Young Talent in Informatics

An AICA – IT STAR Survey

Prepared for the International Conference on Young Talents and the Digital Future, 26 September 2012, Milan, in conjunction with the 24th International Olympiad in Informatics, 23-30 September 2012, Lombardy under UNESCO's patronage

P. Nedkov, G. Occhini and F. Filippazzi with contributions from representatives of Bulgaria, Croatia, Latvia, Poland, Romania and Slovakia

Irina Bokova, Director-General, UNESCO

"UNESCO values the critical role of young people as stakeholders in all aspects of development, and stresses that their energy, motivation and vision are essential assets for positive social change. Through its targeting of talented ICT-savvy youth, UNESCO is convinced that this Olympiad will complement the Organization's own efforts to build inclusive knowledge societies."

[From letter granting UNESCO's patronage to IOI'12; photo - www.unesco.org]

Blagovest Sendov, IOI Initiator

"IOI has matured as the leading international competition of algorithmic nature for secondary school pupils. In the process of national preparations for this premium informatics event young talent is identified, assisted and grown. The experience of the top IOI performing countries is of great value to education, with far-reaching implications."

Bruno Lamborghini, EITO Chairman

"…the most critical target is how to increase investment in new skills, new competences, new forms of education… The main source of concern and risk of a dangerous gap is related to the scarcity of skills required in this new scenario. E-skills represent the real strategic asset for strengthening Europe as a Knowledge Society.

There is a strong need to give policy-makers in Europe the right requests to speed up the change in education, to increase investment of the universities for preparing the right skills. We need to prepare every year hundreds of thousands of engineers in physics, mathematics, informatics, nanotech and biotech, starting from secondary schools."

[B. Lamborghini, ICT Skills Education and Certification (2009), ISBN 88-901620-5-8, Eds. G. Occhini and P. Nedkov]

Giulio Occhini, AICA CEO

"What is coming out is exactly what we wished to get when starting the project: clearly settled indications and well motivated.

The final report will surely represent a fundamental input for the school education managers."

Marek Holynski, Director of Computer Science Institute, Warsaw

"This is a very interesting survey, which could be used at a number of occasions."

Contents

Acknowledgements 4

Introduction 4

Approach and Objectives 4

Questionnaire 7

Further Insights:

Schools as incubators of Talent in Informatics 15

What motivates IOI competitors? 17

Success Factors 21

Findings – Executive Summary 26

Project Team & Respondents 30

Supplementary Information:

An insight of the first International Olympiad in Informatics 31

IOI competitions (dates, venues, country ranking and medals) 34

Young Talent in Informatics

ISBN 978-88-905406-9-1

Publishers:
AICA
Piazzale R. Morandi, 2
I-20121 Milan, Italy

Plamen Nedkov
Halsriegelstraße 55
A-2500 Baden, Austria

Layout and manuscript preparation: D. Hayden, M. Scholze-Simmel

Acknowledgements

We are indebted to all who contributed to the survey on Young Talent in Informatics and made this project possible.

We are grateful to AICA, the Italian Information Technology Association, for initiating and supporting the survey and to IT STAR and its member societies for helping identify the respective individuals and organizations in Bulgaria, Croatia, Latvia, Poland, Romania and Slovakia.

Lastly and importantly, we extend our heart-felt thanks to *Giulio Occhini* and *Franco Filippazzi* (AICA) for their methodological guidance and support at all times.

On behalf of the Project team,

Plamen Nedkov
Project Coordinator

Introduction

The International Olympiad in Informatics (IOI) is widely recognized as a leading international competition of algorithmic nature, in which national teams composed of secondary school pupils show such basic IT skills as problem analysis, design of algorithms and data structures, programming and testing.

The 24th edition of the IOI will convene from 23 to 30 September 2012 in Lombardy, Italy, 25 years after UNESCO's endorsement of the original proposal of Bulgaria for organizing such competitions, an excellent occasion to underline UNESCO's role and activities in this field. The Italian organizers plan an international conference on Young Talent in Informatics on 26 September in Milan. On that occasion and as a contribution to the conference, AICA - the leading Italian Informatics Association in cooperation with IT STAR - the regional ICT Association in Central, Eastern and Southern Europe, launched a survey with the objective to examine and promote the experience of countries in Central, Eastern and Southern Europe whose IOI teams have shown remarkable results in IOI competitions. The findings, based on consultations, interviews and Internet research, will be reported at the conference.

Approach and Objectives

Competitions are embedded in the process of education: whether in the classroom, or on a local, regional, national/international level, constant monitoring of teaching and learning results is a useful practice to access performance, gain new experience, introduce measures to improve the process and reward the best performers. In this regard, the performance of national teams in IOI competitions could be viewed as indicative of ongoing processes in the broad fundament of the national education systems and the national network of mathematics and informatics related institutions.

In considering our project approach, we kept in mind that exact sciences are "difficult". There is a decline of ICT students in many European countries[1]. On the other hand, ICT competences are stra-

1 Jan Dirk Schagen "The ICCT-Mindsets Model – Attracting Young People to the World of ICT", IT STAR Newsletter – http://nl.starbus.org - Vol.9, no.4 Winter 2011/12

tegic assets for the development of Europe as a real Knowledge Society, and any broadening of the gap between the scarcity of ICT-Skills and the needs of informatics professionals and users by the economy might have serious consequences.[2] Policy-makers in Europe should take urgent notice of this fact and ensure the necessary measures and investments in education. We hope the findings of the project would be useful to this end.

The survey is based on a questionnaire related to the selection, preparation and participation of national IOI teams of Bulgaria, Croatia, Latvia, Poland, Romania and Slovakia. These countries provide a representative sample of the whole of Eastern Europe - Latvia for the Baltics, Poland and Slovakia for Central Europe and Bulgaria, Croatia and Romania for South-Eastern Europe. With the exception of Poland, they are relatively small by all counts but deliver remarkable results at international informatics competitions.

Chairpersons/leaders of the national bodies and IOI teams were invited to complete a questionnaire and to comment on such issues as the national team selection, coaching, communication and promotion, motivation and background for success. A section of the questionnaire was on informatics curricula in schools. In addition, personal interviews were organized in some of the countries. This was carried-out so as to gain a deeper understanding of the following:

- How could countries of this region with small economies and tight budgets for education show consistently, within the IOI format, significantly higher results than the larger and richer economies of Western Europe?
- What are the driving forces of this achievement?
- What are the motivation factors?

A separate set of contacts was made with youngsters who are/were national team-members and have won medals in IOI competitions. The perspective of school teachers and trainers was sought to expand our knowledge of the successful organization and experience of these countries and the issues involved and we are of the opinion that the project could lead to further work with wider implications in education and beyond.

The following table and graphs illustrate the performance of the 6 countries that are represented in our survey in IOI and their size and GDP per capita vis-a-vis China, Russia, USA and Germany

Table 1
Overall IOI ranking, on the basis of IOI medals (gold)

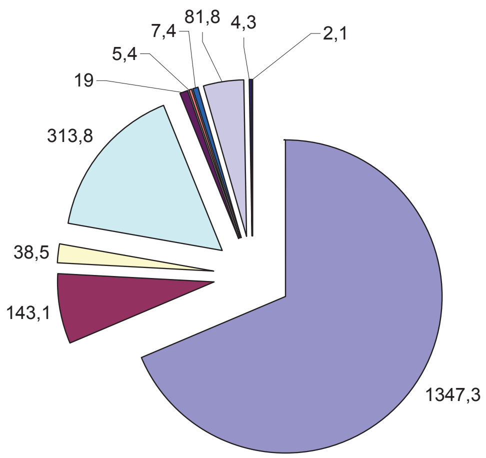
#	Country	Gold	Silver	Bronze	Total
1	China	57	22	12	**91**
2	Russia	40	28	12	**80**
3	**Poland**	**31**	**27**	**23**	**81**
4	United States of America	30	30	14	**74**
6	**Romania**	**21**	**37**	**21**	**79**
7	**Slovakia**	**20**	**32**	**18**	**70**
8	**Bulgaria**	**18**	**32**	**30**	**80**
11	Germany	13	24	29	66
17	**Croatia**	**10**	**23**	**29**	**62**
23	**Latvia**	**5**	**19**	**33**	**57**

Source: http://www.eduardische.com/ioi/

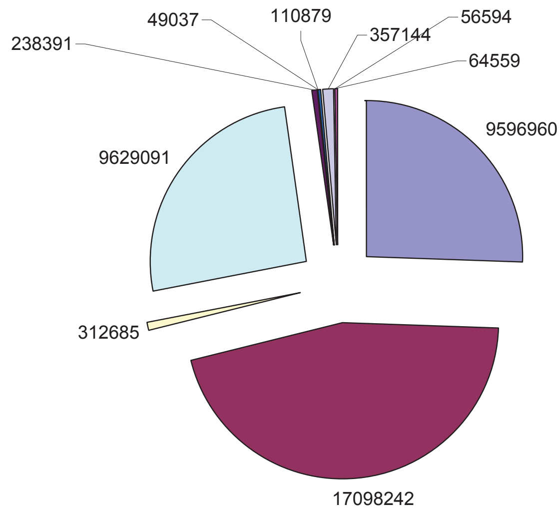
2 B. Lamborghini in ICT Skills Education and Certification, ISBN 88-901620-5-8, Eds. G. Occhini & P. Nedkov

Population, territory and GDP p.c. of countries included in Table 1

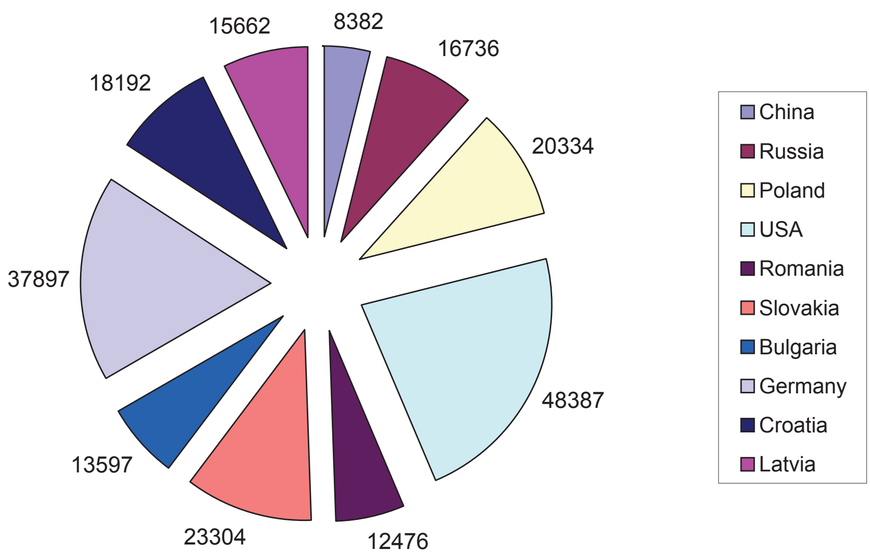
Graph 1
Population
(millions)



Graph 2
Territory
(sq. km)



Graph 3
GDP (PPT) per capita in int. dollars,
IMF data (2011)



Source: Wikipedia

Questionnaire

Completed by IOI respondents from Bulgaria, Croatia, Latvia, Poland, Romania and Slovakia (list of respondents on p. 30).

