← SQL beginner. Day08

Revie

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Private Git project

ssh://git@repos-ssh.21-school.ru:2289/students/SQL_beginner._Day08.ID_574106/marlean_...

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Task

Day 08 - Piscine SQL

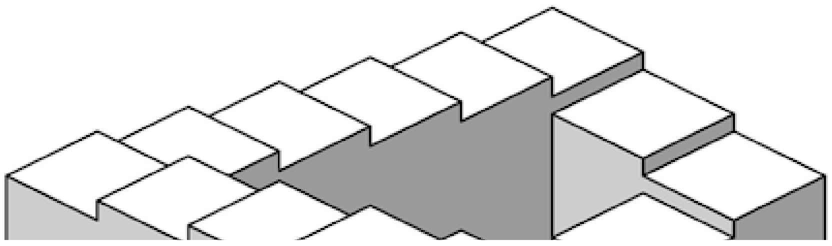
Isolation is one of ACID properties

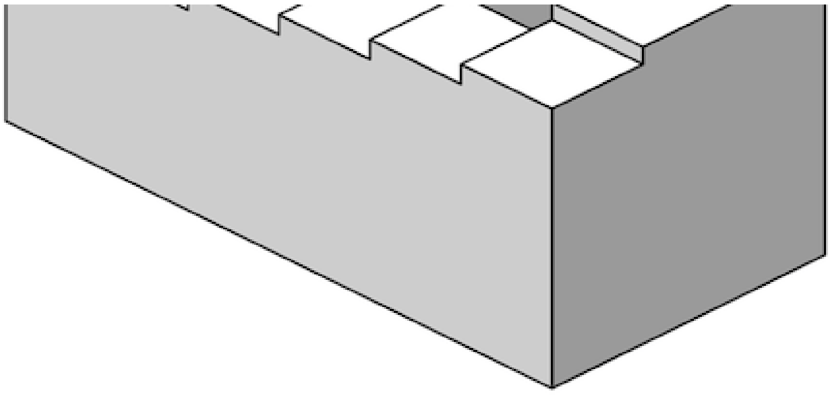
Resume: Today you will see how database works with transactions and isolation levels

Contents

Chapter I

Preamble





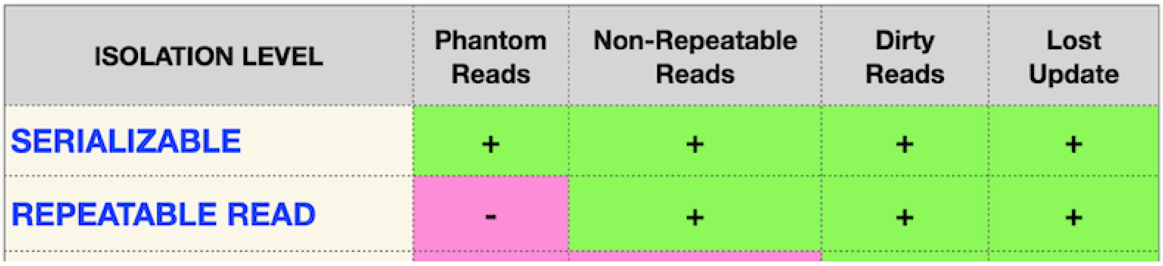
Penrose Stairs

The Penrose stairs or Penrose steps, also dubbed the impossible staircase, is an impossible object created by Lionel Penrose and his son Roger Penrose. A variation on the Penrose triangle, it is a two-dimensional depiction of a staircase in which the stairs make four 90-degree turns as they ascend or descend yet form a continuous loop, so that a person could climb them forever and never get any higher. This is clearly impossible in three dimensions. The "continuous staircase" was first presented in an article that the Penroses wrote in 1959, based on the so-called "triangle of Penrose" published by Roger Penrose in the British Journal of Psychology in 1958.

