UNIVERSIDAD AUTÓNOMA DE MADRID

ESCUELA POLITÉCNICA SUPERIOR

Estructuras de Datos – Práctica 1

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Introducción

Durante esta primera práctica de Estructuras de Datos nos hemos enfrentado por primera vez al estudio en profundidad de una base de datos sencilla. Hemos trabajado a través de Ubuntu, que ofrece muchas facilidades a la hora de ordenar y compilar proyectos; además de contar con un comando *make* más intuitivo que Windows.

Con la guía disponible en Moodle hemos importado la base de datos *flights* a la herramienta de visualización DBeaver, y desde ahí hemos comenzado a escribir el código que nos permitirá cumplir con las consultas. Para ello nos apoyaremos en los ejemplos del libro de Ramez Elmasri y en las diapositivas de teoría. DBeaver nos permitirá además acceder con facilidad al esquema de la base de datos, mostrándonos los nombres de cada tabla con sus respectivas 'claves primarias'. También podremos consultar el diagrama relacional de la base, mostrado más adelante.

Esquema BD

nombreTabla(**attrbA**, attrbB, ...)
otraTabla(**attrb1**, attrb2 → nombreTabla.attrA, attr3, ...)
...

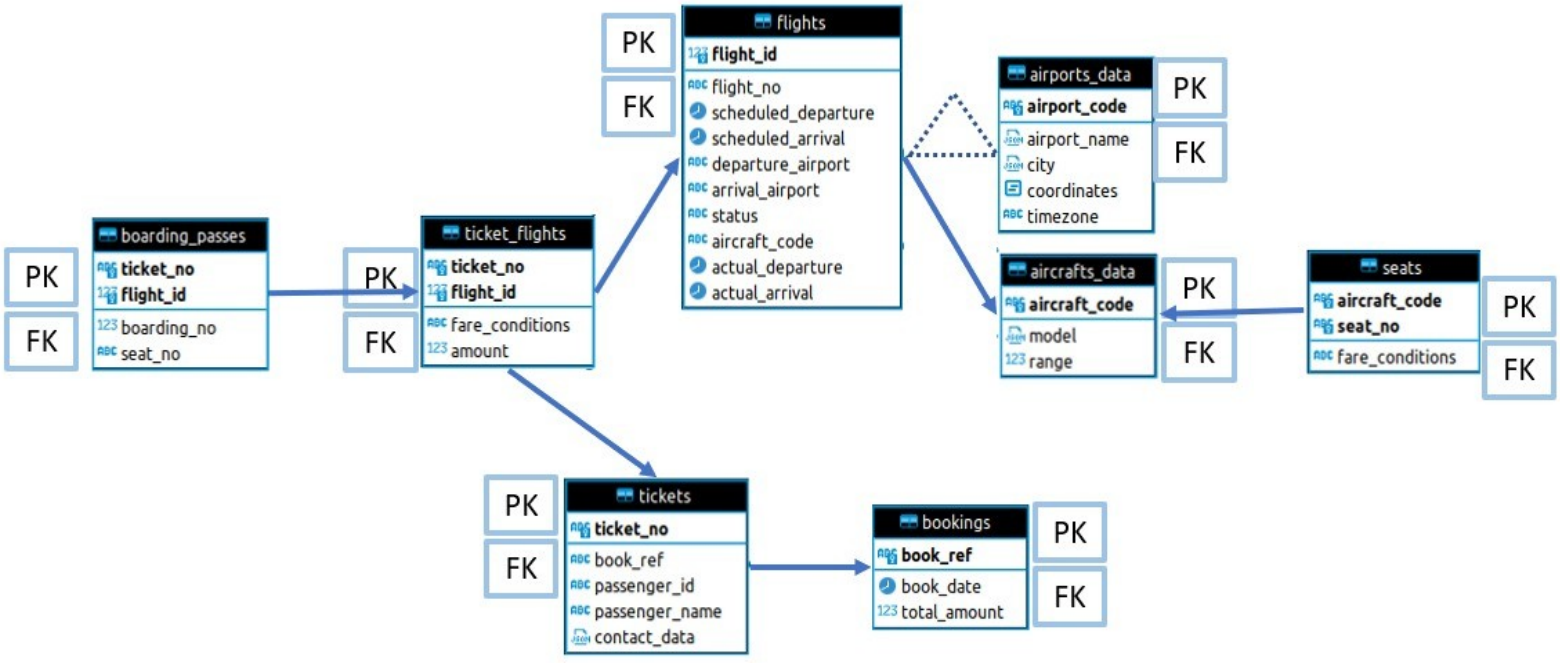
A continuacións se muestran las tablas con cada uno de sus apartados, destacando las claves primarias con **negrita**.

