PRINT YOUR NAME HERE:

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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20 multiple-choice questions, worth 5 points each, for a total of 100 points. **LECTURE** Write your answer to each question in the space to the right of that question. **SESSION** NOTE: Problems vary in difficulty. Some problems are harder than others.

$\sin\frac{\pi}{6} = \cos\frac{\pi}{3} = \frac{1}{2}$; $\sin\frac{\pi}{4} = \cos\frac{\pi}{4} = \frac{\sqrt{2}}{2}$; $\sin\frac{\pi}{3} = \cos\frac{\pi}{6} = \frac{\sqrt{3}}{2}$; $\sin\frac{\pi}{2} = \cos(0) = 1$.

Unit step function $u[n] = 1$ for $n = 0, 1, 2 \ldots$ and $u[n] = 0$ for $n = -1, -2 \ldots$

For #1-#4: L=Linear; TI=Time-Invariant; C=Causal; S=BIBO Stable.

NOTE: "Can't tell" means it can't be told, not just that YOU can't tell!

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1. The system $y[n] - 2y[n-1] = 3x[n] + nx[n+1]$ is:
   (a) L AND TI **(b)** L NOT TI **(c)** TI NOT L **(d)** NOT L;NOT TI **(e)** Can't tell

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2. The system $y[n] = y[n-1]x[n]$ is:
   (a) L AND TI **(b)** L NOT TI **(c)** TI NOT L **(d)** NOT L;NOT TI **(e)** Can't tell

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3. The system $y[n] - y[n-1] = x[n]$ is:
   (a) C AND S **(b)** C NOT S **(c)** S NOT C **(d)** NOT C;NOT S **(e)** Can't tell

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4. The system with impulse response $h[n] = 1/(|n| + 1)$ for all integers n is:
   (a) C AND S **(b)** C NOT S **(c)** S NOT C **(d)** NOT C;NOT S **(e)** Can't tell

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

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6. The impulse response of $y[n] = 3x[n] + x[n-2] + 4x[n-3]$ is:
   (a) $\{3, 1, 4\}$ **(b)** $\{3, 0, 1, 4\}$ **(c)** $\{4, 1, 3\}$ **(d)** $\{4, 1, 0, 3\}$ **(e)** $\{3, 0, 0, 1, 4\}$

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7. The impulse response of $y[n] - \frac{1}{3}y[n-1] = 3x[n]$ is:
   (a) $(\frac{1}{3})^n u[n]$ **(b)** $(\frac{1}{3})^{n-1} u[n-1]$ **(c)** $(\frac{1}{3})^n u[n-1]$ **(d)** $(\frac{1}{3})^{n-1} u[n]$ **(e)** $(\frac{1}{3})^{n+1} u[n]$

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8. The response of a 4-point running average system to $\cos(\frac{\pi}{2}n)$ is:
   (a) 0 **(b)** $\frac{1}{4}\cos(\frac{\pi}{2}n)$ **(c)** $\cos(\frac{\pi}{2}n)$ **(d)** $4\cos(\frac{\pi}{2}n)$ **(e)** 1

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9. The response of a system with $h[n] = \{\underline{1}, -1\}$ to a unit step $u[n]$ is:
(a) 0 **(b)** $u[n-1]$ **(c)** $2u[n]$ **(d)** $\delta[n]$ **(e)** $2\delta[n]$

10. $y[n] = b_0x[n] + b_1x[n-1] + \ldots + b_Nx[n-N]$ is **all of the following except:**
(a) Causal **(b)** BIBO Stable **(c)** FIR **(d)** IIR **(e)** LTI

11. Impulse response of $x[n] \rightarrow \overline{|z[n] = x[n] - x[n-1]|} \rightarrow \overline{|y[n] = z[n] + z[n-1]|} \rightarrow y[n]$:
(a) $2\delta[n]$ **(b)** $\{1, -2, 1\}$ **(c)** $\overline{\{1, 2, 1\}}$ **(d)** $\{1, 0, 1\}$ **(e)** $\overline{\{1, 0, -1\}}$

12. Discrete-time signal $\cos(1.7\pi n + \frac{\pi}{3})$ has the same spectrum as:
(a) 0 **(b)** $\cos(0.3\pi n + \frac{\pi}{3})$ **(c)** $\cos(0.3\pi n - \frac{\pi}{3})$ **(d)** $\cos(0.7\pi n + \frac{\pi}{3})$ **(e)** $\cos(0.7\pi n - \frac{\pi}{3})$

13. $\sin(32\pi t) + \sin(48\pi t)$ is sampled at 40 Hz, then *ideally* interpolated. The result is:
(a) 0 **(b)** $\sin(16\pi t)$ **(c)** $2\sin(16\pi t)$ **(d)** $\sin(32\pi t)$ **(e)** $2\sin(32\pi t)$

14. $\underset{\textbf{PERIOD=4ms}}{\textbf{SQUARE WAVE}} \rightarrow \overline{|\underset{\textbf{ALIAS}}{\textbf{ANTI-}}|} \rightarrow \overline{|\underset{\textbf{AT 400 HZ}}{\textbf{SAMPLE}}|} \rightarrow \overline{|\underset{\textbf{INTERPOLATOR}}{\textbf{IDEAL(SINC)}}|} \rightarrow$:
In the following answers, A and B are some constants.
(a) 0 **(b)** $A\sin(250\pi t)$ **(c)** $A\sin(500\pi t)$ **(d)** $A\sin(250\pi t) + B\sin(500\pi t)$ **(e)** $\underset{\text{wave}}{\text{square}}$

15. $\sin(40\pi t) + 2\sin(160\pi t)$ 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)** $3\sin(160\pi t)$

16. If $|x[n]| \leq 10$ and $x[n]$ is quantized using 8 bits, maximum possible error$\approx$
(a) 0 **(b)** 0.02 **(c)** 0.04 **(d)** 0.08 **(e)** 0.16. (Choose the closest answer.)

17. The DFT of $\{12, 8, 4, 8\}$ is: **(a)** $\{8, 1 + j2, 4, 1 - j2\}$ **(b)** $\{8, 1 - j2, 4, 1 + j2\}$
(c) $\{32, 4 - j8, 16, 4 + j8\}$ **(d)** $\{8, 2, 0, 2\}$ **(e)** $\{32, 8, 0, 8\}$

18. The DFT of $2\cos(\frac{\pi}{4}n)$ is: **(a)** $\{1, 0, 0, 0, 0, 0, 0, 1\}$ **(b)** $\{0, 1, 0, 0, 0, 0, 0, 1\}$
(c) $\{0, 0, 1, 0, 0, 0, 1, 0\}$ **(d)** $\{0, 1, 0, 0, 0, 0, 1, 0\}$ **(e)** $\{0, 0, 0, 1, 1, 0, 0, 0\}$

19. $x[n] = (1 + j)e^{j\pi n/3} + (3 + j4)e^{j2\pi n/3} + (1 - j)e^{-j\pi n/3} + (3 - 4j)e^{-j2\pi n/3}$.
The DFT of $x[n]$ is computed using N=period of $x[n]$. Then $X_4 = X[4] =$:
(a) 0 **(b)** $1 + j$ **(c)** $1 - j$ **(d)** $3 + j4$ **(e)** $3 - j4$

20. A real periodic signal with period=7 has $X_k = X[k] = jk$ for $k = 0, 1, 2, 3$.
The average power of the signal is: **(a)** 0 **(b)** 2 **(c)** 4 **(d)** 14 **(e)** 28

DID YOU REMEMBER TO SIGN THE HONOR PLEDGE?