Project Step 3 Draft Version

Project Name: Fly Anywhere Airlines Flight Database

Team: JKM (Jack/Katherine/Muhammad)

Part 2 Feedback: Feedback received from: Shane McKay (SM), Michelle Ma (MA), John Weathers (JW), and Zachary Dicks (ZD)

Does the schema present a physical model that follows the database outline and the ER logical diagram exactly?

- (SM) Yes, the schema shows 6 entities, which is the same as what's in the outline. To describe the many-to-many relationships, there are 2 intersection tables
- (MA) Yes, there are the 6 entities and 2 intersection tables shown in the schema. The relationships correspond to the outline, and there are no discrepancies between what is listed and what is depicted in the diagram.
- (JW) Yes, everything matches up quite well between the three. All of the tables and attributes seem to match up. The relationships all make sense and are consistently labeled between the outline, ERD, and schema. There are only a few minor variations to mention:
    - FlightStatus in flights listed as varchar in ERD but enum in schema
    - There is at least one optional relationship (bookings to passengers, where the passengerId is optional in bookings), and that isn't properly reflected in the schema
    - Separately to the above, there are a couple other foreign keys in the schema with red diamond icons that are not filled in (located in flights). I think this is supposed to indicate that they're optional, but the relationship lines indicate everything is mandatory, so that should be cleared up.
- (ZD) Yes, the schema diagram presents a physical model that follows the database outline and entity-relationship diagram. The outline identifies the "Flights", "Aircraft", "Routes", "Seats", "Passengers", "Employees", "Bookings", and "Assignments" entity and intersection tables along with their respective attributes. However, there are a couple of improvements that could be made:
    - First, the entity-relationship diagram is almost indistinguishable from the schema diagram. Since the entity-relationship diagram is intended to display the entities and their relationships, I suggest removing all non-key attributes from the entity-relationship diagram. In addition, organizing the tables in the same position in both diagrams will help the reader easily cross-reference the two tables without getting confused or lost.
    - Next, it seems like the "Flights" entity is missing the M:N relationship between flights and employees via the "Assignments" table in the overview section of the report.
    - Finally, there is an optional M:1 relationship between bookings and passengers in the entity relationship diagram that is not shown in the schema diagram.

Is there consistency in a) naming between overview, outline, ER and schema entity/attributes b) entities plural, attributes singular c) use of capitalization for naming?

- (SM) One difference is that the outline and the ERD has every entity capitalized, while the schema has no capitalization. distanceKilometeres and durationSeconds is also plural, while the rest of the attributes are not. I think it would be a bit weird to name them distanceKilometer and durationSecond, but that would keep the plurality the same.
- (MA) Yes, the naming system is pluralized for all entities (except Aircraft, which might be a stylistic choice?), camelCase used for attributes, all ids follow the same naming system (entityId), and intersection tables' foreign keys contain the same naming system for the given IDs.
- (JW) For the most part, yes. The entities seem to all be capitalized (see below for minor note on this). The attributes are all camel case. Everything is consistent, aside from a couple minor things, between all three. Minor issues I've spotted:
    - The entities in the schema are not capitalized, so that needs to be fixed
    - PassengerId in Passengers, in the outline, is listed as passengerID
- (ZD) There is consistency between the naming conventions used in the overview, outline, entity-relationship diagram, and schema diagram. All entities are plural and attributes are singular. On

the other hand, all entities within the outline and entity-relationship diagram are capitalized versus the schema diagram which is lowercase. The entities within the schema diagram should be capitalized.

Is the schema easy to read (e.g. diagram is clear and readable with relationship lines not crossed)?

- (SM) Yes, the schema is easy to read. All the lines are split up, do not cross each other, and are close to each other. One recommendation I would give would be to get rid of the background grid, which would make it blend in better with the proposal (there is an option within Workbench to do this)
- (MA) Yes, all the entities are laid out clearly, where no relationship lines are crossed. I like how the flights and bookings routes are aligned in the center because it's clear to see how all the other entities relate to the flights and bookings.
- (JW) Yes, the schema is easy to read. None of the relationship lines are crossing. The entities are places in a way that makes it easy to scan between the relationships. They are close enough where you can easily look back and forth between a relationship, but not too close to be cramped and messy looking.
- (ZD) Yes, the schema diagram is easy to read as there are no overlapping relationship lines and each entity table has enough spacing to see each attribute.

Are intersection tables properly formed (e.g. two FKs and facilitate a M:N relationship)?

