Ministry of Higher Education
Cairo Higher Institute
Computer and Electronic Systems Engineering Department

Time Allowed: 1 Hour
Open-Book/Notes

Digital Signal Processing Midterm Exam

March 2012

Solve As Much As You Can – Maximum Grade: 100 Points

Q1. Determine the output of the systems described by the following difference equations with input and initial conditions as specified: [8 Points Each]:

(a) $y[n]= x[n] - 0.5\, y[n-1]$, $x[n]= u[n-1]$, $y[-1]= 1$

(b) $y[n]= 2\, x[n] - 0.5\, x[n-1]$, $x[n]= \delta[n-1]$

Q2. Determine whether the following signals are periodic, and for those which are, find the fundamental period [5 Point Each]:

(a) $x(n)= \sin(100\pi n)/n$

(b) $x(n)= e^{(j\, 3\pi n/7)}$

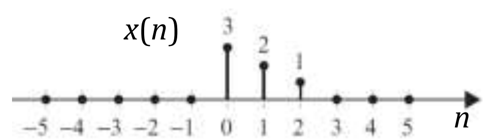
(c) $x(n)= \cos(3n+0.3\pi)$

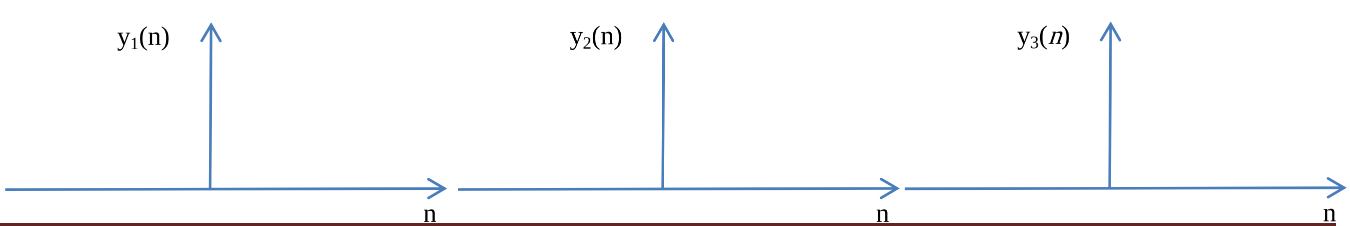
Q3. For the shown a discrete $x(n)$, sketch each of the following signals derived from x(t) [5 Points Each]:

(a) $y_1(n)= x(n+2)$

(b) $y_2(n)= x(2n)$

(c) $y_3(n)= x(-n+1)$





Q4. For each system, determine whether it is (1) linear (2) time invariant, and (3) recursive [6 Points Each]:

(a) $y(t) = \sum_{m=-\infty}^{\infty} x(m) \cdot e^{-2(n-m)}$

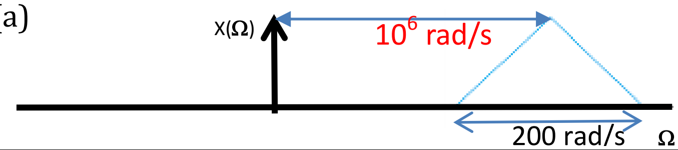
(b) $y(t) =$ x(2-n)

(c) $y(n) = x(n+1) + 2\,n$

(d) $y(n) = n\,x(n) - 2\,y(n-2)$

Q5. Determine a suitable sampling frequency for the signals with the following Fourier transforms: [5 Points Each]:

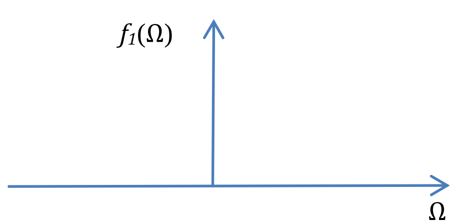
(a)



(b) $x(t)= \sin(100\pi x)/x + 2\sin(200\pi x)/x$

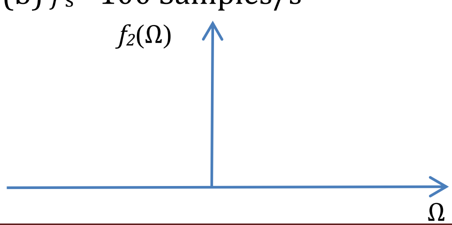
Q6. A signal $f(t) = e^{-j(100\pi t)}$ was sampled with an ideal pulse train. Sketch the continuous-time Fourier transformation for the following values of the sampling rate and estimate the reconstructed signal using a lowpass filter with cutoff frequency of $\Omega_s/2$: [10 Points each]

(a) f_s= 1k Samples/s



$Recovered\ f_1(t) =$

(b) f_s= 100 Samples/s



$Recovered\ f_2(t) =$