

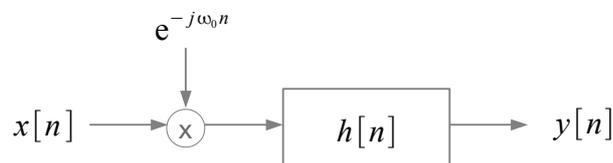


Digital Signal Processing - SS15

Theory Tutorial 3

LTI Systems

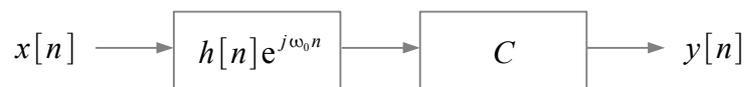
PROBLEM ONE Consider a system S with input $x[n]$ and output $y[n]$ related according to the block diagram shown below.



The input is multiplied by $e^{-j\omega_0 n}$, and the product is passed through a stable LTI system with impulse response $h[n]$.

- (a) Is the system S linear? Justify your answer.
- (b) Is the system S time-invariant? Justify your answer.
- (c) Is the system S stable? Justify your answer.

(d) Specify a system C such that the block diagram shown below represents an alternative way of expressing the input-output relationship of the system S .
(Note: The system C does not have to be an LTI-system).



PROBLEM TWO Signal $x[n]$ and $y[n]$ shown in the Figure 1.1 below are the input and corresponding output for an LTI system.

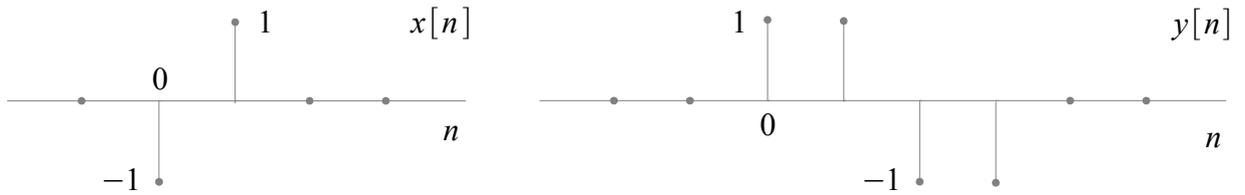


Figure 1.1

(a) Sketch $y_2[n]$, the response of the system to the sequence $x_2[n]$ in Figure 1.2.

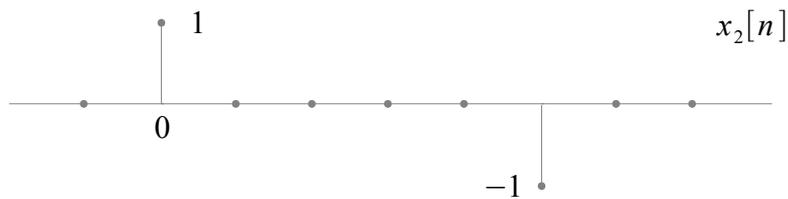


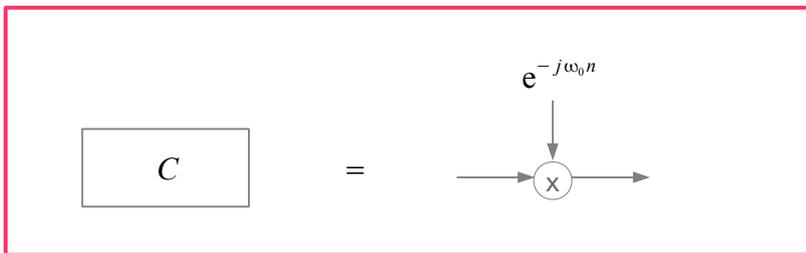
Figure 1.2

(b) Find the impulse response $h[n]$ of this LTI system.

Keys

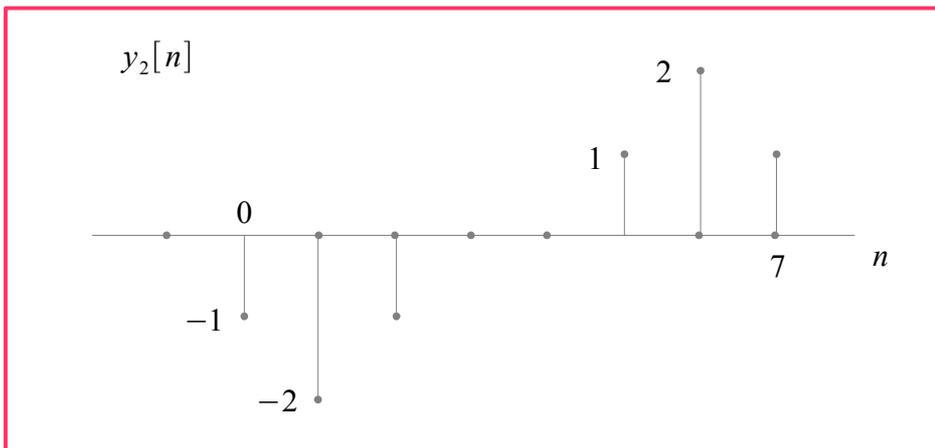
P1.

- (a) Yes. It's linear.
- (b) No. It's time-varying.
- (c) Yes. It's stable.
- (d)



P2.

- (a)



(b)

