School of IT & Engineering
Student Name: Aralbay Abylay
Course: Databases
Laboratory Work 1: ERD Diagram

1. Identified Entities

The following entities were identified from the system description:

1. Airport

2. Airline

3. Flight

4. Passenger

5. Booking

6. Boarding Pass

7. Baggage

8. Baggage Checking

9. Security Check

10. Booking Changes

2. Attributes and PostgreSQL Data Types

Entity: Airport

Attribute	Data Type	Key / Constraint	Description
airport_id	SERIAL	PK	Primary key, unique airport identifier
airport_name	VARCHAR(100)	NOT NULL	Name of the airport
country	VARCHAR(50)	NOT NULL	Country where airport is located
state	VARCHAR(50)	NULL	State or region
city	VARCHAR(50)	NOT NULL	City of the airport
created_at	TIMESTAMP	NOT NULL	Date of creation
updated_at	TIMESTAMP	NULL	Date of last update

Entity: Airline

Attribute	Data Type	Key / Constraint	Description
airline_id	SERIAL	PK	Primary key, unique airline identifier
airline_code	VARCHAR(10)	UNIQUE NOT NULL	Airline code
name	VARCHAR(100)	NOT NULL	Airline name
country	VARCHAR(50)	NOT NULL	Country of airline
created_at	TIMESTAMP	NOT NULL	Date of creation
updated_at	TIMESTAMP	NULL	Date of last update

Entity: Flight

Attribute	Data Type	Key / Constraint	Description
flight_id	SERIAL	PK	Primary key, unique flight identifier
airline_id	INT	FK → Airline(airline_id)	Airline operating the flight
departure_airport_id	INT	FK → Airport(airport_id)	Departure airport
arrival_airport_id	INT	FK → Airport(airport_id)	Arrival airport
departing_gate	VARCHAR(10)	NULL	Gate of departure
arriving_gate	VARCHAR(10)	NULL	Gate of arrival
scheduled_departure_time	TIMESTAMP	NOT NULL	Planned departure
scheduled_arrival_time	TIMESTAMP	NOT NULL	Planned arrival
actual_departure_time	TIMESTAMP	NULL	Actual departure
actual_arrival_time	TIMESTAMP	NULL	Actual arrival
created_at	TIMESTAMP	NOT NULL	Date of creation
updated_at	TIMESTAMP	NULL	Date of last update

Entity: Passenger

Attribute	Data Type	Key / Constraint	Description
passenger_id	SERIAL	PK	Primary key
first_name	VARCHAR(50)	NOT NULL	First name
last_name	VARCHAR(50)	NOT NULL	Last name
gender	CHAR(1)	NULL	Gender (M/F)
date_of_birth	DATE	NOT NULL	DOB
country_of_citizenship	VARCHAR(50)	NOT NULL	Citizenship
country_of_residence	VARCHAR(50)	NOT NULL	Residence country
passport_number	VARCHAR(20)	UNIQUE NOT NULL	Passport number

Attribute	Data Type	Key / Constraint	Description
created_at	TIMESTAMP	NOT NULL	Profile creation date
updated_at	TIMESTAMP	NULL	Last update

Entity: Booking

Attribute	Data Type	Key / Constraint	Description
booking_id	SERIAL	PK	Unique booking ID
flight_id	INT	FK → Flight(flight_id)	Flight booked
passenger_id	INT	FK → Passenger(passenger_id)	Passenger making booking
status	VARCHAR(20)	NOT NULL	Booking status
booking_platform	VARCHAR(50)	NULL	Platform of booking
ticket_price	DECIMAL(10,2)	NOT NULL	Ticket price
created_at	TIMESTAMP	NOT NULL	Booking creation date
updated_at	TIMESTAMP	NULL	Last update

Entity: Boarding Pass

Attribute	Data Type	Key / Constraint	Description
boarding_pass_id	SERIAL	PK	Unique boarding pass ID
booking_id	INT	FK → Booking(booking_id)	Associated booking
seat	VARCHAR(5)	NOT NULL	Seat number
boarding_time	TIMESTAMP	NOT NULL	Boarding time
created_at	TIMESTAMP	NOT NULL	Creation date
updated_at	TIMESTAMP	NULL	Last update

Entity: Baggage

Attribute	Data Type	Key / Constraint	Description
baggage_id	SERIAL	PK	Unique baggage ID
booking_id	INT	FK → Booking(booking_id)	Associated booking
weight_kg	DECIMAL(5,2)	NOT NULL	Baggage weight
created_at	TIMESTAMP	NOT NULL	Registration date
updated_at	TIMESTAMP	NULL	Last update

Entity: Baggage Checking

Attribute	Data Type	Key / Constraint	Description
baggage_checking_id	SERIAL	PK	Unique baggage checking ID
baggage_id	INT	FK → Baggage(baggage_id)	Associated baggage
booking_id	INT	FK → Booking(booking_id)	Associated booking
passenger_id	INT	FK → Passenger(passenger_id)	Passenger owner

Attribute	Data Type	Key / Constraint	Description
check_results	VARCHAR(100)	NOT NULL	Results of baggage check
created_at	TIMESTAMP	NOT NULL	Checking date
updated_at	TIMESTAMP	NULL	Last update

