**Министерство науки и высшего образования Российской Федерации**
федеральное государственное автономное образовательное учреждение высшего образования
**«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО»**

**Отчет**

по лабораторной работе №4 «Запросы на выборку и модификацию данных. Представления. Работа с индексами»

по дисциплине **«Проектирование и реализация баз данных»**

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Санкт-Петербург 2023

# Оглавление

**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.

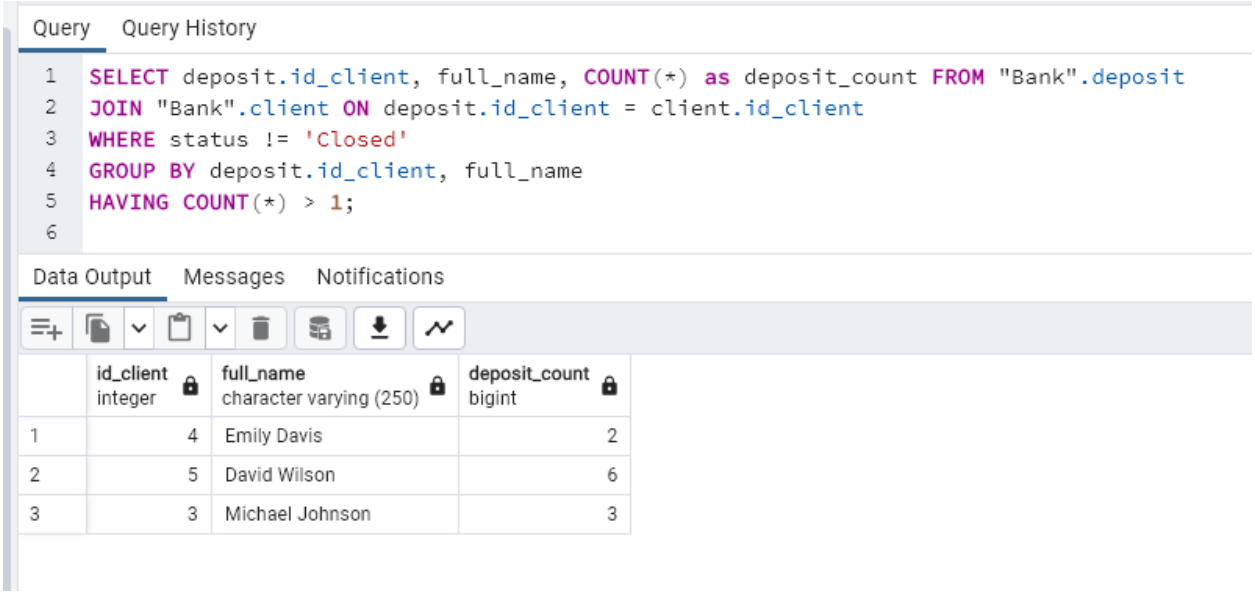
**Практическое задание:**

1. Создать запросы и представления на выборку данных к базе данных PostgreSQL (согласно индивидуальному заданию, часть 2 и 3).
2. Составить 3 запроса на модификацию данных (INSERT, UPDATE, DELETE) с использованием подзапросов.
3. Изучить графическое представление запросов и просмотреть историю запросов.
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.

## 1. Запросы к базе данных

1. Найти вкладчика, имеющего на текущий день несколько вкладов

```
SELECT deposit.id_client, full_name, COUNT(*) as deposit_count FROM
"Bank".deposit
JOIN "Bank".client ON deposit.id_client = client.id_client
WHERE status != 'Closed'
GROUP BY deposit.id_client, full_name
HAVING COUNT(*) > 1;
```




2. Найти вкладчика, имеющего вклады во всех видах валюты на данный момент

```
SELECT DISTINCT deposit.id_client, full_name FROM "Bank".deposit
JOIN "Bank".client ON deposit.id_client = client.id_client
WHERE NOT EXISTS (
```

```
    SELECT currency_code FROM "Bank".currency
    WHERE NOT EXISTS (
        SELECT * FROM "Bank".deposit
        WHERE Deposit.currency_code = Currency.currency_code
        AND Deposit.id_client = Deposit.id_client
    )
)
```

Query | Query History

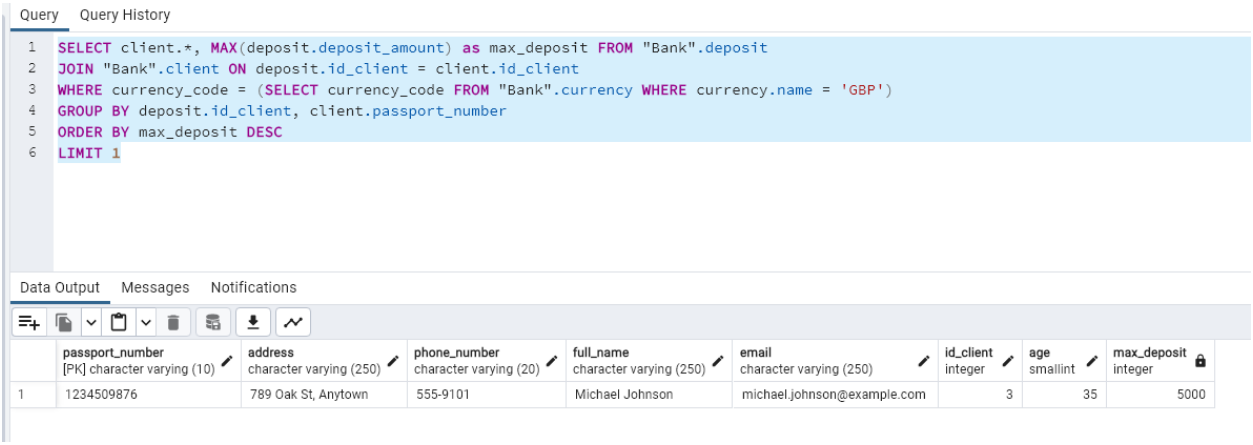
```
SELECT DISTINCT deposit.id_client, full_name FROM "Bank".deposit
JOIN "Bank".client ON deposit.id_client = client.id_client
WHERE NOT EXISTS (
    SELECT currency_code FROM "Bank".currency
    WHERE NOT EXISTS (
        SELECT * FROM "Bank".deposit
        WHERE Deposit.currency_code = Currency.currency_code
        AND Deposit.id_client = Deposit.id_client
    )
)
```

