Software Requirements Specification

for

Integrated LMS and SIS for My University

Version 4.0 approved

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Revision History

Name	Date	Reason For Changes	Version
Berkay Budak	13/06/2024	Sections 2.5, 4 , 5 , 1.5 , 6 , glossary have been updated. Sections 7 ,Appendix C , 6.5 , 3.2 have been implemented. Additionally some items have been removed, some items have been added on the general of the document and the overall documentation has been revised.	4

1. Introduction

1.1 Purpose

The purpose of this document is to provide a detailed description of the requirements for the Learning Management System(LMS) and Student Information System(SIS) those are educational software systems developed by Developers at Işık(DaI). This systems aims to capture both functional and non-functional requirements, ensuring that the final product meets the needs of its intended audience and is compatible with existing educational systems. This document is a guideline for the development team and a reference for stakeholders to understand what is this software and its capabilities.

1.2 Document Conventions

Typographical Conventions:

- Headings and Subheadings:Major sections are numbered as 18 and presented Bold, while sub-sections are numbered as 14 and presented Bold.
- Font:Times New Roman used in this document.
- Numbering: Each section as mainly numbered 1 to 5. Each sub-section continues from 1 to end after main sections number.

1.3 Intended Audience and Reading Suggestions

This document is written and aimed for various stakeholders those are involved in the development, deployment, and use of the new educational software tool. Each group of readers will find sections of the document that are most related to their roles and responsibilities. In below part, there is a description of different types of readers and suggested way to reading the document.

Intended Audience:

- Developers: Designs and implements the system based on requirements.
- Project Managers: Responsible from project planning, starting and ensuring that the project meets the conditions.
- Marketing Staff: Focusing on understand the product’s features, benefits and selling tactics that aims to marketting the software effectively.
- Users: The people that will use the program daily and in various instructional modes.
- Testers: They are responsible for check all specified requirements which must be meeted and reports the system test results.

Document Organization:

The SRS is organized into the following major sections:

1. Introduction
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1.4 Product Scope

These new educational software tools LMS(Learning Management System) and SIS(Student Information System) are designed and developed by DaI(Developers at Işık) to enhance the education for all education intuitions by supporting online, face-to-face and hybrid education systems. These tools aim to meet the emerging needs of education through flexible solutions that can be used integrated to existing systems or independently. Each tool are designed to work single or together with other systems and DaI systems.

Descriptions and Purposes:

1. **Learning Management System(LMS):** LMS module can accessible for all system users. Lecturers can upload course materials, assignments and quizzes or exams. Students can receive and download the course materials to their personal computers. Also LMS module enables the communication of lecturer and student.
2. **Student Information System(SIS):** SIS module manages the students transcript and records all student data and provides to easy access to administrative tasks.

Benefits:

1. **Flexibility:** Modules can be implemented to each educational institutes. It is designed to provide bottom to higher education institutions needs.
2. **Integration:** Modules can be integrated easily because of “Plug and Play” design. Plug and Play design decreases installation time and costs.
3. **Efficiency:** Modules blends the administration and education with technology and saves time in between.
4. **Communication:** Modules became a communication bridge between lecturers and students.

Objectives :

1. **Market Expansion:** DaI’s system extends for each education system from K12 to higher education.
2. **Satisfaction of Users:** Each module user must be satisfied about their needs.

Goals:

1. **Deployment:** Expect no time loss and lesser costs in deployment.
2. **Support:** Keeping the system is updated and provide full time support to enhance user satisfaction.

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2. Overall Description

2.1 Product Perspective

The product must be an combination of the LMS-SIS: Modular and manufactured with an add-on of the "plug and play" characteristic. It has the ODA for stepping into the development fast track of the already existing DaI Online Teaching Component.

It is the extension of the existing product line of Developers at Işık, based on the experience of the company in K–12 and high school instructional software. In fact, ODA, already embedded in the Developers at Işık's K–12 online teaching resources, is typical of what Online Data Analysis will enable in this product. The incorporation of ODA dramatically reduces time for development and marketing while the solution can be re-applied to changing needs much faster.

It has two major functional modules:

SIS: This module verifies information on the academic and administrative records of the student, information on enrolment, and statuses regarding the person.

LMS: This system helps to deliver the course content, grades and attendance, communication and work between lecturers and students. Subsystem Interconnections: Share and connect the SIS and LMS modules.

Enrolment Data :The data enrollment, once combinated into the SIS, will be kept online through an LMS to enableaccess by the students who would have enrolled for a certain course.

Grade Synchronization: In some courses,the instructors enter grades in the LMS so that the instructor can update the SIS.

2.2 Product Functions

The LMS and SIS integration product has to perform or enable users to perform the following major functions:

Registration Module:

First, a student should be able to register the course from the LMS, which is registered and updated on the SIS automatically.

Grading and Assessments:

Both a student and an instructor should be able to obtain the grades from either the LMS or SIS facilities.

On the other hand, the instructor should be able to input the grades on the LMS, which is automatically linked to the SIS.

Course Material:

Instructors should be able to upload course material to the LMS facility.

It should include reading materials, lectures and multimedia items among others.

Class Scheduling:

Class scheduling should be managed from the LMS but should notify the SIS for any changes concerning the timing and class location.

On the other hand, a notification system should be installed to alert the students and faculty about various statuses.

Examination Management:

A system of online examinations should be available through the LMS, where the results are retained in both LMS to SIS.

The LMS should contain an automatic recording of students attendance.

A documented copy should be uploaded on the SIS, showing the attendance pattern.

Student Feedback System:

Students should provide feedback from the courses and the facility at large.

The feedback is retrieved and kept in the SIS for analysis.

2.3 User Classes and Characteristics

User Classes and Characteristics

The types of user classes that may work with the product, in this case, with the educational system, are as follows:

Students:

Frequency of Use: Daily

Functions Used: Course registration, access to course-related materials, viewing grades, feedback to teachers, checking of attendance, participation in online exams.

Technical Expertise: Varies. The average is moderate.

Security Level: Average in terms of data security and user safety.

Educational Level: High school to postgraduate.

Experience: Very different. From zero information on how to use the system to a usual one, as most of the students have already been using LMS and SIS.

Instructors:

Frequency of Use: Daily to weekly.

Functions Used: Uploading material, entering and syncing grades, managing class schedules, giving online exams, students feedback.

Technical Expertise: Moderate to high.

Security Level: Must be high in terms of due access to student's academic history.
Educational Level: Higher education.
Experience: High level of experience as all the instructors are aware of how the LMS operates and all the academic procedures.

Administrators:
Frequency of Use: Daily.
Functions Used: Manage course registration.
Technical Expertise: High.
Security Level: The highest in terms of access as administrators have complete access.
Educational Level: Professional staff.
Experience: Experience in LMS and SIS and administrative systems.

IT Staff:
Frequency of Use: As needed, mostly used for system maintenance and fixes.
Functions Used: Systems configurations, user account managing, data synchronization, security and backups.
Technical Expertise: Very high.
Security Level: Have access from administrative to background level.
Educational Level: Professional IT specialists.
Experience: High experience done regardless of new software.

External Users:
Frequency of Use: Various
Functions Used: Integration with external education tools, digital libraries, financial systems integration.
Technical Expertise: High.
Security Level: Limited information due to the integration and partner agreements.
Educational Level: Same as IT.
Experience: Large experience for they have been working with APIs and systems known to them.

2.4 Operating Environment

Hardware:

Servers: It is possible to remotely access their Cloud Servers, which are also scalable, from major Cloud Service Providers be it Google Cloud Platform, Microsoft Azure, or Amazon Web Services (AWS).
Devices: Desktop and laptop computers with standard specifications. Mobile devices including tablets and smartphones, to ensure access and availability for students and faculty on the go.

Operating System

Server Side: Linux, Windows Server, macOS Server User Side: Windows, MacOS, Linux, iOS, Android Humans(Human control)

Browsers (Safari, Chrome, Opera, Firefox, etc. Databases (MySQL, PostgreSQL)

2.5 Design and Implementation Constraints

Design and Implementation Constraints
Hardware Limitations:

Minimum Specifications: The software has to efficiently work on systems that have at least 4GB RAM, 2GHz dual-core processor and 10GB available space.

Optimization: The software should work efficiently from the low hardware specifications to high so as to make it compatible with as many educational institutions as possible.

Integration with Other Applications:

Compatibility:
It should be compatible with the Student Information Systems (SIS) and Learning Management Systems (LMS) used by various educational institutions.

APIs:
It should offer standard APIs to ensure seamless integration with other applications and databases.

Technology and Tools:

a) Programming Languages

Client-side: JavaScript - React.js
Server-side: Node.js
Database:
Since it is flexible and scalable in nature, the data storage of this system will be done using the MongoDB.

Security Considerations:

Data Encryption:

The data between different components of this system has to be transmitted; any transmission of data should be encrypted by using the TLS to minimize the chance of data in transfer of sensitive information.

Access Control:
To ensure that access to some of the functionality and data within this system is only given to the user authorized for the same, RBAC(to safety)needs to be implemented.

Design Conventions and Programming Standards:

Coding Standards:

The codes have to be written by following the standard coding practices as well as naming conventions that are going to give the ease of maintenance and readability.

Documentation: The code shall be well commented and the comments embedded directly within the code. External documentation shall also be provided.

Regulatory Policies:
The software developed shall adhere to:
Data Privacy: It shall align itself to the local data privacy policies to safeguard the user from his personal information.

Accessibility: It shall comply with accessibility standards such as WCAG (accessible) so that the software is usable for people with impairments.

Communication Protocols

Standard Protocols:. Attach shall make use of standardized communication protocols for exchange of data , for example HTTP/HTTPS.
There is a need to integrate email services for email notifications of the updates.

2.6 User Documentation

User guides:

Administrator Manual: There is a very detailed administrator manual that caters to installation, configuration,and maintenance for systems administrators.

Instructor Manuals: The manuals are fully scripted for the course setup, content handling, and assessment functions.

Student's Manual: Gives students a step-by-step guide on going online and getting orientated with the program procedures, course content and the activities involved in the course.

Online Help:

Context-sensitive help: Help that allows a user to receive integrated support displayed by the software based on the user's context.

Web Browser :

Accessible Knowledge Base: A repository of searchable articles and FAQs that support the endusers with their questions, viewable from the company's website.

Interactive:

Video Tutorials: Short videos illustrating how to use the key features and main tasks viewable at the Işık University website and video platforms.

Interactive Tutorials: Step-by-step in-software guides that walk a user through software setup and common workflows.

2.7 Assumptions and Dependencies

Support for existing systems: Schools already have student information systems and learning management systems in place, so the new software should work with these. All APIs and data formats are expected to comply with standard protocols.
Keep data safe: Keeping the user's data as safe as is practically possible.
Simple styles: The software application will adopt straightforward styles where the users could comprehend the functions and apply it easily.
Dependencies

External software: It uses third-party databases and authentication systems.
Legal compliance: The software will be developed within the rules and ethics of how student data can be managed.
Reuse of existing systems: The software might be reusing some components from existing DaI projects.

3. External Interface Requirements

3.1 User Interfaces

Instructor Interfaces:

Grading and Assessment:
Layout: grid with student names and grade columns
Standard Buttons: Display Student List, Edit
Grades.
Functions: access to student list, enter and change grades, sync grades with the Student Information System
Error Messages: pop-up error messages at sync failure.

Examination Management
Layout: form with exam name, date, duration and questions.
Standard Buttons: Create Exam, Schedule Exam, Notify Exam Schedule, Grade Exam

.

Functions: create, schedule, grade, notify students, sync exam schedule and record exam results to a database for later display to students.
Error Messages: inline errors if fields not filled, pop-ups at failed syncs.

Course Material Distribution
Layout: file upload, choice of file type, description
Standard Buttons: Upload, Cancel.
Functions: upload course materials, store them in the database, notify students of new materials
Error Messages: pop-up notifications at failure, inline messages at unsupported type.

Student Interfaces

Registration Module
Layout: list of courses, filters, and search.
Standard Buttons: Register, Cancel, Display Confirmation.
Functions: pick and submit courses, view available classes, and register with SIS
Error Messages: inline validation errors, pop-ups for register and confirm .

Student Feedback System
Layout: questionnaire, course name, description. Open questions at the end.
Standard Buttons: Submit, Cancel.
Functions: fill and submit, store in SIS, notify SIS feedback.
Error Messages: inline errors for empty fields, pop-ups for submission errors.

General UI Standards

GUI Standards
Color scheme and typography, responsive, accessibility to WCAG
.**Screen Layout**
Constraints: top or side navigation, spacing and padding, icons and tooltips
Standard Buttons and Functions
Context help for every screen, button placement. shortcut buttons like Save, Cancel and Submit, confirm dialogs.
Error Message Display
Form, critical. inline, pop-ups.

