It works on my database

Regression testing of SQL queries

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Skeptic, Turned Believer

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Why?

SQL is the most important thing

SQL Queries are the #1 cause of database problems

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SQL is scary 👻

doesn't feel like "real code"

runs somewhere you might have not seen

might be invisible

developers never "really learned" SQL

Tests for the rescue!

Except we test around it

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What is SQL testing

Syntax correctness

Schema validity

Contract

Predictable query behaviour

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Who's actually writing your SQL?

Developers who learned just enough

ORMs generating queries you've never seen

LLMs!

84% of developers now use LLMs in some way

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LLM might solve the part of problem

Ask for a query. Get a query.

LLMs make this worse, not better

More SQL written by things that never see production

Faster rate of change

The guardrail isn't better prompts - it's regression testing

So what's the problem?

Rate of change might accelerate

How do you scale the rate of reviews?

A simple change

Before

```
SELECT id, user_id, status, total_amount, created_at
FROM orders
WHERE created_at > now() - interval '1 day'
LIMIT 50;
```

After

```
SELECT id, user_id, status, total_amount, created_at
FROM orders
WHERE created_at > now() - interval '1 day'
ORDER BY total_amount DESC
LIMIT 50;
```

Looks reasonable. Ship it.

Your tests passed! Ship it

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For that one query, the planner might choose:

```
Index Scan on primary key
Index Scan on a different index
Bitmap Index Scan
Sequential Scan
Parallel Sequential Scan
```

The planner is smart

It looks at table statistics, available indexes, memory settings, data patterns

And it makes the best choice.

PostgreSQL is very good at guessing - until it isn't 🫠

Same query, different reality

Factor	Your Laptop	CI	Production
Rows	100	1,000	10,000,000
Distribution	Uniform	Uniform	Heavily skewed
Memory	16GB	4GB	128GB

It works on my database

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We solved this for code

"It works on my machine" → Docker

"It works in staging" → Feature flags, gradual rollouts

"It works with my data" → ???

What about code review?

Pop quiz

```sql
SELECT o.*, u.name
FROM orders o
JOIN users u ON u.id = o.user_id
WHERE o.created_at > now() - interval '30 days'
ORDER BY o.created_at DESC
OFFSET 2500
LIMIT 100;
```

Will this use indexes? Which ones?

How many rows will it scan?

You can't tell from reading SQL

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"Just run EXPLAIN before merging"

We need to test two things

Logical correctness: Does it return the right data?

Performance correctness: Does it return them efficiently?

PERFORMANCE
What you going to measure?

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The timing trap

"Just fail the test if it's slow!"

Run	Time
1	154 ms
2	119 ms
3	105 ms

COST?

Cost is the planner's pre-execution estimate based on statistics and cost parameters

BUFFERS FTW!

Buffers, reported with ANALYZE, reflect actual pages accessed during execution

Expect some little things...

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Buffers don't lie

Machine	Time	Buffers
Hetzner ARM64	154 ms	24,108
Hetzner AMD64	119 ms	24,108
M4 Pro VM	98 ms	24,108

Why not cost? that's estimate

If your query suddenly reads just 10% more buffers, that's a regression

If you have reproducible start point

Introducing RegreSQL

https://github.com/boringsql/regresql

SQL Query regression testing framework

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Getting started

```
regresql init postgres://regresql:can123do@192.168.139.28/my_demo
```

regresql/regress.yaml

```
-- default
root: .
pguri: postgres://regresql:can123do@192.168.139.28/my_demo

-- optional configuration
snapshot:
  path: snapshots/test_data.dump
  schema: regresql/schema.sql

analyze:
  enabled: true
```

Flow

- regresql fixturize
- regresql snapshot
- regreqsl discover (think `git status`)
- regresql add/remove
- edit plan in your favourite editor (hx)
- regresql update -- generate `expected` data (reference)
- regresql baseline -- generate `baseline` (reference)
- regresql test

discover

```
regresql discover
SQL files in project:
  [ ] internal/services/auth/create_provider_link.sql (1 query)
  [ ] internal/services/auth/delete_failed_login_attempt_by_user_id.sql (1
query)
  [ ] internal/services/auth/delete_provider_link.sql (1 query)
  [ ] internal/services/auth/get_provider_link.sql (1 query)
  [+] internal/services/auth/select_failed_login_attempt_by_user_email.sql
(1 query)
  [ ] internal/services/auth/select_failed_login_attempt_by_user_id.sql (1
query)
  [ ] internal/services/auth/upsert_failed_login_attempt.sql (1 query)
```

