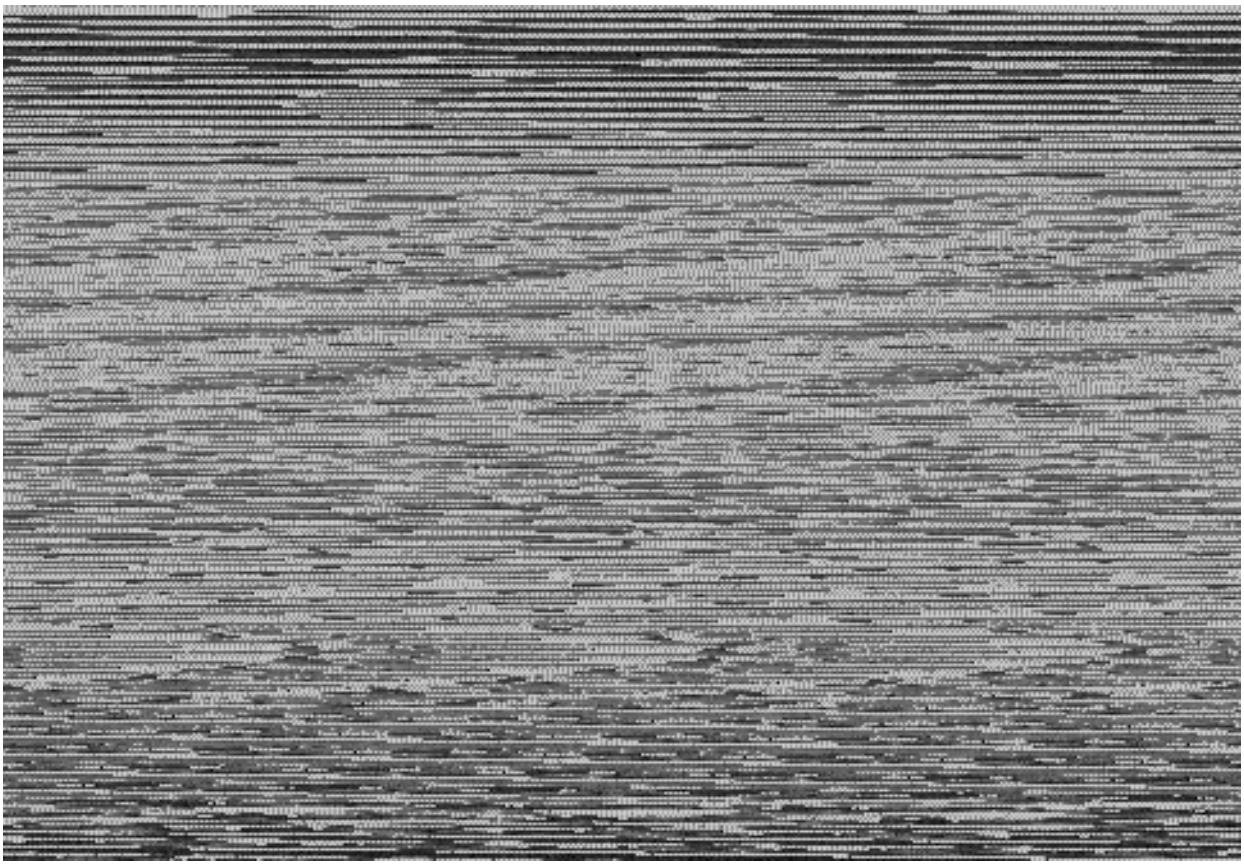

[illegible]

[illegible]

[illegible]

[illegible], [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Examples of graphs

Graphs 8 – 10 will be drawn. Definition in Graph theory relation on V

1. The shape of functional graph in G

2. What are the elements remaining in the left column of R, but not in the right?

3. What are the 3-tuples (a,a,a,a,a) and that (a,b), (a,b), (b,b), and (b,b) are all in G?

4. What is the transitive closure of G?

4. Maintain pairs of elements (x_i, x_j) are used that the sum

$$\lim_{n \to \infty} \frac{\sum_{i=1}^{n} x_i}{n} = \mu \quad \text{and} \quad \lim_{n \to \infty} \frac{\sum_{i=1}^{n} x_i^2}{n} = \sigma^2$$

are maintained and have the same conditional

5. In the conditional of a given random

[illegible] Formal definition of power

Power of power in again a relation

[illegible] is equal to [illegible] in a function [illegible]

- [illegible] relations [illegible] which relations [illegible]

- [illegible] relations [illegible]

This definition is much [illegible] formal

[illegible]

A young man in "illegal"

There is no reason for fear I think.

