

ECE 602 Lecture Notes: Quantifiers

Chen has been careful in his text¹ to use distinct terms for counting different kinds of mathematical objects. Here's a key to the terms.

<u>Quantity</u>	<u>Entity</u>	<u>Informal Definition</u>
Degree	Polynomial	The degree of the monic polynomial $f(\lambda) = \lambda^n + \alpha_1\lambda^{n-1} + \cdots + \alpha_{n-1}\lambda + \alpha_n$ is n .
Grade	Generalized Eigenvector	The grade of a generalized eigenvector \mathbf{v} of a square matrix \mathbf{A} is the smallest integer k such that the $(\mathbf{A} - \lambda\mathbf{I})^k\mathbf{v} = 0$ and $(\mathbf{A} - \lambda\mathbf{I})^{k-1}\mathbf{v} \neq 0$.
Index	Eigenvalue	The index of the eigenvalue λ_i of a square matrix \mathbf{A} is the largest order of a Jordan block corresponding to λ_i .
Multiplicity	Eigenvalue	The multiplicity m_i of an eigenvalue λ_i of a matrix \mathbf{A} is the largest integer k such that $(\lambda - \lambda_i)^k$ divides the characteristic polynomial $\Delta(\lambda)$ of the matrix \mathbf{A} .
Nullity	Matrix	The nullity k of a square matrix \mathbf{A} is the cardinality of a basis of the null space of \mathbf{A} .
Order	Jordan Block	The order of an $m \times m$ Jordan block is m .
Rank	Matrix	The rank of a square matrix \mathbf{A} is the number of linearly independent rows/columns of the matrix \mathbf{A} .

¹Chen, C.-T. *Linear System Theory and Design*, New York, Oxford University Press, 1999.