Chapter 5

System & Database Design

System Design

Systems design is the process of defining elements of a system like modules, architecture, components and their interfaces and data for a system based on the specified requirements. It is the process of defining, developing and designing systems which satisfies the specific needs and requirements of a business or organization.

A systemic approach is required for a coherent and well-running system. Bottom-Up or Top-Down approach is required to take into account all related variables of the system. A designer uses the modelling languages to express the information and knowledge in a structure of system that is defined by a consistent set of rules and definitions. The designs can be defined in graphical or textual modelling languages. Some of the popular examples of graphical modelling languages are:

- Unified Modelling Language
- Flowchart etc.

Unified Modelling Language

UML stands for Unified Modeling Language. It's a rich language to model software solutions, application structures, system behavior and business processes. The purpose of a use case diagram in UML is to demonstrate the different ways that a user might interact with a system. There are two main categories i.e. Structure diagrams and Behavioral diagrams.

- Structure diagrams show the things in the modeled system. In a more technical term, they show different objects in a system.
- Behavioral diagrams show what should happen in a system. They describe how the objects interact with each other to create a functioning system.

Design methods:

Design methods are procedures, techniques, aids, or tools for designing. They offer a number of different kinds of activities that a designer might use within an overall design process.

Some popular design methods:

- Architectural design
- Logical design
- Physical design

USE CASE DIAGRAM (Lu Exam Hive)

Use case diagrams give a graphic overview of the actors involved in a system, different functions needed by those actors and how these different functions interact. It’s a great starting point for any project discussion because you can easily identify the main actors involved and the main processes of the system.

