Accelerating Joins with Filters: Keeping a Limited Memory is Robust

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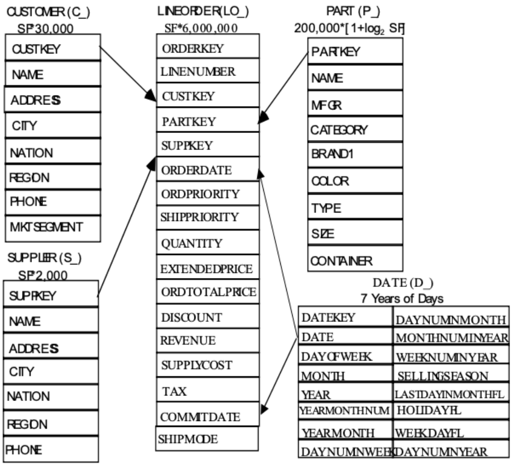
Star Schema



- If the query optimizer chooses a poor join order, intermediate join results may be unnecessarily large.
- Solution: try to filter out extraneous tuples before performing joins

Lookahead Information Passing (LIP)

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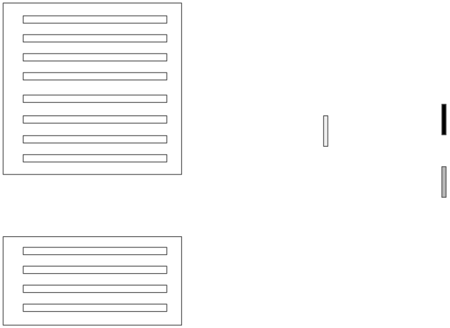

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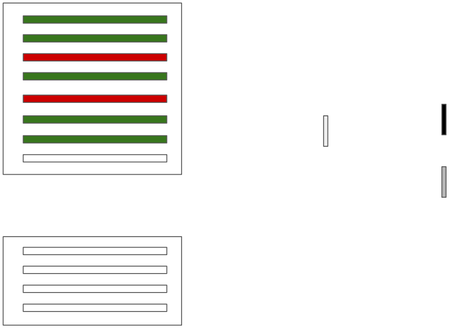

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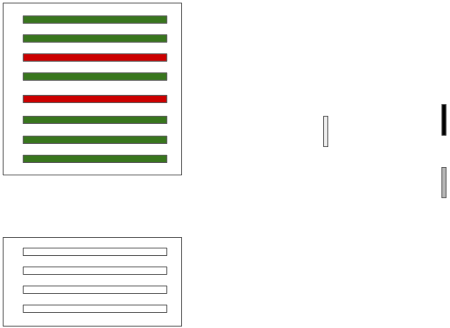

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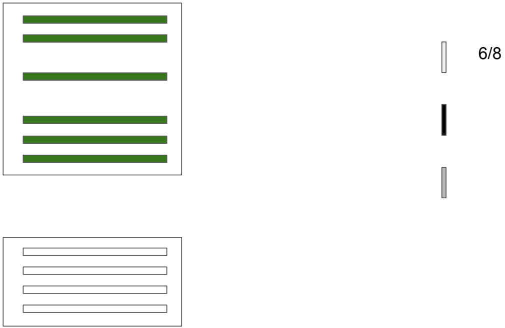

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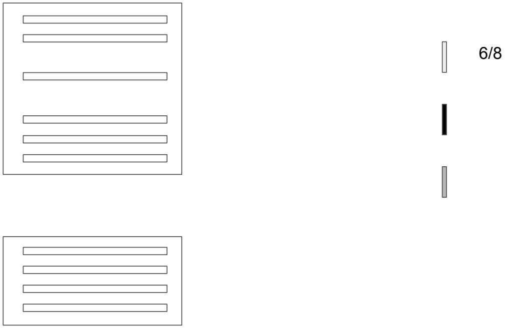

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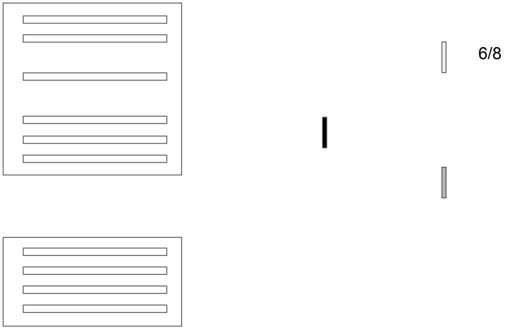

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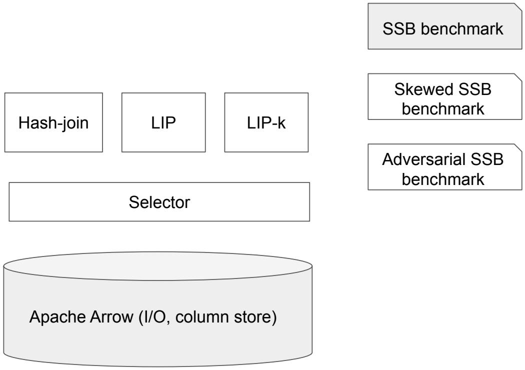
- LIP uses statistics from all previous batches to compute σ
  - Slow response to local changes in key distributions
- **LIP-k**: Only use the previous k batches to compute σ

Implementation and benchmarking



An Example Experiment

Skewed Key	
$\sigma = 1$	
$\vdots$	50 batches
$\sigma = 1$	
$\sigma = 0$	
$\vdots$	50 batches
$\sigma = 0$	
$\sigma = 1$	
$\vdots$	50 batches
$\sigma = 1$	
$\vdots$	

- LIP-k perform performs better than LIP on some queries...
- ...but LIP performs better on others...

LIP is solving an online problem

- Tuples arriving one at a time
- Upon arrival, decide a sequence of filters
- Minimize the total probes
- Deterministic!

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Theorem

Let n be the number of filters in the LIP problem. There is no deterministic mechanism $\mathcal{M}$ achieving a competitive ratio less than n for the LIP problem.

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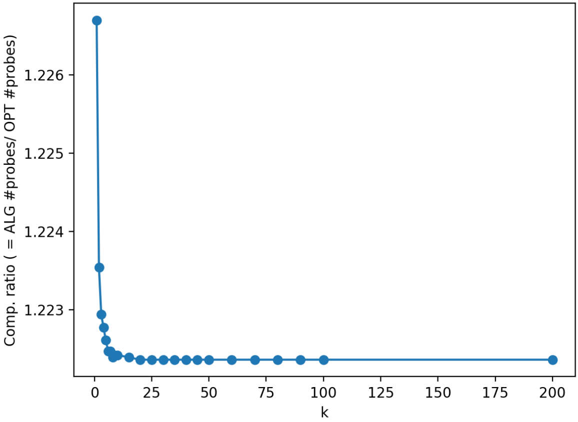
Theorem

Let n be the number of filters in the LIP problem. There is no deterministic mechanism $\mathcal{M}$ achieving a competitive ratio less than n for the LIP problem.

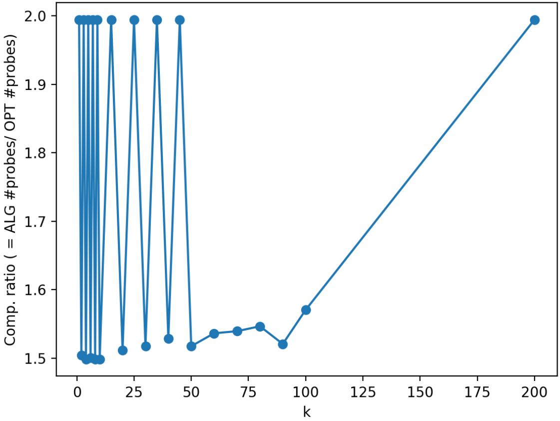
- Not observed in practice, but a theoretical lower bound
- Randomness?

Competitive Ratio vs. k on Uniform Data



Competitive Ratio vs. k on Adversarial Data

- Adversarial dataset constructed such that LIP-k has worst case performance for odd k



Conclusion

- Implemented LIP and its variant LIP-k
- LIP-k is better than LIP in the adversarial/skewed settings
- Randomness to achieve better robustness guarantee

Thank you!

Questions?