

## Assignment 2

*Obligatory assignment. Deadline: Sunday 01.03.2026.*

*Your code should be easy to read:*

- *Use indentation in your code.*
- *DDL for CREATE TABLE should have each column definition on its own line.*
- *Do not use screen dumps to show code. Code should be normal text, formatted as code.*

*The report should include all necessary commands to complete the tasks, printout from the system, explanation of what is done, the result and explanation of the result.*

*Remember to include the names of the group members on the front page of the report. The report can be in English or Norwegian. The report should be handed in via Canvas.*

*The assignment should be accomplished in groups of two or three students. Signing up for a group will be closed on Thursday 26.02.*

*You must select a group “Lab2 N” when delivering to see all the comments that you will get on this assignment.*

**Observe:** *A working solution of task four running on the lab computers must be demonstrated to the lecturer to get the assignment approved.*

**Observe:** *Before you modify an existing configuration file, save a copy of the original somewhere on the computer, e.g. below /root/origs.*

*The built-in GNOME Shell screenshot tool (triggered by pressing the Print Screen key) can take picture of a selected screen area. You can also use the tool flameshot<sup>1</sup> or spectacle (if KDE).*

*Lecturers:*

*Bjarte Wang-Kileng <Bjarte.Kileng@hvl.no>, room D409*

*Haakon André Reme-Ness <Haakon.Andre.Reme-Ness@hvl.no>*

*Last changed, 10/02/26 (BK)*

---

<sup>1</sup> After installing *flameshot*, start the GUI from the command line:  
`flameshot gui &`

### **Task 1: DBMS statements and utilities**

Create some tables as a normal database user (i.e. not root), insert some test data into the tables, and test the following commands and/or utilities one by one. Try all commands both on a InnoDB and a MyISAM table. Document the input and output, and explain what you did in your words.

Use the [MariaDB Knowledge Base](#) to solve this task.

1. Convert a table to InnoDB, and to MyISAM
2. SHOW INDEX
3. ANALYZE TABLE
4. CHECK TABLE
5. REPAIR TABLE
6. OPTIMIZE TABLE
7. CHECKSUM TABLE
8. innochecksum
9. myisamchk

Note that some commands or tools have a requirement on the storage engine, so make sure that you have a table with the correct engine.

What would happens if you try REPAIR TABLE on the InnoDB table?

When would you use the innochecksum program?

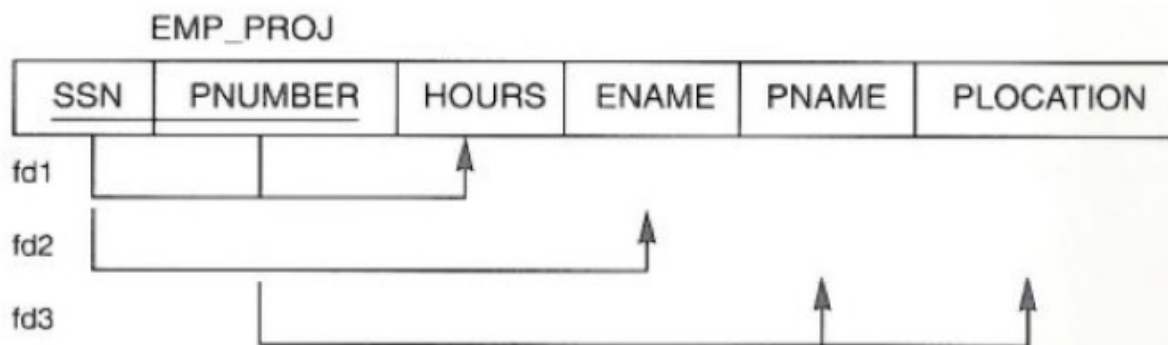
## Task 2: Normalisation

This task is theory only. You do not need to implement anything on the lab computers.

Below a relation (table) is given, including example data.

You can assume that ENAME is atomic.

What normal form does it currently conform to? Normalize it to 3NF if it does not currently conform to 3NF.



**EMP\_PROJ**

	<u>SSN</u>	<u>PNUMBER</u>	HOURS	ENAME	PNAME	PLOCATION
123456789		1	32.5	Smith, John B.	ProductX	Bellaire
123456789		2	7.5	Smith, John B.	ProductY	Sugarland
666884444		3	40.0	Narayan, Ramesh K.	ProductZ	Houston
453453453		1	20.0	English, Joyce A.	ProductX	Bellaire
453453453		2	20.0	English, Joyce A.	ProductY	Sugarland
333445555		2	10.0	Wong, Franklin T.	ProductY	Sugarland
333445555		3	10.0	Wong, Franklin T.	ProductZ	Houston
333445555		10	10.0	Wong, Franklin T.	Computerization	Stafford
333445555		20	10.0	Wong, Franklin T.	Reorganization	Houston
999887777		30	30.0	Zelaya, Alicia J.	Newbenefits	Stafford
999887777		10	10.0	Zelaya, Alicia J.	Computerization	Stafford
987987987		10	35.0	Jabbar, Ahmad V.	Computerization	Stafford
987987987		30	5.0	Jabbar, Ahmad V.	Newbenefits	Stafford
987654321		30	20.0	Wallace, Jennifer S.	Newbenefits	Stafford
987654321		20	15.0	Wallace, Jennifer S.	Reorganization	Houston
888665555		20	null	Borg, James E.	Reorganization	Houston

### Task 3: More normalisation

This task is theory only. You do not need to implement anything on the lab computers.

