Digital Signal Processing - SS15
Theory Tutorial 2

Linear Systems

PROBLEM ONE Determine the properties of the following systems in respect of:
(1) stability, (2) causality, (3) linearity and (4) time invariance. Justify your answers.

(a) $T\{x[n]\} = \sum_{k=n_0}^{n} x[k]$

(b) $T\{x[n]\} = \sum_{k=n-n_0}^{n+n_0} x[k]$

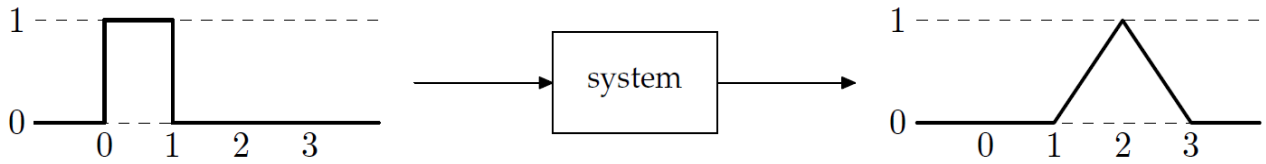
(c) $T\{x[n]\} = x[n-n_0]$

(d) $T\{x[n]\} = \mathrm{e}^{x[n]}$

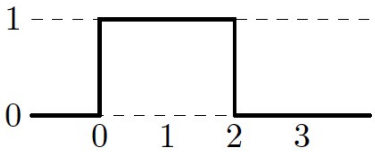
(e) $T\{x[n]\} = ax[n]+b$

(f) $T\{x[n]\} = x[-n]$

PROBLEM TWO A given linear, time-invariant system turns an unit pulse into a triangle:



The system is given the following input signal:



Sketch the output signal.

Keys

P1.

(a) Unstable, non causal, linear, time-varying.

(b) stable, non causal, linear, time-invariant.

(c) stable, causal if $n_0>=0$, otherwise non causal, linear, time-invariant.

(d) stable, causal, non linear, time-invariant.

(e) stable, causal, non linear, time-invariant.

(f) stable, non causal, linear, time-varying.

P2. N.A.