TEL 311E – Homework 1

Due 11.10.2010

1. Consider the system given by,

$$y(n) = \sum_{k=-\infty}^{\infty} h(n-k)\, x^2(k),$$

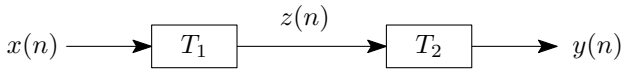
where $x(n)$ is the input and $y(n)$ is the output. Assume that $h(n) = 0$ for $n < 0$ and $n > 50$. Specify whether the system is
(a) Memoriless, (b) Linear, (c) Time-invariant, (d) Causal, (e) Stable.
Please explain your answers. If information is insufficient, write 'insufficient information' (and explain why you think so).

2. Repeat the first question for the system given by

$$y(n) = \sum_{k=-\infty}^{\infty} h^2(n+k)\, x(k),$$

where $x(n)$ is the input and $y(n)$ is the output (notice the sign change in 'k' in argument of 'h'). Assume now that $h(n) = 0$ for $n > 0$.

3. Consider a cascade of two LTI systems as shown below.



We mentioned without proof that the overall system is also LTI. Here you will show it in two steps. You can make use of the intermediate signal $z(n)$ if you like.

(a) Assuming T_1 and T_2 are time-invariant, show that the overall system is time-invariant.

(b) Assuming T_1 and T_2 are linear, show that the overall system is linear.