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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.

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

- С каким количеством спортсменов работает каждый тренер.

```
SELECT coach.number_of_coach
FROM "sport_club".coach
WHERE NOT EXISTS (
    SELECT *
    FROM "sport_club".cooperation
    JOIN "sport_club".sportsmen_injury ON
    cooperation.id_of_qualification_book =
    sportsmen_injury.id_of_qualification_book
    WHERE cooperation.coach_number = coach.number_of_coach
)
```

```
1 SELECT coach.number_of_coach, COUNT(sportsmen.sportsman_id)
2 FROM "sport_club".cooperation
3 JOIN "sport_club".coach ON cooperation.coach_number = coach.number_of_coach
4 JOIN "sport_club".sportsmen ON cooperation.id_of_qualification_book = sportsmen.sportsman_id
5 GROUP BY coach.number_of_coach;
```

Data Output Messages Notifications



	number_of_coach [PK] integer	count bigint
1	1	2
2	5	2
3	4	2
4	2	2
5	3	2

- Найти тренеров, чьи спортсмены не имеют травм.

```
SELECT coach.number_of_coach
FROM "sport_club".coach
WHERE NOT EXISTS (
```

```

SELECT *
FROM "sport_club".cooperation
JOIN "sport_club".sportsmen_injury ON
cooperation.id_of_qualification_book =
sportsmen_injury.id_of_qualification_book
WHERE cooperation.coach_number = coach.number_of_coach
)

```

Query		Query History
1	SELECT coach.number_of_coach	
2	FROM "sport_club".coach	
3	WHERE NOT EXISTS (
4	SELECT *	
5	FROM "sport_club".cooperation	
6	JOIN "sport_club".sportsmen_injury ON cooperation.id_of_qualification_book = sportsmen_injury.id_of_qualification_book	
7	WHERE cooperation.coach_number = coach.number_of_coach	
8)	

Data Output		Messages	Notifications
	number_of_coach [PK] integer		
1	10		
2	2		
3	5		
4	8		
5	6		
6	4		
7	1		
8	3		
9	9		
10	7		

- Найти тренера, получающего минимальную зарплату.

```

SELECT coach.number_of_coach FROM sport_club.coach
WHERE coach.coach_points = (
    SELECT MIN(coach_points)
    FROM sport_club.coach
)

```

Query		Query History
1	SELECT coach.number_of_coach FROM sport_club.coach	
2	WHERE coach.coach_points = (
3	SELECT MIN(coach_points)	
4	FROM sport_club.coach	
5)	

Data Output		Messages	Notifications
	number_of_coach [PK] integer		
1	1		

- Определить количество соревнований каждой категории.

```

SELECT competition_level, COUNT(number_of_competition)
FROM sport_club.competition

```

```
GROUP BY competition_level
```

```

1 SELECT competition_level, COUNT(number_of_competition)
2 FROM sport_club.competition
3 GROUP BY competition_level

```

Data Output Messages Notifications

	competition_level integer	count bigint
1	1	3
2	2	4
3	3	3

- Найти тренера, работающего с самыми молодыми спортсменами (средний возраст спортсменов минимален).

```
SELECT coach.number_of_coach, AVG(DATE_PART('year', age(sportsmen.birth_date)))
AS avg_age
```

```
FROM sport_club.coach
```

```
JOIN sport_club.cooperation ON coach.number_of_coach = cooperation.coach_number
```

```
JOIN sport_club.sportsmen ON cooperation.id_of_qualification_book =
sportsmen.sportsman_id
```

```
GROUP BY coach.number_of_coach
```

```
LIMIT 1
```

- Сколько спортсменов участвует в соревнованиях каждой категории в заданный период.

```
SELECT competition.competition_level, COUNT(DISTINCT sportsman_id) AS
num_of_sportsmen
```

```
FROM sport_club.participation_in_the_competition
```

```
JOIN sport_club.sportsmen ON sportsmen.sportsman_id =
participation_in_the_competition.id_of_qualification_book
```

JOIN sport_club.competition ON competition.number_of_competition = participation_in_the_competition.id_of_competition

WHERE competition.date BETWEEN '2023-03-01' AND '2023-05-31'

GROUP BY competition.competition_level

Query	Query History
1	SELECT competition.competition_level, COUNT(DISTINCT sportsman_id) AS num_of_sportsmen
2	FROM sport_club.participation_in_the_competition
3	JOIN sport_club.sportsmen ON sportsmen.sportsman_id = participation_in_the_competition.id_of_qualification_book
4	JOIN sport_club.competition ON competition.number_of_competition = participation_in_the_competition.id_of_competition
5	WHERE competition.date BETWEEN '2023-03-01' AND '2023-05-31'
6	GROUP BY competition.competition_level

Data Output	Messages	Notifications
competition_level integer	num_of_sportsmen bigint	
1	2	2

- Для всех спортсменов определить количество соревнований, в которых они участвовали.

