

Patuakhali Science and Technology University
Faculty of Computer Science and Engineering

CCE 224 :: Database System Sessional

Sessional Project Report

Project Title : SQL Judge
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SQL Judge

1. Introduction

An SQL learning platform that allows users to learn and practice SQL queries. It provides a set of features including user registration, problem submission, and a leaderboard. And last but not least, it has built in Blog and chatsheet.

Live URL	: http://sql-judge.sharafat.xyz/
GitHub Repo	: https://github.com/SharafatKarim/SQL-Judge

2. Objective

- To create a platform that allows users to learn and practice SQL queries in a fun and interactive way.
- To provide a set of features that will help users to learn and practice SQL queries.
- To create a platform that will help mentors and teachers to help spreading the knowledge of SQL and database management.
- To enable users to share their learnings through blogs and discussions.
- A quick way to find chatsheet and resources related to SQL and database management.

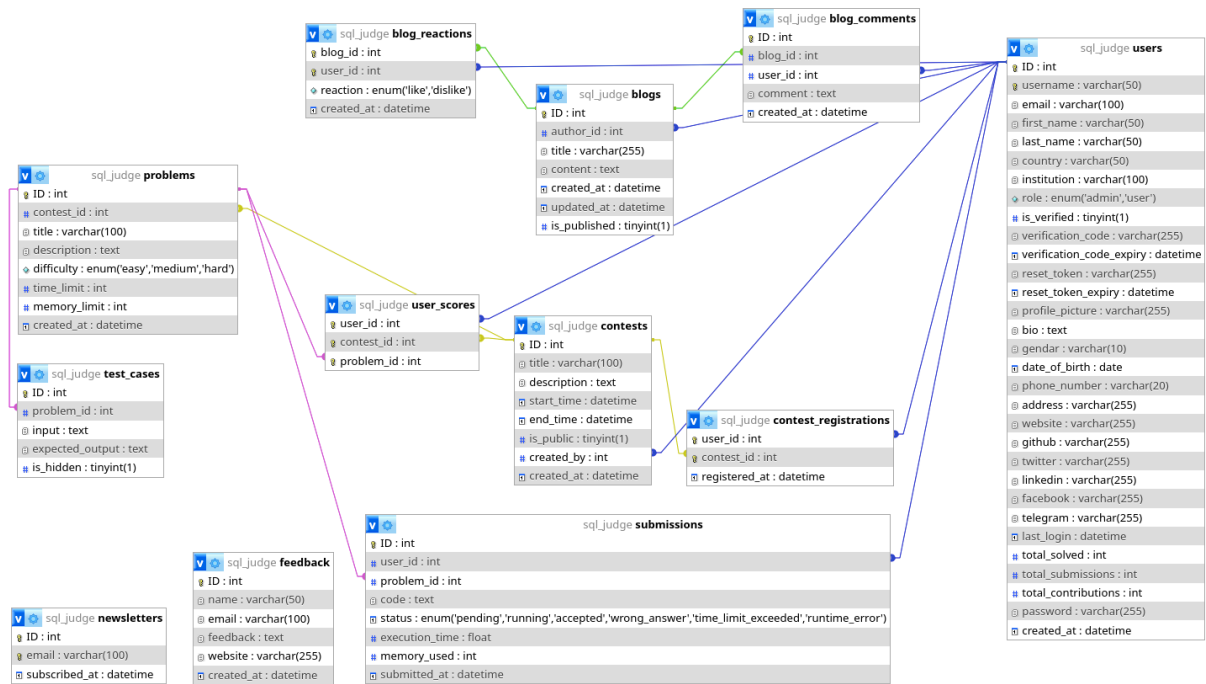
3. Technology

Layer	Technology
Frontend	HTML, CSS & JavaScript
Backend	PHP
Database	MySQL
Authentication	Session storage
Hosting	Localhost, infinityfree
Version control	Git
CI/ CD	GitHub

4. Database Characteristics

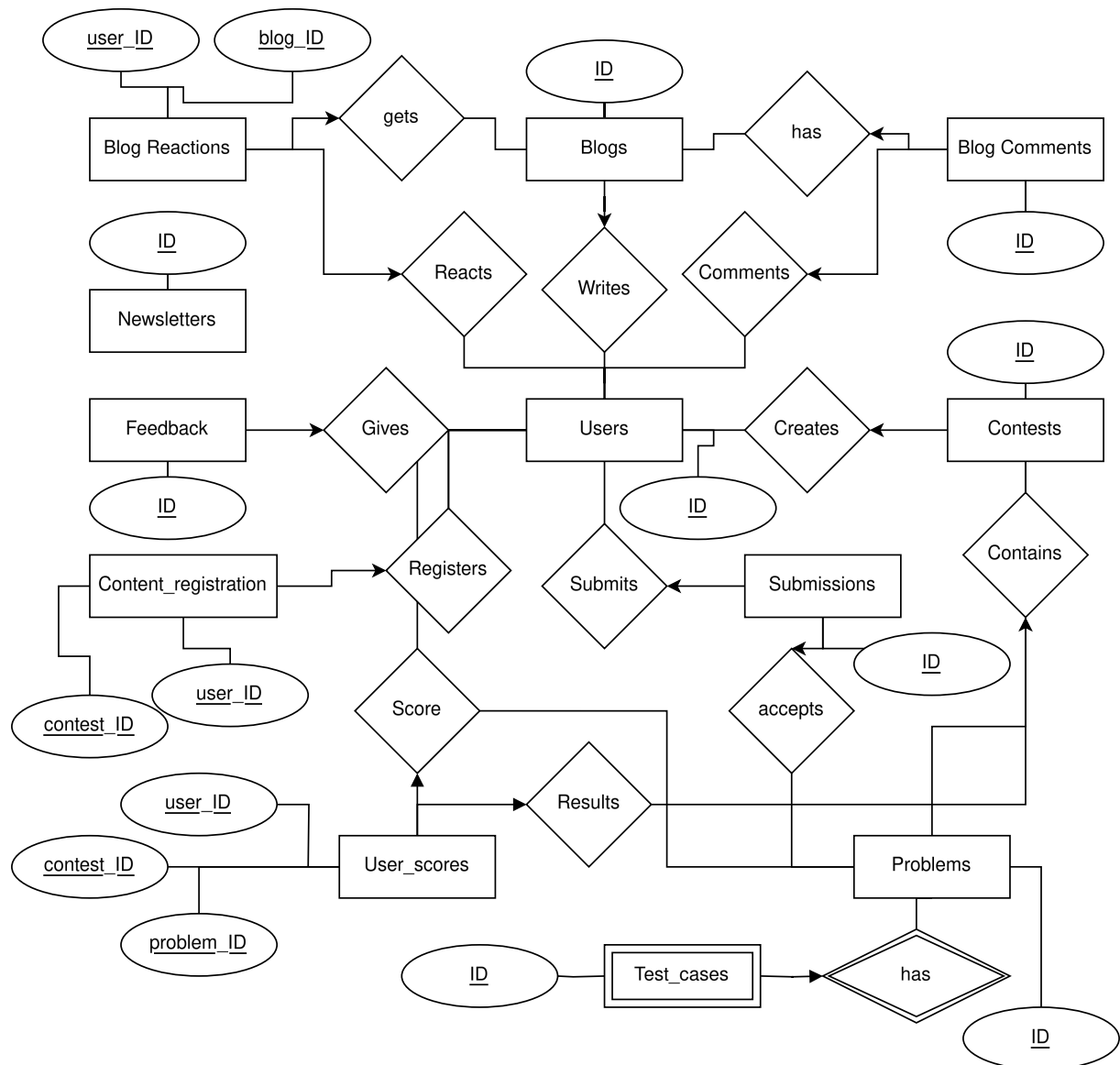
- **CRUD Operations** (Create, Read, Update, Delete) are used in the database in a centralized manner among different frontend instances.
- **Data Integrity** is Enforced through foreign keys and constraints. Also a DDL file is provided to create the database and tables alongside graphical references.
- **Normalization** is applied to reduce redundancy and save disk memory.
- **Auth Security**: Implemented through user authentication and authorization. Mainly session storage is used for user authentication.
- **Php PDO driver** is used for database interactions, so that it can also connect to other databases like PostgreSQL, SQLite, etc.
- **Parameterized arguments** were used to prevent SQL injection attacks and form validations.
- **Database triggers** were used to automatically update total_contribution, total_submission and total_solved per user.
- **Environment variables** (.env) are used to store sensitive information like database credentials, so that they are not hardcoded in the codebase. Also, a **.gitignore** file is used so that database credentials and other sensitive information are not pushed to the public GitHub repository.