Plan

```
# Test cases for select_failed_login_attempt_by_user_email query
# Parameters: $1=base_lockout_time, $2=lockout_multiplier, $3=email

# User with failed login attempts - should return user_id, attempts, locked_until
user_with_failed_attempts:
  arg1: 5          # base_lockout_time in seconds
  arg2: 2          # lockout_multiplier (exponential)
  arg3: "user0@example.com"

# User without failed login attempts - should return empty result
user_without_failed_attempts:
  arg1: 5
  arg2: 2
  arg3: "user5001@example.com"  # index beyond failed_login_attempts count

# Case insensitive email lookup - should still find the user
case_insensitive_email:
  arg1: 5
  arg2: 2
  arg3: "USER0@EXAMPLE.COM"

# Nonexistent user email - should return empty result
nonexistent_user:
  arg1: 5
  arg2: 2
  arg3: "nobody@nowhere.test"
```

```
RESULTS:
  ✓ 8 passing
  0.00s total

WARNINGS:
  select_failed_login_attempt_by_user_email_select_failed_login_attempt_by_user_email.case_insensitive_email.buffers (56 <= 56 * 102%)
  ⚠️  Sequential scan detected on table 'user_account'
    Suggestion: Consider adding an index if this table is large or this query is frequently executed
  ⚠️  Nested loop join with sequential scan detected
    Suggestion: Add index on join column to avoid repeated sequential scans
  select_failed_login_attempt_by_user_email_select_failed_login_attempt_by_user_email.nonexistent_user.buffers (56 <= 56 * 102%)
  ⚠️  Sequential scan detected on table 'user_account'
    Suggestion: Consider adding an index if this table is large or this query is frequently executed
  ⚠️  Nested loop join with sequential scan detected
    Suggestion: Add index on join column to avoid repeated sequential scans
  select_failed_login_attempt_by_user_email_select_failed_login_attempt_by_user_email.user_with_failed_attempts.buffers (56 <= 56 *
102%)
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```

What data to test?

I though that's easy part; turns out it's NOT

Fixturize

github.com/boringSQL/fixturize

- Extract consistent subgraphs from production
- Follow foreign keys. Mask PII. Version the output.
- Not empty. Not full prod. Just right

But real data isn't enough

The planner doesn't care about rows. It cares about statistics.

Same 1M rows, different `pg_stats` → different plan.

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Production query plans without production data

pg_restore_relation_stats
pg_restore_attribute_stats

https://boringsql.com/posts/portable-stats/

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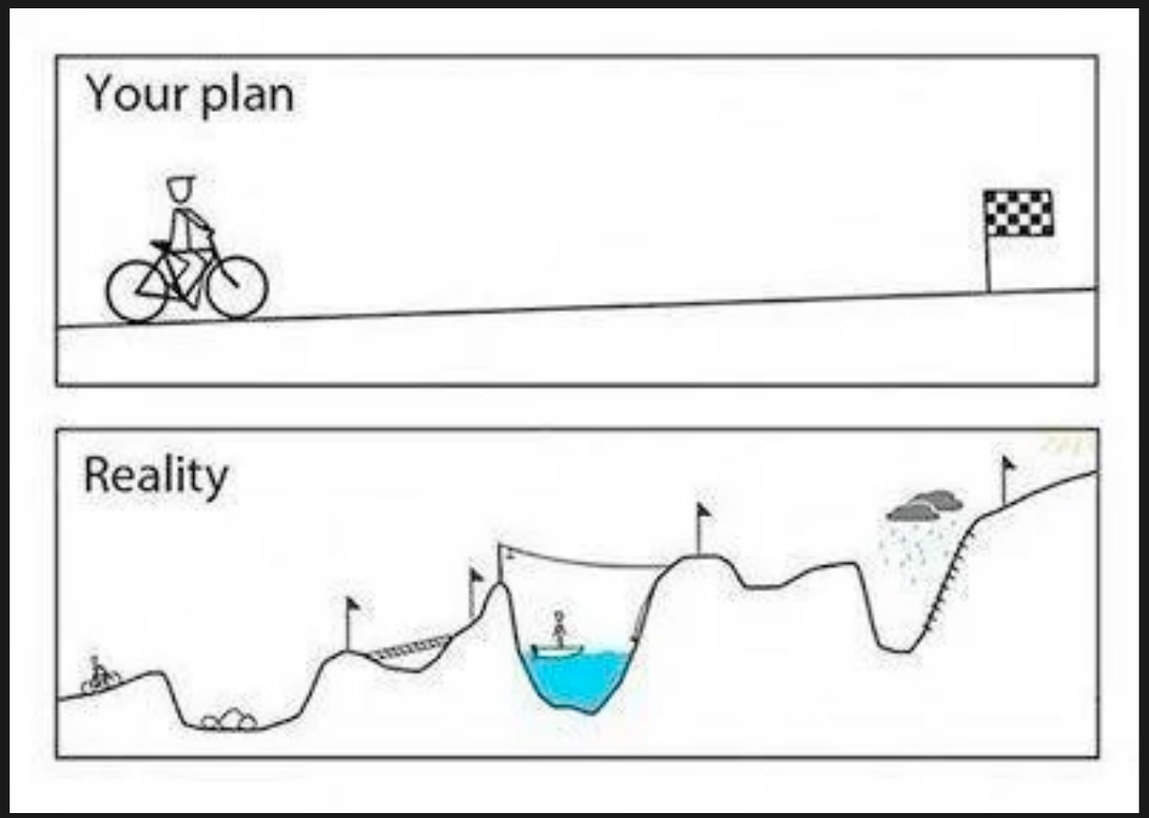

pg_regresql

extension - PGXN / source

https://github.com/boringSQL/regresql/tree/master/pg_ext

Capture production `pg_class` + `pg_stats`.

Inject locally via `get_relation_info_hook`.

Your laptop's planner now behaves like production's.

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```
SELECT pg_restore_relation_stats('schemaname', %L, 'relname', %L,
'relpages', %s, 'reltuples', %s::real, 'relallvisible', %s);',
        n.nspname,
        c.relname,
        c.relpages,
        c.reltuples,
        c.relallvisible
    )
    FROM pg_class c
    JOIN pg_namespace n ON c.relnamespace = n.oid
    WHERE c.relkind IN ('r', 'm')
      AND n.nspname NOT IN ('pg_catalog', 'information_schema',
'pg_toast')
```

