Department of Chemical Engineering
IIT Bombay
CL692, Digital Control
Assignment 3
Handed out on: 14 Aug 2006
To be completed by: 21 Aug 2005

1. Consider the sequence $u(n) = (n+1)1(n)$.

   (a) Find its Z transform using the fact that $u(n) = 1(n) * 1(n)$ (derive this).

   (b) Find the Z transform of u through Z-transform of $n1(n)$ and $1(n)$. Compare the results.

2. Consider the equation

$$y(n) = \sum_{k=-\infty}^{n} u(k)$$

   (a) Express the Z-transform of $y(n)$ in terms of $U(z)$. [Hint: Find the difference $y(n) - y(n-1)$.]

   (b) Use the convolution property to determine the Z-transform of $y(n)$ in terms of $U(z)$. Hint: if the right hand side of the above equation can be written as $u(n) * g(n)$, what is $g(n)$?

3. Find the causal sequence, whose Z-transform is given by

$$G(z) = \frac{1}{(1 - az^{-1})(1 - bz^{-1})}$$

   where, you can assume that $a \neq b$. Verify by computing $g(0)$ and $g(1)$ through some other means.

4. The inverse Z-transform of

$$G(z) = \frac{z^2 + 2z}{(z+1)^2(z-2)}$$

   has already been computed for the case of $1 < |z| < 2$ in Example 4.27. Now, find its inverse for two other cases: (1) $|z| > 2$ (2) $|z| < 1$.