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«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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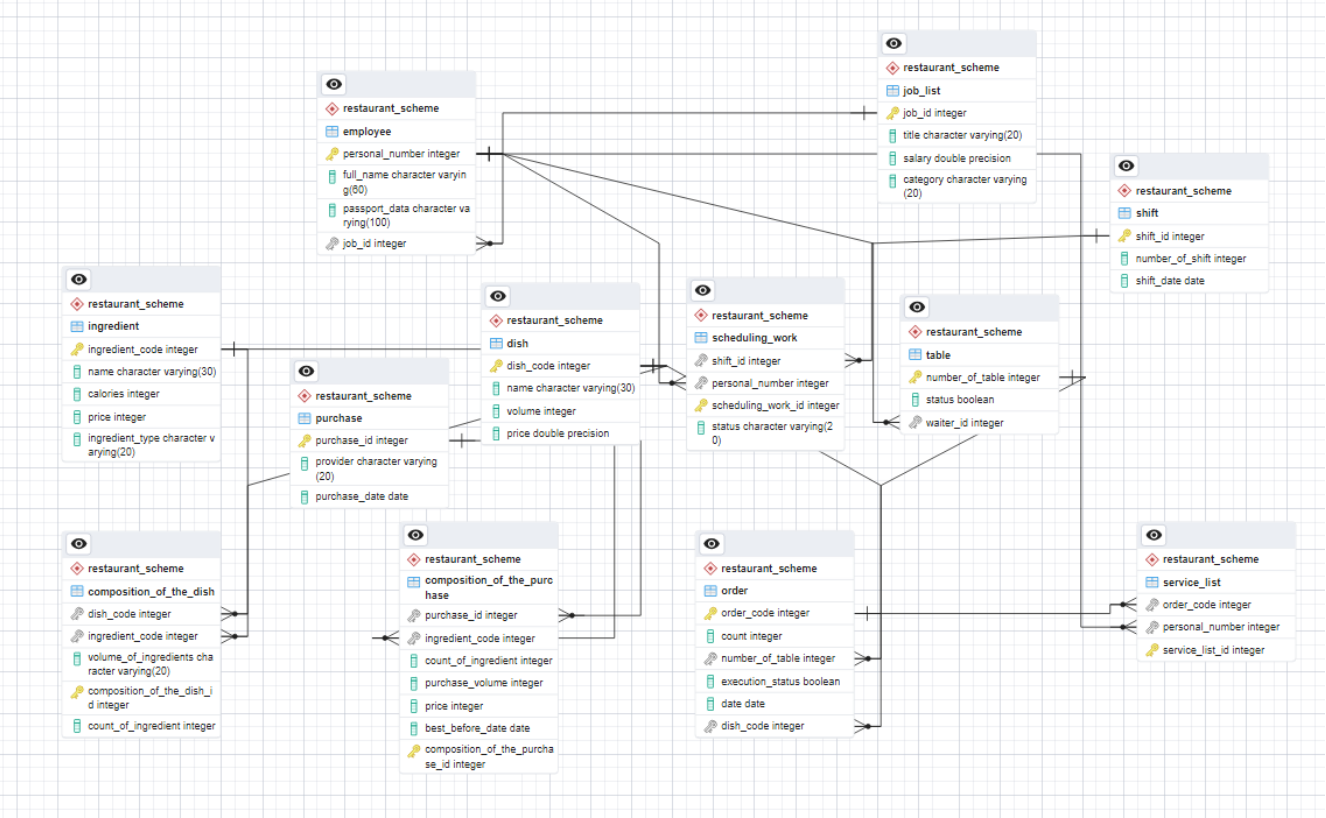
Цель работы

Овладеть практическими навыками создания представлений и запросов на выборку данных к базе данных PostgreSQL, использования подзапросов при модификации данных и индексов.

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.