SELECT id_of_qualification_book, COUNT(*) AS number_of_competitions

FROM sport_club.participation_in_the_competition

GROUP BY id_of_qualification_book

Query	Query History
1	SELECT id_of_qualification_book, COUNT(*) AS number_of_competitions
2	FROM sport_club.participation_in_the_competition
3	GROUP BY id_of_qualification_book

Data Output	Messages	Notifications
id_of_qualification_book integer	number_of_competitions bigint	
1	9	1
2	5	1
3	4	1
4	6	1
5	2	2
6	7	1
7	1	2
8	8	1

2. Представления

- Содержащее сведения обо всех тренерах, соревнованиях, в которых участвовали их спортсмены и местах, которые они заняли.

```
CREATE VIEW sport_club.compet_results AS
SELECT coach.number_of_coach,
       coach.full_name,
       competition.number_of_competition,
       competition.competition_level,
       competition.date,
       participation_in_the_competition.competition_result
FROM sport_club.coach
JOIN sport_club.cooperation ON coach.number_of_coach = cooperation.coach_number
JOIN sport_club.sportsmen ON cooperation.id_of_qualification_book =
    sportsmen.sportsman_id
JOIN sport_club.participation_in_the_competition ON sportsmen.sportsman_id =
    participation_in_the_competition.id_of_qualification_book
JOIN sport_club.competition ON participation_in_the_competition.id_of_competition =
    competition.number_of_competition;
```

	number_of_coach integer	full_name character varying (50)	number_of_competition integer	competition_level integer	date date	competition_result integer
1	5	Козлов Сергей Владимирович	10	2	2023-12-22	1
2	7	Андреев Владимир Андреевич	9	3	2023-12-22	3
3	4	Михайлова Елена Сергеевна	9	3	2023-12-22	2
4	3	Сидоров Алексей Петрович	7	2	2023-04-22	1
5	3	Сидоров Алексей Петрович	7	2	2023-04-22	3
6	2	Петрова Марина Александровна	9	3	2023-12-22	2
7	2	Петрова Марина Александровна	7	2	2023-04-22	1

- Найти самую распространенную травму.

```
CREATE VIEW sport_club.most_injures AS
SELECT injury.number_of_injury, COUNT(sportsmen_injury.sportsmen_injury_id) AS count
FROM sport_club.injury
JOIN sport_club.sportsmen_injury ON injury.number_of_injury =
    sportsmen_injury.number_of_injury
GROUP BY injury.number_of_injury
ORDER BY count DESC
LIMIT 1;
```

Query

Query History

1

SELECT * FROM sport_club.most_injures

2

Data Output

Messages

Notifications

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	number_of_injury integer	count bigint
1	4	4

3. Кастом запросы

- Внести, что спортсмен “Сидоров Алексей Петрович” занял 1 место на определённых соревнованиях.

INSERT INTO sport_club.participation_in_the_competition

(id_of_competition, sport_number, id_of_qualification_book, competition_result, particip_compet_id)

VALUES (7,

5,

(SELECT sportsmen.sportsman_id FROM sport_club.sportsmen WHERE sportsmen.fullname = 'Сидоров Алексей Петрович'),

1,

11);

```

1 SELECT * FROM sport_club.participation_in_the_competition
2 ORDER BY particip_compet_id ASC

```

Data Output

Messages

Notifications

	id_of_competition integer	sport_number integer	id_of_qualification_book integer	competition_result integer	particip_compet_id [PK] integer
1	1	1	1	1	1
2	1	1	2	2	2
3	2	2	1	3	3
4	3	3	2	1	4
5	9	4	4	2	5
6	7	5	5	3	6
7	7	5	6	1	7
8	9	4	7	2	8
9	9	4	8	3	9
10	10	6	9	1	10

Query		Query History				
1	SELECT * FROM sport_club.participation_in_the_competition					
2	ORDER BY particip_compet_id ASC					
Data Output		Messages		Notifications		
	id_of_competition integer	sport_number integer	id_of_qualification_book integer	competition_result integer	particip_compet_id [PK] integer	
1	1	1	1	1	1	
2	1	1	2	2	2	
3	2	2	1	3	3	
4	3	3	2	1	4	
5	9	4	4	2	5	
6	7	5	5	3	6	
7	7	5	6	1	7	
8	9	4	7	2	8	
9	9	4	8	3	9	
10	10	6	9	1	10	
11	7	5	3	1	11	

- Изменить тренера у спортсмена с определённой фамилией

```
UPDATE sport_club.cooperation SET coach_number = 7 WHERE id_of_qualification_book = (
    SELECT sportsmen.sportsman_id FROM sport_club.sportsmen WHERE
sportsmen.fullname = 'Павлова Татьяна Ивановна'
)
```

Query		Query History				
1	SELECT * FROM sport_club.cooperation					
2	ORDER BY id_of_cooperation ASC					
Data Output		Messages		Notifications		
	coach_number integer	id_of_qualification_book integer	id_of_cooperation [PK] integer	cooperation_since date	cooperation_end date	
1	1	1	1	2023-01-01	2023-12-31	
2	1	2	2	2023-02-01	2023-12-31	
3	2	3	3	2023-03-01	2023-12-31	
4	2	4	4	2023-04-01	2023-12-31	
5	3	5	5	2023-05-01	2023-12-31	
6	3	6	6	2023-06-01	2023-12-31	
7	4	7	7	2023-07-01	2023-12-31	
8	4	8	8	2023-08-01	2023-12-31	
9	5	9	9	2023-09-01	2023-12-31	
10	5	10	10	2023-10-01	2023-12-31	

Query

Query History

1

SELECT * FROM sport_club.cooperation

2

ORDER BY id_of_cooperation ASC

Data Output

Messages

Notifications

- Удалить сотрудничества у тренера с минимальным баллом

```
DELETE FROM sport_club.cooperation WHERE coach_number = (SELECT
coach.number_of_coach FROM sport_club.coach
WHERE coach.coach_points = (
SELECT MIN(coach_points)
FROM sport_club.coach
))
```

1SELECT * FROM sport_club.cooperation

2ORDER BY id_of_cooperation ASC

Data Output

Messages

Notifications

</

Query		Query History				
1	SELECT * FROM sport_club.cooperation					
2	ORDER BY id_of_cooperation ASC					
Data Output		Messages				
	coach_number integer	id_of_qualification_book integer	id_of_cooperation [PK] integer	cooperation_since date	cooperation_end date	
1	2	3	3	2023-03-01	2023-12-31	
2	2	4	4	2023-04-01	2023-12-31	
3	3	5	5	2023-05-01	2023-12-31	
4	3	6	6	2023-06-01	2023-12-31	
5	4	7	7	2023-07-01	2023-12-31	
6	7	8	8	2023-08-01	2023-12-31	
7	5	9	9	2023-09-01	2023-12-31	
8	5	10	10	2023-10-01	2023-12-31	

QueryHistory

Query		Query History		
Show queries generated internally by pgAdmin? <input type="checkbox"/>		Remove	Remove All	
Today - 23.11.2023		23.11.2023 01:14:43	8	74 msec
		Date	Rows affected	Duration
SELECT * FROM sport_club.cooperation ORDER BY id_of_cooperation ASC 31:14:43 ► DELETE FROM sport_club.cooperation WHERE coach_number = (SELECT coach.number... 31:14:01 ► DELETE FROM cooperation WHERE coach_number = (SELECT coach.number_of_coach F... 31:13:52 ► SELECT * FROM sport_club.cooperation ORDER BY id_of_cooperation ASC 31:13:21 ► SELECT * FROM sport_club.coach ORDER BY number_of_coach ASC 31:13:09 ► SELECT * FROM sport_club.coach ORDER BY number_of_coach ASC 31:10:37 ► SELECT * FROM sport_club.coach ORDER BY number_of_coach ASC 31:09:59 ► SELECT * FROM sport_club.participation_in_the_competition ORDER BY particip... 31:09:39 ► SELECT * FROM sport_club.participation_in_the_training ORDER BY training ASC 31:08:27 ► SELECT * FROM sport_club.injury ORDER BY number_of_injury ASC 31:08:18 ► SELECT * FROM sport_club.medicine_card ORDER BY number_of_medicine_card ASC 31:07:49 ► SELECT * FROM sport_club.training ORDER BY number_of_training ASC LIMIT 100 31:07:21 ► SELECT * FROM sport_club.medicine_testing ORDER BY number_of_testing ASC 31:07:16 ► SELECT * FROM sport_club.cooperation ORDER BY id_of_cooperation ASC 31:06:27 ► UPDATE sport_club.cooperation SET coach_number = 7 WHERE id_of_qualification... 31:06:25 ► SELECT * FROM sport_club.cooperation ORDER BY id_of_cooperation ASC 31:05:38		Copy Copy to Query Editor SELECT * FROM sport_club.cooperation ORDER BY id_of_cooperation ASC	Messages Successfully run. Total query runtime: 74 msec. 8 rows affected.	

4. Индексы

```
CREATE INDEX idx_coach_points ON sport_club.coach (coach_points);
CREATE INDEX idx_competition_level ON sport_club.competition (competition_level);
CREATE INDEX idx_coach_student ON sport_club.cooperation (coach_number,
id_of_qualification_book);
```

```

SELECT coach.number_of_coach FROM sport_club.coach
WHERE coach.coach_points = (
    SELECT MIN(coach_points)
    FROM sport_club.coach
)

```

Без индекса:

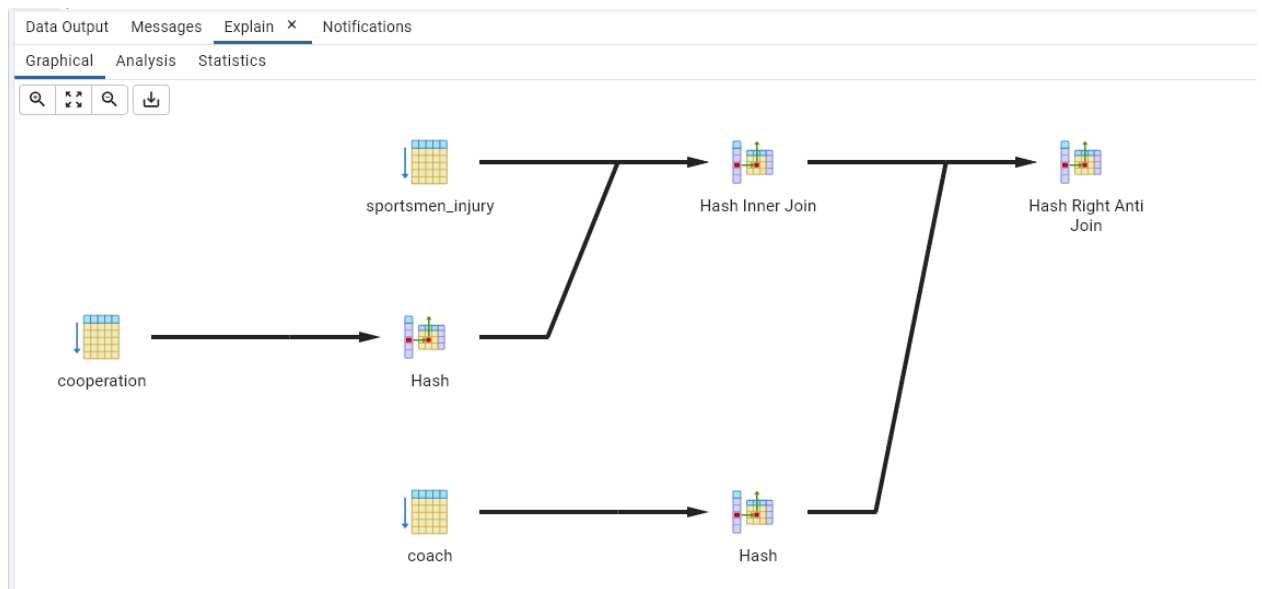
Query	Query History
1	SELECT coach.number_of_coach
2	FROM "sport_club".coach
3	WHERE NOT EXISTS (
4	SELECT *
5	FROM "sport_club".cooperation
6	JOIN "sport_club".sportsmen_injury ON
7	WHERE cooperation.coach_number = coach
8)

Data Output	Messages	Notifications
Successfully run. Total query runtime: 94 msec. 10 rows affected.		

С индексом:

1	SELECT coach.number_of_coach
2	FROM sport_club.coach
3	WHERE NOT EXISTS (
4	SELECT *
5	FROM "sport_club".cooperation
6	JOIN "sport_club".sportsmen_injury ON cooperation.id_of
7	WHERE cooperation.coach_number = coach.number_of_coach
8)

Data Output	Messages	Notifications
Successfully run. Total query runtime: 59 msec. 9 rows affected.		



```
DROP INDEX idx_coach_points ;  
DROP INDEX idx_competition_level;  
DROP INDEX idx_coach_student;
```

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 индексирования полей, в следствие чего были проведены оптимизационные эксперименты.