Data Output | Messages | Notifications

| | id_client integer | full_name character varying (250) |
|---|---|---|
| 1 | 1 | John Smith |
| 2 | 5 | David Wilson |
| 3 | 4 | Emily Davis |
| 4 | 2 | Jane Doe |
| 5 | 3 | Michael Johnson |

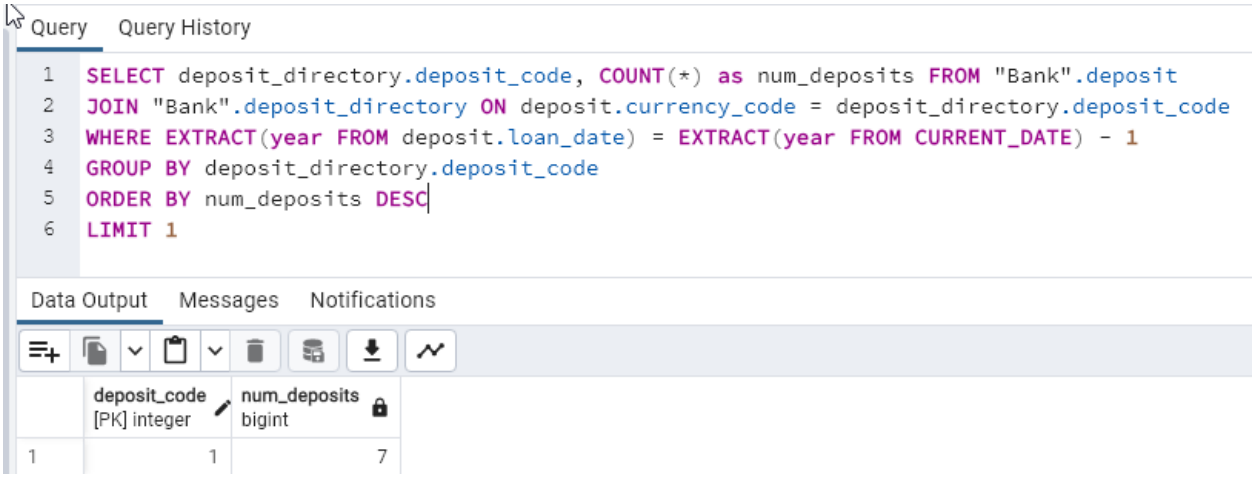
3. Вывести данные вкладчика, имеющего максимальный вклад в английский фунтах.

```
SELECT client.*, MAX(deposit.deposit_amount) as max_deposit FROM
"Bank".deposit

JOIN "Bank".client ON deposit.id_client = client.id_client

WHERE currency_code = (SELECT currency_code FROM "Bank".currency WHERE
currency.name = 'GBP')

GROUP BY deposit.id_client, client.passport_number

ORDER BY max_deposit DESC

LIMIT 1
```




4. Какой из вкладов пользовался наибольшей популярностью за истекший год.

```
SELECT deposit_directory.deposit_code, COUNT(*) as num_deposits FROM
"Bank".deposit
JOIN "Bank".deposit_directory ON deposit.currency_code =
deposit_directory.deposit_code
WHERE EXTRACT(year FROM deposit.loan_date) = EXTRACT(year FROM
CURRENT_DATE) - 1
GROUP BY deposit_directory.deposit_code
ORDER BY num_deposits DESC
LIMIT 1
```




5. Кто из сотрудников заключил максимальное число договоров по кредитам за последний месяц.

SELECT employee.id_employee, full_name, COUNT(*) AS num_contracts FROM "Bank".employee

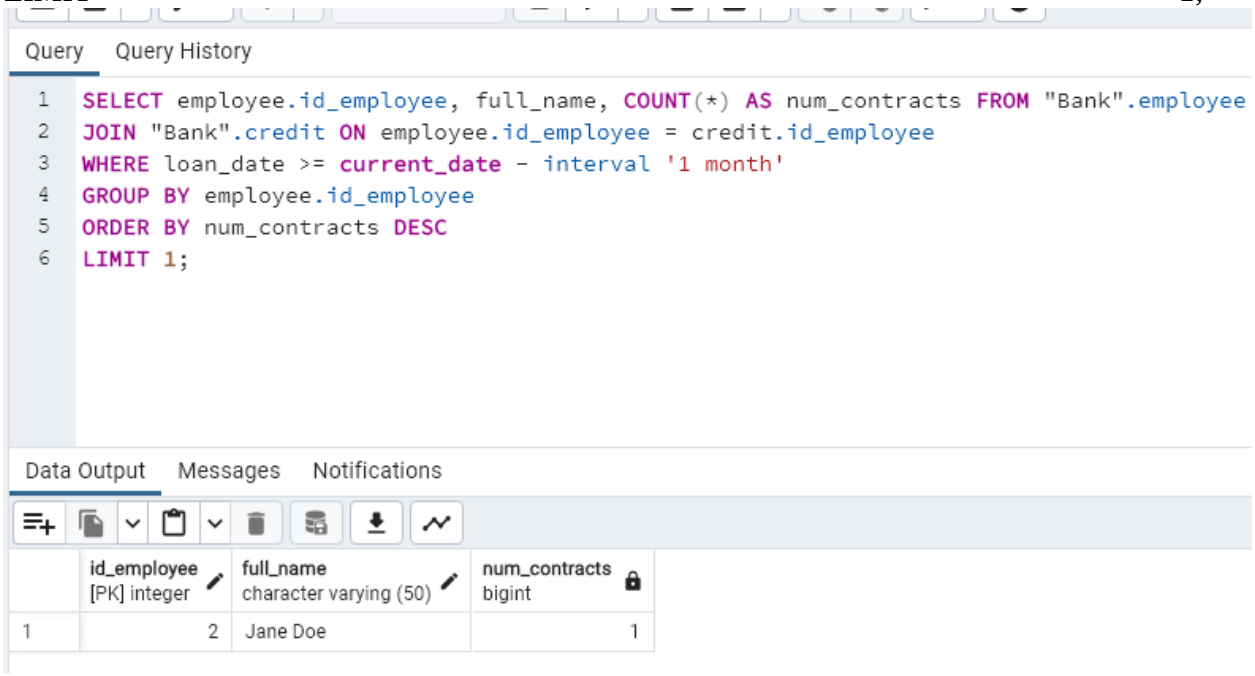
JOIN "Bank".credit ON employee.id_employee = credit.id_employee

WHERE loan_date >= current_date - interval '1 month'

GROUP BY employee.id_employee

ORDER BY num_contracts DESC

LIMIT 1;

