Name:

CU ID: C

A	E	A	C	D	C	E	B	A	B	A	C
1	2	3	4	5	6	7	8	9	10	11	12

Put your name **also** on the second page.

You must show your work on every problem, showing all steps on your test. Do not use scratch paper or write your work anywhere but on the test. Write your letter answers in the bubbles next to each problem and on the first page. The examination lasts 60 minutes and you may use five sheets of notes (front and back); no old test questions can be on your notes. Calculator use is permitted. There is one correct answer per question. In problems asking to find coefficients A, B, C, etc., some of these coefficients may equal zero.

ECE 3300 Fall 2017 (Signals, Systems, and Transforms): Exam 5

You must show your work on every problem, showing all steps on your test. Do not use scratch paper or write your work anywhere but on the test. Write your letter answers in the bubbles next to each problem and on the first page. The examination lasts 60 minutes and you may use five sheets of notes (front and back); no old test questions can be on your notes. Calculator use is permitted. There is one correct answer per question. In problems asking to find coefficients A, B, C, etc., some of these coefficients may equal zero.

Question 1: Suppose $x[n]$ has Z transform $X(z) = (\frac{1-z^{-1}}{1-3z^{-1}})^4$ with ROC $|z| < 3$. Suppose $y[n] = x[-n]$. Determine $Y(z)$ and the ROC. $Y(z)$ has the form $(\frac{A(1-Bz)}{1-Cz})^4$ with ROC $|z| > \frac{1}{D}$. What is $A + B + C + D$? Choose the closest answer.

A: 8.
B: 9.
C: 7.
D: 6.
E: 10.

Question 2: Suppose $x(t) = (\cos(2t) - 2\sin(2t))e^{-t}u(t)$. Determine $X(s)$. The answer has the form $\frac{As+B}{s^2+Cs+D}$. What is $A + B + C + D$? Choose the closest answer. You do not need to determine the ROC.

A: 4.
B: 7.
C: 3.
D: 6.
E: 5.

Question 3: Suppose $X(z) = \frac{8z^{-1}(1-z^{-1})^2}{(1-2z^{-1})^2}$ with ROC $|z| > 2$. It follows that $x[n] = A\delta[n] + B\delta[n-1] + C(2)^n u[n] + D(n+1)(2)^n u[n]$. Determine A. Choose the closest answer.

A: -2.
B: -1.
C: -5.
D: -4.
E: -3.

Question 4: The signal e^{-t^2} has Laplace transform $\sqrt{\pi}e^{s^2/4}$. What time signal has Laplace transform $\sqrt{\pi}s^2e^{s^2/4}$? The answer has the form $(At^2 + Bt + C)e^{-t^2}$. What is $A + B + C$? Choose the closest answer. *Hint:* You will need to use a certain property twice.

A: 3.

B: 5.

C: 2.

D: 4.

E: 1.

Question 5: Suppose $X(z) = \frac{z^{-1}}{1-\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}}$ with ROC $|z| > \frac{1}{D}$. It follows that $x[n] = A(\frac{1}{B})^n \sin(\frac{\pi}{C}n)u[n]$, where $B > 0$, $C > 1$, and $D > 0$. What is $B + C + D$? Choose the closest answer. You do not need to find A.

A: 6.

B: 10.

C: 8.

D: 7.

E: 9.

Question 6: Determine the Laplace transform of $e^{2t}u(t-1)$. The answer has the form $\frac{e^{As+B}}{s-C}$ with ROC $\text{Re}\{s\} > D$. What is $A + B + C + D$? Choose the closest answer. *Hint:* First find the Laplace transform of $e^{2(t-1)}u(t-1)$ and then use amplitude scaling.

A: 2.

B: 4.

C: 5.

D: 1.

E: 3.

Question 7: Suppose $X(z) = \frac{1}{1+z^{-1}} + \frac{4}{1+2z^{-1}}$ with ROC $|z| < 1$. Determine $x[n]$. Let $A = x[1]$ and $B = x[-1]$. What is $A + B$? Choose the closest answer.

A: -1.

B: 1.

C: 5.

D: -3.

E: 3.

Question 8: The signal $x(t) = J_0(t)u(t)$ has Laplace transform $X(s) = \frac{1}{\sqrt{1+s^2}}$ with ROC $\operatorname{Re}\{s\} > 0$. (The signal is a Bessel function but you don't need to know anything about Bessel functions to solve this problem.) Suppose $y(t) = e^{-t}J_0(t)u(t)$. Determine $Y(s)$ and its ROC. $Y(s)$ has the form $\frac{1}{\sqrt{A+Bs+Cs^2}}$ and the ROC has the form $\operatorname{Re}\{s\} > D$. What is $A+B+C+D$? Choose the closest answer.

A: 1.
B: 4.
C: 5.
D: 2.
E: 3.

Question 9: Suppose $x[n]$ has Z transform $X(z) = \frac{(1-z^{-1})(1+2z^{-1})}{(1-3z^{-1})(1+4z^{-1})}$ with ROC $|z| > 4$. Further suppose that $y[n] = x[n] + x[n-1] - 12x[n-2]$. Determine $y[n]$. What is $y[1]$? Choose the closest answer. *Hint:* First use properties to determine $Y(z)$ from $X(z)$.

A: 1.
B: 5.
C: 4.
D: 3.
E: 2.

Question 10: Suppose $X(s) = \frac{(s-1)(s-2)}{s(s+1)^2}$ with ROC $\operatorname{Re}\{s\} > -1$. It follows that $x(t) = Au(t) + (B+Ct)e^{-t}u(t)$. What is B? Choose the closest answer.

A: -4.
B: -1.
C: -5.
D: -2.
E: -3.

Question 11: Suppose $x[n] = (\frac{3}{4})^n u[-n-1] + u[-n-1] + (\frac{1}{2})^n u[n]$. Which statement is correct?

A: The Z transform exists but the Fourier transform does not.
B: The Z and Fourier transforms exist but $X(e^{j\omega})$ can not be found by substituting $z = e^{j\omega}$ in $X(z)$.
C: The Fourier transform exists but the Z transform does not.
D: Neither the Z transform nor the Fourier transform exists.
E: The Z and Fourier transforms exist and $X(e^{j\omega})$ can be found by substituting $z = e^{j\omega}$ in $X(z)$.

Question 12: Suppose a signal $x[n]$ has Z transform $X(z) = \frac{1}{1-z^{-2}}$. Suppose $y[n] = nx[n]$. Determine $Y(z)$. The answer has the form $Y(z) = \frac{Az^{-B}}{(1-z^{-2})^2}$. What is $A + B$? Choose the closest answer. You do not need to determine the ROC.

A: 5.
B: 1.
C: 4.
D: 3.
E: 2.