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.

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

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 $y[n] = nx[n] + 2x[n-1] + 3x[n-2]$ 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 $y[n] + 2y[n-1] = 3x[n] + 4x[n-1]$ 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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3. The system $y[n] = 3x[n+1] + 4x[n] + 3x[n-1]$ 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 $y[n] = \sum_{i=1}^{\infty} x[n-i]/i^2$ 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 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

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6. The period of the discrete-time sinusoid $3\cos(0.3\pi n) + 2\cos(\frac{3\pi}{4}n)$ is:
   (a) 12.5 **(b)** 25 **(c)** 40 **(d)** 50 **(e)** Not periodic

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7. The value of the line spectrum of $3\cos(\frac{\pi}{6}n + 1) + 4\cos(\frac{\pi}{3}n + 2)$ at $\omega = -\frac{7\pi}{3}$ is:
   (a) 0 **(b)** $1.5e^{j1}$ **(c)** $1.5e^{-j1}$ **(d)** $2e^{j2}$ **(e)** $2e^{-j2}$

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8. Average power of $2 + 4\cos(\frac{\pi}{2}n) + 6\cos(\pi n)$ is: **(a)** 0 **(b)** 12 **(c)** 30 **(d)** 48 **(e)** 56

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9. The response of $y[n] = 2x[n] + 3x[n-1] + 4x[n-2]$ to $x[n] = \{5, 6\}$ is:
(a) $\{10, 27, 38, 24\}$ **(b)** $\{10, 28, 39, 24\}$ **(c)** $\{12, 27, 38, 20\}$ **(d)** $\{12, 28, 39, 20\}$

10. The response of $y[n] = 8x[n] + 3x[n-1] + 4x[n-2]$ to $x[n] = (-1)^n$ is:
(a) $(-1)^n$ **(b)** $4(-1)^n$ **(c)** $9(-1)^n$ **(d)** $15(-1)^n$ **(e)** unstable

11. The response of $y[n] = 8x[n] + 3x[n-1] + 4x[n-2]$ to $x[n] = \cos(\frac{\pi}{2}n)$ is:
(a) $9\cos(\frac{\pi}{2}n)$ **(b)** $5\cos(\frac{\pi}{2}n + 37^o)$ **(c)** $15\cos(\frac{\pi}{2}n)$ **(d)** $5\cos(\frac{\pi}{2}n - 37^o)$ **(e)** $9\sin(\frac{\pi}{2}n)$

12. Two systems $y[n] = x[n] + 2x[n-1]$ and $y[n] = 3x[n-1] + 4x[n-2]$ are connected in **parallel**. The combined system has impulse response:
(a) $\{\underline{3}, 10, 8\}$ **(b)** $\{\underline{3}, 11, 8\}$ **(c)** $\{\underline{4}, 11, 6\}$ **(d)** $\{\underline{1}, 5, 4\}$ **(e)** $\{\underline{4}, 6\}$

13. To perfectly reconstruct $\sin(5\pi t + 1) + 2\sin(10\pi t + 2)$ from its samples $x(t = nT_s)$, we need $T_s <$: **(a)** 5 **(b)** 1 **(c)** $\frac{1}{5}$ **(d)** $\frac{1}{10}$ **(e)** $\frac{1}{20}$

14. $\sin(80\pi t) + \sin(120\pi t)$ and which of these are identical after sampling at 100 Hz:
(a) 0 **(b)** $\sin(80\pi t)$ **(c)** $\sin(120\pi t)$ **(d)** $2\sin(80\pi t)$ **(e)** $2\sin(120\pi t)$

15. Continuous-time signal $x(t) = \sin(20\pi t) + \cos(20\pi t)$ is sampled (A-to-D) at 20 Hz. The sampled signal is then *ideally* interpolated (D-to-A). The result is:
(a) 0 **(b)** 1 **(c)** $\sin(20\pi t)$ **(d)** $\cos(20\pi t)$ **(e)** $\sin(20\pi t) + \cos(20\pi t)$

16. A signal is sampled at 1024 Hz and quantized to 256 levels. The bit rate in $\frac{\text{BITS}}{\text{SEC}}$ is:
(a) 1024 **(b)** 4096 **(c)** 8192 **(d)** 16384 **(e)** 262144

17. The DFT of $x[n] = \{8, 2, 0, 2\}$ is $\{X_0, X_1, X_2, X_3\}$=:
(a) $\{3, 2+j, 2, 2-j\}$ **(b)** $\{3, 2-j, 2, 2+j\}$ **(c)** $\{3, 1, 2, 1\}$ **(d)** $\{3, 2, 1, 2\}$ **(e)** $\{3, 2, 2, 2\}$

For #18-#20: $x[n]$ has period=4 and DFT $X_0 = 2, X_1 = 1 - j, X_2 = 0, X_3 = 1 + j$.

18. $x[n]$ =: **(a)** $\{4, 4, 0, 4\}$ **(b)** $\{4, 4, 0, 0\}$ **(c)** $\{4, 0, 4, 4\}$ **(d)** $\{4, 4, 4, 0\}$ **(e)** $\{0, 0, 4, 4\}$

19. Average power of $x[n]$ is: **(a)** 0 **(b)** 8 **(c)** 12 **(d)** 32 **(e)** 48

20. The spectral line at $\omega = -\frac{\pi}{2}$ is: **(a)** 0 **(b)** 2 **(c)** $1 + j$ **(d)** $1 - j$ **(e)** 8

DID YOU REMEMBER TO SIGN THE HONOR PLEDGE?