UNIVERSITY OF DUBLIN

# TRINITY COLLEGE

# COMPUTER LABORATORY

ANNUAL REPORT 1973

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#### Section 1 Introduction

This year was marked by several changes within the Computer Laboratory affecting the equipment, software and organisation. These changes are described in more detail elsewhere in this report but they were all introduced with the common objective of meeting the continually increasing demand for computer service within College, a goal which was satisfactory achieved.

Changes were also introduced to improve the quality of usefulness of service provided to users by the provision of more flexible terminal facilities, improving "turn-around" for certain types of work, and establishing a better flow of information about the current availability of Laboratory facilities and how they should be used.

In summary, it is believed that while the problems arising from continuing growth are as severe as ever, the Computer Laboratory is a more effective unit at the end of 1973 than at any time in recent years.

#### COMPUTER ACTIVITY

Total	System	Elapsed	Hours
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Month	Machine Use				M	
Month	RAX	0.5	Other	Total	ance	Activity
10/72	58.58	457.73	21.48	537.79	17.92	555.71
11/72	74.67	450.63	12.3 <b>3</b>	537.63	10.08	547.71
12/7 <b>2</b>	50.22	382.48	3.65	436.35	4.5 <b>3</b>	440.88
1/73	14.33	478.33	6.68	499 <b>.3</b> 4	23.25	<b>5</b> 22,59
2/73	0.37	471.58	26.17	498.11	15.2 <b>3</b>	513.34
3/73	1.02	493.87	44.28	539.17	2.75	541.92
4/73	0.35	489.49	0.63	490.48	4.58	495.06
5/73	0.0	485.71	4.05	489.76	3.17	492.92
6/73	0.0	470.54	0.92	471.46	2.67	474.13
7/73	0.0	450.61	.34.90	485.51	0.0	485.51
8/73	0.0	484.86	3.88	488.74	8.83	497.58
9/73	0.0	459.29	0.0	459.29	6 <b>.48</b>	465.78
Totals	199.54	5575.11	158.98	5933.6 <b>3</b>	99.48	6033.11

- RAX: Remote Access Computing System replaced during the year by an interactive facility within 0.S.
- 0.S.: Operating System/360. This is the main multiprogramming control program system in use.
- Other: "Stand alone" use of the system without a control program.
- NOTE: These figures are not directly comparable with the corresponding table in the 1972 report due to an estimated 30% increase in system performance.

#### Figure 1

## Analysis of Computer Use

Percent of Total Monthly Use per User Category

User Category					
Month	Library	Academic	Admin	Outside	Systems Support
10/72	7.38	55.86	13.00	17.69	6.07
11/72	6.18	42.32	23.09	17.81	10.60
12/72	7.92	48.82	18.47	14.07	10.72
1/73	4.38	56.06	16.87	18.21	4.48
2/73	7.17	44.50	28.91	9.28	10.14
3/73	15.17	39.86	27.51	8.09	9.37
4/73	16.18	43.57	23.22	10.55	6.48
5/73	13.15	51.10	20.00	10.96	4.79
6/73	10.60	50.17	25.09	9.38	4.76
7/73	11.69	49.17	22.19	12.33	4.67
8/73	9.98	48.92	17.22	18.74	5.14
9/73	19.23	47.29	22.68	3.88	6.92
Overall	11.10	48.07	21.43	12.47	6.93

- "Systems Support" in the time required for central software maintenance, central systems software, and "housekeeping" activities.

## Analysis of Academic Use by Department

	Percent
Department	Academic Use
Computer Science	42.23
Statistics	<b>1</b> 5.19
Engineering	Î0.63
Physics	8.63
Grad. School of Engineering	5.91
Economics	5.23
Chemistry	3.61
Applied Mathematics	2.01
Zoology	1.40
Geology	1.10
Education	0.89
Botany	0.67
Pharmacology	0.61
Genetics	0.43
Psychology	0.42
Geography	0.33
Pure Mathematics	0.33
Biochemistry	0.22
French	0.11
Business Studies	0.08
Paediatrics	0.01
Medicine	0.01
	100.00

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### 2.1 Computer Activity

The level of demand for computer service continued to grow and was met by enhancements to the central processing unit, as described in Section 4.1, by extending the "multiprogramming" mode of operation to cover virtually the entire operating period, by detailed evaluation of the software and equipment performance and subsequent "tuning" of the system, and by a review of operating procedures. It is estimated that these improvements increased the overall performance of the system by approximately 30%.

