

EE 424 – Digital Signal Processing

Quiz # 1

Fall 2010

Duration: 45 minutes

Name:

Student ID:

Section:

Q1) Given the signal;

$$x[n] = \{1, 2, 3, 4, 3, 2, 1\}$$

$$\begin{array}{c} \uparrow \\ n=0 \end{array}$$

a)

i) Interpolate this signal by 2 using the filter $h[n] = \left\{ \frac{1}{4}, \frac{1}{2}, \frac{1}{4} \right\}$. Assume $x[-1] = x[7] = 0$.

$$\begin{array}{c} \uparrow \\ n=0 \end{array}$$

ii) You should use $2h[n]$. Why?

b) Decimate $x[n]$ by 2, using the same filter: $h[n] = \left\{ \frac{1}{4}, \frac{1}{2}, \frac{1}{4} \right\}$

$$\begin{array}{c} \uparrow \\ n=0 \end{array}$$

Q2) Let $x_c(t) = \cos(2\pi 1000t) + \cos(2\pi 333t)$

a) This signal is sampled with $f_s = 8000$ Hz and $x[n] = x_c(nT_s)$ is obtained where $n = 0, \pm 1, \pm 2, \dots$, $T_s = 1/8000$ sec. Plot $X(e^{j\omega})$.

b) Given $x[n] = x_c(nT_s)$, $n = 0, 1, 2, 3, \dots, 999$ and $\text{DFT}_{1000} X[k]$ of $x[n]$ is computed. Approximately plot $|X[k]|$. Clearly indicate peak locations in your $|X[k]|$ plot.