



# Dhirubhai Ambani University

## Database Management System (IT214)

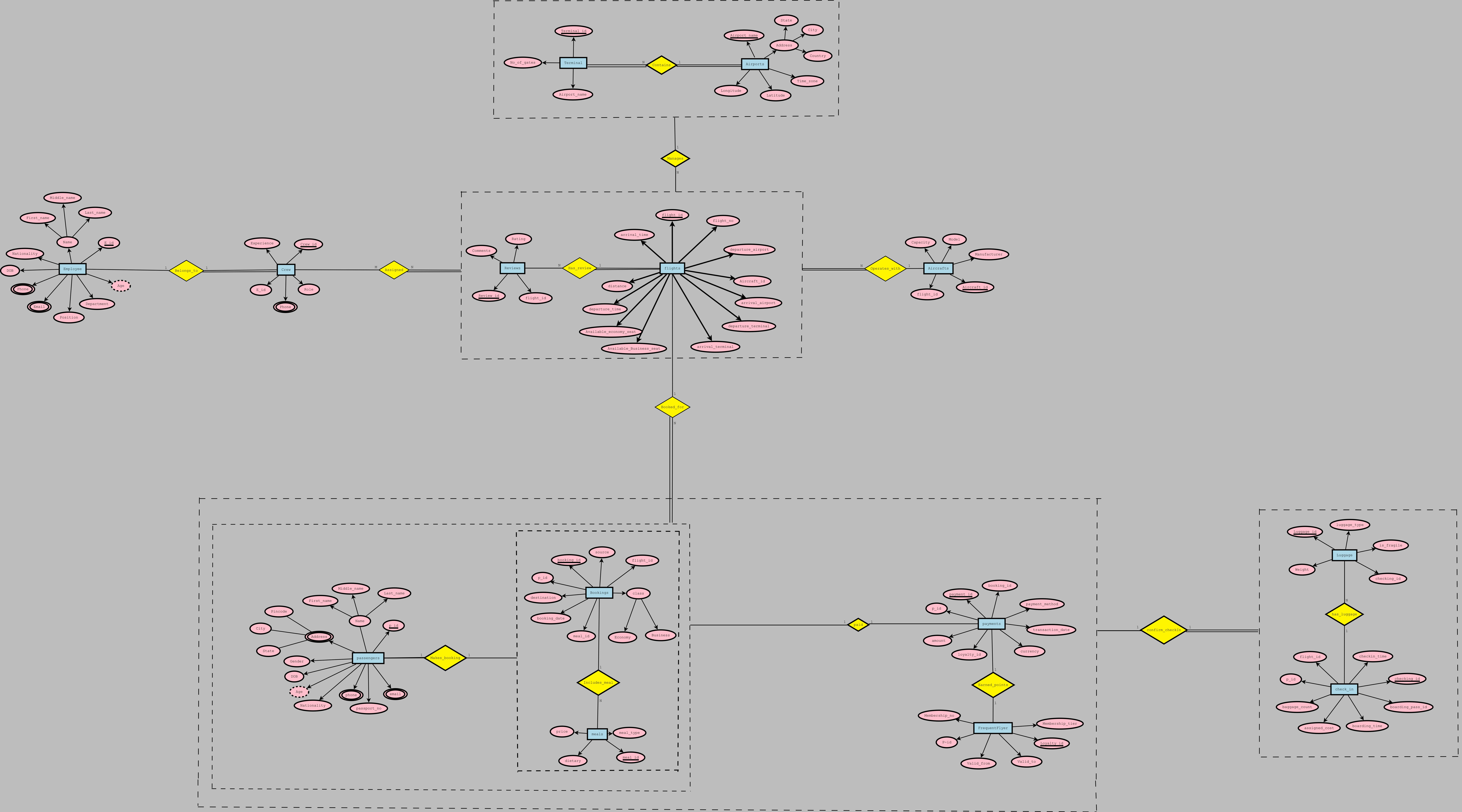
Group:5

### Group Representative:

- 1) Bavarva Megh Dineshbhai (202301402)  
Contact number: 8849855886

### Group Members:

- 1) Patel Naman Vipulbhai (202301423)
- 2) Patel Het Jitendrakumar (202301421)



# Airline Management System - Entities, Attributes, and Relationships

## Entities, Attributes, and Their Work

### Airports

- Attributes:

- airport\_code (Primary Key)
- name
- address
- time\_zone
- latitude
- longitude

Work: Represents airports as the main locations for flight departures and arrivals.

