TDT4145 Data Modeling and Database Systems: Project Assignment

Problem description

We will create a database for domestic flight routes in Norway, where we keep track of airports, airlines, flight routes, actual flights, customers, ticket bookings, aircraft types, aircraft and other information that emerges from this project description. In the project description, we have made a number of simplifications compared to what would have been a real mini-world. You are to stick to the mini-world described. Where you need to make assumptions and extensions, this must be documented.

Airlines are organizations that in this context sell air transport between the Norwegian airports. Airlines have a unique airline code, the name of the company and any other information that you find necessary. An airline operates one or more aircraft types and has a fleet of aircraft of each of these aircraft types. An aircraft type has a unique name, is produced by a specific aircraft manufacturer, and is manufactured from the first year of production until the last year of production, unless it is still in production. All aircraft of a specific aircraft type are configured in the same way when it comes to seats in the aircraft. Aircraft manufacturers have a unique name, nationality, and a year of foundation for the company. All aircraft have a unique serial number within the company that manufactured the aircraft and a unique registration number. It is common for an aircraft to have a name, and we know what year the aircraft was put into service.

Airports have a unique airport code and an airport name that is also unique. For each airport, we keep track of which airports there are flights to and which airports there are flights from. A flight route is a scheduled flight offer from a starting airport to a final airport, with the possibility of one or more stopovers along the way. A flight route has a unique flight number and a weekday code that tells you which days of the week the route is flown. A flight route is not flown more than once a day. There is a specific airline that operates a flight route and it is always flown with the same aircraft type, which must be part of the airline's fleet. The flight itinerary must include the scheduled departure time from the departure airport and the scheduled arrival time at the final airport, as well as the arrival and departure times of all airports where stopovers are made. It must be possible to register the start date and, if applicable, the end date of the flight route.

When a specific flight is made of a flight route, we identify it by a unique serial number for that flight route. When it becomes clear, we must be able to register which aircraft will be used on this flight. Flights have the status that can be planned, active (while flying), completed or cancelled. Ticket sales are only made to flights that have the status of planned. Airlines will therefore add flights in the future, as far ahead as they want to commit. As a flight progresses, actual departure and arrival times for the airports involved will be recorded. We choose to ignore the fact that flights may be changed or rerouted along the way.

To buy airline tickets, you must be registered as a customer in a common ticketing system, with a unique customer number, name, phone number, email address, and nationality. If a customer is part of a loyalty program for an airline, a unique reference to this airline's loyalty program. For each flight route, prices will be registered for three different ticket categories ("budget", "economy", "premium"). These prices apply to all ticket purchases for scheduled flights. If the prices are increased, the new price will only apply to ticket purchases made after the price increase. There will be prices for journeys from the start to the end airport, as well as for all possible segments. A customer can make ticket purchases that have a unique reference number. A ticket purchase can consist of a journey (outbound) from a starting airport to a final

airport, or be a return journey with an outbound and a return flight. An outbound or a return flight can be composed of one or more flights (different flight routes). For each of these, a ticket category is selected, and the price for each leg journey is registered. The total price of the ticket purchase is also recorded. When purchasing the ticket, the customer can choose a seat for each part of the journey, or this will be registered when the customer checks in. The time of check-in must be registered, as well as if customers check in baggage. Checked baggage is linked to the relevant part of the journey and is registered with a unique registration number, weight and time of drop-off (delivery).

Use cases

The following use cases should be implemented in Python and/or SQL:

1. The airports mentioned in Appendix 1 shall be entered in the database. This can be done with SQL, without writing a Python program.

2. The airlines, aircraft types and aircraft mentioned in Appendix 2 shall be entered in the database. This can be done with SQL, without writing a Python program.

3. The flight schedules and fares mentioned in Appendix 3 shall be entered in the database. This can be done with SQL, without writing a Python program.

4. For Tuesday, April 1, 2025, flights of the WF1302 (BOO-TDR), DY753 (TRD-OSL) and SK888 (TRD-BGO-SVG) routes will be added. This can be done with SQL, without writing a Python program.

5. We want to have a SQL query that finds the airline, which aircraft types the airline uses and the number of aircraft the company has of each aircraft type.

6. A Python program will be created (using SQL) that allows the user to select one of the airports in the database, the day of the week and whether they are interested in departures or arrivals. The program will then find all flight routes in or out of this airport on the selected day of the week. The result must consist of the flight flight number, departure or arrival time and the airports the route will visit or has visited.

7. Ten orders will be placed for WF1302 (BOO-TRD) on Tuesday 1 April 2025. All bookings can be registered to the same customer and seats must be reserved. This can be done with SQL, without writing a program.

