

# 39th INTERNATIONAL MATHEMATICAL OLYMPIAD

TAIPEI, TAIWAN

10–21 July 1998

Report by ADAM McBRIDE (UK Team Leader)

## Introduction

*The best laid schemes o' mice an' men gang aft a-gley.*

So wrote Robert Burns in his poem *To a Mouse*. The quotation provides an apt description of the climax to the UK team's preparations for this year's International Mathematical Olympiad (IMO). Everything had gone smoothly during the selection and training of the team. However when it came to the flight from Heathrow to Taipei, things went badly wrong. Because of air traffic control problems, the team missed their connection at Amsterdam. They had to stay in Amsterdam for almost 24 hours before embarking on a 16-hour flight to Taipei via Bangkok. They arrived at their accommodation a mere 15 hours before the first paper (and missed the Opening Ceremony as a result). Their luggage was delayed even longer, so that team and luggage were only reunited a mere 2 hours before the first paper. Needless to say, everyone was exhausted both physically and mentally, hardly an ideal condition in which to tackle two 4½-hour papers. Under the circumstances, the team performed remarkably well and I congratulate all the students on their achievements.

Apart from the difficulties described above, this year's IMO was an enjoyable experience. Almost without exception, the organisation was good. Accommodation for the Leaders was luxurious, almost embarrassingly so at times. The accommodation for the students was rather more basic, especially the beds each of which was essentially a plank of wood and a sheet. However, there were no complaints about the food and other facilities were more than adequate. Our hosts were always gracious and cheerful, going out of their way to make us feel welcome. The weather was dry but humid, with record temperatures of over 100°F being recorded. Fortunately, air conditioning was on hand most of the time. After the papers had been sat, there were various excursions and social events. By this time everyone had almost recovered from jet-lag so that the IMO ended on a happy note. All of us will have fond memories of our visit to Taiwan.

## Selecting the UK IMO team

As usual things got under way on the third Friday in November with the UK Senior Mathematical Challenge (UKSMC), a 1½-hour paper containing 25 multiple-choice questions, of which the first 15 are intended to be accessible to most contestants and the rest are meant to be more taxing. The 1997 UKSMC attracted a record entry of over 44000 students. It is hoped that the number of contestants will continue to increase in future years. Of course, more entrants produce more work for the organisers. However, the results were processed very smoothly and efficiently thanks to the efforts of Bill

Richardson (Chairman of the Senior Challenges Subtrust of the United Kingdom Mathematics Trust) and Heather Macklin (Maths Challenges Office, University of Leeds).

Around 800 pupils went forward to the British Mathematical Olympiad, Round 1 (BMO1), a 3½-hour paper with 5 questions held in mid-January. Of these around 100 were invited to take part in Round 2 (BMO2), another 3½-hour paper with just 4 questions, held at the end of February. On the basis of the marks scored, it would seem that BMO2 was found easier than BMO1.

At this stage, it is appropriate to repeat a comment made in my reports for 1996 and 1997. Of the 100 or so contestants in BMO2, only 9 were girls. Of the 67 schools represented, 60 are in England, 4 in Scotland, 2 in Northern Ireland and 1 in Wales. The small number of girls and the small number of schools outside England are sources of concern. We should all redouble our efforts to rectify the situation.

Based on all the information available, exactly 20 students were selected for a residential Training Session at Trinity College, Cambridge in early April. In addition to all the serious contenders for this year's IMO team, some younger students were blooded as an investment for the future. Each day there were 4 or 5 intensive sessions on Algebra, Combinatorics, Functional Equations, Geometry, Inequalities and Number Theory. In each session the emphasis was on tackling problems, with the bare minimum of exposition from the person leading the session. Thanks are due to all who gave so willingly of their time to prepare material and lead sessions. Special thanks to Julia Gog for the domestic arrangements which helped to make the Training Session so enjoyable and successful.

