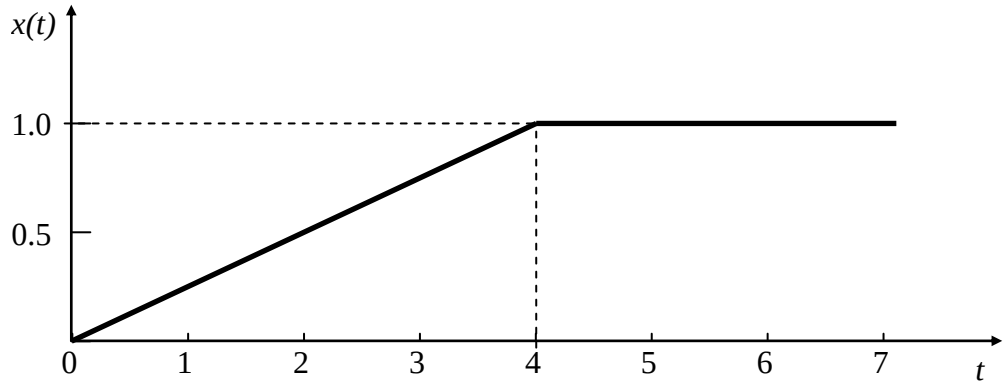
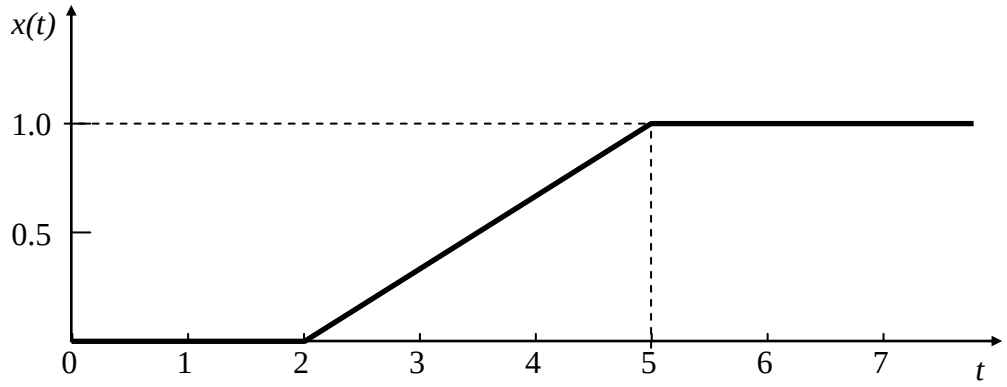
SCHOOL OF MECHANICAL AND MANUFACTURING ENGINEERING
THE UNIVERSITY OF NEW SOUTH WALES

MECH9211 - MODELLING AND CONTROL OF MECHATRONIC SYSTEMS

TUTORIAL 3

1. Find the z-transforms of the unit impulse (Kronecker Delta), step input and the two curves shown below.





2. Use the partial fraction expansion method (use **residue** function) to obtain closed form solutions to the following.

$$\frac{z^{-1}(0.5-z^{-1})}{(1-1.5z^{-1})(1-z^{-1})^2} \qquad \frac{2+z^{-2}}{(1-0.5z^{-1})^2(1-z^{-1})}$$

$$\frac{0.368z^2+0.478z+0.154}{z^2(z-1)} \qquad \frac{z^{-3}}{(1-z^{-1})(1-0.2z^{-1})}$$

verify your results by using **dimpulse** function of MATLAB.

3. Obtain the solutions for the following two difference equations.

$x(k) = 0$ for $k < 0$ and $u(k) = \begin{cases} 0; & k < 0 \\ 1; & k \geq 0 \end{cases}$

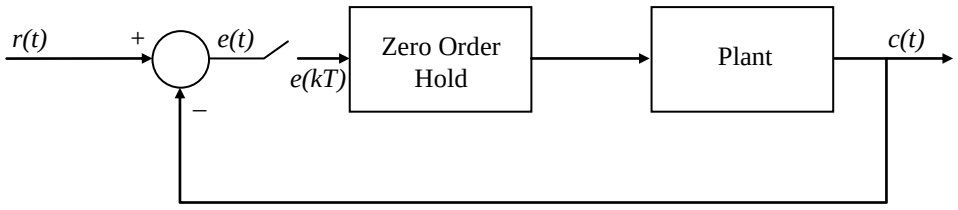
The difference equations are:

$x(k+2) - x(k+1) + 0.25x(k) = u(k+2)$ and

$x(k+2) - 3x(k+1) + 2x(k) = u(k)$

Compare your results with those obtained using **dstep** function.

Obtain the pulse transfer function for the system shown below, where the transfer function of the plant is $K/(s+1)$.



4. Obtain the pulse transfer functions of the two systems shown below. Assume the samplers to be synchronised with a sampling interval of T seconds.