Efficient Query Re-optimization with Judicious Subquery Selections

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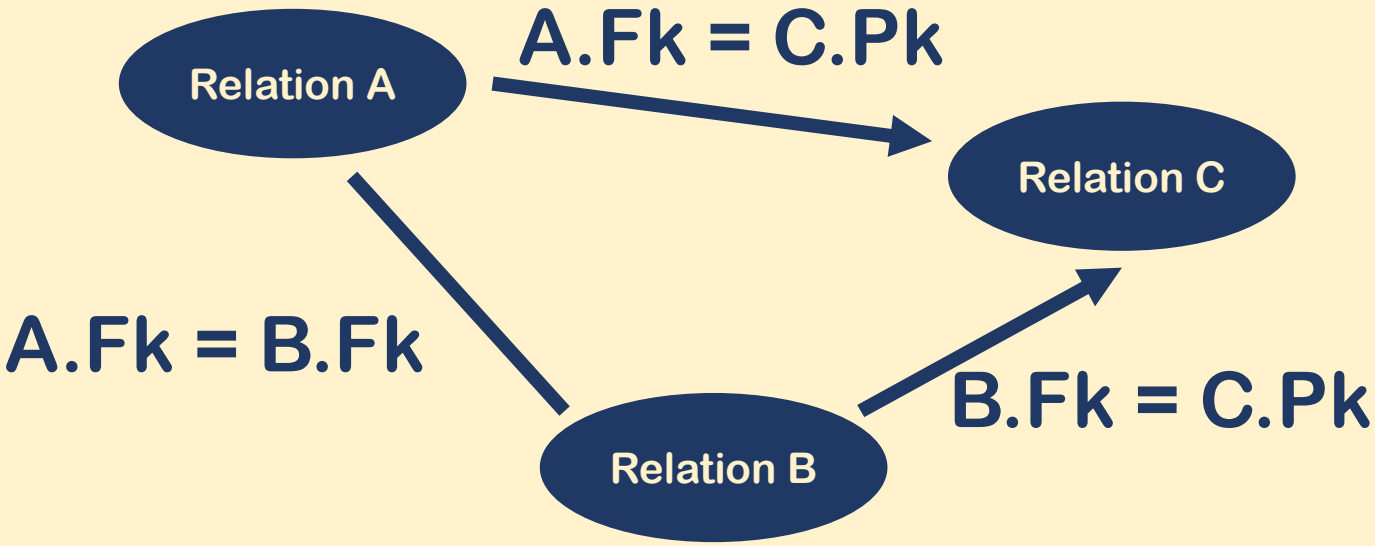
SIGMOD 2023

Wrong CE leads to bad physical plan



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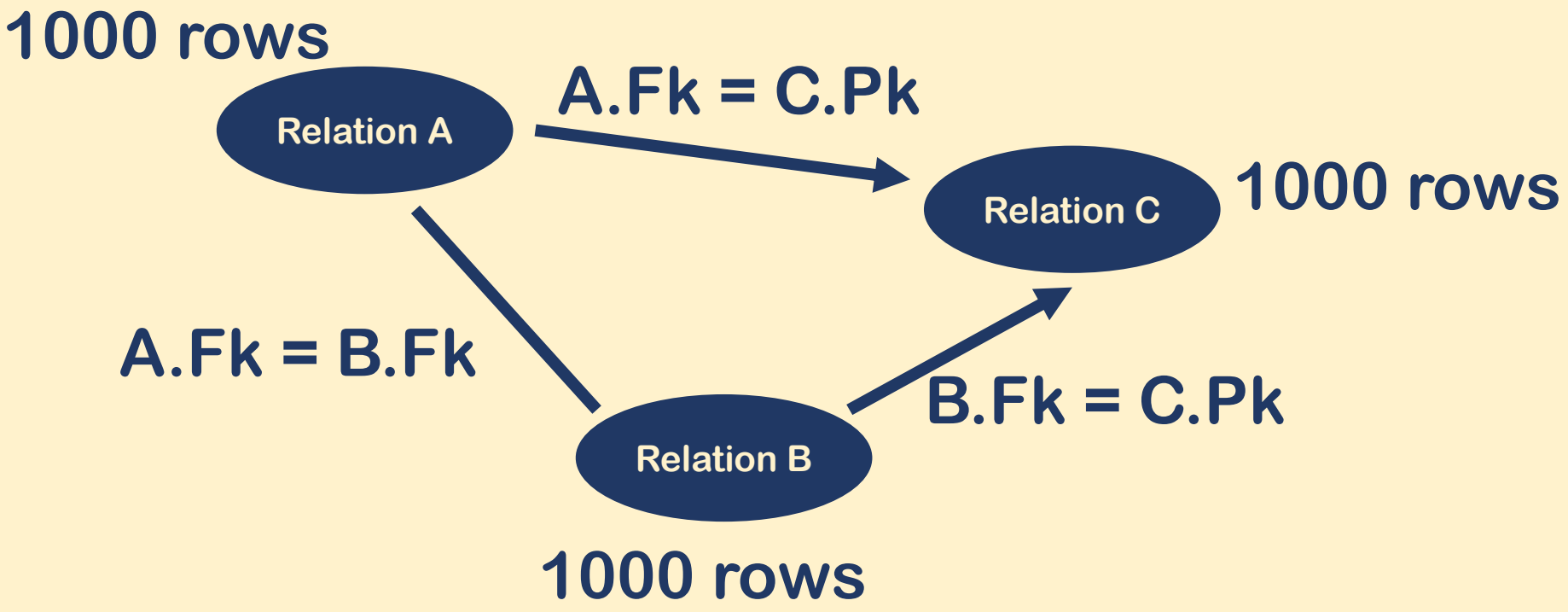

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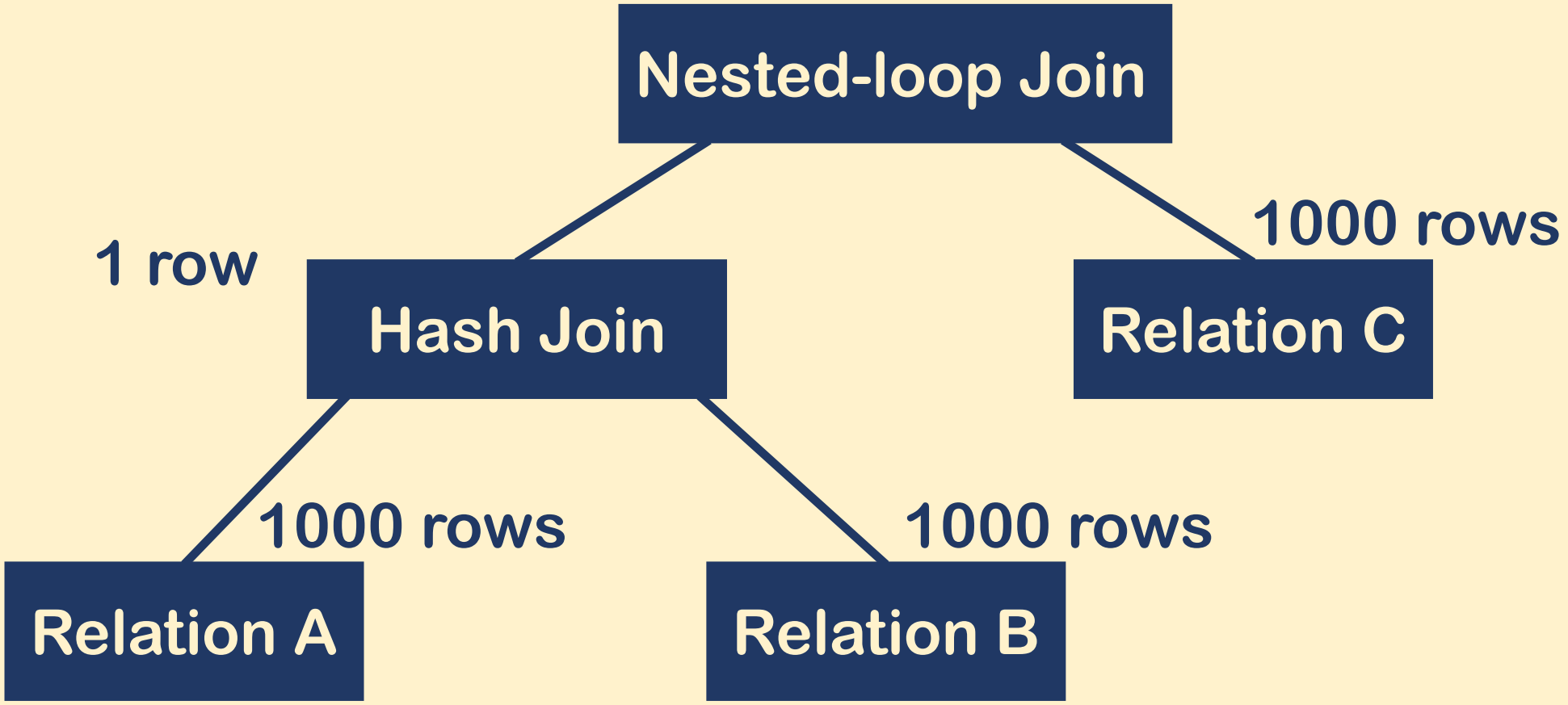

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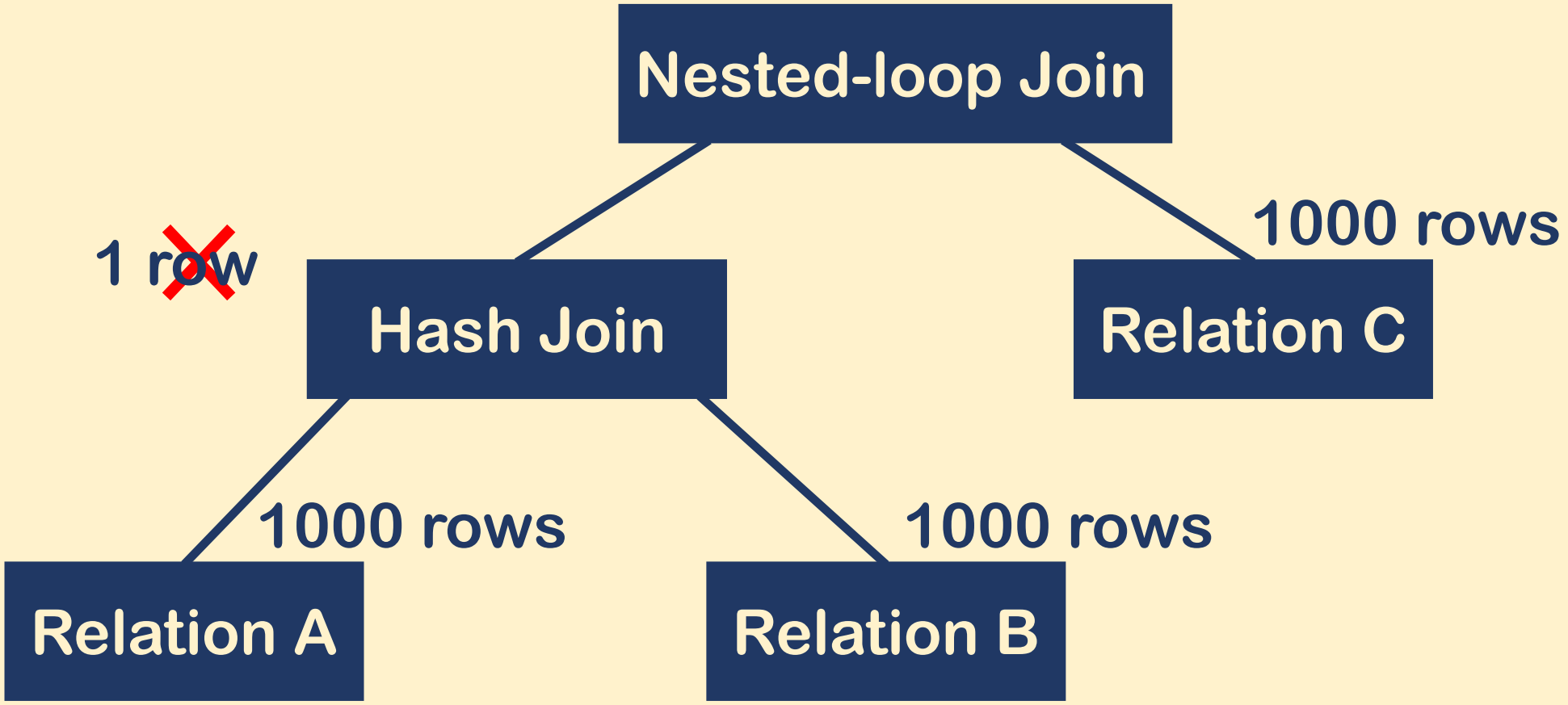

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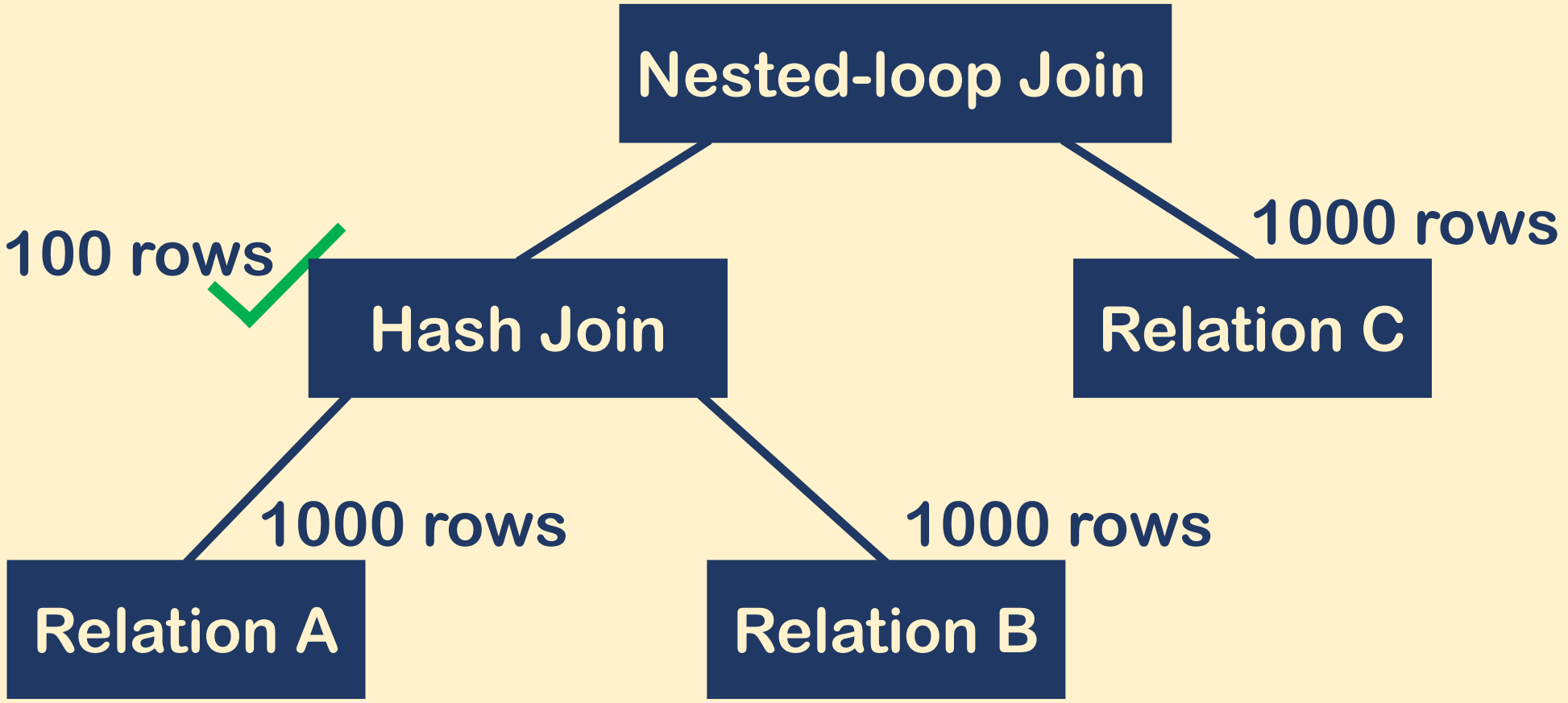