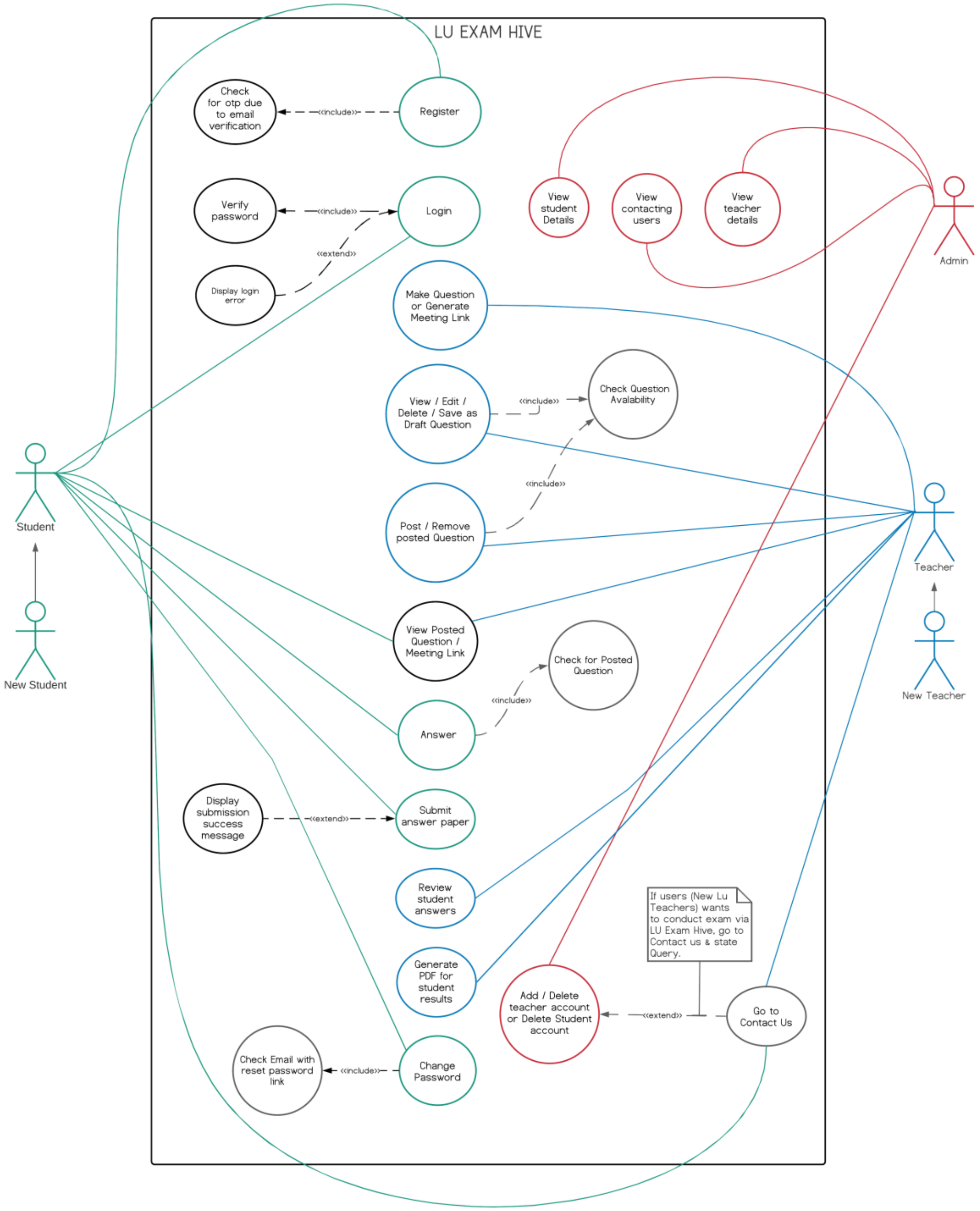

LU EXAM HIVE
Check for otp due to email verification
<<include>>
Register
Verify password
<<include>>
Login
<<extend>>
Display login error
View student Details
View contacting users
View teacher details
Admin
Make Question or Generate Meeting Link
View / Edit / Delete / Save as Draft Question
<<include>>
Check Question Avalability
<<include>>
Post / Remove posted Question
Student
New Student
Teacher
New Teacher
View Posted Question / Meeting Link
Check for Posted Question
<<include>>
Answer
Display submission success message
<<extend>>
Submit answer paper
Review student answers
If users (New Lu Teachers) wants to conduct exam via LU Exam Hive, go to Contact us & state Query.
Generate PDF for student results
Add / Delete teacher account or Delete Student account
<<extend>>
Go to Contact Us
Check Email with reset password link
<<include>>
Change Password

Figure 3: Use Case Diagram for Lu Exam Hive

Activity Diagram (Lu Exam Hive)

Activity diagrams represent workflows in a graphical way. They can be used to describe the business workflow or the operational workflow of any component in a system. Sometimes activity diagrams are used as an alternative to State machine diagrams. Activity diagrams are the perfect UML solution for visualizing process flows. Activity diagrams in UML are a great solution to visualize the actions, outcomes, and flows within a specific process and the behaviors that pair with them. An activity diagram is used to create a simple overview of any process to better identify areas for improvement or model software architecture to help better understand what's going on.

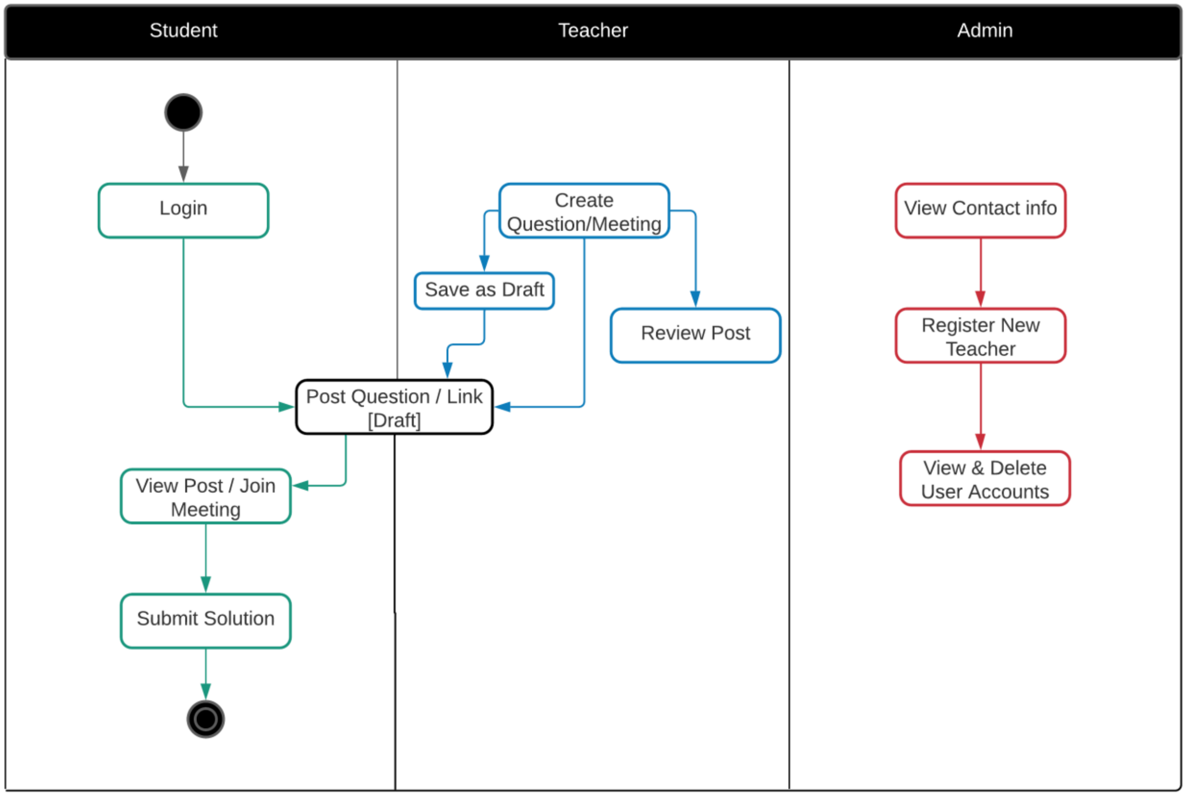


Figure 4: Activity Diagram for Lu Exam Hive

System Sequence Diagrams (Lu Exam Hive)

A system sequence diagram is a type of sequence diagram in UML. These charts show the details of events that are generated by actors from outside the system.

