Contents

1. Abstract

In this report, MySQL is used to develop and implement a University Database System. Exploring typical use cases, and the overall design of the database system. The report also outlines various MySQL queries such as SELECT, ALTER, DELETE, JOIN to tackle the requirements from the project. The implementation of database was successful and is extremely powerful, secure, and easy to use.

2. Overview of Database

The database will be used to store information relating to the University.

Introduction

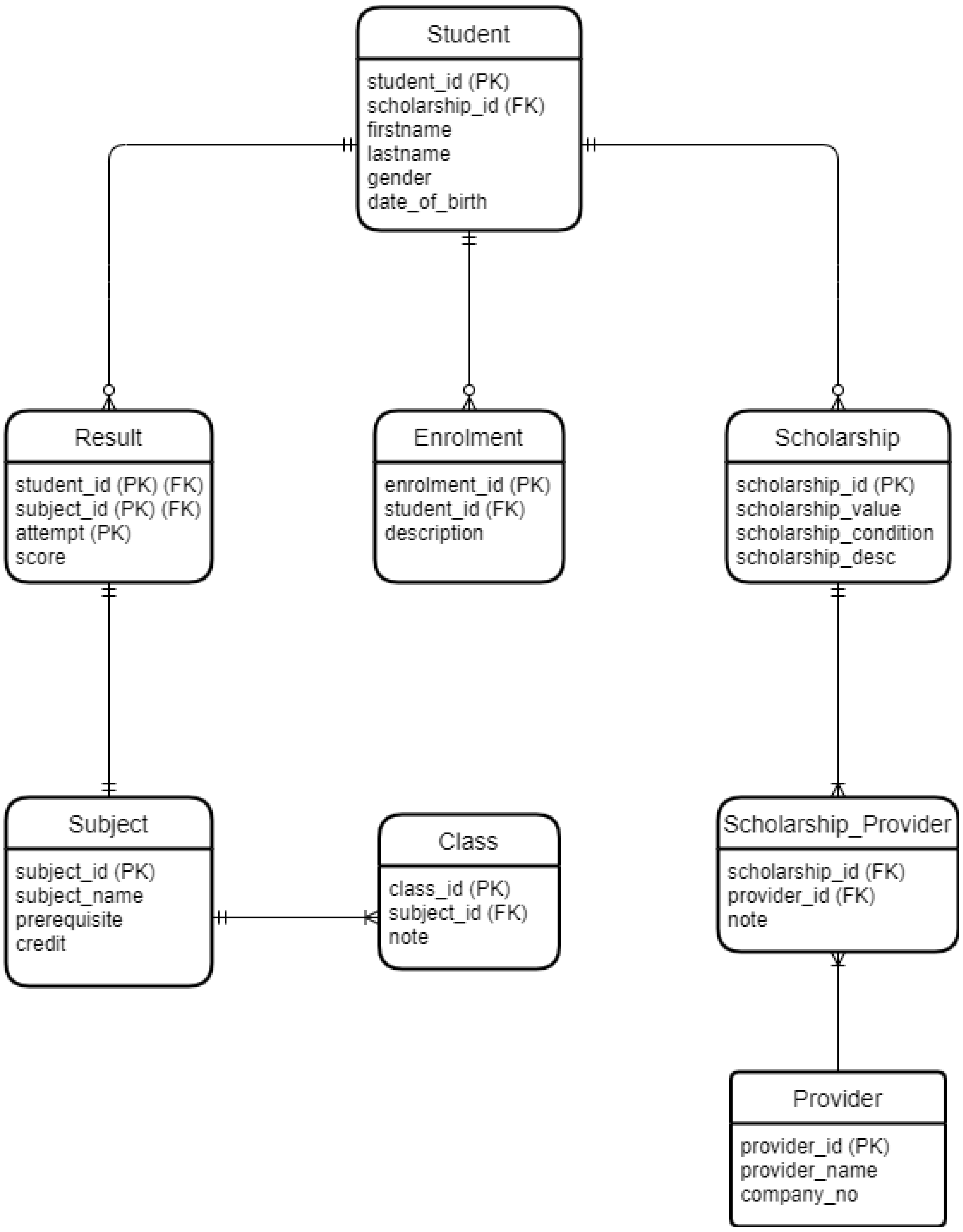
University is a key institutions in the society. A good university will persuade people to join them. As a result of this, there is a need for a system that enables university management in making effective and efficient decision for students.