I.) ORGANIZATION

Who is in charge of the IOI related organization in your country?

- Education Ministry?
- Other – please specify

Bulgaria	Ministry of Education, Union of Bulgarian Mathematicians, Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences
Croatia	IOI related organization is provided in cooperation with the Croatian Ministry of Education. For the last 20 years the Main organizer is the Croatian Computer Science Association – CCSA. CCSA was organizer of IOI 2007 and CEOI 1998 and 2006.
Latvia	Ministry of Education
Poland	Ministry of National Education
Romania	Ministry of Education, Research, Youth and Sport
Slovakia	Ministry of Education; the Slovak Society for Informatics responsible for the scientific level

II.) CANDIDATES' SELECTION

1. What is the minimum age to participate in the regional/national selection?

Bulgaria	10 year old children may participate
Croatia	Approximately 14 years (depending on results)
Latvia	There is no minimum age to participate in National Olympiads
Poland	Actually no limit
Romania	The National Olympiad in Informatics has two sections. The first section includes lower-secondary students: 5th to 8th grade (10-14 years old). The second section is for high-school students: 9th to 12th grade (15-18 years old). Similarly, the National Training Team consists of two distinct sections: - the Junior Training Team, addressed to students from lower-secondary school level (10-14 years old). - the Senior Training Team, composed of upper-secondary school level students (15-18 years old).
Slovakia	The National Olympiad in Informatics has two competition levels A and B. In the competition rules no minimal age for participation is given but in practice, the youngest participants are 12 years old.

2. What are the criteria for the IOI candidates' selection?

- Winners of regional/national competitions
- Recommended by schools / teachers
- Other

Bulgaria	Winners of the national competitions (National Olympiad in Informatics)
Croatia	We have 3 rounds: 1. National competitions (included school and regional) provided by Ministry of Education of Croatia and Croatian Open Competition in Informatics – COCI provided by CCSA, with about 300 students (COCI is also used for students all over the world, see www.hsin.hr/coci) 2. Croatian Olympiad in Informatics – COI, provided by CCSA for 25-30 students with best results on previous competitions 3. FINAL EXAM, provided by CCSA for 8-10 students and the 4 best students enter the Croatian team for IOI
Latvia	Winners of regional/national competitions
Poland	Everyone can participate, the selection is done in the process of competitions
Romania	The Romanian National Olympiad in Informatics is organized in three stages: 1. Municipal Olympiad in Informatics (OMI) 2. County Olympiad in Informatics (OJI) 3. National Olympiad in Informatics (ONI) The National Training Team Selection includes another three stages: 4. Selection contest for Junior and Senior National Training Team 5. First training camp 6. Second training camp For the first three stages the students from 5th to 10th grade receive different subjects according to the level they study. The tasks for the 11th and 12th grades are the same. Once ONI finishes, the National Training Team is selected in the following manner: first, the Selection Contest for the Junior and Senior National Training Team is organized and it is a one-day onsite contest. The first 50% students in the ONI contest in each level of lower-secondary school take part in this Selection contest. The same happens in the case of high-school students who participate in the Selection contest for the Senior National Training Team. In order to join the National Team, the results in ONI are also taken into consideration.
Slovakia	Winners of the national OI competition participate. On that basis there is a selection procedure, after which they compete again. (see reply to item 3 below)

3. How many students per year (approx.) are involved in the overall selection process?

Bulgaria	About 100 at an advanced stage
Croatia	About 30 students starting with COI
Latvia	About 200 contestants
Poland	1000
Romania	a) Municipal Olympiad in Informatics (OMI) – about 4,000 students b) County Olympiad in Informatics (OJI) – about 2,500 students (seniors), 700 students (juniors) c) National Olympiad in Informatics (ONI) – 300 students (seniors), 200 students (juniors) d) First training camp - 20 students in Senior National Training Team and 12 students in Junior National Training Team) e) Second training camp: 16 students in Senior National Training Team and 8 students in Junior National Training Team)
Slovakia	In the first round we have about 140 students, in the second round 120 students and in the national round of OI we have 30 students. In the selection procedure for IOI and CEOI we have 12 students.

III.) COACHING

1. To what extent do the standard school programs cover the IOI Syllabus?

Bulgaria	Almost nothing, some introduction to the idea of algorithms and programming
Croatia	School programs are not completely covering IOI Syllabus, but CCSA programs are fully covering the IOI Syllabus
Latvia	In general, the IOI Syllabus is not covered by standard school programs
Poland	No details. All marked as unlimited is taught in lessons on math and computer science. The best Polish students are on the level of the book of Cormen, Leisserson, … -introduction to algorithms, and have a deep knowledge of C++ programming language – imperative part. STL is commonly used.
Romania	The curriculum covers the IOI Syllabus partly, most important programming techniques being studied in the 11th grade, and in informatics-mathematics classes only. The curriculum doesn't cover the following: DS1. Functions, relations, and sets; DS3. Proof techniques From PF3: Fundamental data structures: priority queue, dynamic set, dynamic map From AL2: Algorithmic strategies: Pattern matching and string/text algorithms Note: Dynamic programming, is included but at an elementary level From AL3: Fundamental computing algorithms: Binary heap data structure, Fenwick trees, Topological sort From AL8: Advanced algorithmic analysis: Basics of Combinatorial game theory, Minimax algorithms for optimal game playing AL10. Geometric algorithms. Note:DS1, DS3 and AL 10 sections are partially covered in math courses.
Slovakia	In the IOI syllabus, there are some parts that are not included in school programs

2. How is the training of the IOI candidates organized?

- Do you have dedicated sessions - How many, how long and during which periods?
- Are there on-line sessions?

Bulgaria	There are National training camps - 1or 2 per year, each has a duration of one week.
Croatia	We have dedicated sessions during Winter School of Informatics (8 days) and Summer Camp of Informatics (10 days). We have preparations before every international competition (5-7 days). We have during the whole year open CCSA FORUM and IRC on the CCSA server.
Latvia	Approximately two months before IOI in 4 one-week sessions.
Poland	First of all the Polish Olympiad in Infomatics is of very high quality. Each year we publish detailed model solutions of all tasks presented to students. For the best students we organize research summer camps. There are about 30-40 summer camps of about 10-14 days, organized during vacation periods. There are no online sessions, but we organize an open, on-line programming contest in which students can participate.
Romania	There are two training camps – 7 days each.The first training camp takes place in May, and the second in June. There are online sessions, but they are not part of the official training schedule of students preparing for IOI. They participate in contests organized by websites such as infoarena.ro and campion.edu.ro.
Slovakia	We have correspondence seminars for students (they solve some algorithmic problems), and some sessions for the best students of the correspondence seminars, two/three sessions yearly (May, October, and in summer). Usually, one session lasts 5-6 days.

IV.) COMMUNICATION AND PROMOTION

1. How are IOI competitions advertised and promoted?

Bulgaria	The national Olympiad is announced; websites are used.
Croatia	Only with Croatian Newspapers and TV with short reports
Latvia	At the top level, as one of the “big” scientific Olympiads, IOI is advertised together with other national scientific Olympiads. There is a constantly updated web page (http://www.lio.lv) of the National Olympiad in Informatics, where various contests are promoted.
Poland	Posters, web site, Ministry.
Romania	The Romanian media always publishes the students’ good results in IOI.
Slovakia	OI has its own web page, also covering seminars and popular lectures for young people. Promotion is also made by the Ministry of Education.

2. Are there incentives for student/schools to participate in the selection? If so, what are they?

Bulgaria	The winners get free entrance to Bulgarian universities.
Croatia	Very rarely.
Latvia	Winners of National Informatics Olympiad have easier access to local universities.
Poland	Valuable prizes (e.g. laptops), free entrance to the best universities in Poland.
Romania	Both schools and local communities provide rewards for the students who got good results in regional, national or international Olympiads. These rewards consist of prizes, school trips and camps.
Slovakia	There are no incentives.

3. Are there rewards for the IOI winners, for instance: scholarships, grants, training courses, easier access to local or foreign universities, etc.?

Bulgaria	Yes, there are scholarships, grants, training courses, easier access to local or foreign universities.
Croatia	Students must personally apply for that.
Latvia	IOI medallists receive government financial awards.
Poland	Not directly, but the winners have access to the best universities in the world and summer internships in the best IT companies.
Romania	The Ministry of Education offers a financial prize and an annual scholarship at the end of each school year for students who have won medals in international contests. The IOI winners are also accepted at universities without having to pass an admission exam.
Slovakia	Usually the winners have easier access to local universities and we start with some scholarships for students.

4. Are incentives provided to teachers and schools of IOI winners?

Bulgaria	Yes, to some small extent.
Croatia	No.
Latvia	Teachers of IOI medallists receive government money awards.
Poland	Yes, financial awards
Romania	Students who get medals in international competitions, their teachers and the schools where they study receive prizes in money from the Ministry of Education at the end of each school year.
Slovakia	No, and it is a big problem. Teachers do it in their free time and after some years they give-up.

V.) BACKGROUND FOR SUCCESS

- **Which are in your opinion the main reasons for the brilliant performance of your representatives at international IOI competitions?**

Bulgaria	Self-motivation
Croatia	Very hard and highly professional work of CCSA associates on the newest IOI achievements during the last 20 years.
Latvia	Hard everyday work and regular participation in on-site and on-line contests.
Poland	Paper submitted in support of this response.
Romania	Specialized mathematics-informatics classes, early start, raising interest, motivation – detailed response is contained in the section on success factors
Slovakia	Existing correspondence seminars for students from all Slovakia, which work very well. Students from Faculty of Mathematics, Physics and Informatics at Comenius University working in the seminars are previous winners of OI and winners and participants of IOI or/and Central European OI (CEOI). There are also teachers who know how to motivate students to take part in the OI and finally we have specialists working for OI and IOI.

