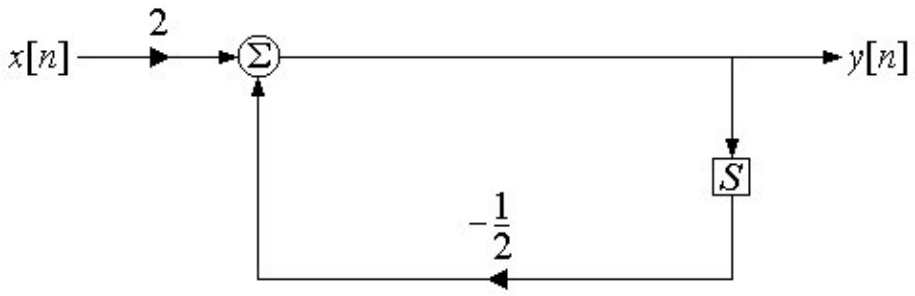
University of California at Berkeley
Department of Electrical Engineering and Computer Sciences
Professor J.M. Kahn
EECS 120
Midterm 1
Monday, October 5, 1998, 2:10-3:10 pm

1. Pace yourself. Don't spend too much time on any one problem.
2. Do all work in the space provided. If you need more room, use the back of previous page.
3. Indicate your answer clearly by circling it or drawing a box around it.
4. Think carefully about the problem before you begin to write.

Problem 1 (45 pts.) Consider the discrete-time system with input $x[n]$ and output $y[n]$ shown below. The element labeled "S" is a one-sample delay.



(a) (10 pts.) Find the difference equation describing the system.

(b) (15 pts.) Find a closed-form expression for the step response $s[n]$ for all n. (You can do this by solving the difference equation. Alternatively, you can do part (c) first, and use the result.)

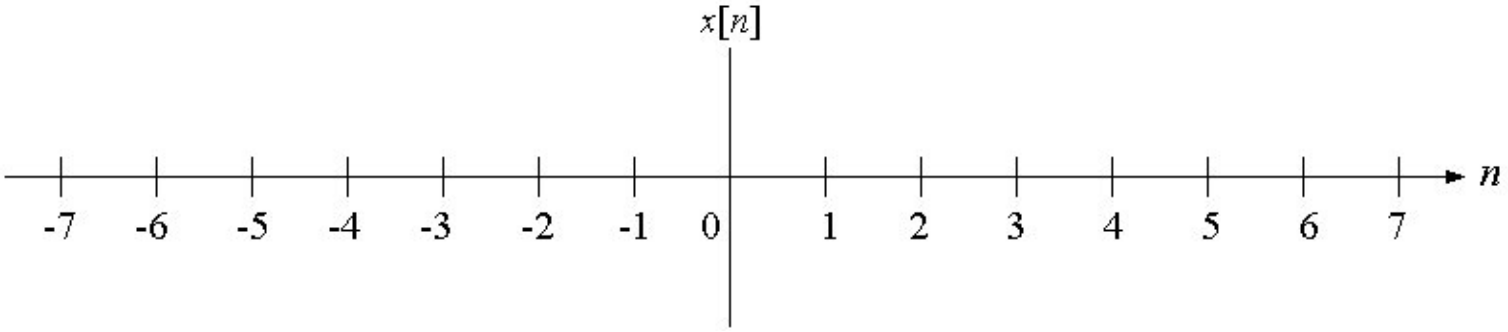
(c) (10 pts.) Find a closed-form expression for the impulse response $h[n]$ for all n. (You can do this using the result of part (b). Alternatively, you can write down $h[n]$ by inspection.)

(d) (10 pts.) Find the frequency response $H(e^{j\Omega})$.

Problem 2 (35 pts.) Consider the periodic discrete-time signal:

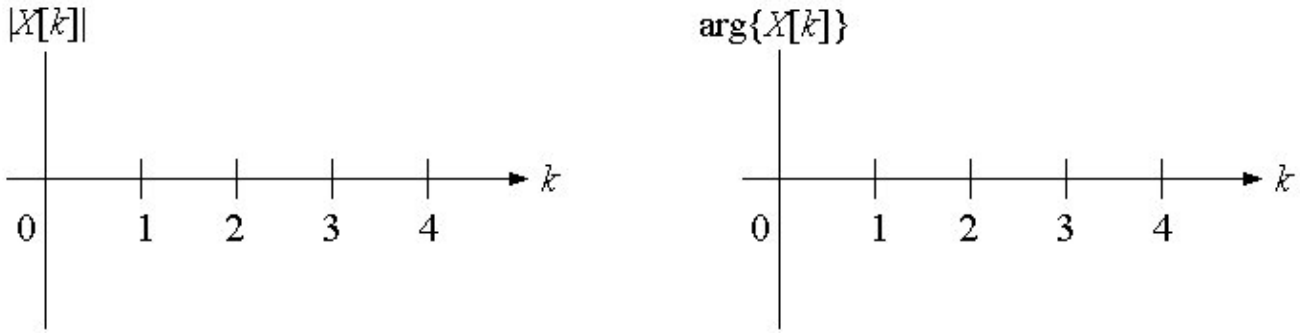
$$x[n] = \sum_{m=-\infty}^{\infty} \{\delta[n-4m-1] - \delta[n-4m+1]$$

(a) (10 pts.) Sketch $x[n]$ versus n.

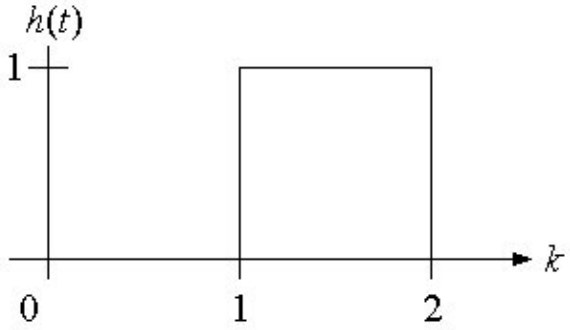


(b) (15 pts.) Find a Fourier series representation of $x[n]$ (i.e., specify Ω_0 and $X[k]$).

(c) (10 pts.) Sketch $|X[k]|$ and $\arg\{X[k]\}$ for 0 &#163 k &#163 4. Be sure to label the vertical axes.



Problem 3 (20 pts.) A continuous-time LTI system has the impulse response $h(t)$ shown below.



The input is $x(t) = e^t u(t)$. Find a closed-form expression for the output $y(t)$.