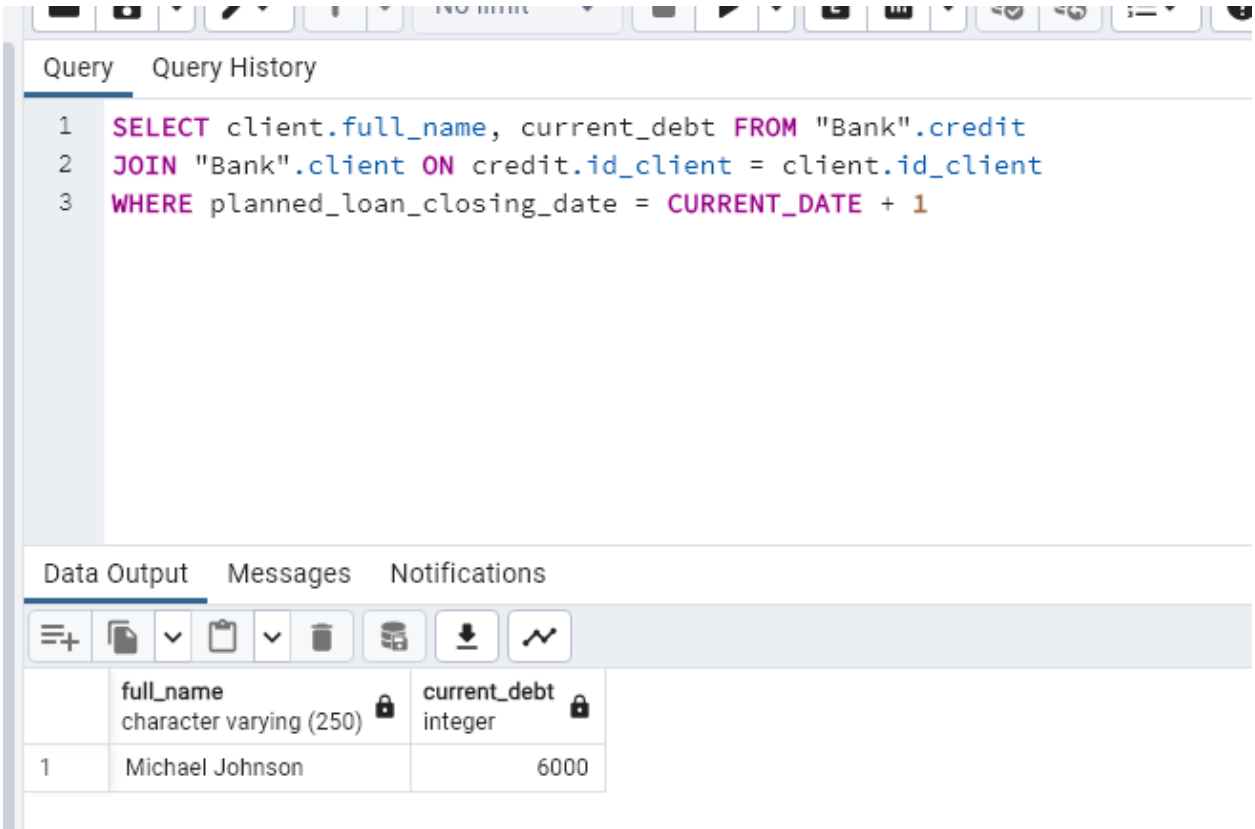



6. Вывести список вкладчиков, у которых срок вклада истекает завтра и суммы начислений, которые могут быть ими востребованы.

SELECT client.full_name, current_debt FROM "Bank".credit

JOIN "Bank".client ON credit.id_client = client.id_client

WHERE planned_loan_closing_date = CURRENT_DATE + 1



7. Вывести список сотрудников, заключивших договоры по вкладам на максимальную сумму за последний месяц.

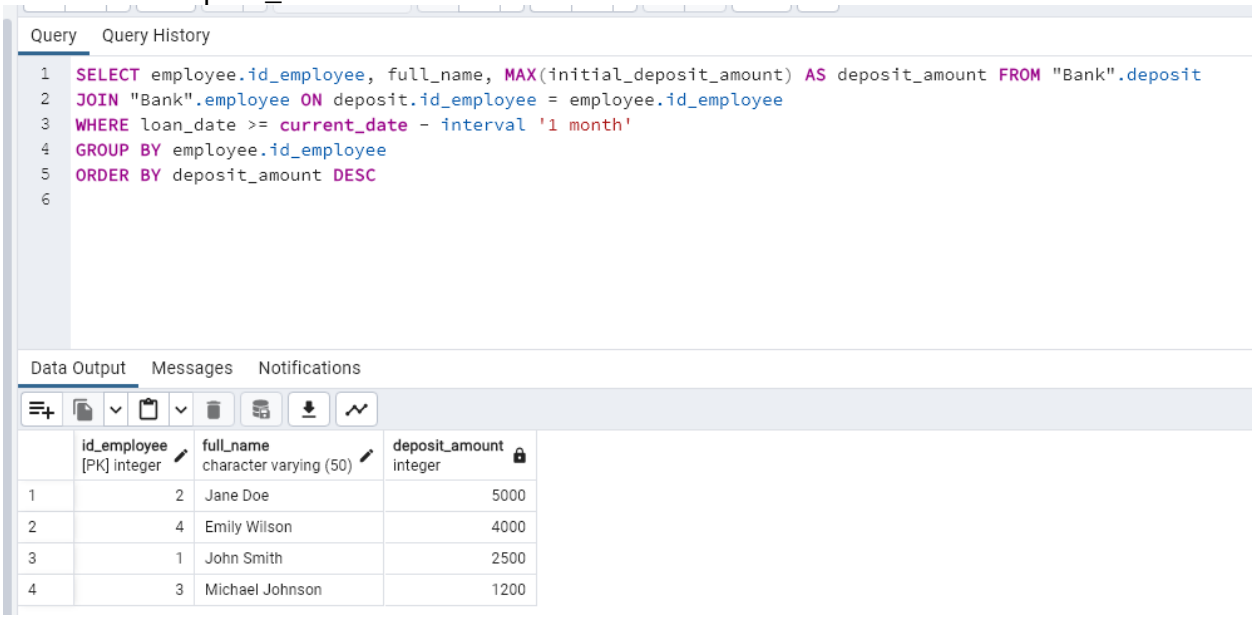
SELECT employee.id_employee, full_name, MAX(initial_deposit_amount) AS deposit_amount FROM "Bank".deposit

