

MAT 320 Quiz 4 Answer Sheet

Fall 2021

Quiz ID: WHK

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?
  - $\frac{z}{z+\frac{1}{4}}$
  - $1 - 4z$
  - $\frac{z-\frac{1}{4}}{z}$
  - $1 - \frac{1}{4}z$
  - $1 - \frac{1}{4z}$
- Same filter  $F_1$  as in the previous question. What is the frequency response  $H(\omega)$  of this filter?
  - $1 - \frac{1}{4}e^{-i\omega}$
  - $\frac{e^{i\omega}-4}{e^{i\omega}}$
  - $1 - 4e^{-i\omega}$
  - $\frac{e^{i\omega}}{e^{i\omega}-\frac{1}{4}}$
  - $\frac{1}{4}e^{i\omega}$
- Same filter  $F_1$  as in the previous question. What is the magnitude response  $|H(\omega)|$  of this filter?
  - $|e^{i\omega} - \frac{1}{4}|$
  - $|\frac{e^{i\omega}-4}{e^{i\omega}}|$
  - $|1 + 4e^{-i\omega}|$
  - $\frac{1}{|e^{i\omega}+\frac{1}{4}|}$
  - $|1 - \frac{1}{4}e^{i\omega}|$
- Same filter  $F_1$  as in the previous question. Which frequency  $\omega$  has the largest frequency response?
  - $\pi/3$
  - $2\pi/3$
  - $\pi/2$
  - $5\pi/6$
  - $3\pi/4$
- 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.)
  - 0
  - $\frac{1}{8}$
  - 1
  - $\frac{1}{4}$
  - $-\frac{1}{4}$
- 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?
  - $\frac{\frac{1}{2}z+1}{z+2}$
  - $\frac{z^2+2z+1}{2z^2}$
  - $\frac{z+2}{z+\frac{1}{2}}$
  - $1 - \frac{1}{2}z$
  - $1 - \frac{1}{2z}$
- 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  $H(\omega)$ .)
  - $1 - \frac{1}{2}e^{-i\omega}$
  - $\frac{e^{i\frac{\omega}{2}} - \frac{1}{2}}{e^{-i\frac{\omega}{2}} + \frac{1}{2}}$
  - $\frac{e^{-i\frac{\omega}{2}} + \frac{1}{2}}{e^{i\frac{\omega}{2}} - \frac{1}{2}}$
  - $\frac{1}{2}e^{i\omega} + 1 + \frac{1}{2}e^{-i\omega}$
  - $e^{i\omega} + \frac{1}{2} + e^{-i\omega}$
- 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.
  - $(\cos \omega - 1)e^{i\omega}$
  - $(\sin \omega + 1)e^{-i\omega}$
  - $(\sin \omega - 1)e^{i\omega}$
  - $(\cos \omega + 1)e^{-i\omega}$
  - $(\cos \omega - \frac{1}{2})e^{i\omega}$
- Same filter  $F_2$  as in the previous question. What is the magnitude response  $|H(\omega)|$  of this filter?
  - $1 - \frac{1}{2}\cos \omega$
  - $\cos \omega + 1$
  - $\cos \omega - \frac{1}{2}$
  - $1 - \frac{1}{2}\sin \omega$
  - $1 - \cos \omega$
- 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?
  - $\frac{3}{2}$
  - 3
  - 2
  - 1
  - $\frac{1}{2}$