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CS5200 - SEC02
Database Management System
Project 16

Trainly.io

By

Sanket Mathur
Eric Ropiak
Prasad Tajane
Wei Du

Abstract

As a group, we set out to build a product which would allow students to complete training courses online. We built Trainly.io to connect students with the online resources that they need to do so.

More specifically, students had to be able to search for and enroll in classes. Once enrolled, they needed to be able to complete course materials in a specified order before a course was marked as complete. Users had to be able to create accounts and securely login. Additionally, there had to be a subset of users, faculty, who could create courses and respond to any questions regarding that course. Another subset of users, admins, needed to have the ability to approve faculty members or fellow admins.

There were primarily two large components that needed to be built out for the product to function. Firstly, we needed a database which could store large amounts of information relevant to the product. Secondly, we needed an interface that people could use to consume this data.

We chose to use a MariaDB database to hold all of the relevant data. Before writing any code, careful thought was put into the entities that would be needed to represent the system. ER and relational diagrams were constructed to display how these entities relate to each other in an organized manner. Once we agreed on the underlying representation for the system, DDL was used to create a working instance of the database, which was then filled with sample data. To ensure that our design was sound and that the database could perform the required tasks, we wrote queries to test actions like user registration, course enrollment and admin verification. Only after all of these pieces were in place did we move on to building a working user interface.

The interface that we chose to use was a Flask web application. There was a small amount of configuration that was needed to connect the application to the database, but once it was set up, we just had to pass our queries to the database and create an elegant display for the user to view the data. PyMySQL, a python library, was used to parameterize queries with user input to prevent SQL injection attacks. Bootstrap styling was used to create the display. Hashlib was used to encrypt user passwords (plus a randomly generated 4 character salt) using SHA256 before they were stored in the database.

Ultimately, we were able to produce a secured, polished system that allows users to sign up, enroll in courses, complete course materials, ask questions, and much more. We built Trainly.io, the future of the training industry!

Textual Description

Each user has a first name, a last name, a unique email address, a password, a profile picture, one or more contact phone numbers, and a contact address consisting of a street, a city, a postal code and a country. Thus, all the common attributes related to every type of user is being added into User relation whereas specific attributes are added in the specialised category Admin, Faculty.

In order to become a faculty member, a user must be approved by an administrator after registering. The date, time and the identity of the approving administrator, must be kept track of when a faculty member is approved. Similarly, to become an administrator a user must be given the role by another administrator, whose identity must be recorded, along with the time and date of the granting.

Every course has a unique course id, a name, a description, a cost, a creation date and at least one creator, who is a faculty member. Additionally, each course belongs to at least one topic (its primary topic), but may also belong to any number of secondary topics. A course consists of at least one course material, but can have any number of materials, which must be completed in a specified order.

Each course material can only be used in a single course and is identified by its order in its courses' sequence of materials. Each material has a name and must be either a downloadable file, a link, a post or a quiz. Downloadable files have a path, a size, and a type. Links have a URL and a flag indicating whether or not the URL is a video. A post contains a block of textual content, which has possibly been marked up. A quiz is comprised of a minimum passing score, and a list of quiz questions. Each quiz question has a number (unique to its quiz), text for the question, and a set of four multiple choice question answers. Each answer is represented by a letter (unique to the quiz question) and has text, feedback upon submission and an indication of whether or not it is the correct answer.

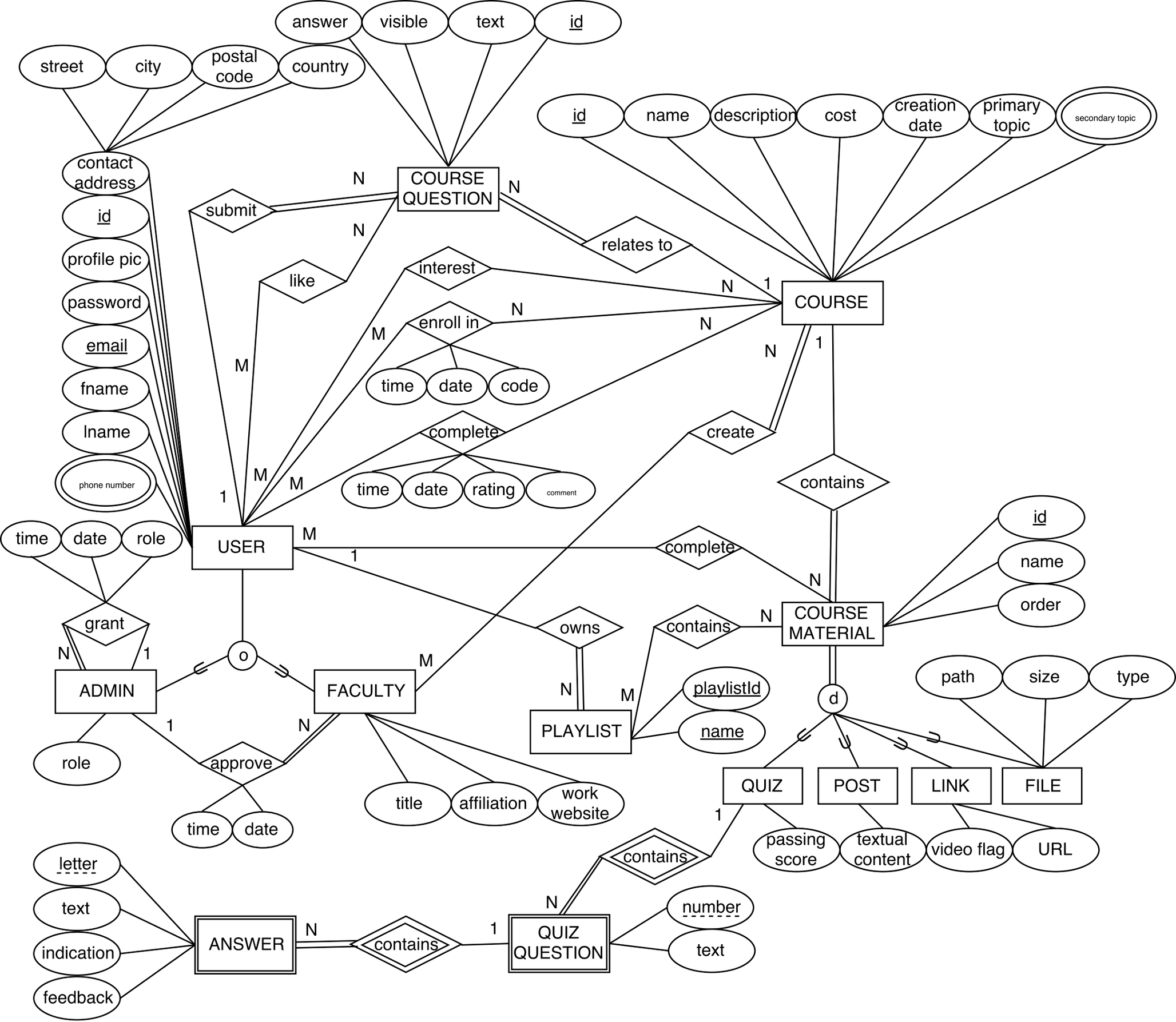
Each student has a list of courses that they are interested in. Students can also enroll in any number of courses. When they enroll in a course, the date and time of payment and the payment confirmation code must be recorded.

To complete a course, a student must complete all associated course materials in the specified order. When a course material is completed (i.e. a video is viewed, a file is downloaded, a quiz is completed, or a post is viewed), the time and date of completion must be recorded.

