Федеральное государственное бюджетное образовательное учреждение высшего образования
"МИРЭА – Российский технологический университет"
РТУ МИРЭА

Институт кибербезопасности и цифровых технологий

Кафедра КБ-14 «Цифровые технологии обработки данных»

ОТЧЁТ ПО УЧЕБНОЙ ПРАКТИКЕ №2-6

По дисциплине

«Программные средства манипулирования данными»

Наименование дисциплины

Тема практики: «Работа со сторонними базами данных. Построение и оптимизация.»

Студент группы БСБО-06-21 Ефимов А. Р.

(учебная группа) Фамилия И. О.

Руководитель учебной практики: Котиливец И. Д. Козлов А. М.

Фамилия И. О.

Работа представлена к защите «11» сентября 2023г.

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Содержание

Практическая работа №2-6.

Разработка ER-диаграммы.

Разработка ER диаграммы и реализация структуры базы данных используя PostgreSQL. База данных должна быть нормализована и лишена аномалий удаления, добавления и редактирования.

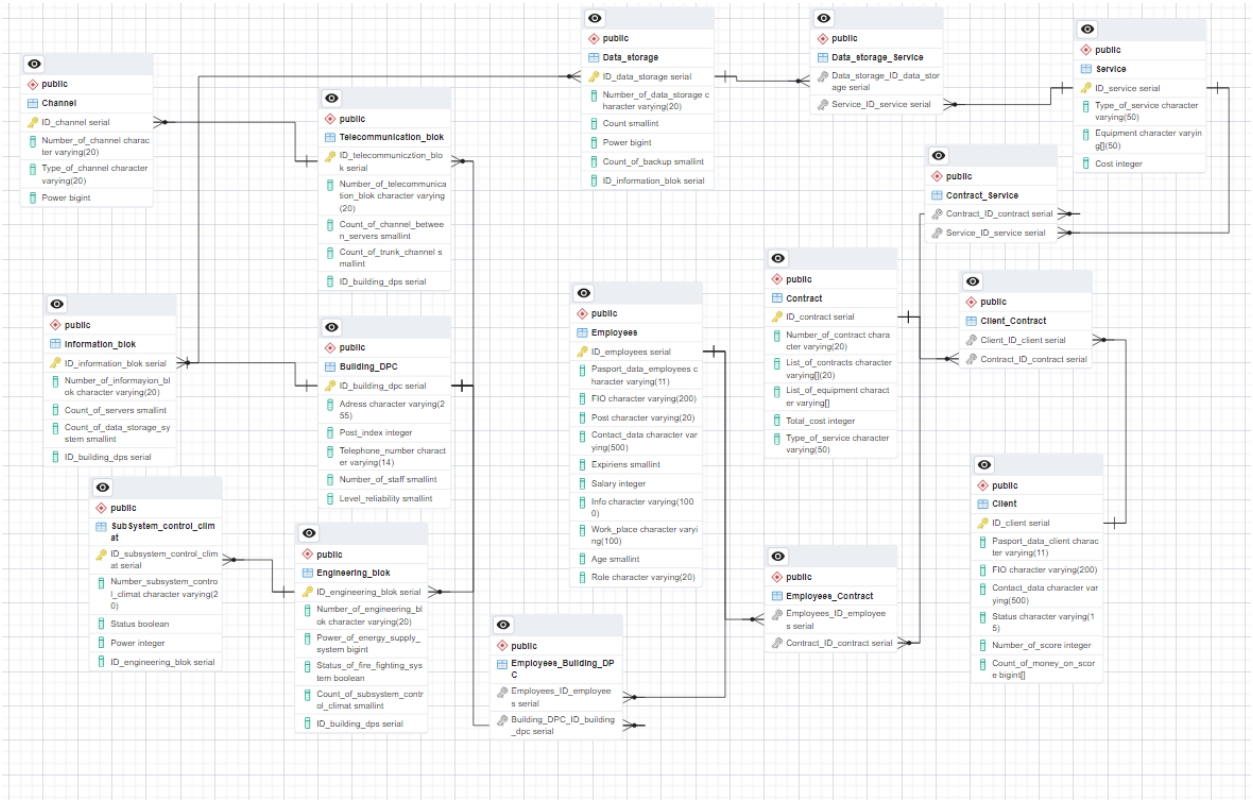


Таблица 1.Описание сущностей БД:

№	Название	Первичный ключ	Внешний ключ
1	Channel	ID_channel	
2	Information_blok	ID_information_blok	ID_building_dps
3	SubSystem_control_climat	ID_subsystem_control_climat	ID_engineering_blok
4	Telecommunication_blok	ID_telecommunication_blok	ID_building_dps
5	Building_DPC	ID_building_dpc	
6	Engineering_blok	ID_engineering_blok	ID_building_dps
7	Data_storage	ID_data_storage	ID_information_blok
8	Employees	ID_employees	
9	Employeees_Building_DPC		Employees_ID_employees Building_DPC_ID_building_pds
10	Contract	ID_contract	

11	Employees_Contract		Employees_ID_employees Contract_ID_contract
12	Client	ID_client	
13	Client_Contract		Client_ID_client Contract_ID_contract
14	Service	ID_service	
15	Data_storage_service		Data_storage_ID_data_storage Service_ID_service
16	Contract_Service		Contract_ID_contract Service_ID_service

Таблица 2. Описание всех атрибутов:

Сущность	Атрибут	Назначение	Тип
Channel	ID_channel	Первичный ключ	serial
	Number_of_chennel	Кол-во каналов	Varchar(20)
	Type_of_channel	Тип канала	Varchar(20)
	Power	мощность	bigint
Information_blok	ID_information_blok	Первичный ключ	Serial
	Number_of_information_blok	Номер блока	Varchar(20)
	Count_of_services	Кол-во сервисов	smallint
	Count_of_data_storage_system	Кол-во хранилищ данных	Smallint
	ID_building_dps	Внешний ключ	serial
SubSystem_control_climat	ID_subsystem_control_climat	Первичный ключ	Serial
	Number_subsystem_control_climat	Кол-во подсистем	Varchar(20)
	Status	Статус	Boolean
	Power	Мощность	Integer
	ID_engineering_blok	Внешний ключ	serial

Telecommunication_blok	ID_telecommunication_blok	Первичный ключ	Serial
	Number_of_telecommunication_blok	Номер блока	Varchar(20)
	Count_of_channel_between_services	Кол-во каналов между сервисами	smallint
	Count_of_trunk_channel	Кол-во магистральный каналов	smallint
	ID_Building_dps	Внешний ключ	Serial
Building_DPC	ID_building_dpc	Первичный ключ	Serial
	Addres	Адрес	Varchar(255)
	Post_index	Почтовый индекс	Integer
	Telephone_number	Телефон	Varchar(14)
	Number_of_staff	Кол-во сотруднико в	Smallint
	Level_of_reliability	Уровень защищенно сти	smallint
Engineering_blok	ID_engineering_blok	Первичный ключ	serial
	Number_of_energy_supply_system	Кол-во систем энергии	Varchar(20)
	Power_of_energy_supply_system	Мощность систем энергии	Bigint
	Status_of_fire_fighting_system	Статус пожарной системы	boolean
	Count_of_subsystem_control_climat	Код-во подсистем климата	Smallint
	ID_building_dps	Внешний ключ	serial

Data_storage	ID_data_storage	Первичный ключ	Serial
	Number_of_data_storage	Номер	Varchar(20)
	Count	Кол-во	Smallint
	Power	Мощность	Bigint
	Count_of_backup	Кол-во резервов	Smallint
	ID_information_blok	Внешний ключ	Serial
Employees	ID_employees	Первичный ключ	Serial
	Passport_data_employees	Паспортные данные	Varchar(11)
	FIO	ФИО	Varchar(200)
	Post	Почта	Varchar(20)
	Contact_data	Контактные данные	Varchar(500)
	Expiriens	Стаж	Smallint
	Salary	Зарплата	Integer
	Info	информация	Varchar(1000)
	Work_place	Место работы	Varchar(100)
	Age	Возраст	Smallint
	Role	Роль	Varchar(20)
Employees_Building_DPC	Employees_ID_employees	Внешний ключ	Serial
	Building_DPC_ID_building_DPC	Внешний ключ	Serial
Contract	ID_contract	Первичный ключ	Serial
	Number_of_contract	Номер договора	Varchar(20)
	List_of_contracts	Список договоров	Varchar[](20)
	List_of_equipment	Список оборудования	Varchar[]
	Total_cost	Стоимость	Integer

	Type_of__service	Тип услуги	Varchar(50)
Employees_Contract	Employees_ID_employees	Внешний ключ	Serial
	Contract_ID_contract	Внешний ключ	Serial
Client	ID_client	Первичный ключ	Serial
	Passport_data_client	Паспортные данные	Varchar(11)
	FIO	ФИО	Varchar(200)
	Contact_data	Контактные данные	Varchar(500)
	Status	Статус	Varchar(15)
	Number_of_score	Номер счета	Integer
	Count_of_money_on_score	Кол-во денег на счету	Bigint[]
Client_Contract	Client_ID_client	Внешний ключ	Serial
	Contract_ID_contarct	Внешний ключ	Serial
Contract_Service	Contract_ID_contract	Внешний ключ	Serial
	Service_ID_service	Внешний ключ	Serial
Service	ID_service	Первичный ключ	serial
	Type_of_service	Тип услуги	Varchar(50)
	Equipment	оборудование	Varchar[](50)
	Cost	Стоимость	Integer
Data_storage_service	Data_storage_ID_data_storage	Внешний ключ	Serial
	Service_ID_service	Внешний ключ	serial

