UNIVERSITY OF DURHAM

UNIVERSITY COMPUTING LABORATORY

KING'S COLLEGE

NEWCASTLE UPON TYNE

REPORT OF THE DIRECTOR

1961/1962

1 & 2, Kensington Terrace, Newcastle upon Tyne, 2.

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ANNUAL REPORT, 1961/1962.

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1. General.

At the beginning of August, 1961, the Computing Laboratory became a department of King's College after four years as a University department. The method of operation of the Laboratory has changed little; the variety and amount of work have again increased. The numbers of students taught, the number of machine users and the amount of machine time used have all about quadrupled since the first year; there has been a similar increase in the number of organisations outside the University which use the computer. The space available for use has been increased by fifty per cent. and the number of academic staff will show a similar increase by next year. The disparity between these rates of growth indicates the pressure on staff, space and equipment. We have ordered an English Electric KDF.9 computing system which is capable of very much faster calculation than our present machine. The purchase of the KDF.9 has been made possible by a grant from the University Grants Committee but, grateful as we are for this help, we have to find a large sum of money from our own resources to buy even the minimum system capable of efficient operation. The delivery of this machine is expected in December, 1963; after its installation the difficulties of obtaining enough machine time when it is needed will be greatly eased. The advantages of such a machine are enormous; however, more space and more staff will be essential to operate it and to teach its use.

2. Staff.

During the year Mr. R. Scott vacated the post sponsored by the British Shipbuilding Research Association and in his stead Mr. J. P. G. Roper was appointed from 1st May as Senior Research Associate to work on

the application of computers to shipbuilding. He has worked closely with the Department of Naval Architecture and Shipbuilding.

Mr. K. Wright has been appointed to the vacant Research Assistantship and will join the staff on 1st August, 1962. Mr. J. S. Clowes takes up a new post of lecturer on 1st September, 1962.

Members of staff have attended several conferences during the year. Dr. Scoins, Dr. Eve, Mr. Elphick and Mr. Wright will take part in the conference of the International Federation for Information Processing Societies in Munich. Dr. Page read a paper on "Process Inspection using Cumulative Sums" to a group of the Royal Statistical Society in Edinburgh; Dr. Scoins contributed to a colloquium at the National Physical Laboratory on a Syllabus of Numerical Analysis for Undergraduates; Dr. Eve to a conference on Computer Service Organisation at the English Electric Company Limited. Dr. Scoins attended a series of lectures on Matrix Methods in Structural Mechanics at Nottingham University. Several members of staff visited the Computer Exhibition in October, 1961.

Dr. Page received leave of absence to visit the University of North Carolina, Chapel Hill, from July, 1962, to March, 1963. He will work in both the Department of Statistics and the Computer Laboratory. Dr. Scoins will take charge of the laboratory during Dr. Page's absence.

Members of staff have been active in the British Computer Society. Dr. Eve has served on the committee of the Newcastle branch and has been appointed Vice-Chairman for 1962/1963. Dr. Page has sat on the Education Committee and on the Editorial Board of the Computer Journal. He has also served on the Royal Society Mathematical Tables Committee, the Editorial Board of the Royal Statistical Society, and the co-ordinating committee of the British Shipbuilding Research Association on the application of computers to shipbuilding.

3. Research Activities.

Dr. Page has continued work on the scheduling of jobs requiring processing on a number of machines in order. A method giving

good results over a wide range of practical situations without excessive computing has been derived. He has also studied process inspection schemes for controlling the variance of a normal population. Schemes based on cumulative sums and charts with warning lines have been compared. Papers incorporating these results have been prepared. Miss Barraclough and Miss Robson have undertaken many of the calculations involved.

Dr. Scoins has continued work on methods for solving the transportation problem. He has constructed and applied improved programmes for calculations on grid frameworks and structures.

Dr. Eve has completed an error analysis of the Householder method of reducing a real symmetric matrix to co-diagonal form and has written a programme using this method for solving the corresponding eigen problem. He has contributed to the formation of the paper tape code for the KDF.9 and with Dr. Scoins has studied the problems of teaching the use of the KDF.9 by both the machine language and ALGOL. His Pegasus simulator for the KDF.9 is complete and will be tested when the machine is available. Dr. Eve's work with Professor Rushbrooke on the Ising problem has continued.

Mr. Elphick has continued studying problems in the solution of partial differential equations.

Miss Barraclough has made progress with her method for the automatic compilation of timetables. Miss Robson has completed a programme for ranking performances in examinations with multiple choice questions and has begun work on the computer part of the automatic typesetting project supported by the Department of Scientific and Industrial Research. This project is being undertaken in collaboration with Mr. Duncan, Department of Photography and Dr. Molyneux, Department of Physics.

The following publications have appeared:

E. S. Page: Cumulative sum charts using gauging. Technometrics (1961), 4, 97-109.

E. S. Page: An approach to the scheduling of jobs on machines. J. Roy. Statist. Soc. B. (1961) 23, 484-492.

E. S. Page: Modified control charts with warning lines. Biometrika (1962) 49, 1-6.

E. S. Page: Quality Control Abstracts. New York, 1961.

E. S. Page: Review of Numerical Analysis by Z. Kopal. J. Roy. Statist. Soc. A. (1962).

E. S. Page: Review of Adaptive Control Processes by R. Bellman. J. Roy. Statist. Soc. A. (1962), 125, 161-2.

H. I. Scoins. The Number of trees with nodes of alternate parity. Proc. Camb. Phil. Soc. (1962) 58, 12-16.

G. S. Rushbrooke and H. I. Scoins: Cluster Sums for the Ising Model. J. Math. Phys. (1962), 3, 176-184.

G. S. Rushbrooke and J. Eve: High temperature Ising partition function and related non-crossing polygons for the simple cubic lattice. J. Math. Phys. (1962) 3, 185-189.

4. Use of the Computer.

The load on the machine is such that any increase brings with it a sharp increase in the inconvenience to the users. It has been a long time since the machine could be booked at will, but the waiting periods have often been much greater than we would like. Only little of the computer time is occupied by industrial organisations; we welcome them for broadening the range of problems tackled and, not least, for their payments which help us to buy more equipment for use by everyone. In order to make more machine time available and to pack more computation into that time we have modified our methods of operation: our engineers, Messrs. Walker and Mitchell, have undertaken the maintenance session earlier; and one of the programme testing sessions is now performed entirely by the laboratory staff. It is difficult to make an exact comparison between this method and the previous "open shop" one, but our impressions are favourable in spite of the additional work entailed. When the new machine arrives almost all the operation will be by this method.

The reliability of the central computer has maintained its previous high standard; unfortunately, the same cannot be said about the magnetic tape equipment. For a period of about four months faults were so frequent that users were reluctant to undertake calculations of even moderate length when they needed magnetic tape. Much of the trouble was

attributed to the buffer store in which we found the torsion delay lines less reliable than the older type. This contrasts with the experience of some other Pegasus systems, but the effect seems well established here. Many of the torsion lines were transferred to the central computer where they could be more easily checked and the maintenance records became more satisfactory.

A graph of the University machine usage is shown in Appendix II.

5. Lecture Courses.

The course in Numerical Analysis to undergraduates at Level II has been given by Dr. Scoins at the request of the Department of Mathematics. It is expected that this course will become a permanent responsibility of the Laboratory.

Previous courses in the laboratory have been continued and have been attended by more people. A list of courses is shown in Appendix III. Lectures have been given to many parties of visitors to the laboratory.

6. Colloquia.

Colloquia have been held at approximately fortnightly intervals during term. The topics have ranged from specialist ones on the speaker's recent research to general descriptions of the applications of automatic computers in particular fields. There have been large attendances at the Colloquia and many departments of the University and industrial and research organisations have been represented. We are grateful to all the speakers for their interesting papers and the stimulating discussions that they provoked.

Professor A. van Wijngaarden, Mathematisch Centrum, Amsterdam.	"Experiences with ALGOL 60".
Mr. F. Taylor, Department of Naval Architecture, King's College.	"The application of a Computer in the Shipbuilding Industry".
Dr. E. Lightfoot, University of Leeds.	"Computer Applications of Generalised Slope-Deflection Theory in Structural Engineering".
Dr. J. L. Martin, National Physical Laboratory.	"Methods of Enumerating Self-Avoiding Walks and Related Configurations by Computer".
Dr. L. Fox, University of Oxford.	"Some New Ideas in Partial Differential Equations".

Dr. J. V. Oldfield, University of Edinburgh.	"Solution of Electrostatic Problems in Three-Dimensions".
Dr. J. M. Watt, University of Liverpool.	"Solution of a Hyperbolic Equation Simulating the Liver".
Mr. J. H. Wilkinson, National Physical Laboratory.	"The Stability of Unitary Transformations".
Mr. E. M. L. Beale, C-E-I-R. (United Kingdom) Ltd.	"Quadratic Programming".
Dr. F. G. Foster, University of London.	"Batch-size Queueing Processes".
Mr. P. Coast, University of Glasgow.	"The Travelling Salesman Problem".
Mr. G. R. Kiss, Department of Psychology, University of Durham.	"Non-numerical applications of computers in behavioural science".

7. Library.

The impact of automatic computing on more and more fields of study has brought with it a large increase in the number of worthwhile publications. In the future it will be necessary to spend more on books and journals in order to serve adequately all using the laboratory.

We wish to thank the United States Office of Naval Research, the National Physical Laboratory, International Business Machines Limited and International Computers and Tabulators Limited, for gifts of their publications for the library.

Early numbers of the Communications of the Association for Computing Machinery and of Computing Reviews have been obtained to complete our series. Two new journals have been ordered: Computational Mathematics and Mathematical Physics, U.S.S.R., and BIT - Nordisk Tidskrift for Information Behandling.

8. Conclusion.

During this year we have given some attention to the problems of installing, operating and teaching the use of the KDF.9 system. In the meantime, the normal work of the laboratory has continued and increased. All members of staff have shared the heavy load. Next year the amount of work will be even greater.

E. S. Page.

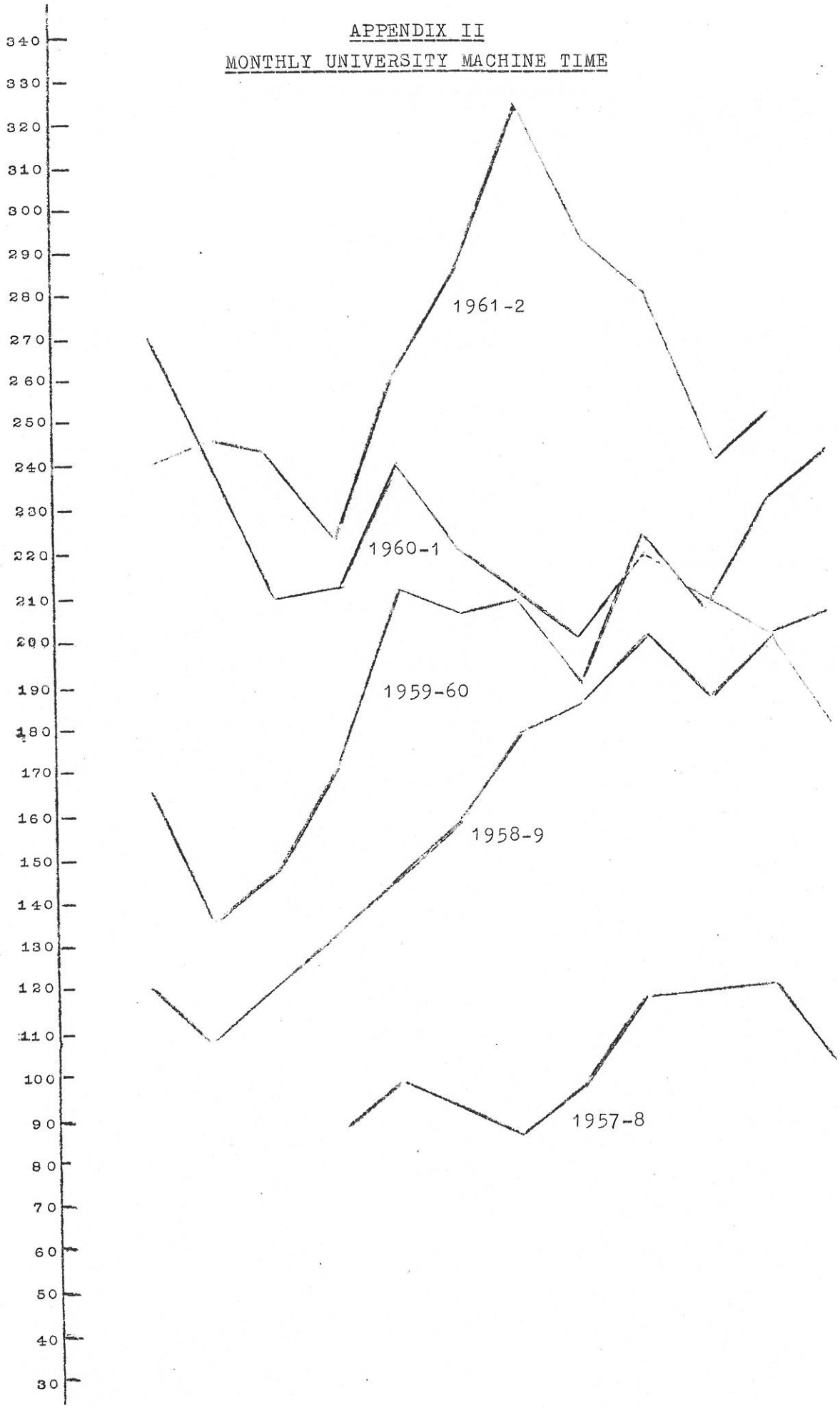
APPENDIX I.

DIVISION OF MACHINE USAGE.

	Hours
Useful Time (University and Industry):	3,520
Maintenance:	550
Idle:	156
Engineering:	43
Fault and Repair Time:	125
Total:	4,394

APPENDIX II

MONTHLY UNIVERSITY MACHINE TIME



APPENDIX III.

LIST OF COURSES HELD.

DATE	TITLE	LECTURER	NO. OF PERSONS ATTENDING	
			UNIVERSITY	INDUSTRY
September, 1961.	Simplified Programming.	Staff of the U.C.L.	27	8
Michaelmas 1961.	Polynomials and Interpolation.	Mr. M. J. Elphick.	10	
Michaelmas 1961.	Monte Carlo Methods and Operational Research.	Dr. E. S. Page.	10	
Michaelmas 1961.	Matrix Methods.	Dr. H. I. Scoins.	13	
Michaelmas 1961, Epiphany & Easter 1962.	Numerical Analysis (SH).	Dr. J. Eve.	16	
Michaelmas 1961, Epiphany & Easter 1962.	Numerical Methods, Level II.	Dr. H. I. Scoins.	36	
November, 1961.	Complete Programming.	Staff of the U.C.L.	28	6
December, 1961.	Simplified Programming.	Staff of the U.C.L.	33	
December, 1961.	Civil Engineering Applications.	Dr. H. I. Scoins.	4	
January, 1962.	Simplified Programming.	Staff of the U.C.L.	32	
Epiphany 1962.	Quadrature.	Dr. E. S. Page.	9	
Epiphany 1962.	Logical Design.	Dr. J. Eve.	22	
Epiphany 1962.	Elementary Linear Programming for Mechanical Engineers.	Dr. H. I. Scoins.	7	
Epiphany & Easter 1962.	Partial Differential Equations.	Mr. M. J. Elphick.	9	
Epiphany & Easter 1962.	Linear Programming.	Dr. H. I. Scoins.	9	
March, 1962.	Simplified Programming.	Staff of the U.C.L.	32	
Easter 1962.	Sorting.	Dr. E. S. Page.	9	
June 1962.	Simplified Programming.	Staff of the U.C.L.	30	
June	Simplified	Staff of the	20	2