When a student completes a course, the date and time of completion are recorded. Additionally, if the student provides a rating (1-5 stars) or comments about the course, those also must be saved.

Students may also submit questions about courses they have enrolled in. Each question must relate to a course, and may additionally relate to one or more specific course materials. Each question is made up of a question id (which is unique within its course), the question text, along with a flag indicating whether or not the question has been made visible to all students by a faculty member. Additionally, the question may contain a textual answer, if one has been given by a faculty member. Students may like questions that they find to be useful.

A student can also create a playlist of course materials. Each playlist has a unique id, a unique name and contains an ordered list of course materials. Students can create, delete and edit playlists.


answer
visible
text
id
street
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postal code
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contact address
COURSE QUESTION
id
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description
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creation date
primary topic
secondary topic
submit
relates to
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COURSE MATERIAL
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ADMIN
FACULTY
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playlistId
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affiliation
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QUIZ
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LINK
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passing score
textual content
video flag
URL
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letter
text
indication
feedback
ANSWER
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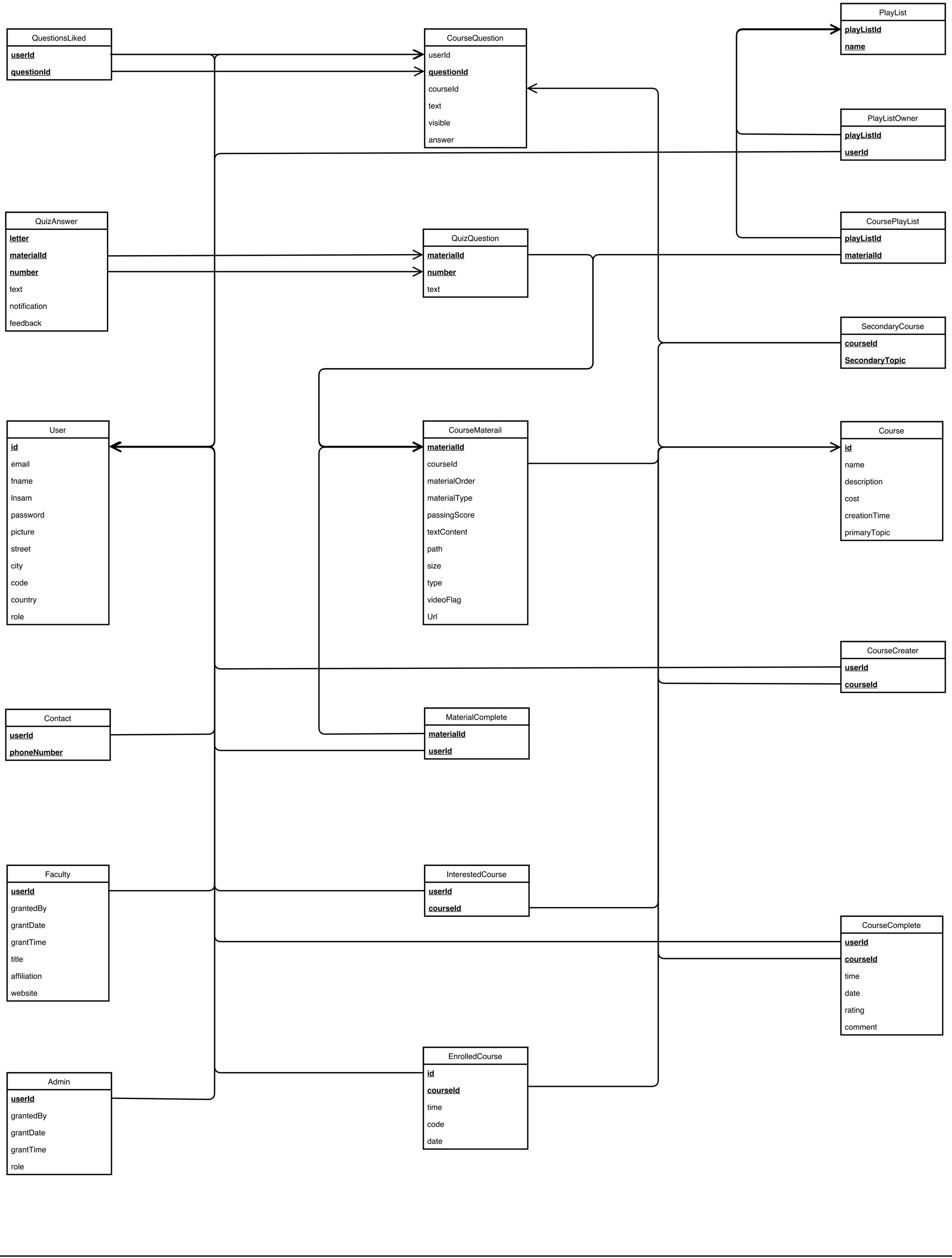
QUIZ QUESTION
number
text

As each user has some common attributes such as name, email and contact, those attributes are merged into one generalized entity ‘User’ whereas specific attributes are added in the specialized entity Admin, Faculty.
All attributes of course are added into the course entity and the materials, questions related to that course are saved into another entity course question, course material. Course material is further categorized into four specialized formats – quiz, post, link and file. Quiz has two different sections questions and answers, they are represented with two different weak entities.
Student can create playlist out of the course material and thus it is delineated in the playlist entity.


QuestionsLiked
userId
questionId
CourseQuestion
userId
questionId
courseId
text
visible
answer
PlayList
playListId
name
PlayListOwner
playListId
userId
QuizAnswer
letter
materialId
number
text
notification
feedback
QuizQuestion
materialId
number
text
CoursePlayList
playListId
materialId
SecondaryCourse
courseId
SecondaryTopic
User
id
email
fname
lnsam
password
picture
street
city
code
country
role
CourseMaterail
materialId
courseId
materialOrder
materialType
passingScore
textContent
path
size
type
videoFlag
Url
Course
id
name
description
cost
creationTime
primaryTopic
CourseCreater
userId
courseId
Contact
userId
phoneNumber
MaterialComplete
materialId
userId
Faculty
userId
grantedBy
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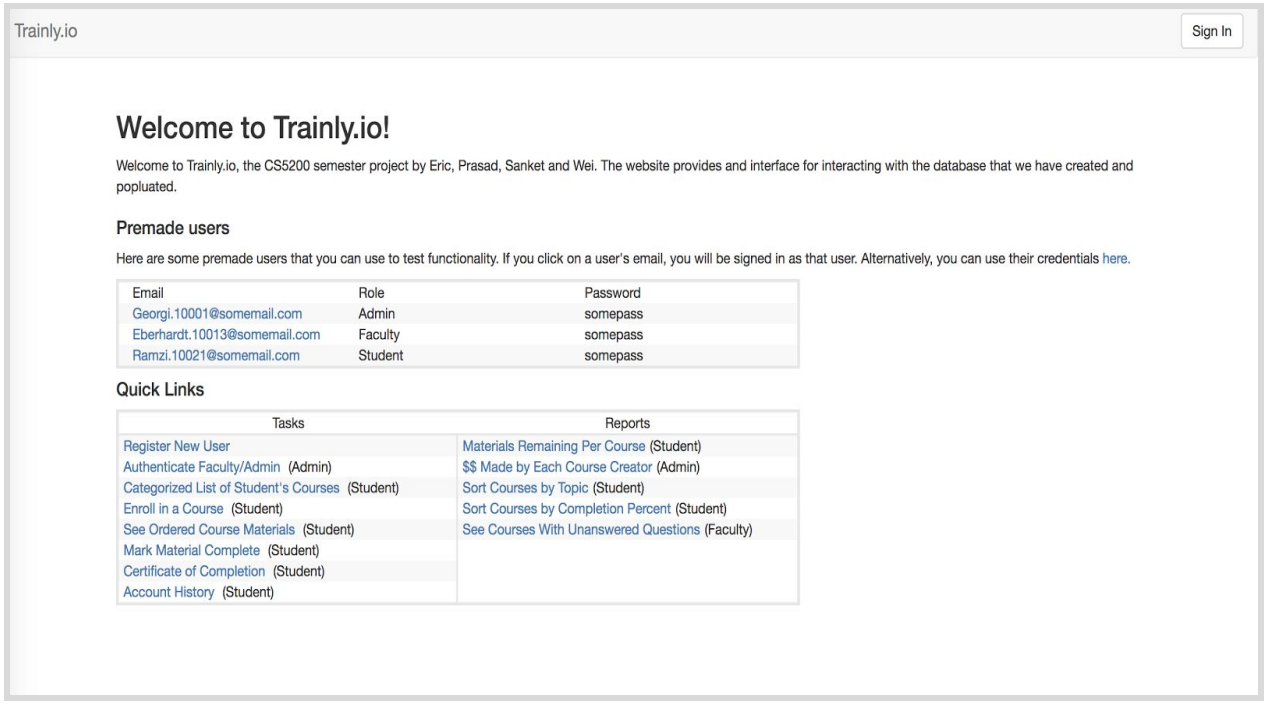
grantTime
title
affiliation
website
InterestedCourse
userId
courseId
CourseComplete
userId
courseId
time
date
rating
comment
Admin
userId
grantedBy
grantDate
grantTime
role
EnrolledCourse
id
courseId
time
code
date

