required at this time.

# 7 Traceability Information

This section contains information about the types of the traceability information to find dependencies. Types include Requirements-Rationale and Requirements-Requirements.

## 7.1 Requirements-Rationale

Links the requirement with a description of why that requirement has been specified.

### 7.1.1 Admin Requirements

| Requirement ID | Description |
|---|---|
| ADMN-EXAM-001 | To allow admins to create exams. |
| ADMN-EXAM-002 | To allow admins to review exams. |
| ADMN-EXAM-003 | To allow admins to update exams. |
| ADMN-EXAM-004 | To allow admins to delete exams. |
| ADMN-QUES-001 | To allow admins to add textual questions to exams. |
| ADMN-QUES-002 | To allow admins to add questions with multiple-choices to exams. |
| ADMN-QUES-003 | To allow admins to review textual questions from exams. |
| ADMN-QUES-004 | To allow admins to review questions with multiple-choices. |
| ADMN-QUES-005 | To allow admins to update textual questions in exams. |
| ADMN-QUES-006 | To allow admins to update questions with multiple-choices in exams. |
| ADMN-QUES-007 | To allow admins to delete textual questions from exams. |
| ADMN-QUES-008 | To allow admins to delete questions with multiple-choices from exams. |
| ADMN-QUES-009 | To allow admins to add images to any question of any exisiting exam. |
| ADMN-QUES-010 | To allow admins to review all images in any question in any existing exam. |
| ADMN-QUES-011 | To allow admins to delete any image in any question of any existing exam. |
| ADMN-QUES-012 | To allow admins to delete any image in any question of any existing exam. |
| ADMN-USER-001 | To allow admins to see various statistics about users. |
| ADMN-USER-002 | To allow admins to create a user account, |
| ADMN-USER-003 | To allow admins to delete a user account, |
| ADMN-USER-004 | To allow admins to update a user account. |
| ADMN-USER-005 | To allow admins to read textual data of a user account |
| ADMN-USER-006 | To allow admins to find users quickly. |
| ADMN-USER-007 | To allow admins to filter for users |
| ADMN-USER-008 | To allow admins to change a user role. |
| ADMN-ANSW-001 | To allow admins to add multiple-choice answers in a question. |
| ADMN-ANSW-002 | To allow admins to change multiple-choice answers in a question. |
| ADMN-ANSW-003 | To allow admins to delete multiple-choice answers in a question. |

### 7.1.2 Teacher Requirements

| Requirement ID | Description |
|---|---|
| TCHR-EXAM-001 | To allow teachers to create exams. |
| TCHR-EXAM-002 | To allow teachers to review exams. |
| TCHR-EXAM-003 | To allow teachers to update exams. |
| TCHR-EXAM-004 | To allow teachers to delete exams. |
| TCHR-QUES-001 | To allow teachers to add textual questions to exams. |
| TCHR-QUES-002 | To allow teachers to add questions with multiple-choices to exams. |
| TCHR-QUES-003 | To allow teachers to review textual questions from exams. |
| TCHR-QUES-004 | To allow teachers to review questions with multiple-choices. |
| TCHR-QUES-005 | To allow teachers to update textual questions in exams. |
| TCHR-QUES-006 | To allow teachers to update questions with multiple-choices in exams. |
| TCHR-QUES-007 | To allow teachers to delete textual questions from exams. |
| TCHR-QUES-008 | To allow teachers to delete questions with multiple-choices from exams. |
| TCHR-QUES-009 | To allow teachers to add images to questions. |
| TCHR-QUES-010 | To allow teachers to review added images to questions. |
| TCHR-QUES-011 | To allow teachers to update added images to questions. |
| TCHR-QUES-012 | To allow teachers to delete images from questions. |
| TCHR-STAT-001 | To allow teachers to get a statistics report from a specific perspective. |
| TCHR-STAT-002 | To allow teachers to get a statistics report from a specific perspective. |
| TCHR-STAT-003 | To allow teachers to get a statistics report from a specific perspective. |
| TCHR-STAT-004 | To allow teachers to get a statistics report from a specific perspective. |
| TCHR-GRAD-002 | To allow teachers to set the grades of students. |
| TCHR-GRAD-001 | To allow teachers to edit the grades of students. |
| TCHR-GRAD-003 | To allow teachers to edit the grades that were set by the system. |
| TCHR-STUD-001 | To allow teachers to register students. |
| TCHR-STUD-002 | To allow teachers to un-register students. |

### 7.1.3 Students Requirements

| Requirement ID | Description |
| --- | --- |
| STUD-EXAM-001 | To allow students to view a list of available exams. |
| STUD-EXAM-002 | To allow students to view a list of the submitted exams. |
| STUD-EXAM-003 | To allow students to view the exam instructions. |
| STUD-EXAM-004 | To allow students to start an examination from the list of available exams. |
| STUD-EXAM-005 | To allow students to view the time taken to finish an exam. |
| STUD-EXAM-006 | To allow students to view the remaining time of the exam during the exam period. |
| STUD-EXAM-007 | To allow students able to submit an exam. |
| STUD-EXAM-008 | To allow students to submit an examination without answering one or more questions. |
| STUD-QUES-001 | To allow students to view the question and any images (if available) clearly. |
| STUD-QUES-002 | To allow students to view the instructions of every question. |
| STUD-QUES-003 | To allow students to view the list of questions marked with a flag. |
| STUD-QUES-004 | To allow students to view the answered and unanswered question differently. |
| STUD-QUES-005 | To allow students to mark a question with a flag for a specific reason. |
| STUD-ANSW-001 | To allow students to choose answer[s] from multiple-choices questions. |
| STUD-ANSW-002 | To allow students to change choice[s] on multiple-choices questions. |
| STUD-ANSW-003 | To allow students to add answer[s] to textual question[s]. |
| STUD-ANSW-004 | To allow students to edit answer[s] to the textual question[s]. |
| STUD-ANSW-005 | To allow students to remove choice[s] on multiple-choices questions. |
| STUD-ANSW-006 | To allow students to remove answer[s] to the textual question[s]. |
| STUD-CMNT-001 | To allow students to add comments to a question. |
| STUD-CMNT-002 | To allow students to edit comments on a question. |
| STUD-CMNT-003 | To allow students to remove comments from a question. |
| STUD-GRAD-001 | To allow students to view the grade automatically after the submission of an only multiple-choices exam. |
| STUD-FDBK-001 | To allow students to view a list of available feedbacks. |

### 7.1.4 User Requirements

| Requirement ID | Description |
| --- | --- |
| USER-AUTH-001 | To allow user to login to the system. |
| USER-AUTH-002 | To allow user to logout from the system. |
| USER-AUTH-003 | To allow user to reset its password. |
| USER-AUTH-004 | To allow user to edit its profile. |

### 7.1.5 Non-functional Requirements

| Requirement ID | Description |
| --- | --- |
| NFRQ-PRVC-001 | To conform with the laws. |
| NFRQ-SECU-001 | To provide a secure connection between the client and the system. |
| NFRQ-PERF-001 | To make the system applicable to the user. |

## 7.2  Requirements-Requirements

Links requirements with other requirements which are, in some way, dependent on them. The following table shows the dependencies between the requirements.

### 7.2.1 Admin Requirements

| Requirement | Depends-on |
|---|---|
| ADMN-EXAM-001 | |
| ADMN-EXAM-002 | ADMN-EXAM-001, TCHR-EXAM-001 |
| ADMN-EXAM-003 | ADMN-EXAM-001, TCHR-EXAM-001 |
| ADMN-EXAM-004 | ADMN-EXAM-001, TCHR-EXAM-001 |
| ADMN-QUES-001 | ADMN-EXAM-001, TCHR-EXAM-001 |
| ADMN-QUES-002 | ADMN-EXAM-001, TCHR-EXAM-001 |
| ADMN-QUES-003 | TCHR-EXAM-001, TCHR-QUES-001, ADMN-EXAM-001, ADMN-QUES-001 |
| ADMN-QUES-004 | ADMN-EXAM-001, ADMN-QUES-002, TCHR-EXAM-001, TCHR-QUES-002 |
| ADMN-QUES-005 | TCHR-EXAM-001, TCHR-QUES-001, ADMN-EXAM-001, ADMN-QUES-001 |
| TCHR-QUES-006 | TCHR-EXAM-001, TCHR-QUES-002 |
| ADMN-QUES-006 | ADMN-EXAM-001, ADMN-QUES-002, TCHR-EXAM-001, TCHR-QUES-002 |
| ADMN-QUES-007 | TCHR-EXAM-001, TCHR-QUES-001, TCHR-QUES-001, ADMN-EXAM-001, ADMN-QUES-001 |
| ADMN-QUES-008 | ADMN-EXAM-001, ADMN-QUES-002, TCHR-EXAM-001, TCHR-QUES-002 |
| ADMN-QUES-009 | TCHR-EXAM-001, TCHR-QUES-001, ADMN-EXAM-001, ADMN-QUES-001 |
| ADMN-QUES-010 | TCHR-EXAM-001, TCHR-QUES-001, TCHR-QUES-010,ADMN-EXAM-001, ADMN-QUES-001, ADMN-QUES-010 |
| ADMN-QUES-011 | TCHR-EXAM-001, TCHR-QUES-001, TCHR-QUES-010, ADMN-EXAM-001, ADMN-QUES-001, ADMN-QUES-010 |
| ADMN-QUES-012 | TCHR-EXAM-001, TCHR-QUES-001, TCHR-QUES-010 ADMN-EXAM-001, ADMN-QUES-001, ADMN-QUES-010 |
| ADMN-USER-001 | ADMN-USER-002 |
| ADMN-USER-002 | |
| ADMN-USER-003 | ADMN-USER-002 |
| ADMN-USER-004 | ADMN-USER-002, ADMN-USER-008 |
| ADMN-USER-005 | ADMN-USER-002 |
| ADMN-USER-006 | ADMN-USER-005, ADMN-USER-002 |
| ADMN-USER-007 | ADMN-USER-005, ADMN-USER-002 |
| ADMN-USER-008 | |
| ADMN-ANSW-001 | ADMN-EXAM-001, TCHR-EXAM-001, ADMN-QUES-002, TCHER-QUES-002 |
| ADMN-ANSW-002 | ADMN-EXAM-001, TCHR-EXAM-001, ADMN-QUES-002, TCHER-QUES-002, ADM-ANSW-001 |
| ADMN-ANSW-003 | ADMN-EXAM-001, TCHR-EXAM-001, ADMN-QUES-002, TCHER-QUES-002, ADM-ANSW-001 |

### 7.2.2 Teacher Requirements

| Requirement | Depends-on |
|---|---|
| TCHR-EXAM-001 | |
| TCHR-EXAM-002 | TCHR-EXAM-001 |
| TCHR-EXAM-003 | TCHR-EXAM-001 |
| TCHR-EXAM-004 | TCHR-EXAM-001 |
| TCHR-QUES-001 | TCHR-EXAM-001 |
| TCHR-QUES-002 | TCHR-EXAM-001 |
| TCHR-QUES-003 | TCHR-EXAM-001, TCHR-QUES-001 |
| TCHR-QUES-004 | TCHR-EXAM-001, TCHR-QUES-002 |
| TCHR-QUES-005 | TCHR-EXAM-001, TCHR-QUES-001 |
| TCHR-QUES-007 | TCHR-EXAM-001, TCHR-QUES-001 |
| TCHR-QUES-008 | TCHR-EXAM-001, TCHR-QUES-002 |
| TCHR-QUES-009 | TCHR-EXAM-001, TCHR-QUES-001 |
| TCHR-QUES-010 | TCHR-EXAM-001, TCHR-QUES-001, TCHR-QUES-010 |
| TCHR-QUES-011 | TCHR-EXAM-001, TCHR-QUES-001, TCHR-QUES-010 |
| TCHR-QUES-012 | TCHR-EXAM-001, TCHR-QUES-001, TCHR-QUES-010 |
| TCHR-STAT-001 | TCHR-EXAM-001 |
| TCHR-STAT-002 | TCHR-EXAM-001 |
| TCHR-STAT-003 | TCHR-EXAM-001 |
| TCHR-STAT-004 | TCHR-EXAM-001 |
| TCHR-GRAD-001 | TCHR-EXAM-001, TCHR-QUES-001 |
| TCHR-GRAD-002 | TCHR-EXAM-001, TCHR-QUES-001 |
| TCHR-GRAD-003 | TCHR-EXAM-001, TCHR-QUES-002 |
| TCHR-STUD-001 | |
| TCHR-STUD-002 | TCHR-STUD-001 |

