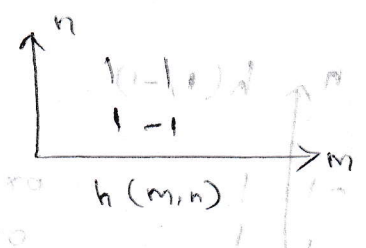
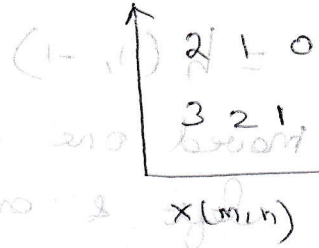
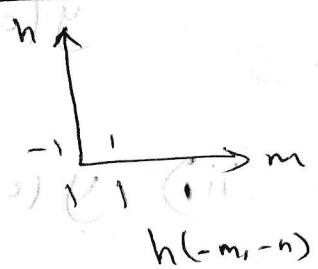
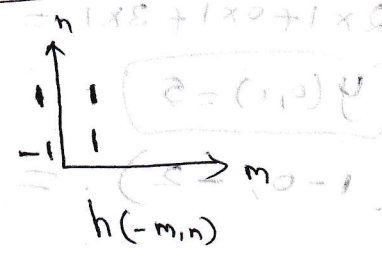


Convolution  $x(m,n) * h(m,n)$

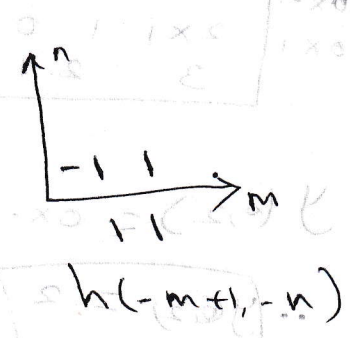


Step 1 :- obtain  $h(-m,n)$

Step 2:  $h(-m,-n)$

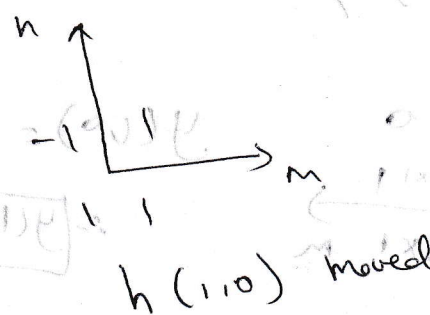


Step 3: obtain  $h(-m+1,-n)$



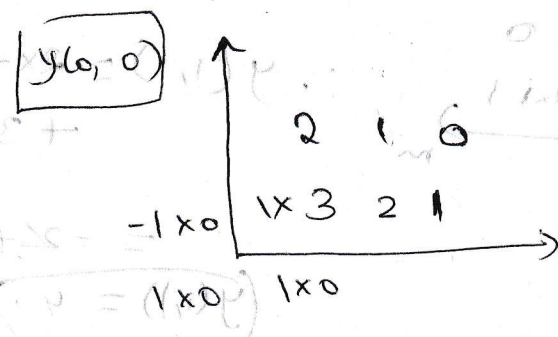
Convolution yields an array of size  $(M_1+M_2-1) * (N_1+N_2-1)$   
 $= (2+2-1) * (3+2-1)$   
 $= 3 * 4$ , Elements in  $y(m,n)$   
 $m = 0, 1, 2$   
 $n = 0, 1, 2, 3$

$y(0,0)$  ?  $\therefore h(1-0, 0) = h(1,0)$



Five column elements are denoted as  $y(0,0)$ ,  $y(0,1)$  &  $y(0,2)$

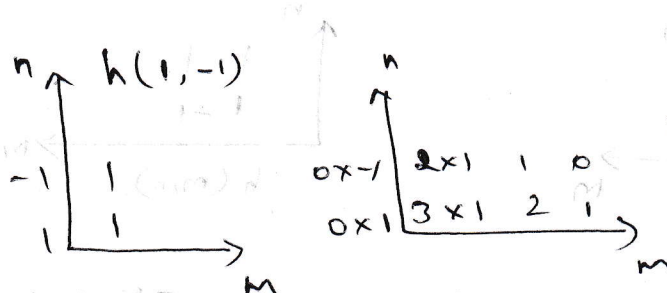
one position left  $(-1,0)$



$\therefore y(0,0) = -1 \times 0 + 3 \times 1 + 0 \times 1 + 0 \times 1 = 3$

$y(0,0) = 3$

ii)  $y(0,1), \therefore h(1-m, -n) = h(1-0, -1)$

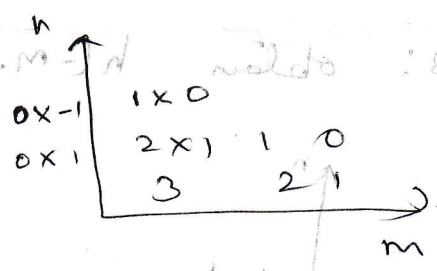
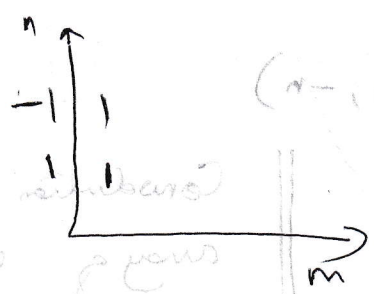


$= h(1, -1)$   
 Moved one position  
 left & one " up.

$y(0,1) = 0 \times -1 + 2 \times 1 + 0 \times 1 + 3 \times 1 = 2 + 3 = 5$

$y(0,1) = 5$

iii)  $y(0,2), \therefore h(1-0, -2) = h(1, -2)$

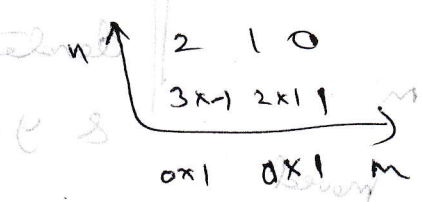
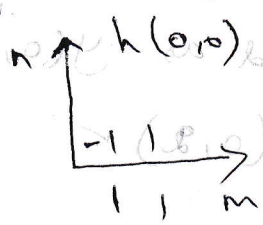


$y(0,2) = 0 \times -1 + 1 \times 0 + 0 \times 1 + 2 = 2$

$y(0,2) = 2$

iii)  $y(1,0), y(1,1) \text{ \& } y(1,2)$

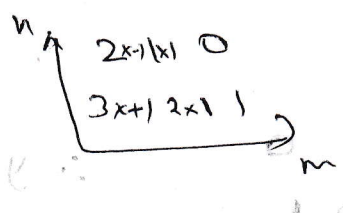
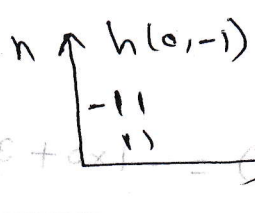
iv)  $y(1,0), \therefore h(1-1, 0) \Rightarrow h(0,0)$



$y(1,0) = -3 + 2 + 0 + 0 = -1$

$y(1,0) = -1$

v)  $y(1,1), \therefore h(0, -1)$



$y(1,1) = 2 \times -1 + 1 \times 1 + 3 \times 1 + 2 \times 1$

$= -2 + 1 + 3 + 2 = 4$

$y(1,1) = 4$

vi)  $y(1,2), \therefore h(0,-2)$

$$1 = (0,0)y$$

$h(0,-2)$

-1	1
1	1

$\therefore y(1,2) = 0 + 0 + 2 + 1 = 3$

$\therefore y(1,2) = 3$

vii)  $y(2,0), y(2,1), y(2,2)$

$y(2,0), \therefore h(-1,0)$

$h(-1,0)$

-1	1
0	1

$y(2,0) = -2 + 0 + 0 = -2$

$y(2,0) = -1$

moved one position right

viii)  $y(2,1), \therefore h(-1,-1)$

$h(-1,-1)$

-1	1
0	1

$y(2,1) = -1 + 0 + 2 + 1 = 2$

$y(2,1) = 2$

moved one position right & moves up

ix)  $y(2,2), h(-1,-2)$

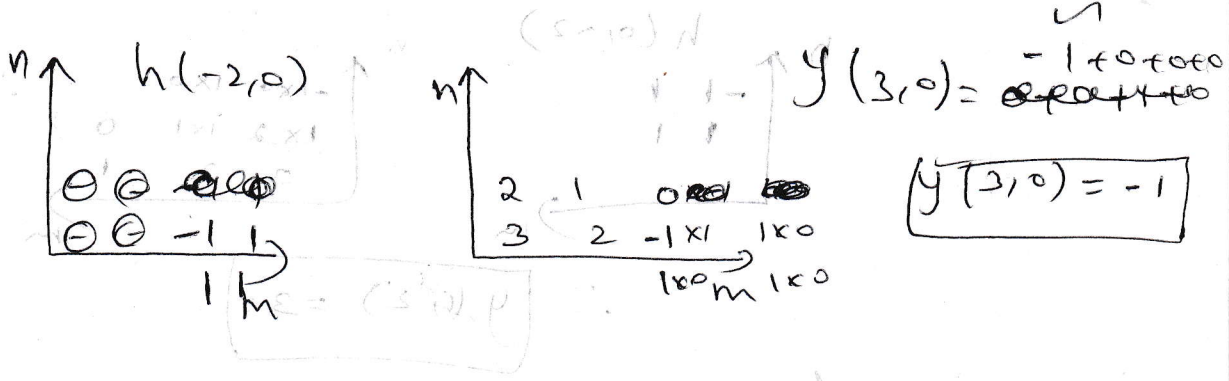
$h(-1,-2)$

0	-1	1
0	1	1
0	0	0

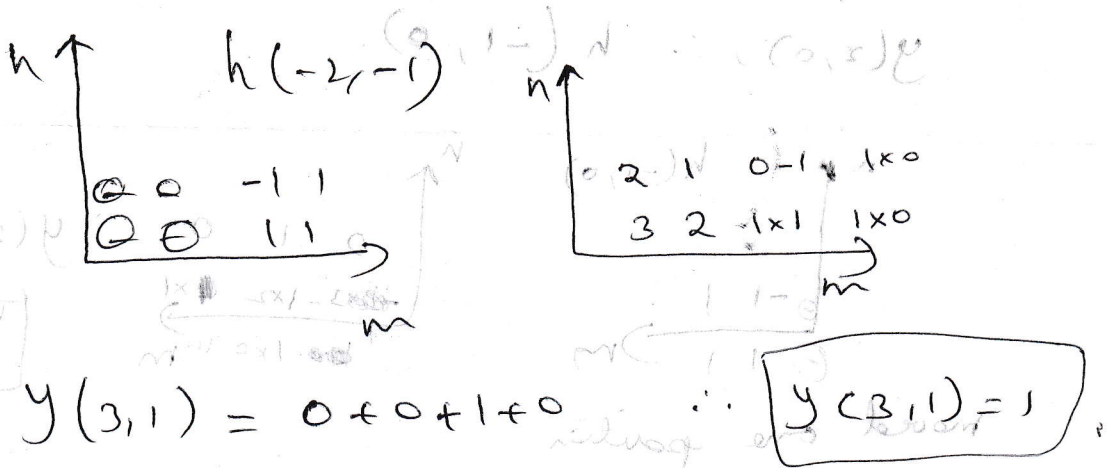
$y(2,2) = 0 + 0 + 1 + 0 = 1$

$y(2,2) = 1$

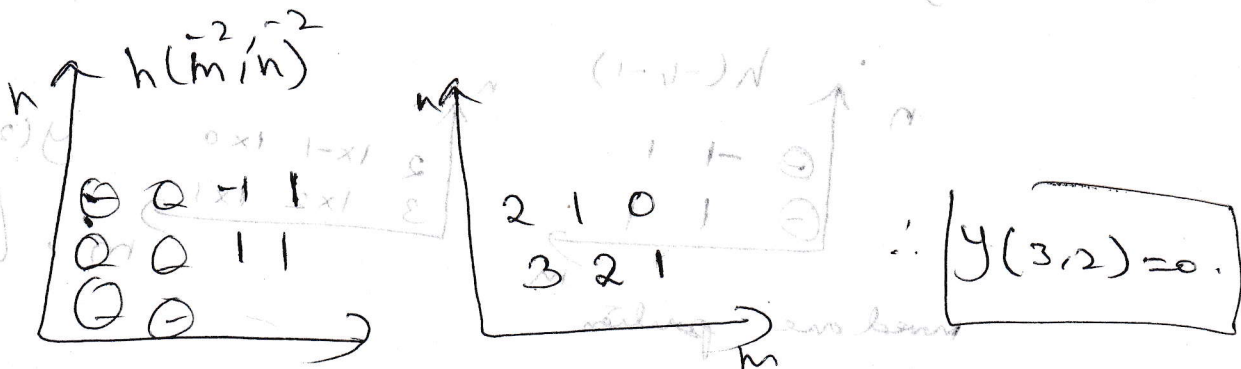
III<sup>ly</sup>  $y(3,0), \therefore h(-2,0) \therefore (s,1) \mu$



$y(3,1), \therefore h(-2,-1)$

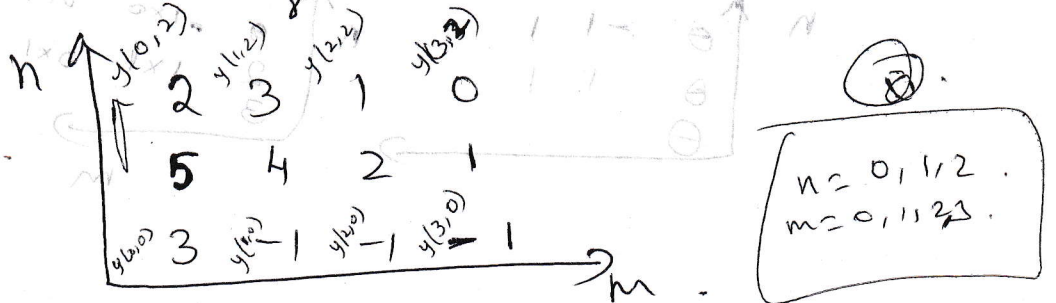


$y(3,2), \therefore h(-2,-2)$

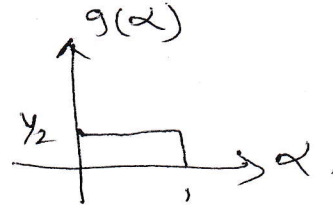
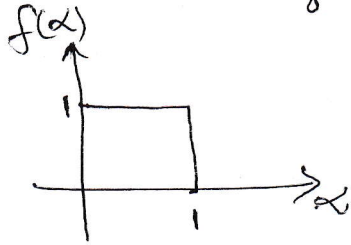


$y(3,2) = -1 \times 0 + 1 \times 0 + 1 \times 0 + 1 \times 0 = 0$

Final convolution of size  $3 \times 4$  is shown in the fig.



① Find convolution of the following signal.



② Determine the convolution of  $x(m)$  with  $h(m)$  where  $x(m)$  &  $h(m)$  are given as follows.

