The 1996 British Informatics Olympiad

BIO'96

Sponsored by

DATA CONNECTION

Report

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Introduction

The British Informatics Olympiad (BIO) was set up in March 1995 as the national computing competition for schools. The general aims of the BIO are to promote an interest in computer programming amongst pupils in secondary education, and to give the best the opportunity to represent Britain at the International Olympiad in Informatics (IOI).

This year, with sponsorship from Data Connection, the BIO has grown by a factor of three. A total of 71 schools and colleges requested information, entering approximately 350 pupils. The main competition paper, the BIO round one, took place in February and March. 56 schools returned marks and over 220 certificates were awarded to competitors ranging in age from 14 to 18.

The best fifteen were invited to the BIO final, which took place at Christ's College, Cambridge, from 12-14 April. After a series of tests, the four winners who will represent Britain at the 8th IOI were announced. The prizes were awarded by Clive Partridge, a director of Data Connection, who said, "Data Connection is proud to sponsor the BIO'96. As one of the UK's most successful software engineering companies, we base our success on recruiting exceptionally talented people and training them to become world-class software engineers, managers and marketeers. BIO'96 has succeeded in attracting some of the country's brightest and best young computing students. The IOI team is a formidable collection of talent - exactly the sort of people we recruit as both pre-university students and full-time employees."

The team will travel to Veszprém, Hungary, on 25 July, to compete against over 200 students from over 55 countries at the 8th IOI.

Comments

Comments on the competition have been generally positive. Many remarked that candidates enjoyed the challenge even though they found it difficult. This year's paper was harder than last year's by design, while at the same time giving less time.

There were two major comments raised, the first relating to the way the papers are marked. We received questions asking if the marking scheme could take into consideration partially correct (but incomplete) programs, and style. In principle this is a good idea, and we take the luxury in the final of doing this. The main problem is that a wide range of teachers are involved in marking the competition, including those with little or no programming experience. The "black box" testing hopefully enables everyone to mark the questions in a consistent, and not too time consuming, manner.

The second main question raised was on the type of machine we were expecting to be used, and the amount of time programs would need to run. Test programs were run on a 20Mhz 286 and no time difficulties were encountered. Test data was also designed so that in most cases even naive algorithms would have a chance. This is discussed further in the comments on the individual questions. Machines used in the competition included Archimedes, Macintosh, IBM PC Compatible and a Psion Organiser.

The level of mathematics in the competition was also commented upon by a couple of people. A certain amount of "back of the envelope calculation" is an integral part of computer programming. You often have to realise, in question 3d) for example, the sheer number of calculations/answers means a non-naive algortihm is required.

Round One

We had two aims when writing the 3-hour round one paper, which schools set in exam conditions. Firstly, we sought to provide a good mix of questions for different abilities; the added time pressure was there to distinguish between those who could answer the questions, and those who could answer them quickly. Secondly we wanted to provide a variety of different types of questions, so there was a question where implementation was the problem and one where it was finding the algorithm.

We asked for most of the papers of those who scored above 53%. Generally papers were consistently marked, with the only question 3a) causing problems. Not all schools returned a complete mark sheet; some only listed total scores, and candidates who failed to score (or withdrew) were often not noted. The following statistics, which are to the nearest percentile, are based only on complete marks.

Overall, marks were well distributed, the main dividing line being between those who scored sufficiently on question 2 to demonstrate a program understanding "Life". Those who did not were approximately normally distributed with mean 19.9 and standard deviation 6.3. Those who did were approximately normally distributed with mean 47.8 and standard deviation 9.8.

Question 1 (Amicable Numbers) was intended to be a gentle introduction into the competition, and to provide a question most competitors could produce a program for. Input data was sufficiently small that no difficulties should have been experienced, even with naive algorithms.

For part a) only 2% of competitors failed to score any marks, with 86% scoring over 14 (which required correctly identifying at least one amicable, and one non-amicable pair). 26% scored 20 with a further 49% scoring 18 (a probable failing on the 496, 496 test).

48% of the competitors failed to solve part b), this being almost independent of the marks for the first part. 10% of those who scored 18 in part a) benefited from available marks for answering "6,6".

Question 2 (Life) presented a task where understanding and implementation were the primary problems, and not designing an algorithm. It hopefully introduced to those who had not previously seen it an interesting, and often beautiful, computing curiosity.

80% of candidates scored some marks for part a), with 46% scoring full marks. A further 14% scored sufficiently to show they had at least a partially correct implementation of the game.

The second part was reasonably answered, with 60% scoring some marks, although only 7% got all 4 marks. Part three however caused far more difficulties, with only 20% of candidates scoring. Just under half of those who did score managed to get the correct answer.

