CONFERENCE SPONSORSHIP

The Irish Mathematical Society has a small fund out of which it can give limited assistance to the organisers of mathematical conferences.

Application forms are available from the Treasurer.

G. Enright (Treasurer)

INVITATION TO NOMINATE SPEAKERS AT CONGRESS 1986

Acting on an invitation from the International Mathematical Union to prepare a panel of mathematicians who will be invited to address the 1986 International Congress of Mathematicians at Berkeley, California, the National Committee for Mathematics hereby solicits names of suitable speakers. Each nomination should be properly motivated and should include a short list of publications. All submissions should be in the hands of the undermentioned by April 30, 1984.

Secretary,
National Committee for Mathematics,
Royal Irish Academy,
19 Dawson Street,
Dublin 2.

NEWS AND ANNOUNCEMENTS

THE BOOLE PAPERS

Late in November, 1983, University College Cork became aware of the following item to be auctioned in Sotheby's (London) on 8 December:

> *Boole (George, 1815-1864), mathematician and logician, Fellow of the Royal Society). Large collection of papers by and relating to Boole assembled by his sister Mary Ann Boole, including the manuscripts and typescripts of her (unpublished) biography of him, her copies of letters by him and of his (unpublished) poems and lectures on mythology, education, astronomy and Ireland, together with some of his autograph poetical drafts, autograph mathematical notes and a notebook, some two hundred or more autograph letters by him to his sister and other letters sent to him, thousands of pages, in a tin box, sold as a collection not subject to return £500-600.
>
> *Boole, who was born and educated at Lincoln and pursued a distinguished academic career at Queen's College Cork, wrote some fifty books and papers on logic and mathematics of which the most important and "durable" is his *Laws of Thought* (1854) - "a work of astonishing originality and power" (*Dictionary of National Biography*).

Naturally, it was felt that the College's Boole Library would be an eminently suitable home for this unique collection of material and an immediate effort was made to raise funds - £600 being regarded as a rather crude under-estimate, considering Boole's international reputation. Through the generosity of the College, the Library, the Royal Irish Academy, Cork Chamber of Commerce and a number of interested individuals, a large amount of money was pledged.

The bidding at Sotheby's was carried out on behalf of the College by the firm of Bernard Quaritch who, on the previous day, had paid the world record price of £8 million for a 12th century illuminated German manuscript on behalf of the German Government. In the event, the College acquired the Boole papers with the more modest bid of £2,400 (sterling) despite some transatlantic opposition. Outside the library of the Royal Society in London, Cork now has the largest collection of Booleana in the world and the Boole Library should certainly become a centre for Boolean studies.

The collection is a very extensive and important one which throws great light on the personal aspects of Boole's life, particularly his life in Cork. It consists mostly of personal letters to and from his family covering the period 1845-1855, but there are a number of items of mathematical interest. For example, there is a copybook written when he was about 16, containing a large number of worked examples from Gregory's *Examples on the Differential Calculus*. Each exercise has been carefully worked out by Boole and neatly written into the copybook with loving care. When doing questions on differentiation, Boole always uses the notation if $y = x^3$ then $dy = 3x^2dx$. There is also a notebook with jottings on geometry, elementary number theory and word games such as "change BLACK to WHITE in the minimum number of moves".

The collection also contains a number of original offprints of Boole's early papers, but the main item of mathematical interest is an unpublished manuscript on astronomy in which Boole uses probability to make various predictions such as the occurrence of binary stars. It is hoped that the various items in the collection, mathematical and non-mathematical will be collected together in book form to give a personal and down-to-earth view of the life and times of George Boole.

Boole's sister Mary Ann, who assembled the collection, also had personal connections with Cork. She was governess to the children of William Fitzgerald, Church of Ireland Bishop of Cork,

who later became Bishop of Killaloe. One of those children, whom Mary Ann taught, afterwards became a famous scientist. He was George Francis Fitzgerald (1851-1901) who was well known for his work in electro-magnetic theory and one of the forerunners of Albert Einstein. Fitzgerald's name is commemorated in "Lorentz-Fitzgerald contractions" in Physics.

Where the Boole papers have lain hidden since Mary Ann's death in 1882 is a mystery and the sellers remain frustratingly anonymous. However, perhaps there were some omens - Sotheby's codename for the auction was "SEAMUS" and the sale took place on the 119th anniversary of Boole's death.

D. MacHale

Editorial Note: D. MacHale's biography of G. Boole is due to appear shortly.

PERSONAL ITEMS

Dr Berthold Franzen has been awarded a Department of Education Post-Doctoral Fellowship at the Dublin Institute of Technology, Kevin Street. His research interests are in the area of Abelian groups and module theory.

Dr Brendan Goldsmith of the Mathematics Department, Dublin Institute of Technology, Kevin Street, has been appointed Head of Department.

Dr Andrew Pressley of the Mathematics Department, Trinity College, Dublin, will be on leave at the Mathematics Institute in Berkeley, California, from March to September 1984.

Dr Brian Smyth of the Mathematics Department, University College, Dublin, has been appointed to a professorship at Notre Dame University, Indiana, U.S.A.

Dr James Ward who had a temporary position at University College, Cork, has taken up a Junior Lectureship in Mathematics at University College, Galway.

CRACKING A RECORD NUMBER

Mathematicians Solve a Three-Century-Old Puzzle in 32 Hours

Sandia National Laboratories in Albuquerque is a sprawling research establishment best known for its work on highly secret defense projects, including nuclear weaponry. Last week Sandia exploded a different sort of bombshell. Its mathematicians announced that they had factored a 69-digit number, the largest ever to be subjected to such numerical dissection. Their triumph is more than an intellectual exercise. It could have far-flung repercussions for national security.

As anyone who has ever passed through intermediate algebra knows (or once knew), factoring means breaking a number into its smallest whole-number multiplicands greater than 1. For example, 3 and 5 are the only such factors of 15. But as numbers get larger, factoring them becomes increasingly difficult. Until recently, mathematicians despaired of factoring any number above 50 digits. They calculated that it would take the fastest computer, performing as many as a billion divisions a second, more than 100 million years to finish the task.

Then, in the fall of 1982, a chance encounter closed the gap. During a scientific conference in Winnipeg, Canada, Gustavus Simmons, head of Sandia's applied-math department, was mulling the factoring problem over a few beers with another mathematician and an engineer from Cray Research, makers of the world's fastest computer. The engineer, Tony Warnock, pointed out that the internal workings of the Cray were especially suited to factoring, which is essentially done by a process of trial and error. Unlike ordinary computers, the Cray

can sample whole clusters of numbers simultaneously, like a sieve sifting through sand for coins.

At Sandia, Simmons joined with his colleagues Mathematicians James Davis and Diane Holdridge to teach their own Cray how to factor. That involved developing an algorithm, or set of algebraic instructions, that would break the problem down into small steps. They succeeded admirably. In rapid succession they factored numbers of 58, 60, 63 and 67 digits.

At this point, however, even the power of their Cray seemed to have reached its limit. But the Sandia team made one more try. This time their target was the last unfactored number in a famous list compiled by the 17th century French mathematician Marin Mersenne. The number:1326861043989720531776085755060905614293539359890335258028914694596 97, which mercifully can be expressed as $2^{251}-1$. After a total of 32 hr. and 12 min. of computer time, snatched at odd hours over a period of a month, they came up with their answer. Mersenne's number had three basic factors: 178230287214063289511 and 616768821-98695257501367 and 120703961782498930399696 81. Says Simmons: "You can't help feeling triumphant after solving a problem that has been around more than three centuries."

Some may not share in the jubilation, especially if they are dependent on a widely used cryptographic system thought to be uncrackable. Known as RSA (the initials of its three inventors), it employs difficult-to-factor multidigit numbers to encode secrets and keep then secure. These include electronic funds transfers and military messages. By factoring the numbers, the codes can be broken. When RSA was first proposed, its inventors suggested using 80-digit numbers on the assumption that they were too big to be factored. Obviously, with researchers at Sandia closing in on ever larger numbers, even RSA could eventually fall to the code breakers.

From *TIME* Magazine (February 13th, 1984)

THE SUPERBRAIN COMPETITION AT U.C.C.

Over coffee after a student mathematics society meeting at University College, Cork, a discussion arose as to who were the best mathematical students in College. Students of Electrical Engineering claimed that because of high points requirements, they were obviously the best. However, Science students hotly disputed this. A challenge went out which led to the organizing of a competitive examination open to all full-time registered students of College, regardless of subjects or faculty. It was dubbed the Superbrain Competition and the questions were set and corrected by Dr D. MacHale. So as not to give an advantage to students who had taken advanced courses, the topics were those of the Honours Leaving Certificate course though, of course, the standard was a good deal more difficult. Prizes were kindly donated by Arthur Guinness and Company.