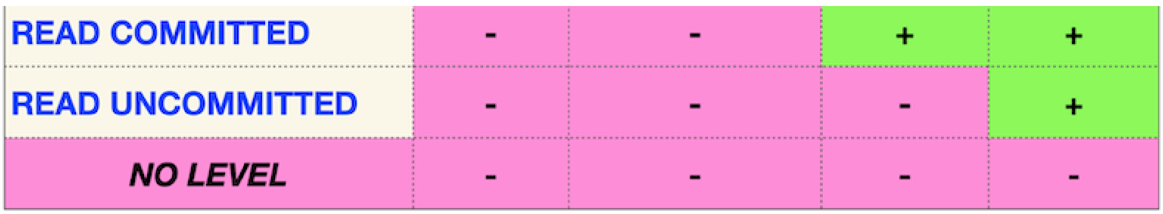
“Penrose Stairs” is a mathematical anomaly, actually Database Theory has 4 foundametal data anomalies (physical anomalies).

- Lost Update Anomaly
- Dirty Reads Anomaly
- Non-repeatable Reads Anomaly
- Phantom Read Anomaly

Therefore there are different Isolation Levels in ANSI SQL standard that prevent famous anomalies.



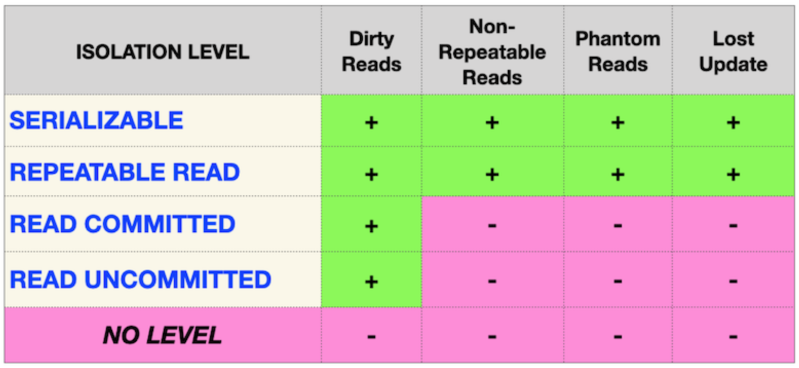
ISOLATION LEVEL	Phantom Reads	Non-Repeatable Reads	Dirty Reads	Lost Update
SERIALIZABLE	+	+	+	+
REPEATABLE READ	-	+	+	+



READ COMMITTED	-	-	+	+
READ UNCOMMITTED	-	-	-	+
NO LEVEL	-	-	-	-

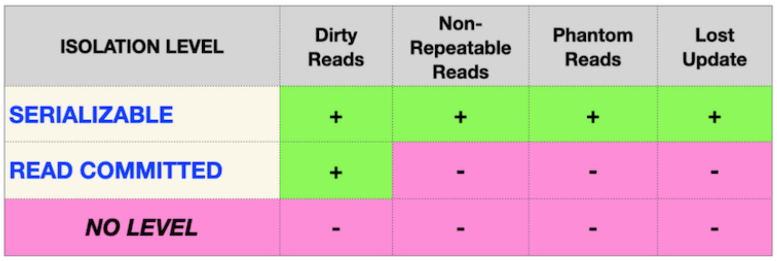
From one side this matrix should be a Standard for every Relational Database, but reality ... looks a bit different.

PostgreSQL



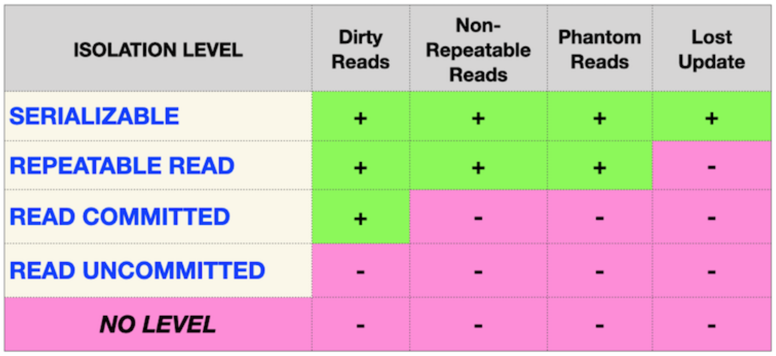
ISOLATION LEVEL	Dirty Reads	Non-Repeatable Reads	Phantom Reads	Lost Update
SERIALIZABLE	+	+	+	+
REPEATABLE READ	+	+	+	+
READ COMMITTED	+	-	-	-
READ UNCOMMITTED	+	-	-	-
NO LEVEL	-	-	-	-

Oracle



ISOLATION LEVEL	Dirty Reads	Non-Repeatable Reads	Phantom Reads	Lost Update
SERIALIZABLE	+	+	+	+
READ COMMITTED	+	-	-	-
NO LEVEL	-	-	-	-

MySQL



ISOLATION LEVEL	Dirty Reads	Non-Repeatable Reads	Phantom Reads	Lost Update
SERIALIZABLE	+	+	+	+
REPEATABLE READ	+	+	+	-
READ COMMITTED	+	-	-	-
READ UNCOMMITTED	-	-	-	-
NO LEVEL	-	-	-	-

Nowadays, IT community found a set of new anomalies based on Database Model (logical view)

- Read Skew Anomaly
- Write Skew Anomaly
- Serialization Anomaly

- Fan Traps Anomaly
- Chasm Traps Anomaly
- Data Model Loops Anomaly
- etc.

Chapter II

General Rules

- Use this page as the only reference. Do not listen to any rumors and speculations on how to prepare your solution.
- Please make sure you are using the latest version of PostgreSQL.
- That is completely OK if you are using IDE to write a source code (aka SQL script).
- To be assessed your solution must be in your GIT repository.
- Your solutions will be evaluated by your piscine mates.
- You should not leave in your directory any other file than those explicitly specified by the exercise instructions. It is recommended that you modify your `.gitignore` to avoid accidents.
- Do you have a question? Ask your neighbor on the right. Otherwise, try with your neighbor on the left.
- Your reference manual: mates / Internet / Google.
- Read the examples carefully. They may require things that are not otherwise specified in the subject.
- And may the SQL-Force be with you!
- Absolutely everything can be presented in SQL! Let’s start and have fun!

Chapter III

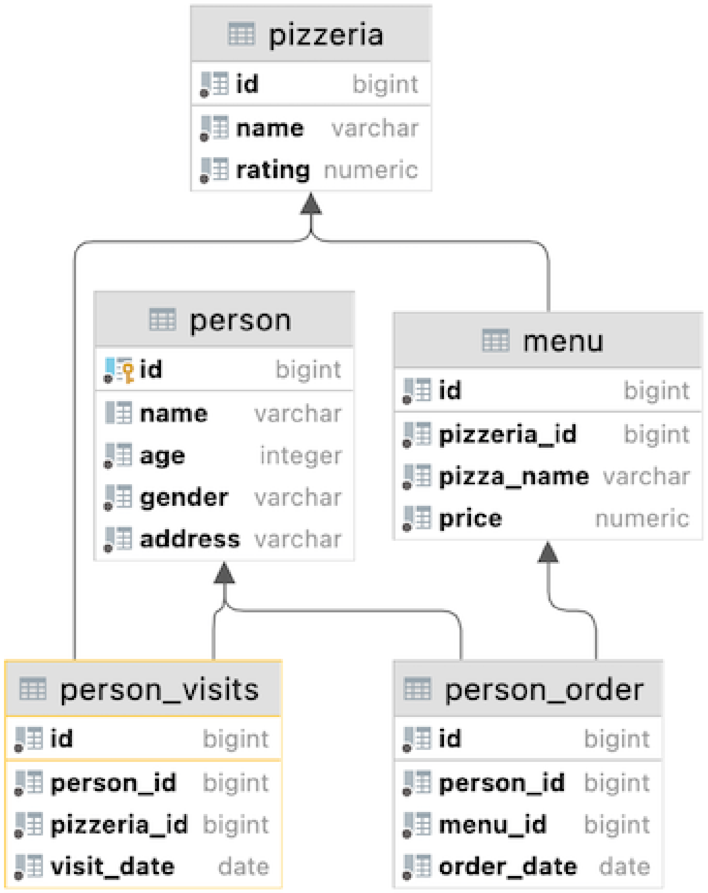
Rules of the day

- Please make sure you have an own database and access for it on your PostgreSQL cluster.

- Please download a script with Database Model here and apply the script to your database (you can use command line with psql or just run it through any IDE, for example DataGrip from JetBrains or pgAdmin from PostgreSQL community).
- All tasks contain a list of Allowed and Denied sections with listed database options, database types, SQL constructions etc. Please have a look at the section before you start.

before you start.

