database normalization principles(1NF, 2NF, 3NF)

Database normalization principles 1NF, 2NF, and 3NF are progressive rules that reduce data redundancy and improve data integrity by organizing tables into simpler, more structured formats. 1NF ensures atomic values in each cell, 2NF addresses partial dependencies (requiring a single-column primary key or full dependency for non-key attributes on the entire key), and 3NF eliminates transitive dependencies, ensuring non-key attributes depend only on the primary key and not other non-key attributes.

First Normal Form (1NF)

- **Principle**: All attributes (columns) must contain atomic values, and there should be no repeating groups or multi-valued attributes within a single cell.
- **Goal**: To ensure each cell in a table holds a single, indivisible value.

Second Normal Form (2NF)

- **Prerequisite**: The table must already be in 1NF.
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- **Principle**: All non-key attributes must be fully functionally dependent on the entire primary key. This means that if a table has a composite primary key (a primary key made of multiple columns), no non-key attribute should only be dependent on a part of that key.
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- **Goal**: To remove partial dependencies, reducing redundancy by ensuring that attributes that do not describe the entire primary key are moved to separate, relevant tables.
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Third Normal Form (3NF)

- **Prerequisite**: The table must be in 2NF.
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- **Principle**: There must be no transitive dependencies. In simpler terms, no non-key attribute can depend on another non-key attribute; all non-key attributes must depend directly on the primary key.
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- **Goal**: To eliminate data duplication by removing any non-key attributes that are dependent on other non-key attributes, ensuring a more robust and consistent database design.