

MAT 320 Quiz 4 Answer Sheet

Fall 2021

Quiz ID: LRP

Name: _____

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Submit electronic answers at

<http://azrael.digipen.edu/cgi-bin/MAT320quiz.pl>

MAT 320

Quiz 4

Spring 2021

- Consider the digital filter F_1 : $y_t = x_t - \frac{1}{4}x_{t-1}$. What is the transfer function $\mathcal{H}(z)$ for this filter?
 - $1 - \frac{1}{4}z$
 - $1 - \frac{1}{4z}$
 - $\frac{z}{z+\frac{1}{4}}$
 - $\frac{z-\frac{1}{4}}{z}$
 - $1 - 4z$
- Same filter F_1 as in the previous question. What is the frequency response $H(\omega)$ of this filter?
 - $\frac{e^{i\omega}}{e^{i\omega}-\frac{1}{4}}$
 - $\frac{1}{4}e^{i\omega}$
 - $1 - \frac{1}{4}e^{-i\omega}$
 - $1 - 4e^{-i\omega}$
 - $\frac{e^{i\omega}-4}{e^{i\omega}}$
- Same filter F_1 as in the previous question. What is the magnitude response $|H(\omega)|$ of this filter?
 - $\frac{1}{|e^{i\omega}+\frac{1}{4}|}$
 - $|1 - \frac{1}{4}e^{i\omega}|$
 - $|e^{i\omega} - \frac{1}{4}|$
 - $|1 + 4e^{-i\omega}|$
 - $|\frac{e^{i\omega}-4}{e^{i\omega}}|$
- Same filter F_1 as in the previous question. Which frequency ω has the largest frequency response?
 - $5\pi/6$
 - $3\pi/4$
 - $\pi/3$
 - $\pi/2$
 - $2\pi/3$
- Same filter F_1 as in the previous question. If the input \mathbf{x} is the unit impulse signal: $(1, 0, 0, 0, \dots)$ then what is the output value y_1 ? (Assume values with index less than zero are equal to 0.)
 - $\frac{1}{4}$
 - $-\frac{1}{4}$
 - 0
 - 1
 - $\frac{1}{8}$
- Consider the digital filter F_2 : $y_t = \frac{1}{2}x_t + x_{t-1} + \frac{1}{2}x_{t-2}$. What is the transfer function $\mathcal{H}(z)$ for this filter?
 - $1 - \frac{1}{2}z$
 - $1 - \frac{1}{2z}$
 - $\frac{\frac{1}{2}z+1}{z+2}$
 - $\frac{z+2}{z+\frac{1}{2}}$
 - $\frac{z^2+2z+1}{2z^2}$
- Same filter F_2 as in the previous question. If $H(\omega)$ is the frequency response of this filter, what is $e^{i\omega}H(\omega)$? (Hint: First factor out an exponential from $H(\omega)$.)
 - $\frac{1}{2}e^{i\omega} + 1 + \frac{1}{2}e^{-i\omega}$
 - $e^{i\omega} + \frac{1}{2} + e^{-i\omega}$
 - $1 - \frac{1}{2}e^{-i\omega}$
 - $\frac{e^{-i\frac{\omega}{2}} + \frac{1}{2}}{e^{i\frac{\omega}{2}} - \frac{1}{2}}$
 - $\frac{e^{i\frac{\omega}{2}} - \frac{1}{2}}{e^{-i\frac{\omega}{2}} + \frac{1}{2}}$
- Same filter F_2 as in the previous question. Use the previous question to find a simple form for $H(\omega)$, the frequency response of this filter.
 - $(\cos \omega + 1)e^{-i\omega}$
 - $(\cos \omega - \frac{1}{2})e^{i\omega}$
 - $(\cos \omega - 1)e^{i\omega}$
 - $(\sin \omega - 1)e^{i\omega}$
 - $(\sin \omega + 1)e^{-i\omega}$
- Same filter F_2 as in the previous question. What is the magnitude response $|H(\omega)|$ of this filter?
 - $1 - \frac{1}{2}\sin \omega$
 - $1 - \cos \omega$
 - $1 - \frac{1}{2}\cos \omega$
 - $\cos \omega - \frac{1}{2}$
 - $\cos \omega + 1$
- Same filter F_2 as in the previous question. If the phasor $e^{i\omega t}$ is the input to F_2 , the output signal will be the same phasor delayed by how many samples?
 - 1
 - $\frac{1}{2}$
 - $\frac{3}{2}$
 - 2
 - 3