The final rider to question 2, along with the final rider to question 3, were there for the more able candidates to play with. Part 2d) was also the only question where time might have been an issue, our test program taking 4 seconds on a Pentium 90, and hence potentially several minutes on slower machines. Since any program written to solve this part must have been run during the 3 hours, and not during a time limited test afterwards, this was deemed acceptable. Only 2% of candidates managed this part.

Question 3 (Dominoes) was a programming exercise requiring the candidates to come up with an algorithm to solve the problem. Any working algorithm should have had no timing difficulties, since there are usually a huge number of valid solutions.

15% of candidates managed to get a program running for part a). These marks were well distributed, with the highest being 23. Tests 4 and 5, for robustness, seemed to consistently cause problems.

Part b) was answered by 6% of the competitors. Interestingly, two thirds of these did not managed to score anything on the first part.

7% scored something on the final part, half of whom did not score on the first part. 1% managed to get all 8 marks, with the remained scoring marks for mentioning the number of ways dominoes could be placed for a given tessellation. This was the second rider designed for the top end of the candidates.

Final

The final took place at Christ's College, Cambridge, from the 12th to 14th of April, across a weekend that was rain free but saw both sun and snow. Only the Saturday was taken up with the competition tasks, with much of the other two days enabling the finalists to socialise.

The finalists arrived late on Friday afternoon, from locations as near as Cambridge to as far as Aberdeen. Once rooms had been found, and possessions deposited, we all met for the formal introduction. After dinner there was an opportunity to play with the various languages, surf the net and talk to us.

Saturday formed the main part of the final, with two written tasks in the morning and three programming ones in the afternoon. The first written question led the competitors through unfamiliar data structures, whilst the second one was an free style "write whatever comes to mind" about checking randomness. Our aim with both these questions was to ask about interesting computing topics which competitors were unlikely to have encountered, or considered in much detail.

The afternoon saw three programming exercises, which the competitors were given three hours to solve. Two questions, a graph problem and an assignment problem, were distributed initially. As soon as a program had been written it was handed in and we tested it on unseen data, with the competitors getting a chance to change their programs if they failed. The assignment problem had a follow-up programming question which was handed out when it had been solved.

The standard of competitors in the final was very high. The first submitted program in the afternoon (which was also correct) arrived after 30 minutes, and was quickly followed by several more. Since there were often many programs needing to be tested we were very grateful for the help of Colin Dancer from Data Connection who joined us for assessing the final.

On Saturday evening we all went out for a pizza. In the evening, while the finalists relaxed, we set to work finishing the marking and choosing our team. Sunday morning was spent in a laid-back manner.

The presentation took place on Sunday lunchtime, after a pleasant buffet lunch. Competitors were kept in the dark as to who had been chosen, and we maintained the suspense until the end when Clive Partridge, a director of Data Connection, awarded the prizes. All the finalists recieved a bundle of goodies (T-shirts, mugs, folders, pens etc.), as well as a book on computing and a more "fun" general interest one. The four winners will also make up the Great Britain team which will compete this year in Hungary at the International Olympiad in Informatics.

The final seemed to be a great success, and went without any major hitches. Ultimately we would have loved to have chosen more competitors for the international final, since the standard of entries was so high. Since one of our aims is to bring likeminded students together, it was very gratifying to see them exchanging addresses at the end of the competition.

Copies of the questions set in round one and at the final can be found in the Documented Computing Problems database on the BIO Web pages at
http://dmg.mjdu75u2m4kh8vcqm1rodsuaeom/external/bio/

List of results

Team

Andrew Cooke	Aylesbury Grammar School
Justin Santa Barbara	Eton College
Michael Anderson	Royal Grammar School, Guildford
Alex Evans	Westminster School

Reserve

Lewpen Kinross-Skeels	Aylesbury Grammar School

Finalists

Simon Nickerson	Bedford School
Jean-Philippe Sugarbroad	Bryanston School
Matthew Meredith	Hills Road Sixth Form College
Paul Johnston	Manchester Grammar School
Alasdair Coull	Mintlaw Academy
Stephen Wassell	Queen Mary's College
Nick Jones	The Judd School
James Blakesley	Tiffin School
Stephen Williams	Torquay Boys' Grammar School
Chris Lightfoot	Westminster School

Distinction

Alan Mitchell	Aylesbury Grammar School
Rory Jackson	Aylesbury Grammar School
Michael Brown	Bancroft's School
Aleric Williams	Bedford Modern School
Brian Drought	Bedford School
Martin Brock	Bedford School
Catalin Userel	Culford School
Ben Roughton	Eton College
Ross Younger	George Watson's College
Jonathan Ingram	Harrow School
Fred Barnes	Henry Box School
Lev Bishop	Manchester Grammar School
Matthew Davis	Manchester Grammar School
Kennedy Cheng	Mill Hill School
James Farrand	Richard Huish College
Andrew Kays	St Cyre's School
Christian Willis	St Cyre's School
Jonathan Hoare	St Olave's Grammar School
Ashley Hirst	St Paul's School
Robert Tickle	The Judd School
Christopher Stewart	Tiffin School
Greg Marsh	University College School
Colin Towers	Whitgift School
Ian Barry	Whitgift School
Peter Clay	Whitgift School

