

MATH 215
Eigenvalues Polynomials Roots

Let $a_0, a_1, a_2, \dots, a_{n-1}$ be real numbers and let A be the $n \times n$ matrix

$$A = \begin{bmatrix} 0 & 0 & 0 & \dots & 0 & -a_0 \\ 1 & 0 & 0 & \dots & 0 & -a_1 \\ 0 & 1 & 0 & \dots & 0 & -a_2 \\ & & & \dots & & \vdots \\ 0 & 0 & 0 & \dots & 1 & -a_{n-1} \end{bmatrix}$$

Then the the characteristic polynomial of A is $p(\lambda) = \lambda^n + a_{n-1}\lambda^{n-1} + a_{n-2}\lambda^{n-2} + \dots + a_1\lambda + a_0$

Let $p(x) = x^4 + 7x^3 + 11x^2 - 7x - 12$ use Octave's `eig` to find the roots of the polynomial (hence factoring it).

$$A = \begin{bmatrix} 0 & 0 & 0 & 12 \\ 1 & 0 & 0 & 7 \\ 0 & 1 & 0 & -11 \\ 0 & 0 & 1 & -7 \end{bmatrix}$$