- boarding_passes (**ticket_no**, **flight_id**, boarding_no, seat_no)
- ticket_flights (**ticket_no**, **flight_id**, fare_conditions, amount)
- flights (**flight_id**, flight_no, schedule_departure, schedule_arrival, departure_airport, arrival_airport, status, aircraft_code, actual_departure, actual_arrival)
- airports_data (**airport_code**, airport_name, city, coordinates, timezone)
- aircrafts_data (**aircraft.code**, model, range)
- seats (**aircraft_code**, **seat_no**, fare_conditions)
- tickets (**ticket_no**, book_ref, passenger_id, passenger_name, contact_data)
- bookings (**book_ref**, book_date, total_amount)

A continuación, las tablas declarando las claves extranjeras que hacen referencia a otras tablas por su clave primaria:

- boarding_passes (**ticket_no** -> ticket_flights.ticket_no, **flight_id** -> tickets_flights.flight_id, boarding_no, seat_no)
- ticket_flights (**ticket_no** -> tickets.ticket_no, **flight_id** -> flights.flight_id, fare_conditions, amount)
- flights (**flight_id**, flight_no, schedule_departure, schedule_arrival, departure_airport -> airports_data.airport_code, arrival_airport -> airports_data.airport_code, status, aircraft_code -> aircrafts_data.aircraft_code, actual_departure, actual_arrival)
- airports_data (**airport_code**, airport_name, city, coordinates, timezone)
- aircrafts_data (**aircraft.code**, model, range)
- seats (**aircraft_code** -> aircraft_data.aircraft_code, **seat_no**, fare_conditions)
- tickets (**ticket_no**, book_ref -> bookings.book_ref, passenger_id, passenger_name, contact_data)
- bookings (**book_ref**, book_date, total_amount)

DIAGRAMA RELACIONAL



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Consultas

- Query 1:

```
SELECT DISTINCT aux1.departure_airport,
                Count(*) AS tickets
FROM   (SELECT bookings.book_ref,
               flights.ticket_no,
               bookings.passenger_name,
               flights.arrival_airport,
               flights.departure_airport
        FROM   (SELECT bookings.book_ref,
                       tickets.ticket_no,
                       tickets.passenger_name
                FROM   bookings
                       natural JOIN tickets) AS bookings,
               (SELECT ticket_flights.ticket_no,
                       flights.arrival_airport,
                       flights.departure_airport
                FROM   ticket_flights
                       natural JOIN flights) AS flights
        WHERE  flights.ticket_no = bookings.ticket_no
        ORDER  BY bookings.book_ref) AS aux1
       JOIN (SELECT bookings.book_ref,
                    flights.ticket_no,
                    bookings.passenger_name,
                    flights.arrival_airport,
                    flights.departure_airport
             FROM   (SELECT bookings.book_ref,
                            tickets.ticket_no,
                            tickets.passenger_name
                     FROM   bookings
                            natural JOIN tickets) AS bookings,
                    (SELECT ticket_flights.ticket_no,
                            flights.arrival_airport,
                            flights.departure_airport
                     FROM   ticket_flights
```

```
                            natural JOIN flights) AS flights
                WHERE  flights.ticket_no = bookings.ticket_no
                ORDER  BY bookings.book_ref) AS aux2
            ON aux1.book_ref = aux2.book_ref
               AND aux1.departure_airport = aux2.arrival_airport
GROUP  BY aux1.departure_airport
ORDER  BY aux1.departure_airport ASC
```