Main Uses of the Database

A university database management system is a record management which enables the user to access necessary data at any place and any time through internet. A student can receive important information and notifications in the university like the timetable, workshops, fee payment, exam registration. The students can check their attendance and marks for every unit. The management staff can also make changes in marks, or some necessary changes in case of any mistake that are made. The tutors and teachers can also retrieve information about the students records and allows them to make changes in student academic or personal details.

3. Illustration of the design

The following figure is an Entity-Relationship Diagram showing the relationships between each table.



4. Normalisation

The following figure is the normalisation for each entities drawn in ER diagram. This will include the first normal form, second normal form, and third normal form.

Subject Table:

Subject_id	Subject_name	Prerequisite	Credit

- This table doesn't need to be normalized.

Scholarship Table:

Scholarship_id	Scholarship_value	Scholarship_condition	Scholarship_desc

- This table doesn't need to be normalized.

Provider Table:

Provider_id	Provider_name	Company_no

- This table doesn't need to be normalized.

Student Table:

Student_id	Scholarship_id	Firstname	Lastname	Gender	Date_of_birth

- This table is in First Normal Form (1NF).

Normalise to Second Normal Form (2NF) :

Student_id	Scholarship_id

student_id $\rightarrow$ scholarship_id

Student_id	Firstname	Lastname	Gender	Date_of_birth

student_id $\rightarrow$ firstname, lastname, gender, date_of_birth

- In this 2NF, there are no more partial dependencies that exist in the table. It has met all the requirements for 2NF.

From 2NF above, we normalise to Third Normal Form (3NF) :

Scholarships

Scholarship_id	Scholarship_value	Scholarship_condition	Scholarship_desc

Scholarship_id $\rightarrow$ scholarship_value, scholarship_condition, scholarship_desc

- The purpose in this 3NF is to check for transitive dependencies and eliminate them if found from the 2NF table. This table are now in 3NF.

Result Table:

Student_id	Subject_id	Attempt	Score

- This table is in First Normal Form (1NF).

Normalise to Second Normal Form (2NF) :

Student_id	Subject_id

Student_id → subject_id

Student_id	Attempt

Student_id → attempt

Student_id	Score

Student_id → score

- In this 2NF, there are no more partial dependencies that exist in the table. It has met all the requirements for 2NF.

From 2NF above, we normalise to Third Normal Form (3NF) :

Subject_id	Subject_name	Prerequisite	Credit

Subject_id → subject_name, prerequisite, credit

- The purpose in this 3NF is to check for transitive dependencies and eliminate them if found from the 2NF table. This table are now in 3NF.

Enrolment Table :

Enrolment_id	Student_id	Description

- This table is in First Normal Form (1NF).

Normalise to Second Normal Form (2NF) :

Enrolment_id	Student_id

Enrolment_id → student_id

Enrolment_id	Description

Enrolment_id → description

- In this 2NF, there are no more partial dependencies that exist in the table. It has met all the requirements for 2NF.

From 2NF above, we normalise to Third Normal Form (3NF) :

Student_id	Scholarship_id	Firstname	Lastname	Gender	Date_of_birth

Student_id → scholarship_id, firstname, lastname, gender, date_of_birth

- The purpose in this 3NF is to check for transitive dependencies and eliminate them if found from the 2NF table. This table are now in 3NF.

Scholarship_Provider Table :

Scholarship_id	Provider_id	Note

- This table is in First Normal Form (1NF).

Normalise to Second Normal Form (2NF) :

Scholarship_id	Provider_id

Scholarship_id → provier_id

Scholarship_id	Note

Scholarship_id → note

- In this 2NF, there are no more partial dependencies that exist in the table. It has met all the requirements for 2NF.

