

# Solution of ECE 315 Test 2 F09

1. Below are some system descriptions in which  $x$  is the excitation and  $y$  is the response. In the spaces provided answer the questions using the letter identifications of the systems.

(a) Which systems are linear? \_\_\_\_\_

ABCE          D is not homogeneous or additive.

(b) Which systems are time-invariant? \_\_\_\_\_

ABCD  
E is time variant because of the presence of the "t" multiplying "x"

(c) Which systems are stable? \_\_\_\_\_

D  
In A,B and C the eigenvalues violate stability criteria. In E, if  $x$  is a constant, then as time proceeds  $y$  has no upper bound.

(d) Which systems are dynamic? \_\_\_\_\_

ABC    The responses in D and E do not depend on a value of the excitation at any time other than the same time "t".

(e) Which systems are causal? \_\_\_\_\_

ACDE          In B,  $y$  at time  $n$  depends on  $x$  at time  $n+1$ .

(f) Which systems are invertible? \_\_\_\_\_

ABC          D is not invertible because if the response is 8 or -8, the excitation cannot be determined. E is not invertible because at time  $t=0$ , any  $x$  produces the same  $y$ , zero.

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

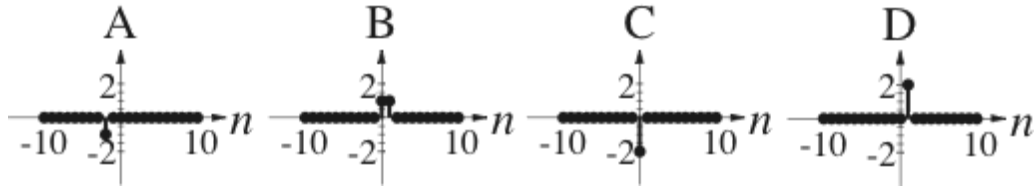
System B.  $y[n] - 2y[n-1] = x[n+1]$

System C.  $y''(t) + y(t) = x(t)$

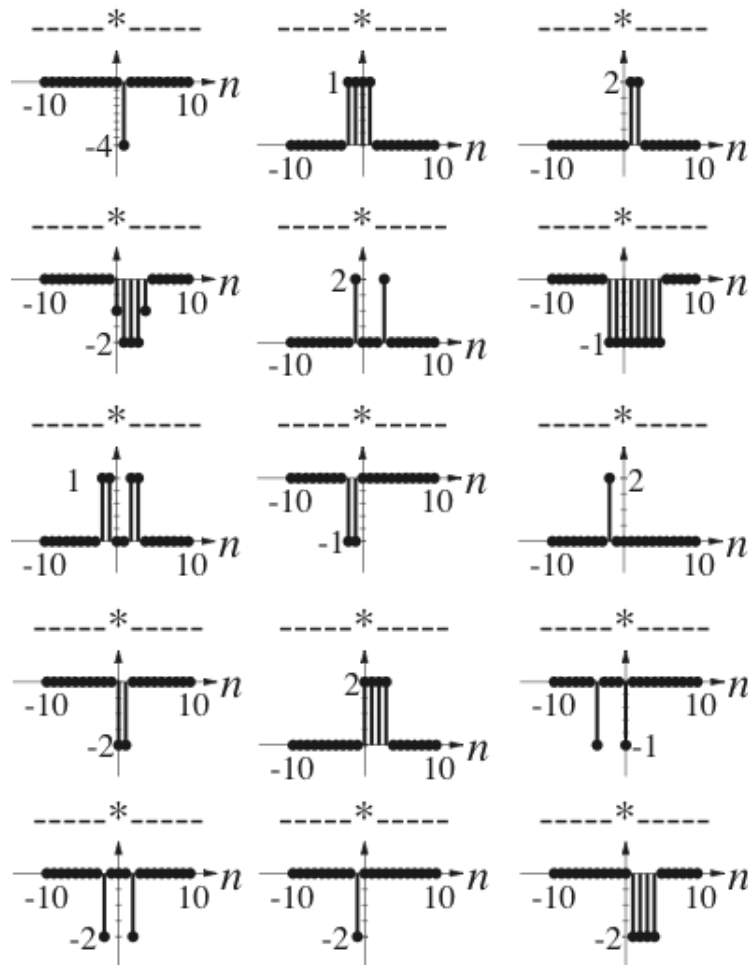
System D.  $y[n] = \begin{cases} 8 & , x[n] > 2 \\ 4x[n] & , -2 < x[n] < 2 \\ -8 & , x[n] < -2 \end{cases}$

System E.  $y(t) = t x(t)$

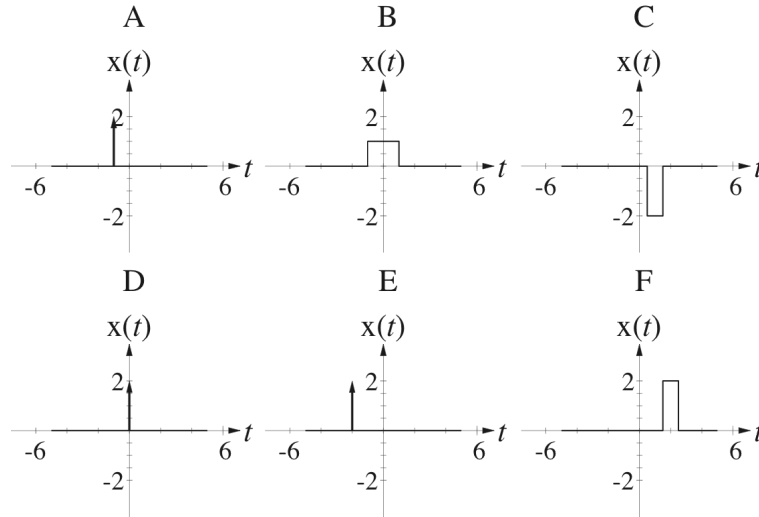
2. Below are four discrete-time functions. All of them are zero outside the range graphed. Below them are 15 candidate convolution results. For each convolution result identify the two functions convolved to obtain it and write their letter designations in the spaces provided. A convolution result could be a function convolved with itself. If no pair of functions is correct just write "None".