- (SM) Yes, the intersection tables both have at least two FKs and they facilitate a M:N relationship. The first one is from flights to passengers/seats. This table is made of three foreign keys, flightId, seatId, and passengerId. The second intersection table, assignments, has two FKs, flightId and employeeID and links the employees with the flights.
- (MA) Yes, there are two intersection tables that each contain two FKs, alongside other attributes that are important to the relationship (such as passengers' IDs). This helps create a valid M:N relationship between Flights, Passengers, and Seats (for intersection table Bookings) and Employees + Flights (for Assignments). I especially like the name Assignments, since it makes the relationship easy to understand upon first glance.
- (JW) Yes, I count three intersection tables, all of which seem to be properly formed. They each have foreign keys from appropriate tables which facilitate a many to many relationship – the Flights table has routeId and aircraftId, the Assignments table has flightId and employeeId, and the bookings table has flightId, seatId, and passengerId.
- (ZD) Yes, the “Bookings” and “Assignments” intersection tables are properly formatted with at least two foreign keys. The “Bookings” intersection table facilitates the M:N relationship between “Flights” and “Seats”, and “Flights” and “Passengers”. Further, the “Assignments” intersection table facilitates the M:N relationship between “Flights” and “Employees”.

Does the sample data suggest any non-normalized issues, e.g. partial dependencies or transitive dependencies?

- (SM) No, I do not see any normalization issues. None of the non-prime attributes are dependent on other non-prime attributes, and every entity is split into its own table. One area I thought was incorrect was that the capacity of the aircraft may rely on the model of the aircraft. However, the capacity may change depending on how the airline sets up the aircraft. Multiple models can have different seat configurations.
- (MA) No, it seems that all non-prime attributes are only dependent on the PK. This aligns with 3NF.
- (JW) By and large, the data suggests no issues. The only thing I can think of that could potentially be changed is the Aircraft entity seems to have potential for duplicate data with model and capacity. I don’t think it’s a big issue since there are only a couple attributes, but I think the intention of the table is individual planes that the airline has as part of the fleet. The model info seems like it could be a separate thing. However, given that there are already a good number of entities, I understand not wanting to add an additional one here. Otherwise, everything seems normalized to a satisfactory extent.
- (ZD) No, the same data is normalized and doesn’t show any partial or transitive dependencies.

Is the SQL file syntactically correct? This can be easily verified by using phpMyAdmin and your CS 340 database (do not forget to take backup of your own database before you do this!)

- (SM) Yes, the SQL file is syntactically correct. All 8 tables were imported with the tables have 3-4 rows each.
- (MA) Yes, the SQL file imported all 8 tables as seen in the Schema diagram. The foreign keys were also imported correctly. Data for Flights, Aircraft, Routes, Seats, Passengers, Employees, Bookings, and Assignments were added successfully.
- (JW) Yes, the SQL file is syntactically correct. I sourced the file without any issues. I was able to view the sample data in each table.
- (ZD) I was successfully able to import the "CS340 Group 118 Project Step 2 DDL.sql" file and all applicable data with the enable foreign key checks option turned off in phpMyAdmin.

In the SQL, are the data types appropriate considering the description of the attribute in the database outline?

- (SM) Yes the data types are appropriate, and are the same, when compared to the description of the attribute in the database outline. Every attribute that would be a number has an INT, dates are created as DATETIME, attributes that have select options are created correctly with ENUM.
- (MA) Yes, the data types make sense for each attribute. The IDs are integers (if PK, has auto_increment), phone numbers are VARCHAR to allow dashes or + for country codes, and aircraftStatus and seatClass is ENUM since there are only three / four possible options given.
- (JW) Yes, the data types are appropriate considering the descriptions of the attributes in the outline. All the attributes have data types that match the outline, including the arguments passed to the data types (where applicable). I don't see any variation from the outline in this regard.
- (ZD) Yes, the datatypes used for the attributes are appropriate to their application. However, I do suggest changing the varchar() attribute values to be more in alignment with their use case. For example, "emailAddress" can be 254 or 320 characters based on IETF / RFC standards, and "phoneNumber" can be 10, 12, or 14 characters based on the stored syntax ("1234567890", "123-456-7890", or "(123) 456-7890").

In the SQL, are the primary and foreign keys correctly defined when compared to the Schema? Are appropriate CASCADE operations declared?

- (SM) The foreign keys and primary keys are defined correctly when comparing the Schema. However, there are no CASCADE operations declared. This could result in intersect tables addressing to blank rows. Some of the CASCADE operations I would suggest would be for bookings and assignments to have a CASCADE DELETE, as they will be deleted if the flight is deleted.I would also add a CASCADE DELETE to seats, as if the aircraft is deleted then the seat would be deleted, along with the flight and bookings.
- (MA) Yes, the PKs and FKs are correctly defined in the SQL. Foreign keys are hardcoded into the create table query, which could be replaced with subqueries in the insert queries. There are no cascade operations defined; I think cascade operations should be added to the entities, especially since you have so many foreign keys.
- (JW) Yes, primary and foreign keys are correctly defined when compared to the schema. This is notwithstanding my prior note about the optional relationships not being 100% correctly documented in the schema diagraming. But every primary key in the schema is correctly defined in the SQL, as is every foreign key.
    - No CASCADE operations are declared. However, I think with an airline, this may actually be the appropriate choice in many cases. That said, the places I would consider declaring CASCADE operations might be the following:
    - A route and/or aircraft record is deleted, should the routeId and/or aircraftId be set to null in flights? Would be easier to spot that a new route or aircraft is needed for a particular flight, rather than old data being referenced there.
    - An aircraft is deleted, should the seats be deleted?
    - For Bookings and Assignments, I would imagine the default setting of no changes could make the most sense because you'd still want fully intact records of those in the intersection table.

- (ZD) Yes, all primary and foreign keys are correctly defined when compared to the schema diagram, but there aren't any CASCADE operations declared in the SQL file. I suggest adding CASCADE operations for any table whose primary key is used as a foreign key in another table.

In the SQL, are relationship tables present when compared to the ERD/Schema?

- (SM) Yes, the tables assignments and books are present in the SQL.
- (MA) Yes, relationship tables Bookings and Assignments are present. All foreign keys are added in the create query.
- (JW) Yes, all the relationships are laid on in the SQL via appropriately defined foreign key constraints. Flights has a reference to Routes and Aircraft, Seats to Aircraft, Bookings to Flights, Seats, and Passengers, Assignments to Flights and Employees.
- (ZD) All relationship tables are present in both the SQL file and the entity-relationship/schema diagram.

In the SQL, is all sample data shown in the PDF INSERTED?

- (SM) Yes, all the data is inserted. All the tables have 3-4 elements inserted.
- (MA) Yes, all sample data that is in the PDF is also in the SQL file as insert queries.
- (JW) All tables shown in the PDF have sample data inserted. There are a couple minor discrepancies:
  - passengerId in Bookings has incorrect info
  - There is an extra row in Bookings that is not in the sample data
- (ZD) Yes, the sample data in the PDF is inserted into the applicable entity tables in the SQL file. The only suggestion is to use subqueries for foreign keys in the SQL file rather than hardcoding them.

Is the SQL well-structured and commented (e.g. hand authored) or not (e.g. exported from MySQL)?

- (SM) Yes. The file is commented nicely, which breaks up the sections and labels what each query does. The file does not appear to be generated in anyway.
- (MA) Yes, the SQL is well-structured, hand-authored, and contains leading comments that specify what the following query is performing. For example, before an insert query, the author has comments stating that the query below is inserting the sample data for entity "Flights".
- (JW) Yes, the SQL is well-structured and commented. The file is well organized with the tables all being dropped in one section. The create statements are separated into a large section together, and each create statement is commented. The insert statements are all in a large group and well commented.
  - The only issue, per the assignment instructions, is the group members' names and group number should have been included in the SQL file but they are missing.
- (ZD) Block comments are present in the SQL file, which makes each code section easily identifiable and understandable.

Fixes Based on Feedback from Part 2

1. Update FlightStatus to be ENUM in ERD
    a. Done

2. Update bookings > passengers relationship in schema to be optional
    a. Done

3. Ensure foreign keys are mandatory, not optional in schema.
    a. Done

4. Update ERD to remove non-key attributes, so it’s different from the schema.
    a. Will not implement: There are not enough non-key attributes to make the ERD too busy.

5. Add M:N relationship for flights with employees to overview.
    a. Done

6. Update schema object (table) names to match ERD in PascalCase
    a. Done

7. Inquiry about distanceKilometers and durationSeconds being plural while remaining objects are singular.
    a. Will not implement: There are no cases of <2 kilometers or seconds in this database.

8. Update passengerID in outline to passengerId
    a. Done

9. Get rid of background grid in next screenshot of Schema
    a. Done

10. Review if an additional “make and model” category table should be made for aircraft.
    a. Will not implement: Mostly due to adding additional complexity; however, each aircraft is uniquely configured so make/model will not necessarily describe the seat quantity or other characteristics.

11. Update VARCHAR lengths to be more appropriate to max phone number and email lengths (14 and 320 respectively)
    a. Updated to 20 and 320 respectively

12. Add CASCADE DELETE to Aircraft table to delete seats on that craft
    a. Updated Seats to delete if Aircraft is deleted

13. Add CASCADE DELETE to ensure that deleting a passenger deletes their bookings
    a. Done

14. Add CASCADE DELETE so when a flight is deleted, bookings and assignments are deleted.
    a. Done

15. Add CASCADE DELETE to ensure when an employee is deleted, their assignments are deleted.
    a. Done

16. Add CASCADE DELETE to ensure that if a route is deleted, the flights on that route are deleted.
    a. Implemented a DELETE RESTRICT; we want to delete a flight prior to a route being decommissioned. This prevents widespread changes to Bookings and Assignments without the user considering them. Also implemented for Flights FK to Aircraft.

17. Update Sample data to correct bookings information in passengerId.

    a. Done via updating screenshot to avoid cutting off data.

18. Update Sample data to either add extra row into sample or remove from the DDL sample insert
    a. Done: Removed sample from DML sample (see team initiated change for passengerId)

19. Add Group Name and Member Names to DDL.SQL file
    a. Done

20. Team Initiated Change:
    a. Updated Bookings to require passengerId.

21. Team Initiated Change:
    a. Updated relationships between the following.
        i. Employees and Assignments: An employee may have no assignment
        ii. Flights and Assignments: A flight may have no assignment
        iii. Flights and Bookings: A flight may have no booking
        iv. Aircraft and Flights: An aircraft may have no flights
        v. Routes and Flights: A route may have no flights.
        vi. Passengers and Bookings: Updated Schema to match ERD (a passenger may have no bookings).

