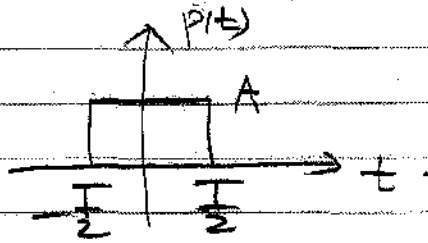
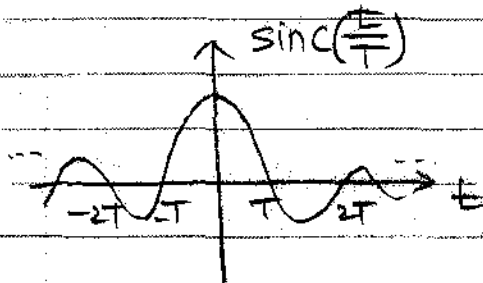


Homework #8

(5) 1(a) Sketch the CTFT of



(b) Sketch the CTFT of



(10) 2 Let  $a(t)$  and  $b(t)$  be finite-energy signals w/ CTFTs  $A(f)$  and  $B(f)$ .

Define  $c(t)$  as

$$c(t) = a(t) * b(t)$$

and

$$c_1[n] \triangleq c(nT)$$

$$a_1[n] \triangleq a(nT)$$

$$b_1[n] \triangleq b(nT)$$

$$c_2[n] \triangleq a_1[n] * b_1[n]$$

Prove or disprove that  $c_1[n] = c_2[n], \forall n$ .

(5) 3 Let  $X$  be a random variable s.t.

$$Pr(X=1) = Pr(X=-1) = 1/2$$

and let  $Y$  be a r.v. s.t.  $Pr(Y=0) = Pr(Y=1) = 1/2$ .

Also let  $Z \sim N(0, \sigma^2)$  w/  $\sigma > 0$ .  
Answer the following questions.

- Find the probability mass function of  $XW$  when  $X$  &  $W$  are i.i.d.
- Find the probability mass function of  $YW$  when  $Y$  and  $W$  are i.i.d.
- Find the probability mass function of  $XY$  when  $X$  and  $Y$  are independent
- " " " " density " of  $XZ$  when  $X$  "  $Z$  " " " " "

(10) 4 Show that

$$\sum_{n=-\infty}^{\infty} \text{sinc}^2(t-n) = 1, \quad \forall t$$

$$\text{where } \text{sinc}(t) \triangleq \begin{cases} \frac{\sin \pi t}{\pi t}, & t \neq 0 \\ 1, & t = 0 \end{cases}$$

- (5) 5. When  $X(t)$  is a complex-valued 2nd-order random process w/ the PSD  $S_{XX}(f)$ , find the PSD of

$$Y(t) = X(t) e^{j2\pi f_c t}$$

- (5) 6 Find the minimum frequency separation for a coherent BPSK given by

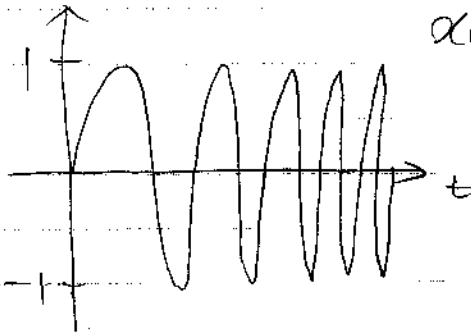
$$H_0: r(t) = P_{T_0}(t) \cos 2\pi f_1 t$$

vs

$$H_1: r(t) = P_{T_0}(t) \cos 2\pi f_2 t$$

where  $2\pi f_1 T_0$  and  $2\pi f_2 T_0$  are both integer multiples of  $2\pi$ .

17. Given a chirp signal



$$x(t) = \sin(2\pi f_0 t^2)$$

for  $0 \leq t \leq T$

Sketch the magnitude square of  $X(f)$ .