- Please take a look at the Logical View of our Database Model.



1. **pizzeria** table (Dictionary Table with available pizzerias)

- field id - primary key
- field name - name of pizzeria
- field rating - average rating of pizzeria (from 0 to 5 points)

1. **person** table (Dictionary Table with persons who loves pizza)

- field id - primary key
- field name - name of person
- field age - age of person
- field gender - gender of person

- field address - address of person

1. **menu** table (Dictionary Table with available menu and price for concrete pizza)

- field id - primary key
- field pizzeria_id - foreign key to pizzeria

- field pizza_name - name of pizza in pizzeria
- field price - price of concrete pizza

1. **person_visits** table (Operational Table with information about visits of pizzeria)

- field id - primary key
- field person_id - foreign key to person
- field pizzeria_id - foreign key to pizzeria
- field visit_date - date (for example 2022-01-01) of person visit

1. **person_order** table (Operational Table with information about persons orders)

- field id - primary key
- field person_id - foreign key to person
- field menu_id - foreign key to menu
- field order_date - date (for example 2022-01-01) of person order

Chapter IV

Exercise 00 - Simple transaction

Exercise 00: Simple transaction	
Turn-in directory	ex00
Files to turn-in	`day08_ex00.sql` with comments for Session #1, Session #2 statements; screenshot of psql output for Session #1; screenshot of psql output for Session #2
Allowed	
Language	SQL

Please for this task use the command line for PostgreSQL database (psql). You need to check how your changes will be published in the database for other database users. Actually, we need two active sessions (meaning 2 parallel sessions in the command lines).

Please provide a proof that your parallel session can’t see your changes until you will make a `COMMIT`;

Take a look at the steps below.

Session #1

- update of rating for “Pizza Hut” to 5 points in a transaction mode .
- check that you can see a changes in session #1

Session #2

- check that you can’t see a changes in session #2

Session #1

- publish your changes for all parallel sessions.

Session #2

- check that you can see a changes in session #2

So, take a look on example of my output for Session #2.

```
pizza_db=> select * from pizzeria where name  = 'Pizza Hut';
id |   name    | rating
----+-----------+--------
1 | Pizza Hut |    4.6
(1 row)

pizza_db=> select * from pizzeria where name  = 'Pizza Hut';
id |   name    | rating
----+-----------+--------
1 | Pizza Hut |      5
(1 row)
```

You can see the same query returns different results, because the first one was run before publishing in Session#1 and the second one was queried after finished Session#1.

Chapter V

Exercise 01 - Lost Update Anomaly

Exercise 01: Lost Update Anomaly	
Turn-in	ex01

directory	ex01
Exercise 01: Lost Update Anomaly Files to turn in	`day08_ex01.sql` with comments for Session #1, Session #2 statements; screenshot of psql output for Session #1; screenshot of psql output for Session #2
Allowed	
Language	SQL

Please for this task use the command line for PostgreSQL database (psql). You need to check how your changes will be published in the database for other database users.

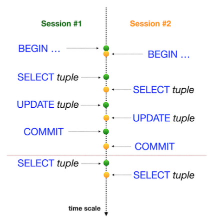
Actually, we need two active sessions (meaning 2 parallel sessions in the command lines).

Before a task, make sure you are at a default isolation level in your database. Just run the next statement

```
SHOW TRANSACTION ISOLATION LEVEL;
```

and the result should be “read committed”;

If not, then please set “read committed” isolation level explicitly on a session level.

Let’s check one of the famous “Lost Update Anomaly” database pattern. You can see a graphical presentation of that anomaly on a picture. Horizontal Red Line means the final results after all sequential steps for both Sessions.	 Session #1
	Session #2
	BEGIN ...
	BEGIN ...
	SELECT tuple
	SELECT tuple
	UPDATE tuple
	UPDATE tuple
	COMMIT
	COMMIT
	SELECT tuple
	SELECT tuple
	time scale

Please check a rating for “Pizza Hut” in a transaction mode for both Sessions and after that make `UPDATE` of rating to 4 value in session #1 and make `UPDATE` of rating to 3.6 value in session #2 (in the same order as in the picture).

