DSP Assignment 1

21/01/21

Q.1. Two discrete time systems *T1* and *T2* are cascaded to form a new system *T*.

$$T = T_1 T_2$$
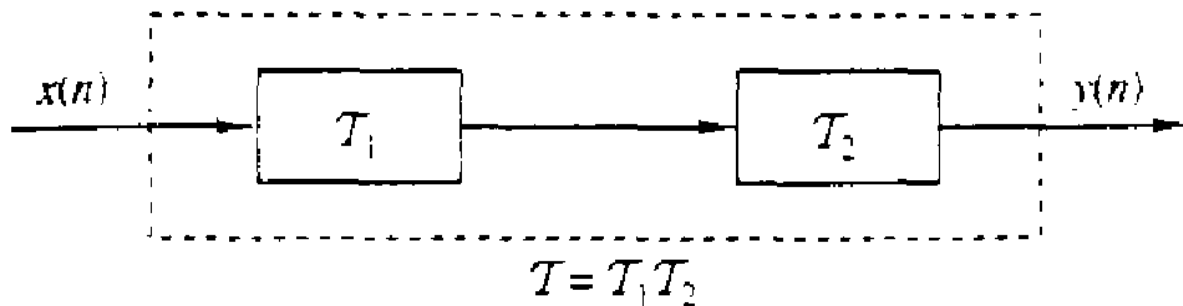
If *T1* and *T2* are non-linear, then *T* is non-linear (True/False). Prove it?

Q.2. Show that the energy of a real-valued energy signal is equal to the sum of energies of its even and odd components.

Q.3. Show that average power of a real valued sequence x[n] is given by the sum of the average powers of the even and odd parts of x[n] respectively.

Q.4. A discrete time signal g[n] is given by g[n] = u[n+3] - u[n-5].

    a.   What is the energy of the signal g[n]?

    b.   What is the power of the signal g[2n]?

Q.5. Find out the convolution: **u[n+3]*u[n-3]**.

Q.6. The impulse response of a discrete LTI system is given by h(n) = $(0.5)n\ u(n)$ the input of which is $x(n) = 2\delta(n)+\delta(n-3)$. Find the output at $n = 1$ and $n = 4$.

Q.7. Consider a discrete-time system:

$$y[n] = \prod_{k=-\infty}^{n} e^{x[k]}$$

Is this a linear or a non-linear system?

Q.8. Let **g[n] = x1[n] * x2[n] * x3[n] and h[n] = x1[n-N1] * x2[n-N2] * x3[n-N3].** Express **h[n]** in terms of **g[n].** (Note * indicates convolution operation)

Q.9 Consider the following signal:

$$x(t) = u(t-1) + r(t-1) - r(t+1) + u(t+1); \quad -1 \le t \le 2$$

Sketch $x(t - kT)$, where T=3 and $k \in (-\infty, \infty)$.

Q.10. Find whether the following systems are causal:-

a. $y[n] = x[n] - x[n+1]$

b. $y[n] = x[-n]$