Part 1 Feedback received from Peer Reviewers and TA

TA: Neil King
This is a great start, something to keep in mind is that there are only 4 total tables required excluding the intersection table. Based on your ERD it looks like you have 8 relationships, while this is not a problem, I would consider cutting a couple of the tables. For the ERD, since these are showing an outline of the problem that this system would solve, there doesn't have to be this much detail, until we do the schemas. I would also consider indicating what relationship is optional in a sentence in addition to your outline, this can make it easier to see.

Feedback Recieved from: Alexander Fox (AF), Payton Bradfield (PB), Joshua Benge (JB), and Jared Northrop (JN)
Does the overview describe what problem is to be solved by a website with DB back end? If yes, summarize. If not, what changes would better support describing the problem to be solved?

- (AF) The overview clearly describes that the goal of the database will be to aid the airline with improving efficiency across multiple different departments, from flight schedules to passenger bookings and everything in between. There is not a description of a problem that is to be solved, although it could be inferred that the airline is looking for a way to improve efficiency and this database will help with that. A small expansion to the outline that more clearly states a problem that the database is solving could help but the outline is well explained otherwise.
- (JN) The overview describes the information airlines need to track to manage airline operations. It displays specific facts about the quantity of different types of information that the airlines receive yearly. The changes I would make would be to discuss the specific areas of an airline enterprise that the database will track. The outline is very broad in what it could do.
- (JB) Yes, the problem is described. Fly Anywhere Airlines is in need of a database that is able to keep track of its flights, planes, passengers, and employees.
- (PB) Yes, the problem is clearly outlined as a need for an organized system to manage airline operations, like flight schedules, crew assignments, aircraft management and passenger bookings.

Does the overview list specific facts? If yes, summarize what the facts illustrate about the proposed DB solution. If not, what facts would better support illustrating the scope and scale of the proposed DB solution?

- (AF) The overview does state specific facts for the number of flights the airline deals with every year and the number of unique routes that it operates. The overview lists less specific numbers for things like number of employees and number of aircraft. Since these are entities being tracked in the database, it may be helpful to be more specific with these two things for better clarity of the scope and scale of the proposed DB solution.
- (JN) The proposal lists some of the facts about how many users, airplanes, and routes. What I think it needs to specify is what areas of an airplane enterprise the database will track. Airlines have to keep track of inventory, employees(both information and what planes/routes they fly), maintenance, Customer info, etc. The scope is not clearly defined on what this database will do in the overview.
- (JB) The overview does list specific facts, but I do think your overview could use a little more detail. For instance, what about the cost of each flight, how much each ticket costs, etc. This overview touches on all the logistics required for an airline to keep track of, except for money related logistics.
- (PB) Yes it explicitly states that the airline handles over 20,00 flights a year across more than 100 routes. While it doesnt give specific ballpark figures for other attributes it states that it will deal with thousands of employees hundreds of aircraft and millions of passenger bookings

Are at least four entities described, and does each one represent a single idea to be stored as a list? If yes, summarize. If not, based on the course material, what changes can you suggest to improve?

- (AF) There are at least four entities described and each one does represent a single idea to be stored in a list. The entities pretty clearly match up with the things that the database intends to keep track of based on the outline. If I could make any improvements here, I would maybe mention that the database would keep track of Seat details in the overview as it is seemingly the only thing not mentioned there.

- (JN) There are more than four entities with additional intersection tables defined on top of that. I like that you made a distinction between intersection tables and entities. The entities reflect what an airline needs to track.
- (JB) Yes, there are 6 entities with 2 placeholder tables for M:N relationships. The 6 entities are Flights, Aircraft, Routes, Seats, Passengers, and Employees.
- (PB) Yes the entities ar Flights: representing individual flight records, Aircraft: representing details about planes in the fleet, Routes: representing the routes taken between airports, Seats representing seats on aircraft, Employees: representing the employees of the airline, assignments: representing employees assigned to particular flights, Passengers representing customers and their contact info and finally booking representing individual passenger bookings on planes and the seat they are assigned to.

Does the outline of entity details describe the purpose of each, list attribute data types and constraints, and describe relationships between entities? If yes, summarize. If not, based on the course material, what changes can you suggest to improve?

- (AF) The outline of entity details does a great job describing the purpose of each and their relationships to other entities. Primary and Foreign Keys are well explained and the types of relationships are clearly listed. Great description of existing intersection tables as well.
- (JN) The entities and attributes are clearly defined. The constraints and data types look accurate to the field. The naming of entities and attributes are self-explaining. All entities' purposes are described.
- (JB) Yes, the outline describes the entities, provides their attributes with proper data types, and explains the relationships between all the entities. Aircraft provides information about the plane, Flights provides information about the aircraft and route, Routes provides information about the flight logistics, Seats provides information about the seat number and Aircraft, and Passengers provides information on the passengers.
- (PB) Yes each entity has an apt description that lists the purpose for the tables. While the attributes data types and constraints are perfectly outlined i.e. routeId INT or emailAddress VARCHAR(1000) NN. There is also a clear description of the relationship between each of the entities.