Physical Design :

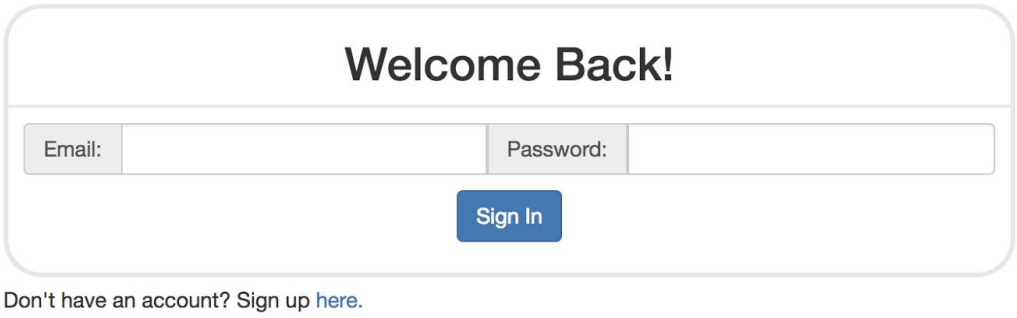
Tables have been created for each of the entities and many to many relationships.
Apart from that as system is not doing any heavy calculations and the data is small there is no need to work on query optimization and thus, we do not have any index in our system so far. However, depending on the profiling and DBMS query explain we can add index or work on physical and design tuning in future if problem arises.
The system has 2 before insert triggers on table faculty and administrator. This is done in order satisfy the constraint that the fields access granted date and time is not left blank and updated with proper time stamp. So whenever a user is given faculty or admin access, an entry is inserted in the appropriate table and the trigger automatically puts the timestamp in those records.

Screenshots of the running system:

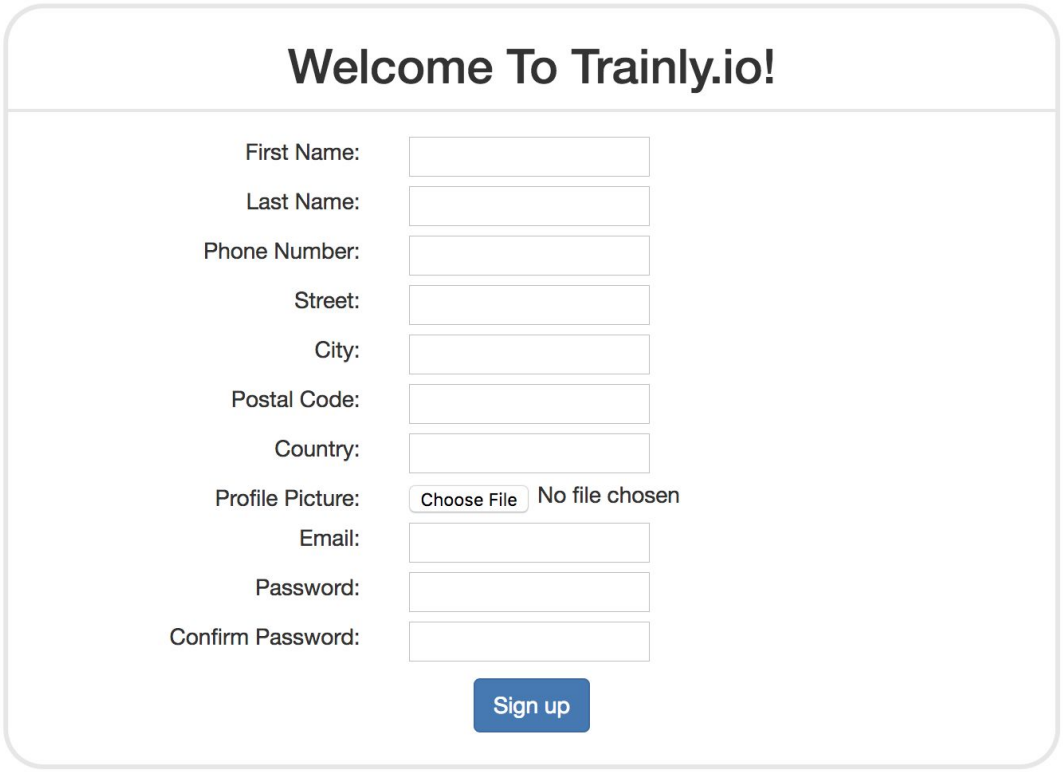
1. Landing page of the system. We have tried to make it informative. It has 3 users shown under the Premade users block which can be used for testing. All the 3 users have different roles.
   Overall in the database there are 30 users, segregated as:
   10001-10010 : Admin
   10011-10020 : Faculty
   10021-10030 : Student
   Using the Sign In button in the top right corner, a user can login into the system.



2. Login page - a registered used can login into the system using their email as the username and password. Access to different functionality will be given to user based upon their roles.
   Use the Sign up here, link (at the bottom of the sign in block) to register for new user.