Схема базы данных:



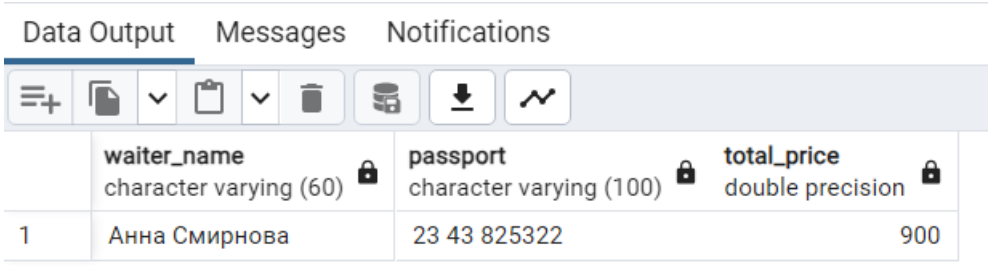
Выполнение

Запросы к базе данных

1. Вывести данные официанта, принявшего заказы на максимальную сумму за истекший месяц.

```
SELECT
  full_name AS waiter_name,
  passport_data AS passport,
  SUM(d.price) AS total_price
FROM restaurant_scheme.employee e
JOIN restaurant_scheme.table ta ON ta.waiter_id = e.personal_number
JOIN restaurant_scheme.order o ON o.number_of_table = ta.number_of_table
JOIN restaurant_scheme.dish d ON d.dish_code = o.dish_code
WHERE
  o.date BETWEEN DATE_TRUNC('month', CURRENT_DATE) - INTERVAL '1 month'
  AND DATE_TRUNC('month', CURRENT_DATE) AND o.execution_status='true'
GROUP BY e.personal_number, e.passport_data
HAVING SUM(d.price) = (
            SELECT SUM(d2.price)
    FROM restaurant_scheme.employee e2
    JOIN restaurant_scheme.table ta2 ON ta2.waiter_id = e2.personal_number
    JOIN restaurant_scheme.order o2 ON o2.number_of_table = ta2.number_of_table
    JOIN restaurant_scheme.dish d2 ON d2.dish_code = o2.dish_code
    WHERE
                    o2.date BETWEEN DATE_TRUNC('month', CURRENT_DATE) - INTERVAL '1 month'
                    AND DATE_TRUNC('month', CURRENT_DATE)
              AND o2.execution_status = 'true'
    GROUP BY e2.personal_number
    ORDER BY SUM(d2.price) DESC
    LIMIT 1
  )
ORDER BY total_price DESC;
```

```sql
SELECT
  full_name AS waiter_name,
  passport_data AS passport,
  SUM(d.price) AS total_price
FROM restaurant_scheme.employee e
JOIN restaurant_scheme.table ta ON ta.waiter_id = e.personal_number
JOIN restaurant_scheme.order o ON o.number_of_table = ta.number_of_table
JOIN restaurant_scheme.dish d ON d.dish_code = o.dish_code
WHERE
  o.date BETWEEN DATE_TRUNC('month', CURRENT_DATE) - INTERVAL '1 month'
  AND DATE_TRUNC('month', CURRENT_DATE) AND o.execution_status='true'
GROUP BY e.personal_number, e.passport_data
HAVING SUM(d.price) = (
    SELECT SUM(d2.price)
    FROM restaurant_scheme.employee e2
    JOIN restaurant_scheme.table ta2 ON ta2.waiter_id = e2.personal_number
    JOIN restaurant_scheme.order o2 ON o2.number_of_table = ta2.number_of_table
    JOIN restaurant_scheme.dish d2 ON d2.dish_code = o2.dish_code
    WHERE
        o2.date BETWEEN DATE_TRUNC('month', CURRENT_DATE) - INTERVAL '1 month'
        AND DATE_TRUNC('month', CURRENT_DATE)
        AND o2.execution_status = 'true'
    GROUP BY e2.personal_number
    ORDER BY SUM(d2.price) DESC
    LIMIT 1
  )
ORDER BY total_price DESC;
```