### 7.2.3 Student Requirements

| Requirement | Depends-on |
|---|---|
| STUD-EXAM-001 | ADMN-EXAM-001, TCHR-EXAM-001 |
| STUD-EXAM-002 | STUD-EXAM-004, STUD-EXAM-007, STUD-EXAM-008 |
| STUD-EXAM-003 | |
| STUD-EXAM-004 | ADMN-EXAM-001, TCHR-EXAM-001 |
| STUD-EXAM-005 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001 |
| STUD-EXAM-006 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001 |
| STUD-EXAM-007 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, TCHR-QUES-002, ADMN-QUES-002 |
| STUD-EXAM-008 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, TCHR-QUES-002, ADMN-QUES-002 |
| STUD-QUES-001 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001 |
| STUD-QUES-002 | |
| STUD-QUES-003 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, STUD-QUES-005 |
| STUD-QUES-004 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, STUD-ANSW-001, STUD-ANSW-003 |
| STUD-QUES-005 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001 |
| STUD-ANSW-001 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-002, ADMN-QUES-002 |
| STUD-ANSW-002 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-002, ADMN-QUES-002, STUD-ANSW-001 |
| STUD-ANSW-003 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001 |
| STUD-ANSW-004 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, STUD-ANSW-003 |
| STUD-ANSW-005 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-002, ADMN-QUES-002, STUD-ANSW-001 |
| STUD-ANSW-006 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, STUD-ANSW-003 |
| STUD-CMNT-001 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, TCHR-QUES-002, ADMN-QUES-002 |
| STUD-CMNT-002 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, TCHR-QUES-002, ADMN-QUES-002, STUD-CMNT-001 |
| STUD-CMNT-003 | STUD-EXAM-004, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-001, ADMN-QUES-001, TCHR-QUES-002, ADMN-QUES-002, STUD-CMNT-001 |
| STUD-GRAD-001 | STUD-EXAM-004, STUD-EXAM-007, ADMN-EXAM-001, TCHR-EXAM-001, TCHR-QUES-002, ADMN-QUES-002, STUD-ANSW-001 |

### 7.2.4 User Requirements

| Requirement | Depends-on |
|---|---|
| USER-AUTH-001 | |
| USER-AUTH-002 | USER-AUTH-001 |
| USER-AUTH-003 | USER-AUTH-001, USER-AUTH-002 |
| USER-AUTH-004 | USER-AUTH-001 |

### 7.2.5 Non-functional Requirements

| Requirement | Depends-on |
|---|---|
| NFRQ-PRVC-001 | |
| NFRQ-SECU-001 | |
| NFRQ-PERF-001 | |

# 8   Completed Requirements

Because the resources were limited -especially the time frame, that implies not all the requirements were implemented and completed. This section describes the completed and the uncompleted requirements.

## 8.1   Admin Requirements

| Requirement ID | Completed | Uncompleted |
|---|---|---|
| ADMN-EXAM-001 | X | |
| ADMN-EXAM-002 | X | |
| ADMN-EXAM-003 | X | |
| ADMN-EXAM-004 | X | |
| ADMN-QUES-001 | X | |
| ADMN-QUES-002 | X | |
| ADMN-QUES-003 | X | |
| ADMN-QUES-004 | X | |
| ADMN-QUES-005 | X | |
| ADMN-QUES-006 | X | |
| ADMN-QUES-007 | X | |
| ADMN-QUES-008 | X | |
| ADMN-QUES-009 | | X |
| ADMN-QUES-010 | | X |
| ADMN-QUES-011 | | X |
| ADMN-QUES-012 | | X |
| ADMN-USER-001 | | X |
| ADMN-USER-002 | X | |
| ADMN-USER-003 | X | |
| ADMN-USER-004 | X | |
| ADMN-USER-005 | X | |
| ADMN-USER-006 | X | |
| ADMN-USER-007 | X | |
| ADMN-USER-008 | X | |
| ADMN-ANSW-001 | X | |
| ADMN-ANSW-002 | X | |
| ADMN-ANSW-003 | X | |

## 8.2 Teacher Requirements

| Requirement ID | Completed | Uncompleted |
|---|---|---|
| TCHR-EXAM-001 | X | |
| TCHR-EXAM-002 | X | |
| TCHR-EXAM-003 | X | |
| TCHR-EXAM-004 | X | |
| TCHR-QUES-001 | X | |
| TCHR-QUES-002 | X | |
| TCHR-QUES-003 | X | |
| TCHR-QUES-004 | X | |
| TCHR-QUES-005 | X | |
| TCHR-QUES-006 | X | |
| TCHR-QUES-007 | X | |
| TCHR-QUES-008 | X | |
| TCHR-QUES-009 | | X |
| TCHR-QUES-010 | | X |
| TCHR-QUES-011 | | X |
| TCHR-QUES-012 | | X |
| TCHR-STAT-001 | | X |
| TCHR-STAT-002 | X | |
| TCHR-STAT-003 | | X |
| TCHR-STAT-004 | | X |
| TCHR-GRAD-001 | | X |
| TCHR-GRAD-002 | | X |
| TCHR-GRAD-003 | | X |
| TCHR-STUD-001 | X | |
| TCHR-STUD-002 | X | |

## 8.3 Student Requirements

| Requirement ID | Completed | Uncompleted |
|---|---|---|
| STUD-EXAM-001 | X | |
| STUD-EXAM-002 | X | |
| STUD-EXAM-003 | | X |
| STUD-EXAM-004 | | X |
| STUD-EXAM-005 | | X |
| STUD-EXAM-006 | | X |
| STUD-EXAM-007 | | X |
| STUD-EXAM-008 | | X |
| STUD-QUES-001 | | X |
| STUD-QUES-002 | | X |
| STUD-QUES-003 | | X |
| STUD-QUES-004 | | X |
| STUD-QUES-005 | | X |
| STUD-ANSW-001 | | X |
| STUD-ANSW-002 | | X |
| STUD-ANSW-003 | | X |
| STUD-ANSW-004 | | X |
| STUD-ANSW-005 | | X |
| STUD-ANSW-006 | | X |
| STUD-CMNT-001 | | X |
| STUD-CMNT-002 | | X |
| STUD-CMNT-003 | | X |
| STUD-GRAD-001 | | X |
| STUD-FDBK-001 | | X |

## 8.4 User Requirements

| Requirement ID | Completed | Uncompleted |
|---|---|---|
| USER-AUTH-001 | X | |
| USER-AUTH-002 | X | |
| USER-AUTH-003 | X | |
| USER-AUTH-004 | X | |

## 8.5 Non-functional Requirements

| Requirement ID | Completed | Uncompleted |
|---|---|---|
| NFRQ-PRVC-001 | X | |
| NFRQ-SECU-001 | X | |
| NFRQ-PERF-001 | X | |

# 9 Test cases

This section includes the proposed test cases for the requirements defined previously.

## 9.1 Admin Requirements

This section describes the test cases for the Admin requirements.

### 9.1.1 Test Case 1

| Identification | TC 1 |
| --- | --- |
| **Requirement** | ADMN-EXAM-001 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully create an exam. |
| **Description** | Admin creating a new exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Create a new exam. |
| **Input** | Valid credentials for the admin |
| **Expected Result** | The exam is inserted into database. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to create an exam. |

### 9.1.2 Test Case 2

| Identification | TC 2 |
|---|---|
| Requirement | ADMN-EXAM-002 |
| Date | 2020-04-10 |
| Goal | Successfully view all the exams in the system. |
| Description | Admin viewing all the exams. |
| Steps | 1. Open the application. 2. Go to the panel for admins. 3. Log in. 4. View exams. |
| Input | Valid credentials for the admin |
| Expected Result | All the exams in the system are shown |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to show all the exams on the system. |

### 9.1.3 Test Case 3

| Identification | TC 3 |
|---|---|
| Requirement | ADMN-EXAM-003 |
| Date | 2020-04-10 |
| Goal | Successfully edit any existing exam in the system. |
| Description | Admin editing any existing exam. |
| Steps | 1. Open the application. 2. Go to the panel for admins. 3. Log in. 4. Pick exam 5. Edit exam 6. Save changes |
| Input | Valid credentials for the admin |
| Expected Result | Exam changes accordingly |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to edit any existing exam. |

### 9.1.4 Test Case 4

| Identification | TC 4 |
|---|---|
| Requirement | ADMN-EXAM-004 |
| Date | 2020-04-10 |
| Goal | Sucessfully delete any existing exam. |
| Description | Admin deleting any existing exam in the system. |
| Steps | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Pick exam <br><br> 5. Delete exam |
| Input | Valid credentials for the admin |
| Expected Result | The exam is deleted. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to delete any existing exam. |

### 9.1.5  Test Case 5

| Identification | TC 5 |
|---|---|
| **Requirement** | ADMN-QUES-001 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully add a question that require textual answer in any given exam in the system. |
| **Description** | Admin adding a question that require textual answer to any exam. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Pick exam. <br><br> 5. Add question with textual answers. |
| **Input** | Valid credentials for the admin |
| **Expected Result** | The question is added to the exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to add a question with textual answer to any given exam in the system. |

### 9.1.6 Test Case 6

| Identification | TC 6 |
|---|---|
| **Requirement** | ADMN-QUES-002 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully add a question that require multiple-choice answers in any given exam in the system. |
| **Description** | Admin adding a question that require multiple-choice answers to any exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick exam.<br><br>5. Add question that requires multiple-choice answers.<br><br>6. Add answers. |
| **Input** | Valid credentials for the admin |
| **Expected Result** | The question is added to the exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to add a question with multiple-choice answers to any given exam in the system. |

### 9.1.7 Test Case 7

| Identification | TC 7 |
| --- | --- |
| Requirement | ADMN-QUES-003 |
| Date | 2020-04-10 |
| Goal | Successfully view any question requiring textual answer in any exam. |
| Description | Admin viewing a question requiring textual answer. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick exam.<br><br>5. View question requiring textual answer. |
| Input | Valid credentials for the admin |
| Expected Result | The question is added to the exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to view a textual question. |

### 9.1.8 Test Case 8

| Identification | TC 8 |
|---|---|
| **Requirement** | ADMN-QUES-004 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully view any question requiring multiple-choice answer in any exam. |
| **Description** | Admin viewing a question requiring multiple-choice answer. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick exam.<br><br>5. View question requiring multiple-choice answer. |
| **Input** | Valid credentials for the admin |
| **Expected Result** | The question is added to the exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to view any multiple-choice question. |

### 9.1.9 Test Case 9

| Identification | TC 9 |
|---|---|
| Requirement | ADMN-QUES-005 |
| Date | 2020-04-10 |
| Goal | Successfully edit any textual question. |
| Description | Admin editing any textual question in any exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick exam.<br><br>5. Edit question requiring textual answer. |
| Input | Valid credentials for the admin |
| Expected Result | The question is edited. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to edit any textual question. |

### 9.1.10 Test Case 10

| Identification | TC 10 |
|---|---|
| Requirement | ADMN-QUES-006 |
| Date | 2020-04-10 |
| Goal | Successfully edit any multiple-choice question. |
| Description | Admin editing any multiple-choice question in any exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick exam.<br><br>5. Edit question requiring multiple-choice answers. |
| Input | Valid credentials for the admin |
| Expected Result | The question is edited. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to edit any multiple-choice question. |

### 9.1.11 Test Case 11

| Identification | TC 11 |
|---|---|
| Requirement | ADMN-QUES-007 |
| Date | 2020-04-10 |
| Goal | Successfully delete a textual question. |
| Description | Admin deleting any textual question from any exam. |
| Steps | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Pick exam. <br><br> 5. delete question requiring textual answers. |
| Input | Valid credentials for the admin |
| Expected Result | The question deleted from the exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to remove a textual question from any exam. |

### 9.1.12 Test Case 12

| Identification | TC 12 |
|---|---|
| **Requirement** | ADMN-QUES-008 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully delete a multiple-choice question. |
| **Description** | Admin deleting any multiple-choice question from any exam. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Pick exam. <br><br> 5. delete question requiring multiple-choice answers. |
| **Input** | Valid credentials for the admin |
| **Expected Result** | The question deleted from the exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to remove a multiple-choice question from any exam. |

