# COMP9313: Big Data Management


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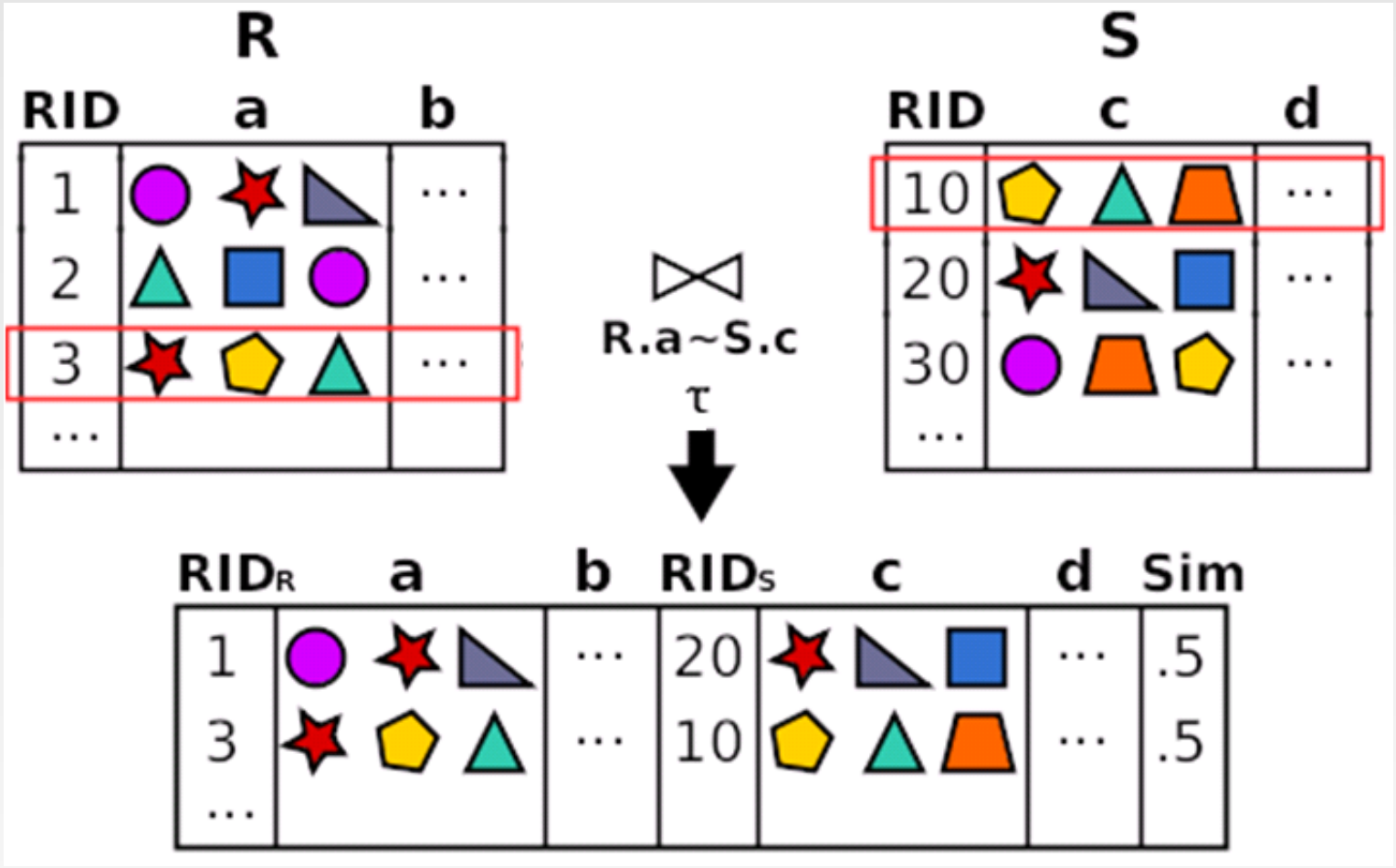
Course web site: http://www.cse.unsw.edu.au/~cs9313/