From 2NF above, we normalise to Third Normal Form (3NF) :

Provider_id	Provider_name	Company_no

Provider_id → provider_name, company_no

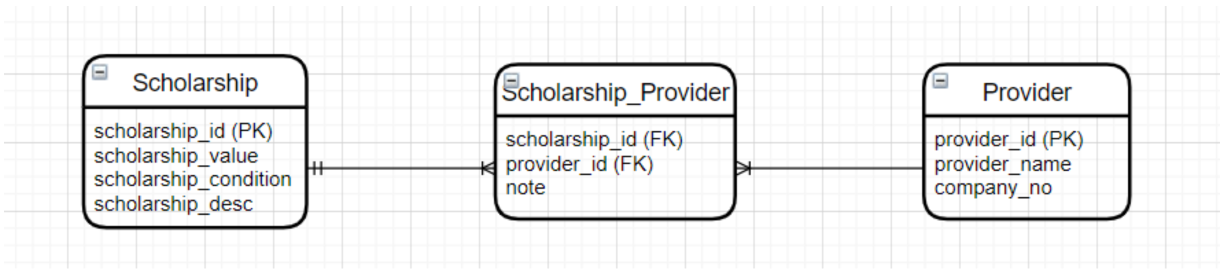
- The purpose in this 3NF is to check for transitive dependencies and eliminate them if found from the 2NF table. This table are now in 3NF.

5. Data Storage Solution

The following table outlines the explanation of each strong entities in the database:

Entity name	**Justification**
Student	Storing student personal details, enrolment, and scholarship.
Subject	This table stores the name and ID of a subject, the prerequisite so that we know if a student could enroll in a subject or not, and also the credit worth in each subject.
Result	This table store grades of students in every subject they enrolled in and the number of attempt they took.
Scholarship	Scholarship reward to students with certain condition. The details of the scholarship such as value and description also exist.
Enrolment	Enroll for academic courses and monitor the progress of students through the semester.
Class	Class id for identification, 1 subject can have many classes.
Provider	This table stores provider of the scholarship which raising fund for the students. One provider can grant multiple scholarship for students.

The following figure outlines many to many relationship:



For many to many relationship, there is a weak entity in between 2 strong entities, so it becomes 2 entities of one to many relationship. For example, in this project, Scholarship_Provider is a weak entity. A scholarship can have many scholarship provider and scholarship are provided by many company.

6. Scripts to create Data Storage

*********** MySQL CREATE TABLE STATEMENT ***********

```
CREATE TABLE Scholarship (
    scholarshipID INT UNSIGNED,
    scholarship_value INT(10) NOT NULL,
    scholarship_condition TEXT NOT NULL,
    scholarship_desc TEXT NOT NULL,
    PRIMARY KEY(scholarshipID)
);

CREATE TABLE Student (
    studentID INT UNSIGNED NOT NULL,
    scholarshipID INT UNSIGNED,
    firstname VARCHAR(35) NOT NULL,
    lastname VARCHAR(35) NOT NULL,
    gender CHAR(1) CHECK (gender IN ('M','F','U')),
    date_of_birth DATE NOT NULL,
    PRIMARY KEY(studentID)
);

CREATE TABLE Subject (
    subjectID CHAR(4) NOT NULL UNIQUE,
    subject_name VARCHAR(40) NOT NULL,
    prerequisite VARCHAR(40) DEFAULT NULL,
    credit INT(5) NOT NULL,
    PRIMARY KEY(subjectID)
);
```

```
CREATE TABLE Result (
        studentID INT UNSIGNED NOT NULL,
  subjectID CHAR(4) NOT NULL,
        score INT(5) NOT NULL,
  attempt INT(5) NOT NULL
);

CREATE TABLE Enrolment (
        enrolmentID INT UNSIGNED NOT NULL UNIQUE,
  studentID INT UNSIGNED NOT NULL,
  description TEXT DEFAULT NULL,
  PRIMARY KEY(enrolmentID)
);

CREATE TABLE Class (
        classID INT UNSIGNED NOT NULL UNIQUE,
  subjectID CHAR(4) NOT NULL,
  note TEXT DEFAULT NULL,
  PRIMARY KEY(classID)
);

CREATE TABLE Provider (
        providerID CHAR(5) NOT NULL,
  provider_name VARCHAR(40) NOT NULL,
  company_no INT(5) NOT NULL,
  PRIMARY KEY(providerID)
);

CREATE TABLE Scholarship_Provider (
        scholarshipID INT UNSIGNED,
    providerID CHAR(5) NOT NULL,
           note TEXT DEFAULT NULL
);
```

