**EECS 120** **Fall 2004**

**Homework 6 : Due by 8 p.m. on Monday October 25**

1. Problem 6. on pg. 444 of LV.
2. Problem 7.29 on pg. 566 of OWN.
3. Problem 7.47 on pg. 577 of OWN.
4. Problem 7.50 on pp. 578 -579 of OWN.
5. This MATLAB problem is aimed at exploring aliasing. First, check that the signal

$$x(t) = \frac{W}{4\pi}\text{sinc}^2(\frac{Wt}{4\pi}) \ ,$$

has Fourier transform

$$X(j\omega) = \begin{cases} 1 - \mid \frac{2\omega}{W} \mid & \text{if } -\frac{W}{2} < \omega < \frac{W}{2} \\ 0 & \text{elsewhere} \end{cases} \ ,$$

which is bandlimited with one sided bandwidth $\omega_M = \frac{W}{2}$. From the sampling theorem we know that if the signal is sampled with sampling interval $T$ satisfying $\frac{2\pi}{T} > W$, then

$$x_r(t) = \sum_{n=-\infty}^{\infty} x(nT)\text{sinc}(\frac{t}{T} - n) \tag{1}$$

is a perfect reconstruction of $x(t)$ (see equation (7.11) on pg. 523 of OWN). If the sampling interval $T$ is such that $W > \frac{2\pi}{T}$ then reconstruction using the formula in equation (1) should result in aliasing.

For this problem, pick $W = 8$. If the sampling interval is $T = 0.5$ we would have perfect reconstruction, while with $T = 2$ we should expect to see aliasing.

(a) Plot $x(t)$ over $-10 < t < 10$ using MATLAB.

(b) For $T = 0.5$, plot $x_r(t)$, given by equation (1), over the range $-10 < t < 10$ using MATLAB. Make sure that you take sample values over the interval $-200 < nT < 200$ in carrying out the computation in equation (1).

(c) For $T = 2.0$, plot $x_r(t)$, given by equation (1), over the range $-10 < t < 10$ using MATLAB. Make sure that you take sample values over the interval $-200 < nT < 200$ in carrying out the computation in equation (1).

Do NOT submit any M-files. You simply need to submit three plots.