4.1. Schema Diagram

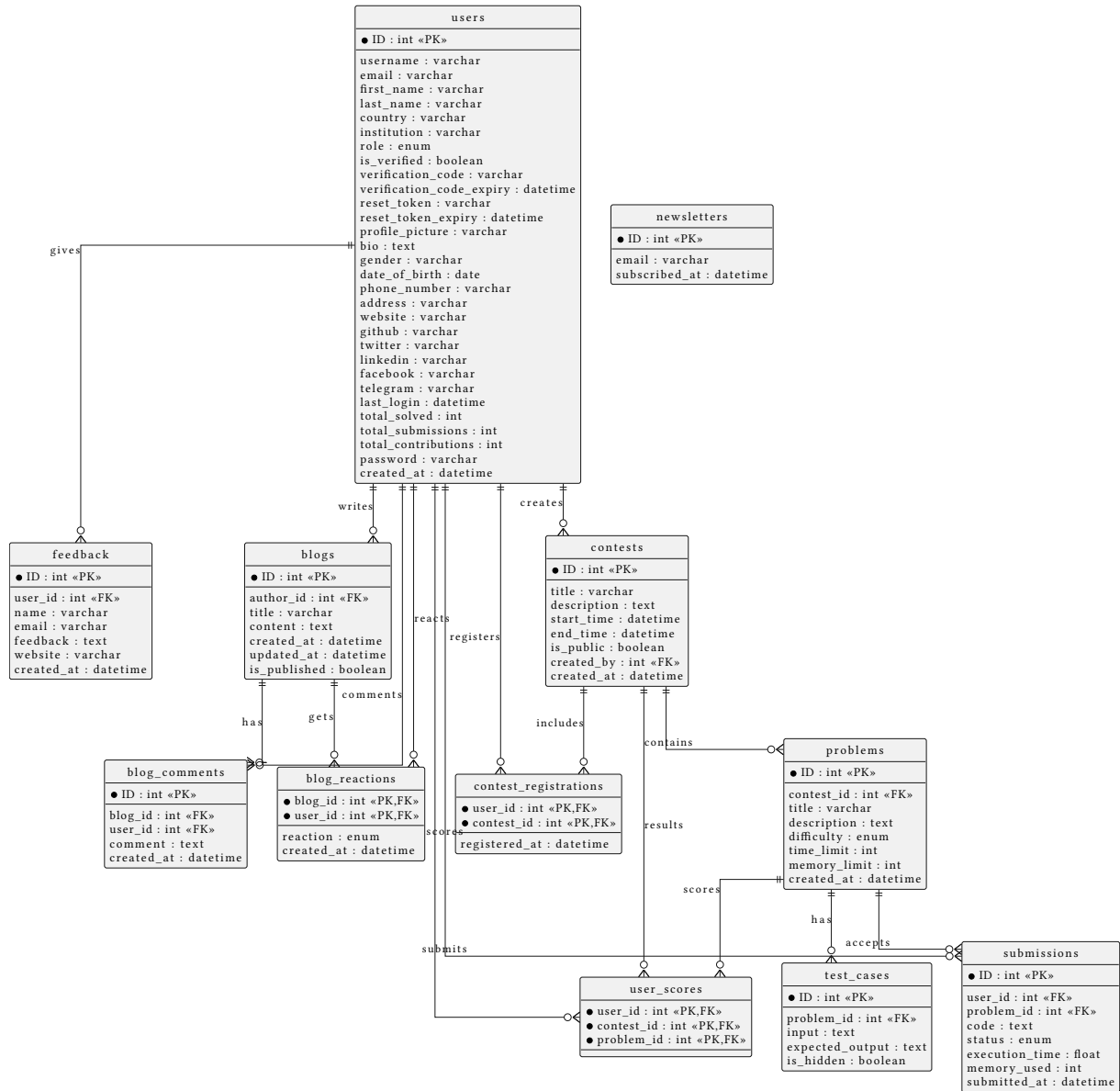


4.2. E-R Diagram

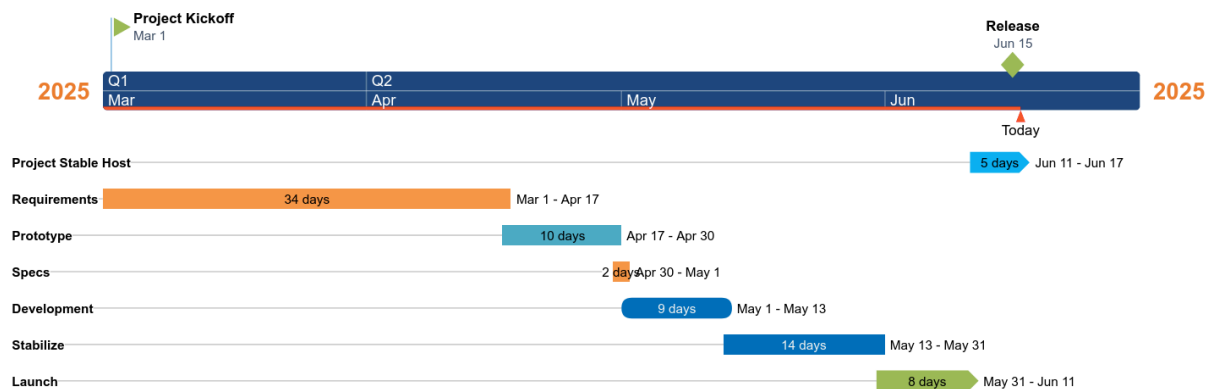
4.2.1. Without attributes



4.2.2. With all attributes



4.3. Gantt Chart



5. Database Implementation

5.1. DDL

Data definition language statements,

5.1.1. Database Creation

```
CREATE DATABASE IF NOT EXISTS sql_judge;  
USE sql_judge;
```

5.1.2. Table Creation

5.1.2.1. Users Table

```
DROP TABLE IF EXISTS users;  
CREATE TABLE users (  
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,  
    username VARCHAR(50) NOT NULL UNIQUE,  
    email VARCHAR(100) NOT NULL,  
    first_name VARCHAR(50) NOT NULL,  
    last_name VARCHAR(50) NOT NULL,  
    country VARCHAR(50),  
    institution VARCHAR(100),  
    role ENUM('admin', 'user') NOT NULL DEFAULT 'user',  
    is_verified BOOLEAN DEFAULT FALSE,  
    verification_code VARCHAR(255),  
    verification_code_expiry DATETIME,  
    reset_token VARCHAR(255),  
    reset_token_expiry DATETIME,  
    profile_picture VARCHAR(255),  
    bio TEXT,  
    gender VARCHAR(10),  
    date_of_birth DATE,  
    phone_number VARCHAR(20),  
    address VARCHAR(255),  
    website VARCHAR(255),  
    github VARCHAR(255),  
    twitter VARCHAR(255),  
    linkedin VARCHAR(255),  
    facebook VARCHAR(255),  
    telegram VARCHAR(255),  
    last_login DATETIME,  
    total_solved INT DEFAULT 0,  
    total_submissions INT DEFAULT 0,  
    total_contributions INT DEFAULT 0,  
    password VARCHAR(255) NOT NULL,  
    created_at DATETIME DEFAULT CURRENT_TIMESTAMP  
);
```

5.1.2.2. Feedback Table

```
DROP TABLE IF EXISTS feedback;  
CREATE TABLE feedback (  
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,  
    user_id INT,  
    name VARCHAR(50) NOT NULL,  
    email VARCHAR(100),  
    feedback TEXT NOT NULL,  
    website VARCHAR(255),
```

```

        created_at DATETIME DEFAULT CURRENT_TIMESTAMP,
        FOREIGN KEY (user_id) REFERENCES users(ID)
    );

```

5.1.2.3. Blogs and Comments

```

DROP TABLE IF EXISTS blogs;
CREATE TABLE blogs (
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
    author_id INT NOT NULL,
    title VARCHAR(255) NOT NULL,
    content TEXT NOT NULL, -- HTML content
    created_at DATETIME DEFAULT CURRENT_TIMESTAMP,
    updated_at DATETIME ON UPDATE CURRENT_TIMESTAMP,
    is_published BOOLEAN DEFAULT FALSE,
    FOREIGN KEY (author_id) REFERENCES users(ID)
);

```

```

DROP TABLE IF EXISTS blog_comments;
CREATE TABLE blog_comments (
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
    blog_id INT NOT NULL,
    user_id INT NOT NULL,
    comment TEXT NOT NULL,
    created_at DATETIME DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (blog_id) REFERENCES blogs(ID),
    FOREIGN KEY (user_id) REFERENCES users(ID)
);

