22/22

EECS20n, Quiz 1, 2/2/05

The quiz is to provide feedback to you and to me about how well you've followed the material so far. It is primarily testing your familiarity with the notation. The quiz will take 20 minutes. Write your response on the sheet.

Please print your name and lab time here:

Last Name Solution First ______ Lab time ______

1. Answer true or false to each part. Given two distinct sets A and B:

2 F (a)
$$A \cup B \subset A$$

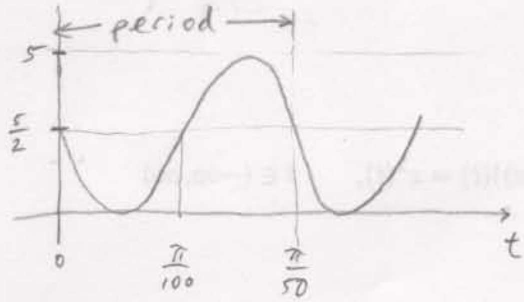
2 T (b)
$$A \cap B \subset A \cup B$$

2 T (c)
If $A \subset B$, then $B^c \subset A^c$.

2 2. Sketch the curve:

$$x(t) = 5\cos^2\left(50t + \frac{\pi}{4}\right), \qquad t \in [0, \infty)$$

and highlight the key features.



Features required:
- period
- amplitude
- start from $\emptyset$.

2 3. Consider the signal space X of all signals y : Naturals $\to$ Reals. Are the following systems $G : X \to X$ well defined? If so, sketch the output corresponding to the input signal y defined by $y(n) = (-1)^n$. (As a comparison please also sketch the input.)

(a)

$$(G(y))(n) = y(\frac{n}{2}) \qquad n \in \text{Naturals}$$

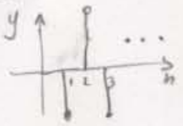
Not well defined

$\frac{n}{2} \notin$ Naturals for odd n

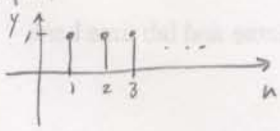
2 (b)

$$(G(y))(n) = y(2n) \qquad n \in \text{Naturals}$$

input



output



* If student includes 0 ∈ Naturals, input and output sequences should start at 0.
- students should not connect points

2 (c)

$$(G(y))(n) = y(n-1) \qquad n \in \text{Naturals}$$

Not well defined

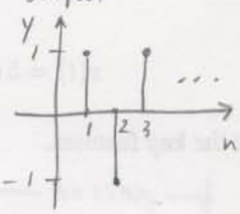
$(n-1) \in$ Naturals for $n=1$ if $0 \notin$ Naturals

2 (d)

$$(G(y))(n) = y(n+1) \qquad n \in \text{Naturals}$$

same input signal as in part (b)

output



4. Is the system G memoryless?

2 Yes (a)

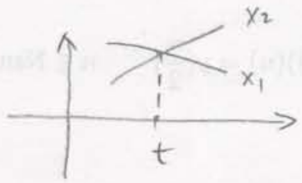
$$(G(x))(t) = x^2(t), \qquad t \in (-\infty, \infty)$$

2 No (b)

$$(G(x))(t) = x(0), \qquad t \in (-\infty, \infty)$$

2 No (c)

$$(G(x))(t) = \frac{dx}{dt}(t), \qquad t \in (-\infty, \infty)$$



x_1 and x_2 are two input signals that intersect at t.

$x_1(t) = x_2(t)$ but

$\dot{x}_1(t) \neq \dot{x}_2(t)$.