2. Рассчитать премию каждого официанта за последние 10 дней (5% от стоимости каждого заказа).

```
SELECT
  e.full_name AS full_name,
  SUM(d.price * 0.05) AS bonus
FROM restaurant_scheme.employee e
JOIN restaurant_scheme.table ta ON ta.waiter_id = e.personal_number
JOIN restaurant_scheme.order o ON o.number_of_table = ta.number_of_table
JOIN restaurant_scheme.dish d ON d.dish_code = o.dish_code
WHERE
  DATE_TRUNC('day', o.date) >= (CURRENT_DATE - interval '10 day')
GROUP BY e.personal_number;
```

Query Query History

```sql
SELECT
  e.full_name AS full_name,
  SUM(d.price * 0.05) AS bonus
FROM restaurant_scheme.employee e
JOIN restaurant_scheme.table ta ON ta.waiter_id = e.personal_number
JOIN restaurant_scheme.order o ON o.number_of_table = ta.number_of_table
JOIN restaurant_scheme.dish d ON d.dish_code = o.dish_code
WHERE
  DATE_TRUNC('day', o.date) >= (CURRENT_DATE - interval '10 day')
GROUP BY e.personal_number;
```

Data Output Messages Notifications

	full_name character varying (60)	bonus double precision
1	Анна Смирнова	45
2	Игорь Сапрыкин	32.5

3. Подсчитать, сколько ингредиентов содержит каждое блюдо.

```
SELECT
    mic.menu_item_id,
    mi.name AS menu_item_name,
    COUNT(mic.ingredient_id) AS num_ingredients
FROM
    schema.menu_item_composition mic
JOIN
    schema.menu_item mi ON mic.menu_item_id = mi.id
GROUP BY
    mic.menu_item_id, mi.name
```

```
SELECT
  d.name AS dish_name,
  COUNT(cd.composition_of_the_dish_id) AS count_of_ingredients
FROM restaurant_scheme.dish d
JOIN restaurant_scheme.composition_of_the_dish cd ON cd.dish_code = d.dish_code
WHERE cd.dish_code=d.dish_code
GROUP BY d.dish_code;
```

Query | Query History

```
1  SELECT
2    d.name AS dish_name,
3    COUNT(cd.composition_of_the_dish_id) AS count_of_ingredients
4  FROM restaurant_scheme.dish d
5  JOIN restaurant_scheme.composition_of_the_dish cd ON cd.dish_code = d.dish_code
6  WHERE cd.dish_code=d.dish_code
7  GROUP BY d.dish_code;
```

Data Output | Messages | Notifications

	dish_name character varying (30)	count_of_ingredients bigint
1	Тирамису	6
2	Лосось с терияки	7
3	Суши сэт "Дракон"	13

4. Вывести название блюда, содержащее максимальное число ингредиентов.

```
SELECT
  d.name AS dish_name,
  COUNT(cd.composition_of_the_dish_id) AS count_of_ingredients
FROM restaurant_scheme.dish d
JOIN restaurant_scheme.composition_of_the_dish cd ON cd.dish_code = d.dish_code
WHERE cd.dish_code=d.dish_code
GROUP BY d.dish_code
```

```
HAVING COUNT(cd.composition_of_the_dish_id) = (
        SELECT COUNT(cd2.composition_of_the_dish_id) AS "c"
        FROM restaurant_scheme.composition_of_the_dish cd2
        GROUP BY cd2.dish_code
        ORDER BY "c" DESC
        LIMIT 1
);
```

Query Query History

```
1  SELECT
2      d.name AS dish_name,
3      COUNT(cd.composition_of_the_dish_id) AS count_of_ingredients
4  FROM restaurant_scheme.dish d
5  JOIN restaurant_scheme.composition_of_the_dish cd ON cd.dish_code = d.dish_code
6  WHERE cd.dish_code=d.dish_code
7  GROUP BY d.dish_code
8  HAVING COUNT(cd.composition_of_the_dish_id) = (
9      SELECT COUNT(cd2.composition_of_the_dish_id) AS "c"
10     FROM restaurant_scheme.composition_of_the_dish cd2
11     GROUP BY cd2.dish_code
12     ORDER BY "c" DESC
13     LIMIT 1
14 );
```