JOIN "Bank".employee ON deposit.id_employee = employee.id_employee

WHERE loan_date >= current_date - interval '1 month'

GROUP BY employee.id_employee

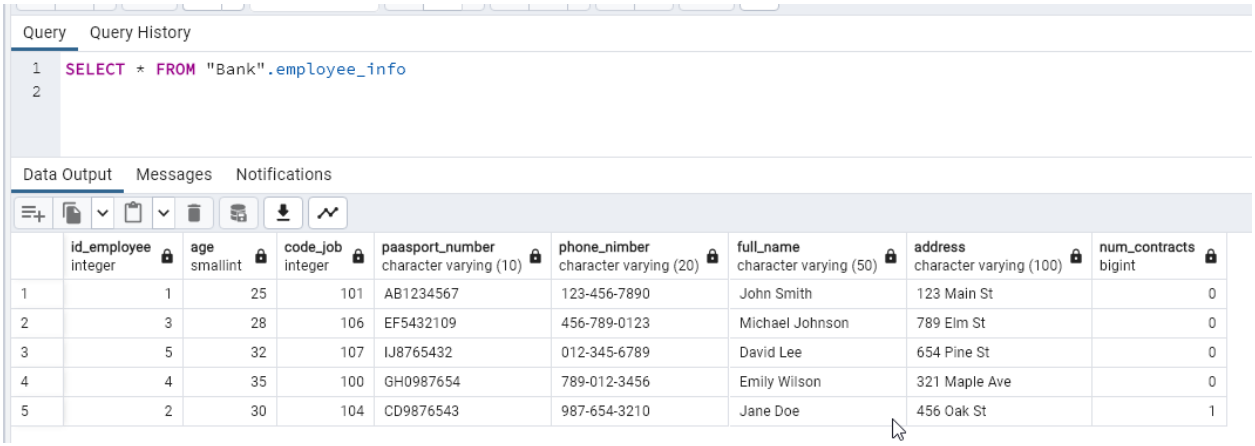
ORDER BY deposit_amount DESC




## 2. Представления

8. Содержащее сведения обо всех сотрудниках банка и заключенных ими договорах по кредитам за прошедший месяц;

CREATE VIEW "Bank".employee_info AS
SELECT employee.*, COUNT(credit.contract_number) AS num_contracts FROM "Bank".employee
LEFT JOIN "Bank".credit ON employee.id_employee = credit.id_employee AND credit.loan_date >= current_date - interval '1 month'
GROUP BY employee.id_employee



Query Query History

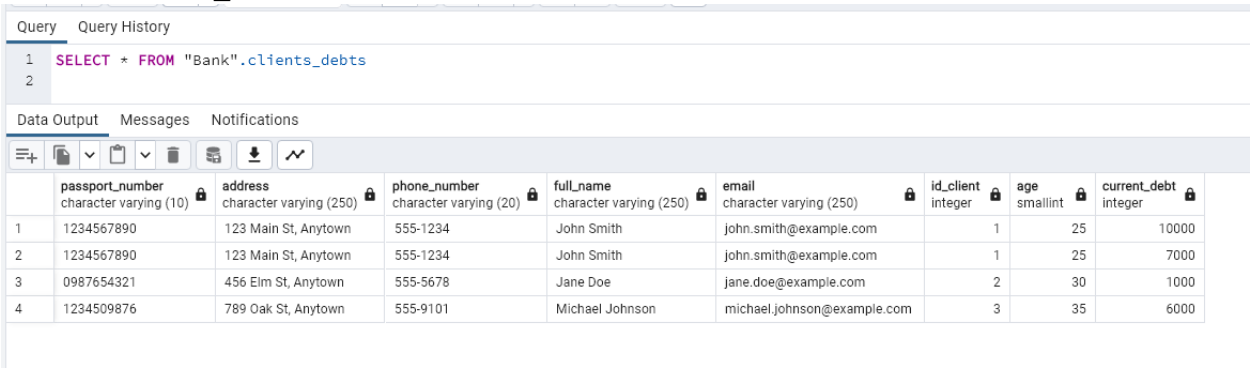
```
SELECT * FROM "Bank".employee_info
```

Data Output Messages Notifications

| | id_employee integer | age smallint | code_job integer | paasport_number character varying (10) | phone_nimber character varying (20) | full_name character varying (50) | address character varying (100) | num_contracts bigint |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 25 | 101 | AB1234567 | 123-456-7890 | John Smith | 123 Main St | 0 |
| 2 | 3 | 28 | 106 | EF5432109 | 456-789-0123 | Michael Johnson | 789 Elm St | 0 |
| 3 | 5 | 32 | 107 | IJ8765432 | 012-345-6789 | David Lee | 654 Pine St | 0 |
| 4 | 4 | 35 | 100 | GH0987654 | 789-012-3456 | Emily Wilson | 321 Maple Ave | 0 |
| 5 | 2 | 30 | 104 | CD9876543 | 987-654-3210 | Jane Doe | 456 Oak St | 1 |

9. Найти клиентов банка, имеющих задолженности по кредитам.

```
CREATE VIEW "Bank".clients_debts AS
SELECT client.*, current_debt FROM "Bank".credit
JOIN "Bank".client ON credit.id_client = client.id_client
WHERE current_debt > 0
```



Query Query History

```
SELECT * FROM "Bank".clients_debts
```

Data Output Messages Notifications

| | passport_number character varying (10) | address character varying (250) | phone_number character varying (20) | full_name character varying (250) | email character varying (250) | id_client integer | age smallint | current_debt integer |
|---|---|---|---|---|---|---|---|---|
| 1 | 1234567890 | 123 Main St, Anytown | 555-1234 | John Smith | john.smith@example.com | 1 | 25 | 10000 |
| 2 | 1234567890 | 123 Main St, Anytown | 555-1234 | John Smith | john.smith@example.com | 1 | 25 | 7000 |
| 3 | 0987654321 | 456 Elm St, Anytown | 555-5678 | Jane Doe | jane.doe@example.com | 2 | 30 | 1000 |
| 4 | 1234509876 | 789 Oak St, Anytown | 555-9101 | Michael Johnson | michael.johnson@example.com | 3 | 35 | 6000 |

