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Факультет инфокоммуникационных технологий

**ЛАБОРАТОРНАЯ РАБОТА №2**  
**«Запросы на выборку и**  
**модификацию данных,**  
**представления и индексы в**  
**PostgreSQL»**

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Санкт-Петербург  
2023

**Цель работы:** овладеть практическими навыками создания представлений и запросов на выборку данных к базе данных PostgreSQL, использования подзапросов при модификации данных и индексов.

**Оборудование:** компьютерный класс.

**Программное обеспечение:** СУБД PostgreSQL, pgadmin 4.

**Практическое задание:**

1. Создать запросы и представления на выборку данных к базе данных PostgreSQL (согласно индивидуальному заданию, часть 2 и 3).

### **Вариант 12. БД «Прокат автомобилей»**

Описание предметной области: Компания предоставляет прокат автомобилей. В пункт проката обращаются клиенты, данные о которых регистрируют в базе. Цена проката зависит от марки автомобиля, технических характеристик и года выпуска.

Для проката авто с клиентом заключается договор, в котором фиксируется период проката, вид страховки, стоимость страховки, залоговая стоимость. Залоговая стоимость возвращается полностью или частично клиенту, в зависимости от страховки, аварий и штрафов. Если залоговая стоимость уже возвращена клиенту, но на авто в компанию пришел штраф, то он оплачивается компанией, а не клиентом. При передаче авто клиенту составляется акт о передаче автомобиля клиенту. При возвращении автомобиля также составляется акт о передаче авто компании.

Если клиент не вернул автомобиль в срок и не оформил продление, ему назначается штраф за каждый час просрочки.