Data Output Messages Notifications

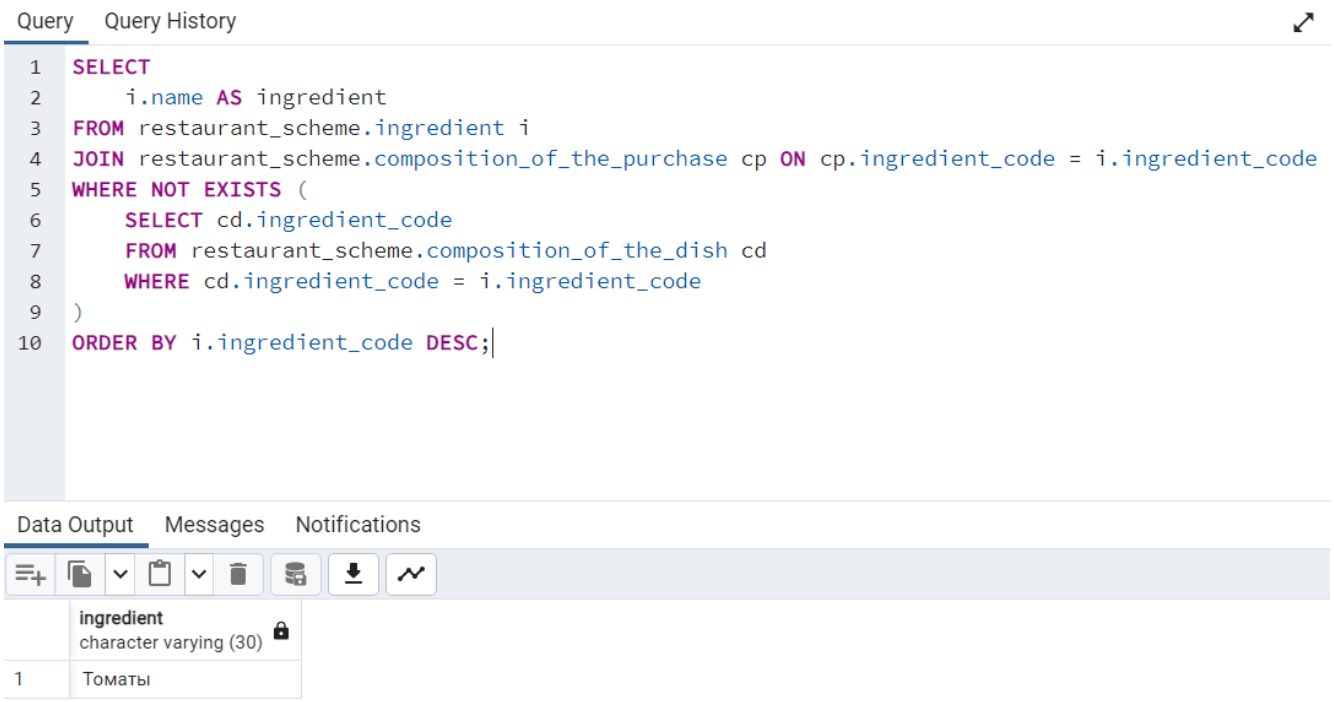
	dish_name character varying (30)	count_of_ingredients bigint
1	Суши сэт "Дракон"	13

5. Вывести ингредиенты, которые закупаются, но не используются в блюдах.

```
SELECT
        i.name AS ingredient
FROM restaurant_scheme.ingredient i
JOIN restaurant_scheme.composition_of_the_purchase cp ON cp.ingredient_code = i.ingredient_code
WHERE NOT EXISTS (
    SELECT cd.ingredient_code
    FROM restaurant_scheme.composition_of_the_dish cd
    WHERE cd.ingredient_code = i.ingredient_code
```

)

ORDER BY i.ingredient_code DESC;



6. Сколько закреплено столов за каждым из официантов?

