SchemaAnalyst
Search-based Testing for Relational Database Schemas

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ICSME

Oct 6, 2016
Relational Databases

Databases are everywhere!
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Database
Application
Server

PostgreSQL
Relational Databases

Databases are everywhere!

Database Application Server

Mobile Phone or Tablet

SQLite

PostgreSQL
Relational Databases

Databases are everywhere!

- Database Application Server
- Mobile Phone or Tablet
- Office and Productivity Software
Relational Databases

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Government

PostgreSQL

SQLite

HyperSQL
Relational Databases

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Astrophysics

PostgreSQL

SQLite

HyperSQL
Relational Databases

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- Astrophysics

Over 1,000,000 posts!
CREATE TABLE DEPT_INFO (  
  DEPT_ID INTEGER NOT NULL,  
  DEPT_NAME VARCHAR(50),  
  PRIMARY KEY (DEPT_ID)  
);  

CREATE TABLE OFFICE_INFO (  
  OFFICE_ID INTEGER NOT NULL,  
  OFFICE_NAME VARCHAR(50),  
  HAS_PRINTER SMALLINT,  
  PRIMARY KEY (OFFICE_ID)  
);  

Figure: A sample of the UnixUsage schema.
Database Schemas

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Testing Database Schemas

Manual testing is onerous and error prone
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DBMonster only supports one DBMS
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Crashes and poor constraint coverage
Manual testing is onerous and error prone

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Crashes and poor constraint coverage

Schemas often not tested at all!
SchemaAnalyst
SchemaAnalyst

Coverage Criterion
SchemaAnalyst

Coverage Criterion

Data Generator

Database Schema
SchemaAnalyst

Coverage Criterion

Data Generator

Database Schema

JUnit Test Suite
SchemaAnalyst

Coverage Criterion
Data Generator
Database Schema

JUnit Test Suite

Extensible tool for test data generation
Search-Based Testing

X: Parameter 1 Value
Y: Parameter 2 Value
Z: Fitness
Automatically Testing Schemas

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Automatically Testing Schemas

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INSERT INTO DEPT_INFO  
VALUES (0, '');  
INSERT INTO DEPT_INFO  
VALUES (NULL, '');  

Figure: Data generated by SchemaAnalyst.
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1
2
3
4
5

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2

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Real-world Ready

Schemas from Firefox and StackOverflow
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Scales to 1,000s of tables and constraints
Real-world Ready

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Extensive documentation available on GitHub
Real-world Ready

- Schemas from Firefox and StackOverflow
- Scales to 1,000s of tables and constraints
- Extensive documentation available on GitHub
- SchemaAnalyst provides an efficient means of generating test data for real-world database applications
Key Contributions

SchemaAnalyst: an open-source test data generator for relational database schemas
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Extensible to new data generators, coverage criteria, and database management systems
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- Extensible to new data generators, coverage criteria, and database management systems
- Extensive documentation supporting the use and modification of the tool
- Enhance the testing of database systems in industry and enable future research!
Key Contributions

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Extensible to new data generators, coverage criteria, and database management systems

Extensive documentation supporting the use and modification of the tool

Enhance the testing of database systems in industry and enable future research!

https://github.com/schemaanalyst-team/schemaanalyst