Example 10-11: We want to determine the signal $x[n]$ when its z-transform $X(z)$ is

$$X(z) = \frac{1 - 2.1z^{-1}}{1 - 0.3z^{-1} - 0.4z^{-2}} = \frac{1 - 2.1z^{-1}}{(1 + 0.5z^{-1})(1 - 0.8z^{-1})}$$

After factoring the denominator, the next step is to write $X(z)$ in the additive form

$$X(z) = \frac{A}{1 + 0.5z^{-1}} + \frac{B}{1 - 0.8z^{-1}}$$

Invoking the procedure for partial fraction expansion, we obtain

$$A = X(z)(1 + 0.5z^{-1})\Big|_{z=-0.5} = \left.\frac{1 - 2.1z^{-1}}{1 - 0.8z^{-1}}\right|_{z=-0.5} = \frac{1 + 4.2}{1 + 1.6} = 2$$

and $$B = X(z)(1 - 0.8z^{-1})\Big|_{z=0.8} = \left.\frac{1 - 2.1z^{-1}}{1 + 0.5z^{-1}}\right|_{z=0.8} = \frac{1 - 2.1/0.8}{1 + 0.5/0.8} = -1$$

Therefore,

$$X(z) = \frac{2}{1 + 0.5z^{-1}} - \frac{1}{1 - 0.8z^{-1}} \tag{10.8}$$

and the two first-order terms can be inverted using entry 6 in Table **??** to obtain

$$x[n] = 2(-0.5)^n u[n] - (0.8)^n u[n]$$

Note that the poles at $z = p_1 = -0.5$ and $z = p_2 = 0.8$ give rise to terms in $x[n]$ of the form $p_1^n u[n]$ and $p_2^n u[n]$.

McClellan, Schafer, and Yoder, *DSP First, 2e*, ISBN 0-13-065562-7.