# Ripple Joins for Online Aggregation

Parag Palekar,

Kashi Vishwanath

# Motivation

- Generalize block nested-loops and hash-joins
- Update running estimates in a
  - smooth and
  - continuous fashion.

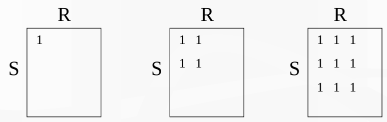
# Motivation

- Previous best : Nested loops join [HHW97].
- R X S, |R| < |S|.
  - Pick a random s from S
  - Scan R to find all tuples <r,s>
  - Update running estimate and confidence interval.
- If R itself is of non-trivial size ? Time between successive updates …
- Does length of successive intervals keep falling ?

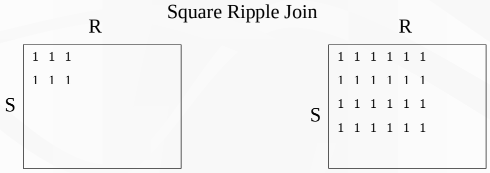
# Ripple join:An overview

- A random tuple r from R
- A random tuple s from S
- Join r and s with previous tuples in R X S and with each other.
  - Square version : equal rates for R and S
  - Rectangular version : unequal rates for each relation
- Tradeoff between sampling rate and confidence-length interval

# A View of Ripple Join



Square Ripple Join



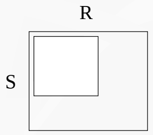
Rectangular Ripple Join

# Ripple Join contd…

- The general algorithm may contain K base relations, each retrieving $\beta_k$ previously-unseen tuples from $R_k$
- The trade-off
  - If $\beta_k$ values are higher
    - more number of I/Os are required…time between updates increases
    - length of the confidence interval is typically shorter

## Ripple Join Algorithms

- Generalization of nested-loops join
- “inner” and “outer” loops keep continually interchanging.



## Iterators

- Most DBMS’s use an iterator model for relational operators.
- Types of iterator models
  - Square Binary Ripple Join iterator
  - Enhanced Ripple Join iterator

## An Enhanced Ripple Join Iterator

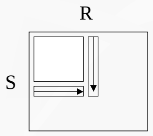
- Considers the non-unitary aspect ratios.
  - Retrieving tuples from two inputs of a ripple join at uneven rates.
  - An obvious solution is to maintain a local ♌ value for each relation.
- Integration of a ripple join iterator into a query plan tree.
  - Input iterators must be restartable
  - Ripple joins can be combined with other join techniques

## Ripple Join variants

- Block ripple join
  - Results in I/O savings factor proportional to the block size
- Index ripple join
  - Index on join attributes of R
  - No alternation between outer and inner loops
- Hash ripple join
  - Old tuples of R and S are maintained in memory and hashed on the join column

## A view of Block ripple join

A block being considered for join instead of a tuple



## Future Work

- Although ripple join is symmetric,it is unclear as to how
  - It should choose among ripple join variants
  - It should order a sequence of ripple joins
- Efficient processing of Self-joins
  - Avoiding two separate samples from the same input table
- Parallelization of ripple joins