# DAT151: Assignment 2 Report

**Group:** 2

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## 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.

We first created the database tables and then input example data into both tables.

```
MariaDB [assignment2]> show tables;
+-----------------------+
| Tables_in_assignment2 |
+-----------------------+
| my_innodb             |
| my_myisam             |
+-----------------------+
2 rows in set (0.001 sec)

MariaDB [assignment2]> describe my_innodb;
+------------+--------------+------+-----+---------------------+----------------+
| Field      | Type         | Null | Key | Default             | Extra          |
+------------+--------------+------+-----+---------------------+----------------+
| id         | int(11)      | NO   | PRI | NULL                | auto_increment |
| name       | varchar(100) | YES  |     | NULL                |                |
| age        | int(11)      | YES  |     | NULL                |                |
| created_at | timestamp    | YES  |     | current_timestamp() |                |
+------------+--------------+------+-----+---------------------+----------------+
4 rows in set (0.002 sec)

MariaDB [assignment2]> describe my_myisam;
+------------+--------------+------+-----+---------------------+----------------+
```

```
| Field      | Type         | Null | Key | Default             | Extra
|
+------------+--------------+------+-----+---------------------+-----------
-----+
| id         | int(11)      | NO   | PRI | NULL                |
auto_increment |
| name       | varchar(100) | YES  |     | NULL                |
|
| age        | int(11)      | YES  |     | NULL                |
|
| created_at | timestamp    | YES  |     | current_timestamp() |
|
+------------+--------------+------+-----+---------------------+-----------
-----+
4 rows in set (0.002 sec)

MariaDB [assignment2]> INSERT INTO my_innodb (name, age) VALUES
    -> ('Elias', 24),
    -> ('Bob', 29),
    -> ('Magnus', 35),
    -> ('Sofie', 22),
    -> ('Henrik', 41),
    -> ('John', 27);
Query OK, 6 rows affected (0.008 sec)
Records: 6  Duplicates: 0  Warnings: 0

MariaDB [assignment2]> INSERT INTO my_myisam (name, age) VALUES  ('Elias',
24), ('Bob', 29), ('Magnus', 35), ('Sofie'
, 22), ('Henrik', 41), ('John', 27);
Query OK, 6 rows affected (0.001 sec)
Records: 6  Duplicates: 0  Warnings: 0

MariaDB [assignment2]> select * from my_innodb;
+----+--------+------+---------------------+
| id | name   | age  | created_at          |
+----+--------+------+---------------------+
|  1 | Elias  |   24 | 2026-02-16 12:19:50 |
|  2 | Bob    |   29 | 2026-02-16 12:19:50 |
|  3 | Magnus |   35 | 2026-02-16 12:19:50 |
|  4 | Sofie  |   22 | 2026-02-16 12:19:50 |
|  5 | Henrik |   41 | 2026-02-16 12:19:50 |
|  6 | John   |   27 | 2026-02-16 12:19:50 |
+----+--------+------+---------------------+
6 rows in set (0.001 sec)

MariaDB [assignment2]> select * from my_myisam;
+----+--------+------+---------------------+
| id | name   | age  | created_at          |
+----+--------+------+---------------------+
|  1 | Elias  |   24 | 2026-02-16 12:20:26 |
|  2 | Bob    |   29 | 2026-02-16 12:20:26 |
|  3 | Magnus |   35 | 2026-02-16 12:20:26 |
|  4 | Sofie  |   22 | 2026-02-16 12:20:26 |
|  5 | Henrik |   41 | 2026-02-16 12:20:26 |
```

```
|  6 | John   |   27 | 2026-02-16 12:20:26 |
+----+--------+------+---------------------+
6 rows in set (0.001 sec)
```

1. **Convert table to InnoDB and to MyISAM**

   **ALTER TABLE** is used to alter the storage engine of a table. In this case, we are converting `my_innodb` to MyISAM and then back to InnoDB.