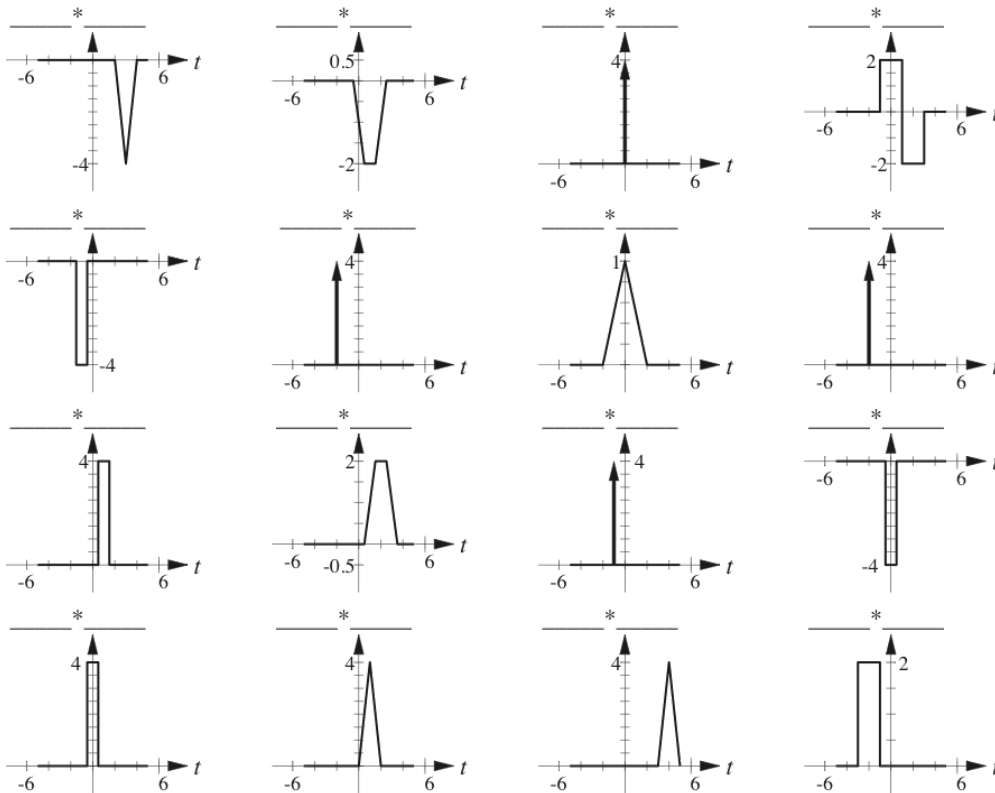
	CD	NONE	BD
	NONE	NONE	NONE
	NONE	AB	AC
	BC	NONE	NONE
	NONE	AD	NONE



3. Below are six continuous-time functions. All of them are zero outside the range graphed. Below them are 16 candidate convolution results. For each convolution result identify the two functions convolved to obtain it and write their letter designations in the spaces provided. A convolution result could be a function convolved with itself. If no pair of functions is correct just write "None".



CF	BC	DD	NONE
CE	AA or DE	NONE	AA or DE
AF	BF	AD	AC
EF	NONE	FF	BE



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1. Below are some system descriptions in which  $x$  is the excitation and  $y$  is the response. In the spaces provided answer the questions using the letter identifications of the systems. (1 point for each correct answer written and 1 point for each incorrect answer not written).

- (a) Which systems are linear? \_\_\_\_\_  
 ABCD E is not homogeneous or additive.
- (b) Which systems are time-invariant? \_\_\_\_\_  
 BCDE  
 A is time variant because of the presence of the "t" multiplying "x"
- (c) Which systems are stable? \_\_\_\_\_  
 E  
 In B,C and D the eigenvalues violate stability criteria. In A, if  $x$  is a constant, then as time proceeds  $y$  has no upper bound.
- (d) Which systems are dynamic? \_\_\_\_\_  
 BCD The responses in A and E do not depend on a value of the excitation at any time other than the same time "t".
- (e) Which systems are causal? \_\_\_\_\_  
 ABDE In C,  $y$  at time  $n$  depends on  $x$  at time  $n+1$ .
- (f) Which systems are invertible? \_\_\_\_\_  
 BCD E is not invertible because if the response is 8 or -8, the excitation cannot be determined. A is not invertible because at time  $t=0$ , any  $x$  produces the same  $y$ , zero.

System A.  $y(t) = t x(t)$

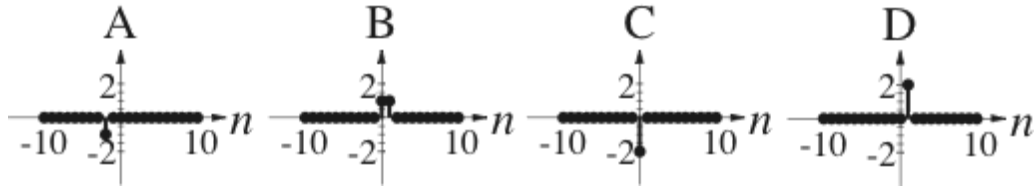
System B.  $y(t) = \int_{-\infty}^t x(\tau) d\tau$