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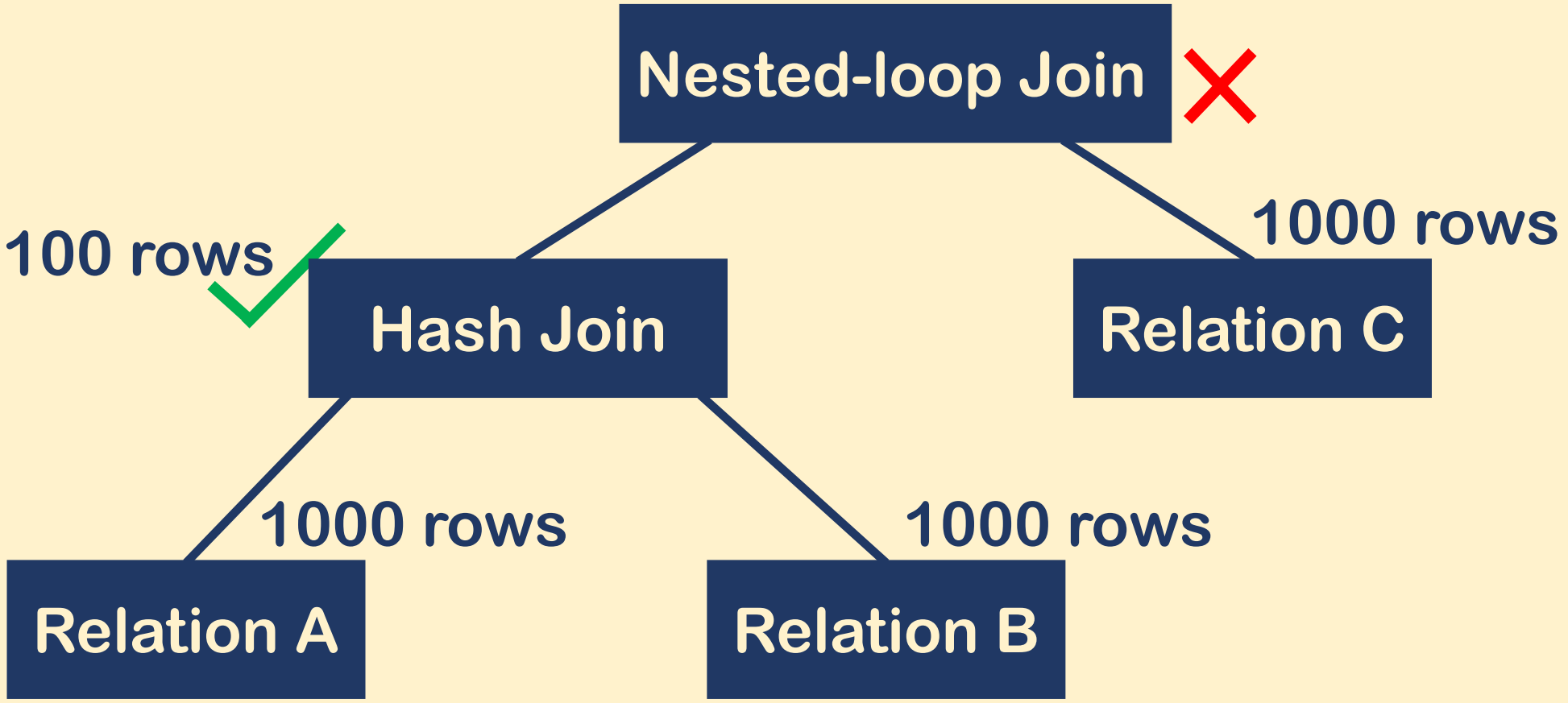
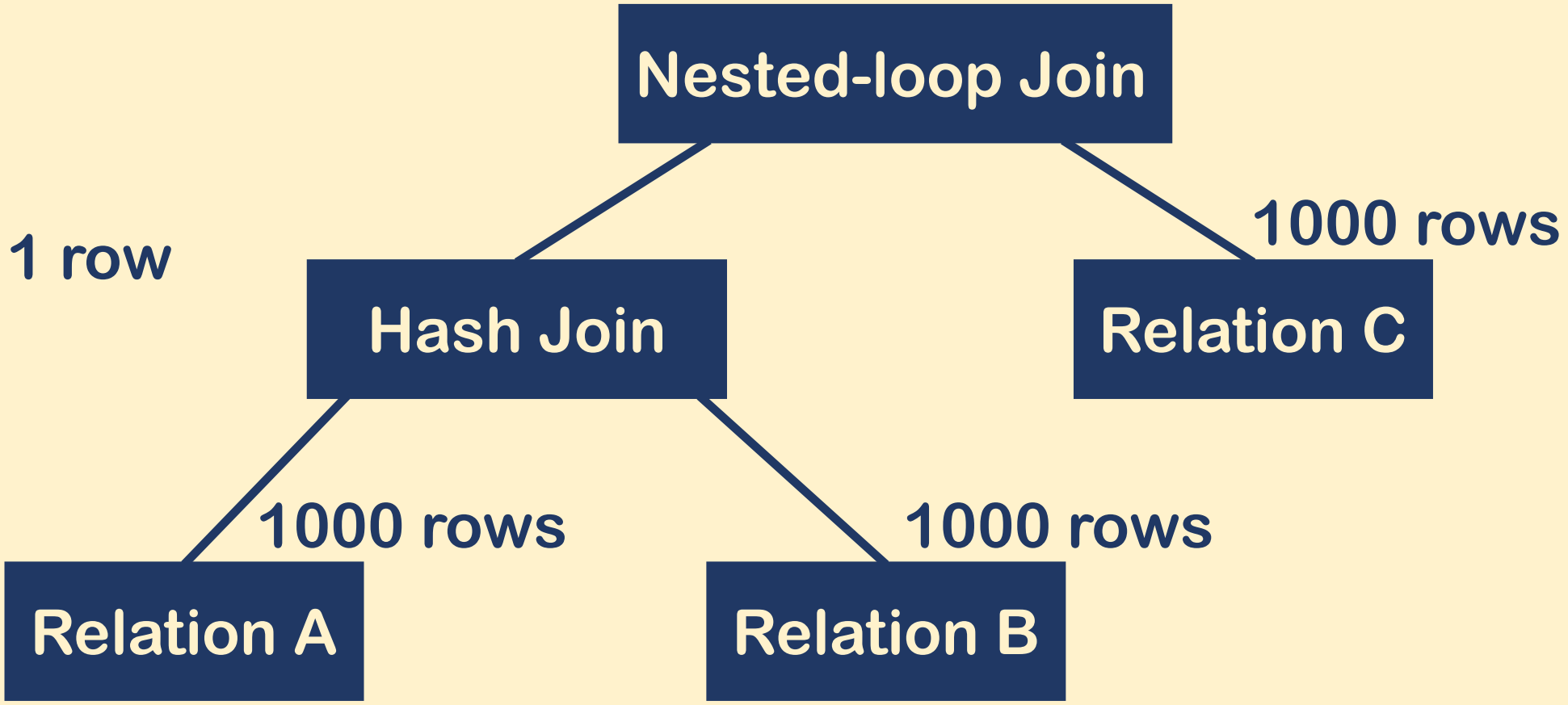


Re-optimization fixes mistakes



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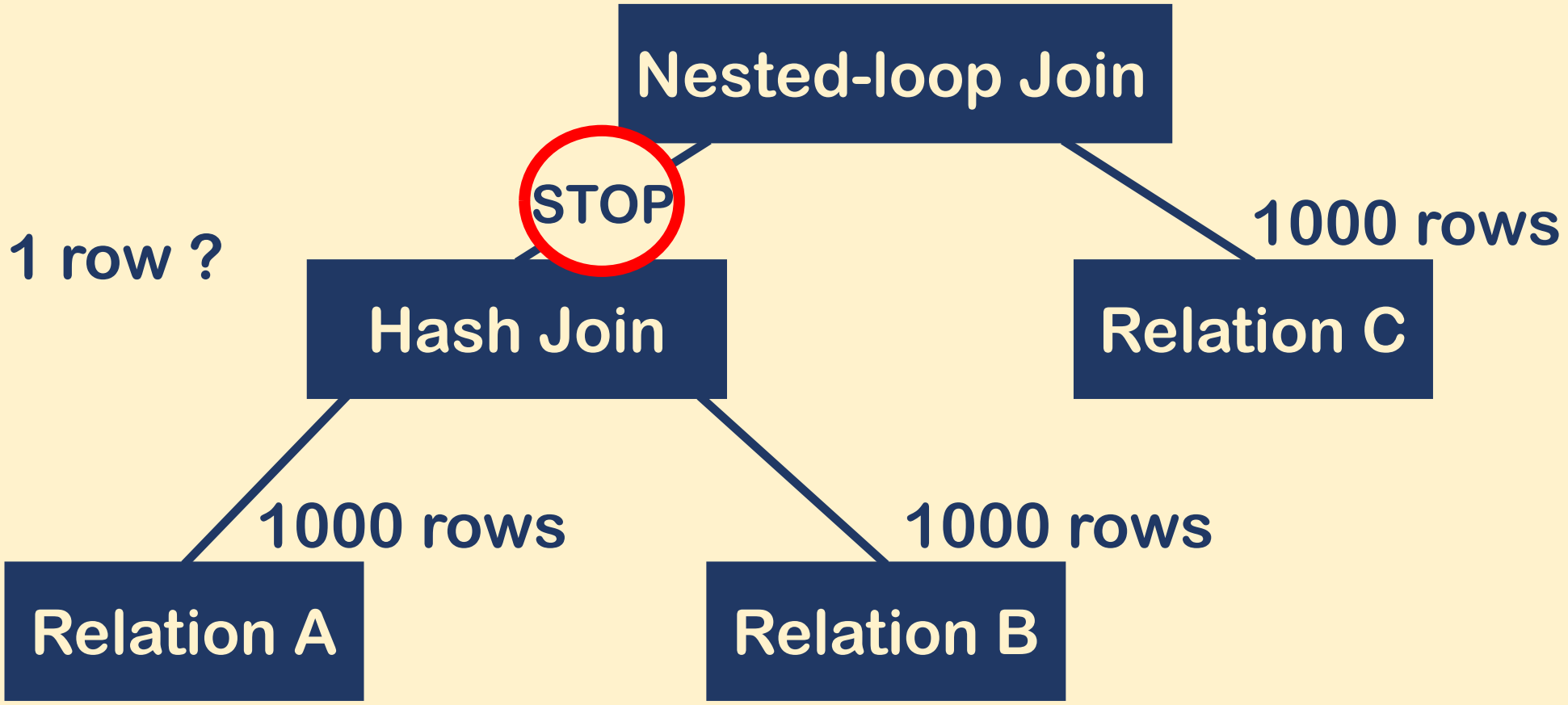

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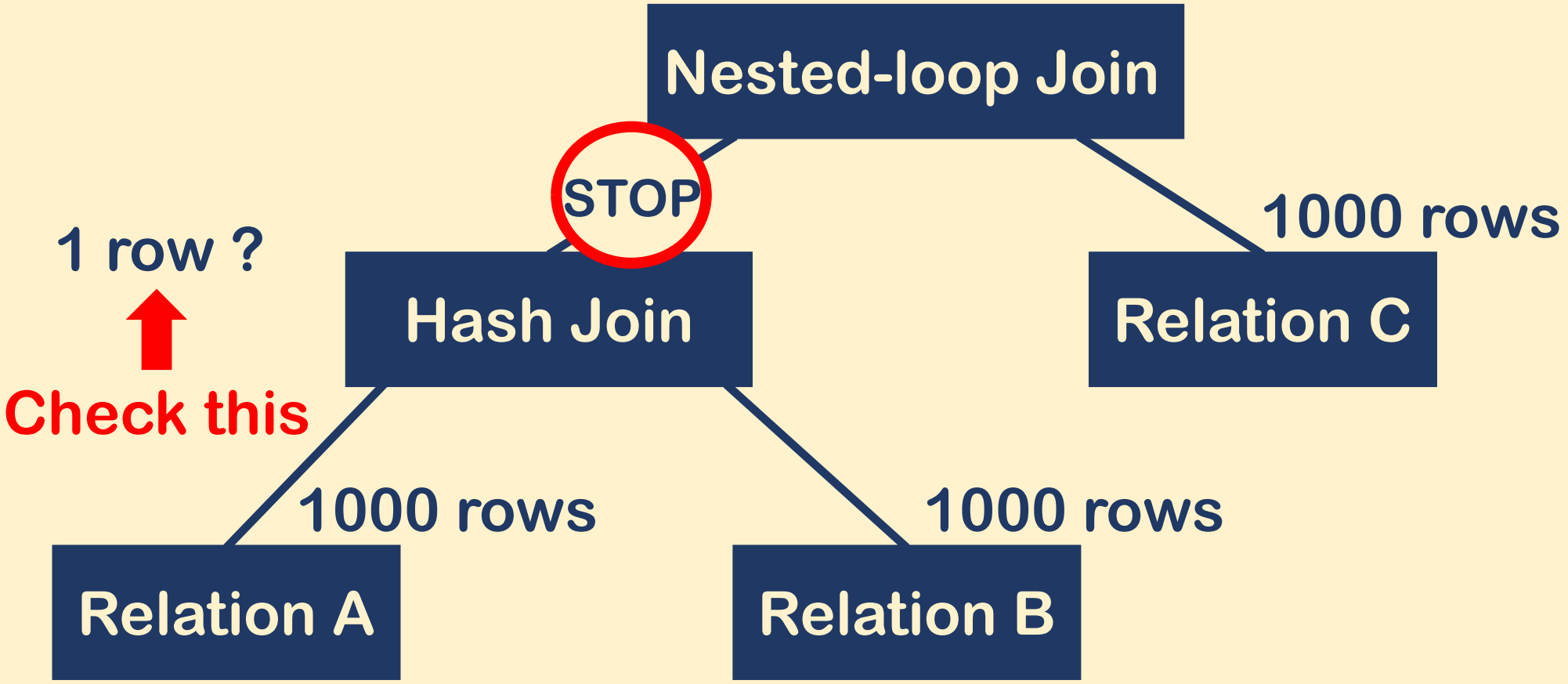

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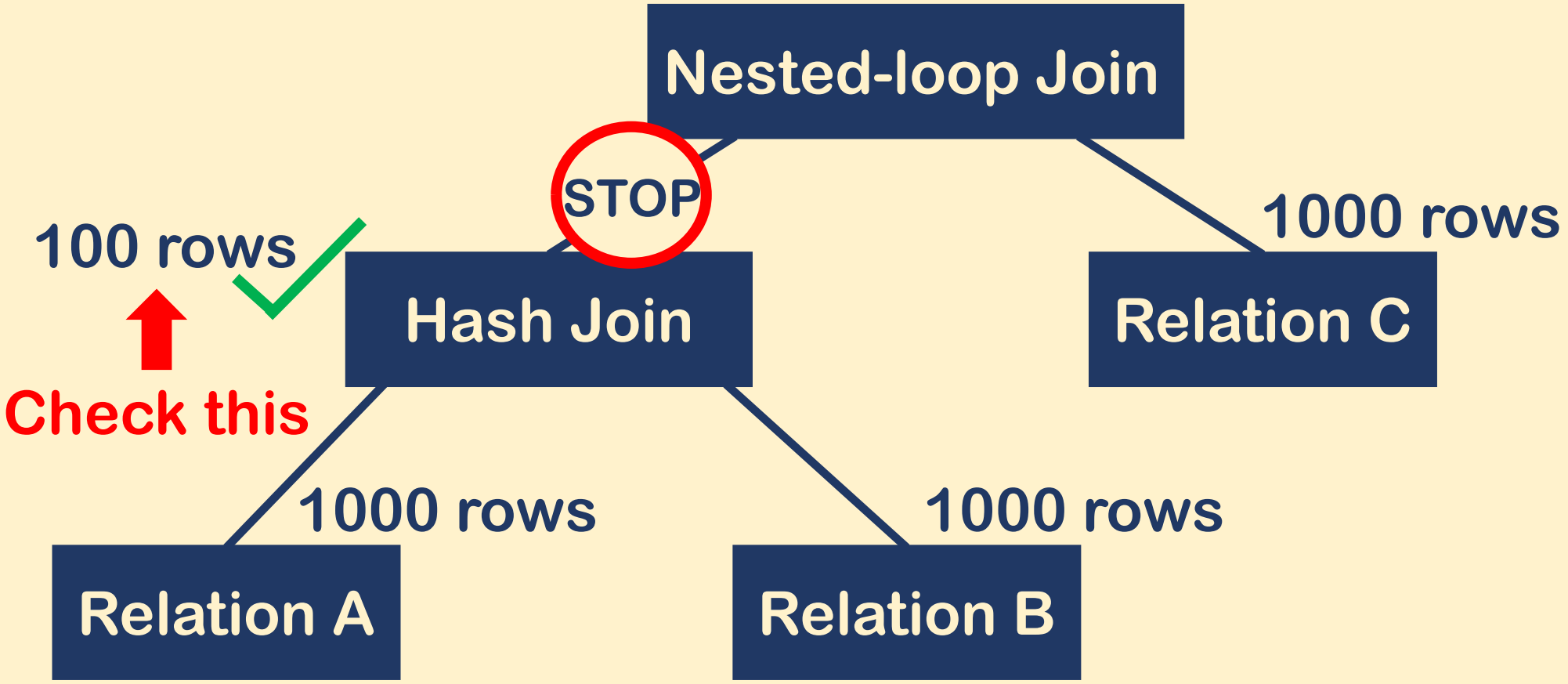

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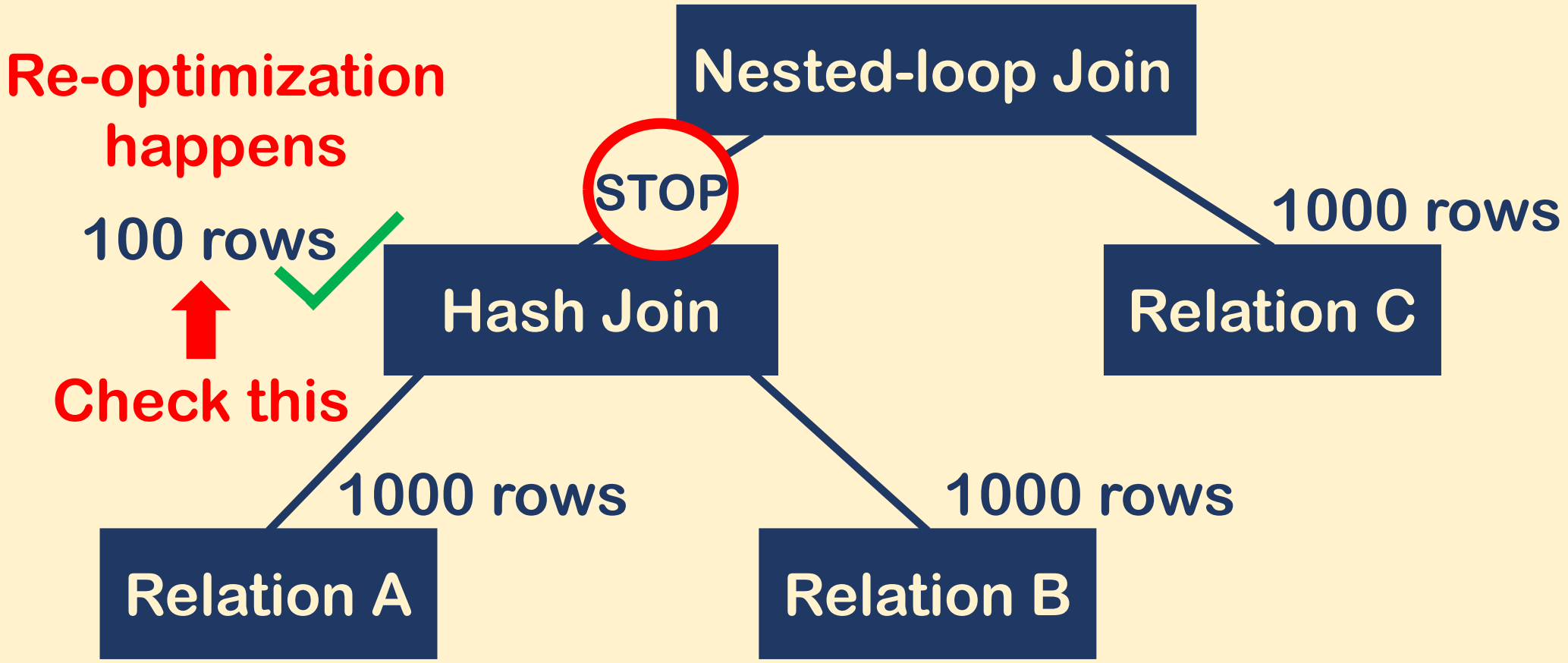

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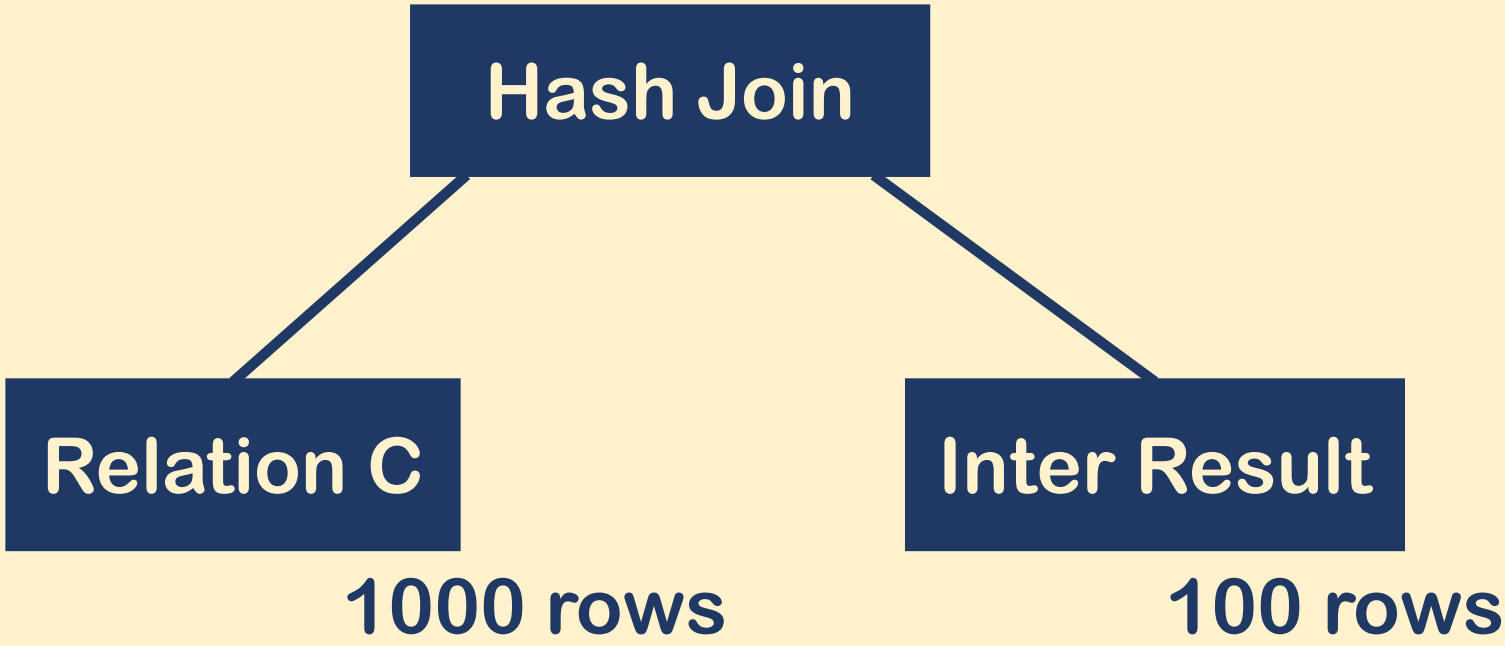