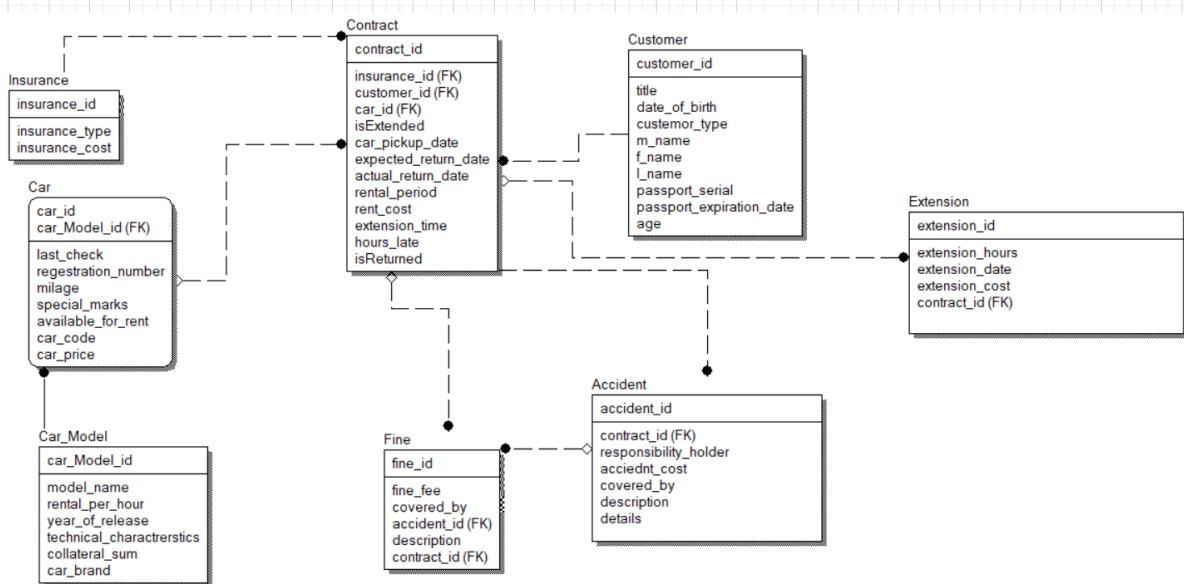
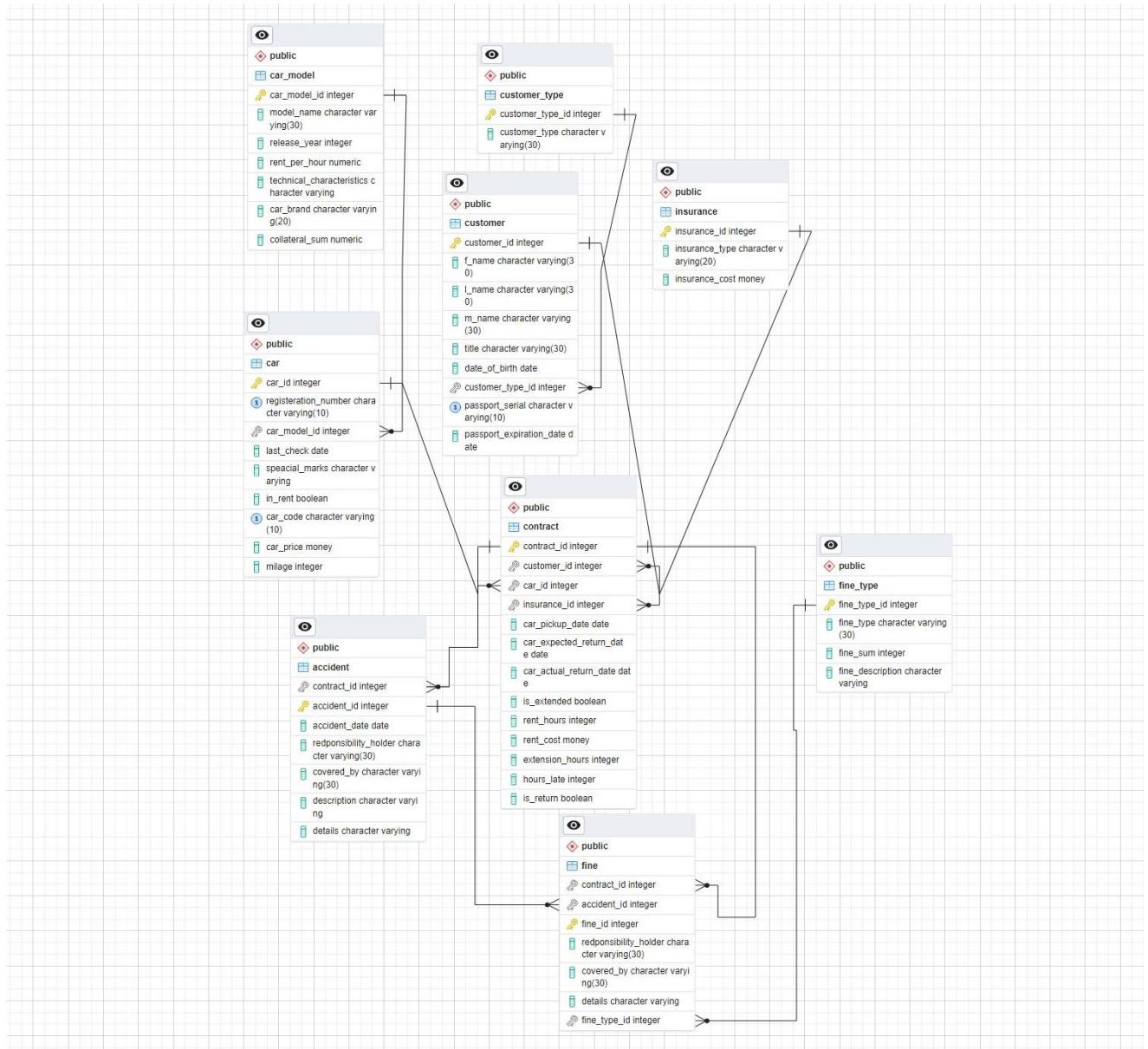
Постоянным клиентам предоставляются скидки.

В системе необходимо хранить историю штрафов и аварий автомобилей.

Цены на прокат автомобилей могут меняться.

БД должна содержать следующий минимальный набор сведений: ФИО. Паспортные данные. Код должности. Наименование должности. Оклад. Обязанности. Код марки. Наименование. Технические характеристики. Описание. Код автомобиля. Регистрационный номер. Номер кузова. Номер двигателя. Год выпуска. Пробег. Цена автомобиля. Цена проката. Дата последнего ТО. Специальные отметки. Отметка о возврате. Код клиента. ФИО. Адрес. Телефон. Паспортные данные. Дата и время выдачи автомобиля. На сколько часов. Дата и время возврата автомобиля. Данные о нарушениях. Данные об авариях. Дата продления. Часов продления.

**Схема базы данных:**



**Задание 2.** Создать запросы:

- Какой автомобиль находился в прокате максимальное количество часов?