************ FOREIGN KEY CONSTRAINTS ************

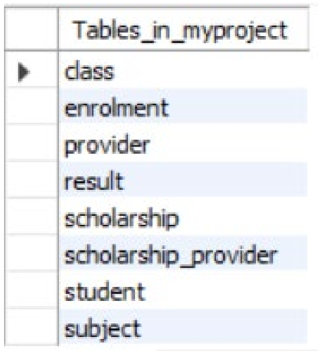
```
ALTER TABLE Student
ADD CONSTRAINT fk_student_scholarship
FOREIGN KEY(scholarshipID) REFERENCES Scholarship(scholarshipID);

ALTER TABLE Result
ADD CONSTRAINT fk_result_student
FOREIGN KEY(studentID) REFERENCES Student(studentID);

ALTER TABLE Result
ADD CONSTRAINT fk_result_subject
FOREIGN KEY(subjectID) REFERENCES Subject(subjectID);

ALTER TABLE Enrolment
ADD CONSTRAINT fk_enrolment_student
FOREIGN KEY(studentID) REFERENCES Student(studentID);

ALTER TABLE Class
ADD CONSTRAINT fk_class_subject
FOREIGN KEY(subjectID) REFERENCES Subject(subjectID);

ALTER TABLE Scholarship_Provider
ADD CONSTRAINT fk_scholarship_provider
FOREIGN KEY(scholarshipID) REFERENCES Scholarship(scholarshipID);
```

ALTER TABLE Scholarship_Provider

ADD CONSTRAINT fk_provider_scholarship

FOREIGN KEY(providerID) REFERENCES Provider(providerID);

Show tables;



```
Tables_in_myproject
class
enrolment
provider
result
scholarship
scholarship_provider
student
subject
```

********** MySQL INSERT STATEMENT **********

INSERT INTO Subject (subjectID, subject_name, credit)

VALUES ('A101', 'Data Management', 15);

INSERT INTO Subject (subjectID, subject_name, credit)

VALUES ('B202', 'Statistics', 15);

INSERT INTO Subject (subjectID, subject_name, credit)

VALUES ('C303', 'Data Visualisation', 20);

INSERT INTO Subject (subjectID, subject_name, credit)

VALUES ('D404', 'Artificial Intelligence', 30);

INSERT INTO Subject (subjectID, subject_name, credit)

VALUES ('E505', 'Data Analytics', 20);

INSERT INTO Scholarship(scholarshipID, scholarship_value, scholarship_condition, scholarship_desc)

VALUES(1111, 15000, 'No fail unit', 'Available');

INSERT INTO Scholarship(scholarshipID, scholarship_value, scholarship_condition, scholarship_desc)

VALUES(2222, 20000, 'At least 2 HD', 'Available');

INSERT INTO Scholarship(scholarshipID, scholarship_value, scholarship_condition, scholarship_desc)

VALUES(3333, 25000, 'At least 3 HD', 'Available');

```
INSERT INTO Scholarship(scholarshipID, scholarship_value, scholarship_condition, scholarship_desc)
VALUES(4444, 26000, 'HD on every subject', 'Available');

INSERT INTO Student(studentID, scholarshipID, firstname, lastname, gender, date_of_birth)
VALUES(1024, 2222, 'Scorlib', 'Lexrin', 'M', '2002-01-05');
INSERT INTO Student(studentID, scholarshipID, firstname, lastname, gender, date_of_birth)
VALUES(1025, 1111, 'Raymond', 'Andilsim', 'M', '2002-01-28');
INSERT INTO Student(studentID, scholarshipID, firstname, lastname, gender, date_of_birth)
VALUES(1026, 3333, 'Edward', 'Apriandy', 'M', '2001-04-11');
INSERT INTO Student(studentID, scholarshipID, firstname, lastname, gender, date_of_birth)
VALUES(1027, 4444, 'Jackson', 'Timmer', 'M', '2001-05-09');
INSERT INTO Student(studentID, scholarshipID, firstname, lastname, gender, date_of_birth)
VALUES(1028, 4444, 'Wilsen', 'Marchlen', 'M', '2001-08-9');
INSERT INTO Student(studentID, scholarshipID, firstname, lastname, gender, date_of_birth)
VALUES(1029, 2222, 'Angela', 'Chua', 'F', '2001-01-31');
INSERT INTO Student(studentID, firstname, lastname, gender, date_of_birth)
VALUES(1030, 'Putri', 'Fellany', 'F', '2002-01-05');
INSERT INTO Student(studentID, firstname, lastname, gender, date_of_birth)
VALUES(1031, 'Rudy', 'Santoso', 'M', '1970-05-24');

INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1027, 'A101', 1, 75);
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1027, 'B202', 3, 60);
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1028, 'C303', 1, 90);
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1028, 'D404', 2, 55);
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1029, 'A101', 1, 80);
```

