Freie Universität Berlin

Objektorientierte Programmierung

Sortieren (Teil 3)

Imperativ!

SoSe 2020

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Sortieralgorithmen

Ohne Vergleiche

Counting-Sort	**O**(n)
Radix-Sort	**O**(n)
Bucket-Sort	**O**(n)

Counting sort

Wenn die Daten, die sortiert werden sollen, ganzzahlige Werte mit einem kleinen Wertebereich zwischen **0** und **k** sind, ist es möglich, Zahlen zu sortieren ohne diese direkt zu vergleichen.

Die Zeitkomplexität, die man dabei hat, ist linear.

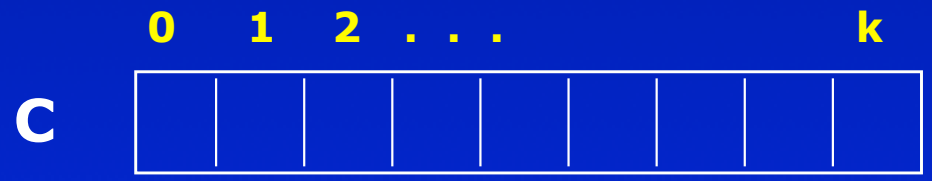
$$T(n) = O(n)$$

Anzahl der Daten, die sortiert werden sollen

Counting sort

Der "Counting sort"-Algorithmus benutzt zwei Hilfsfelder.

1. ein **C**-Feld, das so groß ist wie der Wertebereich (**k=8**) der Zahlen

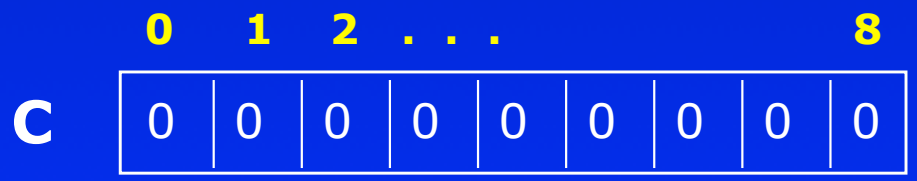


2. ein **B**-Feld, in dem die sortierten Zahlen am Ende gespeichert werden.

Counting sort

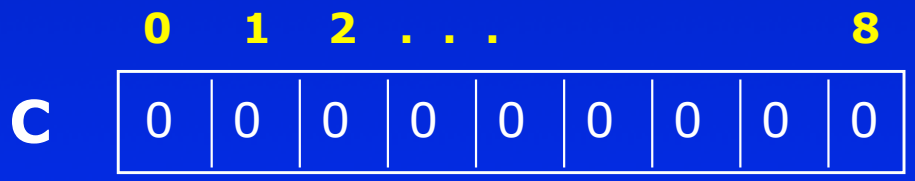
Nehmen wir an, wir wollen die Zahlen des **A**-Feldes sortieren.

Das C-Feld wird mit Nullen initialisiert.



Wertebereich = (0-8)

Counting sort



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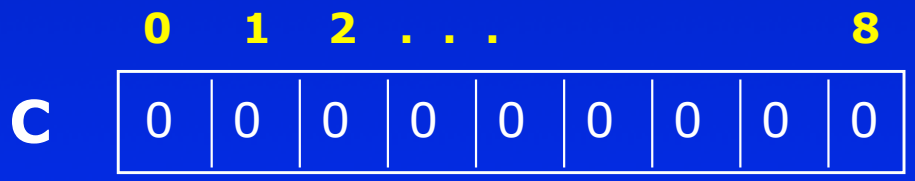

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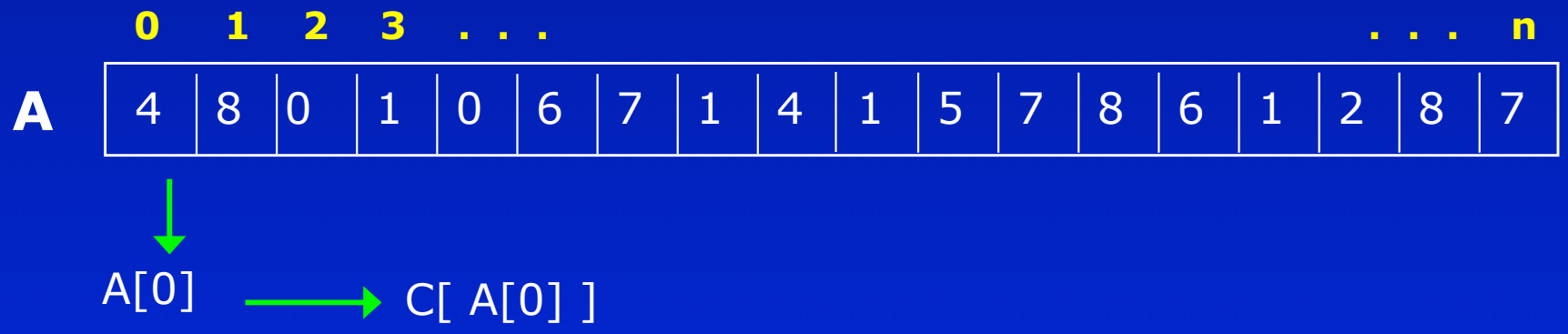

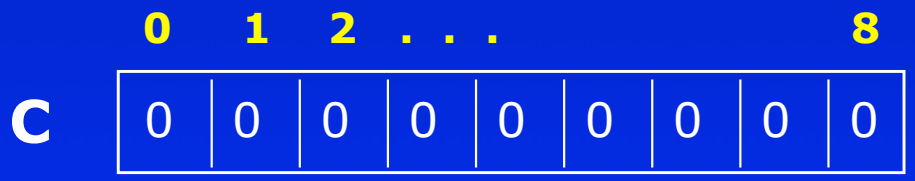

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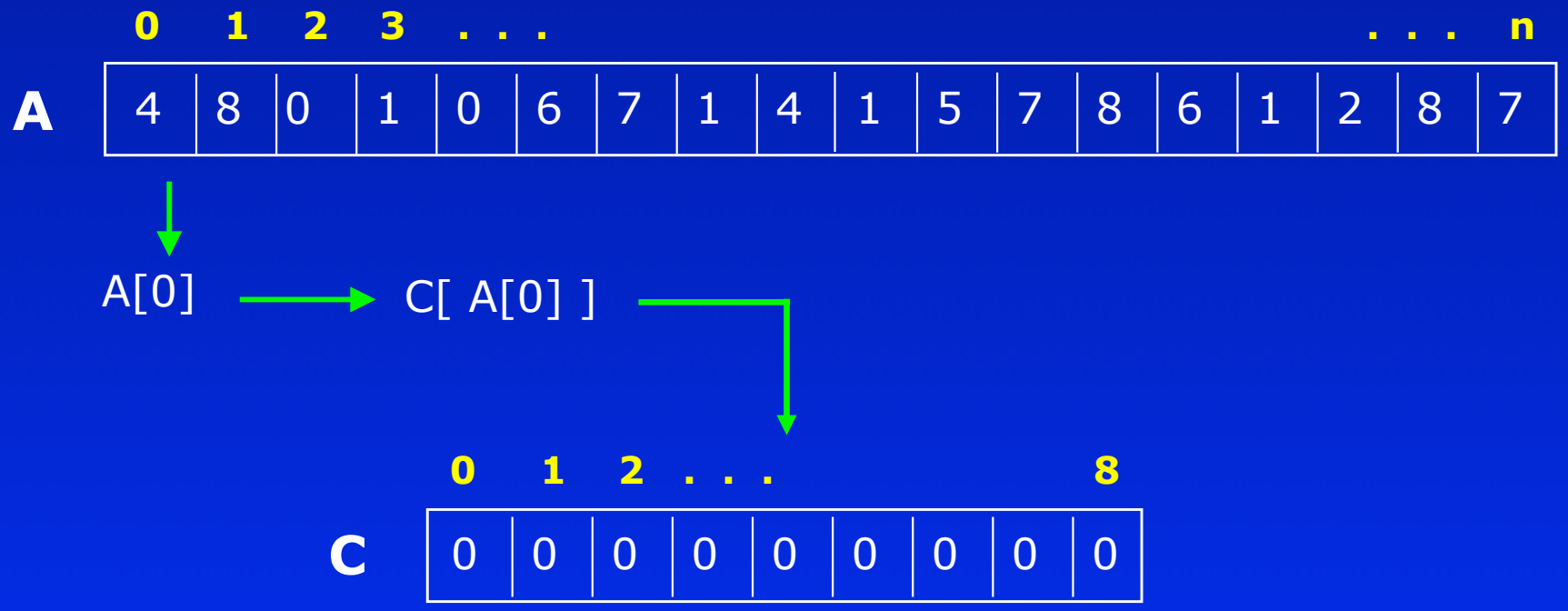

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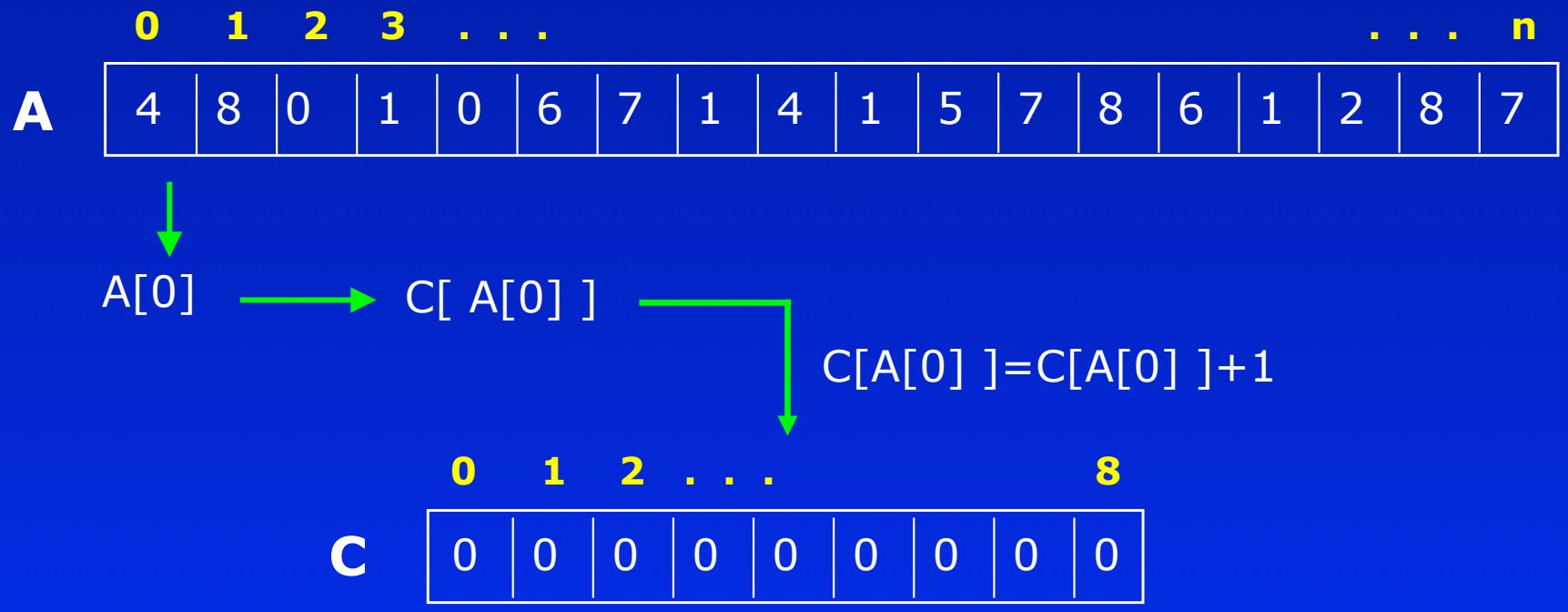

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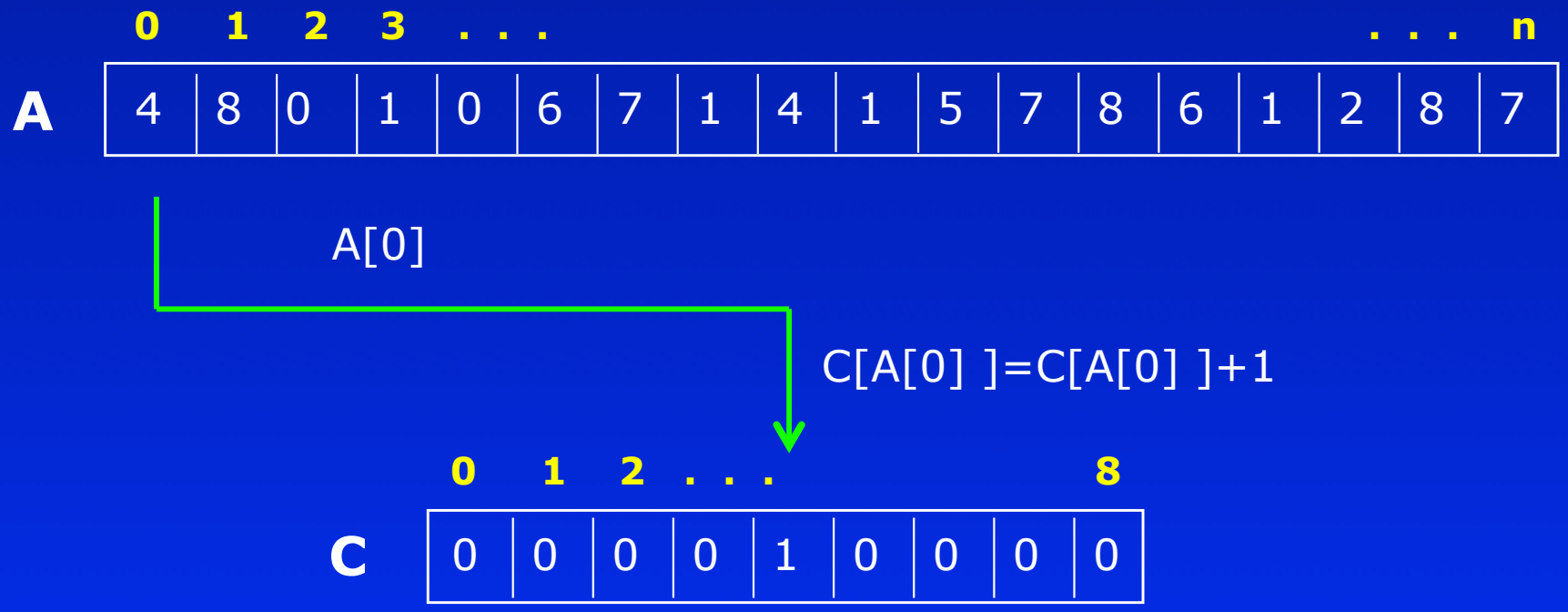

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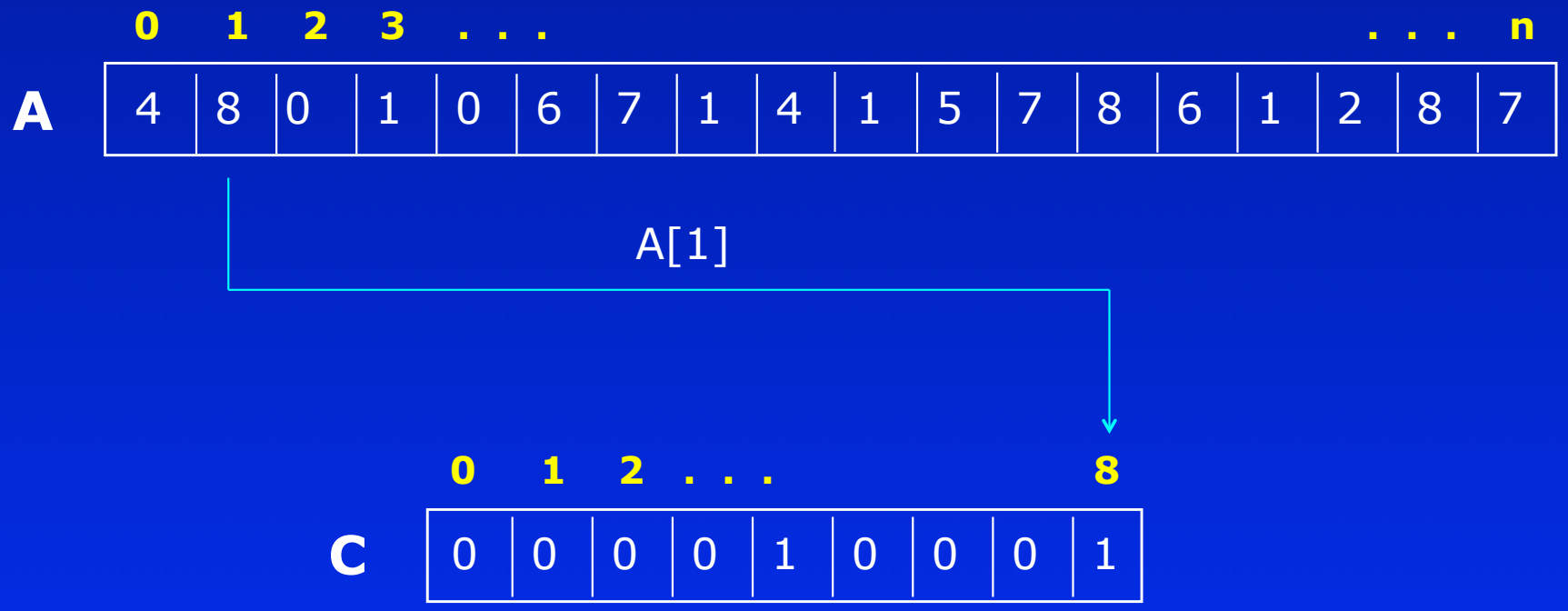

