

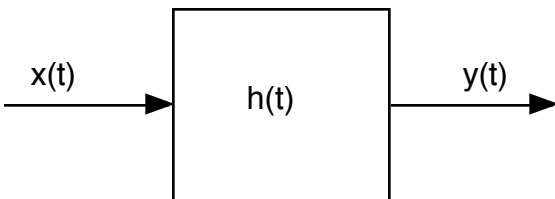
**ECE 425 – Image Science and Engineering
Spring Semester 2000**

PREREQUISITE ASSESSMENT

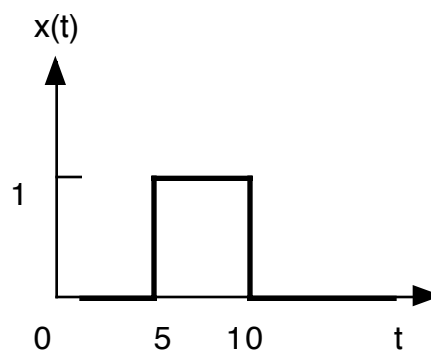
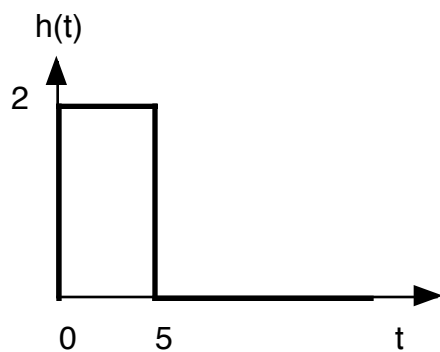
January 25, 2000

Answer all questions to the best of your ability – this quiz will NOT affect your grade in this class!

1. Consider a linear, time-invariant system:



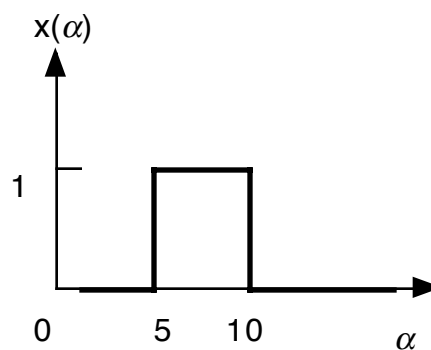
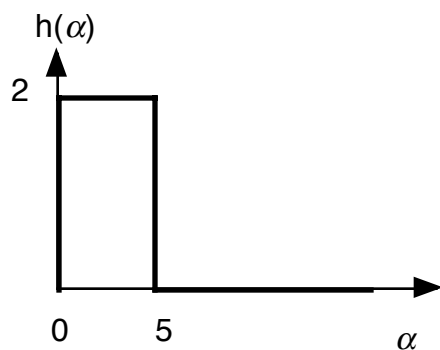
Find the output signal for the given system impulse response and input signal:



output signal = $y(t) = x(t) * h(t)$

To do convolution,

Step 1: write both as function of dummy variable α

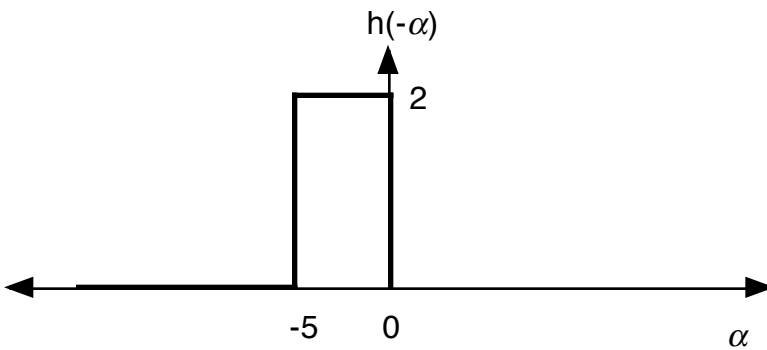


**ECE 425 – Image Science and Engineering
Spring Semester 2000**

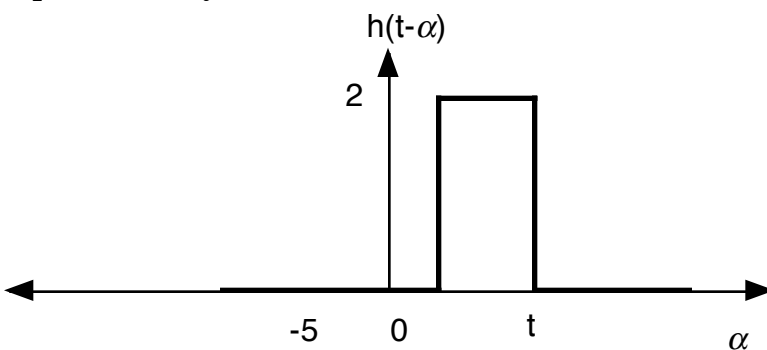
PREREQUISITE ASSESSMENT

January 25, 2000

Step 2: flip one function about $\alpha = 0$



Step 3: shift by t



Steps 4 and 5: multiply $h(t-\alpha)x(\alpha)$ and integrate result over α to get $y(t)$

Step 6: repeat Steps 3-5 until done

a. What is the maximum amplitude of the output signal?

10

b. What is the total duration of the output signal?

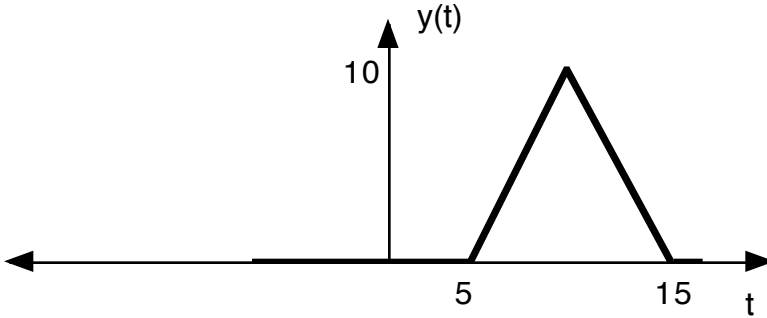
total duration = sum of individual durations = 5 + 5 = 10

**ECE 425 – Image Science and Engineering
Spring Semester 2000**

PREREQUISITE ASSESSMENT

January 25, 2000

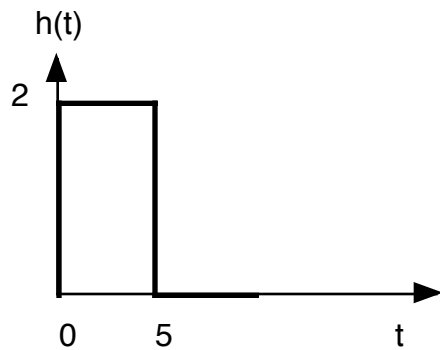
c. Sketch the output signal versus time.



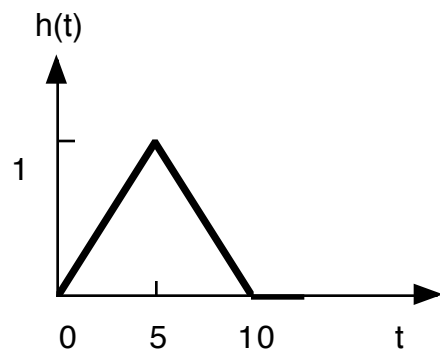
d. If $X(\omega)$, $H(\omega)$ and $Y(\omega)$ are the Fourier transforms of $x(t)$, $h(t)$ and $y(t)$, respectively, write the mathematical relation between X , H and Y .

$$Y(f) = X(f)H(f)$$

2. Sketch the Fourier transforms of the following functions and give their widths:



$$h(t) = 2\text{rect}([t-2.5]/5), H(f) = 2(5)\text{sinc}(5f)e^{-j2\pi 2.5f}$$



$$h(t) = \text{tri}([t-5]/5), H(f) = 5\text{sinc}^2(5f)e^{-j2\pi 5f}$$