CS 353 Database Systems

Project Final Report

Online Course Platform

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1. Application System Description

The project is a web-based database application which is an online course platform that provides courses for students and enables course creation for instructors. There are three types of end users. The first one is the students. Students are able to search for courses, add courses to their wishlists and carts, buy the courses that they desire, add funds to their wallets. They can keep track of their progress on different courses, once they complete a course, they can give feedback and ratings to that course and receive a certificate of completion. Also, they are able to request a refund for a bought course, with valid reasons. They can reach recent information from their notifications. Another end user in the platform is the course creator. Course creators can publish courses, add lectures and assignments to these courses and make announcements for these courses. They can keep track of how much they earn via their own wallets. Students and course creators can participate in Q&A sessions where students ask questions and the course creator answers. The last type of users is admin. Admin can offer discounts for courses, and it is up to the course creator of that course to decide whether to accept the discount or not. Site admins can see complaints from students and should accept or decline refund requests of students. Admin can see statistics (report) about the application.

A course consists of several lectures and may contain assignments. Each of these lectures and assignments must be completed by students if they want to get a completion certificate for those courses. Students can take notes for lectures and associate these notes with lectures. Courses have question & answer sections. In these sections, students can ask their questions related to courses and the creator answers these questions.

2. Final Entity-Relationship (E/R) Diagram

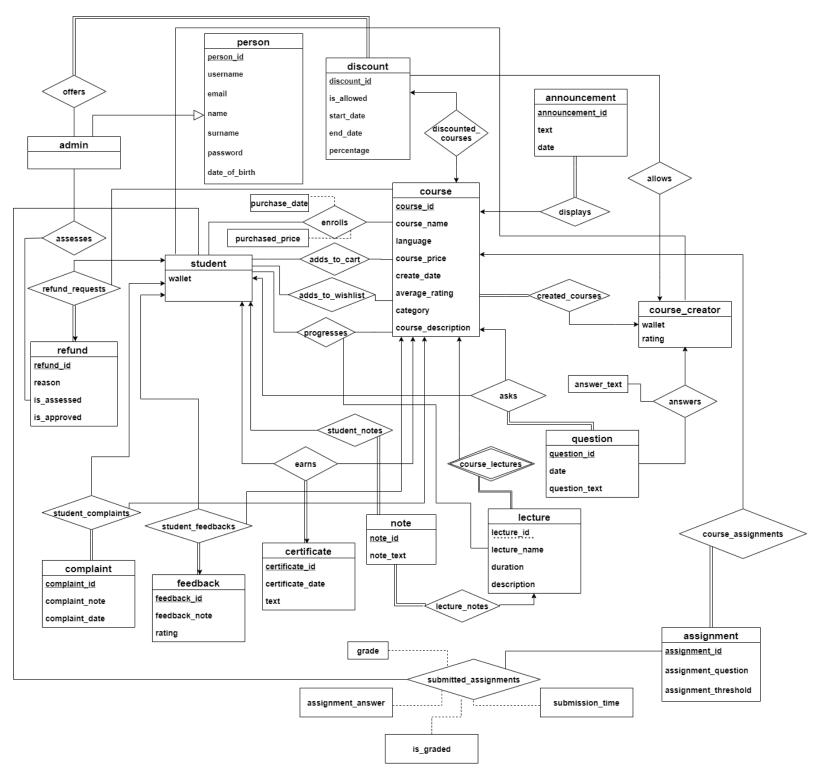


Figure 1: Final E/R Diagram of Online Course Platform

3. Final List of Tables

person

Relational Schema: person(<u>person_id</u>, username, email, name, surname, password, date_of_birth)

Candidate Keys: {person_id}, {username}, {email}

Primary Key: {person_id} Foreign Key: None

student

Relational Schema: student(student id, wallet)

Candidate Key: {student_id}
Primary Key: {student_id}

Foreign Key: student_id references person(person_id)

course creator

Relational Schema: course_creator(<u>course_creator_id</u>, wallet, rating)

Candidate Key: {course_creator_id}
Primary Key: {course_creator_id}

Foreign Key: course creator id references person(person id)

course

Relational Schema: course(<u>course_id</u>, course_name, language, course_price, create_date, average rating, category, course description, course creator id)

Candidate Key: {course_id} Primary Key: {course_id}

Foreign Key: course_creator_id references course_creator(course_creator_id)

enrolls

Relational Schema: enrolls(student id, course id, purchased price, purchase date)

Candidate Key: {student_id, course_id} Primary Key: {student_id, course_id}

Foreign Keys:

- student_id references student(student_id)
- course id references course(course id)

adds to cart

Relational Schema: adds_to_cart(student_id, course_id)

Candidate Key: {student_id, course_id} Primary Key: {student_id, course_id}

Foreign Keys:

- student_id references student(student_id)
- course_id references course(course_id)

adds to wishlist

Relational Schema: adds_to_wishlist(<u>student_id, course_id</u>)

