[ZANG] - [Chuanjie] - ITCAssignment

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**Step 1: Preliminary Analysis**

1. Employees

Description:

This table will store all employee-related information, including agents, administrative staff, management, etc. Agents are divided into two categories: full-time employees and independent agents. Independent agents work only on commission.

Key Point:

Each employee has a unique employee number.

Agents need to additionally record their real estate license number and commission information earned on all transactions.

2. Clients

Description:

This table stores all client-related information. Each client is tied to an agent, and they can be buyers, sellers, or renters.

Key Point:

Each client can only work with one agent.

The client's needs need to be recorded, such as the type of property they are interested in, price range, location, etc.

3. Properties

Description:

This table stores information about all properties, including property type, location, price, number of rooms, etc. Different property types need to be recorded through different fields.

Key Point:

Each property should have a unique property number.

Properties can be searched by multiple criteria such as type, location, price, number of rooms, etc.

Properties may involve multiple transactions (such as sale, rental).

4. Transactions

Description:

This table records all transaction information, including the customer, property, and agent involved in each transaction. Transaction types include purchase, sale, or rental.

Key points:

Each transaction has a unique transaction number.

Details of the transaction need to be recorded, such as transaction amount, date, agents involved, and customers.

The commission rules for the transaction should be clearly reflected in the table.

**Step 2: Identification of Table Attributes**

1. Employees

Table Description: Stores detailed information about employees, including agents and other employees.

Attributes:

EmployeeID (int, Primary Key): A number that uniquely identifies each employee.

FirstName (varchar, 50): The employee's first name.

LastName (varchar, 50): The employee's last name.

Address (varchar, 255): The employee's address.

PhoneNumber (varchar, 15): The employee's contact phone number.

Email (varchar, 100): The employee's email address.

Position (varchar, 50): The employee's position (e.g., agent, administrator, etc.).

EmployeeType (varchar, 20): The type of employee (full-time or independent agent).

RealEstateLicenseNumber (varchar, 20): The real estate license number (applicable only to agents).

CommissionRate (decimal, 5, 2): Commission rate (expressed as a percentage, applicable to agents).

HireDate (date): Employee's start date.

Salary (decimal, 10, 2): Employee's salary (applicable to full-time employees).

2. Clients (Clients Table)

Table Description: Stores detailed information about clients, including their association with agents.

Attributes:

ClientID (int, Primary Key): A number that uniquely identifies each client.

FirstName (varchar, 50): Client's first name.

LastName (varchar, 50): Client's last name.

PhoneNumber (varchar, 15): Client's contact number.

Email (varchar, 100): Client's email address.

PreferredContactMethod (varchar, 20): Client's preferred contact method (phone, email, etc.).

AgentID (int, Foreign Key): Associated agent ID (references EmployeeID from Employees table).

SearchCriteria (varchar, 255): The customer's search criteria (such as price range, property type, etc.).

3. Properties (Property Table)

Table Description: Stores detailed information about properties, including property type, location, price, etc.

Attributes:

PropertyID (int, Primary Key): A number that uniquely identifies each property.

ListingNumber (varchar, 20): The listing number of the property.

Address (varchar, 255): The address of the property.

City (varchar, 100): The city where the property is located.

State (varchar, 50): The state/province where the property is located.

ZipCode (varchar, 10): The zip code of the property.

Price (decimal, 15, 2): The price of the property.

PropertyType (varchar, 50): The type of property (such as detached home, townhouse, condominium, etc.).

Bedrooms (int): The number of rooms.

Bathrooms (int): The number of bathrooms.

SquareFootage (int): The square feet of the property.

ListingAgentID (int, Foreign Key): Listing agent ID (references EmployeeID from Employees table).

4. Transactions

Table Description: Stores detailed information about each transaction, including the associated client, property, and agent.

Attributes:

TransactionID (int, Primary Key): A number that uniquely identifies each transaction.

TransactionType (varchar, 20): Transaction type (buy, sell, lease).

TransactionDate (date): Transaction date.

TransactionAmount (decimal, 15, 2): Transaction amount.

ClientID (int, Foreign Key): Associated client ID (references ClientID from Clients table).

PropertyID (int, Foreign Key): Associated property ID (references PropertyID from Properties table).

SellingAgentID (int, Foreign Key): Selling agent ID (references EmployeeID from Employees table).

CommissionAmount (decimal, 10, 2): Commission amount paid in the transaction.

