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THE LARGEST EIGENVALUE OF NONNEGATIVE
TENSORS

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**The Largest Eigenvalue
of
Nonnegative Tensors**

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

Signature: _____

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Abstract

Tensors are simply generalisation of matrices. Many properties of matrices have been generalised to tensors. Over the past few years, the spectral theory of tensors has been developed. The Perron-Frobenius Theorem and the minimax theorem are two examples of the property of nonnegative matrices which have been extended to nonnegative tensors. This leads to extension of the Collatz method for finding the largest eigenvalue of nonnegative matrices to nonnegative tensors. In this thesis, we study the methods for finding the largest eigenvalue of square tensors and rectangular tensors. We also study the convergence of the methods and show that the method for rectangular tensors is Q-linear convergence under weak irreducibility condition. We further generalise the method to nonnegative polynomial eigenvalue problems. The method is convergent for irreducible nonnegative polynomials. We explore the case for both homogeneous and nonhomogeneous polynomials. We also present a convergent method for solving the optimisation problem where the objective function is a nonnegative general polynomial with spherical constraint.