TABLE OF CONTENTS

	PTER I RODUCTION	1
	PTER II E FOR (2)-INVERSES	5
2.0	Introduction	5
2.1	The Three Phase Inversion Procedure	7
2.2	Constrained Inverses	8
2.3	(2)- and (1,2)-Inverses: The Null Augmented Mappings	12
2.4	{1.5}-Inverses: The Nonnull Augmented Mappings	14
2.5	Construction of Moore-Penrose Type Generalized Inverses	16
2.6	A Geometric Representation of {2}-Inverses	17
2.7	(1.5)-Inverses and Projections	19
2.8	(1.5)-Inverses and Solutions to Linear Equations	22
2.9	Decomposition of (2)-Inverses	26
2.10	Spectral Decomposition in Terms of {2}-Inverses	28
2.11	Computation of {2}-Inverses	33
	PTER III NVERSES, QUADRATIC FORMS AND SECOND DEGREE POLYNOMIALS	35
3.0	Introduction	35
3.1	χ^2 Distribution and Independence of Quadratic Forms and Second Degree Polynomials	38
3.2	Generalized Inverses and Quadratic Forms	39
3.3	$\{2\}$ -Inverses and χ^2 Distributed Quadratic Forms	42
3.4	On The Uniqueness of the {2}-Inverse Representation of χ^2 Distributed Quadratic Forms	45
3.5	A Minimal Sufficient Set of Coefficient Matrices for All χ^2 Distributed Quadratic Forms	47
3.6	Independence of χ^2 Distributed Quadratic Forms	48
3.7	A Canonical Representation of Second Degree Polynomials	51



VIII

3.8	χ ² Distributed Second Degree Polynomials	54
3.9	(2)-Inverses and the Distribution and Independence of Second Degree Polynomials	55
	PTER IV IVERSES AND LEAST SQUARES SOLUTIONS	61
4.0	Introduction	61
4.1	The Least Squares Problem	63
4.1	Strategies For Obtaining Least Squares Solutions	64
4.3	Symmetric {1,2}-Inverses and Sets of Nonestimable Constraints	68
4.4	Bott-Duffin Inverses and Constrained LSS's	71
4.5	(1.5)-inverses and LSS's	73
4.6	Relationships Among LSS's	74
4.7	Minimum Norm LSS's	77
4.8	A General Theorem on Constrained LSS's	80
4.9	Regidual Sum of Squares and Their Difference	80
4.10	Computing Constrained LSS's and Residual Sum of Squares	82
	PTER V VVERSES IN LINEAR MODELS	84
5.0	Introduction	84
5.1	The Models	87
5.2	The Distribution and Relationships Among the LSS's For the Prameters in Various Models	90
5.3	Hypothesis Testing in Linear Models	92
5.4	Equivalent Numerator Sum of Squares for a Test of Hypothesis	95
5.5	Hypotheses Invariant to Cell Sizes	101
5.6	The R Approach and SAS Type I and Type II Sums of Squares	104
5.7	The R ^e Approach and the SAS Type III Sum of Squares	105
REF	ERENCES	107