INFORMATICS CURRICULA IN SCHOOLS

1.

School level (*)	Informatics courses (**)	
Primary (5-9 years)	Bulgaria	None
	Croatia	None
	Romania	None
	Slovakia	Compulsory – 1 hour per week. We teach IT mainly according to ISCED 1
Lower secondary (10-14 years)	Bulgaria	Compulsory: each year with 1 hour each week Information Technology: Foundation of computers and communications: e-mail and internet, text, graphics and electronic tables, presentations, information security, introduction to networks and web publishing
	Croatia	One school hour per week - Optional
	Romania	Optional, one class per week, 40 per year. Basic notions of using the computer are taught. In certain cases, if the teacher has the necessary knowledge, students also study notions of algorithmics. Every lower-secondary school has at least one laboratory with minimum 15 computers and Internet access.
	Slovakia	Compulsory, 1 hour weekly during 3 years
Upper secondary (15-19 years)	Bulgaria	Informatics, compulsory: 1 year with 1 hour each week, includes: Introduction to computer systems, operation systems, algorithms and data structures, programming Information Technology, compulsory: 2 years with 1 hour each week, includes: word processing, electronic tables, computer graphics, data bases, presentations, networks
	Croatia	Four school hours per week in mathematical secondary schools - Compulsory
	Romania	The courses are compulsory only for mathematics-informatics classes (ordinary or intensive). In an ordinary mathematics-informatics class, a student studies 1 hour/week (40 hours/year) in the 9th and 10th grades (15 and 16 years respectively), and 4 hours/week (160 hours/year) in the 11th and 12th grades (17 and 18 years). In special (intensive) classes (which are fewer) the students are studying between 4 and 7 hours/week (160 hours/ year, respectively 280 hours/year). Every high-school has one, two or three laboratories of informatics with 25 computers each and Internet access
	Slovakia	Compulsory 3 hours weekly in all years (usually 2 hours in the first and 1 hour in the second year). Optionally + 3 hours weekly.

(*) Levels according to the international classification ISCED
(**) Significant information such as:
- Compulsory or optional
- Average number of hours per year
- Other information you feel important to share

2. Is there a *Syllabus* or a *Guideline* defining the content of Informatics courses for the different school levels and types? - If yes, may we have a copy?

Bulgaria: The website of Bulgarian Ministry of Edication, Youth and Science contains syllabuses for informatics in the compulsory education
http://www.minedu.government.bg/top_menu/general/ (in Bulgarian),but the topics are far from the curriculum of IOI.
Croatia: Not exactly defined.
Romania: Yes, there is a syllabus for the different school levels and types.
Slovakia: A Syllabus is prepared for all school levels according to the following five areas:
• Information about us
• Communication using ICT
• Methods, solving of problems, algorithmic thinking
• Principles of ICT
• Information society
Latvia: There is state standard of course "Programming basics" (standard in Latvian: http://www.likumi.lv/doc.php?id=181216, name of course "Programmēšanas pamati"). However, the things necessary for IOI contestants are at elementary level.

3. How are students trained to improve their capability in logic, algorithmic and problem solving?

Bulgaria: Mainly through extracurricular activities.
Croatia: see III/2
Latvia: Students are encouraged to improve their capabilities by offering lots of out-of-school activities such as Olympiads and competitions in mathematics and informatics.
Romania: If the question refers to the students who study informatics intensively, then the answer is that they work in informatics laboratories by implementing the algorithms taught during the classes, in one of the following languages: C, C++ or Pascal. They also work online quite frequently, solving tasks from websites archives such as infoarena.ro or campion.edu.ro.
Concerning the infoarena website: it has been created by former IOI and NOI contestants and is at present maintained by students that currently participate in the Olympiads. Over time, the infoarena community appeared, which is very close-knit, bringing together all the students who are passionate about informatics. The contribution of this website is decisive.
Slovakia: In lower secondary schools, we usually use Imagine Logo and students solve algorithmic problems using it. In upper secondary schools, we usually use Free Pascal.

Further Insights

Schools as Incubators of Talent in Informatics
(B*ased on further interviews with academics and teachers whose schools have done well in producing a pool of competitive pupils for national IOI teams)*

Bulgaria

Mariana Todorova, *Director of the Sofia Mathematics Gymnasium*

The standard school programs do not cover the requirements for Olympiad competitions, therefore many of the participants in these competitions come from specialized mathematical schools. The Sofia mathematics gymnasium (high school) is a specialized school focusing on educating children with special interests in IT, possessing preliminary knowledge in the field. Our work has run smoothly so far in being successful. At a later stage, when the future priorities of our pupils are established, some give up the path of a more in-depth study of informatics and concentrate on IT.

We organize supplementary "Saturday schools", financed by the Ministry of Education, which are open to our pupils with interest in the field, and are run by university lectors and other "outside" tutors. This form of education consists of four academic hours, with some 100 pupils involved.

The achievement of our pupils is impressive on the basis of the scarcity of resources for their preparation. The main problem is that good teachers in informatics are hard to find due to comparative levels of remuneration in schools and private businesses, and the access of all children to good education in the subject.

In the Sofia Mathematics Gymnasium there are two school levels of tutoring:
- 12 – 14 years
- 15 – 19 years

IT is introduced at the first level, while IT is supplemented by Informatics in the second stage.

Bisserka Iovcheva*, Lecturer at the University of Shumen and founder of the A&B private school in Shumen, whose main target is the preparation of pupils for national and international informatics-related competitions.*

Preparations for IOI in the A&B private school involve all pupils, independent of whether they have a chance to get in the national IOI team or not. The training consists of a minimum of 2 hours, twice weekly. Before national/international competitions the training is organized for a week, 4 to 6 hours daily. We also organize internal competitions and our pupils compete online in an organized manner.

Besides the training program, our pupils meet in groups of up to 10 participants. At the moment, the school has 62 pupils in all age groups. Our education plan is aligned with the national education program for preparing competitors, published and updated on the site for national competitions - http://www.math.bas.bg/infos/. In addition, we also use Russian training sites and programs, training programs of the US national team, TopCoder related material, and other leading training programs.

The national program "With Care For Every Pupil" stimulates teachers with good results, unfortunately, this is aimed at state schools and the status of our school does not allow it to benefit. The International Foundation "St. St. Cyril and Methodius" awards yearly teachers with excellent results in identifying and working with young talent in informatics - we are eligible and have received their recognition.

The main reason for the excellent results of our pupils at IOI competitions is their thorough preparation and motivation. The preparation is systematic and our methodology is unique and targeted to deliver results. Everyone could enroll in the A&B School though few remain, as the curriculum is hard. The annual tuition costs approx. 300 EUR.

[*A paper[3] by A. Mollov. B. Yovcheva and P. Petrov describes in further detail the experience of the A&B school in training pupils for informatics competitions with a focus on the organization of internal contests. The training has a theoretical part, analysis and solving of problems, individual class and homework and training competitions. On that basis, an assessment is made of the individual performance*.]

Latvia

***Martins Opmanis**, Institute of Mathematics and Informatics, University of Latvia, Team leader of the Latvian IOI team and chairman of the Jury of BOI 2012 - http://www.boi2012.lv*

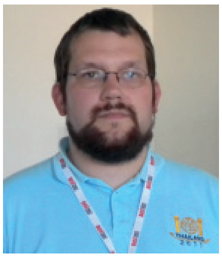
The main reason of a relatively good success of Latvia in IOI is long lasting traditions (since 1986) of programming competitions, which give serious motivation for further work. In the last years it became obvious that the weakest link in the system is the absence of qualified educators. At the moment the most successful educators are still those people who graduated university 25 (or even more) years ago, who saw the first personal computers coming into school, and teaching programming is the passion of their lives. Unsurprisingly the number of such educators is going down due to different reasons and there are just a few regions in Latvia where programming is taught (as a rule, outside the formal education system) on a regular basis. For the immediate future, perhaps the serious turning point in the informatics Olympiad movement and the ability to find deeply interested teachers will be the determinants.

3 INTERNAL CONTESTS AS AN ELEMENT OF THE TRAINING OF PUPILS FOR COMPETITIONS IN INFORMATICS, Anton Mollov, Bisserka Yovcheva, Peter Petrov in Proceedings of the Thirty Eighth Spring Conference of the Union of Bulgarian Mathematicians, http://www.math.bas.bg/smb/2009_PK/tom_2009/pdf/217-223.pdf

The Baltic Olympiads (BOI) is another success story. After the first years in IOI (Latvia together with Estonia and Lithuania was invited to participate in IOI 1992 held in Bonn) it became obvious that there is a need of some similar local competition and team leaders of the three countries (Rein Prank from Estonia, Maris Vitins from Latvia and Gintautas Grigas from Lithuania) were main organizers of the first Baltic Olympiad in Tartu, Estonia (1995). After the formative years the number of participating countries rapidly increased and at the last one (18th BOI 2012 held in Ventspils, Latvia) there were delegations from nine countries. This event is very interesting not only for the contestants but also for problem setters. It is always very interesting how different is description style in different countries. For the Latvian contestants the Baltic Olympiad is a qualification step in getting to IOI and the importance of it cannot be underestimated.

***Sergei Melnik**, Member of the board and principal lecturer, private school Progmeistars – www.progmeistars.lv, supporter of the preparation of Latvian IOI teams.*

The IOI syllabus is not covered by standard school programs and this makes it necessary to go through additional out-of-school courses and training in order to achieve good results at IOI. One such establishment providing training and preparation is Progmeistars. It was established in 1991 and at present has over 30 tutors and some 500 participants attending its courses. It is targeted at 6 to12 grade pupils and provides courses in programming, site administration, internet technologies, preparation for Olympiads and additional preparation in mathematics. The attendance usually ranges from 2 to 6 years. Courses are run in groups of up to 12 participants. Enrollment is possible 3 times a year. The structure of courses and other detailed information can be downloaded from the school's website.



Rihards Opmanis, *Deputy team leader of the Latvian IOI team, Doctoral student and lecturer at the University of Latvia.*

In Latvian schools as in other former Soviet Union republics mathematics is strongly emphasized which is a reason for good results in informatics. There are specialized mathematics schools and their pupils in principle are better equipped for competitions.

The fact that IOI's and related competitions provide possibilities to travel is a motivation for the participants. Another important issue is that participants should feel improvement in their results, which is certainly an incentive for further work.

