King Mongkut's University of Technology Thonburi

Midterm Examination 1/2015

CPE 214 Signals and Systems | **Computer Engineering Department**
Date: September 23, 2015 | **Time: 1:00 – 4:00 p.m.**

Instructions:

Violation of examination rules and regulations will not be tolerated.
Serious violator could face dismissal charge.

1. **Only one calculator and one ruler with mathematical formula are allowed** in the examination room.
2. **One Transparent paper** is allowed.
3. **Books, documents, and notes are not allowed** in the examination room.
4. Carefully read the explanation in each problem and then answer each question.
5. **Do not take the examination sheets out** of the examination room.
6. Write your answers on the examination booklet(s).
7. This examination has **4 pages (6 problems, 60 points)**.

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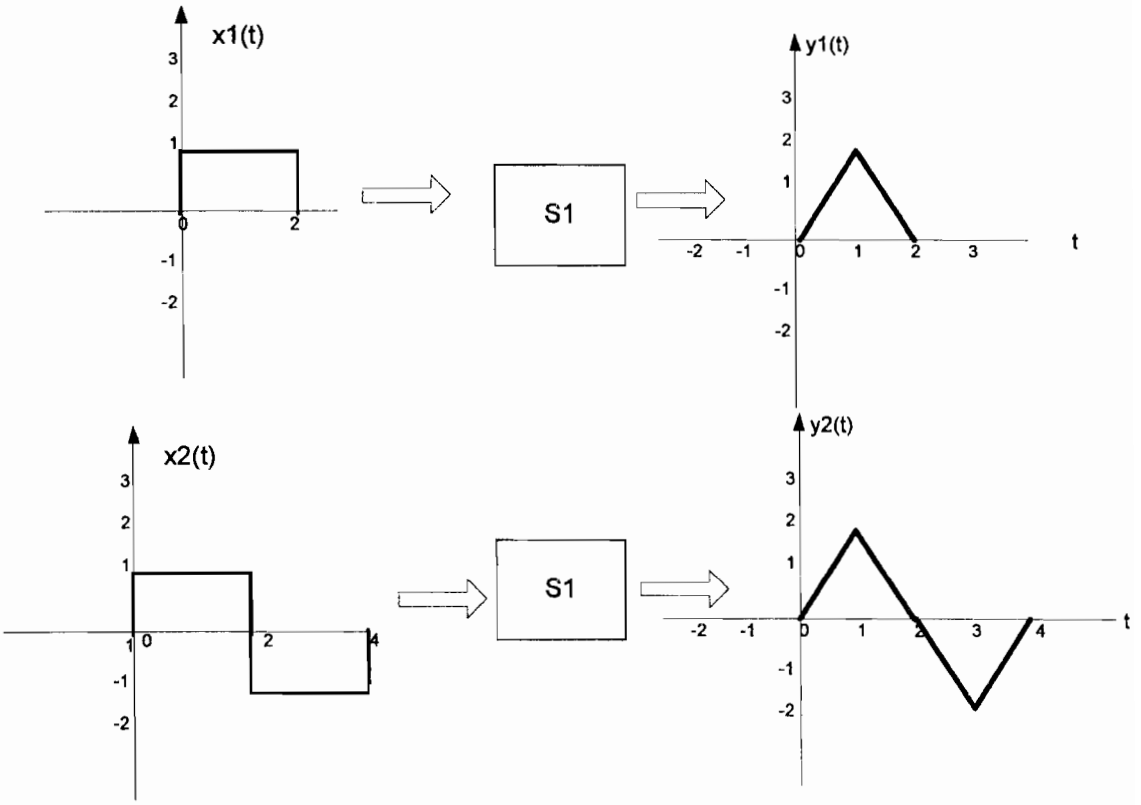
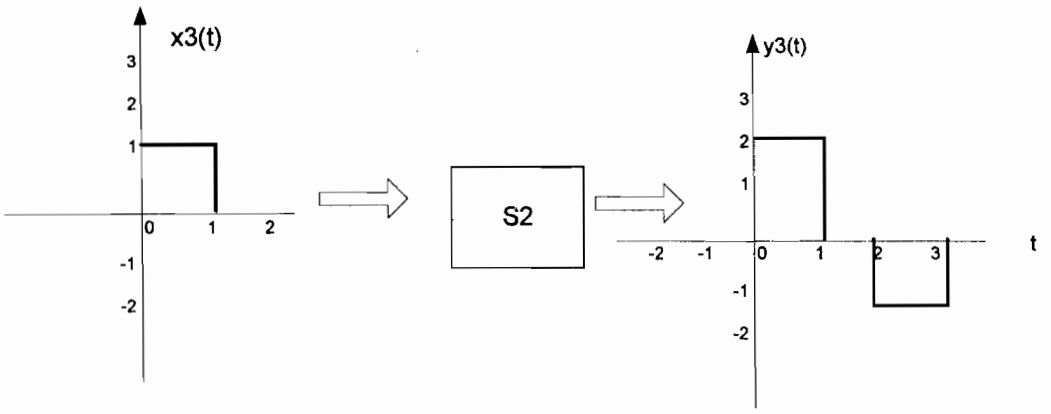
1. Evaluate the following functions: ***(8 points)***
   a) $\sin(\frac{n}{6}\pi)\ \delta[n-2]$ *(2 points)*
   b) $\sum_{n=-\infty}^{\infty}(n-1)n^3\delta[n-4]$ *(2 points)*
   c) $\cos(2\,t)\ \delta(t-\frac{\pi}{4})$ *(2 points)*
   d) $\int_{-\infty}^{\infty} t^2 e^{-t}\delta(t-2)dt$ *(2 points)*

2. Given input-output pairs of the systems as following, determine which properties (causal, memoryless, Time invariant, and stable) hold for each system? Explain with valid reason. ***(12 points)***

