Parte II

1)

a) $f[n] = 2\delta[n+10] + 2\delta[n-10]$ $x[n] = (f * g)[n]$

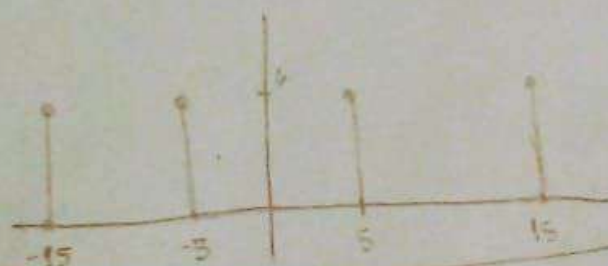$g[n] = 3\delta[n+5] + 3\delta[n-5]$ $x[n] = \sum_{k=-\infty}^{+\infty} f[k] \cdot g[n-k]$

$x[n] = f[-10] \cdot g[n-(-10)] + f[-5] \cdot g[n-(-5)] + f[5] \cdot g[n-5]$
$\quad + f[10] \cdot g[n-10] +$
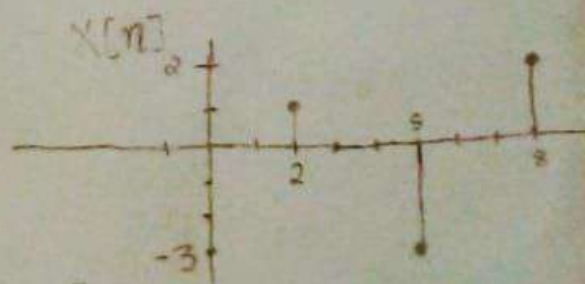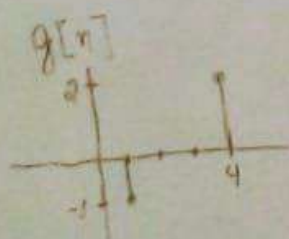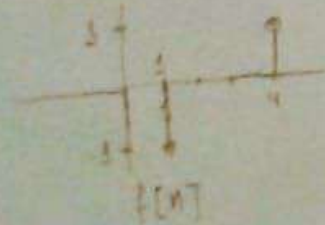
$x[n] = 2 \cdot g[n+10] + 2 \cdot g[n-10]$

$x[n] = 2 \cdot [3(\delta[n+5+10] + \delta[n-5+10]) + 3(\delta[n+5-10] + \delta[n-5-10])]$

$x[n] = 6 \cdot (\delta[n+15] + \delta[n-5] + \delta[n-5] + \delta[n-15])$

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b) $f[n] = \delta[n-4] - \delta[n-1]$

$g[n] = 2\delta[n-4] - \delta[n-1]$

$x[n] = f(1) \cdot g[n-1] + f(4) \cdot g[n-4]$

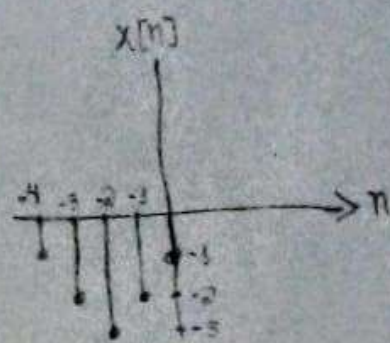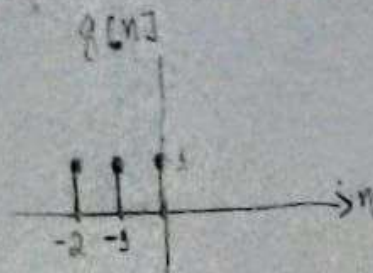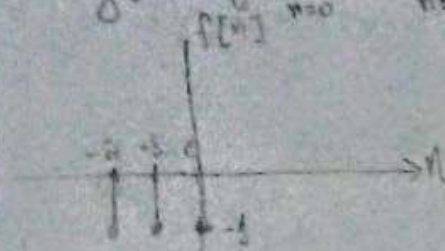$\quad = -1 \cdot g[n-1] + 1 \cdot g[n-4]$

