Name: _____ RIN: _____

Rensselaer Polytechnic Institute
Department of Electrical, Computer, and Systems Engineering
ECSE 2410: Signal and Systems, Fall 2020

Exam #1. Session 1
October 13, 2020, 10:10-11:30 AM

Show all work for full credit.

- Open book, open notes. Calculators allowed.
- Computers, iPads, and similar devices for viewing notes only.
- No typing or writing on computers, iPads or similar devices.
- Cameras on, mic off. Announcements will be sent through Webex Team chat.
- If any doubt or question, send a PRIVATE message through Webex Team to the instructor or TAs.
- Because there are multiple versions of the exam, each of you only gets partial exam problems. To double check, your exam should contain the following problems. if not correct, please contact the instructor.

  Problems 1, 3, 4, 5, 7, 8
- When in doubt, show more work!

Please write down the following statement

"I have not witnessed any wrongdoing, nor have I personally violated any conditions of the Honor Code, while taking this examination."

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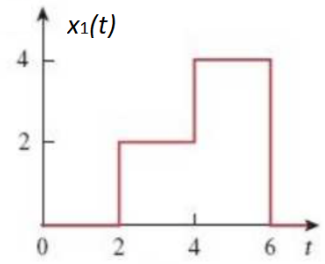
Signature: _____ Date: _____

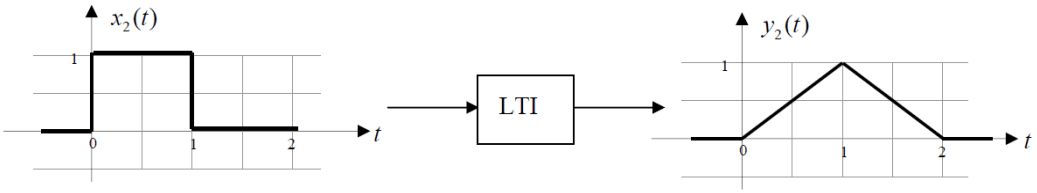
1. (10 points.) Simplify the following $x(t)$ so that x(t) is a **REAL** function of t.

$$x(t) = e^{-t}\left(\frac{e^{(1+j)t}}{1+j} + \frac{e^{(1-j)t}}{1-j}\right)$$

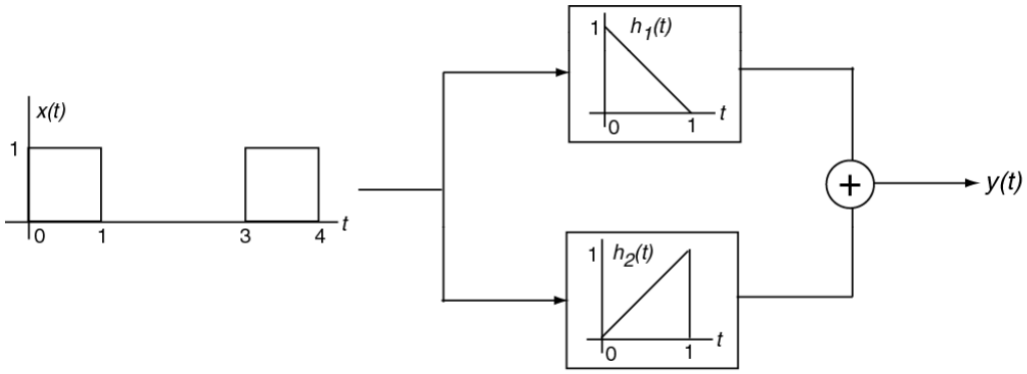
3 (10 points.) $x(t) = \frac{1}{2}r(t-1) - 3\delta(t+3)$, where $r(t)$ is the ramp function and $\delta(t)$ is the Delta function. Determine and sketch $y(t) = \int_{-\infty}^{t} x(\tau)d\tau$.

4 (18 points.) Suppose an LTI system has output $y_1(t)$ when the input signal is $x_1(t)$ is shown below. When the input signal is $x_2(t)$, the system outputs $y_2(t)$. Determine and sketch $y_1(t)$.

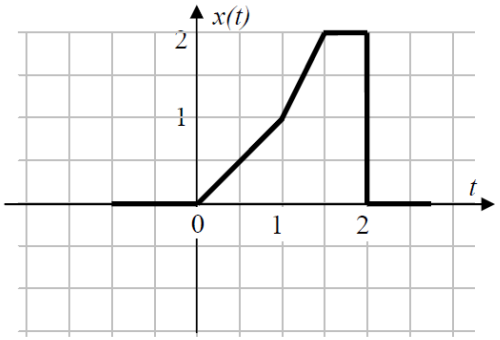




5 (16 points.) Use the distributive property of convolution to compute and sketch $y(t)$.



7 (30 points.) The signal $x(t)$ is shown below.



(a) (8 points.) represent $x(t)$ in a compact form using the unit step function $u(t)$.

(b) (4 points.) Determine the value of $\int_{-\infty}^{3} x(\frac{2}{3}t)\delta(t-1)dt$

Sketch the following signals. No need to write down math expressions.

(c) (6 points.) $x(\frac{t+1}{2})$

(d) (6 points.) The even part of $x(t)$

(e) (6 points.) $\frac{dx(t)}{dt}$

8 (16 points.) The input-output relationship of a system, with input $x(t)$ and output $y(t)$, is characterized by

$$y(t) = x(t+1)\sin(\pi t)$$

(a) (6 points.)Determine weather the system is linear or not.

(b) (6 points.) Determine whether the system is causal or not. Show your work.

(c) (6 points.) Determine whether the system is time-invariant or not. Show your work

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