Dynamic Indexing with Logarithmic Merging

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Dynamic Indexing using Logarithmic Merging

We can do better than $O(T^2/n)$ by introducing $\log_2(T/n)$ indexes $I_0, I_1, I_2, \ldots$ of size $2^0 \times n, 2^1 \times n, 2^2 \times n, \ldots$

Postings percolate up this sequence of indexes and are processed only once on each level.

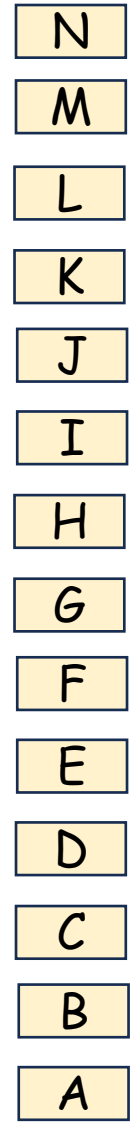
LMERGEADDTOKEN(indexes, Z_0, token):

```
Z_0 ← MERGE(Z_0, {token})
if | Z_0 | = n then
    for i ← 0 to ∞ do
        if I_i ∈ indexes then
            Z_{i+1} ← MERGE(I_i, Z_i)        (Z_{i+1} is a temporary index on disk)
            indexes ← indexes − {I_i}
        else
            I_i ← Z_i                        (Z_i becomes the permanent index I_i)
            indexes ← indexes ∪ {I_i}
            BREAK
    Z_0 ← ∅
```

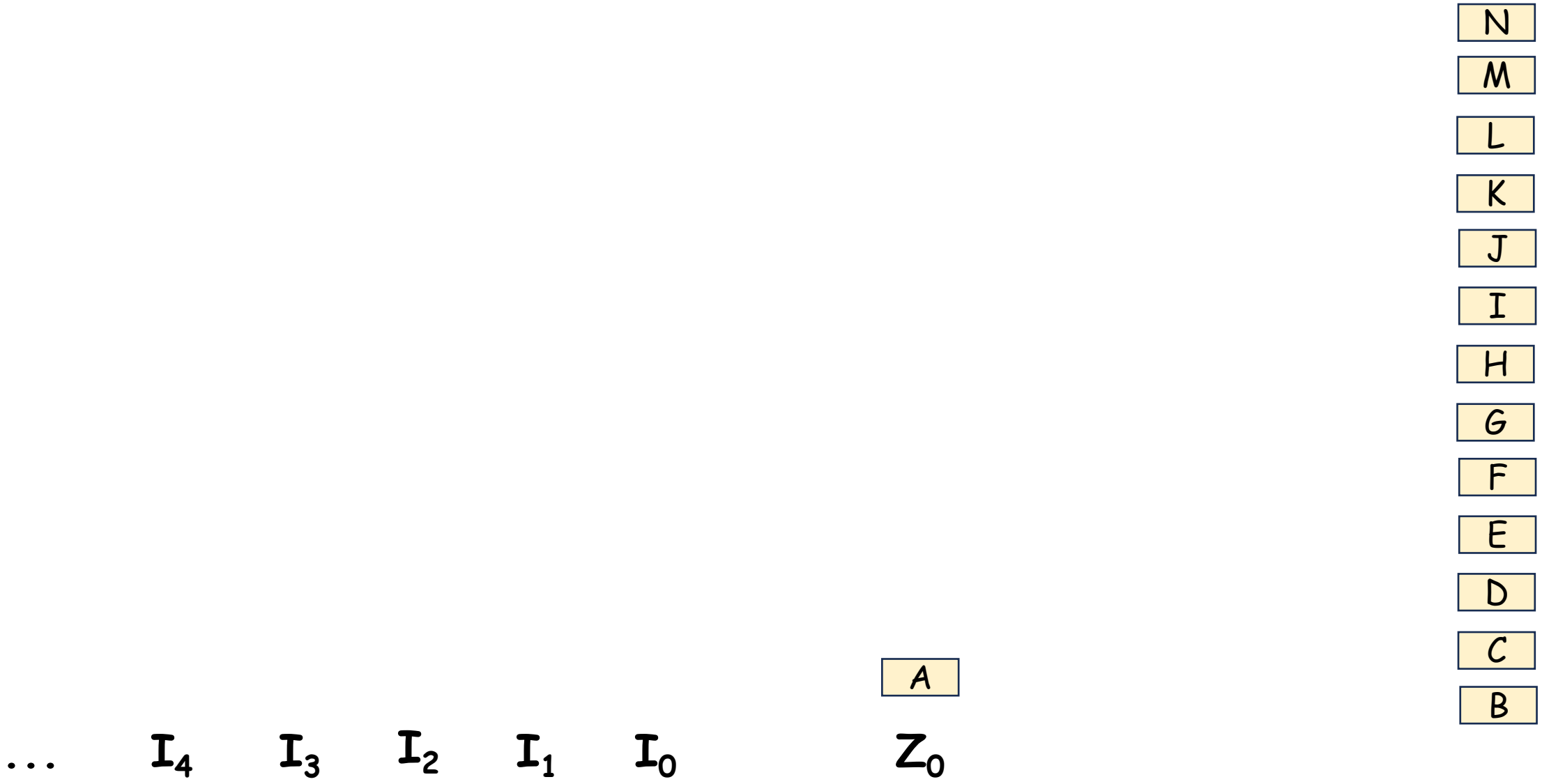
LOGARITHMICMERGE():

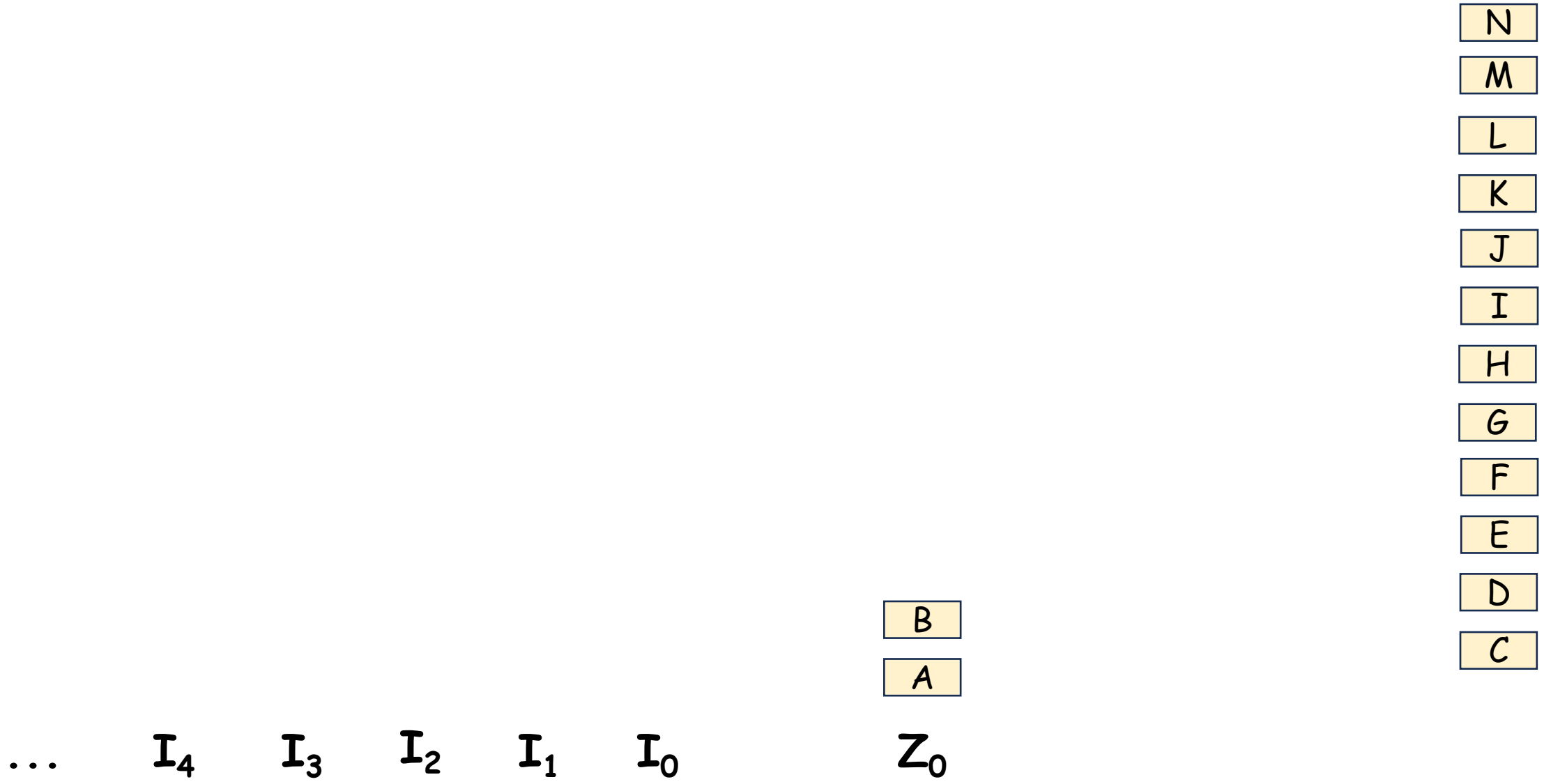
```
Z_0 ← ∅                                      (Z_0 is the in-memory index.)   Ini aux index)
indexes ← ∅
while true do
    LMERGEADDTOKEN(indexes, Z_0, GETNEXTTOKEN())
```

