EE322 Fall 2012 Quiz 4 **Name:** KEY

1. Math/Algebra: Simplify $1+e^{j\pi} =$ 0.

$1+e^{j\pi} = 1+\cos\pi+j\sin\pi = 1-1+j0 = 0$

Note:

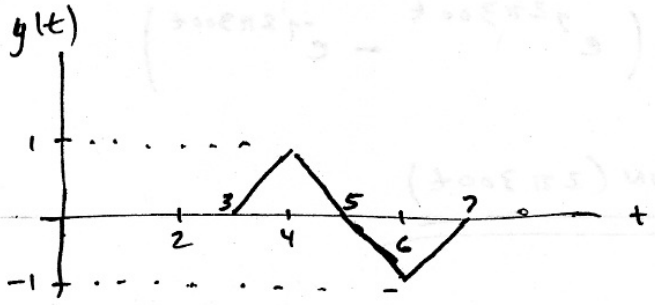
$$e^{j\theta} = \cos\theta + j\sin\theta$$

$$\cos\theta = \frac{e^{j\theta}+e^{-j\theta}}{2}, \quad \sin\theta = \frac{e^{j\theta}-e^{-j\theta}}{2j}$$

2. Sketch the convolution: $y(t) = tri(t) * [\delta(t-4) - \delta(t-6)]$.

$x(t) * A\delta(t-t_0) = Ax(t-t_0)$

So $tri(t) * (\delta(t-4) - \delta(t-6)) = tri(t-4) - tri(t-6)$



3. A discrete-time system is described by 4y[n] + 3y[n-1] = x[n]. Solve for the impulse response h[n]. Determine if the system described by h[n] is BIBO stable.

$y[n] = \frac{x[n]}{4} - \frac{3}{4}y[n-1]$ TO FIND h[n], LET $x[n] = \delta[n]$, THEN $y[n] = h[n]$

n	x[n]	y[n]	y[n-1]
0	1	1/4	0
1	0	$-\frac{3}{4}(1/4)$	1/4
2	0	$(-\frac{3}{4})^2(1/4)$	$-3/4(1/4)$
3	0	$(-\frac{3}{4})^3(1/4)$	$(-3/4)^2(1/4)$
⋮	⋮	⋮	⋮

$h[n] = y[n] = \left(\frac{-3}{4}\right)^n \cdot \frac{1}{4}u[n]$

$\sum_{n=-\infty}^{\infty} |h[n]| = \sum_{n=0}^{\infty} \frac{1}{4}\left(\frac{+3}{4}\right)^n$

$= \frac{1}{4}\left(\frac{1}{1-3/4}\right) = 1 < \infty$

$\therefore$ BIBO STABLE

Do either problem 4 or problem 5 – indicate clearly which problem should be graded:

4. A continuous-time Fourier series harmonic function is given by:

$$X[k]=\frac{j}{2}\delta[k+3]-\frac{j}{2}\delta[k-3],$$

with fundamental period $T_F = 0.01$ sec. Write the corresponding time signal in terms of sinusoid(s).

$f_F = \frac{1}{T_F} = 100\ Hz$

$x(t) = \frac{j}{2}\left(e^{j2\pi(-3)100t} - e^{j2\pi(3)(100)t} \right)$ THEN $j = -\frac{1}{j}$, so ...

$= \frac{1}{2j}\left(e^{j2\pi 300t} - e^{-j2\pi 300t} \right)$

$= \sin(2\pi 300t)$

5. Find the harmonic function $X[k]$ for the signal $x(t) = 4\cos(2\pi 250t)$ if $f_F = 50$Hz.

$250Hz = 5 f_F$

$x(t) = 4\left(\frac{e^{j2\pi 5(50)t} + e^{-j2\pi 5(50)t}}{2} \right)$

$= 2e^{j2\pi(5)50t} + 2e^{j2\pi(-5)50t}$

$\therefore\ X[k] = 2\delta[k-5] + 2\delta[k+5]$

Bonus: On October 25, 1917, the Bolsheviks seized control over the provisional government at the Winter Palace, located in what Russian city?

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