In last year's report, reference was made to the question of obtaining true measure of system utilisation and of the need to implement a method of doing this. During the year, an IBM software package called System Management Facility (SMF) which logs a considerable amount of data about every task performed by the machine, went into regular use and provided a base on which a new computer accounting system can be built. The writing of the programs needed to use the data collected by SMF, and indeed the detailed specification of headings to which such usage should be charged, has not yet been performed due to other demands on the limited programming resources.

Usage figures for 1972/73 are shown on the same basis as last year. Figure 1 shows the overall use of the machine. Figure 2 shows a monthly breakdown on a percentage basis for the five major user categories. Figure 2 further analyses "Academic Use" among user departments.

### 2.2 Ancillary Equipment

Keypunching facilities still continue to constitute a bottleneck. Three machines are now located in the User Preparation Room and apart from one which is reserved for Laboratory use during the day-time, are available to academic users for 24 hours a day, on a "do-it-yourself" basis. The laboratory's data preparation staff are almost totally committed to administrative and library punching, using one of the three machines mentioned above, and one additional one in the Laboratory's Punch Room and a summary of their work is shown in Figure 4. In addition to the cards shown in Figure 4 811,000 were punched either directly by users themselves or automatically by the computer and a further 21,000 by outside agencies.

Data Preparation by

Laboratory Staff

User	Cards Punched
Library	74,358
Academic	176,020
Admin	14,839
Outside	16,251
	281,468

Figure 4

Section 3 Application Development

#### 3.1 Library

The most significant activity during the year was the translation of the microfilm cataloguing system from the experimental to the regular production stage. Introduced to readers on a trial basis in Michaelmas Term, it was found to be generally acceptable and its regular operation required both the optimisation of the computer processes involved and the evolution of satisfactory and reliable procedures for the transport of computer tapes and microfilm cassettes from the Laboratory to Kodak, in the United Kingdom, where the final step of a long sequence is performed. After several unsuccessful methods ranging from air freight to courier, the Dept. of Posts and Telegraphs and the British Post Office jointly extended the latters "Data Post" special service to cover this application and the result has been very satisfactory in every respect. The selection of reliable microfilm readers and the arrangement of suitable maintenance procedures, also occupied a significant fraction of the Computer Laboratory's joint efforts with the Library.

A major new development commenced during the year was the design of an extension to the cataloguing system, to permit the inclusion of non-copyright acquisitions. This extension, which will also play a useful role in the maintenance of the existing copyright catalogue material, is in an advanced state of development and to speed the preparation of the computer input, will use an optical reader at the Bank of Ireland's computer centre to automatically transcribe documents typed in the Library to magnetic tape suitable for entry to our own system.

#### 3.2 Academic Activity

The proportion of total system time used for teaching and research purposes has grown from 40.48% in 1971/72 to 48.07% in 1972/73. This trend, appropriate to a university computer centre, reflects the underlying demand which readily absorbed the extra capacity made available by the various performance improvements introduced during the year. The bulk of this work is programmed and submitted to the Operations Section by the academic users themselves with advice in matters of technical detail provided by the Laboratory programmers when required.

In the research field, the system has been used for many projects from different disciplines. Some examples of these are the cataloguing, by the Dept. of French, of Hugenot books in Marsh's Library, considerable work in the field of text processing by the Dept. of Computer Science, the development and use of a finite element method for the analysis of pavements by the School of Engineering and the simulation of systems by the Dept. of Statistics.

Teaching use also accounted for a considerable part of the growth and this now includes extensive use for undergraduate courses by students in Computer Science, Engineering, Mathematics, Economics, etc., as well as an optional course available to all other undergraduate students in College. Teaching for postgraduates has included use by several M.Sc. courses and the M.Ed. Evening courses including the B.Sc. in Computer Science, and several diploma courses also made considerable teaching use.

#### 3.3 Administrative Applications

The most important development in this field was the decision by University College Cork, and Trinity College to co-operate in the design and implementation of advanced computer based student record procedures, to be subsequently operated independently in each College. This project, still in its early stages, was subsequently joined by University College Dublin and major meetings of its working group are also attended by representatives of University College Galway, and the Higher Education Authority. Progress so far has been satisfactory and it is hoped that the new procedures will be phased in gradually in Hilary and Trinity Terms of 1975. IBM Ireland Limited has contributed the services of an experienced Systems Analyst to work on this project with the computer staff from the three participating colleges.