Are 1:M relationships correctly formulated? Is there at least one M:M relationship? Does the ERD present a logical view of the database? If yes, summarize. If not, based on the course material, what changes can you suggest to improve?

- (AF) M:N Relationships are clearly defined with intersection tables. The existing 1:M relationships seem to be correctly formatted. Others have mentioned the possibility of a Seat not having a passenger and needing to take this into account. I believe that reviewing the cardinality (optional or mandatory) of the relationships could help as all of the relationships are mandatory currently.
- (JN) The relationships are listed for each entity which is reflected in the ERD. I think the relationships look correct for the most part in how they are defined. I agree with Joshua that since bookings link seats to flights and passengers, there needs to be a way for a seat no to have a passenger. I think you the way you thought about it was that a passenger creates a booking which needs a seat and flight, however with the M:M relationship created between seats and flights this creates the problem of bookings that aren't filled with passengers.
- (JB) There are two M:M relationships, but I think the ERD relationships could use a little work. For instance, not every seat of a flight will always be booked, it is possible to have an empty seat. Also, it is possible for a flight to not be part of a flight. So, it would be beneficial for the ERD to have the inclusion described in the relationships.
- (PB) Yes 1:M relationships are present and formatted correctly for example Routes and Flights. M:M relationships are there as well such as the relationship between Employees and Flights via Assignments. The ERD is also there and provides a logical view of the database described in the outline.

Is there consistency in a) naming between overview and entity/attributes b) entities plural, attributes singular c) use of capitalization for naming? If yes, summarize. If not, based on the course material, what changes can you suggest to improve?

- (AF) There is consistency in naming between overview and entity/attributes, entities plural, attributes singular, and the use of capitalization for naming. The style guide seems to be adhered to well. The only thing I would say to improve here (which I mentioned earlier) would be to mention Seats in the overview for greater consistency between the overview and the entities.
- (PB) Yes entity names like Flights and Aircraft are plural though admittedly I had to double check that Aircraft is both singular and plural. Attribute names are Singular for example flightId or jobRole. The capitalization of proper names is also correct and consistent throughout the table.
- (JN) The naming looks good. Each name is clear and self documenting. The capitalization and pluralization is followed. Lower Camel Case is used for all attributes and all entities use upper camel case.
- (JB) Yes, all the entities are capitalized and plural. All the attributes are in camel case, with the PK values being the name of the table + Id. For example, Flights and the PK being flightId.

Fixes Based on Feedback from Part 1

1. Team-initiated design change:
   - Altered seatId to auto-increment to match the remaining Primary Keys.

2. Feedback that the problem statement is missing from the overview, and that the overview is too broad:
   - We updated the Overview Section to more explicitly state the problem being solved

3. Suggestion to clarify Seats in cases where a passenger has not booked:
   - We added Cardinality to the relationship between Bookings and Passengers to clarify that a Passenger ID can be NULL. *(Reverted in Step 3)*

4. Suggestion to cut table count:
   - We did not incorporate this after clarifying with that TA that a 3 person group requires more objects.

5. Suggestion to include more specific facts in overview for employees and aircraft:
   - We did not make specific changes based on this feedback, as we already describe a general range of these facts.

6. Suggestion to add Seats in overview:
   - We added information about Seats to the problem statement and to the facts information.

7. Suggestion to add revenue and ticket costs:
   - We did not include this as the database is already over the minimum required objects, and payment information would potentially add too much complexity.

8. Feedback that a flight may not be part of a flight:
   - We did not incorporate this feedback due to the meaning being unclear.

