

**ECE-320: Linear Control Systems**  
**Homework 5**

Due: Wednesday January 20 by 5 PM

1) Consider the continuous-time plant with transfer function

$$G_p(s) = \frac{1}{(s+1)(s+2)}$$

We want to determine the discrete-time equivalent to this plant,  $G_p(z)$ , by assuming a zero order hold is placed before the continuous-time plant to convert the discrete-time control signal to a continuous time control signal.

Show that if we assume a sampling interval of  $T$ , the equivalent discrete-time plant is

$$G_p(z) = \frac{z(0.5 - e^{-T} + 0.5e^{-2T}) + (0.5e^{-T} - e^{-2T} + 0.5e^{-3T})}{(z - e^{-T})(z - e^{-2T})}$$

Note that we have poles where we expect them to be, but we have introduced a zero in going from the continuous time system to the discrete-time system.