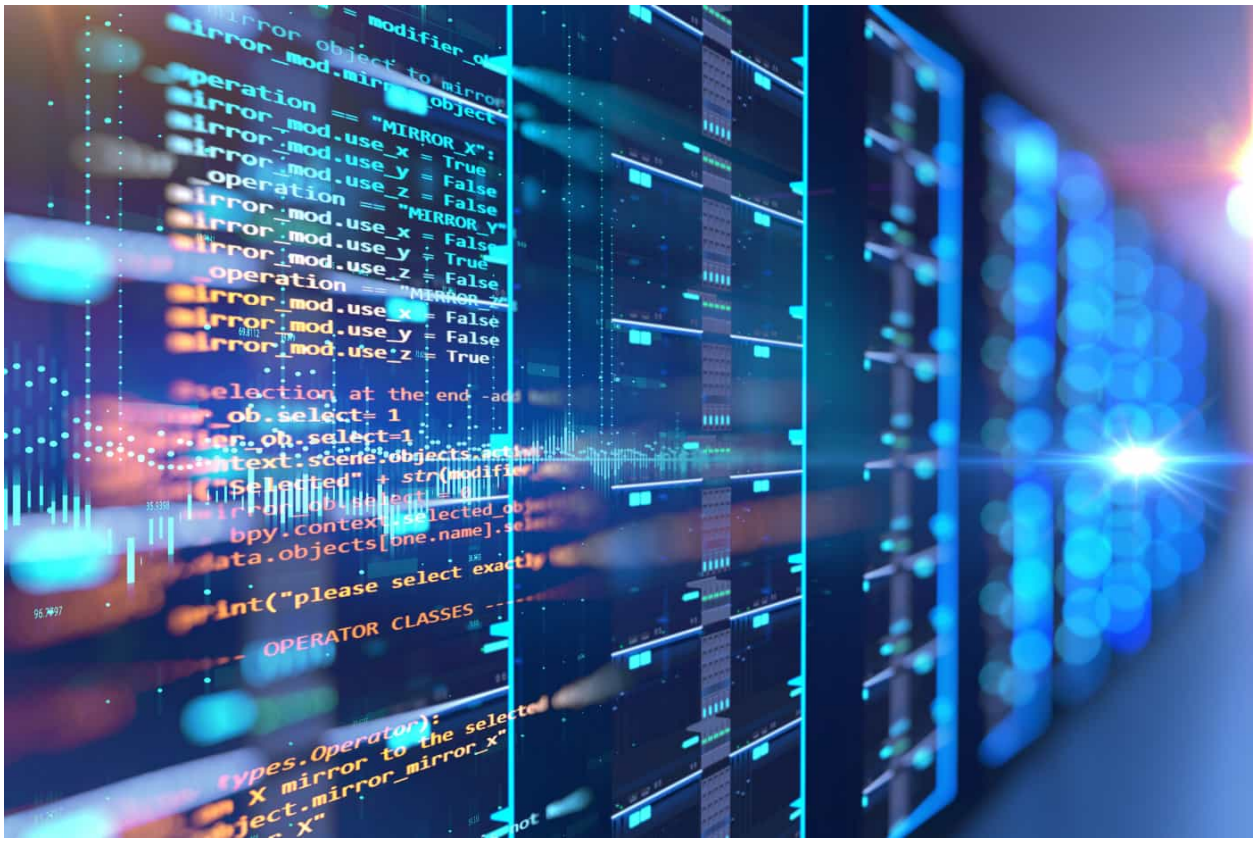
College Dublin
Computing • IT • Business