`SELECT *,max(rent_hours) FROM contract GROUP BY car_id,contract_id HAVING rent_hours = (SELECT max(rent_hours) FROM contract)`

The screenshot shows the pgAdmin 4 interface. On the left is the Browser pane, which lists various database objects like FTS Dictionaries, Functions, and Tables. The 'Tables (9)' section is expanded, showing tables such as accident, car, and car\_model. The 'car\_model' table is currently selected, and its columns (car\_model\_id, model\_name, release\_year, rent\_per\_hour, technical\_characterist, car\_brand, collateral\_sum) are listed. The main area contains a query window with the following SQL code:

```

SELECT *,max(rent_hours) FROM contract
GROUP BY car_id,contract_id
HAVING rent_hours = (SELECT max(rent_hours) FROM contract)

```

Below the query window is a results grid showing two rows of data:

	car_actual_return_date	is_extended	rent_hours	rent_cost	extension_hours	hours_late	is_return	max
1	[null]	false	70	4,000.00	[null]	[null]	false	70
2	[null]	false	70	4,000.00	[null]	[null]	false	70

At the bottom of the interface, it says 'Total rows: 2 of 2 Query complete 00:00:00.111 Ln 3, Col 59'.

- Автомобили какой марки чаще всего брались в прокат?

```

SELECT car_model.car_brand , car_model.model_name,count(*) cnt FROM car_model
JOIN car ON car.car_model_id = car_model.car_model_id
JOIN contract ON contract.car_id = car.car_id
GROUP BY car_model.car_brand , car_model.model_name

```

The screenshot shows the pgAdmin 4 interface. The Browser pane is identical to the previous one, showing the car\_model table and its columns. The main area contains a query window with the following SQL code:

```

SELECT car_brand ,model_name , count(*) FROM car
JOIN car_model ON car.car_model_id = car_model.car_model_id
GROUP BY car_model.car_brand , car_model.model_name

```

Below the query window is a results grid showing five rows of data:

car_brand	model_name	count
Jeep	Hyundai	1
Jeep	JEEP CHEROKI	2
Mazda	TOYOTA	1
Mazda	Mazda car	3
Mazda	Mutsubishi	2

At the bottom of the interface, it says 'Total rows: 5 of 5 Query complete 00:00:00.133 Ln 3, Col 1'.

- Определить убытки от простоя автомобилей за вчерашний день.
- Вывести данные автомобиля, имеющего максимальный пробег.

`SELECT * FROM car GROUP BY car_id HAVING milage = (SELECT max(milage) FROM car)`

The screenshot shows the pgAdmin interface with the following details:

- Left Panel (Browser):** Shows the database schema with tables like accident, car, and car\_model.
- Top Bar:** Properties, Dashboard, SQL, Statistics, Dependencies, Dependents, Processes, Car Rental/postgres@PostgreSQL 15\*
- Query Editor:** Contains the following SQL query:
 

```
SELECT car_model.car_brand , car_model.model_name, count(*) cnt FROM car_model
JOIN car ON car.car_model_id = car_model.car_model_id
JOIN contract ON contract.car_id = car.car_id
GROUP BY car_model.car_brand , car_model.model_name
```
- Result Grid:** Displays the results of the query:
 

car_brand	model_name	cnt
Jeep	JEEP CHEROKI	4
Mazda	TOYOTA	3
- Bottom Status:** Total rows: 2 of 2, Query complete 00:00:00.085, Ln 4, Col 52

- Какой автомобиль суммарно находился в прокате дольше всех.

`SELECT * FROM`

`(SELECT car_id, sum(rent_hours) AS hours_sum FROM contract GROUP BY car_id )a`  
`GROUP BY a.car_id,a.hours_sum HAVING a.hours_sum = max(a.hours_sum)`

The screenshot shows the pgAdmin interface with the following details:

- Left Panel (Browser):** Shows the database schema with tables like accident, car, and car\_model.
- Top Bar:** Properties, Dashboard, SQL, Statistics, Dependencies, Dependents, Processes, Car Rental/postgres@PostgreSQL 15\*
- Query Editor:** Contains the following SQL query:
 

```
SELECT * FROM
(SELECT car_id, sum(rent_hours) AS hours_sum FROM contract GROUP BY car_id )a
GROUP BY a.car_id,a.hours_sum HAVING a.hours_sum = max(a.hours_sum)
```
- Result Grid:** Displays the results of the query:
 

car_id	hours_sum
1	4
2	1
3	3
- Bottom Status:** Total rows: 3 of 3, Query complete 00:00:00.101, Ln 3, Col 69

- Определить, каким количеством автомобилей каждой марки и модели владеет компания.