Entity: Security Check

Attribute	Data Type	Key / Constraint	Description
security_check_id	SERIAL	PK	Unique security check ID
passenger_id	INT	FK → Passenger(passenger_id)	Passenger checked
check_results	VARCHAR(100)	NOT NULL	Results of security check
created_at	TIMESTAMP	NOT NULL	Creation date
updated_at	TIMESTAMP	NULL	Last update

Entity: Booking Changes

Attribute	Data Type	Key / Constraint	Description
change_id	SERIAL	PK	Unique change ID
booking_id	INT	FK → Booking(booking_id)	Booking affected
change_description	TEXT	NOT NULL	Description of change
created_at	TIMESTAMP	NOT NULL	Creation date
updated_at	TIMESTAMP	NULL	Last update

3. Normalization

- All entities are in 3NF.
- Attributes depend only on the primary key.
- No transitive dependencies exist.
- Many-to-many relationships are resolved using linking tables (e.g., Baggage Checking links Booking and Baggage).

4. Relationships and Cardinality

Relationship	Type	Notes
Airport → Flight	One-to-Many	One airport can have many departing/arriving flights
Airline → Flight	One-to-Many	One airline operates many flights

Relationship	Type	Notes
Flight → Booking	One-to-Many	One flight can have many bookings
Passenger → Booking	One-to-Many	One passenger can have many bookings
Booking → Boarding Pass	One-to-One	One booking has one boarding pass
Booking → Baggage	One-to-Many	One booking may have multiple baggage
Baggage → Baggage Checking	One-to-One	Each baggage is checked once
Passenger → Security Check	One-to-One	Each passenger passes security check
Booking → Booking Changes	One-to-Many	One booking may have multiple changes

5. ERD Diagram

[Insert ERD Diagram Here]
(Leave this space empty to add your ERD image later.)

6. Diagram Documentation / Legend

- **PK** – Primary Key

- **FK** – Foreign Key

- **1:N** – One-to-Many Relationship

- **1:1** – One-to-One Relationship

- **Attributes** – Include all required and unique attributes

- **Timestamps** – created_at and updated_at track creation and modification

7. Brief Description of Entities and Relationships

- **Airport:** Stores airport information. Connected to Flight as departure and arrival airports.

- **Airline:** Stores airline company info. Connected to Flight.

- **Flight:** Represents flights. Links to Airport and Airline, connected to Booking.

- **Passenger:** Stores passenger profiles. Connected to Booking, Security Check, and Baggage Checking.

- **Booking:** Central entity linking Flight and Passenger. Connected to Boarding Pass, Baggage, and Booking Changes.

- **Boarding Pass:** Assigned to each booking, contains seat info and boarding time.

- **Baggage:** Registered per booking, includes weight and check info.

- **Baggage Checking:** Stores results of baggage inspection, linked to Passenger and Booking.

- **Security Check:** Records results of passenger security checks.

- **Booking Changes:** Logs any modifications made to bookings.

AIRPORT

int	airport_id	PK
varchar	airport_name	
varchar	country	
varchar	state	
varchar	city	
timestamp	created_at	
timestamp	updated_at	

AIRLINE

int	airline_id	PK
varchar	airline_code	
varchar	name	
varchar	country	
timestamp	created_at	
timestamp	updated_at	

departure/arrival

operates

FLIGHT

int	flight_id	PK
int	airline_id	FK
int	departure_airport_id	FK
int	arrival_airport_id	FK
varchar	departing_gate	
varchar	arriving_gate	
timestamp	scheduled_departure_time	
timestamp	scheduled_arrival_time	
timestamp	actual_departure_time	
timestamp	actual_arrival_time	
timestamp	created_at	
timestamp	updated_at	

PASSENGER

int	passenger_id	PK
varchar	first_name	
varchar	last_name	
char	gender	
date	date_of_birth	
varchar	country_of_citizenship	
varchar	country_of_residence	
varchar	passport_number	
timestamp	created_at	
timestamp	updated_at	

has

makes

passes

BOOKING

int	booking_id	PK
int	flight_id	FK
int	passenger_id	FK
varchar	status	
varchar	booking_platform	
decimal	ticket_price	
timestamp	created_at	
timestamp	updated_at	

SECURITY_CHECK

int	security_check_id	PK
int	passenger_id	FK
varchar	check_results	
timestamp	created_at	
timestamp	updated_at	

issued

registers

modified

BOARDING_PASS

int	boarding_pass_id	PK
int	booking_id	FK
varchar	seat	
timestamp	boarding_time	
timestamp	created_at	
timestamp	updated_at	

BAGGAGE

int	baggage_id	PK
int	booking_id	FK
decimal	weight_kg	
timestamp	created_at	
timestamp	updated_at	

BOOKING_CHANGES

int	change_id	PK
int	booking_id	FK
text	change_description	
timestamp	created_at	
timestamp	updated_at	

checked

BAGGAGE_CHECKING

int	baggage_checking_id	PK
int	baggage_id	FK
int	booking_id	FK
int	passenger_id	FK
varchar	check_results	
timestamp	created_at	
timestamp	updated_at	