ELEC 3004 – Systems: Signals & Controls
Tutorial 2 (Week 7): z-Transforms

Overview
Today is to help introduce the z-Transform with the help of Lathi (Chapter 5)

Reading
Lathi, Linear Systems and Signals, 2nd Ed, Chapter 5 – Sections 5.1 and 5.2 (attached).

Activity
• Read the section
• Review the Time Shift and Linearity Properties
• Work through Examples 5.3
• Work through Exercise E5.6 and E5.7

Z-Transform Properties
Time-shift property:
\[ y[n - n_0] \leftrightarrow z^{-n_0} Y(z) \]

\[ y_2[n] = y[n - n_0] \]
\[ Y_2(e^{j\omega}) = \sum_{k=-\infty}^{\infty} y[k - n_0]z^{-k} \]
\[ = \sum_{k=-\infty}^{\infty} y[l]z^{-(l+n_0)} \]
\[ = z^{-n_0} Y(z) \]

Linearity:
\[ a_1 y_1[n] + a_2 y_2[n] \leftrightarrow a_1 Y_1(z) + a_2 Y_2(z) \]

Exercises
1. Consider the discrete transfer function:
\[ Y(n) = -0.001175X(n - 1) - 0.028772X(n - 3) - 0.176123X(n - 4) \]
\[ + 0.084788X(n - 5) + 0.5X(n - 6) + 0.084788X(n - 7) - 0.176123X(n - 8) - 0.28772X(n - 9) - 0.001752X(n - 11) \]

Write the transfer function in Z domain. Please keep this answer. It might prove handy.