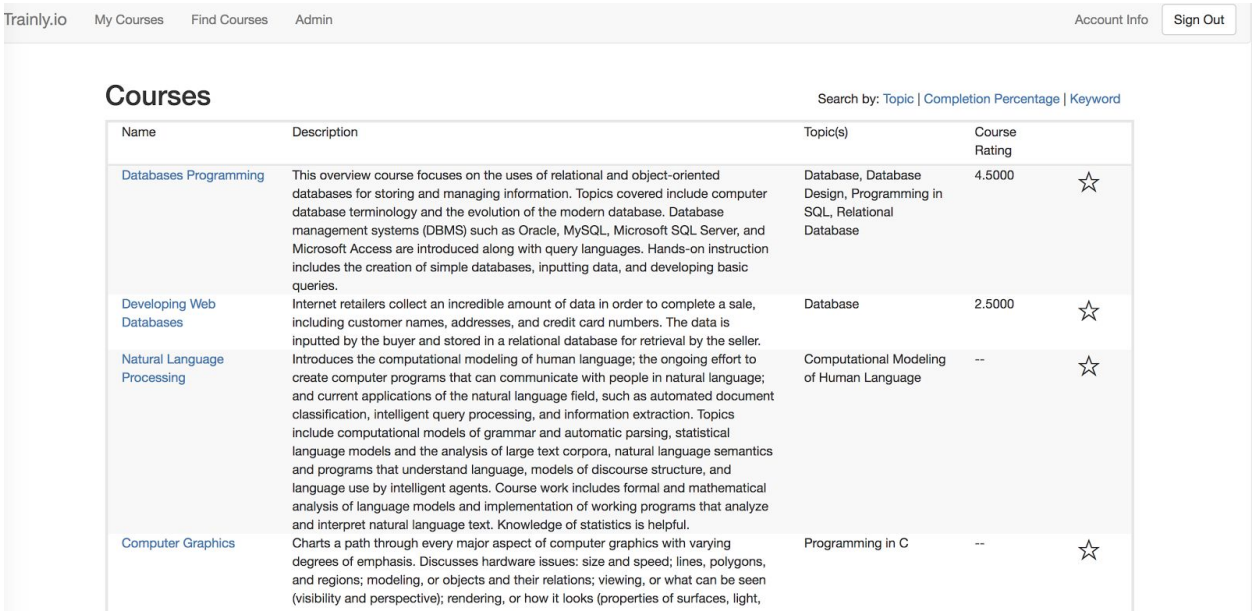


3. Sign-up page: A new user can register himself into the system. Initially every new user is a student. Admin can change the roles of any user based on the request.

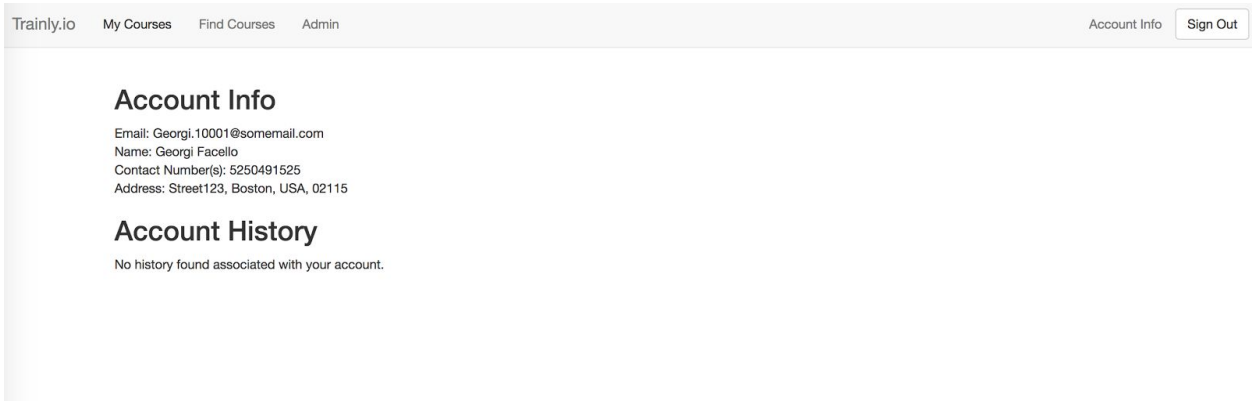


ADMIN:

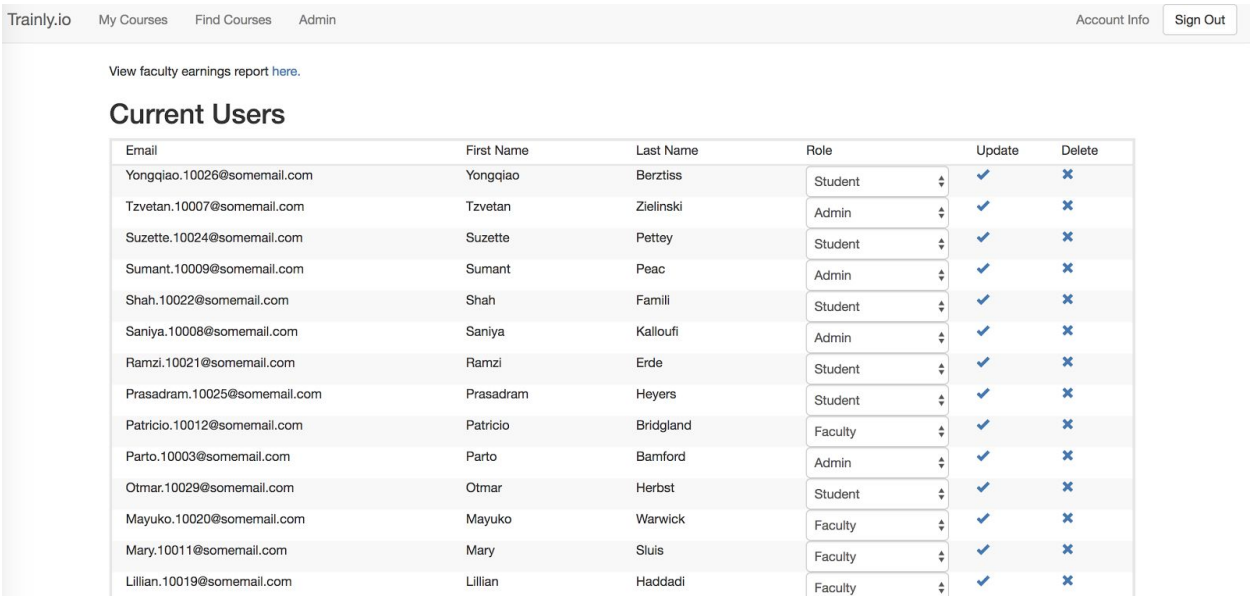
4. Once login as admin into the system, an admin can list all the courses into the system under the Find Courses link at the top.



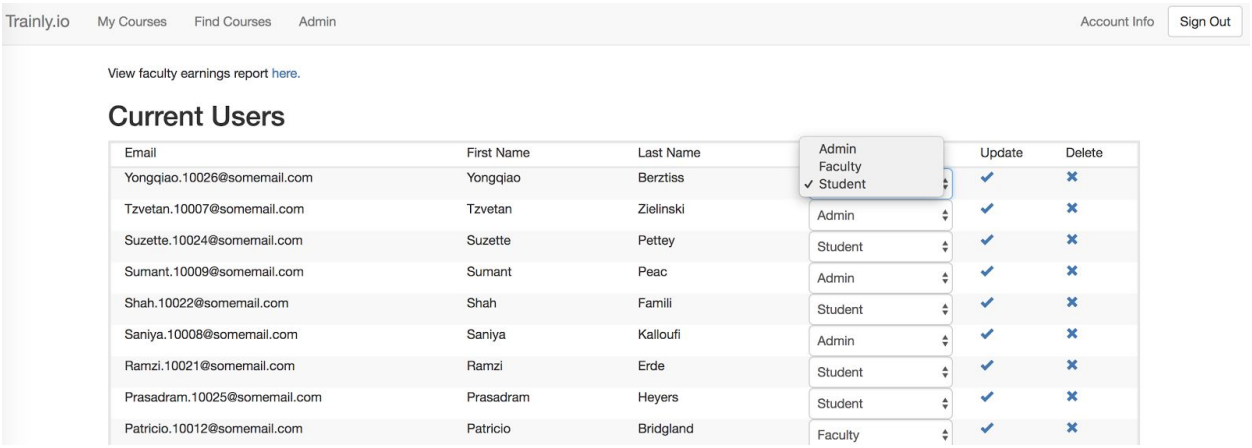
5. Admin can look at its account information under under the Account Info, found on the top right corner of the screen, beside the Sign out button.



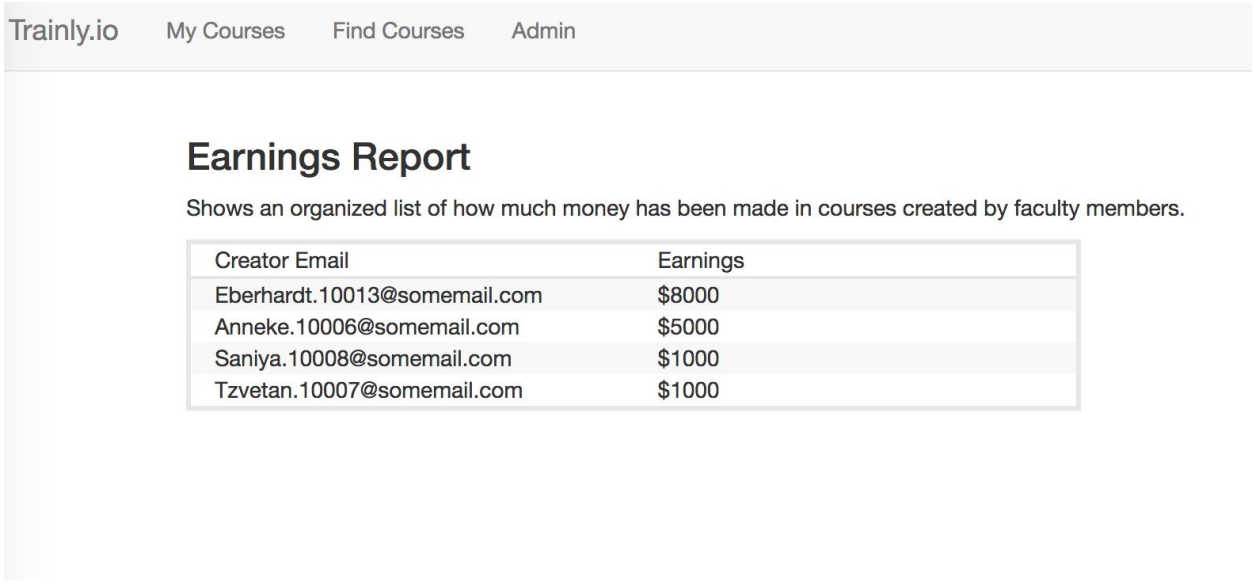
6. Admin can get the list of all the users in the system and the roles associated with them. He/She can also change the role of one or more users.



7. Admin can change the role of any user by selecting the available roles and clicking on the check mark under the Update for that corresponding user.
   Admin can also delete a user by clicking on the X sign under he Delete column.

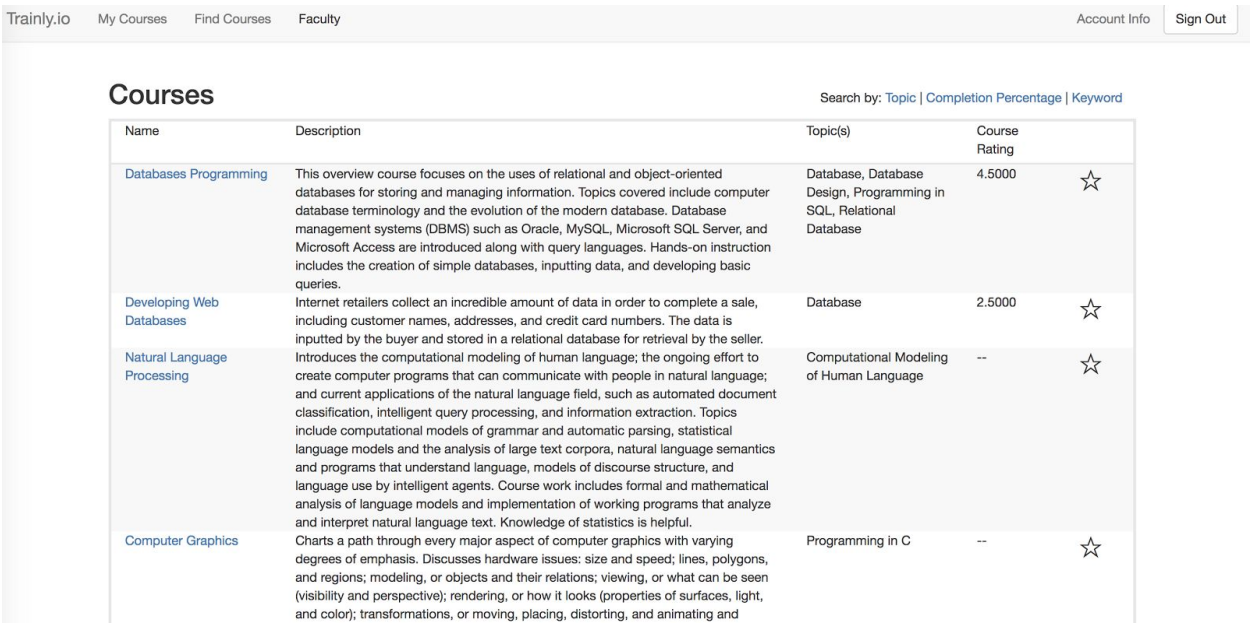


8. Admin can also look at the earnings report of a faculty by clicking on the link “View faculty earning report here”

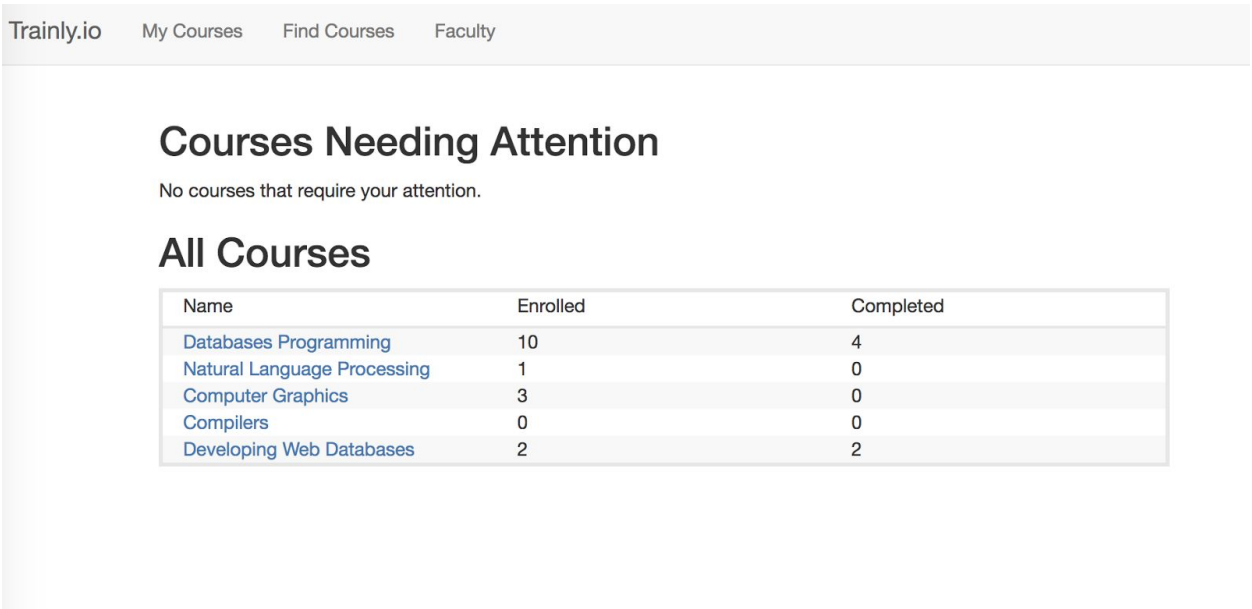


FACULTY:

