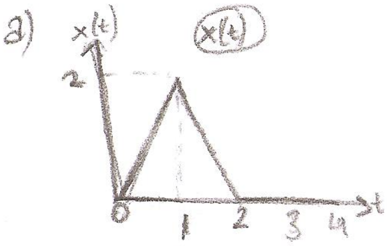
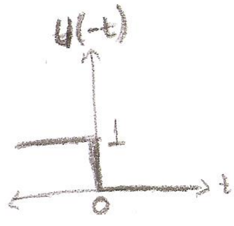
BLG 354E HW2
Baran Kaya 150130032

2-a)
2-b)

a)

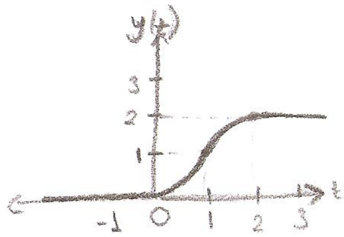




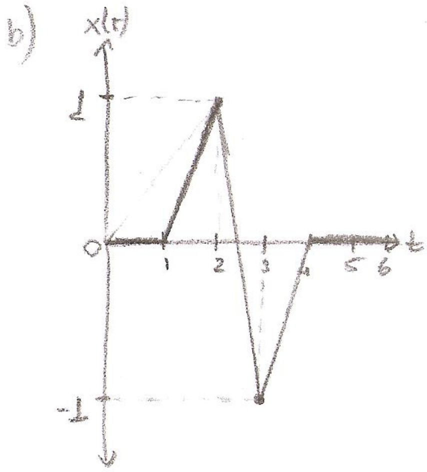
$$y(t) = \begin{cases} 0 & , t<0 \\ t^2 & , 1<t<0 \\ 2-(2-t)^2 & , 2<t<1 \\ 2 & , t>2 \end{cases}$$

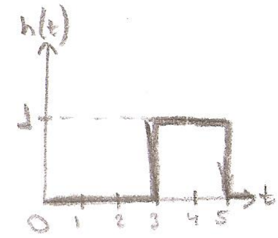
$$y(t) = \int_{-\infty}^{\infty} x(\tau).h(t-\tau)\,d\tau = x(t) * h(t)$$

$$y(t) = \int_{-\infty}^{\infty} x(\tau).u(t-\tau)\,d\tau = x(t) * u(t)$$

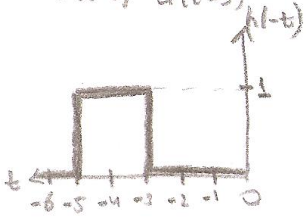


b)

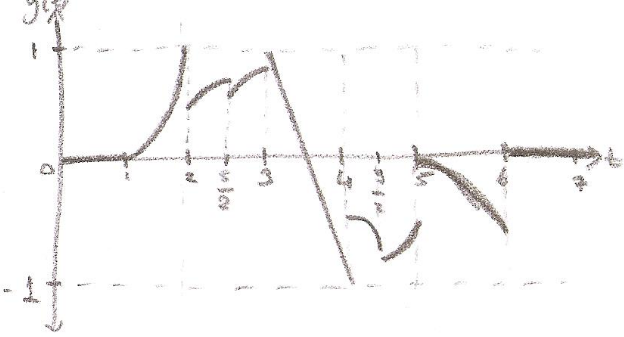




$\rightarrow u(t-3) - u(t-5)$



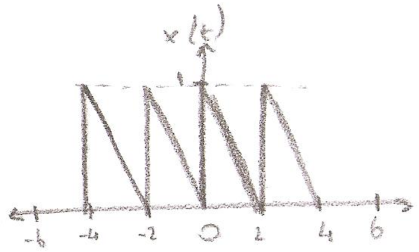
$$y(t) = \begin{cases} 0 & , t<1 \\ (t-1)^2/2 & , 1<t<2 \\ \frac{3}{4} - \left(\frac{5}{2}-t\right)^2 & , 2<t<5/2 \\ \frac{3}{4} - (3-t)^2 & , 5/2<t<3 \\ \frac{1}{2} - (t-3)^2 - \left(\frac{1}{2} - (4-t)^2\right) & , 3<t<4 \\ \frac{1}{4} - (t-4)^2 - (3/4) & , 4<t<9/2 \\ -\left(\frac{1}{4} - (t-9/2)^2 + 1/2\right) & , 9/2<t<5 \\ -\left(\frac{(t-5)^2}{2}\right) & , 5<t<6 \\ 0 & , t>6 \end{cases}$$

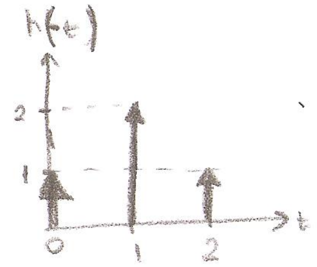


$$y(t) = \int_{-\infty}^{\infty} x(\tau).h(t-\tau)\,d\tau \quad , \quad h(t) = u(t-3) - u(t-5)$$

2-c)
2-d)

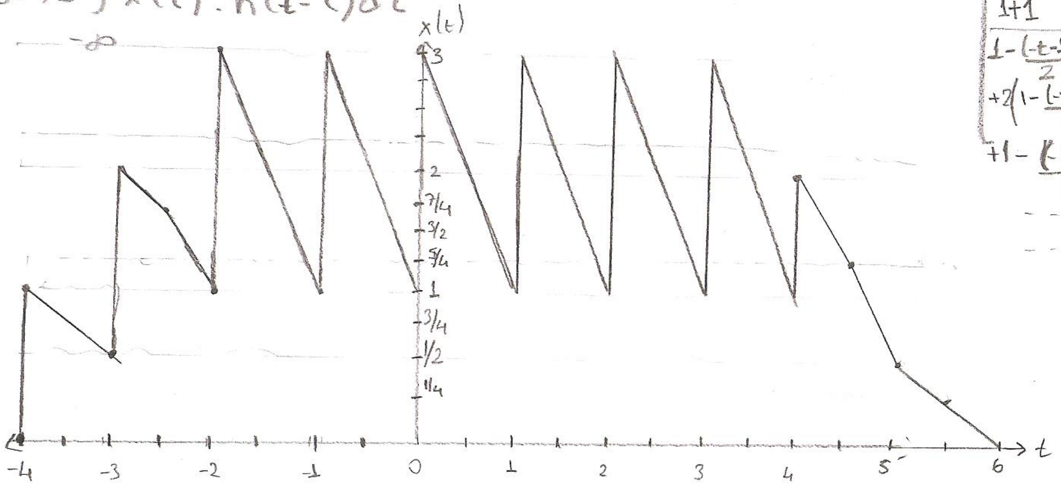
c)



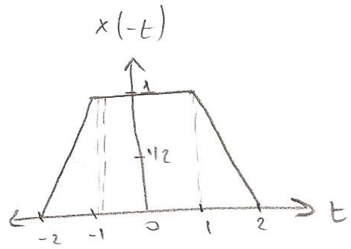


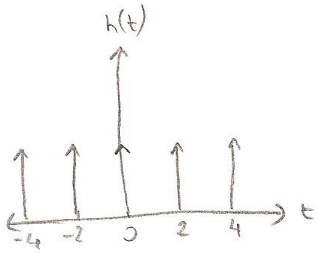
$$y(t) = \begin{cases} 0 & , t < -4 \\ 1 & , t = -4 \\ 1 - \frac{(-t-3)}{2} & , -4 < t < -3 \\ 1 + 1/2 & , t = -3 \\ 1 - \frac{(-t-2)}{2} + 2\left(1 - \frac{(-t-3)}{2}\right) & , -3 < t < -2 \\ 1 + 1 & , t = -2 \\ 1 - \frac{(-t-1)}{2} + 2\left(1 - \frac{(-t-1)}{2}\right) + 1 - \frac{(-t-1)}{2} & , -2 < t < -1 \\ \ldots & \end{cases}$$

$$y(t) = \int_{-\infty}^{\infty} x(\tau) \cdot h(t-\tau) \, d\tau$$

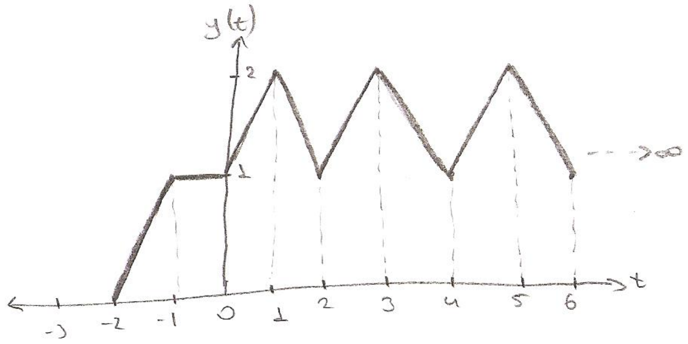


d) $$y(t) = \int_{-\infty}^{\infty} x(\tau) \cdot h(t-\tau) \, d\tau = \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau) \, d\tau$$



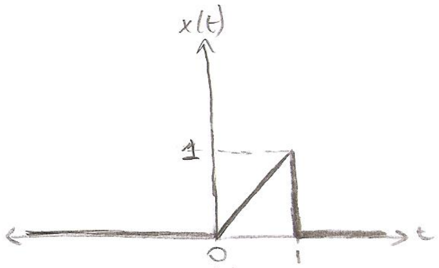


$$y(t) = \begin{cases} 0 & , t < -2 \\ \sum_{t=-2}^{-1} (2+t) & , -2 < t < -1 \\ 1 & , -1 < t < 0 \\ 1 + \sum_{t=-2}^{-1} (2+t) & , 0 < t < 1 \\ 1 + \sum_{t=1}^{2} (2-t) & , 1 < t < 2 \\ 1 + \sum_{t=-2}^{-1} (2+t) & , k < t < k+1 \\ 1 + \sum_{t=1}^{2} (2-t) & , k+1 < t < k+2 \end{cases}$$

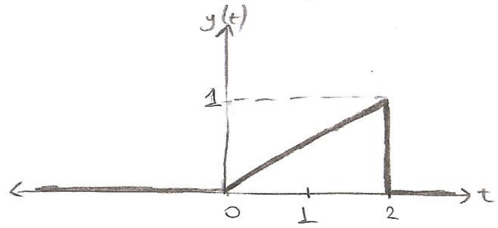


3-a)
3-b)

a)



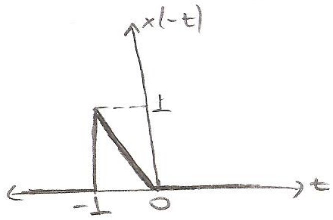
$x(t) = t\,(u(t) - u(t-1))$

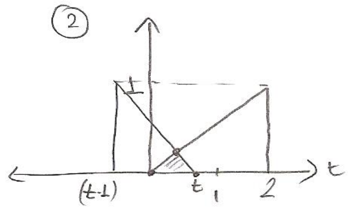


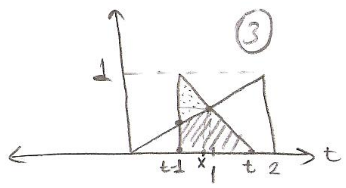
$y(t) = x(2t)$

$$x(t) * y(t) = y(t) * x(t) = \begin{cases} 0 & , t<0 \\ \dfrac{t \cdot t/2}{2} & , 0<t\leq 1 \\ \dfrac{1-\left(1-\frac{(t-1)}{2}\right)\cdot\left(\frac{2t}{3}-(t-1)\right)}{2} & , 1<t\leq 2 \\ \frac{(t-1)}{2}\cdot\left(\frac{2t}{3}-(t-1)\right)+\left(2-\frac{2t}{3}\right)\cdot(t-2) & , 2<t<3 \end{cases}$$

$$+\frac{1}{2}\left[\left(\frac{2t}{3}-(t-1)\right)\cdot\left(\frac{2t}{6}-\frac{(t-1)}{2}\right)+\left(2-\frac{2t}{3}\right)\cdot\left(\frac{2t}{6}-(t-2)\right)\right]$$

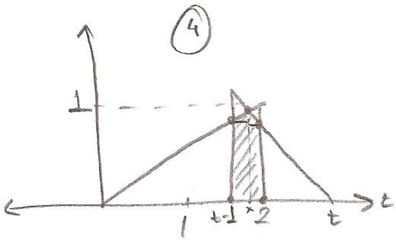




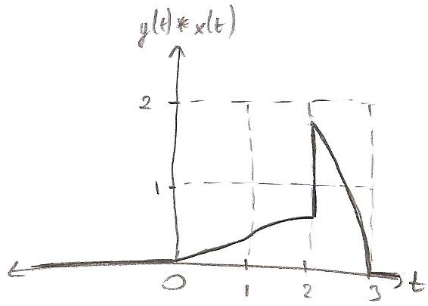


$\frac{x}{2} = t - x$

$x = \frac{2t}{3}$

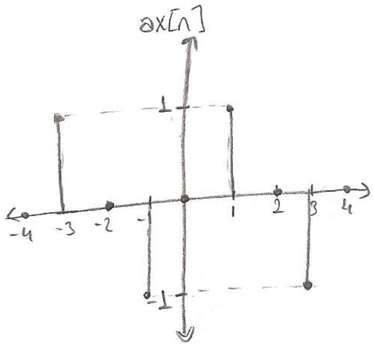


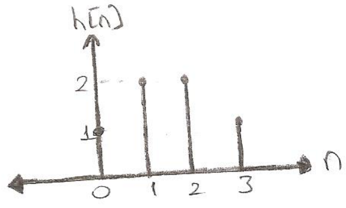
$x = \frac{2t}{3}$



4-a)
4-b)

a)

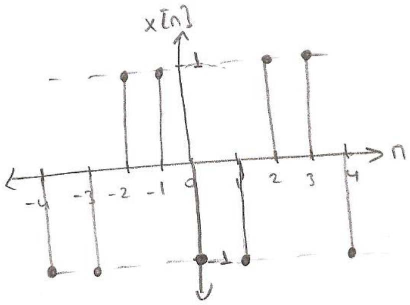




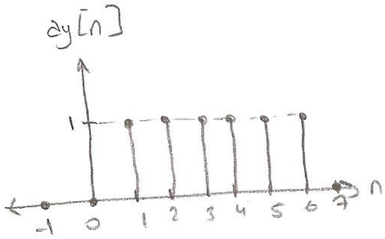
flip $h[n] \to h[-n]$

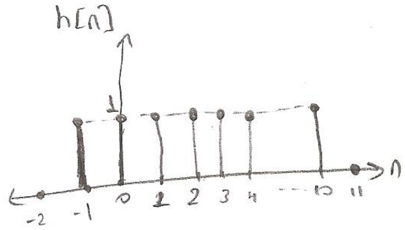
$$x[n] = ax[n] * h[n] = h[n] * ax[n]$$

$$x[n] = \sum_{k=-\infty}^{\infty}$$



b)





$$y[n] = ay[n] * h[n] = h[n] * ay[n]$$

flip $ay[n] \to ay[-n]$

$$y[n] = \sum_{k=-1}^{4} (k+2) + \sum_{k=5}^{10} 6 + \sum_{k=11}^{15} (16-k)$$

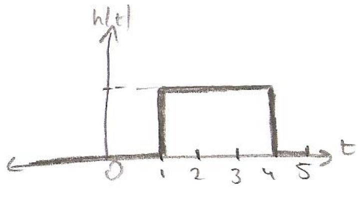
$$y[n] = \begin{cases} n \leq -2 \Rightarrow 0 \\ n = -1 \Rightarrow 1 \\ n = 0 \Rightarrow 2 \\ n = 1 = 3 \\ n = 2 \Rightarrow 4 \\ n = 3 \Rightarrow 5 \\ n = 4 \Rightarrow 6 \\ n = 5 \Rightarrow 6 \\ n = 7 \Rightarrow 6 \\ \vdots \\ n = 10 \Rightarrow 6 \\ n = 11 \Rightarrow 5 \\ n = 12 \Rightarrow 4 \\ n = 13 \Rightarrow 3 \\ n = 14 \Rightarrow 2 \\ n = 15 \Rightarrow 1 \\ n \geq 16 \Rightarrow 0 \end{cases}$$

5) MATLAB codes in rar

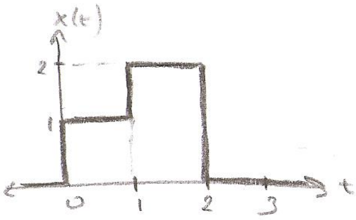
BONUS:

Bonus:

$h(t) = u(t-1) - u(t-4)$



$x(t) = u(t) + u(t-1) - 2u(t-2)$



$$
y(t) = \begin{cases} 0 & , t < 0 \\ t & , 0 < t \leq 1 \\ 1 + 2(t-1) & , 1 < t \leq 2 \\ 3 & , 2 < t \leq 3 \\ 2 + (4-t) & 3 < t \leq 4 \\ 2.(5-t) & 4 < t \leq 5 \\ 0 & t > 5 \end{cases}
$$