### Terminals

- Attributes:

- terminal\_id (Primary Key)
- airport\_code (Foreign Key from Airports)
- no\_of\_gates

Work: Represents specific areas within airports where passengers board or alight flights, linked to airports by airport\_code.

### Crew

- Attributes:

- crew\_id (Primary Key)
- first\_name
- last\_name
- role
- email

- phone
- rank

Work: Represents flight personnel such as pilots, co-pilots, and flight attendants.

## Aircrafts

- Attributes:

- aircraft\_id (Primary Key)
- model
- capacity
- aircraft\_type

Work: Represents the fleet of airplanes used for flights, storing details like model and seating capacity.

## Flights

- Attributes:

- flight\_id (Primary Key)
- departure\_airport (Foreign Key from Airports)
- arrival\_airport (Foreign Key from Airports)
- departure\_terminal (Foreign Key from Terminals)
- arrival\_terminal (Foreign Key from Terminals)
- departure\_time
- arrival\_time

Work: Represents individual flight journeys and their schedules, connecting airports and terminals for departures and arrivals.

## Bookings

- Attributes:

- booking\_id (Primary Key)
- flight\_no (Foreign Key from Flights)
- aircraft\_id (Foreign Key from Aircrafts)
- total\_time
- departure\_time
- arrival\_time

**Work:** Represents reservations made by passengers for specific flights, capturing travel timings and aircraft details.

## **Passengers**

- Attributes:
  - p\_id (Primary Key)
  - first\_name
  - last\_name
  - email
  - phone
  - passport\_no
  - nationality
  - dob
  - gender
  - address
  - booking\_id (Foreign Key from Bookings)
  - ticket\_price
  - ticket\_class
  - travel\_date

**Work:** Represents travelers, storing their personal and booking information like contact details, ticket class, and travel dates.

## **Frequent Flyer**

- Attributes:
  - loyalty\_id (Primary Key)
  - p\_id (Foreign Key from Passengers)
  - membership\_no
  - membership\_tier
  - valid\_from
  - valid\_to

**Work:** Tracks passengers enrolled in loyalty programs, storing their membership details and benefits.

## **Check-In**

- Attributes:

- checkin\_id (Primary Key)
- booking\_id (Foreign Key from Bookings)
- checkin\_time
- baggage\_count
- assigned\_seat
- boarding\_time
- boarding\_pass\_id

Work: Handles passenger check-in processes, including seat assignments, baggage registration, and boarding pass details.

### Luggage

- Attributes:

- luggage\_id (Primary Key)
- checkin\_id (Foreign Key from Check-In)
- weight
- is\_fragile
- luggage\_type

Work: Manages information about passengers' baggage, including weight, type, and special handling requirements.

### Payments

- Attributes:

- payment\_id (Primary Key)
- amount
- currency
- payment\_method
- transaction\_date

Work: Tracks financial transactions for bookings, storing details like payment amount and method.

### Reviews

- Attributes:

- review\_id (Primary Key)
- rating

- comments

Work: Captures passenger feedback about flights, services, or overall travel experiences.

### Meals

- Attributes:

- meal\_id (Primary Key)
- meal\_type
- dietary
- price

Work: Represents meal options available to passengers, including dietary preferences and pricing.

### Crew Assignments

- Attributes:

- assignment\_id (Primary Key)
- crew\_id (Foreign Key from Crew)
- flight\_id (Foreign Key from Flights)
- assignment\_role

Work: Manages flight crew assignments, linking crew members to specific flights and roles.