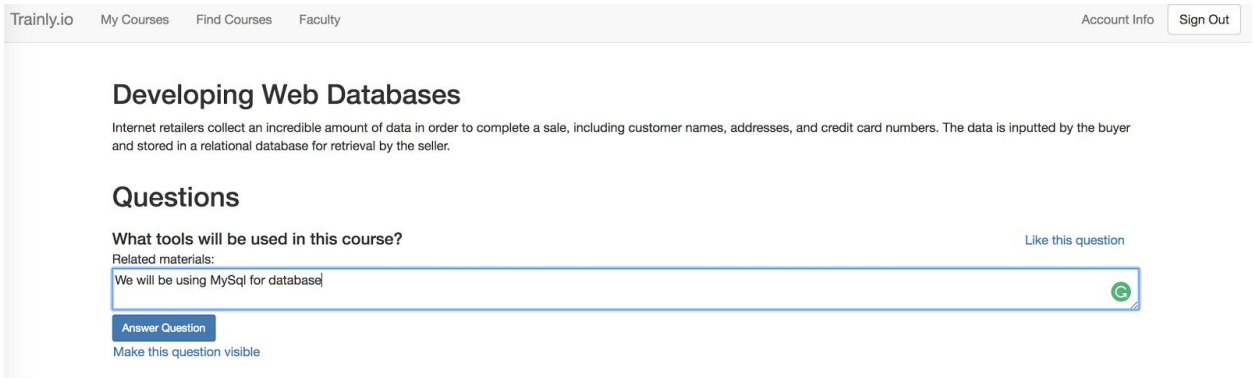
9. Faculty can get the list of courses under the Find Courses link.



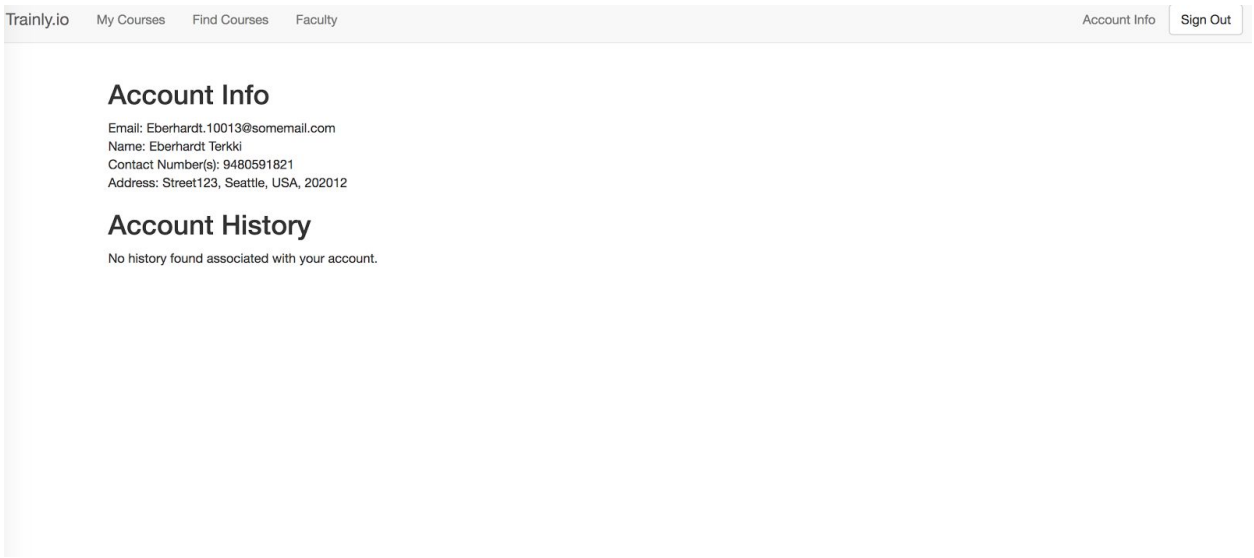
10. Under the Faculty link, a faculty can get the list of courses they need to perform some action under “Courses Needing Attention”. Also, they can see the list of other courses, together with the number of students enrolled and completed the course.



