# Weekly exercises DIGHEL4360 – Relational Databases and SQL

## Relational databases (first week)

### Exercise 1 – Prescriptions and regions

In the appendix of this document, three tables are listed.

- The table named `region` lists all regions in Norway, together with its name, area in square kilometers, and the health-region it is contained in.

- The table named `hospital` lists all the public hospitals in Norway, together with their name, the region it is contained in, the patient base, and the number of employees.

- The table named `primary_care_use` lists the use of primary care in total cases for each group of disorder (*mental* is short for *mental symptoms and disorders*, *cardiovascular* is short *cardiovascular disease* and *musculoskeletal* is short for *musculoskeletal system*) based on region and year.

Use the data in the tables to (manually) find:

1. the name of all regions in health region *Vest*.

2. the number of primary care use in the *mental*-category in *Agder* in *2020*.

3. the name of all regions with area greater than *40 000*.

4. the name and year of the regions having primary care cases in the cardiovascular category less than *25 000* in a year less than or equal to *2018*.

5. the name of all hospitals in health region *Nord*.

6. the total patientbase for all hospitals in *Oslo* and *Viken*.

**Solution**

1. Rogaland and Vestland

2. 50468

3. Innlandet, Trøndelag, Troms og Finnmark

4. Møre og Romsdal in the years 2015-2018, and Nordland in 2018 and Troms og Finnmark in 2017 and 2018.

5. Nordlandssykehuset, Nordlandssykehuset Gravdal, Nordlandssykehuset Vesterålen, Harstad Sykehus, Universitetssykehuset Nord-Norge, Narvik Sykehus, Finnmarkssykehuset, Helgelandssykehuset.

6. $40000 + 298000 + 160000 + 510000 + 600000 + 160000 + 80000 = 1848000$

## Exercise 2 – Rooms and equipment

We want to extend the relational database above to also store information about rooms and equipment of *hospitals*. So make a collection of tables able to contain the following information:

1. Hospitals contain rooms, and each rom is uniquely identified by a *room number* within that hospital (i.e. one needs to know both the hospital name and the room number to uniquely identiy a room), and a number denoting the number of *beds* in that room.

2. Rooms may contain equipment, where each type of equipment is uniquely identified by an *equipment-id*, a *name*, and has the name of a *responsible employee* that is responsible for maintenance of the that type of equipment.

3. Note that the same type of equipment may be in multiple rooms and one room may contain multiple types of equipment. We do want to store the *number* of each equipment type there is in each room.

Below are some examples of the data that can be stored in the database:

1. The hospital with name `Oslo universitetssykehus` contains a room with *room number* 57 which has 2 *beds*; the same hospital also has a room with *room number* 92 with 4 *beds*.

2. The hospital with name `Haukeland universitetssykehus` contains a room with *room number* 7 which has 1 *beds*; the same hospital also has a room with *room number* 92 with 2 *beds*.

3. Equipment type with *equipment-id* `e341` has *name* `defibrillator` and contact person *Ola Norman*.

4. Equipment type with *equipment-id* `hp996` has *name* `EKG Machine` and contact person *Mari Nilsen*.

5. Room `57` at `Oslo universitetssykehus` contains 1 *e341* and 3 `hp996`.

6. Room 7 at `Haukeland universitetssykehus` contains 2 *hp996*.

Create tables that can store the information given above. Structure the tables so that there is no data duplication (as described during the lecture). Also add the example data above into your tables.

It does not matter how/where you make the tables (e.g. draw them on paper or use a tool on your computer that can make tables).

