UNIVERSITY OF DURHAM

UNIVERSITY COMPUTING LABORATORY

REPORT OF THE DIRECTOR

1960/1961.

1, Kensington Terrace, Newcastle upon Tyne, 2.

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ANNUAL REPORT, 1960/1961

1. General.

This is the fourth and last Annual Report on the work of the University Computing Laboratory as it was originally established. During this year there have been changes in staff, equipment, accommodation and administration. The Computing Laboratory was established as a department of the University and whilst working closely both with the Durham Colleges and King's College, it belonged to neither Division. In order to anticipate likely changes in the constitution of the University, the Computing Laboratory became part of King's College, Newcastle upon Tyne, on 1st August, 1961. The effect of these moves on all users will be, we hope, unnoticeable. They mean that the essential administrative services will now be performed by officers of King's College, Newcastle upon Tyne, instead of by corresponding ones of the University in Durham. We have already experienced so much help from the administrative departments of King's College that we know the transfer will occur smoothly.

The activities of the laboratory have continued to expand and both the number of persons wishing to use the computer and the amount of time they required have increased.

Immediately after the end of the academic year, the department of Psychology vacated the building next to the laboratory and the work of conversion was able to start to provide the additional accommodation we have urgently needed. The efforts of the Architects, Messrs. Edwards and Partners, and the co-operation of all the contractors, have ensured that we can make use of the building well before the beginning of the Autumn term. It is now possible for us to teach more students and to give those who come to work in the laboratory less congested surroundings.

We have long known that our present computer would be unable to cope with the University and other demands for computing. When the University Grants Committee visited the University we presented to them our case for a much faster machine and we are pleased that they have made a grant which will make it possible for us to install a new computing system in 1964.

2. Staff.

Mr. M. J. Elphick has taken Dr. Samet's place as Lecturer in the laboratory. The British Shipbuilding Research Association has sponsored a post of Research Assistant for work on the application of computers to shipbuilding, to which Mr. R. Scott was appointed in July, 1961.

During the year members of staff have attended several conferences and have visited other computing establishments. Dr. Page attended a four-day Seminar on Operations Research at the IBM Education Centre in Blaricum, near Amsterdam, and the Symposium on Computers in Higher Education organised by Elliott Automation Limited. He also took part in the conference at the Imperial College on Cumulative Sum Charts. Dr. Scoins attended the Pegasus Managers' Conference and the Symposium on Linear Programming at Ferranti Limited, and has also visited the National Physical Laboratory. Dr. Eve attended a Seminar on the IBM 1620 machine in London, and Mr. Elphick and Miss Barraclough took a similar course when it was held in Newcastle. Mr. Elphick spent a fortnight in the Oxford University Computing Laboratory at their Summer School on the Numerical Solution of Differential Equations. Dr. Page visited the Mathematical Centre at Amsterdam and IBM installations at Risley and at the Central Electricity Generating Board. Dr. Eve and Miss Barraclough have spent some time at the Computer Centre of the English Electric Company at Kidsgrove.

Members of staff have continued to be active in the British Computer Society. Dr. Page relinquished the chair of the Newcastle branch in June and Dr. Scoins and Dr. Eve have joined the Branch Committee. Dr. Page has completed his term on the Council of the

Society and has served on the Education Committee and the Editorial Board of the Computer Journal. He has also served on the Royal Society Mathematical Tables Committee and the co-ordinating committee of the British Shipbuilding Research Association on the applications of computers to shipbuilding.

Dr. Scoins gave a Seminar on Transportation to the University of Leeds Computing Laboratory. Dr. Page has read papers on the Scheduling of Jobs on Machines to the London University Computer Unit, the Liverpool University Computation Laboratory and the Manchester University Statistical Laboratory. Dr. Scoins also lectured to the Newtonian Society and Dr. Samet to the Science Society of King's College Junior Common Room.

3. Research Activities.

Dr. Page has continued studying problems on the scheduling of jobs on machines; the first paper is in press and a second is in preparation. In order to compare the agreement between orders of jobs derived by differing scheduling methods, it has been necessary to develop a test for the agreement between permutations. A short report on this test has been written. He has also worked on process inspection schemes and has studied the use of gauges with cumulative sum schemes and has derived new results for quality control schemes of Shewhart type with warning lines. Much of the computation involved in this work has been programmed and performed by Miss Barraclough and Miss Robson.

Dr. Scoins is preparing a paper on his work on methods of solving the transportation problem. A paper on "The number of trees with nodes of alternate parity" arising from these studies is in press. He has guided several pieces of work on the application of computers to structural problems.

