

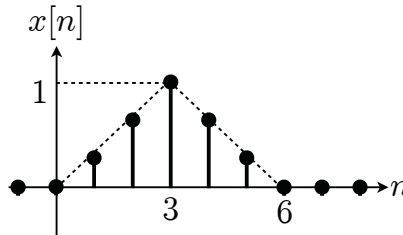
ECE 313 Homework #5 - Due 10/24/2012 at 10:10am

1. The DuBois filter has impulse response $h(t) = 50\text{sinc}(2t)$. Since it's the year 2012, we input the Mayan function $m(t) = 4\text{sinc}^2(2t) - \text{sinc}^2(t)$ to get an apocalyptic output $y(t)$.

- (a) Sketch the magnitudes and phases of the Fourier transforms $H(f)$, $M(f)$. (2 points)
- (b) Sketch the magnitude and phase of the Fourier transform $Y(f)$. (2 points)
- (c) Find the output $y(t)$. (2 points)
- (d) Assume that we change the input to $n(t) = m(t/2)$. Repeat parts (a-c) using $N(f)$. (2 points)
- (e) In words, explain why the outputs are different. (2 points)
 (Hint: What kind of filter is the DuBois filter?)

2. For the signal $x[n]$ shown below, sketch the following signals. (2 points each)

- (a) $x[-n]$ (b) $x[n + 6]$ (c) $x[3n]$ (d) $x[n/2]$ (expanded) (e) $x[n/2]$ (interpolated)



3. Write the signal $x[n]$ from Problem 2 as a sum of discrete-time impulses. (5 points)

4. Describe the signal $x[n]$ from Problem 2 by a single expression valid for all n . (5 points)

5. Sketch the following signals $x[n]$ for $n = -5, \dots, 5$. (4 points each)

- (a) $x[n] = (-1)^n u[n]$ (b) $x[n] = u[n] - u[n + 2]$ (c) $x[n] = (n - 1)(u[n - 1] - u[n - 4])$
- (d) $x[n] = \cos\left(\frac{\pi}{3}n + \frac{\pi}{6}\right)$ (e) $x[n] = \text{sinc}(n/2)$