```

```

DROP TABLE IF EXISTS blog_reactions;
CREATE TABLE blog_reactions (
    blog_id INT,
    user_id INT,
    reaction ENUM('like', 'dislike') NOT NULL,
    created_at DATETIME DEFAULT CURRENT_TIMESTAMP,
    PRIMARY KEY (blog_id, user_id),
    FOREIGN KEY (blog_id) REFERENCES blogs(ID),
    FOREIGN KEY (user_id) REFERENCES users(ID)
);

```

5.1.2.4. Newsletters Table

```

DROP TABLE IF EXISTS newsletters;
CREATE TABLE newsletters (
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
    email VARCHAR(100) NOT NULL UNIQUE,
    subscribed_at DATETIME DEFAULT CURRENT_TIMESTAMP
);

```

5.1.2.5. Contests, Problems

```

DROP TABLE IF EXISTS contests;
CREATE TABLE contests (
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
    title VARCHAR(100) NOT NULL,
    description TEXT,
    start_time DATETIME NOT NULL,
    end_time DATETIME NOT NULL,
    is_public BOOLEAN DEFAULT TRUE,

```



```

        created_by INT NOT NULL,
        created_at DATETIME DEFAULT CURRENT_TIMESTAMP,
        FOREIGN KEY (created_by) REFERENCES users(ID)
    );

DROP TABLE IF EXISTS contest_registrations;
CREATE TABLE contest_registrations (
    user_id INT NOT NULL,
    contest_id INT NOT NULL,
    registered_at DATETIME DEFAULT CURRENT_TIMESTAMP,
    PRIMARY KEY (user_id, contest_id),
    FOREIGN KEY (user_id) REFERENCES users(ID),
    FOREIGN KEY (contest_id) REFERENCES contests(ID)
);

DROP TABLE IF EXISTS problems;
CREATE TABLE problems (
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
    contest_id INT,
    title VARCHAR(100) NOT NULL,
    description TEXT NOT NULL,
    difficulty ENUM('easy', 'medium', 'hard') DEFAULT 'medium',
    time_limit INT DEFAULT 2, -- in seconds
    memory_limit INT DEFAULT 256, -- in MB
    created_at DATETIME DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (contest_id) REFERENCES contests(ID)
);

```

```

DROP TABLE IF EXISTS test_cases;
CREATE TABLE test_cases (
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
    problem_id INT NOT NULL,
    input TEXT,
    expected_output TEXT,
    is_hidden BOOLEAN DEFAULT FALSE,
    FOREIGN KEY (problem_id) REFERENCES problems(ID)
);

```

5.1.2.6. Submissions and User Scores

```

DROP TABLE IF EXISTS submissions;
CREATE TABLE submissions (
    ID INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
    user_id INT NOT NULL,
    problem_id INT NOT NULL,
    code TEXT NOT NULL,
    status ENUM('pending', 'running', 'accepted', 'wrong_answer',
'time_limit_exceeded', 'runtime_error') DEFAULT 'pending',
    execution_time FLOAT,
    memory_used INT,
    submitted_at DATETIME DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (user_id) REFERENCES users(ID),
    FOREIGN KEY (problem_id) REFERENCES problems(ID)
);

```

```

DROP TABLE IF EXISTS user_scores;
CREATE TABLE user_scores (

```

```

    user_id INT NOT NULL,
    contest_id INT NOT NULL,
    problem_id INT NOT NULL,
    PRIMARY KEY (user_id, contest_id, problem_id),
    FOREIGN KEY (user_id) REFERENCES users(ID),
    FOREIGN KEY (contest_id) REFERENCES contests(ID),
    FOREIGN KEY (problem_id) REFERENCES problems(ID)
);

```

5.1.3. Triggers

-- A trigger to increment total_contributions for the author when a new blog is published

```

DELIMITER $$
CREATE TRIGGER increment_contributions_after_insert
AFTER INSERT ON blogs
FOR EACH ROW
BEGIN
    IF NEW.is_published = TRUE THEN
        UPDATE users
        SET total_contributions = total_contributions + 5
        WHERE ID = NEW.author_id;
    END IF;
END$$
DELIMITER ;

```

-- Trigger to decrement total_contributions when a blog is updated from published to draft

```

DELIMITER $$
CREATE TRIGGER decrement_contributions_after_update_to_draft
AFTER UPDATE ON blogs
FOR EACH ROW
BEGIN
    IF OLD.is_published = TRUE AND NEW.is_published = FALSE THEN
        UPDATE users
        SET total_contributions = total_contributions - 5
        WHERE ID = NEW.author_id;
    END IF;
END$$
DELIMITER ;

```

-- Trigger to increment total_contributions when a blog is updated from draft to published

```

DELIMITER $$
CREATE TRIGGER increment_contributions_after_update_to_publish
AFTER UPDATE ON blogs
FOR EACH ROW
BEGIN
    IF OLD.is_published = FALSE AND NEW.is_published = TRUE THEN
        UPDATE users
        SET total_contributions = total_contributions + 5
        WHERE ID = NEW.author_id;
    END IF;
END$$
DELIMITER ;

```

-- Trigger to increment total_contributions by 1 when a new comment is added

```

DELIMITER $$
CREATE TRIGGER increment_contributions_after_comment
AFTER INSERT ON blog_comments
FOR EACH ROW
BEGIN
    UPDATE users
    SET total_contributions = total_contributions + 1
    WHERE ID = NEW.user_id;
END$$
DELIMITER ;

-- Trigger to increment total_submissions by 1 when a new submission is added
DELIMITER $$
CREATE TRIGGER increment_total_submissions_after_insert
AFTER INSERT ON submissions
FOR EACH ROW
BEGIN
    UPDATE users
    SET total_submissions = total_submissions + 1
    WHERE ID = NEW.user_id;
END$$
DELIMITER ;

-- Trigger to increment total_solved by 1 when a new user_scores entry is added
DELIMITER $$
CREATE TRIGGER increment_total_solved_after_user_score_insert
AFTER INSERT ON user_scores
FOR EACH ROW
BEGIN
    UPDATE users
    SET total_solved = total_solved + 1
    WHERE ID = NEW.user_id;
END$$
DELIMITER ;

```

5.1.4. Views

```

-- View to get the top 5 users based on total_solved
CREATE VIEW topRated_5 as
SELECT username, first_name, last_name, total_solved
FROM users
ORDER BY total_solved DESC LIMIT 5;

-- View to get the top 5 users based on total_contributions
CREATE VIEW topContributors_5 as
SELECT username, first_name, last_name, total_contributions
FROM users
ORDER BY total_contributions DESC LIMIT 5;

```

5.2. DML (SQL Queries)

5.2.1. Authentication

1. User Registration

```

INSERT INTO users (username, email, first_name, last_name, password, website, bio)
VALUES (:username, :email, :first_name, :last_name, :password, :website, :bio)

```

Register

Please fill this form to create an account,
and let's embark on a new adventure!

First Name: *

Last Name: *

Username: *

E-mail: *

Password: *

Confirm Password: *

Website:

Bio:

There's no end to EXPLORATION!

Already have an account? [Login here.](#)

2. User Login

```
SELECT id, username, password FROM users WHERE username = :username"
```

Login

Please fill in your credentials to login.

Username: *

Password: *

Don't have an account? [Sign up now.](#)

3. Check if user already exists

```
SELECT id FROM users WHERE username = :username"
```

Username: * This username is already taken.

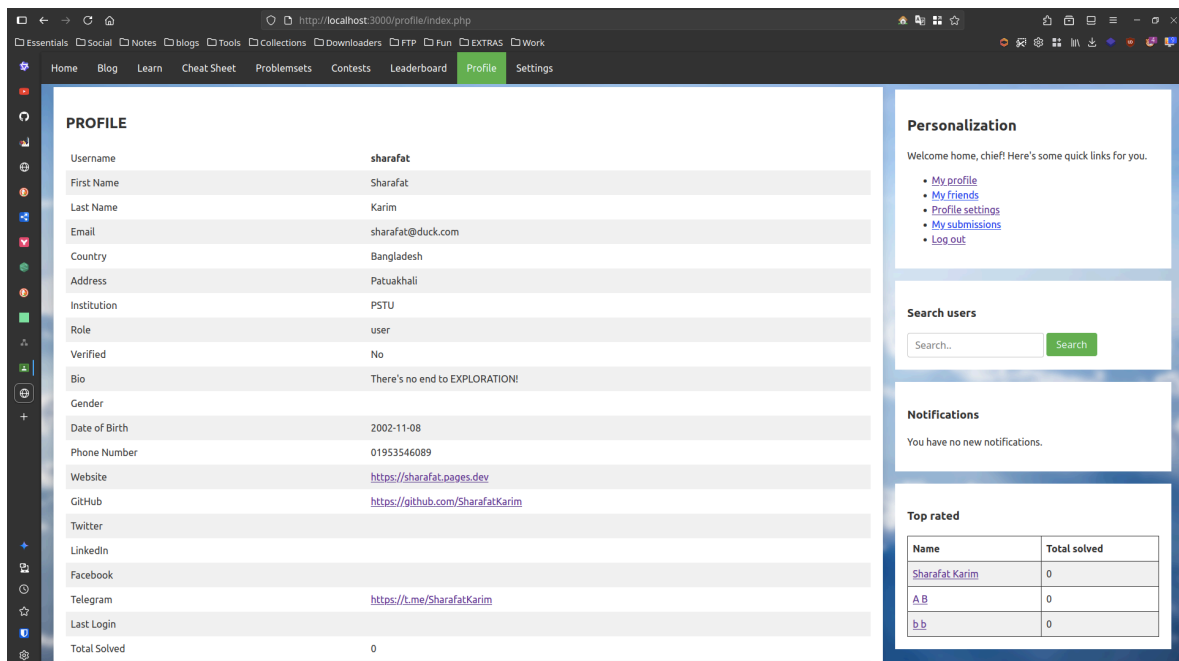
E-mail: *

5.2.2. User Profile

1. Get user profile

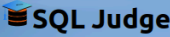
```
SELECT * FROM users WHERE username = :username
```

```
# ID, username, email, first_name, last_name, country, institution, role,
is_verified, verification_code, verification_code_expiry, reset_token,
reset_token_expiry, profile_picture, bio, gendar, date_of_birth, phone_number,
address, website, github, twitter, linkedin, facebook, telegram, last_login,
total_solved, total_submissions, total_contributions, password, created_at
1, sharafat, sharafat@duck.com, Sharafat, Karim, Bangladesh, PSTU, user,
0, , , , , There's no end to EXPLORATION!, Male, 2002-11-08, 01953546089,
Patuakhali, https://sharafat.pages.dev, https://github.com/SharafatKarim, , , ,
https://t.me/SharafatKarim, , 0, 1, 32, $2y$12$CceqDu/
Ww9T44k2SdgT5DuzeeYR2ZanlSD8rvZlA/MXcGd3iC2Gbe, 2025-04-08 06:44:18
```



2. Update user profile

```
UPDATE users SET
    first_name = :first_name,
    last_name = :last_name,
    email = :email,
    country = :country,
    address = :address,
    institution = :institution,
    bio = :bio,
    gender = :gender,
    date_of_birth = :date_of_birth,
    phone_number = :phone_number,
    website = :website,
    github = :github,
    twitter = :twitter,
    linkedin = :linkedin,
    facebook = :facebook,
    telegram = :telegram
WHERE username = :username"
```



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[Blog](#)
[Learn](#)
[Cheat Sheet](#)
[Problemsets](#)
[Contests](#)
[Leaderboard](#)
[Profile](#)
[Settings](#)

