Please staple this cover sheet in front of your answers. (Behind Department of Physics coversheet.)

NAME: **ID#:**

ELEC441: Assignment 2
Due 1pm Friday 19th March 2021

https://amoqt.otago.ac.nz/people/asbradley/elec441

1. Calculate the convolution $(f*h)(t)$ and sketch neatly $f(t)$, $h(t)$ and $(f*h)(t)$. Where
$$f(t)=\begin{cases} 1, & |t|<1 \\ 0, & \text{otherwise} \end{cases} \quad \text{and} \quad h(t)=\begin{cases} 1-|t|, & |t|<1 \\ 0, & \text{otherwise} \end{cases}$$
Note: This question is more fun if you first calculate the derivative of the convolution.

2. Show that the convolution is associative, that is: $(f*g)*h=f*(g*h)$ [You can assume Fubini's theorem holds].

3. The impulse response of a system, $h(t)$, is real valued. Show that the transfer function satisfies
$$H(-\nu)=H^*(\nu).$$

4. Use this to show that for the single frequency input $f(t)=\sin(2\pi\nu t)$, the output will be
$$g(t)=(f*h)(t)=|H(\nu)|\sin\Big(2\pi\nu t+\arg(H(\nu))\Big).$$

SCORE: