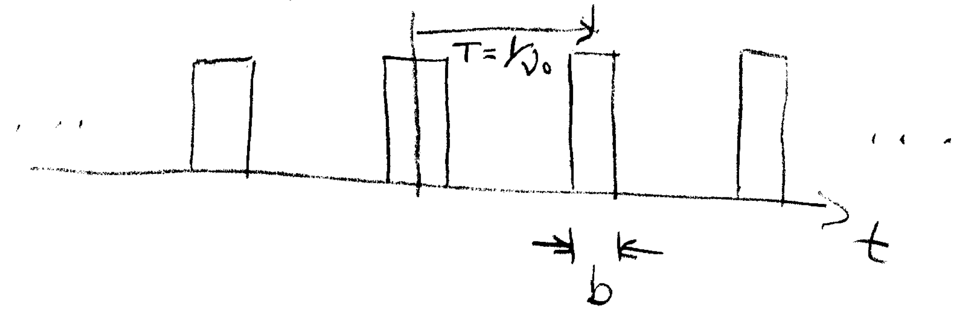
8.1 For a pulse train:



you showed in assignment question 3.1 that

$$D_n = h b \nu_0 \operatorname{sinc}(\pi n b \nu_0) = D_{-n}$$

for $f(t) = \text{pulse train} = \sum_{n=-\infty}^{\infty} D_n e^{2\pi i n \nu_0 t}$

(a) What is $f(t)$ in the frequency domain, $F(\nu)$, ie what is F.T of $f(t)$? Sketch.

(b) What is $F(\nu)$ when the pulse train is modulated by a carrier signal $\cos 2\pi\nu_c t$?

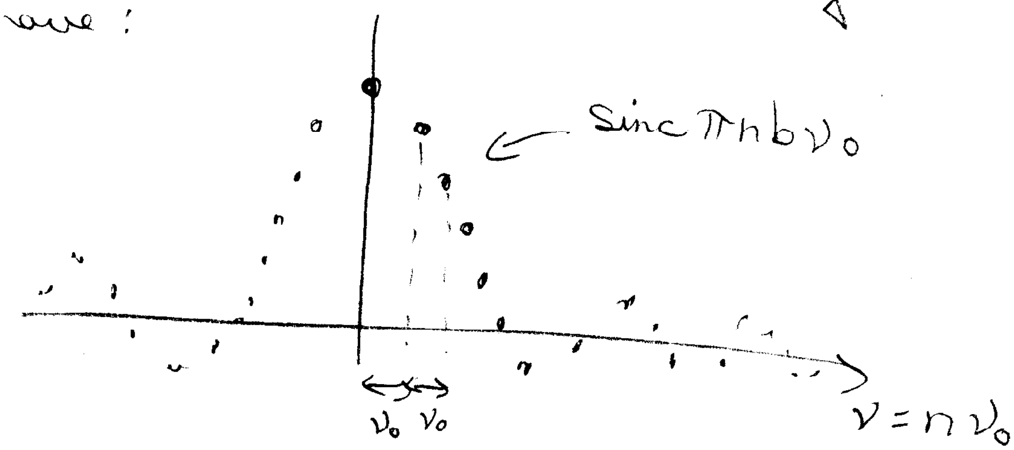
[Hint: you might find the graphical approach to convolution handy here.]

Sol'n

(a) $$f(t) \rightleftharpoons F(\nu) = \sum_{-\infty}^{\infty} D_n \, \mathcal{F}\left(e^{2\pi i n \nu_0 t}\right)$$

$$= \sum_{n=-\infty}^{\infty} D_n \, \delta(\nu - n\nu_0)$$

As per the solution to assignment question 3.1 we have:



(b) $f(t) = \cos 2\pi\nu_c t \cdot \sum_{n=-\infty}^{\infty} D_n e^{2\pi i n \nu_0 t}$

$$\therefore F(\nu) = \mathcal{F}(\cos 2\pi\nu_c t) * \mathcal{F}\left(\sum D_n e^{2\pi i n\nu_0 t}\right)$$

$$= \frac{1}{2}\left(\delta(\nu-\nu_c) + \delta(\nu+\nu_c)\right) * \sum D_n\, \delta(\nu - n\nu_0)$$

Visual convolution