PROFILE SETTINGS

First Name	<input type="text" value="Sharafat"/>
Last Name	<input type="text" value="Karim"/>
Email	<input type="text" value="sharafat@duck.com"/>
Country	<input type="text" value="Bangladesh"/>
Address	<input type="text" value="Patuakhali"/>
Institution	<input type="text" value="PSTU"/>
Bio	<input type="text" value="There's no end to EXPLORATION!"/>
Gender	<input type="text" value="Male"/>
Date of Birth	<input type="text" value="11 / 08 / 2002"/>
Phone Number	<input type="text" value="01953546089"/>
Website	<input type="text" value="https://sharafat.pages.dev"/>
GitHub	<input type="text" value="https://github.com/Sharafa"/>
Twitter	<input type="text"/>
LinkedIn	<input type="text"/>
Facebook	<input type="text"/>
Telegram	<input type="text" value="https://t.me/SharafatKarim"/>

Update Profile

5.2.3. Blog

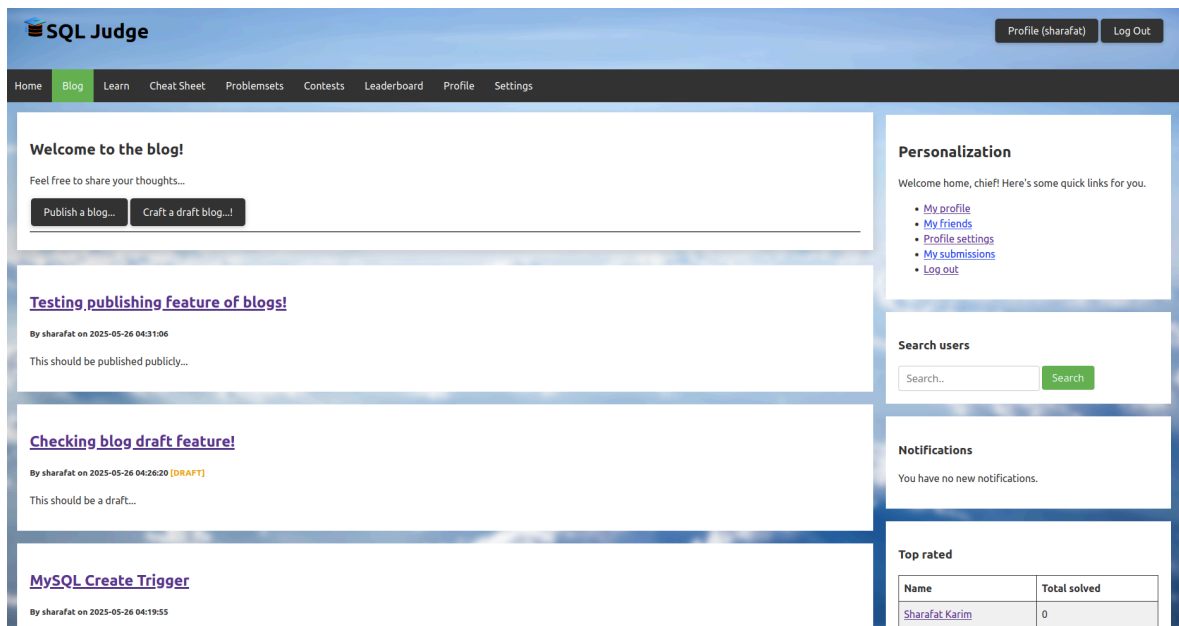
1. Get all blogs

```

SELECT blogs.ID, blogs.title, blogs.content, blogs.created_at, users.username,
blogs.is_published
FROM blogs
JOIN users ON blogs.author_id = users.ID
WHERE blogs.is_published = 1 OR blogs.author_id = 1
ORDER BY blogs.created_at DESC

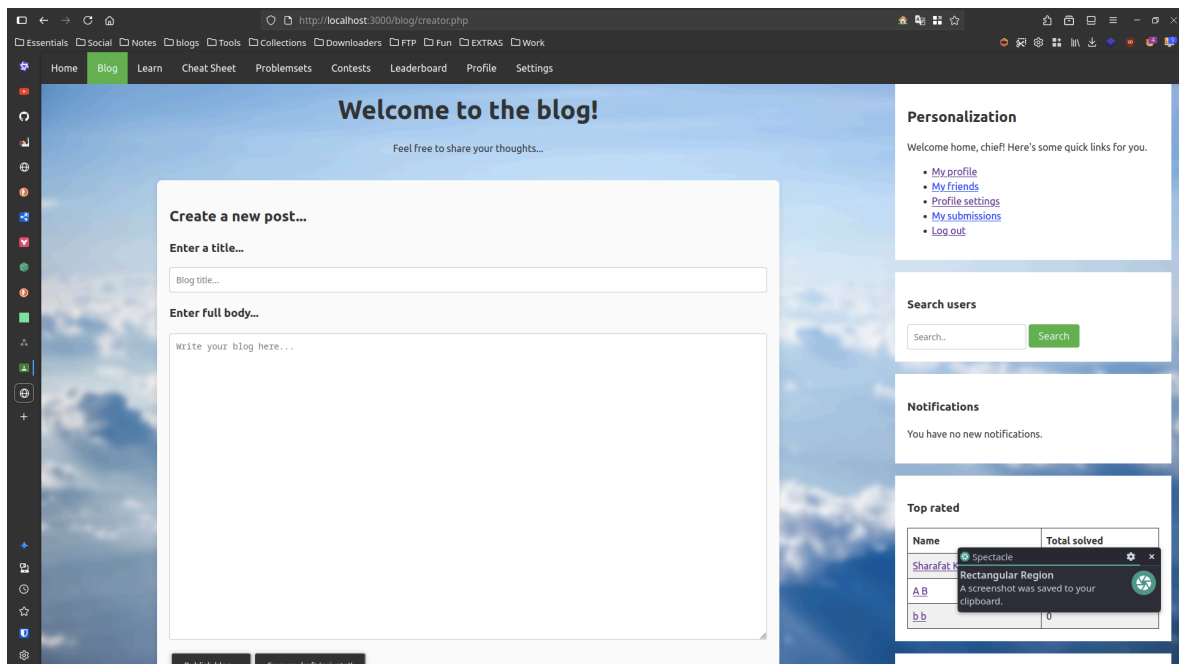
# ID, title, content, created_at, username, is_published
'9', 'Testing publishing feature of blogs!', 'This should be published
publicly...', '2025-05-26 04:31:06', 'sharafat', '1'

