

PRO7

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a) Se tienen las siguientes señales en tiempo discreto

$$f[n] = e^{-n} u[n] ; g[n] = 2^{-n} u[n]$$

a) Realice la correlación $r_{gf}[n]$ de las señales utilizando tablas de convolución

b) Realice la correlación $r_{gf}[n]$ sin utilizar tablas de convolución

a) utilizando tablas.

$$r_{gf}[n] = g[n] * f[-n] \rightarrow f[-n] = w[n]$$

$$\Rightarrow g[n] * w[n] = \sum_{m=-\infty}^{\infty} g[m] w[n-m]$$

$$g[n] = (2^{-1})^n u[n] = \sigma_1^n u[n]$$

$$w[n] = f[-n] = e^n u[-n] = \sigma_2^n u[-n]$$

usando tablas

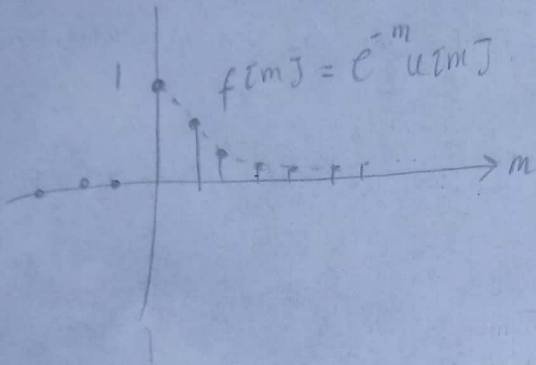
$$\sigma_1^n u[n] * \sigma_2^n u[-n] = \frac{\sigma_1}{\sigma_2 - \sigma_1} \sigma_1^n u[n] + \frac{\sigma_2}{\sigma_2 - \sigma_1} \sigma_2^n u[-n]$$

$$= \frac{z^{-1}}{e - z^{-1}} z^{-n} u[n] + \frac{e}{e - z^{-1}} e^n u[-n]$$

$$b) r_{gf}[n] = \sum_{m=-\infty}^{\infty} g[n+m] f[m]$$

$$g[n] = z^{-n} u[n]$$

$$f[n] = e^{-n} u[n]$$

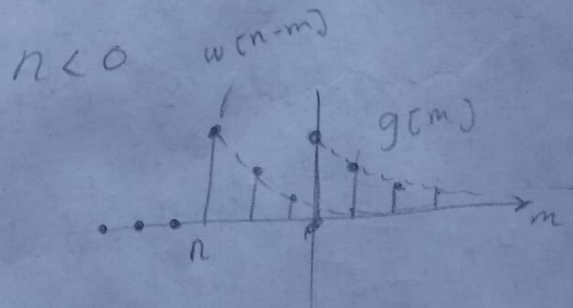
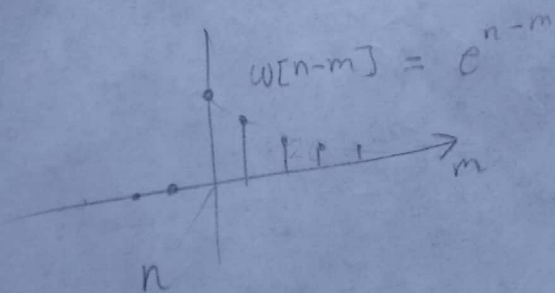
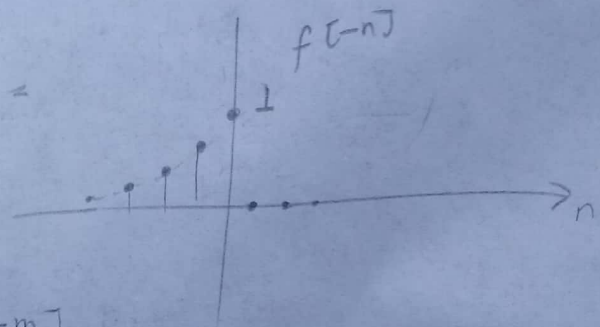


$$r_{gf}[n] = g[n] * f[-n] \quad f[-n] = w[n]$$

$$\rightarrow g[n] * w[n]$$

$$e^n$$

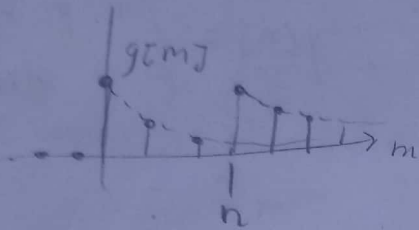
$$g[n] * w[n] = \sum_{m=-\infty}^{\infty} g[m] w[n-m]$$



$$\sum_{m=0}^n z^m e^{n-m} = e^n \sum_{m=0}^n \left(\frac{1}{ze}\right)^m = e^n \frac{1 - \left(\frac{1}{ze}\right)^{n+1}}{1 - \frac{1}{ze}}$$