SELECT

e.full_name AS waiter_name,

COUNT(tb.number_of_table) AS "count"

FROM restaurant_scheme.table tb

JOIN restaurant_scheme.employee e ON e.personal_number = tb.waiter_id

GROUP BY e.personal_number;

Query Query History

```
1  SELECT
2    e.full_name AS waiter_name,
3    COUNT(tb.number_of_table) AS "count"
4  FROM restaurant_scheme.table tb
5  JOIN restaurant_scheme.employee e ON e.personal_number = tb.waiter_id
6  GROUP BY e.personal_number;
```

Data Output Messages Notifications

	waiter_name character varying (60)	count bigint
1	Михаил Петров	4
2	Анна Смирнова	4
3	Игорь Сапрыкин	4

7. Какой из ингредиентов используется в максимальном количестве блюд?

```
SELECT
   i.name AS ingredient,
   COUNT(d.dish_code) AS "count"
FROM restaurant_scheme.ingredient i
JOIN restaurant_scheme.composition_of_the_dish cd ON cd.ingredient_code = i.ingredient_code
JOIN restaurant_scheme.dish d ON d.dish_code = cd.dish_code
GROUP BY i.ingredient_code
HAVING COUNT(d.dish_code) = (
        SELECT COUNT(cd2.dish_code) AS "c"
        FROM restaurant_scheme.composition_of_the_dish cd2
        GROUP BY cd2.ingredient_code
        ORDER BY "c" DESC
```

LIMIT 1

);

Query Query History

```
1  SELECT
2      i.name AS ingredient,
3      COUNT(d.dish_code) AS "count"
4  FROM restaurant_scheme.ingredient i
5  JOIN restaurant_scheme.composition_of_the_dish cd ON cd.ingredient_code = i.ingredient_code
6  JOIN restaurant_scheme.dish d ON d.dish_code = cd.dish_code
7  GROUP BY i.ingredient_code
8  HAVING COUNT(d.dish_code) = (
9      SELECT COUNT(cd2.dish_code) AS "c"
10     FROM restaurant_scheme.composition_of_the_dish cd2
11     GROUP BY cd2.ingredient_code
12     ORDER BY "c" DESC
13     LIMIT 1
14 );
```

Data Output Messages Notifications

	ingredient character varying (30)	count bigint
1	Сахар	3

Представления

1. **Для расчета стоимости ингредиентов блюда**

```
CREATE VIEW restaurant_scheme.ingredient_cost_calculation AS
SELECT
  d.name AS dish,
  SUM(i.price * cd.count_of_ingredient / 1000) AS total_price
FROM restaurant_scheme.dish d
JOIN restaurant_scheme.composition_of_the_dish cd ON cd.dish_code = d.dish_code
JOIN restaurant_scheme.ingredient i ON i.ingredient_code = cd.ingredient_code
GROUP BY d.dish_code;
```

Query | Query History

```sql
CREATE VIEW restaurant_scheme.ingredient_cost_calculation AS
SELECT
  d.name AS dish,
  SUM(i.price * cd.count_of_ingredient / 1000) AS total_price
FROM restaurant_scheme.dish d
JOIN restaurant_scheme.composition_of_the_dish cd ON cd.dish_code = d.dish_code
JOIN restaurant_scheme.ingredient i ON i.ingredient_code = cd.ingredient_code
GROUP BY d.dish_code;
```

Data Output | Messages | Notifications

```
CREATE VIEW

Query returned successfully in 70 msec.
```

Query | Query History

```sql
SELECT * FROM restaurant_scheme.ingredient_cost_calculation;
```

Data Output | Messages | Notifications

	dish character varying (30)	total_price bigint
1	Тирамису	44
2	Лосось с терияки	105
3	Суши сэт "Дракон"	377

2. **Для всех поваров количество приготовленных блюд по каждому блюду за определенную дату.**

```
CREATE VIEW restaurant_scheme.number_of_dishes_cooked AS
SELECT
  e.full_name AS full_name,
  d.name AS dish,
  COUNT(d.dish_code) * o.count AS "count",
  o.date AS date
FROM restaurant_scheme.employee e
JOIN restaurant_scheme.service_list sl ON sl.personal_number = e.personal_number
JOIN restaurant_scheme.order o ON o.order_code = sl.order_code
JOIN restaurant_scheme.dish d ON d.dish_code = o.dish_code
JOIN restaurant_scheme.job_list jl ON jl.job_id = e.job_id
WHERE jl.title = 'Повар' OR jl.title = 'Шеф-повар'
GROUP BY e.personal_number, dish, o.count, date
ORDER BY e.personal_number;
```

Query | Query History

```
1  CREATE VIEW restaurant_scheme.number_of_dishes_cooked AS
2  SELECT
3    e.full_name AS full_name,
4    d.name AS dish,
5    COUNT(d.dish_code) * o.count AS "count",
6    o.date AS date
7  FROM restaurant_scheme.employee e
8  JOIN restaurant_scheme.service_list sl ON sl.personal_number = e.personal_number
9  JOIN restaurant_scheme.order o ON o.order_code = sl.order_code
10 JOIN restaurant_scheme.dish d ON d.dish_code = o.dish_code
11 JOIN restaurant_scheme.job_list jl ON jl.job_id = e.job_id
12 WHERE jl.title = 'Повар' OR jl.title = 'Шеф-повар'
13 GROUP BY e.personal_number, dish, o.count, date
14 ORDER BY e.personal_number;
```

Data Output | Messages | Notifications

```
CREATE VIEW

Query returned successfully in 77 msec.
```

Query Query History

```
1  SELECT * FROM restaurant_scheme.number_of_dishes_cooked;
```

Data Output Messages Notifications

	full_name character varying (60)	dish character varying (30)	count bigint	date date
1	Алексей Васнецов	Тирамису	2	2024-03-08
2	Иван Андреев	Суши сэт "Дракон"	1	2024-03-08
3	София Тимофеева	Лосось с терияки	2	2024-03-08

Запросы на модификацию данных

1. **INSERT**

Query | Query History

```
SELECT * FROM restaurant_scheme.composition_of_the_dish
ORDER BY dish_code ASC;
```

Data Output | Messages | Notifications

	dish_code integer	ingredient_code integer	volume_of_ingredients character varying (20)	composition_of_the_dish_id [PK] integer	count_of_ingredient integer
1	6	24	г	7	300
2	6	5	г	12	30
3	6	10	г	11	200
4	6	4	г	10	70
5	6	13	г	9	50
6	6	27	г	8	100
7	11	4	г	25	60
8	11	7	г	19	480

Total rows: 25 of 25 | Query complete 00:00:00.122

Query | Query History

```
INSERT INTO restaurant_scheme.composition_of_the_dish
(dish_code, ingredient_code, volume_of_ingredients, count_of_ingredient)
VALUES (
  (SELECT dish_code FROM restaurant_scheme.dish WHERE dish.name = 'Лосось с терияки'),
  (SELECT ingredient_code FROM restaurant_scheme.ingredient WHERE ingredient.name = 'Лимон'),
  'г',
  30
);
```

Query | Query History

```
1  SELECT * FROM restaurant_scheme.composition_of_the_dish
2  ORDER BY dish_code ASC;
```

Data Output | Messages | Notifications

	dish_code integer	ingredient_code integer	volume_of_ingredients character varying (20)	composition_of_the_dish_id [PK] integer	count_of_ingredient integer
1	6	27	г	8	100
2	6	18	г	27	30
3	6	5	г	12	30
4	6	10	г	11	200
5	6	4	г	10	70
6	6	13	г	9	50
7	6	24	г	7	300
8	11	28	г	14	95

Total rows: 26 of 26 | Query complete 00:00:00.117

2. UPDATE (изменение данных в таблице order)

Query | Query History

```
1  SELECT * FROM restaurant_scheme.scheduling_work
2  ORDER BY status ASC;
```

Data Output | Messages | Notifications

	shift_id integer	personal_number integer	scheduling_work_id [PK] integer	status character varying (20)
1	7	10	2	Отпуск
2	3	8	8	Отпуск
3	11	11	9	Отпуск
4	9	13	11	Отпуск
5	12	12	10	Отпуск
6	5	4	4	Отпуск
7	2	5	5	Отпуск
8	10	14	12	Отпуск

Total rows: 12 of 12 | Query complete 00:00:00.144

Query | Query History

```
1  UPDATE restaurant_scheme.scheduling_work
2  SET status = 'Вышел'
3  WHERE personal_number IN (SELECT personal_number FROM restaurant_scheme.employee
4                WHERE full_name = 'Иван Андреев');
```

Query | Query History

```
1  SELECT * FROM restaurant_scheme.scheduling_work
2  ORDER BY status ASC;
```

Data Output | Messages | Notifications

	shift_id integer	personal_number integer	scheduling_work_id [PK] integer	status character varying (20)
1	1	3	3	Вышел
2	3	8	8	Отпуск
3	11	11	9	Отпуск
4	9	13	11	Отпуск
5	12	12	10	Отпуск
6	5	4	4	Отпуск
7	7	10	2	Отпуск
8	10	14	12	Отпуск

Total rows: 12 of 12 | Query complete 00:00:00.114

3. DELETE

Query | Query History

```
1  SELECT * FROM restaurant_scheme.composition_of_the_dish
2  ORDER BY dish_code ASC;
```

Data Output | Messages | Notifications

	dish_code integer	ingredient_code integer	volume_of_ingredients character varying (20)	composition_of_the_dish_id [PK] integer	count_of_ingredient integer
1	6	13	г	9	50
2	6	3	кг	29	1
3	6	18	г	27	30
4	6	5	г	12	30
5	6	10	г	11	200
6	6	4	г	10	70
7	6	24	г	7	300
8	6	27	г	8	100

Total rows: 27 of 27 | Query complete 00:00:00.137

Query | Query History

```
1  DELETE FROM restaurant_scheme.composition_of_the_dish
2  WHERE ingredient_code IN (
3    SELECT ingredient_code FROM restaurant_scheme.ingredient
4    WHERE ingredient.name = 'Мука'
5  );
```

Query | Query History

```
1  SELECT * FROM restaurant_scheme.composition_of_the_dish
2  ORDER BY dish_code ASC;
```

Data Output | Messages | Notifications

	dish_code integer	ingredient_code integer	volume_of_ingredients character varying (20)	composition_of_the_dish_id [PK] integer	count_of_ingredient integer
1	6	27	г	8	100
2	6	18	г	27	30
3	6	5	г	12	30
4	6	10	г	11	200
5	6	4	г	10	70
6	6	13	г	9	50
7	6	24	г	7	300
8	11	28	г	14	95

Total rows: 26 of 26 | Query complete 00:00:00.108

Создание индексов

1. **Простой индекс**

До создания индекса:

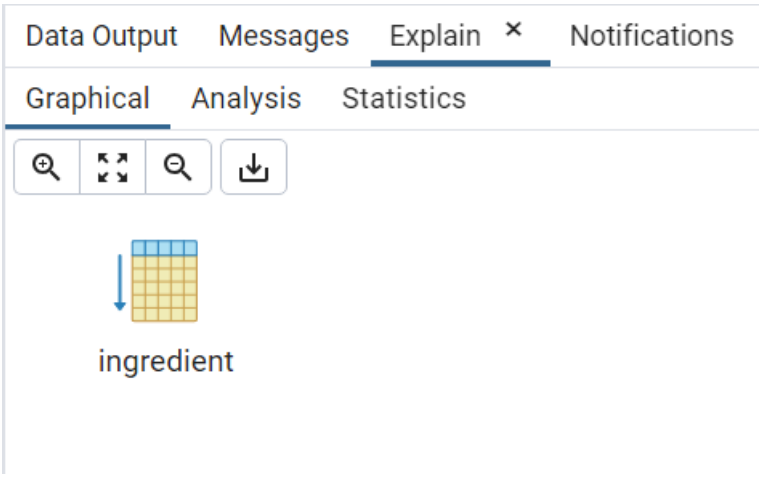
Query Query History

```
1  SELECT name FROM restaurant_scheme.ingredient
2  WHERE ingredient_type = 'Сухие продукты';
```