11. Faculty can answer the questions posted by the students for a course.

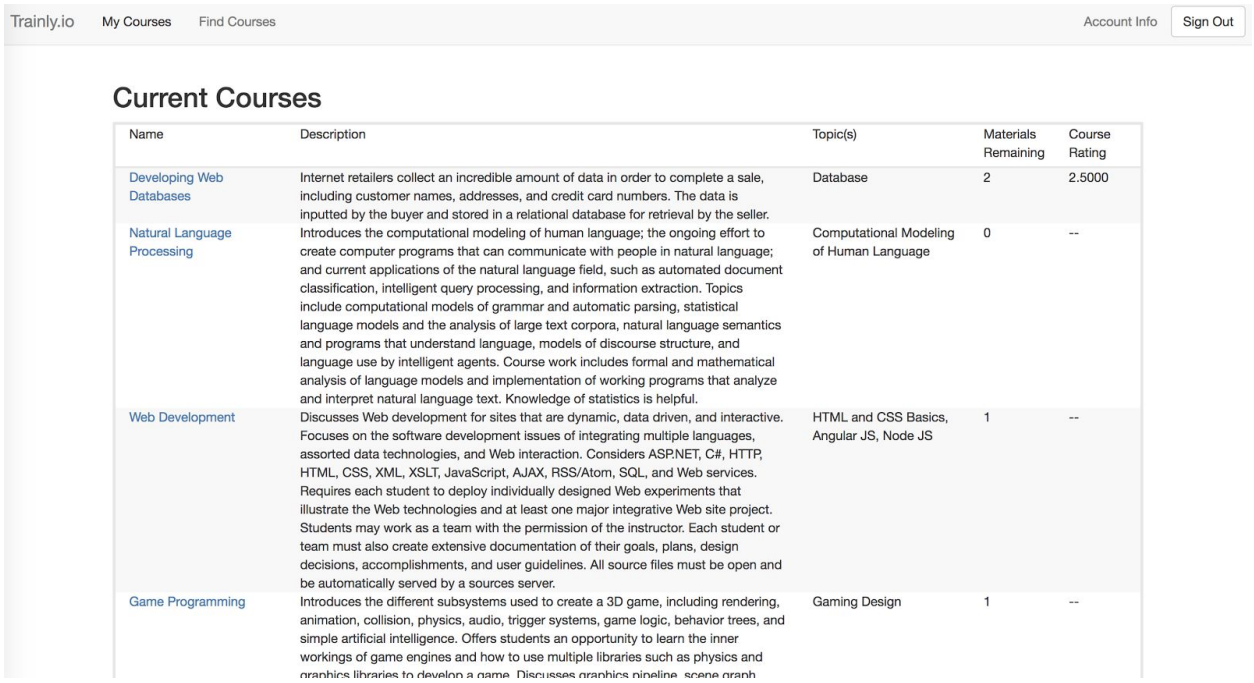


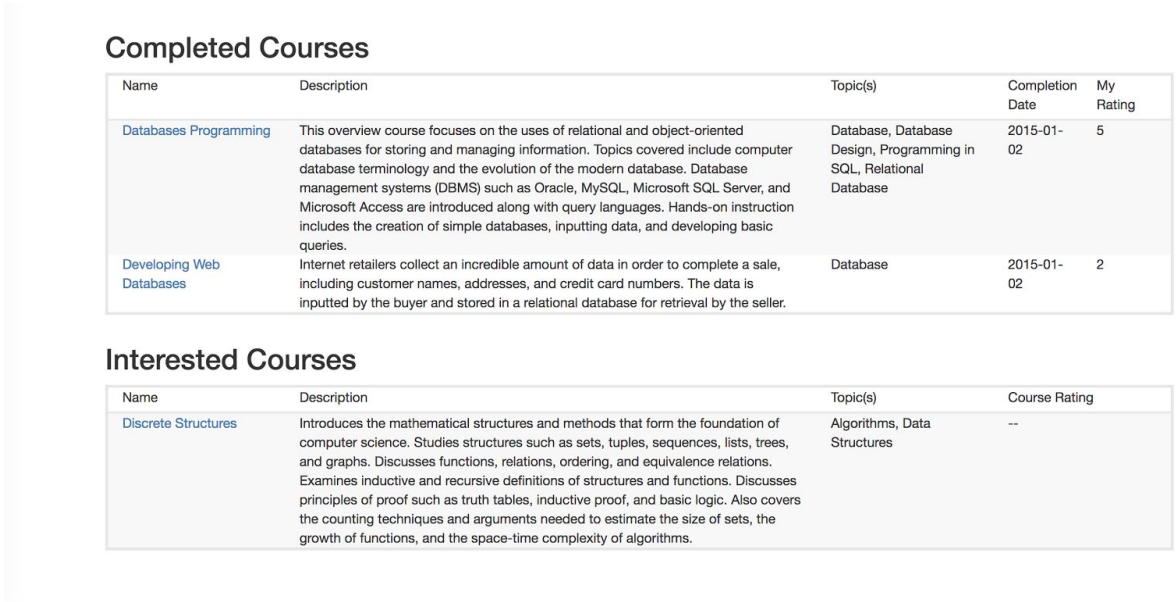
12. Faculty can also get the details about their account under the link Account Info



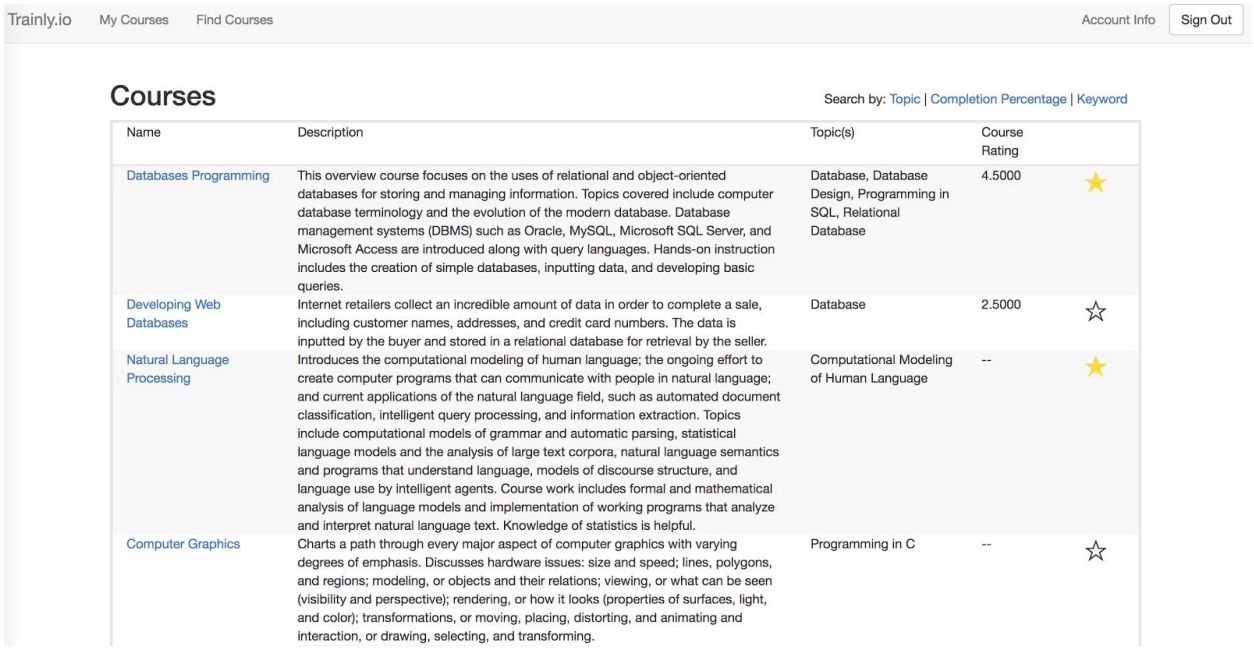
STUDENT:

13. Students can get the list of courses they are associated with under the link My Courses. Current Courses will list all the courses they are enrolled in and currently pursuing. Under the Course Completed, they can see the list of courses they have completed so far. Student can even mark some of the courses they are interested to take, and can get the list under the block Interested Courses.

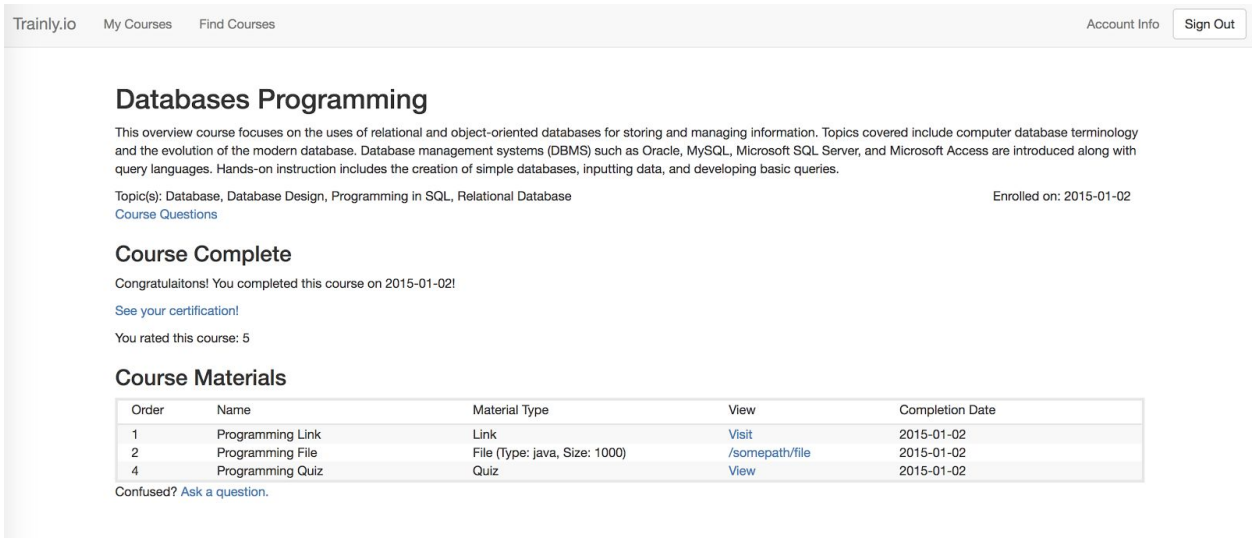




14. Student can get the list of all the courses under the link Find Courses. Course names are clickable which will take the student to the detail description page for the course.

