University ☺f P☺rtland
Sch☺☺l ☺f Engineering

EE 262-*S*ignals & *S*ystems-3 cr. hrs.
Spring 2006

Midterm Exam # 2
(Prepared by Professor A. S. Inan)

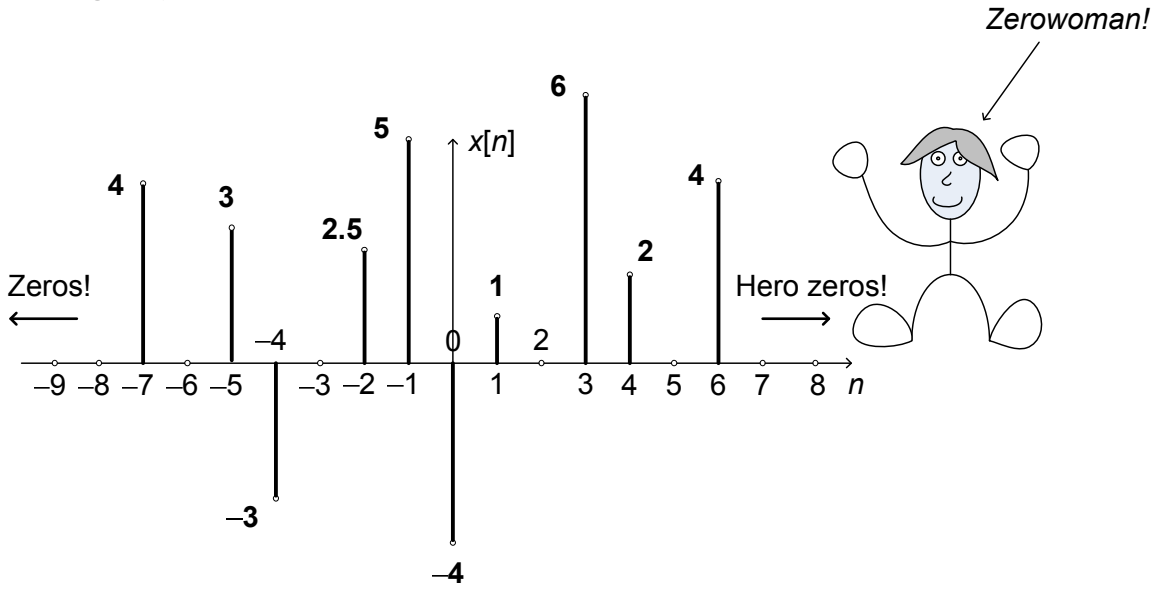
(Friday, March 31, 2006)

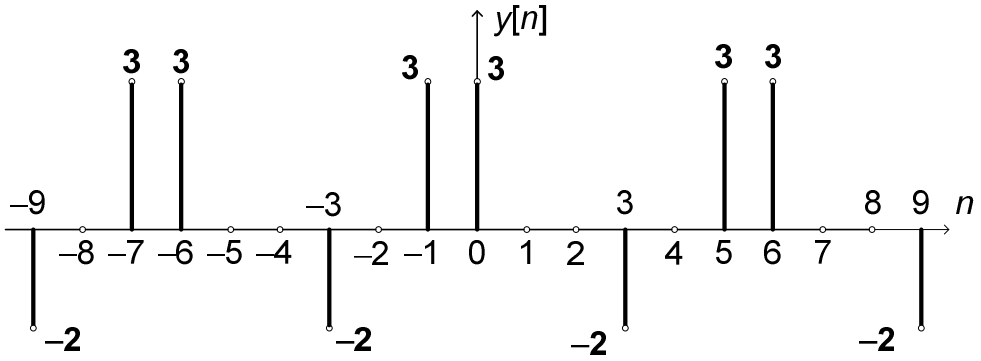
Name:_____☺

Signature:_____☺

> ***"Honesty is the best policy."***
> **Aesop (~ 620B.C. –?)**
>
> ***"An honest mind possesses a kingdom."***
> **Lucius Annaeus Seneca (4B.C.–65A.D.)**
>
> ***"Honest people are the true winners of the universe."***
> **Anonymous**