### 9.1.13 Test Case 13

| Identification | TC 13 |
| --- | --- |
| **Requirement** | ADMN-ANSW-001 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully add an answer to any multiple-choice question in any exam with multiple-choice questions. |
| **Description** | Admin adding an answer to a multiple-choice question. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick any exam.<br><br>5. Pick any multiple-choice question.<br><br>6. Add answer. |
| **Input** | Valid credentials for the admin |
| **Expected Result** | The question deleted from the exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to add an answer to any multiple-choice question in any exam. |

### 9.1.14　Test Case 14

| Identification | TC 14 |
|---|---|
| Requirement | ADMN-ANSW-002 |
| Date | 2020-04-10 |
| Goal | Successfully change an answer to any multiple-choice question in any exam with multiple-choice questions. |
| Description | Admin changing an answer to a multiple-choice question. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick any exam.<br><br>5. Pick any multiple-choice question.<br><br>6. Change answer. |
| Input | Valid credentials for the admin |
| Expected Result | The question deleted from the exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to change an answer to any multiple-choice question in any exam. |

### 9.1.15 Test Case 15

| Identification | TC 15 |
|---|---|
| Requirement | ADMN-ANSW-003 |
| Date | 2020-04-10 |
| Goal | Successfully delete an answer to any multiple-choice question in any exam with multiple-choice questions. |
| Description | Admin deleting an answer to a multiple-choice question. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick any exam.<br><br>5. Pick any multiple-choice question.<br><br>6. Delete answer. |
| Input | Valid credentials for the admin |
| Expected Result | The question deleted from the exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to delete an answer to any multiple-choice question in any exam. |

### 9.1.16 Test Case 16

| Identification | TC 16 |
|---|---|
| Requirement | ADMN-USER-001 |
| Date | 2020-04-10 |
| Goal | Successfully view user statistics. |
| Description | Admin viewing user statistics |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. View user statistics |
| Input | Valid credentials for the admin |
| Expected Result | User statistics is shown. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to show user statistics. |

### 9.1.17 Test Case 17

| Identification | TC 17 |
|---|---|
| Requirement | ADMN-USER-002 |
| Date | 2020-04-10 |
| Goal | Successfully create a new user account |
| Description | Admin creating a new user account. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Create user |
| Input | Valid credentials for the admin, user data |
| Expected Result | User is created with the input data. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to create a new user. |

### 9.1.18  Test Case 18

| Identification | TC 18 |
|---|---|
| Requirement | ADMN-USER-003 |
| Date | 2020-04-10 |
| Goal | Successfully delete user account |
| Description | Admin deleting a user account. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Delete user |
| Input | Valid credentials for the admin |
| Expected Result | User is deleted. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to delete a user. |

### 9.1.19  Test Case 19

| Identification | TC 19 |
|---|---|
| Requirement | ADMN-USER-004 |
| Date | 2020-04-10 |
| Goal | Successfully update user account |
| Description | Admin update a user account. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Update user |
| Input | Valid credentials for the admin, user data |
| Expected Result | User is updated according to the user data. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to update a user. |

### 9.1.20    Test Case 20

| Identification | TC 20 |
|---|---|
| **Requirement** | ADMN-USER-005 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully read any user data |
| **Description** | Admin reading any user data. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Pick user <br><br> 5. Read data |
| **Input** | Valid credentials for the admin |
| **Expected Result** | User data is read. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to read a user. |

### 9.1.21    Test Case 21

| Identification | TC 21 |
|---|---|
| **Requirement** | ADMN-USER-006 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully read any user data matching the search keywords. |
| **Description** | Admin reading any user data matching the search keywords. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Search <br><br> 5. Read data |
| **Input** | Valid credentials for the admin, search keyword[s] |
| **Expected Result** | User data is read. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to read a user matching the search keyword[s]. |

### 9.1.22  Test Case 22

| Identification | TC 22 |
| --- | --- |
| Requirement | ADMN-USER-007 |
| Date | 2020-04-10 |
| Goal | Successfully filter user data. |
| Description | Admin filtering any user data. |
| Steps | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Search <br><br> 5. Read data |
| Input | Valid credentials for the admin, filter values |
| Expected Result | User data is filtered. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to filter user data according to the filter values. |

### 9.1.23  Test Case 23

| Identification | TC 23 |
| --- | --- |
| Requirement | ADMN-USER-008 |
| Date | 2020-04-10 |
| Goal | Successfully change a user's role. |
| Description | Admin changing any user's role. |
| Steps | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Pick any user <br><br> 5. Change role |
| Input | Valid credentials for the admin, role for the user |
| Expected Result | Role changed. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to change the role of a user. |

### 9.1.24 Test Case 24

| Identification | TC 24 |
|---|---|
| Requirement | ADMN-QUES-009 |
| Date | 2020-04-13 |
| Goal | Successfully add an image to any question. |
| Description | Admin adding an image to any question of any existing exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick exam.<br><br>5. Pick question.<br><br>6. Add image |
| Input | Valid credentials for the admin, exam name, question, image. |
| Expected Result | The image is added to the exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to add an image to a question. |

### 9.1.25 Test Case 25

| Identification | TC 25 |
|---|---|
| **Requirement** | ADMN-QUES-010 |
| **Date** | 2020-04-13 |
| **Goal** | Successfully review an image in any question. |
| **Description** | Admin reviewing an image in any question of any existing exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for admins.<br><br>3. Log in.<br><br>4. Pick exam.<br><br>5. Pick question with image.<br><br>6. View image. |
| **Input** | Valid credentials for the admin, exam name, question. |
| **Expected Result** | The image is viewed. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to view an image in a question. |

**9.1.26  Test Case 26**

| Identification | TC 26 |
|---|---|
| **Requirement** | ADMN-QUES-011 |
| **Date** | 2020-04-13 |
| **Goal** | Successfully update an image in any question. |
| **Description** | Admin updating an image in any question of any existing exam. |
| **Steps** | 1. Open the application. 2. Go to the panel for admins. 3. Log in. 4. Pick exam. 5. Pick question with image. 6. Change image. |
| **Input** | Valid credentials for the admin, exam name, question, image |
| **Expected Result** | The image is viewed. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to update an image in a question. |

### 9.1.27 Test Case 27

| Identification | TC 27 |
|---|---|
| **Requirement** | ADMN-QUES-012 |
| **Date** | 2020-04-13 |
| **Goal** | Successfully delete an image in any question. |
| **Description** | Admin deleting an image in any question of any existing exam. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for admins. <br><br> 3. Log in. <br><br> 4. Pick exam. <br><br> 5. Pick question with image. <br><br> 6. Delete image. |
| **Input** | Valid credentials for the admin, exam name, question, image |
| **Expected Result** | The image is deleted. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability to delete an image in a question. |

## 9.2 Teacher Requirements

This section describes the test cases for the Teacher requirements.

### 9.2.1 Test Case 28

| Identification | TC 28 |
| --- | --- |
| Requirement | TCHR-EXAM-001 |
| Date | 2020-04-07 |
| Goal | Successfully to create a new exam. |
| Description | To create a new exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Create a new exam.<br><br>5. Add the name of the exam.<br><br>6. Add the dates and times.<br><br>7. Create exam. |
| Input | Valid credentials, name of the exam, date and time of publication, deadline date and time and duration time of the exam. |
| Expected Result | An exam successfully is created. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of creating a new exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.2 Test Case 29

| Identification | TC 29 |
|---|---|
| Requirement | TCHR-EXAM-002 |
| Date | 2020-04-07 |
| Goal | Successfully to review an exam. |
| Description | To review an exam. |
| Steps | 1. Open the application. <br><br> 2. Go to the panel for teachers. <br><br> 3. Log in. <br><br> 4. Search the exam by its name. <br><br> 5. Open the exam. |
| Input | Valid credentials and the name of the exam. |
| Expected Result | An exam successfully is viewed. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of retrieving an exam from the system and to check whether the requirement contains all the necessary information required for development. |

### 9.2.3 Test Case 30

| Identification | TC 30 |
|---|---|
| **Requirement** | TCHR-EXAM-003 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to update an exam. |
| **Description** | To update an exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Update Exam.<br><br>7. Edit the date and the time of publication, the date and the time of the deadline and the duration time.<br><br>8. Update. |
| **Input** | Valid credentials, the new date and time for the publication, the new date and time for the deadline and the new time for the duration. |
| **Expected Result** | An exam successfully is updated. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of updating an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.4 Test Case 31

| Identification | TC 31 |
|---|---|
| **Requirement** | TCHR-EXAM-004 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to delete an exam. |
| **Description** | To delete an exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Delete the exam.<br><br>7. Confirm the deletion. |
| **Input** | Valid credentials and the name of the exam. |
| **Expected Result** | An exam successfully is removed. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of removing an exam from the system and to check whether the requirement contains all the necessary information required for development. |

### 9.2.5 Test Case 32

| Identification | TC 32 |
|---|---|
| **Requirement** | TCHR-QUES-001 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to add a textual question to an exam. |
| **Description** | To add a textual question to an exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Add a textual question. |
| **Input** | Valid credentials, the name of the exam and the a question. |
| **Expected Result** | An question successfully is added to an exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of adding textual questions to an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.6  Test Case 33

| Identification | TC 33 |
|---|---|
| Requirement | TCHR-QUES-003 |
| Date | 2020-04-07 |
| Goal | Successfully to review textual questions in an exam. |
| Description | To review textual questions in an exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam. |
| Input | Valid credentials and the name of the exam. |
| Expected Result | The exam successfully shows the existing textual questions. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of displaying textual questions in an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.7 Test Case 34

| Identification | TC 34 |
|---|---|
| **Requirement** | TCHR-QUES-005 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to update a textual question in an exam. |
| **Description** | To update a textual question in an exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Select a question.<br><br>7. Edit the question.<br><br>8. Save changes. |
| **Input** | Valid credentials, the name of the exam and the new question. |
| **Expected Result** | The exam successfully updates the textual question in the exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of updating textual questions in an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.8 Test Case 35

| Identification | TC 35 |
| --- | --- |
| Requirement | TCHR-QUES-007 |
| Date | 2020-04-07 |
| Goal | Successfully to delete a textual question in an exam. |
| Description | To delete a textual question in an exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Select a question.<br><br>7. Delete the question.<br><br>8. Confirm the deletion. |
| Input | Valid credentials and the name of the exam. |
| Expected Result | The exam successfully deletes the existing textual question. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of deleting textual questions in an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.9 Test Case 36

| Identification | TC 36 |
|---|---|
| Requirement | TCHR-QUES-002 |
| Date | 2020-04-07 |
| Goal | Successfully to add a question with multiple-choices to an exam. |
| Description | To add a question with multiple-choices to an exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Add a question with multiple-choices. |
| Input | Valid credentials, the name of the exam, a question and multiple-choices. |
| Expected Result | An question with multiple-choices successfully is added to an exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of adding questions with multiple-choices to an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.10   Test Case 37

| Identification | TC 37 |
|---|---|
| **Requirement** | TCHR-QUES-004 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to review questions with multiple-choices in an exam. |
| **Description** | To review questions with multiple-choices in an exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam. |
| **Input** | Valid credentials and the name of the exam. |
| **Expected Result** | The exam successfully shows the existing questions with multiple-choices. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of displaying questions with multiple-choices in an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.11 Test Case 38

| Identification | TC 11 |
|---|---|
| Requirement | TCHR-QUES-006 |
| Date | 2020-04-07 |
| Goal | Successfully to update a question with multiple-choices in an exam. |
| Description | To update a question with multiple-choices in an exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Select a question with multiple-choices.<br><br>7. Edit the question.<br><br>8. Save changes. |
| Input | Valid credentials, the name of the exam, the new question and the new multiple-choices. |
| Expected Result | The exam successfully updates the question with multiple-choices. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of updating questions with multiple-choices in an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.12   Test Case 39

| Identification | TC 39 |
|---|---|
| **Requirement** | TCHR-QUES-008 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to delete a question with multiple-choices in an exam. |
| **Description** | To delete a question with multiple-choices in an exam. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for teachers. <br><br> 3. Log in. <br><br> 4. Search the exam by its name. <br><br> 5. Open the exam. <br><br> 6. Select a question with multiple-choices. <br><br> 7. Delete the question. <br><br> 8. Confirm the deletion. |
| **Input** | Valid credentials and the name of the exam. |
| **Expected Result** | The exam successfully deletes the existing question with multiple-choices. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of deleting questions with multiple-choices in an exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.13   Test Case 40

| Identification | TC 40 |
|---|---|
| **Requirement** | TCHR-STAT-001 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to request a report about the average number of students passed in a given exam. |
| **Description** | To request a report about the average number of students passed in a given exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Generate report.<br><br>7. Select the target perspective. |
| **Input** | Valid credentials, the name of the exam and the name of perspective. |
| **Expected Result** | Report about the average number of students passed in a given exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of generating a report and to check whether the requirement contains all the necessary information required for development. |