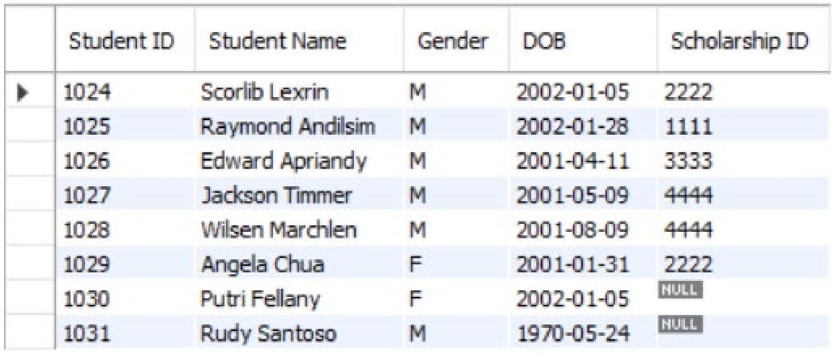
```
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1024, 'A101', 1, 100);
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1025, 'E505', 4, 30);
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1025, 'B202', 3, 45);
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1026, 'C303', 2, 70);
INSERT INTO Result(studentID, subjectID, attempt, score)
VALUES(1026, 'E505', 1, 95);

INSERT INTO Provider(providerID, provider_name, company_no)
VALUES('PT666', 'Microsoft', 116118);
INSERT INTO Provider(providerID, provider_name, company_no)
VALUES('TJ777', 'Government', 113115);
INSERT INTO Provider(providerID, provider_name, company_no)
VALUES('SA888', 'Swinburne', 114116);
INSERT INTO Provider(providerID, provider_name, company_no)
VALUES('CO999', 'Amazon', 115117);

INSERT INTO Scholarship_Provider(scholarshipID, providerID, note)
VALUES(4444, 'CO999', 'Congratulations');
INSERT INTO Scholarship_Provider(scholarshipID, providerID)
VALUES(2222, 'TJ777');
INSERT INTO Scholarship_Provider(scholarshipID, providerID)
VALUES(3333, 'SA888');
```

7. Main Usage and Scripts for typical use cases

- **Retrieve data**

Show all information of student ORDER BY studentID :

SELECT studentID AS 'Student ID', CONCAT(firstname, ' ', lastname) AS 'Student Name', gender AS 'Gender', date_of_birth AS 'DOB', scholarshipID AS 'Scholarship ID' FROM Student ORDER BY studentID;



Student ID	Student Name	Gender	DOB	Scholarship ID
1024	Scorlib Lexrin	M	2002-01-05	2222
1025	Raymond Andilsim	M	2002-01-28	1111
1026	Edward Apriandy	M	2001-04-11	3333
1027	Jackson Timmer	M	2001-05-09	4444
1028	Wilsen Marchlen	M	2001-08-09	4444
1029	Angela Chua	F	2001-01-31	2222
1030	Putri Fellany	F	2002-01-05	NULL
1031	Rudy Santoso	M	1970-05-24	NULL

Show all details information of scholarships :

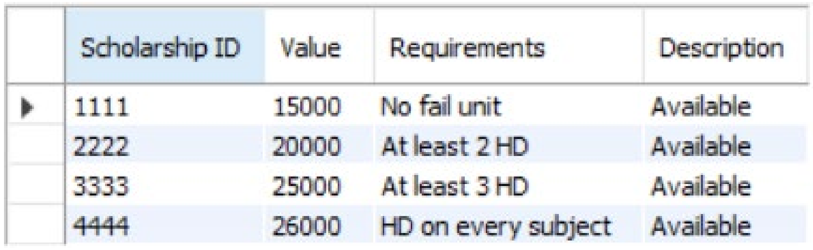
SELECT scholarshipID AS 'Scholarship ID',

scholarship_value AS 'Value',

scholarship_condition AS 'Requirements',

scholarship_desc AS 'Description'

FROM Scholarship ORDER BY scholarshipID;



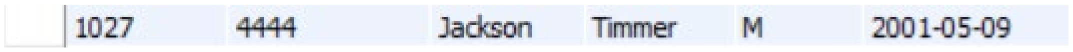
Scholarship ID	Value	Requirements	Description
1111	15000	No fail unit	Available
2222	20000	At least 2 HD	Available
3333	25000	At least 3 HD	Available
4444	26000	HD on every subject	Available

➢ **Update information**

Change the lastname of a student :

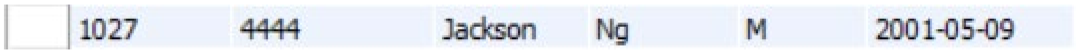
UPDATE Student SET lastname = 'Ng' WHERE studentID = '1027';

Before :



1027	4444	Jackson	Timmer	M	2001-05-09

After :

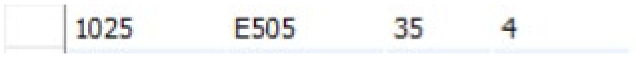


1027	4444	Jackson	Ng	M	2001-05-09

Change student score from Result table :

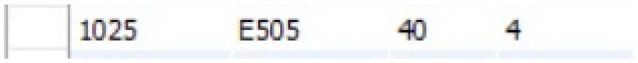
UPDATE Result SET score = 40 WHERE studentID = 1025 AND subjectID = 'E505';

Before :



1025	E505	35	4

After :



1025	E505	40	4

➢ **SQL JOIN Queries**

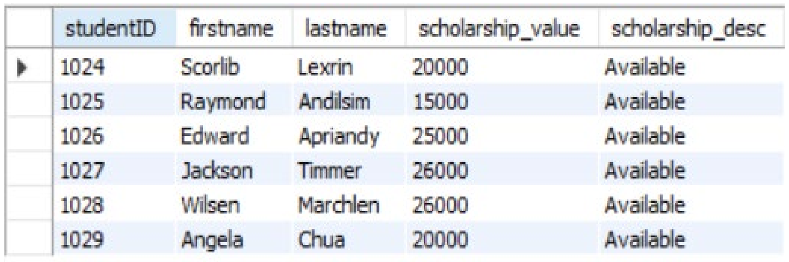
The following command shows the details of scholarship for each students by joining 2 tables:

SELECT s.studentID, s.firstname, s.lastname,

sc.scholarship_value, sc.scholarship_desc

FROM Student s NATURAL JOIN Scholarship sc

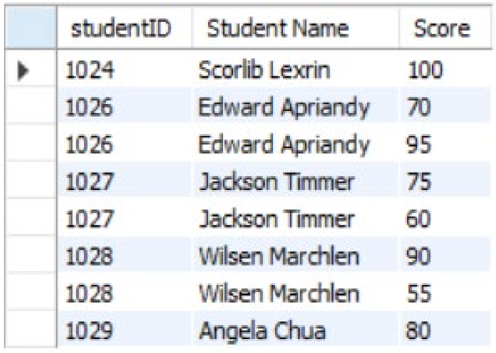
ORDER BY s.studentID;



studentID	firstname	lastname	scholarship_value	scholarship_desc
1024	Scorlib	Lexrin	20000	Available
1025	Raymond	Andilsim	15000	Available
1026	Edward	Apriandy	25000	Available
1027	Jackson	Timmer	26000	Available
1028	Wilsen	Marchlen	26000	Available
1029	Angela	Chua	20000	Available

The following command shows every student that receive Score more than 50 :

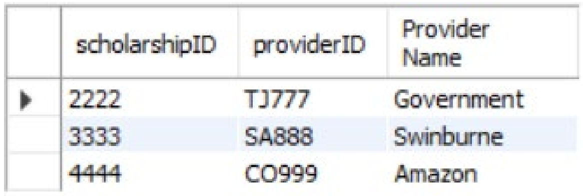
```
SELECT s.studentID, CONCAT(s.firstname, ' ' ,s.lastname)
AS 'Student Name', r.score AS 'Score'
FROM Student s JOIN Result r
ON s.studentID = r.studentID
WHERE r.score > 50
ORDER BY s.studentID;
```



studentID	Student Name	Score
1024	Scorlib Lexrin	100
1026	Edward Apriandy	70
1026	Edward Apriandy	95
1027	Jackson Timmer	75
1027	Jackson Timmer	60
1028	Wilsen Marchlen	90
1028	Wilsen Marchlen	55
1029	Angela Chua	80