Merit

Matthew Lloyd	Abingdon School
A Clavel	Ampleforth College
Julian Phillips	Aylesbury Grammar School
Matthew Kennard	Barton Peveril College
Richard Clarke	Bedford Modern School
Chris Fryer	Colchester Sixth Form College
Dave Elton	Colchester Sixth Form College
Paul Cuthbertson	Colchester Sixth Form College
Robert Bolter	Colchester Sixth Form College
Simon Toop	Colchester Sixth Form College
Leo Rundle	Devonport High School for Boys
Edward Ratzer	Eton College
Giles Radford	Eton College
Alun Owain Davies	Gorseinon College
Andrew Steven Winter	Gorseinon College
Matthew Williams	Haileybury School
Malcom Stockham	Hills Road Sixth Form College
Mark White	Hills Road Sixth Form College
Paul Badcock	Hills Road Sixth Form College
Alistair Houghton	King Edward VI, Southampton
John Cole	King Edward VI, Southampton
Paul Haley	King Edward VI, Southampton
S Egli	King Edward VI Stratford
David Armstrong	Kingston College
Christian Waters	Leeds Grammar School
Joel Harrison	Leeds Grammar School
Matthew Gill	Leeds Grammar School
Keir Fraser	Maidstone Grammar School
Robin Green	Maidstone Grammar School
Tom Coerkamp	Maidstone Grammar School
Anjan Samanta	Manchester Grammar School
Marek Isalski	Manchester Grammar School
Sam Pumphrey	Manchester Grammar School
Jon Cook	Peter Symonds' College
Michael Everitt	Peter Symonds' College
Gareth Harmer	Queen Mary's College
Christopher Cookson	Royal Grammar School, High Wycombe
Simon Waldman	Royal Grammar School, Guildford
Chris Lynch	St Cyre's School
Adam Barnard	St Paul's School
Nick Boultbee	St Paul's School
Philip Sykes	The Judd School
Andrew Flegg	The King's School, Macclesfield
Tim Pullen	Tiffin School
Charles Baylis	Wellington College
Mohan Ganesalingham	Westminster School
Crispin Flowerday	Whitgift School
Kieran Milan	Whitgift School
Nicholas Giles	Whitgift School
Stuart Gardner	Wirral Grammar School for Boys
Nicholas Gibbs	Wyggeston & Queen Elizabeth I College
Ben Corlett	Yale College

The full list of certificates awarded and participating schools is available on our Internet site at
http://d8ngmp8cgb8cen2wv9vf9v48drf2roads-uae.com/~92awr/ioi/bio96_lists.html
or under the BIO Home Page:
http://d8ngmp8du75u2m4khg8vevqm1nroads-uae.com/external/bio/

Development of the BIO

Based on the success of the competition, we conclude that the general format taken by this year's BIO is satisfactory. There are, however, certain areas in which we hope to improve it to make the competition more inclusive and to further its aims. Our only real disappointment was the very low proportion of girls in the competition, a fact which we feel does not represent the numbers who have an interest in computing. This is something we will try to address when planning the next BIO.

Some schools were unable to take part in the BIO because the timing of round one—mainly in March—clashed with a peak period in computer science coursework and some schools' mock exams. With the basic format of the competition established, we hope that it will be possible to allow extra space for schools to set round one, for example giving a longer period earlier on in the Lent term.

The BIO is required to distinguish between competitors of very high ability and experience, and so it has been difficult to keep it accessible to younger or less experienced pupils. A further possibility which we are considering is to run a junior competition, in a similar way to the British Maths and Physics Olympiads; this might take to form of a programming project rather than an exam, although we must stress that this has yet to be decided.

Conclusion

We have been delighted that the British Informatics Olympiad has proved to be such a success this year, much of which is due to the generous sponsorship from Data Connection Limited.

Despite a significant increase in difficulty, the number of participants has grown tremendously since the first BIO in 1995. The standard has also gone up, raising hopes that the team will improve on the two medals won at last year's International Olympiad in Informatics.

The entrants covered a wide range both in age and programming skill. They tried their hands at challenging tasks, and we hope enjoyed and benefitted from the experience.

Overall we were very pleased with the high standard of this year's competition. We hope that the BIO has encouraged students to take programming seriously, and that those pupils who are still able to enter next year do so.