Data Manipulation and Validation

Integrated CA2, Databases, Aldana Louzan

GITHUB REPOSITORY: https://github.com/tolgabp/databases_ca2.git

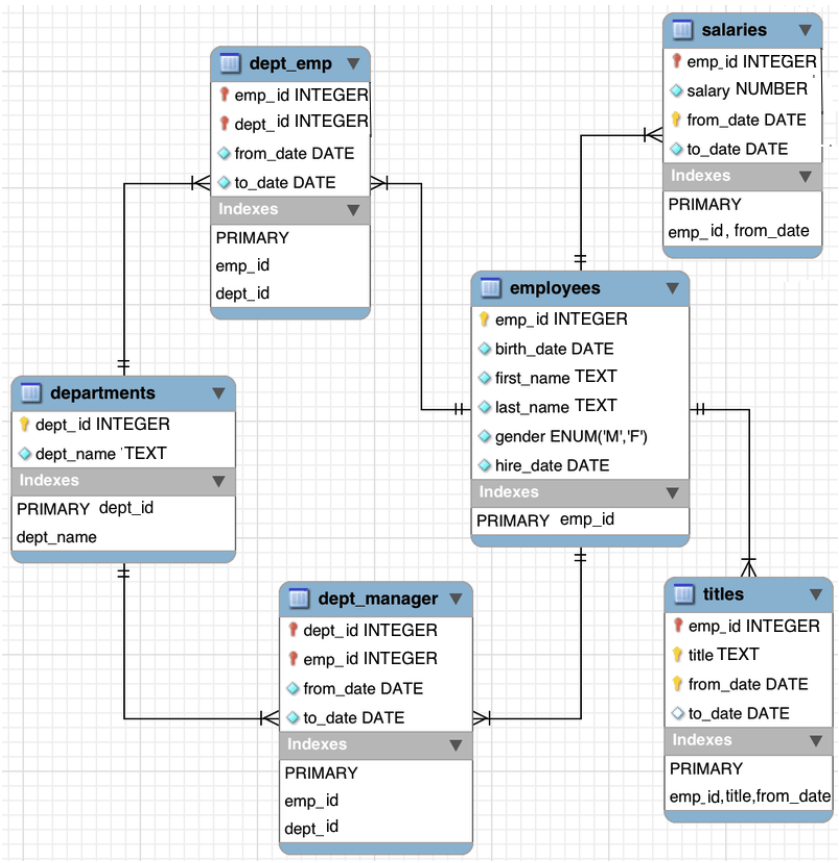


Tolga Baris PINAR - 2022431

02.12.2022 - Higher Diploma in Science in Computing

INTRODUCTION

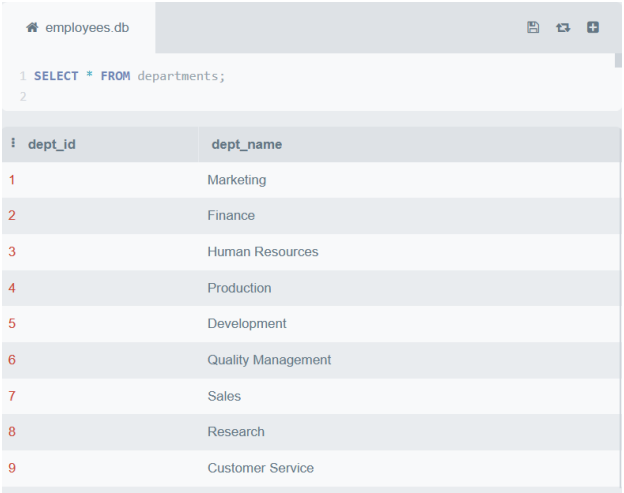
In this assignment, the employees sample database (created by Fusheng Wang and Carlo Zaniolo at Siemens Corporate Research), a large base of data spread over six separate tables and consisting of 4 million records in total that was created for system testing purposes. The following diagram provides an overview of the structure of the employees.db:



1.1 Databases CA Part 1

1.1.1 List all attributes present in the **departments** TABLE.

CODE: SELECT * FROM departments;

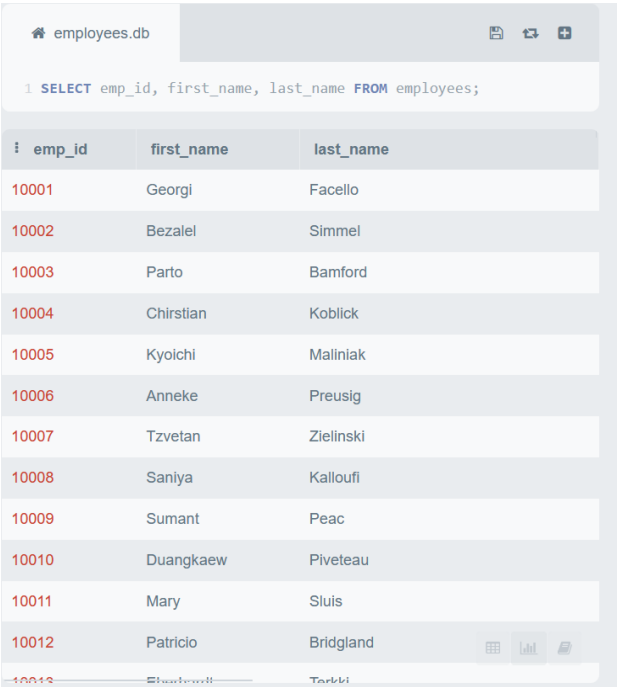


```
SELECT * FROM departments;
```

dept_id	dept_name
1	Marketing
2	Finance
3	Human Resources
4	Production
5	Development
6	Quality Management
7	Sales
8	Research
9	Customer Service

1.1.2. List all **employee IDs** of all past/current employees, their **first** and **last names**.

CODE: SELECT emp_id, first_name, last_name FROM employees;

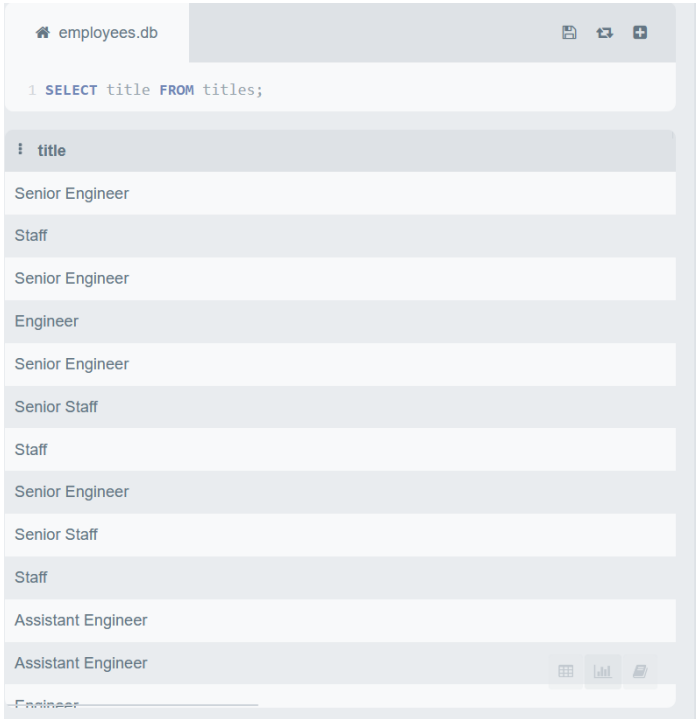


```
SELECT emp_id, first_name, last_name FROM employees;
```

emp_id	first_name	last_name
10001	Georgi	Facello
10002	Bezalel	Simmel
10003	Parto	Bamford
10004	Chirstian	Koblick
10005	Kyoichi	Maliniak
10006	Anneke	Preusig
10007	Tzvetan	Zielinski
10008	Saniya	Kalloufi
10009	Sumant	Peac
10010	Duangkaew	Piveteau
10011	Mary	Sluis
10012	Patricio	Bridgland

