

PROGRESS OF COMPETITIONS IN INFORMATICS: A SUCCESS STORY

Mile Jovanov	Emil Stankov	Bojan Kostadinov	Nevena Ackovska
Faculty of Computer Science and Engineering	Faculty of Computer Science and Engineering	Student at Faculty of Computer Science and Engineering	Faculty of Computer Science and Engineering
Skopje, Macedonia	Skopje, Macedonia	Skopje, Macedonia	Skopje, Macedonia

ABSTRACT

Competitions in informatics are a perfect opportunity to introduce to pupils the art of programming and create a very solid background for becoming engineers in informatics. The Computer Society of Macedonia, as the main organizer of the Macedonian national competitions in informatics, through the last few years has made an effort to increase the quality of the competitions in order to achieve better results in the international competitions.

In this paper we present the format of the international competitions and the results of Macedonian contestants at international level. More importantly, the history of competitions held in Macedonia is presented in order to explain the way to the success of Macedonian teams.

I. INTRODUCTION

Competitions in informatics are usually synonyms for algorithmic programming contests. Usually, separate competitions are organized for high school (HS) and primary school (PS) students. Only the age boundaries determine where one can compete: pupils below a precisely determined age can compete in PS competitions, and the same applies to HS competitions. These competitions are a perfect opportunity to introduce the pupils to the art of programming and create a very solid background for becoming engineers in informatics.

The Computer Society of Macedonia, as the main organizer of the Macedonian national competitions in informatics, through the last few years has made an effort to increase the quality of the competitions by:

- providing better organization,
- attracting as many pupils that would be interested for participation as possible,

- introduction of programming competitions in the primary school education, i.e. as early in the educational process as possible, in order to achieve early identification of talents,
- increasing the competition level (difficulty of tasks) in order to reach the level of the international competitions and to be able to form a team of contestants for participation at those competitions that would have enough knowledge to be competitive with the contestants from the other countries.

Two major competitions where Macedonian teams of pupils participate are International Olympiad in Informatics, and Balkan Olympiad in Informatics.

II. INTERNATIONAL COMPETITIONS IN INFORMATICS

A. *The International Olympiad in Informatics (IOI)*

As stated in [1], the idea of initiating International Olympiads in Informatics (IOI) for school students was proposed to the 24th General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Paris by the Bulgarian delegate Professor Sendov in October 1987. This plan was included into the Fifth Main Program of UNESCO for the biennium 1988–1989. In May 1989, UNESCO initiated and sponsored the first IOI, which was held in Pravetz, Bulgaria, May 16 – 19.

The IOI is one of five international science olympiads (together with the International Mathematical Olympiad – IMO, the International Physics Olympiad – IPhO, the International Chemistry Olympiad – IChO, and the International Biology Olympiad – IBO). The primary goal of the IOI is to stimulate interest in informatics (computing science) and information technology. Another very important

goal is to bring together exceptionally talented pupils from various countries and to have them share scientific and cultural experiences.

The IOI is organized annually in, and by one of the participating countries (78 countries from all around the world participated in the last year's IOI). Each participating country can send a delegation that consists of four pupils and two accompanying adults (a team leader and a deputy leader). The contestants compete individually and try to maximize their score by solving set of (usually 3 or 4) algorithmic programming problems on a personal computer. There are two competition days, while the remaining days are reserved for cultural and recreational events.

IOI is the topmost competition in programming and algorithmic reasoning worldwide. The best computer science pupils, selected through their respective national programming competitions, participate in this prestigious event. Around 250 000 pupils from almost 90 countries compete every year in attempt to represent their country at the IOI.

In order to successfully solve problems at the IOI, the contestants have to demonstrate their skills in problem analysis, algorithm and data structure design, programming and testing. Their enthusiasm, commitment and many, many hours spent in practising are put into test in this competitive, but still friendly competition.

