New Mexico State University
Klipsch School of Electrical Engineering

EE312 - Signals and Systems I
Spring 2015
Exam #1

Name: _____

Prob. 1	/ 25 points
Prob. 2	/ 25 points
Prob. 3	/ 25 points
Prob. 4	/ 25 points
Total	/ 100 points

Prob. 1

For the following problems, determine if $x(t)$ or $x[n]$ is periodic. Check the appropriate box and fill in other information as required. Please see the footnote at bottom for (c) and (d).

(a) Let $x(t) = e^{j(10\pi t+1/5)}$. Is $x(t)$ periodic?

☐ Yes, it is periodic and the frequency, $\omega_0 =$ _____ (radians/s).

☐ No, it is not periodic.

☐ Maybe: (fill in one of these)

It is periodic if _____ but otherwise it is not periodic.

It is not periodic if _____ but otherwise it is periodic.

(b) Let $x(t) = e^{j(15t+\pi/5)}$. Is $x(t)$ periodic?

☐ Yes, it is periodic and the frequency, $\omega_0 =$ _____ (radians/s).

☐ No, it is not periodic.

☐ Maybe: (fill in one of these)

It is periodic if _____ but otherwise it is not periodic.

It is not periodic if _____ but otherwise it is periodic.

(c) Let $x[n] = e^{j(10\pi+1/5)n}$. Is $x[n]$ periodic?

☐ Yes, it is periodic and the frequency[1], $\omega_0 =$ _____ (radians/sample).

☐ No, it is not periodic.

☐ Maybe: (fill in one of these)

It is periodic if _____ but otherwise it is not periodic.

It is not periodic if _____ but otherwise it is periodic.

(d) Let $x[n] = e^{j(15\pi+\pi/5)n}$. Is $x[n]$ periodic?

☐ Yes, it is periodic and the frequency[1], $\omega_0 =$ _____ (radians/sample).

☐ No, it is not periodic.

☐ Maybe: (fill in one of these)

It is periodic if _____ but otherwise it is not periodic.

It is not periodic if _____ but otherwise it is periodic.

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[1] Use the interval $0 \leq \omega_0 < 2\pi$ as per p. 26 of text.

Prob. 2

For the following systems, circle true or false for whether the property holds. If true, provide a mathematical *proof*; if false, provide a mathematical *proof* or *counter-example*.

(a) Let $y(t) = e^{j2\pi t}x(t)$

The system is linear (True / False). Proof / Counter-example:

The system is time-invariant (True / False). Proof / Counter-example:

(b) Let $y[n] = x[n-1]u[n-1]$

The system is linear (True / False). Proof / Counter-example:

The system is time-invariant (True / False). Proof / Counter-example:

Prob. 2 (cont.)

(c) Let $y[n] = x[n+1] + n + x[n-1]$

The system is linear (True / False). Proof / Counter-example:

The system is time-invariant (True / False). Proof / Counter-example:

Prob. 3

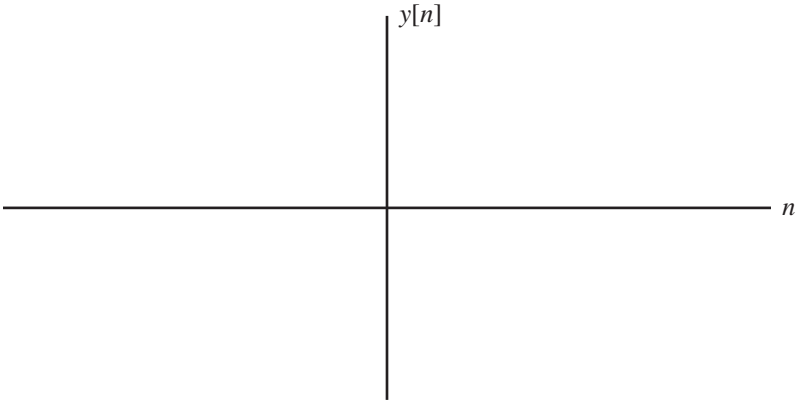
A discrete-time (DT), linear, time-invariant (LTI) system is characterized by the impulse response,

$$h[n] = \left(\frac{1}{2}\right)^n u[n].$$

Let the input signal,

$$x[n] = \begin{cases} 1, & 0 \leq n \leq 1 \\ -1, & 2 \leq n \leq 3 \\ 0, & n < 0 \text{ and } n > 3. \end{cases}$$

Determine the output signal, $y[n] = h[n] * x[n]$ and graph the signal below.



Prob. 4

A continuous-time (CT), LTI system is characterized by the impulse response,

$$h(t) = e^{-t}u(t).$$

Let the input signal,

$$x(t) = \begin{cases} 1, & 0 \leq t < 1 \\ -1, & 1 \leq t < 2 \\ 0, & t < 0 \text{ and } t \geq 2. \end{cases}$$

Determine the output signal, $y(t) = h(t) * x(t)$ and graph the signal below.