

Lab 2 : relational model + SQL basics

Part A:

1. A relation is rows & columns
2. A tuple is a row
3. Each column is an attribute.
An attribute is usually made up by the standard English alphabet
4. A domain are the allowed names for an attribute (type + rule)
5. A schema is the design of tables.
Table names, column names → relations
- A instance is the actual data

6. A key is a set of attributes that uniquely identifies a tuple.

} ex) for the database created cmp308_lab2
• the schema holds the tuples being created with students, courses & enrollments.
• the instance would be a segment of the data → "102,Seema,"database..."

Part B:)

```
CREATE TABLE Students (
    student_id INT PRIMARY KEY,
    name VARCHAR(100),
    major VARCHAR(50),
    class_year INT
);

CREATE TABLE Courses (
    course_id INT PRIMARY KEY,
    title VARCHAR(100),
    credits INT CHECK (credits > 0)
);

CREATE TABLE Enrollments (
    student_id INT,
    course_id INT,
    term VARCHAR(20),
    grade VARCHAR(2),
    PRIMARY KEY (student_id, course_id, term),
    FOREIGN KEY (student_id) REFERENCES Students(student_id),
    FOREIGN KEY (course_id) REFERENCES Courses(course_id)
);
```

```
SELECT * FROM public.students
ORDER BY student_id ASC
```

student_id	name	major	class_year
1001	Seema	Computer Science	2027
1002	Sienna	Psychology	2027
1003	Matt	Education	2026
1004	Marina	Fashion	2025
1005	Jeffrey	Pre Law	2028
1006	Jose	Mathematics	2029

pgAdmin 4 Object Tools Edit View Window Help pgAdmin 4

Servers (1) PostgreSQL 18 Databases (3) cmpt308_lab2

Object Explorer

Dependencies X Dependents X Processes X NinjaSchool/postg... X cmpt308_lab2/postg... X cmpt308_lab2/postg... X public.courses/cmpt308_lab2/postgres@PostgreSQL 18 X

Query History

```
1 SELECT * FROM public.courses
2 ORDER BY course_id ASC
```

Data Output Messages Notifications

course_id	title	credits
1	English	3
2	Database Management	4
3	Discrete Mathematics	4
4	Psychology	3

Total rows: 4 Query complete 00:00:00.409 LF Ln 1, Col 1

pgAdmin 4 Object Tools Edit View Window Help pgAdmin 4

Servers (1) PostgreSQL 18 Databases (3) cmpt308_lab2

Object Explorer

Processes X cmpt308_lab2/postg... X cmpt308_lab2/postg... X public.courses/cm... X public.enrollments/cmpt308_lab2/postgres@PostgreSQL 18 X

Query History

```
1 SELECT * FROM public.enrollments
2 ORDER BY student_id ASC, course_id ASC, term ASC
```

Data Output Messages Notifications

student_id	course_id	term	grade
1001	222	Spring 2026	[null]
1001	333	Spring 2026	B
1002	133	Fall 2025	A
1002	444	Spring 2026	[null]
1003	133	Fall 2025	A
1004	133	Spring 2026	B
1005	333	Fall 2025	C
1006	333	Spring 2026	A

Total rows: 8 Query complete 00:00:00.200 LF Ln 1, Col 1

PART C:

1. projections:

The screenshot shows the pgAdmin 4 interface with the following details:

- Object Explorer:** Shows the database structure under "Servers (1) > PostgreSQL 18 > cmp308_lab2".
- Query Editor:** Contains the SQL query: `SELECT student_id FROM Students`. The results show 6 rows of data:

student_id
1001
1002
1003
1004
1005
1006

Total rows: 6 Query complete 00:00:00.383

2. selection:

The screenshot shows the pgAdmin 4 interface with the following details:

- Object Explorer:** Shows the database structure under "Servers (1) > PostgreSQL 18 > cmp308_lab2".
- Query Editor:** Contains the SQL query: `SELECT * FROM Students WHERE major = 'Computer Science'`. The results show 1 row of data:

student_id	name	major	class_year
1001	Seema	Computer Science	2027

Total rows: 1 Query complete 00:00:00.143

3. multiple conditions :

