

Designing a Relational Database

The Conceptual Schema:

Before defining the logical schema of the database, we should clarify following information:

- Can the hotel name be used as a primary key?
 - No, Hotel names are not guaranteed to be unique. For example, multiple hotels across different cities or countries might share the same name (e.g., “Grand Hotel” or “Hilton”).
 - Use a **HotelID** (a unique, system-generated identifier) as the primary key to ensure uniqueness and avoid conflicts.
- Can a flight number be used as a primary key to identify a flight?
 - No, The same airline can operate the same flight number on different dates (e.g., Flight BA123 operates daily).
 - Define a unique **FlightID** for each specific flight instance or a **composite key** consisting of **FlightNumber**, **AirlineID**, **FlightDate**.
- Even if it is unlikely that 2 reviews have the same textual content, should review content be used as a primary key?
 - No, text fields are variable and potentially large, leading to performance and storage issues. Primary keys must be short, fixed-length, and efficient for indexing.
 - Use a **ReviewID** as the primary key.
- IATA code uniquely identifies an airport, should it be used as a primary key for the entity **Airport**?
 - Yes, possible as not all airports may have an IATA code. However, it is better to use a system-generated **AirportID** as the primary key.

1. Entity and Relation

Based on the application context and previous clarification, we can summarize Entities with Primary Keys:

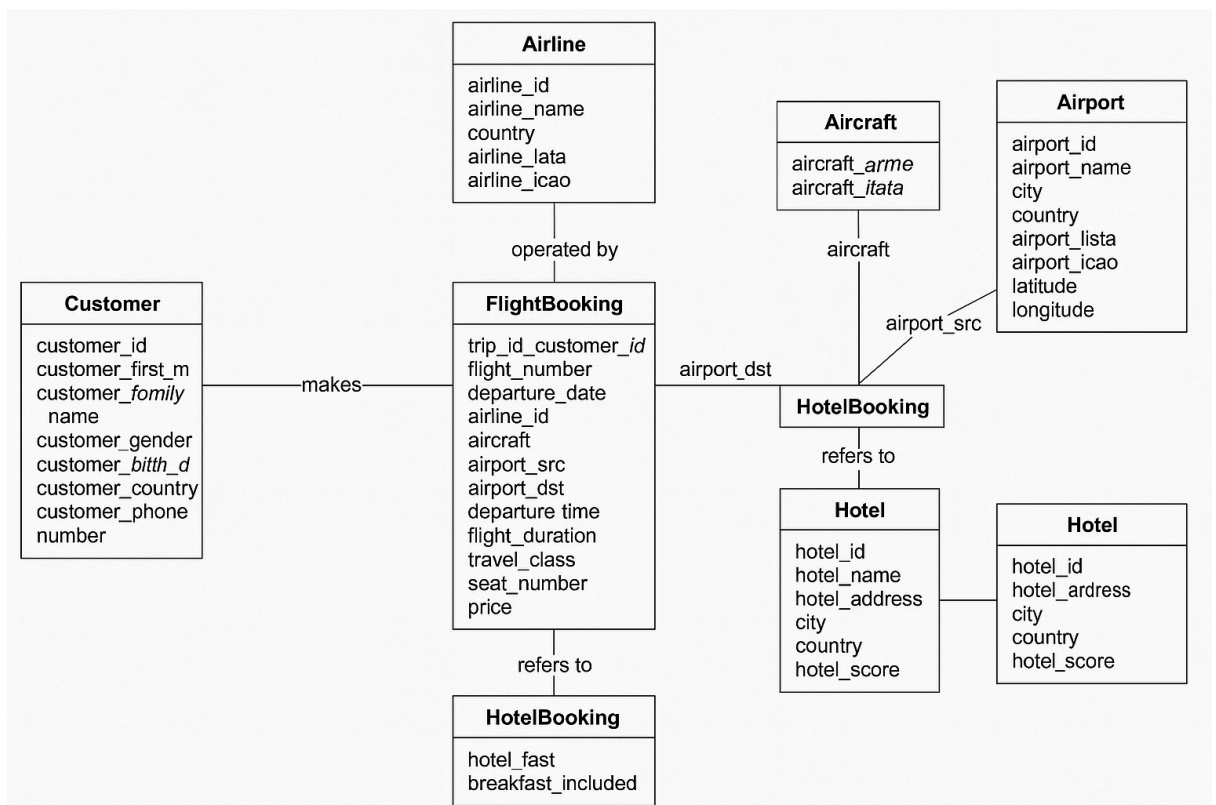
- **Customer:** *CustomerID*, FirstName, LastName, Gender, DateOfBirth, Phone, Country.
- **Airline:** *AirlineID*, Name, Country, IATA, ICAO, Alias.
- **Airport:** *AirportID*, Name, City, Country, Latitude, Longitude, IATA, ICAO.
- **Aircraft:** *AircraftID*, Name, IATA, ICAO.

- **Hotel:** *HotelID*, Name, Address, City, Country, AvgReviewScore.
- **FlightBooking:** *TripID*, CustomerID, FlightNumber, AirlineID, Aircraft, AirportSrc, AirportDst, DepartureTime, DepartureDate, FlightDuration, TravelClass, SearNumber, Price
- **HotelBooking:** *TripID*, HotelID, CustomerID, CheckInDate, CheckOutDate, Price, BreakfastIncluded

Relationships:

- A **Customer** can make many **FlightBookings** and **HotelBookings**.
- Each **FlightBooking** is linked to one **Airline**, **Aircraft**, and two **Airports**.
- Each **HotelBooking** is linked to one **Hotel**.

We can create a **ERD (Entity Relationship Diagram)** to have an initial view of the final database:



2. Tables from Conceptual Schema

Table Name	Entity/Relation	Primary Key	Other Columns
Customer	Customer	CustomerID	FirstName, LastName, Gender, DateOfBirth, Phone, Country

Airline	Airline	AirlineID	Name, Country, IATA, ICAO, Alias
Airport	Airport	AirportID	Name, City, Country, Latitude, Longitude, IATA, ICAO.
Aircraft	Aircraft	AircraftName	IATA, ICAO
Hotel	Hotel	HotelID	Name, Address, City, Country, AvgReviewScore.
FlightBooking	FlightBooking	TripID, CustomerID, FlightNumber	<i>AirlineID, Aircraft, AirportSrc, AirportDst,</i> DepartureTime, DepartureDate, FlightDuration, TravelClass, SearNumber, Price
HotelBooking	HotelBooking	TripID, CustomerID, HotelID	CheckInDate, CheckOutDate, Price, BreakfastIncluded

3. Functional Dependencies and Normal Forms

Currently, all non-key attributes depend fully on the primary key, and there are no transitive dependencies. Therefore, all tables are in 3NF now.

4. Normalize Tables to 3NF

From what we have modelled, most tables are already in 3NF due to:

- Use of synthetic IDs.
- No partial or transitive dependencies.
- Atomic attributes.