# Set Similarity Join on Hadoop

# Set-Similarity Join




**Finding pairs of records with a similarity on their join attributes > t**

大于一个阈值

# Application: Record linkage

Table R

| Star |
| --- |
| Keanu Reeves |
| Samuel Jackson |
| Schwarzenegger |
| … |

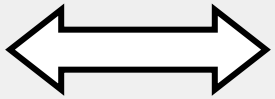
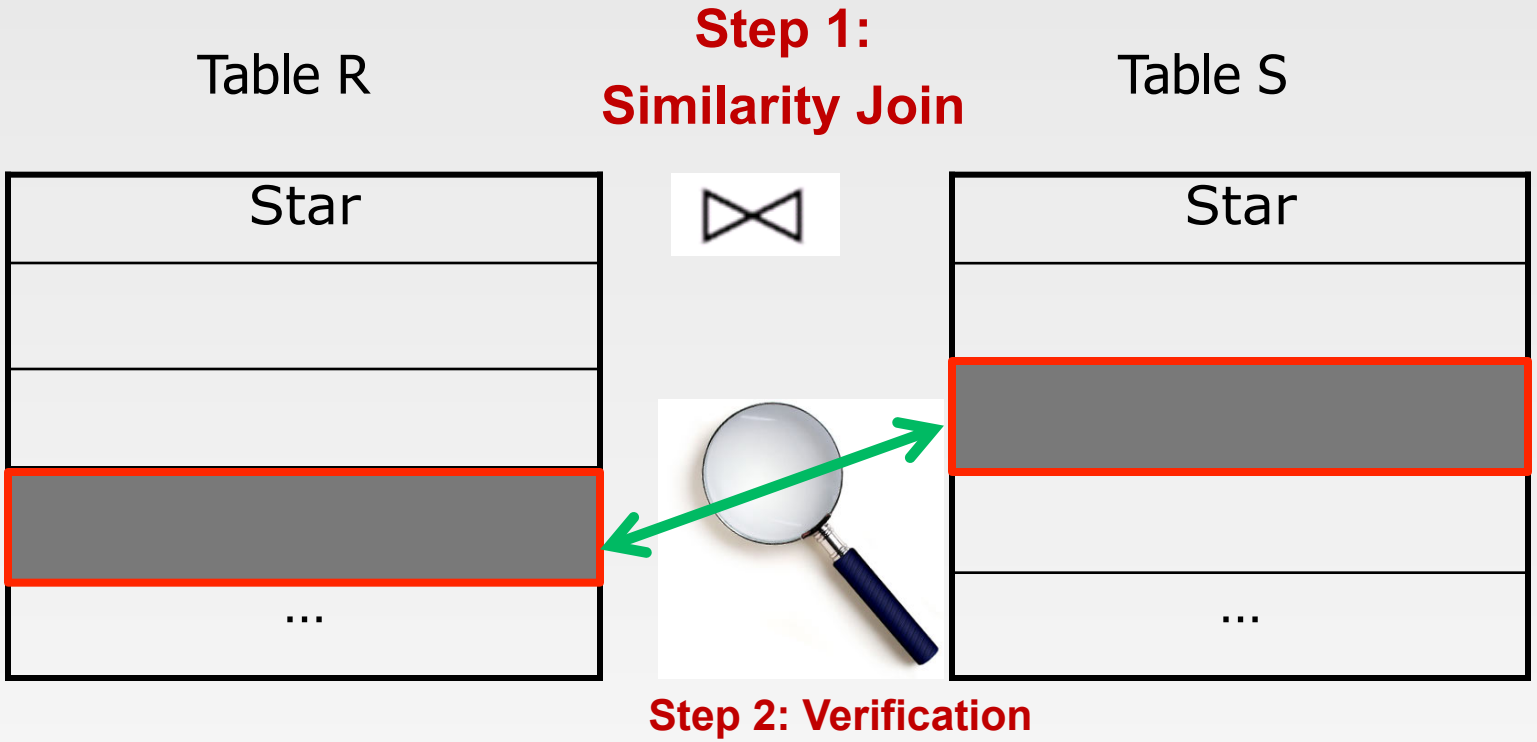


Table S

| Star |
| --- |
| Keanu Reeves |
| Samuel L. Jackson |
| Schwarzenegger |
| … |

# Two-step Solution



# Why Hadoop?

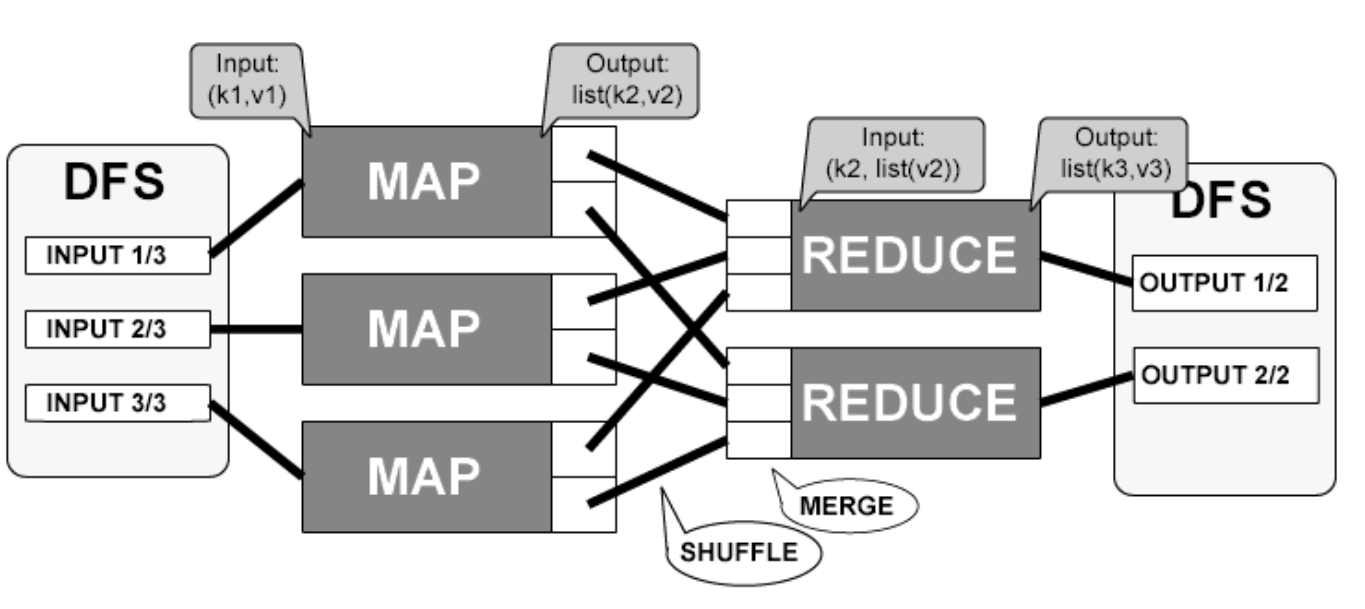
- Large amounts of data
- Data or processing does not fit in one machine

- Assumptions:
  - Self join: R = S
  - Two similar sets share at least 1 token

- Efficient Parallel Set-Similarity Joins Using Hadoop (SIGMOD'10)

# A naïve solution

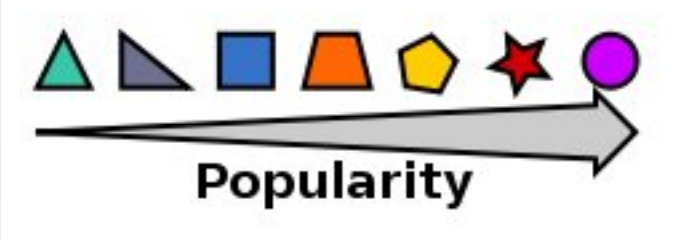
- Map: <23, (a,b,c)> → (a, 23), (b, 23), (c, 23)
- Reduce:(a,23),(a,29),(a,50), …→ Verify each pair (23, 29), (23, 50), (29, 50) … …



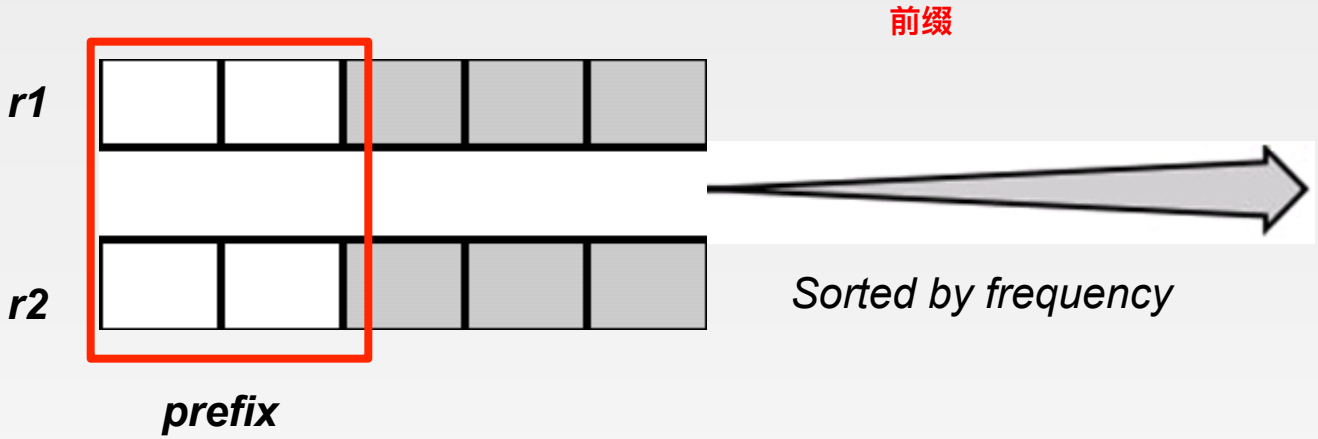

- Too much data to transfer ☹
- Too many pairs to verify ☹.

# Solving frequency skew: prefix filtering

- Sort tokens by frequency (ascending)



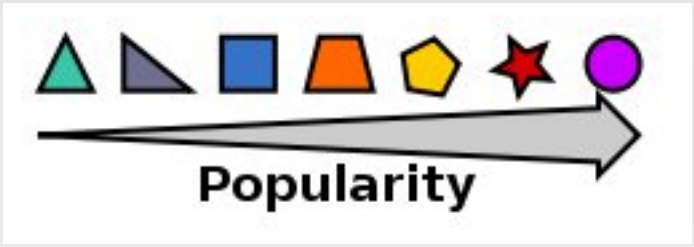

- Prefix of a set: least frequent tokens

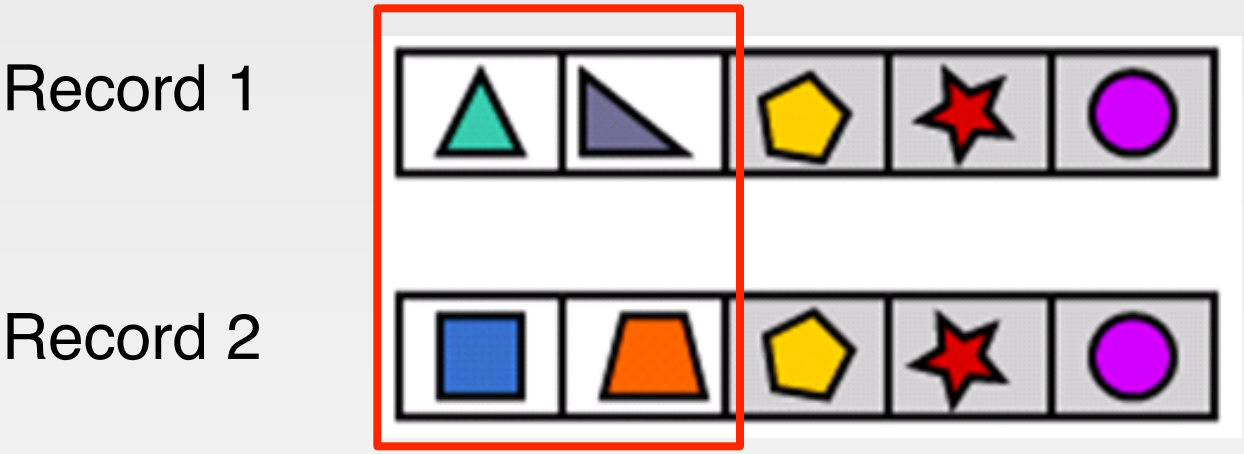



- Prefixes of similar sets should share tokens

Chaudhuri, Ganti, Kaushik: A Primitive Operator for Similarity Joins in Data Cleaning. ICDE'06

# Prefix filtering: example




- Each set has 5 tokens
- “Similar”: they share at least 4 tokens ? ?
- Prefix length: 2

# Hadoop Solution: Overview

- Stage 1: Order tokens by frequency

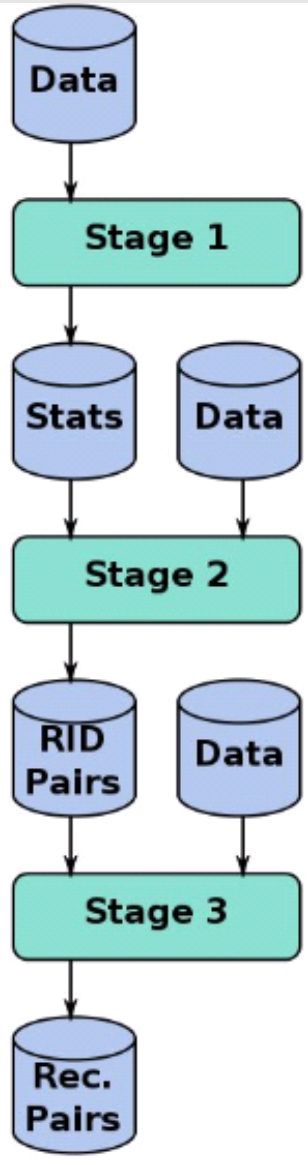
(Already done in the given example data)