Mistake is too large to fix

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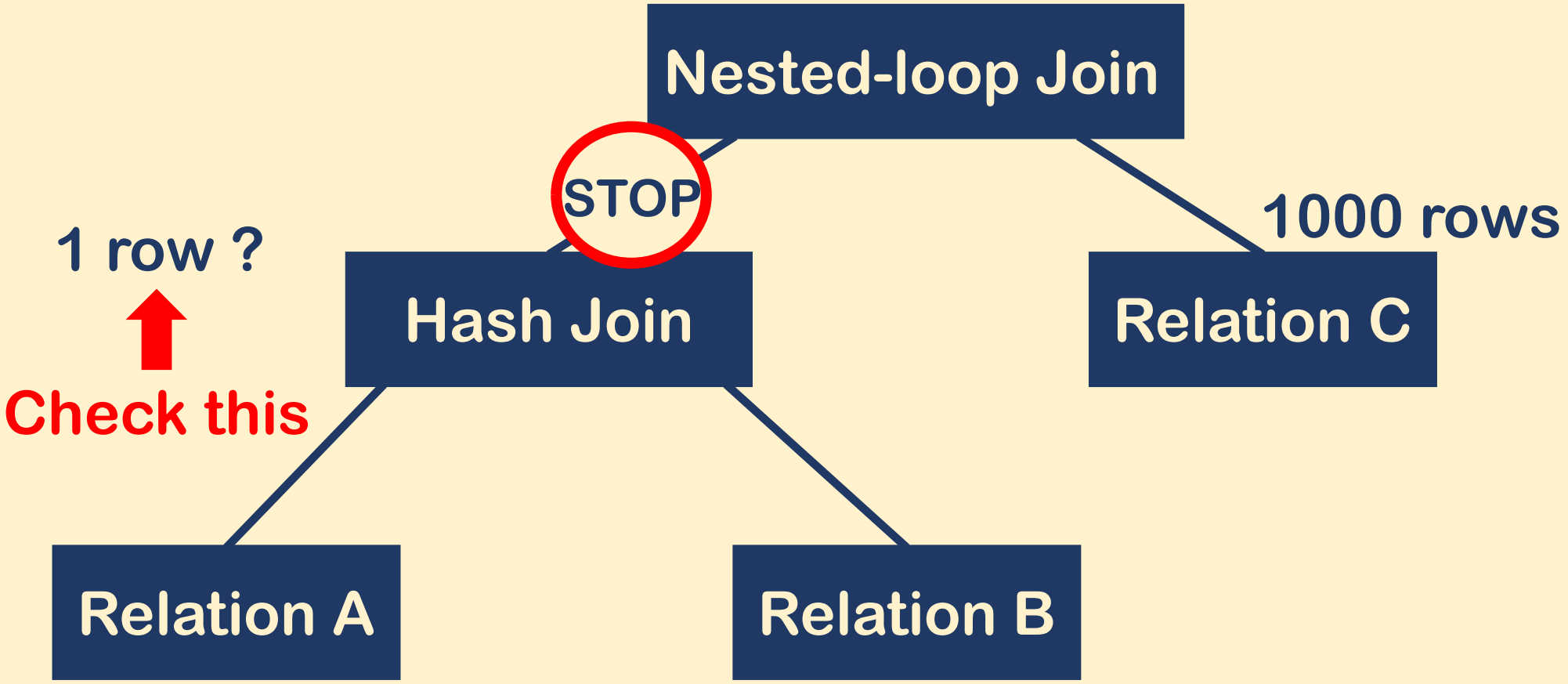

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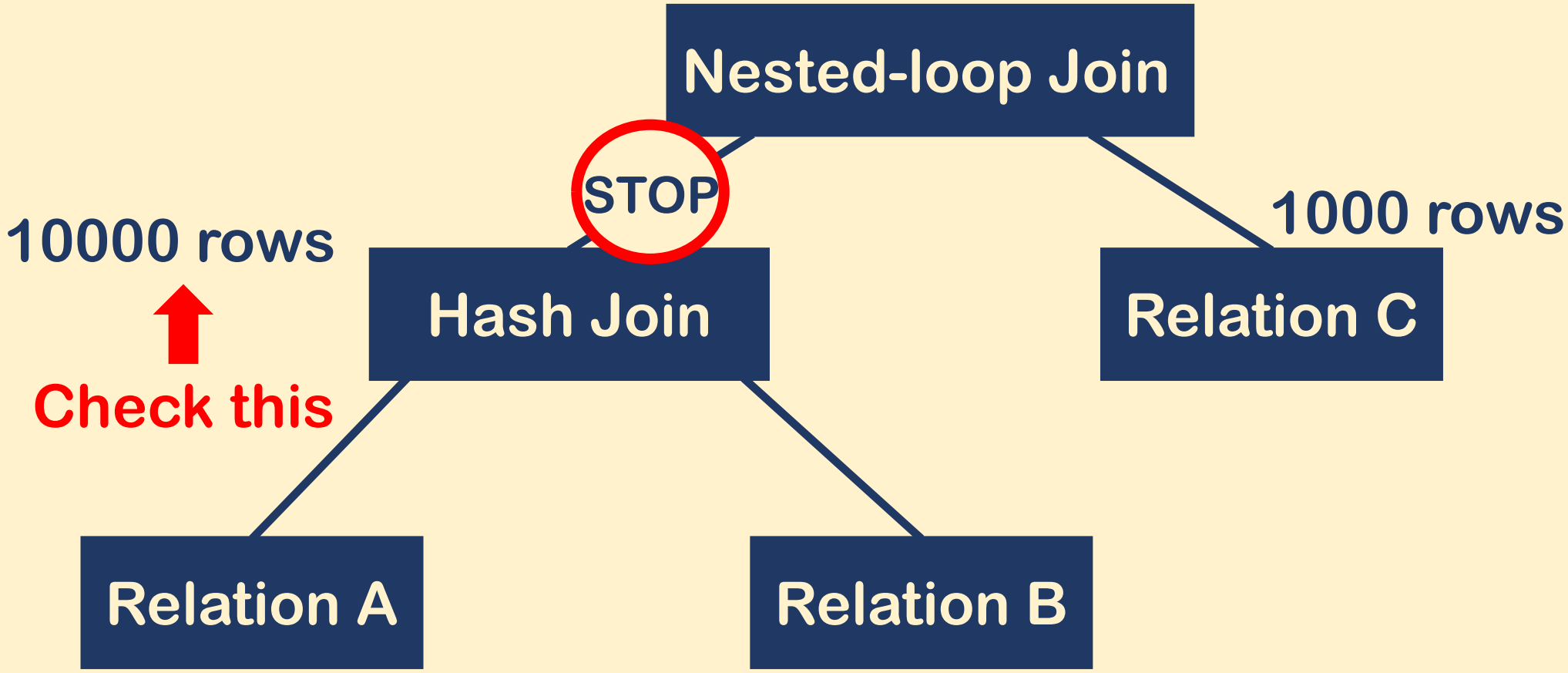

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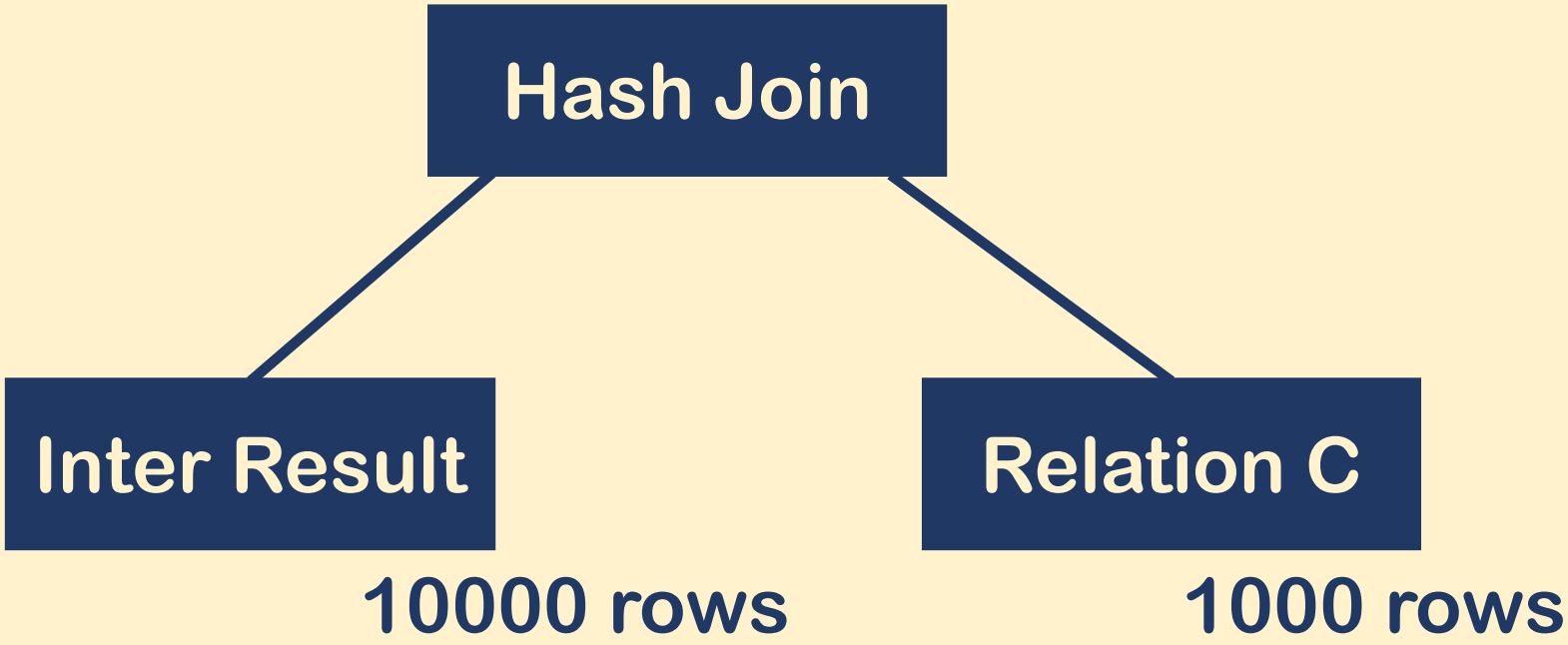

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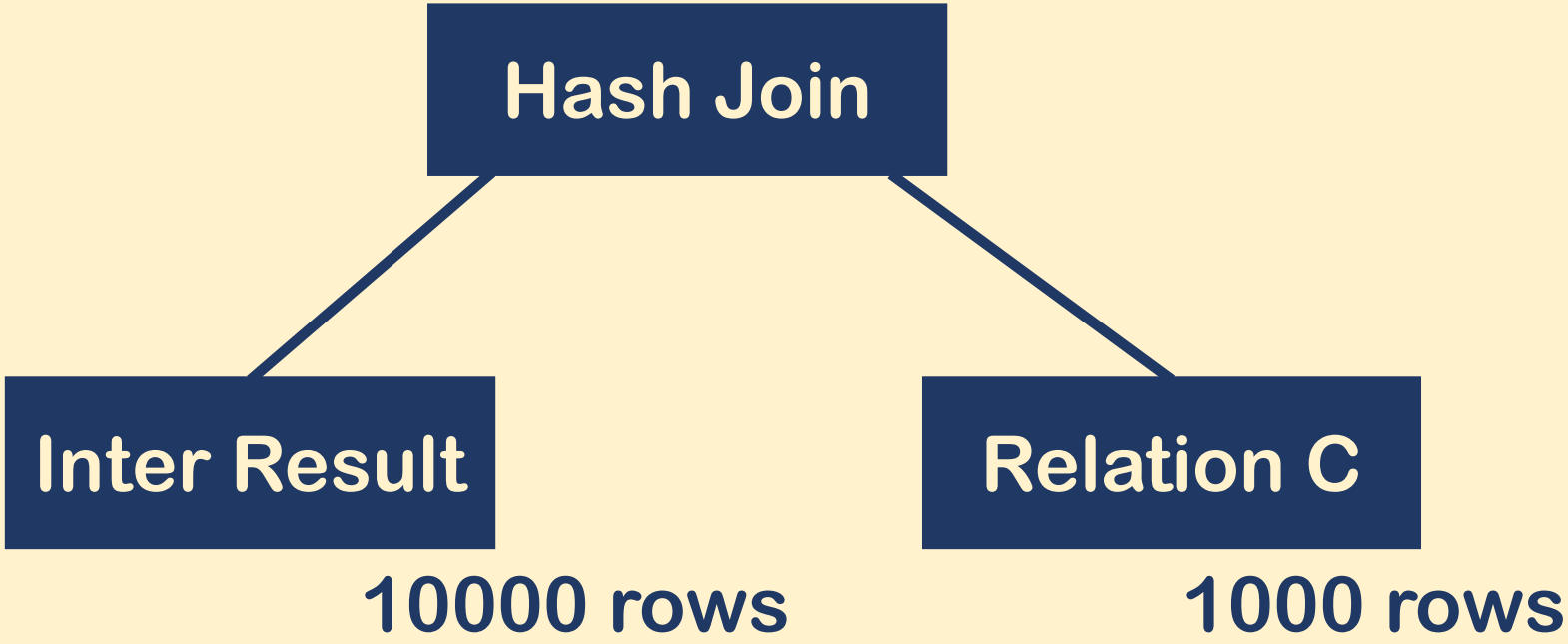
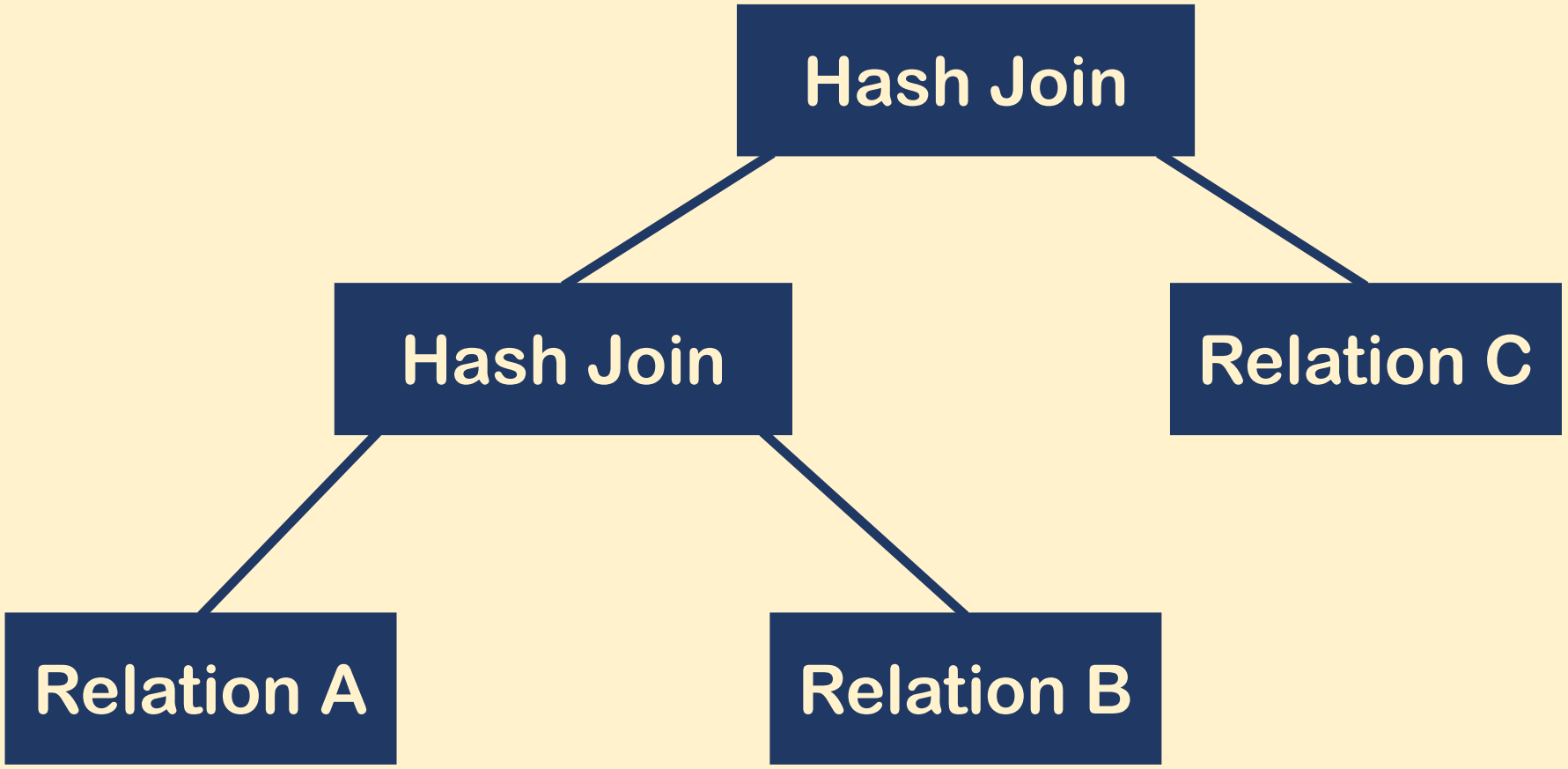