Заполнение тестовыми данными:

```
INSERT INTO public."Building_DPC" ("Adress", "Post_index",
"Telephone_number", "Number_of_staff", "Level_reliability") VALUES
    ('Москва, Академика Анохина, д 2', 34, '89995342345', 200, 2),
     ('Москва, Озёрная, д 5', 67, '894568384539', 2000, 1),
     ('Москва, Стромынка, д 45', 98, '89493793606', 500, 3),
     ('Москва, Малая Пироговская, д 10', 23, '89459375634', 100, 4),
     ('Москва, Проспект Вернадского, д 82', 90, '89009489008', 1000,
2),
     ('Москва, Проспект Вернадского, д 45', 56, '89458348756', 300,
3),
     ('Москва, Советская, д 67', 57, '89448132435', 250, 1),
     ('Краснодар, Ленина, д 34', 43, '89490876756', 560, 4),
     ('Анапа, Запорожская, д 92', 21, '89000123453', 70, 3),
    ('Магадан, Нижняя, д 9', 1, '89456787698', 90, 2);


SELECT * FROM public."Building_DPC"



INSERT INTO public."Information_blok" ("Number_of_informayion_blok",
"Count_of_servers", "Count_of_data_storage_system", "ID_building_dps")
VALUES
    ('A23', 20, 6, 1),
     ('A24', 30, 5, 1),
     ('B10', 35, 7, 2),
     ('B11', 25, 3, 2),
     ('C45', 15, 4, 3),
     ('C46', 20, 1, 3),



INSERT INTO public."Information_blok" ("Number_of_informayion_blok",
"Count_of_servers", "Count_of_data_storage_system", "ID_building_dps")
VALUES
    ('A23', 20, 6, 1),
```

```
      ('A24', 30, 5, 1),
      ('B10', 35, 7, 2),
      ('B11', 25, 3, 2),
      ('C45', 15, 4, 3),
      ('C46', 20, 1, 3),
      ('D91', 19, 5, 4),
      ('D92', 18, 2, 4),
      ('E53', 18, 4, 5),
      ('E54', 22, 1, 5),
      ('F75', 22, 7, 6),
      ('F76', 15, 3, 6),
      ('G65', 7, 6, 7),
      ('G66', 17, 8, 7),
      ('H98', 8, 1, 8),
      ('H99', 9, 2, 8),
      ('J34', 23, 6, 9),
      ('J35', 14, 7, 9),
      ('I78', 11, 3, 10),
      ('I79', 15, 9, 10),
      ('H100', 12, 5, 8),
      ('A25', 16, 3, 1);


SELECT * FROM public."Information_blok"


INSERT INTO public."Telecommunication_blok"
("Number_of_telecommunication_blok",
"Count_of_channel_between_servers", "Count_of_trunk_channel",
"ID_building_dps") VALUES
    ('A21', 20, 6, 1),
      ('A22', 30, 5, 1),
      ('B8', 35, 7, 2),
      ('B9', 25, 3, 2),
```

```
    ('C43', 15, 4, 3),
    ('C44', 20, 1, 3),
    ('D89', 19, 5, 4),
    ('D90', 18, 2, 4),
    ('E51', 18, 4, 5),
    ('E52', 22, 1, 5),
    ('F73', 22, 7, 6),
    ('F74', 15, 3, 6),
    ('G63', 7, 6, 7),
    ('G64', 17, 8, 7),
    ('H96', 8, 1, 8),
    ('H97', 9, 2, 8),
    ('J32', 23, 6, 9),
    ('J33', 14, 7, 9),
    ('I76', 11, 3, 10),
    ('I78', 15, 9, 10),
    ('H98', 12, 5, 8),
    ('A23', 16, 3, 1);


SELECT * FROM public."Telecommunication_blok"


INSERT INTO public."Engineering_blok" ("Number_of_engineering_blok",
"Power_of_energy_supply_system", "Status_of_fire_fighting_system",
"Count_of_subsystem_control_climat", "ID_building_dps") VALUES
    ('A21', 20000, TRUE, 6, 1),
    ('A22', 30000, FALSE, 5, 1),
    ('B8', 40000, TRUE, 7, 2),
    ('B9', 50000, FALSE, 3, 2),
    ('C43', 60000, TRUE, 4, 3),
    ('C44', 70000, FALSE, 1, 3),
    ('D89', 80000, TRUE, 5, 4),
    ('D90', 90000, FALSE, 2, 4),
```

```
      ('E51', 100000, TRUE, 4, 5),
      ('E52', 90000, FALSE, 1, 5),
      ('F73', 80000, TRUE, 7, 6),
      ('F74', 70000, FALSE, 3, 6),
      ('G63', 60000, TRUE, 6, 7),
      ('G64', 50000, FALSE, 8, 7),
      ('H96', 40000, TRUE, 1, 8),
      ('H97', 30000, FALSE, 2, 8),
      ('J32', 20000, TRUE, 6, 9),
      ('J33', 10000, FALSE, 7, 9),
      ('I76', 20000, TRUE, 3, 10),
      ('I78', 30000, FALSE, 9, 10),
      ('H98', 40000, TRUE, 5, 8),
      ('A23', 20000, FALSE, 3, 1);


SELECT * FROM public."Engineering_blok"


INSERT INTO public."SubSystem_control_climat"
("Number_subsystem_control_climat", "Status", "Power",
"ID_engineering_blok") VALUES
      ('B8', TRUE,40000, 2),
      ('B9', FALSE, 50000, 2),
      ('C43', TRUE,60000, 3),
      ('C44', FALSE,70000, 3),
      ('D89', TRUE,80000, 4),
      ('D90', FALSE,90000, 4),
      ('E51', TRUE,100000, 5),
      ('E52', FALSE,90000, 5),
      ('F73', TRUE,80000, 6),
      ('F74', FALSE,70000, 6),
      ('G63', TRUE,60000, 7),
      ('G64', FALSE,50000, 7),
```

```
     ('H96', TRUE,40000, 8),
     ('H97', FALSE,30000, 8),
     ('J32', TRUE,20000, 9),
     ('J33', FALSE,10000, 9),
     ('I76', TRUE,20000, 10),
     ('I78', FALSE,30000, 10),
     ('H98', TRUE,40000, 8),
     ('A23', FALSE,200000, 1);


SELECT * FROM public."SubSystem_control_climat"


INSERT INTO public."Employees" ("Pasport_data_employees", "FIO",
"Post", "Contact_data", "Expiriens",
"Salary","Info","Work_place","Age","Role") VALUES
     ('384765 8723', 'Смиронов Вова Артемович', 'smirnov@dpc.ru',
'вова', 3, 300000, 'хороший работник', 'Стромынка', 23, 'Manager'),
     ('374836 1296', 'Ефремов Коля Викторович', 'efremov@dpc.ru',
'коля', 10, 10000, 'плохой работник', 'Вернадка', 30, 'Analyst'),
     ('294856 2947', 'Самотохин Артем Сергеевич', 'samotoxin@dpc.ru',
'артем', 4, 40000, 'нормальный работник', 'Анапа', 23, 'Admin'),
     ('297568 3857', 'Николаев Гоша Петрович', 'nikolaev@dpc.ru',
'гоша', 6, 60000, 'хороший работник', 'Краснодар', 29, 'Manager'),
     ('592648 3846', 'Еременко Маша Олеговна', 'eremenko@dpc.ru',
'маша', 5, 50000, 'плохой работник', 'Магадан', 34, 'Analyst'),
     ('461946 3746', 'Брязгин Егор Юрьевич', 'brazgin@dpc.ru', 'егор',
7, 70000, 'нормальный работник', 'Москва', 50, 'Admin'),
     ('385519 3847', 'Бушуев Андрей Витальевич', 'byshyev@dpc.ru',
'андрей', 30, 300000, 'хороший работник', 'Стромынка', 60, 'Manager'),
     ('462947 3746', 'Петров Вова Петрович', 'petrov@dpc.ru', 'вова',
23, 230000, 'плохой работник', 'Вернадка', 45, 'Analyst'),
     ('562947 1947', 'Лобанов Семен Семенович', 'lobanov@dpc.ru',
'семен', 3, 300000, 'плохой работник', 'Вернадка', 23, 'Admin'),