B. *The Balkan Olympiad in Informatics (BOI)*

The initiative for the establishment of the Balkan Olympiad in Informatics (BOI) came from the host country of the first BOI – Romania (the first BOI was held in Constanta, in 1993). The BOI is organized by the Ministry of Education and other appropriate institutions and organizations of one of the following countries: Albania, Bulgaria, Bosnia and Herzegovina, Cyprus, Greece, Macedonia, Moldova, Montenegro, Romania, Serbia and Turkey. According to the rules accepted by the initiators of the BOI, teams of these countries are invited as regular participants, but the host country can also invite guest countries as well.

As stated in the initiative manifest [2], the BOI/JBOI aims at motivating HS/PS students of East Europe to:

- get more interested in informatics and information technology in general,

- test and prove their competence in solving problems with the help of computers,
- exchange knowledge and experience with other students of similar interest and qualification,
- establish personal contacts with young people of the East European region,
- provide training for the students participating in the IOI,
- initiate discussion and cooperation in informatics education in the primary/secondary schools of the East European countries.

The competition format of the BOI is in accordance with the IOI competition format. The age boundary for participation in the Junior Balkan Olympiad in Informatics (JBOI) is 15.5 years of age, while the boundary for participation in the BOI is 19 years of age.

Macedonia was a successful host of two BOIs. The 8th BOI was held in Ohrid, in 2000, with 36 contestants from 9 participating countries (including Georgia and USA as guest countries). The 16th BOI was held in Bitola, in 2008, with 34 contestants from 9 participating countries (including Croatia and Poland as guest countries). Macedonian representative, Mile Jovanov, chaired 17th BOI, even though it was organized in Bulgaria.

III. COMPETITIONS IN INFORMATICS IN MACEDONIA

Competitions in informatics have a long tradition in Macedonia. There were 22 national contest cycles till the end of 2011. Every year, the contestants go through many levels of competition until the best are selected: Regional Competition (for HS pupils), National Competition (HS), National Olympiad (HS), and Qualifying Competition and National Competition (for PS pupils). The selected pupils represent themselves and Macedonia at the BOI/JBOI and at the IOI.

The main organizer of competitions in informatics for both HS and PS pupils is the Computer Society of Macedonia (CSM).

A. *Computer Society of Macedonia (CSM)*

The CSM was formed on an initiative of a group of professors at the Institute of Informatics, Faculty of Natural Science and Mathematics, at the University of Ss. Cyril and Methodius in

Skopje, in the year 2000. This organization continued with the activities previously performed by the former Mathematical and Computer Society of Macedonia.

The CSM is one of the holders of the idea for affirmation of the informatics society in Macedonia. Members of this organization are computer science teachers in high schools and primary schools, information technologists, as well as professors and teaching assistants at the Faculties of the Universities in Macedonia.

Among the main goals of the CSM are the following:

- introduction, popularization and promotion of informatics and information technology and its application,
- encouragement and introduction of informatics in all areas of the society, especially in the education,
- organization, implementation and participation in informatics competitions for pupils and students.

B. *Brief History of the Informatics Competitions*

The first steps of informatics in the high school education were made in the middle 1980s. Few years later, in 1990, the first National Competition in Informatics was held in Prilep. In 1993, the CSM started to organize Regional Competitions in Informatics. The first National Olympiad in Informatics was held in 1997. The PS competitions began to be held only few years ago – the first National Competition in Informatics for PS pupils was held in Veles in 2007.

So far, the CSM has organized 20 Regional Competitions (HS), 23 National Competitions (HS), 16 National Olympiads (HS) and 6 National Competitions (PS).

1) *High School Competitions*

At the beginning, in the first few competition years, all the contestants were given only one set of programming tasks at each competition. Later, it was decided that it would be better to have the two groups of contestants solve sets of tasks with different degree of difficulty. So, the contestants were divided into two groups (named A and B), having a different set of tasks for each group (one set being more difficult than the other). After few years, a different naming convention for the contestant groups was introduced – from then on they were named ‘Easier’ and ‘Harder’.