- Query 2:

```
SELECT bookings.total_amount,
       bookings.book_ref,
       Sum(ticket_flights.amount) AS precio_booking
FROM   ticket_flights
       natural JOIN tickets
       natural JOIN bookings
GROUP  BY bookings.book_ref
ORDER  BY bookings.book_ref ASC
```

- Query 3:

```
SELECT airports_data.airport_code,
       Count(flights.arrival_airport) AS passengers
FROM   boarding_passes
       natural JOIN ticket_flights
       natural JOIN flights
       natural JOIN airports_data
WHERE  flights.arrival_airport = airports_data.airport_code
GROUP  BY airports_data.airport_code
ORDER  BY passengers DESC
```

- Query 4:

```
WITH empty_total
     AS (SELECT occupied.flight_id,
                total_seats.seats,
                occupied.purchased,
                ( total_seats.seats - occupied.purchased ) AS empty
```


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```
          FROM   (SELECT flights.flight_id,
                         Count(*) AS purchased
                  FROM   ticket_flights
                         natural JOIN flights
                  GROUP  BY flights.flight_id
                  ORDER  BY Count(*) ASC) AS occupied,
                 (SELECT flights.flight_id,
                         Count(*) AS seats
                  FROM   seats
                         natural JOIN aircrafts_data
                         natural JOIN flights
                  GROUP  BY flights.flight_id) AS total_seats
          WHERE  occupied.flight_id = total_seats.flight_id)
SELECT occupied.flight_id,
       total_seats.seats,
       occupied.purchased,
       ( total_seats.seats - occupied.purchased ) AS empty
FROM   (SELECT flights.flight_id,
               Count(*) AS purchased
        FROM   ticket_flights
               natural JOIN flights
        GROUP  BY flights.flight_id
        ORDER  BY Count(*) ASC) AS occupied,
       (SELECT flights.flight_id,
               Count(*) AS seats
        FROM   seats
               natural JOIN aircrafts_data
               natural JOIN flights
        GROUP  BY flights.flight_id) AS total_seats
WHERE  occupied.flight_id = total_seats.flight_id
       AND total_seats.seats - occupied.purchased = (SELECT( Max(empty) )
                                                     FROM   empty_total)
```

-Query 5:

```
-- yet to be implemented
```


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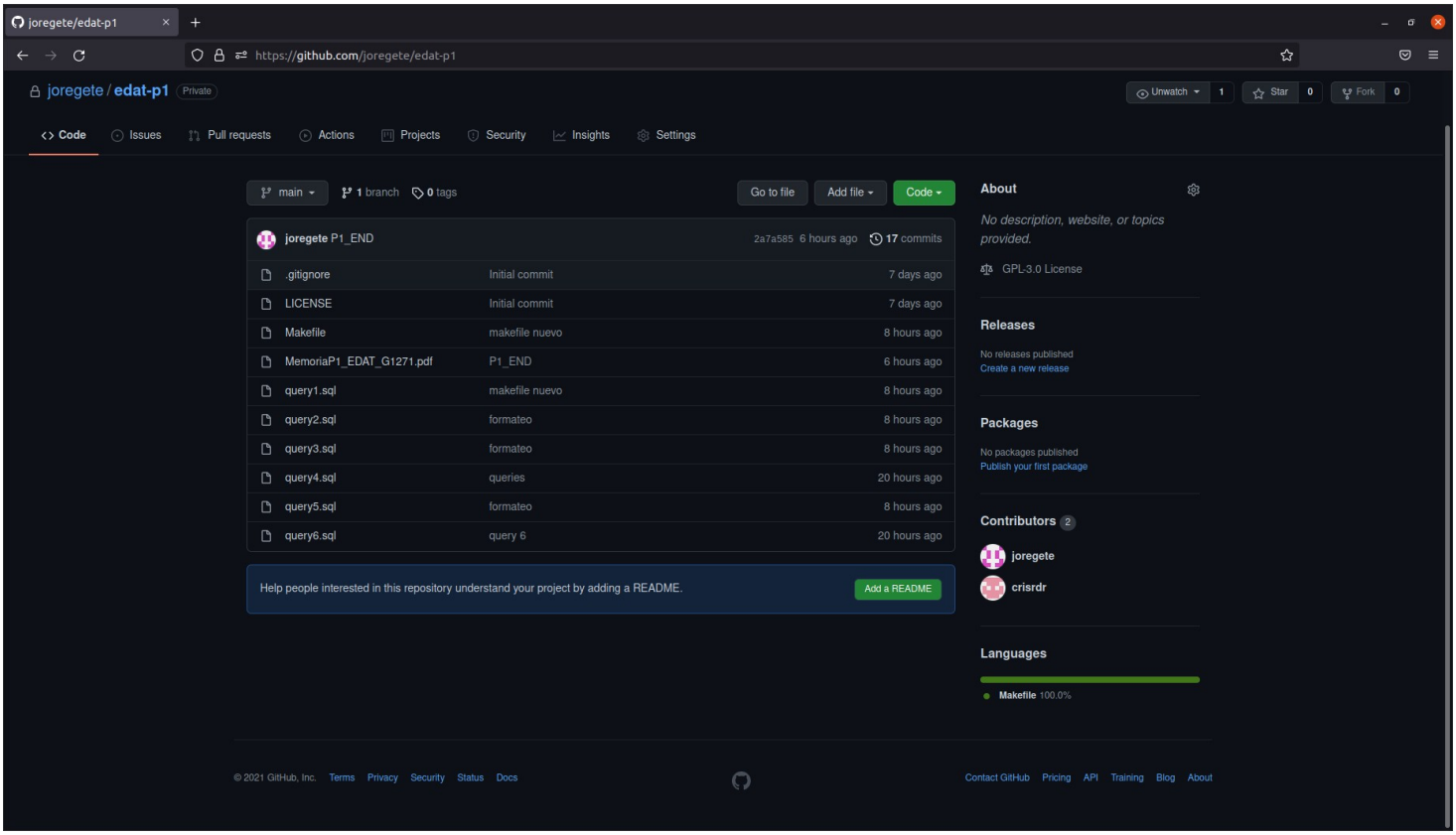
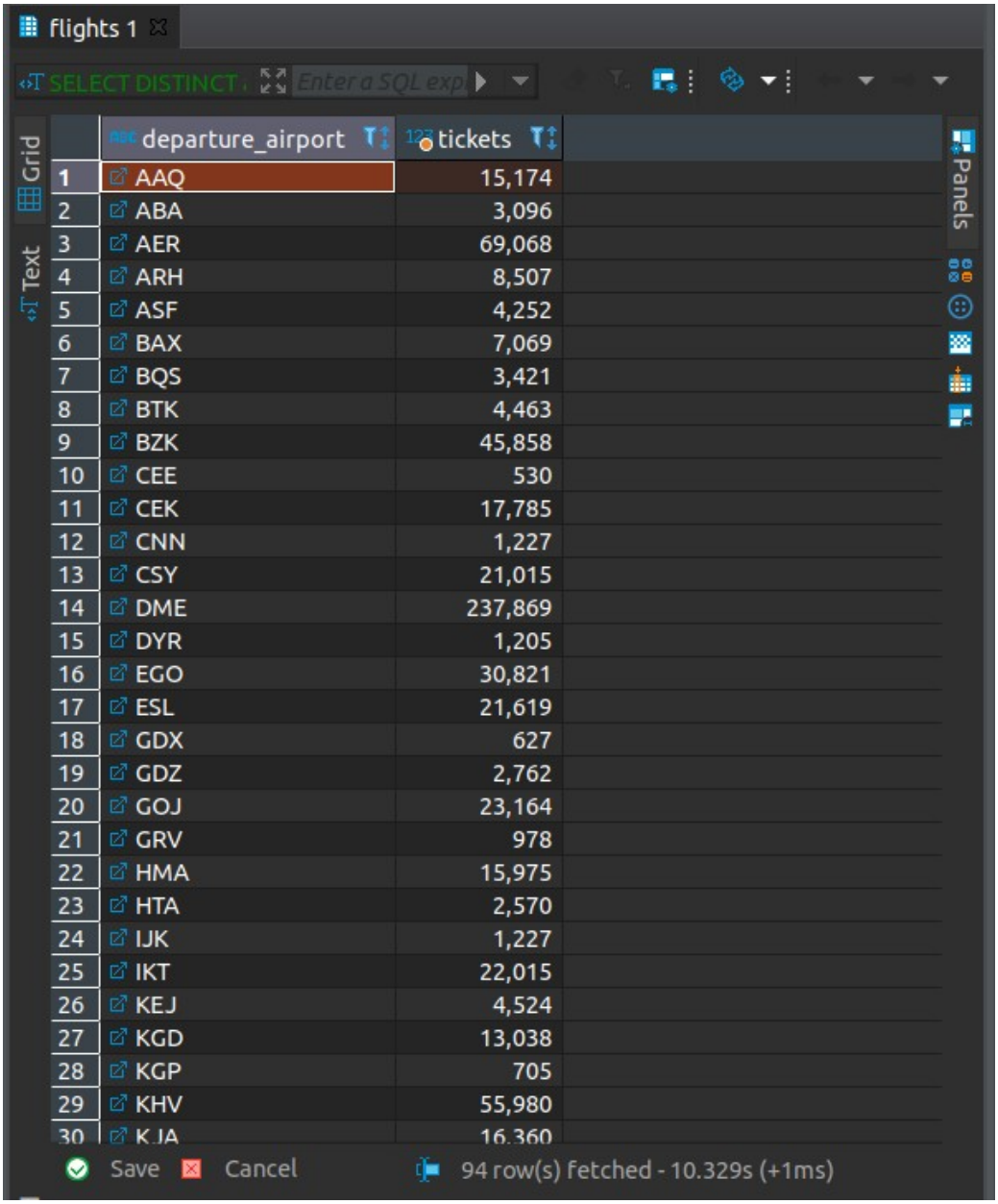
- Query 6:

```
WITH delay
     AS (SELECT flights.flight_no,
                Avg(flights.actual_arrival – flights.scheduled_arrival) AS
                delay_avg
         FROM flights
         GROUP BY flights.flight_no
         ORDER BY delay_avg DESC)
SELECT flights.flight_no,
       Avg(flights.actual_arrival - flights.scheduled_arrival) AS delay_avg
FROM   flights
       natural JOIN delay
WHERE  delay_avg = (SELECT ( Max(delay_avg) )
                    FROM   delay)
GROUP  BY flights.flight_no
ORDER  BY delay_avg DESC
```

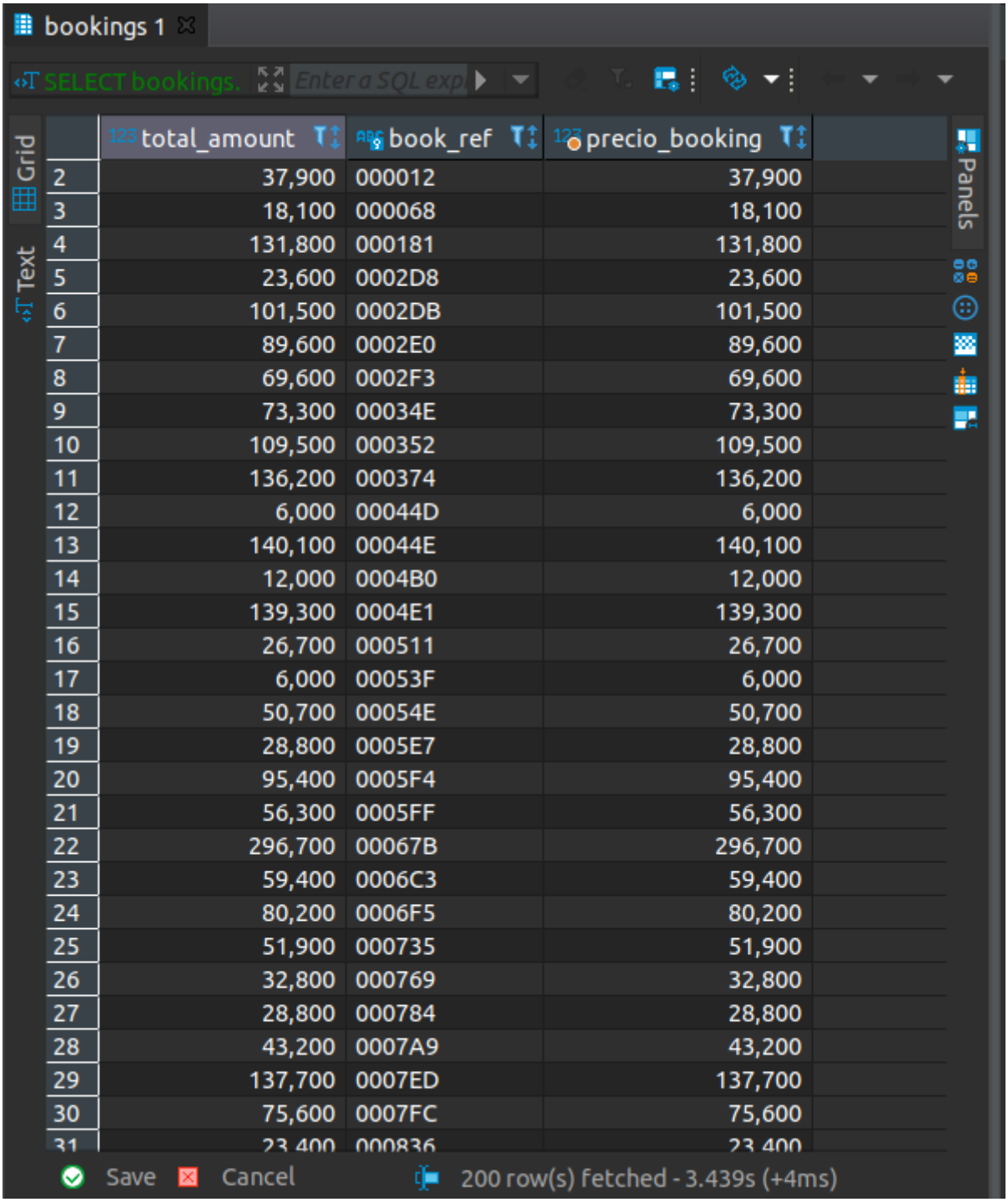
Evidencias



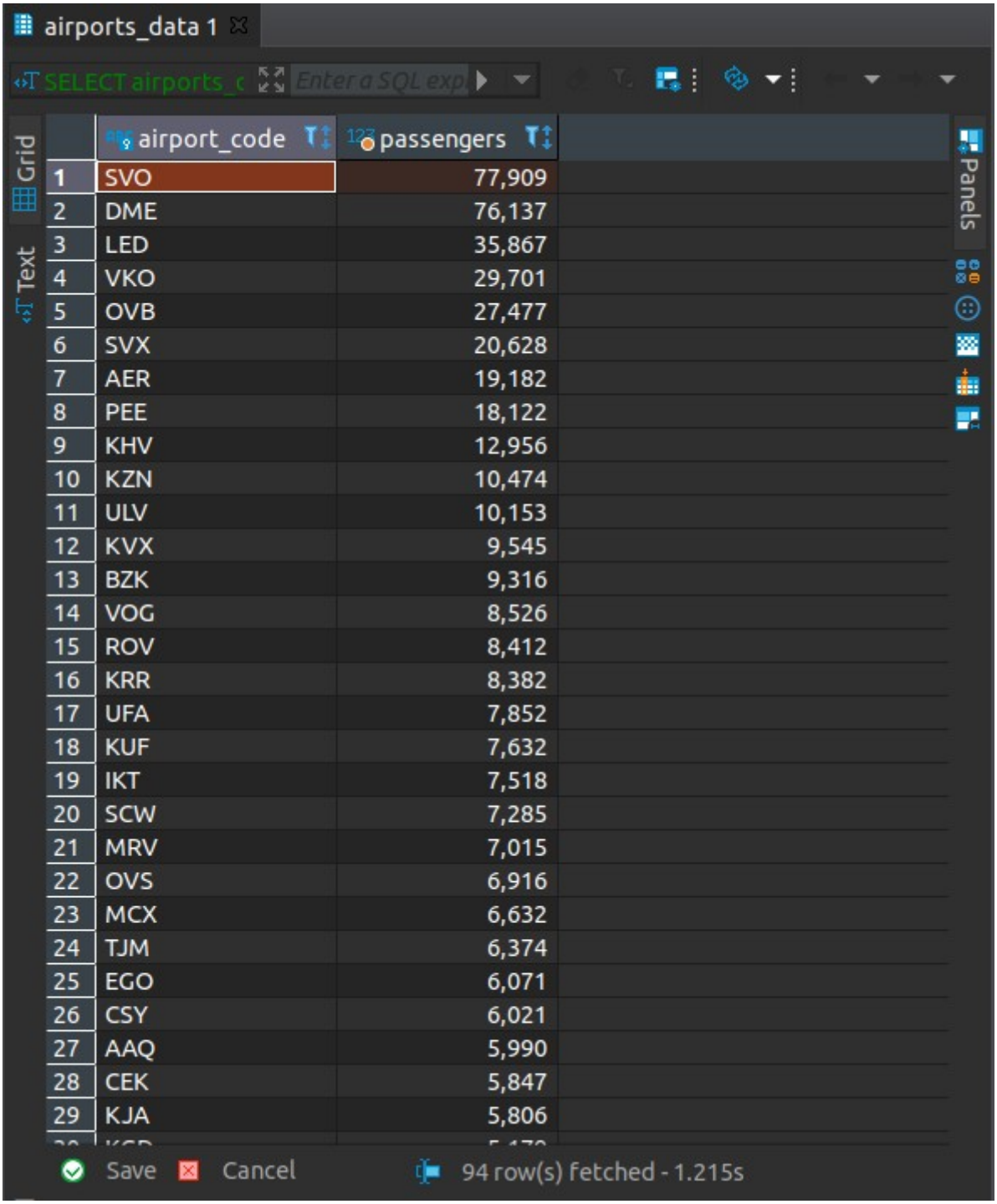
Arriba: repositiorio de la entrega, con 17 commits realizados por ambos miembros del grupo. Para más información sobre los commits se puede ejecutar *git log* en el directorio *tmpDir*.



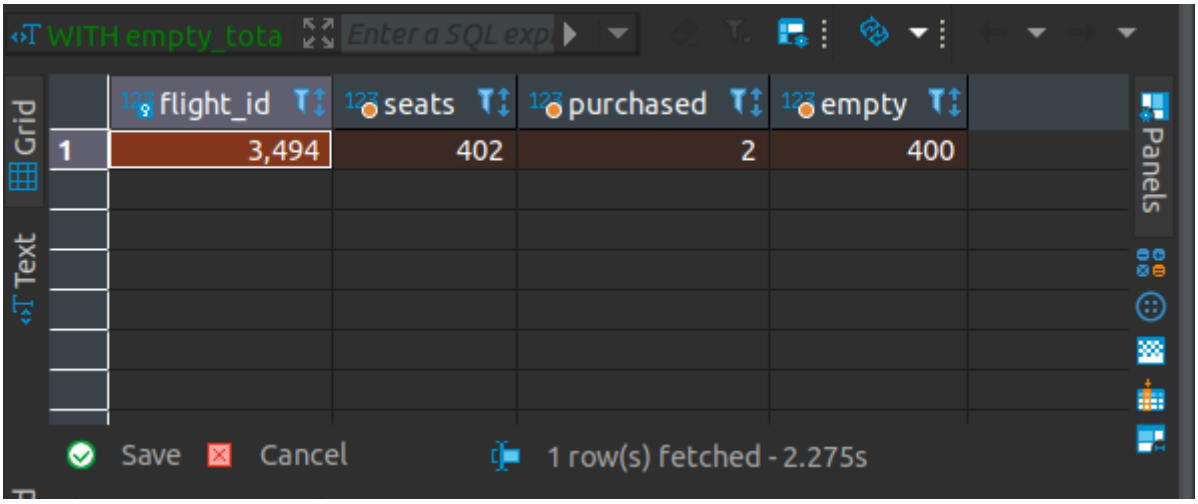
Arriba: Output de la primera query.



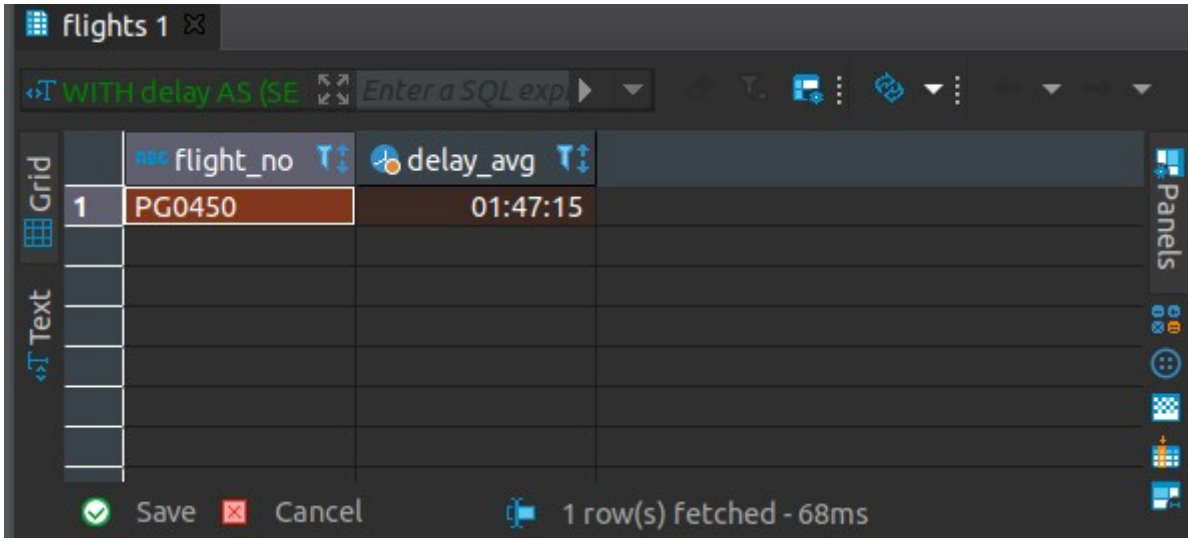
Arriba: Output de la segunda query.



Arriba: Output de la tercera query.



Arriba: Output de la cuarta query.



Arriba: Output de la sexta query.