MATH 221	COMPUTER PROJECT B: DIAGONALIZATION IN THE WILD (100PTS)

Required Documents and Files:

(I.) Matlab .m file with clearly labeled sections and commented code.

(II.) Report pdf which answers questions posed in this project with a combination of complete sentences and claims which are supported by the Matlab file.

Philosophy of Project: use built-in Matlab commands. No need to reinvent the wheel. I am fairly sure there exist Matlab commands to complete most of the tasks I ask below. I am not here to tell you which commands to use, but I am happy to explain any unclear notation in the problem set-up. I do expect you use Matlab to calculate the bulk of what is asked. To be clear, I will not give much partial credit if you were to foolishly attempt these via direct pen and paper calculation (except where I explicitly say use "pen and paper")

Problem 1: For $n = 2, 3, 4, 5, 6, 7, 8$:

(a.) Create an $n \times n$ matrix M using a random matrix generating command in Matlab.

(b.) Calculate $A = M^T M$.

(c.) Find the eigenvalues of A.

(d.) Find an orthonormal eigenbasis for A.

(e.) Explain what sort of set is defined by the quadratic equation $x^T Ax = 1$ where $x = (x_1, \ldots, x_n)$.

(f.) Calculate e^{tA}

(g.) Solve $\frac{dx}{dt} = Ax$ given that $x(0) = (1, 2, 3, \ldots, n)$.

Problem 2: Create invertible $n \times n$ matrices with determinant one $n = 2, 3, 4, 5, 6, 7, 8$.