Re-optimization:
worked but useless

Avoid such explosive join



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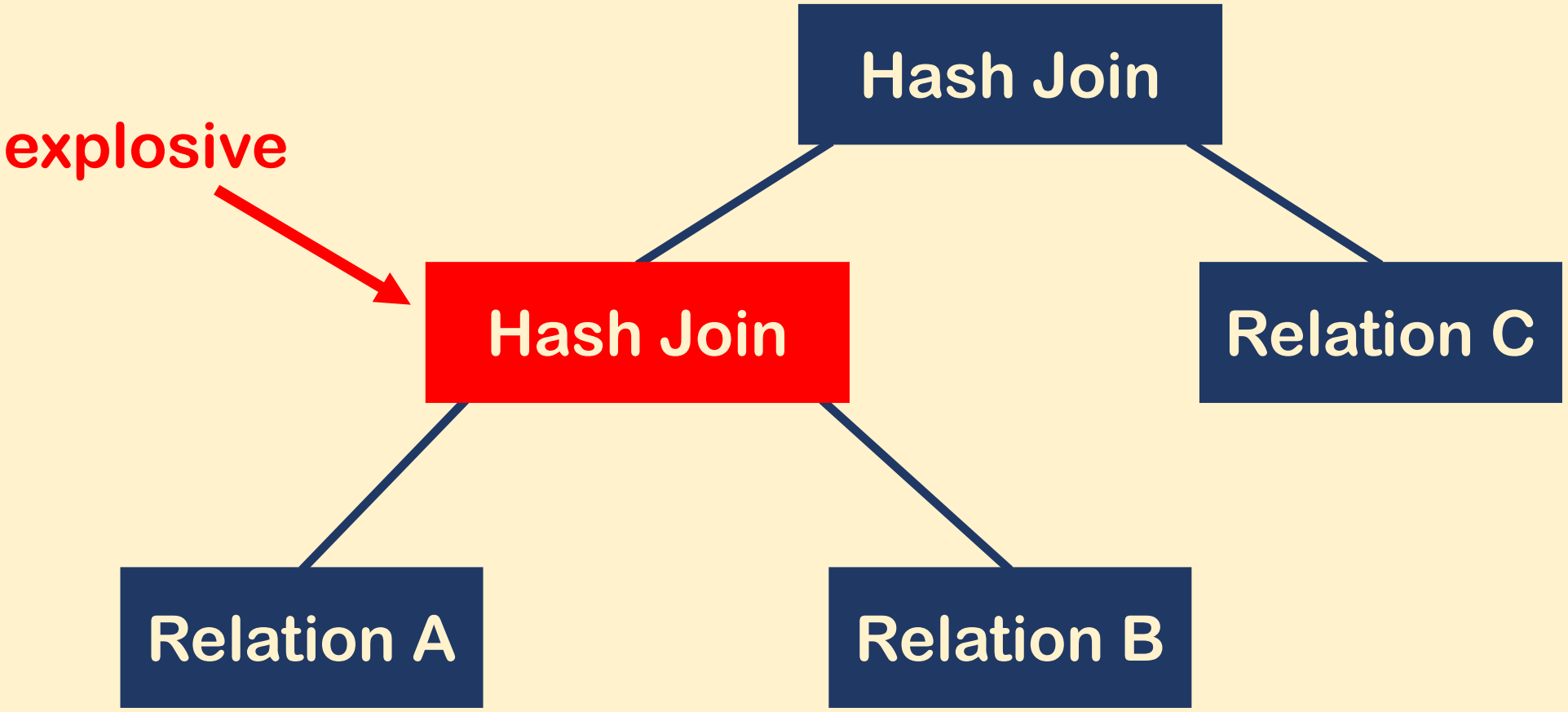

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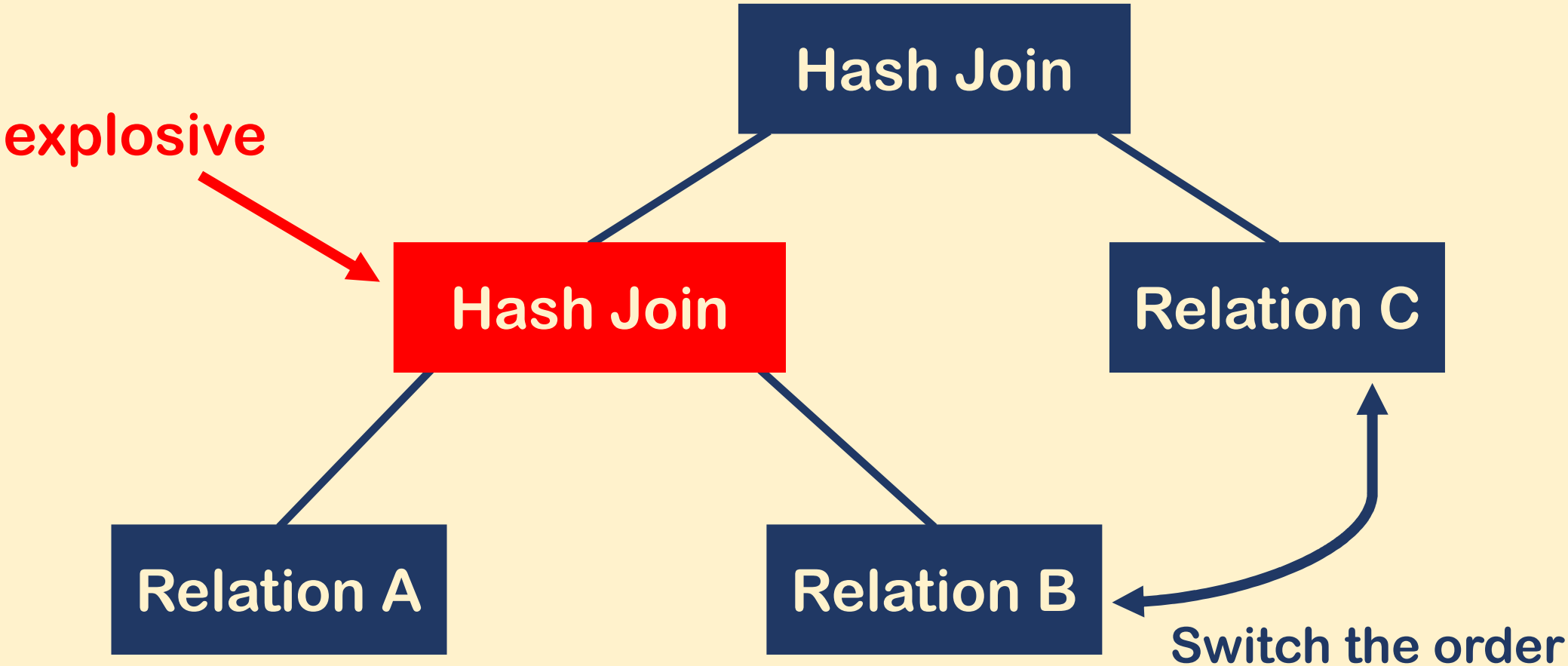

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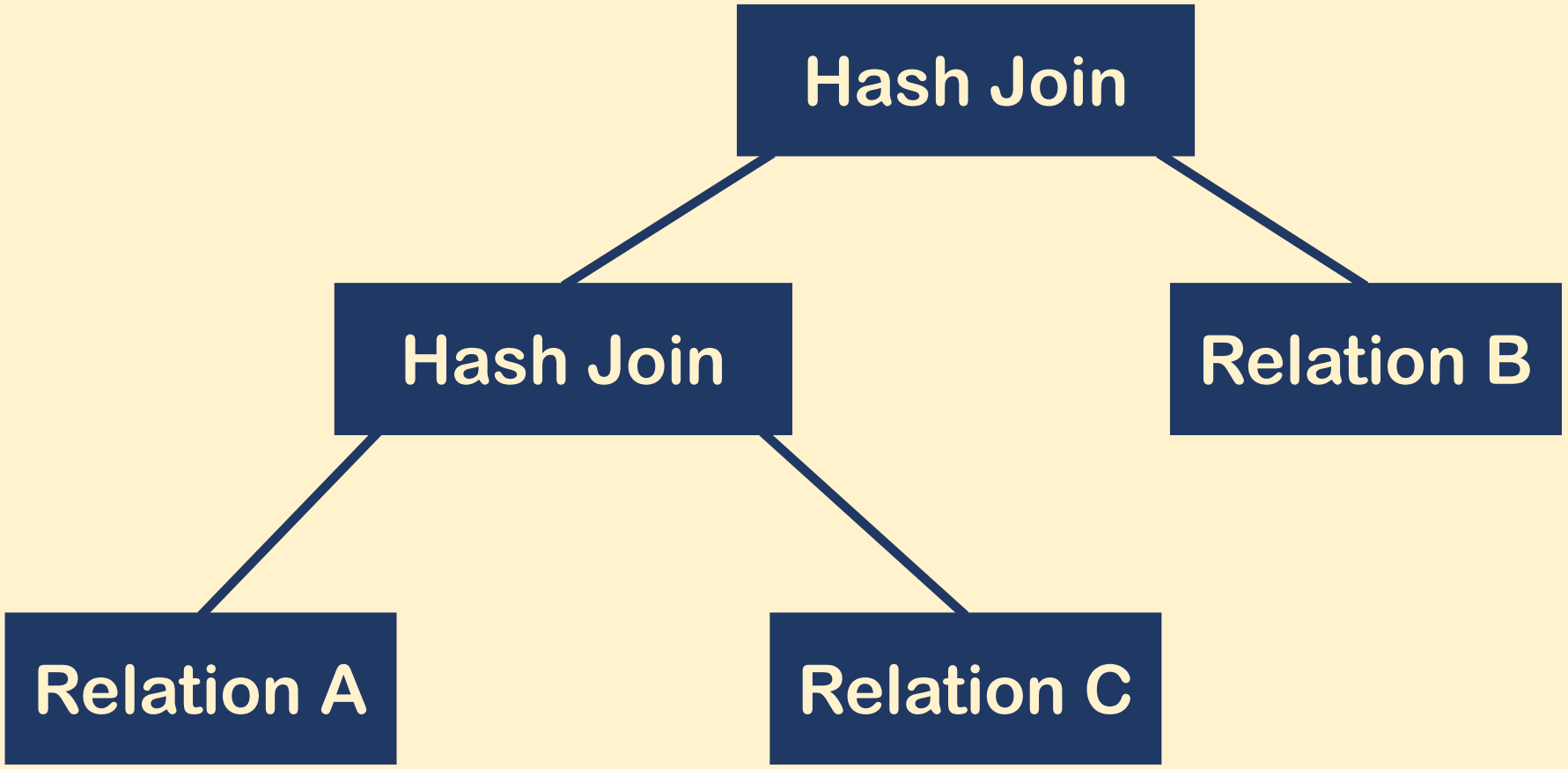
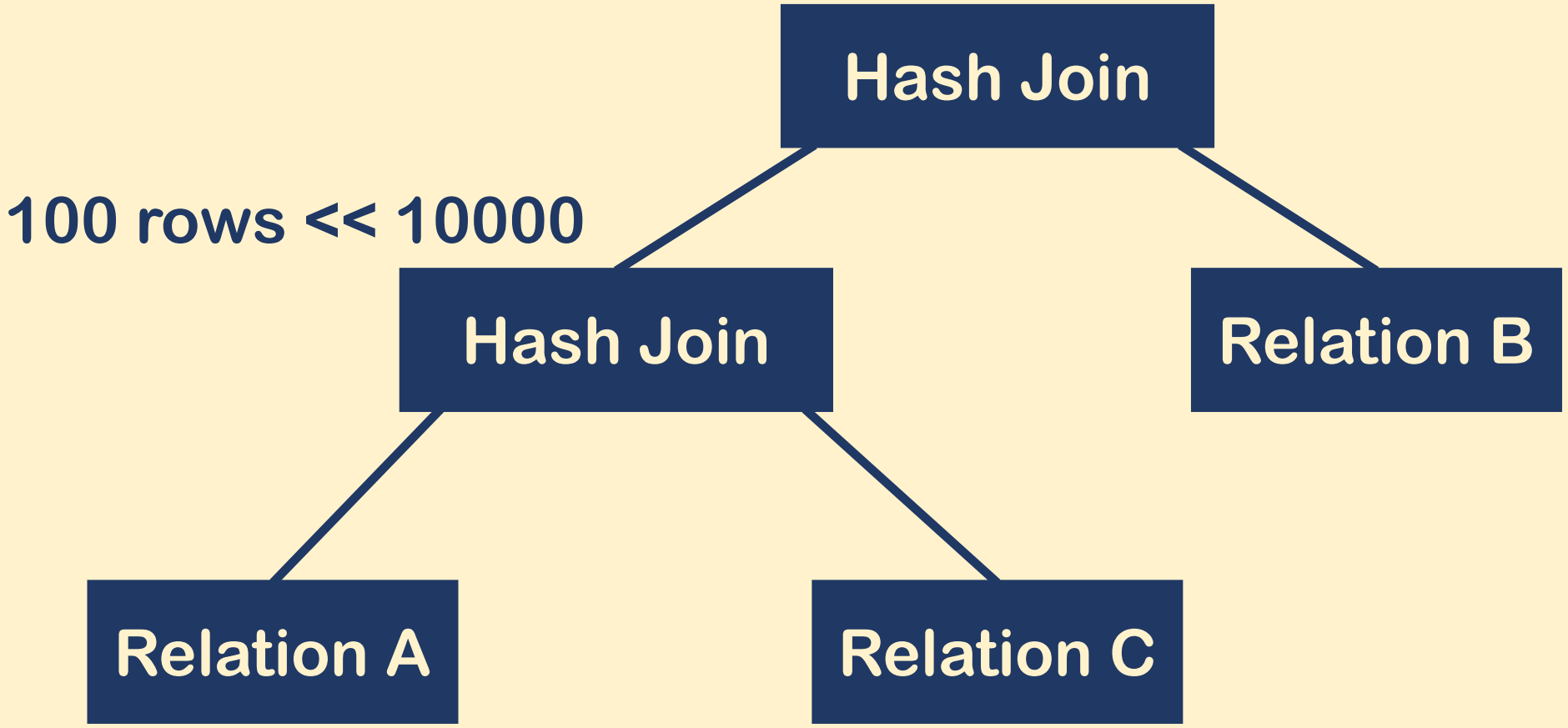
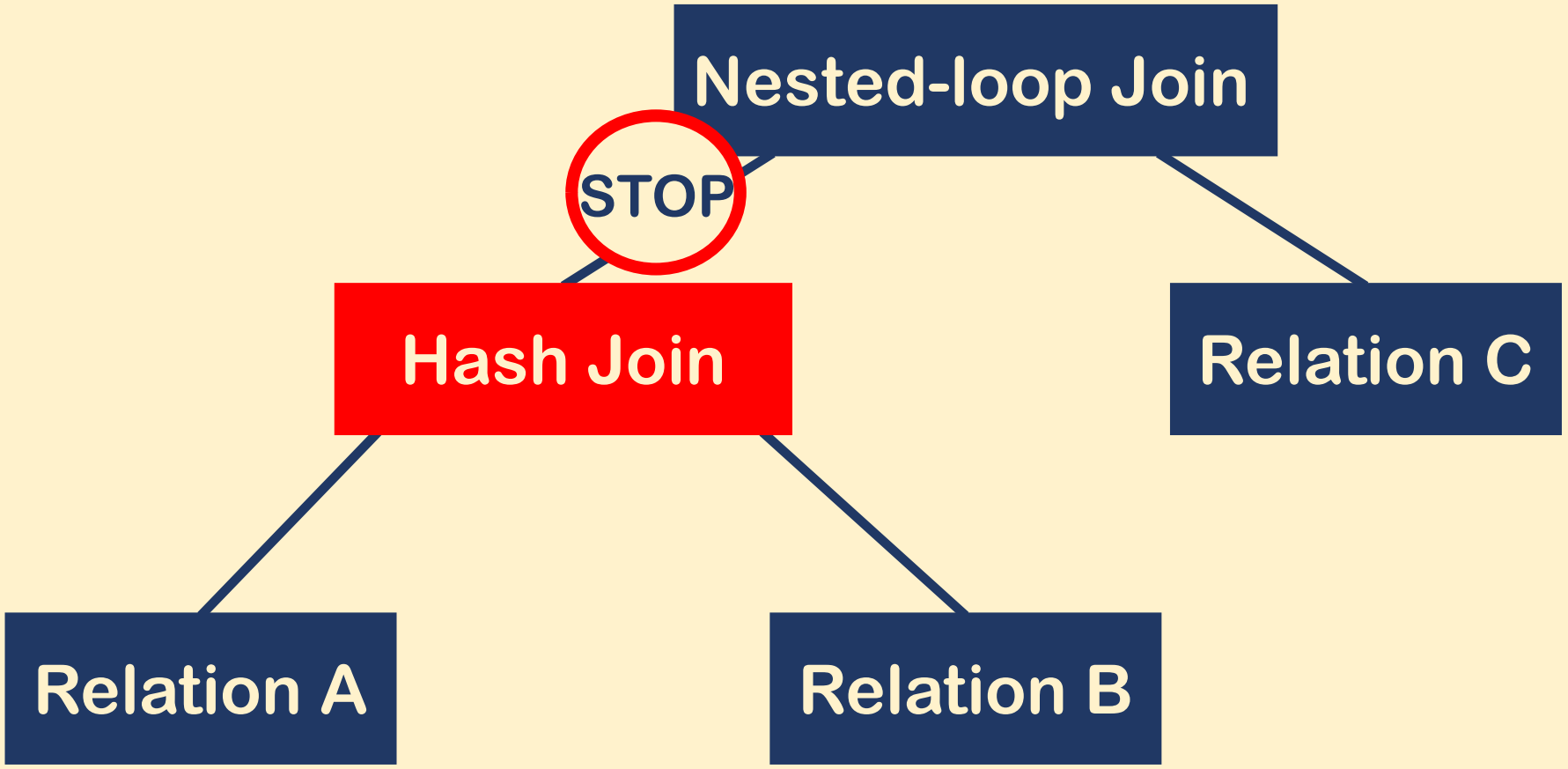


Avoid such explosive join

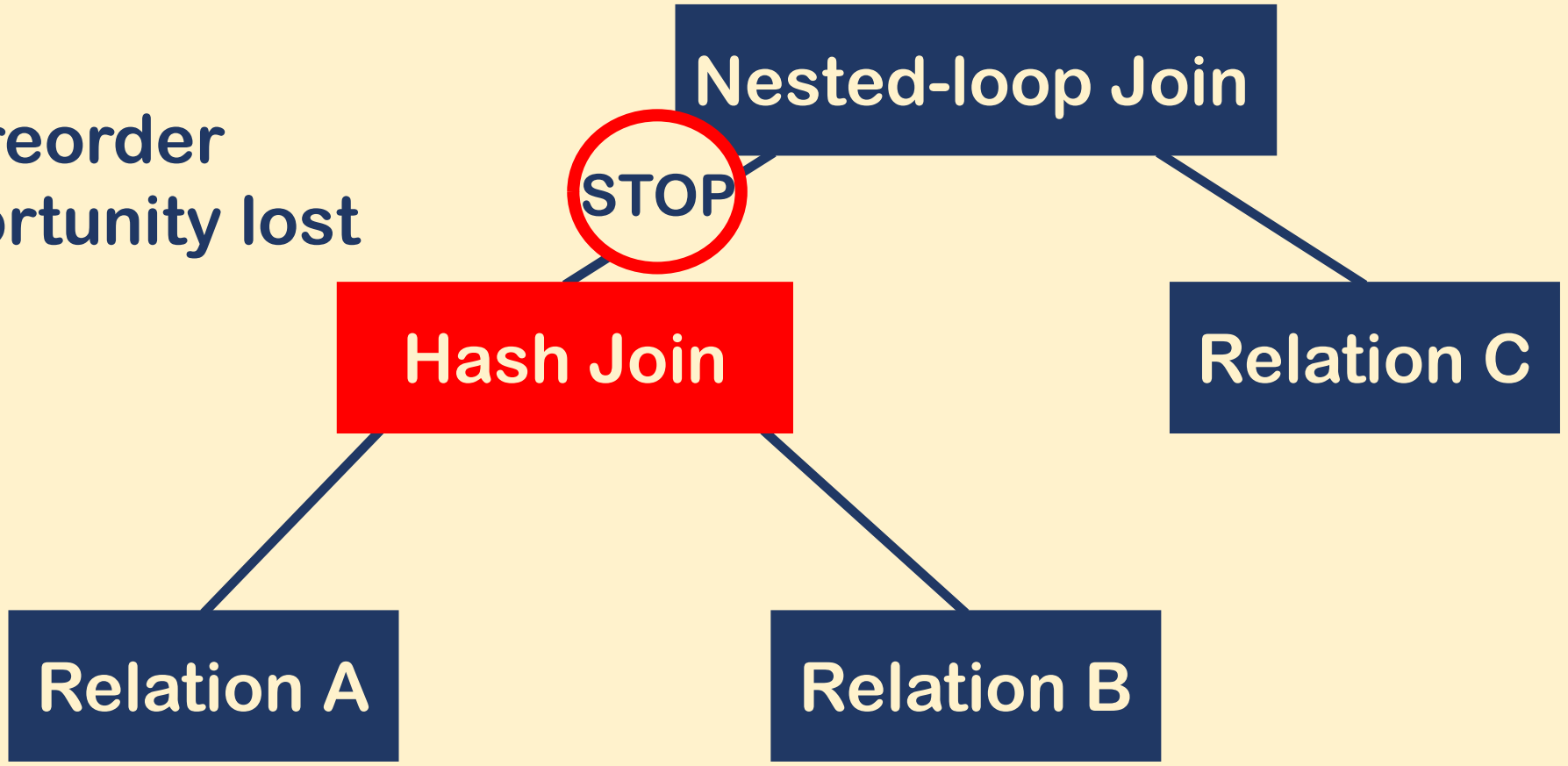


Current re-optimization cannot avoid this

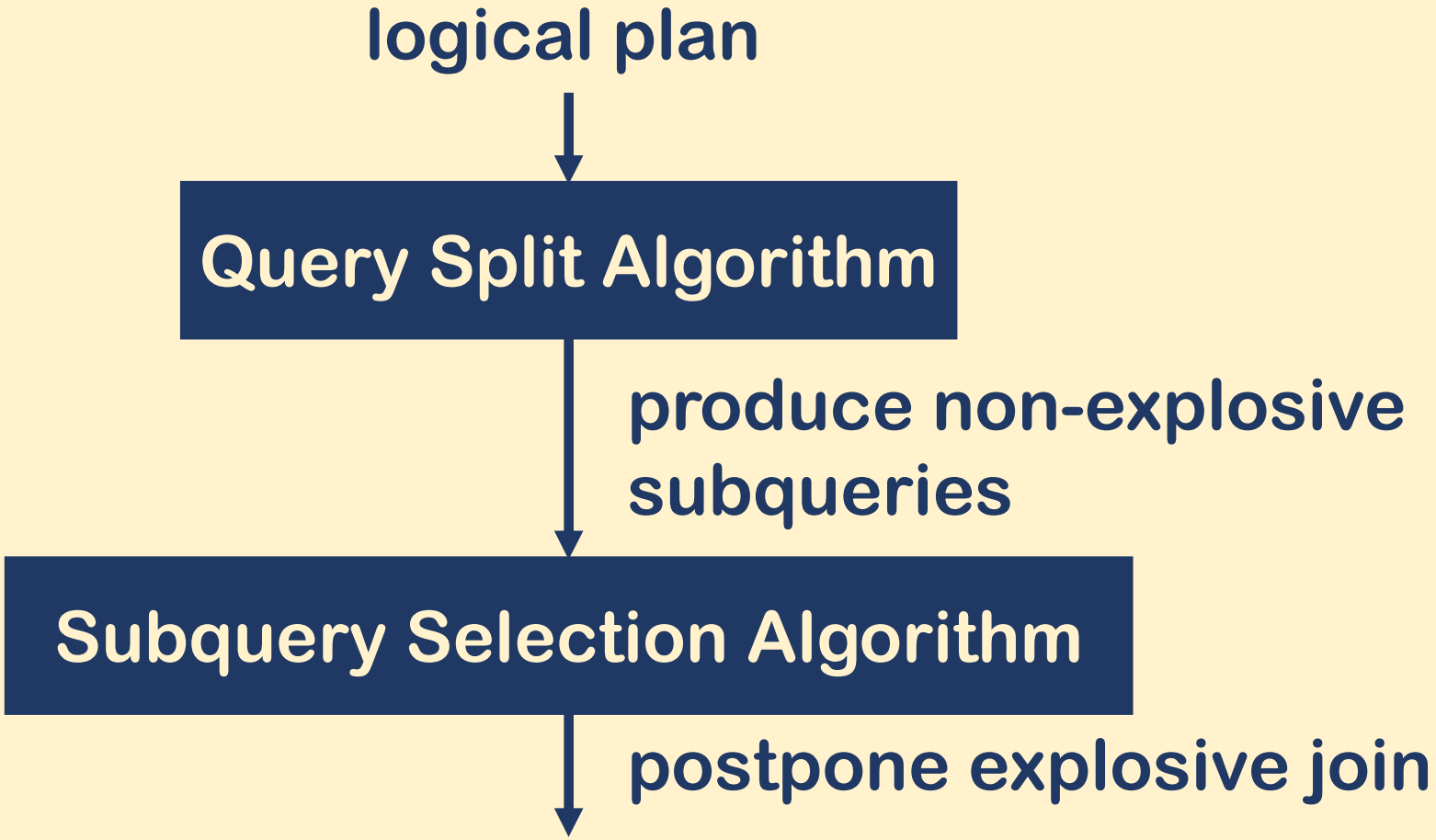


Current re-optimization cannot avoid this

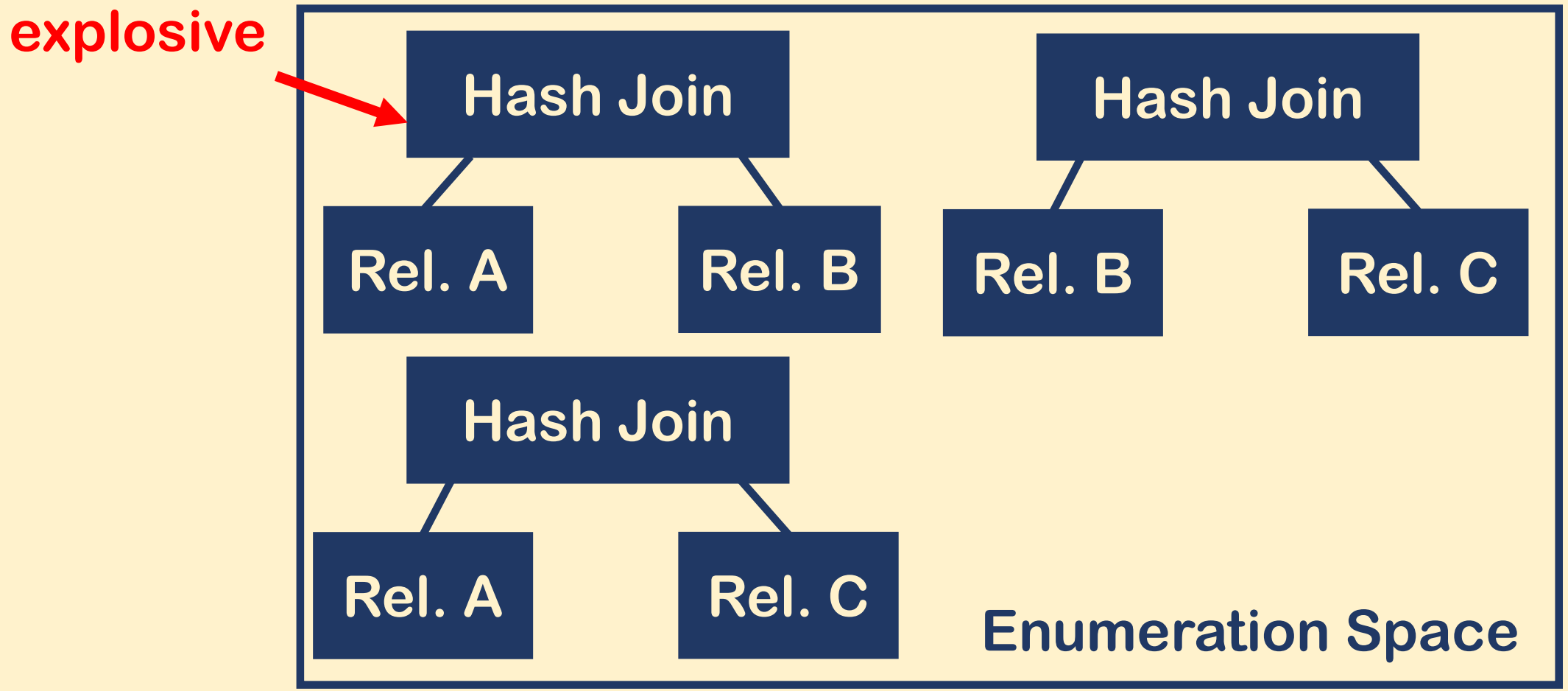
join reorder
opportunity lost



QuerySplit improve from two aspects



First, try to avoid explosive join



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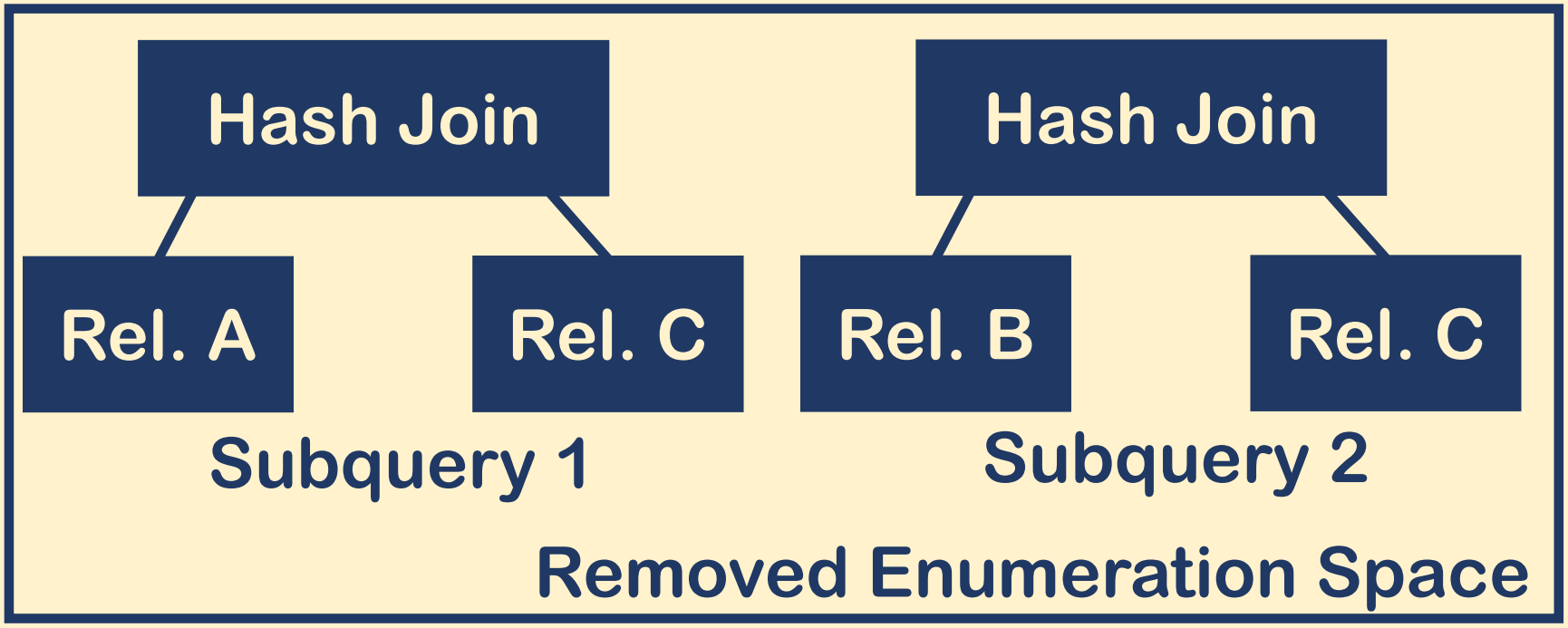
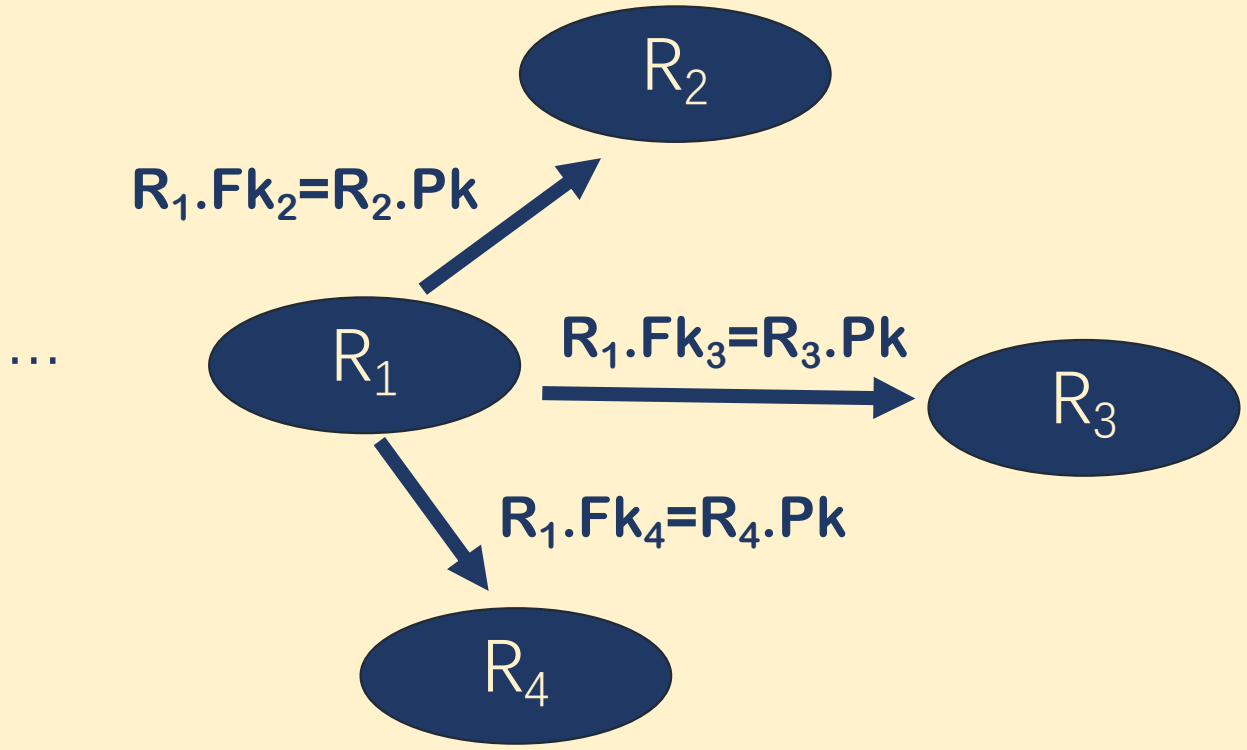


Query Split Algorithm avoids explosive join in advance

Fk-Pk join constrains the result size



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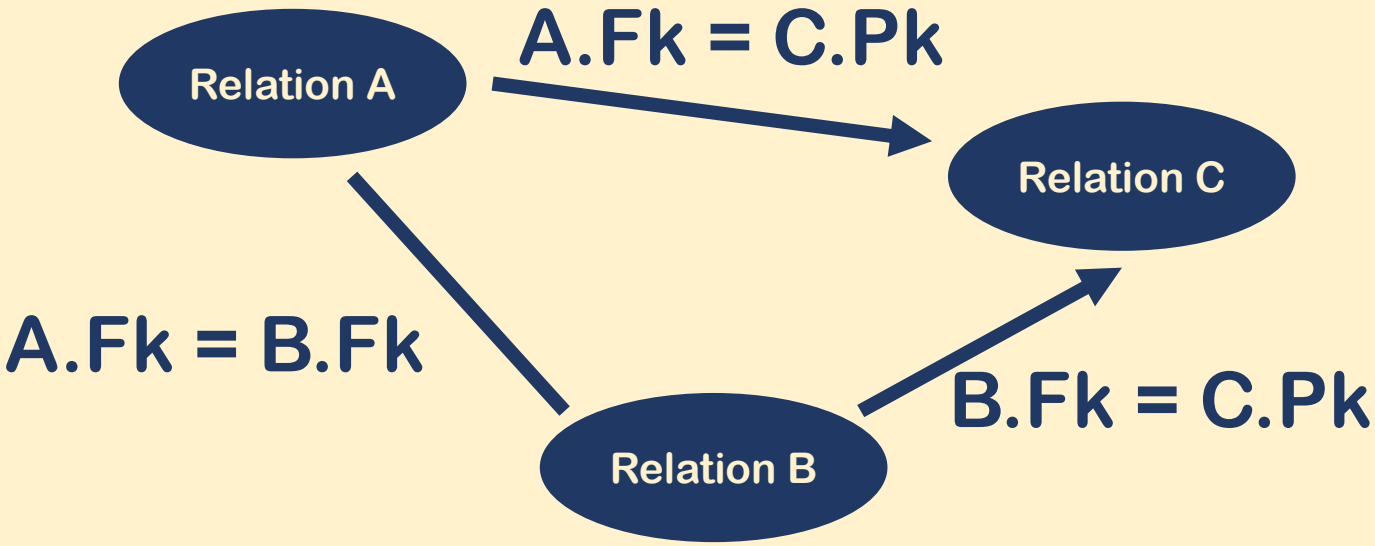

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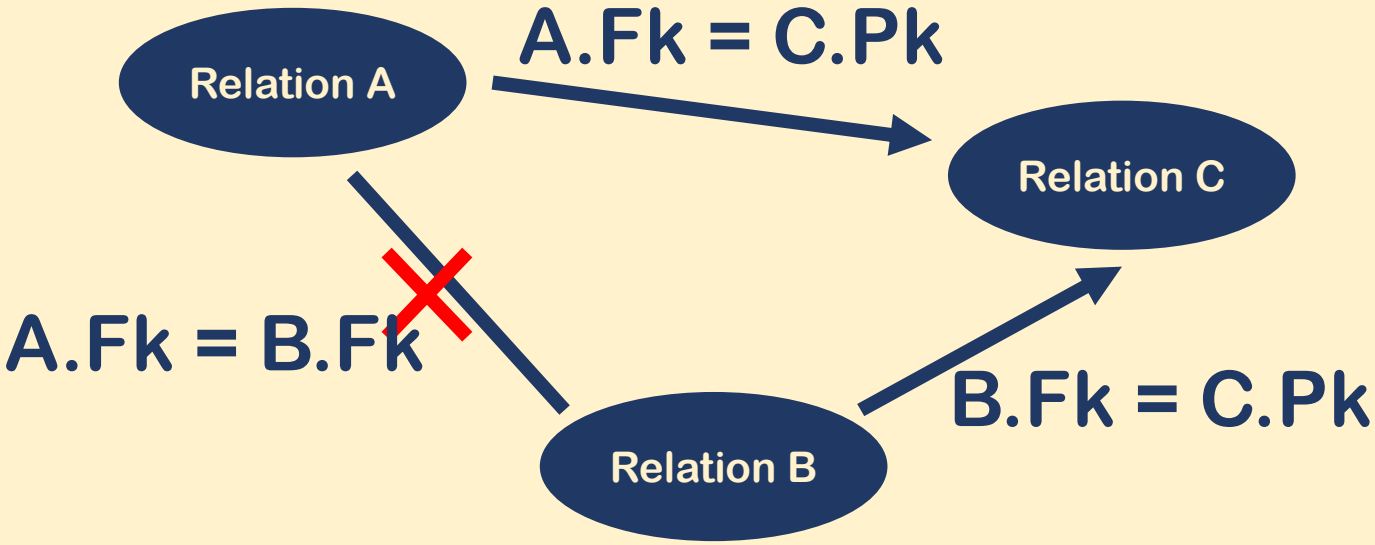