   InnoDB is the default storage engine as of MySQL 5.5, supports ACID, is transactional, supports foreign keys and has row level locking.

   MyISAM was the default storage engine before MySQL 5.5. It doesn't support ACID, is non-transactional, doesn't support foreign keys and has table level locking.

```
MariaDB [assignment2]> ALTER TABLE my_innodb ENGINE=MyISAM;
Query OK, 6 rows affected (0.034 sec)
Records: 6  Duplicates: 0  Warnings: 0

MariaDB [assignment2]> ALTER TABLE my_innodb ENGINE=InnoDB;
Query OK, 6 rows affected (2.252 sec)
Records: 6  Duplicates: 0  Warnings: 0

MariaDB [assignment2]> select * from my_innodb;
+----+--------+------+---------------------+
| id | name   | age  | created_at          |
+----+--------+------+---------------------+
|  1 | Elias  |   24 | 2026-02-16 12:19:50 |
|  2 | Bob    |   29 | 2026-02-16 12:19:50 |
|  3 | Magnus |   35 | 2026-02-16 12:19:50 |
|  4 | Sofie  |   22 | 2026-02-16 12:19:50 |
|  5 | Henrik |   41 | 2026-02-16 12:19:50 |
|  6 | John   |   27 | 2026-02-16 12:19:50 |
+----+--------+------+---------------------+
6 rows in set (0.001 sec)

MariaDB [assignment2]> ALTER TABLE my_myisam ENGINE=MyISAM;
Query OK, 6 rows affected (0.024 sec)
Records: 6  Duplicates: 0  Warnings: 0

MariaDB [assignment2]> select * from my_myisam;
+----+--------+------+---------------------+
| id | name   | age  | created_at          |
+----+--------+------+---------------------+
|  1 | Elias  |   24 | 2026-02-16 12:20:26 |
|  2 | Bob    |   29 | 2026-02-16 12:20:26 |
|  3 | Magnus |   35 | 2026-02-16 12:20:26 |
|  4 | Sofie  |   22 | 2026-02-16 12:20:26 |
|  5 | Henrik |   41 | 2026-02-16 12:20:26 |
|  6 | John   |   27 | 2026-02-16 12:20:26 |
```

```
+----+--------+------+--------------------+
6 rows in set (0.001 sec)
```

2. **SHOW INDEX**

   The SHOW INDEX command outputs information about indexes in the table. As we can see from the output, both tables have primary key on id, so the index is created automatically. Index type is B-Tree (default for both InnoDB and MyISAM). Cardinality is 6 for both cases - we have 6 different values in both tables.

```
MariaDB [assignment2]> SHOW INDEX FROM my_innodb;
+-----------+------------+----------+--------------+-------------+----
-------+-------------+----------+--------+------+------------+--------
-+---------------+---------+
| Table     | Non_unique | Key_name | Seq_in_index | Column_name |
Collation | Cardinality | Sub_part | Packed | Null | Index_type |
Comment | Index_comment | Ignored |
+-----------+------------+----------+--------------+-------------+----
-------+-------------+----------+--------+------+------------+--------
-+---------------+---------+
| my_innodb |          0 | PRIMARY  |            1 | id          | A
|           6 |     NULL | NULL     |      | BTREE      |          |
| NO      |
+-----------+------------+----------+--------------+-------------+----
-------+-------------+----------+--------+------+------------+--------
-+---------------+---------+
1 row in set (0.001 sec)

MariaDB [assignment2]> SHOW INDEX FROM my_myisam;
+-----------+------------+----------+--------------+-------------+----
-------+-------------+----------+--------+------+------------+--------
-+---------------+---------+
| Table     | Non_unique | Key_name | Seq_in_index | Column_name |
Collation | Cardinality | Sub_part | Packed | Null | Index_type |
Comment | Index_comment | Ignored |
+-----------+------------+----------+--------------+-------------+----
-------+-------------+----------+--------+------+------------+--------
-+---------------+---------+
| my_myisam |          0 | PRIMARY  |            1 | id          | A
|           6 |     NULL | NULL     |      | BTREE      |          |
| NO      |
+-----------+------------+----------+--------------+-------------+----
-------+-------------+----------+--------+------+------------+--------
-+---------------+---------+
1 row in set (0.001 sec)
```

3. **ANALYZE TABLE**

   This command analyzes and stores the key distribution for a table. This analysis is used by the optimizer to make better choices for query execution plans. InnoDB updates the index statistics dynamically, MyISAM needs to be updated manually. Command was successful for both tables.

```
MariaDB [assignment2]> ANALYZE TABLE my_innodb;
+-----------------------+---------+----------+----------+
| Table                 | Op      | Msg_type | Msg_text |
+-----------------------+---------+----------+----------+
| assignment2.my_innodb | analyze | status   | OK       |
+-----------------------+---------+----------+----------+
1 row in set (0.004 sec)

MariaDB [assignment2]> ANALYZE TABLE my_myisam;
+-----------------------+---------+----------+----------+
| Table                 | Op      | Msg_type | Msg_text |
+-----------------------+---------+----------+----------+
| assignment2.my_myisam | analyze | status   | OK       |
+-----------------------+---------+----------+----------+
1 row in set (0.001 sec)
```

4. **CHECK TABLE**

   This command checks a table for errors. Both tables returned OK status. InnoDB has built-in crash recovery, MyISAM tables are more likely to corrupt (after crashes). Command was successful for both tables.

```
MariaDB [assignment2]> CHECK TABLE my_innodb;
+-----------------------+-------+----------+----------+
| Table                 | Op    | Msg_type | Msg_text |
+-----------------------+-------+----------+----------+
| assignment2.my_innodb | check | status   | OK       |
+-----------------------+-------+----------+----------+
1 row in set (0.000 sec)

MariaDB [assignment2]> CHECK TABLE my_myisam;
+-----------------------+-------+----------+----------+
| Table                 | Op    | Msg_type | Msg_text |
+-----------------------+-------+----------+----------+
| assignment2.my_myisam | check | status   | OK       |
+-----------------------+-------+----------+----------+
1 row in set (0.001 sec)
```

5. **REPAIR TABLE**

   This command repairs a possibly corrupted table. InnoDB does not support `REPAIR TABLE`, because it has built-in crash recovery - If it’s corrupted, we need to restore from a backup. MyISAM supports REPAIR TABLE , status is OK, but no reparation was needed - table wasn't corrupted.

```
MariaDB [assignment2]> REPAIR TABLE my_myisam;
+-----------------------+--------+----------+----------+
```

```
| Table                   | Op     | Msg_type | Msg_text |
+-------------------------+--------+----------+----------+
| assignment2.my_myisam | repair | status   | OK       |
+-------------------------+--------+----------+----------+
1 row in set (0.001 sec)

MariaDB [assignment2]> REPAIR TABLE my_innodb;
+-------------------------+--------+----------+-------------------------
--------------------------------+
| Table                   | Op     | Msg_type | Msg_text
|
+-------------------------+--------+----------+-------------------------
--------------------------------+
| assignment2.my_innodb | repair | note     | The storage engine for
the table doesn't support repair |
+-------------------------+--------+----------+-------------------------
--------------------------------+
1 row in set (0.000 sec)
```