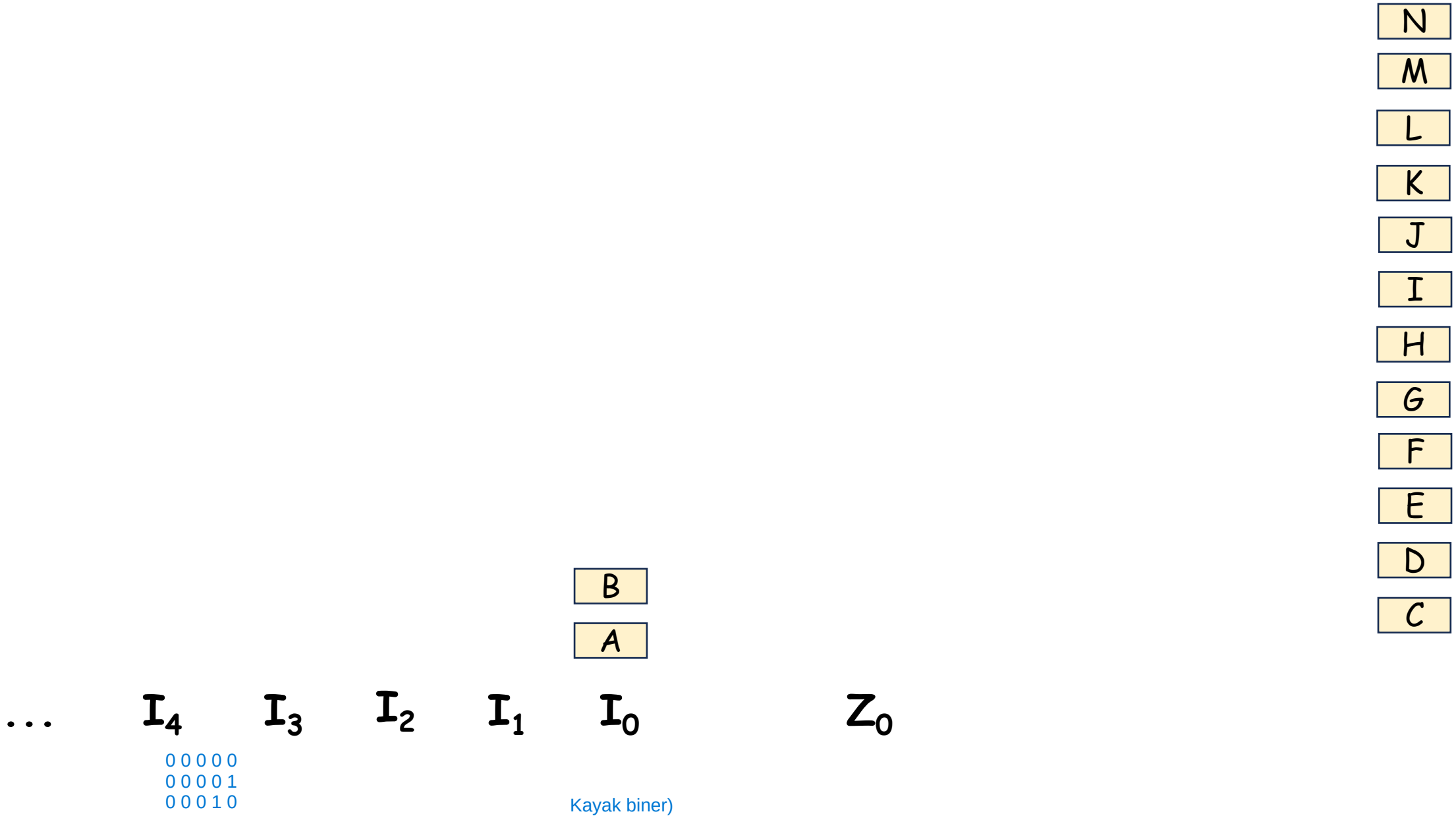
Ukuran Aux Index (n) = 2



... I_4 I_3 I_2 I_1 I_0 Z_0



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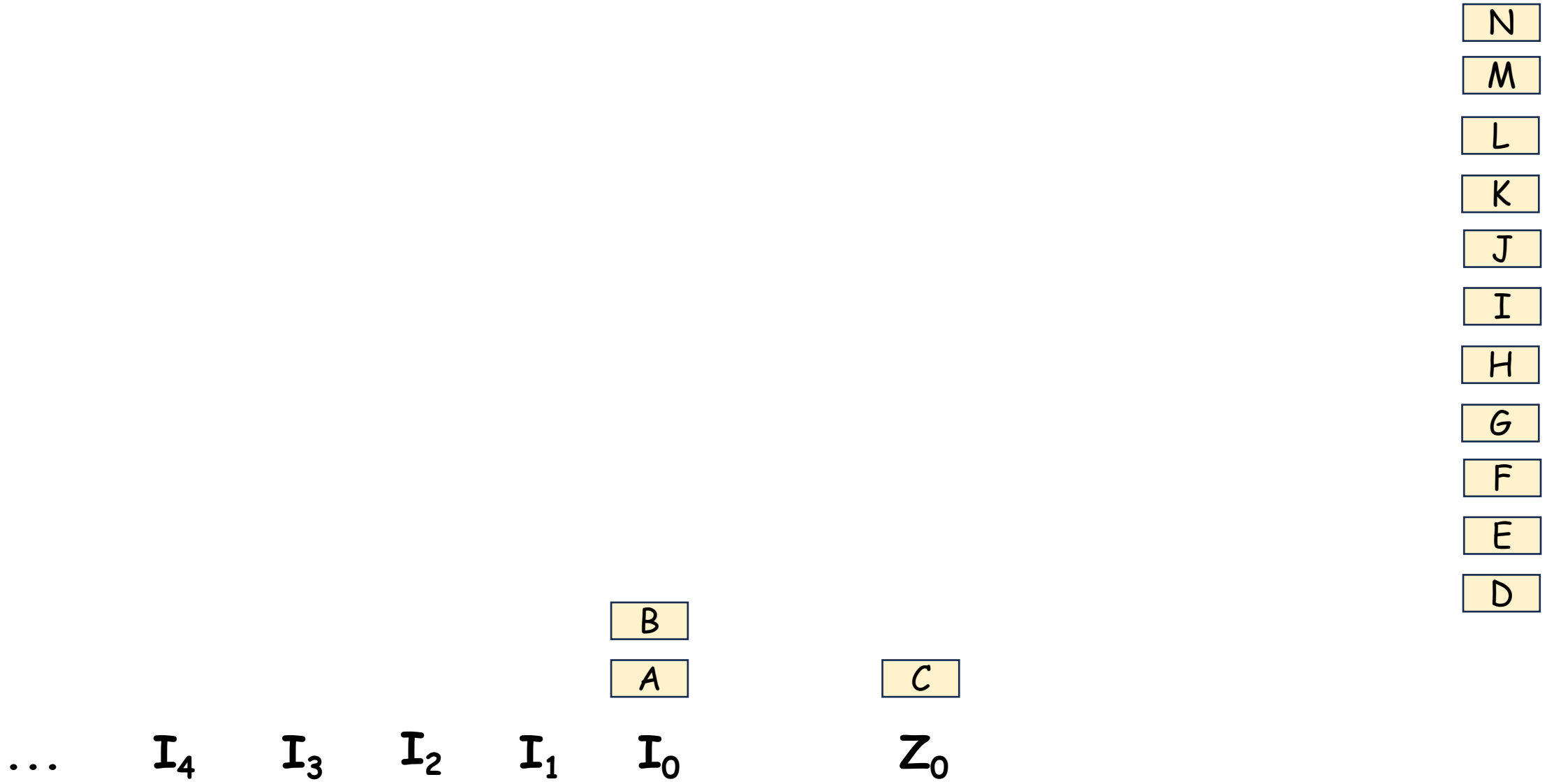
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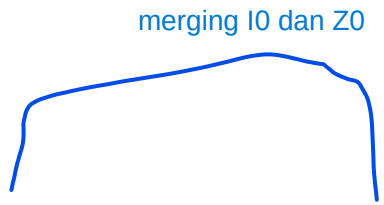

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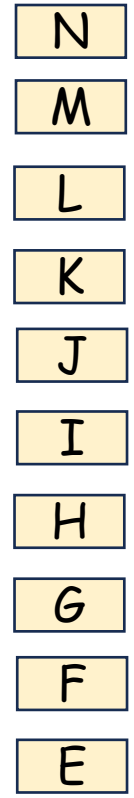
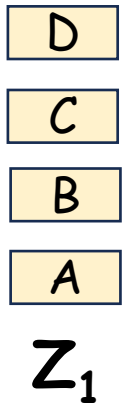




Merge

... I_4 I_3 I_2 I_1 I_0 Z_0

(2^4) * n

2 ^ 3 * n

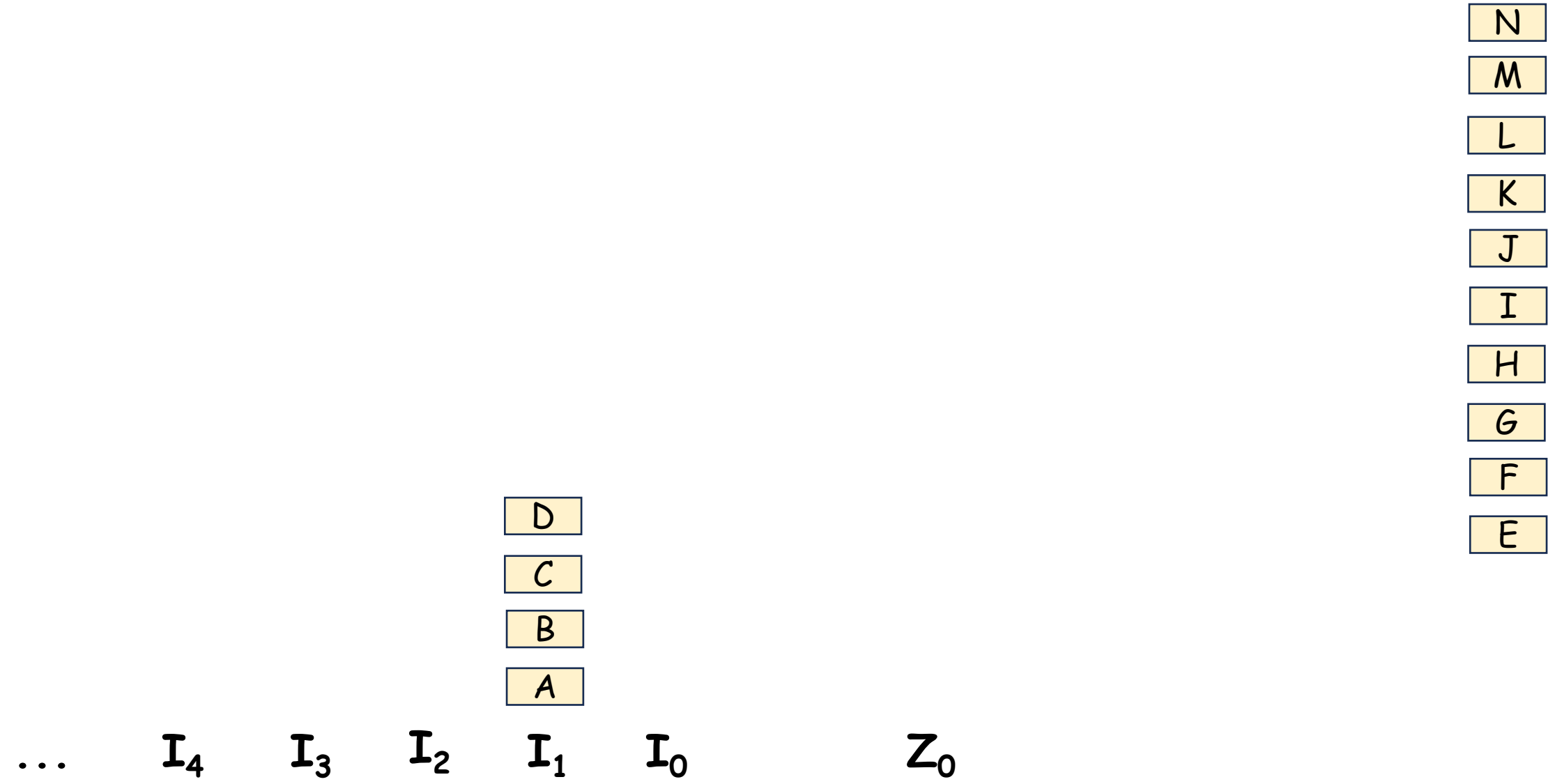
2^2 * n

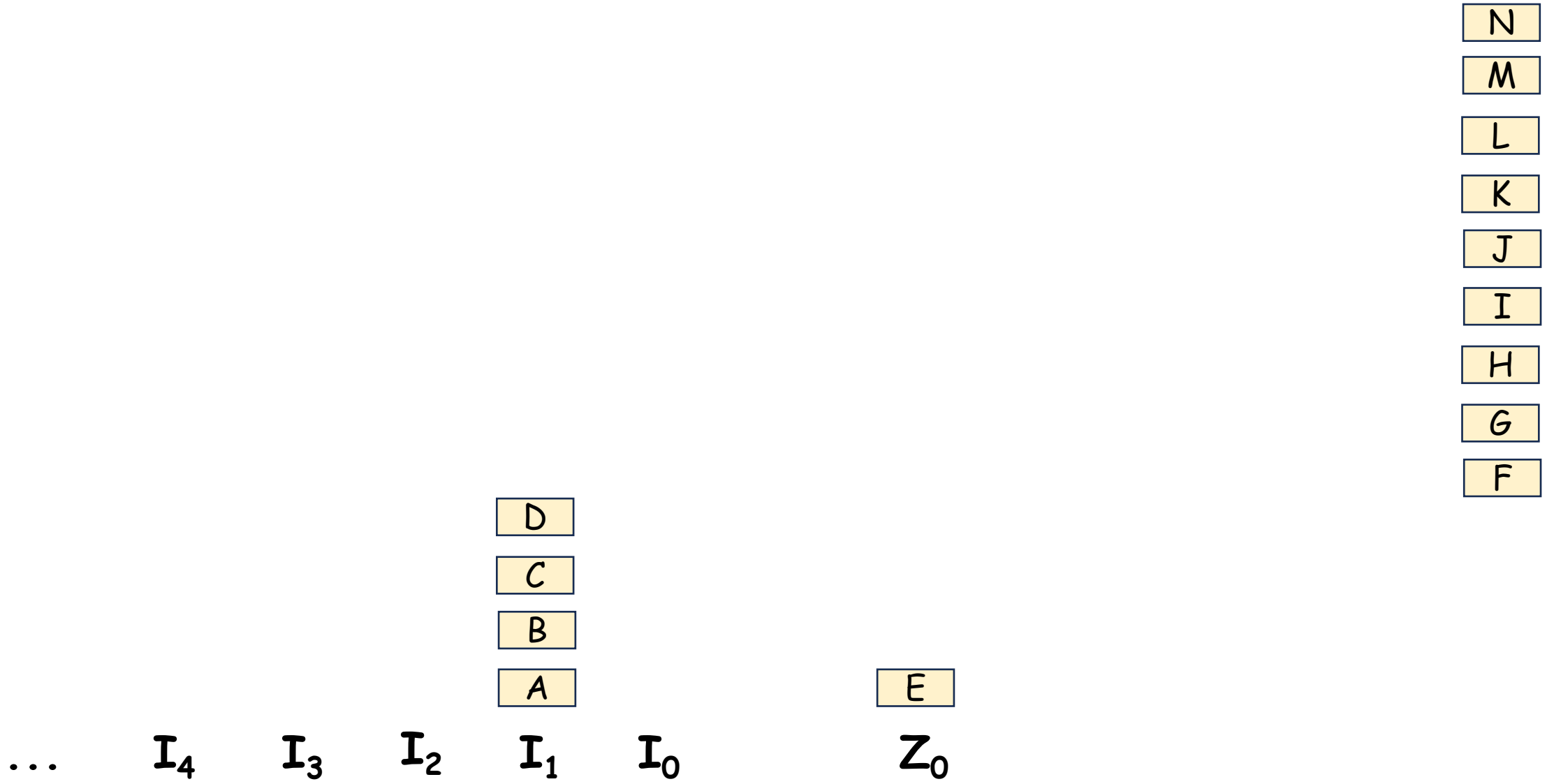
2^1 * n

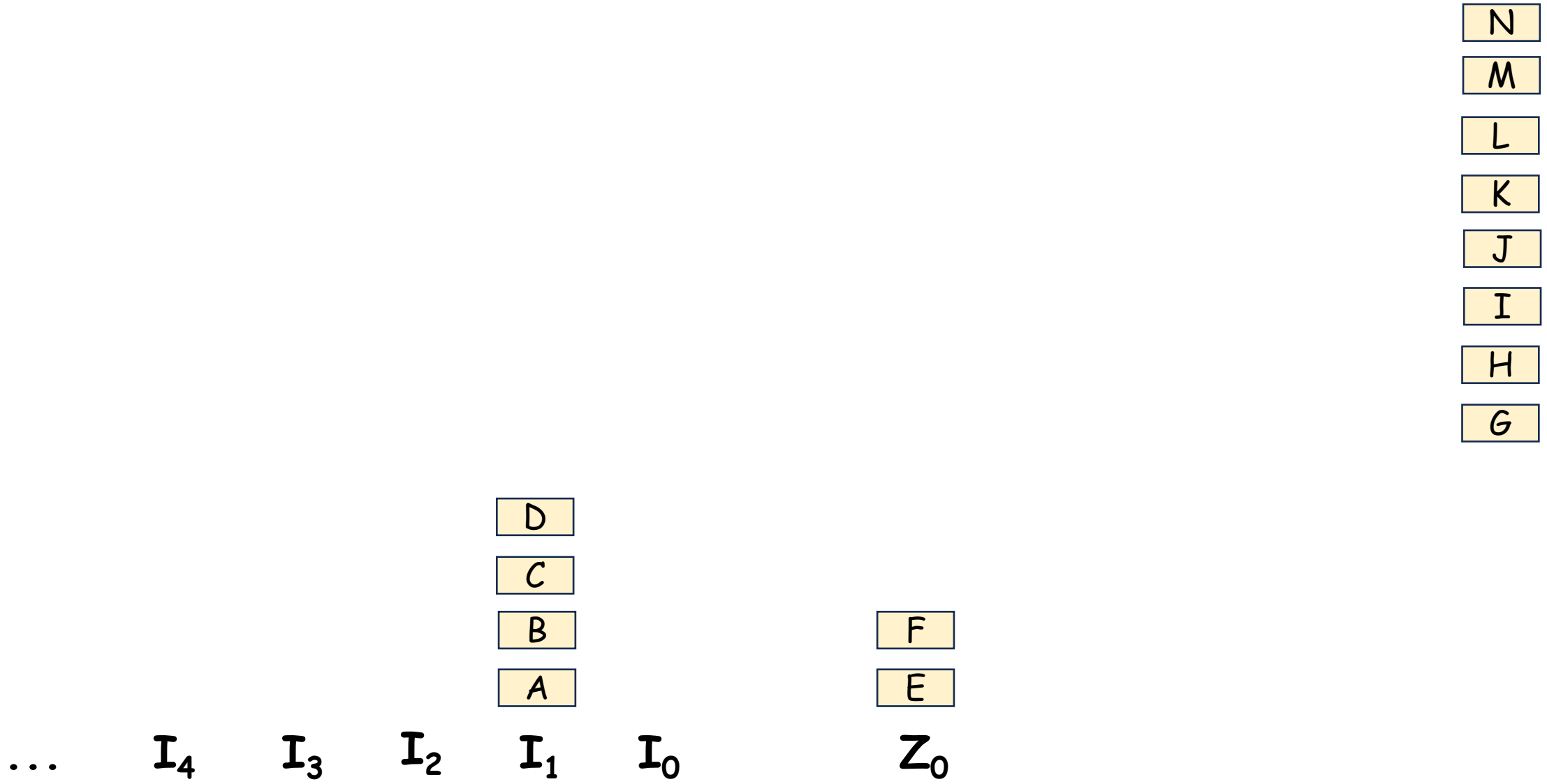
