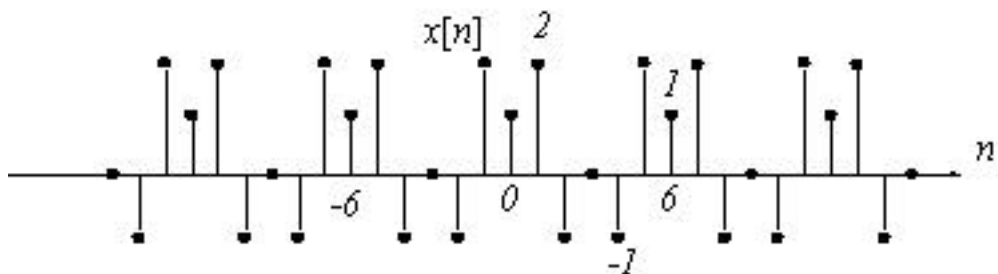
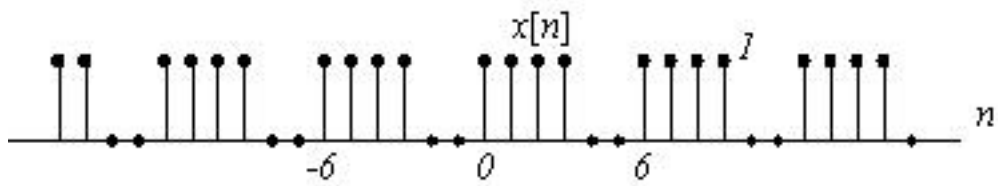
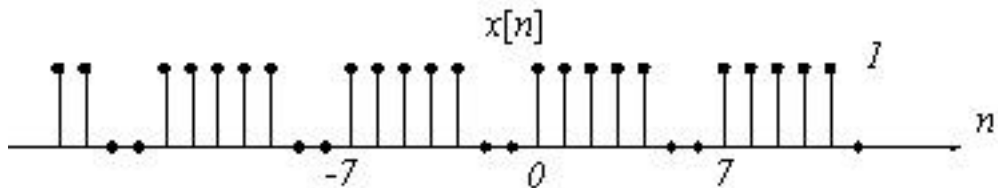


**Esercizi sulla serie e sulla trasformata di Fourier
(tempo discreto)**

1. Determinare lo sviluppo in serie di Fourier dei seguenti segnali periodici:

<p>a) $x[n] = \sin \left[\frac{\pi(n-1)}{4} \right]$</p> <p>b) $x[n] = \cos \left(\frac{2\pi n}{3} \right) + \sin \left(\frac{2\pi n}{7} \right)$</p> <p>c) $x[n]$ periodico di periodo 6 e $x[n] = \left(\frac{1}{2} \right)^n$ per $-2 \leq n \leq 3$</p> <p>d) $x[n] = \sin \left(\frac{2\pi n}{3} \right) \cos \left(\frac{\pi n}{2} \right)$</p> <p>e) $x[n]$ periodico di periodo 4 e $x[n] = 1 - \sin \left(\frac{\pi n}{4} \right)$ per $0 \leq n \leq 3$</p>	<p>f) $x[n]$ periodico di periodo 12 e $x[n] = 1 - \sin \left(\frac{\pi n}{4} \right)$ per $0 \leq n \leq 11$</p> <p>g) $x[n]$ come in figura 1.a</p> <p>h) $x[n]$ come in figura 1.b</p> <p>i) $x[n]$ come in figura 1.c</p> <p>j) $x[n]$ come in figura 1.d</p> <p>k) $x[n]$ come in figura 1.e</p>
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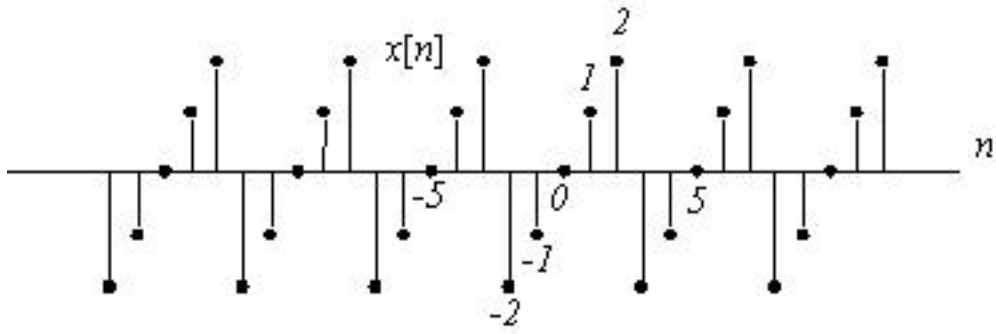


Fig. 1.d

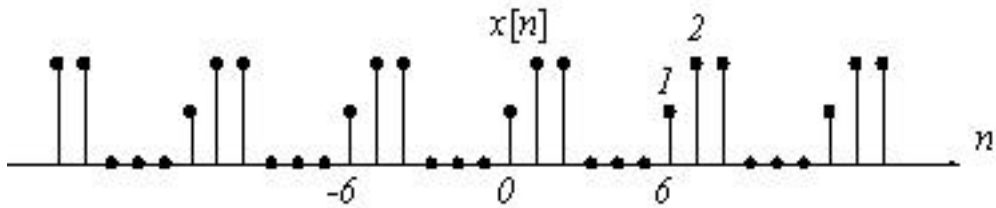


Fig. 1.e

2. Calcolare la trasformata di Fourier dei seguenti segnali:

<p>a) $x[n]$ come in figura 2.a</p> <p>b) $2^n u[-n]$</p> <p>c) $\left(\frac{1}{4}\right)^n u[n+2]$</p> <p>d) $a^n \sin(\mathbf{W}_0 n) u[n] \quad a < 1$</p> <p>e) $a^{ n } \sin(\mathbf{W}_0 n) \quad a < 1$</p> <p>f) $\left(\frac{1}{2}\right)^n \{u[n+3] - u[n-2]\}$</p>	<p>g) $\sum_{k=-\infty}^{+\infty} \left(\frac{1}{4}\right)^n \mathbf{d}[n-3k]$</p> <p>h) $x[n]$ come in figura 2.b</p> <p>i) $\mathbf{d}[4-2n]$</p> <p>j) $x[n] = \begin{cases} \cos(\mathbf{p}n/3) & -4 \leq n \leq 4 \\ 0 & \text{altrove} \end{cases}$</p> <p>k) $n \left(\frac{1}{2}\right)^{ n }$</p>
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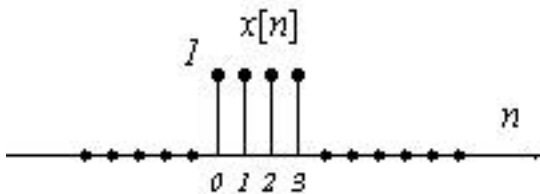


Fig. 2.a

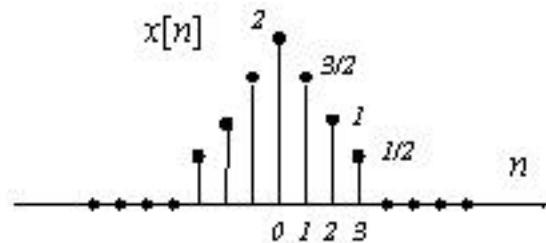


Fig. 2.b

3. Nell'elenco che segue sono riportate le trasformate di Fourier di segnali tempo discreto. Individuare i corrispondenti segnali $x[n]$.

