1. (20%)

A Linear time-invariant (LTI) system has impulse response

$h[n] = 3(1/2)^n$.

Please use the Discrete- time Fourier transform (DTFT) to find the output of this system when the input is

$x[n] = (1/5)^{n-2}u[n-2]$,

where $u[n]$ is the unit step function.

2. (20%)

A linear time-invariant (LTI) discrete-time system has the transfer function described in z-transform as

$$H(z) = \frac{1-2z^{-1}}{1-\frac{2}{3}z^{-1}} .$$

Please find an input $x[n]$ with $x[n] = 0$ for $n < 0$, that gives the output response

$$y[n] = 5\left(\frac{1}{3}\right)^n u[n] - 5\left(\frac{2}{3}\right)^n u[n]$$

3. (20%)

A continuous-time linear time-invariant (LTI) system has its impulse function expressed as

$h(t) = \delta(t) + e^{-t}u(t)$,

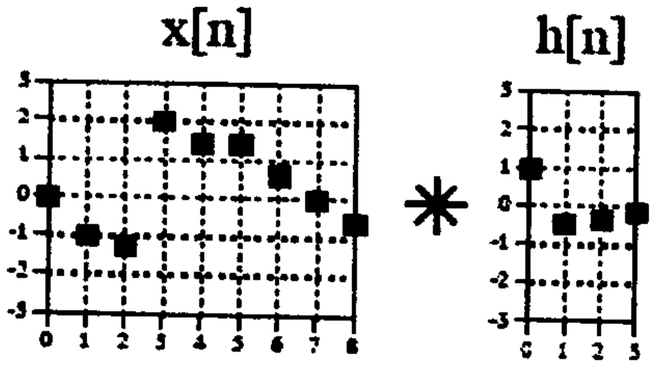
where $\delta(t)$ and $u(t)$ represents the continuous-time dirac delta function and unit-step functions, respectively.

Please find the output, $y(t)$, of this system when the input $x(t)$ is

$x(t) = e^{-2t}u(t)$.

4. (20%)

The following figure is a simple problem: a 9 points input signal, $x[n]$, is passed through a system with a 4 points impulse response, $h[n]$, resulting in an output signal, $y[n]$. Please show the output signal, $y[n]$.



5. (20%)

A pressure gauge that can be modeled as an LTI system has a time response to a unit step input given by $(1-e^{-t}-te^{-t})u(t)$. For a certain input $x(t)$, the output is observed to be $(2-3e^{-t}+e^{-3t})u(t)$. For this observed measurement, determine the true pressure input to the gauge as function of time.