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:

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!

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

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

3. The system $y[n] = \sum_{i=0}^{100} x[n-i]$ 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

4. The system with impulse response $h[n] = (\frac{2}{3})^{|n|}$ 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

For #5-#6: We observe the following two input-output pairs for an LTI system:
The response to $\{\underline{1}, 1\}$ is $\{\underline{1}, 4, 5, 2\}$. The response to $\{\underline{1}, 2\}$ is $\{\underline{1}, 5, 8, 4\}$.

5. The response of the system to the input $\{\underline{3}, 4\}$ is:
   (a) $\{\underline{2}, 9, 13, 6\}$ **(b)** $\{\underline{3}, 13, 18, 8\}$ **(c)** $\{\underline{3}, 14, 21, 10\}$ **(d)** $\{\underline{3}, 12, 15, 6\}$ **(e)** $\{\underline{3}, 7, 10, 13\}$

6. The impulse response is: **(a)** $\{\underline{1}, 2\}$ **(b)** $\{\underline{1}, 1, 2\}$ **(c)** $\{\underline{1}, 2, 2\}$ **(d)** $\{\underline{1}, 3, 2\}$ **(e)** $\{\underline{1}, 4, 2\}$

7. The convolution $\{1, 2, 3\} * \{4, 5, 6\} =$: **(a)** $\{7, 8, 9\}$ **(b)** $\{4, 13, 27, 18\}$
   (c) $\{4, 13, 28, 27, 18\}$ **(d)** $\{4, 14, 32, 28, 18\}$ **(e)** $\{5, 11, 20, 23, 9\}$

8. Let $x[n] = \cos(2\pi\frac{3}{25}n)$ and $y[n] = \cos(2\pi\frac{7}{25}n)$. Their correlation is:
   (a) non-zero imaginary **(b)** always zero **(c)** a nonzero multiple of $\frac{2\pi}{25}$
   (d) product of powers of $x[n]$ and $y[n]$ **(e)** sum of DFT coefficients of $x[n]$ and $y[n]$

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9. Two systems $y[n]=x[n]+x[n-1]$ and $y[n]=2x[n]+3x[n-1]$ are connected in cascade (series). The combined system
(a) Has impulse response $\{\underline{2},5,3\}$ **(b)** Is not LTI **(c)** Is LTI but not BIBO stable
(d) Has impulse response $\{\underline{3},4\}$ **(e)** $h[n]$ depends on *order* of connection

10. Continuous-time signal $x(t)=\sin(10\pi t)+2\cos(12\pi t)$ is sampled (A-to-D) at 10 Hz. The sampled signal is then *ideally* interpolated (D-to-A). The result is:
(a) $\sin(10\pi t)+2\cos(12\pi t)$ **(b)** $\sin(10\pi t)$ **(c)** $2\cos(8\pi t)$
(d) $\sin(10\pi t)+2\cos(08\pi t)$ **(e)** $\sin(5\pi t)+2\cos(8\pi t)$

11. The period of the discrete-time sinusoid $\cos(0.15\pi n+0.1)$ is:
(a) 13.333 **(b)** 10 **(c)** 20 **(d)** 40 **(e)** Not periodic

12. The period of the discrete-time sinusoid $\cos(\frac{3\pi}{4}n+0.2)+2\cos(\frac{2\pi}{3}n+0.3)$ is:
(a) 2.667 **(b)** 9 **(c)** 16 **(d)** 24 **(e)** Not periodic

13. The value of the line spectrum of $\cos(\frac{3\pi}{4}n+0.2)+2\cos(\frac{2\pi}{3}n+0.3)$ at $\omega=-\frac{4\pi}{3}$ is:
(a) 0 **(b)** $e^{j0.3}$ **(c)** $e^{-j0.3}$ **(d)** $2e^{j0.3}$ **(e)** $2e^{-j0.3}$

14. The energy of $x[n]=u[n]-3u[n-1]+2u[n-2]$ is: **(a)** 0 **(b)** 1 **(c)** 5 **(d)** 14 **(e)** ∞

15. The DFT of $\{16,8,12,4\}$ is: **(a)** $\{40,4+4j,16,4-4j\}$ **(b)** $\{10,1+j,4,1-j\}$
(c) $\{40,4-4j,16,4+4j\}$ **(d)** $\{10,1-j,4,1+j\}$ **(e)** $\{4,1-j,10,1+j\}$

16. Average power of $\{...16,8,12,4,16,8,12,4...\}$ is: **(a)** 480 **(b)** 120 **(c)** 30 **(d)** 0 **(e)** ∞

17. If the DFT of $x[n]$ is $\{1,2,3,4\}$, then the DFT of $x[n-1]$ is:
(a) $\{2,3,4,5\}$ **(b)** $\{0,1,2,3\}$ **(c)** $\{1,-2j,-3,4j\}$ **(d)** $\{1,2j,-3,-4j\}$ **(e)** $\{1,-2,3,-4\}$

18. The DFT of $x[n]=2\sin(\frac{3\pi}{4}n)$ is: **(a)** $\{0,0,-j,0,0,0,j,0\}$ **(b)** $\{0,0,0,-j,0,j,0,0\}$
(c) $\{0,0,0,j,0,-j,0,0\}$ **(d)** $\{0,0,-j,0,0,j,0,0\}$ **(e)** $\{0,0,j,0,0,-j,0,0\}$

19. $(\frac{1}{4}+j\frac{\sqrt{3}}{4})(\frac{1}{\sqrt{2}}+j\frac{1}{\sqrt{2}})^n+(\frac{1}{4}-j\frac{\sqrt{3}}{4})(\frac{1}{\sqrt{2}}-j\frac{1}{\sqrt{2}})^n$ can be rewritten as: **(a)** $\cos(\frac{\pi}{4}n+\frac{\pi}{6})$
(b) $\cos(\frac{\pi}{4}n+\frac{\pi}{3})$ **(c)** $\cos(\frac{\pi}{6}n+\frac{\pi}{4})$ **(d)** $\cos(\frac{\pi}{3}n+\frac{\pi}{4})$ **(e)** $(\sqrt{2})^n\cos(\frac{\pi}{4}n+\frac{\pi}{6})$

20. $\cos(30t)+2\cos(70t)$ and which of these are identical after sampling at $\frac{100}{2\pi}$ Hz:
(a) $-\cos(30t)$ **(b)** 0 **(c)** $\cos(30t)$ **(d)** $2\cos(30t)$ **(e)** $3\cos(30t)$

DID YOU REMEMBER TO SIGN THE HONOR PLEDGE?