Maksimal

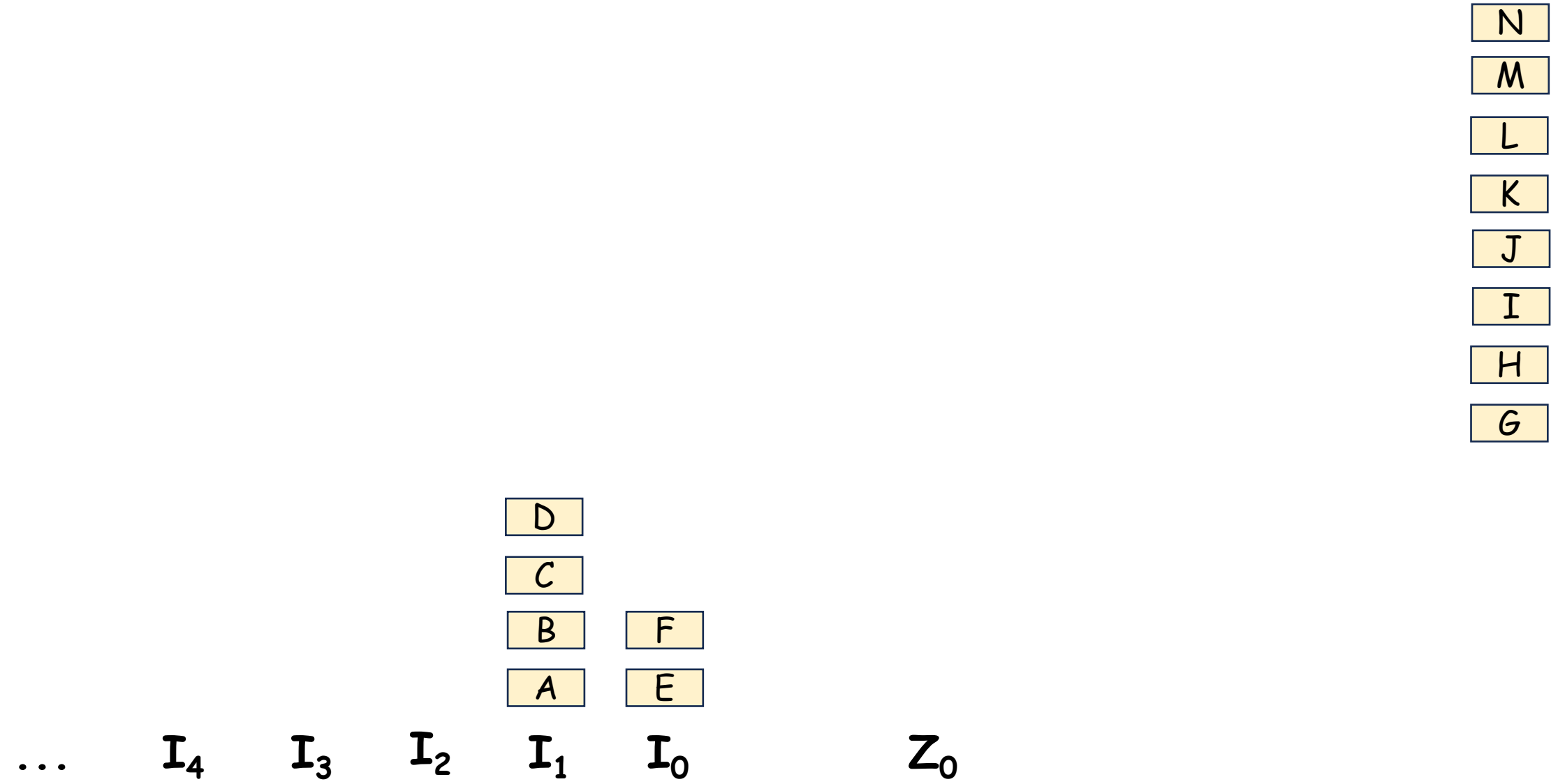
2^0 *n

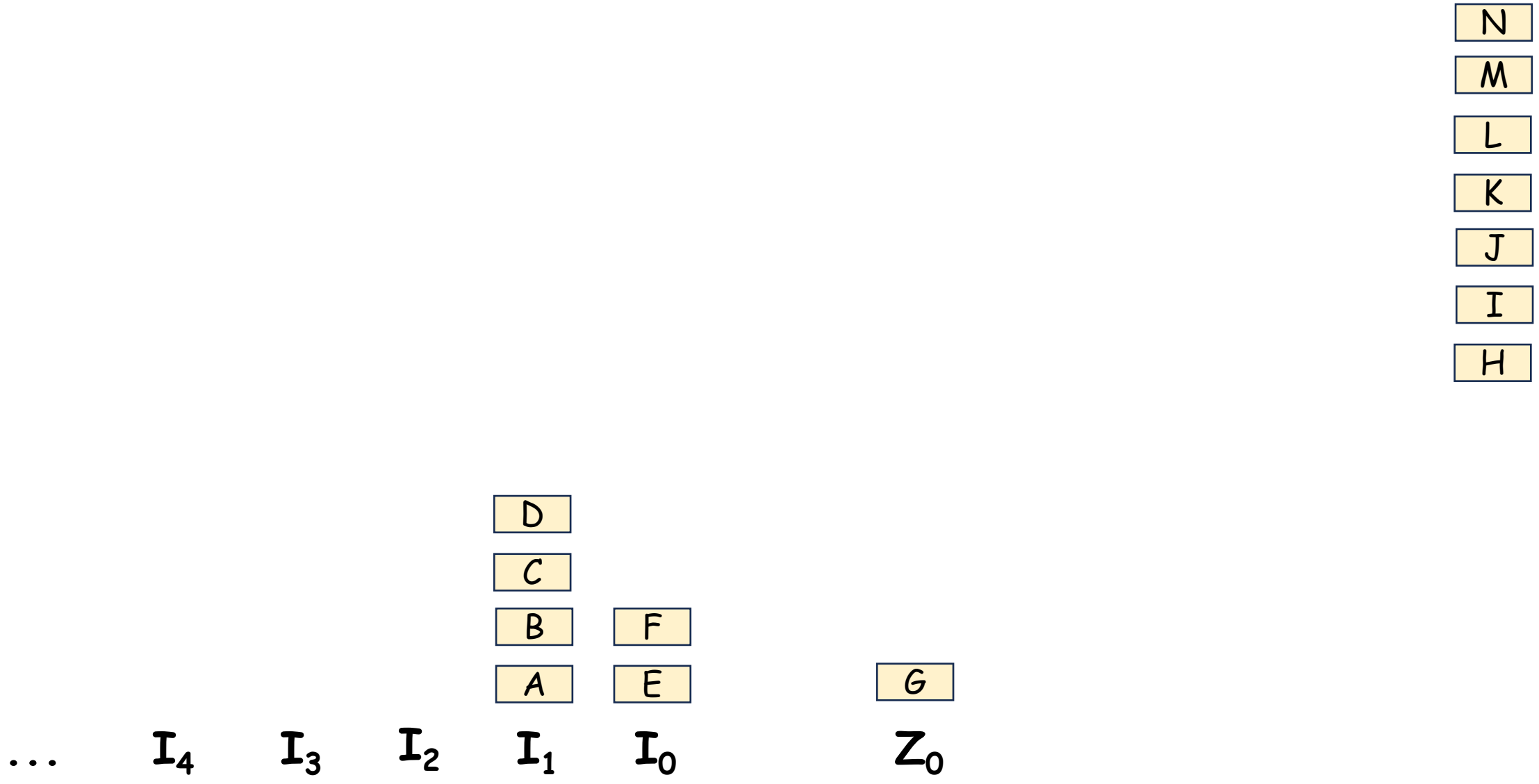
Maksimal n = 2

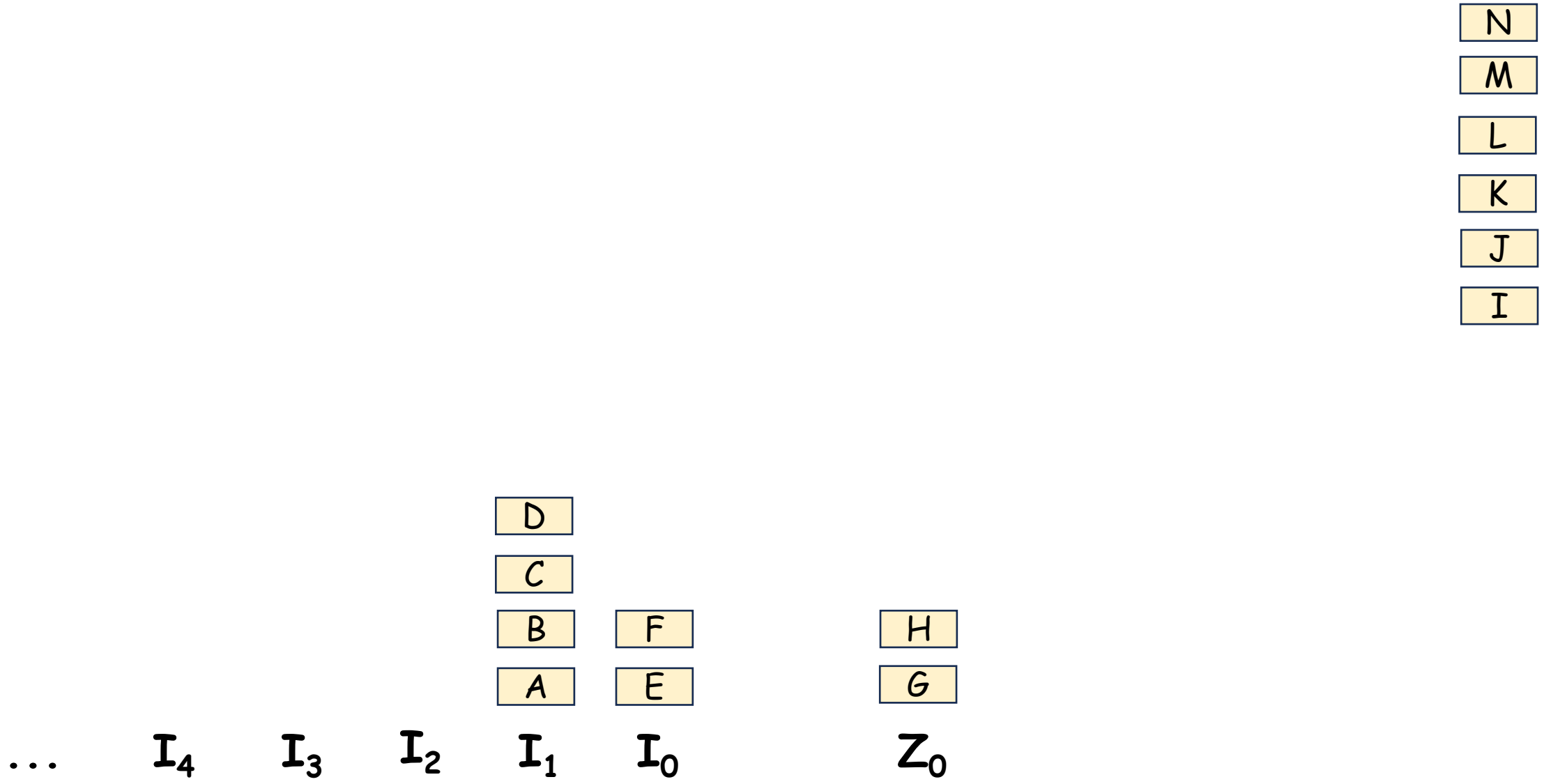


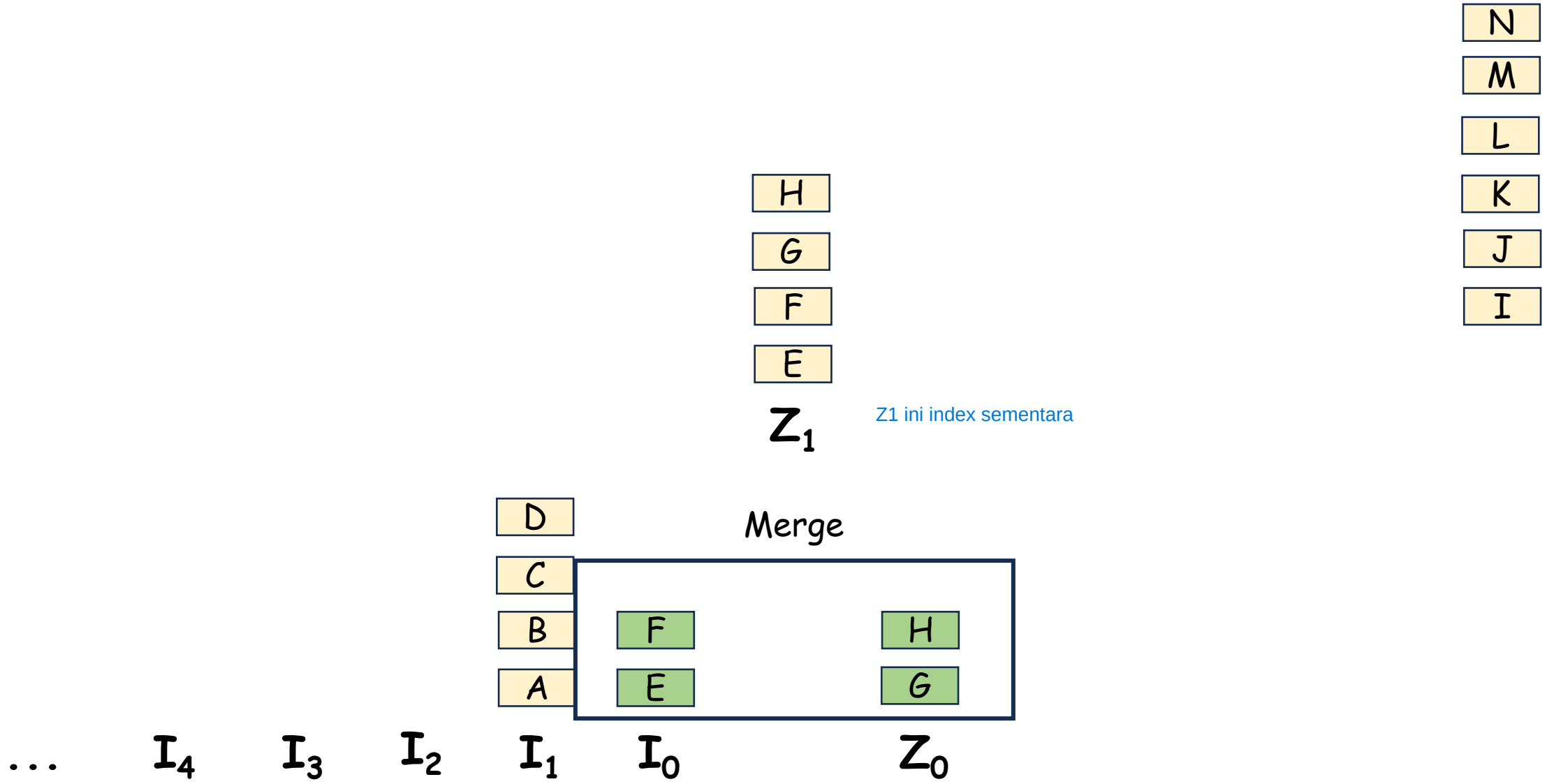








