University of California at Berkeley
Department of Electrical Engineering and Computer Sciences
Professor J.M. Kahn
EECS 120
Midterm 2
Wednesday, November 18, 1998, 2:10 - 3:10 pm

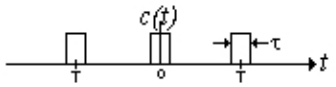
Name: _____

1. Pace Yourself. Dont 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 the 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.

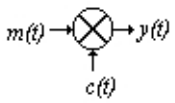
Problem	Points	Score
1	40	0
2	**25**	0
3	35	0
TOTAL:	**100**	**0**

Problem 1 (40 pts.) This problem considers a method of performing DSB-AM modulation.

(a) (10 pts.) Find an expression for $C(j\omega)$, the Fourier transform of the periodic signal $c(t)$. You may find it convenient to define $\omega_0 = 2\pi/T$.

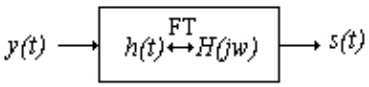


(b) (10 pts.) A message signal $m(t)$, having Fourier transform $M(j\omega)$, is multiplied by $c(t)$ as shown, yielding $y(t)$. Find an expression for $Y(j\omega)$

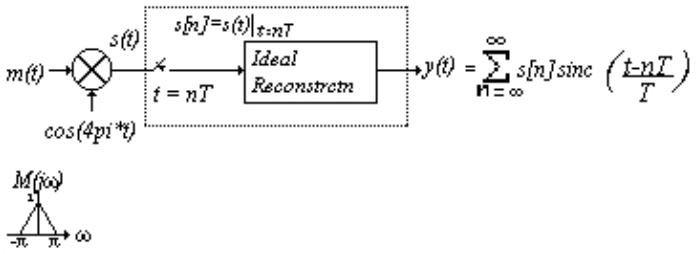


(c) (10 pts.) Let $T = 1$, $\tau = 1/4$, and let $M(j\omega)$ be as indicated. Sketch $Y(j\omega)$ versus ω

(d) (10 pts.) $y(t)$ is passed through the LTI system shown, yielding $s(t)$. For the specific case described in part (c), sketch $H(j\omega)$ such that $s(t) = m(t)\cos 2\pi$

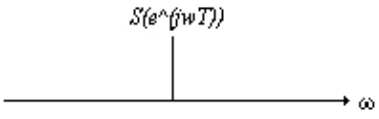


Problem 2 (25 pts.) This problem considers a method for demodulating DSB-Am. Consider the system shown below. $m(t)$ has the Fourier transform $M(j\omega)$ indicated.

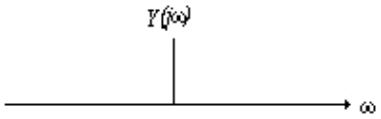


(a) (5 pts.) Sketch $S(j\omega)$, the Fourier transform of $s(t)$.

