Brawl Stars Tournament Database - Normalization Documentation

Overview

This database is designed to manage a Brawl Stars tournament system, including players, clubs, matches, brawlers, and related entities. All tables comply with the Third Normal Form (3NF).

Table-by-Table Normalization Analysis

1. Season Table

Primary Key: `season_id`

1NF (First Normal Form):

- All attributes are atomic and indivisible
- `name`: Single text value (e.g., "Spring 2025")
- `start_date`, `end_date`: Individual date values
- No repeating groups or multi-valued attributes

2NF (Second Normal Form):

- Has a simple primary key (`season_id`)
- All non-key attributes (`name`, `start_date`, `end_date`) depend entirely on the primary key
- No partial dependencies exist

3NF (Third Normal Form):

- No transitive dependencies
- Each attribute depends directly on the primary key
- `start_date` does not depend on `name`, and vice versa
- No non-key attributes depend on other non-key attributes

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2. Player Table

Primary Key: `player_id`

1NF (First Normal Form):

- All values are atomic
- `username`: Single, unique identifier
- `display_name`: Single text value
- `level`, `trophies`: Individual numeric values
- No composite or multi-valued fields

2NF (Second Normal Form):

- Simple primary key (`player_id`)
- Functional Dependencies: `username` → `display_name`, `country`, `level`, `trophies`
- All attributes depend fully on the primary key, not partial

3NF (Third Normal Form):

- `country` does not depend on `username`
- `trophies` does not depend on `level`
- No transitive dependencies between non-key attributes
- Each attribute is independent and depends only on `player_id`

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3. Club Table

Primary Key: `club_id`

1NF (First Normal Form):

- All attributes are atomic
- `name`: Single club name
- `tag`: Single identifier
- `region`: Single region value

2NF (Second Normal Form):

- Simple primary key (`club_id`)
- All non-key attributes depend on the entire primary key

3NF (Third Normal Form):

- No transitive dependencies
- `region` does not depend on `name`
- Each attribute is independent

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4. ClubMembership Table (Bridge Table - Many-to-Many)

Unique Constraint: `(club_id, player_id, joined_at)` UNIQUE

1NF (First Normal Form):

- Each row represents one membership record
- `role`: Single value ("captain", "member")
- `joined_at`, `left_at`: Individual date values
- No repeating groups

2NF (Second Normal Form):

- Uses a surrogate key (`membership_id`) for simplicity
- Foreign keys (`club_id`, `player_id`) reference parent tables
- Non-key attributes (`role`, `joined_at`, `left_at`) depend on the membership entity
- Functional Dependency: `(club_id, player_id, joined_at)` → `role`, `left_at`

3NF (Third Normal Form):

- No transitive dependencies

- `role` depends on the membership, not on any other non-key attribute
- `left_at` depends on the membership, not on `joined_at` independently
- This is a proper junction table for Many-to-Many relationship between Player and Club

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5. Tournament Table

Primary Key: `tournament_id`
Foreign Keys: `season_id` (Season), `owner_id` (Club)

1NF (First Normal Form):

- All attributes are atomic
- `name`: Single tournament name
- `region`: Single region value
- `created_at`, `finished_at`: Individual datetime values

2NF (Second Normal Form):

- Simple primary key (`tournament_id`)
- All non-key attributes depend fully on `tournament_id`
- `season_id` and `owner_id` are foreign keys, not creating partial dependencies

3NF (Third Normal Form):

- No transitive dependencies
- `region` does not depend on `name`
- Foreign key references maintain referential integrity
- All non-key attributes depend only on the primary key

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6. ClubTournament Table (Bridge Table - Many-to-Many)

Unique Constraint: `(club_id, tournament_id)` UNIQUE

1NF (First Normal Form):

- Each row represents one club's participation in one tournament
- `result`: Single value ("champion", "runner-up", etc.)
- `points`: Single numeric value
- No repeating groups

2NF (Second Normal Form):

- Foreign keys (`club_id`, `tournament_id`) uniquely identify the participation
- Non-key attributes (`result`, `points`) depend on this participation
- Functional Dependency: `(club_id, tournament_id)` → `result`, `points`

3NF (Third Normal Form):

- No transitive dependencies
- `result` does not depend on `points`
- `points` does not depend on `result`
- Proper bridge table for Many-to-Many relationship between Club and Tournament

