An interview with "Olympiad Specialists"

by Gonit Sora - Sunday, January 11, 2015

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The Department of Mathematics, North Eastern Hill University, Shillong had organized a Mathematics Olympiad Orientation Camp funded by the National Board for Higher Mathematics (NBHM) from 8th - 11th December 2014. Two of our members Debashish Sharma and Upam Sharma had participated in the camp and they had a chance to interact with the resource persons Prof B.J.Venkatachala (BJV), Prof. C.R.Praneshachar (CRP), Prof. Prithwijit De (PD), all from Homi Bhaba Centre for Science Education, and with Prof. M.B.Rege (MBR) from NEHU. Here we present a write up based on a sort of interview cum group discussion with the resource persons, conducted by DS, US and Ashutosh Kumar (one of the participants).

Q 1: Is this your first visit to North East, Shillong in particular?

BJV : Actually its not my first visit. In fact I had come to NEHU in 2003 for a similar Maths Olympiad program. That was a six day program. But that time I could not visit other places of north east. This time the program is being held in three places and so I got the chance to visit Manipur and Guwahati as well. It's nice to be here and NEHU campus is indeed very beautiful.

PD : For me this is the very first visit to North- eastern part of India. There were Olympiad camps in Manipur and Guwahati too, and now in Shillong and I really am enjoying it very much.

CRP : Well I have a different experience. This is the third time I have come here. Earlier I had come for a maths Olympiad program for teachers and then for the DST-sponsored INSPIRE program.

MBR : This question doesn't apply to me !! (Laughs and then a group laughter follows!!)

DS : Oh yes ! You have been staying in Shillong since so many years …

MBR : Ya, since the last 38 years, to be precise.

Q 2: How long have you been associated with Mathematics Olympiads?

BJV : Well, near about twenty-twenty five years. Exactly, since 1989 I have been associated with maths Olympiad activities. Of course, as students, I and Praneshachar were very much interested in problem solving but during those times there was nothing like 'mathematics olympiad' in our country. But I remember there were some sort of mathematical competitions, one such competition was initiated by Prof. Bhatnagar in Indian Institute of Science, Bangalore. But most of them were of a local level, say in and around Bangalore. Then in 1986, most probably, the National Board for Higher Mathematics thought of conducting this nationwide competition, which we call Indian National Mathematical Olympiad (INMO). So they were looking for people to conduct the exam and we were chosen, among others.

(DS: Ok. So basically, the maths Olympiad activities in India began formally in 1986 ?)
CRP and MBR add further : Actually it was initiated in 1985. In fact the first RMO (Regional Mathematics Olympiad) was conducted in December 1985. Then the first INMO was held in September 1986. And the next year onwards, INMO began to be conducted in February every year.)

PD : I have been involved in Olympiad activities since 2010, that is precisely since I joined HBCSE. But my association with problem solving has been much longer than that. I didn't know about maths Olympiad during my school days. In fact, when I was in class eleven, one of my friends told me about RMO but unfortunately he told me … (CRP sir interrupts with a humor : "after the exam ?") .. (Laughs) No, not after the exam ! He told me about it just on the day before the last date of sending the application form and he also said that I had to go to ISI Kolkata to fill up the form etc. etc... And that time I also didn't know where the ISI was located. All I knew was that ISI was very far from my place of residence ! And ultimately I couldn't appear for the RMO. Well in Kolkata, every year there is a well- known book fair, named Kolkata Book Fair. So when I was in Class ten, I came across a book "Problems in Plane Geometry" by I.F. Sharygin, and that was something I really liked. In fact I couldn't disassociate myself from it even during my PhD life. I kept on solving problems from that book and also from Loney's book whenever I had free time. There is another book by Sharygin – "Problems in Solid Geometry". I must say that these books are like Bible for anyone who is aspiring to perform well in maths Olympiads. In fact, Russia conducts a Geometry Olympiad every year in honour of Sharygin. Formally, I got into hard core problem solving during my PhD – I have a PhD in Statistics. I was in University College and in library there were lots of journals devoted to challenging problems. There also used to be math contests for under graduate and post graduate students and I used to take part in those contests. Again in Ireland they use to have "Mathematics Inter-versities", a mathematics competition among all universities in Ireland. I took part in those contests a number of times. Even in the department, there were couple of professors with whom I interacted and that's how I got gradually introduced to problem solving. And then in 2010 I joined HBCSE and came into the main stream Olympiad activities. So even though I missed the Olympiads as a student, I have come to be associated with them now.

Prof. C. R. Praneshachar

CRP : I have been involved since 1987 when I was invited to Karnataka Pre-INMO camp. As for problem solving , since 1966 I have been solving problems from books like Higher Algebra by Bernard and Child, Higher Algebra by Hall and Knight, Loney's trigonometry. And then on higher level, I followed Topics in Algebra by I.N.Herstein. During our PhD days, Venkat (BJV) and I were able to solve some 'starred problems' in American mathematical monthly. Before 1987, I was not very much interested in geometry but later I found geometry very interesting, specially triangle geometry. I am interested in combinatorics too.

(**BJV** adds : See during our PhD days at IISc, every Saturday all students of mathematics used to assemble and solve problems, specially from Rudin's Principles of Mathematical Analysis. This was a regular activity and it definitely helped us in building the problem solving attitude.)

CRP : Yes that really helped. We learn more through discussion with our own peers.

MBR: Well I have been associated with Olympiads since 1985. I remember having received letters from Prof. B.C. Nanda, one of the persons who had initiated this activity, informing me about conducting maths Olympiad camps and exams. I should mention about Prof. J.N.Kapoor, an eminent educationist and a very learned man having years of experience. He has contributed a lot in popularizing mathematics in India, writing about six hundred articles, a number of books on problems, history of mathematics, biography of mathematicians, etc. So, once when he went to attend International Congress of Mathematics Education, that was in 1984 in Australia, he was questioned by fellow experts there that why India had not been participating in mathematics olympiad in spite of being a country with quality math-researchers and teachers. IMOs have been going on since 1959 but India started participating quite late !

(**CRP** adds : Yes in international level India's participation was quite late. But in Tamil Nadu, Andhra Pradesh and in Gujarat as well there used to be such mathematics competitions since 1974. In this context, in order to strengthen his (Rege Sir's) words I would like to mention Prof. Izhar Hussain of Aligarh Muslim University, who also played a significant role in popularizing maths olympiads in our country.)

Prof B. J. Venkatachala

Q 3 : You all have come across a lot of interesting problems. We would be highly benefitted if you please share one or two of your favorite problems.

BJV: Actually all the problems are interesting in their own way. So its very difficult to single out the favorite one. [One problem](#) which I find worth mentioning is as follows:
Take a square ABCD and take an interior point P such that ?PAB=?PBA=15°. Then show that DPC is an equilateral triangle.
It has got several ways of solutions. In fact I have about eleven solutions for this problem. So you see that very simple ideas can give rise to a wide variety of beautiful results.

CRP: See, all the four topics i.e. Algebra, Geometry, Number theory and Combinatorics have several interesting problems. Usually I find very interesting problems in Geometry. One such problem is :

Take a triangle ABC with sides a,b,c as usual. Let P be an interior point of triangle ABC such that its distances from the vertices A,B and C are u,v and w respectively and each of the sides subtends an angle of 120° at P. Now take an equilateral triangle and take an interior point Q in it such that its distances from the vertices are a,b,c. Prove that the side of the equilateral triangle is $u+v+w$.

This is an USAMO problem and is one of my favorite problems.

(US asks : Sir, why do you find it so interesting?)

Actually this problem can be solved in several ways using geometrical transformations. This makes it really interesting.

PD: Its indeed very difficult to single out a favorite problem. I feel that one should not underestimate any problem. Well I can mention the following problem which I find quite interesting :

If a non-constant polynomial P(x) takes at every integer, a value which is the kth power of an integer, then P(x) itself is the kth power of a polynomial.

Prof. M. B. Rege

MBR: Let me share this problem with you all :

Take any 37 integers from the set {1,2,…,112}. Then show that there will always exist two integers x,y out of those 37 integers such that x-y?{9,10,19}.

Interestingly, you know, I tried this problem for twelve years or so and then I gave up. Later they (CRP and BJV) gave me the solution. Even more surprisingly, thereafter, in an INMO training camp, I had given this problem as an exercise mentioning that it has been troubling me for years but at the end of the class, one of the students came up with the solution saying that he had solved it within three minutes !!

(Amazement and laughter follows ...)

And Deiborlang, one of our research scholars, has also got a much better solution for this problem. Most probably, he will discuss that tomorrow in his allotted class.

Another problem that I would like to mention is :

Do there exist positive integers a, b, c such that S(a+b)<5, S(b+c)<5 and S(c+a)<50 ? Here,S(n) is the sum of the digits of n.
So the interesting thing in this problem is that a+b, b+c and c+a cannot have large digits. In fact the maximum possible digit is 4. But a+b+c may have large digits.

Q 4: Sir, the NBHM is spending a lot of money on mathematics education and on mathematics olympiads in particular but still the performance of Indian team in IMO is not very satisfactory. Could you throw some light on the possible reasons for this mismatch between input and output?

(All in unison : Thats a good and difficult question !! There is no particular trend of performance actually. It fluctuates. There are ups and downs.)

CRP : Actually during the last seven or eight years the performance of the Indian team in IMO was not satisfactory. We received gold medals a few number of times. But you see, getting medals in IMO is not the ultimate thing, although its really a prestigious thing. In fact, it has been seen that many students who qualified INMO but were not selected for IMO, performed very well in the later years. Our aim is to make them interested in problem solving and in mathematics. Also, not many of the students are encouraged by their teachers and parents to study mathematics. And the students do not discuss mathematics with their own peers. That is why they are lagging behind when it comes to problem solving.

BJV : Yes our primary aim is to attract people towards mathematics. About performance, I would say that there is a dearth of trainers in our country. This is one of the very serious problems we are facing in India.
(CRP and PD add: In other countries, past medalists come back and train the students but in India, they

go abroad and most of them settle there. So we lose resources)

PD : Its indeed very difficult to say why other countries are performing so well. Every country has got a different education system. Some countries, as for example Thailand, who were not in the picture earlier, have recently come up with brilliant performance. A matter of concern is that not many teachers are aware of the famous books by Bernard and Child, S.L.Loney, Hall & Knight etc. They are available in markets but people are not aware of the contents of these books. But earlier, say before fifteen-twenty years, teachers and students, even engineering students, were aware of these books and they would solve problems from these books. So, lack of awareness about good books is also one of the reasons. If we can initiate students into solving problems from good books then I think the trend can improve. Also, these multiple choice type of questions in competitive exams has ruined the culture of answering subjective type questions. So these days, many students are not able to write a complete answer with proper arguments. Students who qualify for INMO are exceptional. Their answer scripts having a logical flow and the steps of solution are beautifully justified with valid arguments. Students have to incorporate such writing skills in order to perform better in olympiad level. One more thing I would like to add that these days, in schools, peer to peer interaction on topics outside the syllabus is missing among the students. They do not look beyond the syllabus and also they do not have time for that. All through the day they keep running to coaching centers, tuition classes etc.

Q 5 : Do you think that our school curriculum should include more mathematics, say of olympiad level, so that students become well acquainted with problem solving ?

CRP : See, I believe that whatever is taught must be taught thoroughly, even if it is, say, 50% of the present curriculum. Together with that, teachers should encourage the students to study beyond the curriculum.

BJV : The important thing is that the concerned teacher must know what is there in the syllabus and he or she must be able to teach those particular topics in a very nice manner. And it is also the duty of the teacher to make the students explore more, not only on the things which are taught but also something out of the syllabus. It is not that whatever is in the textbook should only be taught. Some problems beyond textbooks must be discussed.

Prof. Prithwijit De

PD : Yes I totally agree with what Sir (BJV) has mentioned. Even with the usual syllabus, effective teaching can motivate students to develop thinking power. Take a problem from the textbook and solve it, then drop some give conditions or add some conditions and ask the students to see how the solution changes. Such modifications of problems can be done very well in geometry and even in algebra. In fact, many of the Olympiad problems do not require high-level mathematics, you will see that many of the problems just involve playing with numbers, figures etc. If a student wants to prepare for Olympiads he or she has to follow books outside the syllabus. I would like to add one more thing here that every school should have a good library with good collection of books and students should be encouraged to read more and more books.

(**BJV** adds : Here I would say one thing : In most of the institutes in our country library gets the least preference. Whenever any sort of funds come in, the first thing that goes out of the utilization list is

unfortunately the library.)

Q 6 : Sir, you all have been organizing lots of olympiads camps and activities. Do you find any similarities among the camps ? And how do the camps motivate the students towards mathematics ? All in unison : Not many are interested .. that's the similarity !!

(Laughter follows…)

BJV : But of course these kinds of training camps actually have a positive impact on the math-education scenario. These Olympiad activities definitely raise the standard of mathematical understanding among the students and there is always a certain class of students who are really interested in mathematics and who want to pursue higher studies in mathematics.

CRP : Yes certainly there is a positive impact of such Olympiad camps. These camps create a mathematical awareness among the better students.

(US asks : But Sir, there are so many remote areas specially in the northeast where such camps have never been conducted. What would be your message to students from such remote areas ?)

BJV : Yes that's true. We have not yet been able to reach out to the villages. Unless we are able to give an idea of what Olympiad is, to the students from remote areas, we won't be able to attract them. So the only way to do this is through their teachers and this is where we need involvement of school teachers.

CRP : Yes teachers have to keep themselves updated with new and interesting problems and information and they should encourage their students towards problem solving.

(AK asks : Sir, do you think that students from rural areas can perform well in Olympiads, if given proper training ?)

BJV : Certainly ! Rural talent is abundant. They need the proper platform to perform.

PD : Well reaching out to everyone is indeed a major problem. The first reason is because India is a massive country with large number of languages, cultures and societies. So we need a large number of people in order to reach out to all sections of the society. Also, one more thing to note is that a large number of students in India study in government schools where medium of instruction is the mother tongue and mathematics is such a subject which can be studied in any language of the world. So more people should come forward to translate the materials for Olympiad problems into regional languages. See for mathematics, we do not need to learn English. In fact, in IMO the question paper is translated in near about 54 languages. So if any student from India wants to answer the IMO paper in a regional language, then proper arrangements can be made by informing the organizers in advance. So we need to take such initiatives.

Q 7: Any message for Gonitsora ?

CRP : Take more and more active people and continue the good work.

MBR : It's very difficult to run a website consistently publishing good articles. You all are doing a great job !

BJV : Good work ! We can send you lots of problems to publish in Gonitsora.

PD : You can promote good books like those by Martin Gardener. These are excellent books containing lots of mathematical puzzles. These days there are lot of websites which upload nice problems written by quality people. One such site is Awesome Math. It is a nice website of interesting problems. You may provide links to such websites in Gonitsora.

DS,US and AK : Thanks a lot for the wonderful discussion Sir !!

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