$\quad = -(2\delta[n-4-1] - \delta[n-1-1]) + (2\delta[n-4-4] - \delta[n-1-4])$

$\quad = -2\delta[n-5] + \delta[n-2] + 2\delta[n-8] - \delta[n-5]$

c) $f[n] = -\delta[n+2] - \delta[n+1] - \delta[n]$ (with labels $n=-2$, $n=-1$, $n=0$)

$g[n] = \delta[n] + \delta[n+1] + \delta[n+2]$ (with labels $n=0$, $n=-1$, $n=-2$)

$x[n] = f[-2] \cdot g[n-(-2)] + f[-1] \cdot g[n-(-1)] + f[0] \cdot g[n-(0)]$

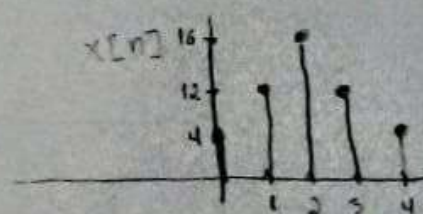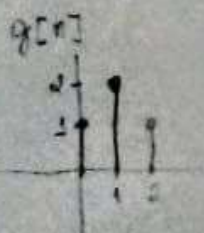$= -g[n+2] - g[n+1] - g[n]$ (labels $n=-2$, $n=-1$, $n=0$)

$= -(\delta[n+2] + \delta[n+1+2] + \delta[n+2+2]) - (\delta[n+1] + \delta[n+1+1] + \delta[n+2+1])$

$\quad - (\delta[n] + \delta[n+1] + \delta[n+2])$

$= -(\delta[n+2] + \delta[n+3] + \delta[n+4]) - (\delta[n+1] + \delta[n+2] + \delta[n+3]) - (\delta[n] + \delta[n+1] + \delta[n+2])$

$x[n] = -2\delta[n+2] - 3\delta[n+3] - 2\delta[n+1] - \delta[n+4] - \delta[n]$

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d) $f[n] = 4$

$g[n] = \delta[n] + 2\delta[n-1] + \delta[n-2]$

$x[n] = f[0] \cdot g[n-0] + f[1] \cdot g[n-1] + f[2] \cdot g[n-2]$

$= 4 \cdot g[0] + 4 \cdot g[n-1] + 4 \cdot g[n-2]$

$= 4[(\delta[n] + 2\delta[n-1] + \delta[n-2]) + (\delta[n-1] + 2\delta[n-1-1] + \delta[n-2-1])$
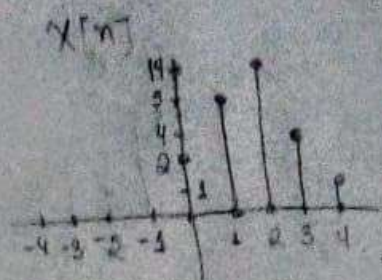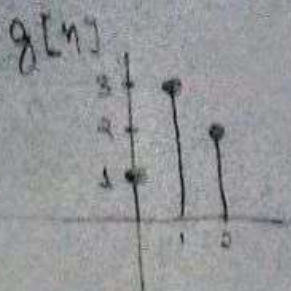
$\quad + (\delta[n-2] + 2\delta[n-1-2] + \delta[n-2-2])]$

