Signals and Systems: PS 06

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① The shooting range acts as the impulse response, meaning that if we input some signal $x(t)$, in this the case, the output from the shooting range is some signal $y(t)$. Because the impulse (violin sound) must be modified by the impulse response $h(t)$ in the frequency domain, we know that in the time domain that is equivalent to convolution. i. $y(t) = x(t) * h(t)$

output impulse impulse response

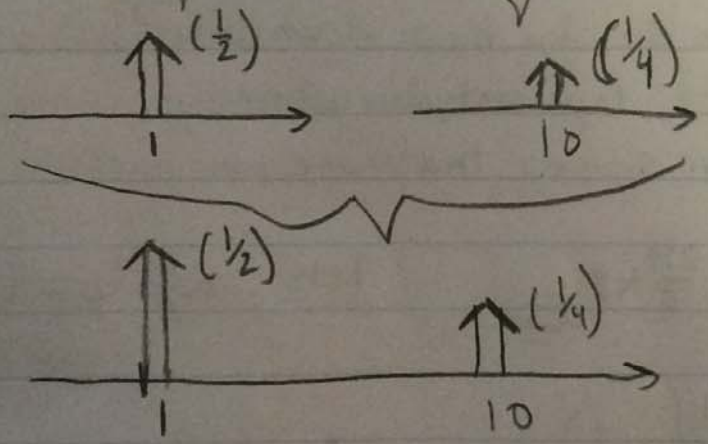
② We know that $y(t) = x(t) * h(t)$ so,

$$y(t) = \frac{1}{2}x(t-1) + \frac{1}{4}x(t-10)$$

$$= \frac{1}{2}(\text{impulse at } t=1) + \frac{1}{4}(\text{impulse at } t=10)$$

$$= \frac{1}{2}\delta(t-1) + \frac{1}{4}\delta(t-10)$$

=



This model can reasonably be called an echo channel since it returns a response 1 second later at half the amplitude and the 9 seconds after that it responds at a quarter of the amplitude. Such it would sound like an echo: