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

Отчет

ПО ПРАКТИЧЕСКОМУ ЗАДАНИЮ

«Лабораторная работа №2»

Автор: Митурский Богдан Антонович

Факультет: ИКТ

Группа: K32392

Преподаватель: Говорова М. М.

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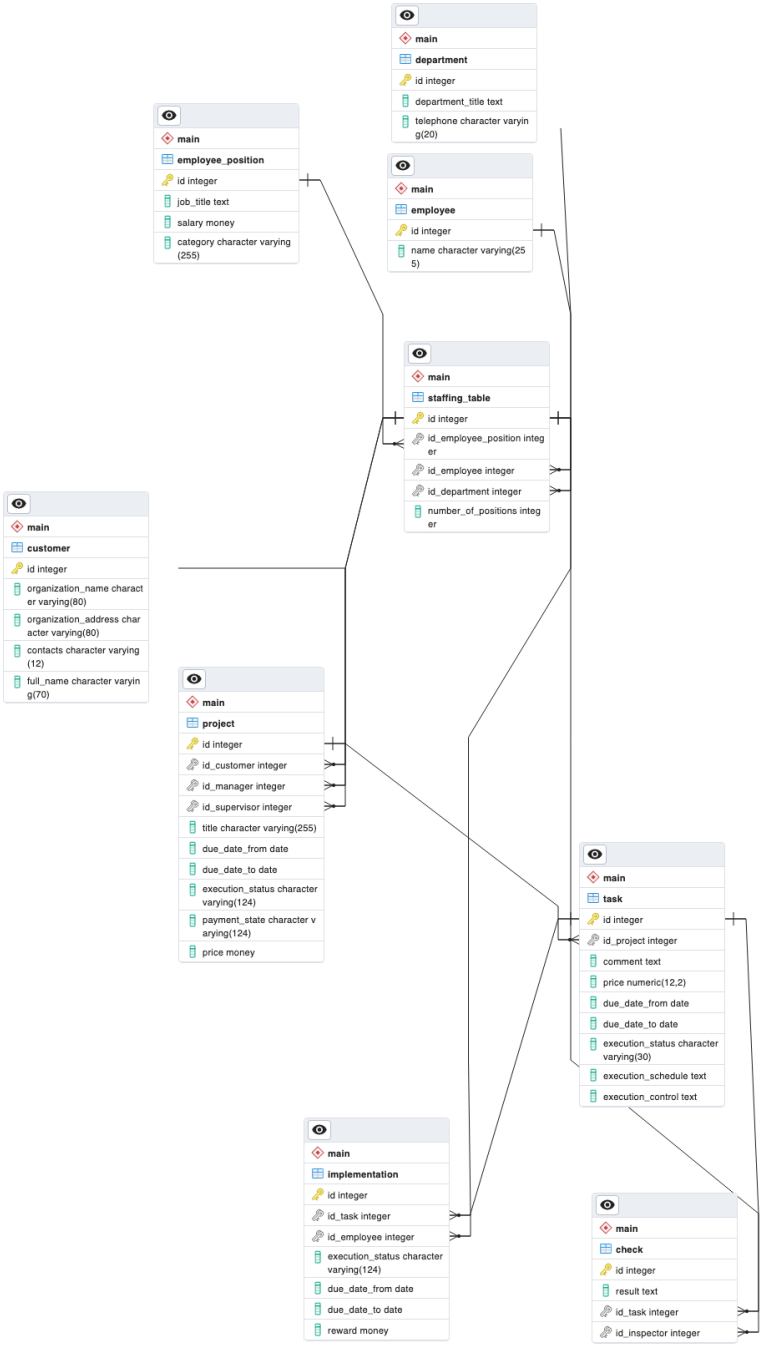
Цель работы: овладеть практическими навыками создания представлений и запросов на выборку данных к базе данных PostgreSQL, использования подзапросов при модификации данных и индексов.

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 логической модели базы данных, сгенерированная в Generate ERD:



Выполнение (запросы):

1. Составить список всех заданий каждого проекта с указанием организаций, отделов и исполнителей, занятых в его выполнении.

```
SELECT p.id as project_id, p.title as project_title, t.id as task_id,
c.organization_name, ep.job_title, e.name as employee_name,
d.department_title
FROM main.project p
JOIN main.task t ON p.id = t.id_project
JOIN main.customer c ON p.id_customer = c.id
JOIN main.implementation i ON t.id = i.id_task
JOIN main.employee e ON i.id_employee = e.id
JOIN main.staffing_table st ON e.id = st.id_employee
JOIN main.employee_position ep ON st.id_employee_position = ep.id
JOIN main.department d ON st.id_department = d.id;
```

	project_id integer	project_title character varying (255)	task_id integer	organization_name character varying (80)	job_title text	employee_name character varying (255)	department_title text
1	8	Project H	1	Master Solutions	Human Resources Specialist	Isabella Thomas	Engineering Department
2	3	Project C	2	Master Solutions	Manager	David Lopez	Sales Department
3	9	Project I	3	ABC Company	Human Resources Specialist	Grace Carter	Finance Department
4	3	Project C	4	Master Solutions	Marketing Coordinator	Chloe Wright	Engineering Department
5	10	Project J	5	123 Industries	Software Engineer	Jane Smith	Engineering Department
6	6	Project F	6	Progressive Company	Marketing Coordinator	Chloe Wright	Engineering Department
7	1	Project A	7	Tech Solutions	Accountant	James Lewis	Sales Department
8	2	Project B	8	First Class Company	Manager	David Lopez	Sales Department
9	7	Project G	9	123 Industries	Manager	David Lopez	Sales Department
10	4	Project D	10	Globe Corporation	Sales Representative	Andrew Hernandez	Human Resources Department
11	7	Project G	11	123 Industries	Software Engineer	Sophia Martinez	Finance Department
12	4	Project D	12	Globe Corporation	Marketing Coordinator	Olivia Brown	Engineering Department
13	1	Project A	13	Tech Solutions	Human Resources Specialist	Grace Carter	Finance Department
14	5	Project E	14	Dynamic Solutions	Manager	David Lopez	Sales Department

2. Составить список проектов, работа над которыми была начата больше месяца назад.

```
SELECT p.id as project_id, p.title as project_title, p.due_date_from,
p.due_date_to
FROM main.project p
```

```
WHERE due_date_from < NOW() - INTERVAL '1 month';
```

	project_id integer	project_title character varying (255)	due_date_from date	due_date_to date
1	1	Project A	2023-05-20	2023-06-20

3. Вывести список сотрудников, оклад которых превышает средний оклад сотрудников своего отдела.

```
SELECT e.id, e.name
FROM main.employee e
JOIN main.staffing_table st ON e.id = st.id_employee
JOIN main.employee_position ep ON st.id_employee_position = ep.id
WHERE CAST(ep.salary AS NUMERIC) > (
    SELECT AVG(CAST(ep2.salary AS NUMERIC))
    FROM main.employee_position ep2
    JOIN main.staffing_table st2 ON ep2.id = st2.id_employee_position
    WHERE st2.id_department = st.id_department
);
```

	id [PK] integer	name character varying (255)
1	1	John Doe
2	2	Jane Smith
3	5	Daniel Wilson
4	7	Matthew Taylor
5	8	Sophia Martinez
6	11	Joseph Garcia
7	13	David Lopez
8	14	Mia Lee
9	17	James Lewis
10	19	Joshua Hall
11	20	Sofia Green
12	23	Benjamin Thompson
13	25	Logan King

4. Найти отдел, работающий над максимальным количеством проектов.

```
SELECT d.id, d.department_title, COUNT(DISTINCT p.id) as project_count
FROM main.department d
    JOIN main.staffing_table st ON d.id = st.id_department
    JOIN main.employee e ON st.id_employee = e.id
    JOIN main.implementation i ON e.id = i.id_employee
    JOIN main.task t ON i.id_task = t.id
    JOIN main.project p ON t.id_project = p.id
GROUP BY d.id, d.department_title
ORDER BY project_count DESC
LIMIT 1;
```

	id [PK] integer	department_title text	project_count bigint
1	1	Sales Department	5

5. Составить список сотрудников, проектов, заданий, в выполнении которых они участвуют и дат предполагаемого выполнения ими заданий. Учесть сотрудников, не участвующих в проектах

```
SELECT e.id as employee_id, e.name as employee_name, p.id as project_id, p.title as project_title, t.id as task_id, t.comment as task_comment, i.due_date_to as task_due_date

FROM main.employee e

    LEFT JOIN main.implementation i ON e.id = i.id_employee

    LEFT JOIN main.task t ON i.id_task = t.id

    LEFT JOIN main.project p ON t.id_project = p.id;
```

	employee_id integer	employee_name character varying (255)	project_id integer	project_title character varying (255)	task_id integer	task_comment text	task_due_date date
1	10	Isabella Thomas	8	Project H	1	Comment A	2023-05-25
2	13	David Lopez	3	Project C	2	Comment B	2023-05-25
3	28	Grace Carter	9	Project I	3	Comment C	2023-06-14
4	30	Chloe Wright	3	Project C	4	Comment D	2023-05-24
5	2	Jane Smith	10	Project J	5	Comment E	2023-06-17
6	30	Chloe Wright	6	Project F	6	Comment F	2023-06-09
7	17	James Lewis	1	Project A	7	Comment G	2023-06-10
8	13	David Lopez	2	Project B	8	Comment H	2023-05-23
9	13	David Lopez	7	Project G	9	Comment I	2023-06-09
10	15	Andrew Hernandez	4	Project D	10	Comment J	2023-06-03
11	8	Sophia Martinez	7	Project G	11	Comment K	2023-05-20
12	6	Olivia Brown	4	Project D	12	Comment L	2023-06-04
13	28	Grace Carter	1	Project A	13	Comment M	2023-05-21
14	13	David Lopez	5	Project E	14	Comment N	2023-06-09
26	16	Abigail Clark	7	Project G	26	Comment Z	2023-05-20
27	21	Christopher Young	3	Project C	27	Comment AA	2023-05-30
28	11	Joseph Garcia	1	Project A	28	Comment BB	2023-05-31
29	26	Ella Scott	8	Project H	29	Comment CC	2023-05-29
30	28	Grace Carter	9	Project I	30	Comment DD	2023-05-30
31	20	Sofia Green	[null]	[null]	[null]	[null]	[null]
32	25	Logan King	[null]	[null]	[null]	[null]	[null]
33	27	Samuel Adams	[null]	[null]	[null]	[null]	[null]
34	12	Emma Rodriguez	[null]	[null]	[null]	[null]	[null]
35	18	Charlotte Walker	[null]	[null]	[null]	[null]	[null]

6. Составить список сотрудников, не выполнивших задания в срок с указанием проектов и заданий, которые они должны были выполнить и количества дней просрочки выполнения заданий.

```
SELECT e.id as employee_id, e.name as employee_name, p.id as project_id, p.title as project_title, t.id as task_id, t.comment as task_comment, t.due_date_to as task_due_date,
    CURRENT_DATE - t.due_date_to as overdue_days
FROM main.employee e
JOIN main.implementation i ON e.id = i.id_employee
JOIN main.task t ON i.id_task = t.id
```

JOIN main.project p ON t.id_project = p.id

WHERE t.due_date_to < CURRENT_DATE AND i.execution_status != 'completed';

	employee_id integer	employee_name character varying (255)	project_id integer	project_title character varying (255)	task_id integer	task_comment text	task_due_date date	overdue_days integer
1	10	Isabella Thomas	8	Project H	1	Comment A	2023-05-25	27
2	13	David Lopez	3	Project C	2	Comment B	2023-05-26	26
3	28	Grace Carter	9	Project I	3	Comment C	2023-05-27	25
4	30	Chloe Wright	3	Project C	4	Comment D	2023-05-28	24
5	2	Jane Smith	10	Project J	5	Comment E	2023-05-29	23
6	30	Chloe Wright	6	Project F	6	Comment F	2023-05-30	22
7	17	James Lewis	1	Project A	7	Comment G	2023-05-31	21
8	13	David Lopez	2	Project B	8	Comment H	2023-06-01	20
9	13	David Lopez	7	Project G	9	Comment I	2023-06-02	19
10	15	Andrew Hernandez	4	Project D	10	Comment J	2023-06-03	18
11	8	Sophia Martinez	7	Project G	11	Comment K	2023-06-04	17
12	6	Olivia Brown	4	Project D	12	Comment L	2023-06-05	16
13	28	Grace Carter	1	Project A	13	Comment M	2023-06-06	15

7. Составить список проектов, в выполнении которого участвует более трех человек.

SELECT p.id as project_id, p.title as project_title, COUNT(DISTINCT e.id) as employee_count

FROM main.project p

JOIN main.task t ON p.id = t.id_project

JOIN main.implementation i ON t.id = i.id_task

JOIN main.employee e ON i.id_employee = e.id

GROUP BY p.id, p.title

HAVING COUNT(DISTINCT e.id) > 3;

	project_id integer	project_title character varying (255)	employee_count bigint
1	7	Project G	7

Выполнение (представления):

1. Для руководителей проектов, содержащее сведения об исполнителях, отделах, сроках выполнения заданий, включенных в проект.

   CREATE VIEW main.project_manager_view AS

   SELECT p.id as project_id, p.title as project_title, e.id as employee_id, e.name as employee_name, d.id as department_id, d.department_title, t.due_date_from as task_start_date, t.due_date_to as task_end_date

   FROM main.project p

   JOIN main.task t ON p.id = t.id_project

   JOIN main.implementation i ON t.id = i.id_task

   JOIN main.employee e ON i.id_employee = e.id

   JOIN main.staffing_table st ON e.id = st.id_employee

   JOIN main.department d ON st.id_department = d.id;

	project_id integer	project_title character varying (255)	employee_id integer	employee_name character varying (255)	department_id integer	department_title text	task_start_date date	task_end_date date
1	8	Project H	10	Isabella Thomas	2	Engineering Department	2023-05-20	2023-05-25
2	3	Project C	13	David Lopez	1	Sales Department	2023-05-21	2023-05-26
3	9	Project I	28	Grace Carter	4	Finance Department	2023-05-22	2023-05-27
4	3	Project C	30	Chloe Wright	2	Engineering Department	2023-05-23	2023-05-28
5	10	Project J	2	Jane Smith	2	Engineering Department	2023-05-24	2023-05-29
6	6	Project F	30	Chloe Wright	2	Engineering Department	2023-05-25	2023-05-30
7	1	Project A	17	James Lewis	1	Sales Department	2023-05-26	2023-05-31
8	2	Project B	13	David Lopez	1	Sales Department	2023-05-27	2023-06-01
9	7	Project G	13	David Lopez	1	Sales Department	2023-05-28	2023-06-02
10	4	Project D	15	Andrew Hernandez	3	Human Resources Department	2023-05-29	2023-06-03

2. Список проектов, срок выполнения которых истекает сегодня и которые включают больше трех невыполненных заданий.

   CREATE VIEW main.projects_due_today_with_uncompleted_tasks AS

   SELECT p.id, p.title, COUNT(t.id) AS uncompleted_tasks_count

   FROM main.project p

   JOIN main.task t ON t.id_project = p.id AND t.execution_status != 'Completed'

   WHERE p.due_date_to = CURRENT_DATE

GROUP BY p.id, p.title

HAVING COUNT(t.id) > 3;

	id integer	title character varying (255)	uncompleted_tasks_count bigint
1	20	Example Project	4

Выполнение (Модификация данных):

1. INSERT - Создать проект цена которого равна продолжительности самого длинного проекта умноженного на 10000.

До:

	id_customer integer	id_manager integer	id_supervisor integer	title character varying (255)	due_date_from date	due_date_to date	execution_status character varying (124)	payment_state character varying (124)	price money
1	7	18	28	Project A	2023-05-20	2023-06-20	In progress	In progress	$5,000.00
2	13	23	9	Project B	2023-06-01	2023-07-01	Completed successfully	Received	$8,000.00
3	19	7	21	Project C	2023-07-10	2023-08-10	Completed with errors	Not sent	$6,000.00
4	9	6	4	Project D	2023-06-15	2023-07-15	Cancelled	Received	$7,000.00
5	14	12	20	Project E	2023-07-05	2023-08-05	Not started	In progress	$5,500.00
6	18	20	9	Project F	2023-06-25	2023-07-25	In progress	Not sent	$4,500.00
7	3	3	13	Project G	2023-06-12	2023-07-12	Completed successfully	Received	$9,000.00
8	19	19	15	Project H	2023-07-08	2023-08-08	In progress	Not sent	$7,500.00
9	1	23	24	Project I	2023-07-15	2023-08-15	Not started	In progress	$6,000.00
10	3	28	24	Project J	2023-06-18	2023-07-18	In progress	Received	$6,500.00
11	20	1	2	Example Project	2023-06-22	2023-06-22	In progress	Not sent	$10,000.00

INSERT INTO main.project (id_customer, id_manager, id_supervisor, title, due_date_from, due_date_to, execution_status, payment_state, price)

VALUES (3, 18, 9, 'Project K', '2023-01-01', '2023-12-12', 'In progress', 'Not sent',

(SELECT (due_date_to - due_date_from) * 10000 FROM main.project ORDER BY (due_date_to - due_date_from) DESC LIMIT 1));

После:

	id_customer integer	id_manager integer	id_supervisor integer	title character varying (255)	due_date_from date	due_date_to date	execution_status character varying (124)	payment_state character varying (124)	price money
1	7	18	28	Project A	2023-05-20	2023-06-20	In progress	In progress	$5,000.00
2	13	23	9	Project B	2023-06-01	2023-07-01	Completed successfully	Received	$8,000.00
3	19	7	21	Project C	2023-07-10	2023-08-10	Completed with errors	Not sent	$6,000.00
4	9	6	4	Project D	2023-06-15	2023-07-15	Cancelled	Received	$7,000.00
5	14	12	20	Project E	2023-07-05	2023-08-05	Not started	In progress	$5,500.00
6	18	20	9	Project F	2023-06-25	2023-07-25	In progress	Not sent	$4,500.00
7	3	3	13	Project G	2023-06-12	2023-07-12	Completed successfully	Received	$9,000.00
8	19	19	15	Project H	2023-07-08	2023-08-08	In progress	Not sent	$7,500.00
9	1	23	24	Project I	2023-07-15	2023-08-15	Not started	In progress	$6,000.00
10	3	28	24	Project J	2023-06-18	2023-07-18	In progress	Received	$6,500.00
11	20	1	2	Example Project	2023-06-22	2023-06-22	In progress	Not sent	$10,000.00
12	3	18	9	Project K	2023-01-01	2023-12-12	In progress	Not sent	$310,000.00

2. UPDATE - Изменить статус выполнения на 'Completed' для всех задач, которые начались более месяца назад и еще не завершены.

До:

	id [PK] integer	id_project integer	comment text	price numeric (12,2)	due_date_from date	due_date_to date	execution_status character varying (30)	execution_schedule text	execution_control text
1	2	3	Comment B	1500.00	2023-05-21	2023-05-26	Completed successfully	Schedule B	Control B
2	7	1	Comment G	900.00	2023-05-26	2023-05-31	Completed successfully	Schedule G	Control G
3	10	4	Comment J	1200.00	2023-05-29	2023-06-03	Completed successfully	Schedule J	Control J
4	14	5	Comment N	900.00	2023-06-02	2023-06-07	Completed successfully	Schedule N	Control N
5	17	2	Comment Q	1200.00	2023-06-05	2023-06-10	Completed successfully	Schedule Q	Control Q
6	21	8	Comment U	900.00	2023-06-09	2023-06-14	Completed successfully	Schedule U	Control U
7	24	7	Comment X	1200.00	2023-06-12	2023-06-17	Completed successfully	Schedule X	Control X
8	28	1	Comment BB	900.00	2023-06-16	2023-06-21	Completed successfully	Schedule BB	Control BB

```
UPDATE main.task

SET execution_status = 'Completed successfully'

WHERE id IN (

   SELECT id

   FROM main.task

   WHERE execution_status NOT LIKE '%Completed%' AND due_date_from < CURRENT_DATE - INTERVAL '1 month'

);
```

После:

	id [PK] integer	id_project integer	comment text	price numeric (12,2)	due_date_from date	due_date_to date	execution_status character varying (30)	execution_schedule text	execution_control text
1	2	3	Comment B	1500.00	2023-05-21	2023-05-26	Completed successfully	Schedule B	Control B
2	7	1	Comment G	900.00	2023-05-26	2023-05-31	Completed successfully	Schedule G	Control G
3	10	4	Comment J	1200.00	2023-05-29	2023-06-03	Completed successfully	Schedule J	Control J
4	14	5	Comment N	900.00	2023-06-02	2023-06-07	Completed successfully	Schedule N	Control N
5	17	2	Comment Q	1200.00	2023-06-05	2023-06-10	Completed successfully	Schedule Q	Control Q
6	21	8	Comment U	900.00	2023-06-09	2023-06-14	Completed successfully	Schedule U	Control U
7	24	7	Comment X	1200.00	2023-06-12	2023-06-17	Completed successfully	Schedule X	Control X
8	28	1	Comment BB	900.00	2023-06-16	2023-06-21	Completed successfully	Schedule BB	Control BB
9	1	8	Comment A	1000.00	2023-05-20	2023-05-25	Completed successfully	Schedule A	Control A

3. DELETE – Удалить все задачи которые не были начаты и срок их выполнения уже истек.

До:

	id [PK] integer	id_project integer	comment text	price numeric (12,2)	due_date_from date	due_date_to date	execution_status character varying (30)	execution_schedule text	execution_control text
1	5	10	Comment E	1100.00	2023-05-24	2023-05-29	Not started	Schedule E	Control E
2	9	7	Comment I	1000.00	2023-05-28	2023-06-02	Not started	Schedule I	Control I
3	13	1	Comment M	1300.00	2023-06-01	2023-06-06	Not started	Schedule M	Control M
4	16	7	Comment P	1000.00	2023-06-04	2023-06-09	Not started	Schedule P	Control P
5	20	5	Comment T	1300.00	2023-06-08	2023-06-13	Not started	Schedule T	Control T
6	23	7	Comment W	1000.00	2023-06-11	2023-06-16	Not started	Schedule W	Control W
7	27	3	Comment AA	1300.00	2023-06-15	2023-06-20	Not started	Schedule AA	Control AA

```
-- Удаляем записи из таблицы "implementation", т.к. они зависят от task и просто удалить task не получится

DELETE FROM main.implementation

WHERE id_task IN (

    SELECT id

    FROM main.task

    WHERE execution_status = 'Not started' AND due_date_to < CURRENT_DATE

);
```

-- Удаляем записи из таблицы "task"

DELETE FROM main.task

WHERE execution_status = 'Not started' AND due_date_to < CURRENT_DATE;

После:

Выполнение (индексы):

До индексов:

EXPLAIN ANALYZE

SELECT st.id_employee, pr.title, t.id

FROM main.project AS pr

JOIN main.task AS t ON pr.id = t.id_project

JOIN main.implementation AS i ON t.id = i.id_task

JOIN main.staffing_table AS st ON st.id_employee = i.id_employee

JOIN main.department AS d ON d.id = st.id_department

WHERE d.id > 1;

Planing Time: 17ms

Excution Time 0.380ms

CREATE INDEX idx_task_project_id ON main.task(id_project);

CREATE INDEX idx_implementation_task_id ON main.implementation(id_task);

```
CREATE INDEX idx_implementation_employee_id ON main.implementation(id_employee);
```

После индексов:

Planing Time: 1ms

Excution Time 2.060ms

Выводы:

В процессе выполнения лабораторной работы было освоено составление запросов INSERT, UPDATE и DELETE. Также, были созданы индексы, что привело к ускорению их выполнения.