

科目：訊號與系統(300B)

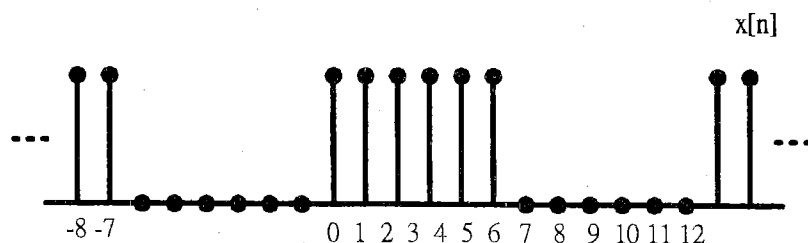
校系所組：中央大學電機工程學系(系統與生醫組)

交通大學生醫工程研究所(乙組)

清華大學電機工程學系(乙組、丁組)

參考用

- 一、(5%) Please define a linear system in terms of mathematical expression.
- 二、(10%) Please define the properties of causality and stability for a Linear Time-Invariant (LTI) System in terms of mathematical expression.
- 三、(10%) Please define an eigenfunction for an LTI system with impulse response  $h(t)$ ; and show its transfer function  $H(s)$  as the corresponding eigenvalue.
- 四、(15%) The linear convolution of a length-100 sequence with a length-1500 sequence is to be computed using 128-point DFTs and IDFTs.
  - (一) (8%) Determine the smallest number of DFTs and IDFTs needed to compute the above linear convolution using the overlap-add approach.
  - (二) (7%) Determine the smallest number of DFTs and IDFTs needed to compute the above linear convolution using the overlap-save approach.
- 五、(15%)
  - (一) (8%) Derive and plot the discrete Fourier series  $X[k]$  of a periodic rectangular pulse  $x[n]$ , whose period is  $N = 12$  as shown in the following figure. Please derive both the magnitude and phase sequences.



- (二) (7%) Derive the Fourier transform  $X(e^{j\omega})$  of one period  $\hat{x}[n]$  of  $x[n]$ . Please plot the magnitude and phase of  $X(e^{j\omega})$ . (7%)

- 六、(15%) An LTI system is described by the difference equation:

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

What is the output if the input is  $x[n] = 10 + 4\cos(0.5\pi n + \pi/4) + 5\delta[n-3]$ ?

注意：背面有試題

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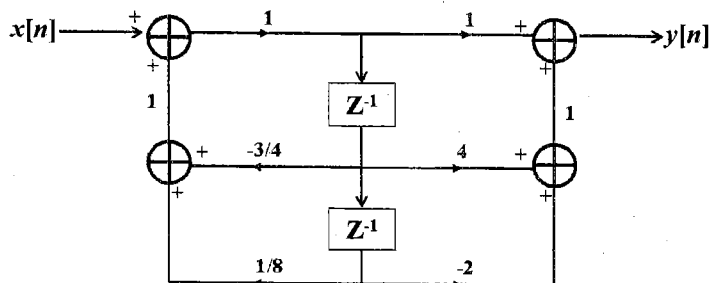
參考用

七、(15%) For a discrete-time multiplier with two input signals  $x[n]$  and  $h[n]$ , the two signals are  $x[n] = u[n] - u[n-6]$  and  $h[n] = a^n u[n]$ , where  $u[n]$  is the unit step function with unity gain for  $n \geq 0$ . The system output  $y[n]$  can be expressed as  $y[n] = x[n] \cdot h[n]$ , where  $\cdot$  represents the multiplication operator.

(一) (8%) Please determine the Z-transform  $Y(z)$  of system output  $y[n]$ .

(二) (7%) Please plot the pole(s) and zero(s) of  $Y(z)$  and indicate its Region of Convergence (ROC).

八、(15%) Consider a signal flow graph shown in the following figure.



(一) (8%) Please find the transfer function  $H(z)$ .

(二) (5%) Please find the impulse response,  $h[n]$ , of the system.

(三) (2%) Is the system stable? Please explain it.