THE AUSTRALIAN NATIONAL UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

ANNUAL REPORT 1981

General comments

The Department of Computer Science provides an introduction to computing and its applications for undergraduates majoring in other disciplines, provides a thorough grounding in the principles of Computer Science for students whose major interest is computing, and undertakes research and supervision of graduate students in Computer Science.

For several years the Department has been concerned about the high wastage and failure rates in its introductory units A01 and A02 (B01 and B02 before 1979). A major reason for these high attrition rates appears to be that A01 and A02 are directed primarily towards the minority of students who intend to take further Computer Science courses, and not towards the majority for whom A01 or A02 is the last Computer Science course which they will take. Consequently, after considerable discussion in the Department and the Faculty of Science, it has been decided to offer two streams at first-year level in 1982: A01/A02 as now, and new courses A03/A04 intended for students who do not wish to progress to second-year Computer Science units. The Department is currently involved in detailed planning for the new courses A03 and A04.

While the Faculties DEC10 computer has met the Department's requirements regarding the quality of computing provided for undergraduate students, it was not able to provide the quantity demanded in 1981. Thus, it was necessary for third and fourth-year Computer Science students to use the CSC Univac computer during 1981. With the growth in computer usage by other teaching Departments, overloading of the DEC10 can only become more evident in 1982. Thus, the Department strongly supported the case made during 1981 by the Faculties Computer Management Committee for an upgrade of the DEC10. Such an upgrade now appears inevitable, but can hardly take place before the end of 1982.

The problem of lack of space for computer terminals, mentioned in the Department's 1980 report, was solved by the conversion of Copland room G5 (formerly a lecture theatre) into a terminal room early in 1981. There is now ample space for the number of terminals which can be connected to the DEC10, although a shortage of space may become apparent when the DEC10 computer is upgraded and the number of terminal lines increased.

The shortage of laboratory and office space which was mentioned in the Department's 1980 report is still a major cause of concern, although it has temporarily been alleviated by subdivision of an office and the resignation of some members of staff (see below).

The Department wishes to take this opportunity to thank the Dean and other officers of the Science Faculty for their support during 1981.

Courses

For the first time in 1981, the introductory courses A01 and A02 used interactive computer terminals on the Faculties DEC10 computer, and the card punches of earlier years were dispensed with. Although it is difficult to quantify the effects of this change, both students and staff agreed that it was long overdue.

The main change in course structure during 1981 was the replacement of the old third-year courses C01-C04 by new courses C11-C16. With the exception of C12 (which is similar to the old C02), the new courses cover different material from the old courses and are designed for students with a background of two years in Computer Science. The new C-level courses were generally successful and will be offered again (with minor changes) in 1982. Early in 1982 it will be necessary to examine third-year courses closely in the light of experience gained with C11-C16 during 1981, enrolment patterns in 1981 and 1982, and staffing constraints, in order to decide on desirable changes in time for introduction in 1983.

The Graduate Diploma in Science was offered for the first time in 1981. There appears to be a moderate demand for a graduate diploma course suitable for graduates without a significant knowledge of Computer Science. However, the Department does not have the resources which would be required to offer such a course. The course offered by the Department was essentially the same as the fourth-year Honours course (with the possibility of some third-year units being included, depending on individual student's interests and backgrounds). Since only one student enrolled in the Graduate Diploma during 1981, it is too early to assess its success.

The Economics Faculty service course "Introduction to Computer Data Processing", which had been taught jointly by the Department of Accounting and Public Finance and the Department of Computer Science, was not offered in 1981. The course had attracted only a small enrolment when offered in 1979 and 1980.