Candidate Key: {student_id, course_id} Primary Key: {student_id, course_id}

Foreign Keys:

- student_id references student(student_id)
- course_id references course(course_id)

progresses

Relational Schema: progresses(student id, course id, lecture id)

Candidate Key: {student_id, course_id, lecture_id} Primary Key: {student_id, course_id, lecture_id} Foreign Keys:

- student id references student(student id)
- {course id, lecture id} references lecture(lecture id)
- {course id} references course(course id)

admin

Relational Schema: admin(admin id)

Candidate Key: {admin_id} Primary Key: {admin_id}

Foreign Key: admin id references person(person id)

lecture

Relational Schema: lecture(course id, lecture id, lecture name, duration, description)

Candidate Key: {course_id, lecture_id} Primary Key: {course_id, lecture_id}

Foreign Key: course_id references course(course_id)

assignment

Relational Schema: assignment id, assignment question, assignment threshold,

course_id)

Candidate Key: {assignment_id} Primary Key: {assignment_id}

Foreign Key: course_id references course(course_id)

submitted_assignments

Relational Schema: submitted_assignments(<u>assignment_id</u>, <u>student_id</u>, <u>submission_time</u>, assignment_answer, grade, is_graded)

Candidate Key: {assignment_id, student_id, submission_time} Primary Key: {assignment_id, student_id, submission_time} Foreign Keys:

- assignment_id references assignment(assignment_id)
- student id references student(student id)

question

Relational Schema: question(question id, date, question text)

Candidate Keys: {question_id}
Primary Keys: {question_id}

Foreign Keys: None

announcement

Relational Schema: announcement(<u>announcement_id</u>, text, date, course_id)

Candidate Key: {announcement_id} Primary Key: {announcement_id}

Foreign Key: course id references course(course id)

discount

Relational Schema: discount(<u>discount_id</u>, is_allowed, start_date, end_date, percentage, discounted_course_id, allower_course_creator_id)

Candidate Keys: {discount id}, {discounted course id}

Primary Key: {discount_id}

Foreign Key:

- discounted course id references course(course id)
- allower_course_creator_id references course_creator(course_creator_id)

refund

Relational Schema: refund(<u>refund_id</u>, reason, is_assessed, is_approved)

Candidate Keys: {refund_id}
Primary Key: {refund_id}
Foreign Key: None

refund requests

Relational Schema: refund_requests(refund_id, student_id, course_id)

Candidate Keys: {refund_id}, {student_id, course_id}

Primary Key: {refund_id}

Foreign Keys:

- refund id references refund(refund id)
- student_id references student(student_id)
- course id references course(course id)

complaint

Relational Schema: complaint (complaint id, complaint note, complaint date)

Candidate Key: {complaint_id} Primary Key: {complaint_id}

Foreign Key: None

feedback

Relational Schema: feedback(feedback_id, feedback_note, rating)

Candidate Key: {feedback_id} Primary Key: {feedback_id} Foreign Key: None

certificate

Relation Schema: certificate(certificate id, date, text)

Candidate Key: {certificate_id} Primary Key: {certificate_id}

Foreign Key: None

student complaints

Relational Schema: student_complaints(<u>complaint_id</u>, student_id, course_id,)

Candidate Key: {complaint_id} Primary Key: {complaint_id}

Foreign Keys:

- student id references student(student id)
- course_id references course(course_id)
- complaint id references complaint(complaint id)

student feedbacks

Relational Schema: student_feedbacks(feedback_id, student_id, course_id)

Candidate Keys: { feedback_id }, { student_id, course_id } Primary Key: { student_id, course_id }

Foreign Keys:

- student id references student(student id)
- course id references course(course id)
- feedback id references feedback(feedback id)

earns

Relational Schema: earns(student id, course id, certificate id)

Candidate Keys: {student_id, course_id}, {certificate_id} Primary Key: { student_id, course_id }

Foreign Keys:

- student_id references student(student_id)
- course id references course(course id)
- certificate id references certificate(certificate id)

note

Relational Schema: note(<u>note_id</u>, student_id, lecture_id, course_id, note_text)

Candidate Key: {note_id} Primary Key: {note_id} Foreign Keys:

• student id from student(student id)

• (lecture id, course id) from lecture(lecture id, course id)

asks

Relational Schema: asks(<u>question_id</u>, student_id, course_id)

Candidate Key: {question_id} Primary Keys: {question_id}

Foreign Keys:

• student id references student(student id)

• course id references course(course id)

question_id references question(question_id)

answers

Relational Schema: answers(question id, course creator id, answer text)

Candidate Key: {question_id}
Primary Key: {question_id}

Foreign Keys:

- question_id references question(question_id)
- course creator id references course creator(course creator id)

4. Implementation Details

MySQL was used for the database management system. PHP was used to develop the back-end and the front-end of the web application. Java was used to create the database. Javascript, CSS, HTML5 were used to develop the front-end (UI) of the web application. Bootstrap was used as a framework (CSS, HTML5 and JS). AJAX was used.

