Homework IV

I. REMARK

- Reading materials: Ch 6, 7, 10 in the textbook.
- Due: 12/9 23:59 PM

II. PROBLEM SET

1). Below are two lists, one of time-domain functions and one of frequency-domain functions. Match the frequency-domain functions to their inverse CTFTs in the list of time-domain functions. (A match may not exist.)

(a)

Time Domain

1. $-(1/2)\delta_{1/8}(t)$
2. $5\,\mathrm{sinc}(2(t+2))$
3. $3\delta(3t-9)$
4. $-7\,\mathrm{sinc}^2(t/12)$
5. $5\,\mathrm{sinc}(2(t-2))$
6. $5\cos(200\pi t)$
7. $2\,\mathrm{tri}((t+5)/10)$
8. $3\delta(t-3)$
9. $-24[u(t+1)-u(t-3)]$
10. $-2\delta_{1/4}(-t)$
11. $9\,\mathrm{rect}((t-4)/20)$
12. $2\,\mathrm{tri}((t+10)/5)$
13. $-24[u(t+3)-u(t-1)]$
14. $10\cos(400\pi t)$

Frequency Domain

A $5[\delta(f-200)+\delta(f+200)]$

B $(5/2)\,\mathrm{rect}(f/2)e^{-j4\pi f}$

C $180\,\mathrm{sinc}(20f)e^{-j8\pi f}$

D $-84\,\mathrm{tri}(12f)$

E $-96\,\mathrm{sinc}(4f)e^{j2\pi f}$

F $-4\delta_8(-f)$

G $e^{-j6\pi f}$

H $10\,\mathrm{sinc}^2(5f)e^{j10\pi f}$

2) Find the Nyquist rates for these signals.

 (a) $x(t) = 15\,\mathrm{rect}(300t)\cos(10^4\,\pi t)$
 (b) $x(t) = 7\,\mathrm{sinc}(40t)\cos(150\pi t)$

3) A signal $x(t) = 4\,\mathrm{sinc}(10t)$ is impulse sampled at a sampling rate of 20 Hz. Graph the impulse-sampled signal $x_\delta(t)$ on the interval $-0.5 < t < 0.5$. Then graph three fundamental periods, centered at $f = 0$, of the CTFT $X_\delta(f)$ of the impulse-sampled signal $x_\delta(t)$. **Also, graph the DTFT X(F) of the x[n]=x(n/20).**

4) A signal x [n] has a DTFT X(F). Some of the values of x[n] are

n	−2	−1	0	1	2	3	4	5	6
x[n]	−8	2	1	−5	7	9	8	2	3

Let $Y(F) = X(2F)$ with $y[n]\xleftarrow{\ \mathcal{F}\ }Y(F)$. Find the numerical values of y[n] for $-2 \le n < 4$.

5) Fill in the blanks with correct numbers for this DFT harmonic function of a real-valued signal with $N = 8$.

k	0	1	2	3	4	5	6	7
X[k]	5	_____	2 − j7	4 + j2	−3	_____	_____	9 + j4

k		11	−9	26	−47
X[k]		_____	_____	_____	_____