The IOI syllabus is not covered in school, so in Latvia we work with contestants individually and through personal contact in out-of-school courses. To be successful in IOI's contestants need to start preparing at least at the age of 12-13. At 15 it is definitely too late. Another factor of importance is the experience in participating in IOIs. Some participants go on for several years and there are visible improvements in results and less stress in participation. The IOI teams are predominantly composed of boys. My explanation is that girls are rather oriented towards art and culture and as we know informatics is mainly a male occupation.

What motivates IOI competitors?

Further to the questionnaire that was sent to the participating individuals and organizations above, we attempted to engage in the project competitors in IOI's and to seek their personal views on such issues as assistance and support, motivation and future plans. Their views are useful in understanding their feelings and perspective of what is important to them in the immediate "learning" environment and what are the circumstances and motivations that have made them highly competitive.

The pupils (some of them already university students and young professionals) were invited to respond to the following 3 questions:

1. **What has contributed most for your achievement in IOI competitions?**
2. **What has motivated you to participate in informatics-related competitions?**
3. **Future challenges?**

Bulgaria

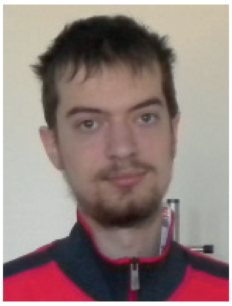
Rumen Hristov*, winner of 2 Gold medals from the last 2 IOIs and 2 Silver IOI medals from the previous IOIs.*

1. Constant training and hundreds of on-line competitions.
2. My parents and the fact that with the first lessons I was very motivated by my teachers and I had perfect conditions for development at the A&B school in Shumen.
3. I continue to participate in many on-line challenging competitions. Most probably in the next years I will take part in university competitions.

Georgi Georgiev, *18 years, pupil at the Mathematical high school (Gymnasium), Sofia. Georgi has participated in many national and international informatics related competitions. Most serious achievements – IOI Bronze Medal (IOI 2011), Silver medal from the Balkan IOI, gold medal from the latest Jautikov Olympiad.*

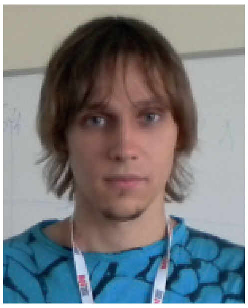
1. My parents, my hard work and my school and environment, and the possibilities to participate in national and international competitions.
2. My external motivation comes from my family and friends while I am internally motivated by my interest in the exact sciences, my interest in traveling and the chance for a better future.
3. I am not yet fully clear about my future but I wish to engage with something in which I could use my knowledge in mathematics and informatics and to be creative. For the near future I plan to continue my education abroad.

Latvia



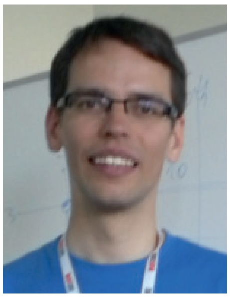
Eduards Kalinicenko, *19 years old, currently student of Computer Science at the University of Latvia, bronze medal from IOI 2008, silver medal from IOI 2009, silver medal from IOI 2010, gold medal from IOI 2011.*

1. The school program is definitely not sufficient to be successful in competitions and I had to join special out-of-school courses, i.e. with *Progmeistars,* that helped me train my logic to think as a programmer. Constant training is very useful, as well as solving tasks from past competitions and participation in on-line contests.
2. The fact that I had a good start in competitions was a motivating factor. I started when I was 11-12 years old. Programming is a form of art in which you have to have an idea and look how to realize it, the language you use is not important. I don't consider my preparation for competitions as hard work. I like to compete so as to achieve better results and learn from my mistakes. It would be nice if this experience has a positive impact on my future realization but honestly I have not thought in school about that. The schoolteachers have not necessarily motivated me to compete but have supported me in this regard and that has gone well.
3. My objective is to get a BSc as a minimum and I have a possibility to continue my studies in Cambridge, UK. For the time being I'm not thinking of a permanent job.



Normunds Vilcins, *21 years old, bronze medal from IOI 2009, silver medal from IOI 2010, bronze medal from IMO 2010, currently mathematics student.*

1. Interest and enthusiasm were most important for me. I must have been around 10 when I got interested. I like to solve problems and have friends who share this interest. I competed in on-line contests. Most of the stuff I learned myself with the help of the Internet. I have had no special regular training.
2. It was fun for me, which also allowed some group activities. My parents liked what I was doing but nothing more than that. One interesting aspect, perhaps not directly related, is that I am also author of programming tasks. I prepared a problem, which was used as a task during IOI 2011 in Thailand. I am told that Genadii Karatzkevitch, the overall winner, had struggled the most with my problem.
3. I would like to do some traveling. After my studies I would need to consider a job, not clear yet but it would probably be related to computers, in all cases not a cubical type of activity.



***Arturs Verza**, 25 years old, bronze medal from IOI 2003, silver medal from IOI 2004 (also medals from Mathematics Olympiads), MSc in Computer Science and presently working at Tom Sawyer Software, helps the IOI organization in Latvia as a volunteer and was Deputy team leader of the Latvian team at IOI 2009 and IOI 2010.*

1. Pre-trainings and summer camps for IOI competitions. A good mathematical background at school and my interest in computers. In school there was hardly any training so it was the online contests in June and July. I must admit I was a bit lazy otherwise my results could have been better.
2. My interest in programming. I was successful at the beginning and had good results without serious training. This motivated me and helped me continue. Achieving good results is a motivating factor. My older brother was also interested in the field and I wanted to outdo him.
3. My work currently has a bit of a scientific side to it and I would like to develop in that direction. In my free time I help with the organization of IOI related activities and competitions such as the present Baltic Olympiad in Informatics 2012.

Romania

***Vlad Gavrilă**, 17 years old, bronze medal from IOI 2010, silver medal from IOI 2011*

1. The most important factor that has contributed to my success at the IOI was, definitely, the preparatory courses I have taken in school. Those courses lasted for about three hours a day, about two or three times a week. We had to solve some of the most difficult problems from various online judge sites (such as TopCoder, Codeforces). After a set period of time, the solutions for those problems were explained to us. Other factors that helped me to win medals at the IOI was the support from my parents and my school.
2. I am very interested in and passionate about solving real-life problems with the help of algorithmics, so this is my primary motivation to participate in computer science contests. Also, the thrill of competing, of trying to get to the top, is another reason for which I like taking part in IOI-like competitions. For me, informatics is partly research, as in trying to find innovative solutions for some problems, partly sport, as in trying to be better than your competitors, and training hard to reach that goal.
3. I have yet to win a gold medal at the IOI, so this is my short-term objective regarding the IOI. On a longer term, I hope to be admitted to a top-ranked university, so that I will be able to study computer science at an even higher level than I do now. Ultimately, I hope to get a job in research, either in a university or in the industry, so that I will be able to contribute to the development of computer science worldwide.

***Adrian Budău**, 19 years old, silver medal from IOI 2011*

1. What most contributed for my achievement in IOI competitions is the website infoarena.ro. It's a website developed by older romanian international olympics in informatics participants and it's the main reason I had evolved from no qualifications at national competitions to medals at international competitions.
2. One of the reasons I've chosen informatics is that it's new, it's an evolving science. But probably the main reason is because it's

practical. It's not just text on a monitor, once you start it it's like bringing it to life. This is something I would not have experienced if I would've chosen mathematics or physics, and motivation is important for success in a field.
3. What I learned in high-school was useful for olympiads but it is not even near enough to make a complex project. In the future I'll most likely need to start writing programs that won't do a single task (such as an olympiad task) but one that combines tens (maybe hundreds) of smaller tasks. I'm only at the beginning of learning this new field of informatics.

Slovakia

Peter Fulla, *silver medal from IOI 2009, 21 years old, currently studying Computer Science at Comenius University, Bratislava.*

1. I practiced solving a lot of tasks from earlier competitions. Learning new algorithms and participating in our Correspondence seminar in programming was also very helpful.
2. It is an enjoyable way to spend one's free time while studying at high school. And I love competitions (mainly those I am good at).
3. I would like to successfully finish my studies and to find an interesting and well-paid job.

Vladimír Boža*, silver medal from IOI 2007 and IOI 2008, also interesting is the fact that Vladimir won a Gold medal at the International Physics Olympiad 2008. He is currently doing his Masters in Computer Science at Comenius University, Bratislava, organizing a Correspondence Seminar in Programming and helping with the organization of Slovak Olympiad in Informatics*.

1. Correspondence seminar in programming. Maybe spending many years in ground school coding games with 3D graphics.
2. Challenge, fun, possibility of not going to school (it was really boring).
3. To start doing some serious research work, mainly in the field of (applied) computer science.

Success Factors

Bulgaria

In analyzing the existing organization and conditions in Bulgaria that have led to the successful participation of the Bulgarian IOI teams, one should keep in mind several factors, including history and tradition, well-established network of organizations and individuals involved in IOI and motivated competitors with a good knowledge base.

History and tradition

During recent centuries the Bulgarian society has not been fortunate to have the affluence of some other countries and this fact to a great extent has modeled an attitude that education is the means to achieve prosperity in its various forms. Hence, teachers and educational institutions have had a very high societal standing. This in turn has led to an imprint on the educational and research field as a competitive environment for personal and professional accomplishment.

The educational system of the country during a period of some 40 years (50s to 90s of last century) emphasized on exact sciences and technical disciplines which of course was aligned with the process of industrialization of the country and its specialization within the then CMEA. Furthermore, competitions in the educational area were seen as part of the learning process and encouraged.

Some 40 years ago, a network of about 30 specialized mathematical gymnasiums formed around the country. These schools in time became incubators for future IT professionals and a pool for successful competitors.

Competitions in programming were organized in the early 80s of last century - the National Olympiad in Informatics started in 1985 and has an established tradition of meticulous organization and an elaborate national network of institutions to draw upon in the process.[4] Bulgaria initiated the International Olympiads in Informatics and organized the first IOI in 1989, which was an international recognition and a source of pride, motivation and obligation.

Well-established network to run the organization

There are many organizations involved in the Olympiad, the principal echelon being the Union of Bulgarian Mathematicians (UBM), Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences, Sofia University and other higher educational institutes, specialized mathematics schools and private colleges (*see above*), as well as sponsors and individual supporters.