The climax of the Trinity Training Session was the Final Selection Test (FST), a 4½-hour paper with just 3 questions, mirroring the structure of an IMO paper. In the event FST was possibly too hard, with most students scoring very few marks. On the basis of BMO1, BMO2 and FST performances, an IMO squad of 8 students was chosen and they immediately embarked on a correspondence course. They received a sheet of 8 or 9 problems every 10 days and had to submit solutions in accordance with strict deadlines. Towards the end of May, our selection was finalised as follows:

<b><u>Team:</u></b>	Mansur Boase (St. Paul's School, London) Mohan Ganesalingam (Westminster School, London) Luke Halliwell (Madras College, St. Andrews) Toby Kenney (Calday Grange Grammar School, Wirral) Robert Morris (Lancaster Royal Grammar School) Jeremy Young (Nottingham High School)
<b><u>Reserves:</u></b>	Rebecca Palmer (Clitheroe Royal Grammar School, Lancashire) Peter Youngs (St. Paul's School, London)
<b><u>Team Leader:</u></b>	Adam McBride (University of Strathclyde, Glasgow)
<b><u>Deputy Leader:</u></b>	Philip Coggins (Bedford School)
<b><u>Observer:</u></b>	Richard Atkins (Oundle School, nr. Peterborough)

Sending an Observer to the IMO allows interested parties to see at first hand what is involved in being either the Leader or the Deputy Leader. On this occasion Richard shadowed Philip.

### **Final Preparations**

The correspondence course continued until the beginning of July, with occasional interruptions because of A-levels and other exams. During the period 1-5 July, the team gathered at Queen's College, Birmingham in conjunction with the National Summer School being run there by Tony Gardiner. There were further sessions on Combinatorics, Geometry and Number Theory, as well as 2-hour mini-papers and another mock IMO paper. An important objective was to get to know each other better and to develop team spirit. One session was devoted to a "pep talk" while Philip dealt with travel arrangements, medical precautions and all the other small things that can be useful in an emergency. Team T-shirts, designed by Luke, were dished out. For light relief we saw a hilarious open-air performance of *Much Ado About Nothing* in which Shakespeare's text underwent some interesting transformations. There was also a "Mathematical Mélange" in which the younger students at the Summer School displayed their abilities in a wide range of music, plus a bit of juggling. The Summer School was a great success and a fitting conclusion to our preparations. We are all most grateful to Tony Gardiner for the huge amount of work he put into its organisation.

### **Timetable of the 39th IMO**

The Jury, comprising the Team Leaders of all competing countries, met for the first time on the evening of 10 July and spent the next three days selecting the problems for the two papers and approving the translation of the papers into all the required languages (48 in total). The Teams arrived (or were supposed to arrive!) on 13 July and the Opening Ceremony was on 14 July. The two examination papers took place between 09.00 and 13.30 on 15 and 16 July. Thereafter the contestants could relax and go on excursions while the Leaders and Deputy Leaders embarked on two days of marking and co-ordination. The Closing Ceremony, including the presentation of medals, took place on 20 July and proceedings concluded with a Banquet.

### **The Problems**

All contestants sat two papers on consecutive days. Each paper contained three problems, each problem being worth 7 points.

On each day the time allowed was 4½ hours.

The problems were proposed by the countries indicated.

### FIRST DAY

1. In the convex quadrilateral  $ABCD$ , the diagonals  $AC$  and  $BD$  are perpendicular and the opposite sides  $AB$  and  $DC$  are not parallel.

Suppose that the point  $P$ , where the perpendicular bisectors of  $AB$  and  $DC$  meet, is inside  $ABCD$ .

Prove that  $ABCD$  is a cyclic quadrilateral if and only if the triangles  $ABP$  and  $CDP$  have equal areas.

(Luxembourg)

2. In a competition, there are  $a$  contestants and  $b$  judges, where  $b \geq 3$  is an odd integer. Each judge rates each contestant as either “pass” or “fail”.

Suppose  $k$  is a number such that, for any two judges, their ratings coincide for at most  $k$  contestants.

