

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ  
ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ  
«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО»

**Факультет безопасности информационных технологий**

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**«Информационная безопасность баз данных»**

**ОТЧЕТ ПО ЛАБОРАТОРНОЙ РАБОТЕ №5**

**«Резервирование БД и восстановление по контрольным точкам»**

**Выполнил студент(ы):**

группа/поток: N3347 / ИББД.Н63 1.2



Чу Ван Доан /

ФИО

Подпись

**Проверил:**

Салихов Максим Русланович /

ФИО

Подпись

Отметка о выполнении (один из вариантов:  
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## **Цель работы**

Получение навыков по резервированию и восстановлению БД

## **Задание**

1. Создание резервной копии БД согласно выбранному расписанию.
2. Внести случайные изменения в таблицы созданной вами базы данных (изменения вносятся до момента создания контрольной точки).
3. Продемонстрировать процесс отката к последней контрольной точке. Откатите изменения, выполненные в пункте 2.
4. Проанализируйте возможность анализа/просмотра изменений, которые были «откачены», с помощью системы логирования СУБД (в том числе сделанной ЛР 3) или с помощью средств системы резервирования.

# Ход Работы

## 1. Создание резервной копии БД согласно выбранному расписанию:

### 1.1. Выбор типа резервной копии

```
chu@chu-Latitude-5510:~/Documents/SOC/Database/BKSDL2/Database_backup_and_recovery_by_checkpoints$ sudo -u postgres pg_dump -F c -b -v -f /tmp/coffee_shop_db.backup coffee_shop_db
[sudo] password for chu:
pg_dump: last built-in OID is 16383
pg_dump: reading extensions
pg_dump: identifying extension members
pg_dump: reading schemas
pg_dump: reading user-defined tables
pg_dump: reading user-defined functions
pg_dump: reading user-defined types
pg_dump: reading procedural languages
pg_dump: reading user-defined aggregate functions
pg_dump: reading user-defined operators
pg_dump: reading user-defined access methods
pg_dump: reading user-defined operator classes
pg_dump: reading user-defined operator families
pg_dump: reading user-defined text search parsers
pg_dump: reading user-defined text search templates
pg_dump: reading user-defined text search dictionaries
pg_dump: reading user-defined text search configurations
pg_dump: reading user-defined foreign-data wrappers
pg_dump: reading user-defined foreign servers
pg_dump: reading default privileges
pg_dump: reading user-defined collations
pg_dump: reading user-defined conversions
pg_dump: reading type casts
pg_dump: reading transforms
pg_dump: reading table inheritance information
pg_dump: reading event triggers
pg_dump: finding extension tables
pg_dump: finding inheritance relationships
pg_dump: reading column info for interesting tables
pg_dump: finding table default expressions
pg_dump: flagging inherited columns in subtables
pg_dump: reading partitioning data
pg_dump: reading indexes
pg_dump: flagging indexes in partitioned tables
pg_dump: reading extended statistics
pg_dump: reading constraints
pg_dump: reading triggers
pg_dump: reading rewrite rules
pg_dump: reading policies
pg_dump: reading row-level security policies
pg_dump: reading publications
pg_dump: reading publication membership of tables
pg_dump: reading publication membership of schemas
pg_dump: reading subscriptions
pg_dump: reading large objects
pg_dump: reading dependency data
pg_dump: saving encoding = UTF8
pg_dump: saving standard_conforming_strings = on
pg_dump: saving search_path =
pg_dump: saving database definition
pg_dump: dumping contents of table "public.bill"
pg_dump: dumping contents of table "public.customer"
pg_dump: dumping contents of table "public.employse"
pg_dump: dumping contents of table "public.main_log"
pg_dump: dumping contents of table "public.order_product"
pg_dump: dumping contents of table "public.orders"
pg_dump: dumping contents of table "public.product"
pg_dump: dumping contents of table "public.roles"
pg_dump: dumping contents of table "public.secret_data"
pg_dump: dumping contents of table "public.secretdata"
pg_dump: dumping contents of table "public.supplier"
pg_dump: dumping contents of table "public.supplier_product"
pg_dump: dumping contents of table "public.users"
pg_dump: dumping contents of table "public.warehouse"
```

### 1.2. Настройка расписания автоматического резервного копирования

```
GNU nano 6.2 /tmp/crontab.DkW39I/crontab *
# Edit this file to introduce tasks to be run by cron.
#
# Each task to run has to be defined through a single line
# indicating with different fields when the task will be run
# and what command to run for the task
#
# To define the time you can provide concrete values for
# minute (m), hour (h), day of month (dom), month (mon),
# and day of week (dow) or use '*' in these fields (for 'any').
#
# Notice that tasks will be started based on the cron's system
# daemon's notion of time and timezones.
#
# Output of the crontab jobs (including errors) is sent through
# email to the user the crontab file belongs to (unless redirected).
#
# For example, you can run a backup of all your user accounts
# at 5 a.m every week with:
# 0 5 * * 1 tar -zcf /var/backups/home.tgz /home/
#
# For more information see the manual pages of crontab(5) and cron(8)
#
# m h dom mon dow command
0 3 * * * sudo -u postgres pg_dump -F c -b -v -f /tmp/coffee_shop_db.backup coffee_shop_db
```

### 1.3. Проверка резервной копии

```
chu@chu-Latitude-5510:~/Documents/SOC/Database/BMCSDL2/Database_backup_and_recovery_by_checkpoints$ ls /tmp/coffee_shop_db.backup
/tmp/coffee_shop_db.backup
```

## 2. Внесение случайных изменений в таблицы

### 2.1. Исходные данные таблицы сотрудников

```
coffee_shop_db=# select * from product;
 product_id | product_category_name | price  | warehouse_id
-----+-----+-----+-----
          1 | Арабика                | 481.21 |           1
          2 | Капучино               | 549.51 |           1
          3 | Латте                  | 778.31 |           5
          4 | Капучино               | 114.89 |           5
          5 | Робуста                | 465.66 |           5
          6 | Эспрессо               | 982.47 |           3
          7 | Робуста                | 347.12 |           2
          8 | Капучино               | 853.89 |           1
          9 | Арабика                | 616.37 |           4
         10 | Латте                  | 239.44 |           3
(10 rows)
```

### 2.2. Внесение изменений в таблицы

#### 2.2.1. Добавление новых данных

```
coffee_shop_db=# INSERT INTO product (product_category_name, price, warehouse_id) VALUES ('Random Coffee', 15.99, 4);
INSERT 0 1
coffee_shop_db=# select * from product;
 product_id | product_category_name | price  | warehouse_id
-----+-----+-----+-----
          1 | Арабика                | 481.21 |           1
          2 | Капучино               | 549.51 |           1
          3 | Латте                  | 778.31 |           5
          4 | Капучино               | 114.89 |           5
          5 | Робуста                | 465.66 |           5
          6 | Эспрессо               | 982.47 |           3
          7 | Робуста                | 347.12 |           2
          8 | Капучино               | 853.89 |           1
          9 | Арабика                | 616.37 |           4
         10 | Латте                  | 239.44 |           3
         12 | Random Coffee          | 15.99  |           4
(11 rows)
```

#### 2.2.2. Изменение существующих данных

```
coffee_shop_db=# UPDATE product SET price = price * 1.1 WHERE product_id = 12;
UPDATE 1
coffee_shop_db=# select * from product;
 product_id | product_category_name | price  | warehouse_id
-----+-----+-----+-----
          1 | Арабика                | 481.21 |           1
          2 | Капучино               | 549.51 |           1
          3 | Латте                  | 778.31 |           5
          4 | Капучино               | 114.89 |           5
          5 | Робуста                | 465.66 |           5
          6 | Эспрессо               | 982.47 |           3
          7 | Робуста                | 347.12 |           2
          8 | Капучино               | 853.89 |           1
          9 | Арабика                | 616.37 |           4
         10 | Латте                  | 239.44 |           3
         12 | Random Coffee          | 17.59  |           4
(11 rows)
```

