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Olympiads in Informatics: the Georgian Experience

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Abstract. This paper describes the history of participation, training, and team selection for the Georgian olympiads, which feed the International Olympiad in Informatics.

Key words: algorithms, online contests, national olympiad in informatics.

1. History of Georgia's International Olympiad Participation

Georgia's first national olympiad was held in 1989 with only a theoretical contest; in 1990, the contest had both theoretical and practical components. Since 1991, the contest has included only practical elements.

The Georgian national team (three students) participated in the olympiad of the former Soviet Union for the first time in 1988 and again in 1989 and 1990. Georgia joined the olympiad of the CIS, Georgia, and Baltic countries in 1992.

From 1989 through 1992 (skipping 1991), the Georgian national team won several diplomas (equivalent of medals) at the Soviet olympiad, including two of II degree and five of III degree in addition to a special prize. One Georgian student, who became a member of Soviet Union's national team owing to his scores in the 1989–1990 Soviet olympiad, won the gold medal at the second international olympiads.

In 1993–1995 the Georgian national team abstained from international olympiads. In 1996, Georgia was invited to the international olympiad in Hungary. Of course, as a country, we had no history of this level of competition, the syllabus, or the types of problems. We had no literature. We worked intensively over the next four years on literature and materials, some of which was shared by our foreign colleagues (from Lithuania, Latvia, Estonia, Russia, Ukraine, Byelorussia, Kazakhstan, and others).

We used those materials to prepare and publish books in the Georgian language. Then, in the second half of the 1990s, the Internet's influence began to grow.

This focus brought us our first silver medal at the IOI in Beijing (China) in 2000. Since then, our students have never returned from an IOI without any medals. Table 1 shows our performance.

In 2001, one of our students won the bronze medal at the age of 11, a feat unrepeated to this day.

The Main Center of Informatics of the Ministry of Education and Science of Georgia started to hold Georgian high school student olympiads and continued to hold them

Table 1
Historical medal counts

Year	Medals			
	Gold	Silver	Bronze	Special
1990	1	–	–	
2000	–	1	–	
2001	–	–	2	
2002	–	1	1	
2003	–	–	2	
2004	–	1	1	Youngest Medalist (IFIP)
2005	–	–	2	Youngest Medalist (IFIP)
2006	–	2	2	
2007	–	–	2	
2008	–	–	3	
2009	–	1	3	
2010	1	–	–	
2011	–	–	1	
2012	–	–	2	
Total	2	6	21	2

until 2005. In 2006–2008 the "club komaroveli" was led to organizing these olympiads. (In both cases these organizations were responsible for organizational support for the selecting and preparing process of the national team and for their participation at the international olympiads). From 2009 till today these olympiads are held by National Examination Center of the Ministry of Education and Science of Georgia. As for organizational support for national team selection, training and participation, the Rustaveli National Science Foundation of the Ministry of Education and Science of Georgia is responsible for the international olympiads.

2. History of Georgia's National Olympiads

The goals and objectives of the national olympiads in informatics are:

- identifying talented, prospective students interested in informatics;
- deepening students' learning of informatics at schools;
- improving students' computer literacy skills;
- the promotion of information technologies;
- raising the interest of study and motivation of young generation in this important area of scientific – technical progress;
- promoting the development of students' professional orientation;
- establishing analytical and creative research, as well as fostering the new computational thinking, which focuses on optimal decisions, including:

- o preparing the ground for adoption in Youth's Information Society and for the future practical activities;
- o growing the country's intellectual potential;
- o raising the Informatics tutors' qualification skills.

The original Georgian national olympiads had three stages. The first stage, school competitions (usually held in January), were the most widespread and enabled all students of public schools to show their practical skills in the field of programming. Winners of the School Olympiads attended the second stage at the regional level, in late February or early March. The third and final stage, the olympiad finals, occurred in late March or early April.

Since the 2004–2005 academic year, the courses for basic programming and study of algorithms were abolished as a compulsory school subject in secondary schools, thus removing the school level contests as well. Accordingly, only students studying in specialized Physics & Mathematical schools or in groups at specialized olympiad training centers participated in olympiads.

These actions, of course sharply reduced the number of students participating in olympiads so, in 2009 it was decided to recreate a school stage of olympiad – which is mostly a theoretical exam – to identify talented students from non-specialized schools and pique their interest in informatics olympiads.

Nowadays, this stage takes place in November and the regional and the final stages are held in first half of February and in the second half of March. Because of the shortage of qualified teaching staff, students who win the theoretical stage generally cannot participate at the next level because they lack programming skill, but for the future we are trying to transfer those students to specialized schools where the informatics olympiad teams operate so the students can exploit their talent and realize their dreams.

In 2010, a set of olympiad alumni now working as professional programmers at various companies independently acquired funds from different sponsors to start the online olympiad (GeOlymp) which now plays a great role in expanding our olympiad and identifying new talents. Additionally, this online olympiad offers opportunities to the students to compete more frequently (along with other international online contests), test their knowledge and abilities, and identify gaps in their knowledge so they can work with the teachers and improve.

3. Competition Levels

There are three groups for the olympiad according to the student's age: 8th grade and younger, 9th–10th grade, and 11th–12th grade. Theoretical and regional contests feature just one contest for every age group, but final round includes a two parts of the olympiad for senior age group.

Younger and middle age group participants are free to participate in more senior age groups' contests if no scheduling conflicts exist. Many students do this and are very successful in the higher-level contests.

Despite the current challenges in our country in the field of teaching of informatics, the format for olympiads sees continuous improvement. Recent innovations cover testing and evaluating participant solutions.