Dr. Eve has continued his work with Professor Rushbrooke on the Ising model and related topics; papers embodying their results are being prepared. Dr. Eve and Miss Barraclough have studied the preparation of a programme to simulate our Pegasus computer on an

English Electric KDF.9. machine and have reached an advanced stage. In this work they have been co-operating with Mr. J. Lucking of the English Electric Company.

Mr. Elphick has commenced a study of the numerical solution of partial differential equations.

The following publications have appeared:-

E. S. Page: Review of "Annual Review in Automatic Programming". Volume I. Ed. R. Goodman. J. Roy. Statist. Soc. A. (1961), 124, 100.

E. S. Page: "Cumulative Sum Charts". Technometrics (1961) 3, 1.

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

4. Use of the Computer.

During the year our magnetic tape equipment was delivered and installed. It was handed over in mid-November, rather later than we had hoped, but since then it has proved a valuable addition to the computing system. Dr. Eve completed his extension to the Pegasus assembly programme soon after the tape was available for use and now users may assemble library subroutines and take complete programmes from magnetic tape instead of from paper tape. Nearly every machine user employs this scheme and the savings, although only a minute or two on each occasion, have yielded more than a hundred hours of time for productive computing in the year. Dr. Eve's programme although restricted in space by our 5120 word drum has achieved a greater speed than its standard counterpart for the 8192 word drum. Some applications have needed the formation of files of data on magnetic tape while others have found the auxiliary store helpful. Some users have found the buffer store a valuable supplement to the small fast store of the computer. The reliability of the tape equipment has been greater than we had reason to expect as the computer room is certainly not dust-free and has no automatic system of temperature or humidity control. The computer itself has maintained its previous standard of reliability. There has been considerably more engineering work on the computer

this year than last; the new equipment needed much and, in addition, our engineers have carried out minor modifications to the machine. The machine use has been heavier, although some time has naturally been lost because of the engineering; about 15 per cent. more computation has been performed. The competition for machine time during the day has been great and long runs could only be obtained by authorised users operating during the night. The number of such users has grown, but the difficulties for them of working through the night have remained and placed a limit on the amount of night operation that we could undertake. The division of machine usage is shown in Appendix I and the University demand in Appendix II.

5. Lecture Courses.

Courses in Numerical Analysis have been given for Diploma students and post-graduate students in other departments and for mathematical Honours students in their final year. Courses on particular topics of interest to them have been given for students in other departments. Courses in Programming have continued to be well attended and in some cases now form part of the normal syllabus for students in other departments. Our new accommodation will ease greatly the task of housing these courses. Appendix III shows the list of courses held.

In December a two-day course on the commercial applications of computers was given primarily for persons from industry. This course was particularly well attended and showed the very great interest felt by persons in the North-East of England. The success of the course was greatly assisted by the co-operation of Mr. H. W. Matthews of Urwick Diebold Limited, London, who delivered some of the lectures and contributed to the planning of the course. We were particularly pleased that Mr. R. W. Mann, O.B.E., Mr. S. A. Sadler-Forster, C.B.E., Mr. E. E. Watkin and Mr. R. A. Cuff agreed to take the chair at the various sessions.

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.

Mr. L. R. Crawley, Standard Telephones and Cables Ltd., London.	"Commercial Data Processing on a small computer".
Miss E. D. Barraclough, University of Durham Computing Laboratory.	"Student Registration".
Dr. J. Eve, University of Durham Computing Laboratory.	"Programming and Use of Magnetic Tape on Pegasus".
Mr. P. Taylor, Ministry of Aviation.	"Efficient Approximations and their Derivation".
Mr. R. A. Brooker, Electrical Engineering Dept., Manchester University.	"Autocodes".
Dr. J. C. P. Miller, Mathematical Laboratory, Cambridge University.	"Number Theory of Binary Non-Carry Arithmetic with an application to error-correcting Codes".
Dr. E. S. Page, University of Durham Computing Laboratory.	"An approach to the scheduling of jobs on machines".
Mr. J. S. Appleby, National Physical Laboratory.	"The Automatic Compilation of Time-tables".
Mr. E. L. Albasiny, National Physical Laboratory.	"A Self-consistent field calculation for methane".
Mr. M. Fieldhouse, University of Cambridge.	"Recent Developments in Linear Programming".
Dr. B. Noble, Royal College of Science and Technology.	"Numerical Solution of Singular Integral Equations".
Mr. H. H. Robertson, Imperial Chemical Industries Ltd.	"The Stability of Formulae for the Numerical Integration of Ordinary Differential Equations".
Mr. D. J. Evans, University of Manchester.	"Iterative Methods for Solving Elliptic Difference Equations".

7. Library.

Dr. Eve has assumed responsibility for the library and under his guidance it continues to grow in size and use. It has been possible

to provide a new room with more space for books for the library and to make available other rooms in which visitors can work. We have been pleased to receive literature from the University of Oslo, the United States Office of Naval Research, the National Physical Laboratory and from manufacturers of computers. The Journal of Research of the National Bureau of Standards has been added to the periodicals taken by the library.

8. Visitors.

In addition to guest speakers for the Colloquia we have been pleased to welcome many visitors to the laboratory. Among them have been:

Professor W. G. Bickley, Department of Mathematics, City and Guilds College, London.
Professor R. Blythe, University of Kentucky.
Professor J. B. Douglas, University of New South Wales.
Mr. R. C. Gray, Hawthorn Leslie (Shipbuilders) Ltd., Hebburn.
Dr. J. Howlett, Atomic Energy Authority.
Mr. R. G. Jecks, Legal and General Assurance Society.
Mr. A. J. Platt, Pilkington Bros. Ltd.
Mr. K. Scott, Rowntrees Ltd., York.
Professor W. L. Smith, University of North Carolina.
Dr. P. V. Youle, Imperial Chemical Industries Ltd., Billingham.

Again there have been many requests for lectures and demonstrations on the computer, but unfortunately some of the requests have had to be refused until the pressure of work of University activities has been eased. However, we have welcomed parties of senior students of neighbouring schools whenever it has been possible and we shall continue to do so. The shortage of mathematicians in the country is such that every effort is necessary to attract and interest capable persons.

Lectures have been given to students of Central High School for Girls, Dame Allans Boys' School (P.A.S.) and Bedlington Grammar School (J.E.) Dr. Samet also spoke to the Purchasing Officers' Association on commercial applications of computers. We have welcomed members of a Symposium on the use of computers in Naval Architecture and Shipbuilding, arranged jointly with the department of King's College.

9. Conclusion.

The activities and the use of the laboratory continue to extend. The limits are those imposed by time. The laboratory staff have full loads of work and free time on the computer occurs only during the night when most users have need of their rest. Even were ample money available - a situation far from being realised - we could increase our staff only by competing with other Universities, research and industrial organisations for the too small number of trained and able people we would like; this problem demands constant attention and effort and unfortunately there is no date at which we can guess that it will be solved. By contrast, we know that in a little over two years we shall have much more powerful computing equipment in the laboratory; during those two years, however, the pressure will not decrease.