## Entity Relationships

1. Passenger – Booking ("Makes\_Booking")
  - Type: 1:1
  - Participation: Total on both sides—each passenger has one booking, and each booking is uniquely owned.
2. Booking – Payment ("Has\_Payment")
  - Type: 1:1
  - Participation: Total on both sides—every booking must be paid for, and each payment is linked to one booking.
3. Payment – Check\_In ("Allows\_CheckIn")
  - Type: 1:1
  - Participation: Payment is partial (some payments do not lead to check-in), and Check-In is total.
4. Check\_In – Luggage ("Has\_Luggage")
  - Type: 1:1
  - Participation: Total on both sides—every check-in record must include luggage details.
5. Booking – Flight ("For\_Flight")
  - Type: M:1
  - Participation: Booking is total; Flight is partial.
6. Flight – Review ("Has\_Review")
  - Type: 1:N
  - Participation: Review is total; Flight is partial.
7. Flight – Aircraft ("Operated\_With")
  - Type: M:1
  - Participation: Flight is total; Aircraft is partial.
8. Flight – Crew Assignment – Crew ("Assigned\_To")
  - Type: M:N

- Participation: Flight is total; Crew is partial.

9. Airport – Terminal ("Has")

- Type: 1:N
- Participation: Total on both sides.

10. Terminal – Flight ("Handles")

- Type: 1:N
- Participation: Flight is total; Terminal is partial.

11. Crew – Employee ("Belongs\_To")

- Type: 1:N
- Participation: Crew is total; Employee is partial.

12. Booking – Meal ("Includes\_Meal")

- Type: M:N
- Participation: Both sides are partial.

13. Payment – Loyalty ("Earns\_Points")

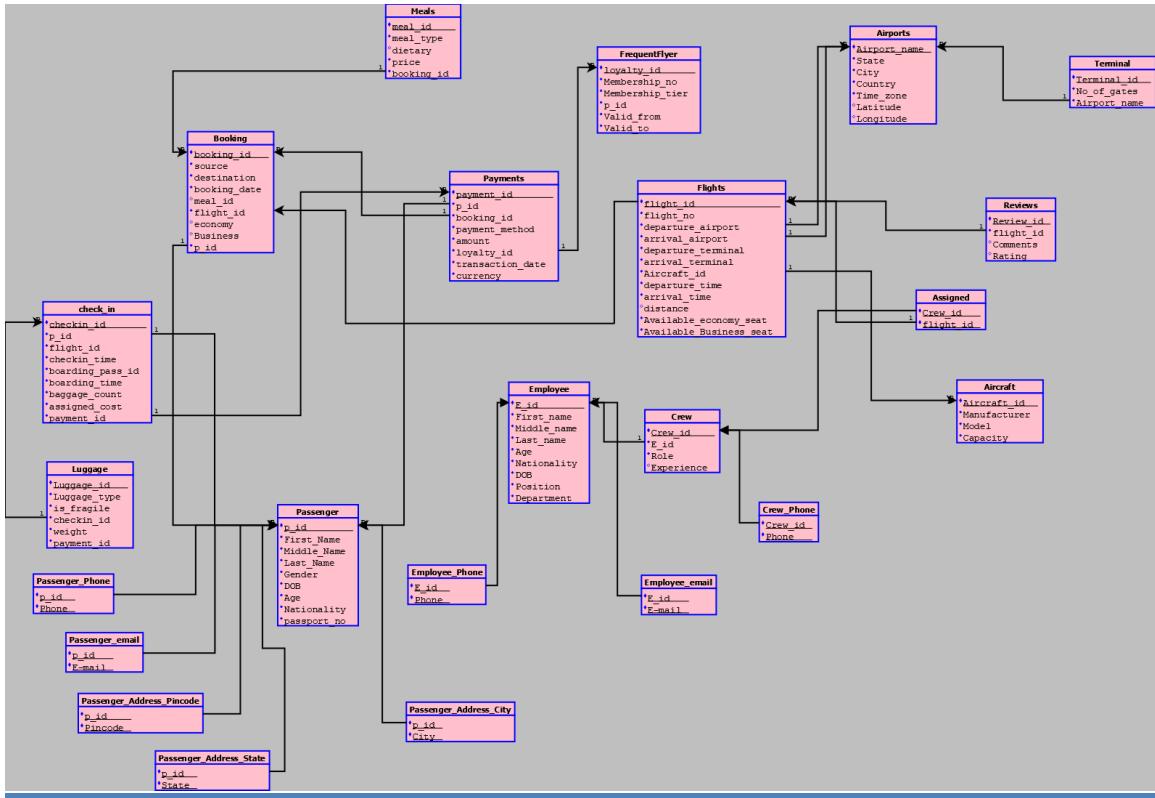
- Type: 1:1
- Participation: Both sides are partial.