**Solution**

`room:`

```
         hospital            | roomnr | num_beds
-----------------------------+--------+----------
 Oslo universitetssykehus     |    57 |        2
 Oslo universitetssykehus     |    92 |        4
 Haukeland universitetssykehus |     7 |        1
 Haukeland universitetssykehus |    92 |        2
```

`employee:`

```
 equipment_id |     name      | responsible_person
--------------+---------------+--------------------
 e341         | defibrillator | Ola Norman
 hp996        | EKG machine   | Mari Nilsen
```

`contains:`

```
         hospital            | roomnr | equipment | num
-----------------------------+--------+-----------+-----
 Oslo universitetssykehus     |    57 | e341      |   1
 Oslo universitetssykehus     |    57 | hp996     |   3
 Haukeland universitetssykehus |     7 | hp996     |   2
```

## Exercise 3 – Stores

Given the following table about stores and the products they sell:
**store:**

```
   address      | chain | product_id | product_name | price
----------------+-------+------------+--------------+-------
 Gateveien 1a   | Kiwi  |          2 | Banana       |  5.79
 Stedplassen 3c | Rema  |          2 | Banana       |  4.99
 Stedplassen 3c | Rema  |          5 | Rice         | 38.99
 Stedplassen 3c | Rema  |          9 | Pasta        | 29.15
 Bryggekaia 89  | Coop  |          5 | Rice         | 35.95
 Bryggekaia 1   | Rema  |          9 | Pasta        | 28.15
 Bryggekaia 89  | Coop  |         11 | Ice cream    |    28
```

We use the address to identify a store and the product's ID to identify a product. The table contains duplicate data. Create a collection of tables containing the same data but without data duplication.

**Solution**

**store:**

```
   address      | chain
----------------+-------
 Gateveien 1a   | Kiwi
 Stedplassen 3c | Rema
 Bryggekaia 1   | Rema
 Bryggekaia 89  | Coop
```

**product:**

```
 product_id | product_name
------------+--------------
          2 | Banana
          5 | Rice
          9 | Pasta
         11 | Ice cream
```

**sells:**

```
    address      | product_id | price
----------------+------------+-------
 Gateveien 1a    |          2 |  5.79
 Stedplassen 3c  |          2 |  4.99
 Stedplassen 3c  |          5 | 38.99
 Stedplassen 3c  |          9 | 29.15
 Bryggekaia 89   |          5 | 35.95
 Bryggekaia 1    |          9 | 28.15
 Bryggekaia 89   |         11 |    28
```

# SQL (second week)

If you go to the following web-page:

<div align="center">

https://dbfiddle.uk/DP9PuyWC?hide=2

</div>

you are taken to a webpage that has loaded all of the data from the tables you used in exercise 1 into a database, over which you can write SQL-queries. On the webpage there is already written a SQL-query (to the left) that find the number of primary care in the *mental* category in the year *2020* for each region. The result of this query is on the right-hand side of the page.

   If you either edit the query directly, or click the pluss-button below it to get a new text-box where you can write a new query. Click the big "run"-button at the top of the page to run your query.

   We will now use SQL to write queries that find the answers to some of the exercises from exercise 1, as well as some more complex queries. So write a SQL-query that finds:

1. all data in the `hospital`-table. (34)

2. the name of all regions in health region *Vest.* (2)

3. the number of primary care use in the *mental*-category in *Agder* in *2020.* (1)

4. the name of all regions with area greater than *40 000.* (3)

5. the name and year of the regions having primary care cases in the cardiovascular category less than *25 000* in a year less than or equal to *2018.* (7)

6. the name of all regions and the year when the number of primary care use in the `mental`-category was greater than double that of the `cardiovascular`-category. (3)

7. the total number of primary use for each category in the year *2020*. (1)

8. the average number of primary use in the `mental`-category in the year *2020*. (1)

