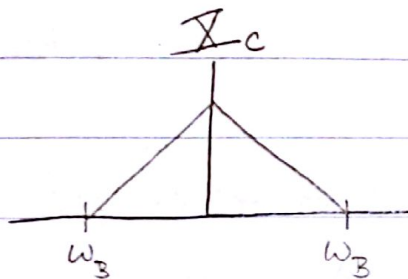


Discussion 7

Questions from Lecture? How are people feeling about sampling & aliasing?

Today, you become a digital music artist.
You create some song w/ freq resp:



← lots of bass, probably clubstep

Where $\omega_B = 20\text{kHz}$, since humans can't hear any higher than that.

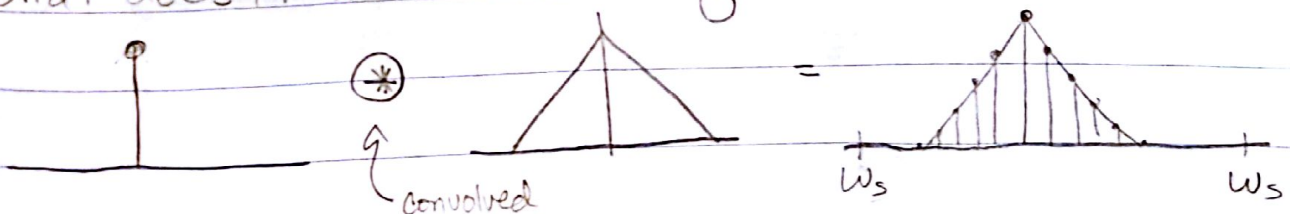
Now, you want to make a high quality file, so what is your sampling freq?

$$2\omega_B = 40\text{kHz}$$

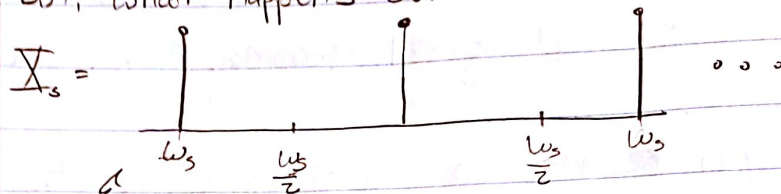
What does a sample look like in time?



What does it look like in freq?

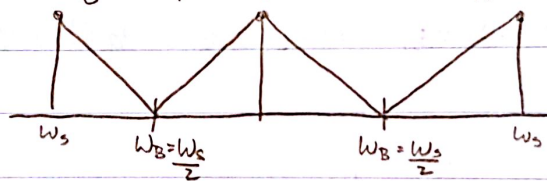


The frequency domain is a convolution w/ $\pm \frac{\omega_s}{2}$.
 But, what happens out of ω_s ?



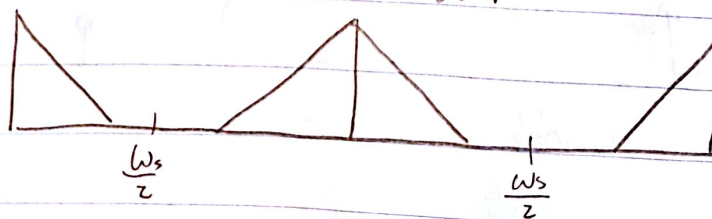
What the frequency domain actually looks like for sampling signal

So, when we convolve the δ train w/ our music freq response, what happens?



This doesn't give much room to make mistakes, because our bandwidth is so close to where frequencies start aliasing.

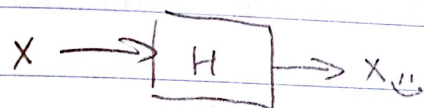
How to fix? increase ω_s , say $50\text{kHz} \cdot 2\pi$.
 What does it look like now?



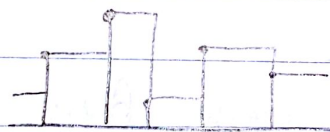
That helps, but we still have those mirrors up at high frequencies.

Additionally, it is difficult to represent lollipops in a real world system

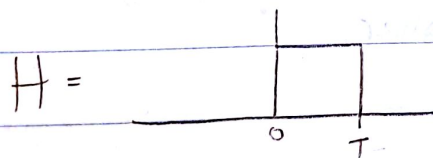
Want some transform that takes in lollipops & outputs some friendlier time function



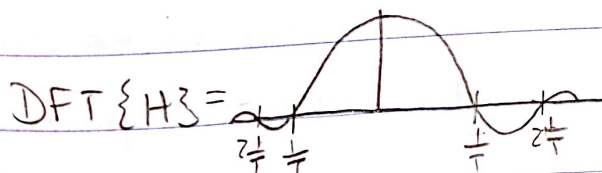
Ideas? Sample & Hold



What is the transform H ?

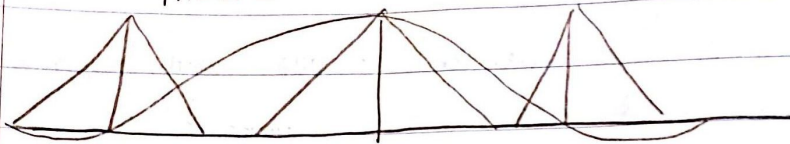


What is the effect in freq domain?



What does $x * H$ look like in freq?

music \rightarrow \leftarrow rect(n)



$$\Sigma \times \text{sinc}$$

What is useful about this multiplication?

Where are the zeros of a sinc?

$$\text{rect}_T \rightarrow \text{sinc}_{\frac{1}{T}} \Rightarrow \text{zeros} = k \frac{1}{T}$$

Where $\frac{1}{T}$ is the sampling freq. Therefore, all the zeros are at ω_s , which is the center of the mirrored freq signal. They are made smaller.