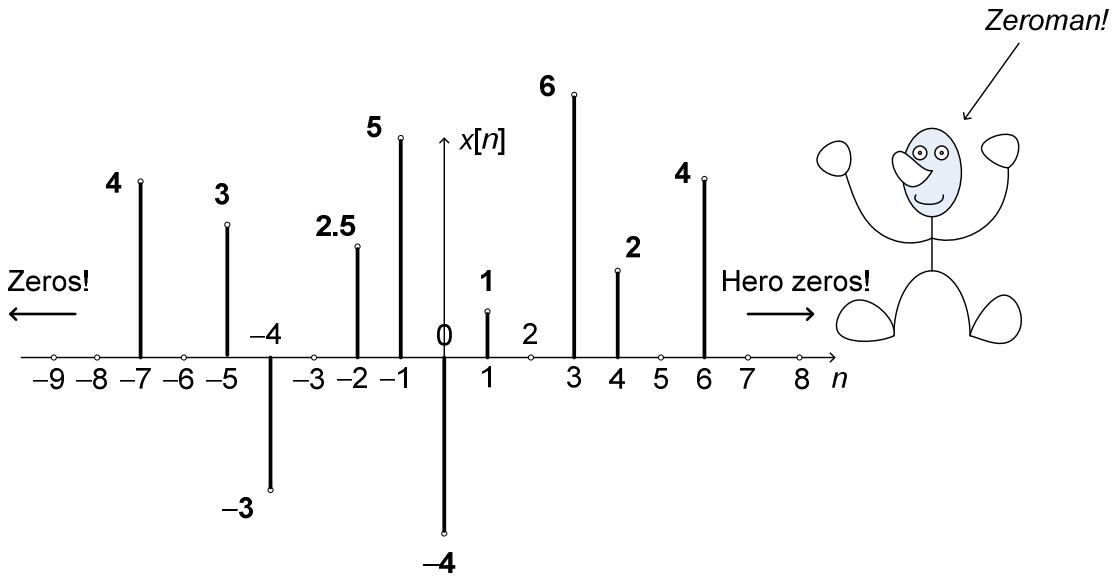
(1) (20 points) **Energy and power of a signal.** Find the energy and power of each of the two discrete-time signals $x[n]$ and $y[n]$ shown and determine which one is energy signal and which one is power signal. (Note that $y[n]$ is a periodic signal.)





(2) (6 points) Using the $y[n]$ signal given on the previous page, is the signal $y[2n]$ periodic? If yes, what is the fundamental period of this signal?

(3) (Total: 30 points) **Time scaling and shifting.** Given the discrete-time signal $x[n]$ as shown, find the following:

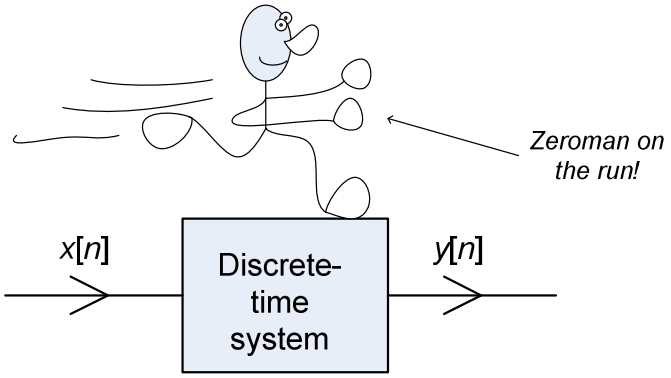


(a) (10 points) Find and sketch the signal $v[n] = x[1-3n]$. (Do the time shifting before the time scaling.)

(b) (10 points) Find and sketch the signal $w[n] = x[2 + 2n]$. (Do the time shifting before the time scaling.)

(c) (10 points) Find and sketch the signal $z[n] = x[1 - 3n]x[2 + 2n]$.

(4) (Total: 24 points) **Discrete-time system.** A discrete-time system with its input-output relationship is given as shown.



$y[n]=3x[2n]$

(a) (4 points) Is this system linear? (Provide a clear justification for your answer.)

(b) (4 points) Is this system time-invariant? (Provide a clear justification.)

(c) (4 points) Is this system invertible? (Provide a clear justification.)

(d) (4 points) Is this system memory-less? (Provide a clear justification.)

(e) (4 points) Is this system causal? (Provide a clear justification.)

(f) (4 points) Is this system BIBO stable? (Provide a clear justification.)

(5) (20 points) **An LTID system.** An LTID system is as shown. Its unit impulse response is also given. Find the zero-state response $y_{zs}[n]$ of this system due to an input signal given by

$$x[n] = 3\delta[n+2] - 2\delta[n]$$