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7. Brawler Table

Primary Key: `brawler_id`

1NF (First Normal Form):

- All attributes are atomic
- `name`: Single brawler name (UNIQUE)
- `rarity`: Single rarity level
- `release_date`: Individual date value

2NF (Second Normal Form):

- Simple primary key (`brawler_id`)
- All non-key attributes depend entirely on the primary key

3NF (Third Normal Form):

- No transitive dependencies
- `rarity` does not depend on `name`
- `release_date` does not depend on `rarity`
- Each attribute is independent

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8. MeleeBrawler Table (Specialization of Brawler)

Primary Key: `brawler_id` (also Foreign Key to Brawler)

1NF (First Normal Form):

- All attributes are atomic
- `damage_range`: Single text value
- `melee_specific_attr`: Single attribute description

2NF (Second Normal Form):

- Primary key `brawler_id` uniquely identifies each melee brawler
- All non-key attributes depend on `brawler_id`

3NF (Third Normal Form):

- No transitive dependencies
- `damage_range` does not depend on `melee_specific_attr`
- This is a proper specialization table (one-to-one with Brawler)

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9. RangeBrawler Table (Specialization of Brawler)

Primary Key: `brawler_id` (also Foreign Key to Brawler)

1NF (First Normal Form):

- All attributes are atomic
- `projectile_speed`: Single numeric value
- `range_specific_attr`: Single attribute description

2NF (Second Normal Form):

- Primary key `brawler_id` uniquely identifies each ranged brawler
- All non-key attributes depend on `brawler_id`

3NF (Third Normal Form):

- No transitive dependencies
- `projectile_speed` does not depend on `range_specific_attr`
- Proper specialization table (one-to-one with Brawler)

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10. PlayerBrawler Table (Bridge Table - Many-to-Many)

Primary Key: `player_brawler_id`
Unique Constraint: `(player_id, brawler_id)` UNIQUE

1NF (First Normal Form):

- Each row represents one player's ownership of one brawler
- `level`: Single numeric value
- `unlocked`: Single boolean value

2NF (Second Normal Form):

- Composite key: `(player_id, brawler_id)` uniquely identifies the relationship
- Non-key attributes (`level`, `unlocked`) depend on this relationship
- Functional Dependency: `(player_id, brawler_id)` → `level`, `unlocked`

3NF (Third Normal Form):

- No transitive dependencies
- `level` does not depend on `unlocked`
- Proper bridge table for Many-to-Many relationship

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11. GameMode Table

Primary Key: `mode_id`

1NF (First Normal Form):

- All attributes are atomic
- `code`: Single identifier
- `name`: Single text value
- `players_per_team`, `teams_count`: Individual numeric values

2NF (Second Normal Form):

- Simple primary key (`mode_id`)
- All non-key attributes depend on the primary key

3NF (Third Normal Form):

- No transitive dependencies
- `players_per_team` does not depend on `name`

- Each attribute is independent

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12. Map Table

Primary Key: `map_id`

1NF (First Normal Form):

- All attributes are atomic
- `name`: Single map name
- `region`: Single region value

2NF (Second Normal Form):

- Simple primary key (`map_id`)
- All non-key attributes depend on the primary key

3NF (Third Normal Form):

- No transitive dependencies
- Each attribute is independent

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13. Match Table

Primary Key: `match_id`
Foreign Keys: `tournament_id` (Tournament), `mode_id` (GameMode), `map_id` (Map)

1NF (First Normal Form):

- All attributes are atomic
- `start_time`, `finish_time`: Individual datetime values

2NF (Second Normal Form):

- Simple primary key (`match_id`)
- All non-key attributes depend on the primary key
- Foreign keys don't create partial dependencies

3NF (Third Normal Form):

- No transitive dependencies
- `start_time` does not depend on `finish_time`
- All attributes depend only on `match_id`

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14. MatchParticipant Table (Bridge Table - Many-to-Many with Attributes)

Primary Key: `participant_id`
Unique Constraint: Implicitly on `(match_id, player_id)` for data integrity

1NF (First Normal Form):

- Each row represents one player's participation in one match

- All attributes are atomic: `team_tag`, `kills`, `damage`, `placement`, `is_winner`

2NF (Second Normal Form):

- Composite natural key: (`match_id, player_id`) uniquely identifies the participation
- Non-key attributes depend on this participation
- Functional Dependencies: (`match_id, player_id`) → `team_tag`, `kills`, `damage`, `placement`, `is_winner`

3NF (Third Normal Form):

- No transitive dependencies
- `kills` does not depend on `damage`
- `placement` does not depend on `is_winner`
- Proper bridge table for match participation tracking

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15. TrophyHistory Table

Primary Key: `trophy_id`
Foreign Key: `player_id` (Player)

1NF (First Normal Form):

- Each row represents one trophy change event
- All attributes are atomic: `changed_at`, `delta`, `total`

2NF (Second Normal Form):

- Simple primary key (`trophy_id`)
- All non-key attributes depend on `trophy_id`
- Foreign key (`player_id`) maintains the relationship

3NF (Third Normal Form):

- No transitive dependencies
- `delta` does not depend on `total`
- `changed_at` does not depend on other attributes

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16. ShopPurchase Table

Primary Key: `purchase_id`
Foreign Key: `player_id` (Player)

1NF (First Normal Form):

- Each row represents one purchase transaction
- All attributes are atomic: `item`, `currency`, `amount`, `purchased_at`

2NF (Second Normal Form):

- Simple primary key (`purchase_id`)
- All non-key attributes depend on `purchase_id`

3NF (Third Normal Form):

- No transitive dependencies
- `item` does not depend on `amount`
- `currency` does not depend on `item`
- Each attribute is independent

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17. Leaderboard Table

Primary Key: `leaderboard_id`
Foreign Key: `season_id` (Season)

1NF (First Normal Form):

- All attributes are atomic
- `region`: Single region value
- `created_at`: Single datetime value

2NF (Second Normal Form):

- Simple primary key (`leaderboard_id`)
- All non-key attributes depend on the primary key

3NF (Third Normal Form):

- No transitive dependencies
- Each attribute is independent

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18. ClubRanking Table (Bridge Table)

Primary Key: `ranking_id`
Foreign Keys: `leaderboard_id` (Leaderboard), `club_id` (Club)
Unique Constraint: (`leaderboard_id, club_id`) UNIQUE

1NF (First Normal Form):

- Each row represents one club's ranking in one leaderboard
- `rank`, `points`: Individual numeric values

2NF (Second Normal Form):

- Composite key: (`leaderboard_id, club_id`) uniquely identifies the ranking
- Non-key attributes depend on this combination
- Functional Dependency: (`leaderboard_id, club_id`) → `rank`, `points`

3NF (Third Normal Form):

- No transitive dependencies
- `rank` does not depend on `points`
- Proper bridge table for ranking management

Summary

All 18 tables in this database comply with 3NF:

Table Name	Normalization Level	Key Characteristics
Season	3NF	Simple key, atomic attributes
Player	3NF	Simple key, independent attributes
Club	3NF	Simple key, independent attributes
ClubMembership	3NF	Bridge table, proper many-to-many
Tournament	3NF	Simple key with foreign references
ClubTournament	3NF	Bridge table, unique composite key
Brawler	3NF	Simple key, atomic attributes
MeleeBrawler	3NF	Specialization, one-to-one relationship
RangeBrawler	3NF	Specialization, one-to-one relationship
PlayerBrawler	3NF	Bridge table, many-to-many
GameMode	3NF	Simple key, independent attributes
Map	3NF	Simple key, independent attributes
Match	3NF	Simple key with foreign references
MatchParticipant	3NF	Bridge table with attributes
TrophyHistory	3NF	Simple key, historical records
ShopPurchase	3NF	Simple key, transactional data
Leaderboard	3NF	Simple key with season reference
ClubRanking	3NF	Bridge table for rankings

Denormalization Decisions

No denormalization was applied in this design. The database maintains strict 3NF for the following reasons:

1. **Data Integrity:** Avoiding redundancy reduces update anomalies
2. **Query Flexibility:** 3NF allows for diverse queries through joins
3. **Performance:** For a tournament system, the overhead of joins is minimal compared to the benefits of clean data
4. **Maintainability:** Future updates and modifications are straightforward

All performance requirements can be met through proper indexing on foreign keys and frequently queried columns.

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