6. **OPTIMIZE TABLE**

This command reorganizes the physical storage of table data and associated index data, which leads to reduction in storage space and improvements of I/O efficiency when accessing the table. InnoDB does not support OPTIMIZE - database instead recreates the table and runs ANALYZE TABLE updating the table index statistics. InnoDB manages the space automatically, so the command is more useful with the MyISAM engine, which supports the command and it was succesfully run

```
MariaDB [assignment2]> OPTIMIZE TABLE my_innodb;
+-------------------------+----------+----------+-----------------------
----------------------------------------------+
| Table                   | Op       | Msg_type | Msg_text
|
+-------------------------+----------+----------+-----------------------
----------------------------------------------+
| assignment2.my_innodb | optimize | note     | Table does not support
optimize, doing recreate + analyze instead |
| assignment2.my_innodb | optimize | status   | OK
|
+-------------------------+----------+----------+-----------------------
----------------------------------------------+
2 rows in set (0.049 sec)

MariaDB [assignment2]> OPTIMIZE TABLE my_myisam;
+-------------------------+----------+----------+----------+
| Table                   | Op       | Msg_type | Msg_text |
+-------------------------+----------+----------+----------+
| assignment2.my_myisam | optimize | status   | OK       |
+-------------------------+----------+----------+----------+
1 row in set (0.001 sec)
```

7. **CHECKSUM TABLE**

   This command reports a checksum for the contents of a table. This value can be used to detect any changes in the table's data. If the data changed, there will be a different checksum.

```
MariaDB [assignment2]> CHECKSUM TABLE my_innodb;
+-----------------------+------------+
| Table                 | Checksum   |
+-----------------------+------------+
| assignment2.my_innodb | 2122584765 |
+-----------------------+------------+
1 row in set (0.001 sec)

MariaDB [assignment2]> CHECKSUM TABLE my_myisam;
+-----------------------+------------+
| Table                 | Checksum   |
+-----------------------+------------+
| assignment2.my_myisam | 2206389053 |
+-----------------------+------------+
1 row in set (0.001 sec)
```

8. **innochecksum**

   This is a command-line utility that can be used to check the checksums of InnoDB files offline - .idb files. By default, innochecksum reports only errors or mismatches.

```
innochecksum /var/lib/mysql/assignment2/my_innodb.ibd
All are zero-filled pages.
```

9. **myisamchk**

   This is a command-line utility that gets information about MyISAM tables by checking the .MYI and .MYD files and can be used to check, repair, and optimize them. The output shows no issues. It also shows that we have 6 data records and 0 deleted blocks (no need to optimize, if some corruption was found, we could use `myisamchk --repair` to repair the table.

```
myisamchk /var/lib/mysql/assignment2/my_myisam.MYI
Checking MyISAM file: /var/lib/mysql/assignment2/my_myisam.MYI
Data records:       6   Deleted blocks:       0
- check file-size
- check record delete-chain
- check key delete-chain
- check index reference
- check data record references index: 1
- check record links
```

# 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.

## Answers

- The schema currently conforms to the 1NF (atomic values)
- It violates the 2NF for the following reasons:
  - ENAME depends only on the SSN, which is only a part of the composite primary key
  - PNAME and PLOCATION depend on PNUMBER, which is also only a part of the composite primary key
- We can normalize the schema into 3NF by creating 3 tables: EMP (Employee), PROJ (Project), and EMP_PROJ. The tables will have the following data:
  - EMP (SSN, ENAME)
  - PROJ (PNUMBER, PNAME, PLOCATION)
  - EMP_PROJ (SSN, PNUMBER, HOURS)
    - SSN and PNUMBER are both foreign keys referenced from the EMP and PROJ tables
- After the changes, the schema is in the 3NF, actually even in BCNF, because all functional dependencies are either trivial or have a full candidate key on the left side.

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# 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.