System C.  $y[n] - 2y[n-1] = x[n+1]$

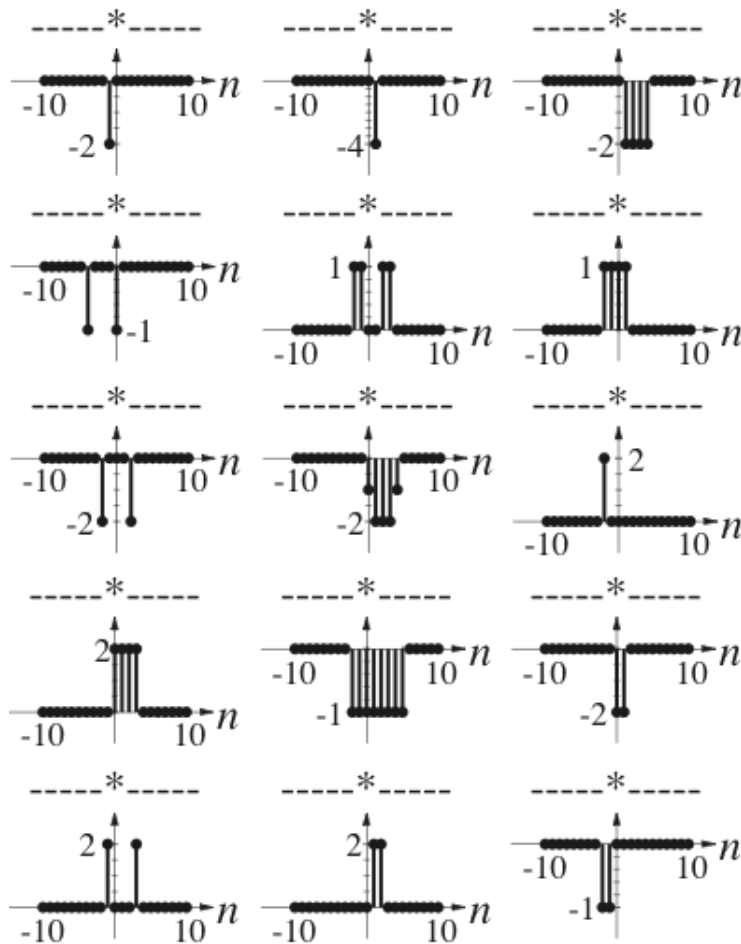
System D.  $y''(t) + y(t) = x(t)$

$$\text{System E. } y[n] = \begin{cases} 8 & , x[n] > 2 \\ 4x[n] & , -2 < x[n] < 2 \\ -8 & , x[n] < -2 \end{cases}$$

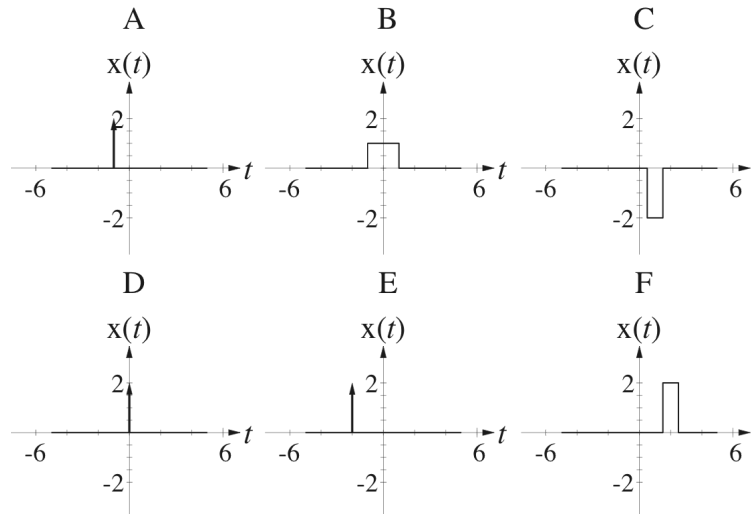
2. Below are four discrete-time functions. All of them are zero outside the range graphed. Below them are 15 candidate convolution results. For each convolution result identify the two functions convolved to obtain it and write their letter designations in the spaces provided. A convolution result could be a function convolved with itself. If no pair of functions is correct just write "None".



