Homework No. 6
Due 11:10 am, May 26, 2005

1. (Textbook 3.48(b) and (c)) Use the defining equation for the DTFS coefficients to evaluate the DTFS representation of the following signals:

    (1) $x[n] = 2\sin\left(\dfrac{14\pi}{19}n\right) + \cos\left(\dfrac{10\pi}{19}n\right) + 1$ (7%)

    (2) $x[n] = \sum_{m=-\infty}^{\infty}(-1)^m\left(\delta[n-2m] + \delta[n+3m]\right)$ (8%)

2. (Textbook 3.49(a) and (c)) Use the definition of the DTFS to determine the time-domain signals represented by the following DTFS coefficients:

    (1) $X[k] = a_k = \cos\left(\dfrac{8\pi}{21}k\right)$ (7%)

    (2) $X[k] = a_k = \sum_{m=-\infty}^{\infty}(-1)^m\left(\delta[k-2m] - 2\delta[k+3m]\right)$ (8%)

3. (Textbook 3.52(a) and (c)) Use the defining equation for the DTFT to evaluate the frequency-domain representations of the following signals:

    (1) $x[n] = \left(\dfrac{3}{4}\right)^n u[n-4]$ (7%)

    (2) $x[n] = \begin{cases} \dfrac{1}{2} + \dfrac{1}{2}\cos\left(\dfrac{\pi}{N}n\right) & , \ |n| \le N \\ \quad\quad 0 & , \ \text{otherwise} \end{cases}$ (8%)

4. (Textbook 3.53(a) and (b)) Use the equation describing the DTFT representation to determine the time-domain signals corresponding to the following DTFTs:

    (1) $X(\Omega) = \cos(2\Omega) + j\sin(2\Omega)$ (7%)

    (2) $X(\Omega) = \sin(\Omega) + \cos\left(\dfrac{\Omega}{2}\right)$ (8%)

5. (Textbook 3.63(a), (b), (c), (d), and (f))

    You are given $x[n] = n(3/4)^{|n|} \xleftarrow{\ DTFT\ } X(\Omega)$. Without evaluating $X(\Omega)$, find $y[n]$ if

    (1) $Y(\Omega) = e^{-j4\Omega}X(\Omega)$ (4%)

    (2) $Y(\Omega) = \text{Re}\{X(\Omega)\}$ (4%)

    (3) $Y(\Omega) = \dfrac{d}{d\Omega}X(\Omega)$ (4%)

    (4) $Y(\Omega) = X(\Omega) \circledast X(\Omega - \pi/2)$ (4%)

    (5) $Y(\Omega) = X(\Omega) + X(-\Omega)$ (4%)

6.

    (1)   (Textbook 3.61(c))Use the tables of transforms and properties to find the inverse DTFTs of the following signals: (10%)

$$X(\Omega) = \cos(4\Omega)\frac{\sin\left(\dfrac{3}{2}\Omega\right)}{\sin\left(\dfrac{\Omega}{2}\right)}$$

    (2)   (Textbook 3.68(c)) Determine the frequency response and the impulse response for the system described by the following difference equations: (10%)

$$y[n] - \frac{1}{4}y[n-1] - \frac{1}{8}y[n-2] = x[n] - \frac{3}{4}x[n-1]$$