One challenge in implementation was to fetch appropriate data with a button click to display appropriate modal content to the user (i.e. in the implementation of accepting/rejecting refund requests as admin) and have the user update data with submission via modal. Hidden inputs were implemented in the form component that was submitted by the button that opens up the modal to carry information to the modal. Additionally a Javascript function (onClick function) had to be written to make modal content change with different fetched data by the button. A problem in assignment functionality occurred during implementation due to missing an attribute in our design. The assignment status was vague, so is_graded attribute was added to the submitted_assignment to indicate a clearer grading status. It enabled the student to see its assignment status as successful, unsuccessful or not graded which is user friendly and allows the student to make meaningful attempts by looking at the assignment status first.

Contribution of Team Members

Mustafa Yaşar

Course market page and filters in it, cart and wishlist page, course page from student's and course creator's perspective and course page redirected from market, making complaints by student and reading them by admin, getting certificate, sign up pages and operations, log in operations, publishing new courses have been implemented.

Cemre Biltekin

All assignment (additional) functionalities & pages of users, management and display pages of refund requests & discount offers by admin, admin page, and log out have been implemented.

Oğuz Kaan İmamoğlu

Course related functionalities for students (see enrolled courses and announcements, watch lectures and take notes), notification related features and statistics/reports page of site have been implemented.

Abdullah Can Alpay

All question & answer related functionalities, all feedback related functionalities and myCertificates page implemented. Additionally, add a discount page for course creator where course creator can accept/reject the offer.

5. Advanced Database Features

Triggers, constraints and secondary indices SQL statements can be found in our Java code.

Reports

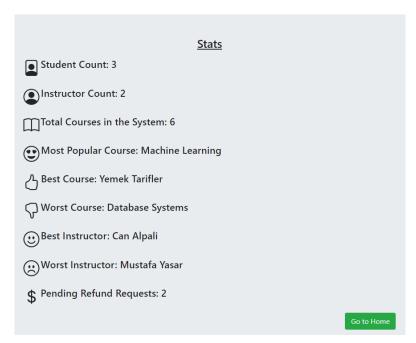


Figure 2: Stats Page Seen by Admin with Reports Queries

SELECT name, surname

FROM person

WHERE person id = (SELECT course creator id FROM course creator WHERE

RATING = (SELECT MAX(RATING) FROM course creator LIMIT 1) LIMIT 1)

SELECT course id, **COUNT**(course id) **AS** occurrence

FROM enrolls

GROUP BY course id ORDER BY occurrence DESC LIMIT 1

These reports find the instructor with the highest rating, in other words the best instructor, and the course that has the highest number of students, in other words the most popular course with aggregate functions.

SELECT C.course_id, C.course_name, C.language, C.average_rating, C.category,

P.name, P.surname, D.percentage, D.start_date, D.end_date,

D.is allowed, (CASE WHEN CURRENT_DATE <= D.end date AND

CURRENT_DATE >= D.start_date **AND** D.is_allowed **THEN** C.course_price *

((100 - D.percentage) / 100) **ELSE** C.course_price **END**) as price

FROM course C LEFT OUTER JOIN discount D ON C.course id =

D.discounted_course_id **LEFT JOIN** person P **ON** C.course_creator_id = P.person_id

With this complex query we can filter the course market, according to course's price, name, discount, category, language; course creator's name. Additionally, we can sort them by price (high to low, low to high) and rating (high to low) of the course.

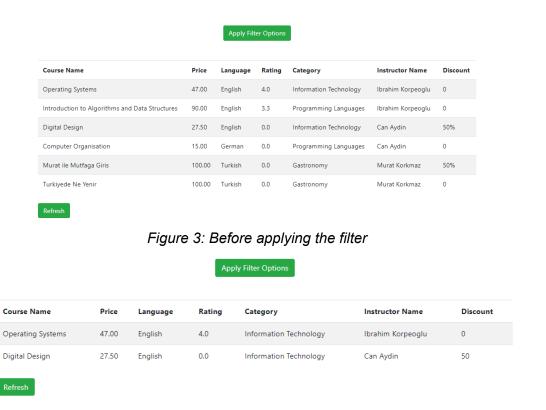


Figure 4: After Applying min price = 0, max price = 100, category = information technology

Views

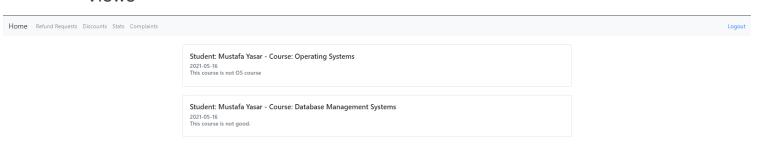


Figure 5: Complaints Page Seen by Admin with Complaint_View

SQL View Statement for Complaints

CREATE VIEW complaint view AS

SELECT C.complaint_id, complaint_note, complaint_date, P.person_id, Co.course_id, name, surname, course_name

FROM complaint C, student_complaints SC, person P, course Co **WHERE**

C.complaint_id=SC.complaint_id AND P.person_id=SC.student_id AND SC.course_id=Co.course_id

This view stores the information about complaints. The information consists of the name of the student who made the complaint, the name of the course the complaint is made about, and the date the complaint was made. This view was used in the Complaints page on admin's side for ease of use and ease of seeing complaints made by students on particular courses.

