Report for CS5200

1. Readme

Readme could be find in the repo main page, or README.md.

2. Technical Specifications

Front-end: React + Vite + Tailwindcss.

Further details refer to the package.json or can be found at my-app/package.json.

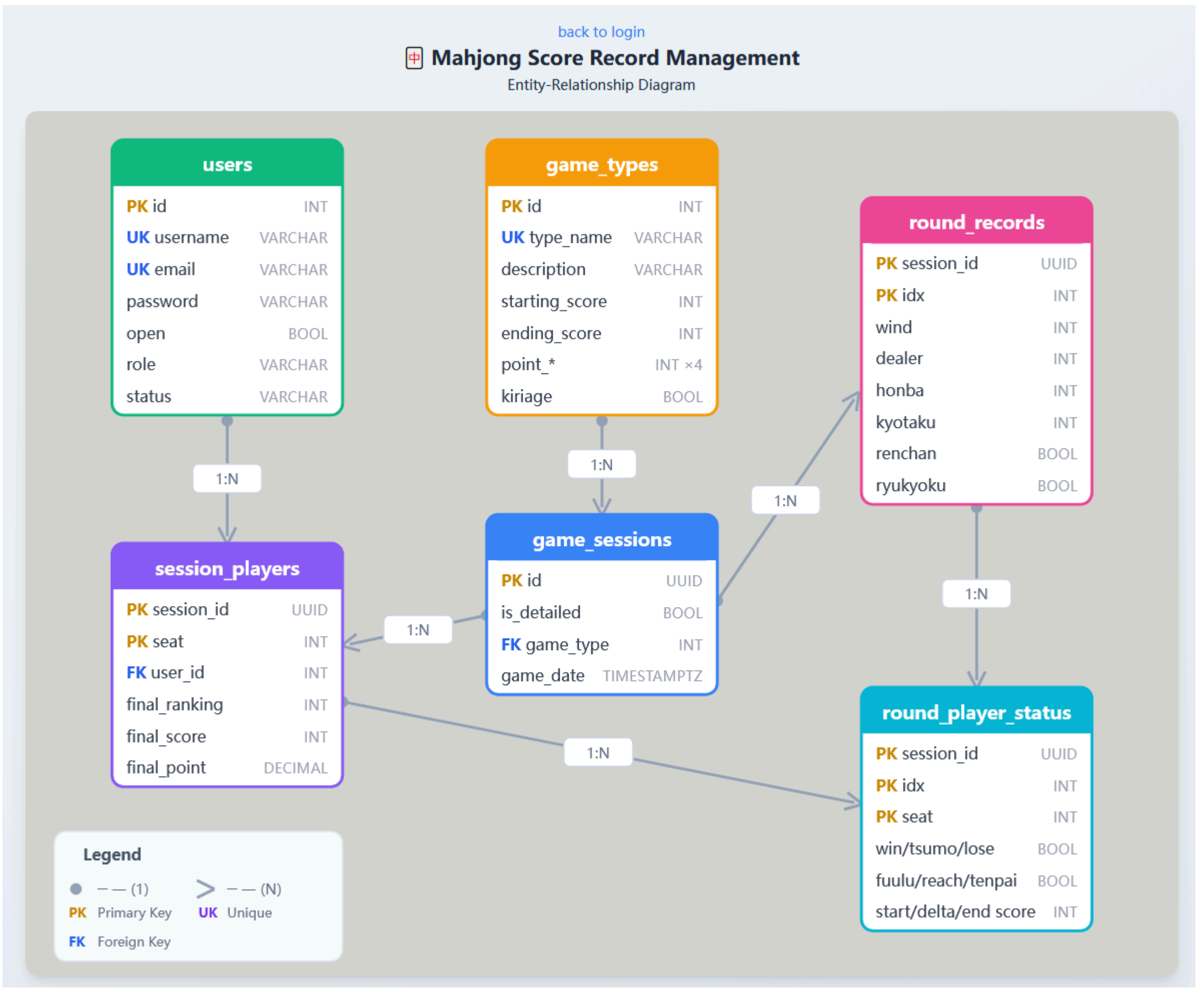
Backend: Nodejs.

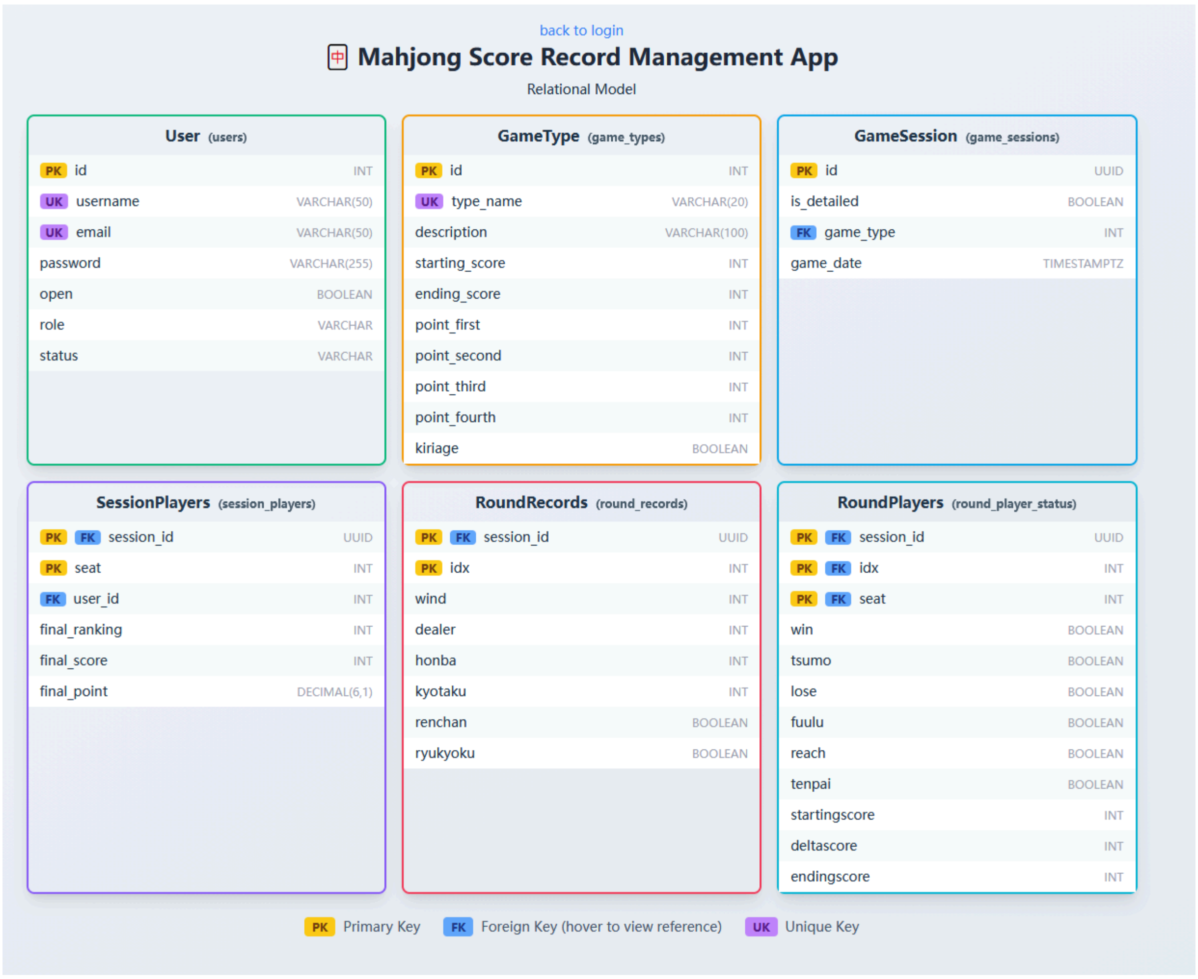
Database: Postgresql + Prisma

Further details refer to the package.json or can be found at backend/package.json.

3. Design

E-R Diagram and Relational Model can be seen in login page.




back to login

🀄 Mahjong Score Record Management App

Relational Model

User (users)

PK	id	INT
UK	username	VARCHAR(50)
UK	email	VARCHAR(50)
	password	VARCHAR(255)
	open	BOOLEAN
	role	VARCHAR
	status	VARCHAR

GameType (game_types)

PK	id	INT
UK	type_name	VARCHAR(20)
	description	VARCHAR(100)
	starting_score	INT
	ending_score	INT
	point_first	INT
	point_second	INT
	point_third	INT
	point_fourth	INT
	kiriage	BOOLEAN

GameSession (game_sessions)

PK	id	UUID
	is_detailed	BOOLEAN
FK	game_type	INT
	game_date	TIMESTAMPTZ

SessionPlayers (session_players)

PK FK	session_id	UUID
PK	seat	INT
FK	user_id	INT
	final_ranking	INT
	final_score	INT
	final_point	DECIMAL(6,1)

RoundRecords (round_records)

