Problem :

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A[i] : | 2 | 1 | 5 | 3 | 7 | 9 | 2 | 5 | 8 |
| i | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| B[i] → | 5 | 5 | 7 | 7 | 9 | -1 | 5 | 8 | -1 |

$$B[i] \triangleq A\left[\min_{j>i}\{j \mid A[j] > A[i]\}\right]$$

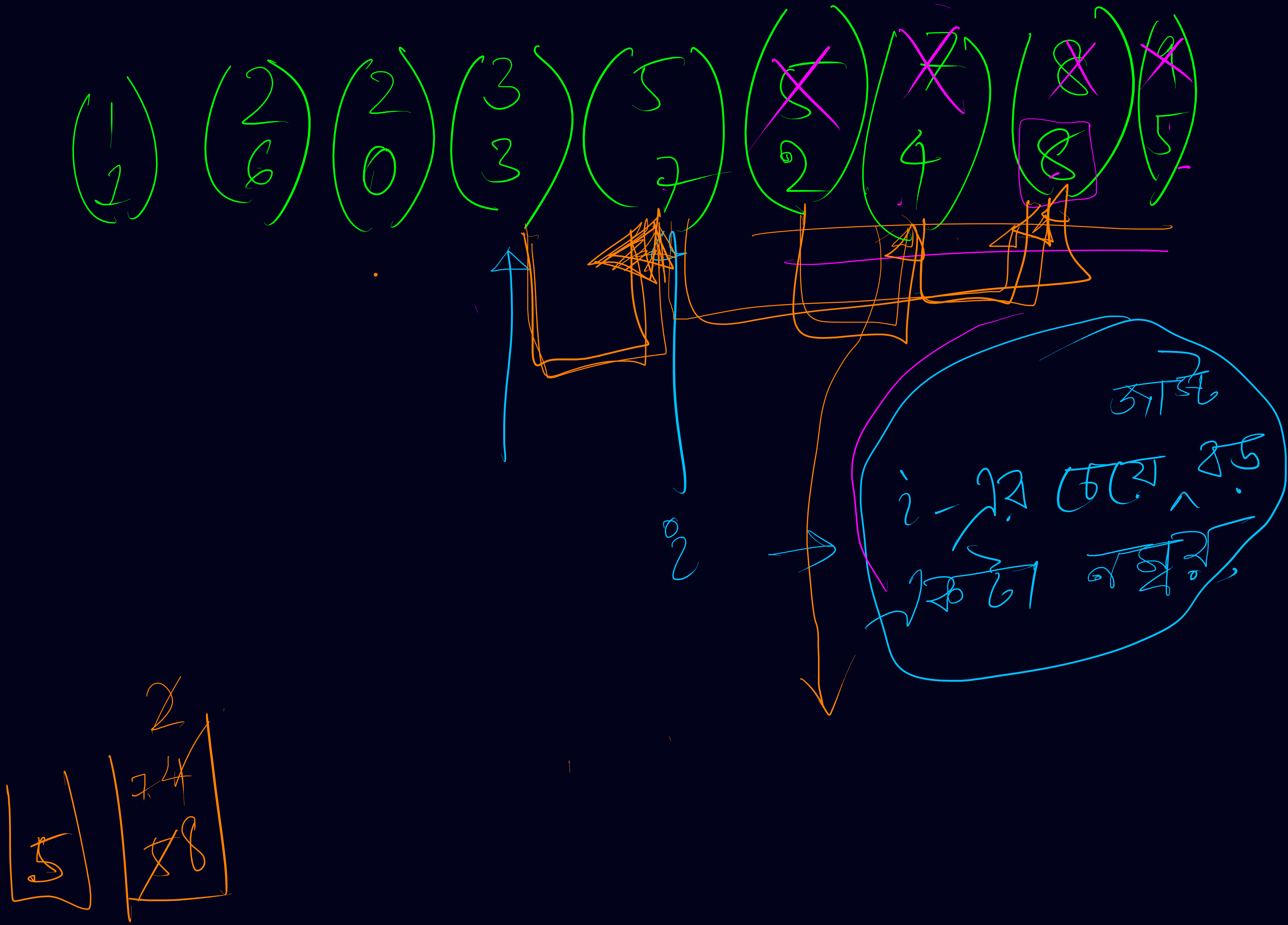
Sol 1 : Brute.

$O(n^2)$

Sol 2 :

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A[i] : | 2 | 1 | 5 | 3 | 7 | 9 | 2 | 5 | 8 |
| i | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

$\begin{pmatrix}1\\1\end{pmatrix}$ $\begin{pmatrix}2\\0\end{pmatrix}$ $\begin{pmatrix}2\\6\end{pmatrix}$ $\begin{pmatrix}3\\3\end{pmatrix}$ $\begin{pmatrix}5\\2\end{pmatrix}$ $\begin{pmatrix}5\\7\end{pmatrix}$ $\begin{pmatrix}7\\4\end{pmatrix}$ $\begin{pmatrix}8\\8\end{pmatrix}$ $\begin{pmatrix}9\\5\end{pmatrix}$



জাস্ট
i -এর চেয়ে বড়
একটা নম্বর

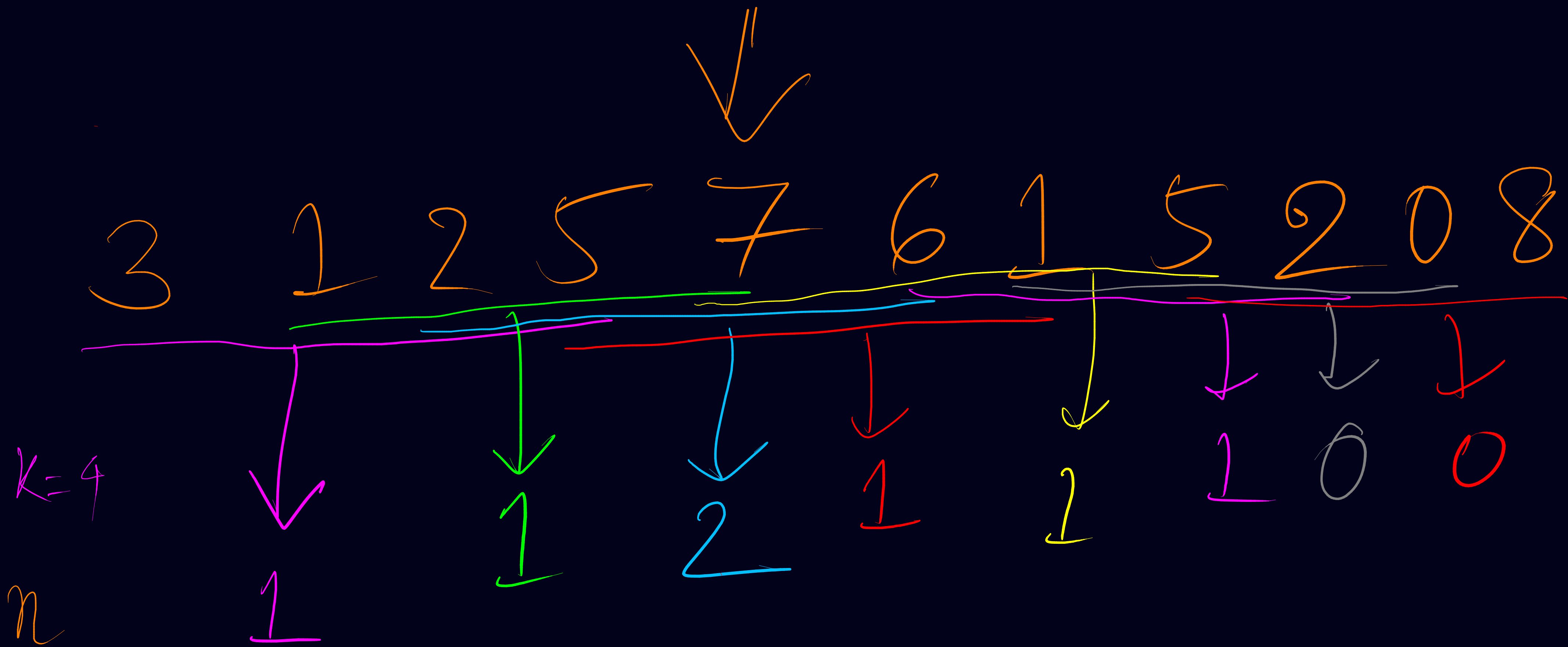
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A[i]: | 2 | 1 | 5 | 3 | 7 | 9 | 2 | 5 | 8 |
| i | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

7

9

$O(n) = O(2n)$

$\boxed{\text{Monotonic queue.}}$




$K \leq n$

$O(n)$

$A[i]$

Furthest to the right

$$B[i] = \max_{j} \{ j \mid j > i,\ A[j] > A[i] \}$$

2 5 1 5 3 8 5 2 1 4

Prefix: 2 2 1 1 1 1 1 1 1 1

Suffix: 4 8 8 8 8 8 5 4 4 4

i                                  j

if suf[j] > pre[i] $\Rightarrow$ j++

else ++i

$i < j < k < l$

How many

$A[i] < A[j] < A[k] < A[l]$

$O(n^2)$

$P[j] = \# i,\ i < j \quad \dfrac{A[i] < A[j]}{}$

$O(n \log n)$ $S[k] = \# l,\ l > k \quad A[l] > A[k]$

$A[j_1]$ $p_1$

$\wedge$

$A[j_2]$ $p_2$

$\wedge$

$A[j_3]$ $p[j_3]$

$\wedge$

$A[j_m]$ $p[j_m]$

$\wedge$

$A[j_{m+1}]$ $p[j_{m+1}]$

$\wedge$

$$S[k] \cdot \left( \sum_{r=1}^{m} p[j_r] \right)$$

$A[k]$

$2, j_3, k, l$

$p[j_3] \cdot S[k]$

A :

$A[i] = B[i] + C[i]$

# possible ways B, C

B is non increasing

C is non decreasing.

$n \le 3000$

$0 < A[i] \le 3000$

$dp[i][j] \triangleq$ # ways for the subarray $A[0] \ldots A[i]$ with $B[i] = j$

index

$B[i]$

$A[i-1] = B[i-1]$

$$dp[i][j] = \sum_{\substack{k \le j \\ \& \ k \le (A[i-1] - A[i] + j)}} dp[i-1][k]$$

$$A[i-1] = k + C[i-1]$$

$$A[i] = j + C[i]$$

$$A[i-1] - k \geq A[i] - j$$

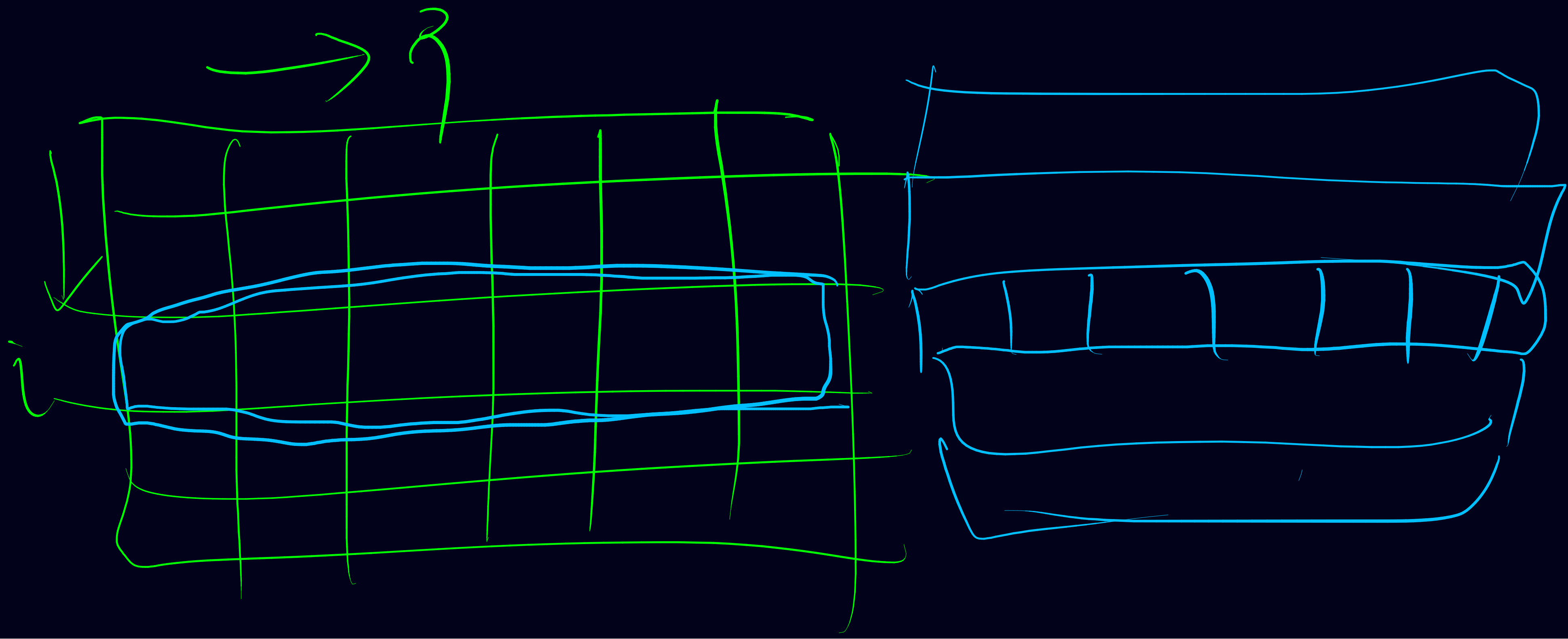
$$k \leq (A[i-1] - A[i] + j)$$

$$\min(j, A[i-1] - A[i] + j) = l$$

$$dp[i][j] = \sum_{k=1} dp[i-1][k] = prefix[i-1][l]$$

$$prefix[i][k] = \sum_{x=1}^{k} dp[i][x]$$

for i :
    for j :
        $l := \min(j, A[i-1] - A[i] + j)$
        $dp[i][j] = pre[i-1][l]$
        $pre[i][j] = pre[i][j-1] + dp[i][j]$



A : _ _ _ _ _ _ _ _

dp[i][j]

index    # toffees used.

$$pre[i][j] = \sum_{x=0}^{j} dp[i][x]$$

$$dp[i][j] = \sum_{k=0}^{a_i} dp[i-1][\boxed{j-k}]$$

x

$$= \sum_{x=j-a_i}^{j} dp[i-1][x]$$

$$= pre[i-1][j] - pre[i-1][j-a_i-1]$$

$$dp[i][j] = pre[i-1][j] - pre[i-1][j-a_i-1]$$

$$pre[i][j] = dp[i][j] + pre[i][j-1]$$

C++ bitset

$$n \quad \underbrace{0\,1\,1\,1\,1\,0}\;\underbrace{0\,1\,1\,1\,1}\;\underbrace{0\,1}$$

$$\Downarrow \qquad \Downarrow \qquad \Downarrow$$

$$\cancel{O(n^2)} \qquad \cancel{O\left(\frac{n^2}{64}\right)} \to n = 1e5$$

– directed acyclic graph