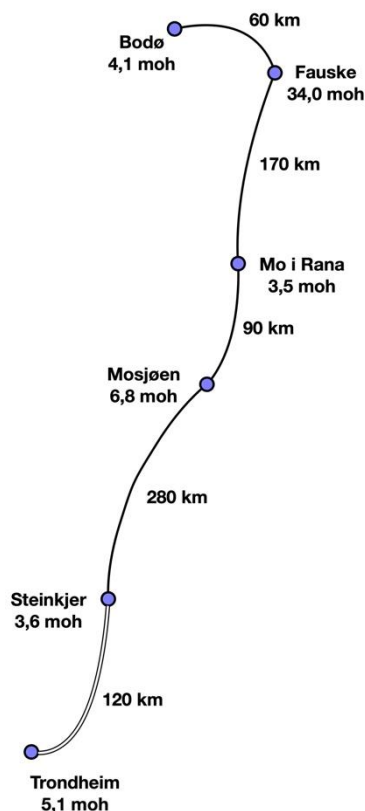


Problem Description

You are tasked to create a database for the Norwegian railway system. In order to achieve appropriate complexity and workload, the description of the railway system has been simplified considerably. During the project, it will be necessary to make some assumptions which must be documented in the project report.

The Norwegian railway system consists of physical track sections, such as the Nordland Line from Trondheim to Bodø and the Dovre Line from Oslo to Trondheim. A track section starts at a railway station, passes through a number of railway stations, and ends at a railway station. All track sections have a name, are equipped for a driving energy that is either electric or diesel, and consist of a number of sub-sections. A sub-section runs between two railway stations, has a length in km, and is either single track or double track. Railway stations have a unique name, and the altitude of the station is recorded (masl - meters above sea level).

The figure shows a simplified version of the Nordland Line, which we will use when storing data in the database. We have assumed a double track between Trondheim and Steinkjer, since this is crucial and should have been in place a long time ago. Trains on the Nordland Line are powered by diesel.



Train routes run on track sections and these train routes may run in the track section's main direction or in the opposite direction. For the Nordland Line, the main direction is from Trondheim to Bodø. A train route can run the entire track section or only parts of it, for instance from Mo i Rana to Trondheim. A train route has a start station and an end station and usually stops at stations in-between. For each railway station on the train route we have an arrival time/departure time, except at the start station where the train route only has a departure time and at the end station where the train route only has an arrival time. A train route runs at most once a day, and it must be recorded on which days of the week the train route runs from the start station.

A train route is operated by an operator; on the Nordland Line, this is SJ, which has a number of car types where customers can buy tickets for seats. A car type has a name and is either a chair car or a sleeping car. Chair cars have a number of seat rows where there are a number of seats in each row. The seats are numbered from the front of the car and from left to right. In a car with four seats per row, we have seat numbers one to four on the first row, seat numbers five to eight on the second row, etc. A sleeping car consists of a number of sleeping compartments that are numbered from the front of the car and backwards, so that a sleeping car with four sleeping compartments will have compartment numbers from one to four. The beds are numbered from the front of the car so that the lower bed has the lowest number in a compartment. A sleeping car with four sleeping compartments will have sleeping places from number one to number eight, where sleeping place number six is the upper bed in compartment number three.

A train route has a fixed car arrangement, made up of available car types, for example, two chair cars and one sleeping car. In a car arrangement, the cars are numbered from the front to the back of the train so that the car right after the locomotive is car number one. In the task, we ignore locomotives and other service cars that can be included in a car arrangement. A train route has a fixed timetable with departure/arrival times for each station on the route.

A train route has a train occurrence for each day the train route is operated. To travel on a train route, a customer buys a ticket for one or more seats in a train occurrence. To purchase tickets, one must be registered as a customer in the operators' common customer registry, with a unique customer number, name, email address, and mobile number. A ticket purchase is organized into a customer order that has a unique order number, day and time of purchase, and a number of ticket purchases in the same train occurrence. To simplify the task, we ignore prices and payment of tickets. A ticket applies to either a seat in a chair car or a bed in a sleeping car and reserves the space from one station on the route to another station on the route. It should not be possible to buy tickets for seats that are already sold. However, the same seat can be sold to several customers as long as their journeys do not overlap. A customer can buy one or two places in a sleeping compartment. If a customer has reserved a bed in a sleeping compartment, we cannot sell the available bed to another customer. If someone has a ticket for one of the beds in a sleeping compartment on a part of the route, we do not sell the seats in the compartment to others, even if their journey does not overlap with the journey of the person who has already purchased a sleeping space.

User Stories

- a) The database should be able to register data about all railway routes in Norway. You should enter data for Nordlandsbanen (as shown in the figure above). This can be done with a script and you do not need to program support for this functionality.
- b) You are supposed to register data about train routes. You should enter data for the three train routes on Nordlandsbanen described in the appendix to this task. This can be done with a script, you do not need to program support for this functionality.
- c) For a specified station, the user should be able to get all train routes that stop at the station on a given weekday. This functionality should be programmed.
- d) The user should be able to search for train routes going between a starting station and an ending station based on date and time. All routes for the same day and the next should be returned and sorted by time. This functionality should be programmed.
- e) The user should be able to register in the customer registry. This functionality should be programmed.
- f) Necessary data should be entered for the system to handle purchasing of tickets for the three train routes on Nordlandsbanen Monday April 3rd and Tuesday April 4th of this year. This can be done with a script, you do not need to program support for this functionality.
- g) Registered customers should be able to find available tickets for a desired train route and purchase the tickets they would like. This functionality should be programmed.
 - Make sure to only sell available seats.
- h) All information about purchases made for future trips should be available for a user. This functionality should be programmed.

It is crucial that you go through the user stories and make sure that your proposed database can support all of the above functionalities.

Appendix

Timetable for a day train from Trondheim to Bodø

Trondheim S	07:49
Steinkjer	09:51
Mosjøen	13:20
Mo i Rana	14:31
Fauske	16:49
Bodø	17:34

This train route runs every weekday and has a car setup with two chair cars of type SJ-chair car-1

Timetable for a night train from Trondheim to Bodø

Trondheim S	23:05
Steinkjer	00:57
Mosjøen	04:41
Mo i Rana	05:55
Fauske	08:19
Bodø	09:05

This train route runs every weekday and has a car setup with one chair car of type SJ-chair car-1, followed by one sleeping car of type SJ-sleeping car-1

Timetable for a morning train from Mo i Rana to Trondheim

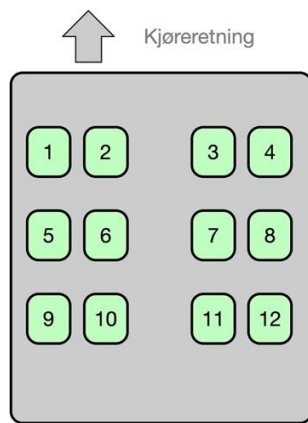
Mo i Rana	08:11
Mosjøen	09:14
Steinkjer	12:31
Trondheim S	14:13

This train route runs every weekday (Monday to Friday) and has a car setup with one chair car of type SJ-chair car-1

Train car types

Chair car (type: SJ-chair car-1)

The car has three rows of four seats making a total of 12 seats numbered from 1 to 12.



Sleeping car (type: SJ-sleeping car-1)

The car has four sleeping compartments with two beds in each making a total of 8 beds.