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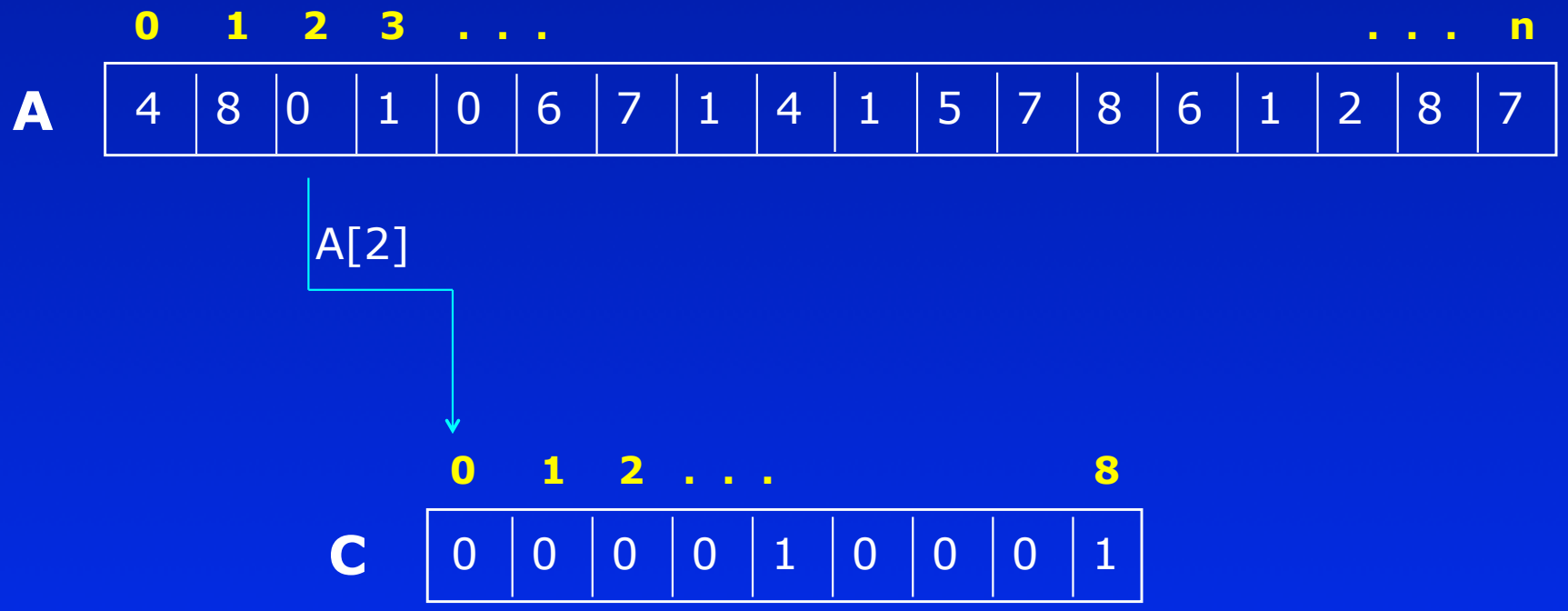

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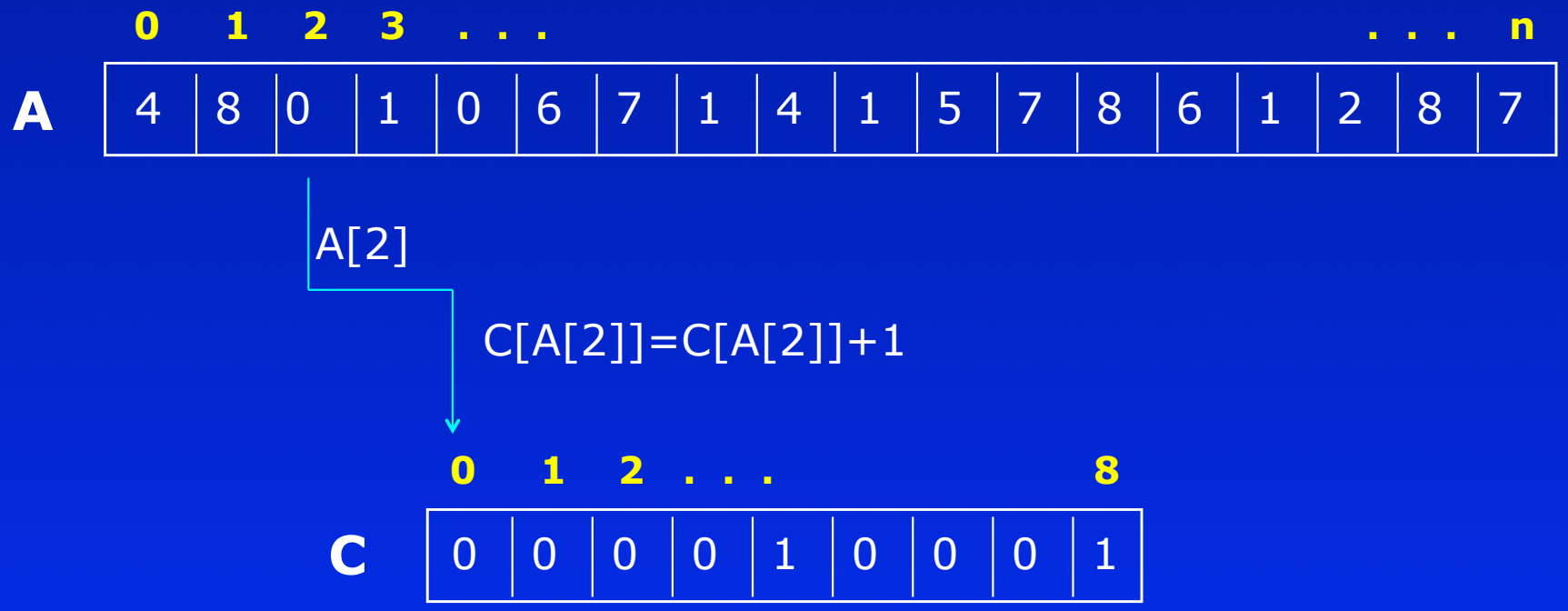

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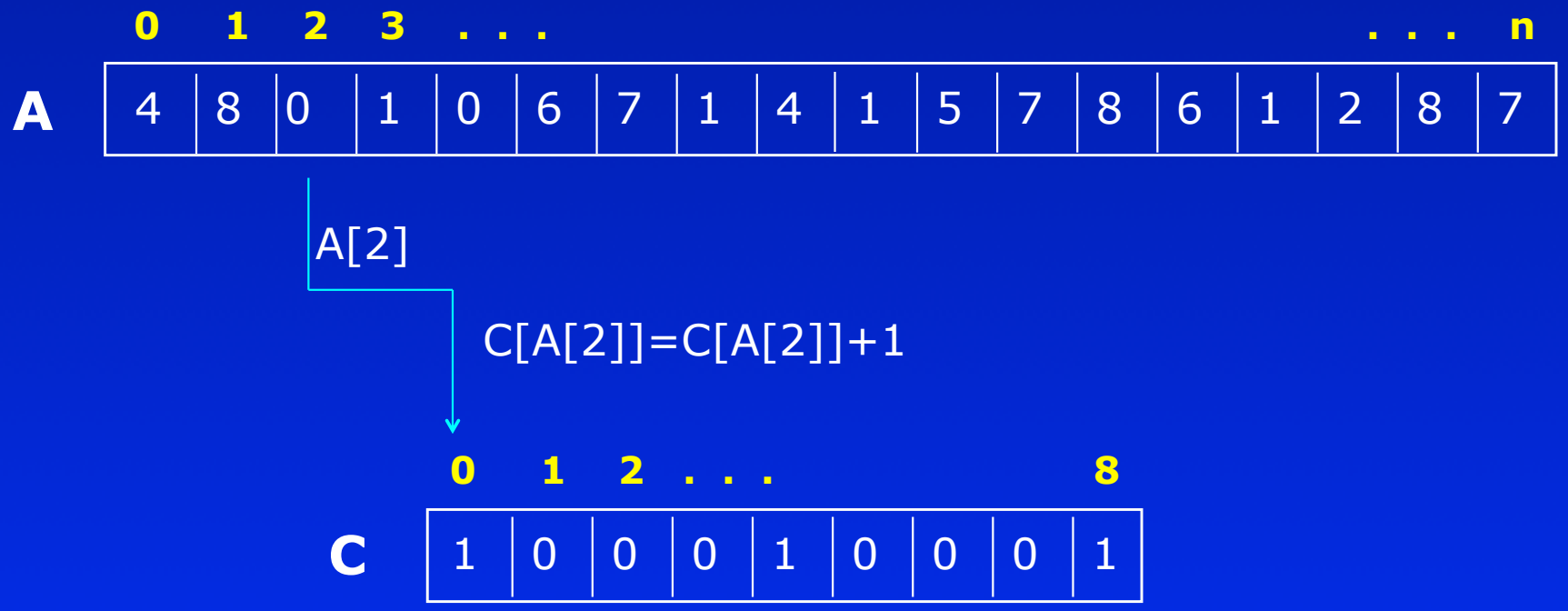

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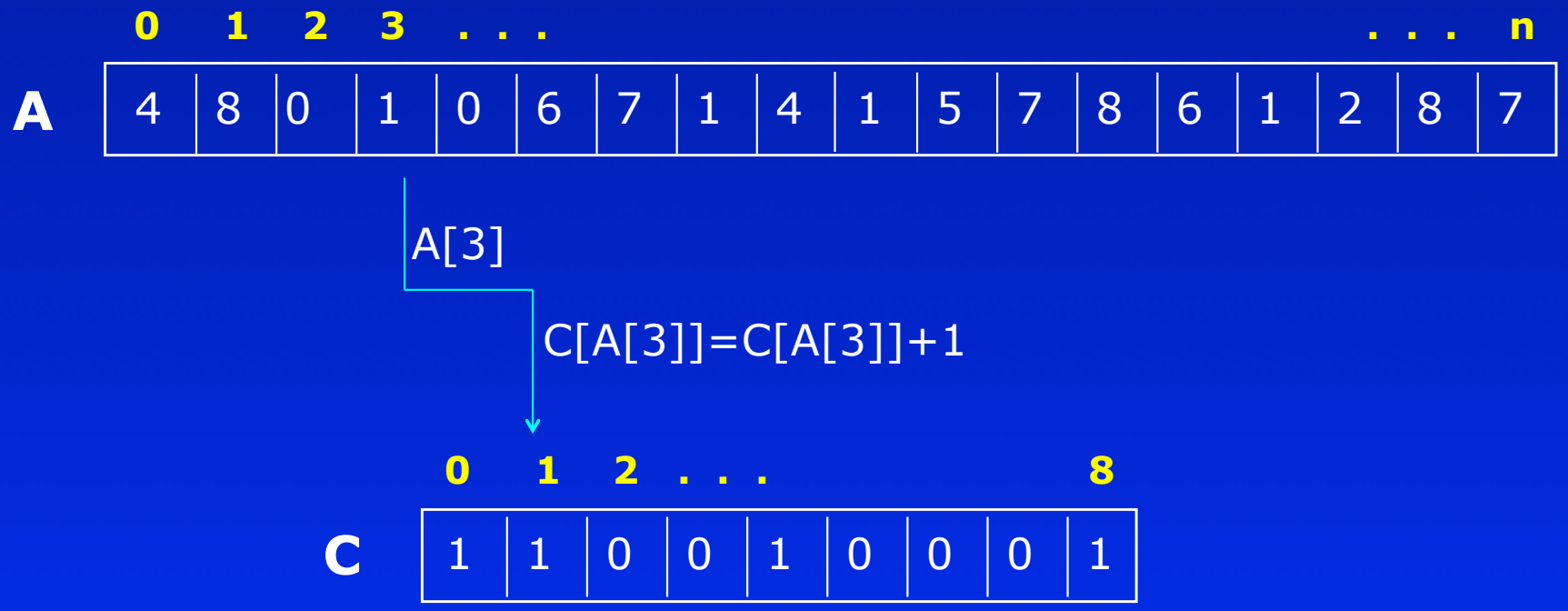

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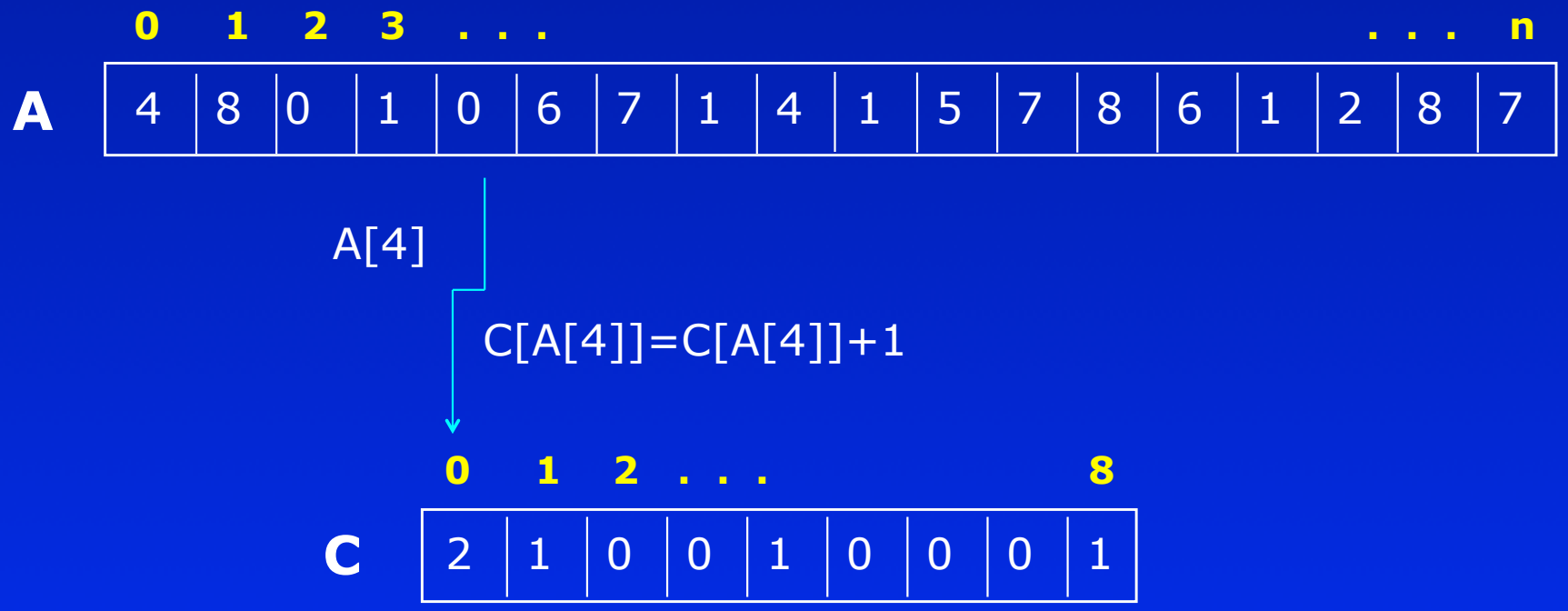

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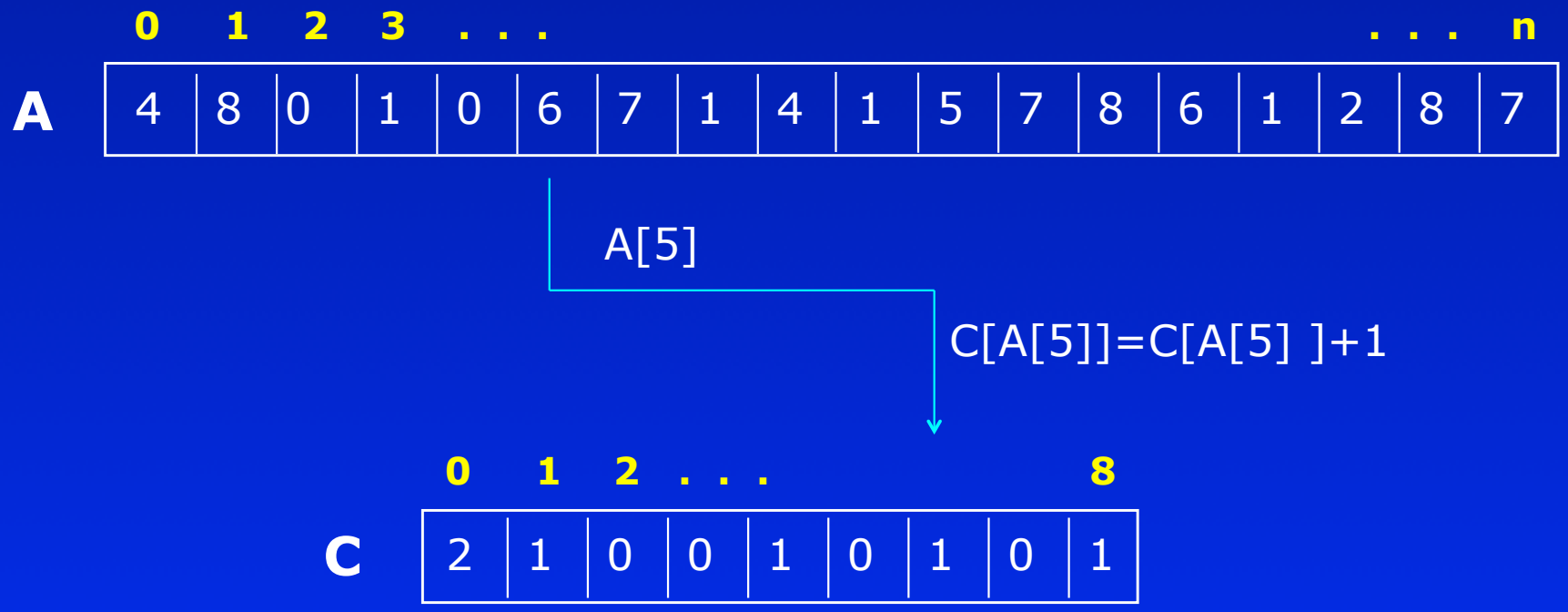