**Solution**

**1:**

```
SELECT *
FROM hospital;
```

**2:**

```
SELECT name
FROM region
WHERE health_region = 'Vest';
```

**3:**

```
SELECT mental
FROM primary_care_use
WHERE region = 'Agder' AND
      year = '2020';
```

**4:**

```
SELECT name
FROM region
WHERE area > 40000;
```

**5:**

```
SELECT region, year
FROM primary_care_use
WHERE cardiovascular < 25000 AND
      year <= 2018;
```

**6:**

```
SELECT region, year
FROM primary_care_use
WHERE mental > 2*cardivascular;
```

**7:**

```
SELECT sum(mental), sum(cardiovascular), sum(musculoskeletal)
FROM primary_care_use
WHERE year = 2020;
```

8:

```sql
SELECT avg(mental)
FROM primary_care_use
WHERE year = 2020;
```

# Appendix: Tables

**regions**

```
         name          | area  | health_region
-----------------------+-------+---------------
 Innlandet             | 52072 | Sør-øst
 Viken                 | 24592 | Sør-øst
 Vestfold og Telemark  | 17465 | Sør-øst
 Oslo                  |   454 | Sør-øst
 Agder                 | 16434 | Sør-øst
 Rogaland              |  9377 | Vest
 Vestland              | 33870 | Vest
 Trøndelag             | 42201 | Midt-Norge
 Møre og Romsdal       | 14355 | Midt-Norge
 Nordland              | 38154 | Nord
 Troms og Finnmark     | 78829 | Nord
```

## hospital

| name | region | patientbase | employees |
|------|--------|------------:|----------:|
| Nordlandssykehuset Gravdal | Nordland | 24000 | |
| Nordlandssykehuset | Nordland | 78000 | |
| Stavanger universitetssjukehus | Rogaland | 369000 | 7800 |
| Molde sjukehus | Møre og Romsdal | 60000 | |
| Kongsberg sykehus | Viken | 40000 | 1000 |
| Sykehuset Telemark | Vestfold og Telemark | 170000 | 4000 |
| Nordlandssykehuset Vesterålen | Nordland | 52000 | |
| Sykehuset Innlandet | Innlandet | 305000 | |
| Haugesund sjukehus | Rogaland | 180000 | |
| Helgelandssykehuset | Nordland | 76000 | |
| Akershus universitetssykehus | Innlandet | 75000 | |
| Harstad sykehus | Nordland | 35000 | |
| Volda sjukehus | Møre og Romsdal | 45000 | |
| Voss sjukehus | Vestland | 30000 | |
| Sykehuset Levanger | Trøndelag | 95000 | |
| Sykehuset Østfold | Viken | 298000 | 5400 |
| Kristiansund sjukehus | Møre og Romsdal | 60000 | |
| Bærum sykehus | Viken | 160000 | 2000 |
| Haukeland universitetssykehus | Vestland | 380000 | 12000 |
| Finnmarkssykehuset | Troms og Finnmark | 75000 | |
| Oslo universitetssykehus | Oslo | 510000 | 23000 |
| Sykehuset i Vestfold | Vestfold og Telemark | 240000 | 5200 |
| Førde sentralsjukehus | Vestland | 110000 | |
| Universitetssykehuset Nord-Norge | Nordland | 130000 | 6000 |
| St. Olavs hospital | Trøndelag | 310000 | 11000 |
| Sørlandet sykehus | Agder | 255000 | |
| Flekkefjord sykehus | Agder | 40000 | |
| Stord sjukehus | Vestland | 50000 | |
| Akershus universitetssykehus | Viken | 600000 | 9000 |
| Narvik sykehus | Nordland | 30000 | |
| Drammen sykehus | Viken | 160000 | 3000 |
| Ålesund sjukehus | Møre og Romsdal | 100000 | |
| Ringerike sykehus | Viken | 80000 | 1000 |
| Sykehuset Namsos | Trøndelag | 45000 | |