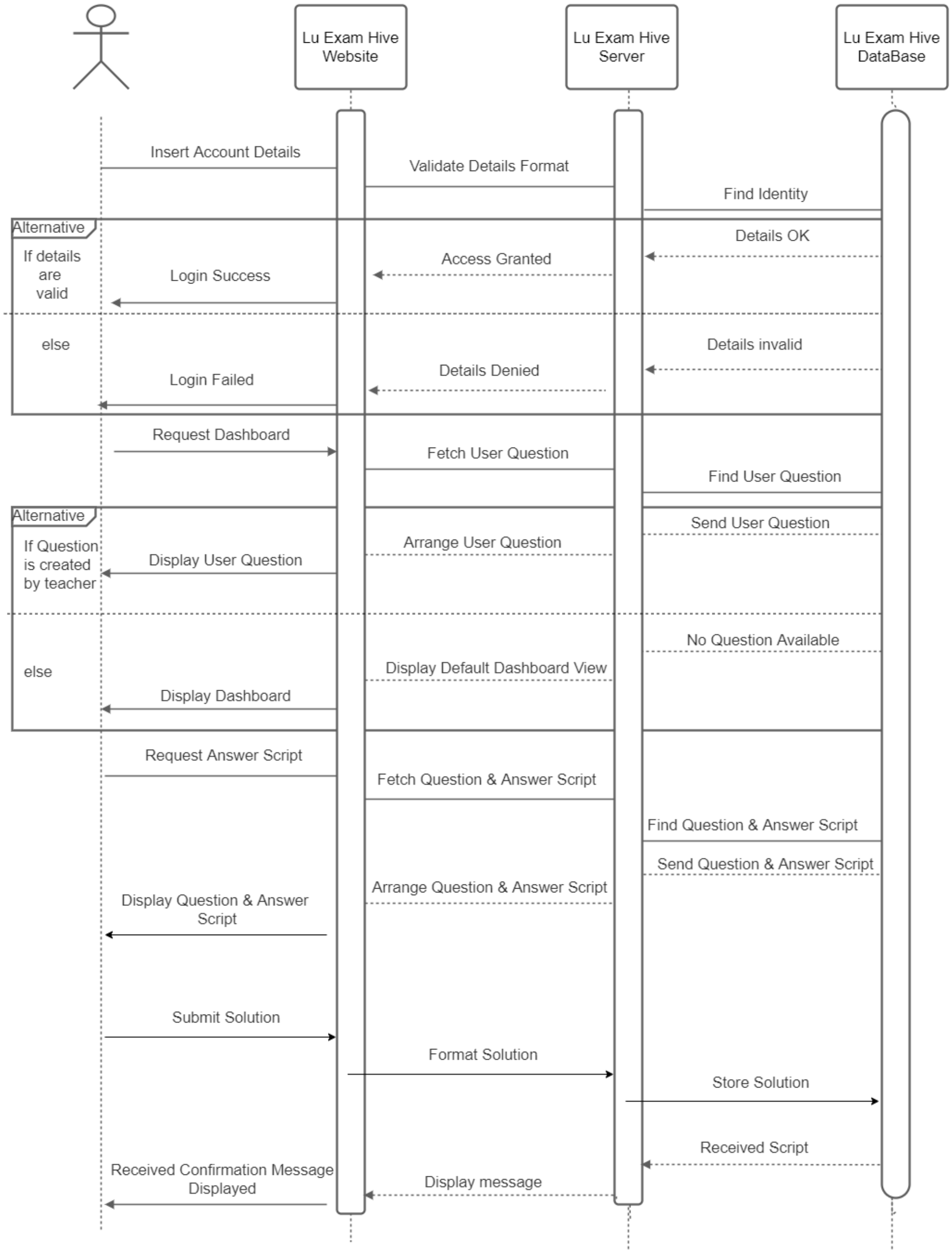


Figure 5: Sequence Diagrams for Lu Exam Hive

Class Diagram (Lu Exam Hive)

Class diagrams are the foundation for all other UML structure diagrams. Class diagrams are the main building block of any object-oriented solution. It shows the classes in a system, attributes, and operations of each class and the relationship between each class.