9. Team-initiated design change:
   - Altered some varchar values to enum lists (seatClass, aircraftStatus)

Project Outline and Database Outline

1. **Flights**
    a. Stores records of all flights, past and upcoming.
    b. Attributes:
        i. **flightId**: int, auto_increment, unique, PK
        ii. **departureAt**: datetime, not NULL, in UTC time zone
        iii. **routeId**: FK to Routes table
        iv. **aircraftId**: int, FK (reference to **aircraftId** in Planes)
        v. **flightStatus**: enum('scheduled', 'delayed', 'cancelled', 'in progress', 'completed') notNULL
    c. Relationships
        i. M:1 with Aircraft
        ii. M:1 with Routes
        iii. M:N to Seats via Bookings intersection table
        iv. M:N to Passengers via Bookings intersection table
        v. M:N to Employees via Assignments intersection table
2. **Aircraft**
    a. Stores data about individual airplanes that can be assigned to flights.
    b. Attributes:
        i. **aircraftId**: int, auto_increment, unique, PK
        ii. **model**: varchar(250), not NULL
        iii. **capacity**: int, not NULL
        iv. **aircraftStatus**: enum('active', 'maintenance', 'inactive'), not NULL
    c. Relationships
        i. 1:M to Seats
            1. aircraftID is used as a foreign key inside of the Seats entity.
        ii. 1:M Flights
            1. aircraftID is used as a foreign key inside of the Flights entity.
3. **Routes**
    a. Stores routes between airports that are available for flight transit.
    b. Attributes:
        i. **routeId**: int, auto_increment, unique, PK
        ii. **originAirport**: varchar(4), not NULL.
            1. 3 or 4 character airport code for origin airport
        iii. **destinationAirport**: varchar(4), not NULL
            1. 3 or 4 character airport code for destination airport
        iv. **distanceKilometers**: int, not NULL
        v. **durationSeconds**: int not NULL
    c. Relationship:
        i. 1:M between Routes and Flights, **routeId** links each flight to a specific route
        ii. routeID is used as a foreign key inside of the Flights entity.
4. **Seats**
    a. Stores information about a specific seat on a specific plane which can be booked by a passenger, allowing for easy passenger seat allocation and tracking.
    b. Attributes
        i. **seatId**: int, auto_increment, not NULL, PK
        ii. **aircraftId**: int, not NULL, FK
        iii. **seatNumber**: varchar(10) not NULL
        iv. **seatClass**: enum('economy', 'premium', 'business', 'first class') not NULL
    c. Relationship:
        i. M:N to Passengers via Bookings intersection table
        ii. M:1 to Aircraft
5. **Passengers**
    a. Stores passenger information. A passenger is defined as anyone who has ever booked a flight on our airline.
    b. Attributes:

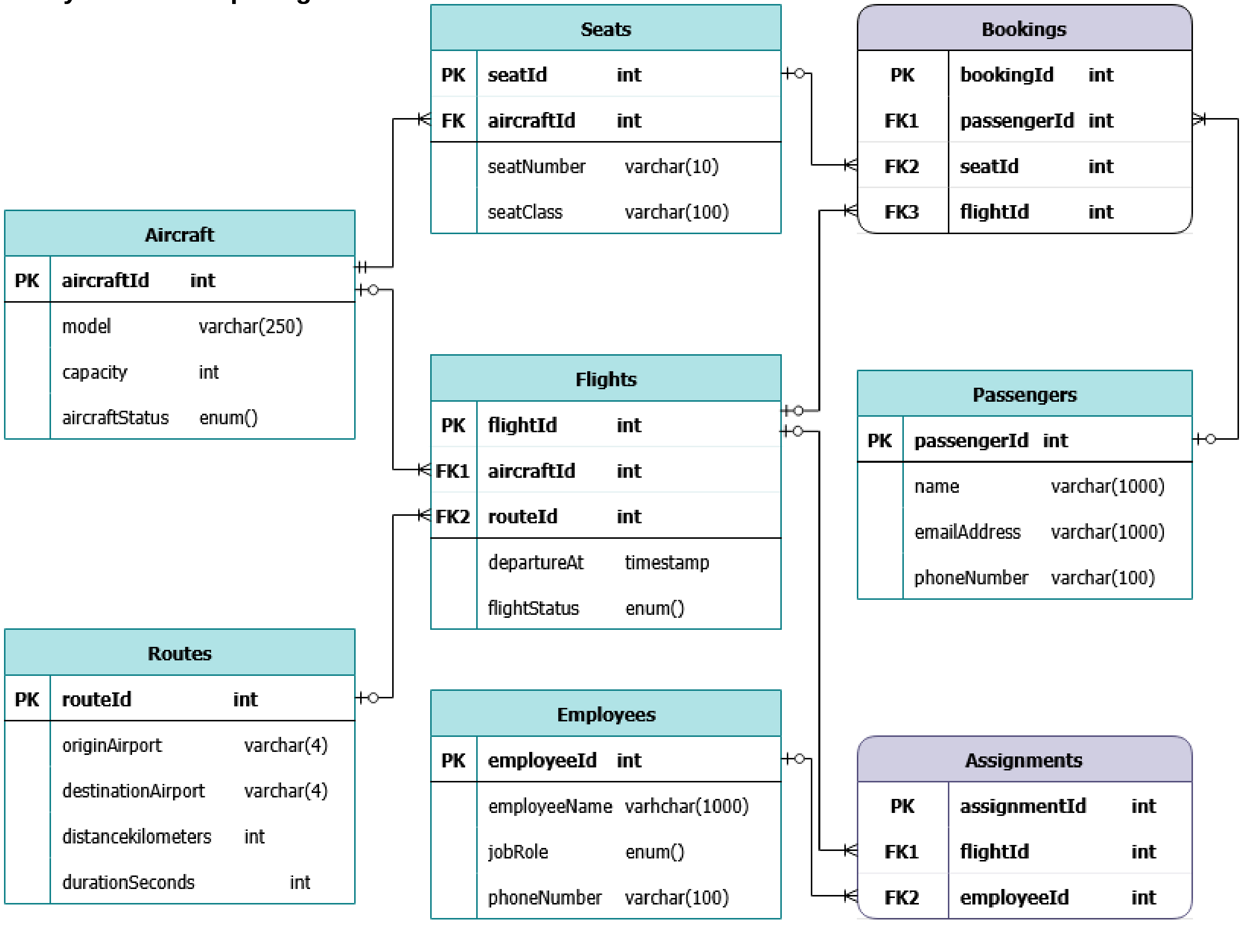
        i. **passengerId**: int, auto_increment, unique, PK
        ii. **name**: varchar(1000), not NULL
        iii. **emailAddress**: varchar(1000), not NULL
        iv. **phoneNumber**: varchar(100), NULL
    c. Relationship:
        i. M:N between Passengers, Seats, and Flights via intersection table Bookings.