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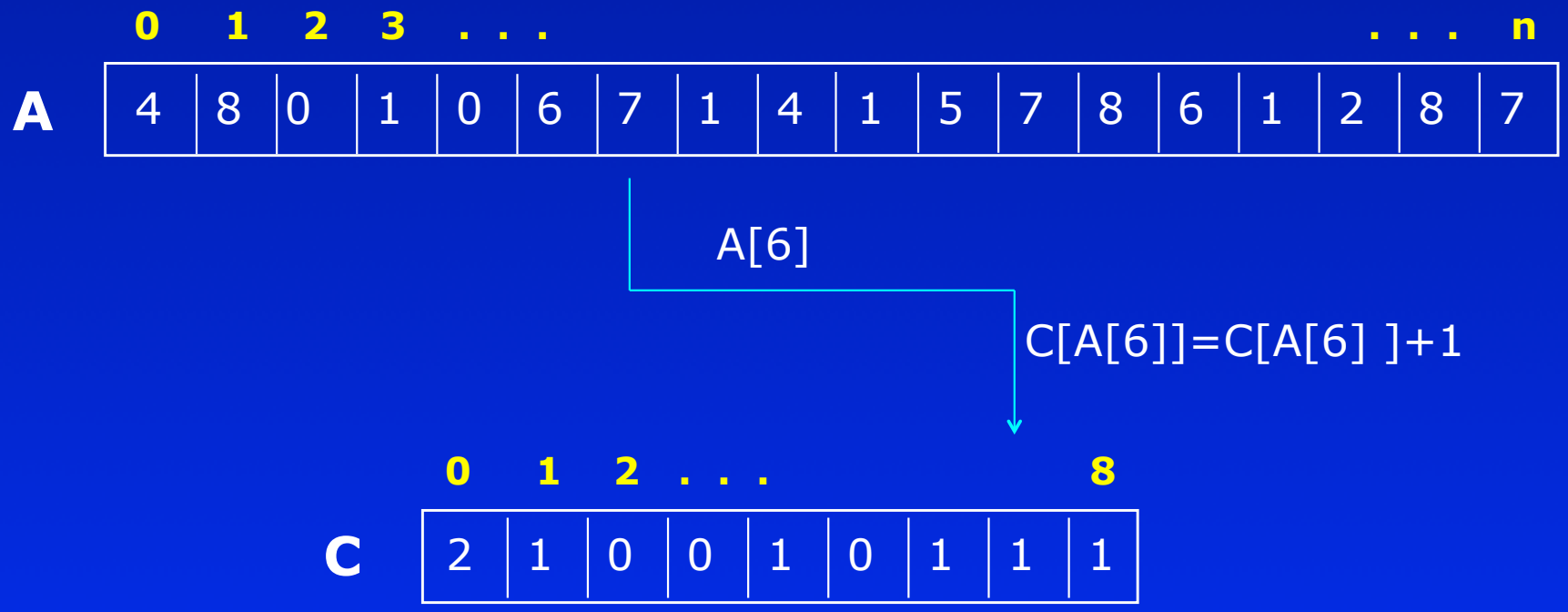

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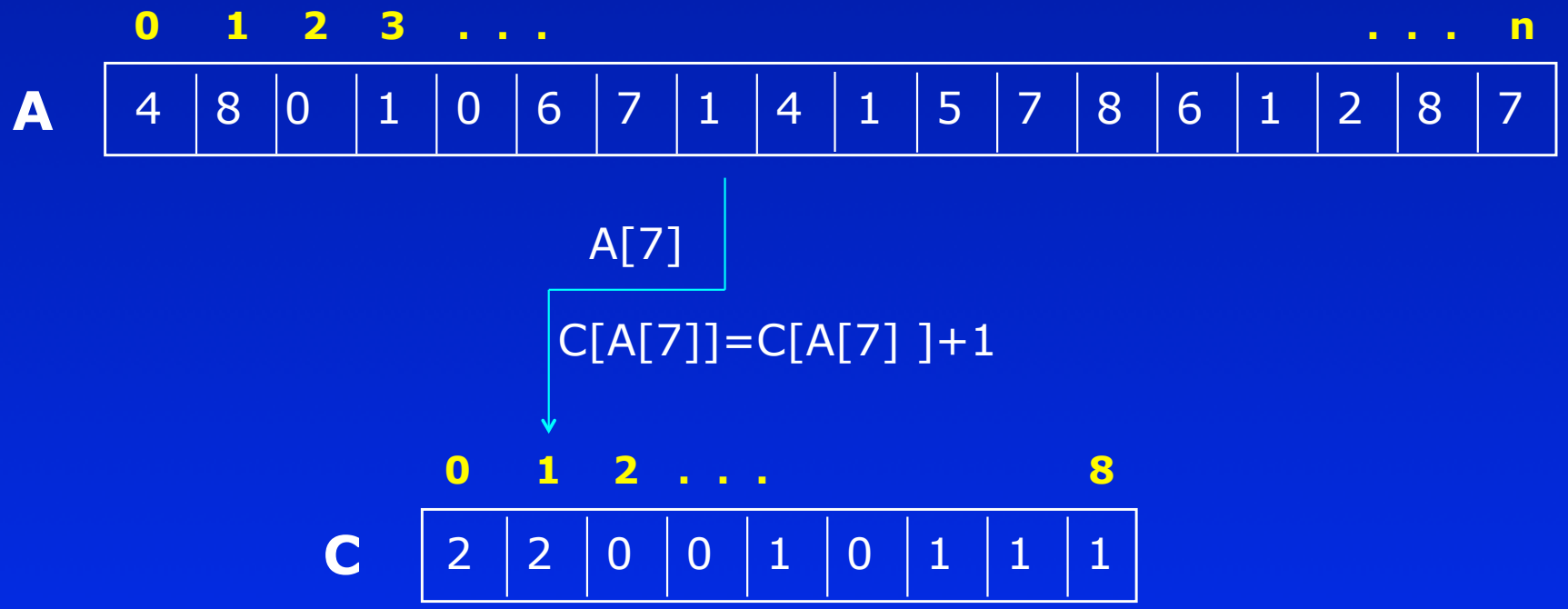

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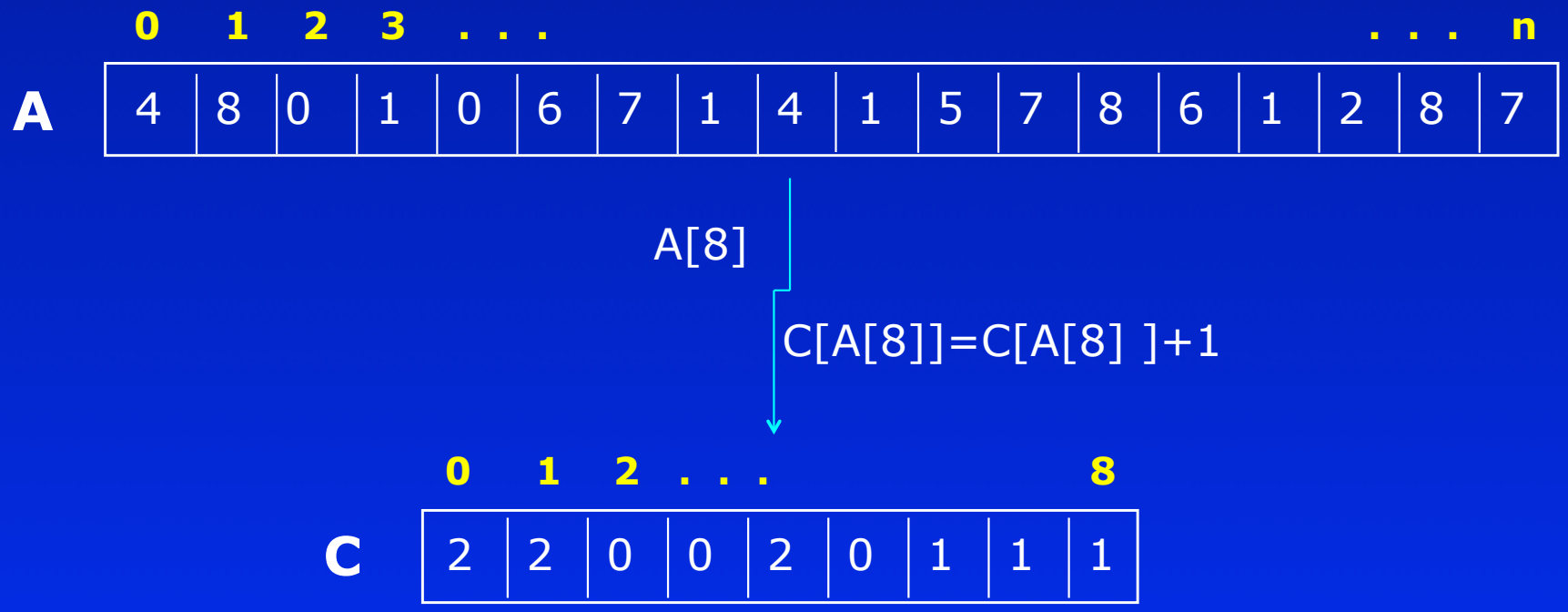

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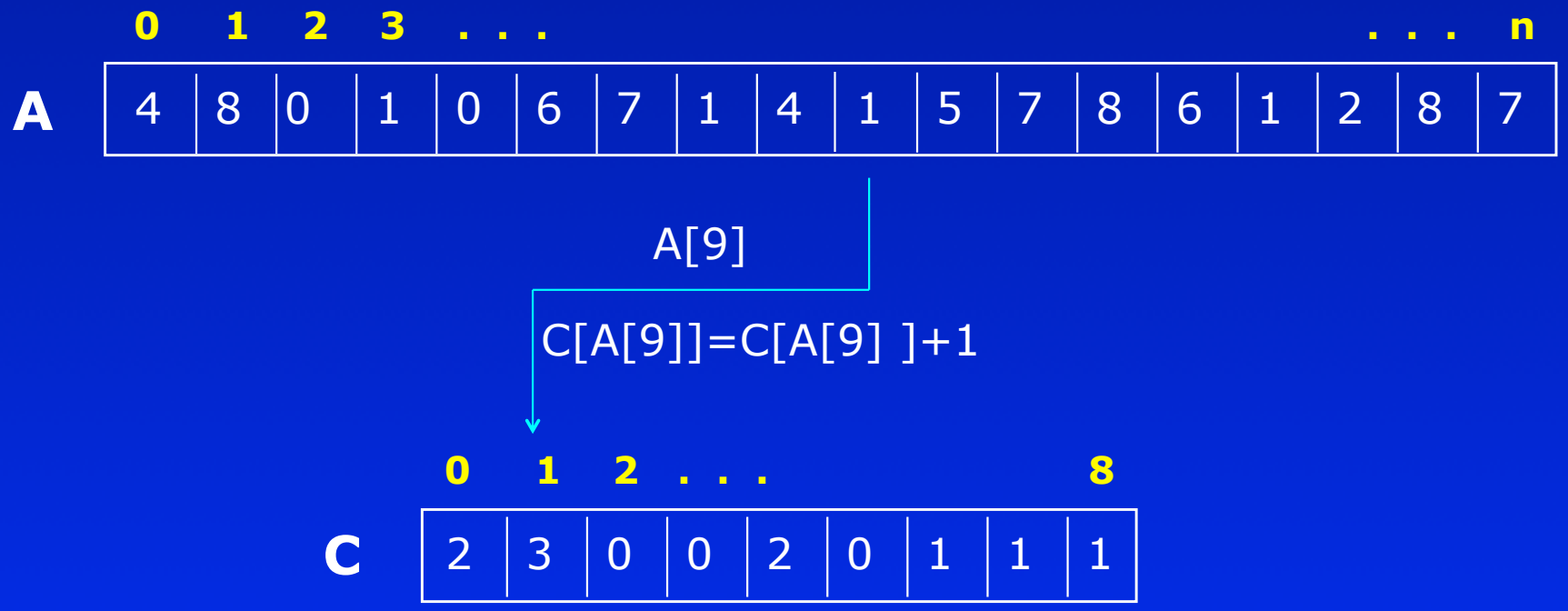

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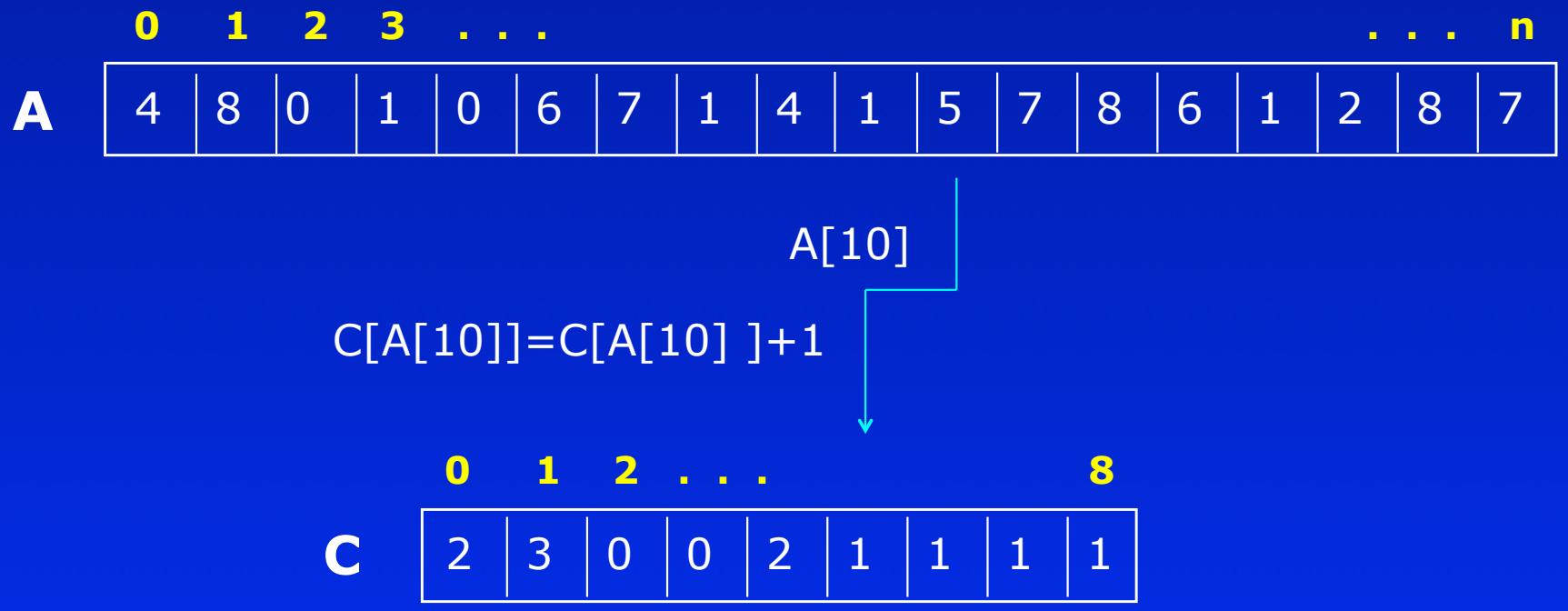