The screenshot shows the pgAdmin 4 interface with a database tree on the left and a query editor on the right. The query editor contains the following SQL code:

```
SELECT * FROM Courses
Where credits >= 3
```

The results table shows four rows of course data:

course_id	title	credits
333	Discrete Mathematics	4
222	Database Management	4
133	English	3
444	Psychology	3

Total rows: 4 Query complete 00:00:00.122

4. pattern matching (like)

The screenshot shows the pgAdmin 4 interface with a database tree on the left and a query editor on the right. The query editor contains the following SQL code:

```
SELECT name FROM Students
Where name LIKE 'Si%';
```

The results table shows two rows of student names:

name
Sema
Sienna

Total rows: 2 Query complete 00:00:00.260

5. null order

The screenshot shows the pgAdmin 4 interface with the following details:

- Servers:** PostgreSQL 18
- Databases:** NinjaSchool, cmp308_lab2
- Query:** SELECT * FROM Enrollments WHERE grade IS NULL;
- Data Output:** Shows two rows of data from the Enrollments table where the grade column is NULL.

student_id	course_id	term	grade
1001	222	Spring 2026	[null]
1002	444	Spring 2026	[null]

- Messages:** None
- Notifications:** None
- SQL:** The original SQL query is shown above the results.
- Status:** Total rows: 2, Query complete 00:00:00.125

6. order by class_year

The screenshot shows the pgAdmin 4 interface with the following details:

- Servers:** PostgreSQL 18
- Databases:** NinjaSchool, cmp308_lab2
- Query:** SELECT * FROM Students ORDER BY class_year;
- Data Output:** Shows six rows of data from the Students table, ordered by class_year.

student_id	name	major	class_year
1004	Marina	Fashion	2025
1001	Matt	Education	2026
1001	Seema	Computer Science	2027
1002	Sienna	Psychology	2027
1005	Jeffrey	Pre Law	2028
1006	Jose	Mathematics	2029

- Messages:** None
- Notifications:** None
- SQL:** The original SQL query is shown above the results.
- Status:** Total rows: 6, Query complete 00:00:00.130

6. Order by name

pgAdmin 4 Object Tools Edit View Window Help pgAdmin 4 pgAdmin 4

Object Explorer Servers (1) PostgreSQL 18 Databases (3) cmpt308_lab2 (1) cmpt308_lab2/postgres@PostgreSQL 18 Query History

```
1 SELECT * FROM Students
2 ORDER BY name;
```

Data Output Messages Notifications

student_id	name	major	class_year
1005	Jeffrey	Pre Law	2028
1006	Jose	Mathematics	2029
1004	Marina	Fashion	2025
1003	Matt	Education	2026
1001	Seem	Computer Science	2027
1002	Sienna	Psychology	2027

Showing rows: 1 to 6 Page No: 1 of 1

Total rows: 6 Query complete 00:00:00.162 ✓ Successfully run. Total query runtime: 162 msec. 6 rows affected. LF Ln 2, Col 15

part 1: relational algebra

- sigma σ — “where”
- projection π — “select”
- join = \bowtie — “multiple tables”

#1 $\pi \bowtie \text{FROM public.students}$
Order by students_id ASC

#2 $\pi \bowtie \text{from Enrollments}$
 $\sigma \text{grade is NULL;}$

Admin 4 Object Tools Edit View Window Help pgAdmin 4 pgAdmin 4 pgAdmin 4

Object Explorer Servers (1) PostgreSQL 18 Databases (3) cmpt308_lab2 (1) cmpt308_lab2/postgres@PostgreSQL 18 Query History

```
1 SELECT * FROM Enrollments
2 Where grade is NULL;
```

Data Output Messages Notifications

student_id	course_id	term	grade
1001	222	Spring 2028	Java
1002	444	Spring 2028	Java

Showing rows: 1 to 2 Page No: 1 of 1