Database Management Systems, Aug–Dec 2025

Assignment 3, 25 October 2025, due 3 November 2025

You are setting up a database for a major domestic airline. You start with a table capturing all the relevant fields.

```
Flights (City, AirportCode, Terminal, FlightNo, DepAirportCode, DepTerminal,
         DepTime, ArrAirportCode, ArrTerminal, ArrTime, Capacity, Class,
         DayOfWeek, Date, AircraftType, PilotID, PilotName, AircraftID)
```

1. Each `AirportCode` maps to a unique `City`. A city may have more than one airport. An airport may have more than one `Terminal`.
2. Each flight operated by the airline has a unique flight number, `FlightNo`. The flight leaves from `DepTerminal` at `DepAirportCode` and arrives in `ArrTerminal` at `ArrAirportCode`.
3. A flight always operates between the same pair of airports — there are no *hopping flights* with several segments having the same flight number. A flight always leaves from and arrives at the same terminal, even if the departure and arrival airports have multiple terminals.
4. `Class` has codes indicating the different classes of seating — *Economy*, *Premium Economy*, *Business* — available on a flight.
5. `Capacity` takes values *Small*, *Medium*, *Large* and indicates the number of seats available on a flight.
6. Not all flights operate daily. `DayOfWeek` takes values `Sun`, `Mon`, ..., `Sat`. The origin and destination of each flight is the same on all days that it operates, but the timings may change.

   `(FlightNo, DayOfWeek, DepTime, ArrTime)` captures the schedule of a flight on a given day of the week. Every flight starts and ends on the same day.

   The seating classes available on a flight are the same on all days of the week. The capacity of a flight is the same on all days of the week.
7. The airline operates multiple types of aircraft. This is captured by `AircraftType`. Each `AirCraftType` has a fixed `Capacity`.
8. Each pilot has a unique `PilotID` that maps to a `PilotName`. Each pilot is licensed to fly one or more of types of aircraft.
9. Each individual plane has a unique `AircraftID`, with an associated `AircraftType`.
10. Different aircraft of the same type may have different seat configurations, and hence different subsets of classes available. One may have *Economy Class* and *Premium Economy* but no *Business Class*, while another may have *Economy Class* and *Business Class* but no *Premium Economy*.
11. The table also records the crew and aircraft assigned to each run of a flight. On each `Date` that a flight operates, it will have two pilots and one aircraft assigned to it. The `Capacity` and `Class` of the flight should match those of the `AircraftID` assigned to it, and the pilots should be licensed to fly the type of aircraft assigned to the flight.

Here are some entries in the original `Flights` table, and their interpretation.

```
(Mumbai, BOM, T2, RS542, DEL, T2, 1350, MAA, T1, 1640, Mon, Large, Business,
 2025-10-25, A321neo, 20342, Anil Shukla, VTAXZ)
```

- The airport with code `BOM` is located in `Mumbai` and has a terminal called `T2`. On Mondays, flight `RS542` leaves `DEL`, terminal `T2`, at `1350` and reaches `MAA`, terminal `T1`, at `1640`. This flight requires a *Large* aircraft and it has a *Business Class* section. On 25 October, 2025, pilot ID `20342`, `Anil Shukla`, was assigned to this flight and the aircraft used was `VTAXZ` of type `A321neo`.

```
(New Delhi, DEL, T3, RS542, DEL, T2, 1345, MAA, T1, 1640, Wed, Large, Economy,
 2025-10-23, B777, 32141, Devika Raj, VTCTD)
```

- The airport with code `DEL` is located in `New Delhi` and has a terminal called `T3`. On Wednesdays, flight `RS542` leaves `DEL`, terminal `T2`, at `1345` and reaches `MAA`, terminal `T1`, at `1640`. This flight

requires a *Large* aircraft and it has an *Economy Class* section. On 23 October, 2025, pilot ID `32141`, `Devika Raj`, was assigned to this flight and the aircraft used was `VTCTD` of type `B777`.

```
(Chennai, MAA, T4, RS4241, CJB, T1, 1745, BLR, T1, 1900, Fri, Small, Economy,
 2025-10-24, ATR, 10124, M J Paul, VTXBJ)
```

- The airport with code `MAA` is located in `Chennai` and has a terminal called `T4`. On Fridays, flight `RS4241` leaves `CJB`, terminal `T1`, at `1745` and reaches `BLR`, terminal `T1`, at `1900`. This flight requires a *Small* aircraft and it has an *Economy Class* section. On 24 October, 2025, pilot ID `10124`, `M J Paul`, was assigned to this flight and the aircraft used was `VTXBJ` of type `ATR`.

Questions

1. Identify all functional dependencies in this table.
2. Compute a BCNF decomposition.
3. Explain whether your BCNF decomposition is dependency preserving.
4. If your BCNF decomposition is not dependency preserving, compute a dependency preserving 3NF decomposition.

How to submit

- Submit your solutions on Moodle.
- Your submission should be a pdf file. It can either be generated using some document writing software, or a scan of a handwritten document.