Triggers

Trigger for Updating Average Rating of Course After Feedback Insertion

A trigger was implemented for after the insertion of a student feedback to update the average rating of the course. After a student gives feedback to a course, the course's rating should be calculated and updated again with the new feedback.

Trigger for Updating Average Rating of Course After Feedback Update

A trigger was implemented for after the update of a student feedback to update the average rating of a course. After a student changes his/her feedback for the course, the course's rating should be calculated and updated again with the updated feedback.

Trigger for Updating Rating for Course Creator After Feedback Update

The course creator's rating is determined by taking the average of his/her course's ratings. A trigger was implemented to calculate/recalculate the course creator's rating after a student makes an update on his/her feedback about a course offered by the course creator.

Trigger for Updating Rating for Course Creator After Feedback Insertion

The course creator's rating is determined by taking the average of his/her course's ratings. A trigger was implemented to calculate/recalculate the course creator's rating after a student sends feedback on one of his/her courses.

Constraints

A constraint for keeping wallet of student and course creator nonnegative, for keeping rating of course and course creator nonnegative, for checking valid category for course, for checking non negativeness of course price, for checking lecture duration being positive number and smaller than 1.5 hours, for checking assignment threshold and assignment grade being nonnegative and smaller than 100, for checking discount percentage to be between 0 and 100 have been implemented.

Secondary Indices

Person Table's Username Index

The search is made more efficient in the login process to search for the instance of a matching username by creating an index on *username* in the person table.

Announcement Table's Course ID Index

The search is made more efficient in the course page to search for the instance of its announcements by creating an index on *course_id* in the announcement table. This was implemented on a foreign key in this table for efficiency.

Course Table's Course Creator ID Index

The search is made more efficient to search for the instance of a course's course creator by creating an index on *course_creator_id* in the course table. This was implemented on a foreign key in this table for efficiency.

6. User's Manual

Getting Started - Login & Sign Up

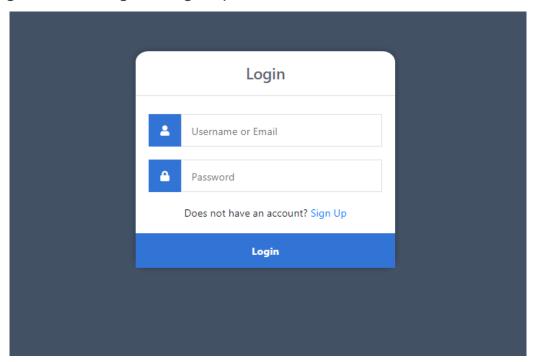


Figure 6: Login Page

To be able to use the features of the online course platform, you have to have a registered account first. On the login page if you already have an account, you are asked to enter your credentials (username/email and password) to have access to the application.

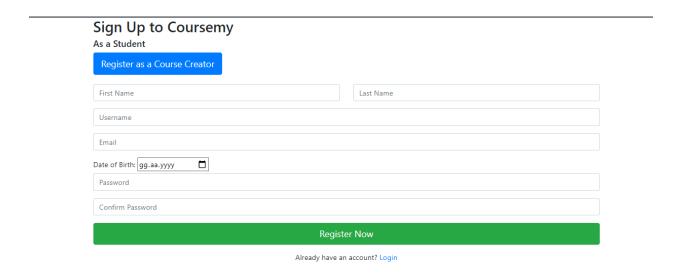


Figure 7: Sign Up Page

If you do not have an account, there is a link on the login page "Does not have an account?" that directs you to the sign up page for registering as a new user. You can either sign up as a course creator or as a student. Administrator accounts are issued/authorized by the system. You have to fill the sign up form as specified by the system. In case an erroneous input is given, the system reports why the sign up has failed with appropriate error messages (i.e. username character constraints, uniqueness of email and username). In case you want to switch to the login page, you can click "Already have an account?" link.

After filling the sign up form successfully, pressing the Register Now button will create your account in the system and direct you to the login page. You can login to your account following the login procedures as explained above.

In case you want to log out, you can log out of your account using the Log Out link on the top navigation bar. This is available on every page.