Right now the process of holding olympiads is strictly regulated, beginning from the selection of tasks and ending with the procedures of testing solutions and of summarizing the results. We proudly believe these satisfy international standards. National olympiad contests and national team selection contests, as well as the contests of international olympiads, are strictly automated. A group of experts is responsible for the selection of olympiad tasks, their high quality, and for the proper working of the automated system. This group comprises mainly ex-olympians, through anyone may compose and submit a problem for contests.

4. Georgia Olympiad Training

Preparation for the informatics olympiads spans several years. It starts, often grades 6–7, with learning of the basics of programming and continues with acquisition of algorithmic methods (perhaps during grades 7–8). Success at the national and international level relies on these algorithmic methods. Of course, students continue deeper study of programming and code-writing in parallel in order to facilitate speedy, correct solution-creation in contests.

Georgian computer science literature includes a variety of books for the study of programming; of course, foreign language texts are also available but the language barrier and cost issues for paper textbooks preclude their widespread use. We've found that most university-level and higher education literature are too difficult for our secondary school students and often for their teachers, as well.

As an additional challenge, these books do not include teaching methodologies or methodical instructions. Thus we have created and piloted several of our own textbooks to work with students. They include a collection of tasks with solutions and methodical instructions, an appropriate syllabus (that satisfies all the requirements of the international olympiad's syllabus), and a set of teaching methods that are constantly being refined.

These books include sequential learning challenges and the necessary theoretical and practical material to support the challenges. The above-mentioned "GeOlymp's" team has use their site to publicize the source codes of tasks they have used in addition to text and video versions of solutions. The regime of "Upsolving" is also included.

We believe it is best to begin learning the basics of programming (what we call the 'zero level') in sixth or seventh grade. After that, successful students are enrolled in new groups, where they begin the four-year cycle of learning algorithmic methods. Teaching proceeds according to the student's age, physical, and mental abilities.

The first two years include simple issues that progress over time; the third and fourth years cover algorithms more thoroughly. Two-hour classes are held two to three times a week.

After the first year of study (after students have studied programming and the basic issues of algorithms), those students who do not display appropriate abilities (could not

overcome the difficulty level of the olympiad problems) due to teacher's recommendation take orientation to study certain programming languages and participate in the Computer Project Olympiads, where they achieve important successes in most cases. Of course, students who overcame successfully the first year program and continue to study on next level are also allowed to participate in this type of olympiad.

Those students, who are in eleventh grade after finishing the four year course, stay in the group with an individual program of work. In particular, they take an active part in the conducting of lessons with the teachers (which is very useful for them) and are intensively involved in various online olympiads (the number of which is more than enough) among high school students as well as among university students and have achieved significant results.

5. National Team Selection

The IOI is the ultimate goal of the national team aspirants. The winners and revealed perspective students of the final round are enrolled as candidates of the Georgian national team.

The 10 best students will be selected from senior and middle age groups along with the five best students from the youngest group. The four IOI representatives are chosen from this group after two additional selection rounds. They undergo a month-long intensive government-sponsored training period before the IOI, along with four reserve competitors.

The team leaders prepared tasks and conduct the contests. The Rustaveli National Science Foundation finances one additional team leader to travel with the team, who is officially considered the team's third coach in Georgia and takes part in the team preparation process. An adjunct teacher also participates.

Former National Team members, when they are nearby and have time, conduct some of the training sessions. These sessions include both theoretical and practical training that span the set of olympiad topics.

Instructors carefully evaluate the efficiency of algorithms, source code testing methods, working techniques with computers, and attach great importance to clear understanding of task conditions and analysis of tasks' restrictions.

In the last week of preparation before the IOI, the four members of the team travel to the Georgians Mountain resort for final training and a bit of relaxation. They must be ready both physically and mentally for the IOI.

As for the 17-year history of the Georgian team's participation in the International olympiads: In 1996, when our team started to participate in international olympiads, no one school in Georgia didn't work in this direction. We, the leaders of the national team, had to choose students in Georgian olympiads with old criteria and after that we started to train our national team from the zero level. It means that we trained them with the program, which is planned over 4 years. So it was really impossible for us to do this for only one month. So, at first we started to focus a bit relatively on young grade 8–9 but

smart students, since they would have sufficient time (before leaving high school) to gain relevant knowledge and experience for achieving success in the international olympiads. This tactic paid off because in 2000 at IOI Beijing our team won the first silver medal and, since then, our National Team has never returned in Georgia without medals.

We wanted to spread our training components more widely than just for IOI team selection so we recruited a number of schools operating their own olympiad groups in informatics and shared our educational programs, relevant literature and recommendations, and constantly communicated. These schools were mainly physics/math schools because they have many gifted children from different regions across the country. Of course, all this yielded positive results, growing the number of candidates for the national team. Competition has increased as well.

Accordingly, since 2000–2001 the team's preparation program was changed, and it suffered some changes annually. Today, the national team training focus has moved to the analysis of more complicated algorithms, improving the knowledge of new team members, on participating in online olympiads, carrying out the daily training competitions and especially on the team members' preparation tactically and psychologically.

We invite students to the team's training camp who will not be team members until the next year or year after that so that they can grow along with the national team (who, of course, too soon graduate to university studies).

6. Conclusion

Informatics olympiads are one of the most efficient means in discovering talented young people and preparing them for future employment in the information technology field. These olympiads perfectly demonstrate their efficiency in search of young talents and the formation of high quality specialists in the field of computer technology.

Additionally, the olympiads provide preparation of high quality staff in this field.

The aim of informatics olympiads is to help students to learn and introduce them to the XXI century professions, when a person's professional and social mobility has decisive importance.

Finally, we note that the Georgian team's achievements at the international olympiads have brought about some very positive emotions between Georgian teachers and students and instilled in them the motivation to work even harder.

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