Chapter VI

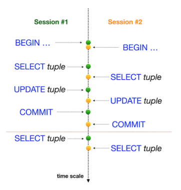
Exercise 02 - Lost Update for Repeatable Read

Exercise 02: Lost Update for Repeatable Read	

Exercise 02: Lost Update for Repeatable Read	
Turn-in directory	ex02
Files to turn-in	`day08_ex02.sql` with comments for Session #1, Session #2 statements; screenshot of psql output for Session #1; screenshot of psql output for Session #2
Allowed	
Language	SQL

Please for this task use the command line for PostgreSQL database (psql). You need to check how your changes will be published in the database for other database users.

Actually, we need two active sessions (meaning 2 parallel sessions in the command lines).

Let's check one of the famous "Lost Update Anomaly" database pattern but under `REPEATABLE READ` isolation level. You can see a graphical presentation of that anomaly on a picture. Horizontal Red Line means the final results after all sequential steps for both Sessions.	 Session #1
	Session #2
	BEGIN ...
	BEGIN ...
	SELECT tuple
	SELECT tuple
	UPDATE tuple
	UPDATE tuple
	COMMIT
	COMMIT
	SELECT tuple
	SELECT tuple
	time scale

Please check a rating for "Pizza Hut" in a transaction mode for both Sessions and after that make `UPDATE` of rating to 4 value in session #1 and make `UPDATE` of rating to 3.6 value in session #2 (in the same order as in the picture).

Chapter VII

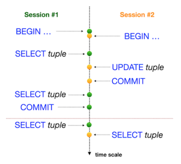
Exercise 03 - Non-Repeatable Reads Anomaly

Exercise 03: Non-Repeatable Reads Anomaly	
Turn-in	ex03

directory	ex03
Exercise 03: Non-Repeatable Reads Anomaly Files to turn-in	`day08_ex03.sql` with comments for Session #1, Session #2 statements; screenshot of psql output for Session #1; screenshot of psql output for Session #2
Allowed	
Language	SQL

Please for this task use the command line for PostgreSQL database (psql). You need to check how your changes will be published in the database for other database users.

Actually, we need two active sessions (meaning 2 parallel sessions in the command lines).

Let’s check one of the famous “Non-Repeatable Reads” database pattern but under `READ COMMITTED` isolation level. You can see a graphical presentation of that anomaly on a picture. Horizontal Red Line means the final results after all sequential steps for both Sessions.	 Session #1
	Session #2
	BEGIN ...
	BEGIN ...
	SELECT tuple
	UPDATE tuple
	COMMIT
	SELECT tuple
	COMMIT
	SELECT tuple
	SELECT tuple
	time scale

Please check a rating for “Pizza Hut” in a transaction mode for both Sessions and after that make `UPDATE` of rating to 3.6 value in session #2 (in the same order as in the picture).

Chapter VIII

Exercise 04 - Non-Repeatable Reads for Serialization

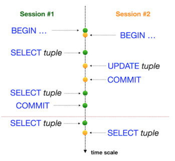
Exercise 04: Non-Repeatable Reads for Serialization	
Turn-in directory	ex04

	`day08_ex04.sql` with comments for Session #1, Session

Files to turn-in	#2 statements; screenshot of psql output for Session #1; screenshot of psql output for Session #2
Exercise 04: Non-Repeatable Reads for Serialization Allowed	
Language	SQL

Please for this task use the command line for PostgreSQL database (psql). You need to check how your changes will be published in the database for other database users.

Actually, we need two active sessions (meaning 2 parallel sessions in the command lines).

Let's check one of the famous "Non-Repeatable Reads" database pattern but under `SERIALIZATION` isolation level. You can see a graphical presentation of that anomaly on a picture. Horizontal Red Line means the final results after all sequential steps for both Sessions.	 Session #1
	Session #2
	BEGIN ...
	BEGIN ...
	SELECT tuple
	UPDATE tuple
	COMMIT
	SELECT tuple
	COMMIT
	SELECT tuple
	SELECT tuple
	time scale

Please check a rating for "Pizza Hut" in a transaction mode for both Sessions and after that make `UPDATE` of rating to 3.0 value in session #2 (in the same order as in the picture).

Chapter IX

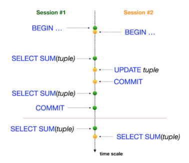
Exercise 05 - Phantom Reads Anomaly

Exercise 05: Phantom Reads Anomaly	
Turn-in directory	ex05
Files to turn-	`day08_ex05.sql` with comments for Session #1, Session #2

Files to turn-in	statements; screenshot of psql output for Session #1; screenshot of psql output for Session #2
Exercise 05: Phantom Reads Anomaly Allowed	
Language	SQL

Please for this task use the command line for PostgreSQL database (psql). You need to check how your changes will be published in the database for other database users.

Actually, we need two active sessions (meaning 2 parallel sessions in the command lines).

Let's check one of the famous "Phantom Reads" database pattern but under `READ COMMITTED` isolation level. You can see a graphical presentation of that anomaly on a picture. Horizontal Red Line means the final results after all sequential steps for both Sessions.	 Session #1
	Session #2
	BEGIN ...
	BEGIN ...
	SELECT SUM(tuple)
	UPDATE tuple
	COMMIT
	SELECT SUM(tuple)
	COMMIT
	SELECT SUM(tuple)
	SELECT SUM(tuple)
	time scale

Please summarize all ratings for all pizzerias in a transaction mode for both Sessions and after that make `UPDATE` of rating to 1 value for "Pizza Hut" restaurant in session #2 (in the same order as in the picture).

Chapter X

Exercise 06 - Phantom Reads for Repeatable Read

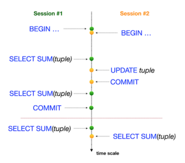
Exercise 06: Phantom Reads for Repeatable Read	
Turn-in directory	ex06
Files to turn-in	`day08_ex06.sql` with comments for Session #1, Session #2 statements; screenshot of psql output for Session #1; screenshot of psql output for Session #2

Allowed	

Exercise 06: Phantom Reads	
Language	SQL

Please for this task use the command line for PostgreSQL database (psql). You need to check how your changes will be published in the database for other database users.

Actually, we need two active sessions (meaning 2 parallel sessions in the command lines).

Let’s check one of the famous “Phantom Reads” database pattern but under `REPEATABLE READ` isolation level. You can see a graphical presentation of that anomaly on a picture. Horizontal Red Line means the final results after all sequential steps for both Sessions.	 Session #1
	Session #2
	BEGIN ...
	BEGIN ...
	SELECT SUM(tuple)
	UPDATE tuple
	COMMIT
	SELECT SUM(tuple)
	COMMIT
	SELECT SUM(tuple)
	SELECT SUM(tuple)
	time scale

Please summarize all ratings for all pizzerias in a transaction mode for both Sessions and after that make `UPDATE` of rating to 5 value for “Pizza Hut” restaurant in session #2 (in the same order as in the picture).

Chapter XI

Exercise 07 - Deadlock

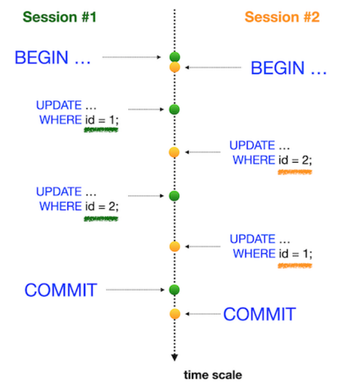
Exercise 07: Deadlock	
Turn-in directory	ex07
Files to turn-in	`day08_ex07.sql` with comments for Session #1, Session #2 statements; screenshot of psql output for Session #1; screenshot of psql output for Session #2
Allowed	
Language	SQL

Please for this task use the command line for PostgreSQL database (psql). You need to check how your changes will be published in the database for other database users.

Actually, we need two active sessions (meaning 2 parallel sessions in the command lines).

Let’s reproduce a deadlock situation in our database.

Let's reproduce a deadlock situation in our database.

You can see a graphical presentation of the deadlock situation on a picture. Looks like a "christ-lock" between parallel sessions.	 Session #1
	Session #2
	BEGIN ...
	BEGIN ...
	UPDATE ... WHERE id = 1;
	UPDATE ... WHERE id = 2;
	UPDATE ... WHERE id = 2;
	UPDATE ... WHERE id = 1;
	COMMIT
	COMMIT
	time scale

Please write any SQL statement on the `person` table to reproduce this deadlock situation.