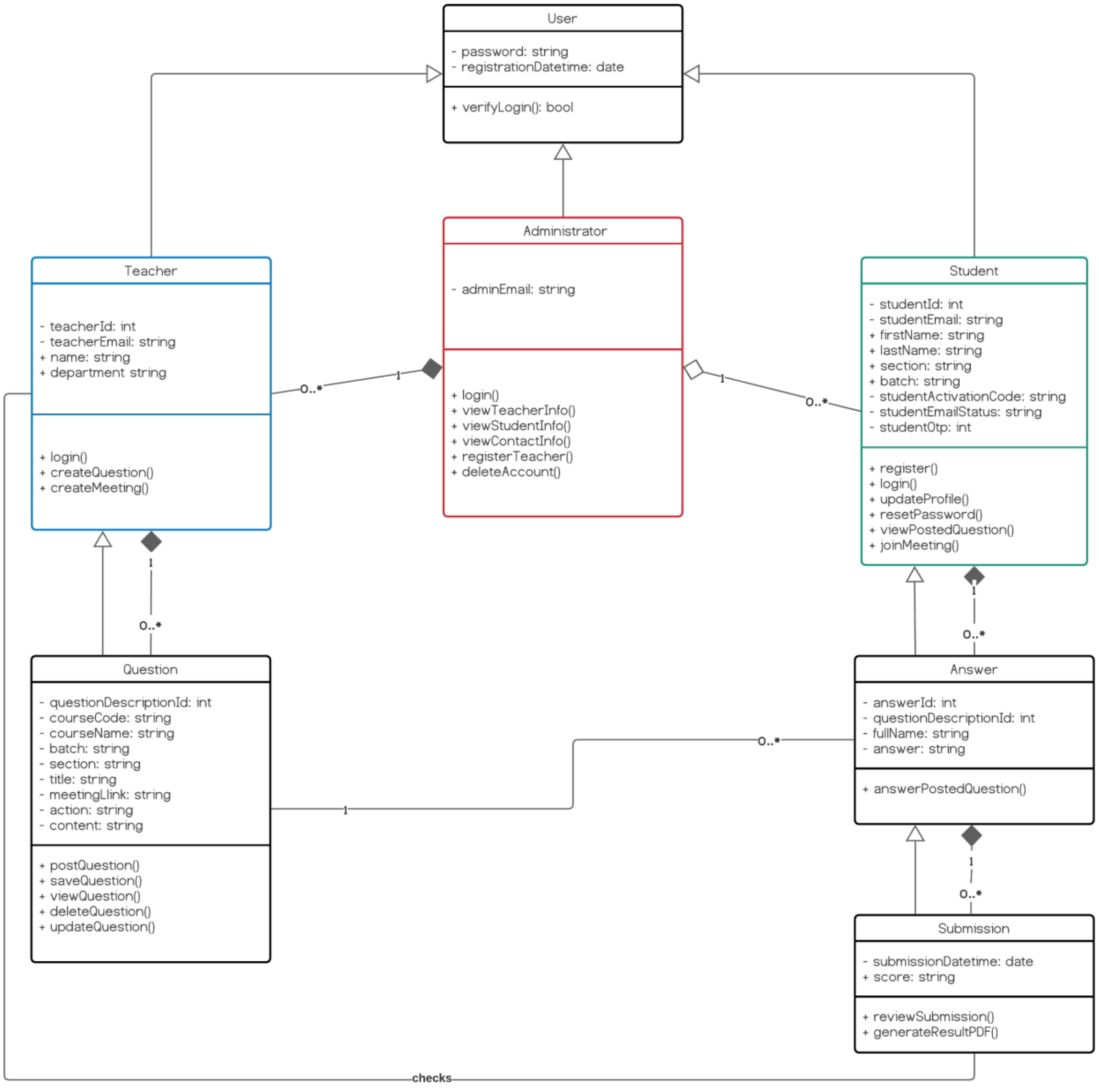


Figure 6: Class Diagram for Lu Exam Hive

Database Design

Database Design is a collection of processes that facilitate the designing, development, implementation and maintenance of enterprise data management systems. Properly designed database are easy to maintain, improves data consistency and are cost effective in terms of disk storage space. The database designer decides how the data elements correlate and what data must be stored. The main objectives of database designing are to produce logical and physical designs models of the proposed database system.

The logical model concentrates on the data requirements and the data to be stored independent of physical considerations. It does not concern itself with how the data will be stored or where it will be stored physically. The physical data design model involves translating the logical design of the database onto physical media using hardware resources and software systems such as database management systems (DBMS).

There are two types of Database Techniques:

