

THE LONDON MATHEMATICAL SOCIETY NEWSLETTER

No.145

December 1987

The Newsletter is published monthly except in August. Items for inclusion in the Newsletter should be sent either to the Administrator (Susan Oakes, London Mathematical Society, Burlington House, Piccadilly, London W1V 0NL) or the Publications Secretary (Professor D.A. Branann, Mathematics Faculty, The Open University, Walton Hall, Milton Keynes MK7 6AA). Advertisements should be addressed to the Administrator at the LMS office. All items and advertising material should arrive before the first day of the month prior to publication.

FORTHCOMING SOCIETY MEETINGS

- Friday 15 January 1988, Burlington House
(T.J. Lyons, D.A. Rand)
- Friday 19 February 1988, Leeds
(K.A. Brown, J.C. McConnell)
- Friday 18 March 1988, Scientific Societies Lecture Theatre
(J.H. van Lint, F.C. Piper)
- Thursday, Friday 19-20 May 1988, Cardiff
- Friday 17 June 1988, Burlington House
- Friday 21 October 1988, Burlington House
- Friday 18 November 1988, Royal Society
-

ST ANDREWS COLLOQUIUM 1988

The four-yearly EMS colloquium will take place at the University of St Andrews from 13th - 20th July 1988. The speakers are: S. Smale on "Topology of algorithms of analysis", S.J. Patterson on "The analytic theory of Gauss sums", J.B. McLeod on "Some problems in applied analysis" and A. Baernstein on "Some recent things that have hap-

pened in analysis".

An application form is enclosed with this newsletter or may be obtained by writing to Dr J.K. Langley, Mathematical Institute, North Haugh, St Andrews, Fife KY16 9SS, Scotland.

EUROPEAN WOMEN IN MATHEMATICS

As a result of the panel discussion at the International Congress of Mathematicians 86 on the situation of women mathematicians in different countries it was decided to try to form an organisation for Women in Mathematics in Europe. The first preliminary meeting was held in Paris, 13-14 December 1986.

The second meeting will take place at the Technical University, Copenhagen, 12th-13th December 1987. Commencing at noon on Saturday the 12th to 12 noon on Sunday the 13th. The

meeting will be used to learn about the situation for women mathematicians in the different countries of Europe, to further discuss if a more formal European organisation for women in mathematics, based on national groups, should be formed and to hear a mathematical talk by Professor Ragni Piene (Oslo).

For further information write to Bodil Branner, Mathematical Institute, The Technical University of Denmark, DK-2800 Lyngby, Copenhagen, Denmark.

FOURTH DUBLIN CONFERENCE ON MATRIX THEORY AND ITS APPLICATIONS

A two-day conference on Matrix Theory and its Applications will be held at University College Dublin, Ireland from 10-11 March 1988. Papers are invited on any aspect of linear algebra. Deadline for abstracts is 15 January 1988. The conference fee is IR£10 (US\$15).

All correspondence should be addressed to the conference organizer Dr F.G. Gaines, Department of Mathematics, University College Dublin, Dublin 4, Ireland.

INDIAN MATHEMATICAL SOCIETY

The Indian Mathematical Society is holding its 53rd Annual Conference from 29 December 1987 to 1 January 1988 at the University of Gorakhpur, India. The Platinum Jubilee of the Society is also being celebrated as part of the conference, as well as celebrations to the Ramanujan Centenary.

For further information contact Professor M.K. Singal, General Secretary, Indian Mathematical Society, Department of Mathematics, Meerut University, Meerut-250 005, India.

INTERNATIONAL CONFERENCE ON GENERAL ALGEBRA

In honour of the 60th birthday of Professor W. Nöbauer an international conference on "General Algebra" is to be held in Krems/Donau (historic town approximately 80km from Vienna) from 21st-27th August 1988.

For further information contact Rainer Mlitz, Institut für Angewandte und Numerische Mathematik, Techn. Universität Wien, A-1040 Wien, Wiedner Hauptstr. 6-10, Austria.