On the financial side the growing need for extension and change of the original salary and wages systems, introduced nearly five years ago, suggested their possible replacement by one of the "package" systems which appeared on the market in the recent past. A number of these were investigated jointly by the Computer Laboratory, Accounts Office and the Staff Office and the UNIPAY package, marketed here by CARA, an Aer Lingus subsidiary, was chosen. Its implementation will require significantly less manpower than the development of a special system of similar capacity and the work of tailoring it to College's needs is well under way. It should be operational in early 1974. Section 4 Central Services

#### 4.1 Equipment

Two changes were made to the central processing unit in January. These were the replacement of existing slow general registers by fast ones and the addition of a second high speed data channel. These effectively increased the throughput of the complete system by 20% overall and enabled the increased workload to be handled.

During the year, orders were placed for equipment to permit the connection, on a "dial-up" basis, of a teletype terminal with paper tape facilities but delivery delays have, so far, prevented installation.

#### 4.2 Software

Major changes in the central system software took place during the year. To cope with the rapid increase in undergraduate use, much more extensive use has been made of fast batch compilers, such as the WATFIV Fortran Compiler developed by the University of Waterloo, the PL/C Compiler from Cornell, and SPASM fast assembler. This has not only made it possible to perform this work but also to offer a job turn-around time significantly better than under the regular general purpose software.

The Interactive Terminal Facility (ITF), introduced at the beginning of the year as a necessary replacement for the RAX system, did not prove as popular with users as its predecessor.

However, the Gothenburg Universities Computing Centre, with whom we have regular contact as member of the SEAS organisation, has now made available the much more attractive Gothenburg Universities Terminal System (GUTS) and following trials carried out here in August and September, it was decided to introduce it as a replacement for ITF.

#### Section 5 Other Activities

#### 5.1 Teaching and Publications

Two courses for users were held in Michaelmas Term. A one day ITF conversion course for RAX users was attended by 30 staff and students and an introductory course in ITF-BASIC on two evenings per week was attended by a total of 21 users.

As before, lectures on non-numeric PL/L programming were given to M.Sc. students in Information Sciences by Mr. A.M. Tucker who also lectured to ASLIB on "Library Mechanisation at Trinity College Dublin". The Director lectured on Data Processing for three terms to M.Sc. students in Computer Applications, Information Sciences, Production Engineering and Applied Electronics and, in Hilary Term, to MBA students.

To improve the flow to technical and administrative information to users about the Laboratory facilities, a "Computer Laboratory Newsletter" was introduced and is circulated to the heads of all academic departments automatically and to individual staff members and graduate students who request it.

Work also started, during the year, on a new edition of the "Computer Laboratory Users' Guide" to be issued in 1973/74.

#### 5.2 Sale of Computer Services

As predicted last year, the revenue from the sale of time on the College system declined from £10,864 to £9,851 as more outside users installed their own systems, and as pressure from internal demands grew. This trend is likely to continue in the near future although it will be partly offset by the fact that much of the purchased equipment now over five years old and will no longer be subject to charge by IBM for non university use under the terms of the original contract.

#### 5.3 External Contacts

In addition to other university contact via the Joint Working Group on Information Systems mentioned in Section 3.3, frequent contact has been maintained at a technical level with the Computer Laboratory in UCD and the Computer Bureau in UCC. Mr. Doherty continued to participate on the working group examining the question of centralized admissions procedures.

The Director continued to serve on the Executive Board of SEAS, the European computer users group, as editor of its quarterly "SEAS Newsletter" and at IBM's invitation visited eleven universities and research establishments in North America with seventeen professors from other European universites.

Mainly through SEAS channels, contact on technical matters has taken place with a number of other institutions including the University of Leuven, University College London, and in particular with the Gothenburg Universities Computing Centre, as mentioned in Section 4.2.

#### Section 6 Future Development

#### 6.1 Short Term Development

Plans are in-hand, within the limits of the 1973/74 budget, to add much needed disk storage to the system. This will correct a serious imbalance in the present machine structure and will result in a significant increase in per-For example, limitations to multiprogrammed formance. operation arising from disk requirements of many jobs will be greatly reduced with a corresponding increase in system throughput and better service to users. Service will be improved also to terminal users and it is hoped that a full time-sharing facility can be operational at certain In particular, a significant improvement will periods. arise in the case of library processing where the large files will benefit considerably from the additional direct access capacity. At this point in the life of the system, it is probable that the most satisfactory action will be the leasing of used machines for which IBM maintenance is guaranteed, rather than the renting of new units. It is hoped to install the equipment in Trinity Term 1974.

The possibility of acquiring, also within 1973/74 budget limitations, a small teaching processor to relieve costly demands for "hands-on" use of the central system is also under investigation and a successful outcome is anticipated.

The operations section has been restructured and a new shift system staffed by teams under the leadership of experienced staff will operate in 1973/74 and is expected to increase both the quality of work and the volume of processing which can be performed. As a result of these changes, it is believed that the 1973/74 peak load can be handled without a crisis situation arising but it should be noted that with such heavy and efficient use of the equipment, the effect of unscheduled machine or power failures could be more severe than in the past.

#### 6.2 Long Term Growth

During the year, the Computer Management Committee, at the Board's request, submitted plans to meet the College's computing requirements for a five year period from 1974/75.

The overall performance at the end of 1972/73 shows a growth pattern consistent with the earlier information on which the plans were based and reinforces the recommendations made.

#### APPENDIX 1

#### EQUIPMENT

The specifications of the equipment currently installed are as follows:

1 x IBM 2044 Model H Central Processing Unit with 262,144 bytes (265K) of core storage and with

- One Multiplexor Channel
- Two high speed multiplexor channel
- Single disk storage drive in CPU
- Store and Fetch protection
- Floating point arithmetic
- Console printer keyboard
- Interval timer
- Commercial Feature (full 360 instruction set)
- High speed general registers

1 x IBM 2841 Model 1 Storage Control with

- File Scan
  - and
- Record Overflow

1 x IBM 2821 Model 2 Control Unit (for 1403 printer)

1 x IBM 1403 Model Printer with Universal Character Set feature and interchangeable Chain Cartridge adapter Print Positions: 132 Maximum Rated Speed: 600 lines/minute Available chains: QN2 TN Modified for Library 1 x IBM 2501 Model B2 Card Reader with Card Image Feature

1 x IBM 1442 Model N2 Card Punch with Card Image Feature Speed: 91 to 256 cards/minute depending on number of columns punched.

8 x IBM 2260 Display Stations Model 1 with alphameric keyboards

4 x IBM 2311 Model 1 Direct Access Storage Units

1 x IBM 2702 Transmission Control Unit

6 x IBM 2741 Terminals in the Laboratory and User Locations

#### APPENDIX & 2

#### STAFF

The Laboratory has a staff of 26 organised as shown in Figure The functions of the main groups are as follows:

DEVELOPMENT STAFF

6.

This section is responsible for the development of new applications, as follows:-

Systems Analysts study the requirements of new systems in the library and administrative fields and design computer based procedures to implement them.

<u>Programmers</u> write and test the computer programs called for by the Systems Analysts' designs. They also act as advisors to academic users who do their own programming.

Systems Programmer. The Systems Programmer is responsible for the generation and maintenance of internal control programs needed to run the computer.

#### OPERATIONS STAFF

This section is responsible for the day-to-day operation of the Laboratory and duties are as follows:-

Data preparation and control is performed by <u>Data</u> <u>Processing Assistants</u> and consists of card punching and verification, reception and dispatch of work, and control of the magnetic disc and tape library and of documents in process. Computer operation is performed by <u>Operators</u> who are organised into teams of two people, one of whom is shift leader. Operators work permanently on a shift rota.

Janitors work on permanent night shift and are responsible for general security.

Janitors ્રું Operations Staff Computer Operations (6) (D.I.Fleming) Operations Manager Data Prep. & Control (5) (J.J. Moriarty) Secretary Director  $(\Xi)$ Systems Programmer (M. Nowlan Development Staff (A. Mc Mahon) (A. M. Tucker) Asst. Director (Systems) (M. A. Doherty) Systems Analysts (J. P. Kirwin) s Programmers (4) Senior Programmer (F. F. Murray)

COMPUTER LABORATOR

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ORGANISATION

Figure at

## APPENDIX 3

#### ACCOUNTS

## COMPUTER LABORATORY

## Year to 30th September 1973

	£
Cost of Salaried Staff	65,617
Wages	3,511
Rentals of Equipment	14,293
Purchases of Ancillary Equipment for Computer	21,296
Maintenance of Equipment	8,083
Purchase of Consumables	5,960
Cost of External Services	335
Miscellaneous Expenses of Computer	2,134
Insurance	538
Cost of Computer Systems Research Staff	2,542
Miscellaneous Expenses of Computer Systems Research	362
	124,671
Less: Income from Computer Systems Research	2,533
NET RECURRENT COST FOR PERIOD	122,138
Amortisation of Cost of Computer	40,000
	162,138

Sales of Computer Time to 30th September 1973 # £9,851