Prove that

$$\frac{k}{a} \geq \frac{b-1}{2b}.$$

(India)

3. For any positive integer  $n$ , let  $d(n)$  denote the number of positive divisors of  $n$  (including 1 and  $n$  itself).

Determine all positive integers  $k$  such that

$$\frac{d(n^2)}{d(n)} = k$$

for some  $n$ .

(Belarus)

### SECOND DAY

4. Determine all pairs  $(a, b)$  of positive integers such that

$$ab^2 + b + 7 \text{ divides } a^2b + a + b.$$

(United Kingdom)

5. Let  $I$  be the incentre of triangle  $ABC$ .

Let the incircle of  $ABC$  touch the sides  $BC$ ,  $CA$  and  $AB$  at  $K$ ,  $L$  and  $M$ , respectively.

The line through  $B$  parallel to  $MK$  meets the lines  $LM$  and  $LK$  at  $R$  and  $S$ , respectively.

Prove that  $\angle RIS$  is acute.

(Ukraine)

6. Consider all functions  $f$  from the set  $\mathbf{N}$  of all positive integers into itself satisfying

$$f(t^2 f(s)) = s(f(t))^2$$

for all  $s$  and  $t$  in  $\mathbf{N}$ .

Determine the least possible value of  $f(1998)$ .

(Bulgaria)

*You are invited to send in solutions, enclosing an SAE please, to*

*Adam McBride, Department of Mathematics,  
University of Strathclyde, Livingstone Tower,  
26 Richmond Street, GLASGOW G1 1XH.*

### **Comments on the Problems**

Participating countries submitted 122 problems, with geometry once again the most popular area. The organisers produced a short list of 28 problems for consideration by the Jury. The United Kingdom submitted 6 problems, of which 3 were composed by David Monk (formerly University of Edinburgh), 2 by Christopher Bradley (Clifton College, Bristol) and 1 by Kevin Buzzard (then at Trinity College, Cambridge). All three of David's problems were included in the short list and one was used as the first problem on the second day. This remarkable achievement reflects David's knack of producing a seemingly endless stream of interesting problems. Thanks to David, Christopher, Kevin and others, we are well blessed with first-rate problemists.

### **How the UK Team Performed**

A total of 419 contestants from 76 countries took part (slightly down on 1997). The UK team finished 17th (equal) out of 76 with 122 points (out of 252). Team members won

1 Silver Medal, 4 Bronze Medals and 1 Honourable Mention.

Individual scores were as follows:

Mansur Boase	13	Honourable Mention
Mohan Ganesalingam	30	Silver Medal

Luke Halliwell	15	Bronze Medal
Toby Kenney	22	Bronze Medal
Robert Morris	20	Bronze Medal
Jeremy Young	22	Bronze Medal.

These bald statistics must not be taken at face value in view of the difficulties mentioned at the start. Mansur and Luke were particularly badly affected by all the hassle and the lack of sleep. Mansur missed out on a medal by just one point but had the consolation of gaining an Honourable Mention for scoring full marks on one particular problem.

### **Overall Performance of All Contestants**

In general, scores were slightly lower than last year. The ranges of scores for the various medals were:

Gold	From 31 to 42	(37 contestants)
Silver	From 24 to 30	(66 contestants)
Bronze	From 14 to 23	(102 contestants).

Only one contestant (from Iran) scored full marks.

Of the six problems, the last one produced far and away the lowest scores. Indeed, 340 students scored 0 on this question. This came about partly because of the difficulty of the problem and partly because of the rather draconian marking scheme.

Although the IMO is, strictly speaking, an individual competition and, officially, there is no team competition, considerable interest still attaches to team totals. For the record, here are the top 20 teams with their totals out of 252:

211	Iran	195	Bulgaria	186	Hungary, USA
184	Taiwan	175	Russia	174	India
166	Ukraine	158	Vietnam	156	Yugoslavia
155	Romania	154	South Korea	146	Australia
139	Japan	135	Czech Republic	129	Germany
122	UK, Turkey	118	Belarus	113	Canada.

### **Organisation of the 39th IMO**

The logistics of running an IMO are very complicated. Getting a crowd of mathematicians from A to B is notoriously difficult. Fortunately, we had a group of delightful young ladies to keep us on the right track. They made sure that nobody got left behind and also cheerfully helped to answer queries and sort out any problems that arose.

Each of the teams is allocated a guide, normally a postgraduate or senior undergraduate who can speak the appropriate language. The UK team's guide, Sophie, was studying English so that there were no communication problems! Sophie's jobs included making sure that everyone turned up in time for the exams and that nobody got lost on the

excursions. She also rose nobly to the challenge by getting emergency supplies of shorts, T-shirts and sandals to tide the team over until their luggage arrived. The team showed their gratitude by presenting Sophie with a large cuddly toy in the form of a bear.

All decisions concerning the actual competition were in the hands of the Jury which comprised the 76 Team Leaders, each of whom had one vote. We each had a plastic wand with our own 3-letter code marked on it. The UK code was UNK so that, as usual, I was “The Man from UNK” (as opposed to “The Hunks from UNK”, who were elsewhere in town!). Votes came thick and fast and majorities were based on the number of wands raised. The business of the Jury was conducted in English, with occasional translations into other languages when required. A good chairman is needed to avoid the whole thing turning into a bear garden. Fortunately, we had the services of Professor Jen-chung Chuan who presided with a judicious mixture of firm control and good humour. For security reasons, the Jury were in a luxury hotel cum beach resort 25 kilometres out of town until the end of the second paper. Then Leaders moved to join Deputy Leaders in another 5-star hotel, this time in the middle of Taipei.

With Leaders and Deputy Leaders all together, marking of scripts and co-ordination got under way in earnest. We had to mark our own team’s scripts and then justify our marks before a panel of co-ordinators. It was up to Philip Coggins, Richard Atkins and myself to get as many marks as possible for our students on the basis of the scripts which had been presented to us. The three of us worked splendidly as a team and I should like to thank Philip and Richard for their sterling contributions. After the exam, the organisers had photocopied every sheet of paper submitted by every student. Co-ordinators were thus able to read scripts in advance and get a feel for various methods of solution used by students. As a result, co-ordination was speeded up considerably. Discussions, while sometimes intense, were always amicable and any disputes were satisfactorily resolved (in one case after a break for lunch!). As soon as the marks for a question had been agreed, they were posted on noticeboards in our hotel and in the students’ accommodation so that everyone was kept up to date with developments. For the most part, things were done with commendable efficiency.

### **Daily Diary**

To try to give a flavour of how the IMO unfolded, I now offer a brief summary of what happened day by day, as seen through my eyes.

**9 July** Another IMO odyssey gets under way. What lies ahead, I wonder? Leave home at midday to catch a flight to Amsterdam. Meet half a dozen other Leaders. The teams from The Netherlands and Russia are also there. At their own expense they are going 3 days early to get acclimatised (something we might think about for the future, given this year’s experience).

**10 July** How do you get a decent sleep on a jumbo jet? I hardly sleep a wink. Entertainment is provided by *The Full Monty*, *The Man in the Iron Mask* and a hilarious Rowan Atkinson short. On a radio channel, the Brahms Violin Concerto comes round every hour or so. After 11½ hours we touch down at Bangkok. There seems to be a golf course right beside the runway with no boundary between. Do golfers give way to

aircraft or vice versa? After a short break, another 3½ hours in the air get us to Taipei. The temperature is 27°C, a bit on the cool side because of a possible typhoon, we are told! During the 1½-hour drive to the hotel, I get my first impressions of Taipei. The streets are full of motor scooters and yellow taxis. Memories of Bombay two years ago but here the city is cleaner, the driving is better and people don't blow their horns so much! Check-in at the hotel is mildly chaotic. I find myself sharing a room with Gregory, the Leader from Cyprus, an amiable chap. It's taken almost 24 hours door-to-door but there's no rest yet. No time for dinner either as the first Jury meeting gets under way. The meeting is relatively short. After a quick look at the short list of problems, I crash out.

**11 July** Woken at 5 a.m. by wind and rain. The south of the island has caught the typhoon, but we escape lightly. I've seen worse in Glasgow on many a day! This turns out to be all the rain we see during the entire visit. We set sail on pruning the short list. Problems are classified as of either Primary or Secondary interest. A problem was defined as being of Secondary interest if it had already been published or if someone didn't like it. We make good progress thanks to our efficient chairman. After lunch, Primary problems are sorted into Easy, Medium and Hard. At one stage there is a procedural wrangle over the difference between a "suggestion" and a "motion". You can second a motion but can you second a suggestion? The barrack room lawyers were in fine form. Eventually after a long day we adjourn to prevent people talking any more nonsense. There is open-air dancing for those with sufficient energy. I settle for writing a few postcards.

**12 July** Good progress during the morning. We choose 5 problems out of 6 and adjourn to decide on a second geometry problem, of which there are still 7 available. We vote by elimination, the least favourite problem dropping out each time. Alas, my favourite problem bites the dust. We are left with a choice of one from two. The vote is a tie! The chairman does not use his casting vote but calls a brief adjournment, after which we vote again and this settles the paper (or so we thought). The Australian leader and I supervise the preparation of the English version of the papers, paying due regard to wording, notation and the spelling of "incentre". Just when everything seems tickety-boo, a mathematical typhoon hits us. It is discovered (rather belatedly and by sheer serendipity) that one of our chosen problems is very similar to one discussed in a recent book review in *Crux Mathematicorum*, which some students will have seen. Panic stations! I call for an adjournment to allow us to take stock. We resume at 22.00 and decide that the chosen problem must be replaced. The late hour leads to more people talking nonsense. Did we vote on something or didn't we? Nobody is sure. Definitely time for bed.

**13 July** After further brief debate, the revised papers are agreed. Not the best outcome in my opinion and rather too much Number Theory, but we are stuck with it. French, German, Russian, Spanish and Chinese versions are prepared and approved. Leaders now use one of the six "authorised versions" as a basis for their own translations. In all, versions in 48 different languages are needed. I relax by going down to the beach. When I return, I get the first hint of trouble ahead. There is a list of all the teams which have arrived safely. No sign of the UK! In response to urgent enquiries, I eventually get a copy of a FAX from Philip, saying "all well, but stuck in Amsterdam!". New

arrival time is 13.00 tomorrow. Bad news! The team will arrive very tired and will miss the Opening Ceremony. Retire to bed, grumpy.

**14 July** Up at 05.30, breakfast at 06.00, then off by bus to the Opening Ceremony at Taipei International Conference Centre. The journey of 25 km takes 1½ hours in the heavy traffic. We have to be segregated from the students because we know the problems in the exam. As a result we hang around for 2 hours. When things get going, there is a distinct lack of atmosphere. The hall is far too big and most of the speeches are boring. A school orchestra entertain us with music by Bizet and Johann Strauss. The Prime Minister is due to make a speech but is delayed because he is busy sacking his Minister of Justice. So the orchestra play most of their repertoire again to fill in time. The fact that my team were still in a plane didn't help matters (although they didn't miss much on this occasion). After a quick kip, I head for the beach but find nobody there. Something to do with mad dogs and Englishmen, I suspect! After 5 minutes in the baking heat, I retreat. At 16.00 there is a joint meeting of the Jury and the IMO Advisory Board, the body which keeps things ticking over between IMOs and plans for the future. There are two contentious issues: the role of Observers at co-ordination and the status of students from one country who are temporarily studying in another country. Much heat is generated but eventually common sense prevails. Following elections to the IMOAB, the meeting is adjourned (unfinished) after 3 hours. We then have a round table dinner of Chinese food. There are ten courses, with lots of seafood. Strange parts of strange creatures are consumed with no obvious ill effects! Get confirmation of team's arrival.

**15 July** Another early start as we head for the National Taiwan Normal University for the first paper. Contestants may ask questions during the first 30 minutes. These questions are written down on special paper and brought by messenger to the Jury which decides, by vote if necessary, on a suitable response. Someone had the bright idea of introducing modern technology. As a result the meeting is a shambles. Too many people run around getting in the way and the computer is more of a hindrance than a help. It takes 75 minutes to handle 23 questions (mostly about the meaning of the term "cyclic quadrilateral"), which is not satisfactory. A simpler, more efficient system is requested for the second day. Outside it is hotter than ever. I wonder how the lads are getting on. I'm sure Philip and Richard will do their best to keep spirits up. Tomorrow we switch hotels and I do some preliminary packing. The present hotel throws a farewell cocktail party. At the end the scripts for the first paper arrive. I decide to go to bed without looking at them, otherwise I won't get any sleep at all!

**16 July** Up again at 05.30, luggage in the lobby at 06.20, off to NTNU at 07.00 for the second paper. We get 28 queries (mainly asking if 0 is a positive integer) but we polish them off much more quickly than the previous day. There have been complaints about the draft marking scheme and the Chief Co-ordinator is summoned. While we await him, the IMOAB business held over from 14 July is completed. There is a long discussion on the mark scheme and a planned visit to the Chiang Kai-Shek Memorial Hall is cancelled. We transfer to our new hotel, every bit as luxurious as the previous one. The view out of the window is interesting. When the traffic lights change, several hundred scooters swarm forward like ants. I meet up with Philip and Richard, who tell me the full story about the delays and missing luggage. The situation was worse than I realised. Back to NTNU to meet the lads as they come out of the exam. Although

exhausted, they are in remarkably good heart. We have lunch and they tell me how they think they have done. Their predictions turn out to be pretty accurate. Back to base to start marking with Philip and Richard.

**17 July** During the day we co-ordinate problems 2, 3 and 5. At lunch the Irish leader asks if we felt the earthquake. What earthquake? It turned out that there had indeed been an earthquake registering 6.2 on the Richter Scale. The epicentre was about 100 km south of Taipei and 5 people had been killed. Considerable structural damage occurred. In our hotel, people on the upper floors reported that doors and windows shook for about 40 seconds. The Brits were unshaken! After lunch, we prepare questions 1, 4 and 6 for the next day. Looks as though most people will get zero on Q6 because of the mark scheme. Philip and Richard head off for Snake Alley, the venue for a night market where you can buy all sorts of interesting things! I pass on that one.

**18 July** A busy morning. In addition to co-ordinating questions 1, 4 and 6 for our team, Philip and I have to act as co-ordinators for the attempts at David Monk's Q4 by the Taiwan team. After an adjournment over lunch to resolve one dispute, we are finished. It is Saturday (I think, but you tend to lose track!) and Philip, Richard and I go for a stroll round two weekend markets, one for flowers and one for jade. These are held under a motorway in what is a car park during the week. Doesn't sound too attractive but at least you are out of the sun! Back at the hotel, most of the scores are now posted. We are heading for 17th equal. It looks as though the cut-offs for the medals won't do us any favours. A game of bridge gets going. At one stage there is an interruption when the Russian Observer seeks help in the matter of projective geometry. Apparently the co-ordinators do not understand what seem to be perfect solutions to Q5 by a number of students. We support our Russian colleague but the dispute goes on well into the night.

**19 July** At last an excursion, to the National Palace Museum, the home for Chinese treasures of great antiquity. We inspect lots of porcelain, jade, carvings and ancient books. Outside the temperature is over 100°F. Back to NTNU for the final Jury meeting to confirm results. Go to see the lads and examine their living quarters. The beds sure are basic! We all have dinner together. A disco party gets going for the students. The rest of us are supposed to be going to another party which promised an evening of "fun and good times". This turned out to be very noisy music in a pub. Richard displayed commendable fortitude, but Philip and I settled for a walk back to the hotel, quite pleasant in the (relative) cool of the evening (only 90°F now!).

**20 July** Spend a quiet morning packing. After lunch we have the Closing Ceremony, a three-hour affair containing speeches, entertainment and medal presentations. The highlight of the entertainment was a chair building routine by an acrobatic troupe. We started with a small chest mounted on four legs. Four empty wine bottles were put on top of the chest. Then a chair was balanced on top of the bottles, one leg on each bottle. A young lad was perched on the chair. One by one, more chairs were handed up to him and the tower got higher and higher. By the end the lad was near the roof on top of about 10 chairs. (Coming down wasn't trivial either!) Back at ground level, students went up for their medals in groups of 6 or 7. I managed to get a picture of the big moment for each of our lads. Outside it was time for team photos. The students came back to our hotel for the Closing Banquet, a bit of a cultural shock for them. It was

another 10-course round table business. Entertainment was provided by a percussion group, a singer who sounded as if she was being strangled and a moderately good magician. Some teams were leaving in the early hours and so it was time for farewells all round. Many new friendships had been made and lots of addresses were exchanged. The evening brought the official proceedings to a happy end.

**21 July** One of those days you can do quite well without when all you want to do is get home. Spend a lot of time sitting in buses which are going nowhere. Luggage gets shuffled around from one place to another. Our flight is not until 19.40 so that there is a lot of time to kill. Many other teams are on the same flight which raises the question as to whether so many mathematicians should all travel together (coplanar mathematicians in the language of one of Philip's better jokes!).

**22 July** Arrive at Heathrow around 07.40 after a trouble-free journey. (Would that this had been true on the outward trip.) Chat to some of the parents before we all head our separate ways. One more flight to Edinburgh. Home by 12.30. It is raining and the temperature is 60°F. Normal service has been resumed.

**Concluding Remarks** IMO 98 will prove to be a memorable experience for all of us. Some things we could have done without. Nevertheless, we have brought back many happy memories of Taiwan and the warm hospitality of our hosts.

The whole process, which started away back in November, involved lots of people. In particular, I should like to thank

- all the pupils who took part at any stage
- all the teachers who encouraged the pupils and supported our endeavours
- Jim Wiegold and Peter Neumann, the chairmen of BMOC and UKMT, for their interest and encouragement
- the Problems Group, notably David Monk, Christopher Bradley and Kevin Buzzard, for creating so many interesting problems
- Bill Richardson and Heather Macklin, organisers of the UKSMC
- Alan West and Brian Wilson, organisers of BMO1 and BMO2 respectively
- all those involved with the marking of BMO1, especially Brian Wilson and Christine Farmer
- all those involved with the Trinity Training Session, especially Julia Gog
- all our sponsors, especially Trinity College, Cambridge for hosting the April training session and the Royal Society for hosting the September celebration
- Tony Gardiner for organising the Summer School and for much more besides
- DfEE for a grant covering travel to and from Taiwan
- Ben Meisner for producing the 1998 BMO booklet, 200 copies of which were taken as gifts for Leaders, Deputy Leaders and our Taiwanese hosts
- Richard Atkins for being an excellent Observer and, notably, retrieving the luggage from the airport
- Philip Coggins for assistance with the correspondence course and for help of all sorts before and during the visit to Taiwan.

That leaves us with the 8 members of the squad. Their attitude throughout was excellent and the quality of work produced, often under pressure, was consistently high. Our two reserves, Rebecca Palmer and Peter Youngs, made the others fight hard for a place and thereby made a valuable contribution to the team effort. The majority of the squad are now leaving us to start the next stage of their mathematical education at university. They have been excellent ambassadors and it has been a privilege and a pleasure to work closely with them. Let us congratulate them on their achievements and wish them all the best for the future.