1.1.3. List all department **titles** present in the database.

CODE: SELECT title FROM titles;

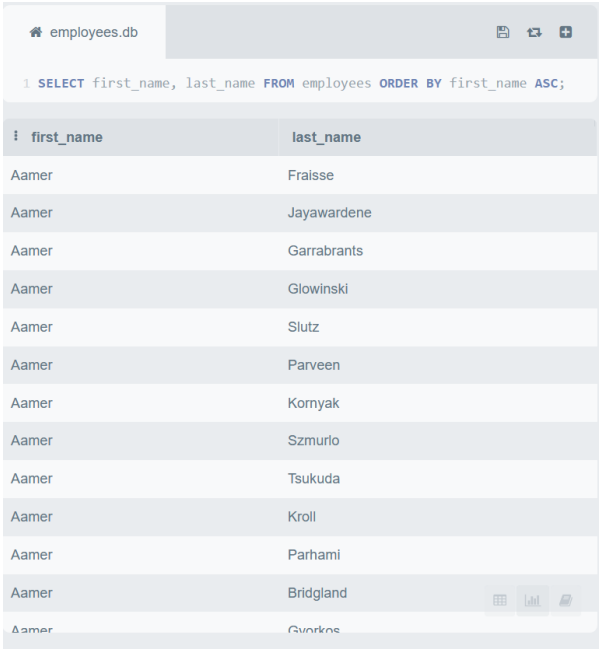


1.1.4. List all **unique job titles** found in the database, and **order them alphabetically**.

CODE: SELECT DISTINCT title FROM titles ORDER BY title ASC;

1.1.5. List all past/current **employees' names ordered alphabetically** in ascending order, i.e. first name and last name in alphabetical order.

CODE: SELECT first_name, last_name FROM employees ORDER BY first_name ASC;



first_name	last_name
Aamer	Fraisse
Aamer	Jayawardene
Aamer	Garrabrants
Aamer	Glowinski
Aamer	Slutz
Aamer	Parveen
Aamer	Kornyak
Aamer	Szmurlo
Aamer	Tsukuda
Aamer	Kroll
Aamer	Parhami
Aamer	Bridgland
Aamer	Gyorkos

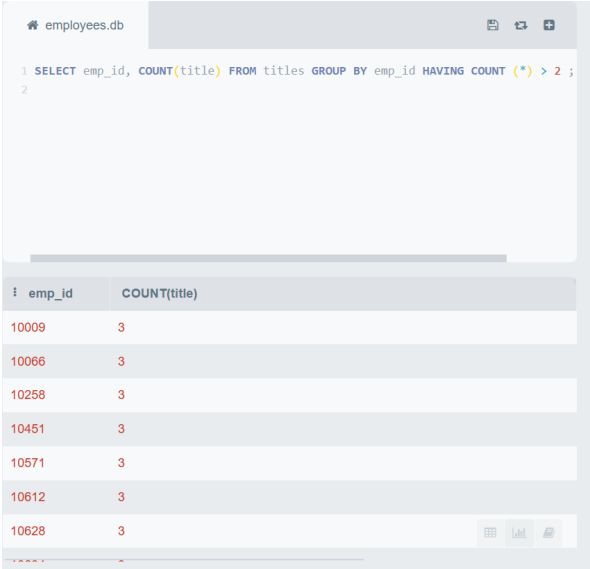
1.2 Database CA Part 2

1.2.1 The number of all employees that started on **1991-05-01**.

CODE: SELECT COUNT(*) FROM employees WHERE hire_date = '1991-05-01';

1.2.2 List all **emp_no** who have had strictly **more than 2 titles** and display **the total number of the titles** they have had.

CODE: SELECT emp_id, COUNT(title) FROM titles GROUP BY emp_id HAVING COUNT (*) > 2 ;



emp_id	COUNT(title)
10009	3
10066	3
10258	3
10451	3
10571	3
10612	3
10628	3

1.2.3 List **female employees** (past/current) together with all other relation attributes.

CODE: SELECT * FROM employees WHERE gender = 'F';

employees.db

```
1 SELECT * FROM employees WHERE gender = 'F';
```

emp_id	birth_date	first_name	last_name	gender	hire_date
10002	1964-06-02	Bezalel	Simmel	F	1985-11-21
10006	1953-04-20	Anneke	Preusig	F	1989-06-02
10007	1957-05-23	Tzvetan	Zielinski	F	1989-02-10
10009	1952-04-19	Sumant	Peac	F	1985-02-18
10010	1963-06-01	Duangkaew	Piveteau	F	1989-08-24
10011	1953-11-07	Mary	Sluis	F	1990-01-22
10017	1958-07-06	Cristinel	Bouloucos	F	1993-08-03
10018	1954-06-19	Kazuhide	Peha	F	1987-04-03
10023	1953-09-29	Bojan	Montemayor	F	1989-12-17
10024	1958-09-05	Suzette	Pettey	F	1997-05-19
10027	1962-07-10	Divier	Reistad	F	1989-07-07
10032	1960-08-09	Jeong	Reistad	F	1990-06-20
10040	1959-09-13	Weiyi	Meriste	F	1993-02-14

