Homework for Module 1

7 questions

1 point

1. (Difficulty: ★) What are the advantages of using digital signals over analog ones? Choose the correct answer(s).

- [x] Processing of digital signals can be easily implemented in modern computers.
- [ ] Digital signals contains more information than analog ones.
- [x] Digital signals are more robust to noise.
- [x] Digital signals can be easily stored.

1 point

2. (Difficulty: ★) Amongst the signals listed below, select those that are in digital format.

- [x] Music recorded on a CD.
- [ ] Music recorded on a vinyl record.
- [x] JPEG image on a website.
- [ ] A handwritten book manuscript.

1 point

3. (Difficulty: ★ ★) Consider the following finite support signal:

$$x[n] = \begin{cases} (-1)^n n & \text{for } n = 1, 2, 3 \\ 0 & \text{otherwise} \end{cases}$$

Consider also its periodic repetition

$$y[n] = \sum_{k=-\infty}^{\infty} x[n + 7k].$$

Compute the energy and power of both $x[n]$ and $y[n]$.

Note: write the answer as E_x P_x E_y P_y i.e. as a list of four space-separated integer numeric values. For a guide to entering numerical results, see here; infinity is written as oo, i.e. a double lowercase letter 'o'.

Ex=14,Px=14/3,Ey=oo,Py=?

1 point

4. (Difficulty: ★ ★) Consider the signal

$$x[n] = \delta[n] + 2\delta[n-1] + 3\delta[n-2].$$

Consider now its moving average, i.e. the signal

$$y[n] = \frac{1}{2}\left(x[n] + x[n-1]\right)$$

Select the correct expressions from the options below.

- [ ] $y[n] = \delta[n] + 2\delta[n-1] + 5\delta[n-2] + 3\delta[n-3]$.
- [x] The output for $n \geq 4$ is always zero.

1 point

5. (Difficulty: ★) A music song recorded in a studio is stored as a digital sequence on a CD. The analog signal representing the music is 2 minutes long and is sampled at a frequency $f_s = 44100\ s^{-1}$. How many samples should be stored on the CD? Write the number of samples without commas or dots. Assume that the audio file is mono, or in other words, single channel.

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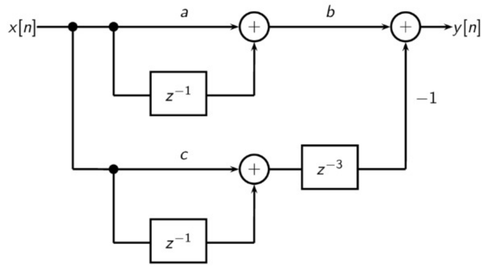
6. (Difficulty: ★ ★ ★) Given the following filter



What is the input-output relationship?

- (●) $y[n] = b(ax[n] + x[n-1]) - (cx[n-3] + x[n-4])$.
- ( ) $y[n] = abx[n] + bx[n-1] + cx[n-3] - x[n-4]$.
- ( ) $y[n] = b(ax[n] + x[n-1]) - (c+1)x[n-3]$.
- ( ) $y[n] = (bax[n] + x[n-1]) + (cx[n-3] + x[n-4])$.

1 point

7. (Difficulty: ★ ★) What is the minimum period P (in samples) of the signal $e^{j(M/N)2\pi n}$ for the following values of M and N?

$M = 1, N = 3$

$M = 5, N = 7$

$M = 35, N = 15$

Please write the three values of P one after the other, with just one white space between each other.

??

- [x] I understand that submitting work that isn't my own may result in permanent failure of this course or deactivation of my Coursera account. Learn more about Coursera's Honor Code

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