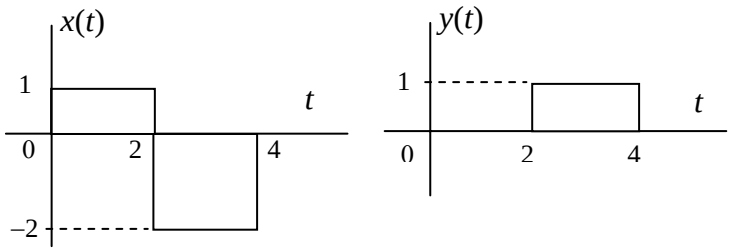
Signals And Systems Exam#1

1. Given $x(t)$ and $y(t)$ below:



(A) Give the expression of $x(t)$ in terms of step functions. (3%)

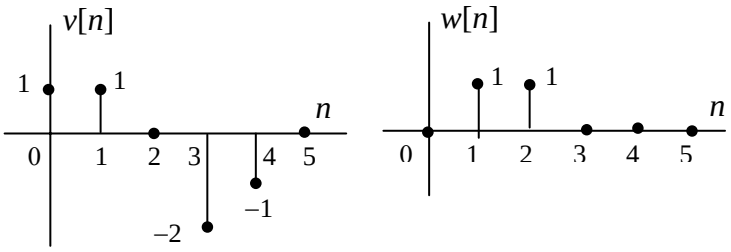
(B) Plot $x(1-0.5t)$. (3%)

(C) Plot $y(2t+1)$. (3%)

(D) Compute $\int_0^4 x(1-0.5t)\,y(2t+1)\delta(t-1)\,dt$. (2%)

(E) Compute $x(t) * y(t)$ (10%)

2. Consider $v[n]$ and $w[n]$ below:



(A) Plot $v_e[n]$ and $v_o[n]$, which are the even and odd parts of $v[n]$. (4%)

(B) Compute $v[n] * w[n]$ (8%)

3. Consider the following periodic signal:

$$z(t) = 2 - sin(1.8t) + 3\,sin(2.7t) + cos(1.8t)$$

(A) Find the fundamental period. (2%)

(B) Express $z(t)$ using complex exponentials. (5%)

(C) What are the Fourier series coefficients? (3%)

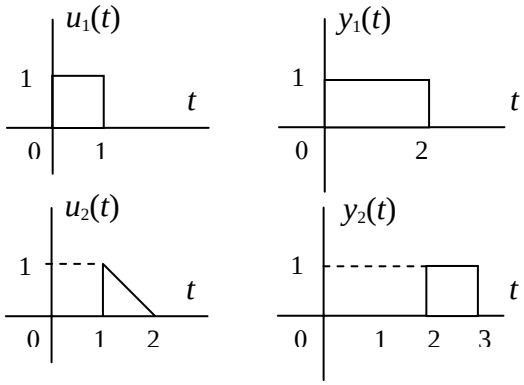
4. Consider $g(t)=sin(3t)$.

(A) Let the sampling period be T=0.2 sec. Is the sampled sequence $sin(3nT)$, n=0,1,2,…, periodic? Why? (3%)

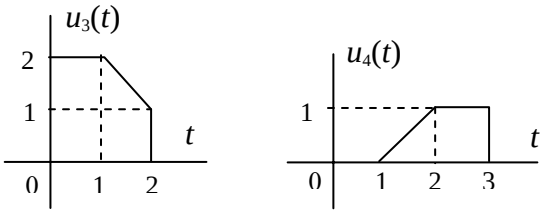
(B) What are the frequencies of the sampled sequences $sin(3nT)$, n=0,1,2,…, for T= 0.4, and 0.8 *sec*? (4%)

(C) Under what condition will the frequency of $sin(3nT)$ equal 3 *rad*/*sec*? (4%)

5. Let $y_1(t)$ and $y_2(t)$ be the output responses of an LTI system corresponding to inputs $u_1(t)$ and $u_2(t)$, respectively. They are depicted as below:



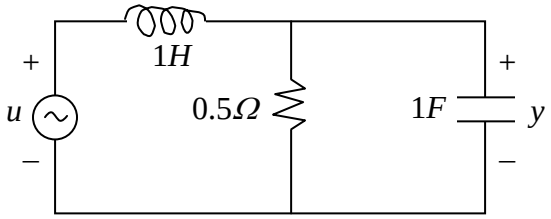
Find the output responses corresponding to $u_3(t)$ and $u_4(t)$ given as



(8%, 8%)

6. Compute the impulse responses of the following two systems:
   (A) $y[n]=u[n]+2u[n-2]-u[n-3]+u[n-5]$ (3%)
   (B) $y[n]-2y[n-1]=u[n-1]-u[n-2]$ (5%)

7. (A) Find a differential equation to describe the following circuit. (8%)
   (B) Determine the steady-state response $y(t)$ as $t\to\infty$ for $u(t)=sin(t)$. (4%)



8. (A) Find a differential equation to describe the following circuit. (6%)
   (B) Determine its step response with zero initial condition. (4%)