1.2.4 List past/current **employees** hired prior to **1986-01-01** with the surname **Simmel**.

CODE: SELECT * FROM employees WHERE hire_date < '1986-01-01' AND last_name = 'Simmel';

employees.db

```
1 SELECT * FROM employees WHERE hire_date < '1986-01-01' AND last_name = 'Simmel';
```

emp_id	birth_date	first_name	last_name	gender	hire_date
10002	1964-06-02	Bezalel	Simmel	F	1985-11-21
39631	1952-03-26	Jiafu	Simmel	M	1985-04-18
47766	1954-03-26	Gunilla	Simmel	F	1985-08-26
48233	1954-01-02	Ugo	Simmel	M	1985-05-06
76743	1953-05-21	Mechthild	Simmel	M	1985-09-13
80534	1960-06-28	Jeane	Simmel	F	1985-08-05
105136	1959-02-03	Stein	Simmel	M	1985-10-27
204187	1954-04-08	Wayne	Simmel	M	1985-10-12
217870	1954-05-21	JoAnna	Simmel	F	1985-06-07
237922	1959-04-12	Etsuo	Simmel	M	1985-03-16
246815	1964-08-08	Conrado	Simmel	F	1985-06-20
247973	1952-11-26	Xuejun	Simmel	F	1985-02-02
252312	1955-07-07	Gonzalo	Simmel	M	1985-09-23

1.2.5 How many past/current **employees' last names** begin with the capital letter B?

Use a column alias **total with B** to output your results.

CODE: SELECT COUNT(last_name) AS totalWithB FROM employees WHERE last_name LIKE 'B%';

employees.db

```
1 SELECT COUNT(last_name) AS totalWithB FROM employees WHERE last_name LIKE 'B%';
```

totalWithB
28794

1.2.6 Create a new table called **emp_training** with 3 columns:

• **trainer_no:** this should be the primary key and is of type integer and is an auto-increment.

• **first_name:** this data type is **varchar(30)** and should not be NULL

• **last_name:** this data type is **varchar(30)** and should not be NULL

• **t_module:** this data type is **varchar(20)**

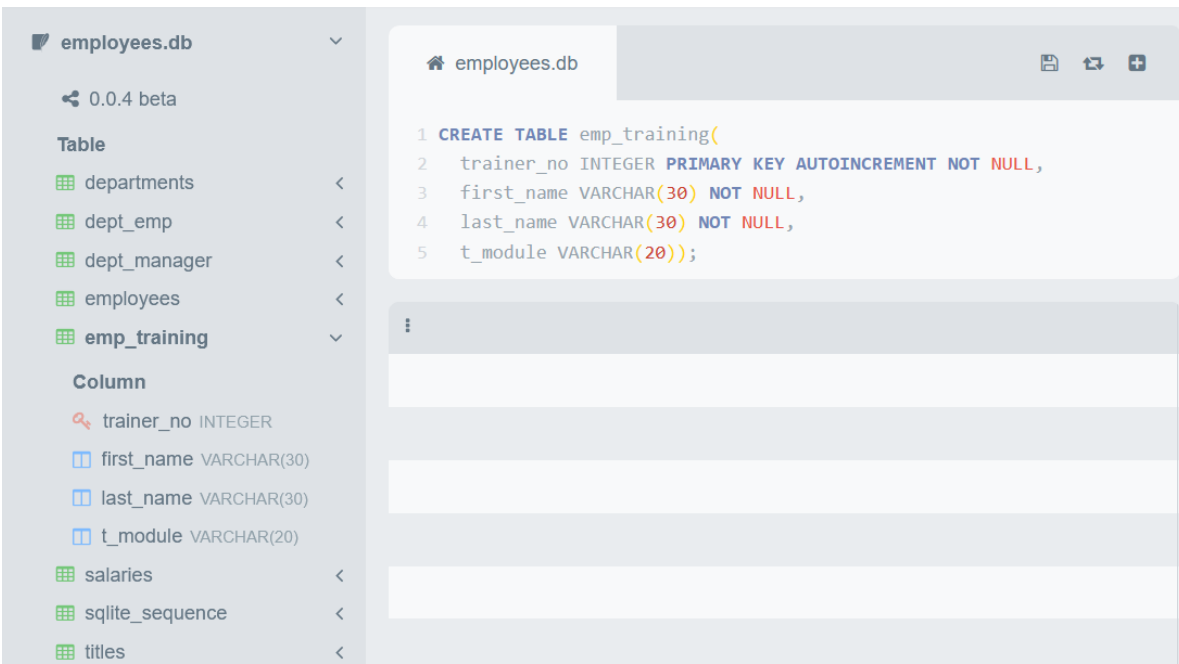
CODE: CREATE TABLE emp_training (

trainer_no INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL,

first_name VARCHAR(30) NOT NULL,

last_name VARCHAR(30) NOT NULL,

t_module VARCHAR(20));