a)
$$X(e^{j\mathbf{W}}) = \begin{cases} 0 & 0 \leq |\mathbf{W}| \leq \mathbf{W} \\ 1 & \mathbf{W} < |\mathbf{W}| \leq \mathbf{p} \end{cases}$$

e periodica di periodo $2\mathbf{p}$

b)
$$X(e^{j\mathbf{W}}) = 1 - 2e^{-j3\mathbf{W}} + 4e^{j2\mathbf{W}} + 3e^{-j6\mathbf{W}}$$

c)
$$X(e^{j\mathbf{W}}) = \sum_{k=-\infty}^{+\infty} (-1)^k d\left(\mathbf{W} - \frac{k\mathbf{p}}{2}\right)$$

d)
$$X(e^{j\mathbf{W}}) = \cos^2 \mathbf{W}$$

e)
$$X(e^{j\mathbf{W}}) = \cos\left(\frac{\mathbf{W}}{2}\right) + j \sin \mathbf{W} \quad \text{per } -\mathbf{p} \leq \mathbf{W} \leq \mathbf{p}$$

f) $X(e^{j\mathbf{W}})$ come in figura 3.a

g) $X(e^{j\mathbf{W}})$ come in figura 3.b

h)
$$|X(e^{j\mathbf{W}})| = \begin{cases} 0 & \text{per } 0 \leq |\mathbf{W}| \leq \mathbf{p}/3 \\ 1 & \text{per } \mathbf{p}/3 < |\mathbf{W}| \leq 2\mathbf{p}/3 \\ 0 & \text{per } 2\mathbf{p}/3 < |\mathbf{W}| \leq \mathbf{p} \end{cases} \quad \text{e } \angle X(e^{j\mathbf{W}}) = 2\mathbf{W}$$

i)
$$X(e^{j\mathbf{W}}) = \frac{e^{-j\mathbf{W}}}{1 + \frac{1}{6}e^{-j\mathbf{W}} - \frac{1}{6}e^{-j2\mathbf{W}}}$$

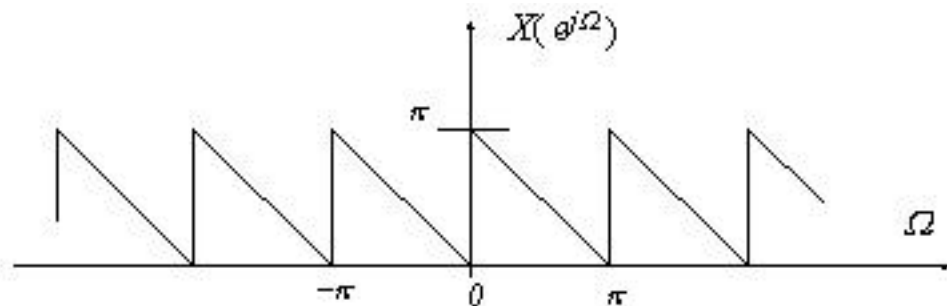


Fig. 3.a

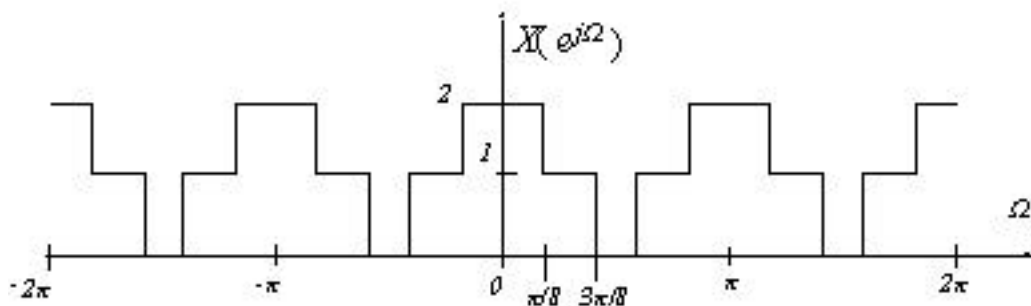


Fig. 3.b