The origins of UBM date back to 1898 (originally founded as Sofia Physical and Mathematical Society). It currently has several thousand individual members - teachers in mathematics and computer science, university lecturers, scholars and specialists, organized in 56 sections throughout Bulgaria.

Related to national and international Olympiads in informatics, UBM promotes schools, seminars and national competitions for secondary school pupils (including on-line competitions) and maintains the relevant sites for competitions, documentation and published material. Its premises are at the Institute of Mathematics and Informatics (IMI) of the Bulgarian Academy of Sciences.

Since its creation in 1947 IMI has been a leading national center for research and training of highly qualified specialists and has maintained an efficient, long-term policy related to the fundamental trends in the development of mathematics, computer science and information technologies. A significant direction of IMI's policy is participation in Bulgarian educational programs at all levels, so that the stable development of the scientific potential in the areas of mathematics and computer science can be guaranteed. The activities in this domain are manifold: training MSc and PhD candidates, outstanding school students (including coaching of the national teams in mathematics, informatics and mathematical linguistics), re-qualification of school teachers,

4 See Programming Contests for School Students in Bulgaria, K. Manev, E. Kelevedjiev, S. Kapralov in Olympiads in Informatics, 2007, Vol. 1, 112–123 © 2007 Institute of Mathematics and Informatics, Vilnius

preparation of undergraduate and postgraduate students for scientific work by directly involving them in research.

One manifestation of IMI's policy is the establishment of the High School Student Institute (HSSI) in 2000 together with UBM, Foundation "Eureka" and the International Foundation "St. St. Cyril and Methodius". HSSI's main objective is to provide possibilities to identify, develop and manifest the talent of pupils who are attracted to the in-depth study of mathematics and informatics.

IMI closely interacts with Sofia University, the oldest and biggest university in the country, and with other higher educational institutions. This network is based on personal (IMI's researchers are also university professors and lectures) and institutional (joint programs and projects) interaction, which also plays a positive role in the preparation of Bulgarian teams and informatics related competitions.

Clearly, the organization of the Olympiad is a large-scale activity in Bulgaria, which requires funding. Apart of some funds available through the Ministry of Education and the support of other public institutions, the sponsoring role of the IT industry and other private bodies and foundations in which past Bulgarian IOI competitors and medallists engage is defining.

<u>Motivated competitors with a good knowledge base</u>

The Bulgarian experience in preparing motivated IOI competitors is widely acknowledged and Bulgarians have been active abroad in coaching university and other national teams. The motivation factor is important in all competitions and in addition to the methodology used in Bulgaria, such factors as free entry to Bulgarian universities and indeed to ivy-league universities and open doors to many IT companies are convincingly strong.

Latvia

Latvia is a small Baltic country of 2 million inhabitants, nearly half of them living in or in the surroundings of Riga. Unlike its Baltic neighbors – Lithuania and Estonia – it is protestant and, like Estonia, a large part of its population is ethnically Russian implying that Russian is in common use.

Being small, and also considering its recent history, there are both positive and negative implications – from the perspective of this survey, we consider size and recent history in the education field as largely positive.

The economic landscape in Latvia has changed from energy consuming industries to IT, logistics and some other branches (along with the traditional agriculture and forestry areas). Furthermore, Russia, along with the Scandinavian countries, continues to be financially and economically interested and this has implications in areas, which depend on IT competences. In Soviet times, there were significant military operations in Latvia related to communications and logistics that were directly linked to the use of computers and the need for informatics specialists. Similarly to other eastern European and post-Soviet republics, the exact sciences were strongly emphasized in education and research. IT related professions are now considered as attractive, students doing studies abroad tend to consider returning for professional engagements and work in their home-country and the IT field in general provides good opportunities for young professionals.

This introduction outlines the broader frame, in which one could look for the Latvian success in IOI competitions.

As to the concrete circumstances, based on our interviews we could single out the following broad base for success:

- Latvia has long traditions of programming competitions, which are a source of stimulation for further endeavor.
- There is a motivated and dedicated crew of individuals, mainly working as volunteers, involved in the phase of preparations and

participation in IOI competitions. This network involves persons at the University of Latvia, Progmeistars, the Ministry of Education, volunteers among past IOI participants and others who devote their time and energy to this exercise. There is also some essential sponsorship involved, from the Ministry of Education, Air Baltic and IT industry firms, but this is not overemphasized. At the same time it seems the current model needs some refreshment.

- Mathematics and its offshoots are well embedded in Latvian education and this has its affirmative implications.
- Being a small country, IT educators and professionals are in closer contact and this has some helpful aspects related to the IOI preparations. Likewise, the pool of qualified participants is small which allows a more focused individual preparation of the team.
- Finally, it appears that the strategy in preparing the IOI teams is based on experience, meaning that longer participation of team members is positive (also suggested by individual performance).

Poland

A paper by Krzysztof Diks and Jan Madey[5], provided to us by the Polish respondent, contains an overview of the history of Polish Olympiads, and the participation of Polish students and teams in international competitions such as the IOI, ACM's ICPS, Top Coder, Imagine Cup and the IEEE CS IDC. One Chapter deals with the factors for success of the Polish youngsters in international competitions, which we briefly summarize below. One of the conclusions is that the Polish experience is sufficiently universal to be investigated and adopted by other countries and could be helpful in identifying and working with talented IT students.

Obviously, there is no coincidence in the Polish ranking in IOI competitions. The authors of the paper highlight the first National Olympiad in 1993 in Poland as an important event with long-term implications for the development of informatics among young people. Since then the Olympiad has turned into a national institution which is sustained by the efforts of the Ministry of National Education, the University of Warsaw, Jagiellonian University, the University of Wrocław, Poznań University of Technology, AGH University of Science and Technology, teachers and the IT industry. It is a process in which talented high school IT students are selected and their development guided further in an organized manner. This happens in a competitive environment in which tasks are prepared by leading scientists as well as by past participants in IOI competitions with solid experience in academic competitions. Former contestants are also active in Olympiad-related activities (preparing model solutions of tasks and as authors of sophisticated software used during the Olympiad for automation of the process, particularly the automatic evaluation of contestants' solutions).

The Olympiad conducts intensive educational activity: the Olympiad materials are published after the events and contain detailed analysis of solutions to tasks and model programs. Former Olympiad contestants maintain an Internet educational portal for beginners in the field of programming and algorithmics. Finalists of the Olympiad take part in summer camps and practical programming workshops combining recreation and education, during which they attend lectures prepared by researchers and older students.

A very important role in the development of gifted young people is played by the Polish Children's Fund, which works with talented pupils (not only within the IT field). The Fund organizes workshops and camps and participants have the chance to familiarize themselves with these fields of computer science, which are not necessarily covered by competitions. The Fund co-operates with numerous higher educational and/or research institutions, as well as individual academics in working with talented children and young people.

School teachers are in the majority of cases the first to notice the talent of a pupil and assist the choice of development path. For this reason, the Olympiad organizes workshops for teachers to

5 From Top Coders to Top IT Professionals, Authors Krzysztof Diks, Jan Madey see http://www.informatik.uni-trier.de/~ley/db/indices/a-tree/d/Diks:Krzysztof.html

familiarize them in practice with the specificity of computer science competitions.

Financing is clearly important and the activity of the Olympiad in Informatics is financed from both public (grant from the Ministry of National Education) and private sources from leading IT companies in Poland.

An important detail is that the best Olympiad contestants form an elite and are role models for future generations. Benefits include free entrance in universities without going through a qualification procedure. As an example, the Faculty of Mathematics, Informatics and Mechanics yearly admits around 50 finalists who belong to the group of the best students. In turn, such a group of gifted students gives teachers the opportunity to prepare classes at the highest level.

In a nutshell, success in the Polish case is based on:

- Dedicated individuals (researchers, teachers, students, pupils),
- Supportive organizations (universities, the Ministry of National Education, schools),
- Financial security (the Ministry, sponsors — PROKOM SOFTWARE Company, ATM S.A.),
- Quality (both quality assurance and organization quality).

Romania

There are several factors, which lead to reaching performance in informatics in Romania, such as:

- The Romanian education system has been and to a certain extent is still oriented towards individual performance.

- There is a significant number of ordinary or special mathematics-informatics classes in Romanian high-schools. Almost every high-school or college has at least one such class per level of study. In their case, the curriculum includes the study of programming language, elementary algorithms and practice in informatics labs. Therefore, we have a wide range of students to select from.

- The fact that the National Olympiad in Informatics has a section for lower-secondary students.

- The National Training Team has a junior section. In fact, almost all the members from the Senior National Training Team have been first members of the Junior National Training Team (for at least one or two years),

- The Junior Balkan Olympiad in Informatics and more recently the Shumen Tournament, are competitions that really raise the students' interest in informatics, especially those aged between 10 and 14.

- The Ministry of Education supports financially the training of the National Team and its participation in international contests.

- The Ministry of Education also rewards the students who get good results in these competitions.

- There are on-line preparation websites such as infoarena.ro and campion.edu.ro, which play an important role in raising the students' interest in algorithmic contests, providing a tasks archive and discussion forums.

- Many former IOI and NOI medallists become volunteers in organizing the National Olympiad and training camps. Their involvement is essential in order to maintain the high level of difficulty of the tasks, but they also motivate the younger contestants.

- It is important to mention the *International Computer High School of Bucharest* (ICHB), which attracts a lot of talented students from all over the country in order to study informatics intensively, having as teachers former IOI and NOI medallists.

- The existence of *Centers of Excellence for Young People Capable of High Performance* founded by the Ministry of Education, with the observation that in some counties this program has never worked, due to lack of budget or interest, but, in other counties, this program really works, year after year.

Slovakia

A paper by Gabriela Andrejkova[6] describes the Slovak experience and the necessity of special training for informatics related competitions such as the International Olympiad in Informatics (IOI), the Central European Olympiad in Informatics and the National Olympiad in Informatics. It also contains some recommendations related to future work based on e-training and e-learning.

During the period 1993 – 2011, as illustrated in the table below, Slovak teams were successful at IOI competitions. During the last five years there were no gold medals, which might be a consequence of the reorganization of education in basic and high school, which reduced the weekly teaching hours of mathematics.