     ('294756 2947', 'Быков Андрей Евгеньевич', 'bikov@dpc.ru',
'андрей', 50, 500000, 'лучший работник', 'Вернадка, 82', 80,
'Manager')
```

```
SELECT * FROM pg_roles


SELECT * FROM public."Employees"


ALTER TABLE public."Client" ALTER COLUMN TYPE integer USING
"Count_of_money_on_score"::integer

ALTER TABLE public."Client" ALTER COLUMN "Count_of_money_on_score"
TYPE integer USING ("Count_of_money_on_score"::integer)

SELECT * FROM public."Client"


INSERT INTO public."Client" ("Pasport_data_client", "FIO",
"Contact_data", "Status", "Number_of_score","Count_of_money_on_score")
VALUES

     ('384755 8724', 'Смиронов Петя Артемович', 'петя','обычный', 23,
23000),

     ('474836 2296', 'Ефремов Вова Викторович', 'вова', 'постоянный',
57, 58000),

     ('264856 2547', 'Самотохин Леша Сергеевич', 'леша', 'премиум',
34, 230000),

     ('298568 3057', 'Николаев Никита Петрович', 'никита', 'обычный',
98, 98000),

     ('592548 3746', 'Еременко Маша Олеговна', 'маша','постоянный',
84, 84000),

     ('461446 8746', 'Брязгин Петр Юрьевич', 'петр', 'премиум', 25,
76000),

     ('385819 3947', 'Бушуев Данил Витальевич', 'данил', 'обычный',
76, 23000),

     ('462247 3796', 'Петров Данил Петрович', 'данил','постоянный',
57, 57000),

     ('564947 1147', 'Лобанов Андрей Семенович', 'андрей','премиум',
87, 87000),

     ('294856 4947', 'Быков Семен Евгеньевич', 'семен', 'обычный', 11,
11000)

SELECT * FROM public."Client

INSERT INTO public."Channel" ("Number_of_channel", "Type_of_channel",
"Power") VALUES
```

```
      ('A23', 'обычный', 50000000),
      ('A24', 'обычный', 50000000),
      ('A25', 'обычный', 60000000),
      ('A26', 'обычный', 60000000),
      ('A29', 'обычный', 70000000),
      ('A28', 'обычный', 70000000),
      ('B30', 'магистарльный', 500000000),
      ('B31', 'магистральный', 600000000),
      ('B32', 'магистральный', 600000000),
      ('B33', 'магистральный', 700000000)
SELECT * FROM public."Channel"


INSERT INTO public."Data_storage" ("Number_of_data_storage", "Count",
"Power","Count_of_backup", "ID_information_blok") VALUES
    ('A21', 40, 20, 6, 1),
     ('A22',34,  30, 5, 1),
     ('B8', 56, 35, 7, 2),
     ('B9',23,  25, 3, 2),
     ('C43', 25, 15, 4, 3),
     ('C44',15,  20, 1, 3),
     ('D89',20,  19, 5, 4),
     ('D90', 19, 18, 2, 4),
     ('E51',18,  18, 4, 5),
     ('E52',18,  22, 1, 5),
     ('F73',22, 22, 7, 6),
     ('F74',22, 15, 3, 6),
     ('G63', 15, 7, 6, 7),
     ('G64',7, 17, 8, 7),
     ('H96',17, 8, 1, 8),
     ('H97',8,  9, 2, 8),
     ('J32',9, 23, 6, 9),
```

```
     ('J33',23, 14, 7, 9),
     ('I76', 14, 11, 3, 10),
     ('I78', 11, 15, 9, 10),
     ('H98', 15, 12, 5, 8),
     ('A23',12, 16, 3, 1);
SELECT * FROM public."Data_storage"


INSERT INTO public."Contract"
("Number_of_contract","List_of_contracts","List_of_equipment","Total_c
ost","Type_of_service") VALUES
    ('A1', '{"Договор1", "Договор2"}', '{"Сервер", "Компьютер"}',
5000, 'Аренда'),
     ('A2', '{"Договор3", "Договор4"}', '{"Сервер", "Канал"}', 3000,
'Продление аренды'),
     ('A3', '{"Договор5"}', '{"Компьютер"}', 10000, 'Покупка'),
     ('A4', '{"Договор6", "Договор7"}', '{"Компьютер", "Сервер"}',
5000, 'Аренда'),
     ('A5', '{"Договор8", "Договор9"}', '{"Сервер", "Канал"}', 3000,
'Продление аренды'),
     ('A6', '{"Договор10"}', '{"Компьютер"}', 10000, 'Покупка'),
     ('A7', '{"Договор11", "Договор12"}', '{"Канал", "Компьютер"}',
8500, 'Аренда'),
     ('A8', '{"Договор13", "Договор14"}', '{"Канал", "Сервер"}',
23500, 'Аренда'),
     ('A9', '{"Договор15", "Договор16"}', '{"Компьютер", "Сервер"}',
3500, 'Продление аренды'),
     ('A10', '{"Договор17", "Договор18"}', '{"Компьютер", "Канал"}',
8500, 'Аренда')
SELECT * FROM  public."Contract"


INSERT INTO public."Service" ("Type_of_service","Equipment","Cost")
VALUES
     ('Продление аренды', '{"Канал"}', 500),
     ('Покупка', '{"Компьютер"}', 10000),
     ('Аренда', '{"Сервер"}', 20000),
```

```
	('Продление аренды', '{"Сервер"}', 2500),
	('Покупка', '{"Сервер"}', 100000),
	('Аренда', '{"Компьютер"}', 5000),
	('Покупка', '{"Канал"}', 5000),
	('Продление аренды', '{"Компьютер"}', 1000),
	('Аренда', '{"Канал"}', 3500)
SELECT * FROM public."Service"


INSERT INTO public."Employees_Building_DPC"
("Employees_ID_employees","Building_DPC_ID_building_dpc") VALUES
	(1, 3),
	(2, 6),
	(3, 9),
	(4, 8),
	(5, 10),
	(6, 2),
	(7, 3),
	(8, 5),
	(9, 6),
	(10, 5)
SELECT * FROM public."Employees_Building_DPC"


INSERT INTO public."Data_storage_Service"
("Data_storage_ID_data_storage","Service_ID_service") VALUES
	(1, 3),
	(2, 1),
	(3, 4),
	(4, 9),
	(5, 7),
	(6, 2),
	(7, 1),
	(8, 5),
```

```
      (9, 6),
      (10, 5),
      (1, 8),
      (2, 9),
      (3, 3),
      (4, 4),
      (5, 5),
      (6, 7),
      (7, 3),
      (8, 3),
      (9, 6),
      (10, 5)
SELECT * FROM public."Data_storage_Service"


INSERT INTO public."Employees_Contract"
("Employees_ID_employees","Contract_ID_contract") VALUES
      (2, 1),
      (5, 2),
      (8, 3),
      (2, 4),
      (5, 5),
      (8, 6),
      (2, 7),
      (5, 8),
      (5, 9),
      (8, 10)
SELECT * FROM public."Employees_Contract"


INSERT INTO public."Client_Contract"
("Client_ID_client","Contract_ID_contract") VALUES
      (1, 1),
      (2, 2),
```

```
      (3, 3),
      (4, 4),
      (5, 5),
      (6, 6),
      (7, 7),
      (8, 8),
      (9, 9),
      (10, 10)
SELECT * FROM public."Client_Contract"


INSERT INTO public."Contract_Service"
("Contract_ID_contract","Service_ID_service") VALUES
      (11, 3),
      (11, 6),
      (12, 1),
      (12, 4),
      (13, 2),
      (14, 6),
      (14, 3),
      (15, 1),
      (15, 4),
      (16, 2),
      (17, 6),
      (17, 9),
      (18, 3),
      (18, 9),
      (19, 4),
      (19, 8),
      (20, 9),
      (20, 6)
SELECT * FROM public."Contract_Service"
```

Создание ролей и групп ролей и назначение привиллегий.

Создание ролей и групп ролей и назначение привиллегий. Создаётся 10 пользователей, по 3 администратора и аналитика и 4 менеджера. Для пользователей, аналитиков, админов и менеджеров создаются супергруппы. Пользователи могут входить в систему. Администраторы получают все привиллегии к базе данных. Аналитики могут читать все данные и делать все с договорами. Менеджеры могут выбирать, вставлять и удалять данные, связанные с пользователями, услугами и оборудованием.

```
CREATE ROLE samotoxin_artem superuser createrole createdb

CREATE ROLE briazgin_egor superuser createrole createdb

CREATE ROLE lobanov_semen superuser createrole createdb

CREATE ROLE sirnov_vova superuser

CREATE ROLE efremov_kolia superuser

CREATE ROLE nikolaev_gosha superuser

CREATE ROLE eremenko_maria_analyst superuser

CREATE ROLE bushuev_andrey superuser

CREATE ROLE petrov_vova superuser

CREATE ROLE bikov_andrey superuser


CREATE ROLE admininstrator

CREATE ROLE manager

CREATE ROLE analyst

GRANT samotoxin_artem, briazgin_egor, lobanov_semen to administrator

GRANT sirnov_vova, nikolaev_gosha, bushuev_andrey, bikov_andrey to
manager

GRANT efremov_kolia, eremenko_maria_analyst, petrov_vova to analyst

GRANT ALL PRIVILEGES on database "DPC_1" to admininstrator;


GRANT pg_read_all_data to analyst

GRANT ALL PRIVILEGES on public."Contract", public."Client_Contract",
public."Contract_Service" to analyst;

REVOKE SELECT, INSERT, DELETE on public."Client" from analyst
```

```
REVOKE SELECT, INSERT, DELETE on public."Service" from analyst
REVOKE SELECT, INSERT, DELETE on public."Data_storage" from analyst
GRANT SELECT, INSERT, DELETE on public."Client" to manager
GRANT SELECT, INSERT, DELETE on public."Service" to manager
GRANT SELECT, INSERT, DELETE on public."Data_storage" to manager

SELECT * FROM pg_roles

CREATE ROLE smirnov_petia LOGIN
CREATE ROLE efremov_vova LOGIN
CREATE ROLE samotoxin_alex LOGIN
CREATE ROLE nikolaev_nikita LOGIN
CREATE ROLE eremenko_maria LOGIN
CREATE ROLE briazgin_petr LOGIN
CREATE ROLE bushuev_danil LOGIN
CREATE ROLE petrov_danil LOGIN
CREATE ROLE lobanov_andrey LOGIN
CREATE ROLE bikov_semen LOGIN

CREATE ROLE users
GRANT smirnov_petia, efremov_vova,
samotoxin_alex,nikolaev_nikita,eremenko_maria,briazgin_petr,bushuev_da
nil,petrov_danil,lobanov_andrey,bikov_semen to users
GRANT SELECT on public."Service" to users
ALTER ROLE smirnov_petia WITH PASSWORD 'smirnov_petia_password';
ALTER ROLE efremov_vova WITH PASSWORD 'efremov_vova_password';
ALTER ROLE samotoxin_alex WITH PASSWORD 'samotoxin_alex_password';
ALTER ROLE nikolaev_nikita WITH PASSWORD 'nikolaev_nikita_password';
ALTER ROLE eremenko_maria WITH PASSWORD 'eremenko_maria_password';
ALTER ROLE briazgin_petr WITH PASSWORD 'briazgin_petr_password';
ALTER ROLE bushuev_danil WITH PASSWORD 'bushuev_danil_password';
ALTER ROLE petrov_danil WITH PASSWORD 'petrov_danil_password';
```

```
ALTER ROLE lobanov_andrey WITH PASSWORD 'lobanov_andrey_password';

ALTER ROLE bikov_semen WITH PASSWORD 'bikov_semen_password';
```

Настройка политик безопасности.

Настройка политик безопасности - менеджер имеет доступ только к своим клиентам.

```
CREATE POLICY admin_samotoxin ON public."Building_DPC" TO
samotoxin_artem USING ("ID_building_dpc" = 9);

CREATE POLICY admin_briazgin ON public."Building_DPC" TO briazgin_egor
USING ("ID_building_dpc" = 2);

CREATE POLICY admin_lobanov ON public."Building_DPC" TO lobanov_semen
USING ("ID_building_dpc" = 6);

CREATE POLICY manager_sirnov ON public."Client" TO sirnov_vova USING
("ID_client" IN (1,2,3));

CREATE POLICY manager_nikolaev ON public."Client" TO nikolaev_gosha
USING ("ID_client" IN (4,5,6));

CREATE POLICY manager_bushuev ON public."Client" TO bushuev_andrey
USING ("ID_client" IN (7,8,9));

CREATE POLICY manager_bikov ON public."Client" TO bikov_andrey USING
("ID_client" IN (10));

ALTER POLICY manager_bushuev ON public."Client" TO bushuev_andrey
USING ("ID_client" IN (7,8));

ALTER POLICY manager_bikov ON public."Client" TO bikov_andrey USING
("ID_client" IN (9,10));
```

Добавление функций, триггеров и процедур.

Добавление функций, триггеров и процедур. Добавление триггеров определения статуса клиента, бонусной программы и создания договора.

```
CREATE FUNCTION automatic_status_trigger_1() RETURNS trigger AS $$

BEGIN

    UPDATE public."Client" SET OLD."Status" = 'премиум' WHERE
OLD."Count_of_money_on_score" > 100000;

    UPDATE public."Client" SET OLD."Status" = 'постоянный'WHERE
OLD."Count_of_money_on_score" > 50000 and

     OLD."Count_of_money_on_score" <= 100000;

    UPDATE public."Client" SET OLD."Status" = 'обычный' WHERE
OLD."Count_of_money_on_score" > 10000
```

```
      and OLD."Count_of_money_on_score" <= 50000;
      RETURN NULL;
END;
$$ LANGUAGE plpgsql

CREATE TRIGGER status_client AFTER UPDATE OF "Count_of_money_on_score"
ON public."Client" FOR EACH ROW EXECUTE
FUNCTION automatic_status_trigger_1()

DROP TRIGGER status_client ON public."Client"

CREATE FUNCTION bonyc_programm_1() RETURNS trigger AS $$
BEGIN
    UPDATE public."Client" SET OLD."Count_of_money_on_score" =
OLD."Count_of_money_on_score" + 10000 WHERE
OLD."Count_of_money_on_score" > 100000;
    UPDATE public."Client" SET OLD."Count_of_money_on_score" =
OLD."Count_of_money_on_score" + 5000 WHERE
OLD."Count_of_money_on_score" > 50000
      and OLD."Count_of_money_on_score" <= 100000;
    UPDATE public."Client" SET OLD."Count_of_money_on_score" =
OLD."Count_of_money_on_score" + 1000 WHERE
OLD."Count_of_money_on_score" > 10000
      and OLD."Count_of_money_on_score" <= 50000;
      RETURN NULL;
END;
$$ LANGUAGE plpgsql

CREATE TRIGGER dop_money AFTER UPDATE OF "Count_of_money_on_score"
ON public."Client" FOR EACH ROW EXECUTE
FUNCTION bonyc_programm_1()

DROP TRIGGER dop_money on public."Client"
```

```
CREATE FUNCTION automatic_income_by_equipment_2() RETURNS trigger AS
$$
BEGIN
     UPDATE public."Income_by_equipment" SET "Total_income" =
"Total_income"
+ NEW."Total_cost"
      WHERE "Title_eqipment" = 'Канал' AND 'Канал' =
ANY(NEW."List_of_equipment");
     UPDATE public."Income_by_equipment" SET "Total_income" =
"Total_income"
+ NEW."Total_cost"
      WHERE "Title_eqipment" = 'Сервер' AND 'Сервер' =
ANY(NEW."List_of_equipment");
     UPDATE public."Income_by_equipment" SET "Total_income" =
"Total_income"
+ NEW."Total_cost"
      WHERE "Title_eqipment" = 'Компьютер' AND 'Компьютер' =
ANY(NEW."List_of_equipment");

     RETURN NEW;
END;
$$ LANGUAGE plpgsql
CREATE TRIGGER income_by_equipment AFTER INSERT ON public."Contract"
FOR EACH ROW EXECUTE
FUNCTION automatic_income_by_equipment_2()
```

Добавление функций и триггеров связывания таблицы строений и контрактов, добавление значений в таблицу доход зданий, добавление триггеров для подсчёта общего дохода и дохода по услугам, триггера связывания стоек и контрактов и добавления в таблицу загруженности, а также функции создания контракта.

```
CREATE FUNCTION automatic_building_id_to_contracts_id() RETURNS
trigger AS $$

BEGIN

INSERT INTO public."Building_DPC_Contract"
("Building_DPC_ID_buildingdpc","Contract_ID_contract") VALUES

    ((SELECT "Building_DPC_ID_building_dpc" FROM
public."Employees_Building_DPC"

      WHERE "Employees_ID_employees" = NEW."Employees_ID_employees"),
NEW."Contract_ID_contract");


     RETURN NEW;

END;

$$ LANGUAGE plpgsql


CREATE TRIGGER building_to_contract AFTER INSERT ON
public."Employees_Contract"

FOR EACH ROW EXECUTE

FUNCTION automatic_building_id_to_contracts_id()


CREATE FUNCTION automatic_building_id_to_contracts_sum_id_7() RETURNS
trigger AS $$

BEGIN

    INSERT INTO public."Building_DPC_Contract_sum"
("Building_DPC_ID_buildingdpc","Contract_sum") VALUES

    ((SELECT NEW."Building_DPC_ID_buildingdpc" WHERE

       NOT EXISTS (SELECT "Building_DPC_ID_buildingdpc" FROM
public."Building_DPC_Contract_sum"

                      WHERE "Building_DPC_ID_buildingdpc" =
NEW."Building_DPC_ID_buildingdpc")), 0);


     UPDATE public."Building_DPC_Contract_sum" SET "Contract_sum" =
"Contract_sum"

+ (SELECT "Total_cost" FROM public."Contract"

      WHERE "ID_contract" = NEW."Contract_ID_contract"
```

```
   )
      WHERE "Building_DPC_ID_buildingdpc" =
NEW."Building_DPC_ID_buildingdpc";


     RETURN NEW;
END;
$$ LANGUAGE plpgsql


CREATE TRIGGER building_to_contract_sum AFTER INSERT ON
public."Building_DPC_Contract"
FOR EACH ROW EXECUTE
FUNCTION automatic_building_id_to_contracts_sum_id_7()
CREATE FUNCTION automatic_income_by_equipment_2() RETURNS trigger AS
$$
BEGIN
     UPDATE public."Income_by_equipment" SET "Total_income" =
"Total_income"
+ NEW."Total_cost"
      WHERE "Title_eqipment" = 'Канал' AND 'Канал' =
ANY(NEW."List_of_equipment");
     UPDATE public."Income_by_equipment" SET "Total_income" =
"Total_income"
+ NEW."Total_cost"
      WHERE "Title_eqipment" = 'Сервер' AND 'Сервер' =
ANY(NEW."List_of_equipment");
     UPDATE public."Income_by_equipment" SET "Total_income" =
"Total_income"
+ NEW."Total_cost"
      WHERE "Title_eqipment" = 'Компьютер' AND 'Компьютер' =
ANY(NEW."List_of_equipment");


     RETURN NEW;
END;
$$ LANGUAGE plpgsql
```

```
CREATE TRIGGER income_by_equipment AFTER INSERT ON public."Contract"
FOR EACH ROW EXECUTE
FUNCTION automatic_income_by_equipment_2()

CREATE TABLE IF NOT EXISTS public."Total_income"
(
    "Name" character varying(20) NOT NULL,
    "Total_income" integer
);
SELECT * FROM public."Total_income"

CREATE FUNCTION automatic_income_2() RETURNS trigger AS $$
BEGIN
     UPDATE public."Total_income" SET "Total_income" = "Total_income"
+ NEW."Total_cost"
      WHERE "Name" = 'DPC-1';

     RETURN NEW;
END;
$$ LANGUAGE plpgsql
CREATE TRIGGER income_service AFTER INSERT ON public."Contract"
FOR EACH ROW EXECUTE
FUNCTION automatic_income_2()

SELECT * FROM public."Count_by_service"

CREATE FUNCTION automatic_income_by_service_2() RETURNS trigger AS $$
BEGIN
     UPDATE public."Count_by_service" SET "Total_income" =
"Total_income"
+ NEW."Total_cost"
```

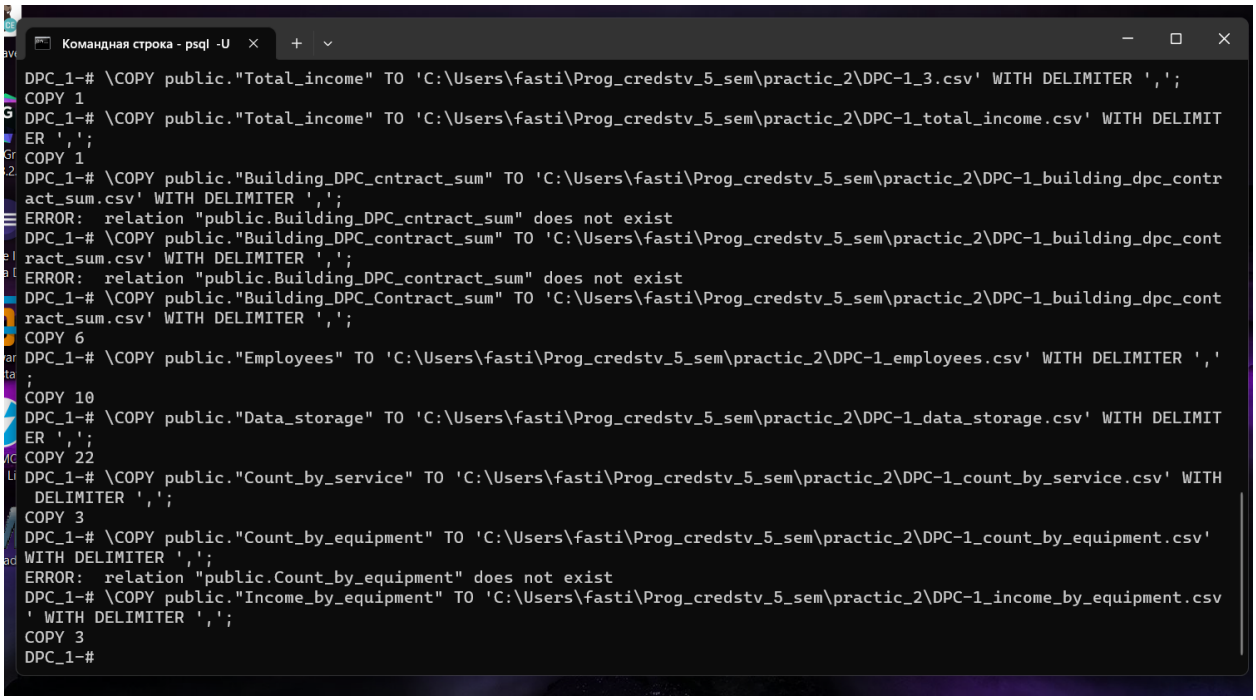
```
      WHERE "Service_title" = NEW."Type_of_service";


     RETURN NEW;
END;
$$ LANGUAGE plpgsql
CREATE TRIGGER income_by_service AFTER INSERT ON public."Contract"
FOR EACH ROW EXECUTE
FUNCTION automatic_income_by_service_2()


CREATE FUNCTION do_contract(number_con character varying(20),
list_contract character varying(20)[],
                                    list_equipment character varying[],
total_cost integer,
                                    type_service character varying(50))
RETURNS void AS $$
BEGIN
    INSERT INTO public."Contract"
("Number_of_contract","List_of_contracts","List_of_equipment","Total_c
ost","Type_of_service") VALUES
    (number_con, list_contract, list_equipment, total_cost,
type_service);
END;
$$ LANGUAGE plpgsql


SELECT do_contract('A11', '{"Договор19", "Договор20"}', '{"Компьютер",
"Канал"}', 8500, 'Аренда')


CREATE FUNCTION automatic_data_storage_id_to_contracts_id() RETURNS
trigger AS $$
BEGIN
INSERT INTO public."Data_storage_Contract"
("Data_storage_ID_data_storage","Contract_ID_contract") VALUES
    ((SELECT "Data_storage_ID_data_storage" FROM
public."Data_storage_Service"
```

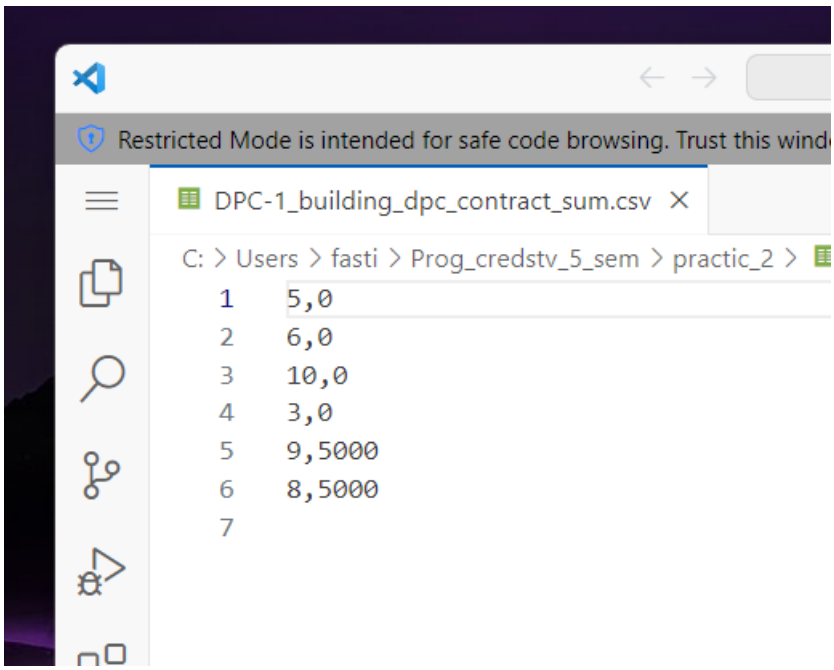
```
      WHERE "Service_ID_service" = NEW."Service_ID_service" LIMIT 1),
NEW."Contract_ID_contract");


     RETURN NEW;

END;

$$ LANGUAGE plpgsql


CREATE TRIGGER data_storage_to_contract AFTER INSERT ON
public."Contract_Service"

FOR EACH ROW EXECUTE

FUNCTION automatic_data_storage_id_to_contracts_id()



CREATE FUNCTION automatic_data_id_to_contracts_heavy_id_4() RETURNS
trigger AS $$

BEGIN

     UPDATE public."Data_storage" SET "Count_of_equipment_now" =
"Count_of_equipment_now"

+ (SELECT array_length("List_of_equipment", 1) FROM public."Contract"

      WHERE "ID_contract" = NEW."Contract_ID_contract"

   )

      WHERE "ID_data_storage" = NEW."Data_storage_ID_data_storage" and
("Count_of_equipment_now" +

      (SELECT array_length("List_of_equipment", 1) FROM
public."Contract"

      WHERE "ID_contract" = NEW."Contract_ID_contract"

   )) / "Count_of_equipment_total" < 0.9;


     RETURN NEW;

END;

$$ LANGUAGE plpgsql

CREATE TRIGGER data_to_contract_heavy AFTER INSERT ON
public."Data_storage_Contract"
```

```
FOR EACH ROW EXECUTE

FUNCTION automatic_data_id_to_contracts_heavy_id_4()
```

Экспорт отчета в формат csv команды и пример.

```
\COPY public."Total_income" TO
'C:\Users\fasti\Prog_credstv_5_sem\practic_2\DPC-1_3.csv' WITH
DELIMITER ',';

\COPY public."Building_DPC_Contract_sum" TO
'C:\Users\fasti\Prog_credstv_5_sem\practic_2\DPC-
1_building_dpc_contract_sum.csv' WITH DELIMITER ',';

\COPY public."Employees" TO
'C:\Users\fasti\Prog_credstv_5_sem\practic_2\DPC-1_employees.csv' WITH
DELIMITER ',';

\COPY public."Data_storage" TO
'C:\Users\fasti\Prog_credstv_5_sem\practic_2\DPC-1_data_storage.csv'
WITH DELIMITER ',';

\COPY public."Count_by_service" TO
'C:\Users\fasti\Prog_credstv_5_sem\practic_2\DPC-
1_count_by_service.csv' WITH DELIMITER ',';

\COPY public."Income_by_equipment" TO
'C:\Users\fasti\Prog_credstv_5_sem\practic_2\DPC-
1_income_by_equipment.csv' WITH DELIMITER ',';
```





Оптимизация работы с счет индексов.

```
CREATE INDEX ix_employees_fio ON public."Employees" ("FIO");

CREATE INDEX ix_employees_post ON public."Employees" ("Post");

CREATE INDEX ix_employees_salary ON public."Employees" ("Salary");


CREATE INDEX ix_data_storage ON public."Data_storage"
("ID_data_storage");


CREATE INDEX ix_building_dpc_address ON public."Building_DPC"
("Adress");

CREATE INDEX ix_building_dpc_post_index ON public."Building_DPC"
("Post_index");


CREATE INDEX ix_client_fio ON public."Client" ("FIO");

CREATE INDEX ix_client_status ON public."Client" ("Status");
```