Max Area Rectangle in Binary Matrix

Problem Statement

Given a binary, find the maximum size rectangle binary-sub-matrix with all 1's.

Example:-

Input   0 1 1 0   Output
            1 1 1 1   1 1 1 1
            1 1 1 1   1 1 1 1
            1 1 0 0

(Revision)

MAH (int arr[], int size)   → reuse
{
  right () → NSR (arr, size)

  Left () → NSL (arr, size)

  width [i] → right [i] - left [i] - 1;

  area = arr[i] * width [i]

  return max of area[i];

}

$\xleftarrow{\hspace{1cm}} m \xrightarrow{\hspace{1cm}}$ Histogram (level)

0	1	1	0	$\longrightarrow$ H_1 level = 0 1 2 0
1	1	1	1	$\longrightarrow$ H_2 vector = 1 2 2 1
2	2	1	1	$\longrightarrow$ H_3 vector = 2 3 3 2
1	1	0	0	$\longrightarrow$ H_4 vector = 3 4 0 0

n

- Create one vector and push ~~columns~~ rows in that

I/P n, m
arr[]

Vector <int> V; // create one vector
     // copy 1st row in vector
for (int j=0; j<m; j++)

     V. push-back (arr [0] [j]); $\underline{0,0,0,1,0,2,0,3}$

int $\overset{2}{MX}$ = MAH(V); // MAH for 1st row.

for (int i=1; i<n; i++)

   for (int j=0; j<m; j++)

     { if (arr[i][j] ==0)

         V[j] =0;

     else

         V[j] = V[j] + arr[i][j]

$\cancel{Af}$ ⑧

   $\cancel{MX}$ = max (MX, MAH(V));   V: 2 3 3 2
                                     3 4 0 0

In teu problem we have

$$\begin{array}{cccc} 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 \end{array} \rightarrow 3 \times 2 = 6$$

$$\rightarrow 4 \times 2 = 8$$

$\downarrow 4 \times 1 = 4$
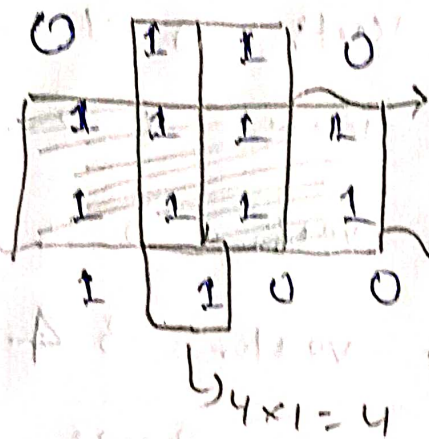
MAH diff/Similarity

• Binary No ← → Natural No
• 2 D-Array ← → 1 D Array

Similarity

Max area ← → Max Area of
of recth.   rectigle

• So what we need to do is to Compare 2D Array to 1D Array,

$$\begin{array}{cccc} 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 \end{array}$$
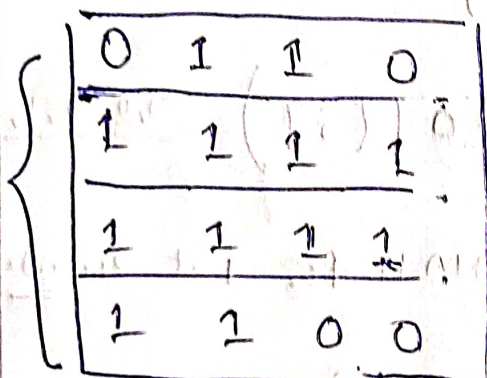
2D — 1D
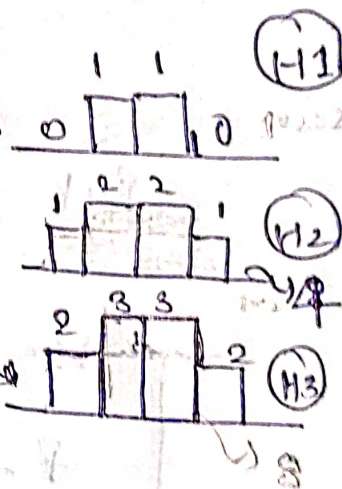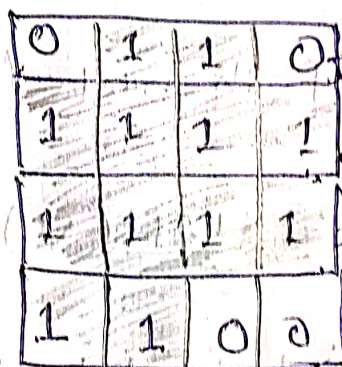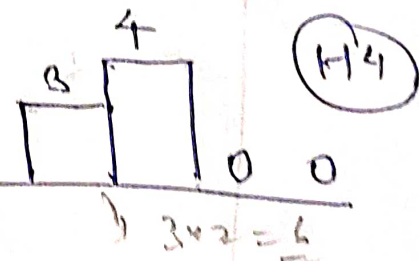
No Building

$$ans = Max \left(\begin{array}{l} \underline{MAH(H_1)} \longrightarrow 2 \\ \underline{MAH(H_2)} \longrightarrow 4 \\ \underline{MAH(H_3)} \longrightarrow 8 \\ \underline{MAH(H_4)} \longrightarrow 6 \end{array} \right) \rightarrow 8 \text{ Ans}$$

• Building Cant be ∞ air so we wite a with teu (x) column (zeus on teu bottom)