The following command shows the provider details for each scholarship given :

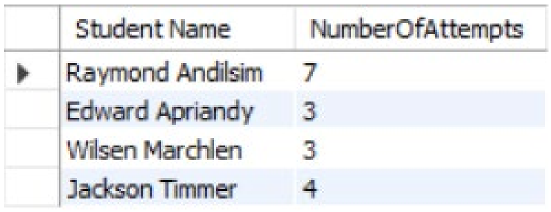
```
SELECT sp.scholarshipID, sp.providerID, p.provider_name AS 'Provider Name'
FROM Scholarship_Provider sp LEFT JOIN Provider p
ON sp.providerID = p.providerID
ORDER BY scholarshipID;
```



scholarshipID	providerID	Provider Name
2222	TJ777	Government
3333	SA888	Swinburne
4444	CO999	Amazon

The following command returns the number of attempts student did on all subject :

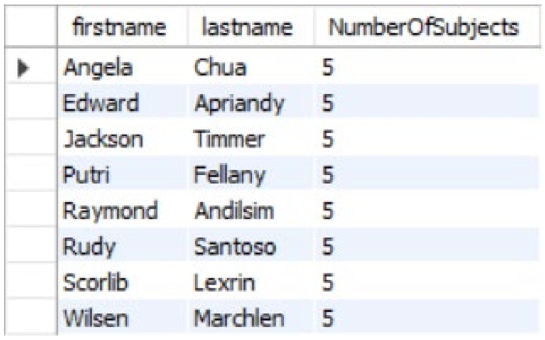
```
SELECT CONCAT(s.firstname,' ',s.lastname) AS 'Student Name',
SUM(r.attempt) AS 'NumberOfAttempts'
FROM Student s
INNER JOIN Result r
ON s.studentID = r.studentID
GROUP BY s.lastname HAVING COUNT(r.attempt)>1;
```



Student Name	NumberOfAttempts
Raymond Andilsim	7
Edward Apriandy	3
Wilsen Marchlen	3
Jackson Timmer	4

The following command returns the number of subjects each student enrolled in :

```
SELECT s.firstname, s.lastname, COUNT(sj.subjectID)
AS 'NumberOfSubjects'
FROM Student s
NATURAL JOIN Subject sj
GROUP BY s.firstname;
```

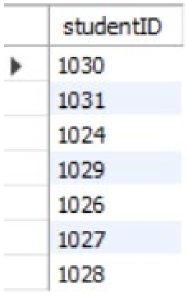


firstname	lastname	NumberOfSubjects
Angela	Chua	5
Edward	Apriandy	5
Jackson	Timmer	5
Putri	Fellany	5
Raymond	Andilsim	5
Rudy	Santoso	5
Scorlib	Lexrin	5
Wilsen	Marchlen	5

➢ **Checking non-existing data in a table**

The following commands returns the student id of all students that pass every unit(score more than 50). Studentid 1025 is missing because the student have score less than 50 so it means he/she didn't pass the unit :

```
SELECT studentID FROM Student s
WHERE NOT EXISTS(
                    SELECT * FROM Result
       WHERE Score <= 50 AND studentID = s.studentID );
```

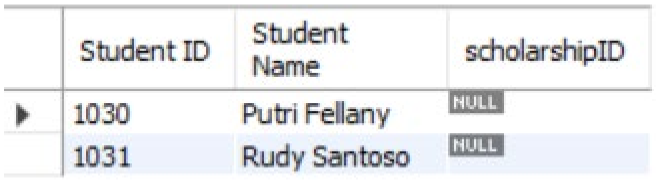


studentID
1030
1031
1024
1029
1026
1027
1028

➢ **Create VIEW**

A view is a virtual table created by query by joining one or more tables. The following commands creates a VIEW called No_Scholarship that contains information about students that didn't receive any scholarship.

```
CREATE VIEW No_Scholarship AS
SELECT studentID AS 'Student ID',
CONCAT(firstname, ' ' ,lastname) AS 'Student Name',
scholarshipID FROM Student
WHERE scholarshipID IS NULL;
```



Student ID	Student Name	scholarshipID
1030	Putri Fellany	NULL
1031	Rudy Santoso	NULL