MAX-PLANCK-INSTITUT FÜR MATHEMATIK

Amongst the visitors to the Max-Planck-Institut in 1988 are the following:

E. Ballico, Trento, February
B. Branner, Denmark, February – May
P. Cvitanovic, Göteborg, March
S. Donaldson, Oxford, January
A. Fialowski, Budapest, January – October
E. Friedman, Pennsylvania, January – June
P. Grassberger, Wuppertal, February – March
S. Grossman, Marburg, January – July
G. Henniart, Orsay, February – July
T. Katsura, Yokohama, January – July
F. Kirwan, Oxford, January
K.C. Mong, Oxford, March

K. Nomizu, Brown, February – July
Ch. Okonek, Göttingen, February – May
A. Papadopoulos, Paris, February – June
H. Peitgen, Bremen, February – July
P. Richter, Bremen, February – July
L. Schneps, Paris, January – December
T. Shioda, Tokyo, February – April
M. Shishikura, Kyoto, March – August
V.V. Shokurov, Moscow, January – February
A. Van de Ven, Leiden, January – July

For further information contact Silke Suter, Max-Planck-Institut für Mathematik, Gottfried-Claren-Strasse 26, 5300 Bonn 3.

LMS DURHAM SYMPOSIA 1988

There will be three symposia in 1988:

30 June – 10 July
Dynamical Systems
Organisers: Professor P. Walters, Professor D.A. Rand*, Dr A.K Manning.

Main Speakers: J.M. Franks, M. Herman, A. Katok, R.R. Mané, J.N. Mather, J.K. Moser, S. Newhouse, Ya Sinai, D.P. Sullivan.

5 – 15 July
Spinors, twistors and complex structure in general relativity.

Organisers: Professor R. Penrose, Professor C.J. Isham*.

Main Speakers: A. Ashtekar, R.L. Bryant, M. Eastwood, C.R. LeBrun, E. Newman.

18 – 28 July
Model theory and groups

Organisers: Professor O.H. Kegel, Dr P.M. Neumann, Dr. W. Hodges*.

Main Speakers: P.J. Cameron, A.H. Lachlan, B.H. Neumann, S. Shelah, S. Thomas, B.I. Zil'ber.

These research symposia are organised under the auspices of the LMS and are supported by Research Grants from SERC. There may be a few places available for mathematicians not yet invited. Those interested should write for more information to the organisers marked* at the following addresses: Professor D.A. Rand, Mathematics Institute, University of Warwick, Coventry CV4 7AL; Professor C.J. Isham, Department of Physics, Imperial College, The Blackett Laboratory, Prince Consort Road, London SW7 2BZ; Dr. W. Hodges, School of Mathematics, Queen Mary College, Mile End Road, London E1 4NS.

ANDREI KOLMOGOROV

Andrei Nikolaevitch Kolmogorov who was elected an honorary member of the London Mathematical Society in 1959 died on 20 October 1987 at

the age of 84. He was the founder of modern probability theory and held from 1937 the chair of theory of probability at Moscow University.

THE BRAILOVSKYS

In September Dr Viktor Brailovsky and his wife Irina received permission to emigrate from the Soviet Union and emigrated on 24 September. The

Brailovskys are both members of the London Mathematical Society.

UNIONE MATEMATICA ITALIANA

Membership dues for members of associations with a reciprocity agreement with the UMI for 1988 are as follows (50% reduction with respect to ordinary dues for foreign members): It. L. 40.000

Membership privileges include:
- Notiziario dell'U.M.I. (11 issues + supplements), free
- Membership list, free (included in the first issue of the year of the Notiziario)
- Bollettino dell'U.M.I., section A (3 issues), free
- Bollettino dell'U.M.I., section B (4 issues in 1988) and other publications of the UMI with discounts. Subscription price to section B for 1988 (for mem-

bers) is L. 30.000: please, subscribe in this case by January 31st.

- Discount fees for UMI meeting (a main Congress is held every 4 years).
- Right to vote in the election of officers.
- A book (from a special list) is sent as a gift to all members paying their dues by 31st January, 1988.

Money can be sent by bank cheque or by international postal order. Apply to: Segreteria U.M.I., Dipartimento di Matematica, Piazza Porta S. Donato 5, I-40126 Bologna, Italy.

ALGEBRA AND AUTOMATED DEDUCTION

The London Mathematical Society and Hewlett Packard have agreed to support a two-day meeting to introduce mathematicians to some of the current applications of algebra in computer science, and to bring together computer scientists and mathematicians working in this area. The meeting will be held at Royal Holloway and Bedford New College, Egham, on 7 and 8 of January 1988. The speakers will include Manfred Broy (Passau), Pierre Lescanne (Nancy), Klaus Madlener (Kaiserslautern), David Epstein (Warwick), Derek Holt (Warwick) and Geoff C. Smith (Bath). Special emphasis will

be given to term rewriting and automated deduction, algebraic specification and computational methods in groups and systems defined by equations.

There will be a registration fee of £6, to include coffee and tea. Meals, and accommodation in the college for the night of 7th January, will be available.

For further details contact Ursula Martin, Computer Science Department, RHBNC, Egham, Surrey TW20 0EX. Phone 0784 39014.

FOR SALE

*Sirius 1 computer with 'user Friendly' Vuwriter
mathematical/scientific software,
MSDOS and CPM operating systems, mailshot software;
Toshiba 2100G high quality matrix dot printer with single sheet feeder.*

*Offers around £2,000 invited. Contact
Ms. Elaine Shiels,
Mathematics Research Centre,
University of Warwick,
Coventry CV4 7AL,
Telephone: 0203-523053.*

BRITISH MATHEMATICAL COLLOQUIUM

The 40th British Mathematical Colloquium will be held at the University of Exeter on 12th, 13th and 14th April 1988.

The speakers will include L. Lovasz (Budapest), S. Shelah (Jerusalem), I. Singer (M.I.T.), C.E. Praeger (Perth), K.A. Brown, T.K. Carne, M.H.A. Davis, J.J. Gray, R. Hill, H.R. Morton, L. O'Carroll, S.J. Pride, L.C.G. Rogers, B.D. Sleeman, C.T. Sparrow, A.G. Thomason and R.C. Vaughan. An invitation has also been extended to Ju. I. Manin (Moscow).

The registration fee is £12, increasing to £18 for

applications received after 31st January 1988. For research students, for those who have retired and for those without jobs each of these fees is halved.

The cost of accommodation and meals from dinner on 11th April to tea on 14th April inclusive is £57. From dinner on 11th April to breakfast on 15th April it is £74.

A copy of the application form accompanies the Newsletter. More copies and further information are available from the Colloquium Secretary, Dr D.K. Oates, Dept. of Mathematics, University of Exeter, North Park Road, Exeter EX4 4QE.

JOURNAL BACKLOG 1987

| | No. of Issues | No. of pages | Backlog | Estimate |
|----------------------|---------------|--------------|---------|----------|
| Math Proc. Camb | 6 | 1200 | 20 | 9-12 |
| Edin. Math Soc | 3 | 450 | 150 | 12-16 |
| Glasgow Math Journal | 3 | 360 | 200 | 14-18 |
| L.M.S. Bulletin | 6 | 624 | 180 | 11-13 |
| Journal | 6 | 1152 | 200 | 11-13 |
| Proceedings | 6 | 1300 | 150 | 16-18 |
| Mathematika | 2 | 300 | — | 9-18 |
| Oxford Q.J.M. | 4 | 512 | 128 | 12-18 |
| R.S.Edin.Proc.A. | 6 | 1080 | — | 8-12 |

QUEEN MARY COLLEGE UNIVERSITY OF LONDON LECTURESHIP IN PURE MATHEMATICS

Applications are invited for a permanent lectureship in pure mathematics, to be taken up on 1st October 1988.

The College's research interests in pure mathematics centre on algebra, especially algebraic and matrix groups, homological algebra and representation theory, including integral representations. It is hoped by appointment to strengthen the research base in representation theory, particularly as it relates to arithmetic and topology. But this is not a restriction and candidates in related areas are encouraged to apply.

Salary either on Lecturer Scale A, £9,260 – £14,500, or scale B £15,105 – £19,130, depending on age and experience, plus London Allowance of £1,393. For further particulars and application forms contact Prof. I.W. Roxburgh, Head, School of Mathematical Sciences, Queen Mary College, Mile End Road, London E1 4NS.

Completed application forms, together with Curriculum vitae, publications list, the names of 3 referees and a description of research interests to reach QMC by 15th December, 1987.

**UNIVERSITY
OF
NEWCASTLE UPON TYNE**

**School of Mathematics/Computing Laboratory
Joint Appointment to a
CHAIR or READERSHIP IN PURE MATHEMATICS**

Applications are invited for appointment either to a newly established Chair or to a Readership in Pure Mathematics.

The post has been established using funds allocated to enhance teaching and research in computing science, but it is to be located in the Department of Pure Mathematics in the School of Mathematics. Applicants should be able to demonstrate a successful record of research in a branch of discrete pure mathematics relevant to computing science (for example algebra, mathematical logic, number theory, combinatorics or theory of computation) and have an active interest in Computing Science. The successful applicant will be expected to take a leading role in promoting and conducting joint research in mathematical aspects of computing science.

Salary will be at an appropriate point on either the Professorial or Reader salary scales according to the qualifications and experience of the successful applicant.

Further particulars may be obtained from the Deputy Registrar, the University, 6 Kensington Terrace, Newcastle Upon Tyne, NE1 7RU with whom applications (15 copies), giving the names of three referees, should be lodged not later than 31st December 1987. (Applicants from outside the U.K. may submit one copy only). Applicants are asked to indicate whether they are applying for appointment at Chair or Readership level.

WHAT MATHEMATICS FOR COMPUTER SCIENTISTS?

The interface between the undergraduate disciplines of Mathematics and Computing Science has undergone a significant change during recent years. In particular Computing Science is underpinned by elaborate theories of an intrinsically mathematical nature. However the mathematics is more closely related to logic and pure mathematics rather than to the approximate numerical solution of algebraic and differential equations which had predominated in years gone by. The mathematical requirements of a modern degree course in Computing Science are analysed and an outline syllabus drawn up.

0 Scenario

This paper arises from the work of study group M2 of the 1986 UMTC (Undergraduate Mathematics Teaching Conference) held at the University of Nottingham, 16–19 September 1986 and, following a suggestion by one of the invited speakers – Mr Norman Biggs, of Royal Holloway and Bedford New College – ways were sought by which the report produced could be made available to a wider audience. This wider dissemination has been made possible thanks to the London Mathematical Society, The Institute of Mathematics and its Applications and the British Computer Society as well as the organisers of UMTC. (Reports from other working groups at the Nottingham conference are to be found in the proceedings edited by David Towers of Lancaster University Mathematics Department, available from the Shell Centre for Mathematical Education, University of Nottingham, Nottingham, NG7 2RD.)

Taking the opportunity of adopting the usual computing convention of counting from zero, we have augmented the paper with sections 0 and 9. The remainder is essentially as produced in Nottingham, modulo slight editorial changes and deletion/introduction of errors.

1 Introduction

The question of what mathematics should be included in a computer science course has been looked at by several groups in recent years, most notably by the ACM in their curriculum 68, curriculum 78 and curriculum 84 proposals. A brief study of these curricula shows that some topics considered to be central one year are considered to be peripheral the next. This report first explains the approach adopted by the group and then goes on to consider the constraints on time and staffing. The section on style and presentation expresses our view of the difference in approach to some of the mathematical topics between computer scientists and mathematicians. Sections 5,6 and 7 are concerned with the size of the syllabus, the ways in which it can be integrated into existing courses and the computer science content assumed. In section 8 an outline mathematics syllabus is presented.