### 9.2.14 Test Case 41

| Identification | TC 41 |
| --- | --- |
| **Requirement** | TCHR-STAT-002 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to request a report about the number of participants in a given exam. |
| **Description** | To request a report about the number of participants in a given exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Generate report.<br><br>7. Select the target perspective. |
| **Input** | Valid credentials, the name of the exam and the name of perspective. |
| **Expected Result** | Report about the number of participants in a given exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of generating a report and to check whether the requirement contains all the necessary information required for development. |

### 9.2.15  Test Case 42

| Identification | TC 42 |
|---|---|
| **Requirement** | TCHR-STAT-003 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to request a report about the common difficult question[s] in a given exam. |
| **Description** | To request a report about the common difficult question[s] in a given exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Generate report.<br><br>7. Select the target perspective. |
| **Input** | Valid credentials, the name of the exam and the name of perspective. |
| **Expected Result** | Report about the common difficult question[s] in a given exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of generating a report and to check whether the requirement contains all the necessary information required for development. |

### 9.2.16 Test Case 43

| Identification | TC 43 |
|---|---|
| **Requirement** | TCHR-STAT-004 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to request a report about the distribution of the grades in a given exam. |
| **Description** | To request a report about the distribution of the grades in a given exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Generate report.<br><br>7. Select the target perspective. |
| **Input** | Valid credentials, the name of the exam and the name of perspective. |
| **Expected Result** | Report about the distribution of the grades in a given exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of generating a report and to check whether the requirement contains all the necessary information required for development. |

### 9.2.17  Test Case 44

| Identification | TC 44 |
| --- | --- |
| **Requirement** | TCHR-GRAD-002 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to set a grade of a student. |
| **Description** | To set a grade of a student. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for teachers. <br><br> 3. Log in. <br><br> 4. Search the exam by its name. <br><br> 5. Open the answers of the student. <br><br> 6. Set the points. <br><br> 7. Set the grade. <br><br> 8. Save the grade. |
| **Input** | Valid credentials, the name of the exam and the identification number of a student. |
| **Expected Result** | The grade of the student is set. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of setting grades of students and to check whether the requirement contains all the necessary information required for development. |

### 9.2.18  Test Case 45

| Identification | TC 45 |
|---|---|
| **Requirement** | TCHR-GRAD-001 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to edit a grade of a student. |
| **Description** | To edit a grade of a student. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for teachers. <br><br> 3. Log in. <br><br> 4. Search for a student by their identification number. <br><br> 5. Open the profile of the student. <br><br> 6. Edit the grade. <br><br> 7. Save the grade. |
| **Input** | Valid credentials, the name of the exam and the identification number of the student. |
| **Expected Result** | The grade of the student is edited. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of editing grades of students and to check whether the requirement contains all the necessary information required for development. |

### 9.2.19 Test Case 46

| Identification | TC 46 |
|---|---|
| Requirement | TCHR-GRAD-003 |
| Date | 2020-04-07 |
| Goal | Successfully to edit a grade of a student, that was set by the system. |
| Description | To edit a grade of a student, that was set by the system. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search for a student by their identification number.<br><br>5. Open the profile of the student.<br><br>6. Edit the grade.<br><br>7. Save the grade. |
| Input | Valid credentials, the name of the exam and the identification number of the student. |
| Expected Result | The grade of the student is edited. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of editing grades of students that were set by the system and to check whether the requirement contains all the necessary information required for development. |

### 9.2.20 Test Case 47

| Identification | TC 47 |
|---|---|
| **Requirement** | TCHR-QUES-009 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to add an image to a question in a en exam. |
| **Description** | To add an image to a question in a en exam. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Create an exam.<br><br>5. Add a question.<br><br>6. Upload an Image<br><br>7. Save the image. |
| **Input** | Valid credentials, the name of the exam, the dates and times of the exam, a question and an image. |
| **Expected Result** | The image uploaded and added to the question. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of uploading and adding images to questions in exams and to check whether the requirement contains all the necessary information required for development. |

### 9.2.21 Test Case 48

| Identification | TC 48 |
|---|---|
| Requirement | TCHR-QUES-010 |
| Date | 2020-04-07 |
| Goal | Successfully to review an image that was added to a question in a en exam. |
| Description | To review an image that was added to a question in a en exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Select the question.<br><br>7. View the question. |
| Input | Valid credentials, the name of the exam and the target question. |
| Expected Result | The image displayed. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of reviewing images from questions in exams and to check whether the requirement contains all the necessary information required for development. |

### 9.2.22 Test Case 49

| Identification | TC 49 |
|---|---|
| Requirement | TCHR-QUES-011 |
| Date | 2020-04-07 |
| Goal | Successfully to update an image that was added to a question in a en exam. |
| Description | To update an image that was added to a question in a en exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Select the question.<br><br>7. Upload a new image.<br><br>8. Save changes. |
| Input | Valid credentials, the name of the exam and the target question, and a new image. |
| Expected Result | The image updated. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of updating images that were added to questions in a exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.23 Test Case 50

| Identification | TC 50 |
|---|---|
| Requirement | TCHR-QUES-012 |
| Date | 2020-04-07 |
| Goal | Successfully to delete an image from a question in a exam. |
| Description | To delete an image from a question in a exam. |
| Steps | 1. Open the application. <br><br> 2. Go to the panel for teachers. <br><br> 3. Log in. <br><br> 4. Search the exam by its name. <br><br> 5. Open the exam. <br><br> 6. Select the question. <br><br> 7. Select the image. <br><br> 8. Delete image. <br><br> 9. Confirm. |
| Input | Valid credentials, the name of the exam and the target question. |
| Expected Result | The image deleted. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of deleting images that were added to questions in a exam and to check whether the requirement contains all the necessary information required for development. |

### 9.2.24 Test Case 51

| Identification | TC 51 |
|---|---|
| Requirement | TCHR-STUD-001 |
| Date | 2020-04-07 |
| Goal | Successfully to register a student to a exam. |
| Description | To register a student to a exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for teachers.<br><br>3. Log in.<br><br>4. Search the exam by its name.<br><br>5. Open the exam.<br><br>6. Register students.<br><br>7. Fill the information of the student.<br><br>8. Register. |
| Input | Valid credentials, the name of the exam and the information of the student. |
| Expected Result | Student registered to a exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of registering students to exams and to check whether the requirement contains all the necessary information required for development. |

#### 9.2.25   Test Case 52

| Identification | TC 52 |
|---|---|
| **Requirement** | TCHR-STUD-002 |
| **Date** | 2020-04-07 |
| **Goal** | Successfully to un-register a student from a exam. |
| **Description** | To un-register a student from a exam. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for teachers. <br><br> 3. Log in. <br><br> 4. Search the exam by its name. <br><br> 5. Open the exam. <br><br> 6. Current Participants. <br><br> 7. Select the student. <br><br> 8. Un-register. <br><br> 9. Confirm. |
| **Input** | Valid credentials, the name of the exam and the information of the student. |
| **Expected Result** | Student un-registered from a exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of un-registering students from exams and to check whether the requirement contains all the necessary information required for development. |

### 9.3   Student Requirements

This section describes the test cases for the Student requirements.

### 9.3.1 Test Case 53

| Identification | TC 53 |
|---|---|
| Requirement | STUD-EXAM-001 |
| Date | 2020-04-10 |
| Goal | Successfully to view a list of the available exams after the student has logged in. |
| Description | To view a list of the available exams after the student has logged in. |
| Steps | 1. Open the application. 2. Go to the panel for students. 3. Log in. 4. View list of the available exams. |
| Input | Valid credentials for the student |
| Expected Result | The student can view a list of available exams |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of viewing all the available exams for the student |

### 9.3.2 Test Case 54

| Identification | TC 54 |
|---|---|
| Requirement | STUD-EXAM-002 |
| Date | 2020-04-10 |
| Goal | Successfully to view a list of the submitted exams after the student has logged in. |
| Description | To view a list of the submitted exams after the student has logged in. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. View a list of the submitted exams done by the student. |
| Input | Valid credentials for the student |
| Expected Result | The student can view a list of submitted exams done by the student |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of showing all the submitted exams that the student has already done |

### 9.3.3 Test Case 55

| Identification | TC 55 |
|---|---|
| Requirement | STUD-EXAM-003 |
| Date | 2020-04-10 |
| Goal | Successfully to view the exam instructions before taking the exam. |
| Description | To view the exam instructions before taking the exam. |
| Steps | 1. Open the application. 2. Go to the panel for students. 3. Log in. 4. View the exam instructions of the available exams. |
| Input | Valid credentials for the student |
| Expected Result | The student can view the exam instructions of the available exams. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of showing the exam instructions of the available exams to the student. |

### 9.3.4 Test Case 56

| Identification | TC 56 |
|---|---|
| **Requirement** | STUD-EXAM-004 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to start an examination from the list of available exams. |
| **Description** | to start an examination from the list of available exams. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can start an examination from the list of available exams. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of starting an examination for the student. |

### 9.3.5 Test Case 57

| Identification | TC 57 |
|---|---|
| Requirement | STUD-EXAM-005 |
| Date | 2020-04-10 |
| Goal | Successfully to view the time taken to finish an exam directly after the submission of the exam by the student. |
| Description | To view the time taken to finish an exam directly after the submission of the exam. |
| Steps | 1. Open the application. 2. Go to the panel for students. 3. Log in. 4. Start an examination from the list of available exams. 5. Submit the exam. 6. View the time taken by the student to finish the exam. |
| Input | Valid credentials for the student |
| Expected Result | The student can view the time taken to finish an exam directly after the submission of the exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of showing time taken to finish an exam. |

### 9.3.6 Test Case 58

| Identification | TC 58 |
| --- | --- |
| Requirement | STUD-EXAM-006 |
| Date | 2020-04-10 |
| Goal | Successfully to view the remaining time of the exam during the exam period for the student. |
| Description | To view the remaining time of the exam during the exam period for the student. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View the remaining time. |
| Input | Valid credentials for the student |
| Expected Result | The student can view the remaining time of the exam during the exam period for the student. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of showing how much time is left for the student to complete the exam. |

### 9.3.7 Test Case 59

| Identification | TC 59 |
|---|---|
| Requirement | STUD-EXAM-007 |
| Date | 2020-04-10 |
| Goal | Successfully to submit an exam during the exam period. |
| Description | To submit an exam during the exam period. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. Submit the exam. |
| Input | Valid credentials for the student |
| Expected Result | The student can submit an exam during the exam period. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of submitting the exam by the student during the exam period. |

### 9.3.8 Test Case 60

| Identification | TC 60 |
|---|---|
| **Requirement** | STUD-EXAM-008 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to submit an examination without answering one or more questions. |
| **Description** | To submit an examination without answering one or more questions. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for students. <br><br> 3. Log in. <br><br> 4. Start an examination from the list of available exams. <br><br> 5. Answer all questions except for two questions. <br><br> 6. Submit the exam. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can submit an examination without answering one or more questions. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of submitting the exam by the student without answering all one or more questions. |

### 9.3.9 Test Case 61

| Identification | TC 61 |
|---|---|
| Requirement | STUD-QUES-001 |
| Date | 2020-04-10 |
| Goal | Successfully to view the question and any images (if available) clearly before the answer field. |
| Description | To view the question and any images (if available) clearly before the answer field. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View a question. |
| Input | Valid credentials for the student |
| Expected Result | The student can view the question and any images (if available) clearly before the answer field. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of showing questions clearly before the answer field |

### 9.3.10 Test Case 62

| Identification | TC 62 |
|---|---|
| **Requirement** | STUD-QUES-002 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to view the instructions of every question, i.e. multiple-choices or textual answers. |
| **Description** | To view the instructions of every question, i.e. multiple-choices or textual answers. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View a question.<br><br>6. View instruction of the question. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can view the instructions of every question, i.e. multiple-choices or textual answers. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of showing the instructions of every question, i.e. multiple-choices or textual answers clearly for the student. |

### 9.3.11 Test Case 63

| Identification | TC 63 |
|---|---|
| **Requirement** | STUD-QUES-003 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to view the list of questions marked with a flag. |
| **Description** | To view the list of questions marked with a flag. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View a question.<br><br>6. Mark the question with a flag.<br><br>7. View the list of all question marked with a flag. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can view the list of questions marked with a flag. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of showing the list of questions marked with a flag for the student. |

