University of Massachusetts Lowell
Department of Electrical and Computer Engineering
16.520 Computer Aided Engineering Analysis
Problem Set 6

1. Given the function e^z, Determine the $N+1$ term Chebyshev expansion valid for $0 \leq z \leq 1$.

$$e^z = \sum_{n=0}^{N} a_n T_n(x)$$

To do so one must provide an map between the z and x in the Chebyshev domain $-1 \leq x \leq 1$. We will use the algebraic map $x = 2z - 1$. Hence $z = (x+1)/2$ and

$$e^{(x+1)/2)} = \sum_{n=0}^{N} a_n T_n(x)$$

for $-1 \leq x \leq 1$.

   a. For $N = 8$ find the coefficients a_n by minimizing the residual at the extreme points of T_N. These points are $x_i = cos(\theta_i)$ where $\theta_i = i\pi/N$ for $i = (0, N)$.

   b. Once the coefficients are evaluated compute the error between the approximate and the exact result at uniformily sampled points along the z-axis.

   c. Using your result find its derivative with respect to z and compare it to the exact result.