$$r_{gf}[n] = \frac{ze^{n+1} u[-n]}{ze - 1} \quad \text{para } n < 0$$

para $n > 0$



$$\Rightarrow \sum_{m=n}^{\infty} z^{-m} e^{n-m} = e^n \sum_{m=n}^{\infty} (ze)^{-m}$$

$$\left| \frac{1}{ze} \right| < 1$$

$$\frac{e^n \left(\frac{1}{ze} \right)^n}{1 - \frac{1}{ze}} = \frac{e^n z^{-n} e^{-n}}{1 - \frac{1}{ze}}$$

$$r_{g_f}[n] = \frac{(e z)^{-n+1}}{ze-1} \quad \text{para } n > 0$$

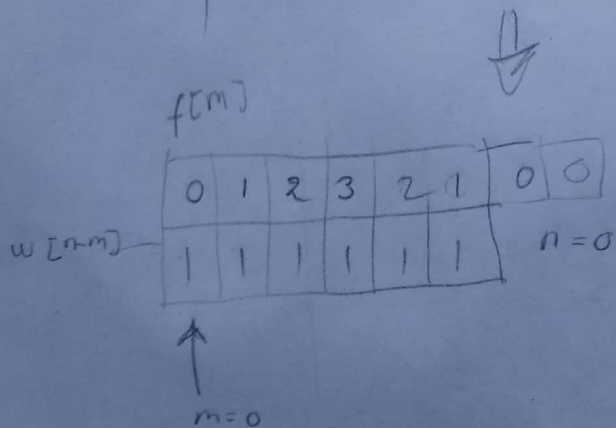
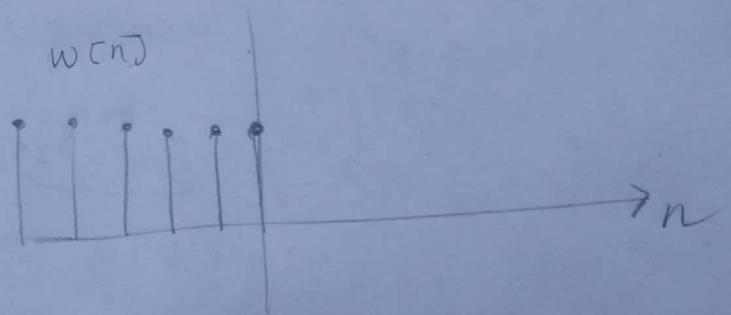
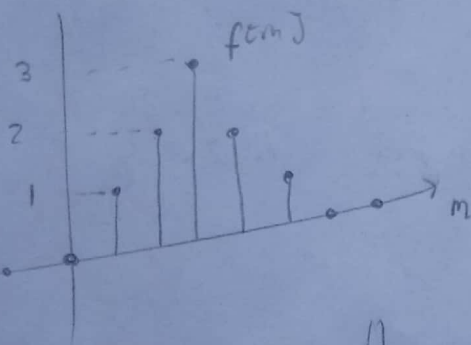
$$r_{g_f}[n] = \begin{cases} \frac{ze^{n+1}}{ze-1} & n < 0 \\ \frac{ze^{-n+1}}{ze-1} & n > 0 \end{cases}$$

b) $r_{fg}[n] = ?$

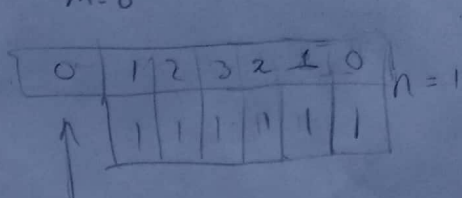
$$f[n] = \begin{cases} n & \text{si } n \in \{1, 2, 3\} \\ -n+6 & \text{si } n \in \{4, 5, 6\} \\ 0 & \text{otro caso} \end{cases} ; g[n] = \begin{cases} 1 & \text{si } 0 \leq n \leq 5 \\ 0 & \text{otro caso} \end{cases}$$

$$r_{fg}[n] = f[n] * g[-n] \Rightarrow w[n] = g[-n]$$

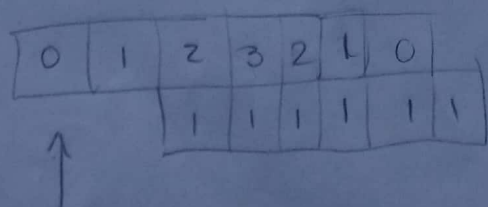
$$r_{fg}[n] = f[n] * w[n] = \sum_{m=-\infty}^{\infty} f[m] w[n-m]$$



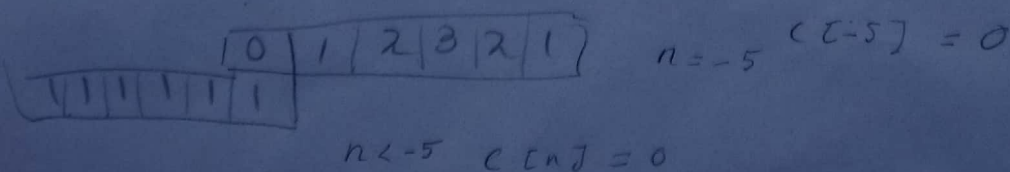
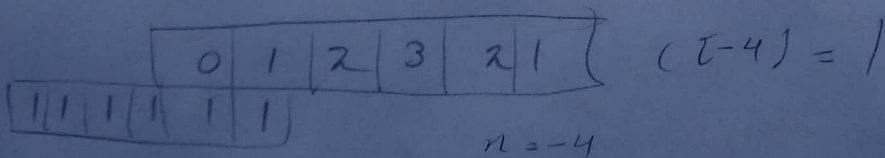
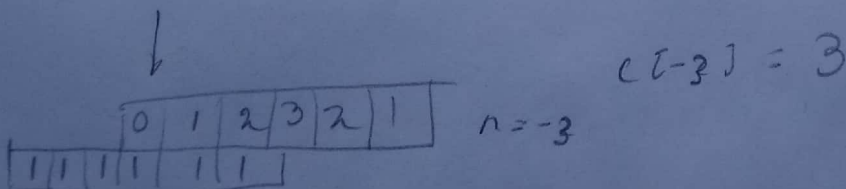
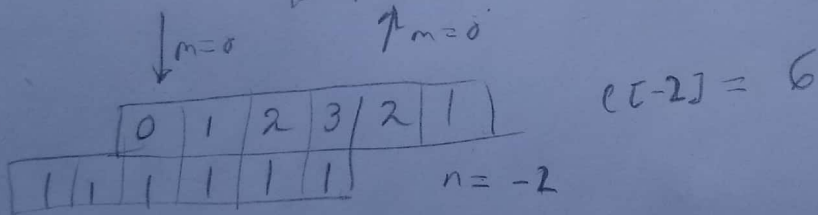
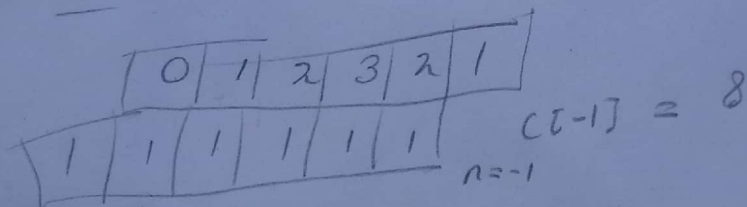
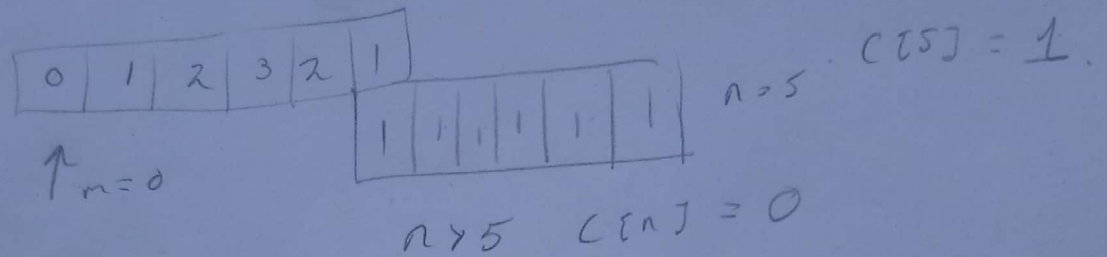
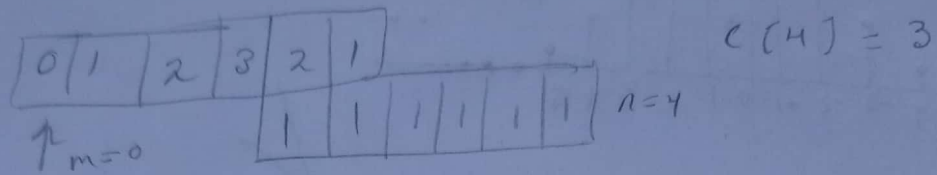
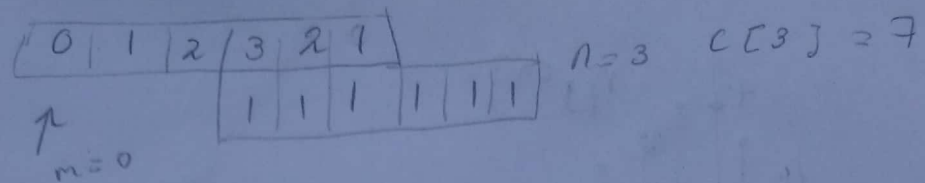
$$c[0] = 0$$



$$c[1] = 1$$



$$c[2] = 2$$



$$\Rightarrow x_{fg}[n] = \{ \dots, 0, 1, 3, 6, 8, 9, 9, 8, 9, 3, 1, 0, \dots \}$$

$$\uparrow$$
 $n=0$