Enrolments and examination results

The Department's wsu figure for 30 April 1981 was 118.5, of which 15.0 was attributable to postgraduate enrolments. This is to be compared with 138.1 (17.5 postgraduate) in 1980. The fall in enrolments for the first time since 1978 warrants some concern, but no clear trend is apparent: first-year enrolments were down by 4% and third-year enrolments down by 12%, but second-year enrolments were up by 44%. In 1982 we anticipate a slight drop in second-year enrolments but a significant increase in third-year enrolments. It is difficult to anticipate the effect that the introduction of the new first-year courses A03-A04 (see above) and various factors external to the University will have on first-year enrolments in 1982.

As mentioned above, the Department is concerned about the high attrition rate in first-year: the combined wastage and failure rate in A01 was 35% (34% in 1980) and in A02 was 36% (20% in 1980). It is hoped that the introduction of the new first-year courses A03-A04 in 1982 will reduce this attrition rate because students who would have dropped out of the A01/A02 stream may find the A03/A04 stream more compatible with their interests.

Computer Science students were awarded the following prizes:

Australian Computer Society Prize : Mr H.L. Gibson and Mr P.G. Hobson

Computer Science Prize : Mr B.C. Lim

Student participation and the Departmental Committee

The Departmental Committee consists of academic staff, four undergraduate students (one from each year), a graduate student and a member of nonacademic staff. The full Committee met three times during 1981, and sub-committees met on several occasions.

Student members of the Committee made valuable contributions to the discussion of course changes planned for 1982. Early in the year the main topic of interest was the proposal to split the Department's first-year courses into two streams (see above). Later in the year the Committee considered possible changes in the organisation of fourth-year Honours in 1982 (the first year in which Honours students will have a background of three rather than two years in Computer Science, following the introduction of A01 and A02 in 1979).

The student members of the Departmental Committee, along with other members of the Committee, were concerned at the Department's level of staffing, and at the meeting of 28 September 1981 the following motion was passed unanimously

> "The current level of support staff (technical, programming and secretarial) for the Department of Computer Science is inadequate, given the nature of Computer Science as substantially an experimental discipline. The Faculties should accept an increase of the level of support staff as a desirable objective."

Since the above motion was passed, the Department has lost one Programmer (Mr H.P.G. Jones) and its half-time typist (Ms K. Nixon), leaving it with one Secretary, one temporary Technical Officer, two Programmers, and nine academic staff. Computer Science is recognised internationally as primarily an experimental discipline, but it is impossible to do justice (in either teaching or research) to the experimental aspects of Computer Science with the current level of staff. The low staff/student and support staff/academic staff ratios in Computer Science must be given due weight when the research work and outside activities of the Department's academic staff are assessed and when the Department's effectiveness is compared with that of other experimental Science Departments which enjoy much more favourable ratios.

Work of graduate students

Three M.Sc. theses were submitted and/or conferred during 1981:

G.N. Justusson, "The design and implementation of Modula for the Burroughs B1700 computer";

M.J. Schoppers, "Contributions to the theory of a heuristic search for feasibility in design automation";

B.E. Smith, "Intermediate languages: an approach to portability".

In addition, Mr Robson submitted a collection of his published works, "Worst-case fragmentation of dynamic storage allocation algorithms" for the degree of Ph.D.

The Department currently has three Masters candidates and seven Ph.D. candidates working on topics which include computer architecture, provable properties of programs, program verification, colour image transformations, artificial intelligence and database systems.

The Department wishes to maintain the high quality of its Honours and graduate program, but has had difficulty in persuading good students to enrol for Honours or postgraduate studies. This is not because of lack of employment prospects; on the contrary, it results from the good employment opportunities for pass Computer Science graduates and the paucity of financial support available for Honours and postgraduate students.