### 9.3.12 Test Case 64

| Identification | TC 64 |
|---|---|
| **Requirement** | STUD-QUES-004 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to view the answered and unanswered questions differently. |
| **Description** | To view the answered and unanswered questions differently. |
| **Steps** | 1. Open the application. 2. Go to the panel for students. 3. Log in. 4. Start an examination from the list of available exams. 5. Answer a question. 6. View exam panel. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can differentiate by answered questions and unanswered questions. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of showing the answered questions and unanswered questions differently for the student. |

### 9.3.13 Test Case 65

| Identification | TC 65 |
|---|---|
| **Requirement** | STUD-QUES-005 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to mark a question with a flag for a specific reason. |
| **Description** | To mark a question with a flag for a specific reason. |
| **Steps** | 1. Open the application. 2. Go to the panel for students. 3. Log in. 4. Start an examination from the list of available exams. 5. View a question. 6. Mark the question with a flag. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can mark a question with a flag. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of marking a question with a flag by the student. |

### 9.3.14 Test Case 66

| Identification | TC 66 |
|---|---|
| **Requirement** | STUD-ANSW-001 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to choose answer[s] from multiple-choices questions. |
| **Description** | To choose answer[s] from multiple-choices questions. |
| **Steps** | 1. Open the application. 2. Go to the panel for students. 3. Log in. 4. Start an examination from the list of available exams. 5. View a multiple-choices question. 6. Select an answer. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can choose answer[s] from multiple-choices questions. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of choosing answer[s] from multiple-choices questions for the student. |

### 9.3.15 Test Case 67

| Identification | TC 67 |
|---|---|
| **Requirement** | STUD-ANSW-002 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to change the student's choice[s] on multiple-choices questions during the exam period. |
| **Description** | To change the student's choice[s] on multiple-choices questions during the exam period. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View a multiple-choices question.<br><br>6. Change an answer. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can change choice[s] on multiple-choices questions during the exam period. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of changing answer[s] from multiple-choices questions for the student. |

### 9.3.16 Test Case 68

| Identification | TC 68 |
|---|---|
| Requirement | STUD-ANSW-003 |
| Date | 2020-04-10 |
| Goal | Successfully to add answer[s] to textual question[s]. |
| Description | To add answer[s] to textual question[s]. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View a textual question.<br><br>6. Add an answer. |
| Input | Valid credentials for the student |
| Expected Result | The student can add answer[s] to textual question. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of adding answer[s] to textual question[s] by the student. |

### 9.3.17 Test Case 69

| Identification | TC 69 |
|---|---|
| **Requirement** | STUD-ANSW-004 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to edit the student's answer[s] to a textual question[s] during the exam period. |
| **Description** | To edit the student's answer[s] to a textual question[s] during the exam period. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View an answered textual question.<br><br>6. Edit the answer. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can edit answer[s] to a textual question[s] during the exam period. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of editing answer[s] to textual question[s] by the student. |

### 9.3.18    Test Case 70

| Identification | TC 70 |
|---|---|
| **Requirement** | STUD-ANSW-005 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to remove the student's choice[s] on multiple-choices questions during the exam period. |
| **Description** | To remove the student's choice[s] to a multiple-choices question[s] during the exam period. |
| **Steps** | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View an answered multiple-choices question.<br><br>6. Remove the answer. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can remove choice[s] to a multiple-choices question[s] during the exam period. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of removing choice[s] to multiple-choices question[s] by the student. |

### 9.3.19 Test Case 71

| Identification | TC 71 |
|---|---|
| Requirement | STUD-ANSW-006 |
| Date | 2020-04-10 |
| Goal | Successfully to remove the student's answer[s] on to a textual question[s] questions during the exam period. |
| Description | To remove the student's answer[s] to a textual question[s] during the exam period. |
| Steps | 1. Open the application. <br><br> 2. Go to the panel for students. <br><br> 3. Log in. <br><br> 4. Start an examination from the list of available exams. <br><br> 5. View an answered textual question. <br><br> 6. Remove the answer. |
| Input | Valid credentials for the student |
| Expected Result | The student can remove answer[s] to a textual question[s] during the exam period. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of removing answer[s] to textual question[s] by the student. |

### 9.3.20 Test Case 72

| Identification | TC 72 |
|---|---|
| Requirement | STUD-CMNT-001 |
| Date | 2020-04-10 |
| Goal | Successfully to add comments to every question during the exam period by the student. |
| Description | To add comments to every question during the exam period. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. View a question.<br><br>6. Add a comment. |
| Input | Valid credentials for the student |
| Expected Result | The student can add comments to every question during the exam period. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of adding comments to every question during the exam period. |

### 9.3.21  Test Case 73

| Identification | TC 73 |
|---|---|
| Requirement | STUD-CMNT-002 |
| Date | 2020-04-10 |
| Goal | Successfully to edit comments on every question during the exam period by the student. |
| Description | To add comments to every question during the exam period. |
| Steps | 1. Open the application. <br><br> 2. Go to the panel for students. <br><br> 3. Log in. <br><br> 4. Start an examination from the list of available exams. <br><br> 5. View a question with comment. <br><br> 6. Edit the comment. |
| Input | Valid credentials for the student |
| Expected Result | The student can edit comments on every question during the exam period. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of Editing comments by the student during the exam period. |

### 9.3.22 Test Case 74

| Identification | TC 74 |
|---|---|
| **Requirement** | STUD-CMNT-003 |
| **Date** | 2020-04-10 |
| **Goal** | Successfully to remove comments from every question on the exam. |
| **Description** | To remove comments from every question on the exam. |
| **Steps** | 1. Open the application. <br><br> 2. Go to the panel for students. <br><br> 3. Log in. <br><br> 4. Start an examination from the list of available exams. <br><br> 5. View a question with comment. <br><br> 6. Remove the comment. |
| **Input** | Valid credentials for the student |
| **Expected Result** | The student can remove comments from every question on the exam. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of the ability of removing comments by the student during the exam period. |

### 9.3.23 Test Case 75

| Identification | TC 75 |
|---|---|
| Requirement | STUD-GRAD-001 |
| Date | 2020-04-10 |
| Goal | Successfully to view the grade automatically after the submission of an only multiple-choices exam. |
| Description | To view the grade automatically after the submission of an only multiple-choices exam. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. Start an examination from the list of available exams.<br><br>5. Submit the exam.<br><br>6. View the grade. |
| Input | Valid credentials for the student |
| Expected Result | The student can view the grade automatically after the submission of an only multiple-choices exam. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of showing the grade automatically after the submission of an only multiple-choices exam by the student. |

### 9.3.24 Test Case 76

| Identification | TC 76 |
|---|---|
| Requirement | STUD-FDBK-001 |
| Date | 2020-04-10 |
| Goal | Successfully to view a list of available feed-backs from the teachers by the student. |
| Description | To view a list of available feed-backs from the teachers. |
| Steps | 1. Open the application.<br><br>2. Go to the panel for students.<br><br>3. Log in.<br><br>4. View list of available feed-backs. |
| Input | Valid credentials for the student |
| Expected Result | The student can view a list of available feed-backs from the teachers. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability of showing a list of available feed-backs from the teachers to the student. |

## 9.4 User Requirements

This section describes the test cases for the User requirements.

### 9.4.1 Test Case 77

| Identification | TC 77 |
|---|---|
| Requirement | USER-AUTH-001 |
| Date | 2020-04-12 |
| Goal | Successfully login to the system. |
| Description | User logging to the system. |
| Steps | 1. Open the application.<br><br>2. Enter email.<br><br>3. Enter password. |
| Input | Valid email and password. |
| Expected Result | Login Successfully. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | User shall login to be able to use the system. |

### 9.4.2 Test Case 78

| Identification | TC 78 |
| --- | --- |
| Requirement | USER-AUTH-002 |
| Date | 2020-04-12 |
| Goal | Successfully logout from the system. |
| Description | User logging out from the system. |
| Steps | 1. Press logout button. |
| Input | - |
| Expected Result | Logout Successfully. |
| Actual Result | - |
| Post-condition | - |
| Comments | User should be logged in. |
| Objectivity: | User can log out to secure its account. |

### 9.4.3 Test Case 79

| Identification | TC 79 |
| --- | --- |
| Requirement | USER-AUTH-003 |
| Date | 2020-04-12 |
| Goal | Reset Password successfully. |
| Description | User wants to reset its password. |
| Steps | 1. Press reset password button. 2. Enter email. 3. Open new email which received from the system. 4. Click on an link to enter new password. |
| Input | - |
| Expected Result | Password is changed. |
| Actual Result | - |
| Post-condition | - |
| Comments | User should be registered in the system. |
| Objectivity: | To let the user reset its password. |

### 9.4.4 Test Case 80

| Identification | TC 80 |
|---|---|
| Requirement | USER-AUTH-004 |
| Date | 2020-04-12 |
| Goal | Edit profile successfully. |
| Description | User wants to edit its phone number. |
| Steps | 1. Press edit profile button.<br><br>2. Enter new phone number.<br><br>3. save your changes. |
| Input | - |
| Expected Result | Profile updated successfully |
| Actual Result | - |
| Post-condition | - |
| Comments | User should be logged in to the system. |
| Objectivity: | To let the user edit its profile information. |

## 9.5 Non-functional Requirements

This section describes the test cases for the non-functional requirements.

### 9.5.1 Test Case 81

| Identification | TC 81 |
|---|---|
| Requirement | NFRQ-PERF-001 |
| Date | 2020-04-13 |
| Goal | The loading time for the page should not exceed 2 second. |
| Description | The time between start and finish loading the page should be less than 1 second |
| Steps | 1. Enter the address of the website in Chrome.<br><br>2. Open Console tools.<br><br>3. Monitor the load time.<br><br>4. Press enter.<br><br>5. The time should not exceed 2 second. |
| Input | Loading the page is less than 1 second. |
| Expected Result | The image is deleted. |
| Actual Result | - |
| Post-condition | - |
| Comments | - |
| Objectivity: | To check whether the system is able to meet the requirement in terms of the ability to load the home page in less than 2 seconds. |

### 9.5.2 Test Case 82

| Identification | TC 82 |
|---|---|
| **Requirement** | NFRQ-PRVC-001 |
| **Date** | 2020-04-13 |
| **Goal** | The system conforms with GDPR. |
| **Description** | The information in the website should be deleted when the user is removed and the user must agree to the license |
| **Steps** | 1. Create a student with information. 2. Delete the student. 3. Check if the student exists in the database. |
| **Input** | - |
| **Expected Result** | The student is removed with all data referring to him/her. |
| **Actual Result** | - |
| **Post-condition** | - |
| **Comments** | - |
| **Objectivity:** | To check whether the system is able to meet the requirement in terms of privacy. |

# 10 Requirements Modeling

This section describes the purpose of the requirements modeling and the primary models for the current set of requirements.

## 10.1 Purpose of the requirements modeling

The purpose of the requirements modeling is to inform the stakeholders about the progress of the work. The modeling will provide the stakeholders the opportunity to reflect their opinions to assist in assessing the accuracy of the current requirements. Moreover, it enables users to express their specifications concretely.

## 10.2 USER-AUTH-001

The following state machine diagram shows the login of the student and all the states it goes through during its lifetime.

The student starts by entering his or her username and password, the student is in the first state "Entering username and password", and then the system checks if the student's credentials are valid or not. If they are valid the process continues and the system shows a welcome message to the student, the student is in the "Display Welcome" state. If they are not valid the system shows an error message to the student, the student is in the "Display error message".
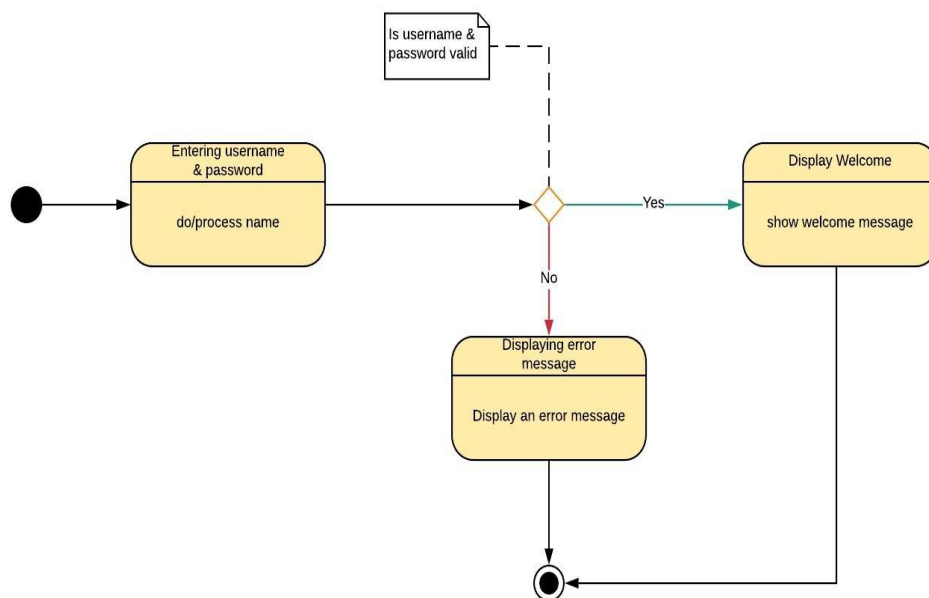


Figure 1: A state machine diagram describes the process of login.

