

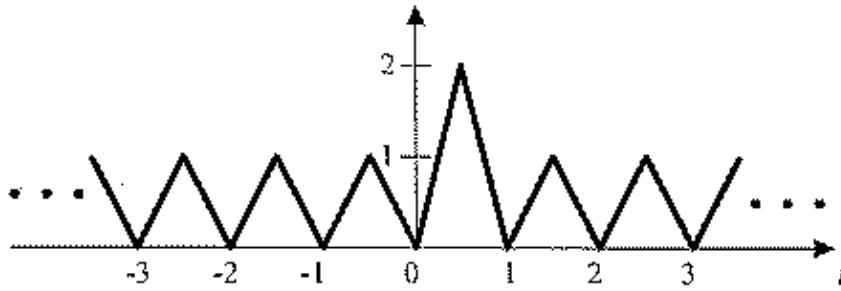
**EECS 120, Spring 2001
Midterm 1
Professor Lau**

1.5 hour. No homework, books, or other materials allowed except 2 pages of handwritten notes, no calculator.

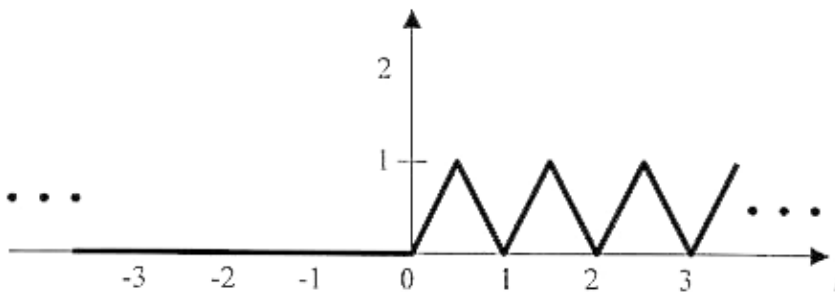
Problem #1

Find the Fourier transform of the following functions:

(a)

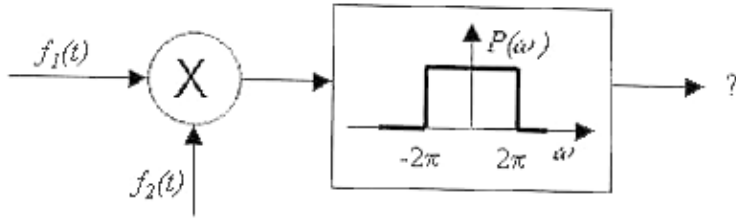


(b)



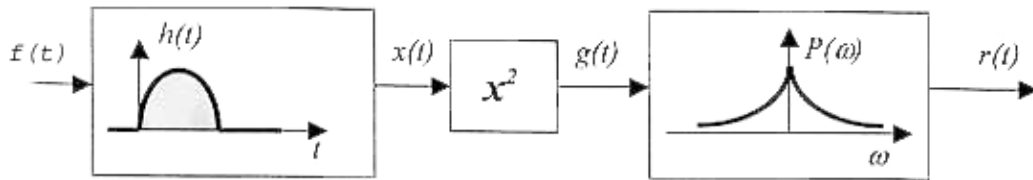
Problem #2

(a)



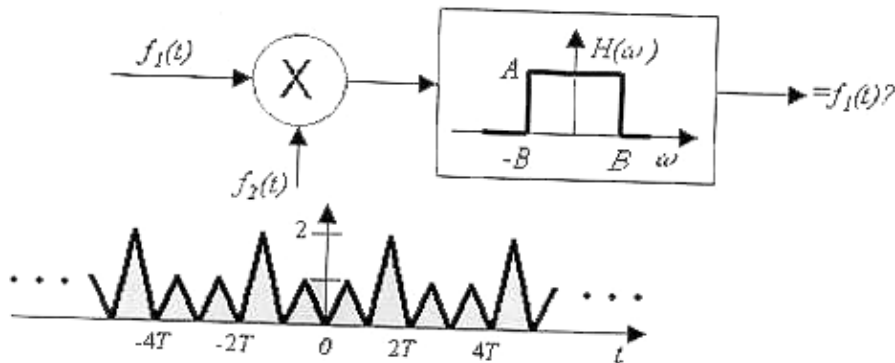
In the above, $f_1(t) = \sum_{k=-\infty}^{+\infty} [e^{i 2 \pi k t}]$, $f_2(t) = \sum_{n=-\infty}^{+\infty} [\delta(t - n + 0.5)]$. What is the output from the lowpass filter $P(\omega)$?

