

## Newton method project – Math 502b

Let  $A$  be  $n$  by  $n$  tridiagonal matrix, such that  $A_{ij} = \begin{cases} 2 & \text{for } i = j \\ -1 & \text{for } |i - j| = 1 \\ 0 & \text{otherwise} \end{cases}$

To within 12 significant digits, determine  $\alpha > 0$  so that the solution  $x$  to  $(A + \alpha I)x = \text{ones}(n, 1)$  satisfies the constraint  $x^T x = 1$ .

Hint: extend the problem to  $n+1$  unknowns where  $\alpha$  is the additional element in  $x$ , and use the Newton method on it.

Present a discussion of your method's performance.