1.2.7 Insert 2 new rows into the **emp_training** table:

Row 1: fname: **Joe** lname: **Bloggs**

module: **Google Docs** lname: **Bloggs**

Row 2: fname: **Fred** module: **Google Sheets**

CODE:

INSERT INTO emp_training (first_name, last_name, t_module) VALUES ('Joe', 'Bloggs', 'Google Docs');

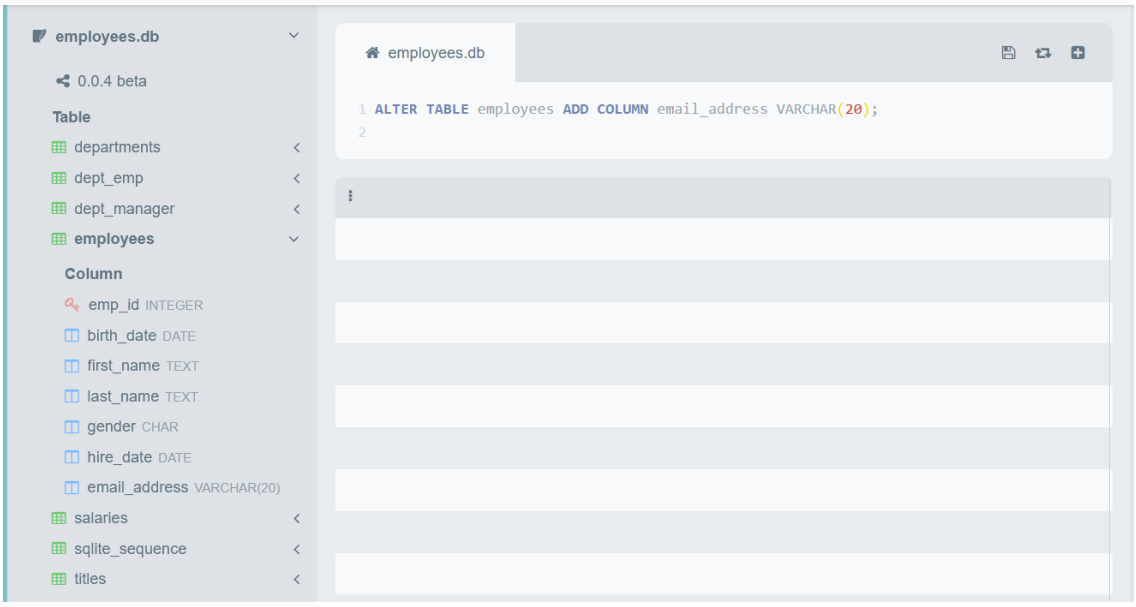
INSERT INTO emp_training (first_name, last_name, t_module) VALUES ('Fred', 'Bloggs', 'Google Sheets');

1.2.8 The organisation no longer wishes to record the employees training within the database. Therefore, delete the newly created **emp_training** table.

CODE: DROP TABLE IF EXISTS emp_training;

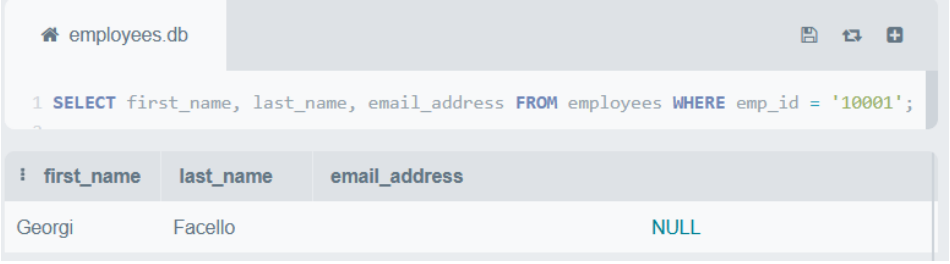
1.2.9 Alter the **employees** table to include an **email_address** field of type **varchar(20)**.

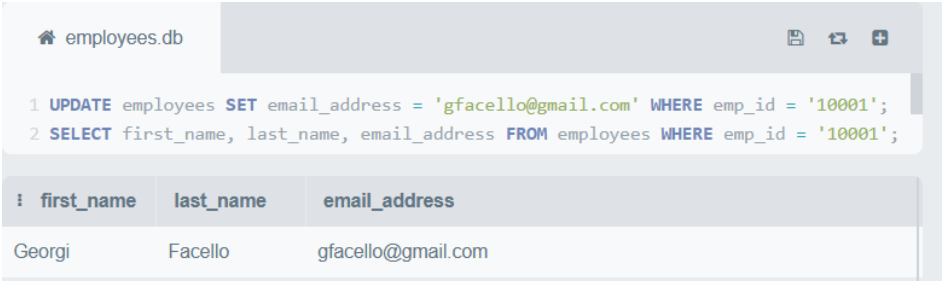
CODE: ALTER TABLE employees ADD COLUMN email_address VARCHAR(20);



1.2.10 Update the email address of **Georgi Facello** to **gfacello@gmail.com**, where **emp_no** equals to **10001**.

CODE: UPDATE employees SET email_address = 'gfacello@gmail.com' WHERE emp_id = '10001';





1.3 Database CA Part 3

1.3.1 List the number of male managers and female managers who work for each department. Make sure to display the gender, the number of employees (renamed as num_empGender) and dept_no, ordered by department number in an ascendant order.