### Step 3: Identification of Data Types

#### 1. ****Employees Table****

| **Attribute Name** | **Data Type** | **Size/Precision** | **Description** |
| --- | --- | --- | --- |
| EmployeeID | int | - | Unique identifier for each employee. |
| FirstName | varchar | 50 | First name of the employee. |
| LastName | varchar | 50 | Last name of the employee. |
| Address | varchar | 255 | Address of the employee. |
| PhoneNumber | varchar | 15 | Contact phone number of the employee. |
| Email | varchar | 100 | Email address of the employee. |
| Position | varchar | 50 | Position of the employee (e.g., agent, admin staff). |
| EmployeeType | varchar | 20 | Type of employee (full-time or independent agent). |
| RealEstateLicenseNumber | varchar | 20 | Real estate license number (for agents only). |
| CommissionRate | decimal | 5, 2 | Commission rate (percentage for agents). |
| HireDate | date | - | Hire date of the employee. |
| Salary | decimal | 10, 2 | Salary of the employee (for full-time employees). |

#### 2. ****Clients Table****

| **Attribute Name** | **Data Type** | **Size/Precision** | **Description** |
| --- | --- | --- | --- |
| ClientID | int | - | Unique identifier for each client. |
| FirstName | varchar | 50 | First name of the client. |
| LastName | varchar | 50 | Last name of the client. |
| PhoneNumber | varchar | 15 | Contact phone number of the client. |
| Email | varchar | 100 | Email address of the client. |
| PreferredContactMethod | varchar | 20 | Preferred contact method (phone, email, etc.). |
| AgentID | int | - | Associated agent ID (references Employees table). |
| SearchCriteria | varchar | 255 | Search criteria for the client (e.g., price range, property type). |

#### 3. ****Properties Table****

| **Attribute Name** | **Data Type** | **Size/Precision** | **Description** |
| --- | --- | --- | --- |
| PropertyID | int | - | Unique identifier for each property. |
| ListingNumber | varchar | 20 | Listing number of the property. |
| Address | varchar | 255 | Address of the property. |
| City | varchar | 100 | City where the property is located. |
| State | varchar | 50 | State/Province where the property is located. |
| ZipCode | varchar | 10 | Postal code of the property. |
| Price | decimal | 15, 2 | Price of the property. |
| PropertyType | varchar | 50 | Type of property (e.g., detached, townhouse, condo). |
| Bedrooms | int | - | Number of bedrooms. |
| Bathrooms | int | - | Number of bathrooms. |
| SquareFootage | int | - | Square footage of the property. |
| ListingAgentID | int | - | Listing agent ID (references Employees table). |

#### 4. ****Transactions Table****

| **Attribute Name** | **Data Type** | **Size/Precision** | **Description** |
| --- | --- | --- | --- |
| TransactionID | int | - | Unique identifier for each transaction. |
| TransactionType | varchar | 20 | Type of transaction (purchase, sale, rental). |
| TransactionDate | date | - | Date of the transaction. |
| TransactionAmount | decimal | 15, 2 | Amount of the transaction. |
| ClientID | int | - | Associated client ID (references Clients table). |
| PropertyID | int | - | Associated property ID (references Properties table). |
| SellingAgentID | int | - | Selling agent ID (references Employees table). |
| CommissionAmount | decimal | 10, 2 | Commission amount paid in the transaction. |

### Step 4: Normalization of the Database Design

#### First Normal Form (1NF)

To satisfy the first normal form, we need to ensure that each table in the database contains atomic values (no repeating groups or arrays) and that each column contains only one type of data.

* **Employees Table**: Already in 1NF, as each column holds atomic values.
* **Clients Table**: Already in 1NF, as each column holds atomic values.
* **Properties Table**: Already in 1NF, as each column holds atomic values.
* **Transactions Table**: Already in 1NF, as each column holds atomic values.

#### Second Normal Form (2NF)

To satisfy the second normal form, the database must first be in 1NF, and all non-key attributes must be fully dependent on the primary key.

**Employees Table**:

* + All non-key attributes (e.g., FirstName, LastName) are fully dependent on the primary key (EmployeeID).
  + No changes needed.

**Clients Table**:

* + All non-key attributes (e.g., FirstName, LastName) are fully dependent on the primary key (ClientID).
  + No changes needed.

**Properties Table**:

* + All non-key attributes (e.g., Address, Price) are fully dependent on the primary key (PropertyID).
  + No changes needed.

**Transactions Table**:

* + All non-key attributes (e.g., TransactionType, TransactionDate) are fully dependent on the primary key (TransactionID).
  + No changes needed.

#### Third Normal Form (3NF)

To satisfy the third normal form, the database must first be in 2NF, and all the attributes must be non-transitively dependent on the primary key (i.e., no transitive dependencies).

**Employees Table**:

* + Already in 3NF, as all attributes are directly dependent on the primary key (EmployeeID).

**Clients Table**:

* + Already in 3NF, as all attributes are directly dependent on the primary key (ClientID).

**Properties Table**:

* + Already in 3NF, as all attributes are directly dependent on the primary key (PropertyID).

**Transactions Table**:

* + Already in 3NF, as all attributes are directly dependent on the primary key (TransactionID).