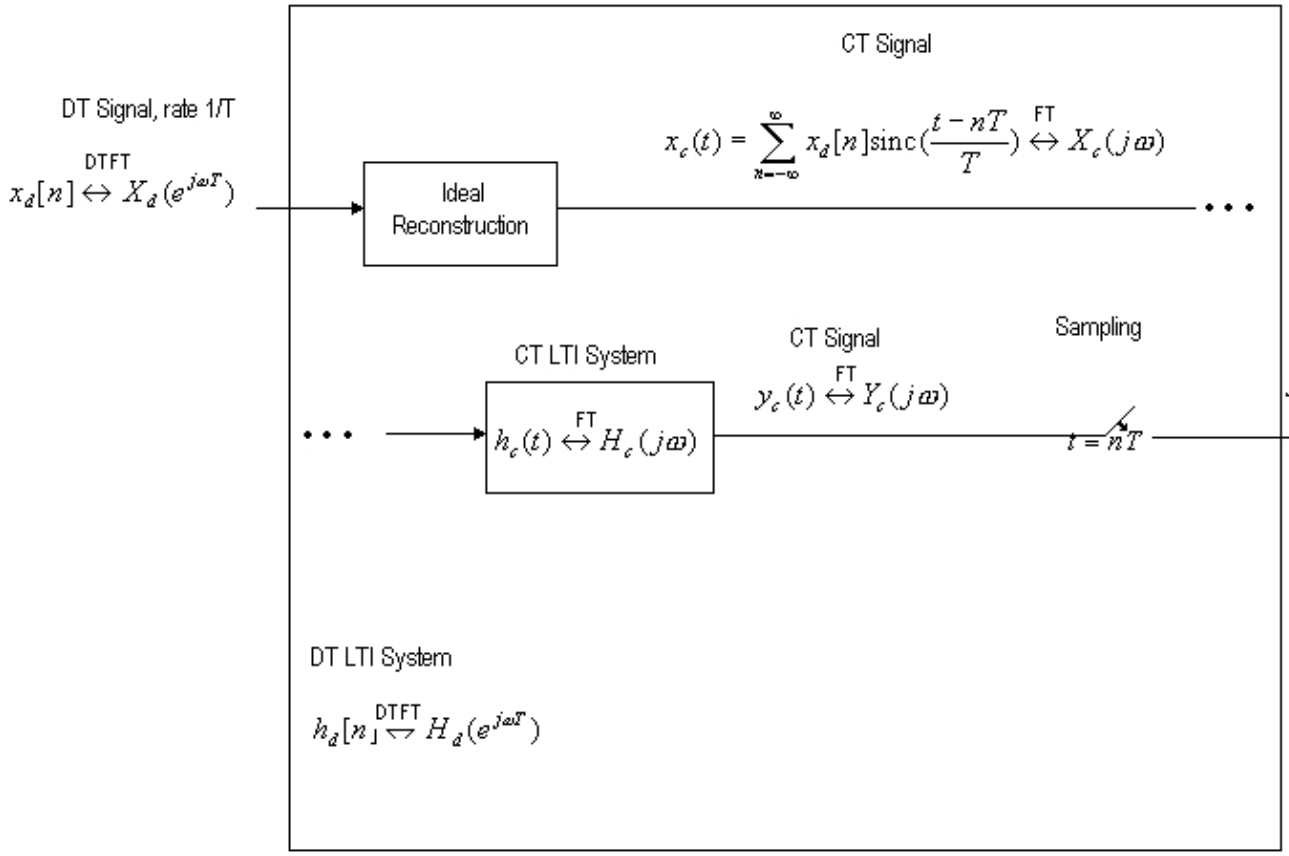
(b) (10 pts.) Let $T = 1$. Sketch $S(e^{j\omega})$, the DTFT of $s[n]$.



(c) (10 pts.) Continue to assume $T = 1$. Sketch $Y(j\omega)$, the Fourier transform of $y(t)$.



Problem 3 (35 pts.) We usually consider discrete-time processing of sampled continuous-time signals. Here, we consider continuous-time processing of reconstructed discrete-time signals. We will characterize the overall discrete-time system enclosed in the dashed box, working backwards from the output toward the input.



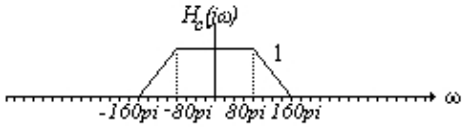
(a) (5 pts.) Relate $Y_d(e^{j\omega})$ to $Y_c(j\omega)$

(b) (5 pts.) Relate $Y_c(j\omega)$ to $X_c(j\omega)$

(c) (10 pts.) Relate $X_c(j\omega)$ to $X_d(e^{j\omega})$.

(d) (10 pts.) Use the results from the previous section to relate $Y_d(e^{j\omega})$ to $X_d(e^{j\omega})$, thereby determining the frequency response of the overall discrete-time system, $H_d(e^{j\omega})$. In other words, relate $H_d(e^{j\omega})$ to $H_c(e^{j\omega})$.

(e) (5 pts.) Assume $T = 0.01$ second, and assume $H_c(j\omega)$ is as sketched below:



Use your answer from part (d) to sketch $H_d(e^{j\omega})$.