Year	IOI – Country venue	Gold	Silver	Bronze
2011	Thailand	0	2	1
2010	Canada	0	2	2
2009	Bulgaria	0	2	1
2008	Egypt	0	2	2
2007	Croatia	0	2	1
2006	Mexico	0	3	0
2005	Poland	4	0	0
2004	Greece	0	2	2
2003	USA	1	1	1
2002	South Korea	1	2	1
2001	Finland	2	2	0
2000	China	0	2	2
1999	Turkey	2	0	1
1998	Portugal	4	0	0
1997	South Africa	1	3	0
1996	Hungary	2	2	0
1995	Holland	0	2	2
1994	Sweden	1	2	1
1993	Argentina	2	1	1

Results of Slovak teams at IOI 1993-2011 – Source see footnote.

As illustrated in the table above, the top performances up to 2005 have not been repeated lately, nevertheless, Slovak teams continue to bring home medals and the success factors could be looked for in the following broadly outlined areas:

- **Sound education in Mathematics**
- **Training and competitions**
- **Dedicated teachers and university students**
- **University support**

Good foundation in mathematics in secondary schools

Similarly to other countries involved in the survey, mathematics is well emphasized in secondary school education in Slovakia. There are also specialized schools oriented towards mathematics and natural sciences. In some schools programming is taught, however, to achieve good results in international competitions this knowledge base is not sufficient and further training is necessary.

Further activities and competitions

One activity targetted in this direction is the *Correspondence seminar in programming (CSP)* - http://www.ksp.sk. The seminar has a long tradition and is moderated and organized by students of the Faculty of mathematics, physics, and informatics at Comenius University, Bratislava. CSP is a competition for secondary school students. On the seminar's web-page one could find the problem sets and other information. The competition is of theoretical nature and is organized in rounds with 2 categories of participants involved. There is no direct contact - all is done by correspondence. The problems of the round are posted on the website (previously pupils received them by ordinary mail) and the participants have one month to submit solutions in written form (containing a description of algorithm, a computer program, correctness and complexity of algorithm) to the seminar organizers. After correction, the solutions are returned with remarks regarding mistakes and possibilities for corrections. The best participants are invited to a special seminar twice annually, with a scientific part but also allowing time for entertainment.

6 Gabriela Andrejkova "E-learning and e-training of students and their teachers in informatics" - http://virtuni.eas.sk/rocnik/2005/data/program/64_15_Andrejkova.pdf

The Faculty of Science of P. J. Safarik University has developed another form of training/competition for students from secondary schools named "PALMA" – Programming, algorithms, and mathematics - http://palma.strom.sk. This is an on-line competition involving real programming and automatic evaluation. Part of it includes time for the participants to study a theory. The competition is organized in two domestic rounds, the third round is final with a face-to-face presentation of participants. Another form of competition is PALMA Junior, using Imagine as programming environment. It is organized for pupils at basic school and is prepared for one- or two-member teams.

Dedicated teachers, university students and support of Universities

The whole organization related to the selection training and participation in national and international competitions of the Slovak IOI teams is predominantly based on the volunteer work of teachers, university students and professors who are dedicated to the activities. It is a challenge to continue recruiting motivated and dedicated individuals in support of the IOI activity. Universities and the Slovak Society for Computer Science have a guiding role.

Findings – Executive Summary

On the basis of our work we were able to identify the following groupings of factors contributing to the successful participation of the national teams of these countries in IOI competitions:

- *Tradition*
- *Strong emphasis on mathematics in national education*
- *Targeted extracurricular activities*
- *Early start and gaining experience by participating in competitions*
- *Systematic management, dedicated people*
- *Motivation and reward*

Tradition

Math competitions were organized in the region as early as the end of the 19th century: a primary-school math competition was reportedly held in Bucharest, Romania in 1885 and in 1894 the Eotvos competition in Hungary set the model for math competitions of secondary school pupils. Mathematics journals were launched in both countries in the 90's of the 19th century. In 1934 a Mathematical Olympiad was organized in Leningrad, now St. Petersburg, Russia. The 1st International Mathematical Olympiad (IMO) was organized by Romania in 1959 with seven countries from Eastern Europe participating – the idea to organize such a competition matured during the 4th Congress of the Romanian Mathematicians in 1956 and provided a model for the organization of other competitions, including in the field of informatics [Today, IMO brings together competitors from over 90 countries].[7]

The proposal for an International Olympiad in Informatics (IOI) was made by Blagovest Sendov[8] on behalf of Bulgaria, and endorsed by UNESCO's General Conference in 1987. The 1st IOI was held in Pravetz, Bulgaria in 1989 with

7 For further details on the history of competitions – Petar. S. Kenderov "Competitions and Mathematics Education", Proceedings of the International Congress of Mathematicians, Madrid, Spain, 2006

8 Mathematician, was Rector of Sofia University and President of the Bulgarian Academy of Sciences

the participation of teams from 13 countries.[9]

The respondents from the countries involved in our survey point out that they possess tradition and culture in organizing programming competitions – an important factor for the success of their teams, and an inspiration for further work.

Emphasis on Mathematics in Schools

The regular school curricula in mathematics and informatics are not sufficient to form good competitors in IOI related competitions, however, a solid mathematical knowledge base is certainly a tipping success asset – as a matter of fact, some of the competitors and winners of medals in past IOI competitions have done similarly well in IMO competitions.

The Eastern European model of secondary education during the 60s, 70s and 80s of last century has had a strong emphasis on the study of exact sciences. In addition, a network of gymnasiums specializing in mathematical education (similar to the model of foreign language schools in these countries) was established in the late 60s - early 70s. Such specialized math-oriented schools continue to function today, though, in some of our interviews it was made clear that the ongoing reorganizations of the educational field might negatively influence math education in secondary education in general, which might also reflect on the performance in math and informatics-related education and competitions. In the case of Slovakia, the reorganization of school education has led to a reduction of the weekly number of math teaching in basic and secondary school. On that backdrop, the results of the Slovak IOI teams show a decline with no gold medals won during the last 6 years.

Extracurricular Activities

There are some informatics related courses in the curricula of lower secondary (10-14 years) and upper secondary schools. This as mentioned above is not sufficient for the preparation of highly competitive participants in informatics related competitions. Several of the IOI competitors we interviewed said that on-line competitions, training, solving tasks from previous competitions, participation in correspondence seminars in programming, participation in special courses for math and informatics competitions, summer camps and other forms of preparation have contributed to their success.

There are many paths and activities to ensure a solid preparation for IOI-related competitions. We give the following for illustration:

In the case of Bulgaria and Latvia, private educational institutions are involved in preparing all who wish to compete: in Bulgaria, the A&B private school in Shumen was established with the objective to prepare pupils for national and international informatics related competitions, in Latvia, Progmeistars private school has similar objectives. Both institutions have developed and introduced methodologies in delivering results and a confirmation of this is that pupils who have attended their courses have won gold medals during the last IOI-2011 in Thailand. A gold medallist who had taken part in such courses said that this has helped him think as a programmer – an important detail related to the performance of these private schools.

One successful training activity in Slovakia is the Correspondence seminar in programming (CSP). On the seminar's website one can find the problem sets and other information. The competition is of theoretical nature and is organized in rounds. Another form of training/competition for students from secondary schools is "PALMA" – Programming, algorithms, and mathematics. This is an on-line competition involving real programming and automatic evaluation. There is also PALMA Junior organized for pupils at basic school and prepared for one- or two-member teams.

The Polish Children's fund has an important function to work with talented children in various fields, including IT. Similarly, there are centers of Excellence for Young People Capable of High Performance in Romania and in Bulgaria

9 Petar S. Kenderov "Bulgaria – Birthplace of International Competitions in Informatics for School Students" in IT STAR Newsletter Vol. 5, no.3, Autumn 2007 – http://nl.starbus.org

the High School Student Institute (HSSI) was established by the Institute of Mathematics and Informatics, the Union of Bulgarian Mathematicians, Foundation "Eureka" and the International "St. St. Cyril and Methodius" Foundation with the objective to identify, develop and manifest the talent of pupils in mathematics and informatics. In Croatia, the programs of the Croatian Computer Science Association (CCSA), the main organizer of the selection and preparation of the national IOI teams, fully cover the IOI syllabus.

In most of these countries, the Olympiad itself is an educational activity: materials are published after the events and contain detailed analysis, Internet portals are maintained and summer camps are organized.

Early Start, Gaining Experience by Participating

Most of the respondents to our questionnaire said there is no minimal age for participating in regional and national competitions, but in practice the youngest participants are from 10 to 14 years old. In our further interviews, opinions were expressed that, to be successful in IOI competitions, contestants should start at least at the age of 12-13 as at 15 it is already late.

Another aspect of this is that many contestants experience an initial "stage fright" related to their participation in international competitions. Gaining experience by participating is an important success factor and this is reflected in the record of top performers during the course of several consecutive years of participation in IOI competitions. In the case of Romania almost all the members of their senior national training team have passed through their junior section and team. Such initiatives as the Junior Balkan Olympiad in Informatics raise interest in informatics of youngsters aged between 10 and 14.

Systematic Management, Dedicated People

Formally IOI related matters are under the broad umbrella of the national ministries of education, yet in all countries there are specialized professional institutions, which have responsibilities to prepare and oversee the process of selection through internal competitions of the national teams, their additional coaching and participation in IOI competitions.

This is a tested process of meticulous organization based on several tiers of selection – school/local, regional and national competitions, summer schools, training camps and international competitions. Teams from all the countries involved in this survey take part in interregional competitions such as the Balkan Olympiad in Informatics, the Baltic Olympiad in Informatics and the Central European Olympiad in Informatics. For some countries (i.e. the Baltic OI for Latvia) these interregional competitions are an element in the selection process, for others (i.e. Poland in the case of the Baltic OI) they present opportunities for "younger" participants to gain experience.

In the core of this process are dedicated individuals – university professors and students, teachers, tutors, ex-competitors. Many of them have started their involvement as early as the first participation of their country in the IOI process. Some fears were expressed that it is hard to find "new recruitments" for this activity. At the same time, it was a pleasure to meet with the Latvian organizers during the recent 18th Baltic OI, 3-7 May 2012 in Ventspils, Latvia and to observe that many ex-members of the Latvian IOI teams (currently students or young professionals) continue to be involved as organizers, deputy team leaders for recent IOIs, and as authors of tasks and other activities related to IOI.

The ministries for education provide some funds for the organization of competitions, training camps and international travel and associated activities, though these are reportedly far from sufficient. Additional funds are sought and sponsors attracted, very often on the basis of personal connections, in some cases also related to ex-competitors that have consequently done well professionally. Sponsorship from the IT Industry, foundations and other sources is an important aspect of the funding of IOI related activities in Bulgaria, Latvia and Poland.

Motivation and reward

Motivation is in the core of success and all stakeholders in the process are motivated to take part and see opportunities in doing so. There are two types of participants – the pupils that go through the process and compete at IOIs, and their teachers, instructors, methodological leaders and organizers.

The competitors we interviewed are bright young men, yet no one of them considers himself as exceptional in any respect. After one session of interviews in Latvia I was asked jokingly by one of them whether this would make him famous. This reminded me of a reaction from Genadii Karatzkevitch (Belarus)[10], then 14 years old. Asked whether he has his own strategy of problem-solving his response was that he tries various ways and one works … followed by "I am no genius. I am simply good at it".

Yes, they are good at it and this is achieved with a lot of practice and exercises and the motivation comes from various sources including family and friends, teachers and tutors, computers and ICT, challenging problem-solving, learning from mistakes and improving, competing and winning, … One should also not forget the fun part of it – summer camps, meeting friends, local and international travel.

When entering the path of international competitions, the link between success in IOI's and its impact on future professional development is hardly a fixation for anyone. But the possibilities are there and these competitors are gradually exposed to them - top performers are "noticed" and become heroes of sorts in their communities, travel more, have possibilities for internships in leading IT companies, receive awards and scholarships, gain easier access to top universities in their countries and internationally.

For the other type of participants – teachers, researchers, instructors, team-leaders – there are some financial awards, according to some of the respondents, though the highest reward for a good performance in our mind is professional satisfaction, accomplishment and recognition. Clearly, most of the persons involved in IOIs are professional academics and educators and their experience with IOI is directly reflected in their academic output.

10 http://www.ioi2009.org/downloads/br8-3str-en.pdf

Postscript

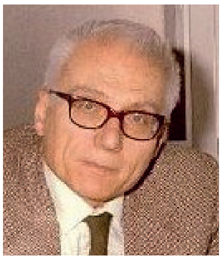
Just as this report was being finalized for publication we were made aware of the results of the Central European Olympiad in Informatics (CEOI), 7 - 13 July 2012 in Tata, Hungary.

Competitors from Bulgaria, Czech Republic, Croatia, Germany, Israel, Hungary, the Netherlands, Poland, Slovakia, Slovenia and Switzerland had taken part.

All gold medals were won by members of the teams of three countries included in our survey – Bulgaria (2 gold medals), Poland (1 gold medal) and Romania (2 gold medals). Three of the five gold medallists - Adrian Budău, Vlad Gavrilă and Rumen Hristov – were previously interviewed for our survey and their responses are included in this report.

The CEOI'12 gold medallists will be among the strongest contenders for gold during IOI'2012 in Italy.

Project Team – Talent in Informatics



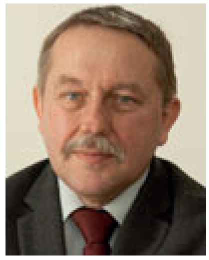
Franco Filippazzi *(project methodological leadership)* graduated in physics and later was a member of the team that designed the first Italian computer, the Olivetti Elea, which entered the market in 1959. His career included university teaching and industrial research in advanced technologies - thin-film integrated circuits, superconducting devices, optical associative memories and other. He is published widely and has translated professional literature into Italian. Franco has held management positions in various professional associations and is currently serving on the board of AICA as Editor of Mondo Digitale.

Giulio Occhini *(project methodological leadership)* is AICA's Chief Executive Officer. He has graduated in physics and has held various academic and industry research-oriented positions. He was President of CEPIS in the mid-90s during a period that was crucial for introducing the European Computer Driving Licence (ECDL) on a pan-European scale. Giulio has held leading positions in AICA including National President and Chairman of the Board. He served as IT STAR Coordinator for the period 2006-2010.

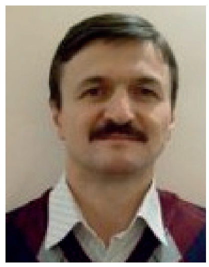
Plamen Nedkov *(Project Coordinator)* is chief executive of IT STAR and editor of the IT STAR Newsletter. His background is in international economics. He is widely published and is involved in the organization of conferences. Plamen was head of Department for International Organizations at the Bulgarian Academy of Sciences, executive director of IFIP, delegate to many sessions of UNESCO's General Conference and elected representative to the NGO-UNESCO Liaison Committee. He is member of the Steering committee of CEN's WS on ICT Skills.

Respondents to Questionnaire

Prof. Gabriela Andrejkova
Chairperson, Slovak committee for the Olympiad in Informatics, Institute of Informatics, P. J. Safarik University in Kosice



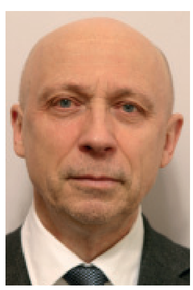
Prof. Krzysztof Diks
Chair, Polish IOI Committee
Warsaw University



Mr. Constantin Gălățan
Head coach of the Romanian Informatics Training Team and Member of the National Committee of Informatics
"Liviu Rebreanu" National College, Bistrița

Mr. Emil Kelevedjiev
Researcher at the Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences, Sofia, Bulgaria. Activities related to IOI: Member of the jury of the First IOI, 1989
Team leader and trainer of the Bulgarian team in Informatics at Balkan and International Olympiads in Informatics: 1993, 2000 – now.

Mr. Ivo Separovic, B. Sc.E E
Head for IOI competitions in Croatia
General secretary of CCSA



Prof. Maris Vitins
Head of Chair for Lifelong Informatics Education, University of Latvia
Chair, Latvian IOI Committee

Supplementary Information

An insight of the first Informatics Olympiad

Bulgaria – Birthplace of International Competitions in Informatics for School Students[11]

by Petar S. Kenderov

Prof. Dr. Petar S. Kenderov is Member of the Bulgarian Academy of Sciences. He coached the Bulgarian Team for the International Mathematical Olympiad in 1976 and 1977. From 1976 to 1988 he chaired the Bulgarian National Commission for the Mathematics Olympiad (Mathematics and Informatics Olympiads, since 1985). Petar was Chairman of the International Jury and organizer of the First International Olympiad in Informatics for Secondary School students (Pravetz, 1989). Since 1988 he is President of the International Foundation "St Cyril and St Methodius", based in Sofia, Bulgaria.

Competitions in programming appeared in some Bulgarian schools already in the late 70's last century. Originally, the solutions to problems given at the contests required mainly "paper work". The contestants were asked to write on a paper a program, which, if executed on a computer, performed a specific task. Then the papers were checked and assessed by the jury. If "computer time" was available, the programs of the students were executed on computer as well. The number of computers in the country in those years was very limited and the access to them for school students was rather restricted. With the advent of microcomputers the situation changed. More and more school students got access to computers and this made it possible to organize competitions which are similar to the ones practiced today - the execution of the code on a computer became an obligatory part of the assessment.

To compete means to compare your abilities and skills with the abilities and skills of others. The broader the base of comparison (larger participation in the competition), the better. This is in the base of the frequently observed trend when school competitions outgrow the frames of the school and become town competitions, the latter grow again to national competitions and, finally, students get involved in international competitions. In Bulgaria regular national competitions in Informatics are conducted since 1981. The nationwide Olympiad in Informatics (with this name) started in May 1985. An international competition called "Open Competition on Programming" took place in Sofia (May 17-19, 1987). It was organized just before (and in connection with) the Second International Conference and Exhibition "CHILDREN IN THE INFORMATION AGE" (May 19 – 23, 1987) with the intention to make it a traditional event conducted every two years. There were 28 contestants (school students) from 6 countries: Bulgaria (BG), Czechoslovakia (CZ), Federal Republic of Germany (FRG), Hungary (H), Romania (R) and Soviet Union (SU). Bulgaria and Romania participated with two teams. The students were divided in three age groups (less than 14, less than 16 and less than 18 years). The International Jury chaired by Petar S. Kenderov (with Zdravko Vassilev as Deputy) gave two first prizes - to Markus Gutschke (FRG) and to Vulcho Vulchev (BG1). There were three second prizes: Dimitrij Evsjuhin (SU), Andrei Dobos (CZ) and Tomas Mueller (FRG). Vladimir Vesely (CZ), Michael Sperber (FRG) and Svetoslav Nestorov (BG2) got third prize. The competition was a success and sparked great interest and enthusiasm both among participants and organizers. At the 24th session of the General Conference of UNESCO held six months later in Paris, Professor Blagovest Sendov, a member of the Bulgarian delegation, suggested to include an International Olympiad in Informatics (IOI) in the Fifth Main Programme of the UNESCO Plan for 1988-89. The proposal was approved and by a contract with the UNESCO Division of Science, Technical and Environmental Education, Bulgaria took the obligation to organize the first IOI just before the third Conference and Exhibition "CHILDREN IN THE INFORMATION AGE" (Sofia, May 20 – 23, 1989).

Additional experience in conducting international informatics competitions was gained in 1988

11 This paper was originally published in IT STAR Newsletter Vol.5, no 3 Autumn 2007 – http://nl.starbus.org

when a competition for school students from technical schools was held in Bulgaria (Varna, October 5 – 8). There were 18 students from six countries: Bulgaria, Cuba (C), German Democratic Republic, Hungary, Poland (P) and Soviet Union. The International Jury was guided by Pavel Azalov (Chairman) and Evgeni Genchev (Deputy Chairman). There were two first prizes which went to Georghi Rivov (BG) and Marchin Wojas (P). A second prize was given to Alexiel Matos (C) while the third prize went to Pavlin Kostov (BG).

The first IOI was conducted in Pravetz, Bulgaria, from 16 to 19 May 1989. It was modeled after the International Mathematical Olympiad (IMO) and this was explicitly mentioned in the written Regulations of IOI. For instance, the participating countries were obliged to send in advance to local organizers sample problems from which the International Jury had to select the problems to be given at the competition. Only school students who have not completed certain age (in this case 19 years) by the beginning of the competition were admitted to participate. In the first half hour after the start of the competition the participants had the right to put questions to the International Jury (in written form) concerning the formulation of the problems. The student work was preliminarily checked and assessed by the respective team-leader and then finally marked by the "Coordinating Commission". The final marking was with the International Jury which decided also how many first, second and third prizes are to be given to the most successful participants. All expenses related to the stay in Bulgaria of the teams and the team-leaders were covered by the organizers. There was an excursion to Sofia and an entertainment program for the participants in the competition. Professor Iltscho Dimitrov, Minister of Education, gave a reception for IOI participants.

There were however significant deviations from the established routine of IMO. According to the rules of IOI, a team consisted of not more than three students accompanied by a team-leader. With teams of six students which was the case in IMO, it would have been difficult for organizers to ensure support for local expenses of participants and to provide the necessary number of computers (APPLE II compatibles or IBM PC/XT/AT/ compatibles) for all contestants. Another deviation from the practice of IMO was that, while doing the preliminary assessment of the papers, the team-leader had the right to talk to the participant and to ask for explanations of his/her work. This helped significantly the process of marking the papers. At the end of the competition each team leader accompanied by a member of the Coordinating Commission collected the problem solutions from the members of the respective team. The work of each student (the final version of the solution) was copied on two floppy disks. One remained with the team leader and the other stayed with the Coordinating Commission. The program of each student was run with a set of preliminarily prepared (and approved by the Jury) Test Examples.

Thirteen countries have sent teams to IOI. These were (alphabetically): Bulgaria, Cuba, Czechoslovakia, Federal Republic of Germany, German Democratic Republic (GDR), Greece, Hungary (H), Peoples Republic of China (PRC), Poland, Soviet Union (SU), Vietnam, Yugoslavia and Zimbabwe. The teams from Hungary and from Yugoslavia had two students each. Bulgaria participated with two teams and Soviet Union with three teams. Thus, altogether, there were 46 students distributed in 16 teams. The International Jury consisting of Chairman (Petar S. Kenderov), Deputy Chairman (Nelly Maneva) and the team leaders gathered on Wednesday morning (May 17, 1989) to select a problem for the competition. A special Scientific Commission has prepared in advance six problems based on suggestions made by team-leaders before the IOI. The International Jury selected a problem originally proposed by China. Then the problem was refined and formulated in the official languages of the Olympiad: English and Russian. The team-leaders translated the problem into the respective languages understandable for their students.

Here is the problem given at the first IOI (by default N stands for an arbitrary positive integer):

Given 2N boxes in line, side by side; two adjacent boxes are empty, and the other boxes contain N - 1 symbols "A" and N - 1 symbols "B".

Example for N =5.

A	B	B	A			A	B	A	B

Exchanging rule:

The contents of any two adjacent non-empty boxes can be moved into the two empty ones, preserving their order.

Aim:

Obtain a configuration where all A's are placed to the left of all B's, no matter where the empty boxes are.

Problem:

Write a problem that:
1. *Inputs from the keyboard the initial state as a sequence of A's and B's and zeros (for the empty boxes), and models the exchanging.*
2. *For a given initial state finds at least one exchanging plan, which riches the aim or reports that such a plan does not exist. The output should contain the initial state, the intermediate states after each step, and the final state.*
3. *Finds a plan reaching the aim with a minimal number of steps.*

Results:

Present at least one solution for the example mentioned above.

The maximal number of points given for a complete solution to this problem was 100. Those students who scored 91 and more points were given the first prize. These were:
Teodor Tonchev (BG2), Markus Kuhn (FRG), Emanuil Todorov (BG1), Andrius Cepaitis (SU1), Igor Maly (CZ) and Daniel Szabo (H). Second prize was given to students who got between 80 and 90 points. These were: A. Altanov (BG1), I. Marinov (BG1), H. Schwetlick (GDR), U. Nielaender (GDR) and L. Novick (SU1). The third prize went to students who got points in the range 60-80. Two encouragement prizes were also awarded. One of them went to Alexei Kolybin (SU3) who was the youngest participant and the second was given to Anita Laloo (Zimbabwe) – the only girl among the participants.

The first eight places in the unofficial country (team) ranking is given by the next table:

No	Country/team	Team Leader	Score
1	Bulgaria (first team)	P. Azalov	275
2	Peoples Republic of China	W. Wu, Q. Ling (Deputy)	221
3	Federal Republic of Germany	P. Heyderhoff	215
4	Czechoslovakia	O. Demacek	209
5	German Democratic Republic	M. Fothe	207
6	Soviet Union	V. Kirjuchin	190
7	Bulgaria (second team)	K. Manev	188
8	Hungary (two students only!)	T. Toeroek L. Zsako (Deputy)	149

Many people contributed to the organization and conduction of IOI. The work of the International Jury was supported by the software system created by P. Azalov and V. Dimitrov. In the hands of I. Nenova and V. Dimitrov this system served perfectly all the information needs of IOI – starting with the registration of participants and ending with the ranking with respect to results obtained in the competition. Alexander Pokrovsky from UNESCO (Division of Science, Technical and Environmental Education) was involved on all stages with the organization and conduction of IOI.

Since then IOI is taking place annually. In 2009, twenty years after its birth, the IOI will be conducted again in its native country Bulgaria.

IOI competitions (dates, venues, country ranking and medals)

23rd IOI
IOI 2012 - Sirmione, Italy, September 22–29, 2012

Dates and Locations of past IOI competitions

IOI 2011 - Pattaya, Thailand, July 22–29, 2011
IOI 2010 - Waterloo, Ontario, Canada, August 14–21, 2010
IOI 2009 - Plovdiv, Bulgaria, August 8–15, 2009
IOI 2008 - Cairo, Egypt, August 16–23, 2008
IOI 2007 - Zagreb, Croatia, August 15–22, 2007
IOI 2006 - Mérida, Yucatán, Mexico, August 13–20, 2006
IOI 2005 - Nowy Sącz, Poland, August 18–25, 2005
IOI 2004 - Athens, Greece, September 11–18, 2004
IOI 2003 - Kenosha, Wisconsin, USA, August 16–23, 2003
IOI 2002 - Yong-In, Korea Rep., August 18–25, 2002
IOI 2001 - Tampere, Finland, July 14–21, 2001
IOI 2000 - Beijing, China, September 23–30, 2000
IOI 1999 - Antalya-Belek, Turkey, October 9–16, 1999
IOI 1998 - Setúbal, Portugal, September 5–12, 1998
IOI 1997 - Cape Town, South Africa, November 30 – December 7, 1997
IOI 1996 - Veszprém, Hungary, July 25 – August 2, 1996
IOI 1995 - Eindhoven, The Netherlands, June 26 – July 3, 1995
IOI 1994 - Haninge, Sweden, July 3–10, 1994
IOI 1993 - Mendoza, Argentina, October 16–25, 1993
IOI 1992 - Bonn, Germany, July 11–21, 1992
IOI 1991 - Athens, Greece, May 19–25, 1991
IOI 1990 - Minsk, Belarus, Soviet Union, July 15–21, 1990
IOI 1989 - Pravetz, Bulgaria, May 16–19, 1989

Source: Wikipedia

Country ranking and medals

#	Country	Gold	Silver	Bronze	Total
1	China	57	22	12	91
2	Russia	40	28	12	80
3	Poland	31	27	23	81
4	United States of America	30	30	14	74
5	Republic of Korea	25	28	23	76
6	Romania	21	37	21	79
7	Slovakia	20	32	18	70
8	Bulgaria	18	32	30	80
9	Chinese Taipei	13	35	18	66
10	Thailand	13	27	33	73
11	Germany	13	24	29	66
12	Czech Republic	13	20	28	61
13	Iran	12	40	20	72
14	Belarus	11	27	26	64
15	Hungary	11	24	36	71
16	Sweden	11	18	21	50
17	Croatia	10	23	29	62
18	Japan	10	10	6	26
19	Vietnam	9	26	40	75
20	Canada	8	18	26	52
21	Singapore	6	20	29	55
22	Ukraine	6	16	37	59
23	Latvia	5	19	33	57
24	Finland	5	18	25	48
25	Estonia	5	16	24	45
26	United Kingdom	5	13	25	43
27	Israel	4	17	17	38
28	South Africa	4	13	26	43
29	Hong Kong	3	14	32	49
30	Netherlands	3	14	31	48
31	Australia	3	7	25	35
32	Sri Lanka	3	7	16	26
33	Denmark	3	6	15	24
34	Austria	3	5	16	24
35	Czechoslovakia	3	4	2	9
36	Soviet Union	3	4	0	7
37	Lithuania	2	21	34	57
38	Serbia and Montenegro	2	15	17	34
39	Indonesia	2	13	19	34
40	Argentina	2	8	21	31
41	Kazakhstan	2	6	21	29
42	France	2	5	20	27
43	Turkey	1	13	33	47
44	Italy	1	11	18	30
45	Georgia	1	6	20	27
46	Brazil	1	4	23	28
47	Ireland	1	4	11	16
48	Yugoslavia	1	3	1	5
49	Armenia	1	2	12	15
50	Turkmenistan	1	0	1	2
51	India	0	9	19	28
52	Switzerland	0	7	21	28
53	Cuba	0	6	26	32
54	Macau	0	4	9	13
55	Greece	0	3	18	21
55	Slovenia	0	3	18	21
57	Spain	0	3	11	14
58	Egypt	0	3	8	11
59	German Democratic Republic	0	3	0	3
60	Moldova	0	2	19	21
61	Serbia	0	2	10	12
62	Colombia	0	2	6	8
63	Luxembourg	0	1	11	12
64	Mexico	0	1	10	11
65	New Zealand	0	1	7	8
66	Bosnia and Herzegovina	0	1	5	6
67	Azerbaijan	0	1	4	5
68	Norway	0	1	3	4
69	Belgium	0	1	2	3
70	Syria	0	1	1	2
71	Bangladesh	0	1	0	1
72	Macedonia	0	0	8	8
73	Kyrgyzstan	0	0	3	3
73	Portugal	0	0	3	3
73	Trinidad and Tobago	0	0	3	3
76	Malta	0	0	2	2
76	Mongolia	0	0	2	2
76	Tajikistan	0	0	2	2
79	Cyprus	0	0	1	1
79	Tunisia	0	0	1	1

Source: http://www.eduardische.com/ioi/

This report contains the findings of a Survey on Young Talent in Informatics initiated by Associazione Italiana per l'Informatica ed il Calcolo Automatico (AICA) in cooperation with the Regional ICT Association in Central, Eastern and Southern Europe (IT STAR). It is based on the experience of six European countries with remarkable results in identifying, assisting and growing talented youngsters in the process of competitions within the format of the International Olympiad in Informatics, and includes the views and perspectives of leaders of national bodies and IOI teams, academics, teachers, trainers, former and current contestants.

It addresses issues of attention to the IOI community, which have wider implications within education and beyond, and provide a platform for further consideration by a broader circle of educationalists, researchers, decision-makers, public and private organizations in Europe and worldwide.

For further information, please contact info@starbus.org