Student User Manual

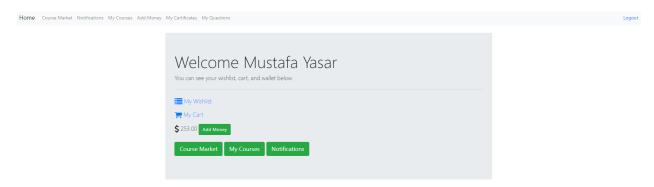


Figure 8: Student Welcome Page

When you log in as a student, the student home page welcomes you and lists the courses you have in the table if you have any. You can see your wishlist and cart by clicking "My Wishlist" or "My Cart". You can add money to your wallet by clicking the "Add Money" button and specifying the amount you want to add. The amount can be at most 250\$.

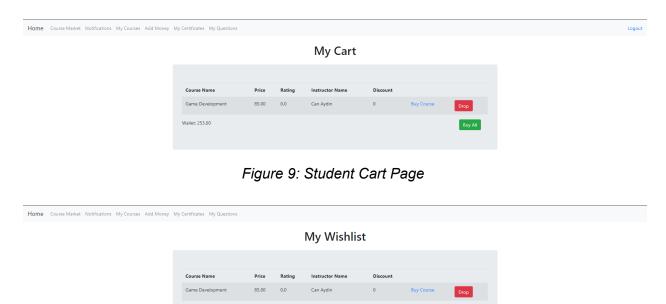


Figure 10: Student Wishlist Page

You can buy a course in your cart or in your wishlist by clicking "buy course", or delete the course by clicking the "drop" button. You can click the "buy all" button to buy every course in your wishlist or cart.

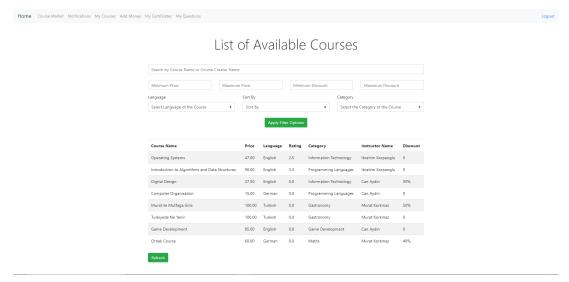


Figure 11: Course Market

In order to see the course market, you can click the "Course Market" button. This button directs you to the course market where you can find every course with their information. You can specify as many filters as you wish while searching for a course. If you have applied filters, by clicking the "Refresh" button, you can list every course again.

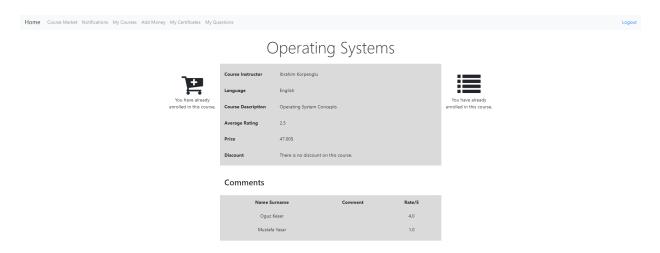


Figure 12: Course Page from Market

When you click on a course in the course table, you are directed to the course page where you can see every information about that course. In this page, you can add the course to your cart and wishlist and you can see comments. If you have already purchased it, you cannot add it to your cart or your wishlist.

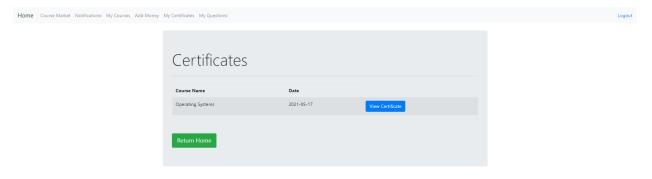


Figure 13: My Certificates

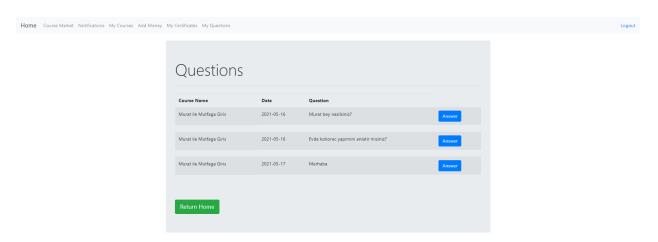


Figure 14: My Questions

Navigation bar at the top of the page directs you to every page at any time. For instance, you can see your certificates by clicking "My Certificates", and questions by clicking "My Questions". In "My Questions", you can see the answer of the instructor by clicking "Answer" button.

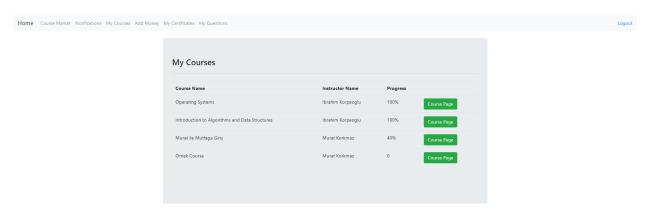


Figure 15: My Courses Page

If you click "My Courses", you're directed to the page where you can see the courses you have bought. To go to the course page, you can click the "Course Page" button.