`SELECT car_brand ,model_name, count(*) FROM car JOIN car_model ON car.car_model_id = car_model.car_model_id GROUP BY car_model.car_brand, car_model.model_name`

```

SELECT car_brand ,model_name, count(*) FROM car
JOIN car_model ON car.car_model_id = car_model.car_model_id
GROUP BY car_model.car_brand, car_model.model_name

```

car_brand	model_name	count
Jeep	Hundai	1
Jeep	JEEP CHEROKI	2
Mazda	TOYOTA	1
Mazda	Mazda car	3
Mazda	Mutsubishi	2

Total rows: 5 of 5 Query complete 00:00:00.133 Ln 3, Col 1

- Определить средний “возраст” автомобилей компании.

```

SELECT AVG(a.age) FROM (SELECT *, date_part('year', CURRENT_DATE)- release_year
AS age FROM car_model
JOIN car ON car.car_model_id = car_model.car_model_id) a

```

```

SELECT AVG(a.age) FROM
(SELECT *, date_part('year', CURRENT_DATE)- release_year AS age
FROM car_model
JOIN car
ON car.car_model_id = car_model.car_model_id) a

```

avg
6.66666666666667

Total rows: 1 of 1 Query complete 00:00:00.131 Ln 5, Col 3

### Задание 3. Создать представление:

- Какой автомобиль ни разу не был в прокате?
- ```

CREATE VIEW unused_cars AS

```

```
SELECT * FROM car WHERE car_id NOT IN (SELECT car_id FROM contract)
```

Properties Dashboard SQL Statistics Dependencies Dependents Processes Car Rental/postg Untitled\* Car Rental/postg < > x

Servers (1) PostgreSQL 15 Databases (3) Car Rental Casts Catalogs Event Triggers Extensions Foreign Data Wrappers Languages Publications Schemas (1) public Aggregates Collations Domains FTS Configurations FTS Dictionaries FTS Parsers FTS Templates Foreign Tables Functions Materialized Views Operators Procedures Sequences Tables (9) accident car car\_model Columns (7) car\_model\_id

```
CREATE VIEW unused_cars AS
SELECT * FROM car WHERE car_id NOT IN (SELECT car_id FROM contract)
```

Data Output

| car_id [PK] integer | registration_number character varying (10) | car_model_id integer | last_check date   | speciai_marks character varying | in_rent boolean | car_code character varying (10) | cm |
|---------------------|--------------------------------------------|----------------------|-------------------|---------------------------------|-----------------|---------------------------------|----|
| 1                   | 12345                                      |                      | 2021-01-01 [null] |                                 | false           | run123                          | 1  |
| 2                   | 12245                                      |                      | 2020-01-01 [null] |                                 | false           | rat123                          | 1  |
| 3                   | 12445                                      |                      | 2020-01-01 [null] |                                 | false           | run432                          | 1  |
| 4                   | 12235                                      |                      | 2020-01-01 [null] |                                 | false           | rat654                          | 1  |
| 5                   | 16656                                      |                      | 2020-01-01 [null] |                                 | false           | run875                          | 1  |
| 6                   | 12647                                      |                      | 2020-01-01 [null] |                                 | false           | rat154                          | 1  |
| 7                   | 24453                                      |                      | 2020-01-01 [null] |                                 | false           | run134                          | 1  |
| 8                   | 23445                                      |                      | 2020-01-01 [null] |                                 | false           | rat243                          | 1  |
| 9                   | 435246                                     |                      | 2020-01-05 [null] |                                 | false           | run321                          | 1  |

Total rows: 9 of 9 Query complete 00:00:00.093 Ln 2, Col 68

- Вывести данные клиентов, не вернувших автомобиль вовремя.

```
CREATE VIEW late_returners AS SELECT
DISTINCT customer.customer_id , customer.f_name, customer.l_name, m_name
FROM customer JOIN contract ON contract.customer_id = customer.customer_id
WHERE (contract.hours_late IS NOT NULL AND contract.hours_late > 0)
```

Properties Dashboard SQL Statistics Dependencies Dependents Processes Car Rental/postg Untitled\* Car Rental/postg < > x

Messages Query Notifications Query History

```
CREATE VIEW late_returners AS SELECT
DISTINCT customer.customer_id , customer.f_name, customer.l_name, m_name
FROM customer JOIN contract ON contract.customer_id = customer.customer_id
WHERE (contract.hours_late IS NOT NULL AND contract.hours_late > 0)
```

Data Output

| customer_id integer | f_name character varying (30) | l_name character varying (30) | m_name character varying (30) |
|---------------------|-------------------------------|-------------------------------|-------------------------------|
| 1                   | 4 MOhameed                    | Almoski                       | ABDO                          |
| 2                   | 1 Kozman                      | Hesham                        | Nasher                        |
| 3                   | 3 ABDULwahab                  | ESMAIL                        | Almoshki                      |

Total rows: 3 of 3 Query complete 00:00:00.092 Ln 7, Col 1

2. Составить 3 запроса на модификацию данных (INSERT, UPDATE, DELETE) с использованием подзапросов.

### 1-INSERT

INSERT into customer Values

(7, 'Mohanad','Al-fakih','M.', 'student', '1999-06-27', 2, '345243', '2028-01-01')

The screenshot shows the pgAdmin 4 interface. At the top, there's a toolbar with various icons. Below it is a navigation bar with tabs: 'Messages', 'Query' (which is selected), 'Notifications', and 'Query History'. The main area contains a query editor window with the following content:

```
SELECT * FROM customer
```

```
INSERT into customer Values
(7, "Mohanad", "Al-fakih", "M.", "student", "1999-06-27", 2,
(8, "Ahmed", "Basonbol", "Y", "student", "1999-05-17", 1, "2342314", "2030-02-02")
```

Below the query editor is a 'Data Output' grid. The columns are labeled:

|   | customer_id<br>[PK] integer | f_name<br>character varying (30) | l_name<br>character varying (30) | m_name<br>character varying (30) | title<br>character varying (30) | date_of_birth<br>date | customer_type_id<br>integer | passport_s<br>character v |
|---|-----------------------------|----------------------------------|----------------------------------|----------------------------------|---------------------------------|-----------------------|-----------------------------|---------------------------|
| 1 | 1                           | Kozman                           | Hesham                           | Nasher                           | HALALALOQAD                     | 2001-02-12            |                             | 1 0135234                 |
| 2 | 2                           | Ahmed                            | Ghamdan                          | ABDULLAH                         | Programmer                      | 2000-02-12            |                             | 1 034523234               |
| 3 | 3                           | ABDULwahab                       | ESMAIL                           | Almoski                          | DATABASE designer               | 2002-02-22            |                             | 3 01355345                |
| 4 | 4                           | MOhameed                         | Almoski                          | ABDO                             | manager                         | 2000-05-25            |                             | 1 0153434                 |
| 5 | 5                           | Mohammed                         | ABDULKareem                      | Alzubidi                         | programmer                      | 2001-02-12            |                             | 1 01453453                |
| 6 | 6                           | KAREEM                           | MOHSEN                           | BO AWF                           | AI expert                       | 2001-02-15            |                             | 1 033322534               |

At the bottom of the data grid, there are several icons for file operations like saving, opening, and deleting. Below the grid, a status bar displays 'Total rows: 6 of 6' and 'Query complete 00:00:00.230'.

Properties Dashboard SQL Statistics Dependencies Dependents Processes Car Rental/pos... Untitled\* Car Rental/postg < > x

Car Rental/postgres@PostgreSQL 15 No limit E ?

Usages Query Notifications Query History ↗

```
INSERT INTO customer Values
(7, 'Mohanad', 'Al-fakih', 'M.', 'student', '1999-06-27', 2, '345243', '2028-01-01');

SELECT * FROM customer
```

Data Output ↗

|   | customer_id<br>[PK] integer | f_name<br>character varying (30) | l_name<br>character varying (30) | m_name<br>character varying (30) | title<br>character varying (30) | date_of_birth<br>date | customer_type_id<br>integer | passport_s<br>character v |
|---|-----------------------------|----------------------------------|----------------------------------|----------------------------------|---------------------------------|-----------------------|-----------------------------|---------------------------|
| 1 | 1                           | Kozman                           | Hesham                           | Nasher                           | HALALALOQAD                     | 2001-02-12            | 1                           | 0135234                   |
| 2 | 2                           | Ahmed                            | Ghamdan                          | ABDULLAH                         | Programmer                      | 2000-02-12            | 1                           | 034523234                 |
| 3 | 3                           | ABDULwahab                       | ESMAIL                           | Almoshki                         | DATABASE designer               | 2002-02-22            | 3                           | 01355345                  |
| 4 | 4                           | MOhameed                         | Almoski                          | ABDO                             | manager                         | 2000-05-25            | 1                           | 0153434                   |
| 5 | 5                           | Mohammed                         | ABDULKareem                      | Alzubidi                         | programmer                      | 2001-02-12            | 1                           | 01453453                  |
| 6 | 6                           | KAREEM                           | MOHSEN                           | BO AWF                           | AI expert                       | 2001-02-15            | 1                           | 033322534                 |
| 7 | 7                           | Mohanad                          | Al-fakih                         | M.                               | student                         | 1999-06-27            | 2                           | 345243                    |

## 2-DELETE

DELETE FROM car WHERE car\_code ='run321';

Properties Dashboard SQL Statistics Dependencies Dependents Processes Car Rental/postg... Untitled\* Car Rental/postg...

Car Rental/postgres@PostgreSQL 15

File Edit View Insert Tools Window Help

Usages Query Notifications Query History

```
DELETE FROM car WHERE car_code ='run321';
SELECT * FROM car;
```

Data Output

|   | car_id<br>[PK] integer | registration_number<br>character varying (10) | car_model_id<br>integer | last_check<br>date | speacial_marks<br>character varying | in_rent<br>boolean | car_code<br>character varying (10) | car_price<br>money | milage<br>integer |
|---|------------------------|-----------------------------------------------|-------------------------|--------------------|-------------------------------------|--------------------|------------------------------------|--------------------|-------------------|
| 1 | 1                      | 12345                                         |                         | 1                  | 2021-01-01<br>[null]                | false              | run123                             | 12,000.00          | 5000              |
| 2 | 2                      | 12245                                         |                         | 2                  | 2020-01-01<br>[null]                | false              | rat123                             | 11,000.00          | 5000              |
| 3 | 3                      | 12445                                         |                         | 4                  | 2020-01-01<br>[null]                | false              | run432                             | 12,000.00          | 5000              |
| 4 | 4                      | 12235                                         |                         | 1                  | 2020-01-01<br>[null]                | false              | rat654                             | 11,500.00          | 5000              |
| 5 | 5                      | 16656                                         |                         | 5                  | 2020-01-01<br>[null]                | false              | run875                             | 13,000.00          | 5000              |
| 6 | 6                      | 12647                                         |                         | 2                  | 2020-01-01<br>[null]                | false              | rat154                             | 12,000.00          | 5000              |
| 7 | 7                      | 24453                                         |                         | 2                  | 2020-01-01<br>[null]                | false              | run134                             | 11,000.00          | 5000              |
| 8 | 8                      | 23445                                         |                         | 3                  | 2020-01-01<br>[null]                | false              | rat243                             | 16,000.00          | 5000              |

Total rows: 8 of 8    Query complete 00:00:00.121    Ln 1, Col 41

Properties Dashboard SQL Statistics Dependencies Dependents Processes Car Rental/postg Untitled\* Car Rental/postg < > Sign

Car Rental/postgres@PostgreSQL 15 No limit

Messages Query Notifications Query History

```
SELECT * FROM car
DELETE FROM car WHERE car_code ="run321"
```

