EE 123: Quiz 1, Spring 2008, Prof. Kannan Ramchandran

Name Solution SID _____

1. (3 points) Given the system difference equation $y[n]+0.5y[n-1] = x[n]$, with $x[n] = (-1)^n$, the maximum value of the output $y[n]$ is

2

$H(z) = \frac{Y(z)}{X(z)} = \frac{1}{1+0.5z^{-1}}$

$(-1)^n$ input $\Rightarrow$ $H(-1)\cdot(-1)^n$ output {Eigen function}

$= 2\cdot(-1)^n \Rightarrow \max\{\text{output}\} = 2$

2. (4 points) Let the transfer function of an LTI system be given by,

$$H(z) = \frac{z^8 - 2}{1 - z^{-8}}, \quad |z| > 1, |z| < \infty.$$

Then,

$h[-4] =$ 0 $\quad h[0] =$ -1 Is the system causal? No Is the system stable? No

$H(z) = z^8 - \frac{1}{1-z^{-8}} = z^8 - \sum_{k=0}^{\infty} (z^{-8})^k$

$h[n] = \delta[n+8] - \sum_{k=0}^{\infty} \delta[n-8k]$; $\sum_{n=-\infty}^{N} |h[n]| \to \infty$ as $N \to \infty$

↳ non-causal part Unstable.

3. (3 points) Let $x[n]$ be given by,

$$x[n] = \frac{1}{8}\sum_{k=0}^{7} e^{\frac{j2\pi nk}{8}}, \quad 0 \le n \le \infty.$$

Then, $x[1] =$ 0 $\quad x[8] =$ 1 $\quad x[15] =$ 0

$x[n] = \delta[(n)_8]$. (See DFT and inverse DFT).

$\Rightarrow x[1] = 0$; $x[15] = 0$; $x[8] = 1$.