Out of 44 entrants, top place was filled by a fourth year Science student, Stephen Buckley, with a score of 70%. However, the next eight places were filled by students of Electrical Engineering, led by James Cunnane and Barry Ambrose, with scores of 66, 58, 57, 42, 41, 38, 36 and 34. A Science student filled tenth place with 33. Further down the scale, marks were 32, 31, 30, 29 (3), 28, 27, 26, 25 (2), 24 (3), 23, 22, 21 (3), 19, 17, 16 (2), 15, 14, 13, 8 (2), 7, 4, 3 (2). Interestingly the bottom three places were also filled by Engineering students! The average mark was thus about 25 and the pass mark was declared to be 0 - taking part being equivalent to passing!

There were many ingenious solutions and suggestions but weaknesses appeared on topics such as Geometry, Diophantine Equations, Induction, and the Associative Law. Many of the students found themselves labouring at a mathematics examination for the first time. It was comforting to note that a girl came in sixth position with an excellent score of 41. Put that in your pipe and smoke it!

U.C.C. SUPERBRAIN 1984

Answer any *ten* questions

1. Using each number once and once only, place the numbers 1, 2, 3, 4, 5, 6, 7, 8 and 9 in a 3x3 square so that all rows, columns and diagonals sum to eight *different* totals, i.e. no two sums are equal.

2. If x and y are positive integers, find all solutions of the equation
$$2xy - 4x^2 + 12x - 5y = 11.$$

3. If ABC is a triangle show, with proof, how to find points S and R on the line BC, P on the line AB, and Q on the line AC, such that PQRS is a square.

4. Evaluate the indefinite integral $\int (\sec^9\theta + \sec^8\theta)d\theta$.

5. Ten books are arranged in a row on a shelf. In how many different ways can this be done, if one particular book A must always be to the left of another book B?

6. Assuming that $\lim_{x\to 0} \sqrt[x]{\frac{1+x}{1-x}}$ exists, find its value.

7. If $n = 2^k$ for $k \geq 1$, show that ${}^nC_r = \binom{n}{r}$, the number of combinations of n things r at a time, is an even number, for $1 < r < n$.

8. If $A = \{a,b,c,d\}$ is a set of four distinct elements, is it possible to define a closed binary operation * on A such that the associative law $x*(y*z) = (x*y)*z$ *never* holds for any triple $x,y,z \in A$, equal or distinct?

9. If $\alpha = 1 + \frac{x^3}{3!} + \frac{x^6}{6!} + \ldots$, $\beta = x + \frac{x^4}{4!} + \frac{x^7}{7!} + \ldots$,

$\gamma = \frac{x^2}{2!} + \frac{x^5}{5!} + \frac{x^8}{8!} + \ldots$, assuming that all three series converge for $x \in R$, prove that $\alpha^3 + \beta^3 + \gamma^3 = 1 + 3\alpha\beta\gamma$.

10. Prove that $\cos 29^\circ$ is not a rational number.

11. Form a nine digit number using each of the digits 1, 2, 3, 4, 5, 6, 7, 8, 9, once and only once so that the number formed by the nine digits is a multiple of nine, the number formed by the first eight digits is a multiple of eight, the number formed by the first seven digits is a multiple of seven, and so on, i.e. the number formed by the first n digits is a multiple of n, for $1 \leq n \leq 9$.

LETTER TO THE EDITOR

December 1983

Dear Editor,

The National Committee for Mathematics received the following letter from the International Mathematical Union appealing for financial support for the Special Development Fund, and would appreciate your bringing it to the notice of your readers in the belief that many of them would wish to contribute to the fund. Donations can be sent anytime either directly to the banks mentioned in Professor Lehto's letter or to the undersigned, marked "I.M.U. Special Development Fund".

Yours sincerely,
Secretary,
National Committee for Mathematics,
Royal Irish Academy,
19 Dawson Street,
Dublin 2.

May 4, 1983

TO ALL NATIONAL COMMITTEES FOR MATHEMATICS

The Special Development Fund aids IMU to fulfill the important obligation of helping developing countries within the framework of mathematical research. The means of the Fund, which go unreduced to mathematicians from developing countries, are used primarily for travel grants to young mathematicians, to make them possible to participate in International Congresses of Mathematicians. The Executive Committee of IMU elects an international committee to distribute the grants.

Means to the Special Development Fund come from private donations. This letter is addressed to you in the hope that you could make a contribution to the Fund, either directly or by making an appeal among the mathematical community of your country. Donations can be sent at any time and in any convertible currency, to the following accounts: