

5.

$$S_n = \frac{1 - e^{-j\frac{\pi n}{2}}}{n^2} = \frac{1 - \cos\frac{\pi n}{2} + j\sin\frac{\pi n}{2}}{n^2}$$

$$S_{-n} = \frac{1 - \cos\frac{\pi n}{2} - j\sin\frac{\pi n}{2}}{n^2}$$

a)  $S_n = S_{-n}^* \Rightarrow s(t)$  reale

b)  $S_n \neq S_{-n} \Rightarrow$  no pari  $S_n \neq -S_{-n} \Rightarrow$  no dispari  $\Rightarrow$  Non presenta simmetrie

c)  $S_1 = 1 + j = \sqrt{2} e^{j\frac{\pi}{4}}$

$S_{-1} = 1 - j = \sqrt{2} e^{-j\frac{\pi}{4}}$

$S_2 = \frac{1}{2}$

$S_{-2} = \frac{1}{2}$

$S_3 = \frac{1}{9} - j\frac{1}{9}$

$S_{-3} = \frac{1}{9} + j\frac{1}{9}$

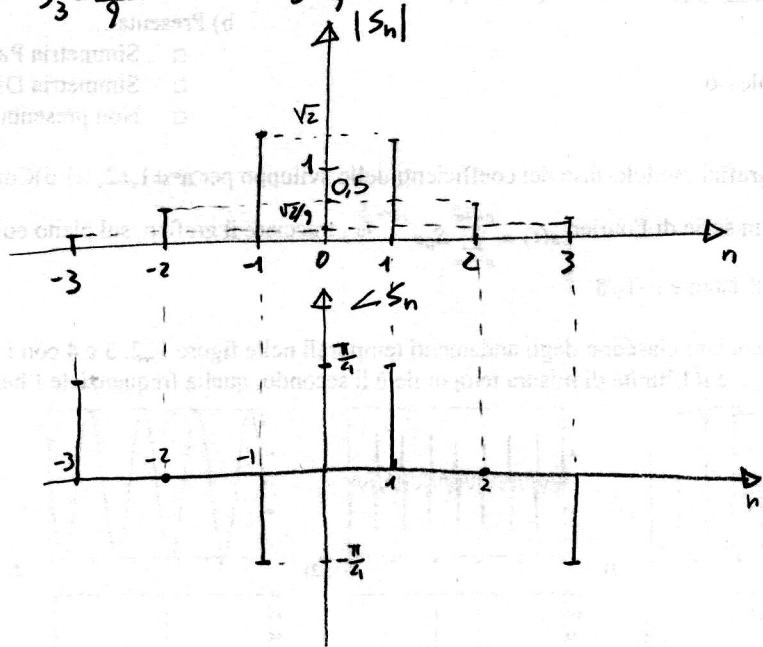
$|S_3| = \frac{\sqrt{2}}{9}$

$\angle S_3 = -\frac{\pi}{4}$

$\angle S_{-3} = \frac{\pi}{4}$

$S_3 = \frac{\sqrt{2}}{9} e^{-j\frac{\pi}{4}}$

$S_{-3} = \frac{\sqrt{2}}{9} e^{j\frac{\pi}{4}}$

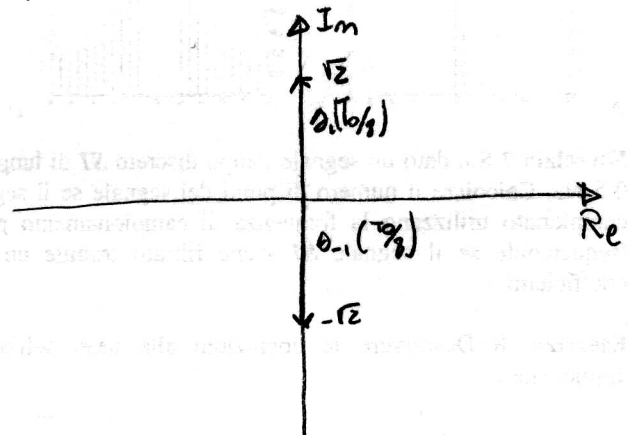


d)  $\vartheta_1(t) = S_1 e^{j2\pi t/T_0}$

$\vartheta_{-1}(t) = S_{-1} e^{-j2\pi t/T_0}$

$\vartheta_1(\frac{T_0}{8}) = \sqrt{2} e^{j\frac{\pi}{4}} e^{j\frac{\pi}{4}} = \sqrt{2} e^{j\frac{\pi}{2}} = j\sqrt{2}$

$\vartheta_{-1}(\frac{T_0}{8}) = \sqrt{2} e^{-j\frac{\pi}{4}} e^{-j\frac{\pi}{4}} = \sqrt{2} e^{-j\frac{\pi}{2}} = -j\sqrt{2}$



7.

lunghezza temporale  $S_1$   $T = 2$  s.  $\Delta f = 0,5 \text{ Hz} \Rightarrow \frac{1}{T} = \Delta f = 0,5 \text{ Hz}$   $T = 2$  s

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

$S_1 \xrightarrow{\text{h[un]}} S_{1 \text{ out}}$ 
Num Punti  $S_1 = T \cdot f_c = 2 \text{ s} \cdot 9 \text{ KHz} = 18'000$   
h[un] lunga 500 punti.

$$\text{Num punti out} = 18'000 + 500 - 1$$

$$T_{\text{out}} = 18'499 \cdot \frac{1}{f_c} \Rightarrow \Delta f_{\text{out}} = \frac{f_c}{18'499}$$

4. num. colori = 7

$$1) D_{7,6} = \frac{7!}{1!} = 7!$$

$$2) 7 \times D_{6,3}^{(1)} = 7 \cdot 6^3$$

$$3) p = 0,8$$

$$P_{10}(7) = \binom{10}{7} 0,8^7 0,2^3 = \frac{10!}{7! 3!} 0,8^7 0,2^3 \approx 0,2$$