## Flow Explanation

- Passenger books a flight, creating a booking tied to a specific flight and aircraft.
- Payment details are recorded for the booking.
- The passenger checks in, with details of their seat assignment and baggage recorded.
- Luggage is handled during check-in, and any special requirements (like fragile items) are noted.
- For frequent flyers, membership benefits are applied as part of their journey.
- Meal preferences, if selected, are logged and associated with the passenger's booking.

**THANK YOU**

# Relational Schema



# Final Minimal Functional Dependencies (FDs)

## Passenger-Related

- $p\_id \rightarrow First\_Name$
  - $p\_id \rightarrow Middle\_Name$
  - $p\_id \rightarrow Last\_Name$
  - $p\_id \rightarrow Pincode$
  - $p\_id \rightarrow City$
  - $p\_id \rightarrow State$
  - $p\_id \rightarrow Gender$
  - $p\_id \rightarrow DOB$
  - $p\_id \rightarrow Age$
  - $p\_id \rightarrow Nationality$
  - $p\_id \rightarrow Phone$
  - $p\_id \rightarrow passport\_no$
  - $p\_id \rightarrow E-mail$
  - $p\_id \rightarrow loyalty\_id$
- 
- $loyalty\_id \rightarrow Membership\_no$
  - $loyalty\_id \rightarrow Membership\_tier$
  - $loyalty\_id \rightarrow Valid\_from$
  - $loyalty\_id \rightarrow Valid\_to$

---

## Booking & Check-in

- $booking\_id \rightarrow source$
- $booking\_id \rightarrow destination$
- $booking\_id \rightarrow booking\_date$
- $booking\_id \rightarrow meal\_id$
- $booking\_id \rightarrow flight\_id$
- $booking\_id \rightarrow economy$

- booking\_id → Business
  - booking\_id → p\_id
- 
- checkin\_id → payment\_id
  - checkin\_id → checkin\_time
  - checkin\_id → boarding\_pass\_id
  - checkin\_id → boarding\_time
  - checkin\_id → baggage\_count
  - checkin\_id → assigned\_cost
- 
- Luggage\_id → Luggage\_type
  - Luggage\_id → is\_fragile
  - Luggage\_id → checkin\_id
  - Luggage\_id → weight
  - Luggage\_id → payment\_id

---

## Meals

- meal\_id → meal\_type
- meal\_id → dietary
- meal\_id → price

---

## Payments

- payment\_id → booking\_id
- payment\_id → payment\_method
- payment\_id → amount
- payment\_id → loyalty\_id
- payment\_id → transaction\_date
- payment\_id → currency

## Flights

- flight\_id → flight\_no
  - flight\_id → departure\_airport
  - flight\_id → arrival\_airport
  - flight\_id → departure\_terminal
  - flight\_id → arrival\_terminal
  - flight\_id → Aircraft\_id
  - flight\_id → departure\_time
  - flight\_id → arrival\_time
  - flight\_id → distance
  - flight\_id → Available\_economy\_seat
  - flight\_id → Available\_Business\_seat
- 

## Airports & Terminals

- Airport\_name → State
  - Airport\_name → City
  - Airport\_name → Country
  - Airport\_name → Time zone
  - Airport\_name → Latitude
  - Airport\_name → Longitude
- 
- Terminal\_id → No\_of\_gates
  - Terminal\_id → Airport\_name
- 

## Aircraft

- Aircraft\_id → Manufacturer
  - Aircraft\_id → Model
  - Aircraft\_id → Capacity
-