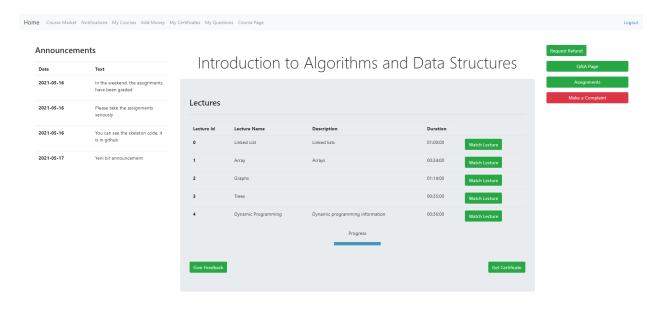


Figure 16: Course Page

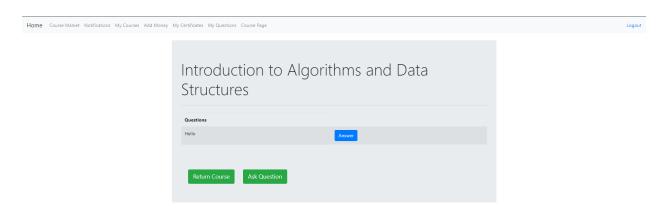


Figure 17: Course Q&A Page

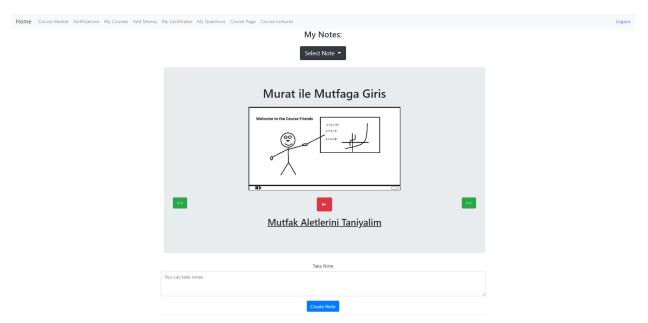


Figure 18: Lecture Watching Page

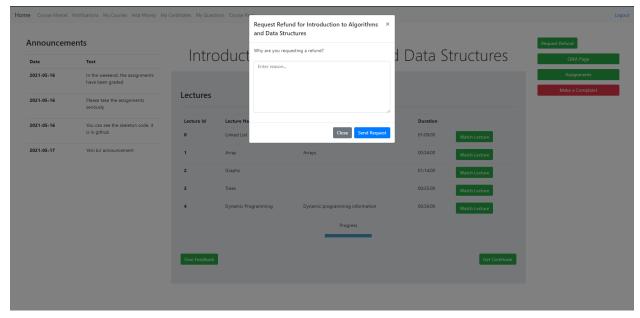


Figure 19: Request Refund as Student

If you go to the course page you have bought, you can see the announcements at the left hand side and lectures in the middle. To watch a lecture, you can click the "Watch Lecture" button, to refund a request, you can click the "Refund Request" button. If you have already requested a refund for a course, this button is inactive. "Q&A Page" button directs you to the questions and answers page where the questions asked and answers given in that course are displayed. In order to be able to get a certificate, you must complete the assignments and get a grade greater than or equal to the threshold from every assignment and you must have a full progress.

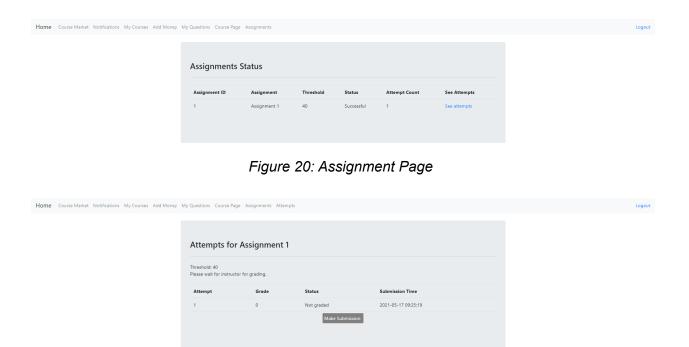


Figure 21: Assignment Attempts Page

You can see the assignments by clicking the "Assignments" button. To see the status of your submission, you can click "See attempts" for the assignment you wish to see. If the assignment is not yet successfully completed, you can make a submission by clicking the "Make Submission" button. If you want to make a complaint to the admin, you can click the "Make a Complaint" button on Course Page.

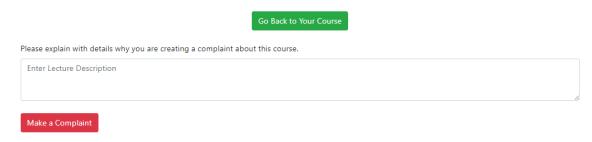


Figure 22: Complaint Page

If you have completed the course (i.e, you have watched every lecture and completed every assignment with a passing grade), you can get your certificate by clicking the Get Certificate button.