RegreSQL 2.0

v2.0.0-beta1

full release imminent

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What about ORMs?

The N+1 elephant in the in the room

The invisible SQL

- RegreSQL assumes you have SQL files.
- ORMs hide them
- Third problem. Third tool.

  Are ORMs going to actually survive AI agentic coding?

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Query Detection/Clustering

- Dynamic Query Shapes
- The Sea of Anonymous Queries
- N+1 is not easy to detect
- Hash Instability

instead of specific ORM support

Making Postgres strong, not ORMs

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qShape - the workload layer

Extract query shapes from `pg_stat_statements`
Synthesize realistic parameters
from stats + fixtures
Feed them back into RegreSQL

The ORM user's on-ramp.

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And ... one more thing; schema intelligence

DryRun PostgreSQL MCP

Schema + stats + migration safety

Offline, from a JSON snapshot. No prod credentials.

Shadow EXPLAIN. Drift detection. Migration preflight.

Because the same portable statistics that make

regression testing work also power

migration safety and drift monitoring.

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It works with my database

The stack

Layer	Tool	Answers
Data	**fixturize**	What does production-like data look like?
Planner	**pg_regresql**	How would production's planner choose?
Workload	**qShape**	What queries does my app actually run?
Verification	**RegreSQL**	Did anything regress?
Intelligence	**DryRun**	Is my schema/migration safe?

LLM wrote it. Who verified it?

LLMs can generate SQL.
They cannot know your data distribution,
your workload, your SLAs,
your production planner.

The faster you go, the more you need this stack.

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Beyond?

- Query Store, CI/CD gates, automations
- PlanAdvisors integration (they are needed
- better developer experience
- Improve the contract governance aspect of the tool
- Policy kits (template on what's critical)

Coming Soon: Your database does not know it's a bank

Thank you!

Don't be afraid to talk to me

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