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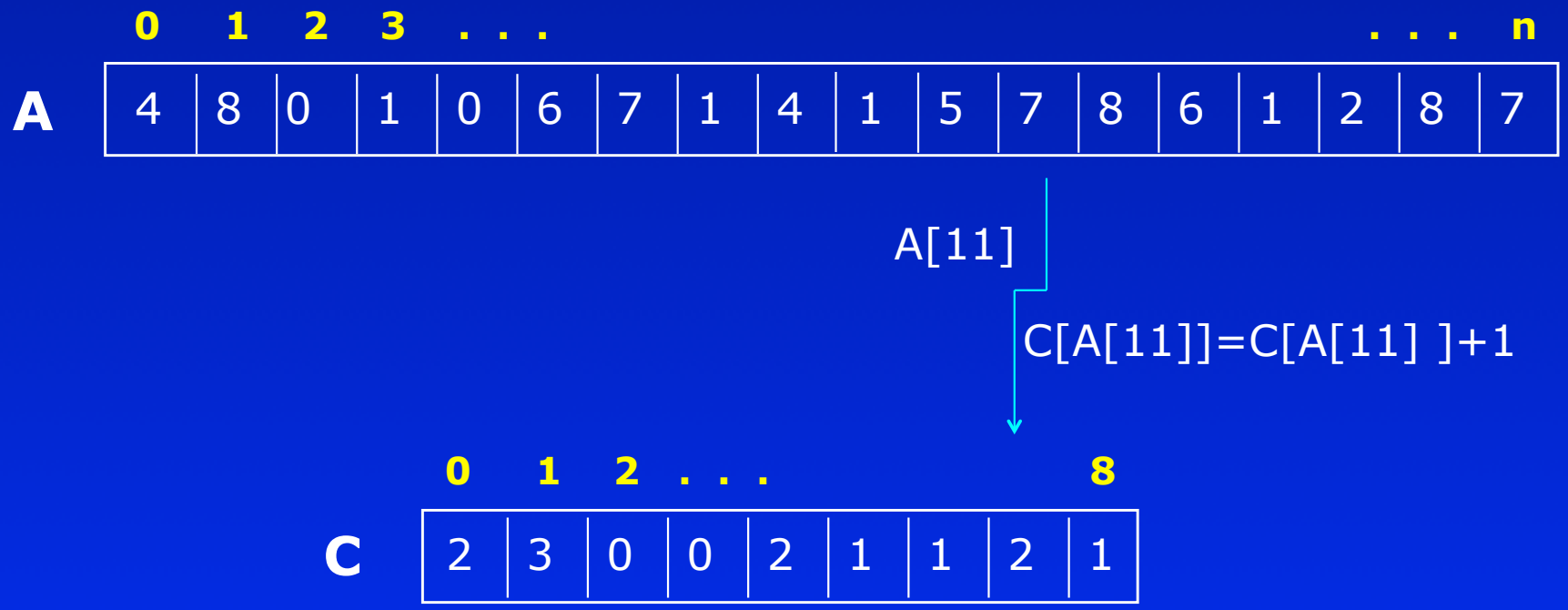

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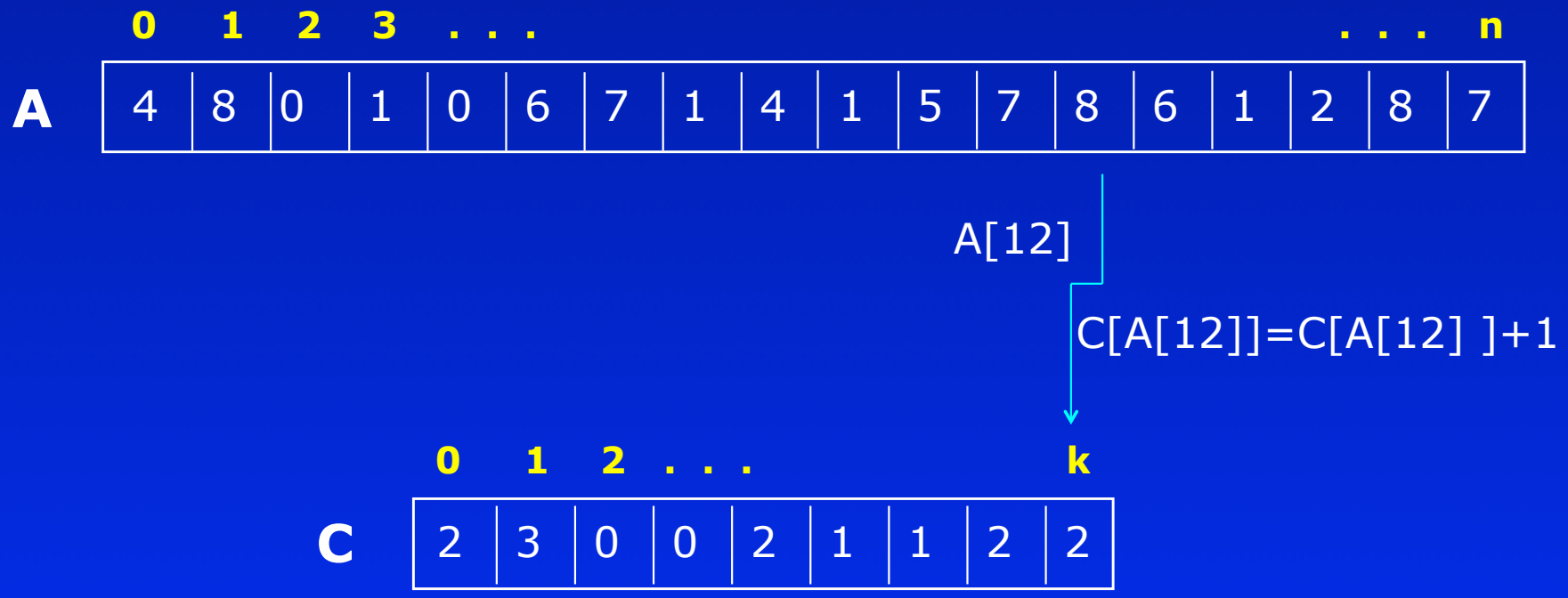

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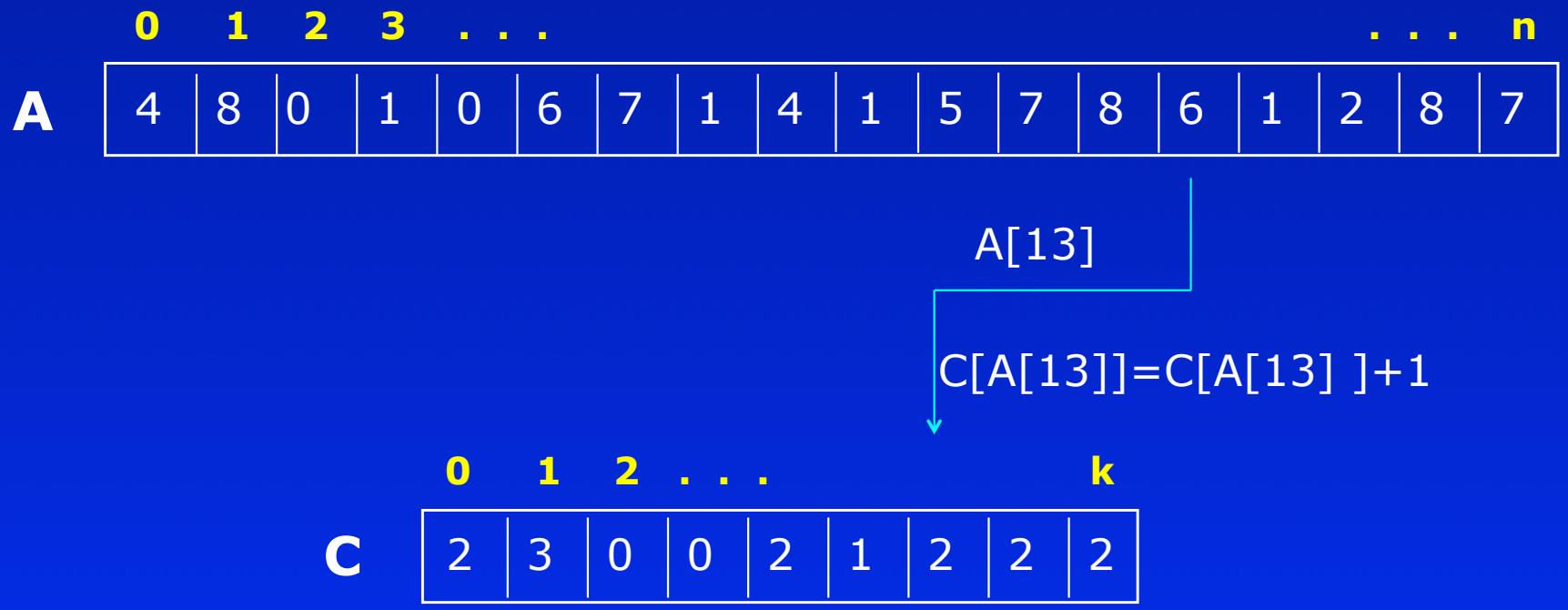

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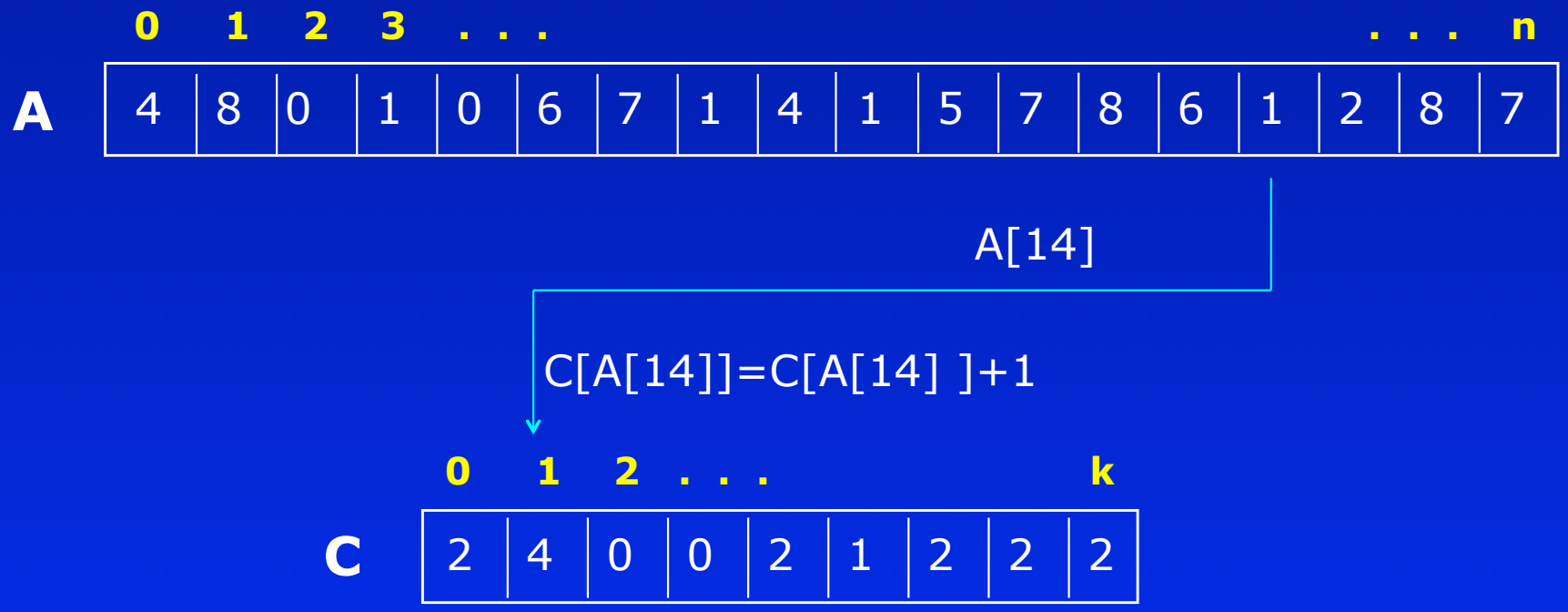

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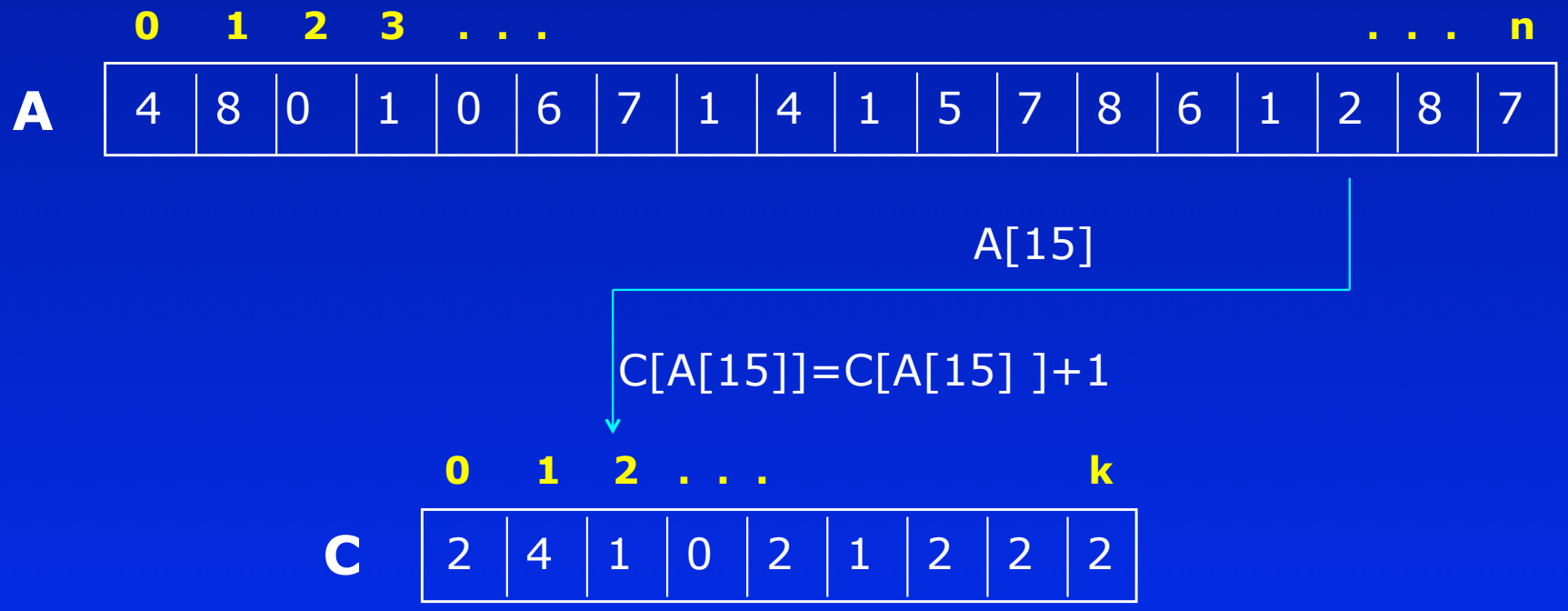

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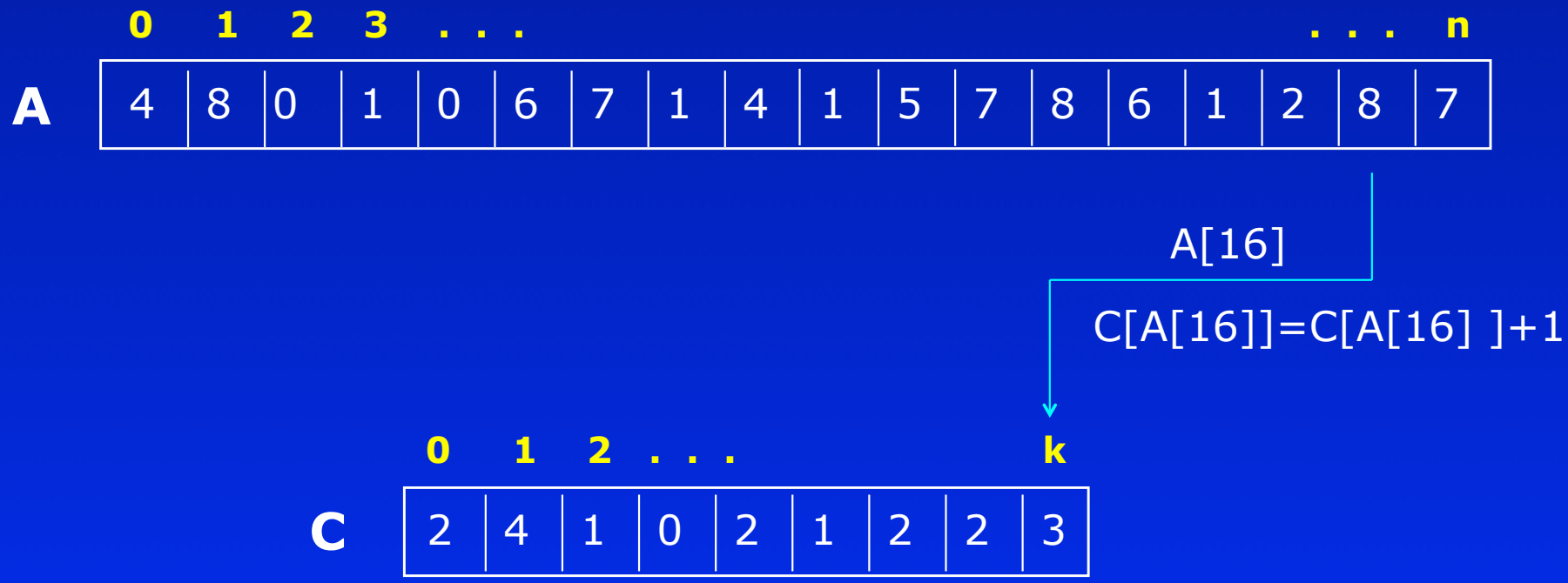

