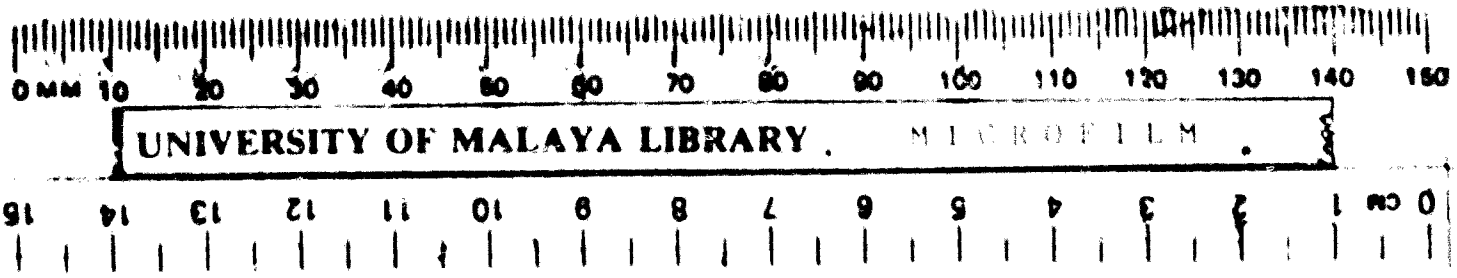

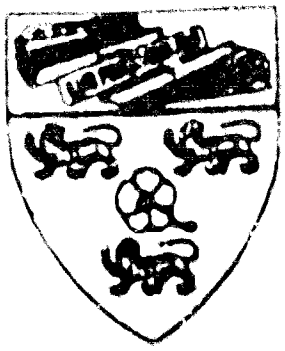

MULA

THE BINOMIAL DISTRIBUTION

ITS DERIVATION AND APPLICATIONS

by

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A Graduation Exercise submitted as
part fulfilment towards the
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SYNOPSIS

This exercise gives an account of the derivation of the Binomial Distribution from first principles and the applications of the distribution to various fields of human activities.

As the Binomial Distribution is based on the theory of probability, which is the corner-stone of many physical, biological and social sciences, we first discuss some fundamental concepts and the basic calculus of probability for experiments with a number of possible outcomes. A probability measure is first introduced over the events of a sample space; independence of events and trials repeated under identical conditions are then discussed.

Next we introduce the analytic theory of probability in the finite case. Random variables are defined as functions on sample spaces, and probability distributions, means, variance and standard deviation are dealt with.

In the chapter on the Binomial Distribution, which is the most important probability function defined on a finite sample space, we derive the basic properties of a Bernoulli process and a binomially distributed random variable, and discuss some of the important properties of the distribution. We include in this chapter a discussion on the law of large numbers, which serves as a basis for the intuitive notion of probability as a measure of relative frequencies. Without this law, the whole probability theory would lose its intuitive foundation.

In many practical problems, the values of n and k in the Binomial Distribution formula $b(k;n,p)$ are very large; a direct use of the formula becomes almost impossible as the binomial coefficients are difficult to evaluate. Two approximate methods of calculation, based on the Poisson distribution and the Normal distribution, are discussed. We also illustrate, with examples, the computation of the Binomial Distribution for very large n, ($n \geqslant 100$) by means of a short method.

The Binomial Distribution is applied, to a large extent, in economics, engineering, medicine and genetics. Included in this exercise are the applications of this distribution in industrial quality control, decision-making, testing of a statistical hypothesis, testing of

significance for differences in samples, in power supply, in sera or vaccine testing, in random walk, in parking problem and in the Mendelian hereditary theory.

Appendices in this exercise explain the mathematical derivation of some formulae and approximations.

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LIST OF TABLES