3.2 Hardware Interfaces

Supported Device Types:

Servers: The software can run on both cloud servers (like Google Cloud, Microsoft Azure, AWS) and on-premise servers.
User Devices: Various user devices are supported, including desktop and laptop computers, tablets, and smartphones.

Data and Control Interactions:

Data Transmission: The software uses internet connections to transmit data between user devices and servers.
Control Signals: User commands are sent over the internet to the server, where they are processed.

Communication Protocols:

HTTP/HTTPS: Secure HTTP and HTTPS protocols are used for all data transmissions.
TLS Encryption: The TLS encryption protocol is used to ensure data security.

3.3 Software Interfaces

Software Interfaces This consists of the software that will be on the interface of the SIS and LMS software.
The integration will have the following software interfaces:
Databases MySQL/PostgreSQL: This is where the student information, course content, grades, and more will be stored.
Data elements: User profiles, course registrations, grades, attendance records.
Purpose: This is to contain data requirements in a way that is easy to handle and retrieve for all parts of the system.
Operating Systems
Windows, Linux, macOS: This should include major operating systems to enable abroader user audience.
Purpose: The aim is to deliver a safe and reliable base directly on which to run theapplication.
APIs and Web Services
Advanced integrations with other systems, APIs as part of the product, and other systems.
Data elements: API calls may include course-related data.
Objective: To make the LMS/SIS system an interface where all data transactions are easy and accessible to other systems.
Communication Tools
SMTP(Mail transferinterface) for emails: This is to enable the system to send messages to the users.
Data items: Email notifications on course changes, grading, and scheduling changes.
Objectives: To keep the users updated on the relevant systems or communications.
Libraries and Frameworks
Frontend libraries: Use of React, Angular framework for their client user interfaces.
Backend frameworks: Will use Django, Spring Boot framework for their server-side application.
Objectives: To establish a front end that is faster and reliable and a backend at a platform that supports the logic.

3.4 Communications Interfaces

Product of LMS and SIS integration involves the use of multiple communication interfaces for delivering application service:
Human Interface to Web Browser
The protocols used by Websockets
Thus, the intention is to make a web interface to the functionalities of both LMS and SIS, taking into account security and response.
Email notifications

Protocol in use: SMTP
MIME standards to include applicability in user email Format
Purpose: Automated notifications of course registrations, grade changes, and schedule changes should be sent to the administrator.

Discussion network

In this project these TCP/IP, FTP protocols are used for file transfers, and WebSocket for real-time communication.
Purpose: This specification describes stateful message exchange between an LMS client, enabling the SIS and LMS, as well as other integrated systems, to use that information in the exchange of data with one another.
Security and Encryption Protocol in use: SSL/T

Purpose: This will encrypt your data in transit, ensuring secure communication and data protection. Data transfer rates and synchronization High-speed data transfer rate for real-time data updating synchronization between LMS and SIS Mechanisms: regular synchronization jobs and real-time data synchronization for consistency.

4. System Features //by feature

4.1 System Feature 1

Feature 1: Registration Module
Description: The Registration Module is a pivotal feature within the Learning Management System (LMS), allowing students to enroll in courses effortlessly. When a student registers for a course, their details in the Student Information System (SIS) are immediately updated, ensuring seamless data integration. This feature is of maximum importance, efficient the enrollment process and maintaining accurate records across the platform.
Specification (4) Stimulus/Response Sequences:
Stimulus: The student logs in and navigates to the course registration section.
Response: The screen displays all available courses.
Trigger: The student selects a course and completes the registration
Answer: The SIS enrolls the student at the time of their choice.

Functional Requirements FREQ-1: The system allows students to view and enroll in available courses. The system enables SIS to be immediately updated with the enrollment status.
Enter Email ID and Name: Register for a class in e-campus Primary Actor: User Participating Actors: e-campus system
Description: User logs on the e-campus system. Then, click on the course named "SOFT3511". Then, to enroll in this course, the request for quota is sent. Finally, the system logs out.
Trigger: The request is made through the register course page
Prerequisite: The User has logged in. A basic Flow Log in the Işık e-campus system The result:
Postconditions: A message of "Goodbye" will be displayed. Under the Register Tab, click on "Register Courses" Go to the "Register Courses" page and search for the Course code "SOFT3511". Add the course to my program. On the CRS registration page, click Send Request. Log out from e-campus.
Alternate Flows: 2. If system is not allowing to log in, then check/ reset your password. Check if there still isn't running your system and then you can't get user login and retype User. Other than this, if the course does not have an admissions-related quota then you will only have to wait for your manager or instructor to allocate quota.
Sometimes, if too many people try to log in at once through the e-campus, the system may temporarily crash at the system level for 30 minutes.
Miscellaneous: Each communication and response should be logged into the system for record-keeping.
System Feature 2: Grading and Evaluation
Description & Priority Faculty enters grades of students and publishes the grades online. This is where your LMS is reintegrated with the SIS, the inputs received would be updated in the latter.
Priority: High
Stimulus/Response Flow: Stimulus: Login of teacher selects the grade component
Reply: The list of the students and the assignment will be displayed.
Stimulus: Faculty Grades into the system and submit
Response: The system is then updated in the steps previously outlined in SIS-grades with confirmation of update

Functional Requirements:
FREQ-1: The system will receive grades based on faculty input
FREQ-2: Automatically update the grades from SIS grades
Distribution of Course Material (A Key System Feature)
Description and Priority: This is a feature to upload course material through an LMS, it can be downloaded anytime by enrolled students.
Priority: High

Stimulus Faculty logs in and creates a course.
Answer: It keeps the materials and provides them to the student Stimulus Student logs in > course materials The system will show the materials to the student.
Functional Requirements: FREQ-1: The system shall be able to upload many types of course material FREQ-2: The system must prevent non-classroom-enrolled students from accessing the materials
System Feature 4. Scheduling of Classes
Case Name and Priority: Class Scheduling class scheduling to update class scheduling in real-time to the Student System (changing with the system)
Priority: Medium
Stimulus/Response Sequences Stimulus: Administrator logs in and updates the class schedule
Reply: The timetable is updated and reports to the users.
Stimulus: User Logs in and Requests New Calendar The system then presents the user with the new timetable.
FREQ-1: The system shall save the class schedules.
FREQ-2 - Class alterations shall be alerted to users.
System Feature 5: Examination Management
Description and Priority: This feature enables teachers to create and manage online exams through the integrated Learning Management System (LMS). Exam Results are magically synced back into the Student Information System (SIS) .
Priority: High
Stimulus/Response Sequences Stimulus: A teacher logs into LMS and makes an exam.
Answer: The exam is saved by the system and that makes the exam accessible to students. When a student logs in and attempts the exam, this ensured the stimulus.
Answer: The result will be logged and the SIS will be updated.
FREQ-1 Functional Requirements: Supporting Online exams: The system shall have a capability to generate and monitor online exams.
FREQ-2: The system shall persist and synchronize exam results with the SIS.
System Feature 7: Student Attendance Monitoring
Description and Priority Ability for the systems to fully address the capturing of attendance view the LMS and push the information to the SIS.
Priority: Medium
Stimulus/Response Sequences Stimulation A student logs in to attend a lesson. Answer: Attendance is marked / Update SIS Context: A teacher reviews the role. System: The system displays the attendance records.
Functional Requirements: FREQ-1: Track attendance and Track Minister attendance. The system must generate attendance reports (FREQ-2).
System Feature 8: Student Feedback System
System Feature 8: Student Feedback System: This feature is used to provide feedback to courses and the learning process in general to the students and the feedback is stored in the SIS for further analysis.
Priority: Medium
A student gives feedback to course Reply: The feedback is stored in the system Intervention: Organizers collect feedback data and administrator reviews. Answer: The system displays the feedback for a deeper analysis.
Functional Requirements FREQ-1: Provide Feedback by Students FREQ-2: Save feedback data i.e. retrieve for analysis

4.2 System Features //by use case

Use Case: Registration Module Description: This module optimizes the student enrollment process within the Learning Management System (LMS), ensuring that every registration action is immediately synchronized with the Student Information System (SIS) to keep both systems updated accurately.
Functional Requirements:
FREQ-1: Enable students to search for and register in courses.
FREQ-2: Ensure real-time updates of registration details in the SIS.
Scenario: Register for a course on e-campus
Primary Actor: Student Participating Actors: e-campus system
Description: Students log into the e-campus system, select the course "SOFT3511", send a quota request to their manager at Işık University, and log out.
Trigger: Submitting a request from the course registration page.
Preconditions: Successful login to the system.
Postconditions: The system displays a "Goodbye" message upon logout.
Normal Flow:
Log into the Işık e-campus system.
Click the "Register Courses" link.
On the "Register Courses" page, locate the course "SOFT3511".
Add the course to the program.
Click "Send Request" on the registration page.
Log out of the e-campus.
Alternative Flows:
If login fails, verify or reset the password.
Ensure the userID is correct if login fails.
If the course is full, wait for manager/instructor approval.
Exceptions:
If the e-campus system is overloaded, it may shut down for up to 30 minutes.
Other Information:
All communications and requests should be logged for future reference.

Use Case: Grading and Assessments Description: Teachers enter students' grades into the LMS, which then synchronizes with the SIS to ensure consistent and accurate academic records.
Functional Requirements:
FREQ-1: Teachers must be able to input grades.
FREQ-2: Grades should be automatically updated in the SIS.

Use Case: Course Material Distribution Description: This module centralizes the distribution of course materials, making them easily accessible to students through the LMS.
Functional Requirements:
FREQ-1: Support uploading various types of course materials.
FREQ-2: Restrict access to enrolled students only.

Use Case: Class Scheduling Description: Manages class schedules and updates them in real-time in the SIS to minimize conflicts and ensure efficient use of resources.
Functional Requirements:
FREQ-1: Provide class schedule management.
FREQ-2: Issue notifications for schedule changes.

Use Case: Examination Management Description: Handles online exams through the LMS, with results synchronized to the SIS for comprehensive academic records.
Functional Requirements:
FREQ-1: Support the creation and management of online exams.
FREQ-2: Ensure synchronization of exam results with the SIS.

Use Case: Student Attendance Tracking Description: Monitors and records student attendance automatically in the LMS,

storing the data in the SIS for further analysis.
Functional Requirements:
FREQ-1: Provide attendance tracking capabilities.
FREQ-2: Generate comprehensive attendance reports.

Use Case: Student Feedback System Description: Allows students to submit feedback on courses, which is then stored in the SIS for review and analysis.
Functional Requirements:
FREQ-1: Enable students to provide feedback.
FREQ-2: Store feedback data for analysis.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

Response Time: We provide that the information refreshes from LMS to SIS within a span of almost 2 seconds, mostly in the registration time of courses and when the grades are entered.

Load Capacity: We design our system such that it could easily bear 10,000 accesses simultaneously during peak periods of registration and examination.

5.2 Safety Requirements

Data Protection: We take the most amalgamative protective measures to protect against unauthorized alteration, access to, or destruction of the sensitive pupil information and academic information including data backup and storage practice.

Disaster Recovery: We develop and maintain a complete disaster recoverability plan meant to guarantee recoverability to lost information and services in the case of hardware failure, data corruption, catastrophes, among others. Such mechanisms' effectiveness is tested constantly.

Error Handling and Recovery: The mechanisms for error handling and recovery are robust to ensure the system does not fail during, and after faults. This includes automatic failover commercially available that put the server into safe mode. The software keeps a step log to assist in problem troubleshooting.

User Safety The UI and flows are designed in such a way that it is not possible through the user interface that any action which causes data loss or corruption is not possible. But still alerts and confirmation validations are provided for the operation of critical actions such as data deletion and system update. System checks always validate the working conditions and assure safety on this by following up on the potential issues before accident occurrence in Real-time. One such feature is the intrusion detection system so that automatic alerts are raised in case abnormal activity is detected.

5.3 Security Requirements

Data Encryption: Any data imported or exported between LMS and SIS is to be done through standard industry encryption protocols like TLS.

Access Control: Strong access control mechanism must be in place, whereby only concerned personnel shall be allowed, to access the concerned functionality and data.

Audit Trails: There is a complete audit trail of all activities and changes by the users and also by the systems; this allows security auditing, as well as troubleshooting.

5.4 Other Quality Requirements

Availability:
Uptime: The systems are designed to be available with an uptime of 99.9% or greater except in cases of periodic maintenance windows, so that the systems are available and reliable.

Redundancy: The various components of the critical LMS and SIS implement redundancy to avoid single points of failure as a result of both hardware as well as software failures.