```



2. Insert a new data (blog)

```
INSERT INTO blogs (author_id, title, content, is_published) VALUES
(:author_id, :title, :content, :is_published)
```



3. Update a blog

```
UPDATE blogs SET
    title = :title,
    content = :content,
    is_published = :is_published
WHERE ID = :blog_id"
```

Edit your post...

Enter a title...

Enter full body...

This should be a draft...

4. Delete a blog

```
DELETE FROM blogs WHERE ID = :blog_id
```

5.2.4. Comment & React

1. Insert a new comment

```
INSERT INTO blog_comments (blog_id, user_id, comment) VALUES
(:blog_id, :user_id, :comment)
```

Comments

sharafat:

interesting!

2025-05-24 03:37:50

sharafat:

A comment with some emoji, ★
Can you really view it? 🤖

2025-05-24 03:35:27

2. Get all comments for a blog


```

SELECT blog_comments.comment, blog_comments.created_at, users.username
FROM blog_comments
JOIN users
ON blog_comments.user_id = 1
WHERE blog_comments.blog_id = 1
ORDER BY blog_comments.created_at DESC

# comment, created_at, username
'interesting!', '2025-05-24 03:37:50', 'a'

```

3. Fetch reactions

```

SELECT reaction, COUNT(*) as count
FROM blog_reactions
WHERE blog_id = 1 GROUP BY reaction

```

5.2.5. feedback

1. Insert a new feedback

```

INSERT INTO feedback (user_id, name, email, feedback, website) VALUES
(:user_id, :name, :email, :feedback, :website)

```

5.2.6. Contest

1. Get all upcoming contests

```

SELECT contests.*, users.username
FROM contests
JOIN users
ON contests.created_by = users.ID
WHERE contests.start_time > NOW()
ORDER BY contests.start_time ASC;

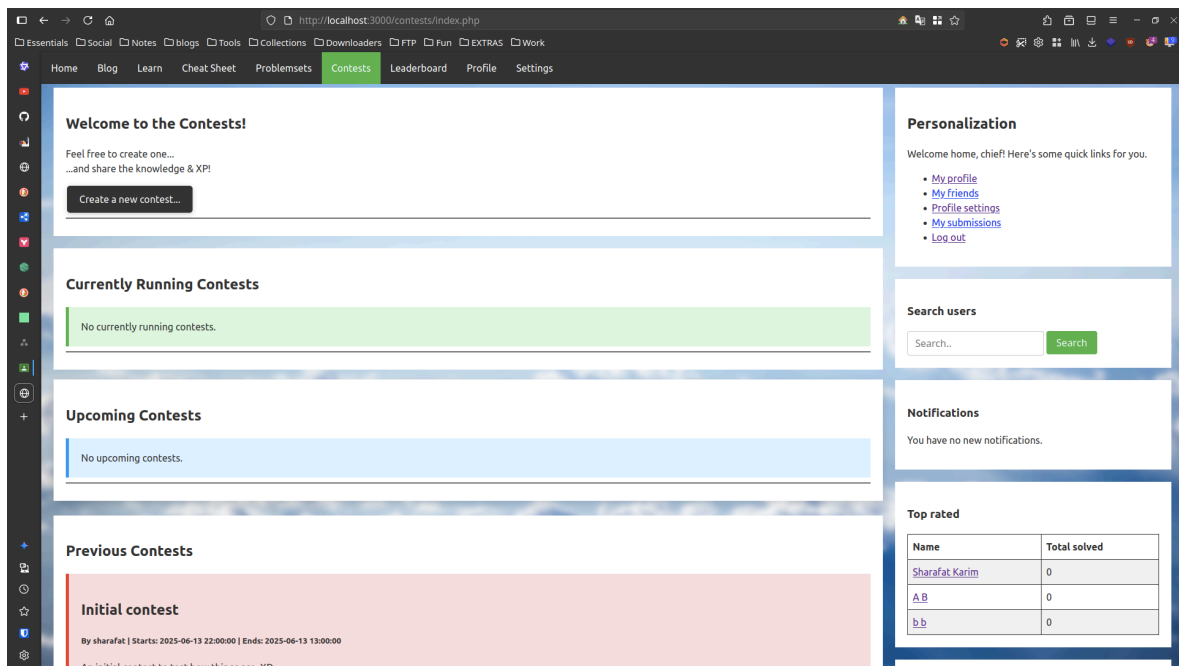
```

2. Get all ongoing contests

```

SELECT contests.*, users.username
FROM contests
JOIN users
ON contests.created_by = users.ID
WHERE contests.start_time <= NOW()
AND contests.end_time > NOW()
ORDER BY contests.start_time ASC;

```



3. Get all previous contests

```
SELECT contests.*, users.username
FROM contests
JOIN users
  ON contests.created_by = users.ID
WHERE contests.end_time <= NOW()
ORDER BY contests.start_time ASC;
```

```
# ID, title, description, start_time, end_time, is_public, created_by, created_at,
username
'3', 'A past title!', 'A title happended to be happed in the past.', '1992-06-13
00:00:00', '2000-06-21 00:00:00', '1', '1', '2025-06-13 05:03:46', 'sharafat'
'2', 'Second one...', 'A second contest!', '2025-06-13 10:00:00', '2025-06-13
11:00:00', '1', '1', '2025-06-13 04:28:17', 'sharafat'
'1', 'Initial contest', 'An initial contest to test how things are, XD',
'2025-06-13 22:00:00', '2025-06-13 13:00:00', '1', '1', '2025-06-13 04:22:07',
'sharafat'
```

4. Add new contest

```
INSERT INTO contests (title, description, start_time, end_time, is_public,
created_by)
VALUES (:title, :description, :start_time, :end_time, :is_public, :created_by)
```

Create a new contest

Contest Title

Description

Describe the contest...