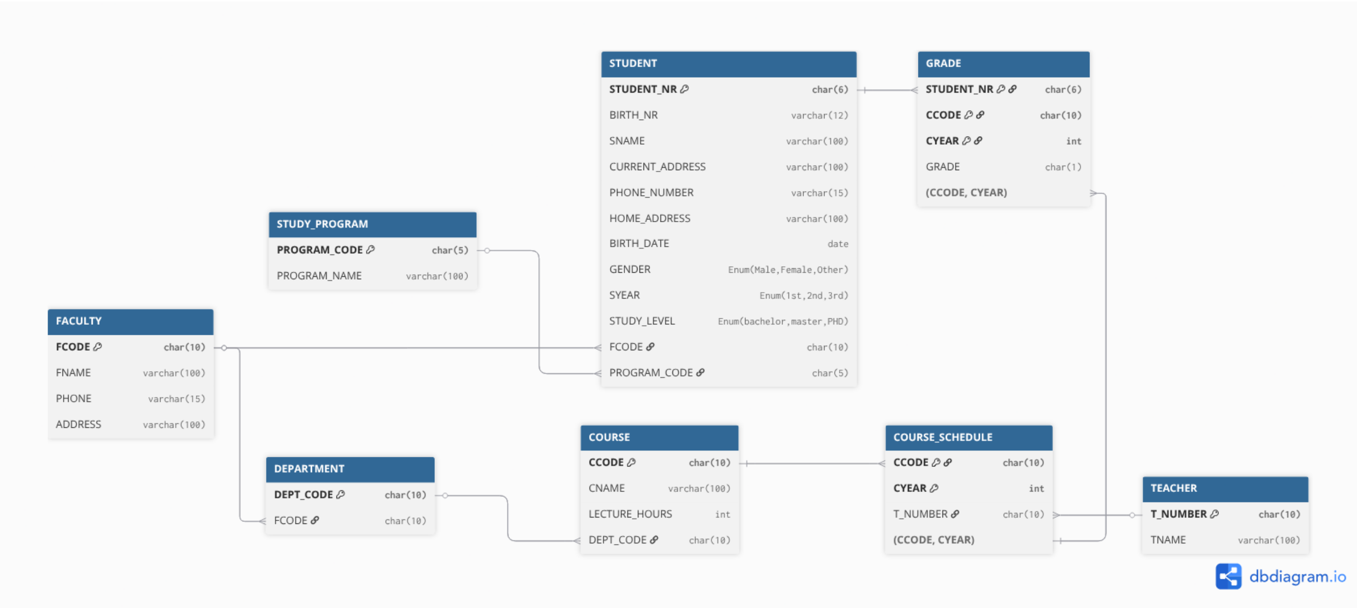
## Answers

- The schema currently conforms to the 1NF (atomic values). It also conforms to the 2NF (no non-key attribute is dependent on part of a composite key),
  - 2NF allows for a non-key attribute to be dependent on another non-key attribute
  - As such, `DNUMBER → [DNAME, DMGRSSN]` is okay
- It violates the 3NF because the non-key attributes **DNAME** and **DMGRSSN** are transitively dependent on the key via another non-key attribute, **DNUMBER**. We can normalize it into 3NF by splitting it into 2 tables: EMP and DEPT.
- `EMP (SSN, ENAME, BDATE, ADDRESS, DNUMBER)` where **DNUMBER** is a foreign key referenced from the DEPT table
- `DEPT (DNUMBER, DNAME, DMGRSSN)`

## Task 4: Normalisation & Denormalisation

```
Table Faculty {
  f_code varchar(10) [pk]
  f_name varchar(100) [unique]
  phone varchar(15)
  address varchar(100)
}

Table Department {
  dept_name varchar(100) [pk]
  f_code varchar(10) [ref: > Faculty.f_code]
}

Table StudyProgram {
  program_code varchar(15) [pk]
  program_name varchar(100)
  study_level Enum('Bachelors', 'Masters', 'PhD')
  f_code varchar(10) [ref: > Faculty.f_code]
}

Table Student {
  student_nr varchar(15) [pk]
  birth_nr varchar(12) [unique]
  s_name varchar(100)
  current_address varchar(100)
  phone_number varchar(15)
  home_address varchar(100)
  birth_date date
  s_gender Enum ('Male', 'Female', 'Other')
  s_year Enum ('1st', '2nd', '3rd')
  program_code varchar(15) [ref: > StudyProgram.program_code]
}

Table Teacher {
  t_number varchar(20) [pk]
  t_name varchar(100)
}

Table Course {
  c_code varchar(10) [pk]
  c_name varchar(100)
  lecture_hours_per_week int
  dept_name varchar(100) [ref: > Department.dept_name]
}

Table CourseSchedule {
  c_code varchar(10) [ref: > Course.c_code]
  c_year int
  teacher_number int [ref: > Teacher.t_number]

  indexes {
```

```
      (c_code, c_year) [pk]
    }
}

Table Grade {
  student_nr varchar(15) [ref: > Student.student_nr]
  c_code varchar(10)
  c_year int
  grade char(1)

  indexes {
    (student_nr, c_code, c_year) [pk]
  }
}

Ref: Grade.(c_code, c_year) > CourseSchedule.(c_code, c_year)
```




## MariaDB Implementation

```
MariaDB [PRIVBASE]> show tables;
Empty set (0.001 sec)

MariaDB [PRIVBASE]> CREATE TABLE FACULTY (
    ->      FCODE CHAR(10) PRIMARY KEY,
    ->      FNAME VARCHAR(100) UNIQUE,
    ->      PHONE VARCHAR(15),
    ->      ADDRESS VARCHAR(100)
    -> ) ENGINE=InnoDB;
Query OK, 0 rows affected (0.021 sec)

MariaDB [PRIVBASE]> CREATE TABLE DEPARTMENT (
    ->      DEPT_CODE CHAR(10) PRIMARY KEY,
    ->      FCODE CHAR(10),
    ->      FOREIGN KEY (FCODE) REFERENCES FACULTY(FCODE)
```

```
    -> ) ENGINE=InnoDB;
Query OK, 0 rows affected (0.024 sec)

MariaDB [PRIVBASE]> CREATE TABLE STUDY_PROGRAM (
    ->     PROGRAM_CODE CHAR(5) PRIMARY KEY,
    ->     PROGRAM_NAME VARCHAR(100)
    -> ) ENGINE=InnoDB;
Query OK, 0 rows affected (0.015 sec)

MariaDB [PRIVBASE]> CREATE TABLE STUDENT (
    ->     STUDENT_NR CHAR(6) PRIMARY KEY,
    ->     BIRTH_NR VARCHAR(12) UNIQUE,
    ->     SNAME VARCHAR(100),
    ->     CURRENT_ADDRESS VARCHAR(100),
    ->     PHONE_NUMBER VARCHAR(15),
    ->     HOME_ADDRESS VARCHAR(100),
    ->     BIRTH_DATE DATE,
    ->     GENDER ENUM('Male', 'Female', 'Other'),
    ->     SYEAR ENUM('1st', '2nd', '3rd'),
    ->     STUDY_LEVEL ENUM('bachelor', 'master', 'PHD'),
    ->     FCODE CHAR(10),
    ->     PROGRAM_CODE CHAR(5),
    ->     FOREIGN KEY (FCODE) REFERENCES FACULTY(FCODE),
    ->     FOREIGN KEY (PROGRAM_CODE) REFERENCES
STUDY_PROGRAM(PROGRAM_CODE)
    -> ) ENGINE=InnoDB;
Query OK, 0 rows affected (0.026 sec)

MariaDB [PRIVBASE]> CREATE TABLE TEACHER (
    ->     T_NUMBER CHAR(10) PRIMARY KEY,
    ->     TNAME VARCHAR(100)
    -> ) ENGINE=InnoDB;
Query OK, 0 rows affected (0.016 sec)

MariaDB [PRIVBASE]> CREATE TABLE COURSE (
    ->     CCODE CHAR(10) PRIMARY KEY,
    ->     CNAME VARCHAR(100),
    ->     LECTURE_HOURS INT,
    ->     DEPT_CODE CHAR(10),
    ->     FOREIGN KEY (DEPT_CODE) REFERENCES DEPARTMENT(DEPT_CODE)
    -> ) ENGINE=InnoDB;
Query OK, 0 rows affected (0.021 sec)

MariaDB [PRIVBASE]> CREATE TABLE COURSE_SCHEDULE (
    ->     CCODE CHAR(10),
    ->     CYEAR INT,
    ->     T_NUMBER CHAR(10),
    ->     PRIMARY KEY (CCODE, CYEAR),
    ->     FOREIGN KEY (CCODE) REFERENCES COURSE(CCODE),
    ->     FOREIGN KEY (T_NUMBER) REFERENCES TEACHER(T_NUMBER)
    -> ) ENGINE=InnoDB;
Query OK, 0 rows affected (0.022 sec)

MariaDB [PRIVBASE]> CREATE TABLE GRADE (
```

```
    ->     STUDENT_NR CHAR(6),
    ->     CCODE CHAR(10),
    ->     CYEAR INT,
    ->     GRADE CHAR(1),
    ->     PRIMARY KEY (STUDENT_NR, CCODE, CYEAR),
    ->     FOREIGN KEY (STUDENT_NR) REFERENCES STUDENT(STUDENT_NR),
    ->     FOREIGN KEY (CCODE, CYEAR) REFERENCES COURSE_SCHEDULE(CCODE,
CYEAR)
    -> ) ENGINE=InnoDB;
Query OK, 0 rows affected (0.024 sec)

MariaDB [PRIVBASE]> show tables;
+--------------------+
| Tables_in_PRIVBASE |
+--------------------+
| COURSE             |
| COURSE_SCHEDULE    |
| DEPARTMENT         |
| FACULTY            |
| GRADE              |
| STUDENT            |
| STUDY_PROGRAM      |
| TEACHER            |
+--------------------+
8 rows in set (0.001 sec)
```