2 Method

In view of the initial lack of agreement on mathematics content we decided, after some general discussion, that before tackling the question of 'what mathematics', it would be sensible to agree on a set of topics that would be included in most computer science courses. The list of such courses is not meant to be exhaustive but is representative of our experience. From this list we synthesised a list of mathematical topics. In doing this we were aware that any particular computer science course might need a specialised piece of mathematics which, as explained below, might best be taught in conjunction with the course in which it was used, eg, co-ordinate geometry in computer graphics. The remaining mathematics was then organised into a syllabus for a first year mathematics course. Finally we considered how this material should be treated.

3 Constraints and Pre-requisites

The constraints include the number of hours available in the first year, and the availability of suitable lecturers. Whilst ideally the core of the mathematics course should be taught as a separate course for computer scientists with all the applications taken from the student's current computer science courses, we recognize that this can only be achieved with major changes to existing courses. The emergence of new topics (eg, software engineering) which require the strong mathematical background outlined below, is having an influence in other areas such as electronics and electrical engineering. The Institute of Electrical Engineers is placing increasing emphasis on formal methods and hence courses of this type could in the future have a wider appeal.

It is necessary to find pure mathematicians to teach these courses who have empathy with the style and presentation used in computer science and who can communicate with the staff and students of another discipline. One way that this could be achieved is by the appointment to a computer science department of a lecturer whose main interest is the mathematics used by computer scientists.

We felt that a mathematics 'A' level was highly desirable although the variety of syllabuses and of students' performance make it necessary that we have an extensive mathematics course to ensure an even standard. Therefore it is possible for students without 'A' level mathematics to cope with this course provided they have an 'A' level which demands some formal reasoning; some language courses might be satisfactory. Students who have not studied maths at 'A' level will be disadvantaged

by not having the extra 2 years daily contact with mathematics. It is important that the course tutors are aware of this potential problem and take steps to provide remedial courses to increase their familiarity with mathematics (mathematics of the type listed in our syllabus).

4 Style and Presentation

The major aim of mathematics in computer science is to serve as a notation and simple reasoning calculus, to facilitate formal or abstract reasoning about computational systems, rather than as a body of theorems. In that respect, the content of a course will need to be treated in a radically different way. A mathematician will aim to get to theorems as quickly as possible, whereas in this course we aim to give students facility with formal notations. We should therefore present the material slowly, together with multiple examples from various parts of computing. It is most important to point out occurrences of common mathematical structures in different fields, showing that the structures are a useful abstraction. At the same time, it is crucial that the students perform numerous basic exercises (basic with a small 'b'!), which can familiarise them with notational manipulation — as we all realise, we only understand and are happy with notations (or languages, either natural or programming) if we use them. These exercises should be backed up with regular examples classes or tutorials.

We were struck by the different interpretations associated with commonly used phrases by mathematicians and by computer scientists. Even the phrase 'function' could admit differing interpretations, and a phrase like 'predicate calculus' meant wildly different things. It is most important that we are as explicit as possible about both the style and content of presentation.

5 The Size of the Syllabus

The range of mathematical material within the syllabus is quite narrow. This is perhaps fortunate, given the style of presentation we expect. However, we see mathematics as entering a computing course in two other ways:-

In particular courses, background material can be introduced as needed. As already noted coordinate geometry is certainly a pre-requisite for most graphics applications, but is not necessary in any other course, and so could be presented within the graphics course, for instance.

Some "computing" courses are themselves primarily mathematical — the — calculus and domain theory are two examples.

6 Course Integration

There is a great danger in producing service mathematics courses, which aim to supply 'all' the relevant material in a single course. This problem is familiar to all of us. Particular problems include:-

Lack of motivation for the general approach or the particular examples.

Material, even if motivated briefly, is often taught a long time before or in a different style from that used in its application.

There are additional integration problems within most computer science departments, since there is a much smaller common background amongst staff than there is in a mathematics department, say.

The core mathematical material for computer science would appear in a service course, but this could well be run in parallel with its use (in a first computing course) for program specification and development. Logic and set notation are crucial to this.

Other material, such as language and machine theory which are relevant to a (2nd Year?) compiling techniques course, seem best taught in 'short service courses' run in parallel with the application. If taught before, we encounter the problems above; if taught after, we could give students the implicit message that the theory is unnecessary! In the latter respect, we felt that some material could be 'revisited' mathematically (from 2nd to 3rd year) to show that topics could be recovered more easily or rigorously than previously. One example would be the use of Poisson processes in the analysis of scheduling, etc, in operating systems.

One general topic which might help to integrate material is that of modelling — a course drawing on students' computing science background and asking them to build (simple) mathematical models can help both with their mathematics and in drawing topics together.

The mathematical ideas introduced in our proposed syllabus are given a coherence by their development and application in a computing science context.

7 Computing Science Content

The following topics were identified as forming a central core of theoretical material within a computing science course.

Program specification, construction and verification.
Formal specification of programming language syntax and semantics.
Computability.
Concurrency.

Additional topics regarded as essential parts of the course are

- Operating Systems
- Communications and Networks
- Computer Architecture
- Programming Languages
- Compilation Techniques

Some of these topics might be subsumed under the general heading "Software Engineering". There is also a range of further topics which are likely to be included in a typical undergraduate course. The more frequent of these include

- Data Bases/Information Systems/File Processing
- Computer Graphics/Human Computer Interaction
- Analysis of Algorithms
- Performance Modelling/Simulation
- Reliability
- Artificial Intelligence/Expert Systems/Robotics

The group regarded aspects of programming – encompassing problem specification, systematic program construction, and program verification – as the central concern of computer science. Mathematics, especially the theory of sets and relations and the predicate calculus, is used as a language to express precise specifications of a computing process; pre-conditions indicating the properties that are required of any valid input to the process and post-conditions giving the desired relationship between the input and valid output, are expressed in this language. The pre-conditions together with an informal understanding of the effect of elements of the programming language, are used to support the claim that the program generates output which satisfies the post-conditions. Such arguments can be made more formal using detailed descriptions of programming language semantics which appear later in the course. The approach to these topics extends to accommodate logic and functional styles of programming. The mathematical theory required is drawn from the theory of sets, relations and functions, with particular emphasis on certain topics, identified in a later section.

Whilst this mathematical material is regarded as most central, several other mathematical topics are important in certain specialist computing subjects which commonly occur in computer science degrees. In particular, analysis of algorithms relies on a knowledge of the characteristic behaviour of particular functions (such as $\log(x)$) and the growth rates of functions (the big 'O' notation). Familiarity with the common notations (Σ , π , etc) would also be very useful here. Similarly probability theory can be used in performance modelling and simulation. Other subjects, such as graph theory and matrix manipulation, are important in the study of concurrency and language theory.

8 Mathematics: Outline Syllabus

The following is one possible syllabus for a first-year course of 40 lectures. We assume throughout an emphasis on examples and include a partial list where appropriate.

(a) Sets and Logic Notation (5 lectures)

Set notation, union, intersection, subsets, difference, (relative) complementation, power sets, Venn diagrams. Associativity, commutativity, distributivity and deMorgan's Laws. Conjunctive and disjunctive normal forms. Union and intersection over index sets. Formal expression of statements, Logic notation (\Rightarrow , \Leftrightarrow , \wedge , \vee , \neg , \exists , \forall), Truth tables, Intuitive idea of proof.

Examples: Finite sets, $1..n \triangleq \{1,2,\dots,n\}$, $\emptyset \subset \mathbf{N} \subset \mathbf{Z} \subset \mathbf{Q} \subset \mathbf{R}$. Alphabets.

(b) Functions (4 lectures)

The notation $f:A \rightarrow B$, partial and total functions, domain and range. Composition, injective, surjective and inverse functions. λ -notation. Asymptotic behaviour, O -notation. Graph sketching.

Examples: x^n , \log , \ln , \exp , polynomial and rational functions. Functions defined elementwise on finite sets.

(c) Relations (6 lectures)

Definition, graph and Boolean Matrix representation of a relation. Properties: reflexive, symmetric, anti-symmetric, transitive. Equivalence relations and equivalence classes, partitions. Composition, powers, reflexive and transitive closure.

Order Relations: Hasse diagrams. Partial and total orders. (Linear and Topological Sorting) Well-ordering of \mathbf{N} . The notion of induction on \mathbf{N} and on posets.

Examples: Subsets of $1..n$, divisors of n .

(d) Proof and Logic (4 lectures)

Methods of proof eg. direct, (classical) induction, contradiction, bisection (eg. lion hunting!) and

proof by reduction. Formal presentation of logical proofs. Tautology and contradiction. It will also be important to include examples of false proofs.

(e) Algebraic Structures (7 lectures)

Monoids (and semigroups), Submonoids and homomorphisms. Concatenation of strings, regular algebra. Lists. Finite-state machines. Definition of Boolean algebras.

Examples: Cyclic and 2-generator function monoids. Groups – modular arithmetic and matrix algebra.

(f) Graph Theory (8 lectures)

Paths, cycles, valency, connectivity, bipartite graphs. Digraphs. Relations as digraphs. Eulerian graphs and Hamiltonian circuits. Networks and Flows. Max flow/Min cut theorem. Simple algorithms.

Examples: Minimal spanning trees. Tree traversal strategies, infix to postfix translation.

(g) Probability (6 lectures)

Elementary counting, permutations and combinations, selections with replacement. Bayes theorem, conditional expectation, sampling, random variables, Binomial and Poisson distributions.

9 Conclusion

The major worry expressed by those at UMTC86 who commented on our report concerned the amount of time allocated to logic. Of course logic, proof theory and inference, cannot be absolutely separated from other topics and hence the total time spent on logic is more than the notional 4 lectures given in our outline syllabus. There was also some comment on the apparent sparsity of the syllabus. Our reaction to this was to point out that any particular course would vary from the scheme so as to cater for local specialization but, instead of cramming more material into a first year course, an additional second year course would be preferred. Such a course, which might be optional, could draw more strongly on experience gained from first year Computing Science (and Mathematics) courses.

There may be great temptation to equate our course with the traditional 'techniques' course which provides pure mathematics results for students of applied mathematics before the students have sufficient background to appreciate how those results are derived. Whilst there are parallels with this situation it must again be emphasised that the prime requirement is for mathematics to aid computing (science) and not for computing to help solve mathematics problems as was the case some 20 years ago. Computing Science now generates its own mathematics problems and needs the help of mathematicians in solving them. It is therefore appropriate that this discussion document should appear in publications that span the entire Computer Science/Applied Mathematics/Pure Mathematics spectrum and we hope that it will act as a catalyst in promoting co-operation and collaboration in the educational aspects of this problem domain.

One final point, not addressed by the M2 study group, is that of suitable published material from which to extract teaching material. Steering clear of attempting a quick, and inevitably incomplete and biased, survey of appropriate teaching texts it is sufficient to say that several relevant books, written by British authors for British publishers (and therefore, perhaps, more closely matched with the needs of UK higher education), have appeared during recent years. The newer ones are aimed more specifically at Software Engineering and are less wide in their coverage than required by full degree courses in Computing Science; nevertheless, together with the more general texts they provide adequate material from which degree level courses can be constructed.

The debate is really only just beginning and in closing we would like to thank once more the BCS, the IMA and the LMS for permitting us to make our contribution through their publications.

Members of Study Group M2 of the 1986 UMTC held at the University of Nottingham, 16-19 September 1986

| | |
|-----------------|---|
| Mandy Chetwynd: | Mathematics, University of Lancaster |
| *John Cooke: | Computer Studies, Loughborough University of Technology |
| Roy Dennett: | Pure Mathematics, University of Hull |
| John Lloyd: | Computing Laboratory, University of Newcastle-Upon-Tyne |
| Andrew Slade: | Computer Science, University of Durham |
| Simon Thompson: | Computing Laboratory, University of Kent |
| Chris Wensley: | Mathematics, UCNW, Bangor |

*To whom all correspondence should be directed, c/o Dept. of Computer Studies, LUT, Loughborough, Leics LE11 3TU

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December, 1987

Re: Enclosure: **SPRINGER-VERLAG: A Christmas Mathematics Miscellany**

Dear Mathematician,

Another Christmas ! And there was a time (in November) when I doubted we would see Christmas again but then I started preparing a Christmas Mathematics Miscellany and all was well. (A free copy of Peitgen/Richter: The Beauty of Fractals to the first three who correctly identify where I plagiarized my opening sentence !).

Talking about "The Beauty of Fractals", this has, in 1987, become something of a publishing phenomenon with 50,000 copies in print. (Order now while stocks last !).

More generally, 1987 witnessed unabated the growth of our book and journal programmes in mathematical sciences and the miscellany details only a few highlights and includes, for the first time, mathematics titles from Birkhäuser, Basel, a long established Swiss publishing house, with a strong mathematical tradition, that joined the Springer Group of international companies at the end of 1986.

A 1987 publishing landmark is our launch of "ENCYCLOPEDIA OF MATHEMATICAL SCIENCES", "a countable union of open books", destined to join Grundlehren and Ergebnisse in the everyday parlance of mathematicians worldwide.

To round off the year, two additions to our journal list COMBINATORICA and ARCHIVE for MATHEMATICAL LOGIC augment our existing list (example copies of all our mathematical journals are available on request).

In the interim, "Festive Greetings", and our Bedford office will be pleased to answer any enquiries you may have on our complete range of books and journals in mathematical sciences.

Yours sincerely

David S. Anderson
Marketing Manager

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DIARY

The diary lists Society meetings and other events publicised in previous issues of the Newsletter.

1987

DECEMBER

- 15-17 Technical Conference, of the British Computer Society, Specialists Group on Expert Systems, Brighton (140)
16-18 Restructuring Higher Education, Birmingham (143)
16-21 Transformation Groups, Japan (142)

1988

JANUARY

- 7-8 Algebra and Automated Deductions, Surrey (145)
15 LMS Meeting, London

FEBRUARY

- 7-11 Applied Mathematics Conference, Australia (138)
19 LMS Meeting, Leeds

MARCH

- 14-18 Second International Conference on Hyperbolic Problems, Federal Republic of Germany (138)
18 LMS Meeting, London*

APRIL

- 12-14 British Mathematical Colloquium, Exeter (145)

MAY

- 19-20 LMS Meeting, Cardiff

JUNE

- 17 LMS Meeting, London
20-24 Bail V Conference, China (141)

JULY

- 5-8 Theory of Ordinary and Partial Differential Equations, Dundee (144)
13-20 1988 St Andrews Colloquium (138 & 145)
17-27 IXth Congress of the International Association of Mathematical Physics, Swansea (138)
24-30 Radicals – Theory and Applications, Japan (143)
25-30 Computational and Applied Mathematics, Belgium (142)
27-3 Aug ICME-6 1988, Hungary (144)

SEPTEMBER

- 16-19 Physical Interpretation of Relativity Theory, London (143)

OCTOBER

- 19-20 Fractals in the Natural Sciences, The Royal Society, London (144)
21 LMS Meeting, London

NOVEMBER

- 18 LMS Annual General Meeting, London

DECEMBER

- 8-9 Physics and Mathematics of Strings, The Royal Society, London (144)

For further information, refer to the figure in brackets, which is a cross reference to the LMS Newsletter Number.

UNIVERSITY OF LIVERPOOL Chair of Pure Mathematics

Applications are invited for a Chair in the Department of Pure Mathematics. The other Chair in the Department is held by Professor C.T.C. Wall, F.R.S. currently holder of a SERC Senior Fellowship from 1983 to 1988.

The Department has an excellent international reputation and attracts considerable research funding. It works closely with the Departments of Applied Mathematics and Theoretical Physics and of Statistics and Computational Mathematics. Applications are welcome from candidates who have an outstanding research record and whose research has possibilities of interaction with current departmental work.

The salary will be within the range approved for non-clinical professorial salaries, currently not less than £23,105 per annum.

Applications, together with the names of three referees, should be received not later than 21st January, 1988, by the Registrar, The University, P.O. Box 147, Liverpool L69 3BX, from whom further particulars may be obtained. Quote ref. RV/623.

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