Some of the people question the this illegal nature

A young man the responsible people on the basis of the information passed in the Bahamas

Does in Jamaica child?

Tarski's logical notions

Formalizing discourse:

D_e := D, D_{et} := $\mathcal{P}(D)$, D^t := $\{0, 1\}$

Some traditional objects considered as sets of D like in D^t

In particular Relations and functions

Tarski: R D^t is logic if R [illegible] — R for every permutation of D

- The individual elements of D is logical
- D and $\emptyset$ are logical
- Union and Intersection relations are logical

The higher up we go, the more complex logical notions are D

Gaussian quadrature

All the numerical quantities are logical

Our "illogical" group is indeed not logical

Generality: Constructing estimators for quantities from only sets of Gaussian theory, based on numerical manipulations

[Ken Ullman, Charles Zwell]

Group g is generic if for all permutations π of M,

$$\alpha_{\pi(i)} - \alpha_{\pi(j)} = \alpha_{\pi(k)} - \alpha_{\pi(l)}$$

Ω group is generic if it is logical in Tarski's sense.

$\square$

Codd's relational algebra

Operations on data also required in combination of the basic operations on relations

1. union ∪

2. difference −

3. cartesian product ×

4. projection

$$\pi_{a_1,\ldots,a_k}(r) = \{(a_1,\ldots,a_k) \mid (a_1,\ldots,a_m) \in r\}$$

5. selection

$$\sigma_{a=b}(r) = \{(a_1,\ldots,a_m) \in r \mid a_i = a_j\}$$

.

Sample sequences

(a) Find all the elements occurring in the column of G, that end in the right

$$a_{[G]} - a_{[G]}$$

(b) Find all the 5-tuples $[a_{[G]}, a_{[G]}, a_{[G]}, a_{[G]}, a_{[G]}]$ such that $[a_{[G]}, a_{[G]}]$, $[a_{[G]}, a_{[G]}]$, $[a_{[G]}, a_{[G]}]$, and $[a_{[G]}, a_{[G]}]$ are all in S

$$a_{[G]}, a_{[G]}, a_{[G]}, a_{[G]}, a_{[G]} \in S \times S \times S \times S \times S$$

[illegible]-order quantifier

[illegible] is called [illegible]-order if there is a [illegible]-order formula $\varphi(x_1, \ldots, x_n)$ such that [illegible]

$\varphi(x_1, \ldots, x_n)$ [illegible] $\varphi(x_1, \ldots, x_n)$ [illegible] [illegible]

[illegible]'s [illegible], [illegible] in [illegible]'s [illegible] algebra [illegible] [illegible]-order

[illegible] [illegible] of [illegible]

[illegible]-order quantifier are generally [illegible] [illegible] in higher-order logic in logical [illegible]

Relational complexity

Basic complexity results for relational algebra

- "Relational complexity" of database query languages

Lower, many interesting queries are not first-order

(a) Most in the functional closure of $\mathcal{B}$

(b) Minimal pairs of elements (a_1, a_2) are such that the path

$$(a_1 | (a_1, d) = a_2) \quad \text{and} \quad (a_2 | (a_1, d) = a_2)$$

are necessarily not have the same minimalizing

(c) In the minimalizing of $\mathcal{B}$ a given minimal

[illegible]-complexness

[illegible], [illegible]'s relational algebra [illegible] is [illegible] complete

[illegible] complexness on the input level

[illegible]

> [illegible] [illegible] [illegible] [illegible]
> [illegible] [illegible] [illegible] [illegible]
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[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [

[illegible] and algebra

[illegible] $x_1, \ldots, x_n$

[illegible] $\mathbb{C}$, [illegible] $\mathbb{C} \vdash x_i$, [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] $|\mathbb{C}|$.

1. [illegible]

2. [illegible] $|\mathbb{C}|^n$ [illegible]

3. [illegible] [illegible] [illegible] [illegible]

   [illegible] $x_1, \ldots, x_n \in |\mathbb{C}|^n$ | [illegible] $|\mathbb{C}|$.
   [illegible] $x_1, \ldots, x_{n-1}, x_{\underline{n}}, \ldots, x_n \in$ [illegible]

[illegible] [illegible] [illegible]

$x_1, \ldots, x_n \in |\mathbb{C}|^n$ | x_1 [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible] $|\mathbb{C}|$

[illegible]'s [illegible] [illegible] in [illegible]

[illegible] [illegible] [illegible]-[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]-[illegible]

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Relation algebra

Dropping all the type subscripts, we have a number of operations on binary relations on U:

1. union

2. complementation w.r.t. U^2

3. composition

   $x\,(r;s)\,y \iff \exists z\,[x\,r\,z \wedge z\,s\,y]$

4. converse: $x\,r^{\smile}\,y \iff [y\,r\,x]$

Define 0 with all relations empty, 1 with all relations $U \times U$.

$\Box$ Call the n-ary relations from relations to U to itself operations and consider the [inductive closure]

The relevant operations on U, are then $|U|$

[illegible]

[illegible]

[illegible]

[

[illegible]

[illegible] is programming language:

- [illegible] [illegible] [illegible] [illegible]
- [illegible] [illegible] [illegible]
- [illegible], [illegible]

[illegible]

[illegible] [illegible] — [illegible]

[illegible]

[illegible] [illegible] [illegible] [illegible]

[illegible], [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [

Spatial database

In the case, I can understand

- Sample multi-processing return of
  database operations

However, in reality I have have thousand

Some applications need to use this thousand

E.g. up [illegible] I in [illegible]

Set of points in R^d — Nearest neighbor [illegible]

[illegible]

[illegible]

[illegible] all points in [illegible] on a [illegible] [illegible] [illegible] [illegible]

$$[illegible]$$

[illegible] [illegible] [illegible]-[illegible] [illegible] [illegible] [illegible]

$$[illegible]$$

- [illegible]-[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [

[illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible]

$$[illegible] \mid [illegible]$$

$$[illegible] \quad [illegible] \quad [illegible]$$

$$[illegible] - [illegible] \quad [illegible] - [illegible]$$

[illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible]

$$[illegible] \mid [illegible]$$

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$$[illegible] - [illegible] \quad [illegible] - [illegible]$$

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible]

Semi-algebraic sets

Sets in $\mathbb{R}^n$ defined by formulas over $\mathbb{R}$

Quick view properties

Tarski: The first-order theory of $\mathbb{R}$ is
decidable: is effectively closed
quantifier elimination

- Algebraic representations of semi-algebraic sets using formulas in semiring

- Tarski and Seidel algorithms

- Number of quantifiers in Seidenberg-Lojasiewicz

[illegible]

[illegible] semi-algebraic sets and only on subsets, that also on inputs

- Solutions in [illegible] and no longer the [illegible] only semi-algebraic

  Sample $\{x_1, x_2, x_3\}$ as also for semi solution a quantifier-free formula over $\mathbb{R}$

- Bounds for any intermediate polynomial $\mathbb{R}$ will affection p.m.

  Tarski: Every semi-algebraic subset of $\mathbb{R}$ is a finite union of intervals

- $\mathbb{R}$-minimality, tame topology

  Substitution principleness for $\mathbb{R}$ holds over any $\mathbb{R}$-minimal $\mathbb{R}$ with p.m.

[illegible]

[illegible] in generating the spatial relations quantifiers

- [illegible] imaginary order all permutations of the

[illegible] data elements in a spatial relation:

  - real numbers

  - points in space [illegible]

- [illegible] imaginary order all permutations of [illegible]

[illegible] groups of permutations connected in

[illegible] [illegible] [illegible]

[illegible] [illegible] [illegible]

[illegible] begin as an unknown kind of permutation

[illegible]

[illegible]

[illegible] is [illegible] is [illegible] [illegible] all [illegible]

[illegible] [illegible]

[illegible] [illegible]

[illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [

[illegible]

[illegible]

[illegible] [illegible] [illegible] [

[illegible] on non-general [illegible]

In [illegible]

$$[illegible]$$

In [illegible]

$$[illegible]$$

$$[illegible]$$

In [illegible] minimal [illegible] non-general, [illegible] in [illegible]

[illegible], non-general [illegible] in [illegible] [illegible] in [illegible]

[illegible] [illegible] [illegible] of [illegible] [illegible] [illegible] [illegible] in [illegible]

Conclusion

Sustainable strong online handling on login

And accepting that many of Tandi's ideas had application

- Tandi's DDOS mitigation work cannot be fully about Sustainable strong at DDI

Thanks! Questions Welcome, Find Me Outside