CODE:

```
SELECT dept_id,
        sum( gender = 'F' ) AS num_empFemale,
        sum( gender = 'M' ) AS num_empMale
        FROM dept_manager dm INNER JOIN employees e ON dm.emp_id = e.emp_id
        GROUP BY dept_id ORDER BY dept_id ASC;
```

employees.db

```
SELECT dept_id,
    sum( gender = 'F' ) AS num_empFemale,
    sum( gender = 'M' ) AS num_empMale
FROM dept_manager dm INNER JOIN employees e ON dm.emp_id = e.emp_id
GROUP BY dept_id ORDER BY dept_id ASC;
```

dept_id	num_empFemale	num_empMale
1	0	2
2	1	1
3	2	0
4	2	2
5	1	1
6	3	1
7	0	2
8	1	1
9	3	1

1.3.2 List the average salary of male and female employees whose title is "Technique Leader". In your result table should appear, gender, average salary named as avg_salary and title.

CODE:

SELECT gender, AVG(salary) AS avg_salary, title FROM titles tile INNER JOIN employees e, salaries sal ON tile.emp_id = e.emp_id

AND tile.emp_id = sal.emp_id AND e.emp_id = sal.emp_id

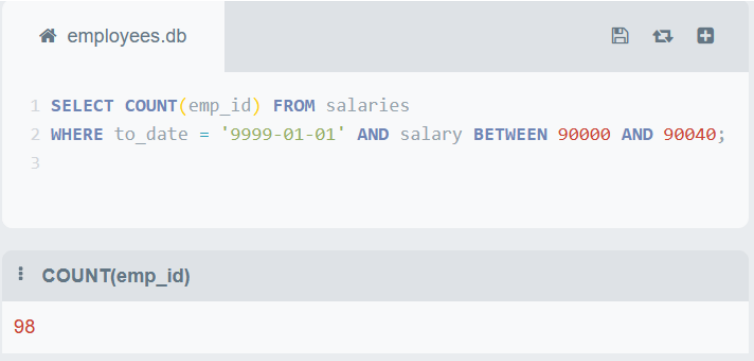
WHERE title = 'Technique Leader' GROUP BY gender;

gender	avg_salary	title
F	59238.58634267654	Technique Leader
M	59332.19594183215	Technique Leader

1.3.3 The number of employees that have a current salary (i.e., **to_date** equals to **9999-01-01**) between **90000** and **90040**.

CODE: SELECT COUNT(emp_id) FROM salaries

WHERE to_date = '9999-01-01' AND salary BETWEEN 90000 AND 90040;



COUNT(emp_id)
98

1.3.4 List all unique employees' last and first names (using **GROUP BY** method) that have a current salary (i.e., **to_date** equals to **9999-01-01**) greater than **90000**, outputting both names in descending order (sort by the last name first and then the first name) and also displaying their current salaries (using the **INNER JOIN** method).

CODE:

```
SELECT DISTINCT last_name, first_name, salary

FROM employees e INNER JOIN salaries sal ON e.emp_id = sal.emp_id

WHERE to_date = '9999-01-01' AND salary > 90000

GROUP BY last_name, first_name

ORDER BY  LOWER(last_name) DESC, LOWER(first_name) DESC;

/* Lower should be used since there are people with the surname called " dAstous" which basically starts with a lowercase letter*/
```

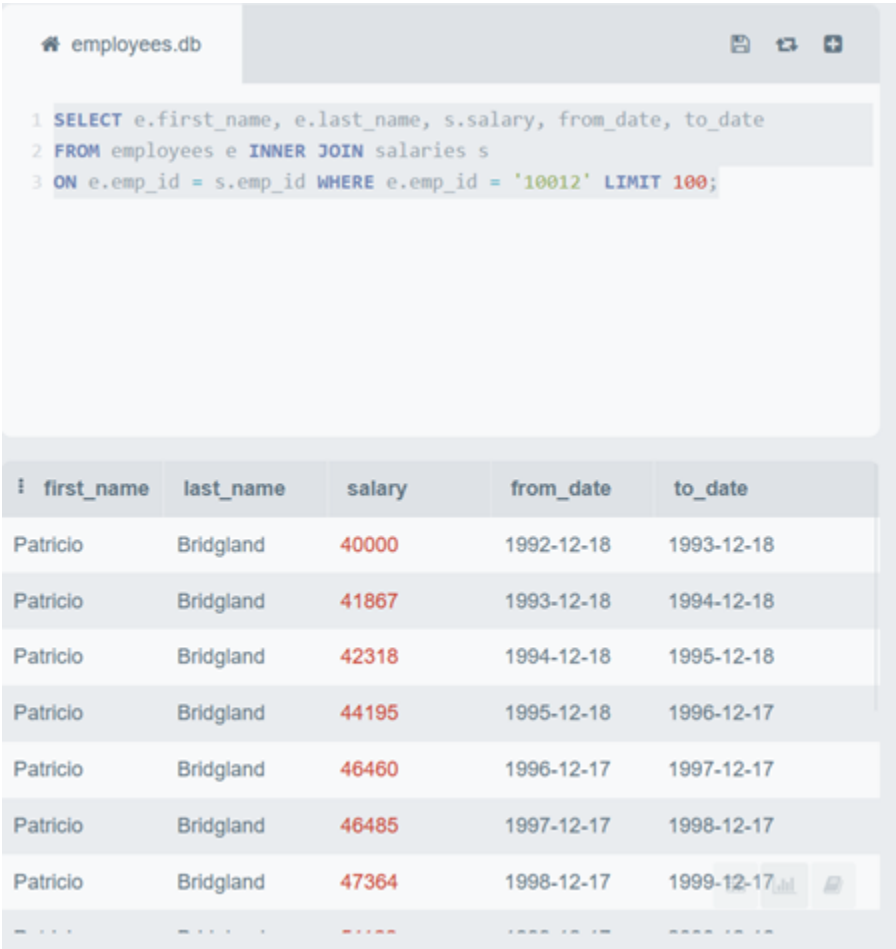
employees.db

```
SELECT DISTINCT last_name, first_name, salary
FROM employees e INNER JOIN salaries sal ON e.emp_id = sal.emp_id
WHERE to_date = '9999-01-01' AND salary > 90000
GROUP BY last_name, first_name
ORDER BY  LOWER(last_name) DESC, LOWER(first_name) DESC;
```