E. S. Page.

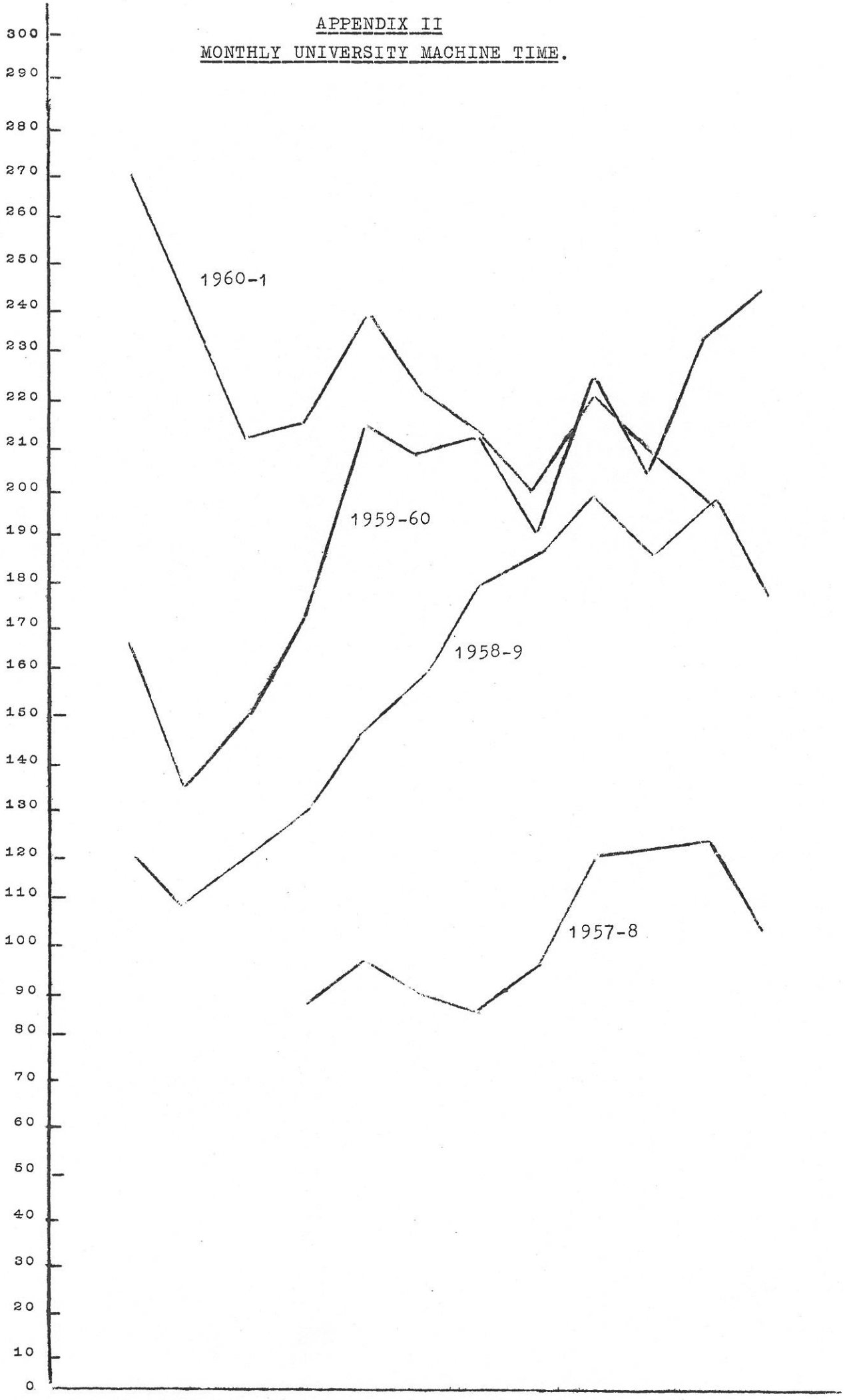
APPENDIX I.

DIVISION OF MACHINE USAGE.

	Hours
Useful Time (University and Industry):	2,930
Maintenance:	520
Idle:	140
Engineering:	260
Fault and Repair Time:	100
Total:	3,950

APPENDIX II

MONTHLY UNIVERSITY MACHINE TIME.



APPENDIX III.

LIST OF COURSES HELD.

DATE	TITLE	LECTURER	NO. OF PERSONS ATTENDING	
			UNIVERSITY	INDUSTRY
September 1960.	Simplified Programming.	Staff of the D.U.C.L.	24	7
Michaelmas 1960.	Polynomials and Interpolation.	Dr. J. Eve.	3	
Michaelmas 1960 and Epiphany 1961.	Matrix Methods.	Dr. H. I. Scoins.	7	
Michaelmas 1960	Numerical Analysis.	Dr. P. A. Samet. Dr. J. Eve.	15	
Epiphany & Easter 1961.	Introduction to Operational Research and Monte Carlo Methods.	Dr. E. S. Page.	4	
November 1960.	Programming.	Staff of the D.U.C.L.	20	4
November 1960.	Programming.	A. Reyrolle & Co.		10
November & December 1960.	Civil Engineering Applications.	Dr. H. I. Scoins.	9	
December 1960.	Business Applications of Computers.	Staff of the D.U.C.L. & Mr. H. W. Matthews of Urwick Diebold Ltd.	3	43
December 1960 and January 1961.	Linear Programming.	Dr. H. I. Scoins.	6	
January 1961.	Simplified Programming.	Staff of the D.U.C.L.	29	2
January 1961.	Simplified Programming.	Staff of the D.U.C.L.	30	1
Epiphany 1961.	Quadrature.	Dr. E. S. Page.	3	
Epiphany 1961.	Sorting.	Dr. E. S. Page.	3	
Epiphany 1961.	Mechanical Engineering Applications.	Dr. H. I. Scoins.	9	
Epiphany 1961.	Logical Design of Digital Computers.	Dr. J. Eve.	12	
Epiphany 1961 and Easter 1961.	Partial Differential Equations.	Mr. M. J. Elphick.	3	
March, 1961.	Simplified Programming.	Staff of the D.U.C.L.	30	
June, 1961.	Simplified Programming.	Staff of the D.U.C.L.	32	
June, 1961.	Simplified Programming.	Staff of the D.U.C.L.	9	