(b)



In the above, $f(t) = \sum_{k=-\infty}^{+\infty} [e^{i 2 \pi k t}]$. The impulse response of the first filter is $h(t) = \sin(\pi t) \text{ prod } [t - 0.5]$. The frequency response of the second filter is $P(\omega) = e^{-\text{abs}(\omega)}$. What are $g(t)$ and $r(t)$?

Problem #3



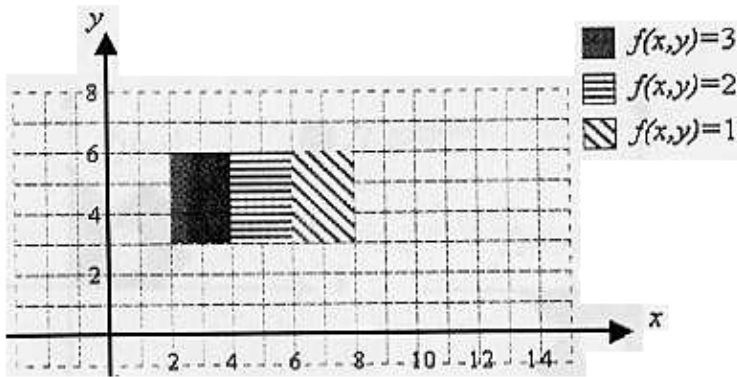
In the above, $f_1(t) = \sum_{k=1}^{10} [e^{-k^2} \cos(2 \pi k t)]$

(a) Consider it a sampling operation. What is the condition on T and B such that the output from the filter $H(\omega)$ is a fully recovered version of $f_1(t)$?

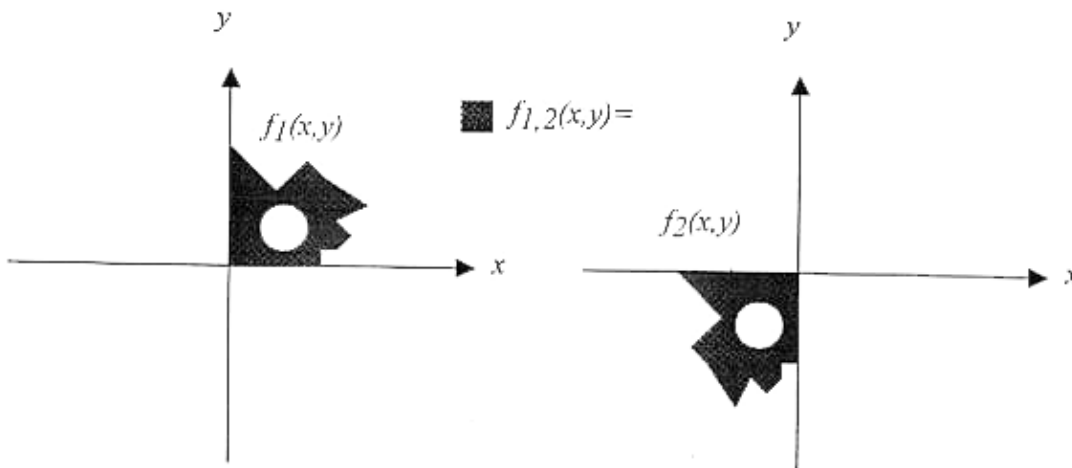
(b) What is the amplitude A of the passband function $H(\omega)$ so that the output is *exactly* equal to $f_1(t)$?

Problem #4

(a) Find the 2-D Fourier transform of the following:



(b) If the Fourier transform of $f_1(x, y)$ below is $F_1(\omega_x, \omega_y)$, what is the Fourier transform of $f_2(x, y)$?



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