## 10.3 USER-AUTH-003

The following state machine diagram shows the resetting password of a user and all the states it goes through during its lifetime.

It starts by the user providing his or her email address, the user is "Entering user email" state, and then the system checks if the user's email is valid or not, and then the user can be in two different states depending on the validations of the system, the "sending reset password email" state, or the "Displaying error message" state.
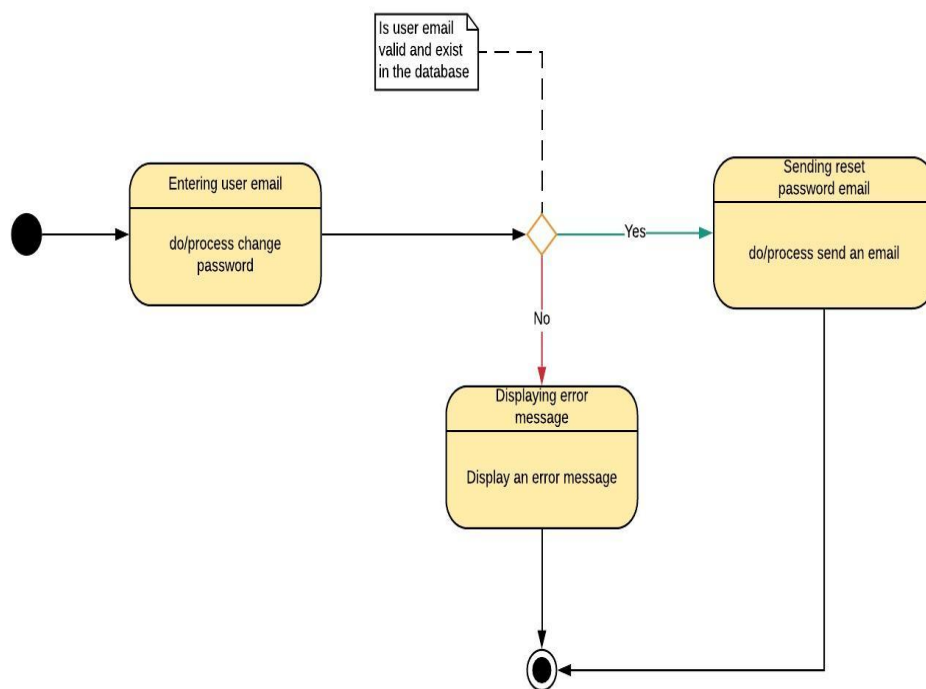


Figure 2: A state machine diagram describes the process of resetting password.

## 10.4   STUD-GRAD-001

The following state machine diagram shows the process of showing multiple-choice exam results by the system and all the states it goes through during its lifetime.

it starts in the "Submitting multiple-choice exam" state, and then the process continues and the system checks if it was submitted before the end time of the exam, and lastly, it will be in the "Displaying result" state where the system shows the result, but if the exam was submitted after the end time the process ends with no further states.
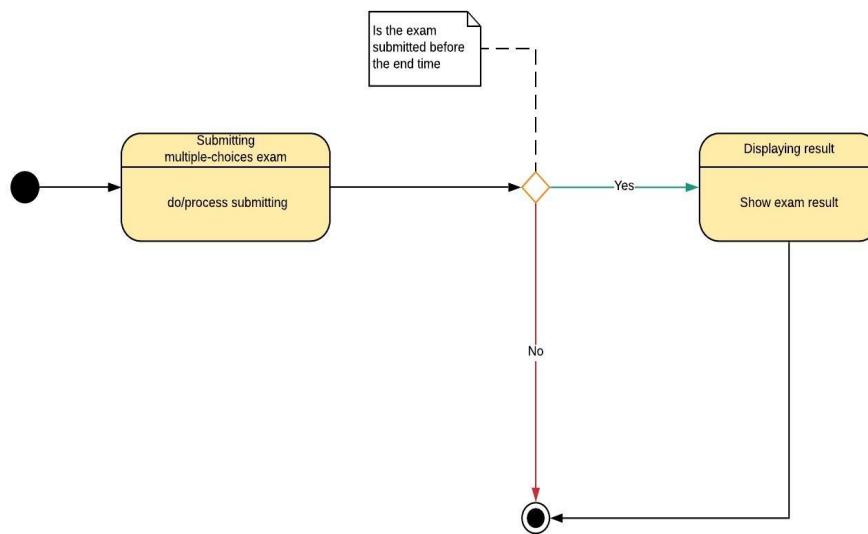
Figure 3: A state machine diagram describes the process of showing multiple-choice exam results by the system.

## 10.5   TCHR-GRAD-003

The following state machine diagram shows the process of editing students' results by the teacher and all the states it goes through during its lifetime.

It starts in the "Displaying existing exam" state, and then the system checks if the exam id is valid, and then it moves to the "Editing existing exam grade" state if the is valid, after the editing it continues to the "Updating database" if the student identification is valid and finally the process ends.
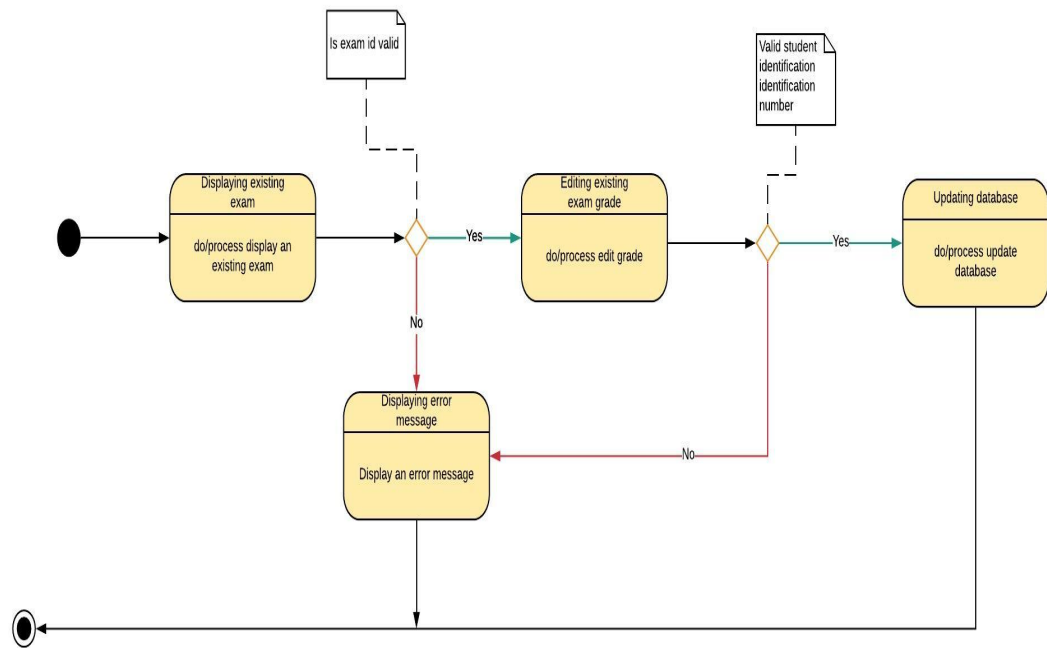
Figure 4: A state machine diagram describes the process of editing students' results by the teacher.

## 10.6 STUD-EXAM-001

The following state machine diagram shows the process of displaying available exams for the students and all the states it goes through during its lifetime.

It starts by the student entering his or her username and password, the student is in the first state "Entering username and password", and then the system checks if the student's credentials are valid or not. If they are valid the process continues and the student will be in the "Displaying available exams" state where the system shows all available exams for the students if the credentials are not valid the student will be in the "Displaying error message" where the system informs the student by showing an error message.
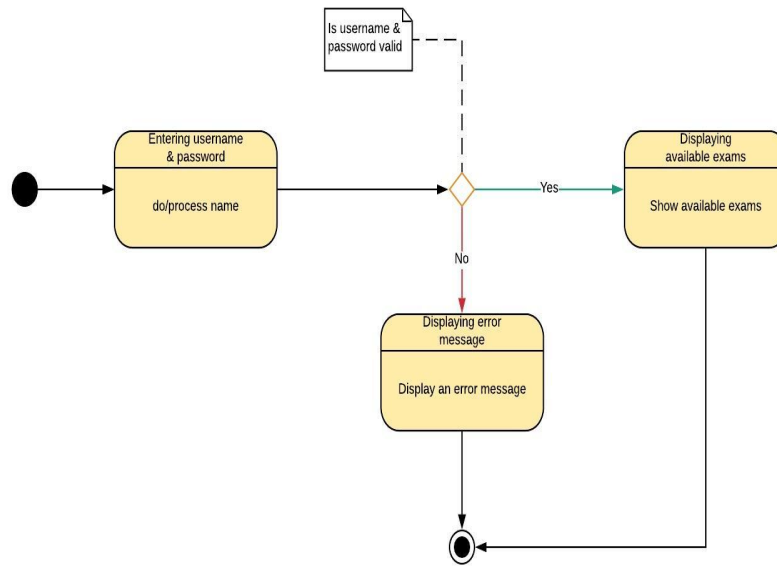
Figure 5: A state machine diagram describes the process of displaying available exams for the students.

## 10.7 STUD-EXAM-002

The following state machine diagram shows the process of displaying submitted exams for the students and all the states it goes through during its lifetime.

It starts by the student entering his or her username and password, the student is in the first state "Entering username and password", and then the system checks if the student's credentials are valid or not. If they are valid the process continues and the student will be in the "Displaying submitted exams" state where the system shows all submitted exams by the student if the credentials are not valid the student will be in the "Displaying error message" where the system informs the student by showing an error message.
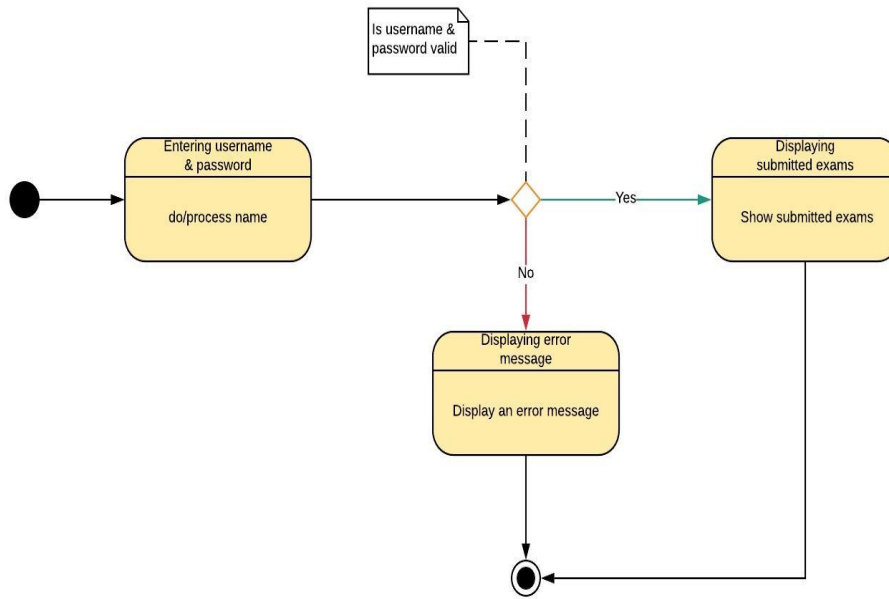
Figure 6: A state machine diagram describes the process of displaying submitted exams for the students.

## 10.8 STUD-EXAM-004

The following state machine diagram shows the process of starting an exam session for the students and all the states it goes through during its lifetime.

It starts with the student in the "Displaying available exams" and the system checks if there are available exams for the student, and the student moves to the "Starting exam session" state where he starts an exam.
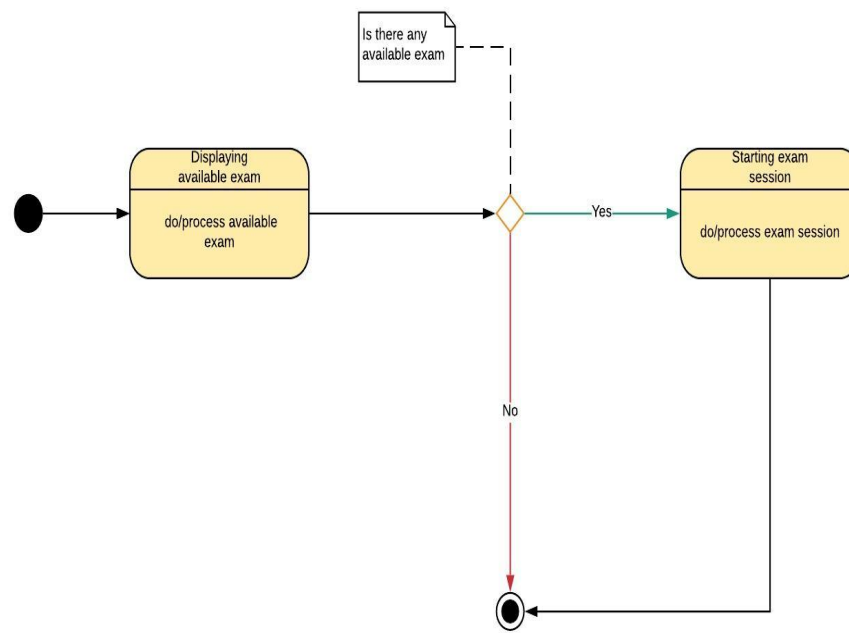
Figure 7: A state machine diagram describes the process of starting an exam session for the students.

## 10.9  ADMN-EXAM-001

The following state machine diagram shows the process of creating an exam by the admin and all the states it goes through during its lifetime.

It starts by the admin entering his or her username and password, the admin is in the first state "Entering admin name and password", and then the system checks if the student's credentials are valid or not. If not the admin will be in the "Displaying error message" where the system informs the admin of invalid credentials. If the credentials are valid the admin will be in the "creat exam" state where admin can create a new exam, and then will be in the state "updating database" where the system updates the database.
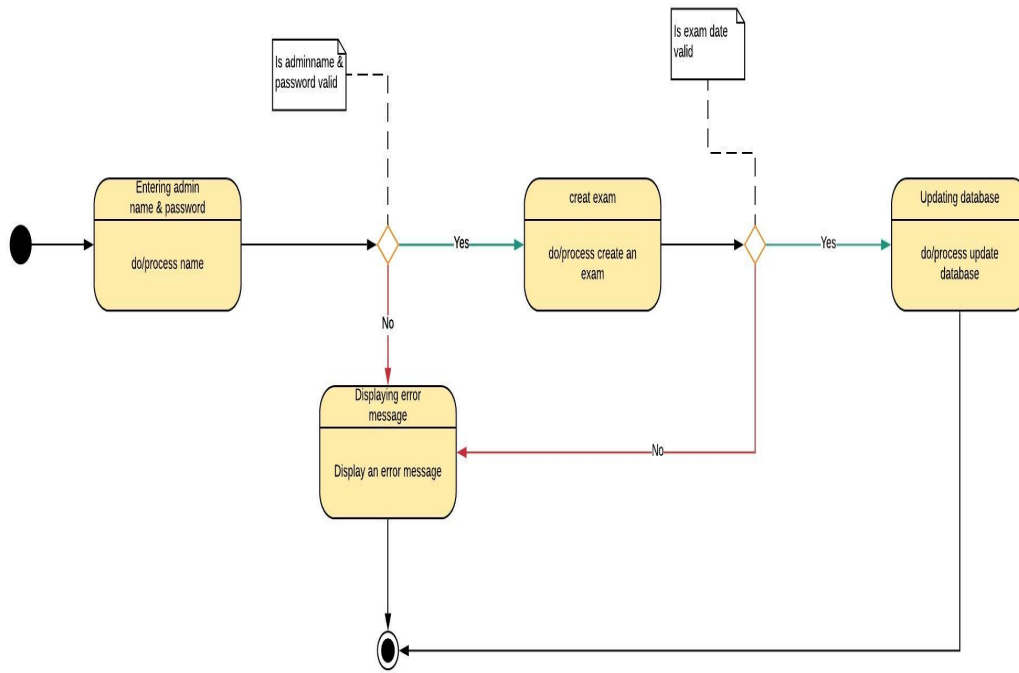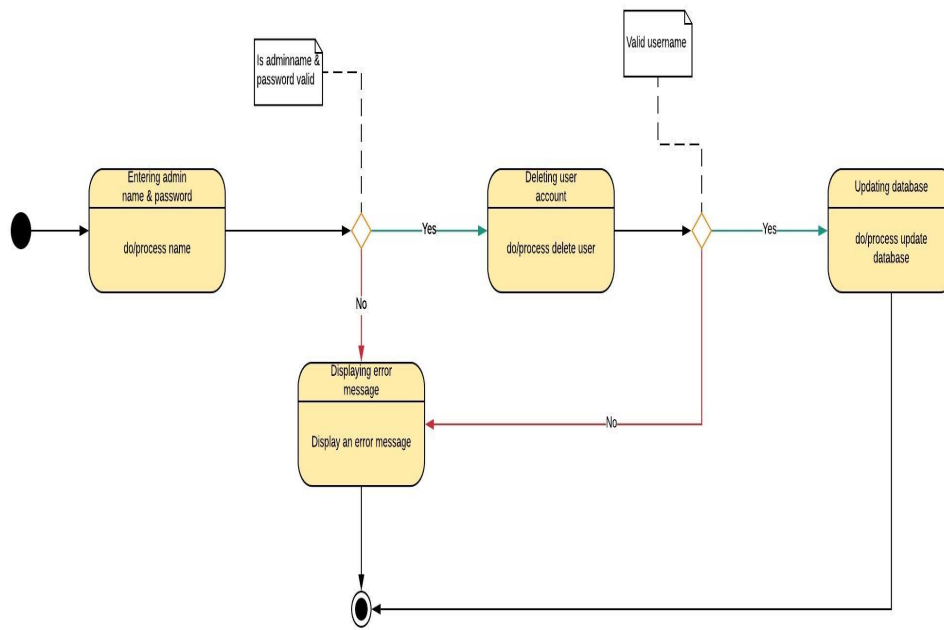
Figure 8: A state machine diagram describes the process of creating an exam by the admin.

## 10.10  ADMN-EXAM-003

The following state machine diagram shows the process of editing an existing exam by the admin and all the states it goes through during its lifetime.

It starts by the admin entering his or her username and password, the admin is in the first state "Entering admin name and password", and then the system checks if the student's credentials are valid or not. If not the admin will be in the "Displaying error message" where the system informs the admin of invalid credentials. If the credentials are valid the admin will be in the "Editing exam" state where admin can edit an exam, and then will be in the state "updating database" where the system updates the database.
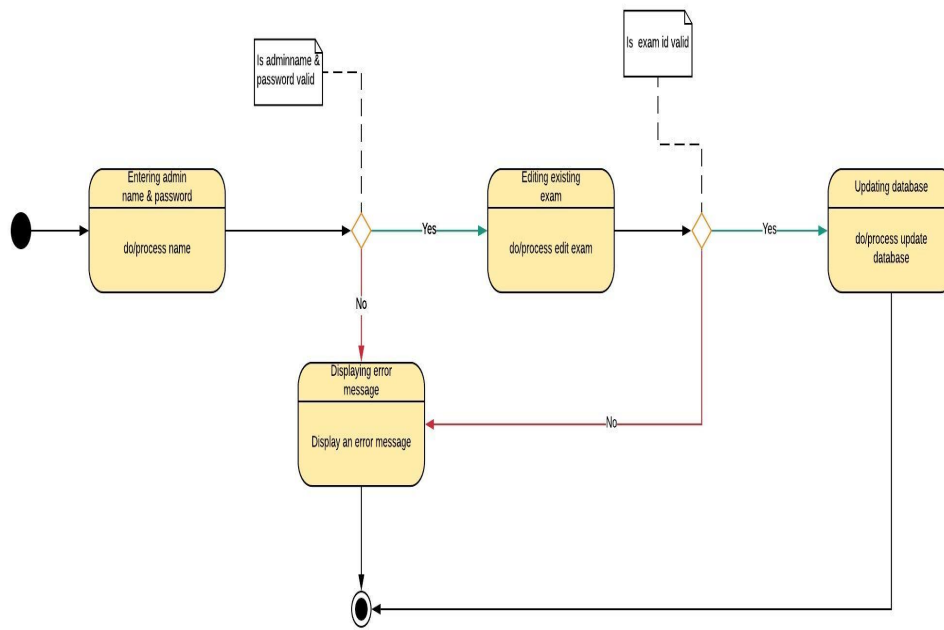
Figure 9: A state machine diagram describes the process of editing an existing exam by the admin.

## 10.11   ADMN-USER-003

The following state machine diagram shows the process of deleting a user account by the admin and all the states it goes through during its lifetime.

It starts by the admin entering his or her username and password, the admin is in the first state "Entering admin name and password", and then the system checks if the student's credentials are valid or not. If not the admin will be in the "Displaying error message" where the system informs the admin of invalid credentials. If the credentials are valid the admin will be in the "Deleting user account" state where admin can delete a user account, and then will be in the state "updating database" where the system updates the database.
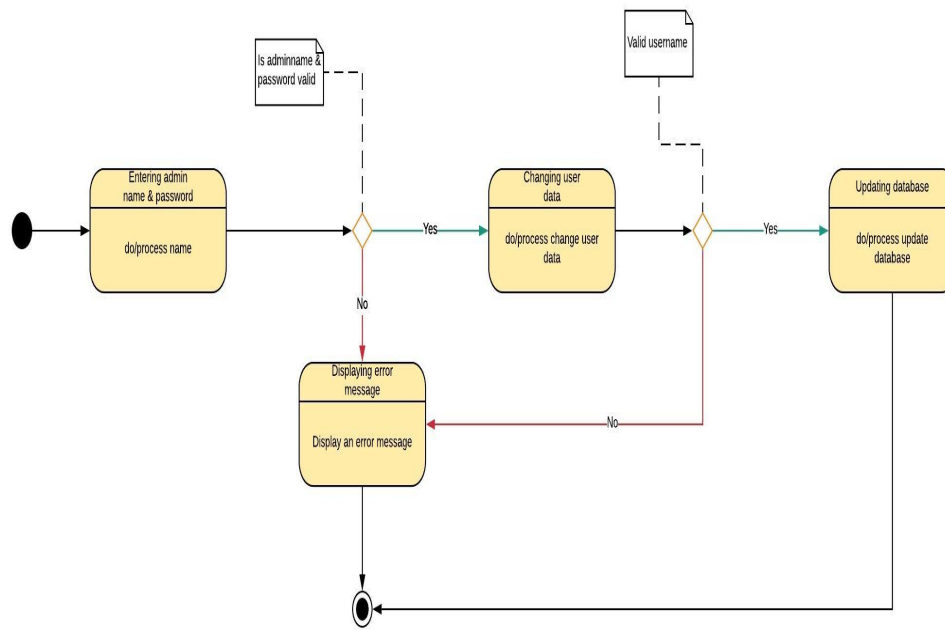
Figure 10: A state machine diagram describes the process of deleting a user account by the admin.

## 10.12 ADMN-USER-004

The following state machine diagram shows the process of changing a user account data by the admin and all the states it goes through during its lifetime.

It starts by the admin entering his or her username and password, the admin is in the first state "Entering admin name and password", and then the system checks if the student's credentials are valid or not. If not the admin will be in the "Displaying error message" where the system informs the admin of invalid credentials. If the credentials are valid the admin will be in the "Changing user data" state where admin can change a user account, and then will be in the state "updating database" where the system updates the database.

Figure 11: A state machine diagram describes the process of changing a user account data by the admin.