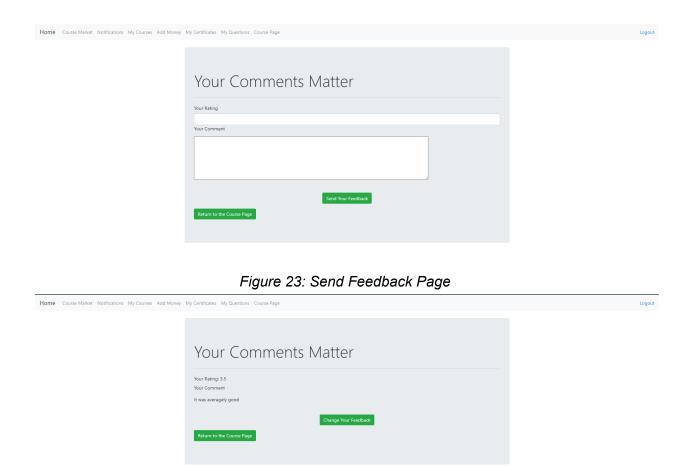


Figure 24: Feedback Page (After Sending Feedback)

If you have watched every lecture of a course, you can give feedback for that course. These feedbacks are seen by other students who visit the page of that course. You can change your feedback anytime.

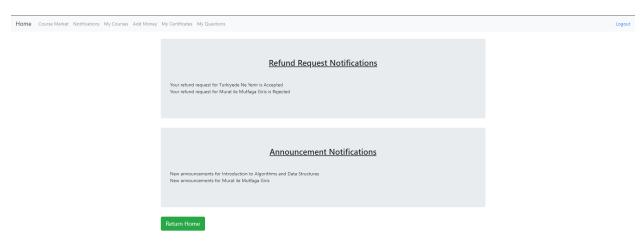


Figure 25: Notifications Page

Notifications about your recently issued refund requests and recent announcements about the courses you have enrolled to are shown in the Notifications page which is accessible with Notifications button.

Course Creator User Manual

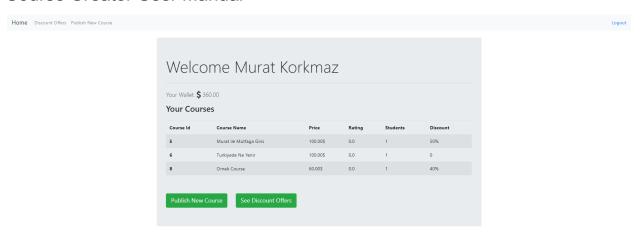


Figure 26: Course Creator Home Page

When you log in to the website, the home page welcomes you with information about your wallet and your courses (if you have created any).

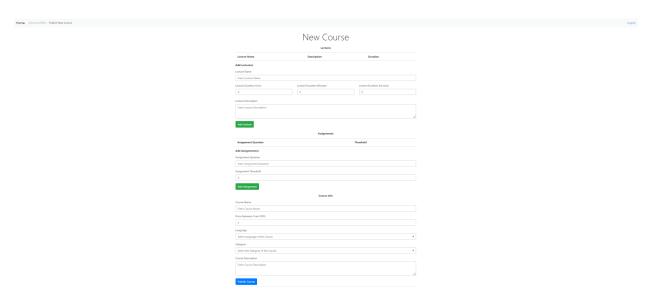


Figure 27: Publish A Course Page

You can publish a course by clicking the "Publish New Course" button or "Publish New Course" link in the navigation bar. In order to publish a course, you must create at least one lecture. Assignment is optional while creating a course. You can go to the course page of your courses by clicking the course in the table in the home page.



Figure 28: Course Page from the Perspective of Course Creator

You can create an announcement easily by writing the text and clicking the "Announce" button. You can see the questions asked by the students by clicking the "Q&A Page" button. You can answer the questions asked on this page.

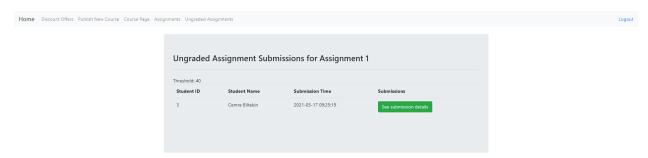


Figure 29: Ungraded Submissions Page

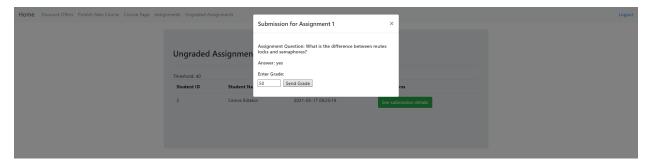


Figure 30: Giving Grade to Student

You can grade the assignments of the students by going to the assignments page by clicking the View Assignments button. You can see ungraded submissions and grade them by clicking on a certain assignment and send the grade you desire.