Scalability:
Horizontal Scaling: The systems are horizontally scalable. They can thus cope with spikes in the loads put on them by users, especially during peak periods in the academic calendar.

Database Scalability: The Database is scaled to support sharding or partitioning; this is meant to help deal with vast volumes of data both efficiently and effectively as its volume grows.

Reliability : The integrity of data is guaranteed as proper mechanisms are in place which ensure that the transfer of data between LMS and SIS doesn't corrupt or lose data.

Usability:
Consistent User Interfaces: Similar in design and functionality in LMS and SIS enhance their usability by reducing the learning curve.

Accessibility: The interfaces shall be designed in accordance with general international standards on Accessibility, such as Web Content Accessibility Guidelines which enable persons with Disability to make proper use of the system .

Maintainability:
Modularity: The system shall be designed modulary for update/maintenance with minimal down time.

5.5 Business Rules

Course Registration Regulation:

Registration Time and Method: Courses shall be registered on the registration dates as shown in the academic calendar and are held one week before classes start. The course must be registered and approved by the advisor.

Add/Drop Period: After the first day of classes, students will be given a period to Add/Drop a course or courses to their registered course list according to the relevant dates. The student shall be considered for enrollment in new courses or different sections in the course of add/drop procedures.

Course Load Restrictions: The normal course load at Işık University is 30 ECTS credits. Students are expected to follow the course load restrictions, as decided and declared with reference to the overall grade point average.

Grade Conversion Regulation:

Conversion of Grades: Letter grades are given in accordance with the conversion table approved at Işık University. The system of conversion is the ground for the calculation of the overall grade point average of students.

Exam Implementation Regulation:

Scheduling and administration The exams shall be done on fixed dates - according to the approved academic calendar, at a location notified by the instructor responsible. An identity card and relevant material shall be compulsory during the examination process .

Examination results : Examinations grades shall be officially communicated within two weeks of the examination date and notified to the students.

6. Other Requirements

6.1 Database

Storage: Scalable database to handle lots of data: student records, course materials, grades, attendance records.

Integrity: ACID (Atomicity, Consistency, Isolation, Durability) in the database management system to ensure data integrity and consistency across LMS and SIS.

Backup and Recovery: Automated backups scheduled regularly to prevent data loss and recovery procedures in place to restore data in case of system failure.

6.2 Internationalization

Multi-Language: Support multiple languages for users from different regions. This includes user interface text, error messages, help documentation.

Date and Time: Support different date and time formats based on user preferences or regional settings.

Currency: Support various currency formats for financial transactions if the system is used in multiple countries.

6.3 Legal Requirements

Data Privacy: Ensure compliance with local and international data privacy laws to protect student information.

Accessibility: Follow accessibility standards to make the system usable for individuals with disabilities.

Intellectual Property: Ensure all course materials and content uploaded to the system comply with intellectual property laws and appropriate permissions and licenses are obtained.

6.4 Reuse

Modularity: Design the system in a modular way to allow reuse of components across different modules or future projects.

Code Reusability: Implement coding practices that promote reusability (e.g. reusable libraries, frameworks).

Documentation Reuse: Maintain comprehensive documentation to allow reuse of design documents, code, and other project materials in future projects.

6.5 Performance

Response Time: 2 seconds max for critical operations like course registration and grade submission.

Concurrent Users: 1000+ concurrent users without performance degradation.

Load Testing: Regular load testing to ensure the system can handle peak usage periods.

6.6 Security

Data Encryption: Encrypt data transmitted between clients and servers using TLS.

Role-Based Access Control (RBAC): Implement RBAC to limit users to only what they need to see and do.

Audit Trails: Audit trails for all critical operations to monitor and log changes made to the system.

6.7 Backup and Recovery

Automated Backups: Automated backups scheduled regularly to prevent data loss.

Disaster Recovery Plan: Disaster recovery plan to restore the system within 24 hours in case of major failure.

6.8 Integration

External Systems: Integrate with external system like third-party educational tools.

APIs: Well-documented APIs to integrate with other systems and services.

6.9 Documentation

User Documentation: User manuals, help guides, FAQs to help users use the system.

Technical Documentation: Technical documentation for developers and IT staff to maintain, troubleshoot and extend the system.

6.10 QA

Test Plans: Test plans (unit tests, integration tests).

Monitoring: Monitoring tools to measure and improve performance.

Appendix A: Glossary

ACID (Atomicity, Consistency, Isolation, Durability)

Atomicity: Ensures that each transaction is treated as a single unit, such that it either succeeds totally or completely fails.
Consistency: Provides a guarantee that a transaction can bring the database from one valid state to another, maintaining database rules.
Isolation: Ensures that concurrent execution of transactions would leave the database in the same state that would be obtained if the transactions all were carried out sequentially.
Durability: This ensures that once a transaction has been committed, then it remains so even in the advent of a system failure or crash.

API:
Application Programming Interface; these are rules and definitions that allow software programs to communicate amongst themselves.

Audit Trail:

A chronological set of records that trace system activities in monitoring and logging changes made in the system.

Browser:
Software application used to access and view websites - Chrome, Firefox, Safari, etc.

Client-side:
Plan that details the processes to recover and protect a business in case of a disaster.

Encryption Key:
A Random series of binary or alphanumeric characters that are used to encrypt and decrypt data.

Extranet:
Network that shares data between member companies and trading partners.

Firewall:
Security software in a computer network that policies access to a network according to predetermined rules

Human Resources Data:
Employee's personal and professional information that is maintained in the database.

Human Resources Master Data:
Information like employee demographics and benefits that include personal, wife, children, and other demographics are called

Kilobits Per Second:
Data Transfer rate measured in which is

HTTP Hypertext Transfer Protocol:
Is a protocol used for transmitting a structured text document across the internet—for example, HTML.

HTTPS Hypertext Transfer Protocol Secure:
It is an HTTP extension that is used in a secure session of a computer network.

Integration:
It refers to connecting different Computer systems and software applications physically or functionally to work concurrently as one unit.

LMS Learning Management System:
Software application for administration, documentation, tracking, reporting, automation, and delivery of educational courses, training programs, or learning and development programs.

MongoDB:
A source-available cross-platform document-oriented database program.

MySQL:
An open-source relational database management system based on SQL- Structured Query Language.

Operating Environment:
The environment where a system is to operate, which includes hardware, software as well as network configurations.

Plug and Play:
A system design that supports the addition of new components or features to a system without requiring a manual change.

RBAC - Role-Based Access Control:

A method to restrict access to computer or network resources based on a user's role in an organization.

SIS - Student Information System:
An M.I.S system that is made easily accessible to educational institutes for organizing students' data.

SMTP - Simple Mail Transfer Protocol
An internet standard for sending electronic mail between hosts using IP. TLS - Transport Layer Security.

Usability:
Ease with which people born this application and website or other man-made object can use.

Uptime:
Elapsed time of system operation and accessibility.

WCAG Web Content Accessibility Guidelines:
Set guidelines for making web content more accessible to people especially with the disability.

WebSocket
A protocol providing full-duplex communication channels over a single TCP connection.

Definition of availability:
The degree to which a system is in an operational and functional state when required for use.

Backup and Recovery:
Backup and recovery are the procedures that involve copying and saving the data so that it is not lost and using the measures for recovery and system restoration in the case of failure.

Business Rule:
concrete specifications, situations and policies that must be enforced in practice concerning an organization's business processes

Cloud Servers:
Servers hosted on the Internet rather than local servers or personal computers that store, manage, and process data .

Coding Practices:
Standardised methods and guidelines whilst writing clean, efficient, readable and easy to maintain code by developers.

Compliance:
Act of compliance to all the relevant laws, regulations, guidelines and specifications concerning the business.

Concurrent Sessions:
More than one session that is active at the same time on the system .

Configuration:
Properly arranged and configured set of components, options and settings of a system so that it functions correctly .

Data Backup:
Making a copy of data in case the original data is lost; the copy is used to restore the lost data.

Database Scalability:
Capacity of a database to manage increased load without recompense during exposed periods
Error Handling:
Deals with the process of responding to and correcting errors in an application

External Interface:
The point where a system interfaces with external systems, users, or devices

Firewall:
A network security system that has the ability to regulate and check the flow of the incoming and outgoing network traffic on the basis of a set of given security rules.

Integration Testing:
Testing is done to ensure that different components or systems work together in a desired manner.

Maintenance Window:
A scheduled period of time during which maintenance activities on a system are performed, and it often includes a downtime or reduced accessibility.

Middleware:
Software, acting as an intermediary in the communication among two systems and/or databases and associated applications in a networked environment.

Modularity:
A module is a separate part of the design that performs a specific function, and this is done to make it easier to maintain sections of the program as well as to update it.

Non-functional requirements
They determine how a system works rather than what a system does.

Performance Testing
The process whereby a system's efficacy shows its responsiveness as well as stability under a particular workload.

Redundancy:
This refers to the provision or installation of extra components or systems that will be able to take over should the original one fail.

Regulatory Policies:
Policies and procedures set forth by the government that a system must obey.

Reliability:
The probability that a system will perform its desired functions over a long-enough timespan without failure.

Response Time:
The amount of time a system spends responding to a specific input or request.

Role-Based Access Control (RBAC):
A method for access control to resources that either permits or denies the user activity for a user based on the role assigned to them in the controls of an organization.

Scalability:
The capacity of a system to handle increasingly higher amounts of workload, or its ability to be increased in size or enhanced to meet a larger level of usage.

Security Needs:
The needs related to a system's immunity to attacks aimed at unauthorized access to information or other forms of breach in security.

Server-side:
A portion of the operations directly run on the server that manage the requests in the client-server model of a computer network.

SQL Structured Query Language:

A standard computer language used to control and manage relational databases.

System Configuration:
The setting up and putting together hardware, application, and network settings of a system.

System Requirements Specification SRS:
A specification document of functions, features, and constraints of a software system.

Test Plan:
A well detailed document that designs strategy, resources, schedule, and scope of testing activities.

UAT User Acceptance Testing:
The process of validating that the solution works for the user and meets all the specified requirements.

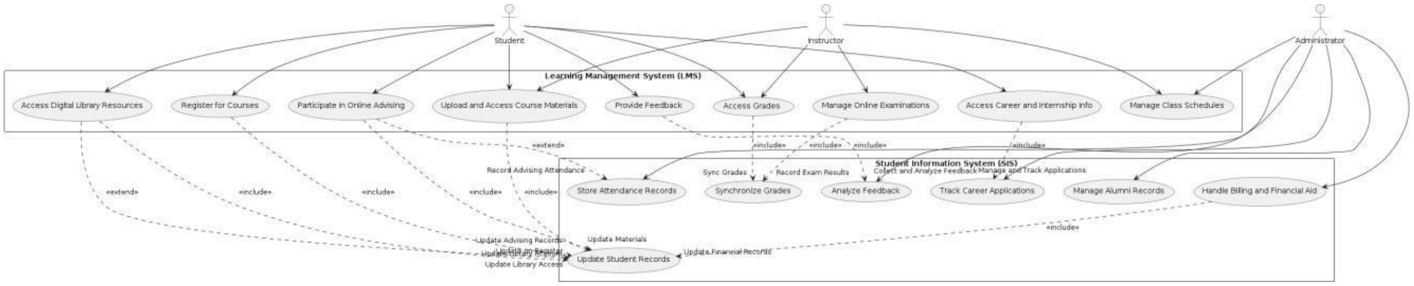
User Interface UI:
The process in which a user provides input to a computer system, software or application.

Validation Rules:
The criteria that curate assurance towards the integrity and accuracy of data by scrutinizing data inputs with the prescribed set of standards.

Web Services:
Services offered through computer software that exchange information through the Internet with the help of standardized protocols like HTTP and HTTPS.

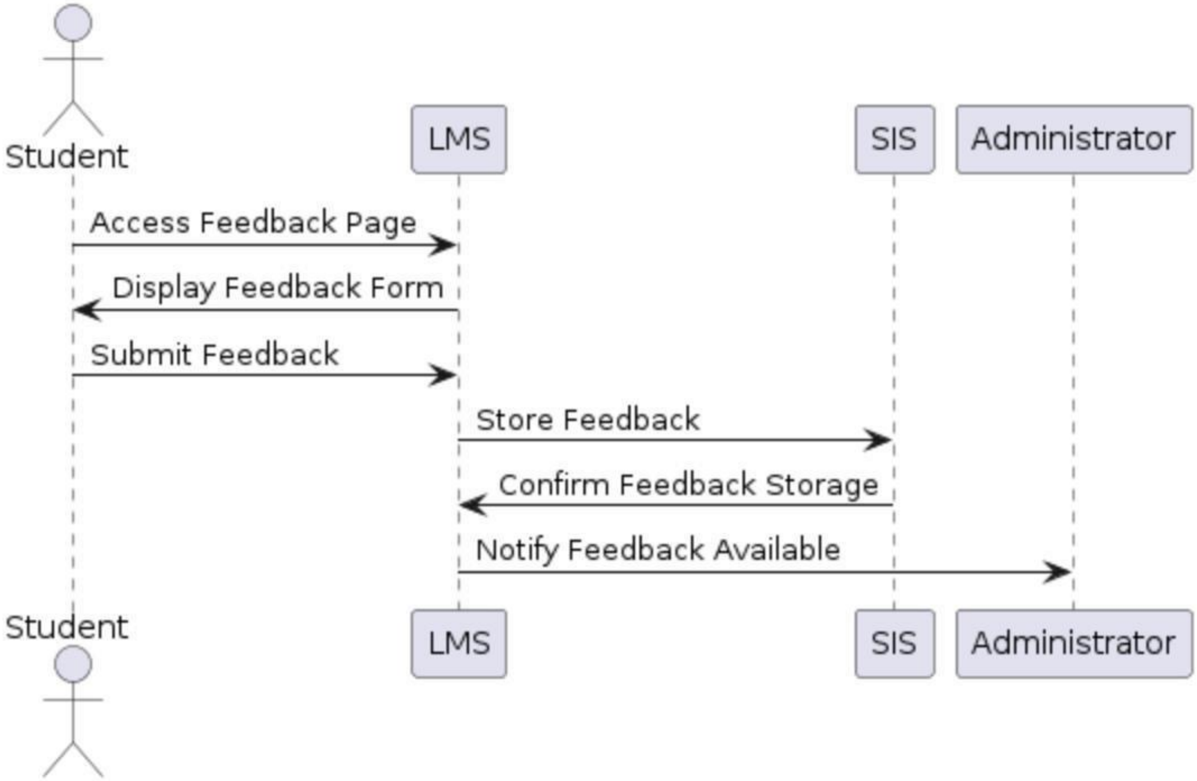
Appendix B: Analysis Models

Fully dressed use case diagram:

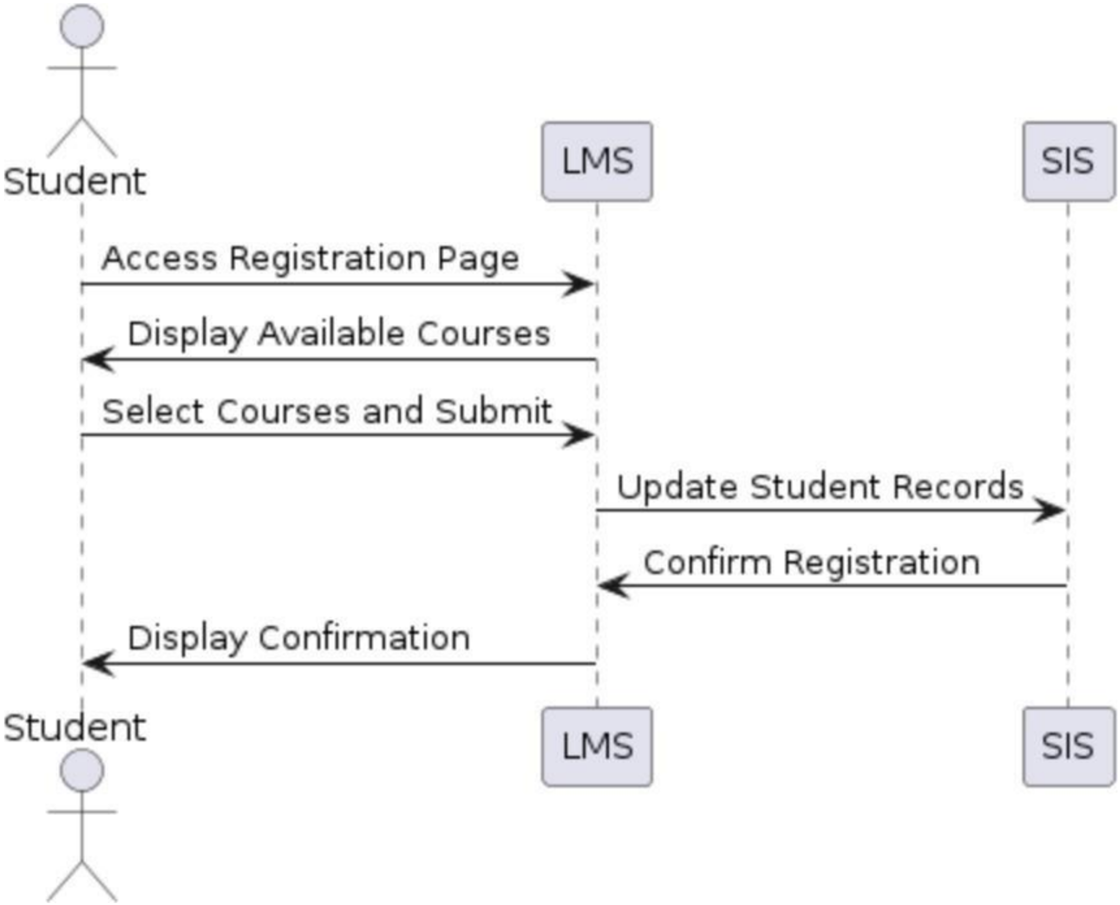


Dialog maps for high priority use cases:

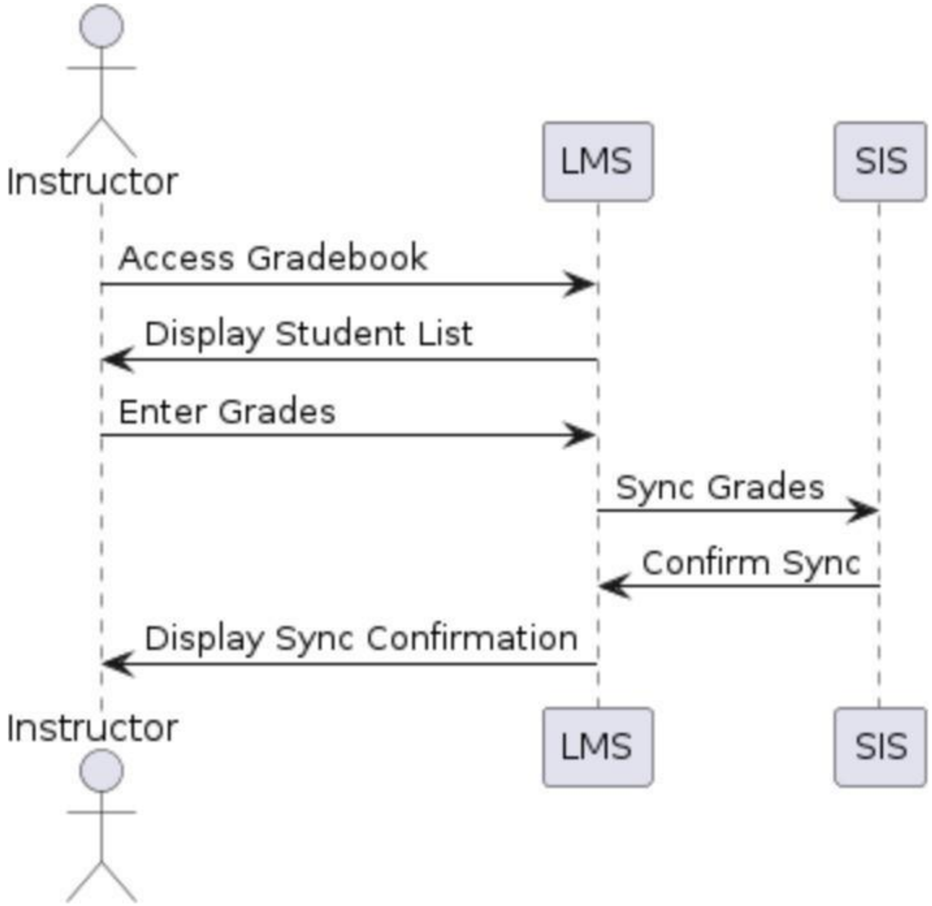
Student Feedback System:



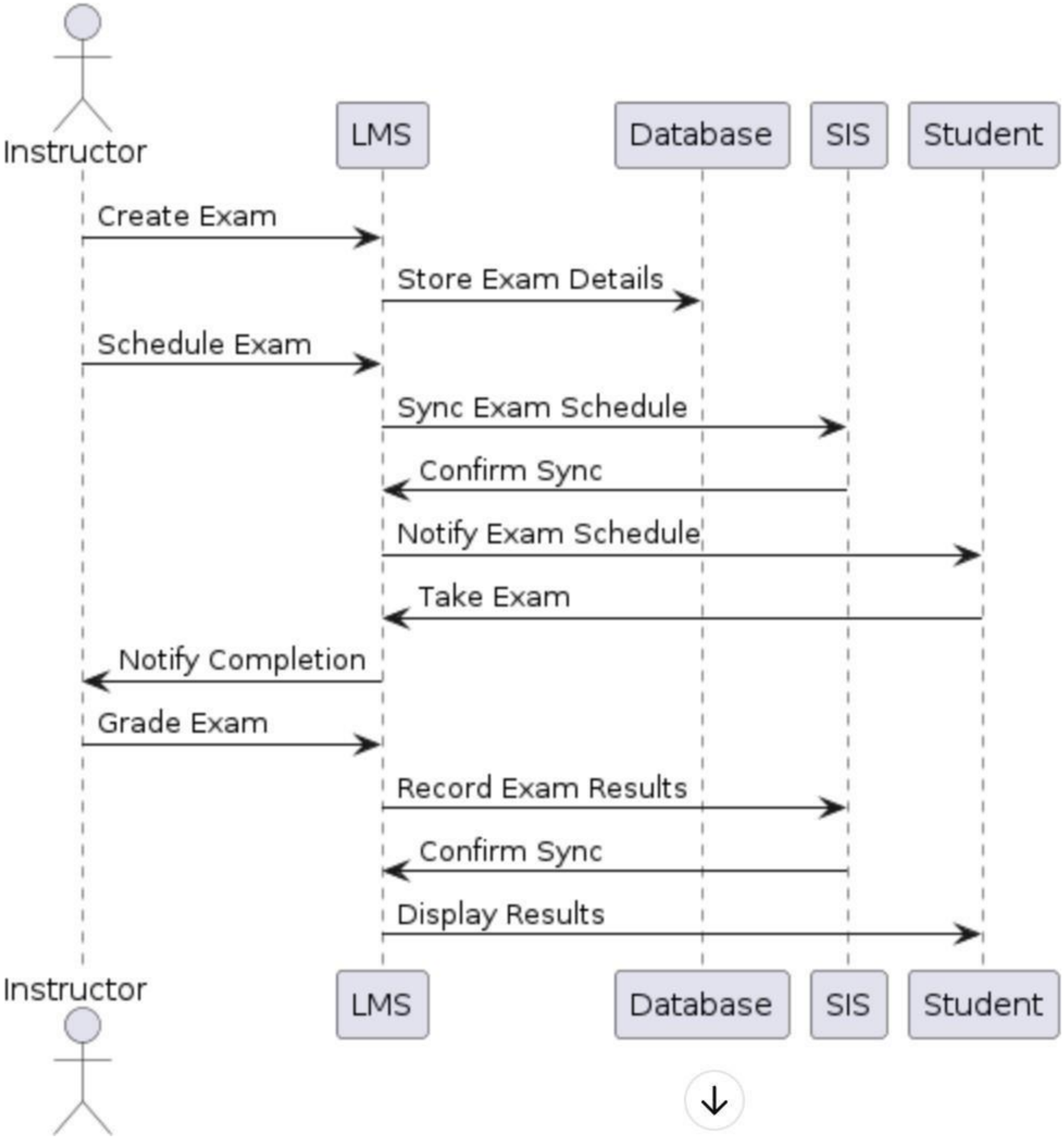
Registration Module:



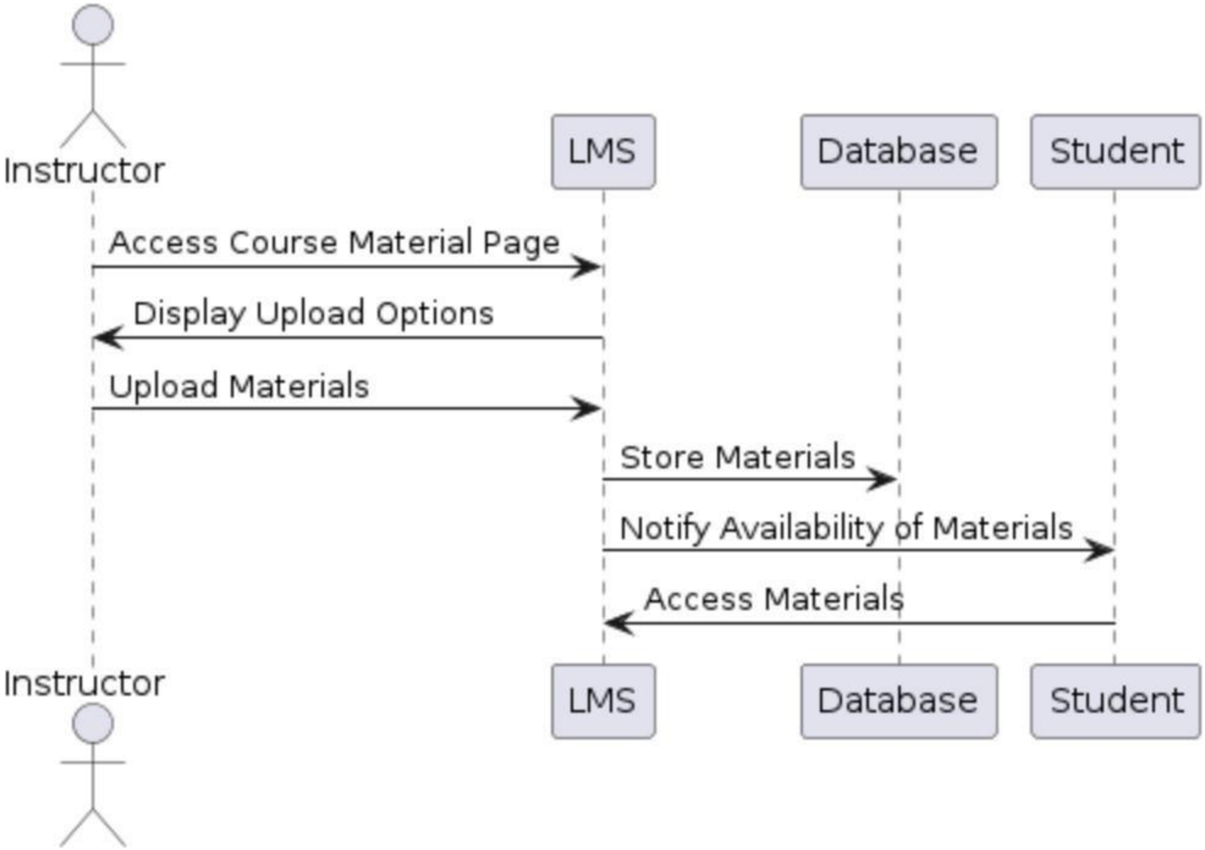
Grading and Assessments:



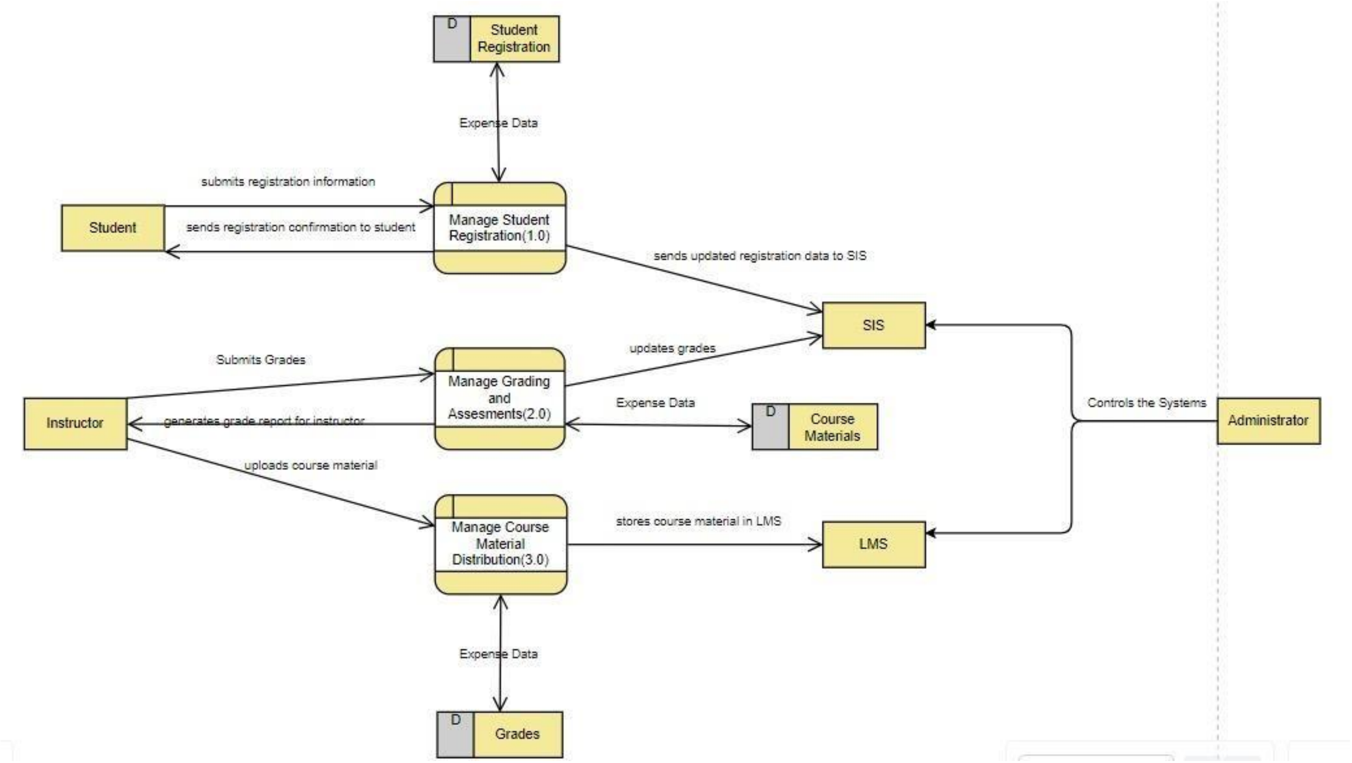
Examination Management:



Course Material Distribution:

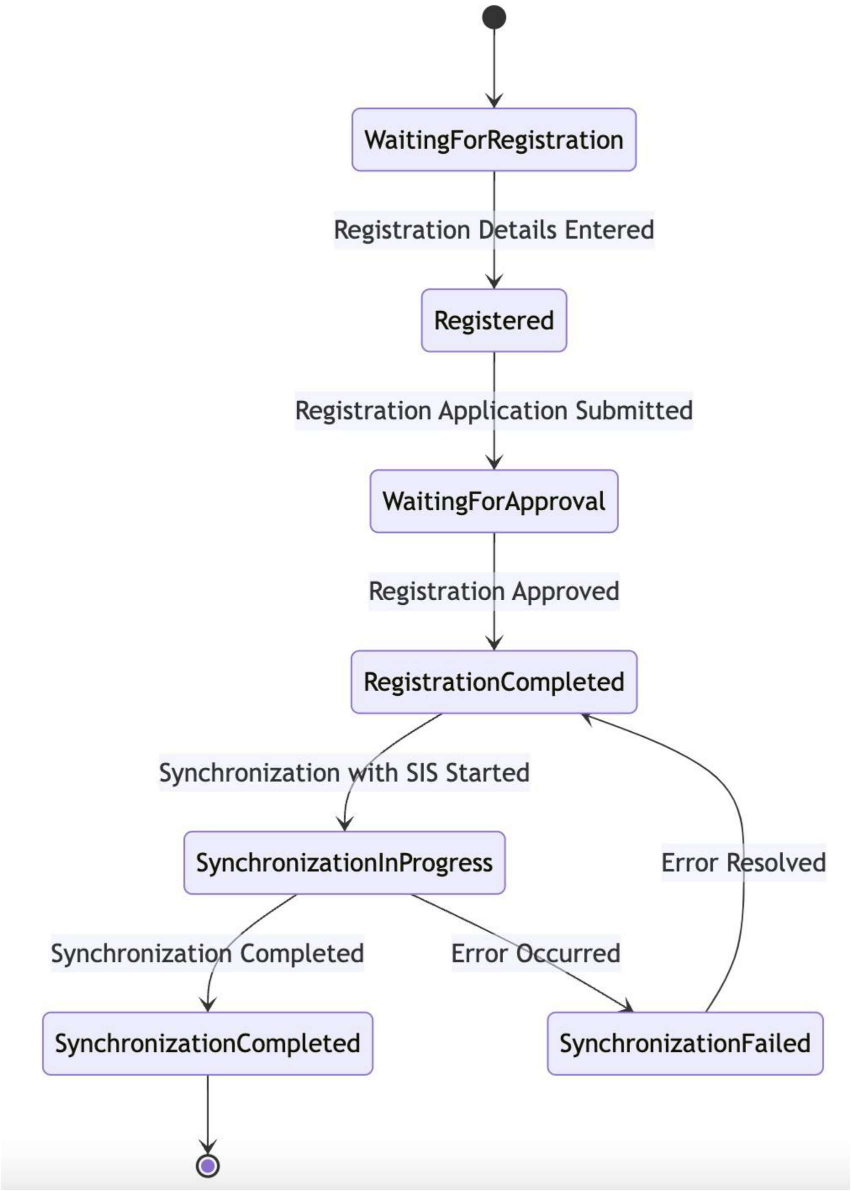


DFD Level 1 for high priority use cases:

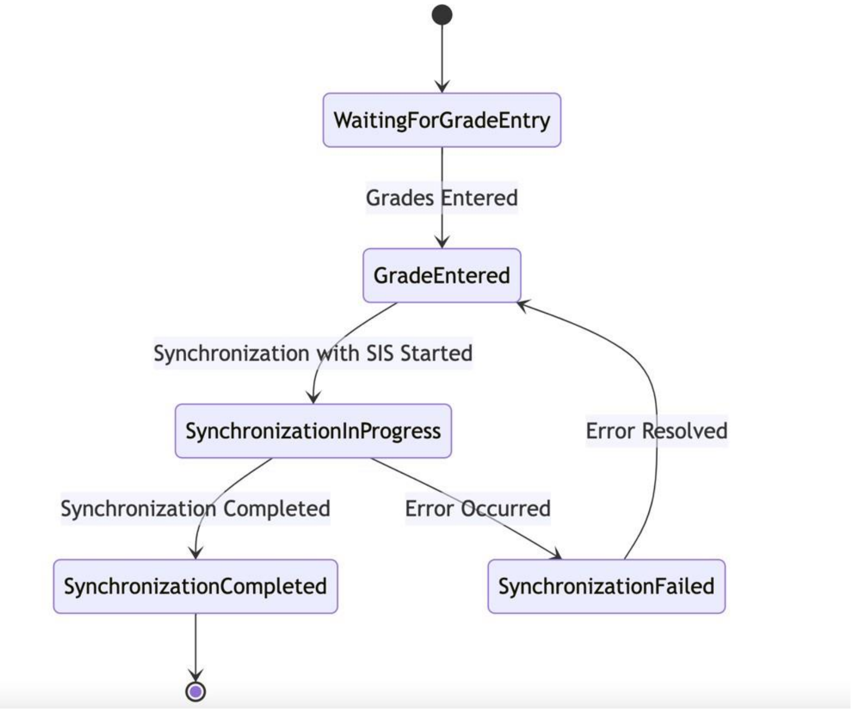

D
Student Registration
Expense Data
submits registration information
Student
sends registration confirmation to student
Manage Student Registration(1.0)
sends updated registration data to SIS
SIS
updates grades
Submits Grades
Manage Grading and Assesments(2.0)
Expense Data
D
Course Materials
Controls the Systems
Administrator
Instructor
generates grade report for instructor
uploads course material
Manage Course Material Distribution(3.0)
stores course material in LMS
LMS
Expense Data
D
Grades

State machines for some certain objects:

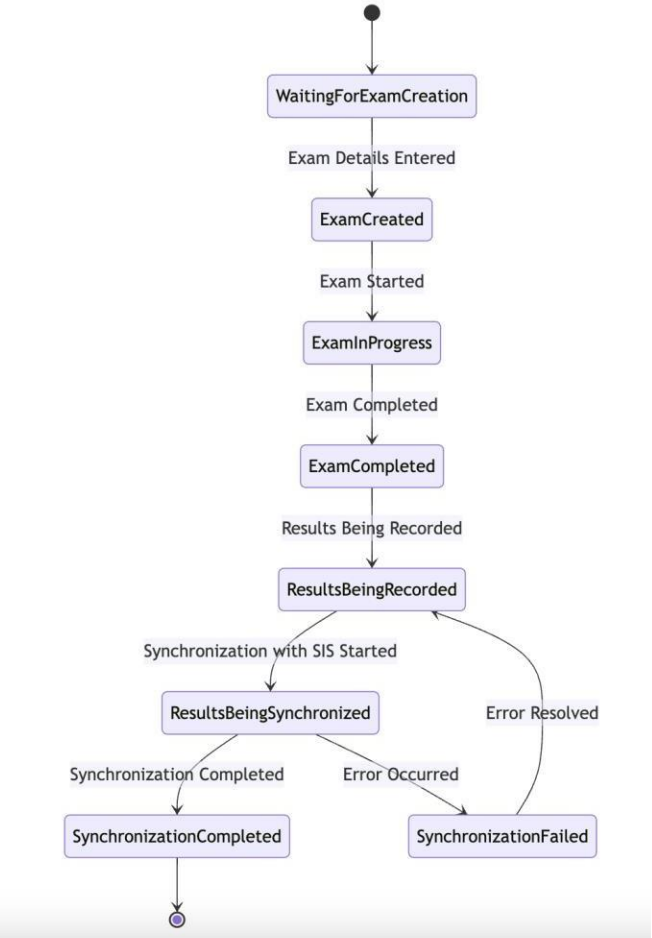
Student Registration and Integration Module:



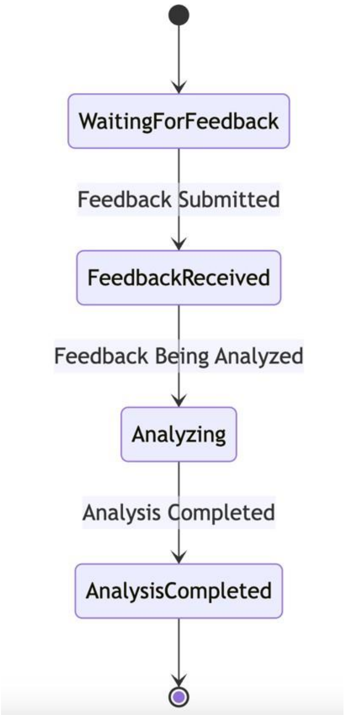
Grade Entry and Synchronization:



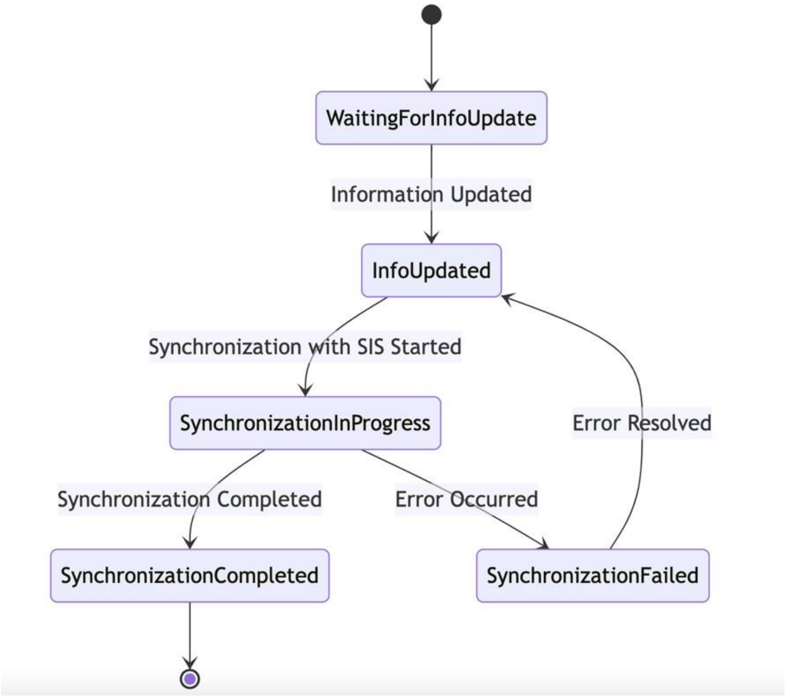
Exam Management:



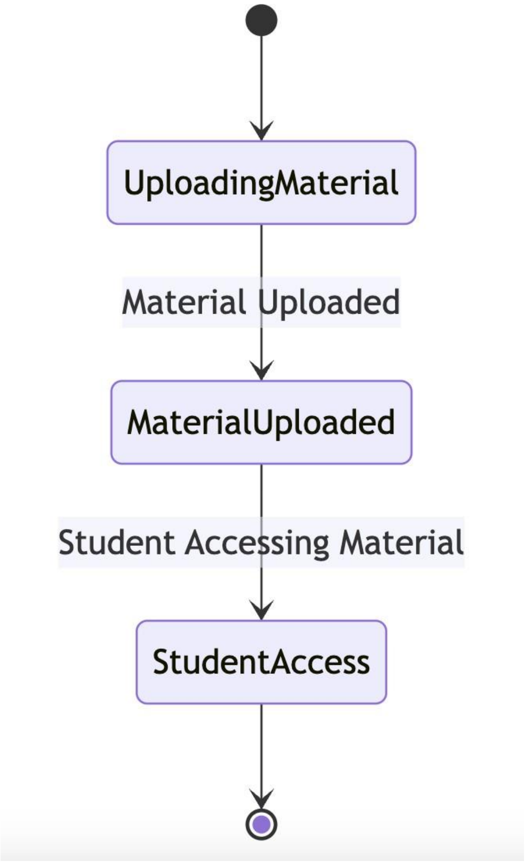
Student Feedback System:



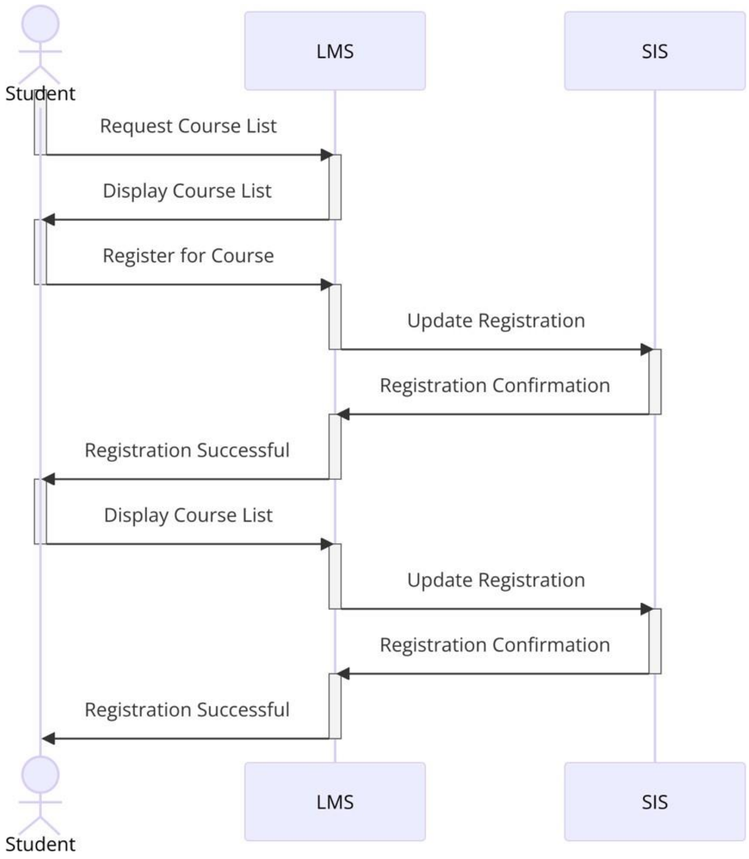
Student Information and Record Management:



Course Material Distribution:

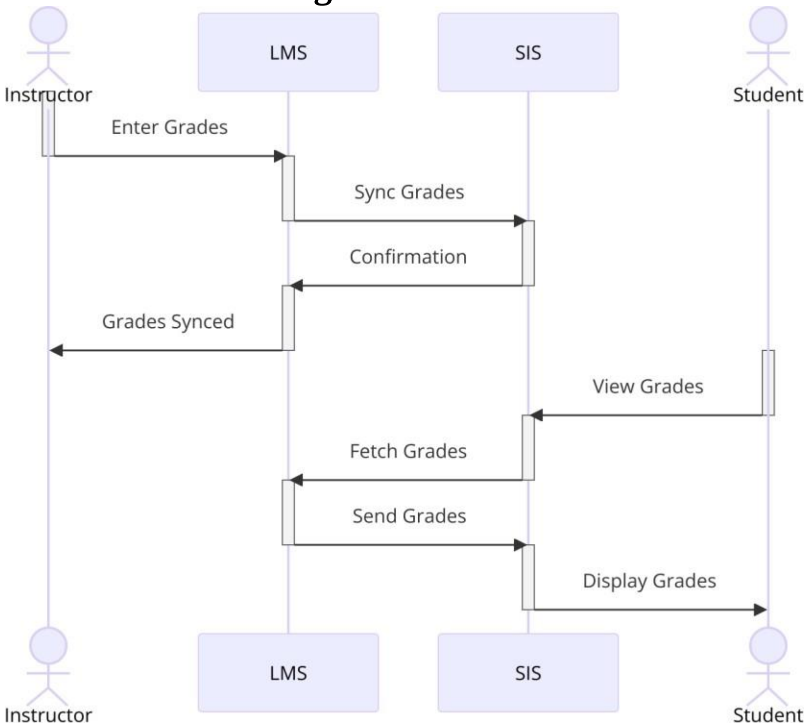


Sequence diagrams for high priority use cases:

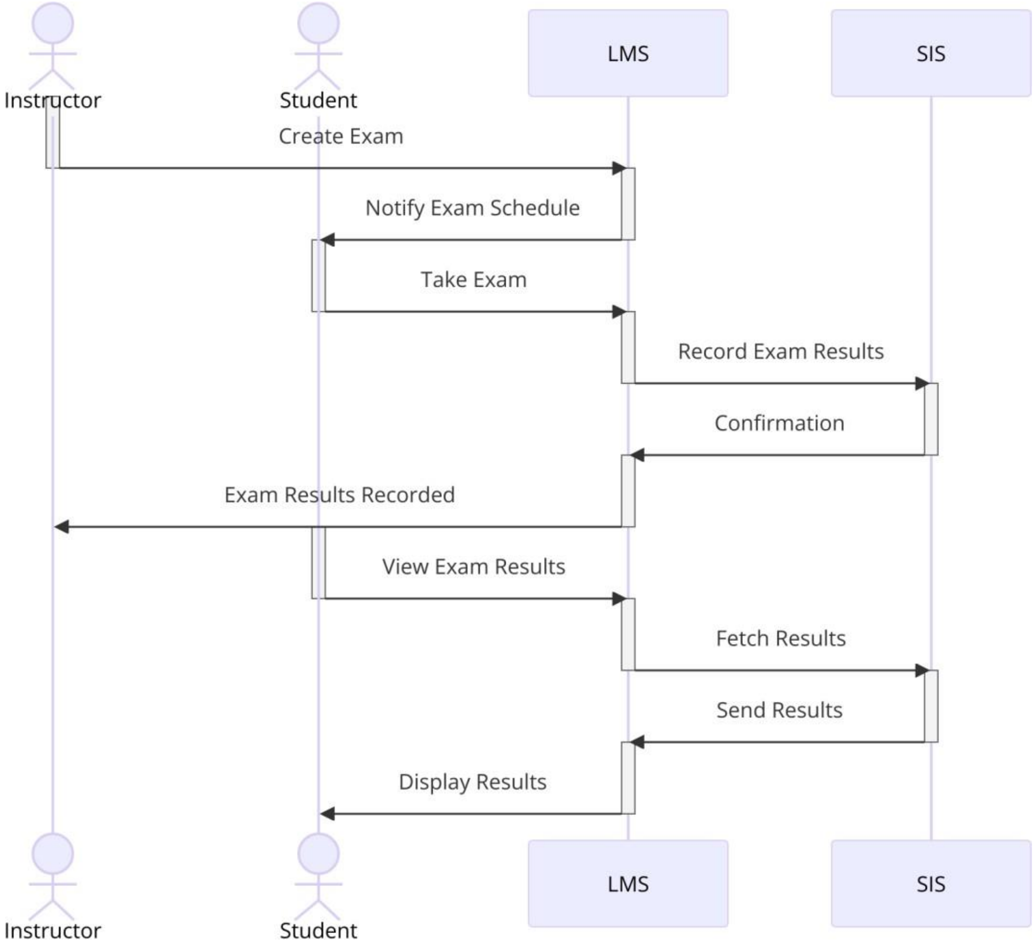


Student Registration:

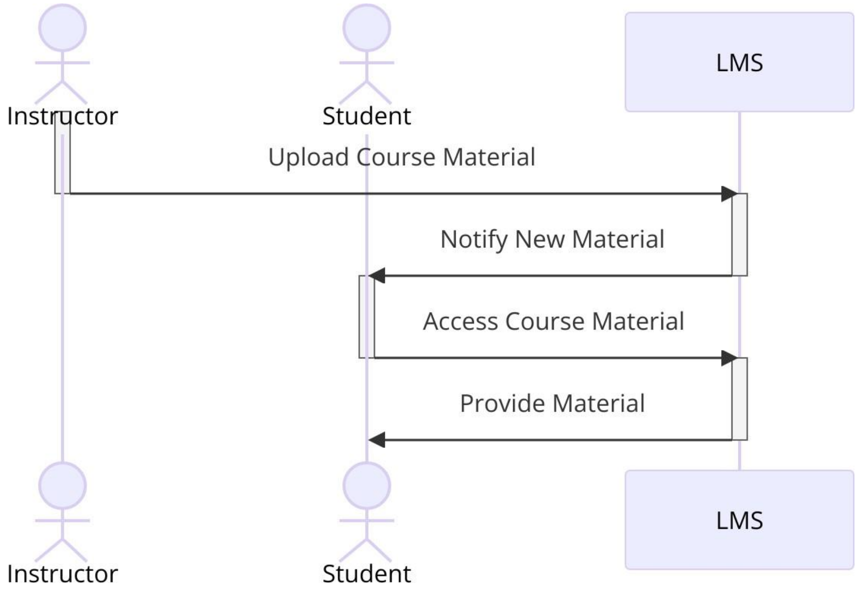
Grading and Assessments:



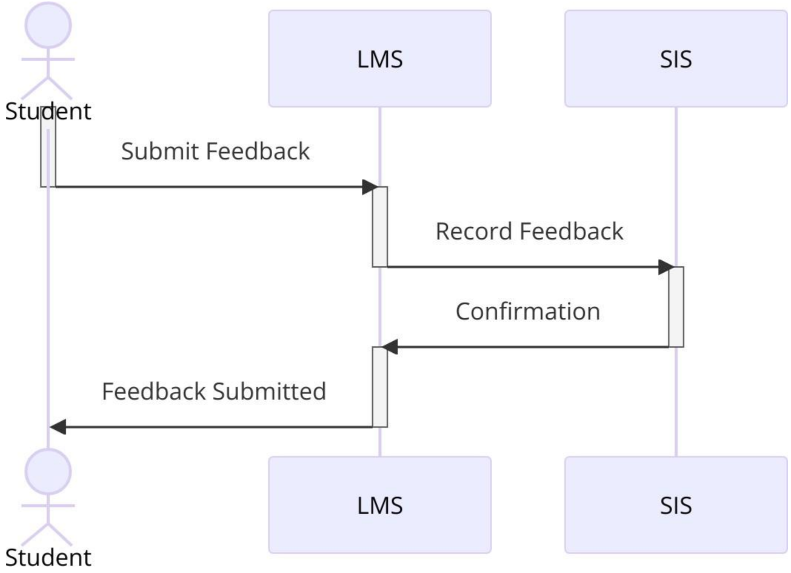
Examination Management:



Course Material Distribution:

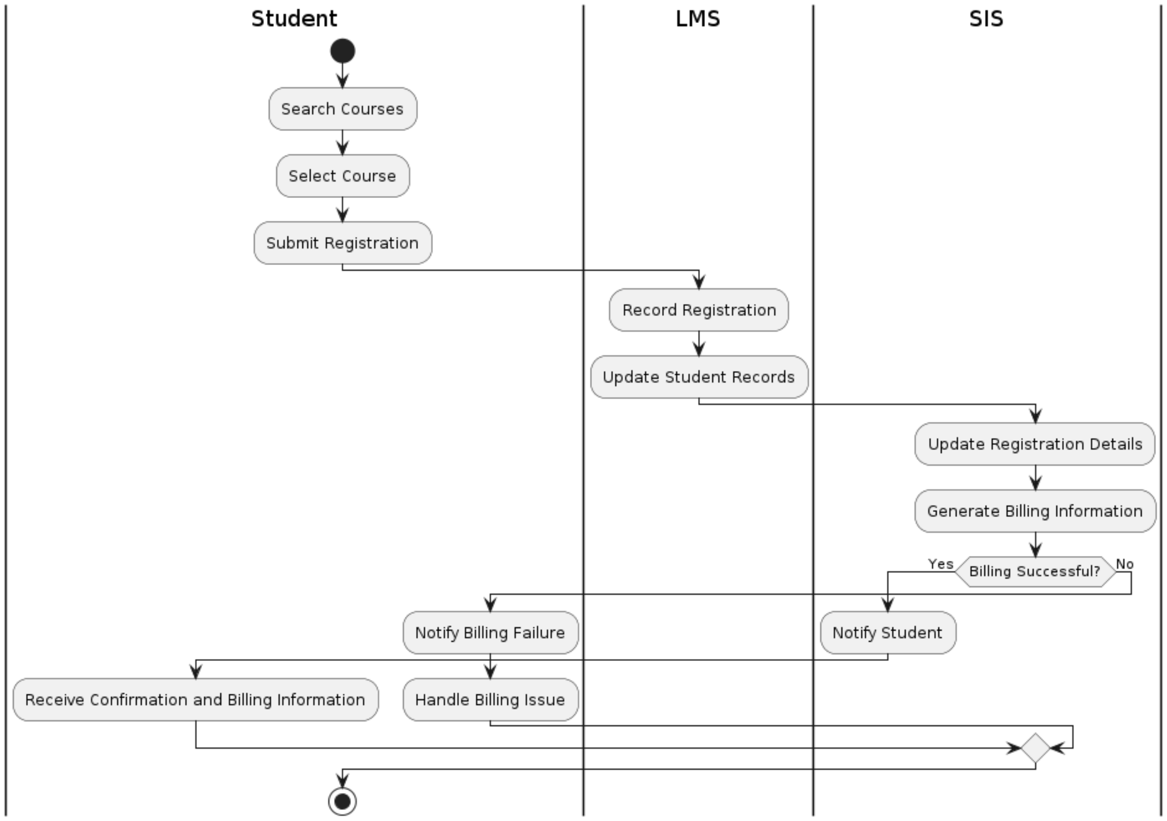


Student Feedback System:

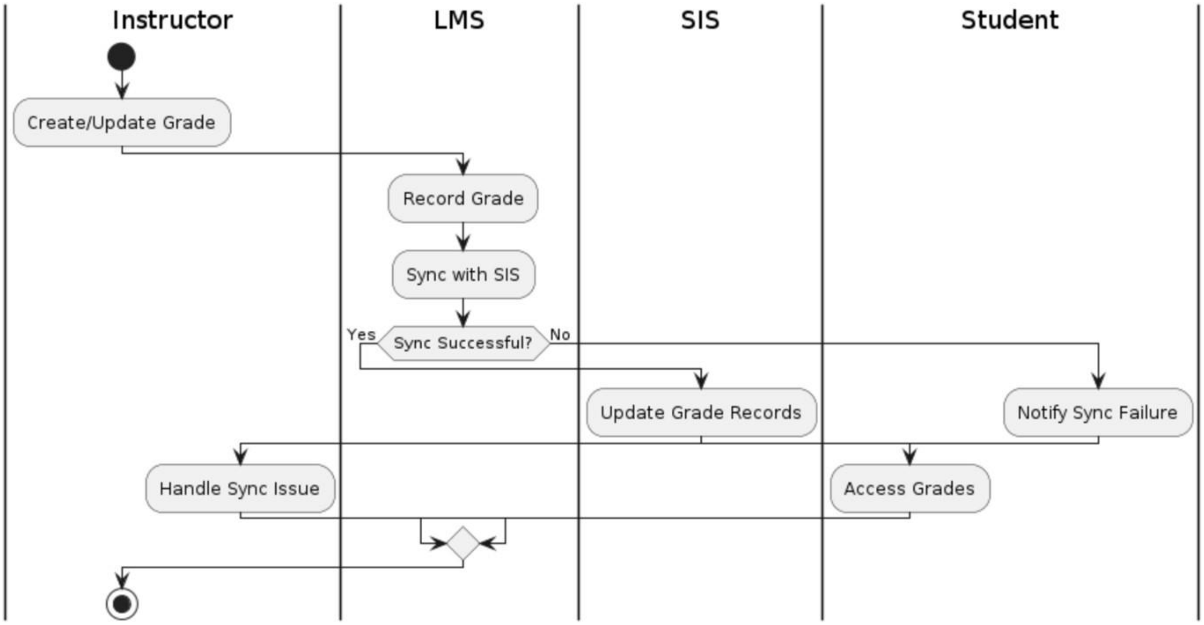


Activity (or swimlane) diagrams for high priority use cases:

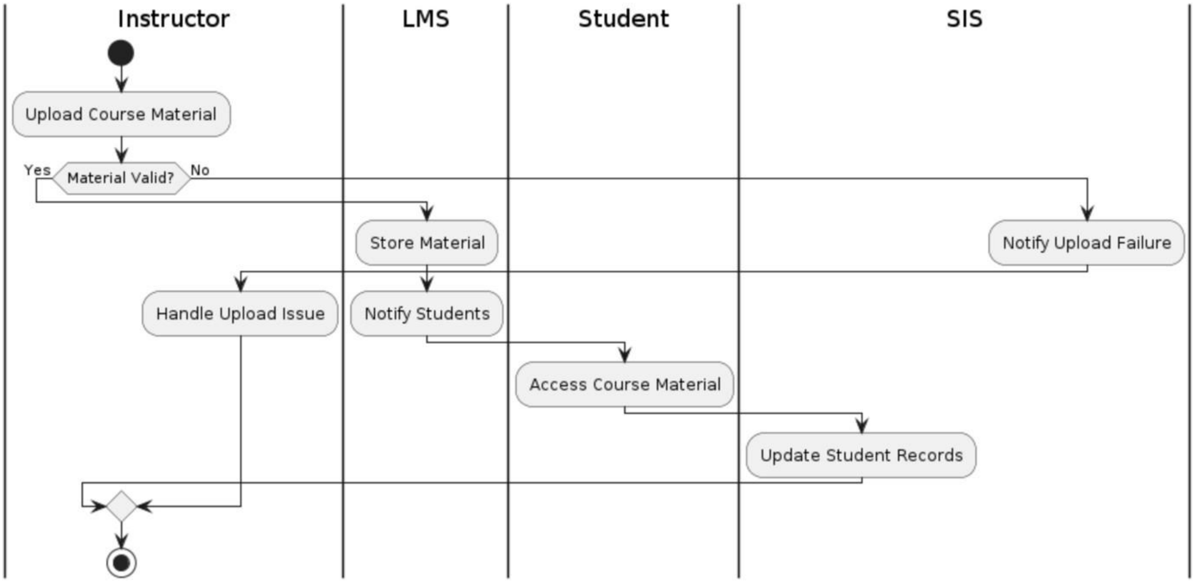
Registration Module:



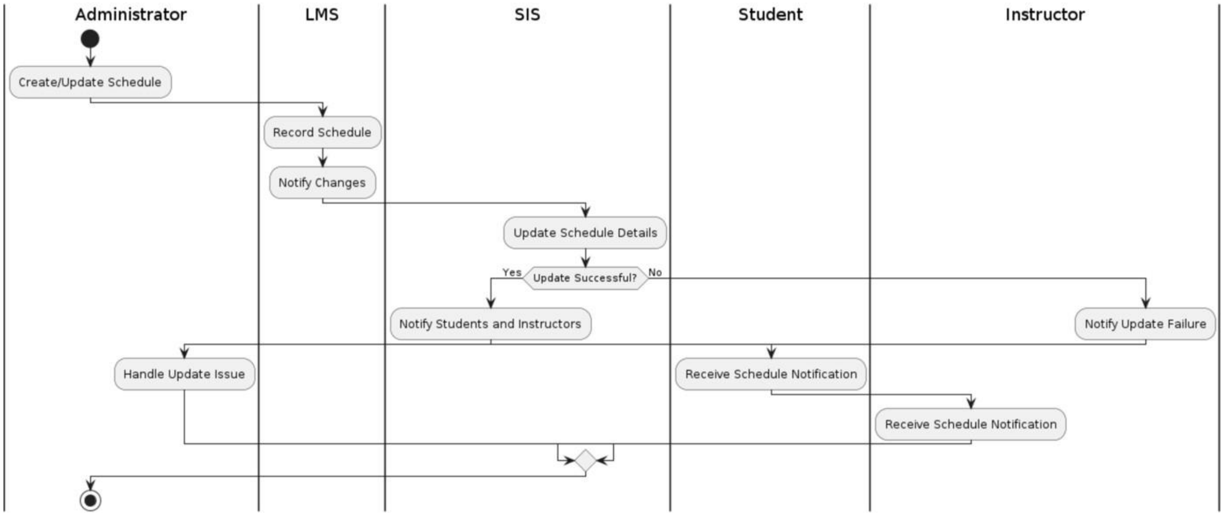
Grading and Assessments



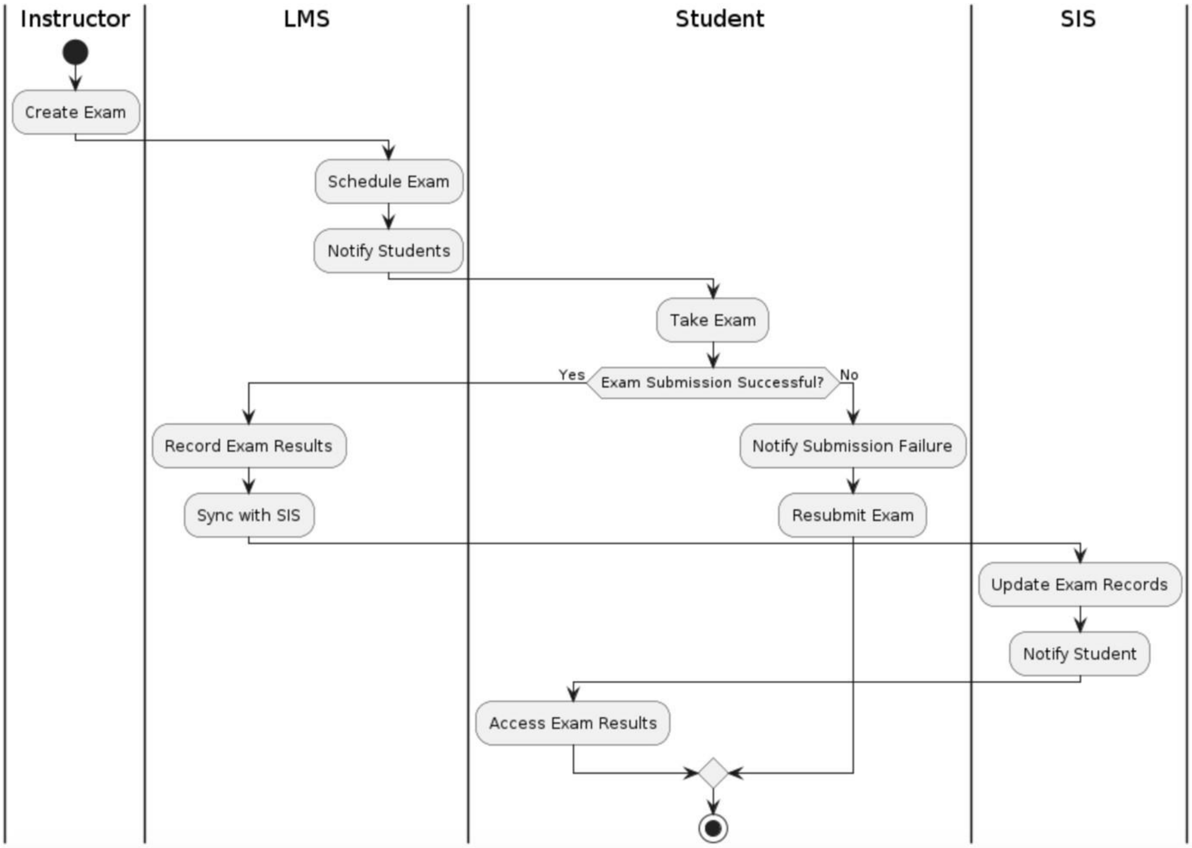
Course Material Distribution



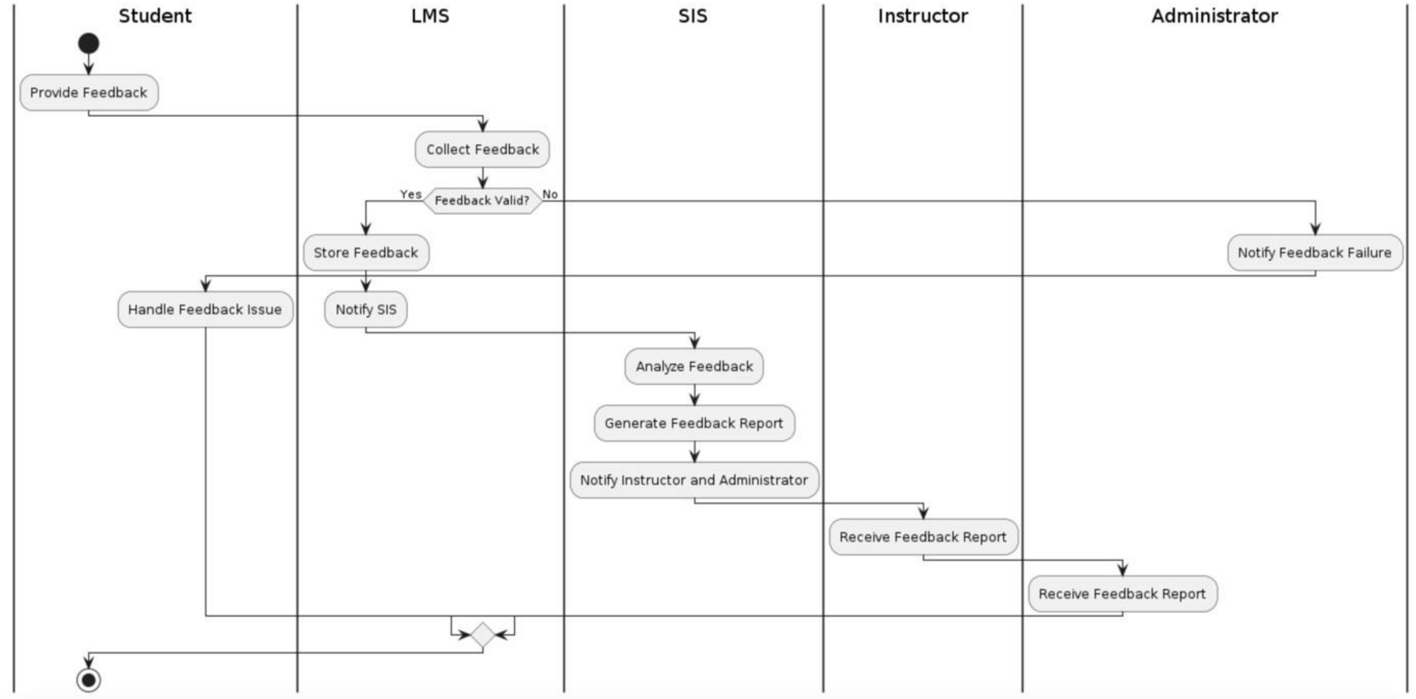
Class Scheduling:



Examination Management:

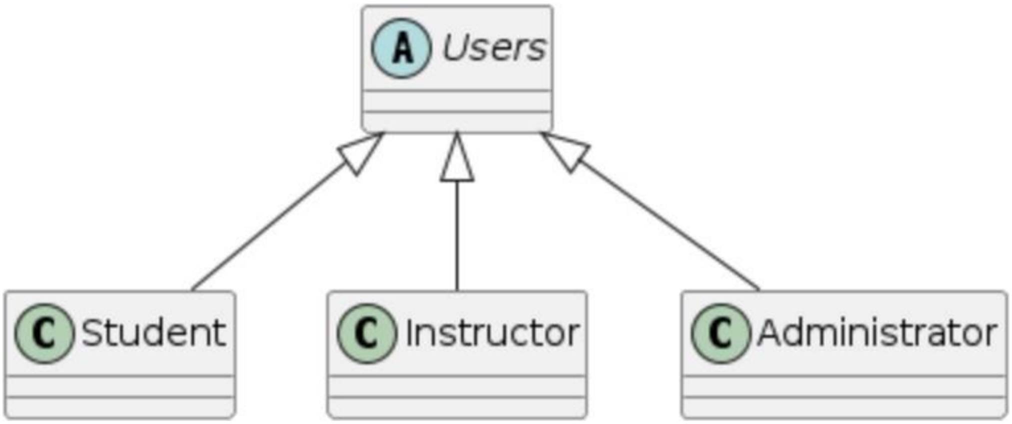


Student Feedback System:

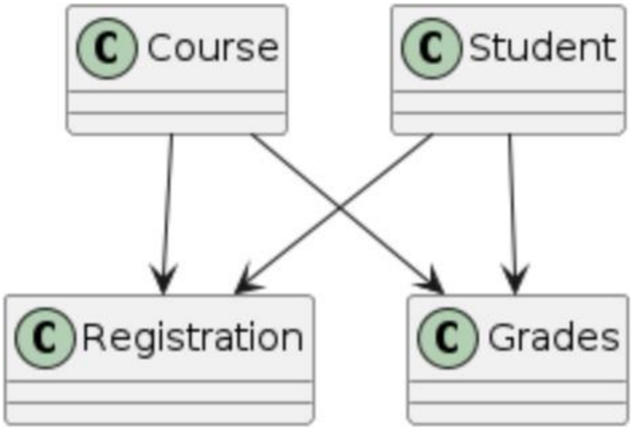


Class diagram:

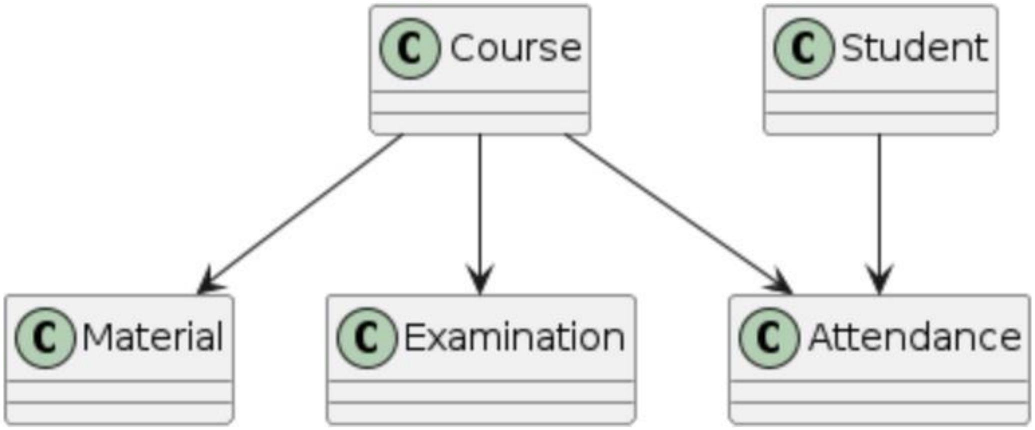
Basic Class diagram for User Classes:



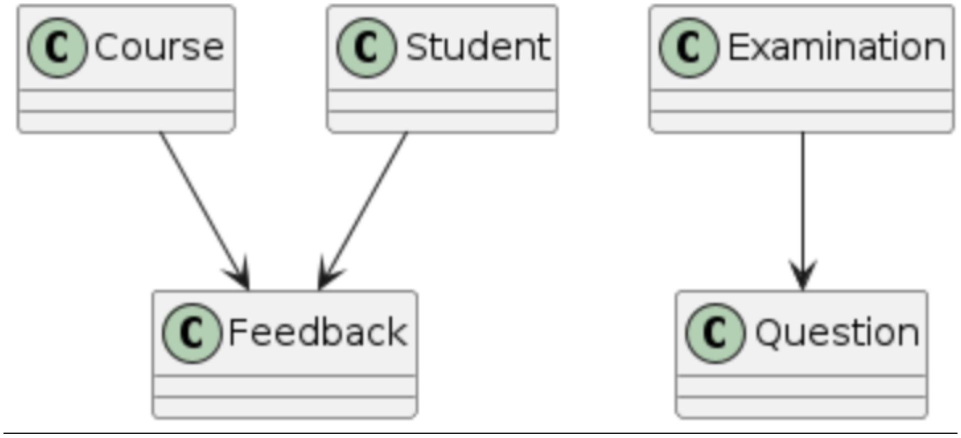
Basic Class diagram for the Course and Registration classes:



Basic Class diagram for Material and Examination Management:



Class diagram for the Feedback System:



Appendix C: To Be Determined List

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