Data Output

| car_id<br>[PK] integer | registration_number<br>character varying (10) | car_model_id<br>integer | last_check<br>date | speacial_marks<br>character varying | in_rent<br>boolean | car_code<br>character varying (10) | car_price<br>money | milage<br>integer |
|------------------------|-----------------------------------------------|-------------------------|--------------------|-------------------------------------|--------------------|------------------------------------|--------------------|-------------------|
| 1                      | 12345                                         |                         | 2021-01-01         | [null]                              | false              | run123                             | 12,000.00 .₪.      | 5000              |
| 2                      | 12245                                         |                         | 2020-01-01         | [null]                              | false              | rat123                             | 11,000.00 .₪.      | 5000              |
| 3                      | 12445                                         |                         | 2020-01-01         | [null]                              | false              | run432                             | 12,000.00 .₪.      | 5000              |
| 4                      | 12235                                         |                         | 2020-01-01         | [null]                              | false              | rat654                             | 11,500.00 .₪.      | 5000              |
| 5                      | 16656                                         |                         | 2020-01-01         | [null]                              | false              | run875                             | 13,000.00 .₪.      | 5000              |
| 6                      | 12647                                         |                         | 2020-01-01         | [null]                              | false              | rat154                             | 12,000.00 .₪.      | 5000              |
| 7                      | 24453                                         |                         | 2020-01-01         | [null]                              | false              | run134                             | 11,000.00 .₪.      | 5000              |
| 8                      | 23445                                         |                         | 2020-01-01         | [null]                              | false              | rat243                             | 16,000.00 .₪.      | 5000              |
| 9                      | 435246                                        |                         | 2020-01-05         | [null]                              | false              | run321                             | 15,000.00 .₪.      | 5002              |

### 3- UPDATE

UPDATE contract SET car\_actual\_return\_date = CURRENT\_DATE WHERE contract\_id = 5

The screenshot shows the pgAdmin 4 interface. At the top, there's a navigation bar with links like Properties, Dashboard, SQL, Statistics, Dependencies, Dependents, Processes, and Car Rental/postg. Below the navigation bar is a toolbar with various icons for file operations, search, and database management. The main area has tabs for usages, Query, Notifications, and Query History, with the Query tab selected. The query editor contains the following SQL code:

```

SELECT * FROM contract;
UPDATE contract SET car_actual_return_date = CURRENT_DATE WHERE contract_id = 5

```

Below the query editor is a Data Output viewer. It has a header row with column names: contract\_id [PK] integer, customer\_id integer, car\_id integer, insurance\_id integer, car\_pickup\_date date, car\_expected\_return\_date date, car\_actual\_return\_date date, is\_extended boolean, and rent\_hours integer. The data table below shows 7 rows of data:

|   | contract_id<br>[PK] integer | customer_id<br>integer | car_id<br>integer | insurance_id<br>integer | car_pickup_date<br>date | car_expected_return_date<br>date | car_actual_return_date<br>date | is_extended<br>boolean | rent_hours<br>integer |
|---|-----------------------------|------------------------|-------------------|-------------------------|-------------------------|----------------------------------|--------------------------------|------------------------|-----------------------|
| 1 | 2                           | 4                      | 3                 | 1                       | 2023-05-15              | 2023-05-17                       | [null]                         | false                  | 7                     |
| 2 | 3                           | 3                      | 4                 | 1                       | 2023-05-15              | 2023-05-18                       | [null]                         | false                  | 7                     |
| 3 | 4                           | 4                      | 3                 | 1                       | 2023-05-15              | 2023-05-22                       | [null]                         | false                  | 4                     |
| 4 | 7                           | 3                      | 4                 | 1                       | 2023-05-15              | 2023-05-29                       | [null]                         | false                  | 5                     |
| 5 | 1                           | 1                      | 1                 | 1                       | 2023-05-15              | 2023-05-15                       | [null]                         | false                  | 5                     |
| 6 | 5                           | 3                      | 4                 | 1                       | 2023-05-15              | 2023-05-23                       | [null]                         | false                  | 5                     |
| 7 | 6                           | 4                      | 3                 | 1                       | 2023-05-15              | 2023-05-30                       | [null]                         | false                  | 4                     |

At the bottom of the pgAdmin window, there are status messages: "Total rows: 7 of 7" and "Query complete 00:00:00.162". To the right, it says "Ln 2, Col 80".

3. Изучить графическое представление запросов и просмотреть историю запросов.

Properties Dashboard SQL Statistics Dependencies Dependents Processes Car Rental/pos... Untitled\* Car X

Car Rental/postgres@PostgreSQL 15 No limit

Messages Query Notifications Query History

Show queries generated internally by pgAdmin?

Remove Remove All

Today - ٢٠٢٣/١٢/٢٨ ١٢:٤٧:٥٣

▶ SELECT \* FROM car JOIN contract ON car.car\_id = contract.car\_id; 12:49:51

▶ SELECT \* FROM car JOIN contract ON car.car\_id = contract.car\_id; 12:47:09

▶ SELECT \* FROM car JOIN contract ON car.car\_id = contract.car\_id; 12:46:01

▶ SELECT \* FROM car JOIN contract ON car.car\_id = contract.car\_id; 12:45:53

▶ UPDATE contract SET car\_actual\_return\_date = CURRENT\_DATE; 12:47:47

Date 1 Rows affected 482 msec Duration

**Select Query:**

```
SELECT * FROM car JOIN contract ON car.car_id = contract.car_id;
```

Messages  
Successfully run. Total query runtime: 482 msec. 1 rows affected.