Figure 31: Discount Offers Page

If you click the discount offers, you can see the discount offers made by the admin. You must approve the discount offer in order for that discount offer to be applied. That way you can increase the number of students who bought your course. You can also Reject the offer.

Admin User Manual

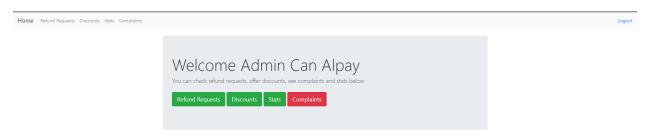


Figure 32: Admin Welcome Page

When you login as the administrator, a welcome page (home page) opens. On the page, you can see four buttons. Each button directs you to another page. You can also use the top navigation bar to access these pages that the corresponding buttons open.

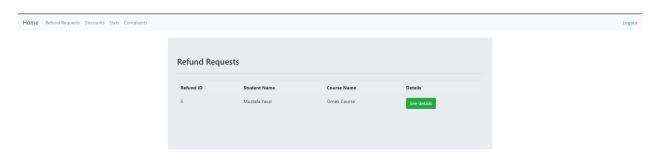


Figure 33: Refund Requests Page

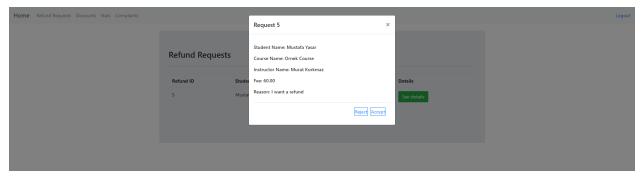


Figure 34: Assessment of Refund Request

When you click on "Refund Requests", you can access the page where you can see refund requests made by students in a table. To be able to see the details of the request, you must click on the "See details" link on the corresponding row. The modal that opens up has the refund request details like the refund reason. You can reject it via Reject button or accept it via Accept button.

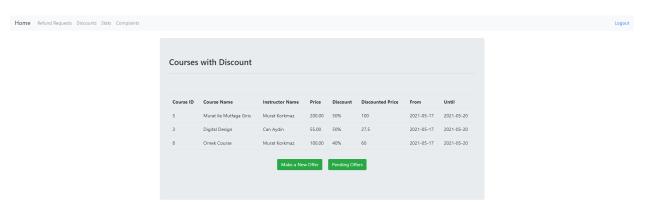


Figure 35: Discounts Page (Ongoing Discounts)

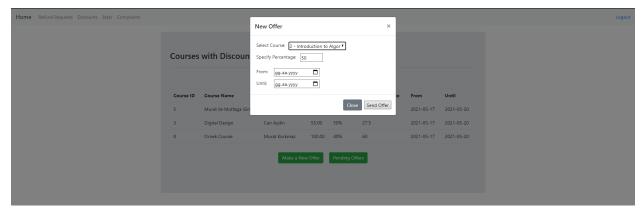


Figure 36: Making a New Offer as Admin

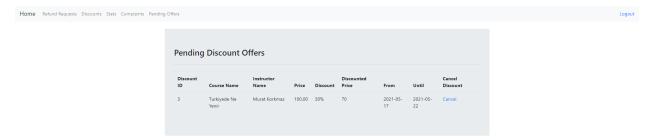


Figure 37: Pending Discount Offers

When you click on "Discounts", you can see the current applied discounts on courses and the information about them. You can choose to make a new discount offer for a course by clicking on "Make a New Offer". You have to specify discount attributes and hit send to send the offer to the corresponding course creator. If you wish to see the pending discount offers that have not yet been assessed by their course creators, you must click on "Pending Offers" to see which discount offers are still waiting to be assessed.

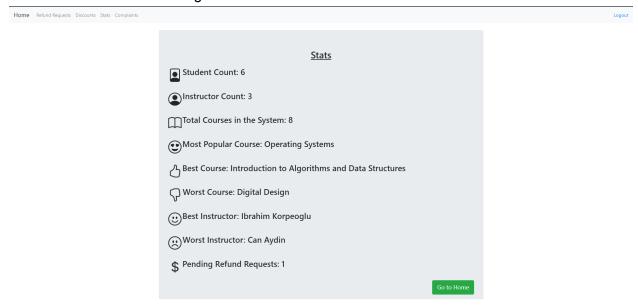


Figure 38: Stats Page

When you click on "Stats", you can see certain statistics data about the application like number of registered students, course creators on Stats page. You can see the most popular course, worst course based on its rating etc. too. This page is an informative report page about the application.



Figure 39: Admin View of Complaints Page

When you click on "Complaints", you can access the student complaints page where the complaints about the courses by students are shown in detail.

Website

https://oguzkaanimamoglu.github.io/Online-Course-Platform/