last_name	first_name	salary
Zykh	Zhongwei	99167
Zykh	Yongdong	93183
Zykh	Xumin	92320
Zykh	Toshimori	101401
Zykh	Seongbae	122466
Zykh	Rosalyn	120103
Zykh	Palash	118873
Zykh	Leni	99774
Zykh	Leandro	97363
Zykh	Kwee	91013
Zykh	Kinh	114596

1.3.5 First name, last name, all salary dates and related amounts for the employee with employee number **10012**.

CODE: SELECT e.first_name, e.last_name, s.salary, from_date, to_date FROM employees e INNER JOIN salaries s ON e.emp_id = s.emp_id WHERE e.emp_id = '10012';



first_name	last_name	salary	from_date	to_date
Patricio	Bridgland	40000	1992-12-18	1993-12-18
Patricio	Bridgland	41867	1993-12-18	1994-12-18
Patricio	Bridgland	42318	1994-12-18	1995-12-18
Patricio	Bridgland	44195	1995-12-18	1996-12-17
Patricio	Bridgland	46460	1996-12-17	1997-12-17
Patricio	Bridgland	46485	1997-12-17	1998-12-17
Patricio	Bridgland	47364	1998-12-17	1999-12-17

1.3.6 In relation to the table named salaries in **Figure 1** above. Answer in text:

a) What is the **degree** of this table?

- The table named salaries has four degrees, which are emp_id, salary, from_date and to_date, at total.

b) What column(s), if any, make(s) up the **primary key**?

-emp_id and from_date are the primary keys in this table.

c) What column(s), if any, make(s) up the **foreign key**?

-emp_id is the only foreign key in this table.

1.3.7 In the given schema, the tables dept_emp, dept_manager, salaries, titles have composite keys.

Explain for each relation why this is the case? Support your answer with appropriate references.

-TABLE **dept_emp**: This table has a composite key, consists of **emp_id** FOREIGN KEY and **dept_id** FOREIGN KEY . This composite key uses the combination of the PRIMARY KEY of the **employees** TABLE and **departments** TABLE, thus one can identify an employee, retrieve the data of the department an employee works in, and the date an employee starts and ends working in that department.

-TABLE **dept_manager**: This table has a composite key, consists of **emp_id** FOREIGN KEY (also a PRIMARY KEY in this table) and **dept_id** FOREIGN KEY . This composite key uses the combination of the PRIMARY KEY of the **employees** TABLE and **departments** TABLE, and therefore one can identify an employee, who is a manager, retrieve the data of the department a manager manages, and the managing period of a department.

-TABLE **salaries**: This table has a composite key, consists of **emp_id** FOREIGN KEY and **from_date** PRIMARY KEY. This is a composite key, but also a compound key since it consists of one primary and one foreign key. This composite key uses the combination of the PRIMARY KEY of the **employees** TABLE and its own PRIMARY KEY so that one can identify an employee, retrieve the data of the salary an employee gets, and the period an employee gets a salary. However

-TABLE **titles**: This table has a composite key, which is also a compound key, which consists of **emp_id** FOREIGN KEY (also a PRIMARY KEY in this table), **title** PRIMARY KEY and **from_date** PRIMARY KEY. This composite key uses the combination of the PRIMARY KEY of the **employees** TABLE and its own PRIMARY KEYs so that one can identify an employee, retrieve the data of a title of an employee, and the period an employee holds

the title.

SQL QUERIES SUMMARY:

1.1.1 SELECT * FROM departments;

1.1.2 SELECT emp_id, first_name, last_name FROM employees;

1.1.3 SELECT title FROM titles;

1.1.4 SELECT DISTINCT title FROM titles ORDER BY title ASC;

1.1.5 SELECT first_name, last_name FROM employees ORDER BY first_name ASC;

1.2.1 SELECT COUNT(from_date) FROM dept_emp WHERE from_date = '1991-05-01';

1.2.2 SELECT emp_id, COUNT(title) FROM titles GROUP BY emp_id HAVING COUNT (*) > 2 ;

1.2.3 SELECT * FROM employees WHERE gender = 'F';

1.2.4 SELECT * FROM employees WHERE hire_date < '1986-01-01' AND last_name = 'Simmel';

1.2.5 SELECT COUNT(last_name) AS totalWithB FROM employees WHERE last_name LIKE 'B%';

1.2.6 CREATE TABLE emp_training(trainer_no INTEGER

PRIMARY KEY AUTOINCREMENT NOT NULL, first_name

VARCHAR(30) NOT NULL, last_name VARCHAR(30) NOT

NULL, t_module VARCHAR(20));