6. **Employees**
    a. Stores airline employee data. An employee is any person who has worked or will work on any flight on our airline.
    b. Attributes:
        i. **employeeId**: int, auto_increment, unique, PK
        ii. **employeeName**: varchar(1000), not NULL
        iii. **jobRole**: enum('pilot', 'copilot', 'flight attendant', 'engineer', 'tarmac'), not NULL
        iv. **phoneNumber**: varchar(100), not NULL
    c. Relationship:
        i. M:N between Employees and Flights, via intersection table Assignments

Intersection Tables:

7. **Bookings**
    a. Join table for relationship between Flights, Passengers, and Seats. M:N relationship. Represents a seat that is or can be booked by a passenger; as such, the "passengerId" will remain NULL until that seat is booked. This relationship is maintained so that operations can determine available seats and unavailable seats on a given flight.
    b. Attributes
        i. **bookingId**: int, auto_increment, unique, PK
        ii. **flightId**: int, FK (reference to flightId in Flights)
        iii. **seatId**: int, FK (reference to seatId in Seats)
        iv. **passengerId**: int, FK (reference to passengerId in Passengers) * Can be NULL
    c. Relationships
        i. M:1 with Flights via flightId
        ii. M:1 with Seats via seatId
        iii. M:1 with Passengers via passengerID
8. **Assignments**
    a. Join table between Employees and Flights M:N relationship. Represents an employee being assigned to work on a specific flight.
    b. Attributes
        i. **assignmentId**: int, auto_increment, unique, PK
        ii. **flightId**: int, FK (reference to flightId in Flights)
        iii. **employeeId**: int, FK (reference to employeeId in Employees)
    c. Relationships
        i. M:1 with Flights via flightId
        ii. M:1 with Employees via employeeId

Entity-Relationship Diagram



Seats

PK	seatId	int
FK	aircraftId	int
	seatNumber	varchar(10)
	seatClass	varchar(100)

Bookings

PK	bookingId	int
FK1	passengerId	int
FK2	seatId	int
FK3	flightId	int

Aircraft

PK	aircraftId	int
	model	varchar(250)
	capacity	int
	aircraftStatus	enum()

Flights

PK	flightId	int
FK1	aircraftId	int
FK2	routeId	int
	departureAt	timestamp
	flightStatus	enum()

Passengers

PK	passengerId	int
	name	varchar(1000)
	emailAddress	varchar(1000)
	phoneNumber	varchar(100)

Routes

PK	routeId	int
	originAirport	varchar(4)
	destinationAirport	varchar(4)
	distancekilometers	int
	durationSeconds	int

