BIRZEIT UNIVERSITY

Electrical and computer engineering

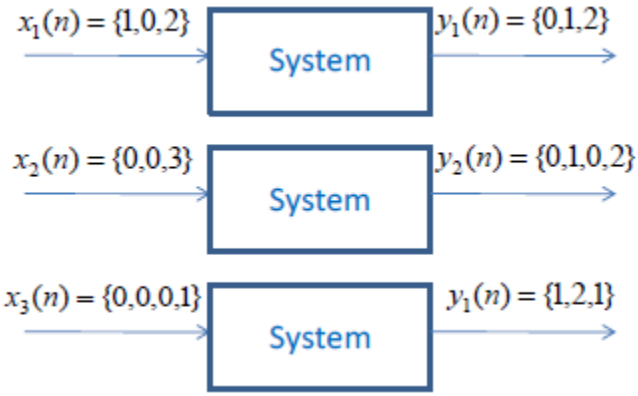
Digital Signal Processing (DSP)

Assignment No (3)

Submission deadline: **Monday 12/10/2015** (23:55 PM) only through Moodle (itc.birzeit.edu)

Q1:

The following input-output pairs have been observed during the operation of a time-invariant system:



Can you draw any conclusions regarding the linearity of the system? What is the impulse response of the system?

Q2:

Determine the impulse response for the cascade of two linear time-invariant systems having impulse responses:

$$h_1(n) = a^n[u(n) - u(n-N)] \quad and \quad h_2(n) = u(n) - u(n-M)$$

Q3:

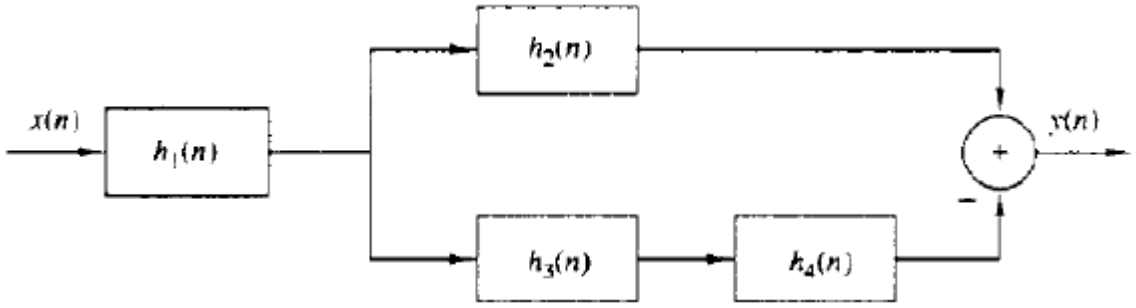
Consider a system with impulse response

$$h(n) = \begin{cases} (\frac{1}{2})^n & ,0 \le n \le 4 \\ 0 & ,elsewhere \end{cases}$$

Determine the input x(n) for 0≤n≤4 that will generate the output sequence y(n)={1, 2, 2.5, 3, 3, ….}.

Q4:

Consider the following LTI system:



(a) Express the overall impulse response h(n) in terms of h1(n), h2(n), h3(n), and h4(n).

(b) Determine h(n) when

$$h_1(n) = \{\frac{1}{2}, \frac{1}{4}, \frac{1}{2}\}$$
$$h_2(n) = u(n)$$
$$h_3(n) = -u(n)$$
$$h_4(n) = \delta(n-4)$$

(c) Determine the response of the system in part (b) if

$$x(n) = \delta(n+2) + 3\delta(n-1) - 4\delta(n-3)$$

Q5:

Determine the range of values of the parameter a for which the linear time-invariant system with impulse response

$$h(n) = \begin{cases} a^n & , n \geq 0, n\,is\,even \\ 0 & , otherwise \end{cases}$$ is stable?

Now, replace even by odd?

Q6:

Determine (by hand) the autocorrelation sequence of the following signal:

x(n)={1,2,1,1}. What is your conclusion?

Q7:

Using MATLAB, generate a 10 kHz sinusoid sampled at 100 kHz. Plot four cycles of the signal. Also plot the spectrum of this signal in the interval (-π, π). Use the **fft** and **fftshift** commands for this purpose. The horizontal axis must be scaled appropriately to represent the interval (-π, π).