ABSTRACTS OF THESES

S. Abbas, M.A., <u>The Approximate Distribution of the Serial Correlation of a Prestationary Linear Markov Process</u>, University of Alberta, Edmonton, May, 1964.

The purpose of this thesis is to obtain the approximate distribution of an estimate of the serial correlation coefficient of a prestationary linear Markov process. The relevant literature is reviewed in Chapter I. Chapter II describes the prestationary linear Markov process, gives Daniels' development of the distributions of a sample serial correlation coefficient for the stationary linear Markov process with known and unknown means and reviews Patton's stationary distribution of an estimate of the serial correlation coefficient. In Chapter III, following Daniels' method, we obtain the approximate distribution of an estimate of the serial correlation coefficient for known mean and in Chapter IV for unknown mean. We also compare our distributions with those of Daniels' for $\rho = 0$.

William S. Adams, M.A., <u>Probabilistic and Deterministic Aspects of Digital Computers</u>, University of Alberta, Edmonton, May, 1964.

This thesis surveys three main topics, - information theory, coding theory and the structure of digital machines. These topics represent the main theoretical lines of inquiry into the concept of information.

The probabilistic assumptions and methods which form the basis of information theory are presented and developed as far as the fundamental theorem for finite discrete noisy channels. This theorem guarantees that information can be transmitted without error despite the presence of noise but produces impractical encoding methods.

Coding theory offers less powerful but more practical error-correcting codes based on deterministic aspects of information. Modern algebra provides methods of analysis for these codes and their mathematical development and implementation in terms of simple electronic devices are discussed.

The same electronic devices are used in the construction of digital computers which may be displayed as complex sequential sets of internal transfers of information. The static and dynamic structures of a modern digital computer are analysed by means of directed graphs and an algorithmic language.

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The thesis attempts to unify several distinct lines of inquiry and to trace their significance in the analysis of existing digital computers and in the design of new computers. The analysis by directed graphs in Chapter 5 is believed to be new.

Khursheed Alam Khan, M.A., Axially Symmetric Gravitational Fields in General Relativity, University of Alberta, Edmonton, May, 1964.

The object of this thesis is to survey and collate the extensive literature relating to axially symmetric vacuum solutions of Einstein's gravitational field equations, and to develop a number of new results.

"Space-time" considerations have imposed fairly severe restrictions on the range of topics covered. For instance, the large amount of work on approximate solutions, on axially symmetric gravitational waves and on solutions of combined Einstein-Maxwell field equations has been left entirely out of account. Within these limitations, however, the author has aimed to be reasonably comprehensive.

A number of new results are scattered through the thesis, e.g.

(1) the fields of oblate and prolate spheroids given here are based on the original calculations of the author.

(2) Field of a set of collinear particles.

(3) Isolation of a new class of axially symmetric stationary fields.

(4) Derivation of an explicit solution of Bondi's problem.

Where other new results involve novelty of substance rather than merely of presentation they have been explicitly indicated as such.

Charles A. Patrick, M.A., Approximate Distribution Functions of Certain Sample Serial Correlation Coefficients, University of Alberta, Edmonton, May, 1964.

This study is concerned with the derivation of approximate distribution functions for sample serial correlation coefficients in linear Markov processes. Two cases are considered: first, when the defined process is circularly correlated, and second, when the process is stationary to the second order. Chapter one contains a review of the literature relevant to this special problem. In Chapter two, certain results, preliminary to the application of asymptotic procedures, are established. Asymptotic expansions for the distribu-

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tion functions are derived in Appendix three, following the techniques developed by A. Erdélyi and M. Wyman, and in Chapter three these results are used to obtain asymptotic representations for the distribution functions.

Vijay Kumar Rohatgi, M.A., On Some Combinatorial Problems Arising in Probability Theory·and Statistics, University of Alberta, Edmonton, May, 1964.

A considerable volume of recent research work has been devoted to the fluctuation theory of random variables and queueing theory. The purpose of this thesis is to study a very special class of combinatorial problems connected with these fields. Such problems are sometimes posed in the literature as generalized ballot theorems.

In Chapter I we review some recent work in these fields, namely, the work of Takacs, Graham and Dwass. In Chapter II we generalize the ballot problem in yet another direction and obtain certain refinements of it using an analogue of the multinomial theorem. However, we have not been able to establish any connection between our work and the theorems of Chapter I though they appear to be somewhat similar. Chapter III contains a variety of results which are obtained as a by-product of our approach.

F. Holens, M.A., Two Aspects of Doubly Stochastic Matrices: Permutation Matrices and the Minimum of the Permanent Function, University of Manitoba, May, 1964.

A survey of the problem of representing a doubly stochastic matrix as a convex combination of permutation matrices is undertaken. If N is the number of edges in the graph of an n by n doubly stochastic matrix and if k is the number of irreducible subgraphs, then at most $N - 2n + k + 1$ permutation matrices are necessary. If the matrix can be represented as a direct sum of m submatrices then it can be represented as a convex combination of permutation matrices the number of which need never exceed the sum of the numbers needed to represent each submatrix of the direct sum less $(m - 1)$. In any event the first result is shown to give as good, if not a better value for the upper bound of the number of permuation matrices necessary.

A conjecture regarding the problem of the minimum value of a permanent of a doubly stochastic matrix is stated and partially solved. Let $\Sigma p(A_k)$ denote the sum of the permanents of the $_nC_k$ matrices formed by replacing all the elements of k rows of the n by n doubly stochastic matrix by $1/n$. Then it is conjectured that

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$$p(A) \geq \frac{\Sigma p(A_1)}{{}_nC_1} \geq \cdots \geq \frac{\Sigma p(A_k)}{{}_nC_k} \geq \cdots \geq p(A_n) .$$

A survey of the problem of representing matrices of non-negative elements with fixed row and column sum vectors as a convex combination of vertex matrices is undertaken. If A is an m by n matrix of this class having r graphically indecomposable components and k zero entries, then A can be written as a convex combination of at most (m-1)(n-1) + r - k vertex matrices.