

# Homework 11

CSCI-UA.0480-005

Special Topics: Electrical Engineering for Computer Scientists  
Prof. Rappaport

Due: May 12, 2015 @ 9:30 AM

1. Determine and sketch the convolution of  $x[t] * h[t]$  from Figure 1.

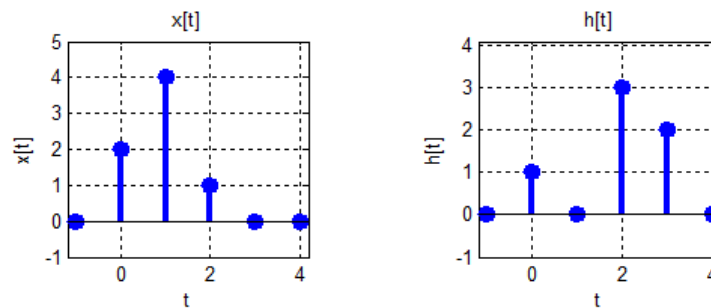


Figure 1

2. For the following parts,  $s_1(t) = \cos(2\pi \cdot 200t)$  and  $s_2(t) = \cos(2\pi \cdot 300t)$
- Sketch the Fourier Transform of  $s_1(t)$  and  $s_2(t)$ :  $S_1(f)$  and  $S_2(f)$ .
  - If  $y(t) = s_1(t) \cdot s_2(t)$ , what is the resulting maximum frequency of  $y(t)$  and sketch the Fourier Transform:  $Y(f)$ . Hint: multiplication in time domain is convolution in the frequency domain.

3. Determine and sketch the Fourier Transform of  $g(t)$  in Figure 2:

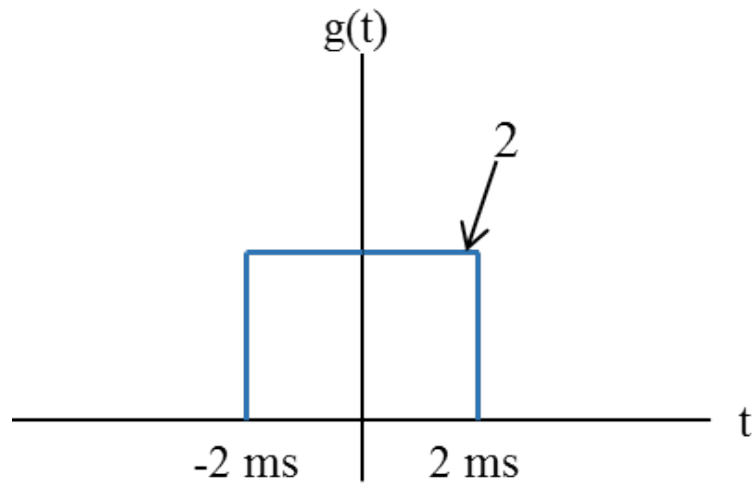


Figure 2

4. If we digitally sample a signal that has highest frequency content of 5 MHz, what is the Nyquist rate? After sampling, which type of filter should be used to preserve only the frequency content of interest? low-pass, high-pass, notch, or passband, explain your answer by describing the cutoff, notch, or passband frequencies.
5. Find the power gain in dB.
- Power into an amplifier is 10 Watts, and the power out is 20 Watts.
  - Power into an amplifier is 10 Watts, and the power out is 100 Watts.
  - Power into an amplifier is 100 Watts, and the power out is 2000 Watts.
  - Power into an amplifier is 1000 Watts, and the power out is 100 Watts.