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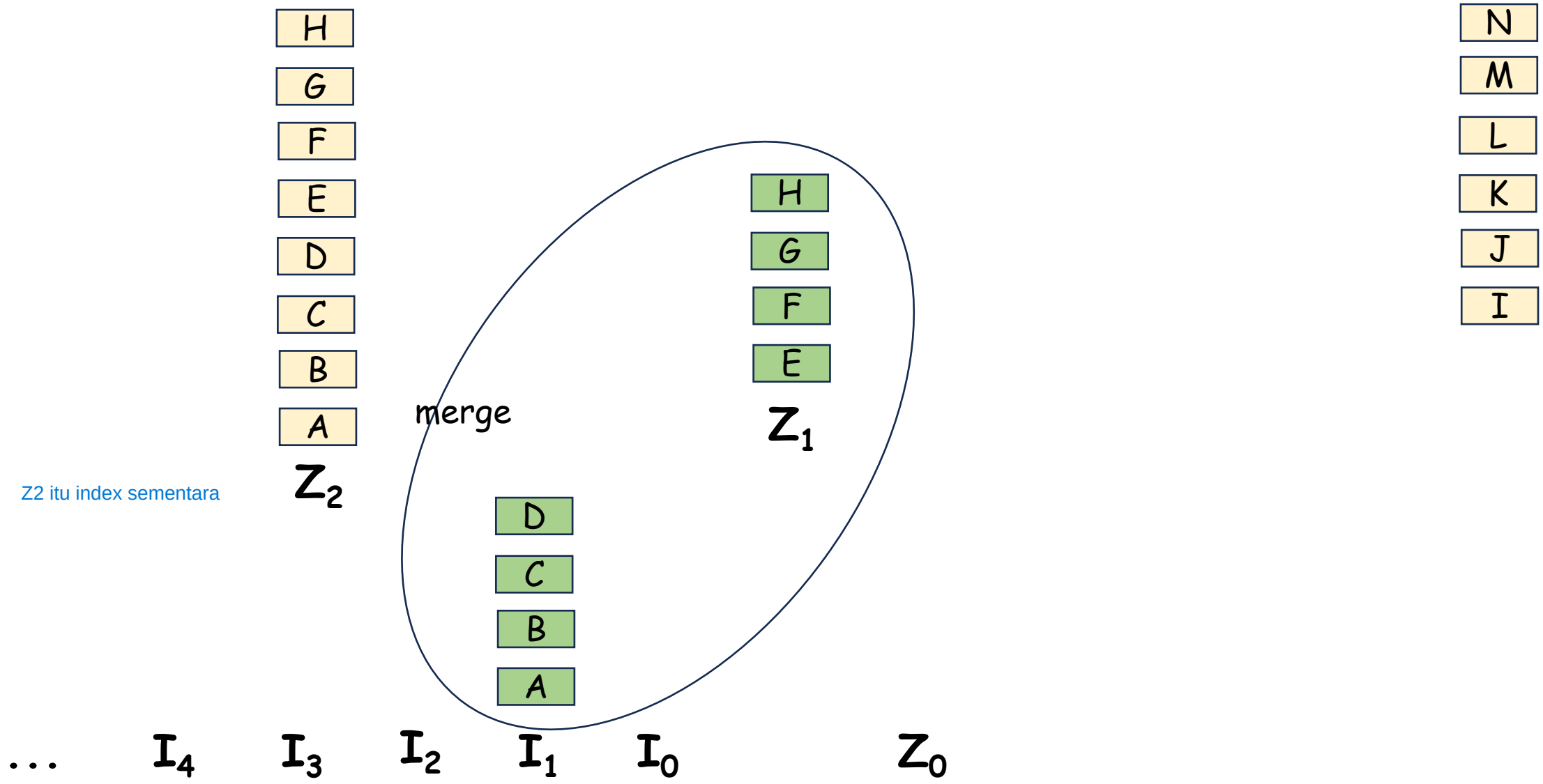
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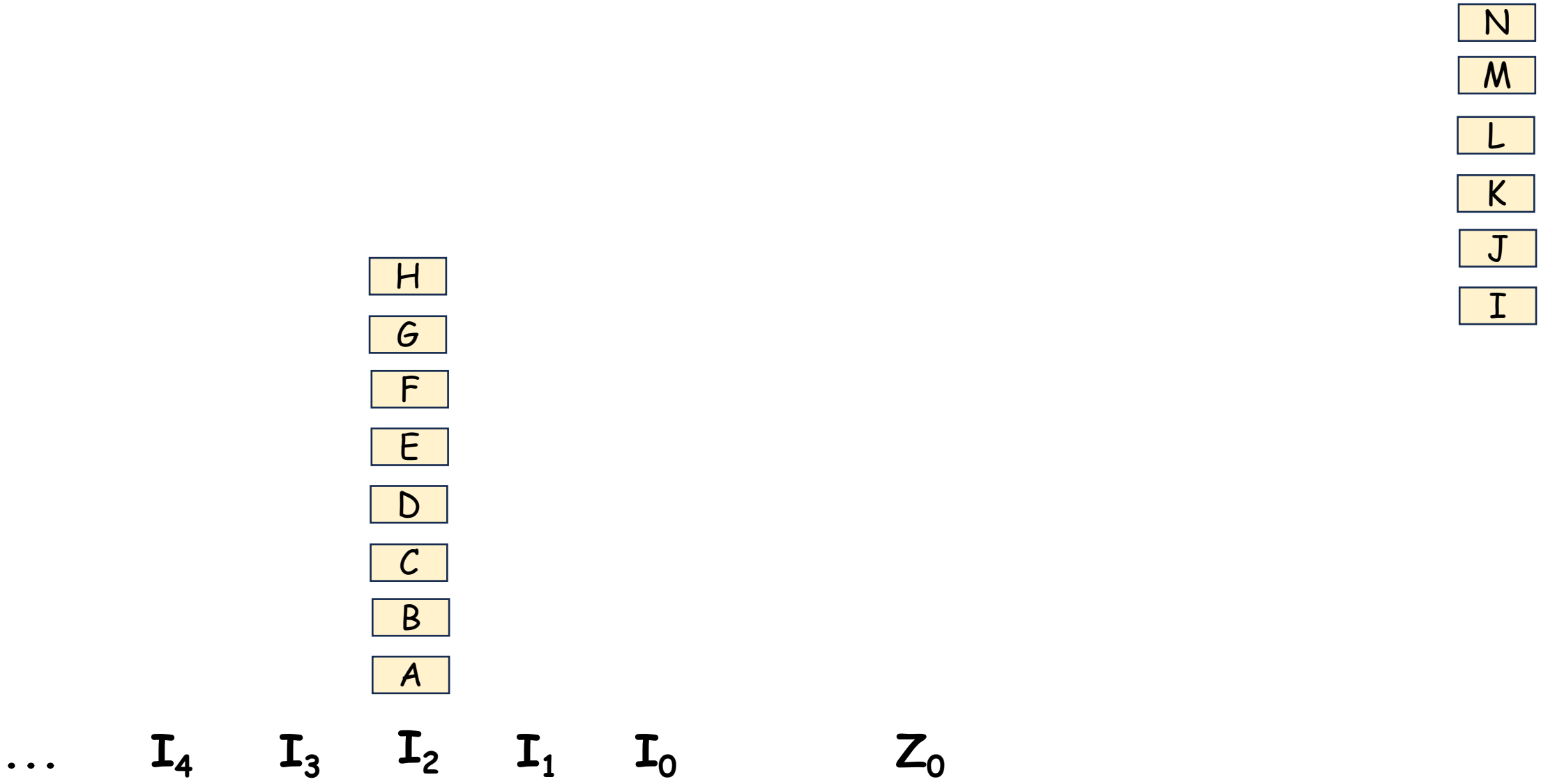