1. 按照freq排序

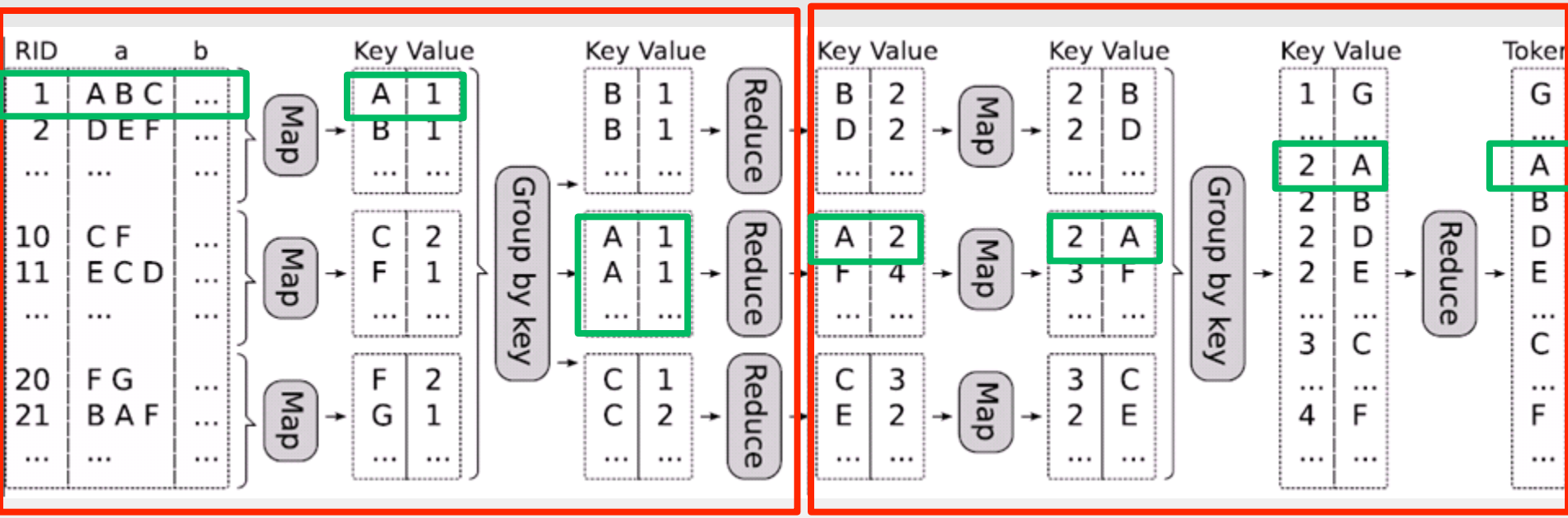
- Stage 2: Finding “similar” id pairs (verification)