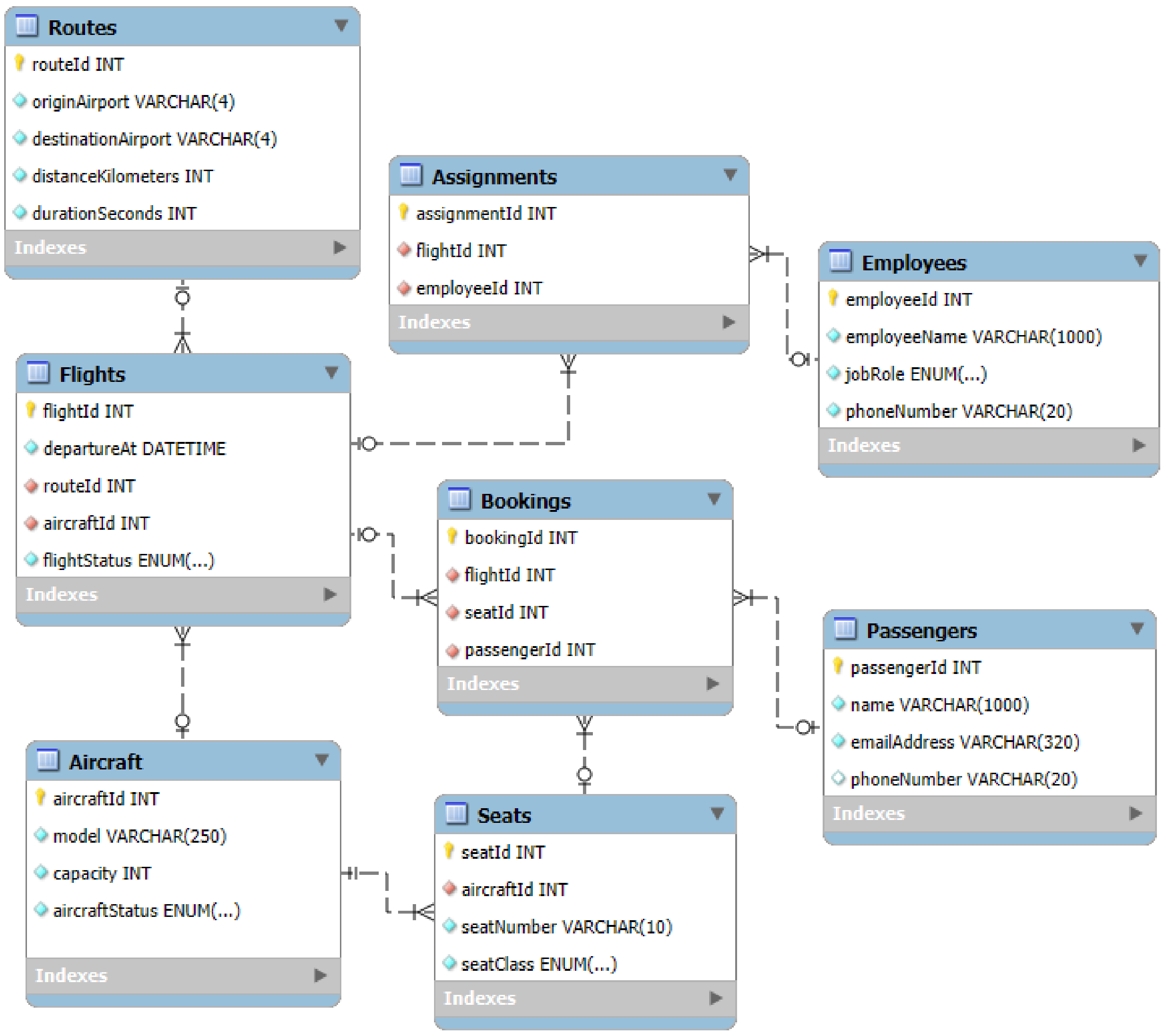
Employees

PK	employeeId	int
	employeeName	varhchar(1000)
	jobRole	enum()
	phoneNumber	varchar(100)

Assignments

PK	assignmentId	int
FK1	flightId	int
FK2	employeeId	int

Schema



Routes
routeId INT
originAirport VARCHAR(4)
destinationAirport VARCHAR(4)
distanceKilometers INT
durationSeconds INT
Indexes
Assignments
assignmentId INT
flightId INT
employeeId INT
Indexes
Employees
employeeId INT
employeeName VARCHAR(1000)
jobRole ENUM(...)
phoneNumber VARCHAR(20)
Indexes
Flights
flightId INT
departureAt DATETIME
routeId INT
aircraftId INT
flightStatus ENUM(...)
Indexes
Bookings
bookingId INT
flightId INT
seatId INT
passengerId INT
Indexes
Passengers
passengerId INT
name VARCHAR(1000)
emailAddress VARCHAR(320)
phoneNumber VARCHAR(20)
Indexes
Aircraft
aircraftId INT
model VARCHAR(250)
capacity INT
aircraftStatus ENUM(...)
Indexes
Seats
seatId INT
aircraftId INT
seatNumber VARCHAR(10)
seatClass ENUM(...)
Indexes

Example Data

Assignments

assignmentId	flightId	employeeId
1	1	1
2	1	2
3	3	1
4	3	3

Bookings

bookingId	flightId	seatId	passengerId
1	1	1	1
2	1	2	2
3	3	3	1

Employees

employeeId	employeeName	jobRole	phoneNumber
1	Rhonda Smith	pilot	347-203-1967
2	James Wilson	engineer	347-204-1969
3	Samuel Smith	flight attendant	347-352-1964

Passengers

passengerID	name	emailAddress	phoneNumber
1	Katherine Pillsbury	pillsk@gmail.com	253-867-5309
2	Jack Mustonen	jackmustonen123@gmail.com	971-303-3385
3	Muhammad Akbar	muhammadakbar@gmail.com	923-453-3451

Seats

seatId	aircraftId	seatNumber	seatClass
1	1	1	first class
2	1	2	first class
3	3	1	economy
4	2	1	first class

Routes

routeId	originAirport	destinationAirport	distanceKilometers	durationSeconds
1	SEA	LAX	1545	9300
2	LAX	SFO	543	3600
3	SFO	SEA	1094	7200

Aircraft

aircraftId	model	capacity	aircraftStatus
1	A220	133	active
2	A220	133	active
3	747	467	maintenance

Flights

flightId	departureAt	routeId	aircraftId	flightStatus
1	2024-12-31 00:00:00Z	1	1	completed
2	2025-01-01 00:00:00Z	1	2	in progress
3	2025-01-02 00:00:00Z	2	2	scheduled