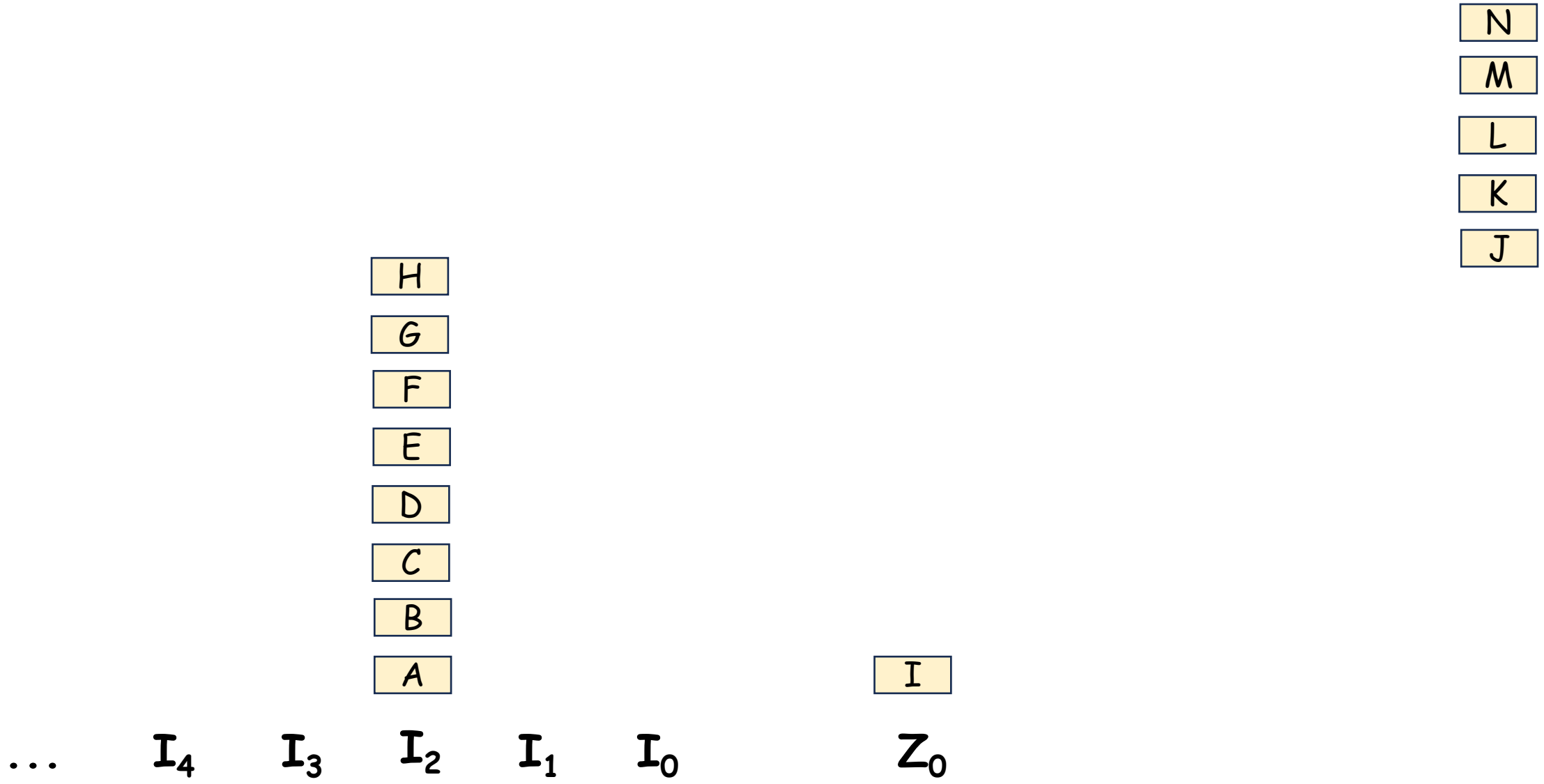

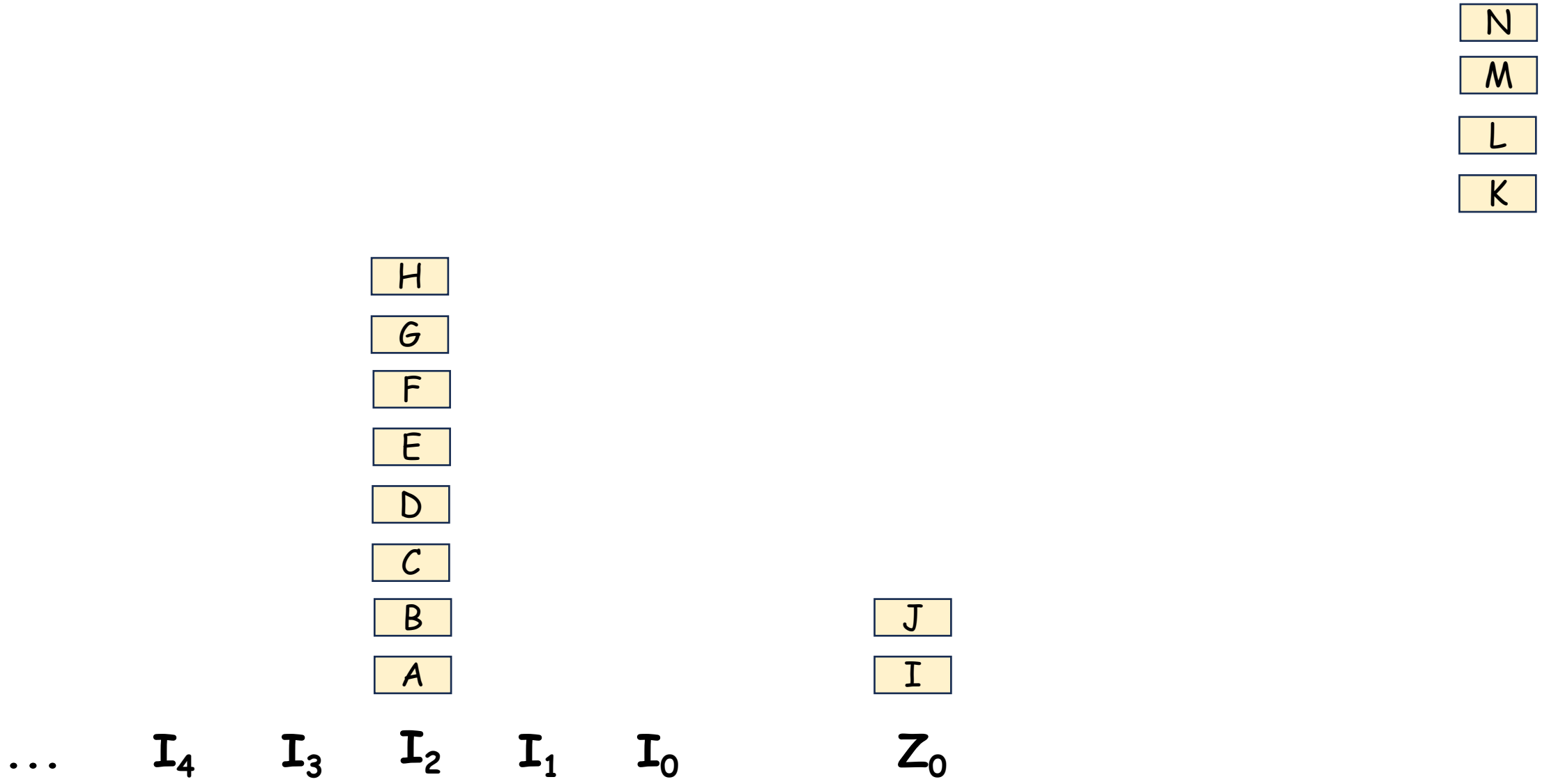

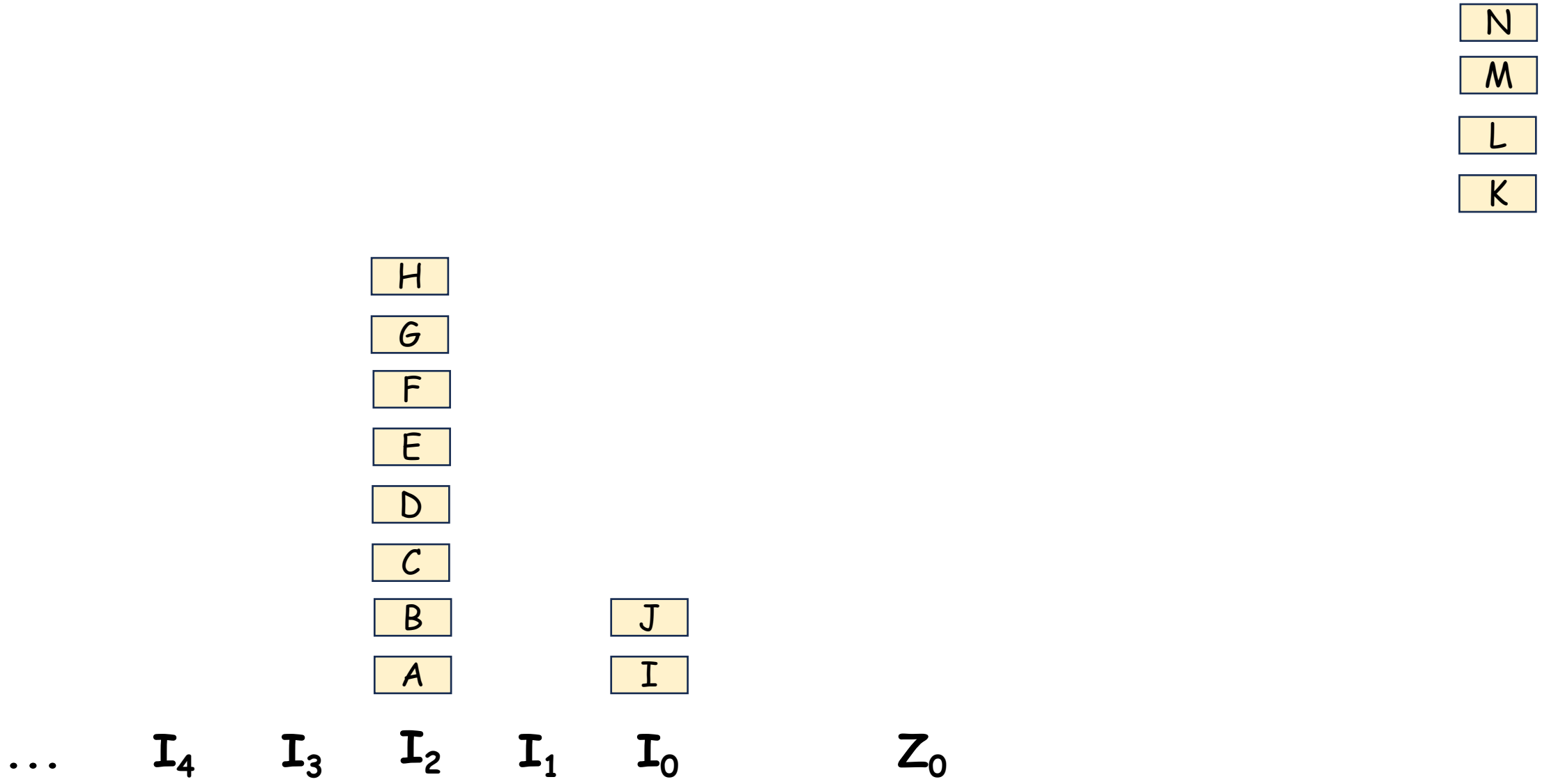

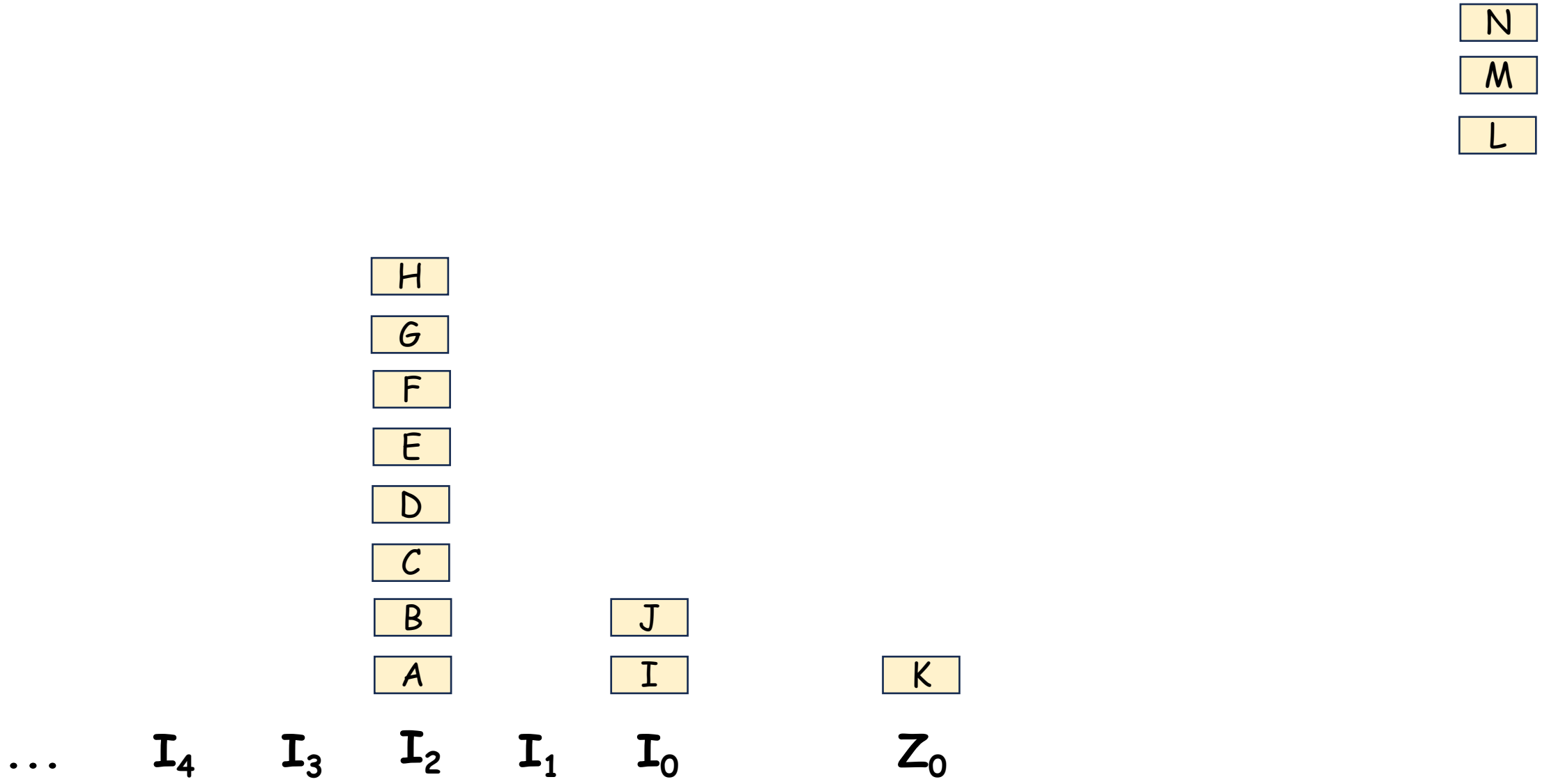