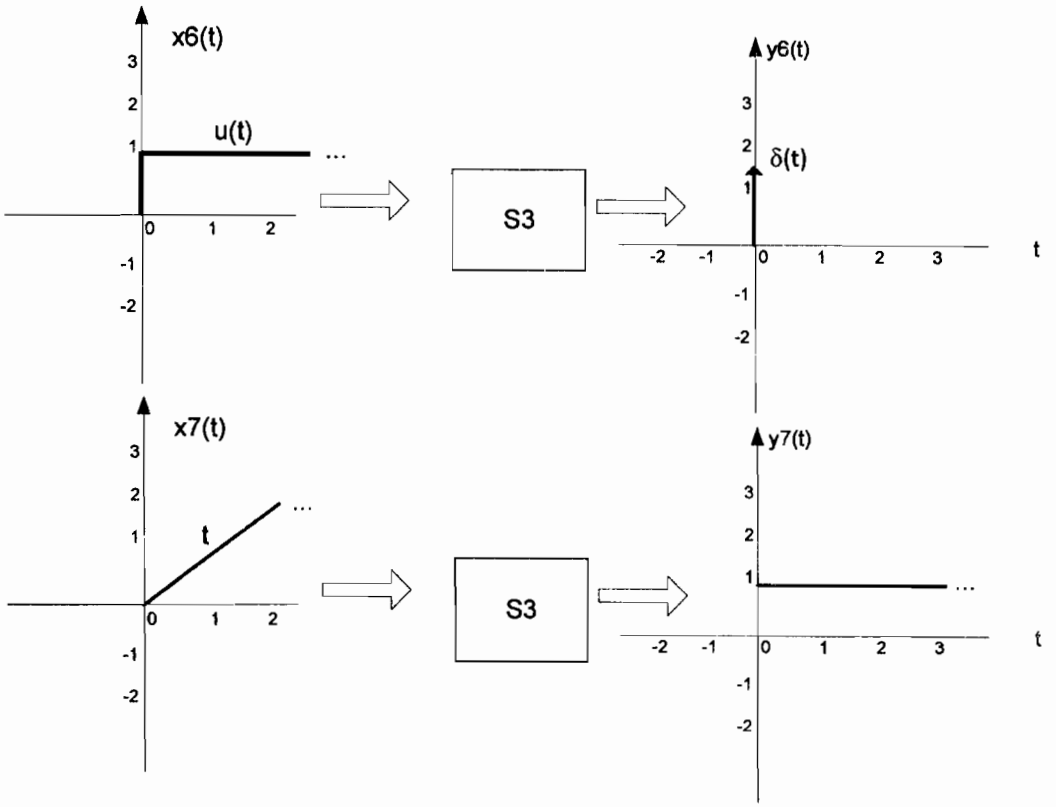
a) *(4 points)*



b) *(4 points)*



c) *(4 points)*

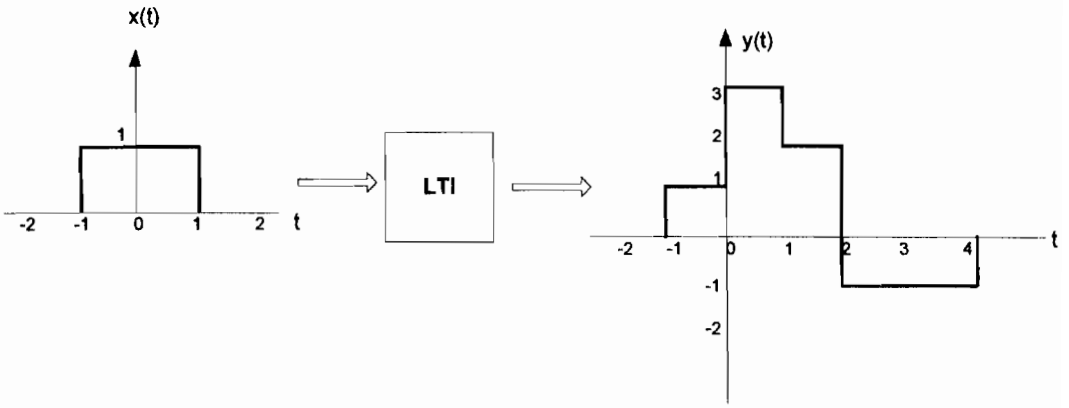


3. Given a difference equation of an LTI system as: $y[n-1] = \sum_{k=0}^{\infty} x[n-k]$
   Determine: ***(10 points)***
   a) The impulse response of this system. *(2 points)*
   b) The response of this system when the input is $x[n] = (\frac{1}{3})^n u[-n-1]$ *(5 points)*
   c) Is this system a causal and stable system? *(3 points)*

4. The difference equation of systems S1 and S2 are represented as:
   S1: $2y[n] = x[n] - 5x[n-4]$
   S2: $y[n] = x[n+1] - x[n]$ ***(10 points)***
   a) Are these systems an LTI systems? *(2 points)*
   b) Determine the impulse response of these two systems. *(2 points)*
   c) If these two system are **serially** connected, determine the output of the overall system when the input is $x[n] = (2)^n u[n-1]$ *(6 points)*

5. Given $x(t) = \begin{cases} |t| & , -1 \leq t \leq 1 \\ 0 & , otherwise \end{cases}$ and $h(t) = u(t)$
Determine the result of $x(t) * h(t)$ ***(10 points)***

6. Given input-output pair of an LTI system as following: ***(10 points)***



Determine:

a) The differential equation representing the relationship between input and output. *(1 points)*
b) The impulse response (h(t)) of this system. *(2 points)*
c) The function of the response of this system when the input is $x(t) = t^2u(t)$ *(7 points)*

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