Staff

At 20 December 1981 the Department's academic staff were:

Professor and Head:	R.P. Brent, PhD Stanford, DSc Monash
Reader:	R.A. Jarvis, BE, PhD WA
Senior Lecturers:	B.P. Molinari, BE WA, PhD Camb
	R.B. Stanton, BE, PhD NSW
Lecturers:	P.N. Creasy, BSc Adel
	A.J. Hurst, BSc, BE Adel, PhD NSW
	M.C. Newey, BSc, BE, MSc Syd, PhD Stanford
	J.M. Robson, MSc, MA Oxon
Senior Tutor:	A.V. Peterson, SB MIT, MS, PhD CalTech

The Department's nonacademic staff were:

Programmers:	R.R. Ewin, BSc Monash, BA ANU
	C.J.S. Vance, BSc ANU
Technical Officer:	W.D. Spire
Secretary:	B.J. Johnstone

Staff Movements

Dr Hurst returned from his study leave and leave without pay at the University of Manchester.

Mr Jones was appointed Programmer Grade 1 but subsequently resigned to accept a position with Computer Sciences of Australia.

Dr Newey took up his appointment as Lecturer (formerly Associate Professor, University of Colorado, Boulder).

Ms Nixon was appointed Typist (half-time) but subsequently transferred to a position in the Registrar's section.

Dr Peterson was appointed Senior Tutor (formerly Senior Tutor in Statistics, Macquarie University).

Mr Schoppers took up a 60% fractional full-time Tutorship which he subsequently resigned to become a Ph.D. scholar at the University of Illinois, Urbana.

Mr Wishart resigned his temporary Tutorship to return to his studies as a Ph.D. scholar.

Visitors

Professor L. Schoenfeld (SUNY at Buffalo, USA) visited the Department and the Mathematics Research Centre for five months. During this period a monograph on numerical computation of the Riemann zeta function was almost completed (in collaboration with Prof. Brent).

Other visitors to the Department included Dr M. Brooks (Flinders University), Dr E. Gehringer (Carnegie-Mellon University), Dr B.J. Grosz (SRI International, USA), Ms L. Gurdin (IMSL Inc., USA), Dr D. Herbison-Evans (University of Sydney), Dr M. Klawe (IBM Research, San Jose, USA), Professor E. Luks (Bucknell University, USA), Professor J. Mitchell (SUNY at Buffalo, USA), Dr G.M. Nijssen (Free University of Brussels, Belgium), Dr N. Pippenger (IBM Research, San Jose, USA), Professor V. Pratt (Stanford University, USA), Dr P.A. Pritchard (Cornell University), Dr T.J. Rivlin (IBM Research, Yorktown Heights, USA), and Professor Y. Umetani (Tokyo Institute of Technology, Japan).

The Department continued its series of joint seminars with CSIRO Division of Computing Research, and most of the visitors just mentioned gave seminars in this series.

Research

The Department was active in several research areas, including computational complexity, analysis of algorithms, data models, computer architecture, computer vision, robotics, semantics of programming languages, and program verification. A booklet "Research in the Department of Computer Science", which describes the Department's current research projects in more detail, is available on request from the Department.

Research grants

Professor Brent received an ARGC grant of $12000 for 1982 ($10000 for 1981) to continue funding for his research project "Machine-independent variable-precision interval arithmetic".

Dr Jarvis received an ARGC grant of $27495 for 1982 ($15000 for 1981) to continue funding for his research project "Computer vision in partially known environments".

Other activities

Professor Brent became an Associate Editor of Numerische Mathematik, International Coordinator for SIGNUM, and temporary Minutes Secretary for the Association of Australian Professors of Computer Science (which held its first meeting in May 1981). He served as a member of the Computing Policy Committee and was chairman of its subcommittee on University Computing 1982-84. He also served as a member of the interim Mathematics Research Centre Committee and as a member of IFIP Working Group 2.5 on Numerical Software.

Mr Creasy and Dr Hurst served as members of the Computer Services Centre Users Committee.

Dr Jarvis served as chairman of the Faculties Computer Management Committee, as a member of the Computer Services Centre Management Committee, as an elected member of the Board of the Faculties, and as a member of the interim Steering Committee of the Australian Robot Association.

Dr Molinari served as a member of the Faculties Computer Management Committee and the Computing Policy Committee, and as chairman of the latter Committee's subcommittee on University Computing Requirements. He was elected a sub-Dean of the Faculty of Science and served on the Standing Committee of the Faculty of Science. He also became a member of the Editorial Panel of Australian Computer Science Communications.

Mr Robson participated on behalf of the Department in the ACT Schools Authority "Moderation Day" program.

Dr Stanton served on the ACT Schools Authority Accreditation Panel for Computing Studies and on the Science Faculty Education Committee.

Mr Ewin completed his BA, and Mr Robson earned a PhD (to be conferred in 1982) for his published works on dynamic storage allocation. Professor Brent was awarded a DSc by Monash University.

Professor Brent attended the IFIP Working Group 2.5 Conference on "The relationship between numerical computation and programming languages" and the subsequent Working Group meeting (Boulder, Colorado, August 1981).

Dr Jarvis presented papers at a Symposium on Robots and Australian Industry (Melbourne, July 1981), and at a Symposium on Stereology, Image Analysis and Mathematical Morphology (Linfield, NSW, Sept. 1981). Several members of the Department attended the fourth Australian Computer Science Conference (Brisbane, May 1981); papers were presented by Professor Brent and Mr Robson.

Publications

Brent, R.P., Efficient implementation of the first-fit strategy for dynamic storage allocation, Australian Computer Science Communications 3 (1981), 25-34. Also appeared as Report TR-CS-81-05, Dept. of Computer Science, ANU, February 1981, 10pp.

Brent, R.P., Comments on papers by Maddison and Westreich (correspondence), Computer Journal 24 (1981), 95-96.

Brent, R.P., New factors of Mersenne numbers (preliminary report), American Mathematical Society Abstracts 2 (1981), 367, 81T-10-246.

Brent, R.P. & Kung, H.T.≠, The area-time complexity of binary multiplication, Journal of the Association for Computing Machinery 28 (1981), 521-534.

Brent, R.P. & Pollard, J.M.≠, Factorization of the eighth Fermat number, Mathematics of Computation 36 (1981), 627-630.

Griewank, A.O.*, Generalized descent for global optimization, Journal of Optimization Theory and Applications 34 (1981), 11-39.

Griewank, A.O.*, and Osborne, M.R.≠, Newton's method for singular problems when the dimension of the null space is greater than one, SIAM Journal of Numerical Analysis 18 (1981), 145-149.

Hurst, A.J., Pascal-P: program structure and program behaviour, Software Practice and Experience 10 (1980), 1029-1036.

Jarvis, R.A., Computer vision and robotics, Proc. Symposium on Robots and Australian Industry, Caulfield Institute of Technology, July 1981.

Jarvis, R.A., Interactive graphics and image displays for computer aided instruction, Bringing Computer into College and University Teaching (edited by A.H. Miller and J.F. Ogilvie), Higher Education Research and Development Society of Australia, Canberra, 1981, 13-16.

Robson, J.M., Storage allocation is NP-hard, Information Processing Letters 11 (1980), 119-125.

Robson, J.M., Optimal storage allocation decisions require exponential time, Australian Computer Science Communications 3 (1981), 162-172. Corrigendum: ibid, 314. Also appeared as Tech. Report TR-CS-81-03, Dept. of Computer Science, ANU, Jan. 1981.

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≠ not a member of this University
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Technical Reports

Bojanczyk, A.†, Brent, R.P. and Kung, H.T.†, Numerically stable solution of dense systems of linear equations using mesh-connected processors, TR-CS-81-01, May 1981, 22 pp. Also appeared as Tech. Report TR-CS-81-118, Dept. of Computer Science, Carnegie-Mellon University.

Brent, R.P., Succinct proofs of primality for the factors of some Fermat numbers, TR-CS-81-04, January 1981, 6 pp.

Brent, R.P., MP user's guide (4th edition), TR-CS-81-08, June 1981, 73 pp.

Brent, R.P. (editor), Research in the Department of Computer Science, TR-CS-81-12, October 1981, 28 pp.

Brent, R.P., An idealist's view of semantics for integer and real types, TR-CS-81-14, November 1981, 13pp.

Griewank, A.O.*, Analysis and modification of Newton's method at singularities, TR-CS-81-09, July 1981, 182 pp. (Ph.D. thesis)

Jarvis, R.A., A computer vision and robotics laboratory, TR-CS-81-06, April 1981, 49 pp.

Jarvis, R.A., A perspective on range finding techniques for computer vision, TR-CS-81-07, April 1981, 57 pp.

Jarvis, R.A., A laser time-of-flight range scanner for robotic vision, TR-CS-81-10, September 1981, 27 pp.

Jarvis, R.A., Polyhedra obstacle growing for collision-free path planning, TR-CS-81-16, November 1981, 16 pp.

Justusson, G.N., The design and implementation of Modula for the Burroughs B1700 computer, TR-CS-81-13, April 1981, 151 pp. (M.Sc. thesis)

Penm, J.H.W. & Molinari, B.P., Petri net analysis and deadlock detection, TR-CS-81-11, October 1981, 20 pp.

Robson, J.M., Another intractable game on Boolean expressions, TR-CS-81-02, January 1981, 16 pp.

Robson, J.M., Worst case fragmentation of dynamic storage allocation algorithms, TR-CS-81-18, May 1981, 89 pp. (Ph.D. thesis)

Robson, J.M., The asymptotic behaviour of the height of binary search trees, TR-CS-81-15, November 1981, 11 pp.

Stanton, R.B., Non-chronological backtracking, TR-CS-81-17, December 1981, 12 pp.

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The Australian National University

Department of Computer Science Analysis of Student Performance 1981

Subject or Unit	Enrolled No.	Percentage of Number Enrolled: Sitting No. (%)	Wastage No. (%)	Failure No. (%)	Percentage of Number Sitting: Sitting No.	HD No. (%)	D No. (%)	CR No. (%)	Pass No. (%)	Fail No. (%)
A01	225	197 (88)	28 (12)	50 (22)	197	29 (15)	26 (13)	38 (19)	54 (27)	50 (25)
A02	122	89 (73)	33 (27)	11 (9)	89	8 (9)	9 (10)	25 (28)	36 (40)	11 (12)
B11	74	69 (93)	5 (7)	1 (1)	69	5 (7)	8 (12)	23 (33)	32 (46)	1 (1)
B12	70	62 (89)	8 (11)	5 (7)	62	8 (13)	9 (15)	24 (39)	16 (26)	5 (8)
C11	36	34 (94)	2 (6)	2 (6)	34	4 (12)	5 (15)	7 (21)	16 (47)	2 (6)
C12	20	19 (95)	1 (5)	2 (10)	19	2 (11)	3 (16)	2 (11)	10 (53)	2 (11)
C13	35	31 (89)	4 (11)	1 (3)	31	3 (10)	6 (19)	8 (26)	13 (42)	1 (3)
C14	26	20 (77)	6 (23)	1 (4)	20	5 (25)	1 (5)	7 (35)	6 (30)	1 (5)
C15	18	14 (78)	4 (22)	2 (11)	14	3 (21)	1 (7)	1 (7)	7 (50)	2 (14)
C16	12	10 (83)	2 (17)	3 (25)	10	2 (20)	1 (10)	3 (30)	1 (10)	3 (30)

	Enrolled (as at 30 April 1981)	Sitting	Results
Final Honours	5	4	1 x I, 1 x IIA, 1 x IIB, 1 x III
Graduate Diploma	0.5	0.5	0.5 Incomplete
M.Sc.	2.5		3 x M.Sc.
Ph.D.	5		2 x Ph.D.