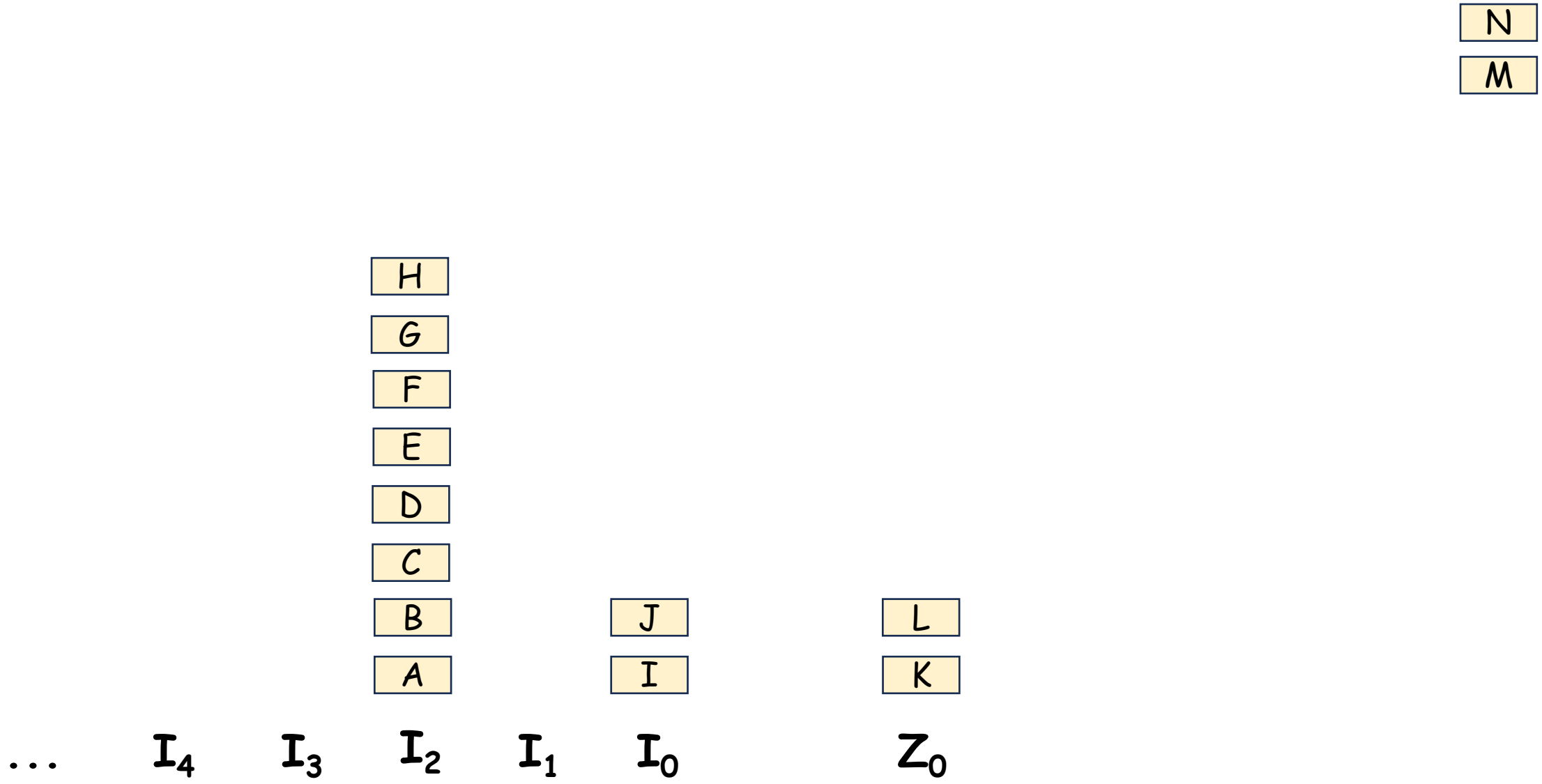

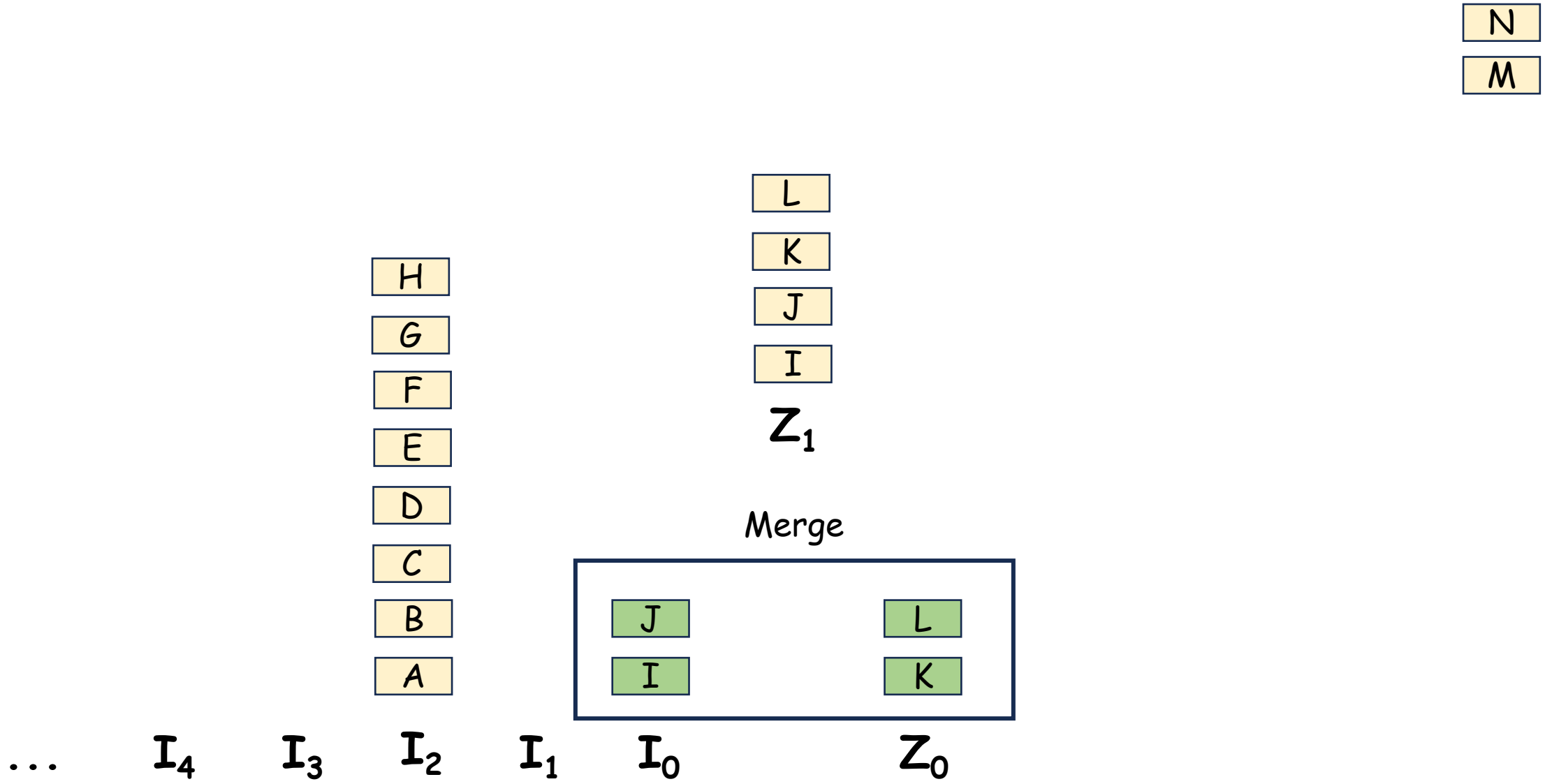
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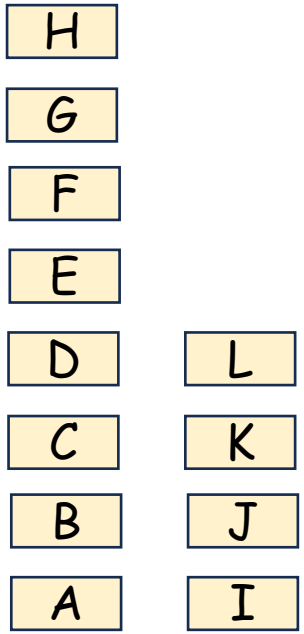