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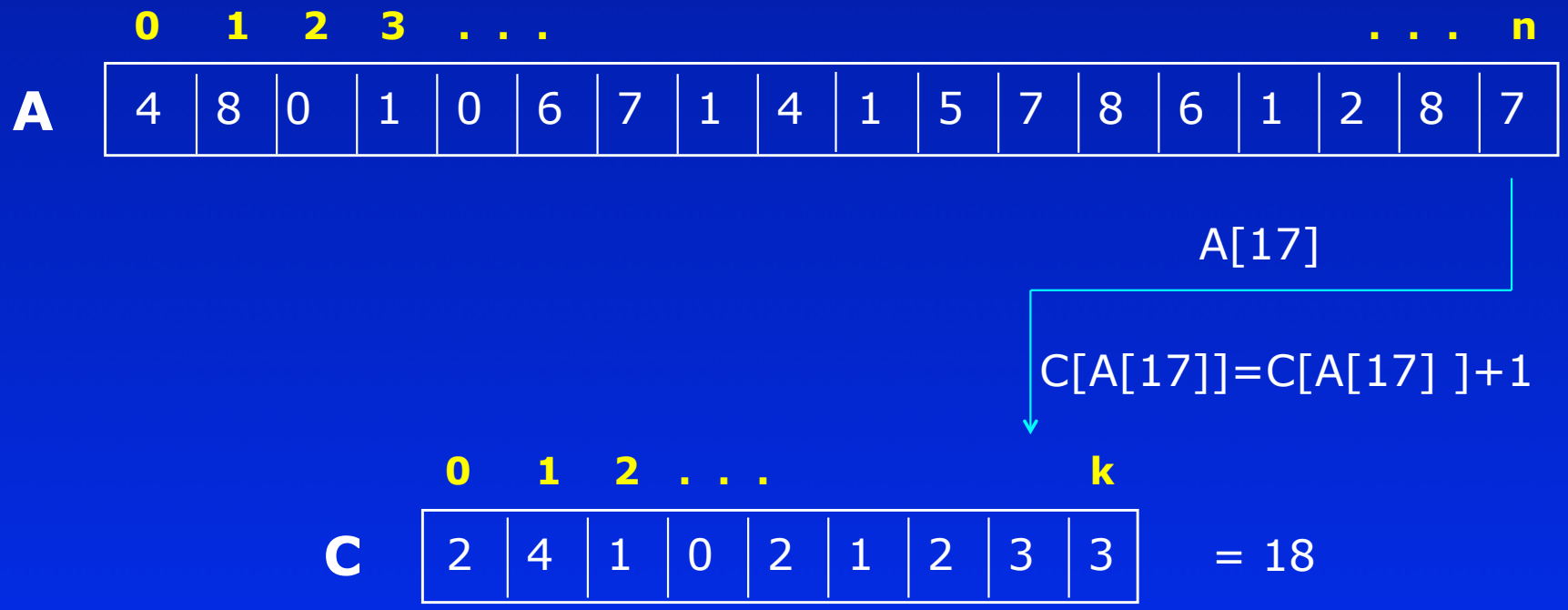

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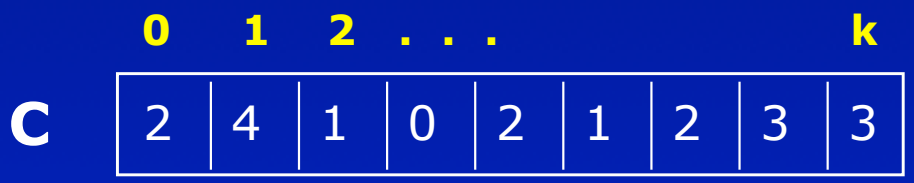
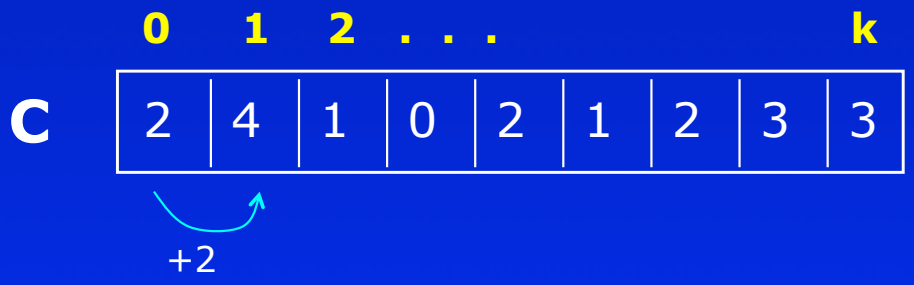


C[i] = C[i] + C[i-1]



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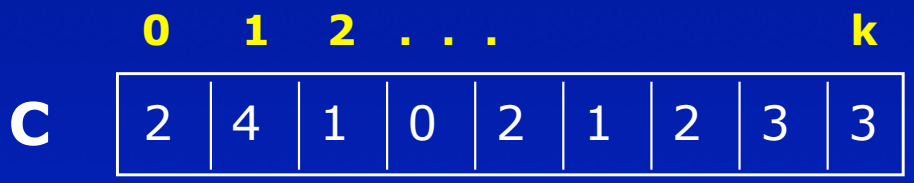

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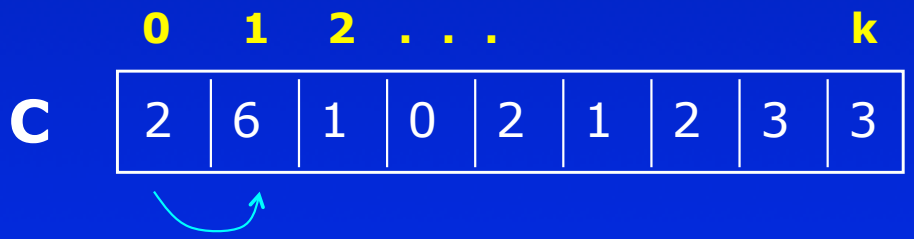

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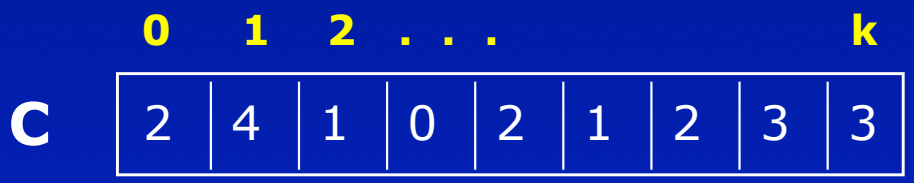

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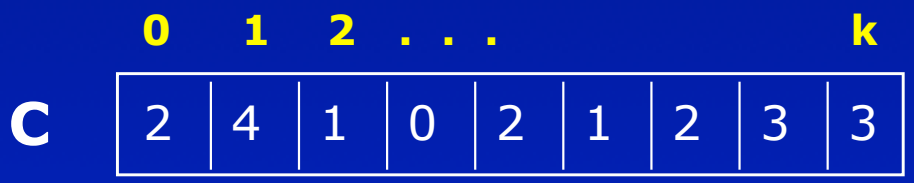

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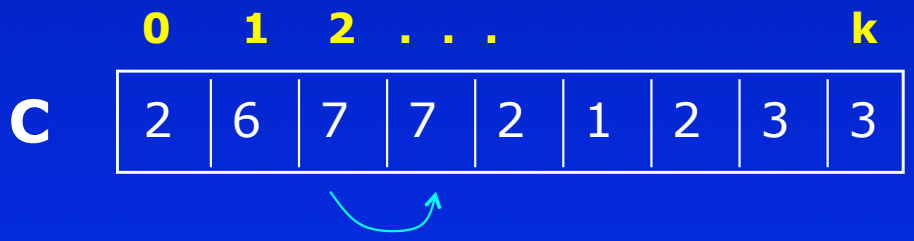

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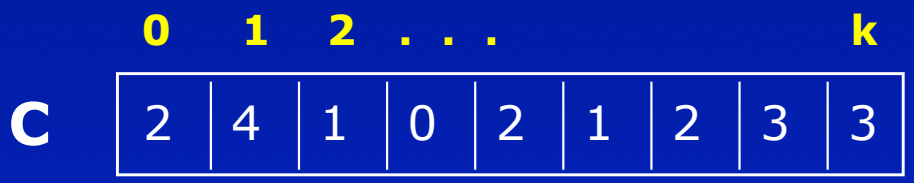

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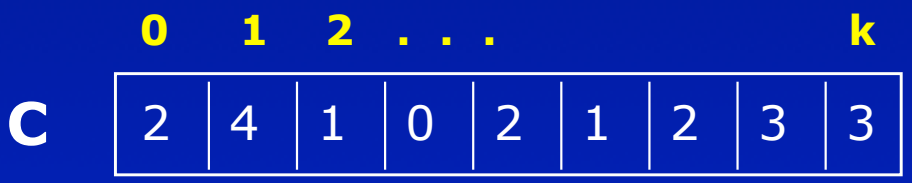

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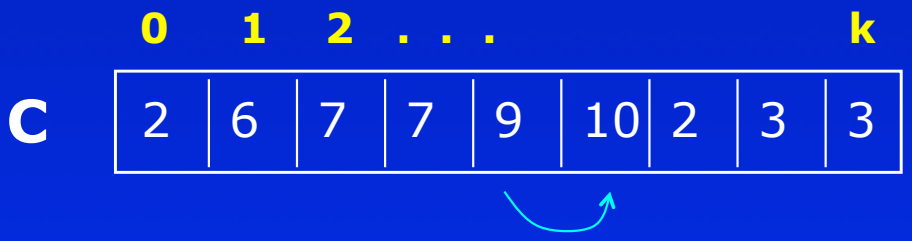

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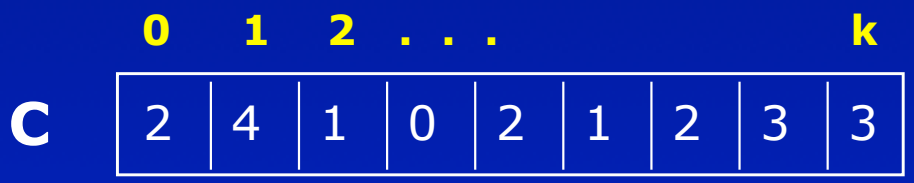

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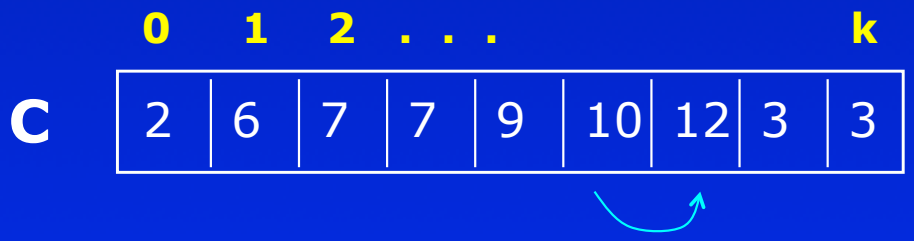

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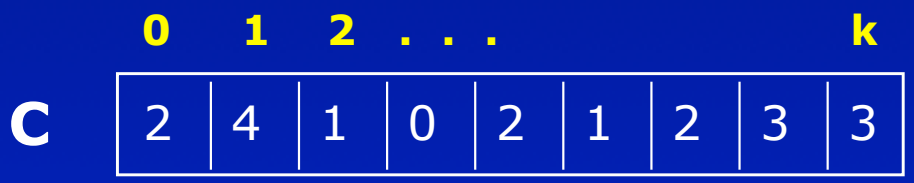

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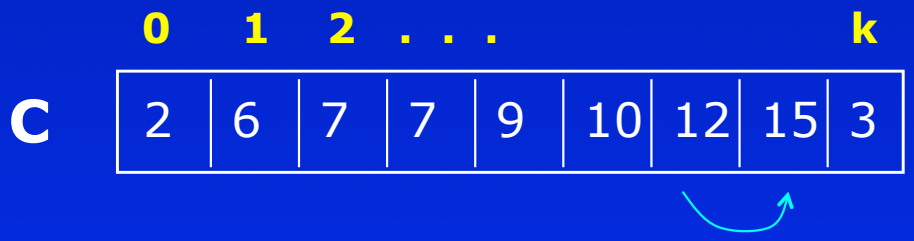

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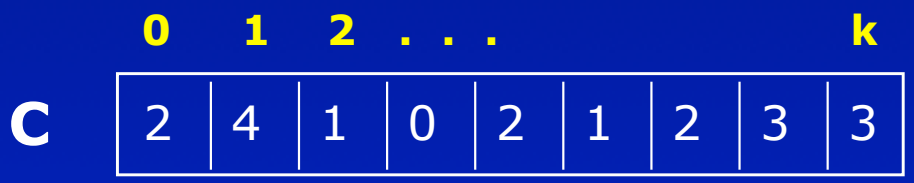
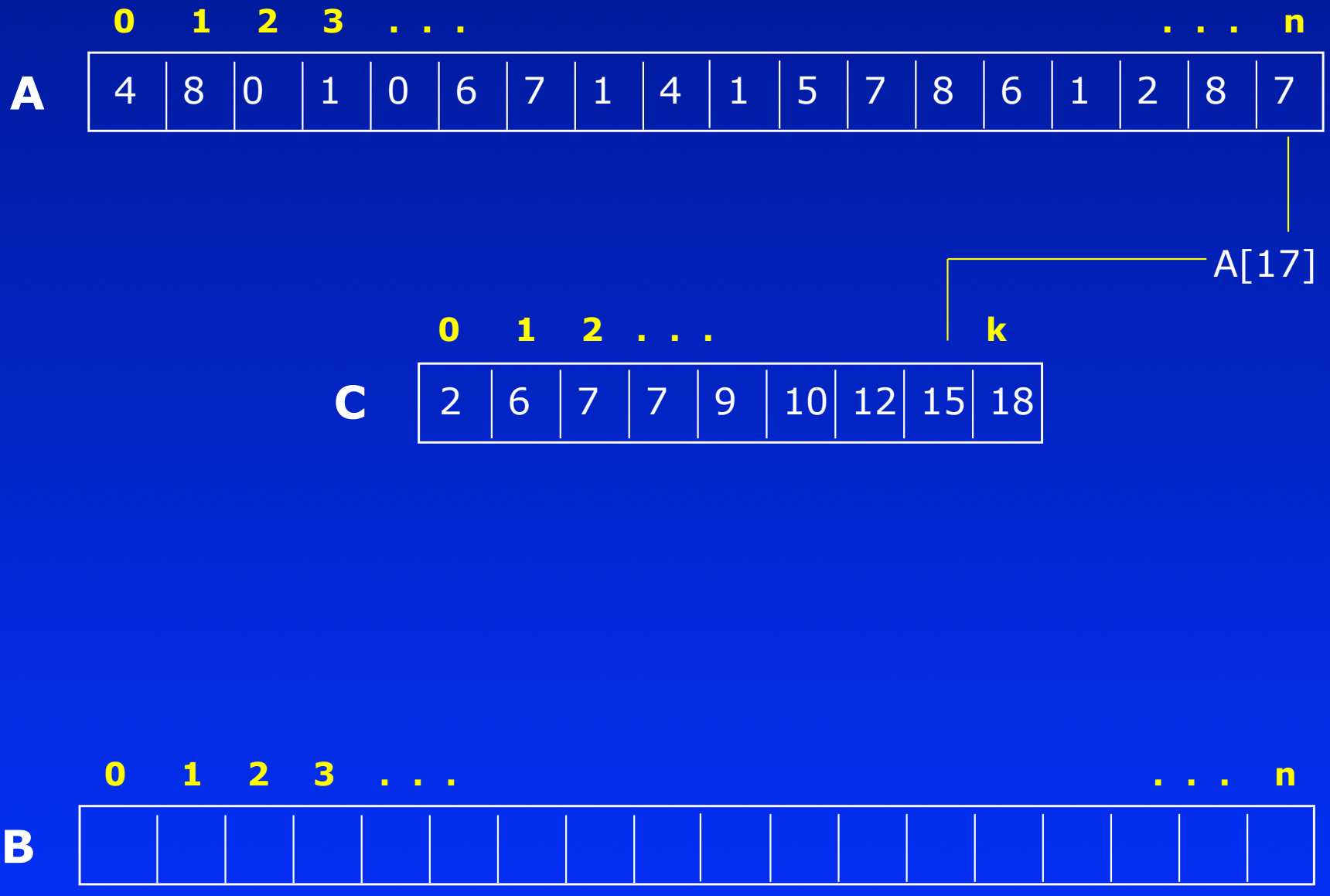


C[i] = C[i] + C[i-1]

Jetzt beinhalte C[i] alle Elemente, die kleiner oder gleich **i** sind.

9 Zahlen sind kleiner oder gleich 4

Counting sort



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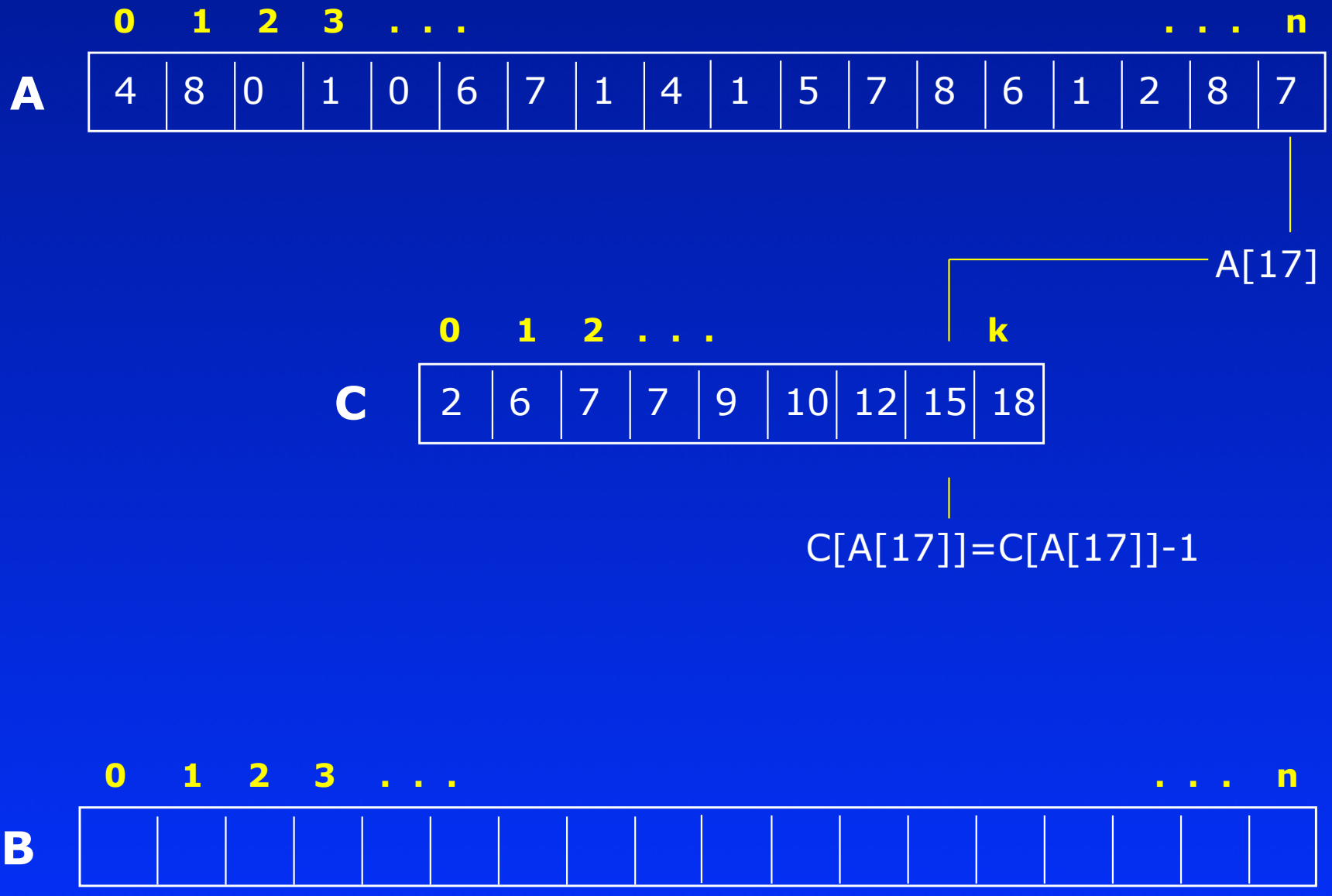

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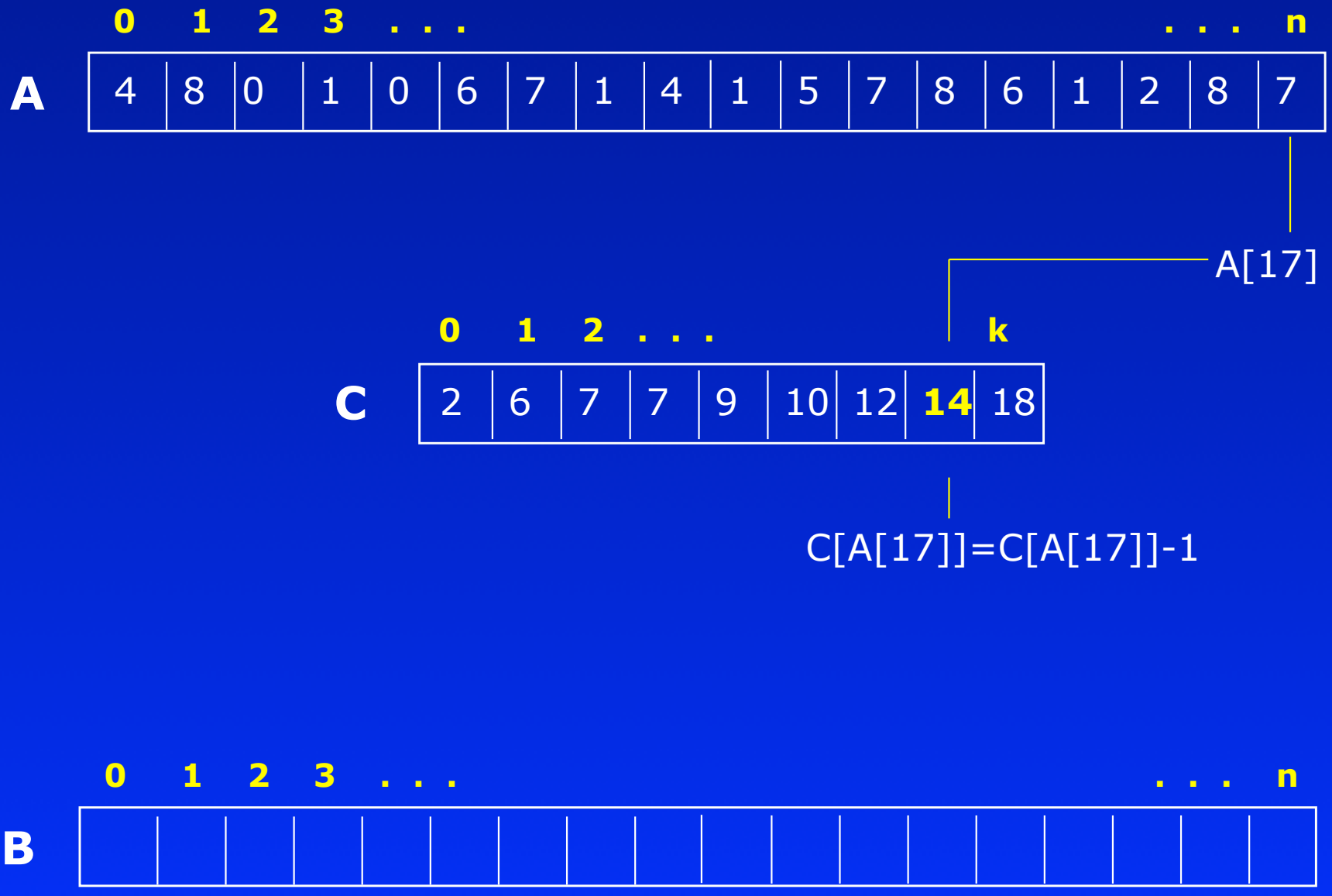

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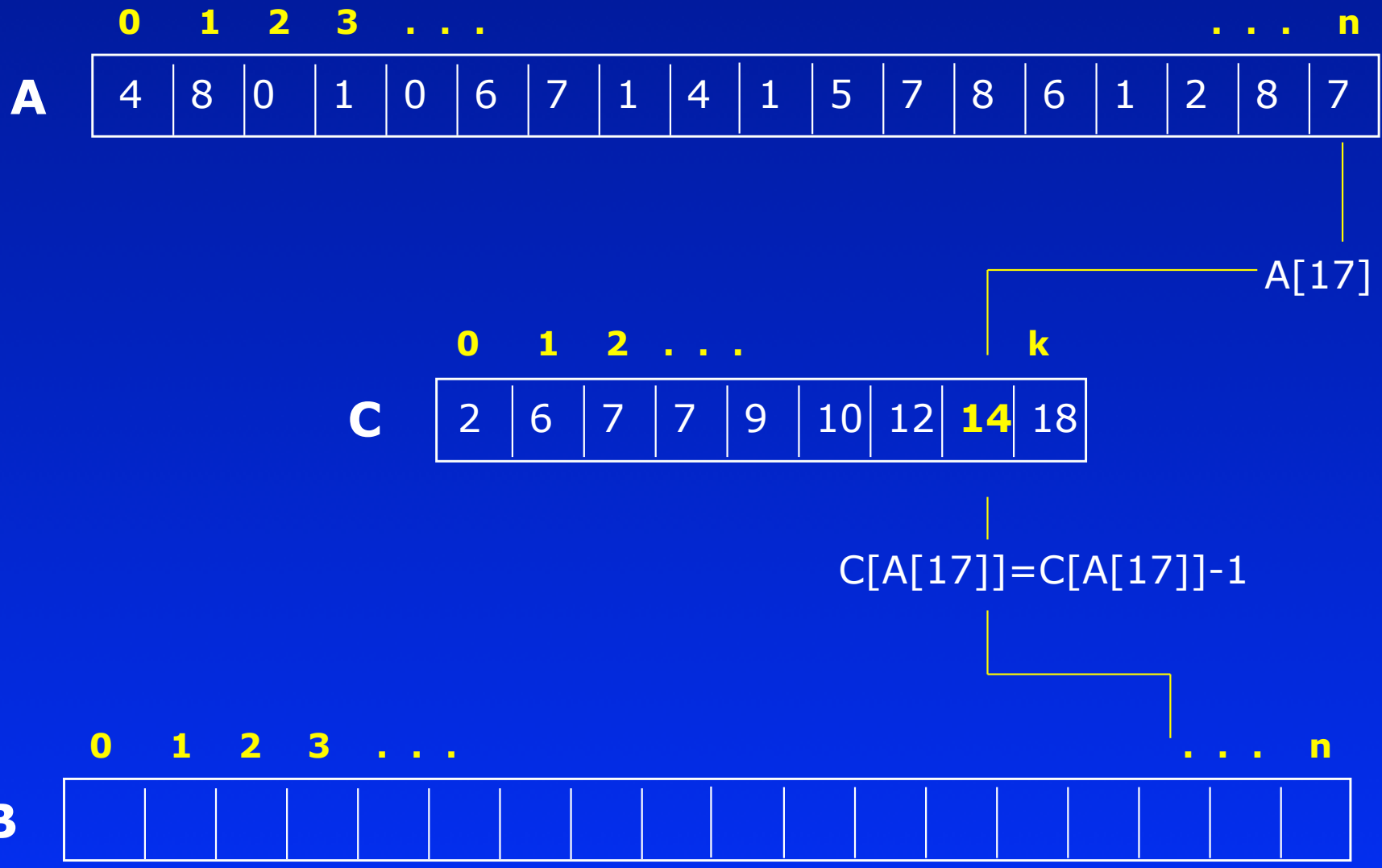

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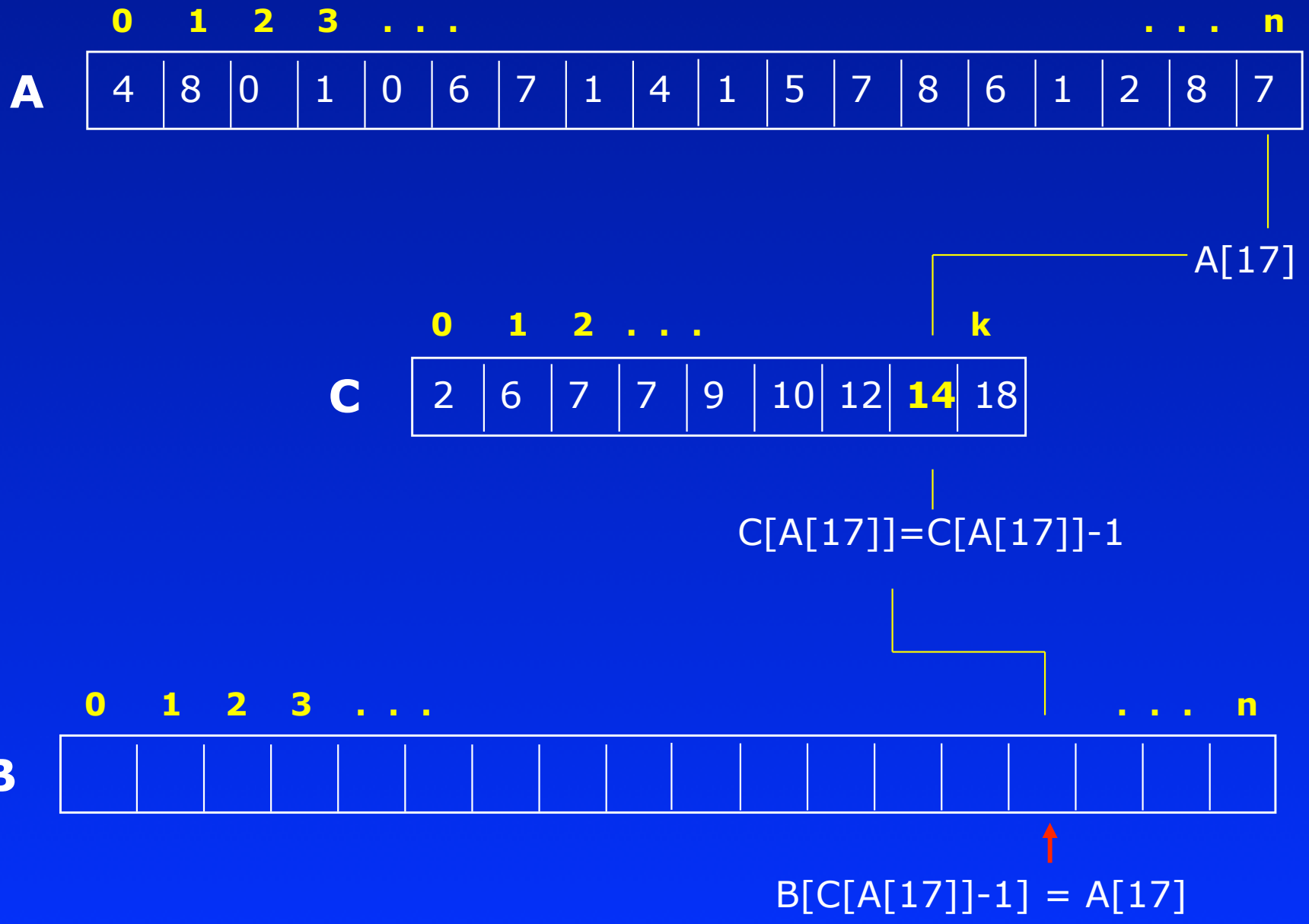

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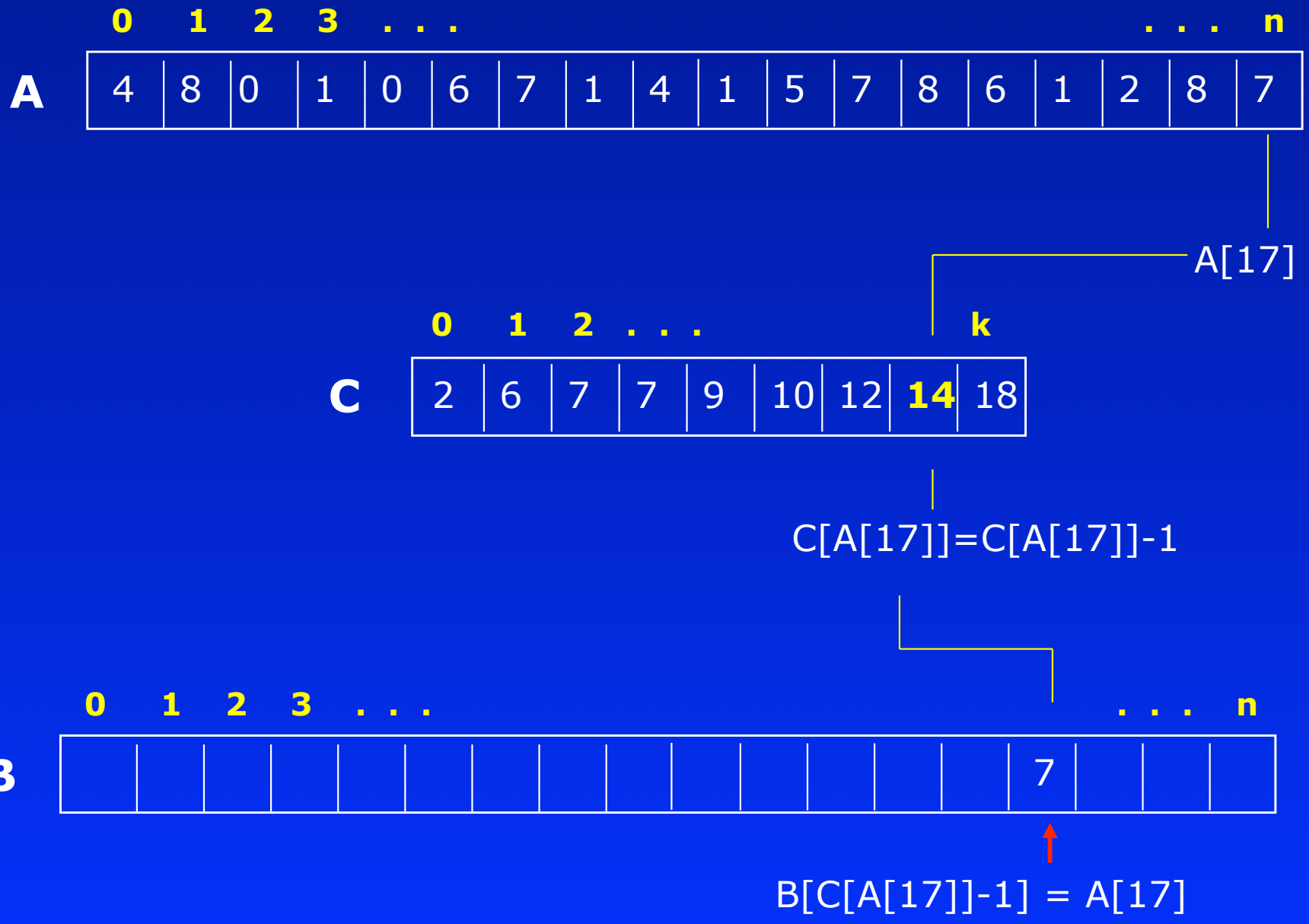

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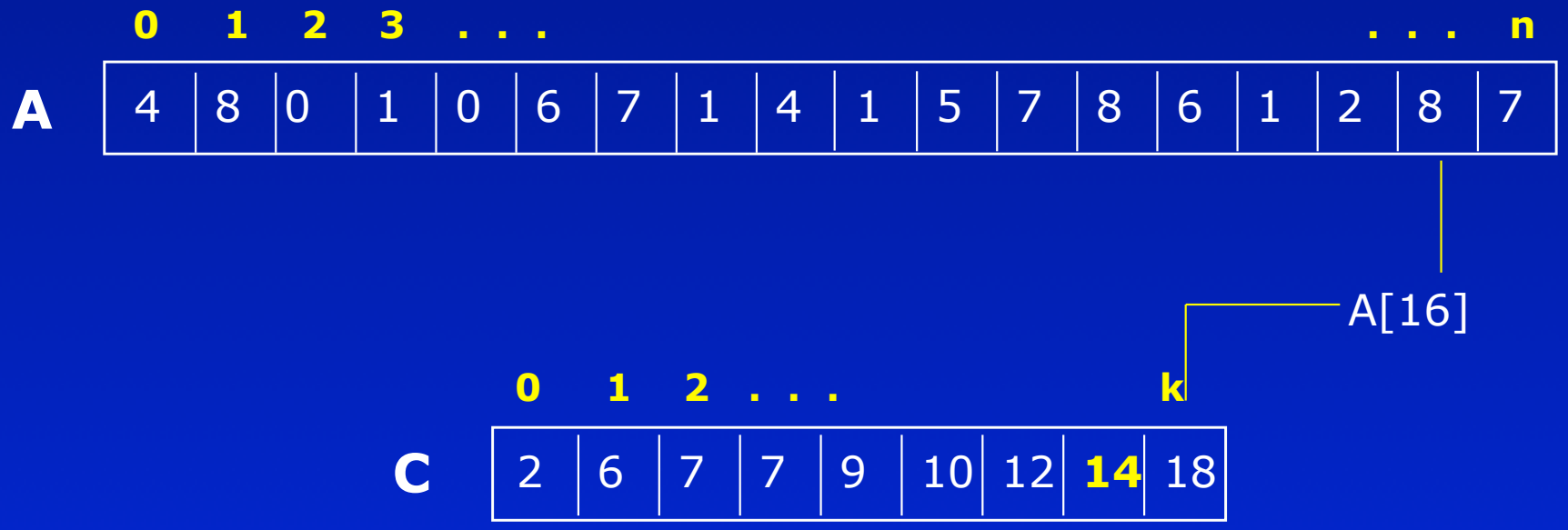

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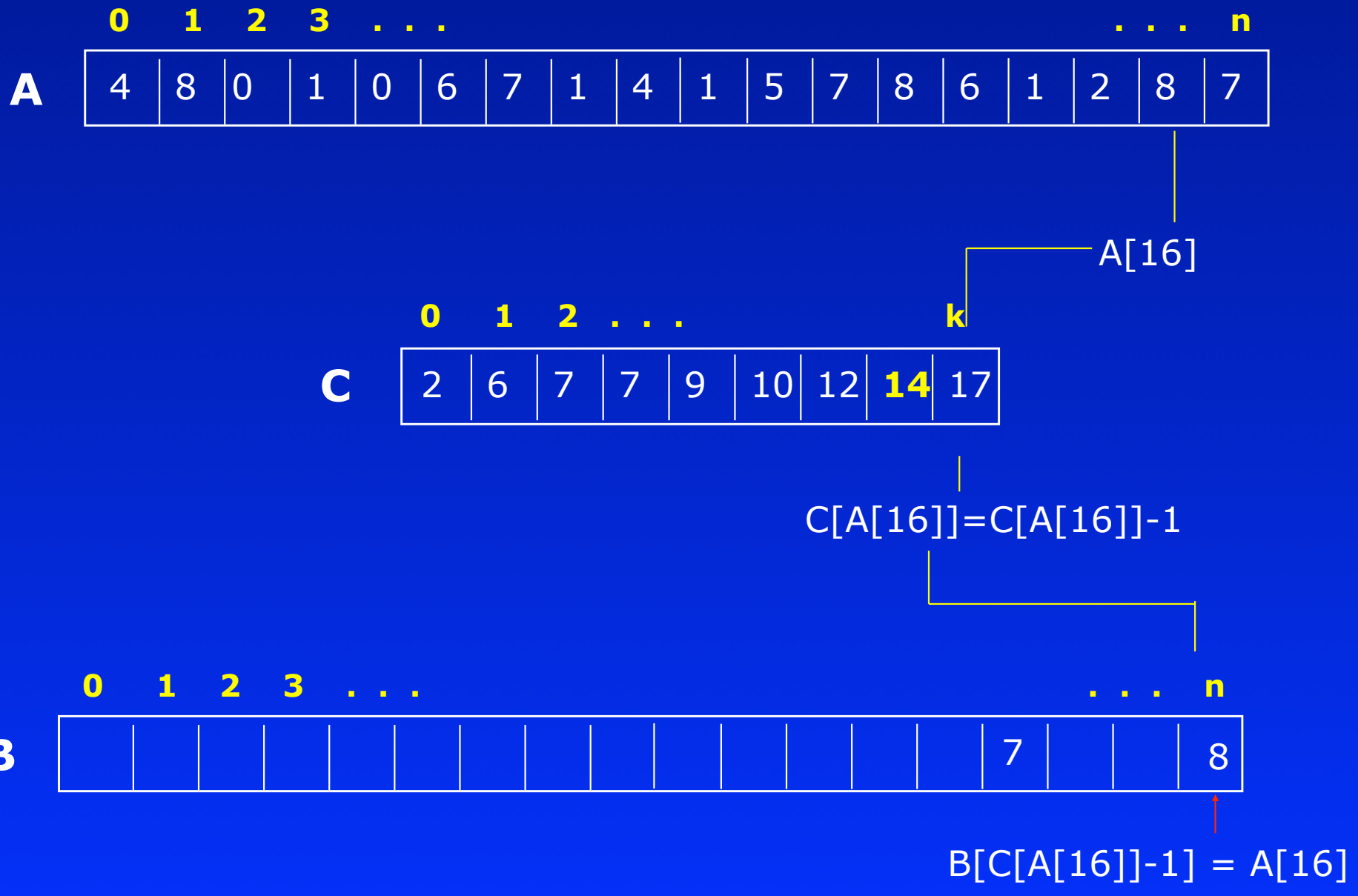

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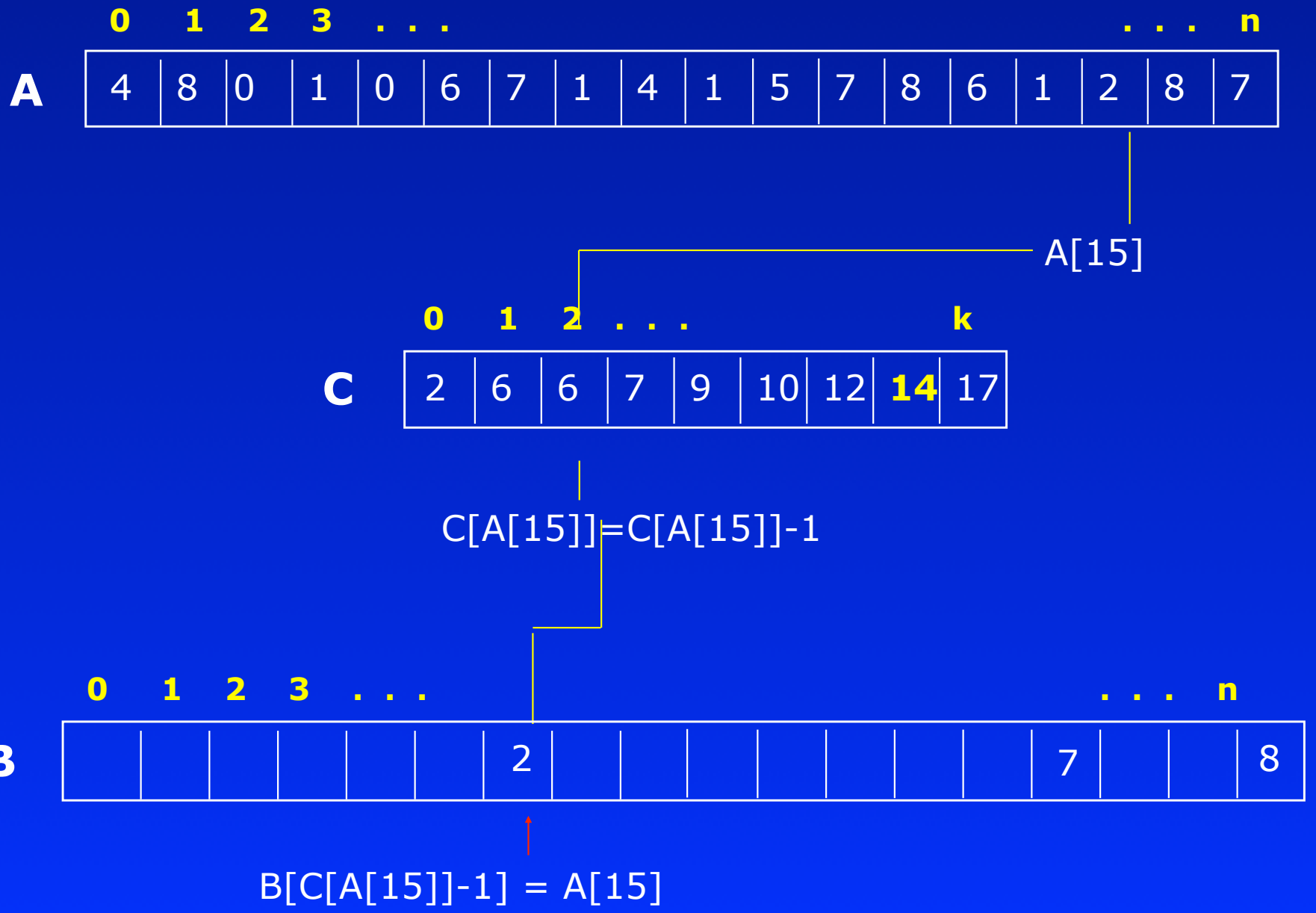

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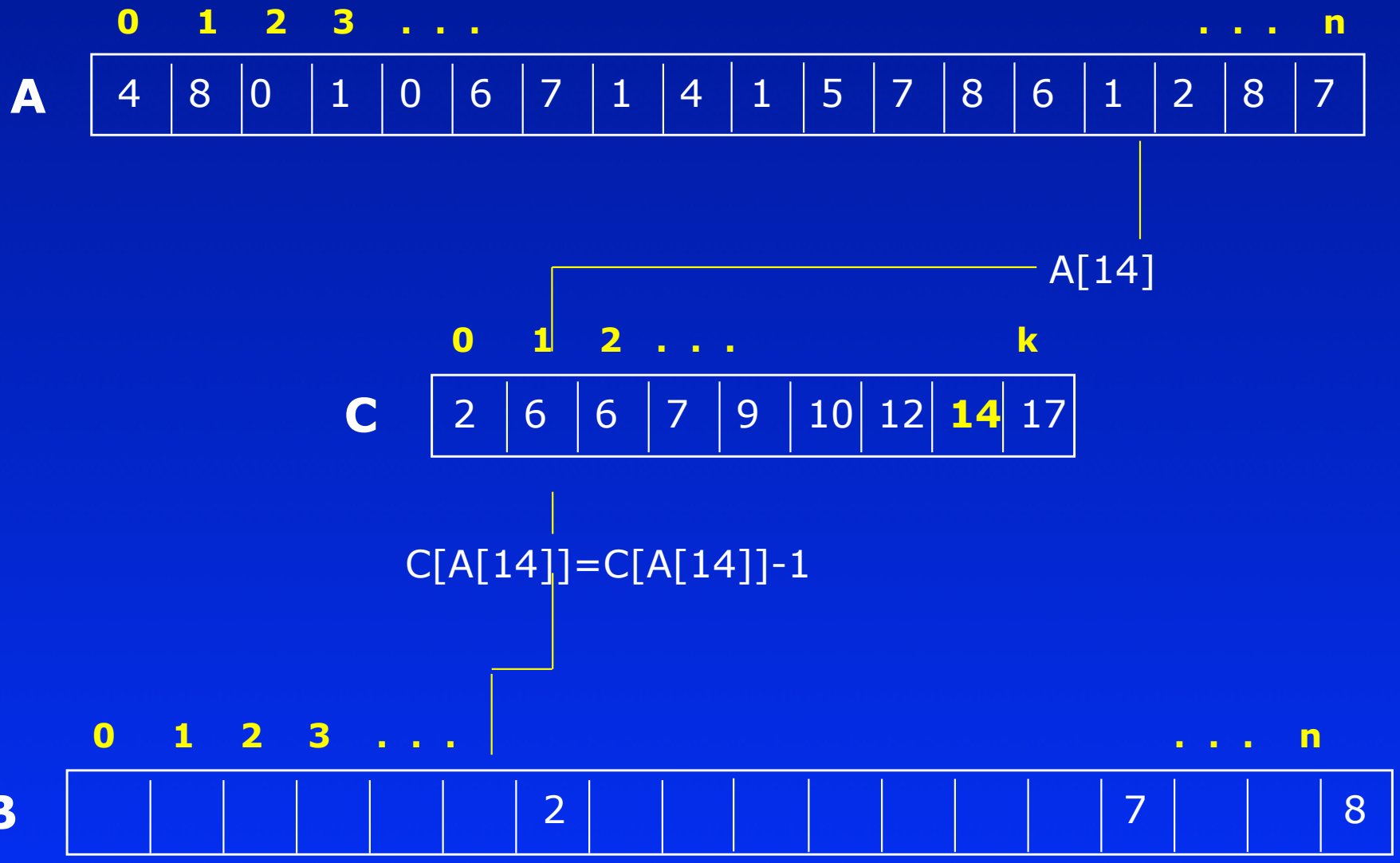

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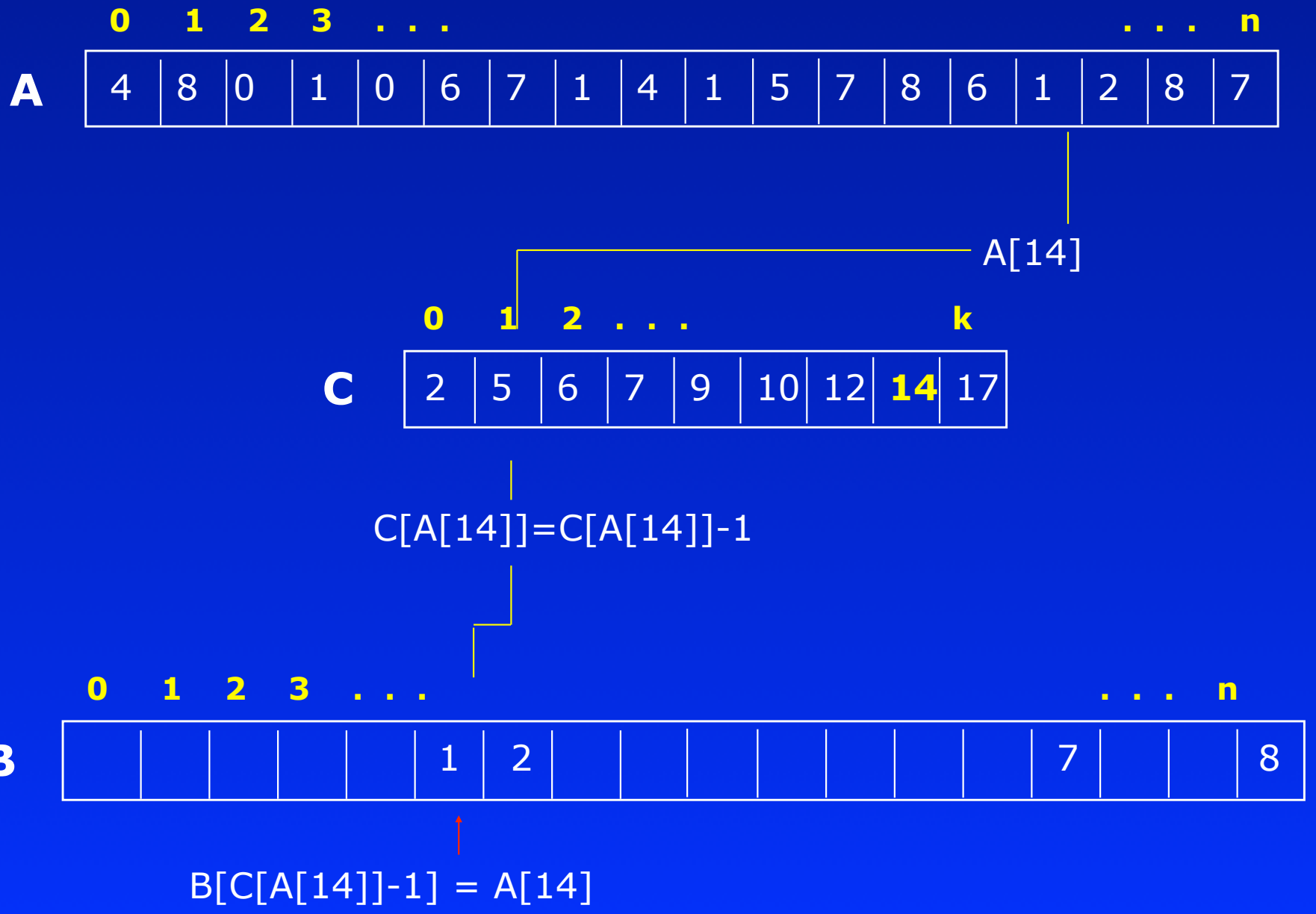

