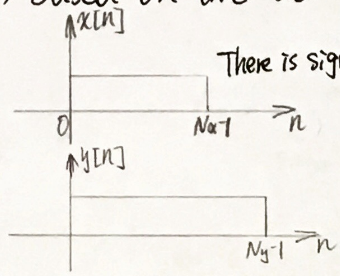
EEE5502 Code #2 Hudanyun Sheng

## Question #1

I spent 3 hours.

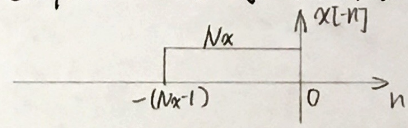
## Question #2

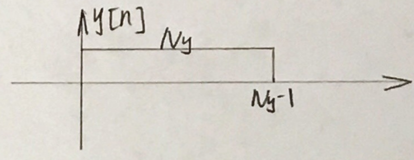
(a) Based on the description of $x[n]$, $y[n]$, they can be illustrated:



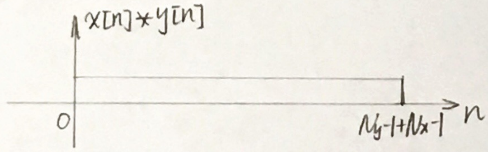

There is signal only at time with in the boxes

To compute $x[n] * y[n]$, with the help of ~~grap~~ plots, we have




It is easy the ~~sket~~ sketch the result of $x[n] * y[n]$:




~~There will only be~~ Signal will only exist in the range $[0, N_x+N_y-2]$

$\therefore x[n] * y[n] = 0$, for $n<0$ and $n > N_x+N_y-2$.

(b) Similar to convolution, but in this case, we don't have to time reverse a signal. Hence, $c[n]$ will have signal from $-(N_x-1)$ to $(N_y-1)$. Which is $c[n]=0$ for $n<-(N_x-1)$ and $n>N_y-1$.

(c) $c[n] = \sum_{m=-\infty}^{\infty} x[m]x[n+m]$

Based on Cauchy-Schwarz inequality, we have $c[n] \le (\sum_{m=-\infty}^{\infty} x[m])(\sum_{m=-\infty}^{\infty} x[n+m])$

The equality if and only if $x[m] = x[n+m]$, i.e. $n=0$.

$\therefore$ When $n=0$, $c[n]$ is maximum. The maximum value is $(\sum_{m=-\infty}^{\infty} x[m])^2$.

(d) $c[n] = \sum_{m=-\infty}^{\infty} x[m]\, y[n+m] = \sum_{m=-\infty}^{\infty} x[m]\, x[n-n_0+m] \le \left(\sum_{m=-\infty}^{\infty} x[m]\right)\left(\sum_{m=-\infty}^{\infty} x[n-n_0+m]\right)$

The equality holds if and ~~only~~ only if $x[m] = x[n-n_0+m]$, i.e. $n = n_0$

$\therefore$ When $n = n_0$, $c[n]$ is maximum. The maximum value is $\left(\sum_{m=-\infty}^{\infty} x[m]\right)^2$.