

**BIRZEIT UNIVERSITY**  
**COMPUTER SYSTEM ENGINEERING DEPARTMENT**

ENCS431: Digital Signal Processing

First Semester 2007/2008

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**First Exam**

Date: 17/11/2007

Student Name: \_\_\_\_\_ Student Number: \_\_\_\_\_  
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Question 1: (30 marks)

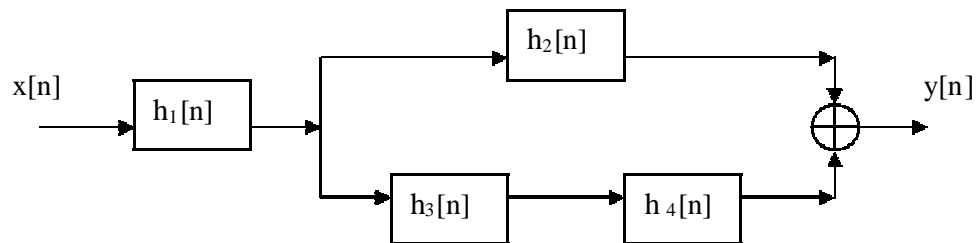
(a) Find the z-transform, including the region of convergence, for the sequence:

$$x[n] = \left(\frac{1}{3}\right)^{|n+1|}, \quad \left[ \text{Hint: } \sum_{n=0}^{\infty} a^n = \frac{1}{1-a}, |a| < 1 \right]$$

(b) Does the Fourier Transform exist for this sequence? If so, what is it?

Question 2: (20 marks)

Consider the interconnection of LTI systems shown in the figure below.



a) Express the frequency response of the overall system in terms of  $H_1(e^{j\omega})$ ,  $H_2(e^{j\omega})$ ,  $H_3(e^{j\omega})$ , and  $H_4(e^{j\omega})$ .

b) Find the frequency response if

$$h_1[n] = d[n] + 2d[n - 2] + d[n - 4]$$

$$h_2[n] = h_3[n] = (0.2)^n u[n]$$

$$h_4[n] = d[n - 2]$$

Question 3: (20 marks)

A discrete-time causal LTI system has the system function

$$H(z) = \frac{(1 + 0.2z^{-1})(1 - 9z^{-2})}{(1 + 0.81z^{-2})}$$

- (a) Is the system stable?
- (b) Can the inverse system,  $H_i(z)$ , be both stable and causal?

Question 4: (30 marks)

Consider the system

$$H(z) = \frac{(1 + 0.2z^{-1})(1 - 9z^{-2})}{(1 + 0.81z^{-2})}$$

- (a) Draw the signal flow graph for implementation of the system as a cascade of a second-order IIR system and an FIR system.
- (b) Draw the transposed form of the graph you made in (a).