**primary_care_use**

| region | year | mental | cardiovascular | musculoskeletal |
|------------------------|------|--------|----------------|-----------------|
| Oslo | 2015 | 87335 | 48951 | 167467 |
| Oslo | 2016 | 91228 | 49844 | 170339 |
| Oslo | 2017 | 92022 | 47364 | 169705 |
| Oslo | 2018 | 94967 | 46961 | 170354 |
| Oslo | 2019 | 99394 | 46686 | 172010 |
| Oslo | 2020 | 102563 | 47028 | 166926 |
| Viken | 2015 | 164007 | 124983 | 352826 |
| Viken | 2016 | 168905 | 126186 | 360084 |
| Viken | 2017 | 170649 | 123127 | 363453 |
| Viken | 2018 | 174744 | 122427 | 366855 |
| Viken | 2019 | 183881 | 122412 | 376215 |
| Viken | 2020 | 185886 | 121691 | 358327 |
| Innlandet | 2015 | 53896 | 44348 | 116010 |
| Innlandet | 2016 | 55065 | 44787 | 117702 |
| Innlandet | 2017 | 56312 | 44362 | 118344 |
| Innlandet | 2018 | 56976 | 43016 | 119081 |
| Innlandet | 2019 | 59274 | 42437 | 121601 |
| Innlandet | 2020 | 58803 | 41460 | 114993 |
| Vestfold og Telemark | 2015 | 62870 | 42747 | 121400 |
| Vestfold og Telemark | 2016 | 65244 | 43858 | 125375 |
| Vestfold og Telemark | 2017 | 64231 | 41392 | 123691 |
| Vestfold og Telemark | 2018 | 64619 | 40756 | 124297 |
| Vestfold og Telemark | 2019 | 67185 | 40443 | 126176 |
| Vestfold og Telemark | 2020 | 66612 | 39941 | 119069 |
| Agder | 2015 | 45177 | 28960 | 87336 |
| Agder | 2016 | 47033 | 28781 | 88626 |
| Agder | 2017 | 47861 | 27568 | 89652 |
| Agder | 2018 | 49017 | 26604 | 89638 |
| Agder | 2019 | 50740 | 26612 | 92862 |
| Agder | 2020 | 50468 | 26026 | 89765 |
| Rogaland | 2015 | 60661 | 43111 | 136714 |
| Rogaland | 2016 | 62436 | 44078 | 137460 |
| Rogaland | 2017 | 63892 | 42219 | 137481 |
| Rogaland | 2018 | 66387 | 41786 | 138900 |
| Rogaland | 2019 | 67870 | 41459 | 141022 |
| Rogaland | 2020 | 69834 | 42099 | 137634 |
| Vestland | 2015 | 81197 | 59999 | 172948 |
| Vestland | 2016 | 83990 | 60948 | 174093 |
| Vestland | 2017 | 80354 | 54940 | 168238 |
| Vestland | 2018 | 81205 | 53874 | 167998 |
| Vestland | 2019 | 82614 | 52742 | 169202 |
| Vestland | 2020 | 83201 | 52254 | 161643 |
| Møre og Romsdal | 2015 | 33815 | 24540 | 81981 |
| Møre og Romsdal | 2016 | 34845 | 24831 | 83420 |
| Møre og Romsdal | 2017 | 35791 | 24060 | 83698 |

```
Møre og Romsdal      | 2018 |  36259 |           23875 |             83710
Møre og Romsdal      | 2019 |  37753 |           23982 |             84710
Møre og Romsdal      | 2020 |  37581 |           23950 |             81023
Trøndelag            | 2015 |  61439 |           41158 |            138287
Trøndelag            | 2016 |  64048 |           41841 |            140896
Trøndelag            | 2017 |  66729 |           41483 |            141578
Trøndelag            | 2018 |  68381 |           41289 |            141057
Trøndelag            | 2019 |  70809 |           40900 |            142202
Trøndelag            | 2020 |  72381 |           40800 |            138620
Nordland             | 2015 |  33558 |           25499 |             76332
Nordland             | 2016 |  33725 |           25633 |             76073
Nordland             | 2017 |  34196 |           25107 |             76260
Nordland             | 2018 |  35326 |           24698 |             76619
Nordland             | 2019 |  36861 |           24275 |             77517
Nordland             | 2020 |  37158 |           23735 |             74174
Troms og Finnmark    | 2015 |  33465 |           25350 |             74884
Troms og Finnmark    | 2016 |  33809 |           25373 |             74695
Troms og Finnmark    | 2017 |  34806 |           24857 |             74634
Troms og Finnmark    | 2018 |  35473 |           24625 |             74885
Troms og Finnmark    | 2019 |  36670 |           24082 |             75502
Troms og Finnmark    | 2020 |  37081 |           23456 |             71986
```