

MAT 320 Quiz 5 Answer Sheet

Fall 2021

Quiz ID: QDC

Name: _____

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MAT 320

Quiz 5

Fall 2021

- At 44100 Hz sample rate, suppose we want to calculate the plucked string filter coefficients to produce a fundamental frequency (pitch) of exactly 500 Hz, by choosing parameters L for the delay in the comb filter, and a for the all-pass filter. Assuming that we are also using a low-pass filter with phase delay of one half sample, in order to find a we should use what value for δ ?
 - 0.7
 - 0.4
 - 0.6
 - 0.3
 - 0.5
- If a comb filter has frequency response function with peaks (maximum values) at 24 dB, and valleys (minimum values) at -6 dB, then the amplitude range of the signal is varying from low to high by a factor of about:
 - 2
 - 64
 - 32
 - 4
 - 128
- The low-pass filter $y_t = \frac{1}{2}(x_t + x_{t-1})$ used in the plucked string filter has which of the following properties:
 - linear phase
 - magnitude response $\sin(\omega/2)$
 - allows exact frequency adjustment in plucked string filter
 - i) only
 - ii) and iii) only
 - ii) only
 - all of them
 - i) and ii) only
- The all-pass filter $y_t = ax_t + x_{t-1} - ay_{t-1}$ used in the plucked string filter has which of the following properties:
 - transfer function with two complex poles
 - magnitude response 1
 - allows exact frequency adjustment in plucked string filter
 - ii) and iii) only
 - i) only
 - ii) only
 - all of them
 - i) and ii) only
- Which of the following could be the transfer function \mathcal{H} of an all-pass filter?
 - $\frac{4+z^{-1}}{1+2z^{-1}}$
 - $\frac{1+2z^{-1}}{1+\frac{1}{2}z^{-1}}$
 - $\frac{2z+1}{z+2}$
 - $\frac{4z+1}{z+2}$
 - $\frac{2+z^{-1}}{1+\frac{1}{2}z^{-1}}$
- Which of the following could be the frequency response function $H(\omega)$ of an all-pass filter?
 - $\frac{e^{i\omega/2} - 2e^{i\omega/2}}{e^{-i\omega/2} + 2e^{-i\omega/2}}$
 - $\frac{e^{-i\omega/2} + 2e^{i\omega/2}}{e^{i\omega/2} + 2e^{-i\omega/2}}$
 - $\frac{e^{-i\omega/2} + 3e^{i\omega/2}}{e^{i\omega/2} + \frac{1}{3}e^{-i\omega/2}}$
 - $\frac{4e^{-i\omega/2} + e^{i\omega/2}}{4e^{i\omega/2} - 3e^{-i\omega/2}}$
 - $\frac{e^{i\omega/2} + 3e^{i\omega/2}}{e^{i\omega/2} - \frac{1}{3}e^{-i\omega/2}}$
- We used the approximation that for x close to zero: $x = \tan x = \tan^{-1} x$. For $x < 0$ which inequalities are actually true?
 - $\tan^{-1} x < \tan x < x$
 - $\tan^{-1} x < x < \tan x$
 - $\tan x < x < \tan^{-1} x$
 - $\tan x < \tan^{-1} x < x$
 - $x < \tan x < \tan^{-1} x$
- Suppose a comb filter has $L = 9$ and $R = 0.9$, and let $\mathbf{h} = (h_0, h_1, h_2, \dots)$ be the impulse response. Find the sum, to two decimal places. (Hint: the number $(0.9)^9$ is about 0.387.)

$$\sum_{t=0}^{\infty} h_t.$$
 - 1.48
 - 1.63
 - 1.57
 - 1.36
 - 1.71