Problem G
Convolution

Time Limit: 5 seconds
Memory Limit: 512 Megabytes

Problem description

Convolution is an important technique in Image Processing, used mainly in image operations such as image smoothing, edge extraction. This exercise considers the simplest case of convolution (Stride = 1 and Padding = 0, don't worry, ignore this information if you haven't heard of convolution). The illustration of convolution is described as follow:

Given: Image matrix = $\begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix}$ and the Filter matrix = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$. The size of Filter matrix is assumed to be always smaller than

The filter matrix will be slid through the Image matrix. It will not slip outside of the scope of the Image matrix

Image matrix = $\begin{bmatrix} \mathbf{1} & \mathbf{1} & \mathbf{1} & 0 & 0 \\ \mathbf{0} & \mathbf{1} & \mathbf{1} & 1 & 0 \\ \mathbf{0} & \mathbf{0} & \mathbf{1} & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix}$ * Filter matrix = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ → $\begin{bmatrix} 4 & & \end{bmatrix}$

Image matrix = $\begin{bmatrix} 1 & \mathbf{1} & \mathbf{1} & \mathbf{0} & 0 \\ 0 & \mathbf{1} & \mathbf{1} & \mathbf{1} & 0 \\ 0 & \mathbf{0} & \mathbf{1} & \mathbf{1} & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix}$ * Filter matrix = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ → $\begin{bmatrix} 4 & 3 & \end{bmatrix}$

Image matrix = $\begin{bmatrix} 1 & 1 & \mathbf{1} & \mathbf{0} & \mathbf{0} \\ 0 & 1 & \mathbf{1} & \mathbf{1} & \mathbf{0} \\ 0 & 0 & \mathbf{1} & \mathbf{1} & \mathbf{1} \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix}$ * Filter matrix = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ → $\begin{bmatrix} 4 & 3 & 4 \end{bmatrix}$

Image matrix = $\begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix}$ * Filter matrix = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ → $\begin{bmatrix} 4 & 3 & 4 \\ 2 & & \end{bmatrix}$

……. Keep doing….

Finally we get: Image matrix = $\begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix}$ * Filter matrix = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ →

$\begin{bmatrix} 4 & 3 & 4 \\ 2 & 4 & 3 \\ 2 & 3 & 4 \end{bmatrix}$

At the end of the convolution's process we obtained $\begin{bmatrix} 4 & 3 & 4 \\ 2 & 4 & 3 \\ 2 & 3 & 4 \end{bmatrix}$ as the feature matrix.

You are asked to write a program that allows users to enter the Image matrix and Filter matrix to produce the feature matrix.

Input

The first line indicates the size of Image matrix (m x n) and Filter matrix (p x q)

The next n lines contain m integer numbers I_{ij} where $0 \leqslant I_{ij} \leqslant 255$ - the value of the pixel in the Image matrix separated by spaces ($0 \leqslant i \leqslant n$, $0 \leqslant j \leqslant m$).

The next p lines contain q integer numbers F_{ij} where $0 \leqslant F_{ij} \leqslant 255$ - the value of the pixel in the Filter matrix separated by spaces ($0 \leqslant i \leqslant p$, $0 \leqslant j \leqslant q$).

Output

The feature matrix values separated by space.

Example:

Input	Output
6 6 3 3 206 205 247 245 244 253 244 161 137 244 254 255 192 154 75 200 249 255 90 109 96 143 223 255 67 69 107 196 236 255 55 51 45 134 218 251 0 0 0 0 1 0 0 0 0	161 137 244 254 154 75 200 249 109 96 143 223 69 107 196 236

A relax page, open to next page for the next challenge in your journey to the TOP.