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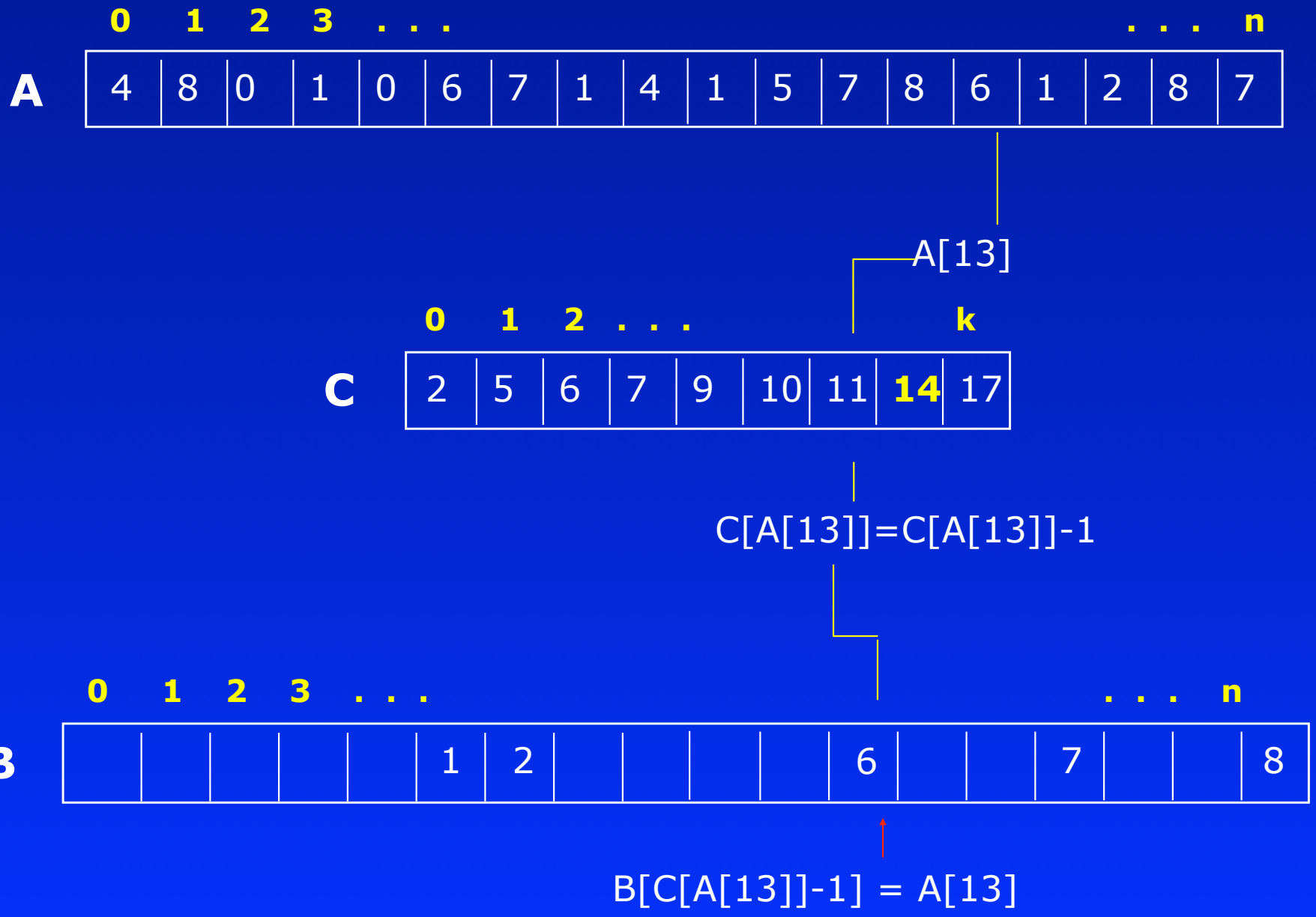

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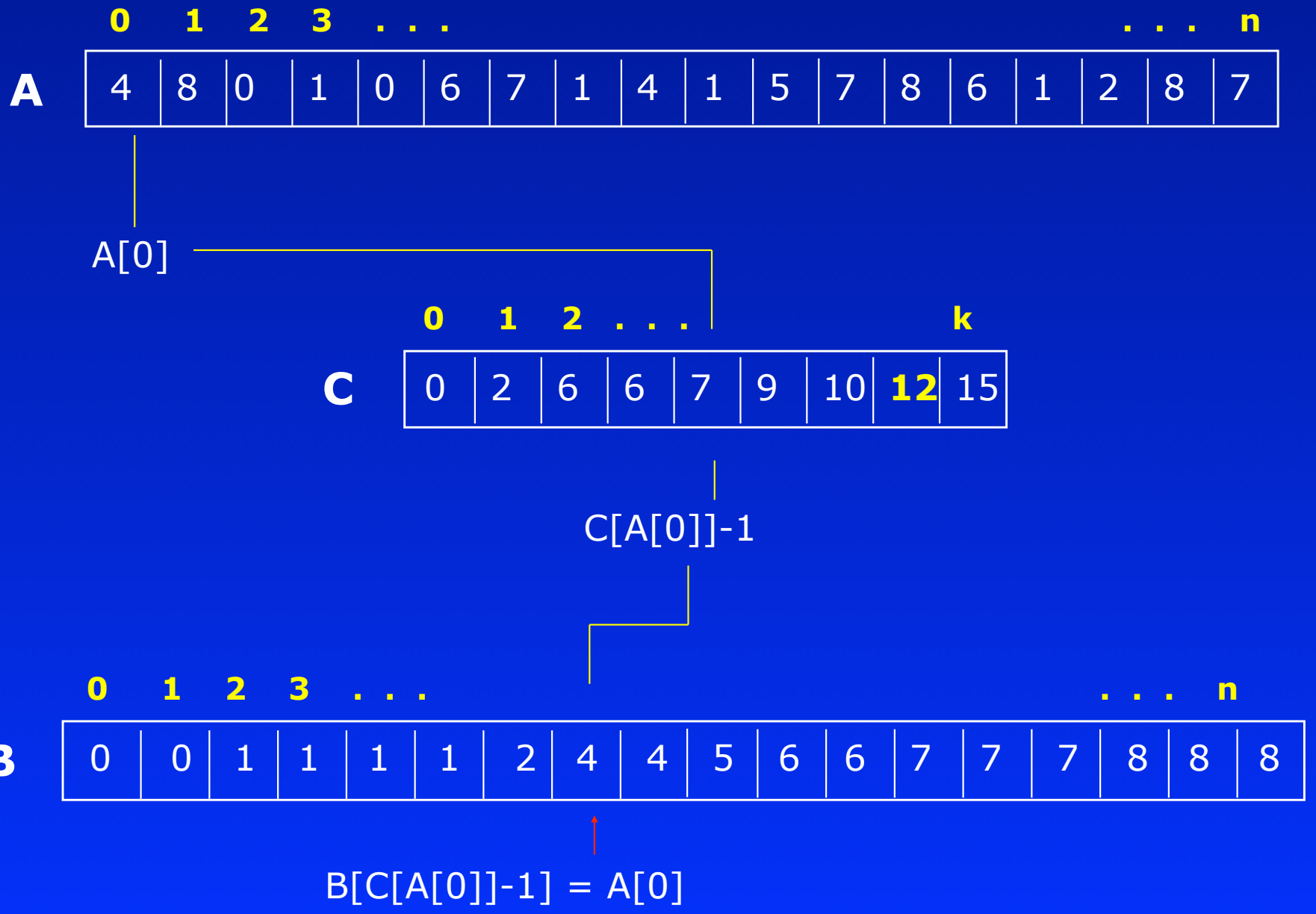


Counting sort

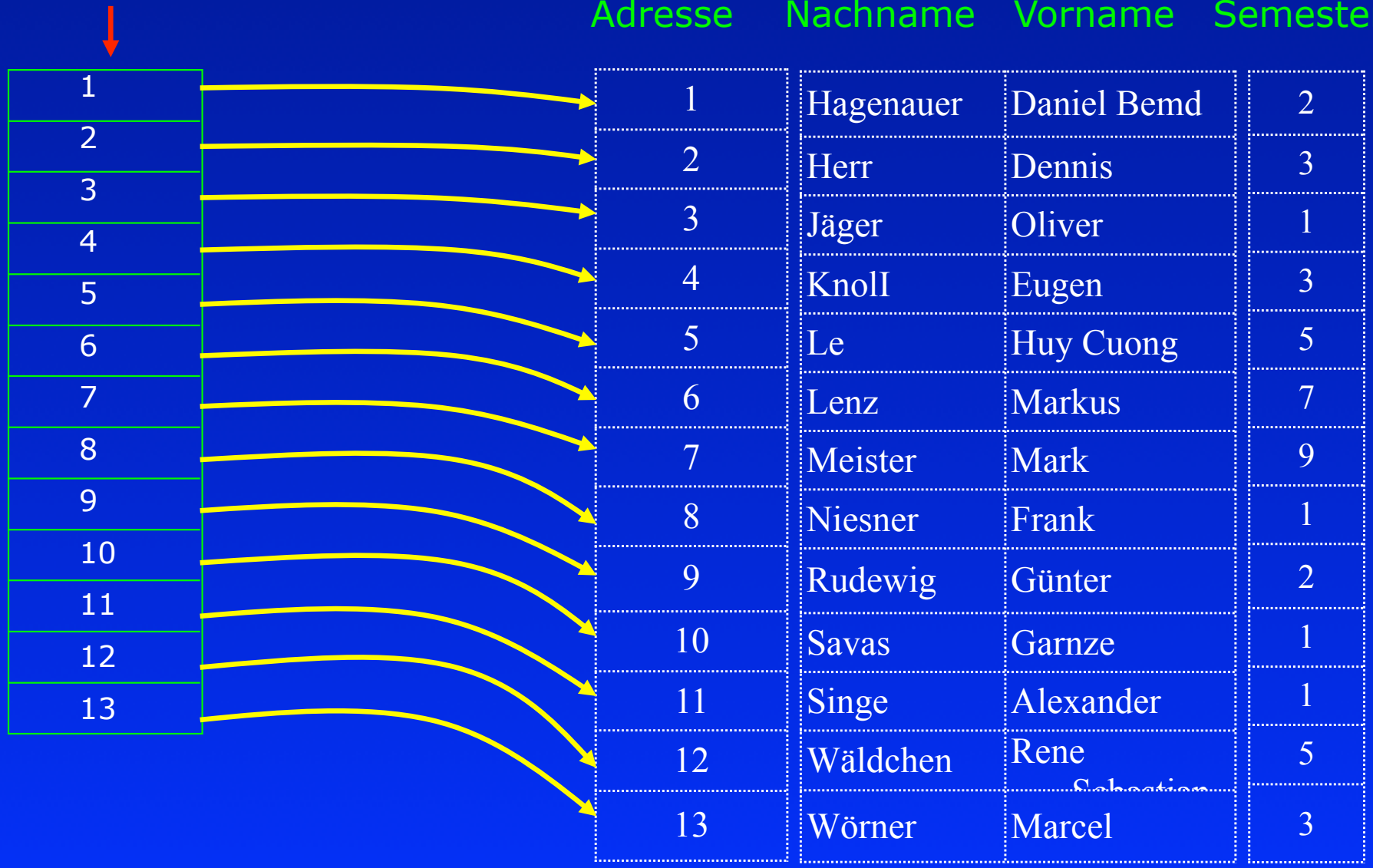
```
def counting_sort(A, k):
        size = len(A)
        B = [0 for i in range(0, size)]
        C = [0 for i in range(0, k+1)]

        for j in range(0, size):
                C[A[j]] += 1
        for i in range(1, k+1):
                C[i] += C[i-1]
        for j in range(size-1, -1, -1):
                C[A[j]] -= 1
                B[C[A[j]]] = A[j]
        return B
```

Eine sehr wichtige Eigenschaft des **Counting-Sort**-Algorithmus ist, dass er stabil ist.

Counting sort

Im Array sind nur die Adressen (Referenzen)

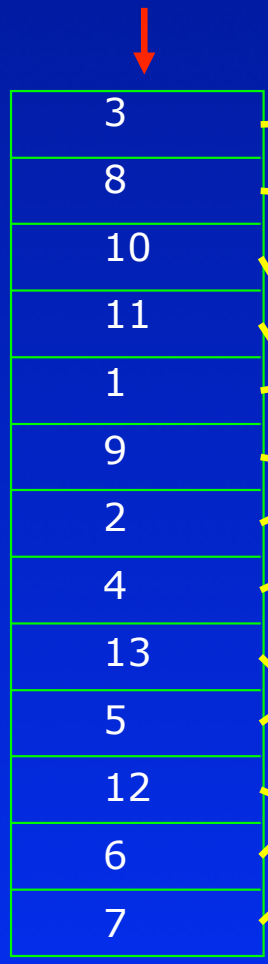
Datenbank



	Adresse	Nachname	Vorname	Semester
1	1	Hagenauer	Daniel Bemd	2
2	2	Herr	Dennis	3
3	3	Jäger	Oliver	1
4	4	KnolI	Eugen	3
5	5	Le	Huy Cuong	5
6	6	Lenz	Markus	7
7	7	Meister	Mark	9
8	8	Niesner	Frank	1
9	9	Rudewig	Günter	2
10	10	Savas	Garnze	1
11	11	Singe	Alexander	1
12	12	Wäldchen	Rene Sebastian	5
13	13	Wörner	Marcel	3

Counting sort

Im Array sind nur die Adressen



Datenbank

Adresse	Nachname	Vorname	Semester
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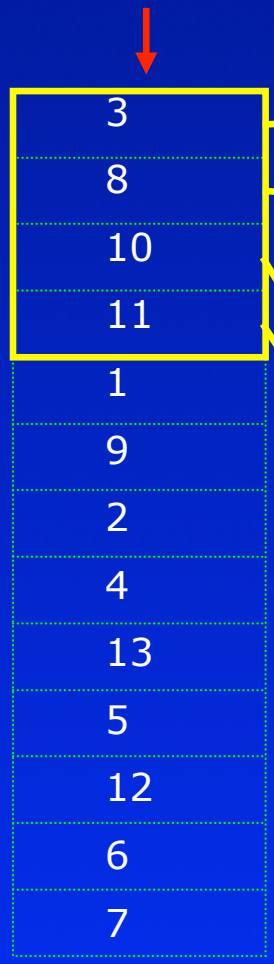
3	Jäger	Oliver	1
4	KnolI	Eugen	3
5	Le	Huy Cuong	5
6	Lenz	Markus	7
7	Meister	Mark	9
8	Niesner	Frank	1
9	Rudewig	Günter	2
10	Savas	Garnze	1
11	Singe	Alexander	1
12	Wäldchen	Rene	5
13	Wörner	Marcel	3

Sortiert nach Semester

Counting sort

Im Array sind nur die Adressen



Datenbank

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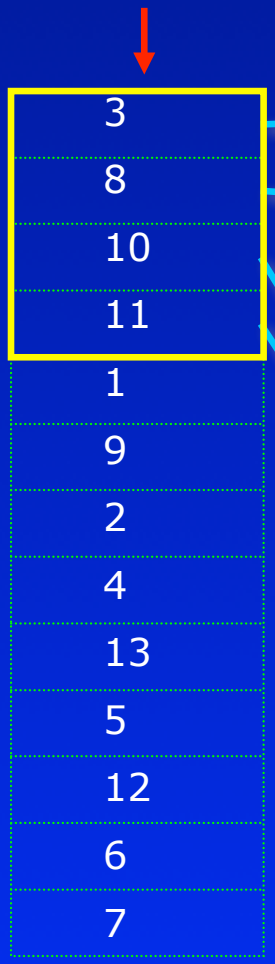
12	Wäldchen	Rene Sebastian	5
13	Wörner	Marcel	3

Sortiert nach Semester

Counting sort

Im Array sind nur die Adressen



Datenbank

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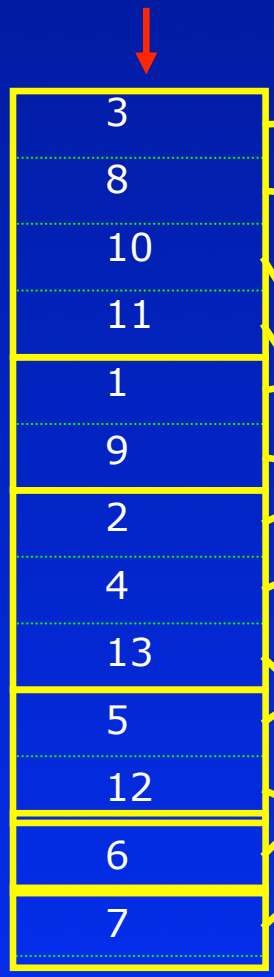
Sortiert nach Semester

Counting sort

Im Array sind nur die Adressen



Datenbank

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Sortiert nach Semester