Start Time

End Time

☒ Public contest

Create Contest

5. Update contest

```

UPDATE contests SET
    title = :title,
    description = :description,
    start_time = :start_time,
    end_time = :end_time,
    is_public = :is_public
WHERE ID = :contest_id"
    
```

Edit Contest

Contest Title

Description

An initial contest to test how things are, XD

Start Time

End Time

☒ Public contest

Update Contest

6. Delete contest

```

DELETE FROM contests WHERE ID = :contest_id
    
```

A past title!

By sharafat | Starts: 1992-06-13 00:00:00 | Ends: 2000-06-21 00:00:00

A title happened to be happed in the past.

[Delete Contest](#)
[Add Problemsets](#)
[Validate Answers](#)
[Back to Contests](#)

Problems

No problems added yet.

5.2.7. Problemsets

1. Add a new problem

```
INSERT INTO problems (contest_id, title, description, difficulty, time_limit,
memory_limit)
VALUES (:contest_id, :title, :description, :difficulty, :time_limit, :memory_limit)
```

Add Problem to: A past title!

Title:

Description:

Difficulty:

Time Limit (seconds):

Memory Limit (MB):

Test Cases

Input	Expected Output	Hidden?	Action
<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	Remove

[Add Test Case](#)

[Add Problem](#)

[Back to Dashboard](#)

2. Delete a problem

```
DELETE FROM problems WHERE ID = :problem_id
```

3. Get all problems from previous contests

```
SELECT problems.*, contests.title AS contest_title
FROM problems
JOIN contests
ON problems.contest_id = contests.ID
```

```
WHERE contests.end_time <= NOW()
ORDER BY contests.end_time DESC, problems.ID ASC;
```

```
# ID, contest_id, title, description, difficulty, time_limit, memory_limit,
created_at, contest_title
'2', '1', 'Bye! Bye!', 'Print the title!', 'easy', '2', '256', '2025-06-13
15:42:11', 'Initial contest'
```

Problems from Previous Contests	
Title	Contest
Bye! Bye!	Initial contest

5.2.8. Leaderboard

1. Get top 5 users based on total_solved

```
SELECT *
FROM topRated_5
```

```
# username, first_name, last_name, total_solved
'sharafat', 'Sharafat', 'Karim', '1'
'a', 'A', 'B', '0'
'b', 'b', 'b', '0'
```

Top rated	
Name	Total solved
Sharafat Karim	0
A B	0
b b	0

2. Get 50 user's rank based on total_contribution

```
SELECT first_name, last_name, username, total_contributions
FROM users
ORDER BY total_contributions DESC
LIMIT 50"
```

```
# first_name, last_name, username, total_solved
'Sharafat', 'Karim', 'sharafat', '1'
'A', 'B', 'a', '2'
'b', 'b', 'b', '0'
```

3. Get 50 user's rank based on total_submission

```
SELECT first_name, last_name, username, total_submissions
FROM users
ORDER BY total_submissions DESC
LIMIT 50
```

```
# first_name, last_name, username, total_submissions
'Sharafat', 'Karim', 'sharafat', '1'
```

```
'A', 'B', 'a', '2'  
'b', 'b', 'b', '0'
```

Most hard worker...	
Name	Total submissions
Sharafat Karim	1
A B	0
b b	0

4. Get 50 user's rank based on total_contribution

```
SELECT first_name, last_name, username, total_contributions  
FROM users  
ORDER BY total_contributions DESC  
LIMIT 50
```

```
# first_name, last_name, username, total_contributions  
'Sharafat', 'Karim', 'sharafat', '32'  
'A', 'B', 'a', '1'  
'b', 'b', 'b', '0'
```

Most contribution...	
Name	Total contributions
Sharafat Karim	32
A B	1
b b	0

5.2.9. Newsletters


1. Insert a new newsletter subscription

```
INSERT INTO newsletters (email) VALUES (:email)
```

NEWSLETTER

Become a Better SQL Enthusiast!

With the SQL Judge periodic Newsletter, you'll get practical SQL tips, discover new challenges, explore database concepts, and stay updated with the latest features and events from the SQL Judge community.



6. Limitations

- The platform is currently hosted on a free hosting service, which may have limitations on performance and uptime.
- Currently the creator of the contest has to manually review the submissions and update the user scores. This can be automated in the future.
- Markdown editor is not implemented yet, so users cannot format their blogs and comments using markdown syntax everywhere.

7. Conclusion

Finally we can conclude that, SQL Judge platform will help mentors and teachers to help spreading the knowledge of SQL and database management. It will also help students to learn and practice SQL queries in a fun and interactive way. The platform is designed to be user-friendly and easy to navigate, making it accessible to users of all skill levels.

8. References

8.1. Documentations

- <https://www.w3schools.com/html/> [**W3Schools HTML**]
- <https://www.w3schools.com/css/> [**W3Schools CSS**]
- <https://www.w3schools.com/js/> [**W3Schools JavaScript**]
- <https://www.w3schools.com/sql/> [**W3Schools SQL**]
- <https://www.php.net/manual/en/> [**PHP Manual**]
- <https://www.w3schools.com/php/default.asp> [**W3Schools PHP**]

THE END