#### 2.2.3. Удаление данных

```
coffee_shop_db=# DELETE FROM product WHERE product_id = 12;
DELETE 1
coffee_shop_db=# select * from product;
 product_id | product_category_name | price  | warehouse_id
-----+-----+-----+-----
          1 | Арабика                | 481.21 |           1
          2 | Капучино               | 549.51 |           1
          3 | Латте                  | 778.31 |           5
          4 | Капучино               | 114.89 |           5
          5 | Робуста                | 465.66 |           5
          6 | Эспрессо               | 982.47 |           3
          7 | Робуста                | 347.12 |           2
          8 | Капучино               | 853.89 |           1
          9 | Арабика                | 616.37 |           4
         10 | Латте                  | 239.44 |           3
(10 rows)
```

### 2.3. Проверка листа истории

```
coffee_shop_db=# select * from main_log;
 log_id | operation_type | operation_date | user_operator | changed_data
-----+-----+-----+-----+-----
      1 | INSERT        | 2024-11-22 23:37:04.072942 | postgres | [{"product_id":11,"product_category_name":"Latte","price":700.00,"warehouse_id":1}]
      2 | UPDATE        | 2024-11-22 23:37:20.029167 | postgres | [{"product_id":11,"product_category_name":"Latte","price":750.00,"warehouse_id":1}]
      3 | DELETE        | 2024-11-22 23:37:33.057911 | postgres | [{"product_id":11,"product_category_name":"Latte","price":750.00,"warehouse_id":1}]
     11 | INSERT        | 2024-11-23 15:08:06.054768 | postgres | [{"order_id":18,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     12 | INSERT        | 2024-11-23 15:08:10.361622 | postgres | [{"order_id":19,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     13 | INSERT        | 2024-11-23 15:08:36.393031 | postgres | [{"order_id":20,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     14 | INSERT        | 2024-11-23 15:08:39.520798 | postgres | [{"order_id":21,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     15 | DELETE        | 2024-11-23 15:19:29.940888 | postgres | [{"order_id":21,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     16 | DELETE        | 2024-11-23 15:19:33.596735 | postgres | [{"order_id":20,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     17 | DELETE        | 2024-11-23 15:19:38.354701 | postgres | [{"order_id":19,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     18 | DELETE        | 2024-11-23 15:19:41.542559 | postgres | [{"order_id":18,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     19 | INSERT        | 2024-11-23 15:23:05.986397 | postgres | [{"order_id":22,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     20 | UPDATE        | 2024-11-23 15:24:46.286265 | postgres | [{"order_id":22,"order_date":"2024-11-23","total_amount":1200.00,"customer_id":2,"employee_id":3}]
     21 | DELETE        | 2024-11-23 15:25:06.203573 | postgres | [{"order_id":22,"order_date":"2024-11-23","total_amount":1200.00,"customer_id":2,"employee_id":3}]
     22 | INSERT        | 2024-11-23 20:54:01.593109 | postgres | [{"order_id":23,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     23 | INSERT        | 2024-11-23 20:54:03.904274 | postgres | [{"order_id":24,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     24 | INSERT        | 2024-11-23 20:54:04.944042 | postgres | [{"order_id":25,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     25 | INSERT        | 2024-11-23 20:54:05.715966 | postgres | [{"order_id":26,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     26 | DELETE        | 2024-11-23 21:19:23.37565 | postgres | [{"order_id":26,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     27 | DELETE        | 2024-11-23 21:19:44.603828 | postgres | [{"order_id":25,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     28 | INSERT        | 2024-11-23 21:49:00.898587 | postgres | [{"order_id":27,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     29 | INSERT        | 2024-11-25 21:12:45.252283 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":15.99,"warehouse_id":4}]
     30 | UPDATE        | 2024-11-25 21:16:44.70449 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":17.59,"warehouse_id":4}]
     31 | DELETE        | 2024-11-25 21:19:34.736279 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":17.59,"warehouse_id":4}]
(24 rows)
```

### 3. Откат к последней контрольной точке

```
coffee_shop_db=# select * from main_log;
 log_id | operation_type | operation_date | user_operator | changed_data
-----+-----+-----+-----+-----
      1 | INSERT        | 2024-11-22 23:37:04.072942 | postgres | [{"product_id":11,"product_category_name":"Latte","price":700.00,"warehouse_id":1}]
      2 | UPDATE        | 2024-11-22 23:37:20.029167 | postgres | [{"product_id":11,"product_category_name":"Latte","price":750.00,"warehouse_id":1}]
      3 | DELETE        | 2024-11-22 23:37:33.057911 | postgres | [{"product_id":11,"product_category_name":"Latte","price":750.00,"warehouse_id":1}]
     11 | INSERT        | 2024-11-23 15:08:06.054768 | postgres | [{"order_id":18,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     12 | INSERT        | 2024-11-23 15:08:10.361622 | postgres | [{"order_id":19,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     13 | INSERT        | 2024-11-23 15:08:36.393031 | postgres | [{"order_id":20,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     14 | INSERT        | 2024-11-23 15:08:39.520798 | postgres | [{"order_id":21,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     15 | DELETE        | 2024-11-23 15:19:29.940888 | postgres | [{"order_id":21,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     16 | DELETE        | 2024-11-23 15:19:33.596735 | postgres | [{"order_id":20,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     17 | DELETE        | 2024-11-23 15:19:38.354701 | postgres | [{"order_id":19,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     18 | DELETE        | 2024-11-23 15:19:41.542559 | postgres | [{"order_id":18,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     19 | INSERT        | 2024-11-23 15:23:05.986397 | postgres | [{"order_id":22,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     20 | UPDATE        | 2024-11-23 15:24:46.286265 | postgres | [{"order_id":22,"order_date":"2024-11-23","total_amount":1200.00,"customer_id":2,"employee_id":3}]
     21 | DELETE        | 2024-11-23 15:25:06.203573 | postgres | [{"order_id":22,"order_date":"2024-11-23","total_amount":1200.00,"customer_id":2,"employee_id":3}]
     22 | INSERT        | 2024-11-23 20:54:01.593109 | postgres | [{"order_id":23,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     23 | INSERT        | 2024-11-23 20:54:03.904274 | postgres | [{"order_id":24,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     24 | INSERT        | 2024-11-23 20:54:04.944042 | postgres | [{"order_id":25,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     25 | INSERT        | 2024-11-23 20:54:05.715966 | postgres | [{"order_id":26,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     26 | DELETE        | 2024-11-23 21:19:23.37565 | postgres | [{"order_id":26,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     27 | DELETE        | 2024-11-23 21:19:44.603828 | postgres | [{"order_id":25,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     28 | INSERT        | 2024-11-23 21:49:00.898587 | postgres | [{"order_id":27,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
     29 | INSERT        | 2024-11-25 21:12:45.252283 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":15.99,"warehouse_id":4}]
     30 | UPDATE        | 2024-11-25 21:16:44.70449 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":17.59,"warehouse_id":4}]
     31 | DELETE        | 2024-11-25 21:19:34.736279 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":17.59,"warehouse_id":4}]
     32 | INSERT        | 2024-11-25 22:02:46.283572 | postgres | [{"product_id":15,"product_category_name":"Random Coffee","price":15.99,"warehouse_id":3}]
     33 | INSERT        | 2024-11-25 22:13:57.293985 | postgres | [{"product_id":17,"product_category_name":"Random Coffee","price":15.99,"warehouse_id":1}]
     34 | INSERT        | 2024-11-25 22:17:08.97821 | postgres | [{"order_id":28,"order_date":"2024-11-22","total_amount":15.99,"customer_id":3,"employee_id":2}]
     35 | INSERT        | 2024-11-25 22:18:49.732459 | postgres | [{"order_id":29,"order_date":"2024-11-22","total_amount":252.00,"customer_id":3,"employee_id":2}]
     36 | INSERT        | 2024-11-25 22:19:49.231681 | postgres | [{"order_id":30,"order_date":"2024-11-22","total_amount":15.99,"customer_id":3,"employee_id":4}]
     37 | INSERT        | 2024-11-25 22:20:06.680498 | postgres | [{"order_id":31,"order_date":"2024-11-22","total_amount":15.99,"customer_id":3,"employee_id":2}]
(30 rows)
```

```
chu@chu-Latitude-5510:/tmp$ sudo -u postgres pg_restore --clean --if-exists -d coffee_shop_db /tmp/coffee_shop_db.backup
[sudo] password for chu:
```

```

coffee_shop_db=# select * from main_log;
 log_id | operation_type | operation_date | user_operator | changed_data
-----
 1 | INSERT | 2024-11-22 23:37:04.072942 | postgres | [{"product_id":11,"product_category_name":"Latte","price":700.00,"warehouse_id":1}]
 2 | UPDATE | 2024-11-22 23:37:20.029167 | postgres | [{"product_id":11,"product_category_name":"Latte","price":750.00,"warehouse_id":1}]
 3 | DELETE | 2024-11-22 23:37:33.057911 | postgres | [{"product_id":11,"product_category_name":"Latte","price":750.00,"warehouse_id":1}]
11 | INSERT | 2024-11-23 15:08:06.054768 | postgres | [{"order_id":18,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
12 | INSERT | 2024-11-23 15:08:10.361622 | postgres | [{"order_id":19,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
13 | INSERT | 2024-11-23 15:08:36.393031 | postgres | [{"order_id":20,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
14 | INSERT | 2024-11-23 15:08:39.520798 | postgres | [{"order_id":21,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
15 | DELETE | 2024-11-23 15:19:29.940088 | postgres | [{"order_id":21,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
16 | DELETE | 2024-11-23 15:19:33.596735 | postgres | [{"order_id":20,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
17 | DELETE | 2024-11-23 15:19:38.354701 | postgres | [{"order_id":19,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
18 | DELETE | 2024-11-23 15:19:41.542559 | postgres | [{"order_id":18,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
19 | INSERT | 2024-11-23 15:23:05.906397 | postgres | [{"order_id":22,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
20 | UPDATE | 2024-11-23 15:24:46.286265 | postgres | [{"order_id":22,"order_date":"2024-11-23","total_amount":1200.00,"customer_id":2,"employee_id":3}]
21 | DELETE | 2024-11-23 15:25:06.203573 | postgres | [{"order_id":22,"order_date":"2024-11-23","total_amount":1200.00,"customer_id":2,"employee_id":3}]
22 | INSERT | 2024-11-23 20:54:01.593109 | postgres | [{"order_id":23,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
23 | INSERT | 2024-11-23 20:54:03.904274 | postgres | [{"order_id":24,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
24 | INSERT | 2024-11-23 20:54:04.944042 | postgres | [{"order_id":25,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
25 | INSERT | 2024-11-23 20:54:05.715966 | postgres | [{"order_id":26,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
26 | DELETE | 2024-11-23 21:19:23.37565 | postgres | [{"order_id":26,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
27 | DELETE | 2024-11-23 21:19:44.603828 | postgres | [{"order_id":25,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
28 | INSERT | 2024-11-23 21:49:00.898587 | postgres | [{"order_id":27,"order_date":"2024-11-22","total_amount":1000.00,"customer_id":1,"employee_id":1}]
29 | INSERT | 2024-11-25 21:12:45.252283 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":15.99,"warehouse_id":4}]
30 | UPDATE | 2024-11-25 21:16:44.70449 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":17.59,"warehouse_id":4}]
31 | DELETE | 2024-11-25 21:19:34.736279 | postgres | [{"product_id":12,"product_category_name":"Random Coffee","price":17.59,"warehouse_id":4}]
(24 rows)

```



## **Вывод**

В этой лабораторной работе мы сделали полную резервную копию базы данных. Мы можем полностью вернуть данные в последнюю точку резервного копирования. Это удобно для предотвращения потери данных из-за неправильных операций с базой данных