$= 4(\delta[n] + 3\delta[n-1] + 4\delta[n-2] + 3\delta[n-3] + \delta[n-4])$

$= 4\delta[n] + 12\delta[n-1] + 16\delta[n-2] + 12\delta[n-3] + 4\delta[n-4]$

e) $f[n] = 2\delta[n] + 3\delta[n-1] + \delta[n-2]$

$g[n] = \delta[n] + 3\delta[n-1] + 2\delta[n-2]$

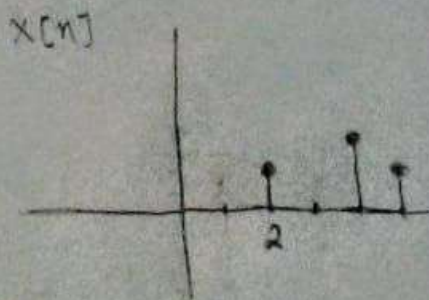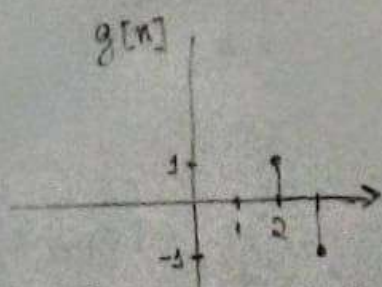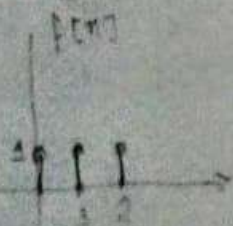$x[n] = f[0]\cdot g[n] + f[1]\cdot g[n-1] + f[2]\cdot g[n-2]$

$= 2\cdot g[n] + 3\cdot g[n-1] + g[n-2]$

$= 2(\delta[n] + 3\delta[n-1] + 2\delta[n-2]) + 3(\delta[n-1] + 3\delta[n-1-1] + \delta[n-2-1])$
$+ (\delta[n-2] + \delta[n-1-2] + \delta[n-2-2])$

$= \delta[n-4] + 4\delta[n-3] + 14\delta[n-2] + 6\delta[n-1] + 2\delta[n]$

f) $f[n] = \delta[n] + \delta[n-1] + 2\delta[n-2]$

$g[n] = \delta[n-2] - \delta[n-3]$

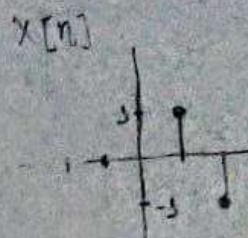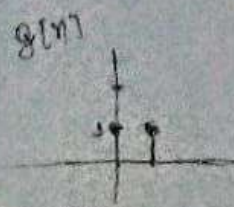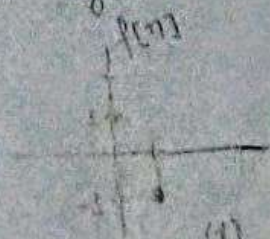$x[n] = f[1]\cdot g[n-1] + f[2]\cdot g[n-2] + f[0]\cdot g[n]$

$= (\delta[n-2-1] - \delta[n-3-2]) + 2\cdot(\delta[n-2-2] - \delta[n-3-2])$
$+ (\delta[n-2] - \delta[n-3])$

$= \delta[n-5] + 2\delta[n-4] + \delta[n-2]$
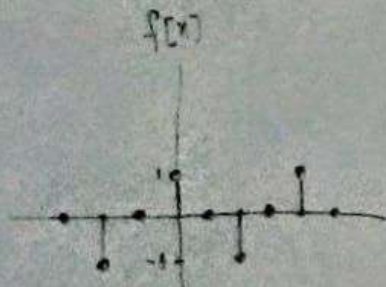
g) $f[n] = (-1)^n$

$g[n] = \delta[n] + \delta[n-1]$

$f[n]$

$g[n]$

$x[n]$

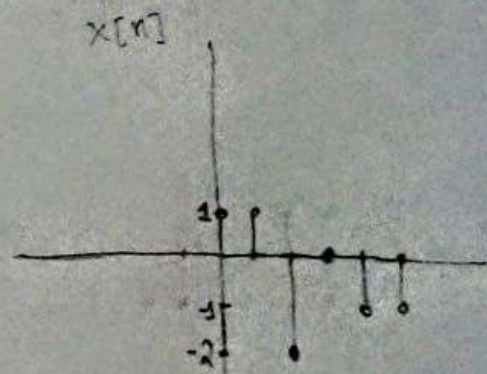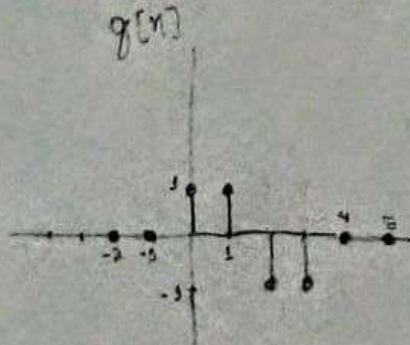$x[n] = f[0] \cdot g[n] + f[1] \cdot g[n-1] +$

$= (\delta[n] + \delta[n-1]) - (\delta[n-1] + \delta[n-1-1])$

$= \delta[n] - \delta[n-2]$

h) $f[n] = \cos\left(\pi n / 2\right)$

$g[n] = \delta[n] + \delta[n-1] + \delta[n-2] + \delta[n-3]$

$f[n]$

$g[n]$

$x[n]$

$x[n] = f[0] \cdot g[n] + f[2] \cdot g[n-2]$

$= (\delta[n] + \delta[n-1] - \delta[n-2] + \delta[n-3]) - (\delta[n-2] + \delta[n-3-2] - \delta[n-2-2] - \delta[n-3-2])$

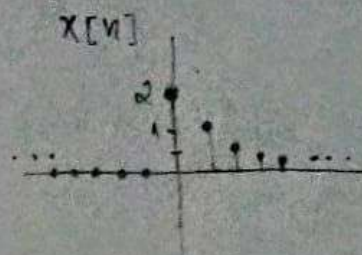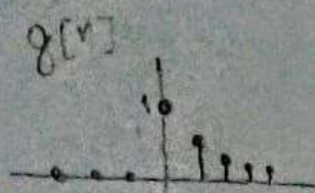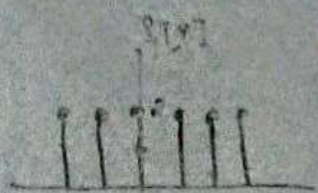$= \delta[n] + \delta[n-1] - 2\delta[n-2] - \delta[n-4] - \delta[n-5]$

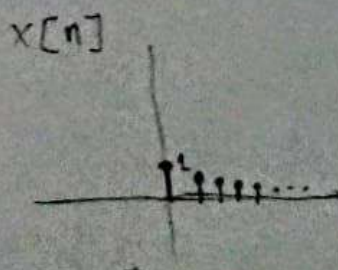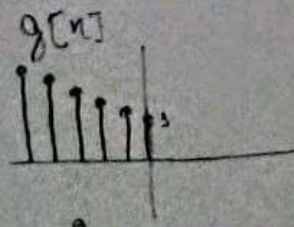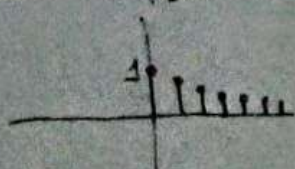i) $f[n] = 2$
$g[n] = \left(\frac{1}{2}\right)^n v[n]$

$v[n] = \begin{cases} 0, & n < 0 \\ 1, & n \geq 0 \end{cases}$

$f[n]$

$g[n]$

$x[n]$

$x[n] = f[0] \cdot g[n] + f[1] \cdot g[n-1] + f[2] \cdot g[n-2] + f[-1] \cdot g[n-(-1)]$

$= 2(1 \cdot v[n]) + 2 \cdot (0,5 \cdot v[n-1]) + 2 \cdot (0,25 \cdot v[n-2]) + 2(0,5 \cdot v[n+1]$

2) $f[n] = 0,9^n v[n]$
$g[n] = f[-n] = 0,9^{-n} \cdot v[-n]$

$v[-n] = \begin{cases} 0, & n > 0 \\ 1, & n \leq 0 \end{cases}$

$f[n]$

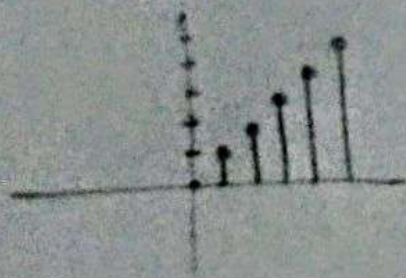$g[n]$

$x[n]$

$x[n] = f[0] \cdot g[n] + f[-1] \cdot g[n-(-1)] + f[1] \cdot g[n-1]$

$= 1 \cdot \left(0,9^n \cdot v[-n]\right) + 0,9 \cdot \left(0,9^{-n+1} \cdot v[-n+1]\right)$

