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Principles of Communication

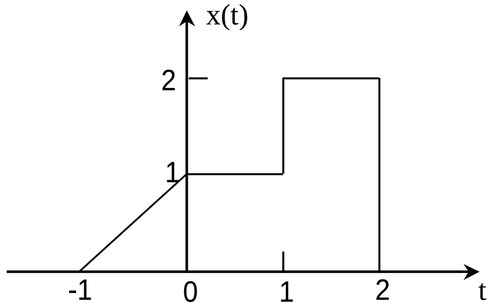
EPOC432C Date of Submission:

ASSIGNMENT 2

1. Show that

$$u(-t) = \begin{cases} 0 & t > 0 \\ 1 & t < 0 \end{cases}$$

2. A continuous-time signal x(t) is shown in the figure below. Sketch and label each of the following signals



(a) x(t)u(1-t) **(b)** x(t)[u(t)-u(t-1)] **(c)** x(t)δ(t-3/2)

3. Show that

(a) $t\,\delta(t) = 0$

(b) $\sin t\,\delta(t) = 0$

(c) $\cos t\,\delta(t-\pi) = -\,\delta(t-\pi)$

4. Show that

$$\delta(t) = u'(t) = \frac{du(t)}{dt}$$

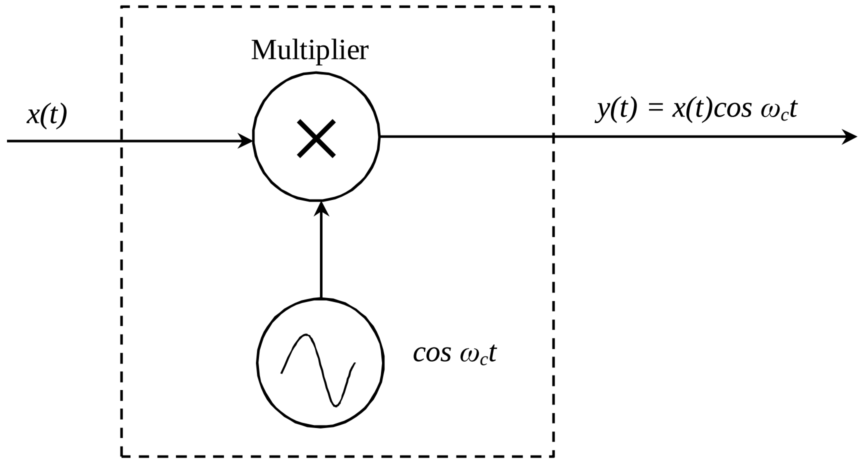
5. Find and sketch the first derivatives of the following signals:

(a) $x(t) = u(t) - u(t-a),\ a>0$

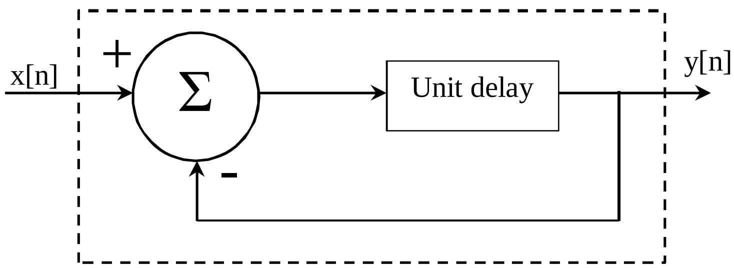
(b) $x(t) = t[u(t) - u(t-a)],\ a>0$

(c) $x(t) = \operatorname{sgn} t = \begin{cases} 1 & t > 0 \\ -1 & t < 0 \end{cases}$

6. Consider the system shown in figure below. Determine whether it is (a) memoryless, (b) causal, (c) linear, (d) time-invariant, or (e) stable.



7. Find the input-output relation of the feedback system shown in figure below



8. A system has the input-output relation given by,

$$y\{n\} = \mathbf{T}\{x[n]\} = x[k_0 n]$$

where k_0 is a positive integer. Is the system time-invariant?

9. Evaluate the following integrals:

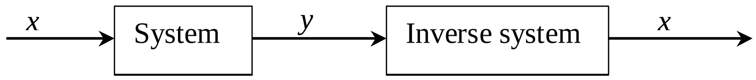
(a) $\int_{-\infty}^{t} (\cos\tau)u(\tau)d\tau$

(b) $\int_{-\infty}^{t} (\cos\tau)\delta(\tau)d\tau$

(c) $\int_{-\infty}^{\infty} (\cos t)u(t-1)\delta(t)dt$

(d) $\int_{0}^{2\pi} t\left(\sin\frac{t}{2}\right)\delta(\pi - t)dt$

10. A system is called invertible if we can determine its input signal x uniquely by observing its output signal ***y.*** This is shown in figure below. Determine if each of the following systems is invertible. If the system is invertible, give the inverse system.



(a) $y(t) = 2x(t)$

(b) $y(t) = x^2(t)$

(c) $y(t) = \int_{-\infty}^{t} x(\tau)d\tau$

(d) $y[n] = \sum_{k=-\infty}^{n} x[k]$

(e) $y[n] = nx[n]$