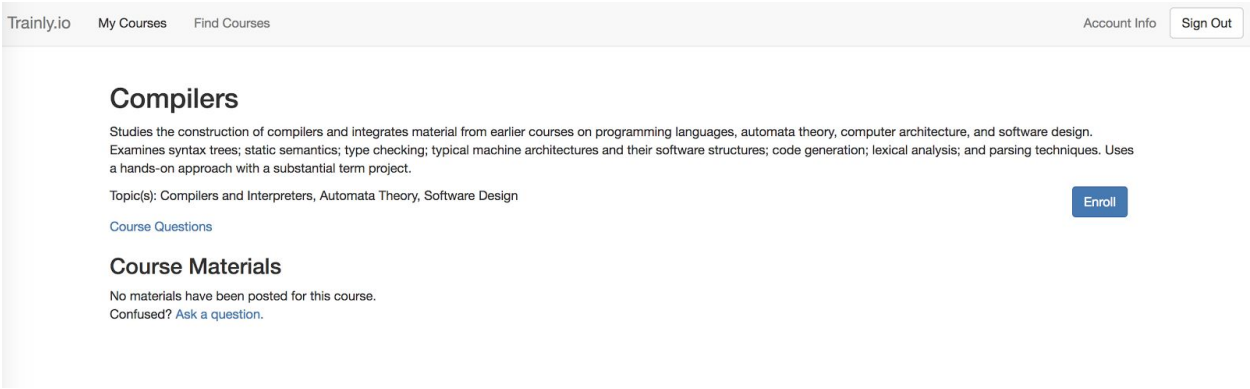


15. A detailed description page of a course, including the information whether the student has finished the course or not. A link to the certificate if the student has finished the course. What are the course materials associated with this course and a link to ask question if in doubt.

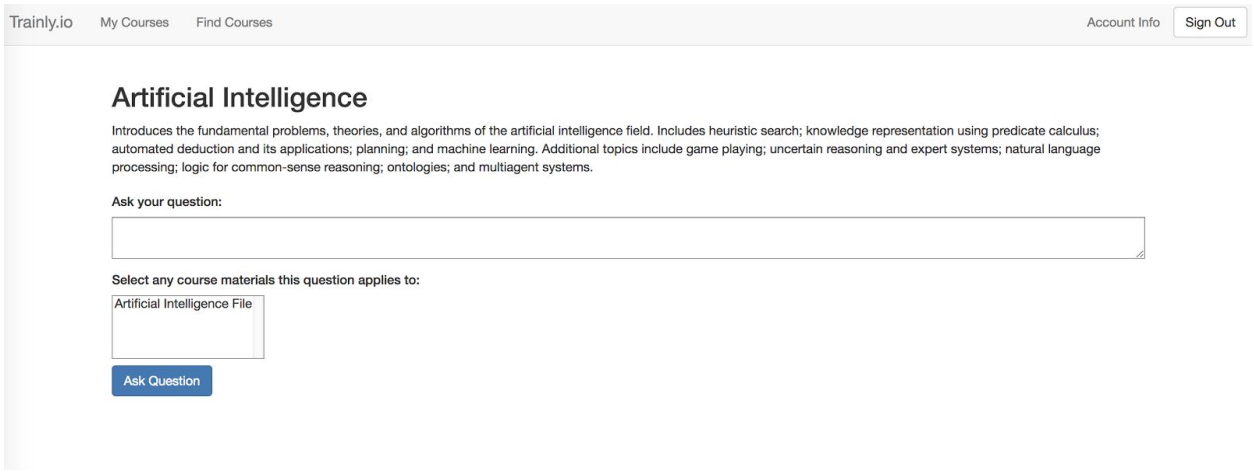


16. Certificate of course completed

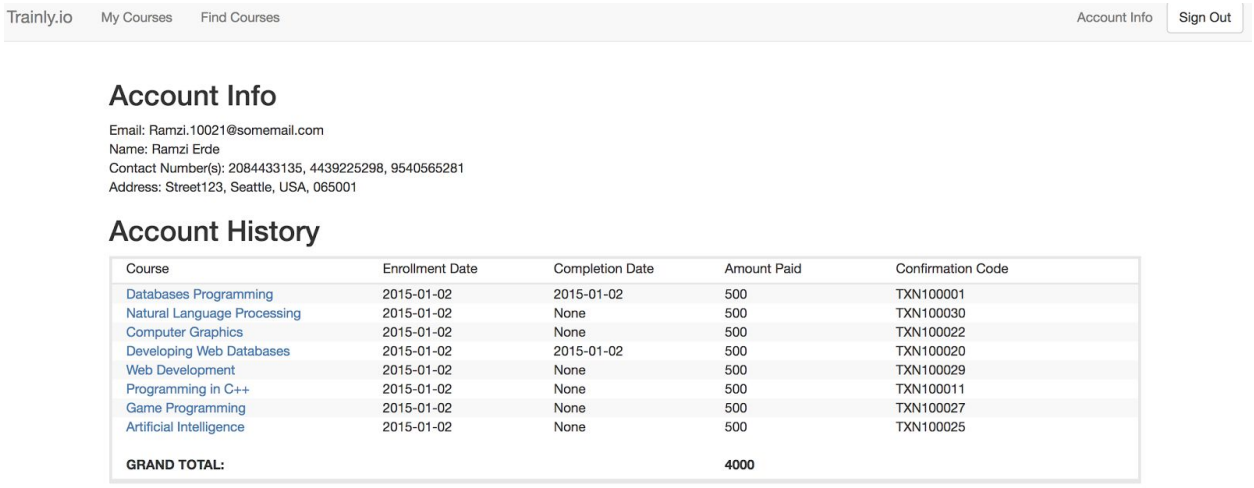
17. A course detail page of a course which student has not completed and can enroll into it by clicking on the Enroll button.



18. Student can ask question related to a course which will be answered by the faculty members.



19. Student can see their account information under the link Account Info. They can see their account history related to the course details about enrolled date, completion date, amount paid and transaction id.



Project Retrospective:

The project start from the very beginning of any real time project by designing a database system from the description of a system. The database design must be good to make a perfect working system. This project has given us a proper understanding and knowledge of database design and structure together with development of ER model and physical design of the system.

There is no point which we can mark as easiest or hardest for the project but we have put majority of out effort in building a good and detailed ER diagram and to make sure that the physical design is in 3NF form.

Additionally, working in team helped a lot in completing this project on time and in the best possible way. Every large scale project has a team associated with it which and the contribution of every team member led to its success. In this project every team member has contributed their knowledge of database systems to make it a better product.

Conclusion:

We have built a training system to train a student in the courses available in Trainly.io. Student can register himself, enroll in a course, ask a question about a course or like other students questions and take quizzes to check its progress. A faculty manages courses, decide the course content and answer the students' questions regarding a course. To manage all of those things there will be some administrators who are responsible for managing the details of the users.

Overall, we have successfully developed an interactive and polished training system convenient for students to learn and interact with faculty members in the best possible way.

Since almost all of this has been covered, in future we can add a payment portal for the students to pay the fee for the enrolled courses and an on demand live chat or video room for the students to communicate with the faculty members.