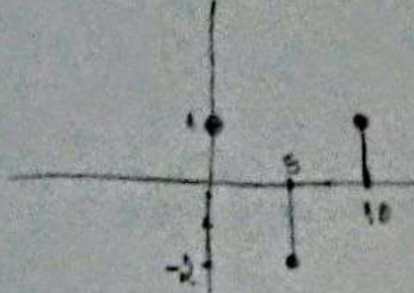m) $h[n] = n \, U[n]$
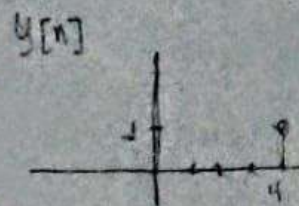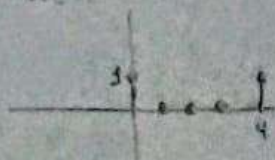
$x[n] = \delta[n] - 2\delta[n-5] + \delta[n-10]$
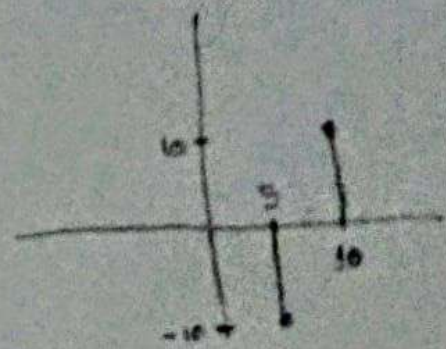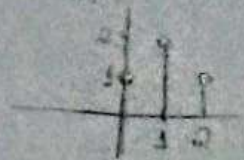

$y[x] = x[0] + h[n] + x[5] \cdot h[n-5] + x[10] \cdot h[n-10]$

$= (n)(n]) - 2(n-5)U[n-5] + 1 \cdot (n-10)U[n-10]$

K) $h[n] = \delta[n] + 2\delta[n-1] + \delta[n-2]$
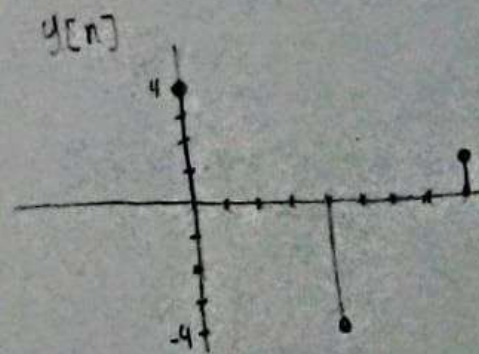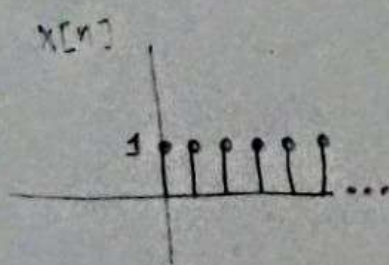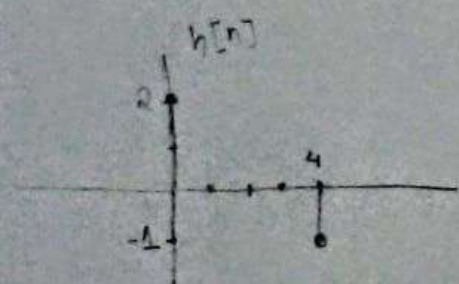
$x[n] = \sum_{k=0}^{\infty} \delta[n-4k]$

$y[n] = h[0] \cdot x[n] + h[1] \cdot x[n-1] + h[2] \cdot x[n-2]$

$= \delta[n-4]$

l) $h[n] = 2\delta[n] - \delta[n-4]$

$x[n] = U[n]$

$y[n] = h[0] \cdot x[n] + h[4] \cdot x[n-4]$

$= 2 \cdot (2\delta[n] - \delta[n-4]) - (2\delta[n-4] - \delta[n-4-4])$

$= 4\delta[n] - 4\delta[n-4] + \delta[n-8]$