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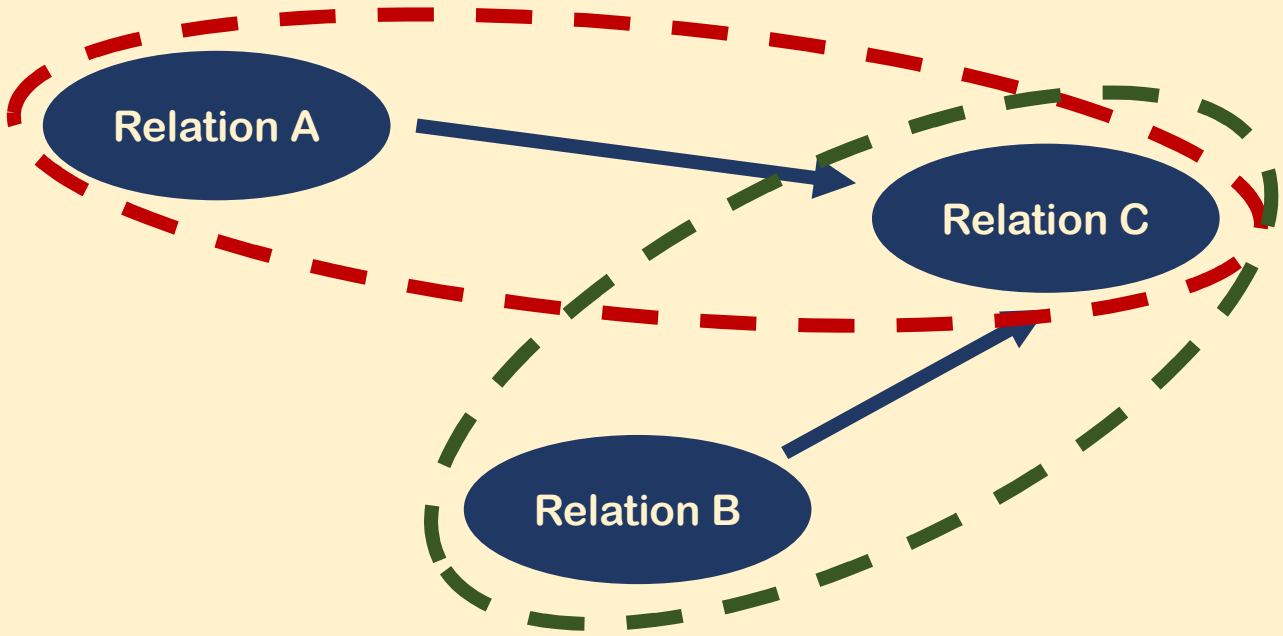
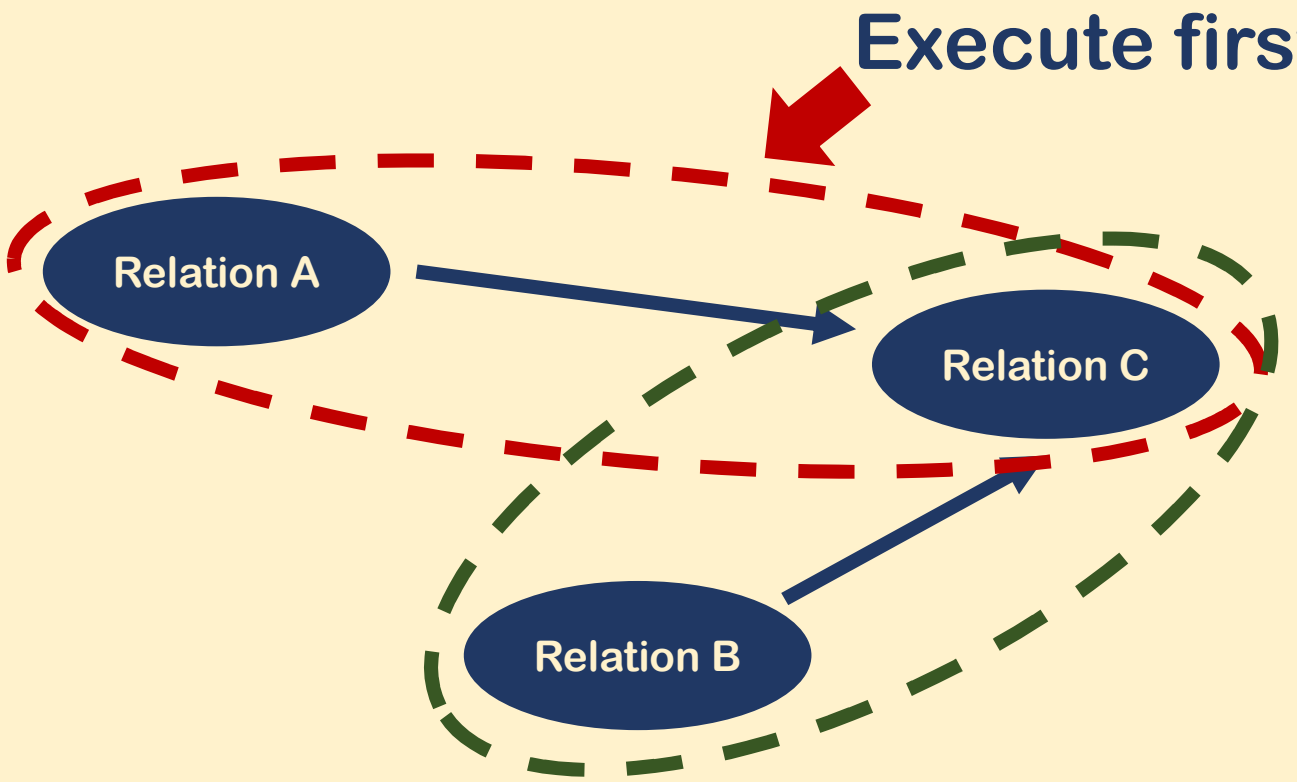


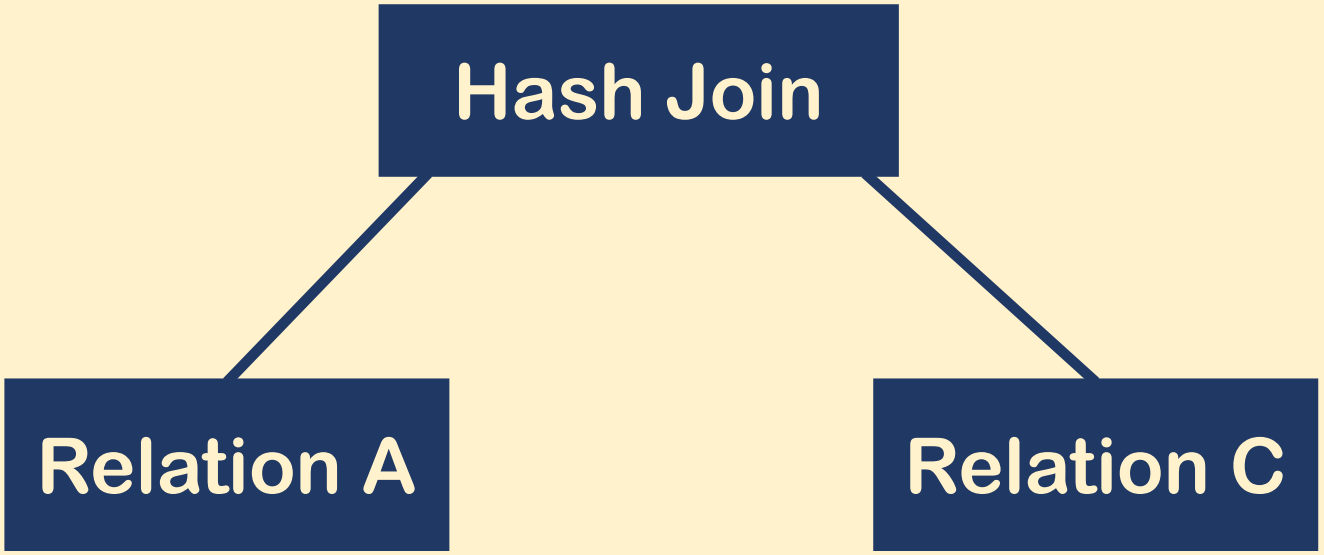
FK Center

First, try to avoid explosive join



First, try to avoid explosive join

100 rows << 10000



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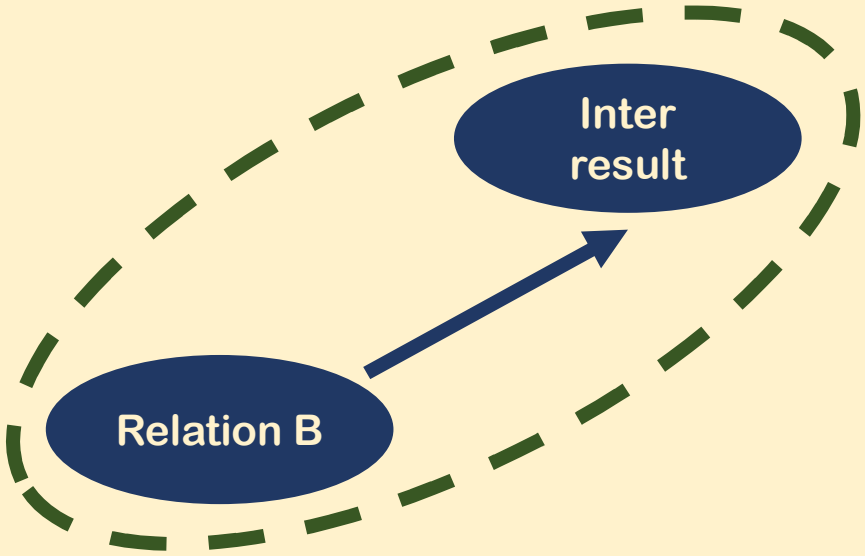

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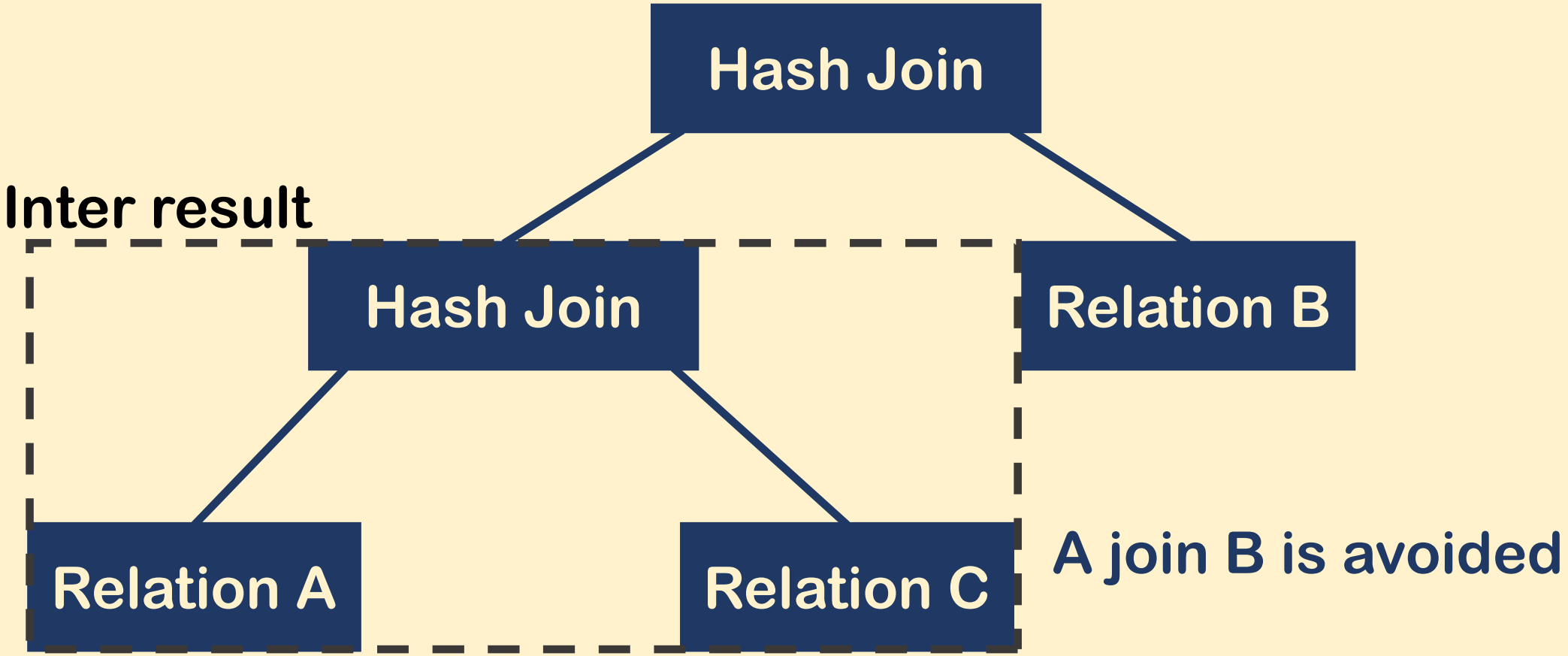
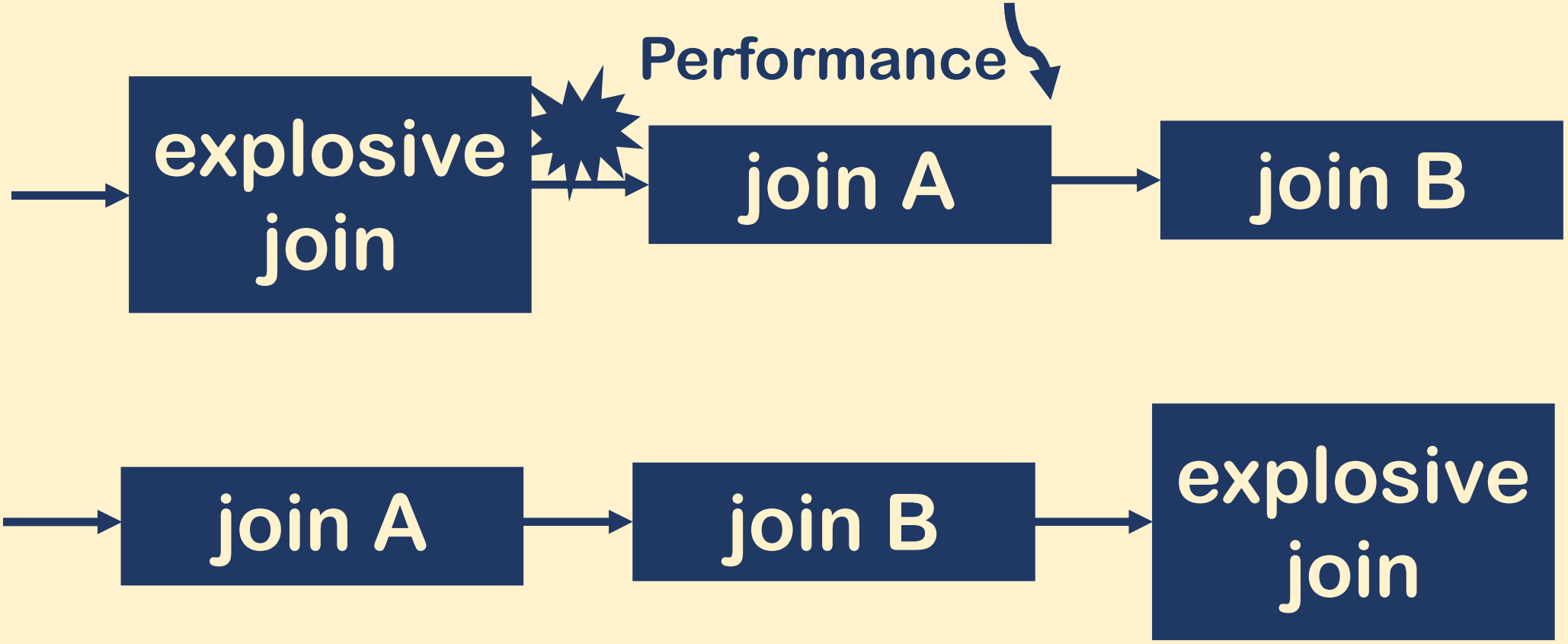
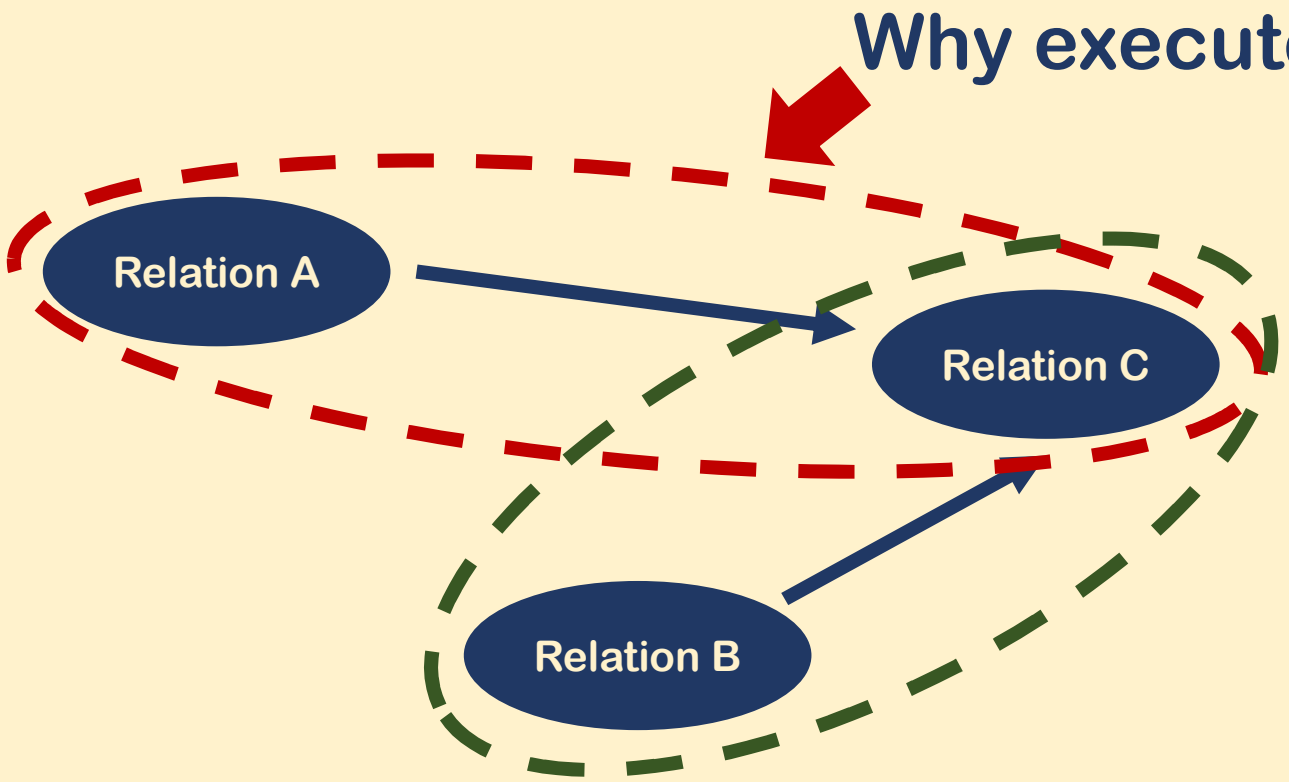


Second, postpone explosive join



Subquery Selection Algorithm delays explosive join

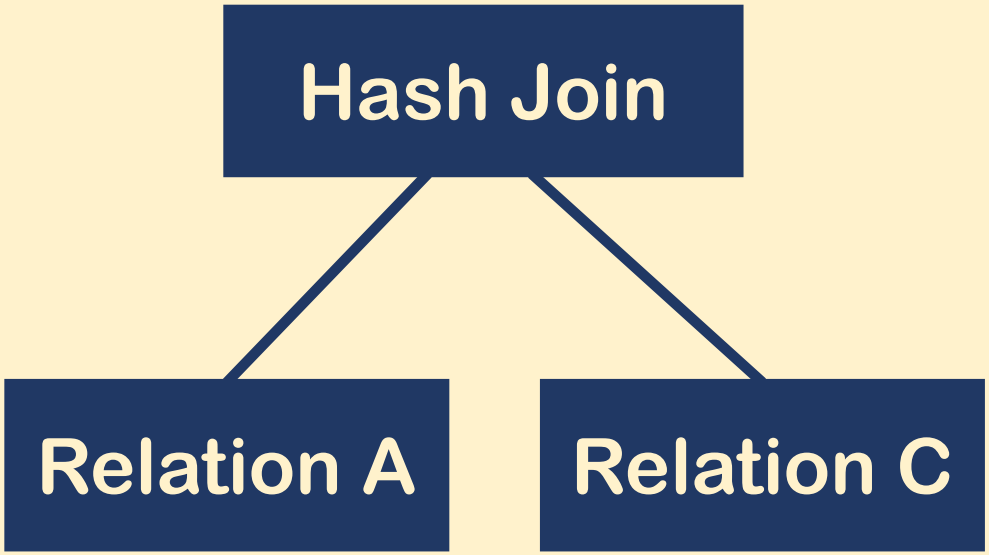
Associated with execution order



Prefer executing small subquery

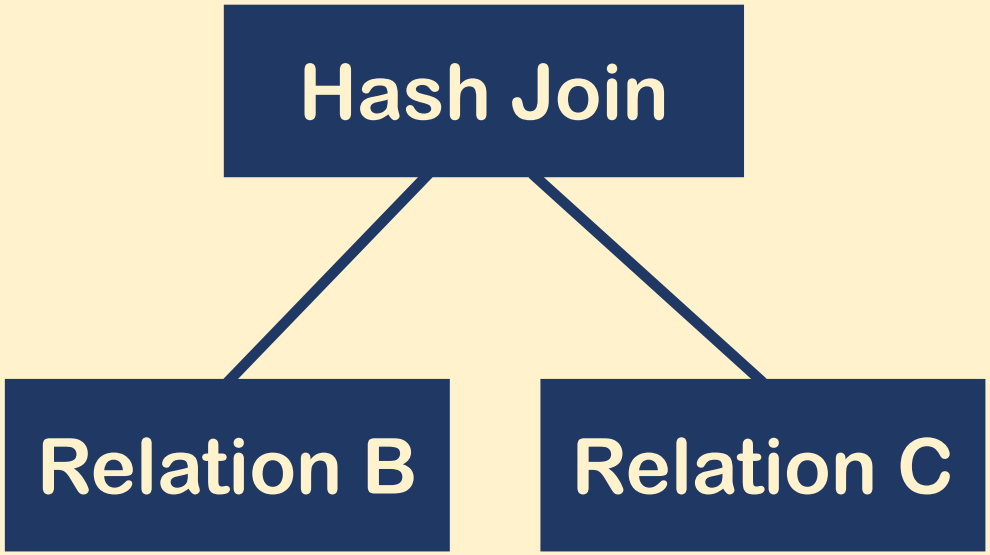
output rows: x_1

execution time: y_1



output rows: x_2

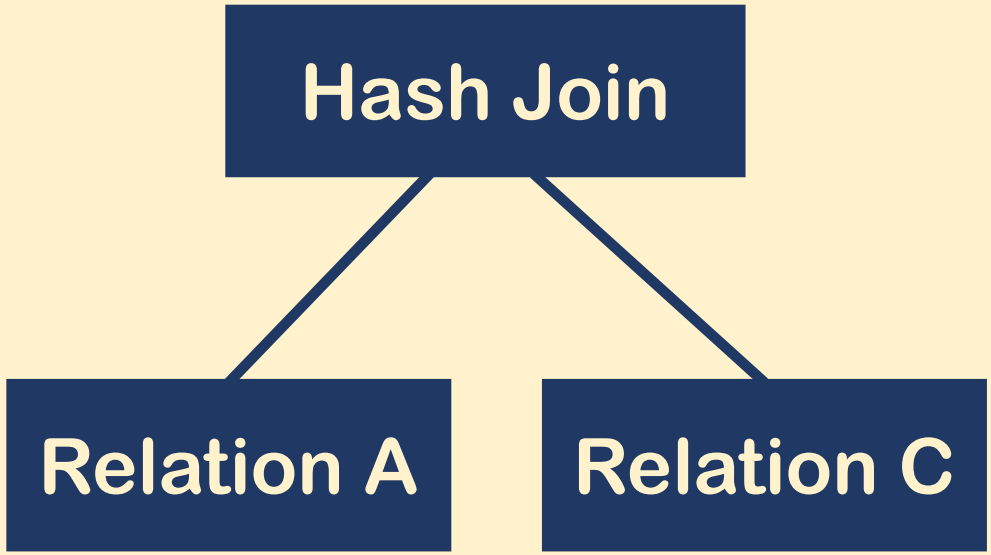
execution time: y_2



Prefer executing small subquery

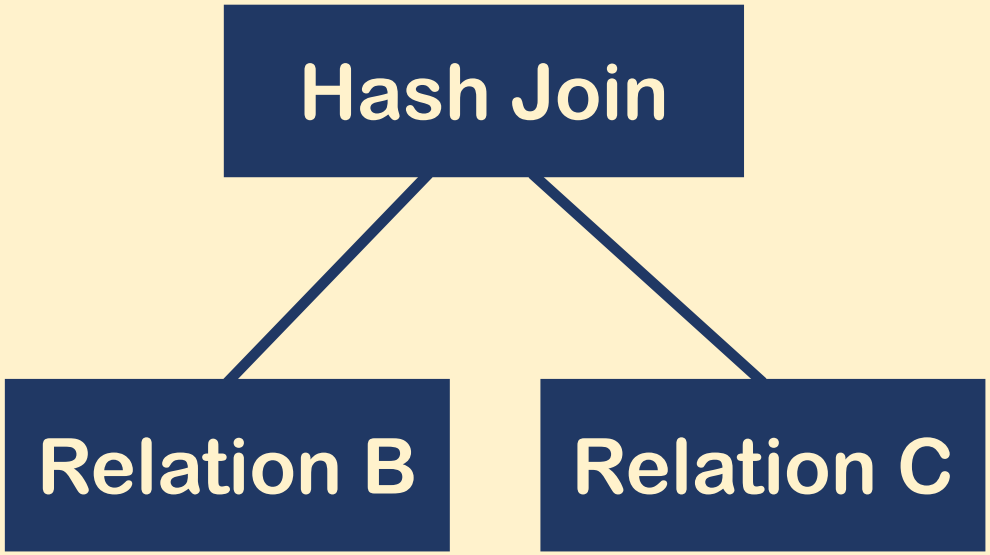
output rows: x_1

execution time: y_1



output rows: x_2

execution time: y_2



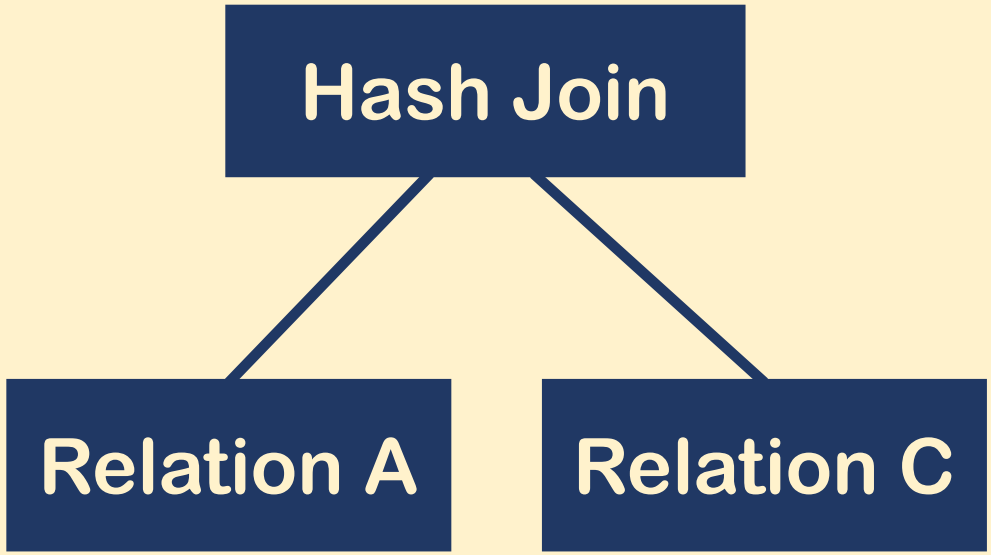
$x_1 < x_2$

$y_1 < y_2$

Prefer executing small subquery

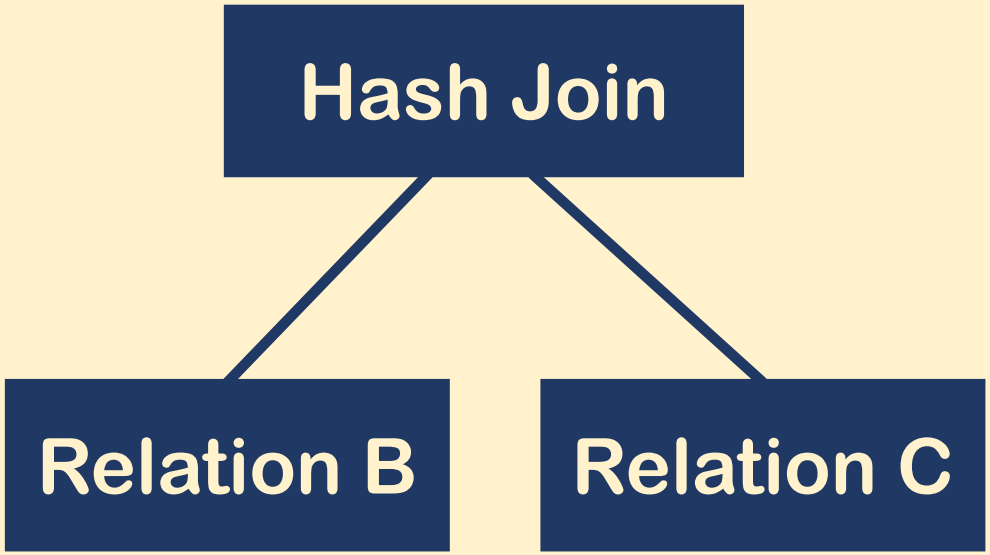
output rows: x_1

execution time: y_1



output rows: x_2

execution time: y_2



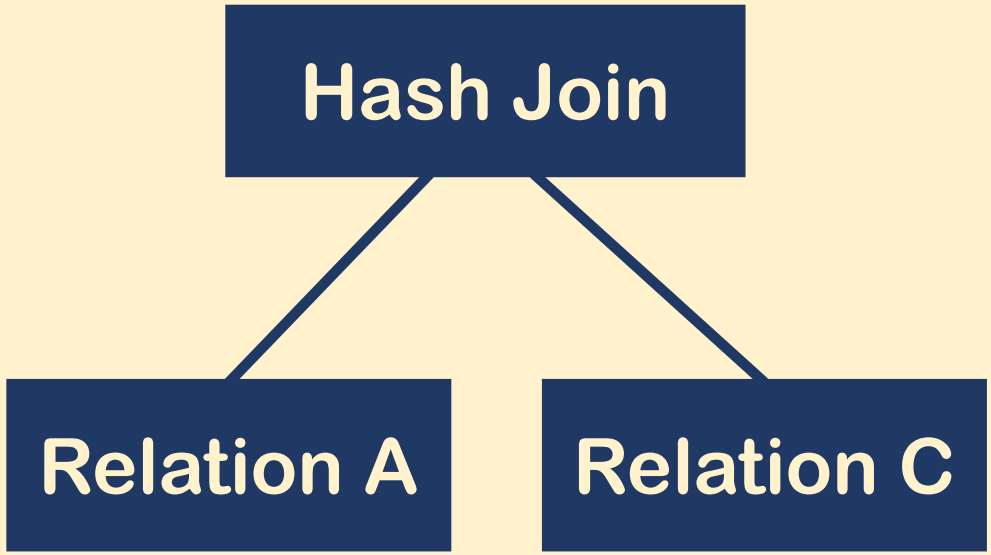
$x_1 < x_2$

$y_1 > y_2$?

Prefer executing small subquery

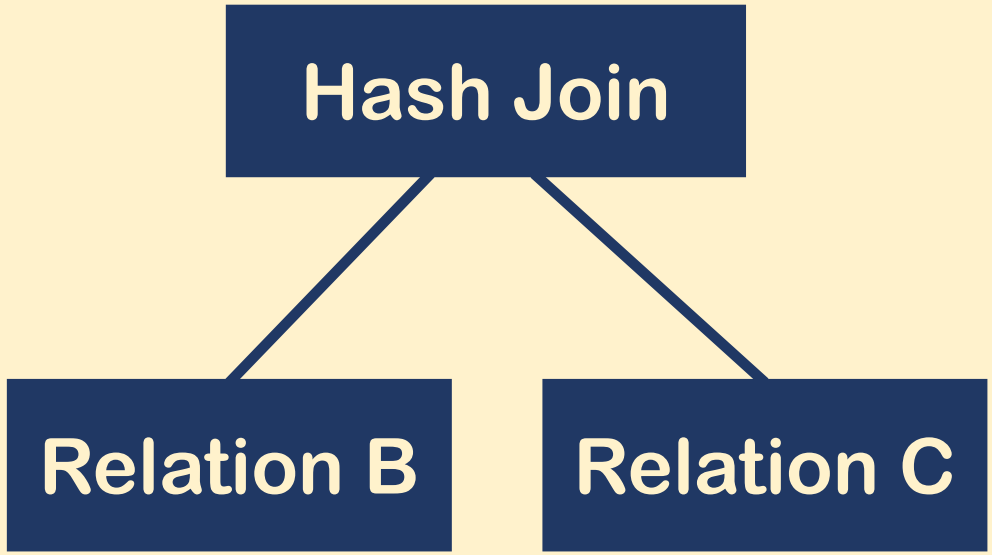
output rows: x_1

execution time: y_1



output rows: x_2

execution time: y_2



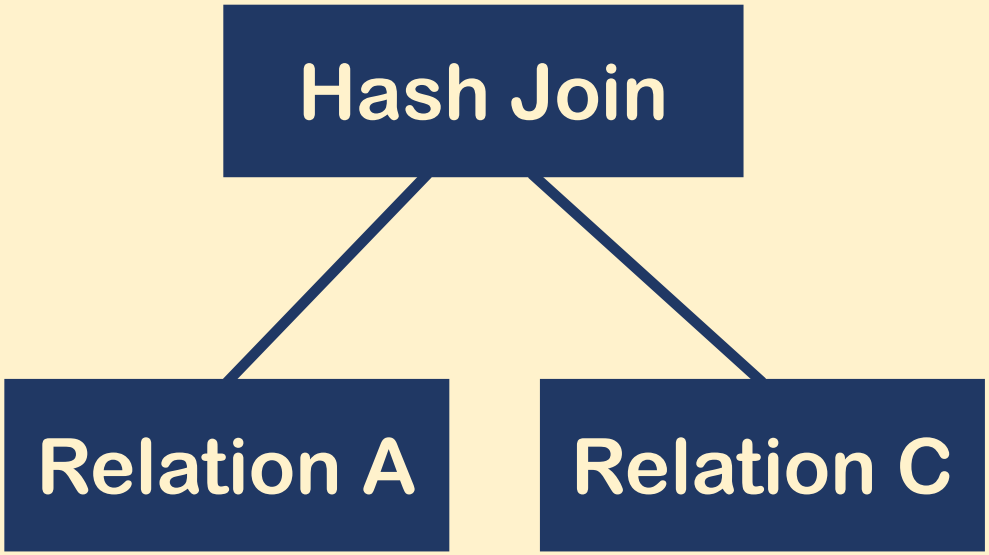
$x_1 < x_2$ Future?

$y_1 > y_2$ Current?

Prefer executing small subquery

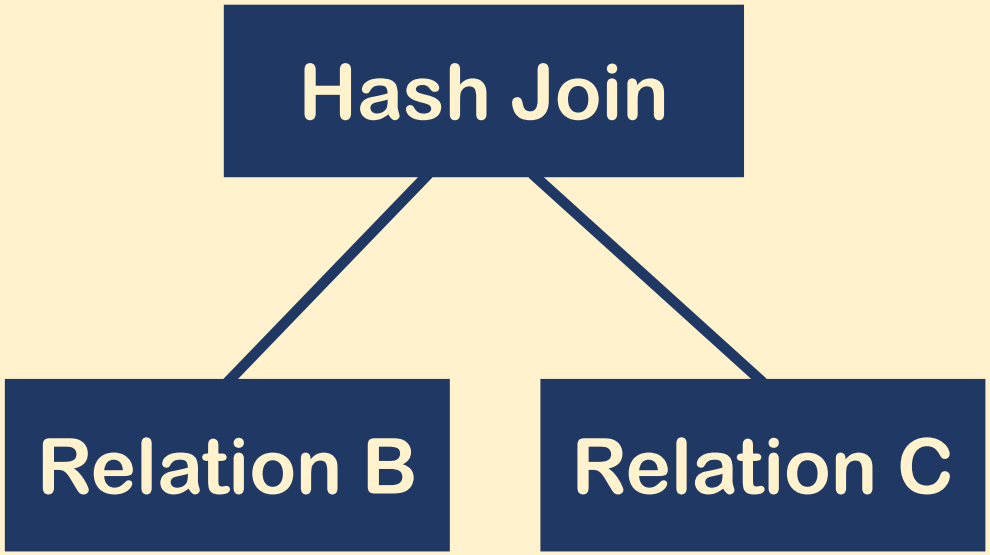
output rows: x_1

execution time: y_1



output rows: x_2

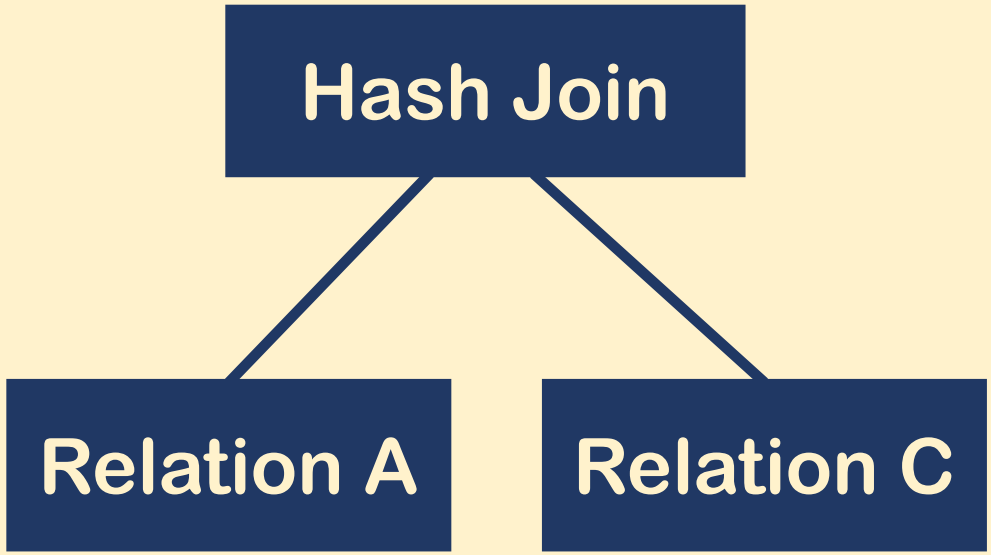
execution time: y_2



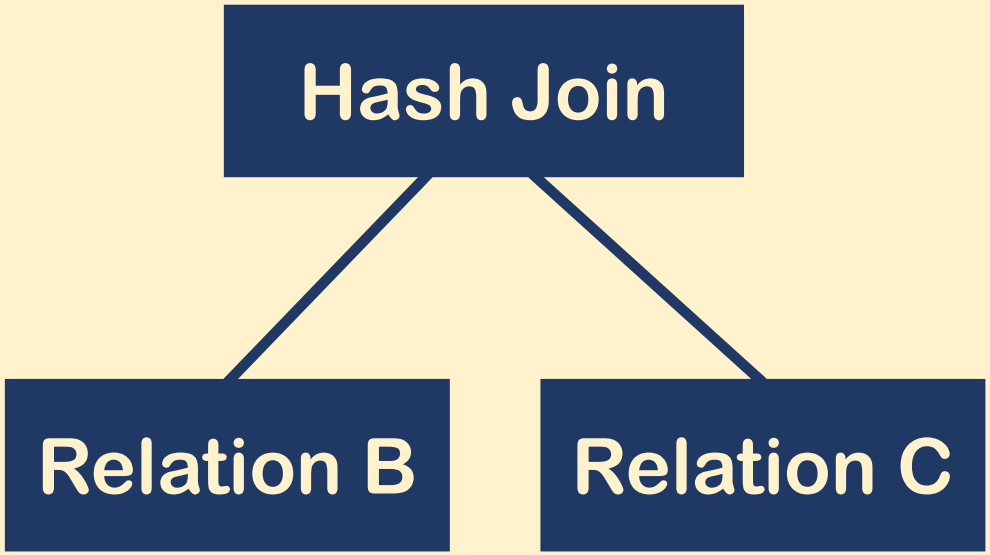
$f(x_1, y_1)$? $f(x_2, y_2)$

Prefer executing small subquery

output rows: x_1
execution time: y_1



output rows: x_2
execution time: y_2



$f(x_1, y_1) < f(x_2, y_2)$

Prefer executing small subquery

Φ_1	x
Φ_2	log(x) * y
Φ_3	sqrt(x) * y
Φ_4	x * y
Φ_5	y

output rows: x

execution time: y

Evaluation Setup: a real-world workload

Workload

- **JOB (main)**
- **DSB**
- **TPC-H**

Evaluation Setup: a real-world workload

Workload

- JOB (main)
- TPC-H
- DSB

System Config

- Windows 10
- 128 GB Memory

Evaluation Setup: a real-world workload

Workload

- JOB (main)
- DSB
- TPC-H

System Config

- Windows 10
- 128 GB Memory

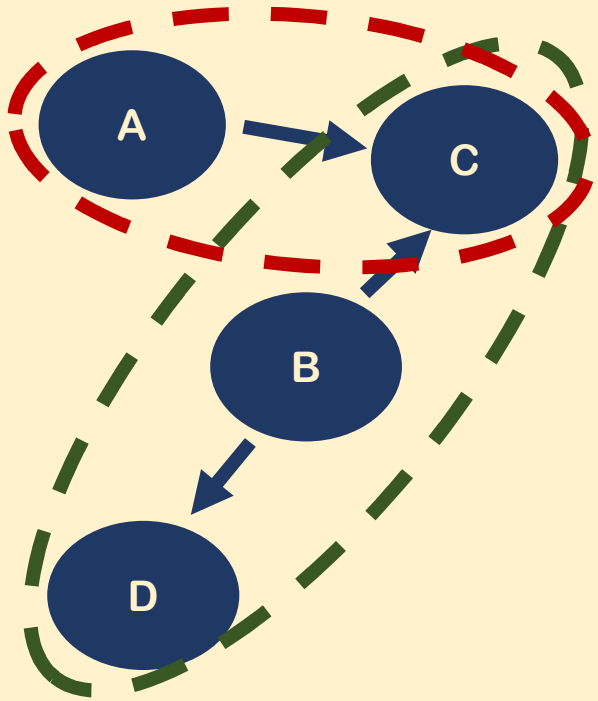
Database Config

- PostgreSQL
- No parallelization
- 8GB effective cache
- 1000s Timeout

Best Implementation for QuerySplit

FK-Center vs. other 2 strategies

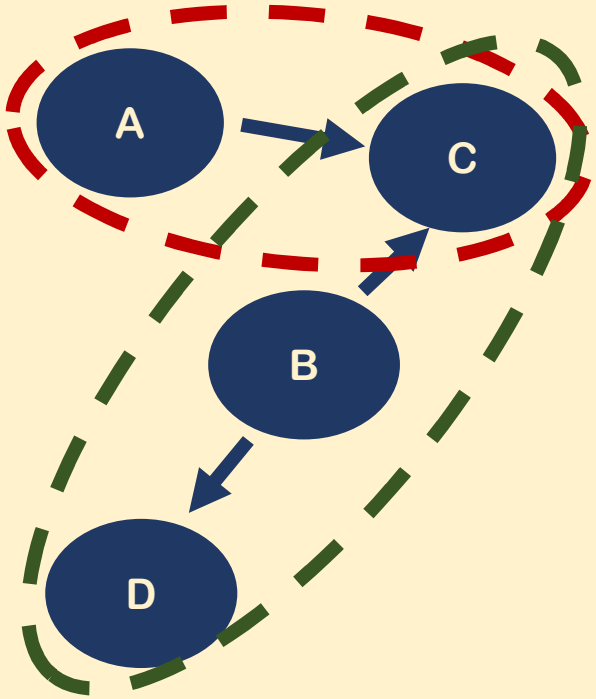
FK-Center



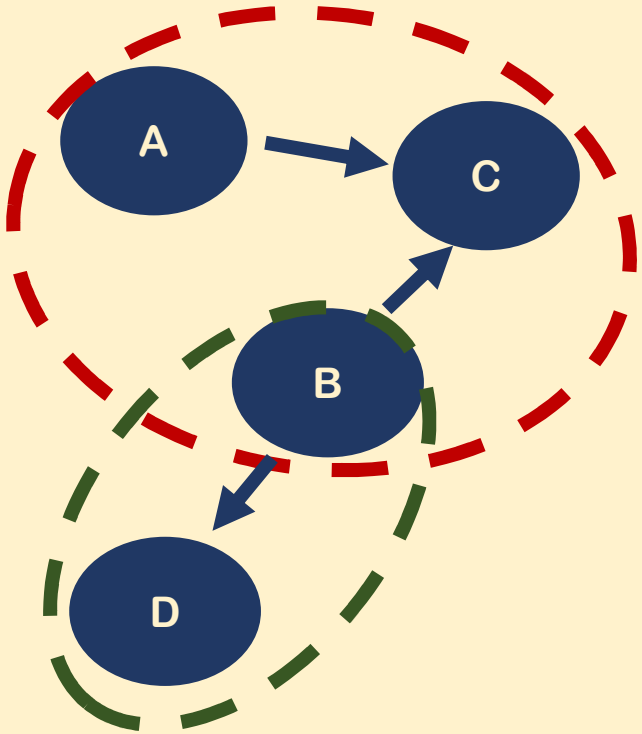
Best Implementation for QuerySplit

FK-Center vs. other 2 strategies

FK-Center



PK-Center



Best Implementation for QuerySplit

FK-Center vs. other 2 strategies

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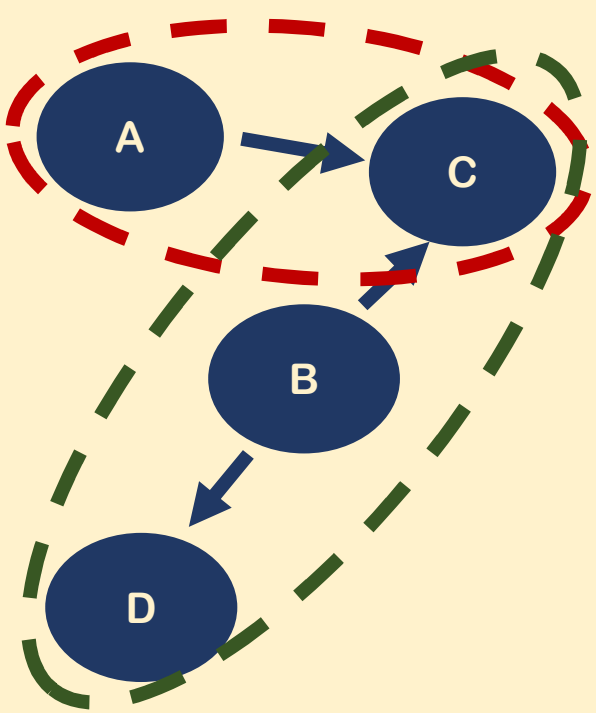
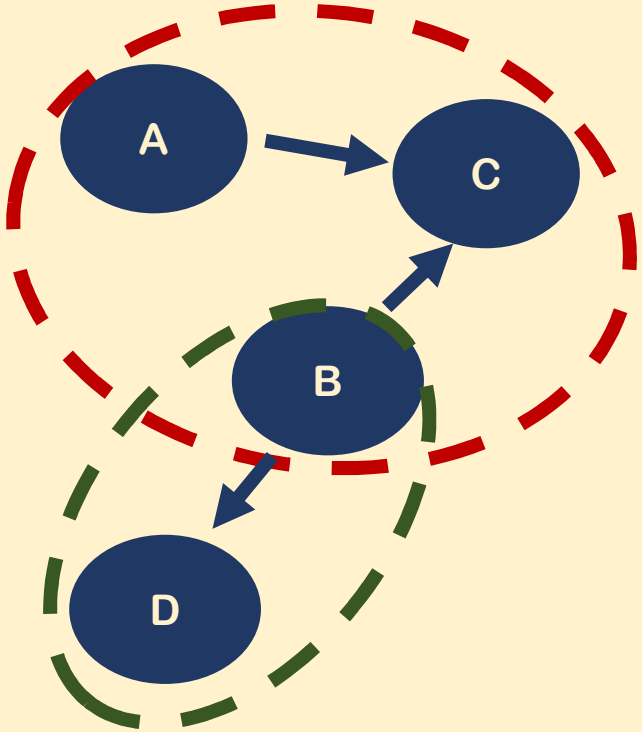
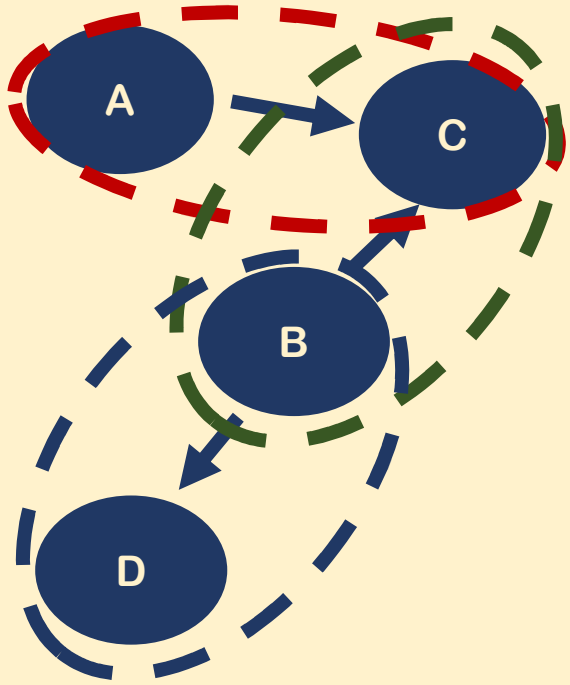


PK-Center



MinSubquery



Best Implementation for QuerySplit

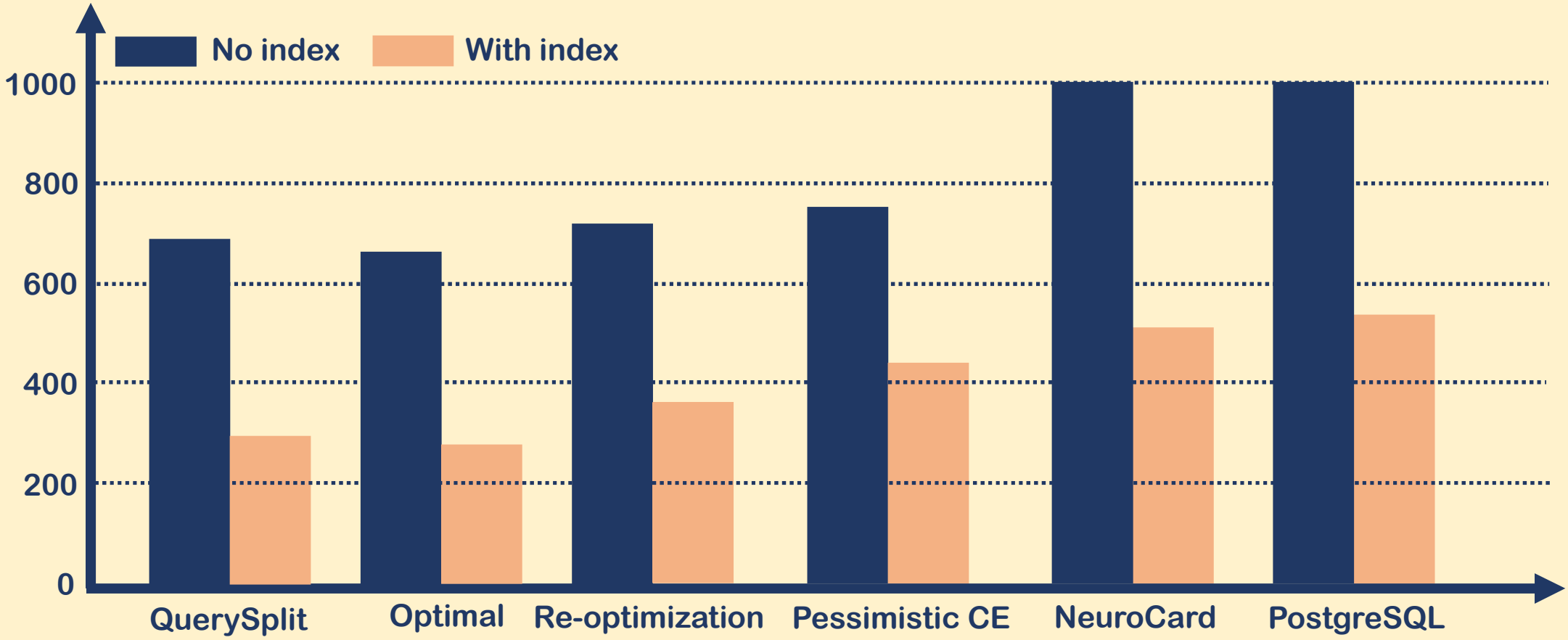
	FK-Center	PK-Center	MinSubquery
Φ_1 = x	421s	378s	463s
Φ_2 = log(x) * y	327s	349s	428s
Φ_3 = sqrt(x) * y	328s	339s	418s
Φ_4 = x * y	295s	350s	427s
Φ_5 = y	348s	407s	474s

Best Implementation for QuerySplit

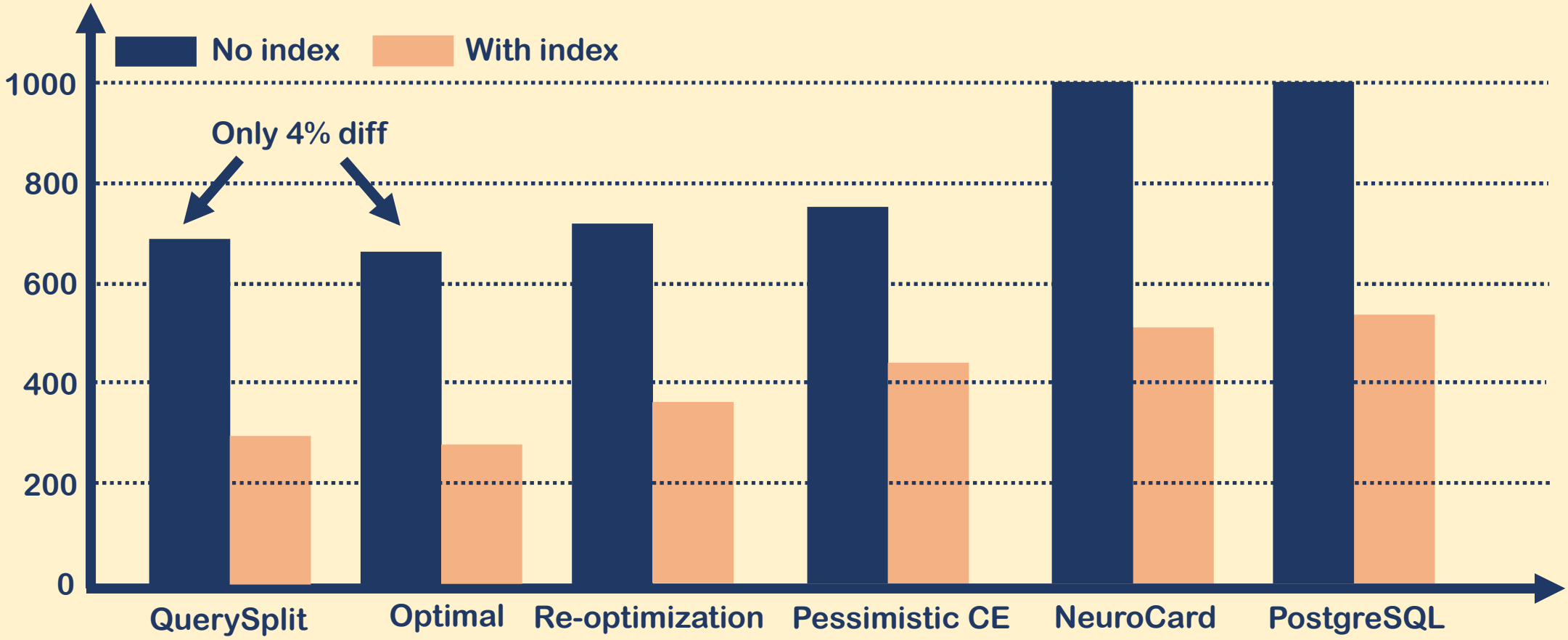
	FK-Center	PK-Center	MinSubquery
Φ_1 = x	421s	378s	463s
Φ_2 = log(x) * y	327s	349s	428s
Φ_3 = sqrt(x) * y	328s	339s	418s
Φ_4 = x * y	2	350s	427s
Φ_5 = y	348s	407s	474s

Best

QuerySplit speeds up end-to-end latency



QuerySplit speeds up end-to-end latency



Conclusion

- Current re-optimization can be misled by the initial physical plan
- Two key ideas of QuerySplit
  - Query Split Algorithm produces non-explosive subuquery
  - Subquery Selection Algorithm postpones the inevitable explosive join