**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;`

For this join, the primary goal of denormalization is to eliminate the cost of linking the two tables every time. We have two options (that we came up with) to solve this issue:

- **Create a Materialized View/Snapshot:** We could build a dedicated table that just holds `sname` and `fname`.
- **Add a Column:** We could add the `fname` column directly into the `STUDENT` table.

Both approaches remove the need for a join, making reads much faster. However, the trade-off is that we break 3NF. It also makes **DML operations** (INSERT/UPDATE/DELETE) more costly, as we have to update multiple tables. We would need to set up database **triggers** or stored procedures to ensure that if a faculty member changes their name, that change propagates to our denormalized data instantly.

However, since the `FACULTY` table is likely very small (has low cardinality), the database engine can join these tables very efficiently in memory. A standard index on the foreign key (`FCODE`) is most likely the better choice here rather than dealing with the maintenance of denormalization.

2. `SELECT COUNT(*) FROM STUDENT WHERE FCODE = 'FTMS';`

This is a good example of **Derived Attributes** from lectures. Instead of counting the rows from scratch every time we run the query, we can store the current count as a value in a parent table (like `FACULTY`) or a separate summary table.

- **Maintenance:** We have to keep this value updated. We could use triggers to increment/decrement the count whenever a student is added or removed. Another option, if real-time accuracy isn't needed, is to run a batch job to update the count once a day (at night for example).
- **Performance:** This makes the `SELECT` query almost instantaneous, which is great if the `STUDENT` table is massive.

However, similar to the previous query, it might be better to just use an index. If we have an index on `FCODE`, the database can perform an index scan (counting the entries in the index leaves) without touching the actual table heap. That solution might be fast enough without duplicating data.

3. `SELECT DISTINCT CYEAR FROM COURSE_SCHEDULE;`

We think that denormalization is not necessary here. If we have an index on `CYEAR`, the database can just scan the unique keys in the index tree very quickly.

But, if we strictly wanted to denormalize this to optimize for the distinct selection, we could create a separate lookup table containing only unique `CYEAR` values.

- **Insert:** When a new schedule is added, we check if the year exists in our lookup table - if not, we add it.
- **Delete:** This is more complicated. If we delete a row from `COURSE_SCHEDULE`, we have to scan the whole lookup table to see if that was the last record with that specific year before we can safely remove it from our lookup table. This operation is quite expensive and will most likely negate the read benefits of read. If DELETE does not happen often, then it might be worth keeping it. This could again be solved using and an index.