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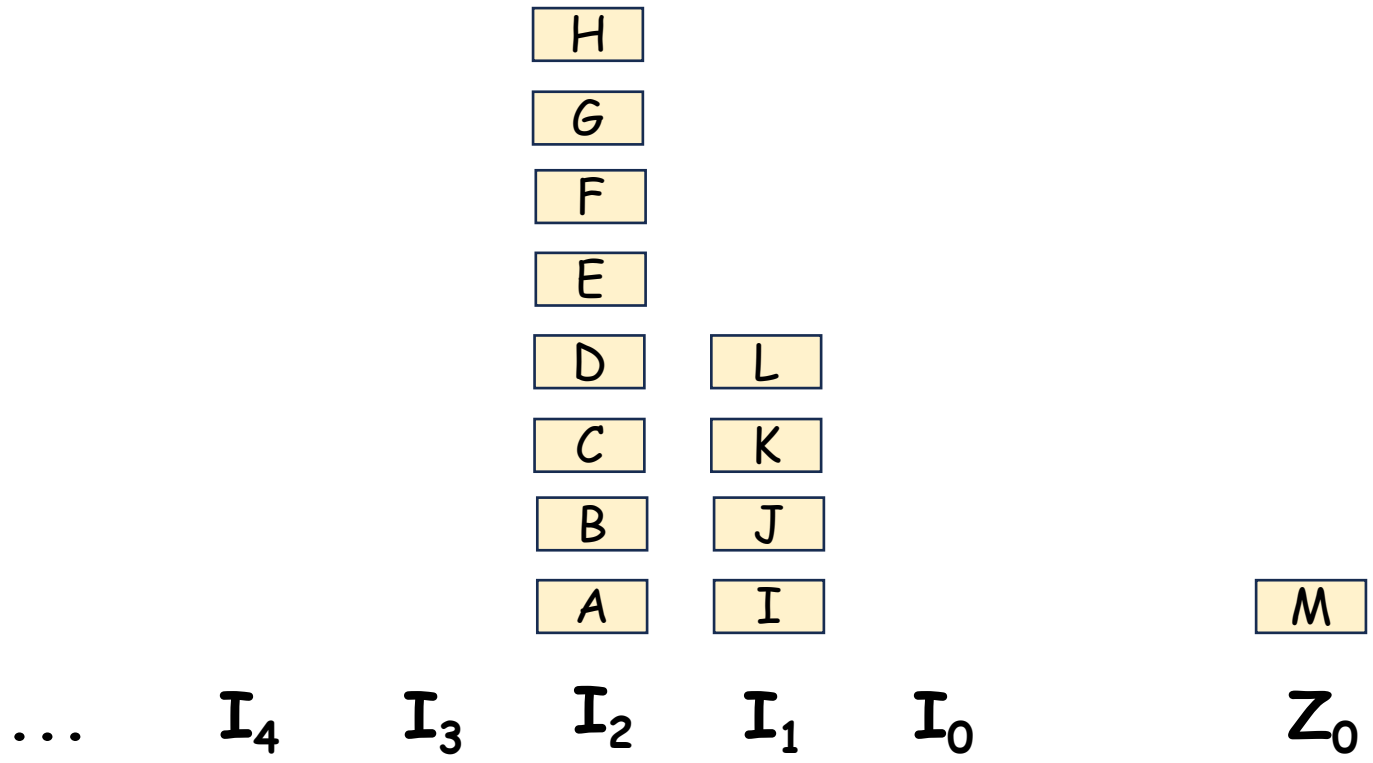
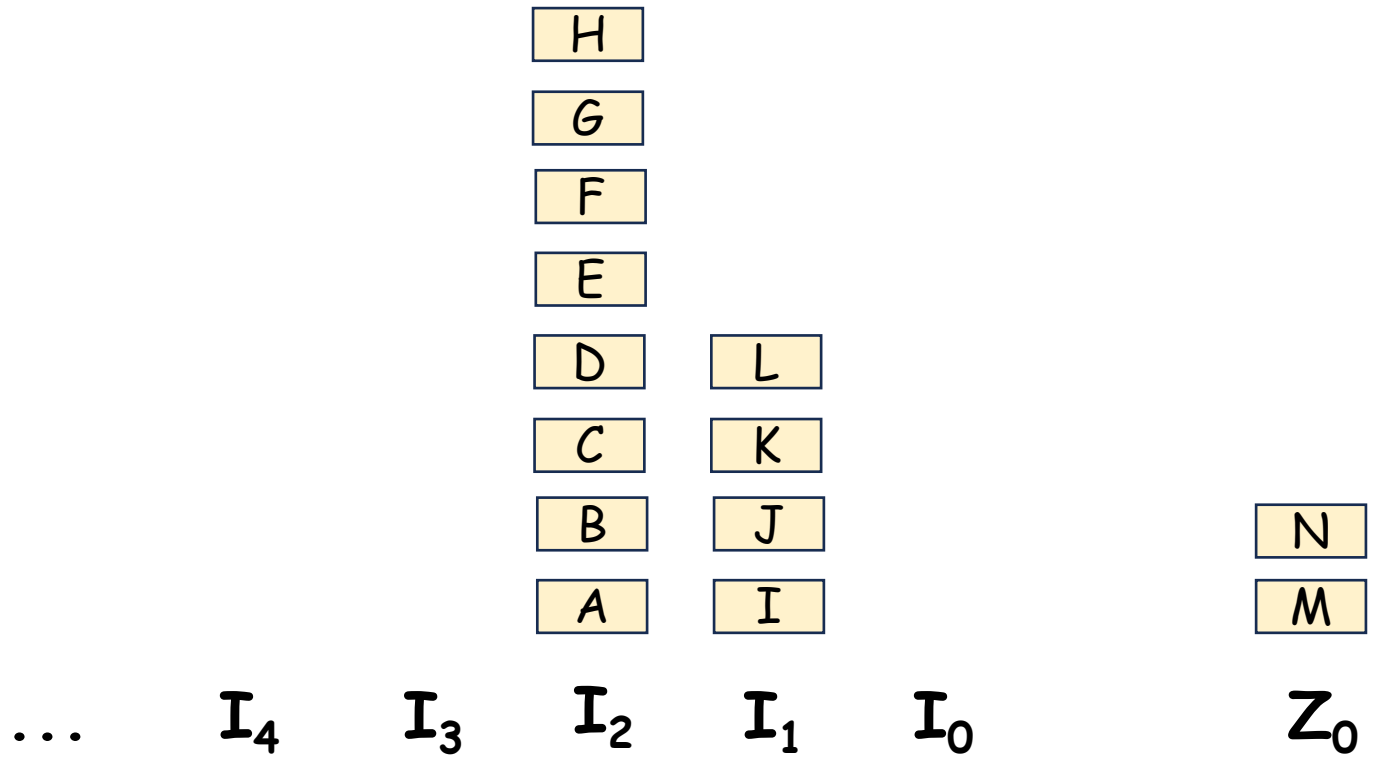




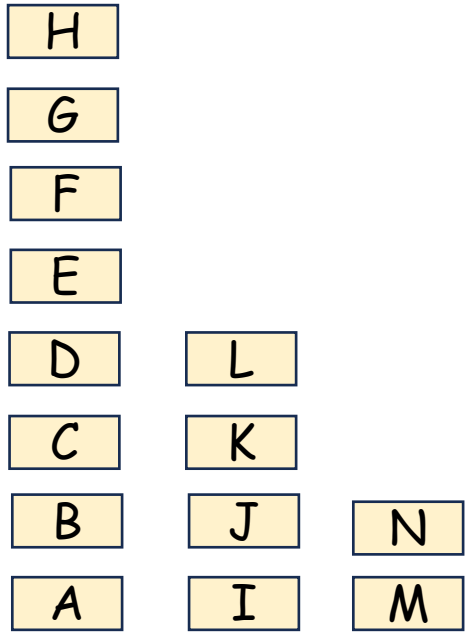
There are $\log_2(T/n)$ indexes.

O T log T/n) , karena untuk setiap posting cuman di proses sekali setiap log2 (T/n)

Ada T term, masing-masing t (posting) hanya di proses sekali setial log2 T/n

Overall index construction time is $O(T \log_2(T/n))$ because each posting is processed only once on each of $\log_2(T/n)$ the levels.

Kayak A cuman di pindah-pindah/dievaluasi sekali aja setiap per level).

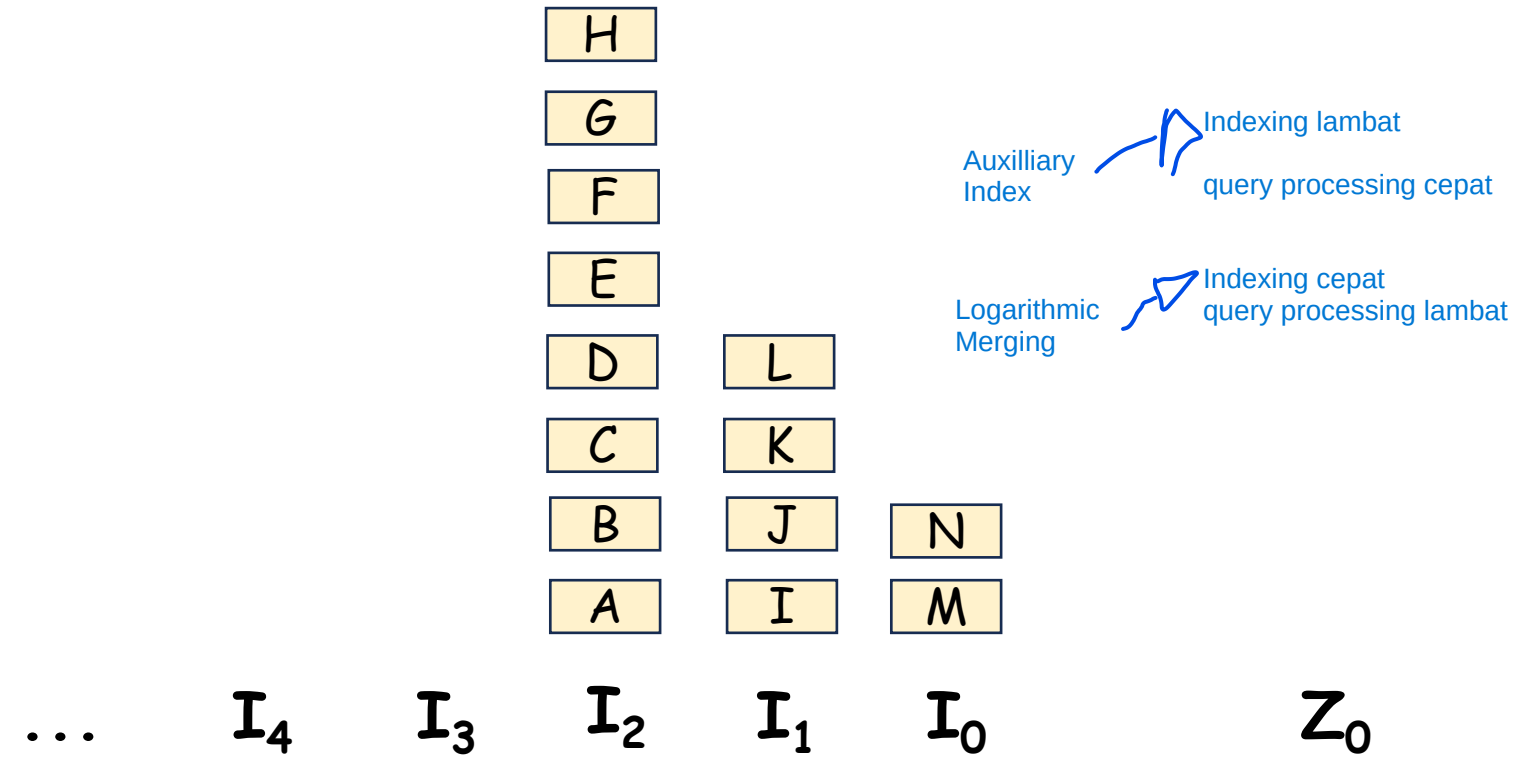


... I_4 I_3 I_2 I_1 I_0 Z_0

Dan seterusnya ...

However, We trade this efficiency gain for a slow down of query processing. We now need to merge results from $\log_2(T/n)$ indexes as opposed to **just two**.

Kita harus merge hasil dari Log2 (T/n) indexes, dibandingkan hanyalah 2 (main index dan aux index)



Auxilliary Index → Indexing lambat, query processing cepat

Logarithmic Merging → Indexing cepat, query processing lambat

Kalau menghapus akan di kasih flag (lazy deletion, jadi gak dihapus total)

Dan seterusnya ...