### 3. Кастом запросы

- Внести, что в контракт по кредиту, который был оформлен сотрудником с номером , было сегодня внесено зачисление на 50000 рублей

```
INSERT INTO "Bank".accruals(id_accruals, payments, actual_date_payments, planned_date_payments, contract_number) VALUES
(11, 50000, CURRENT_DATE, '2023-12-20', (
    SELECT contract_number FROM "Bank".credit
    WHERE id_employee = 4
))
```

Data Output | Messages | Notifications

| | payments integer | id_accruals [PK] integer | actual_date_payments date | planned_date_payments date | contract_number integer |
|---|---|---|---|---|---|
| 1 | 1000 | 1 | 2022-06-01 | 2022-06-01 | 2 |
| 2 | 2000 | 2 | 2022-06-07 | 2022-06-01 | 3 |
| 3 | 3000 | 3 | [null] | 2022-07-01 | 4 |
| 4 | 4000 | 4 | [null] | 2022-10-01 | 8 |
| 5 | 5000 | 5 | 2022-10-05 | 2022-10-10 | 9 |
| 6 | 6000 | 6 | [null] | 2022-12-01 | 8 |
| 7 | 7000 | 7 | [null] | 2023-03-01 | 4 |
| 8 | 8000 | 8 | 2022-09-07 | 2022-09-01 | 3 |
| 9 | 9000 | 9 | 2023-01-01 | 2023-01-01 | 2 |
| 10 | 10000 | 10 | 2022-11-05 | 2022-11-10 | 9 |

Query | Query History

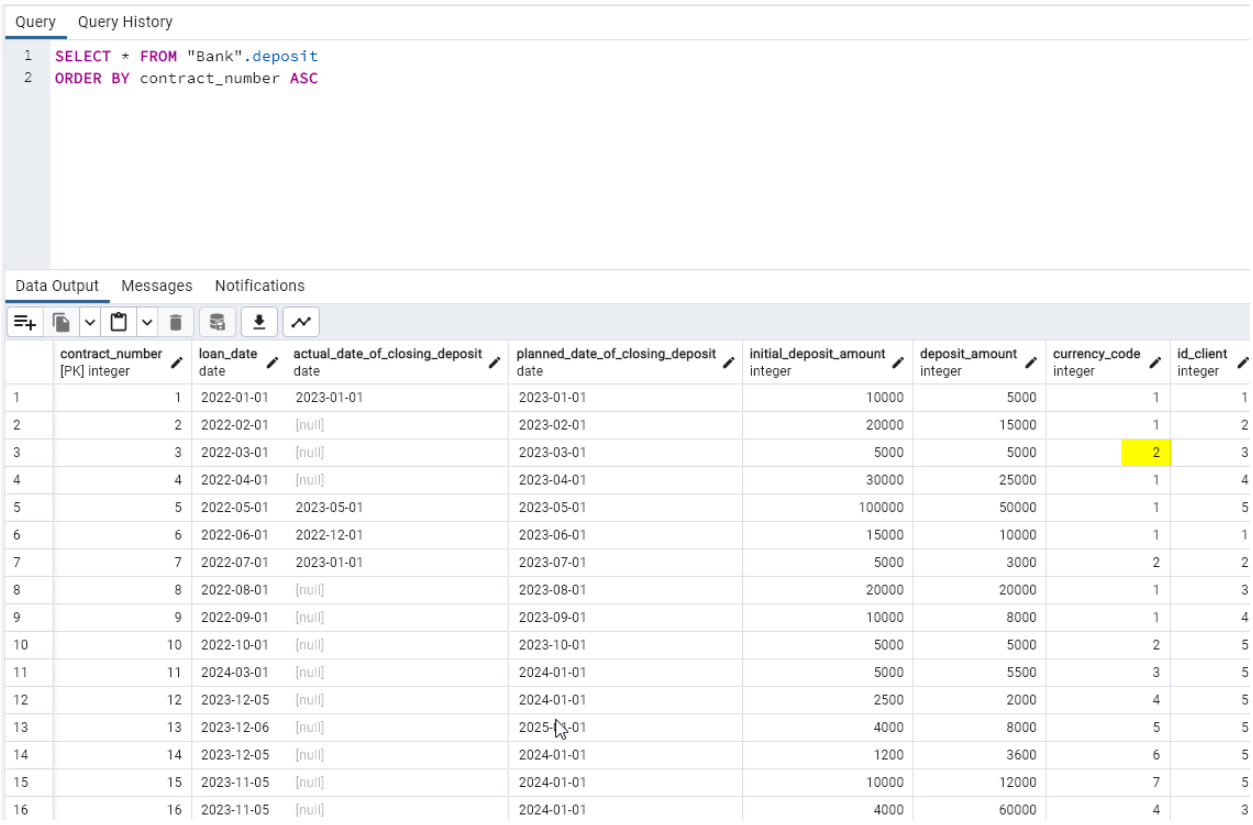
```
1  SELECT * FROM "Bank".accruals
2  ORDER BY id_accruals ASC
```

Data Output | Messages | Notifications

| | payments integer | id_accruals [PK] integer | actual_date_payments date | planned_date_payments date | contract_number integer |
|---|---|---|---|---|---|
| 1 | 1000 | 1 | 2022-06-01 | 2022-06-01 | 2 |
| 2 | 2000 | 2 | 2022-06-07 | 2022-06-01 | 3 |
| 3 | 3000 | 3 | [null] | 2022-07-01 | 4 |
| 4 | 4000 | 4 | [null] | 2022-10-01 | 8 |
| 5 | 5000 | 5 | 2022-10-05 | 2022-10-10 | 9 |
| 6 | 6000 | 6 | [null] | 2022-12-01 | 8 |
| 7 | 7000 | 7 | [null] | 2023-03-01 | 4 |
| 8 | 8000 | 8 | 2022-09-07 | 2022-09-01 | 3 |
| 9 | 9000 | 9 | 2023-01-01 | 2023-01-01 | 2 |
| 10 | 10000 | 10 | 2022-11-05 | 2022-11-10 | 9 |
| 11 | 50000 | 11 | 2023-12-17 | 2023-12-20 | 4 |

- Изменить код валюты во вкладе на USD

```
UPDATE "Bank".deposit
SET currency_code = (SELECT currency_code FROM "Bank".currency WHERE currency.name = 'USD')
WHERE contract_number = 3
```

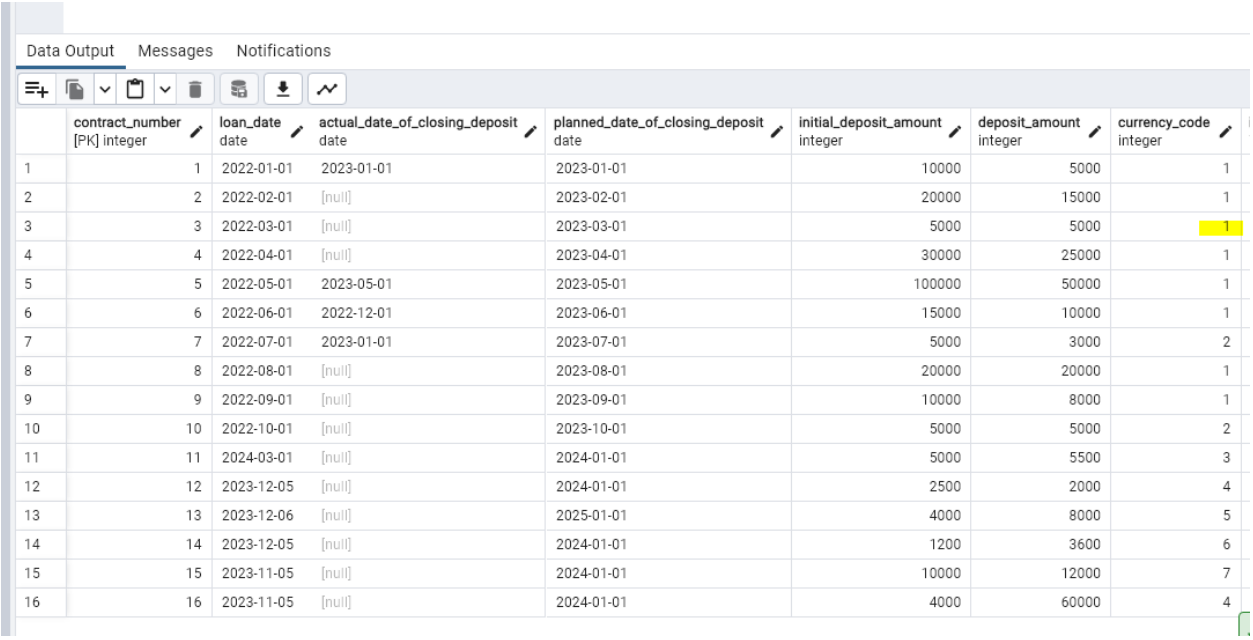


Query | Query History

```
SELECT * FROM "Bank".deposit
ORDER BY contract_number ASC
```

Data Output | Messages | Notifications

| | contract_number [PK] integer | loan_date date | actual_date_of_closing_deposit date | planned_date_of_closing_deposit date | initial_deposit_amount integer | deposit_amount integer | currency_code integer | id_client integer |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2022-01-01 | 2023-01-01 | 2023-01-01 | 10000 | 5000 | 1 | 1 |
| 2 | 2 | 2022-02-01 | [null] | 2023-02-01 | 20000 | 15000 | 1 | 2 |
| 3 | 3 | 2022-03-01 | [null] | 2023-03-01 | 5000 | 5000 | 2 | 3 |
| 4 | 4 | 2022-04-01 | [null] | 2023-04-01 | 30000 | 25000 | 1 | 4 |
| 5 | 5 | 2022-05-01 | 2023-05-01 | 2023-05-01 | 100000 | 50000 | 1 | 5 |
| 6 | 6 | 2022-06-01 | 2022-12-01 | 2023-06-01 | 15000 | 10000 | 1 | 1 |
| 7 | 7 | 2022-07-01 | 2023-01-01 | 2023-07-01 | 5000 | 3000 | 2 | 2 |
| 8 | 8 | 2022-08-01 | [null] | 2023-08-01 | 20000 | 20000 | 1 | 3 |
| 9 | 9 | 2022-09-01 | [null] | 2023-09-01 | 10000 | 8000 | 1 | 4 |
| 10 | 10 | 2022-10-01 | [null] | 2023-10-01 | 5000 | 5000 | 2 | 5 |
| 11 | 11 | 2024-03-01 | [null] | 2024-01-01 | 5000 | 5500 | 3 | 5 |
| 12 | 12 | 2023-12-05 | [null] | 2024-01-01 | 2500 | 2000 | 4 | 5 |
| 13 | 13 | 2023-12-06 | [null] | 2025-01-01 | 4000 | 8000 | 5 | 5 |
| 14 | 14 | 2023-12-05 | [null] | 2024-01-01 | 1200 | 3600 | 6 | 5 |
| 15 | 15 | 2023-11-05 | [null] | 2024-01-01 | 10000 | 12000 | 7 | 5 |
| 16 | 16 | 2023-11-05 | [null] | 2024-01-01 | 4000 | 60000 | 4 | 3 |



Data Output | Messages | Notifications

| | contract_number [PK] integer | loan_date date | actual_date_of_closing_deposit date | planned_date_of_closing_deposit date | initial_deposit_amount integer | deposit_amount integer | currency_code integer |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2022-01-01 | 2023-01-01 | 2023-01-01 | 10000 | 5000 | 1 |
| 2 | 2 | 2022-02-01 | [null] | 2023-02-01 | 20000 | 15000 | 1 |
| 3 | 3 | 2022-03-01 | [null] | 2023-03-01 | 5000 | 5000 | 1 |
| 4 | 4 | 2022-04-01 | [null] | 2023-04-01 | 30000 | 25000 | 1 |
| 5 | 5 | 2022-05-01 | 2023-05-01 | 2023-05-01 | 100000 | 50000 | 1 |
| 6 | 6 | 2022-06-01 | 2022-12-01 | 2023-06-01 | 15000 | 10000 | 1 |
| 7 | 7 | 2022-07-01 | 2023-01-01 | 2023-07-01 | 5000 | 3000 | 2 |
| 8 | 8 | 2022-08-01 | [null] | 2023-08-01 | 20000 | 20000 | 1 |
| 9 | 9 | 2022-09-01 | [null] | 2023-09-01 | 10000 | 8000 | 1 |
| 10 | 10 | 2022-10-01 | [null] | 2023-10-01 | 5000 | 5000 | 2 |
| 11 | 11 | 2024-03-01 | [null] | 2024-01-01 | 5000 | 5500 | 3 |
| 12 | 12 | 2023-12-05 | [null] | 2024-01-01 | 2500 | 2000 | 4 |
| 13 | 13 | 2023-12-06 | [null] | 2025-01-01 | 4000 | 8000 | 5 |
| 14 | 14 | 2023-12-05 | [null] | 2024-01-01 | 1200 | 3600 | 6 |
| 15 | 15 | 2023-11-05 | [null] | 2024-01-01 | 10000 | 12000 | 7 |
| 16 | 16 | 2023-11-05 | [null] | 2024-01-01 | 4000 | 60000 | 4 |

