DSA-Assignment-3

Deadline: 23rd April, 2023

Instructions

1. Deadline for the assignment is **23rd April, 2023**
2. Solve all the questions and submit a handwritten document
3. Plagiarism will be penalized
4. Submit a pdf of the form **<roll_no>_dsa3.pdf**

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1. Find the linear and circular convolution of the following sequences
   $x[n] = \{-\underset{\uparrow}{1}, 1, 0, 1\}$ and $h[n] = \{1, 2, \underset{\uparrow}{3}, 4, 5\}$.

2. Determine the output $y[n]$ of a relaxed LTI system with impulse response
   $h[n] = a^n u[n], |a| < 1$ and when input is a unit step sequence i.e., $x[n] = u[n]$.

3. Obtain and sketch the impulse response of the shift-invariant system given
   below:
   $y[n] = 0.1x[n] + 0.2x[n-1] + 0.3x[n-2] + 0.4x[n-4]$

4. A digital system is described by the following difference equation:

   $$y[n] = x[n] - 0.5x[n-1] + 0.36x[n-2]$$

   Find the transfer function H(z), the denominator polynomial A(z), and
   the numerator polynomial B(z).

5. Find the z-transform for the following and also mention the ROC:

   (a) $x(n) = \{2, 4, \underset{\uparrow}{5}, 7, 0, 1\}$

   (b) $x(n) = a^n u(n) + b^n u(-n-1)$

6. Consider two sequence,

   $$x_1(n) = 3\delta(n) + 2\delta(n-1)$$
   $$x_2(n) = 2\delta(n) - \delta(n-1)$$

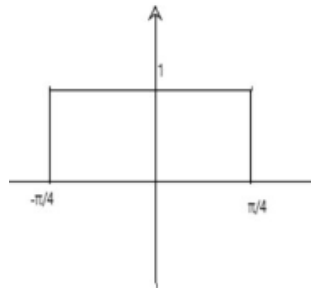(a) Find the z-transform of the convolution

$$X(Z) = Z(x_1(n) * x_2(n))$$

(b) Determine the convolution sum using the z-transform

$$x(n) = x_1(n) * x_2(n) = \sum_{k=0}^{\infty} x_1(k)x_2(n-k)$$

7. Design below filter using

   (a) without window
   (b) with Hamming window

$$H(e^{\hat{k}_o})$$

8. Record your name in Wavesurfer software and observe different sounds. Submit spectrogram, formants, plot figures obtained using Wavesurfer.