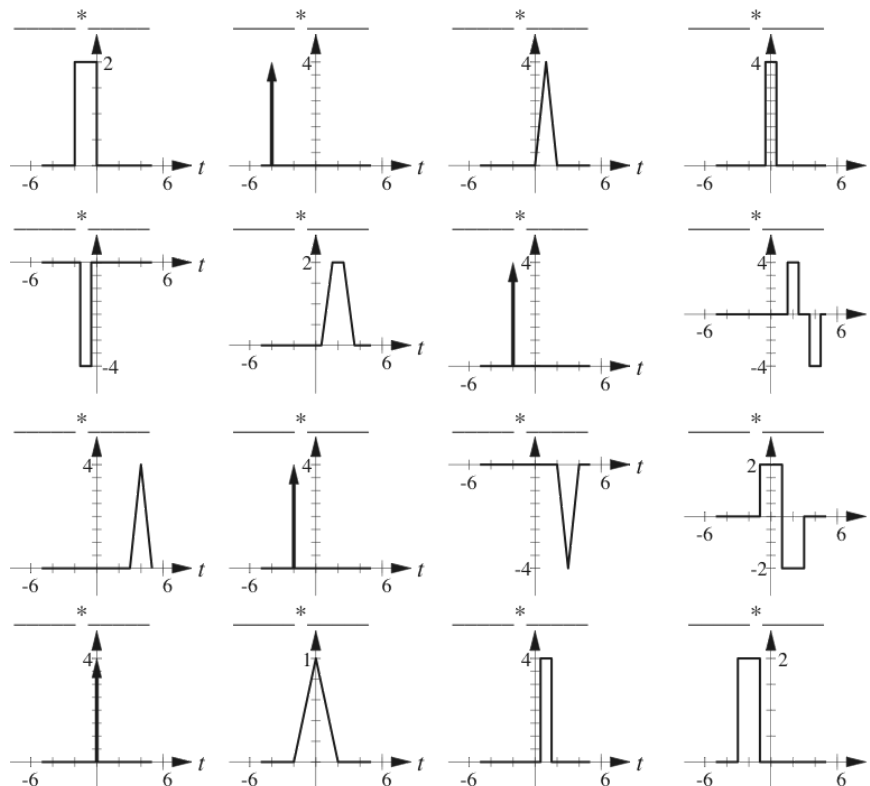
AD	CD	NONE
NONE	NONE	NONE
NONE	NONE	AC
NONE	NONE	BC
NONE	BD	AB



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AB	EE	NONE	EF
CE	BF	AA or DE	NONE
FF	AA or DE	CF	NONE
DD	NONE	AF	BE



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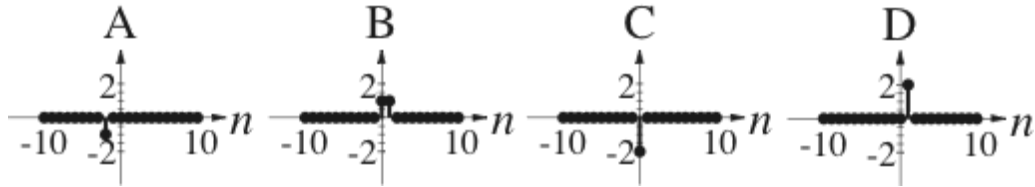
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 A  
 In C,D and E the eigenvalues violate stability criteria. In B, if  $x$  is a constant, then as time proceeds  $y$  has no upper bound.
- (d) Which systems are dynamic? \_\_\_\_\_  
 CDE      The responses in A and B do not depend on a value of the excitation at any time other than the same time "t".
- (e) Which systems are causal? \_\_\_\_\_  
 ABCE      In D,  $y$  at time  $n$  depends on  $x$  at time  $n+1$ .
- (f) Which systems are invertible? \_\_\_\_\_  
 CDE      A is not invertible because if the response is 8 or -8, the excitation cannot be determined. B is not invertible because at time  $t=0$ , any  $x$  produces the same  $y$ , zero.

$$\text{System A. } y[n] = \begin{cases} 8 & , x[n] > 2 \\ 4x[n] & , -2 < x[n] < 2 \\ -8 & , x[n] < -2 \end{cases} \quad \text{System B. } y(t) = tx(t)$$

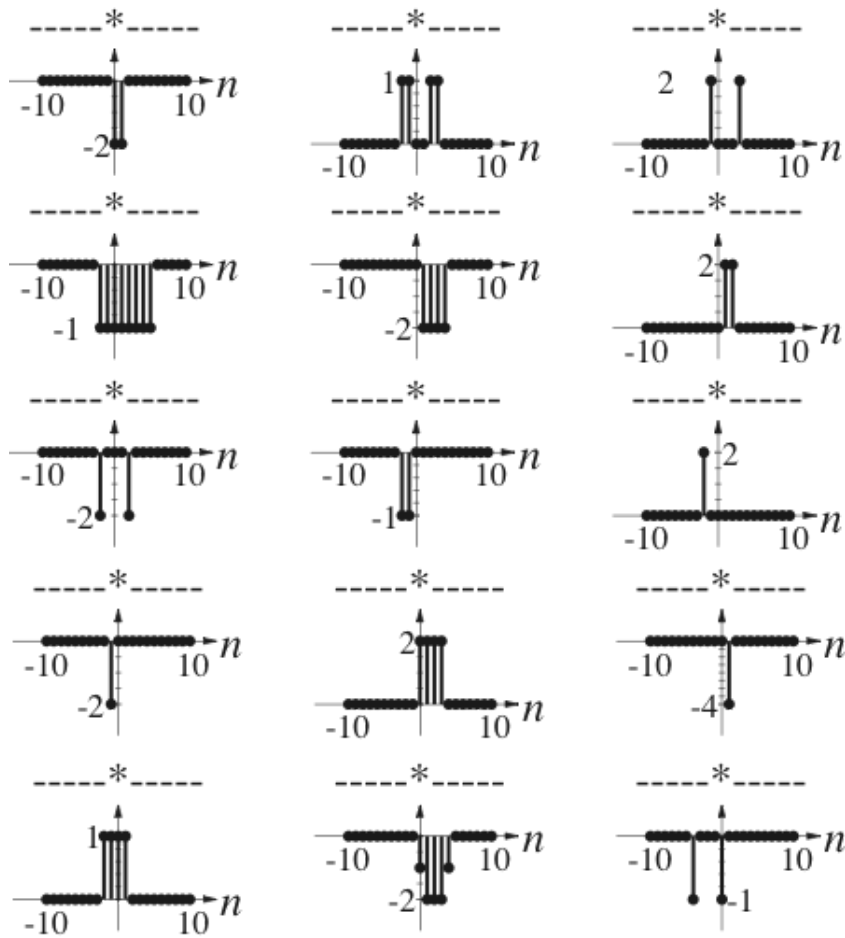
$$\text{System C. } y(t) = \int_{-\infty}^t x(\tau) d\tau \quad \text{System D. } y[n] - 2y[n-1] = x[n+1]$$

$$\text{System E. } y''(t) + y(t) = x(t)$$

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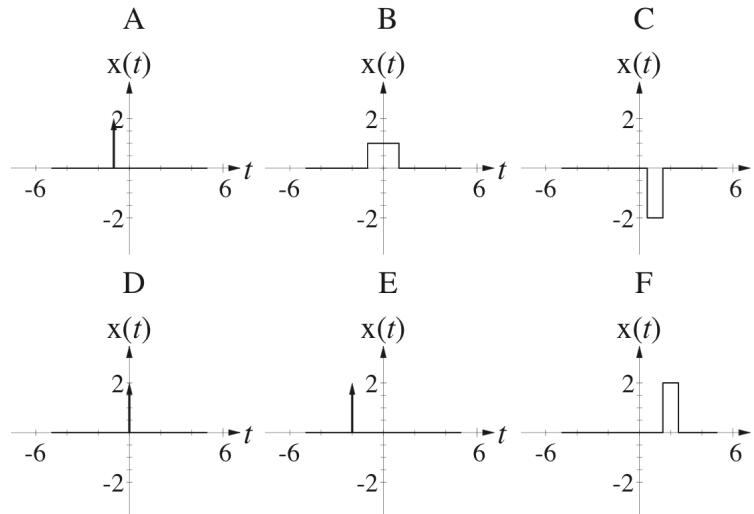


	BC	NONE	NONE
	NONE	NONE	BD
	NONE	AB	AC
	AD	NONE	CD
	NONE	NONE	NONE





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CE	AA or DE	NONE	BC
AB	BF	AE	AD
NONE	AF	BE	AC
NONE	CF	DE	DF