Data Output Messages Explain Notifications

	name character varying (30)
1	Сахар
2	Мука
3	Рис
4	Соль поваренная
5	Кофе
6	Какао порошок
7	Нори

```
Successfully run. Total query runtime: 130 msec.
7 rows affected.
```


Data Output
Messages
Explain
Notifications
Graphical
Analysis
Statistics
ingredient

Создадим индекс:

Query Query History

```
1  CREATE INDEX find_ingredient_with_type
2  ON restaurant_scheme.ingredient (ingredient_type);
```

Data Output Messages Explain Notifications

```
CREATE INDEX

Query returned successfully in 1 secs 132 msec.
```

После создания индекса:

```
Successfully run. Total query runtime: 98 msec.
7 rows affected.
```

2. **Составной индекс**

До создания индекса:

Query | Query History

```sql
SELECT
    e.personal_number AS "id",
    e.full_name AS waiter_name,
    COUNT(tb.number_of_table) AS "count"
FROM restaurant_scheme.table tb
JOIN restaurant_scheme.employee e ON e.personal_number = tb.waiter_id
GROUP BY "id";
```

Data Output | Messages | Explain | Notifications

	id integer	waiter_name character varying (60)	count bigint
1	5	Михаил Петров	4
2	4	Анна Смирнова	4
3	12	Игорь Сапрыкин	4

```
Successfully run. Total query runtime: 132 msec.
3 rows affected.
```

Создадим индекс:

Query Query History

```
1  CREATE INDEX ind2
2  ON restaurant_scheme.table (number_of_table, waiter_id);
```

Data Output Messages Explain Notifications

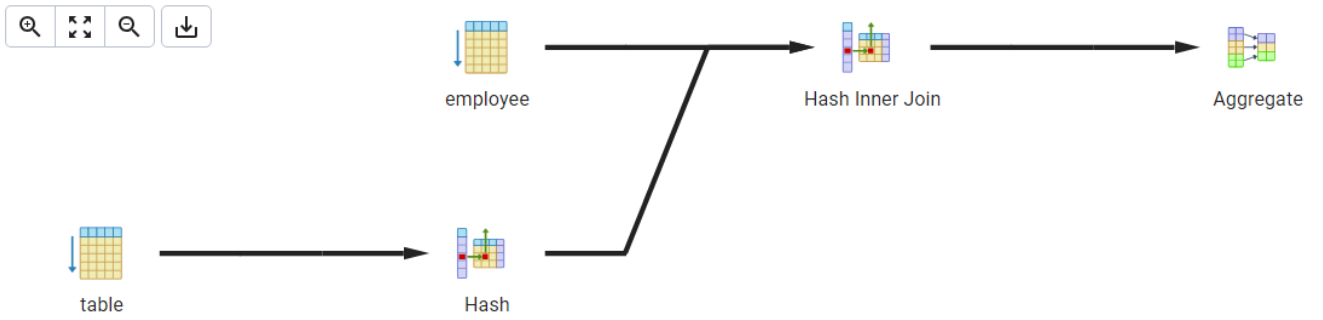
```
CREATE INDEX

Query returned successfully in 72 msec.
```

После создания индекса:

```
Successfully run. Total query runtime: 98 msec.
3 rows affected.
```

Data Output Messages Explain Notifications

Graphical Analysis Statistics



Вывод

В ходе выполнения данной лабораторной работы я научился писать sql запросы на выборку данных, создал представления, создал запросы на модификацию данных, а также разобрался в простых и составных индексах.