PK FK	session_id	UUID
PK	idx	INT
	wind	INT
	dealer	INT
	honba	INT
	kyotaku	INT
	renchan	BOOLEAN
	ryukyoku	BOOLEAN

RoundPlayers (round_player_status)

PK FK	session_id	UUID
PK FK	idx	INT
PK FK	seat	INT
	win	BOOLEAN
	tsumo	BOOLEAN
	lose	BOOLEAN
	fuulu	BOOLEAN
	reach	BOOLEAN
	tenpai	BOOLEAN
	startingscore	INT
	deltascore	INT
	endingscore	INT

PK Primary Key FK Foreign Key (hover to view reference) UK Unique Key

DDL and DML are at mahjong_db, it could be dumped with dbeaver.

4. User flow

Functionalities at front-end are listed in README.md.

At backend server, the functionalities are implemented in `backend/src/controllers/` files.

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1) Authentication Flow

Action	Method	Endpoint	Description
Register	`POST`	`/api/auth/register`	Create new account with username, email, password
Login	`POST`	`/api/auth/login`	Authenticate with username/email and password
Get Profile	`GET`	`/api/auth/me`	Retrieve current logged-in user info
Update Profile	`PUT`	`/api/auth/profile`	Update username, email, or privacy setting

User Flow:

```
New User:       Register → Login → Access System
Returning User: Login → Access System
```

2) Game Session Flow

Action	Method	Endpoint	Description
Upload Game Record	`POST`	`/api/game-session/upload`	Submit a new game session with players and rounds
Get Session Detail	`GET`	`/api/game-session/detail?uuid=`	View detailed information of a specific game

User Flow:

```
After Game:   Select Game Type → Enter Players → Input Scores → (Optional) Add
Round Details → Submit
View History: Select Game → View Full Details with Round-by-Round Data
```

3) User Statistics Flow

Action	Method	Endpoint	Description
Get Game Sessions	`GET`	`/api/user/sessions?id=&limit=&ranking=&gametype=&from=&to=`	List user's game history with filters
Get Round Data	`GET`	`/api/user/rounds?id=&limit=`	Get detailed round-level statistics
Get Statistics Grid	`GET`	`/api/user/:id/datagrid`	Get aggregated statistics (win rate, lose rate, etc.)
Search Users	`GET`	`/api/user/search?q=&id=`	Search for users by username
Get User by ID	`GET`	`/api/user/:id`	Get user profile information
Compare Points	`GET`	`/api/user/compare?id1=&id2=`	Head-to-head comparison between two players

User Flow:

```
View Own Stats:  Dashboard → View Statistics Grid → Filter by Date/Game Type
Compare Players: Search User → Select Competitor → View Head-to-Head Record
Browse History:  View Sessions List → Apply Filters → Click Session for Details
```

4) Game Type Flow

Action	Method	Endpoint	Description
Get Game Types	`GET`	`/api/game-type/list`	List all available game rule sets
Get Type Detail	`GET`	`/api/game-type/detail?id=`	Get scoring rules for specific game type

5) Admin Flow

Action	Method	Endpoint	Description
Get All Users	`GET`	`/api/admin/users`	List all registered users
Update User Status	`PUT`	`/api/admin/users/:id/status`	Ban or activate user accounts
Delete Game Session	`DELETE`	`/api/admin/sessions/:uuid`	Remove a game session from system

Admin Flow:

```
User Management:      View All Users → Select User → Change Status
(active/banned)
Content Moderation:   View Sessions → Identify Invalid Data → Delete Session
```

Complete User Journey Diagram

```
┌─────────────────────────────────────────────────────────────────┐
│                          GUEST USER                              │
│                                                                 │
│  ┌──────────┐    ┌──────────┐                                   │
│  │ Register │ ──▶│  Login   │                                   │
│  └──────────┘    └────┬─────┘                                   │
└───────────────────────┼─────────────────────────────────────────┘
                        │
                        ▼
┌─────────────────────────────────────────────────────────────────┐
│                      AUTHENTICATED USER                          │
│                                                                  │
│                                                                 │
│  ┌─────────────────┐    ┌─────────────────┐    ┌──────────────┐ │
│  │ Upload Game     │    │ View Statistics │    │ Search Users │ │
│  │ Session         │    │ & History       │    │ & Compare    │ │
│  └────────┬────────┘    └────────┬────────┘    └──────┬───────┘ │
│           │                      │                    │          │
│           ▼                      ▼                    ▼          │
│  ┌─────────────────┐    ┌─────────────────┐    ┌──────────────┐ │
│  │ Add Round       │    │ View Session    │    │ Head-to-Head │ │
│  │ Details         │    │ Details         │    │ Comparison   │ │
│  └─────────────────┘    └─────────────────┘    └──────────────┘ │
│                                                                  │
│  ┌─────────────────┐                                              │
│  │ Update Profile  │                                              │
│  └─────────────────┘                                              │
└───────────────────────────────────────────────────────────────────┘
                          │
                          ▼ (if role = admin)
┌───────────────────────────────────────────────────────────────────┐
│                       ADMIN USER                                   │
│  ┌─────────────────┐    ┌─────────────────┐                       │
│  │ Manage Users    │    │ Delete Sessions │                       │
│  │ (ban/activate)  │    │                 │                       │
│  └─────────────────┘    └─────────────────┘                       │
└───────────────────────────────────────────────────────────────────┘
```

Key Statistics Provided by System

The `getDataGrid` endpoint calculates the following aggregated statistics:

Statistic	Description
Total Games	Number of games played
Highest Score	Maximum final score achieved
Lowest Score	Minimum final score achieved
Average Rank	Average placement (1st-4th)
Busting Rate	Percentage of games ending with negative score
Win Rate	Percentage of rounds won
Lose Rate	Percentage of rounds lost (deal-in)
Tsumo Rate	Percentage of wins by self-draw
Draw Tenpai Rate	Tenpai rate at exhaustive draw
Exhaustive Draw Rate	Percentage of rounds ending in draw
Fuulu Rate	Percentage of rounds with open hand
Reach Rate	Percentage of rounds declaring riichi
Dama Rate	Percentage of wins with closed hand (no riichi)
Average Win Score	Average points gained when winning
Average Lose Score	Average points lost when dealing in

5. Lesson Learned

a. Technical Expertise Gained

Advanced SQL Queries

Used Common Table Expressions (CTEs) extensively for complex statistical calculations, improving query readability. Learned PostgreSQL-specific `FILTER` clause for conditional aggregation and `NULLIF` to prevent division by zero:

```
WITH round_stats AS (...),
     session_agg AS (...),
     round_agg AS (...)
SELECT
  count(*) FILTER (WHERE win)::float / count(*) AS Win_Rate,
  count(*) FILTER (WHERE tsumo)::float / NULLIF(count(*) FILTER (WHERE win), 0)
AS Tsumo_Rate
FROM round_stats;
```

ORM Integration (Prisma)

Learned to map complex database relationships to Prisma schema. Used `prisma.$queryRaw` for analytical queries difficult to express in ORM syntax, and `prisma.$transaction` for atomic operations across multiple tables.

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b. Insights

- **Data Domain**: Mahjong scoring requires tracking multiple states per player per round (win, tsumo, lose, reach, fuulu, tenpai), leading to a wide table design for `round_player_status`.
- **Time Management**: Spending adequate time on initial schema design saved significant refactoring time later. Changes to primary keys after data insertion proved costly.
- **Performance**: Added indexes on `session_players.user_id` and `game_sessions.game_date` after using `EXPLAIN ANALYZE` to identify slow queries.

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c. Alternative Design Approaches

Considered: Denormalized Statistics Table

Current design calculates statistics on-the-fly using complex CTEs. An alternative would be a pre-computed `user_statistics` table updated via triggers:

```
CREATE TABLE user_statistics (
    user_id INTEGER PRIMARY KEY REFERENCES users(id),
    total_games INTEGER,
    win_rate DECIMAL(5,4),
    average_rank DECIMAL(3,2),
    last_updated TIMESTAMPTZ
);
```

Trade-off: Faster reads but added complexity for maintaining consistency. Not implemented due to time constraints.

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d. Known Issues

Prisma Raw Query Type Casting

PostgreSQL aggregate functions return `BIGINT` or `NUMERIC` types, which Prisma serializes as strings instead of numbers in JavaScript:

```sql
-- Returns string "0.65" instead of number 0.65
avg(final_ranking)::float AS Average_Rank
```

Workaround: Manual type conversion in application layer.

e. Future Work

Planned Uses

- Serve as the backend database for a Mahjong club management system, tracking member performance and game history over multiple seasons.

Potential Added Functionality

- **Materialized Views**: Create pre-computed statistics views refreshed periodically to improve query performance for the `getDataGrid` endpoint.
- **Ranking System**: Add a `user_rankings` table with ELO/Glicko rating calculations based on game results.
- **Audit Logging**: Implement a `game_sessions_audit` table using triggers to track modifications and deletions for data integrity.