

THE AUSTRALIAN NATIONAL UNIVERSITY

## ANNUAL REPORT 1963

## Department of Statistics

## Institute of Advanced Studies

## S t a f f

|               |                                                             |
|---------------|-------------------------------------------------------------|
| Professor     | P.A.P. Moran, M.A., Sc.D.(Cambridge), D.Sc.(Sydney), F.A.A. |
| Reader        | J.E. Moyal, Dipl. de l'Inst. de Stat. (Paris)               |
| Senior Fellow | J. Gani, B.Sc., D.I.C. (Lond.), Ph.D.(A.N.U.)               |
| Fellow        | P.D. Finch, B.A. (Durh.).                                   |

Dr A.M. Walker joined the department as a Visiting Fellow for one year, from the department of Mathematics at Cambridge. C.E.M. Pearce, P.J. Brockwell and A.W. Davis were appointed as Scholars. W.J. Ewens and G.F. Yeo completed their courses and submitted their theses. Mr. Heyde spent one term as a visiting lecturer in the University of Western Australia. Dr Gani returned from study leave in April, and later attended the conference on Inference in Stochastic Processes at Michigan State University in July.

## Research Programme

## (1) Probability Theory

Mr Heyde continued work on the moment problem, and on the general theory of first passage time distribution. Professor Moran showed that the expected range of cumulative sums of independent random variables can increase as any power of the number of variables between  $\frac{1}{2}$  and unity. He also devised a new type of approximation to the t-distribution which enables tests of significance to be carried out without the use of tables when the number of degrees of freedom exceeds five. Mr Brockwell obtained a new asymptotic formula for the tail of a binomial distribution.

## (2) Random Processes

Papers in the theory of queues were written by Mr Finch, Mr Yeo, and Mr Pearce. Mr Finch and Mr Moyal also wrote papers on multiplicative population chains. The closely related field of the theory of the scattering of particles on their passage through matter was studied by Mr Moyal and Mr Brockwell who obtained a series of new results.

Dr Gani continued his work on stochastic models for phage reproduction, and on the age distribution in a system of replaceable elements.

Dr Walker discovered a simplified method of deriving asymptotic distributions of estimates of the spectral density of stationary processes and began work on the effect of sampling a continuous parameter stationary process at points generated by an independent discrete parameter process.

## (3) Statistical Inference

Mr Finch concentrated on the development of a general theory of statistical inference based on measuring the amount of information provided by an experiment. This theory embraces the three main diverging trends in

statistical thinking on this subject, namely, Bayesian inference, likelihood inference, and inference based on the frequency interpretation of probability. This unified treatment removes the grounds for many current statistical controversies.

(4) Mr Moyal continued fundamental work on Boolean algebras and semi-groups, on algebraic logic, and on the manuscript of a book on functional analysis and its applications.

(5) Dr Gani and Mrs Bartlett made a statistical survey of student enrolments, and of the position of mathematics in Australian universities, in continuation of their previous work on this subject.

(6) Professor Moran continued study of genetic polymorphisms and showed that the commonly held theory of adaptive topographies was erroneous and that in general evolutionary change does not occur in the direction of maximising genetic "fitness". He also studied a possible model for human polymorphisms based on class migration.

## Publications

Brockwell, P.J. -

"The transient behaviour of a single server queue with batch arrivals".  
J. Aus. Math. Soc. 3, 241-248.

"The transient behaviour of the queueing system GI/M/1".  
J. Aus. Math. Soc. 3, 249-256.

Finch, P.D. -

"The single-server queueing system with non-recurrent input process and Erlang service time".

J. Aus. Math. Soc. 3, 220-236.

"A coincidence problem in telephone traffic with non-recurrent arrival process".

J. Aus. Math. Soc. 3, 237-240.

"A limit theorem for Markov Chains with continuous state space".

J. Aus. Math. Soc. 3, 351-358.

Gani, J. -

"Models for a bacterial growth process with removals".

J.R. Statist. Soc. B 25, 140-149.

"Formulae for projecting enrolments and degrees awarded in Australian universities".

J.R. Statist. Soc. A. 126, 392-399.

Gani, J., Prabhu, N.U.\* -

"A storage model with continuous infinitely divisible inputs".

Proc. Cam. Phil. Soc. 59, 417-429.

Gani, J., assisted by Bartlett, C., Rodgers, R., and Watterson, P.

The Condition of Science in Australian Universities. Pergamon.  
Oxford. 1963.

Heyde, C.C. -

"Some remarks on the moment problem. I."

Q. Jour. Math. 2nd series. Oxford 14, 91-96.

"Some remarks on the moment problem. II."

Q. Jour. Math. 2nd series. Oxford 14, 97-105.

"On a property of the log-normal distribution".

J.R. Statist. Soc. B. 25.

Moran, P.A.P. -

"Balanced polymorphisms with unlinked loci".

Aus. J. Biol. Sci. 16, 1-5.

"On the measurement of natural selection dependent on several loci".

Evolution. 17, 182-186.

"Theory of an experiment on the replication of DNA".

Sankhya. 25, 65-68.

Ohlsen, S. -

"Further models for phage reproduction in a bacterium".

Biometrics. 19, 441-449.

Walker, A.M. -

"A note on the asymptotic efficiency of an asymptotically normal estimator sequence".

J.R. Statist. Soc. B. 25, 195-200.

Yeo, G.F. -

"Single server queues with modified service mechanisms".

J. Aus. Math. Soc. 3, 499-507.

\* Not a member of this University.