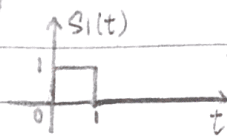


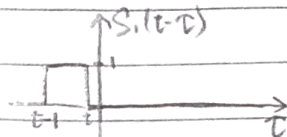
Prelab 4 *Dynghita Li*

Q1. $s(t)$:

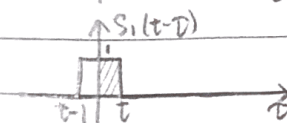


$$y(t) = s_1(t) * s_1(t) = [r(t) - r(t-2)] u(t)$$

option A

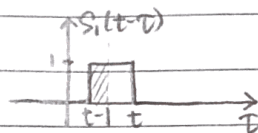


$t < 0$, no overlap, $y_1(t) = 0$



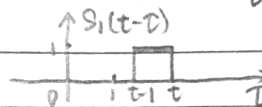
$t > 0, t-1 < 0 \rightarrow 0 < t < 1$

$y_1(t) = t$ for $0 < t < 1$



$t > 1, t-1 < 1 \rightarrow 1 < t < 2$

$y_1(t) = 1 - (t-1) = 2 - t$ for $1 < t < 2$

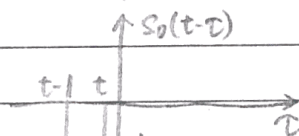
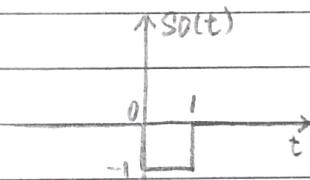


$t-1 > 1 \rightarrow t > 2$

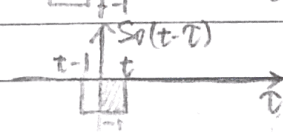
no overlap, $y_1(t) = 0$

$$\therefore y_1(t) = \begin{cases} t, & 0 < t < 1 \\ 2-t, & 1 < t < 2 \\ 0, & \text{o.w.} \end{cases} = u(t)[r(t) - r(t-2)] \rightarrow A$$

critical point: $t=0, t=1, t=2$
peak value = 1, peak time $\rightarrow t=1$
start time: $t=0$ end time $\rightarrow t=2$

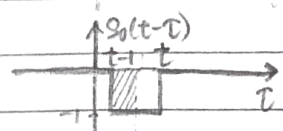


$t < 0$, no overlap, $y_0(t) = 0$



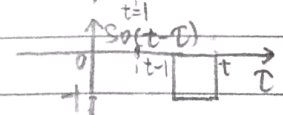
$t-1 < 0, t > 0 \rightarrow 0 < t < 1$

$y_0(t) = -1 \cdot (t-0) = -t$



$t > 1, t-1 < 1 \rightarrow 1 < t < 2$

$y_0(t) = -1 \cdot (1 - (t-1)) = t-2$



$t-1 > 1 \rightarrow t > 2$

$y_0(t) = -1 \cdot 0 = 0$

$$\therefore y_0(t) = \begin{cases} -t, & 0 < t < 1 \\ t-2, & 1 < t < 2 \\ 0, & \text{o.w.} \end{cases} = -y_1(t) \rightarrow B$$

critical points: $t=0, t=1, t=2$

peak value = -1, peak time $t=1$

start time: $t=0$ end time: $t=2$

Q2: if (y1_corr > y0_corr):
 s = 1

else:

 s = 0

Q3: def decode(r, fs, s0, s1):

 y1 = np.convolve(r, s1) / fs

 y0 = np.convolve(r, s0) / fs

 y1_corr = y1[len(y1)/2]

 y0_corr = y0[len(y0)/2]

 if (y1_corr > y0_corr):

 return 1

 else:

 return 0