

Es. 3

maleri 1000
sani 1000

	P	M
m	VP	FN
s	FP	VM

$$FN = 50 \Rightarrow VP = 950$$

$$FP = 5 \Rightarrow VM = 995$$

$$\text{Sensibilita} = \frac{VP}{VP+FN} = \frac{950}{1000} = 95\%$$

$$\text{Spec} = \frac{VM}{FP+VM} = \frac{995}{1000} = 99,5\%$$

$$P_{m, tp} = \frac{\text{sens} * \text{prev}}{[\text{sens} * \text{prev} + (1 - \text{prev}) * (1 - \text{spec})]} = \frac{0,95 * 0,1}{0,1 * 0,95 + 0,9 * 0,005} = \frac{0,095}{0,095 + 0,0045}$$

$$= \frac{0,095}{0,0995} = 0,95477$$

Es. 4

$$p = 0,02$$

$$n = 30$$

$$a) k=5 \quad P_{30}(5) = \binom{5}{30} p^5 q^{30-5} = \binom{5}{30} 0,02^5 0,98^{25} = \frac{5!}{30! 25!} 0,02^5 0,98^{25}$$

$$b) P = P_{30}(5) + P_{30}(6) + P_{30}(7) + P_{30}(8) + P_{30}(9) + P_{30}(10) =$$

$$\binom{5}{30} 0,02^5 0,98^{25} + \binom{6}{30} 0,02^6 0,98^{24} + \binom{7}{30} 0,02^7 0,98^{23} + \binom{8}{30} 0,02^8 0,98^{22} +$$

$$+ \binom{9}{30} 0,02^9 0,98^{21} + \binom{10}{30} 0,02^{10} 0,98^{20}$$

ES5 $S_n = \frac{\cos \frac{\pi n}{2}}{n^2} + j \frac{\sin \frac{\pi n}{2}}{2n} \quad S_0 = 0$

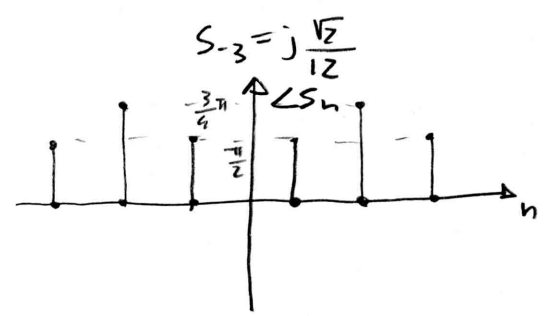
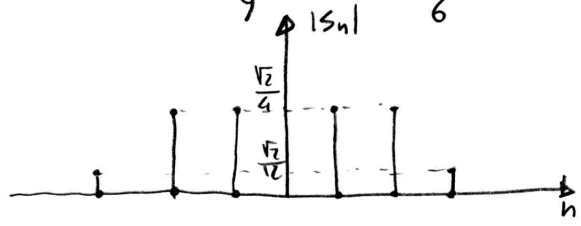
- $S_{-n} = \frac{\cos(-\frac{\pi n}{2})}{(-n)^2} + j \frac{\sin(-\frac{\pi n}{2})}{-2n} = \frac{\cos \frac{\pi n}{2}}{n^2} + j \frac{\sin \frac{\pi n}{2}}{2n} \neq S_n^* \quad \text{non è reale}$

- $S_{-n} = S_n \Rightarrow$ pari

$n=1 \quad S_1 = \frac{\cos \frac{\pi}{2}}{1} + j \frac{\sin \frac{\pi}{2}}{2} = j \frac{\sqrt{2}}{4} \quad S_{-1} = j \frac{\sqrt{2}}{4}$

$n=2 \quad S_2 = \frac{\cos \pi}{4} + j \frac{\sin \pi}{4} = -\frac{1}{4} + j \frac{1}{4} = \frac{\sqrt{2}}{4} e^{j \frac{3\pi}{4}} \quad S_{-2} = \frac{\sqrt{2}}{4} e^{j \frac{3\pi}{4}}$

$n=3 \quad S_3 = \frac{\cos \frac{3\pi}{2}}{9} + j \frac{\sin \frac{3\pi}{2}}{6} = j \frac{\sqrt{2}}{12}$

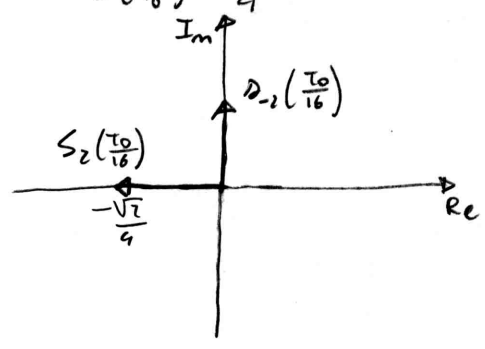


$D_2(t) = \frac{\sqrt{2}}{4} e^{j \frac{3\pi}{4}} e^{j 4\pi \frac{t}{T_0}}$

$D_2(\frac{T_0}{16}) = \frac{\sqrt{2}}{4} e^{j \frac{3\pi}{4}} e^{j \frac{\pi}{4}} = \frac{\sqrt{2}}{4} e^{j \pi} = -\frac{\sqrt{2}}{4}$

$D_{-2}(t) = \frac{\sqrt{2}}{4} e^{j \frac{3\pi}{4}} e^{-j 4\pi \frac{t}{T_0}}$

$D_{-2}(\frac{T_0}{16}) = \frac{\sqrt{2}}{4} e^{j \frac{3\pi}{4}} e^{-j \frac{\pi}{4}} = \frac{\sqrt{2}}{4} e^{j \frac{\pi}{2}} = j \frac{\sqrt{2}}{4}$



ES7

Passa Basso

$$f_c \gg 2f_{max} = 18 \text{ KHz}$$

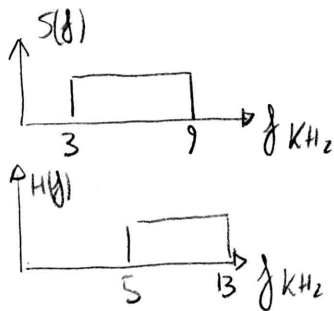
Passa Banda

$$B = (9-3) \text{ KHz} = 6 \text{ KHz}$$

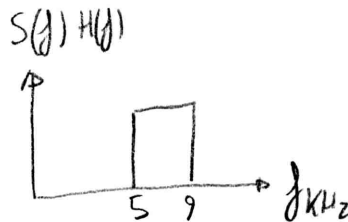
$$\frac{f_{max}}{B} = \frac{9 \text{ KHz}}{6 \text{ KHz}} = 1,5 \Rightarrow m=1 \quad f_c = \frac{2f_{max}}{m} = 18 \text{ KHz}$$

Segnale filtrato tra 5 e 13 KHz

mostriamo l'occupazione di Banda del segnale in ingresso, del filtro e del segnale in uscita



\Rightarrow



Passa Basso

$$f_c \gg 18 \text{ KHz}$$

Passa Banda

$$B = (9-5) \text{ KHz} = 4 \text{ KHz}$$

$$\frac{f_{max}}{B} = \frac{9 \text{ KHz}}{4 \text{ KHz}} = 2,5$$

$$f_c = \frac{2f_{max}}{m} = 9 \text{ KHz}$$

troviamo f_L minima come richiesto nell'ultimo punto

$$B = (9 - f_L) \text{ KHz}$$

$$m = \frac{f_{max}}{B} = \frac{9}{9 - f_L}$$

la f_L minima che fornisce $m=2$

$$\bar{e} \quad 9 - f_L = \frac{9}{m} \Rightarrow f_L = 9 - \frac{9}{2} = 4,5 \text{ KHz}$$