EBU4375 Exercise

Date: 3 November 2023

Please answer all the questions in this sheet.
The duration of the exercise is **30 minutes** only.
You're welcome to work in groups.
THIS IS NOT MARKED.

Student name: ———————————————————

QM student number: ———————————————————

BUPT student number: ———————————————————

Class number: ———————————————————-

Question 1

The discrete-time systems considered in this question are defined by difference equations with input $x[n] = u[n]$ and output $y[n]$. Indicate whether the systems are linear and/or time-invariant. Show your work. HINT: A linear system is one for which the output $y_{sum}[n]$ of the input $x_1[n] + x_2[n]$ is the same as the output $y_1[n]$ plus the output of $y_2[n]$. A system is time-invariant if for a delayed input $x_{del}[n] = x[n - n_0]$ the output $y_{del} = y[n - n_0]$.

$$y[n] = n \cdot y[n-1] + x[n] \tag{1}$$

$$y[n] = \sqrt{x[n]} \tag{2}$$

$$y[n] = x[n] + 1 \tag{3}$$

Question 2

For the LTI system $h[n]$ shown below, find the Fourier Transform $H(\Omega)$. Hint: Plot h[n] or find the values of $h[n]$ for $n = -10 \ldots 10$ before calculating $H(\Omega)$.

$$h[n] = (n+4)u[-n-1] + (-n+4)u[-n+4]u[n] \tag{4}$$

What would be the output $y[n]$ if the input signal is $x[n]$ shown below:

$$x[n] = 2\delta[n-4] - 2\delta[n+4] \tag{5}$$

THIS IS THE END

ANSWER BOOK
QUESTION 1

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QUESTION 2

ANSWER BOOK