## 10.13 Non-functional Requirements

The following activity diagram shows the Non-functional Requirements specified in the system by using the UML profile for Modeling and Analysis of Real-Time Embedded Systems (MARTE)

It specifies "NFRQ-PRVC-001" which is a privacy-related requirement that says "The system shall conform the GDPR." And "NFRQ-SECU-001" which is a security-related requirement and that says "The system shall use strong security measures by applying the SSL certificate." And finally "NFRQ-PERF-001" which is a performance-related requirement that says "The home page shall be loaded in less than two seconds."
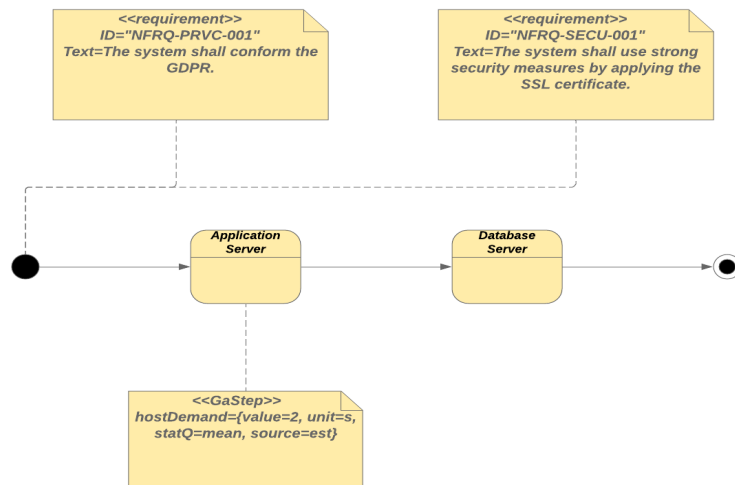
Figure 12: An activity diagram shows the Non-functional Requirements by using MARTE.

# 11 USE CASE

This section describes the interactions between the different users and the application.

## 11.1 Admin USE CASE

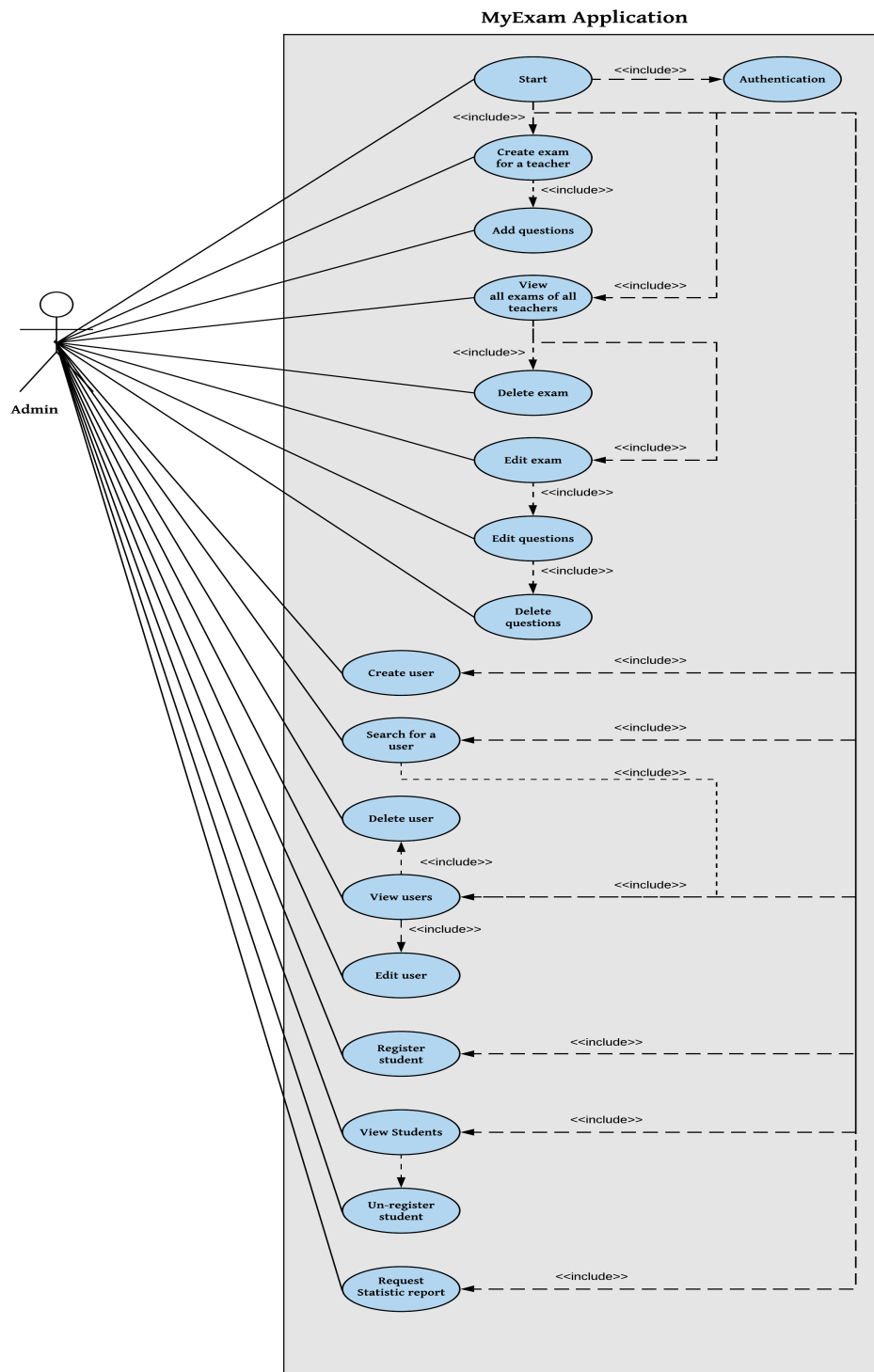The diagram shows the interaction between the admin and the application.



Figure 13: Admin USE CASE Diagram

## 11.2  Teacher USE CASE

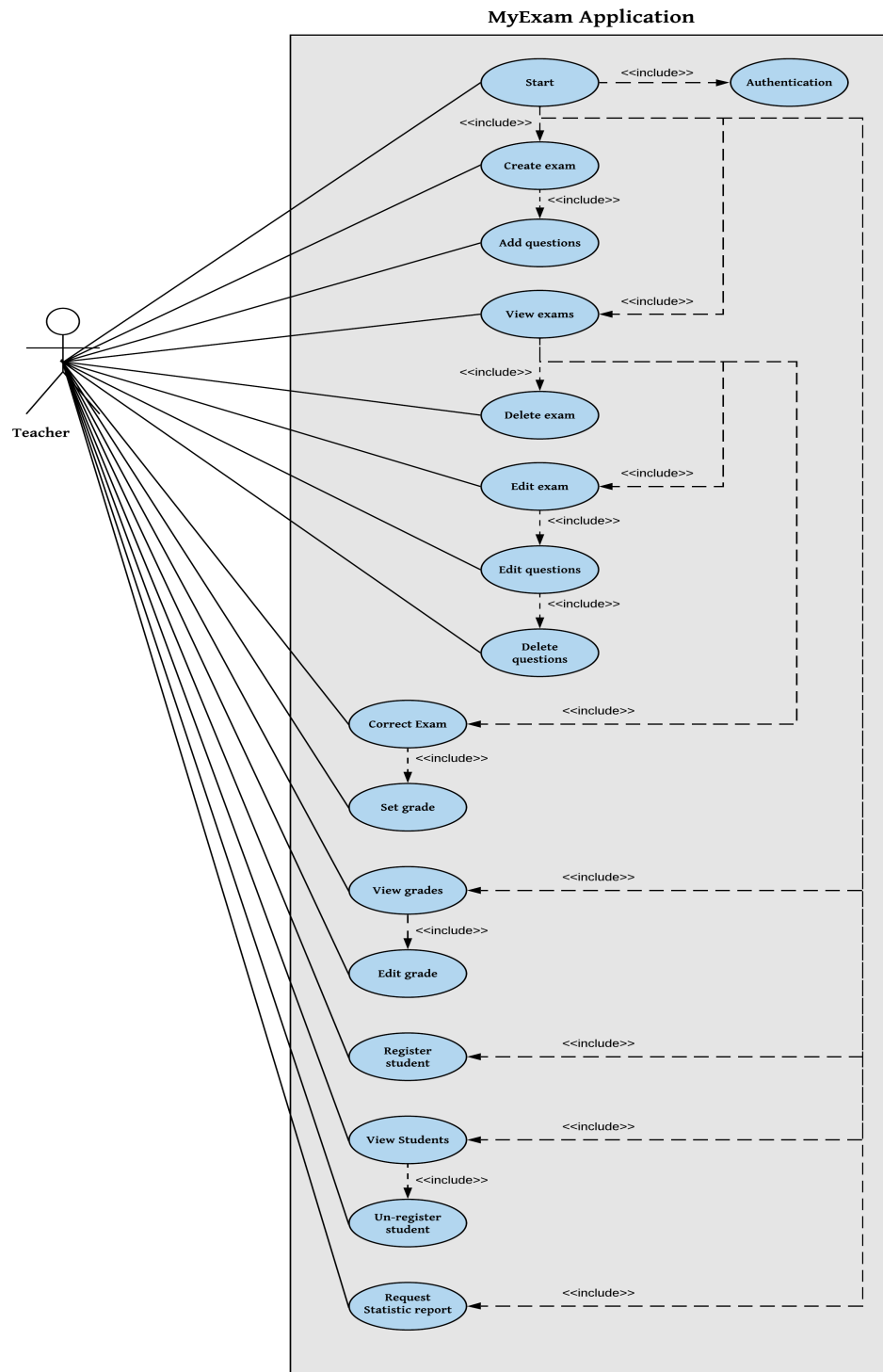The diagram shows the interaction between the teacher and the application.



Figure 14: Teacher USE CASE Diagram

## 11.3 Student USE CASE

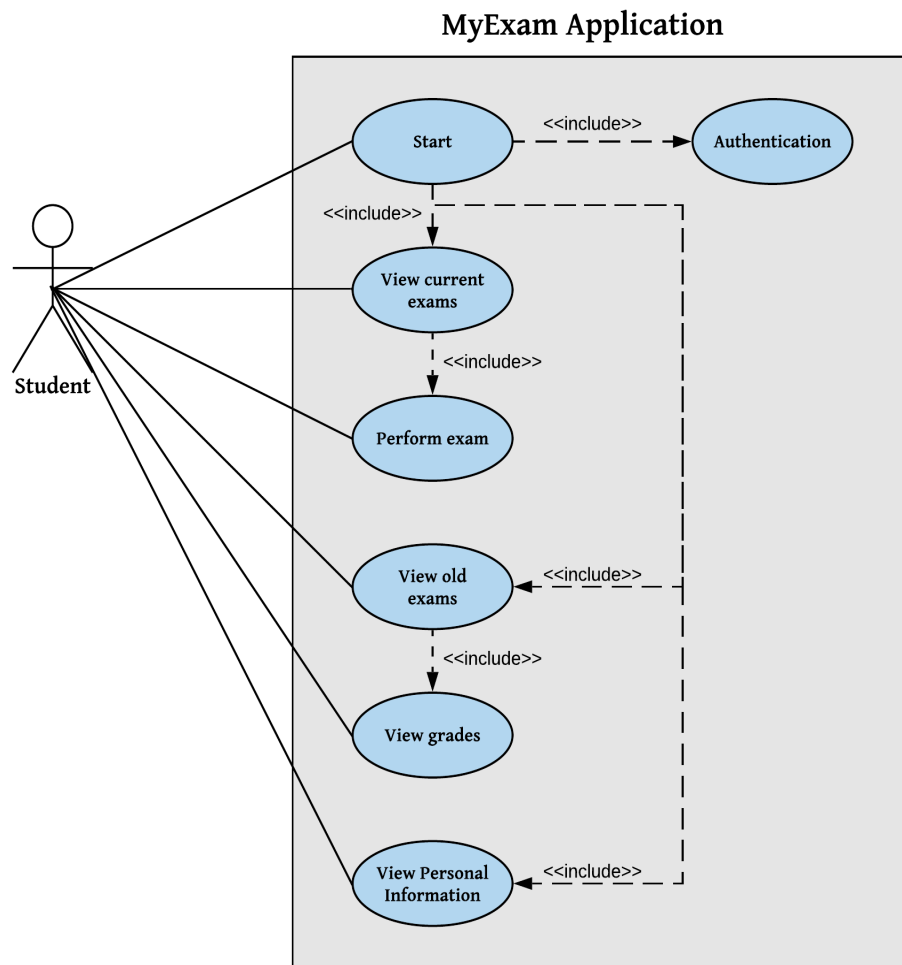The diagram shows the interaction between the student and the application.



Figure 15: Student USE CASE Diagram