

ASSIGNMENT 1a - 601.315/415/615 - Databases

Due date: Thursday, September 21, 2023 at 11:59PM EDT

Part 1: Database Schema Design (45 points)

Your task is to design a database for an airline dispatch office for a new airline *JHair* that keeps records on the flights, crews, airports and airplane operations but not on passenger reservations. To save costs, all the information of several cooperating airlines is in the system.

From the database, it should be possible to answer (at a minimum) the following questions:

- (a) List the city, airport-code and miles-from-the-city of all airports in Iowa.
- (b) For each AirTran airline flight that is scheduled to depart BWI weekdays before 0900 hours, list the scheduled arrival time and arrival city code.
- (c) List the actual arrival time, arrival city code, and airplane ID number (unique one for every physical plane) of all flights on 17-JUL-23.
- (d) List the airport code, city and state of the destinations of all flights that are scheduled to depart BWI on weekends.
- (e) List the name, SSN, birthdate and position working (e.g. captain, first-officer, flight attendant) of all flights on 14-AUG-23 that actually arrived in BWI before 2200 hours.
- (f) List all flight crew members that are certified to fly Boeing 787's that actually flew Boeing 787's yesterday (29-SEP-23).
- (g) List the types of aircraft (manufacturer, model, weight and seating capacity) that are small enough to land in some airport in Delaware.
- (h) List the airlines that have nonstop flights from some city in Maryland to some city in California.

Simplifying assumptions:

The database only contains domestic flights. All flights only have one leg (no stops or connections). No plane is in the air at midnight. Flights either fly *daily*, *weekdays*, or *weekends*. The basic information about a flight (city codes served, scheduled arrival and departure times, etc.) does not change from day to day, but information such as actual arrival time does change. Flight crew members can potentially work in different roles (captain, 1st officer, flight attendant) on different flights - the flight attendants are striking and need other employees to fill in for them. Flight crew certifications of ability to work on a given aircraft type do not change over time. In the information about a flight, you may only store airport codes (e.g. BWI, JFK, LAX), not cities or states.

- 1.1 (*30 points*) Design the database using the entity-relationship database model and draw it. Your design should minimize repetitions of information. and should compartmentalize the permanent attributes of a flight/thing and the attributes that change on different dates, etc. Be sure to mark the primary keys, as well as mapping constraints (\leftrightarrow , \rightarrow , \leftarrow) and participation constraints (\rightarrow or \Rightarrow). Mapping constraints and participation constraints may also be expressed in the alternative notation using $(0,1)$ or $(1,N)$, for example.

You should *very* briefly justify any unusual or potentially controversial design decisions you make. Do *not* spend much time on such notes.

This section will be graded on aesthetics and completeness as well as correctness.

- 1.2 (*10 points*) Represent this database design using the relational model. You should use a tabular notation and include at least one row of sample values for each relation.

You should *very* briefly justify any unusual or potentially controversial decisions you make in the conversion process. Do *not* spend much time on such notes.

- 1.3 (*15 points*) Write relational algebra expressions to answer any 10 of the queries above. You may use assignment to intermediate relations to make your expressions clearer. *Students in 601.315 only need to do 6 of these queries.* Will be submitted with HW1b. Listed here for your planning.

Submission will be via gradescope, with instructions distributed via piazza.