- Удалить данные о расписании оплаты для кредита, у которого статус ‘Finished’ и имя клиента “Michael Johnson”

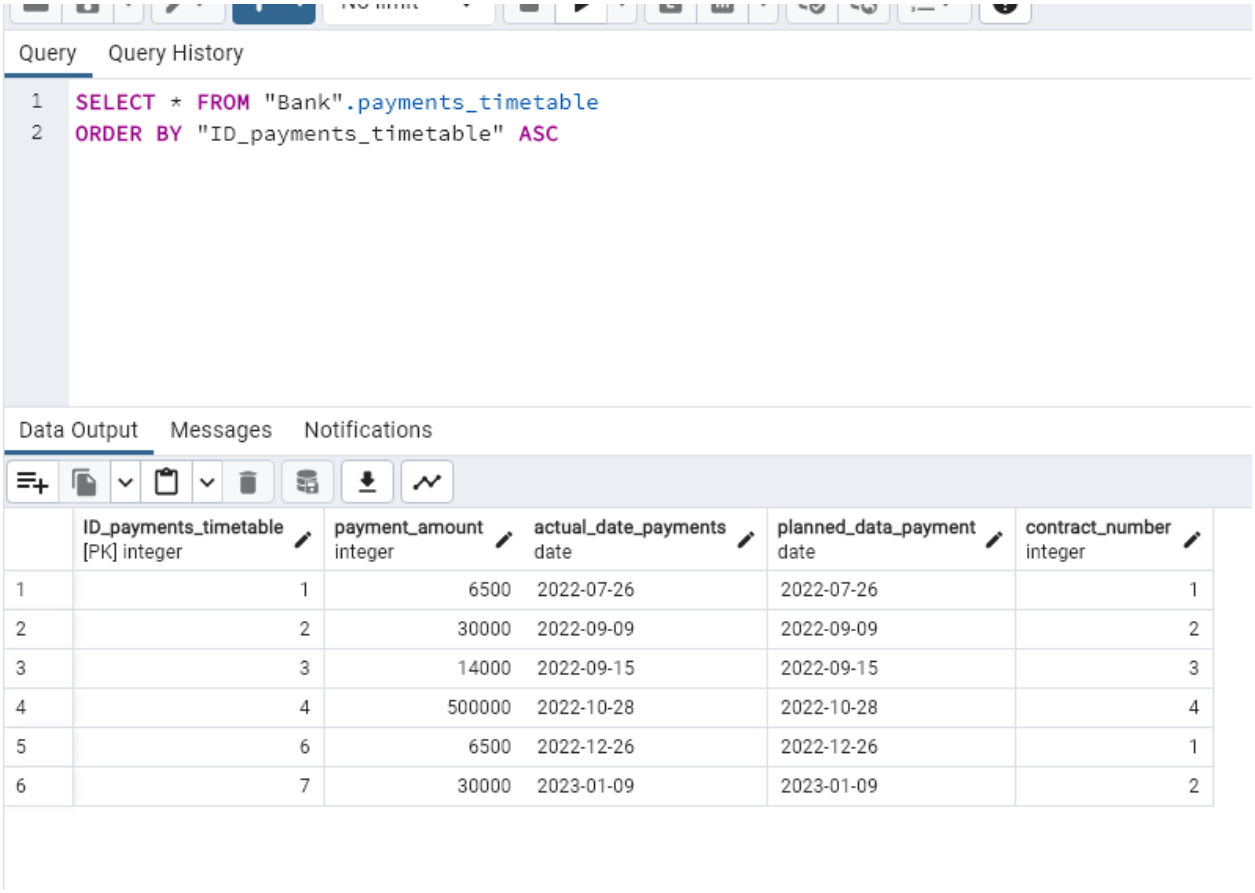
```
DELETE FROM "Bank".payment_timetable
WHERE contract_number = (
        SELECT contract_number FROM "Bank".credit WHERE id_client = (SELECT id_client FROM "Bank".client WHERE full_name = 'Michael Johnson') AND status = 'Finished'
) AND status = 'Finished'
```

Query | Query History

```
1  SELECT * FROM "Bank".payments_timetable
2  ORDER BY "ID_payments_timetable" ASC
```