1.2.7 INSERT INTO emp_training (first_name, last_name, t_module) VALUES ('Joe', 'Bloggs', 'Google Docs');

INSERT INTO emp_training (first_name, last_name, t_module) VALUES ('Fred', 'Bloggs', 'Google Sheets');

1.2.8 DROP TABLE IF EXISTS emp_training;

1.2.9 ALTER TABLE employees ADD COLUMN email_address VARCHAR(20);

1.2.10 UPDATE employees SET email_address = 'gfacello@gmail.com' WHERE emp_id = '10001';

1.3.1 SELECT dept_id, sum(gender = 'F') AS num_empFemale, sum(gender = 'M') AS num_empMale FROM dept_manager dm INNER JOIN employees e ON dm.emp_id = e.emp_id GROUP BY dept_id ORDER BY dept_id ASC;

1.3.2 SELECT gender, AVG(salary) AS avg_salary, title FROM titles tile INNER JOIN employees e, salaries sal ON tile.emp_id = e.emp_id AND tile.emp_id = sal.emp_id AND e.emp_id = sal.emp_id WHERE title = 'Technique Leader' GROUP BY gender;

1.3.3 SELECT COUNT(emp_id) FROM salaries WHERE to_date = '9999-01-01' AND salary BETWEEN 90000 AND 90040;

1.3.4 SELECT DISTINCT last_name, first_name, salary FROM employees e INNER JOIN salaries sal ON e.emp_id = sal.emp_id WHERE to_date = '9999-01-01' AND salary > 90000 GROUP BY last_name, first_name ORDER BY LOWER(last_name) DESC, LOWER(first_name) DESC;

1.3.5 SELECT e.first_name, e.last_name, s.salary FROM employees e INNER JOIN salaries s ON e.emp_id = s.emp_id WHERE e.emp_id = '10012';

REFERENCES

1. www.w3schools.com. (n.d.). *MySQL Joins*. [online] Available at: https://www.w3schools.com/mysql/mysql_join.asp.
2. Otieno, J. (n.d.). *Ambiguous Column Name with SQL Join Query*. [online] Available at:

https://linuxhint.com/ambiguous-column-name-with-sql-join-query/ [Accessed 1 Dec. 2022].

3. sqlite.org. (n.d.). *Built-in Aggregate Functions*. [online] Available at: https://sqlite.org/lang_aggfunc.html [Accessed 1 Dec. 2022].
4. sqlite.org. (n.d.). *SQLite Documentation*. [online] Available at: https://sqlite.org/docs.html.
5. www.bestinterviewquestion.com. (n.d.). *What is the degree of a table in MySQL? - Best Interview Question*. [online] Available at: https://www.bestinterviewquestion.com/question/what-is-the-degree-of-a-table-in-mysql-5xe4y5359j4 [Accessed 1 Dec. 2022].
6. K, S. and asamy (n.d.). *What is degree of a relation in dbms*. [online] Available at: https://www.exploredatabase.com/2017/02/what-is-degree-of-relation-table-in-dbms.html.
7. SolveXia (2019). *5 Top Tips for Data Manipulation*. [online] www.solvexia.com. Available at: https://www.solvexia.com/blog/5-top-tips-for-data-manipulation.
8. Stack Overflow. (n.d.). *indexing - Differences between INDEX, PRIMARY, UNIQUE, FULLTEXT in MySQL?* [online] Available at: https://stackoverflow.com/questions/707874/differences-between-index-primary-unique-fulltext-in-mysql [Accessed 1 Dec. 2022].
9. Stack Overflow. (n.d.). *mysql - What is difference between primary index and secondary index exactly?* [online] Available at: https://stackoverflow.com/questions/20824686/what-is-difference-between-primary-index-and-secondary-index-exactly.
10. dev.mysql.com. (n.d.). *MySQL :: MySQL 8.0 Reference Manual :: MySQL Glossary*. [online] Available at: https://dev.mysql.com/doc/refman/8.0/en/glossary.html.

11. www.ibm.com. (2022). *Defining Composite Primary and Foreign Keys*. [online] Available at: https://www.ibm.com/docs/en/informix-servers/14.10?topic=format-defining-composite-primary-foreign-keys.
12. www.youtube.com. (n.d.). *SQL Index |¦| Indexes in SQL |¦| Database Index*. [online] Available at: https://www.youtube.com/watch?v=fsG1XaZEa78.
13. www.youtube.com. (n.d.). *SQL Joins Explained |¦| Joins in SQL |¦| SQL Tutorial*. [online] Available at: https://www.youtube.com/watch?v=9yeOJ0ZMUYw.
14. Stack Overflow. (n.d.). *sql - What do the mysql workbench column icons mean*. [online] Available at: https://stackoverflow.com/questions/10778561/what-do-the-mysql-workbench-column-icons-mean.
15. Studytonight (2019). *Concept of Keys in DBMS - Super, Primary, Candidate, Foreign Key, etc*. *YouTube*. Available at: https://www.youtube.com/watch?v=p3yJZH8_bsc.
16. Aldana Louza(2022) described Relational Databases(Moodle)
17. Aldana Louza(2022) described SQL (Moodle)
18. Aldana Louza(2022) described Classic Models
19. Aldana Louza(2022) described Data Manipulation Language (Moodle)
20. Aldana Louza(2022) described Data Definition Language (Moodle)
21. Aldana Louza(2022) described SQL & Data Query Language (Moodle)