2. 找 similar pairs

- Stage 3: remove duplicates



# Stage 1: Sort tokens by frequency




Compute token frequencies

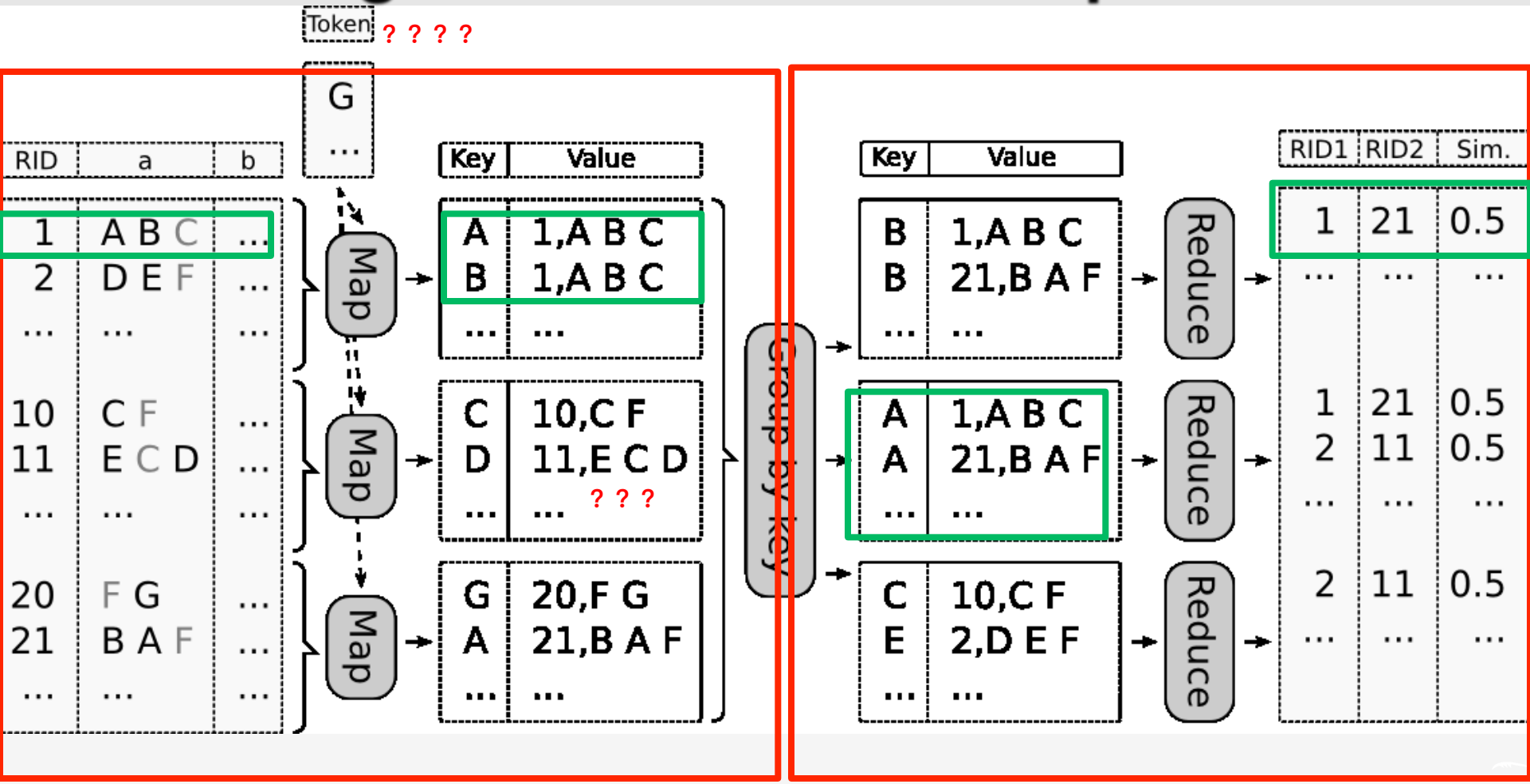
Sort them

**MapReduce phase 1**

**MapReduce phase 2**

先算频率，再sort

# Stage 2: Find "similar" id pairs



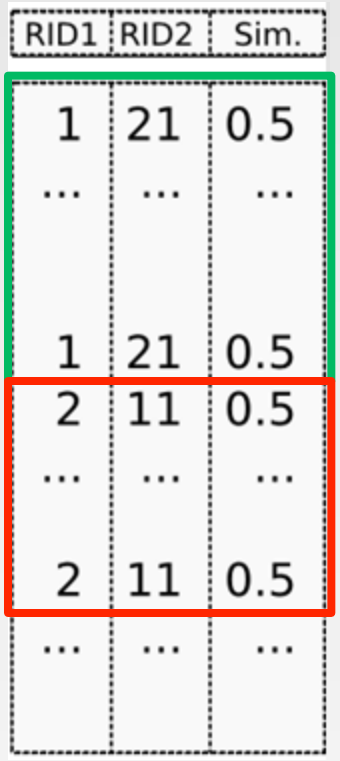

Partition using prefixes

Verify similarity

# Compute the Length of Shared Tokens

- Jaccard Similarity: **sim(r, s) = |r∩s|/|r∪s|**
- If **sim(r, s) >= τ, l = |r∩s| >= |r∪s| * τ >= max(|r|, |s|) * τ**
- Given a record r, you can compute the prefix length as p = |r| - l + 1
- r and s is a candidate pair, they must share at least one token in the first (|r| - l + 1) tokens
- Given a record r = (A, B, C, D) and p = 2, the mapper emits (A, r) and (B, r)

# Stage 3: Remove Duplicates



| RID1 | RID2 | Sim. |
|---|---|---|
| 1 | 21 | 0.5 |
| ... | ... | ... |
| 1 | 21 | 0.5 |
| 2 | 11 | 0.5 |
| ... | ... | ... |
| 2 | 11 | 0.5 |
| ... | ... | ... |

# More Optimization Strategies

- It is your job!!!
- The faster the better