**HONOR CODE PLEDGE:** “I have neither given nor received aid on this exam, nor have I concealed any violations of the honor code.” Closed book; 2 sides of 8.5×11 "cheat sheet."

**SIGN YOUR NAME HERE:**

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<tr>
<th>CIRCLE ONE:</th>
<th>Undergraduate</th>
<th>Graduate</th>
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Write your answer to each question in the answer space to the right of that question. Problems #1-15 are multiple choice (same as fill-in-the-blank) worth 5 points each.

1. The period of the discrete-time sinusoid \( 4 \cos(0.56\pi n + 0.7) \) is:
   (a) 12.5 (b) 25 (c) 40 (d) 50 (e) Not periodic

2. \( \sin(40\pi t) + 2\sin(160\pi t) \) and which of these are identical after sampling at 100Hz:
   (a) 0 (b) \( -\sin(40\pi t) \) (c) \( 3\sin(40\pi t) \) (d) \( -\sin(160\pi t) \) (e) \( 3\sin(160\pi t) \)

3. The convolution \( \{1, 2\} \ast \{3, 4, 5\} = \): (a) \( \{3, 6, 4, 10\} \) (b) \( \{3, 10, 13, 10\} \)
   (c) \( \{3, 10, 14, 10\} \) (d) \( \{3, 11, 13, 10\} \) (e) \( \{3, 11, 14, 10\} \)

4. The system (transfer) function if \( 2^n u[n] \rightarrow \text{LTI} \rightarrow u[n] + 2^n u[n] \) is:
   (a) \( \frac{1+2z}{z+2} \) (b) \( 1 + \frac{1}{z+2} \) (c) \( \frac{2z^3}{z-1} \) (d) \( \frac{1}{z^2-3z+2} \) (e) \( 1 + \frac{1}{z-1} \)

5. The system (transfer) function if \( \{1, 2, 3\} \rightarrow \text{LTI} \rightarrow \{4, 5, 6\} \) is:
   (a) \( \frac{3z^2+12z+1}{6z+6z+4} \) (b) \( \frac{6z^2+5z+4}{3z^3+2z+1} \) (c) \( \frac{z^2+2z+3}{4z^2+3z+6} \) (d) \( \frac{4z^2+5z+6}{z^2+2z+3} \) (e) \( 1 + z + z^2 \)

6. The z-transform of \( (2)^n u[n] + (-4)^n u[n] \) is:
   (a) \( \frac{1}{z^2+2z-8} \) (b) \( \frac{z^2+2z}{z^2+2z-8} \) (c) \( \frac{2z^2+2z}{z^2+2z-8} \) (d) \( \frac{z^2-2z}{z^2+2z-8} \) (e) \( \frac{2z^2-2z}{z^2+2z-8} \)

7. The inverse z-transform of \( \frac{2z}{z^2+4} \) is:
   (a) \( (-1)^n \) (b) \( 2 \cos(\pi n) u[n] \) (c) \( 2 \sin(\pi n) u[n] \) (d) \( 2 \cos(\pi n) u[n] \) (e) \( 2 \sin(\pi n) u[n] \)

8. The inverse z-transform of \( \frac{z^2-5z+6}{z^2(z-1)} \) is:
   (a) \( \{1, -5, 6\} u[n] \) (b) \( \{1, -6\} \) (c) \( \{1, -5, 6\} u[n-1] \) (d) \( \{0, 1, -6\} \)

9. The impulse response if \( 2^n u[n] + 4^n u[n] \rightarrow \text{LTI} \rightarrow \delta[n] \) is:
   (a) \( \left(\frac{1}{2}\right)^n u[n] + \left(\frac{1}{4}\right)^n u[n] \) (b) \( \{1, 2, 4\} \) (c) \( \{1, -2, -4\} \) (d) \( C3^n \) for \( n > 3 \) for some \( C \)

10. The zero-input response for \( y(n)-2y(n-1)=2x(n)+3x(n-1) \) with \( y(-1)=1 \) is:
    (a) \( 2^{n+1} u(n) \) (b) \( 2^n u(n) \) (c) \( 2^{n-1} u(n-1) \) (d) \( 2^n u(n)+2^{n-1} u(n-1) \) (e) \( 0 \)
For problems #11-15: An LTI system has transfer function \( H(z) = \frac{z}{(z-1)(z-2)} \).

11. The poles and zeros are, respectively,
   (a) \( \{0\}; \{1, 2\} \) (b) \( \{0\}; \{-1, -2\} \) (c) \( \{1, 2\}; \{0\} \) (d) \( \{-1, -2\}; \{0\} \)

12. The difference equation is:
   (a) \( y[n] - 3y[n - 1] + 2y[n - 2] = x[n - 2] \)
   (b) \( y[n] - 3y[n - 1] + 2y[n - 2] = x[n - 1] \) (c) \( y[n] - 3y[n - 1] + 2y[n - 2] = x[n] \)
   (d) \( y[n] + 3y[n - 1] + 2y[n - 2] = x[n - 1] \) (e) \( y[n] + 3y[n - 1] + 2y[n - 2] = x[n] \)

13. The impulse response \( h[n] \) is:
   (a) \( 2^n u[n] \) (b) \( 2^n u[n] + u[n] \) (c) \( 2^n u[n] - u[n] \) (d) \( 3(2)^n u[n] + 2u[n] \) (e) \( 3(2)^n u[n] - 2u[n] \)

14. The response to \( x[n] = \{2, -6, 4\} \) is:
   (a) \( 2^n u(n) + u(n) \) (b) \( 2^n u[n] - u[n] \) (c) \( 2^{n+1} u[n] + 3u[n] \) (d) \( 2\delta[n + 1] \) (e) \( 2\delta[n - 1] \)

15. The response to \( x[n] = \delta[n] - \delta[n - 1] \) is:
   (a) \( 2^{n+1} u[n + 1] \) (b) \( 2^n u[n] \) (c) \( 2^{n-1} u[n - 1] \) (d) \( 2^n u[n] + u[n] \) (e) \( 2^n u[n] - 2^{n-1} u[n - 1] \)

[24] 16. \( X(z) = \frac{z}{z-1} + \frac{z}{z-2} \) has 3 different inverse z-transforms. For each one, compute:
   (a) \( x[n] \) (b) ROCs (c) if stable (d) if causal. Write below.

\[
\begin{array}{ccc}
\text{STABLE} & \text{CAUSAL} & \text{STABLE} \\
\text{STABLE} & \text{CAUSAL} & \text{STABLE} \\
\end{array}
\]

[1] 17. Did you: (a) PRINT your name; (b) SIGN your name; (c) CIRCLE grad or undergrad?