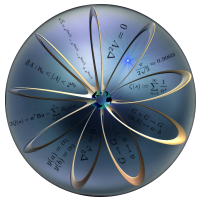

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Perron-Frobenius theorem

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Let A be a nonnegative matrix. Denote its spectrum by $\sigma(A)$. Then the spectral radius $\rho(A)$ is an eigenvalue, that is, $\rho(A) \in \sigma(A)$, and is associated to a nonnegative eigenvector.

If, in addition, A is an irreducible matrix, then $|\rho(A)| \geq |\lambda|$, for all $\lambda \in \sigma(A)$, $\lambda \neq \rho(A)$, and $\rho(A)$ is a simple eigenvalue associated to a positive eigenvector.

If, in addition, A is a primitive matrix, then $\rho(A) > |\lambda|$ for all $\lambda \in \sigma(A)$, $\lambda \neq \rho(A)$.