Below a relation (table) is given, including example data.

You can assume that ENAME and ADDRESS are atomic.

Which normal form does it currently conform to? Normalize it to 3NF if it does not currently conform to 3NF.

**EMP\_DEPT**

ENAME	<u>SSN</u>	BDATE	ADDRESS	DNUMBER	DNAME	DMGRSSN
Smith, John B.	123456789	09-JAN-55	731 Fondren, Houston, TX	5	Research	333445555
Wong, Franklin T.	333445555	08-DEC-45	638 Voss, Houston, TX	5	Research	333445555
Zelaya, Alicia J.	999887777	19-JUL-58	3321 Castle, Spring, TX	4	Administration	987654321
Wallace, Jennifer S.	987654321	19-JUN-31	291 Berry, Bellaire, TX	4	Administration	987654321
Narayan, Ramesh K.	666884444	15-SEP-52	975 FireOak, Humble, TX	5	Research	333445555
English, Joyce A.	453453453	31-JUL-62	5631 Rice, Houston, TX	5	Research	333445555
Jabbar, Ahmad V.	987987987	29-MAR-59	980 Dallas, Houston, TX	4	Administration	987654321
Borg, James E.	888665555	10-NOV-27	450 Stone, Houston, TX	1	Headquarters	888665555

**EMP\_DEPT**

ENAME	<u>SSN</u>	BDATE	ADDRESS	DNUMBER	DNAME	DMGRSSN
Smith, John B.	123456789	09-JAN-55	731 Fondren, Houston, TX	5	Research	333445555
Wong, Franklin T.	333445555	08-DEC-45	638 Voss, Houston, TX	5	Research	333445555
Zelaya, Alicia J.	999887777	19-JUL-58	3321 Castle, Spring, TX	4	Administration	987654321
Wallace, Jennifer S.	987654321	19-JUN-31	291 Berry, Bellaire, TX	4	Administration	987654321
Narayan, Ramesh K.	666884444	15-SEP-52	975 FireOak, Humble, TX	5	Research	333445555
English, Joyce A.	453453453	31-JUL-62	5631 Rice, Houston, TX	5	Research	333445555
Jabbar, Ahmad V.	987987987	29-MAR-59	980 Dallas, Houston, TX	4	Administration	987654321
Borg, James E.	888665555	10-NOV-27	450 Stone, Houston, TX	1	Headquarters	888665555

## Task 4: Normalisation & Denormalisation

- a) Western Norway University of Applied Sciences (*Høgskulen På Vestlandet*) needs a new system to store grades of students. You will design the database schema. These are the requirements:
- The school needs the name, student number, birth number, current address, telephone number, home address, birth date, gender, year (1<sup>st</sup>, 2<sup>nd</sup> or 3<sup>rd</sup>), faculty (FTMS, FLKI, FHS, FØS), study program (Computing, Chemistry, Teaching, etc.), and study level (bachelor, master, PHD). Both student number and birth number are unique for each student.
  - Each faculty is described by a name (“Faculty of Engineering and Science”), a code (FIN), a phone number, and an address. Both name and code are unique for each faculty.
  - Each course has a name, a code (DAT151), a number of lecture hours each week, and a responsible department (“Department of Computing, Mathematics and Physics”). Each department belongs to a faculty. The code is unique for each course. (The same course is usually thought multiple years, but if the content of the course is changed significantly, it gets a new code.)
  - Each course is thought once a year, and has a teacher that is responsible the course that year. Observe, there is only one responsible teacher of a course a specific year.
  - It is desired to have a table where one row represents the student’s grade in one course a specific year.
  - You can assume that the student name and student address are atomic values.
  - The following entity names are used later in this task:
    - STUDENT is the entity with student data, e.g. student name and current address.
    - FACULTY is the entity with e.g. faculty name and code.
    - COURSE\_SCHEDULE is the entity that couples a course with a responsible teacher when the course is thought a specific year.
  - The following attribute names are used later in this task:
    - SNAME is the name of a student.
    - FNAME is the name of a faculty, e.g. “Faculty of Engineering and Science”.
    - FCODE is the faculty code, e.g. “FTMS”.
    - CYEAR is a year a that a course is thought.
  - You can choose yourself the names of the remaining entities and attributes.

Design a logical database model for this application, in 3NF.

- b) Implement this database schema into your MariaDB database. Create the tables as a normal database user (i.e. not root), using the command line interface.

Can you implement the needed foreign keys as well? Create the tables using the InnoDB engine. The foreign key constraint is ignored by the MyISAM and Aria engines.

Optional: Also create the tables using a GUI, e.g. *DBeaver*.

There are several GUIs that work with MariaDB, but most are either commercial, or Windows only (see [list at the MariaDB knowledge base](#)). Some open source GUIs that run on AlmaLinux 9 are [phpMyAdmin](#) and [DBeaver](#).

- c) For each of the following SQL-queries, propose a concrete solution for a denormalized model of the schema from **a)**. Discuss whether the denormalised model might improve performance:
1. `SELECT s.SNAME, f.FNAME FROM STUDENT s, FACULTY f  
WHERE s.FCODE = f.FCODE;`
  2. `SELECT COUNT(*) FROM STUDENT WHERE FCODE = 'FTMS';`
  3. `SELECT DISTINCT CYEAR FROM COURSE_SCHEDULE;`