8. A Python program (using SQL) will be created that allows the user to select a flight (i.e. a flight route on a specific date) and that finds available seats on each flight. You don't need to book the flight, just find the available seats.

Appendix 1: Airports

There are many airports in Norway, so we limit ourselves to:

- Bodø Airport. Airport code BOO

- Bergen Airport, Flesland. Airport code BGO

- Oslo Airport, Gardermoen. Airport code OSL

- Stavanger Airport, Sola. Airport code SVG

- Trondheim Airport, Værnes, airport code TRD

Appendix 2: Airlines, aircraft types and fleets

To limit the amount of data, we limit ourselves to the airlines Norwegian, SAS and Widerøe. They have the airline codes DY, SK and WF.

We limit ourselves to three aircraft types:

- "Boeing 737 800" which was produced by the American company The Boeing Company. The aircraft type was in production between 1997 and 2020.

- "Airbus a320neo" which is produced by Airbus Group. Airbus Group is a French, German, Spanish and British company. The aircraft type has been in production since 2016.

- The "Dash-8 100" which was produced by the Canadian aircraft manufacturer De Havilland Canada between 1984 and 2005.

The configuration of the passenger cabin is as follows for the following aircraft types:

- The Boeing 737 800 has 31 rows with six seats in each row. The rows are numbered from 1 to 31. The seats in a row are marked with A, B, and C on one side of the aisle and D, E, and F on the other side of the aisle. Row number 13 is located at the emergency exit.

- The Airbus a320neo has 30 rows with six seats in each row. The rows are numbered from 1 to 30. The seats in a row are marked with A, B, and C on one side of the aisle and D, E, and F on the other side of the aisle. Rows 11 and 12 are located at emergency exits.

- The Dash-8 100 has 10 rows, most with four seats in each row. The rows are numbered from 1 to 10. Row one consists of two seats, C and D on the right side of the aisle. The seats in rows 2-10 are marked with A and B on one side of the aisle and C and D on the other side of the aisle. Row number 5 is located at the emergency exit.

Norwegian flies with the Boeing 737 800. We limit ourselves to registering four aircraft of this type:

- Serial number 42069 with registration number LN-ENU. The aircraft entered service in 2015.

- Serial number 42093 with registration number LN-ENR. The aircraft is called Jan Bålsrud and was put into service in 2018.

- Serial number 39403 with registration number LN-NIQ. The aircraft is called Max Manus and was put into service in 2011.

- Serial number 42281 with registration number LN-ENS. The aircraft entered service in 2017.

SAS flies with the Airbus a320neo. We limit ourselves to registering four aircraft of this type:

- Serial number 9518 which is called Birger Viking and was put into service in 2020. Registration number is SE-RUB.

- Serial number 11421 which is called Nora Viking and was put into service in 2023. The registration number is SE-DIR.

- Serial number 12066 named Ragnhild Viking and was put into service in 2024. The registration number is SE-RUP.

- Serial number 12166 which is called Ebbe Viking and was put into service in 2024. Registration number is SE-RZE.

Widerøe flies with the Dash-8 100. We limit ourselves to registering three aircraft of this type:

- Serial number 383, registration number LN-WIH. Called Oslo and was put into use in 1994.

- Serial number 359, registration number LN-WIA. Called Nordland and was put into use in 1993.

- Serial number 298, registration number LN-WIL. Called Narvik and was put into use in 1995.

Appendix 3: Flight Routes

- WF1311: TRD-BOO. 15:15-16:20. Weekdays: 12345 (Monday to Friday). Fly with the Dash-8 100. Prices: 2018 (premium), 899 (economy), 599 (budget)

- WF1302: BOO-TRD. 07:35-08:40. Weekdays: 12345. Fly with the Dash-8 100. Prices: 2018 (premium), 899 (economy), 599 (budget)

- DY753: TRD-OSL. 10:20-11:15. Weekdays: 1234567. Fly with Boeing 737 800. Prices: 1500, 1000, 500

- SK332: OSL-TRD. 08:00-09:05. Weekdays: 1234567. Fly with the Airbus a320neo. Prices: 1500, 1000, 500

- SK888: TRD-BGO-SVG. Weekdays: 12345. Fly with the Airbus a320neo.

  o TRD-BGO. 10:00-11:10. Prices: 2000, 1500, 800. [Travel: TRD-BGO]

  o BGO-SVG. 11:40-12:10. Prices: 1000, 700, 350. [Travel: BGO-SVG]

  o TRD-SVG. 10:00-12:10. Fares: 2200, 1700, 1000. [Journey: TRD-SVG via BGO]