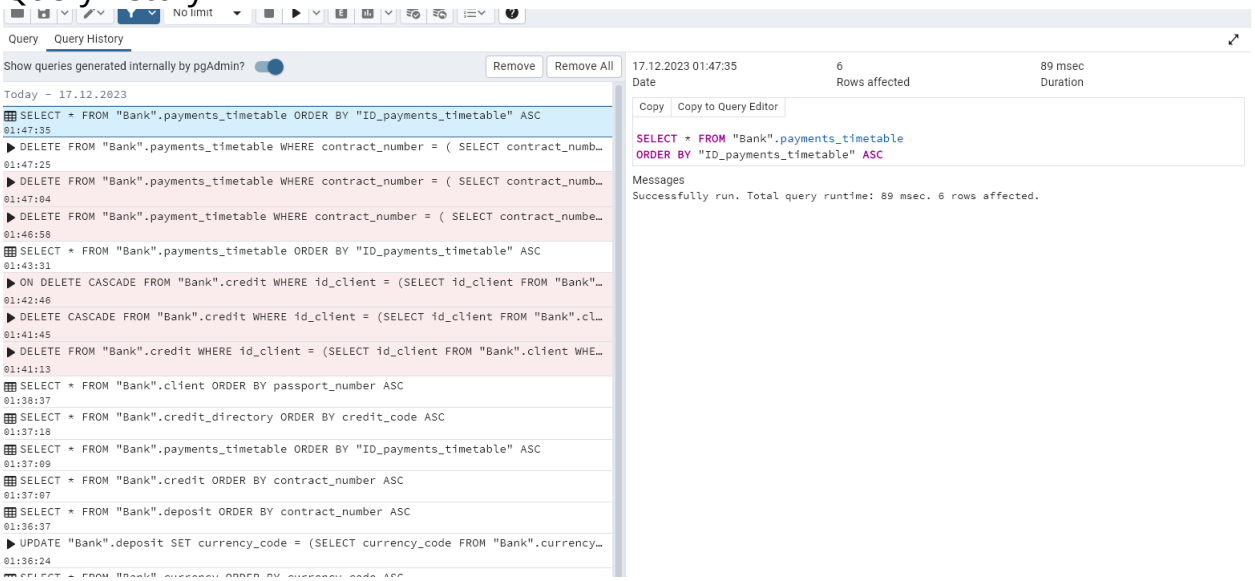
Data Output | Messages | Notifications

| | ID_payments_timetable [PK] integer | payment_amount integer | actual_date_payments date | planned_data_payment date | contarct_number integer |
|---|---|---|---|---|---|
| 1 | 1 | 6500 | 2022-07-26 | 2022-07-26 | 1 |
| 2 | 2 | 30000 | 2022-09-09 | 2022-09-09 | 2 |
| 3 | 3 | 14000 | 2022-09-15 | 2022-09-15 | 3 |
| 4 | 4 | 500000 | 2022-10-28 | 2022-10-28 | 4 |
| 5 | 5 | 1000 | 2022-10-28 | 2022-10-28 | 5 |
| 6 | 6 | 6500 | 2022-12-26 | 2022-12-26 | 1 |
| 7 | 7 | 30000 | 2023-01-09 | 2023-01-09 | 2 |




| | ID_payments_timetable [PK] integer | payment_amount integer | actual_date_payments date | planned_data_payment date | contract_number integer |
|---|---|---|---|---|---|
| 1 | 1 | 6500 | 2022-07-26 | 2022-07-26 | 1 |
| 2 | 2 | 30000 | 2022-09-09 | 2022-09-09 | 2 |
| 3 | 3 | 14000 | 2022-09-15 | 2022-09-15 | 3 |
| 4 | 4 | 500000 | 2022-10-28 | 2022-10-28 | 4 |
| 5 | 6 | 6500 | 2022-12-26 | 2022-12-26 | 1 |
| 6 | 7 | 30000 | 2023-01-09 | 2023-01-09 | 2 |

QueryHistory




## 4. Индексы

CREATE INDEX currency_name_idx ON "Bank".currency (name);
CREATE INDEX loan_date_idx ON "Bank".credit (loan_date);
CREATE INDEX credit_end_dates ON "Bank".credit (loan_date, planned_loan_closing_date);

SELECT client.*, MAX(deposit.deposit_amount) as max_deposit FROM "Bank".deposit
JOIN "Bank".client ON deposit.id_client = client.id_client
WHERE currency_code = (SELECT currency_code FROM "Bank".currency WHERE currency.name = 'GBP')
GROUP BY deposit.id_client, client.passport_number
ORDER BY max_deposit DESC
LIMIT 1
Без индекса:

Query | Query History

```
1  SELECT client.*, MAX(deposit.deposit_amount) as max_deposit FROM "Bank".deposit
2  JOIN "Bank".client ON deposit.id_client = client.id_client
3  WHERE currency_code = (SELECT currency_code FROM "Bank".currency WHERE currency.name = 'GBP')
4  GROUP BY deposit.id_client, client.passport_number
5  ORDER BY max_deposit DESC
6  LIMIT 1
7
```

Data Output | Messages | Notifications

```
Successfully run. Total query runtime: 526 msec.
1 rows affected.
```

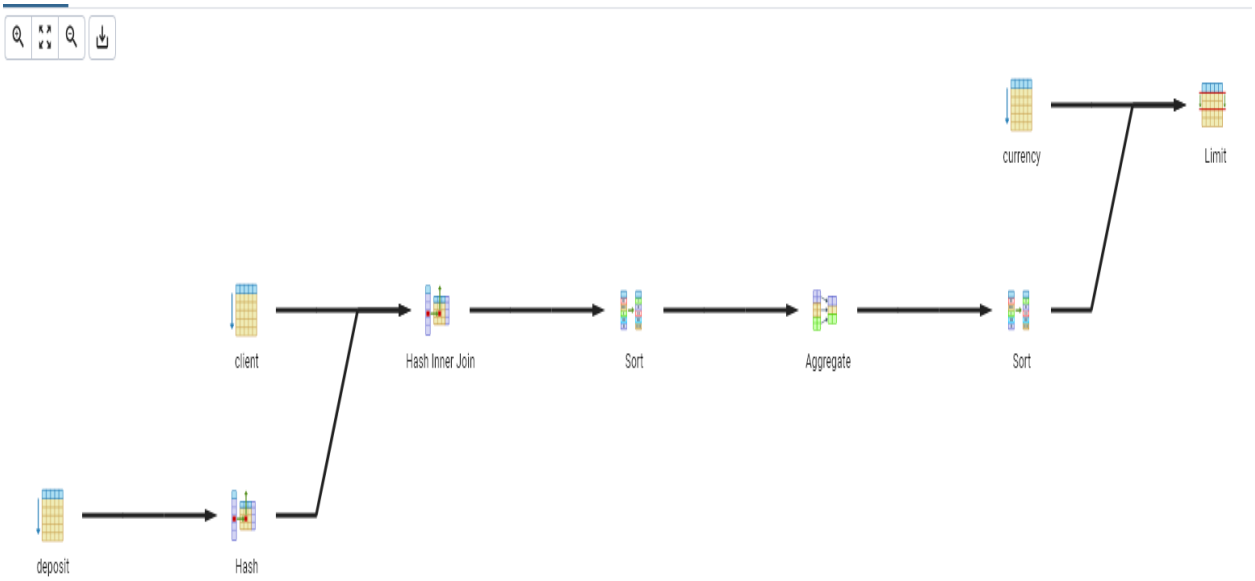
С индексом:

Query | Query History

```
1  SELECT client.*, MAX(deposit.deposit_amount) as max_deposit FROM "Bank".deposit
2  JOIN "Bank".client ON deposit.id_client = client.id_client
3  WHERE currency_code = (SELECT currency_code FROM "Bank".currency WHERE currency.name = 'GBP')
4  GROUP BY deposit.id_client, client.passport_number
5  ORDER BY max_deposit DESC
6  LIMIT 1
7
```

Data Output | Messages | Notifications

```
Successfully run. Total query runtime: 65 msec.
1 rows affected.
```




DROP INDEX currency_name_idx;
DROP INDEX loan_date_idx
DROP INDEX credit_end_dates;

**Вывод**

В ходе лабораторной работы была освоена работа с Query Tool, а именно с выборкой данных, добавлением, обновлением и их удалением. Также получены навыки создания представления данных и индексировании полей, в следствии чего были проведены оптимизационные эксперименты.