## Employee & Crew

- E\_id → First\_name
  - E\_id → Middle\_name
  - E\_id → Last\_name
  - E\_id → Age
  - E\_id → Nationality
  - E\_id → DOB
  - E\_id → Phone
  - E\_id → E-mail
  - E\_id → Position
  - E\_id → Department
- 
- Crew\_id → E\_id
  - Crew\_id → Phone
  - Crew\_id → Role
  - Crew\_id → Experience
- 

## Review

- Review\_id → flight\_id
- Review\_id → Comments
- Review\_id → Rating

# Normalization to BCNF

---

## Passenger

- The primary key is p\_id (Passenger ID).
- All attributes — first name, middle name, last name, pincode, city, state, gender, DOB, age, nationality, phone number, passport number, email, and loyalty ID — depend only on p\_id.
- That means p\_id uniquely identifies every other attribute in the relation.
- There are no partial or transitive dependencies.
- Hence, the Passenger table is in BCNF.

## Loyalty

- The primary key is loyalty\_id.
- Attributes such as membership number, tier, valid from, and valid to dates depend only on loyalty\_id.
- loyalty\_id uniquely identifies each loyalty record.
- Therefore, this table satisfies BCNF.

## Booking

- The key is booking\_id.
- Attributes like source, destination, booking date, meal ID, flight ID, economy, business, and passenger ID depend entirely on booking\_id.
- There are no non-key attributes that depend on anything other than the full primary key.
- So, the Booking table is in BCNF.

## Check-in

- The key is checkin\_id.
- Attributes such as payment ID, check-in time, boarding pass ID, boarding time, baggage count, and assigned cost are functionally dependent only on checkin\_id.
- No partial or transitive dependency exists.
- Thus, the Check-in table is in BCNF.

## Luggage

- The primary key is Luggage\_id.
- Attributes like luggage type, fragility status, related check-in ID, weight, and payment ID all depend only on Luggage\_id.
- Each luggage item is uniquely identifiable, and no other attribute has independent dependencies.
- So, the Luggage table is in BCNF.

## Meals

- The key is meal\_id.
- Attributes like meal type, dietary information, and price all depend directly on meal\_id.
- Since meal\_id is the only determinant and there are no transitive dependencies, this relation is in BCNF.
- Therefore, the Meals table is in BCNF.

## Payments

- The key is payment\_id.
- Other attributes such as booking ID, payment method, amount, loyalty ID, transaction date, and currency all depend on payment\_id only.
- No attribute depends on any other non-key attribute.
- Hence, Payments is in BCNF.

## Flights

- The primary key is flight\_id.
- All other attributes — flight number, departure and arrival airports, terminals, aircraft ID, times, distance, and available seats — are functionally dependent on flight\_id.
- The key determines the entire row.
- So, the Flights table is in BCNF.

## Airports

- The primary key is Airport\_name.
- Attributes like state, city, country, time zone, latitude, and longitude are uniquely determined by Airport\_name.

- No non-prime attribute depends on another non-key attribute.
- Hence, the Airports table is in BCNF.

## Terminals

- The key is Terminal\_id.
- Terminal\_id determines number of gates and which airport it belongs to.
- All attributes are fully functionally dependent on the key.
- Therefore, Terminals is in BCNF.

## Aircraft

- The key is Aircraft\_id.
- It determines manufacturer, model, and capacity of the aircraft.
- There are no other dependencies outside of this.
- So, Aircraft table is in BCNF.

## Employee

- The key is E\_id.
- From this ID, we can determine first name, middle name, last name, age, nationality, DOB, phone number, email, position, and department.
- All attributes are dependent only on E\_id.
- Thus, Employee is in BCNF.

## Crew

- The key is Crew\_id.
- This determines which employee it refers to (E\_id), their role, experience, and phone.
- No other functional dependencies exist.
- So, the Crew table is in BCNF.

## Review

- The key is Review\_id.
- It determines the flight being reviewed, the comments, and the rating given by the passenger.
- Every attribute is dependent on Review\_id only.
- Hence, Review is in BCNF.

## Conclusion

- In each and every relation above:
  - The left-hand side of each functional dependency is a superkey.
  - There are no partial dependencies, and no transitive dependencies.
- Therefore, every table is in Boyce-Codd Normal Form (BCNF).

Since all relations in the database are in BCNF, the entire database is in BCNF.