- Normalization
- ER Modeling

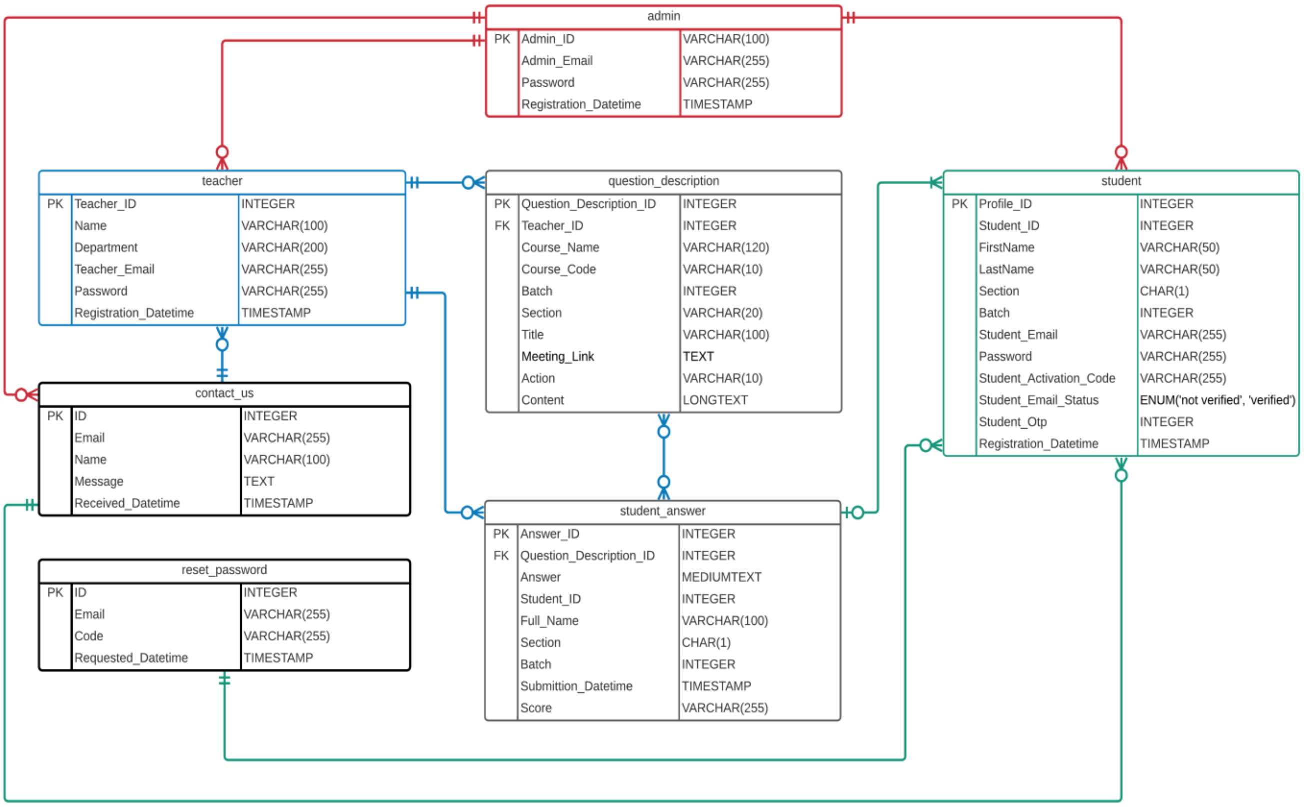
Normalization

Normalization is a database design technique that reduces data redundancy and eliminates undesirable characteristics like Insertion, Update and Deletion Anomalies. Normalization rules divides larger tables into smaller tables and links them using relationships. The purpose of Normalization in SQL is to eliminate redundant (repetitive) data and ensure data is stored logically.

ER-Diagram

An Entity Relationship (ER) Diagram is a type of flowchart that illustrates how “entities” such as people, objects or concepts relate to each other within a system. ER Diagrams are most often used to design or debug relational databases. Also known as ERDs or ER Models, they use a defined set of symbols such as rectangles, diamonds, ovals and connecting lines to depict the interconnectedness of entities, relationships and their attributes. They mirror grammatical structure, with entities as nouns and relationships as verbs.

ER-Diagram (Lu Exam Hive)



admin

PK	Admin_ID	VARCHAR(100)
	Admin_Email	VARCHAR(255)
	Password	VARCHAR(255)
	Registration_Datetime	TIMESTAMP

teacher

PK	Teacher_ID	INTEGER
	Name	VARCHAR(100)
	Department	VARCHAR(200)
	Teacher_Email	VARCHAR(255)
	Password	VARCHAR(255)
	Registration_Datetime	TIMESTAMP

question_description

PK	Question_Description_ID	INTEGER
FK	Teacher_ID	INTEGER
	Course_Name	VARCHAR(120)
	Course_Code	VARCHAR(10)
	Batch	INTEGER
	Section	VARCHAR(20)
	Title	VARCHAR(100)
	Meeting_Link	TEXT
	Action	VARCHAR(10)
	Content	LONGTEXT

student

PK	Profile_ID	INTEGER
	Student_ID	INTEGER
	FirstName	VARCHAR(50)
	LastName	VARCHAR(50)
	Section	CHAR(1)
	Batch	INTEGER
	Student_Email	VARCHAR(255)
	Password	VARCHAR(255)
	Student_Activation_Code	VARCHAR(255)
	Student_Email_Status	ENUM('not verified', 'verified')
	Student_Otp	INTEGER
	Registration_Datetime	TIMESTAMP

contact_us

PK	ID	INTEGER
	Email	VARCHAR(255)
	Name	VARCHAR(100)
	Message	TEXT
	Received_Datetime	TIMESTAMP

student_answer

PK	Answer_ID	INTEGER
FK	Question_Description_ID	INTEGER
	Answer	MEDIUMTEXT
	Student_ID	INTEGER
	Full_Name	VARCHAR(100)
	Section	CHAR(1)
	Batch	INTEGER
	Submittion_Datetime	TIMESTAMP
	Score	VARCHAR(255)

reset_password

PK	ID	INTEGER
	Email	VARCHAR(255)
	Code	VARCHAR(255)
	Requested_Datetime	TIMESTAMP

Figure 7: ER Diagram for Lu Exam Hive