Data Output Explain

| car_id | registration_number | car_model_id | last_check_date | special_marks | in_rent | car_code | car_price | milage | contr |
|--------|---------------------|--------------|-----------------|---------------|---------|----------|-----------|--------|-------|
| 1      | 3                   | 12445        | 2020-01-01      | [null]        | false   | run432   | 12,000.00 | 5000   |       |
| 2      | 4                   | 12235        | 2020-01-01      | [null]        | false   | rat654   | 11,500.00 | 5000   |       |
| 3      | 3                   | 12445        | 2020-01-01      | [null]        | false   | run432   | 12,000.00 | 5000   |       |
| 4      | 4                   | 12235        | 2020-01-01      | [null]        | false   | rat654   | 11,500.00 | 5000   |       |
| 5      | 1                   | 12345        | 2021-01-01      | [null]        | false   | run123   | 12,000.00 | 5000   |       |
| 6      | 3                   | 12445        | 2020-01-01      | [null]        | false   | run432   | 12,000.00 | 5000   |       |
| 7      | 4                   | 12235        | 2020-01-01      | [null]        | false   | rat654   | 11,500.00 | 5000   |       |

Total rows: 7 of 7 Query complete 00:00:00.219 Ln 1, Col 64

Properties Dashboard SQL Statistics Dependencies Dependents Processes Car Rental/pos... Untitled\* Car X

Car Rental/postgres@PostgreSQL 15 No limit

Messages Query Notifications Query History

1 SELECT \* FROM car JOIN contract ON car.car\_id = contract.car\_id

Data Output Explain

Graphical Analysis Statistics

```

graph LR
    car[car] --> Hash[Hash]
    Hash --> HJoin[Hash Inner Join]
    contract[contract] --> HJoin
    HJoin --> result[Result]
  
```

Total rows: 1 of 1 Query complete 00:00:00.482 Ln 1, Col 14

4. Создать простой и составной индексы для двух произвольных запросов и сравнить время выполнения запросов без индексов и с индексами. Для получения плана запроса использовать команду EXPLAIN.

The screenshot displays two pgAdmin 4 sessions. Both sessions have the following tabs open: Properties, Dashboard, SQL, Statistics, Dependencies, Dependents, Processes, Car Rental/pos..., Untitled\*, Car Rental/pos..., Car, and a toolbar at the top.

**Session 1 (Top):**

- Query Tab:** Contains the SQL query: `SELECT * FROM customer WHERE f_name = 'KAREEM';`
- Data Output Tab:** Shows the result of the query, displaying one row from the customer table.
- Status Bar:** Shows "Total rows: 1 of 1" and "Query complete 00:00:00.229".

| customer_id | f_name | l_name | m_name | title     | date_of_birth | customer_type_id | passport_s |
|-------------|--------|--------|--------|-----------|---------------|------------------|------------|
| 6           | KAREEM | MOHSEN | BO AWF | AI expert | 2001-02-15    | 1                | 033322534  |

**Session 2 (Bottom):**

- Query Tab:** Contains the SQL queries: `CREATE INDEX f_name_indx ON customer(f_name);` followed by `SELECT * FROM customer WHERE f_name = 'KAREEM';`
- Data Output Tab:** Shows the result of the second query, displaying one row from the customer table.
- Status Bar:** Shows "Total rows: 1 of 1" and "Query complete 00:00:00.109".

| customer_id | f_name | l_name | m_name | title     | date_of_birth | customer_type_id | passport_s |
|-------------|--------|--------|--------|-----------|---------------|------------------|------------|
| 6           | KAREEM | MOHSEN | BO AWF | AI expert | 2001-02-15    | 1                | 033322534  |

Индексирование сводит к минимуму время поиска, но оно может отнимать много времени в таблицах, в которые поступает много вставок.

**Вывод:**

В этой лабораторной работе я освоил команды DML SQL в postgresql и научился создавать сложные запросы и подзапросы.