Presently, the HS competitions are organized as follows. The contestants, depending on the level of acquired knowledge in the programming area, at the start of each contest cycle have to choose between:

- Beginners group: first time contestants with no experience, usually in their first or second year of high school education or still in primary school
- Basic group: first or second time contestants, that consider themselves not to have enough experience to participate in international competitions
- Advanced group: contestants that consider themselves to have enough experience to solve complex algorithmic problems and to participate in international competitions (BOI, IOI)

All the competitions are entirely conducted through the system called MENDO [3], [4]. This system was created few years ago in order to provide an integrated and compact environment for realization of all the activities during an electronic contest: uploading of the competition tasks (organizers) and the solutions (contestants), evaluation and grading of the uploaded solutions, publishing of the results, and the entire communication. Beside as a national programming contests management system, MENDO is also used as a training and preparation system for the contestants (programming tasks from many past national and international competitions are available, as well as programming related materials organized in a Wiki), and as an official Macedonian algorithmic gateway, containing a news page and a public forum.

2) *Primary School Competitions*

At the beginning, in the very first national competition for primary school pupils, the contestants competed only in their knowledge and skills in applications (such as MS Word, Excel or PowerPoint). The next year, beside the ‘skills in applications’ group of contestants, another group called ‘algorithmic skills’ was introduced to the competition. The group of contestants called ‘algorithmic skills’ was given an IQ test and a set of algorithmic/programming tasks (virtual robot movement, classic algorithmic tasks). The format of one ‘skills in applications’ group and one ‘algorithmic skills’ group was kept until 2011, when the latter was subdivided into two groups: Beginners group, which was essentially the same as the ‘algorithmic skills’ group from the previous years, and Olympic group – a group of contestants that competed on tasks given to the HS competition’s ‘beginners’

group. The best pupils in the Olympic group were the ones that were selected to represent Macedonia at JBOI.

Finally, this year there were only two groups of contestants at the national competition: the ‘skills in applications’ group and the Olympic group. The removal of the beginners group from the previous year was due to the organizers’ estimation that there had been enough progress in the PS pupils’ knowledge so that they are able to compete in the more advanced group.

C. Interest in the Informatics Competitions

Table 1 shows the number of participating contestants throughout the last three national contest cycles. As can be seen from the first row of this table, the number of contestants in the Regional Competition, which is the most realistic indicator of the pupils’ interest in the competitions (since this is the starting point of the contest cycle where all the pupils that applied can participate), grows rapidly from year to year. This means that one of the goals of the CSM has been accomplished.

Table 1: Interest in the competitions in informatics in Macedonia (expressed through the number of participating contestants).

Competition\Year	2010	2011	2012
Regional Competition (HS)	55	118	209
National Competition (HS)	45	68	95
National Olympiad (HS)	23	19	21
National Competition (PS)	34	55	70

IV. THE MACEDONIAN SUCCESS AT THE INTERNATIONAL COMPETITIONS IN INFORMATICS

A. The Macedonian Success at BOI

The Macedonian pupils have won 16 medals in total at the 16 BOIs held so far. Here is a list of all the medal winners in chronological order:

- At the 3rd BOI held in Varna, Bulgaria, in 1995
 - Zharko Aleksovski, bronze medal
- At the 4th BOI held in Nicosia, Cyprus, in 1996

- Zharko Aleksovski, silver medal
- Igor Trajkovski, bronze medal
- At the 5th BOI held in Drama, Greece, in 1997
 - Zharko Aleksovski, silver medal
 - Vladica Sark, bronze medal
- At the 6th BOI held in Ankara, Turkey, in 1998
 - Vladica Sark, bronze medal
- At the 12th BOI held in Plovdiv, Bulgaria, in 2004
 - Nikola Postolov, bronze medal
- At the 13th BOI held in Rhodes, Greece, in 2005
 - Nikola Postolov, bronze medal
- At the 14th BOI held in Nicosia, Cyprus, in 2006
 - Dimitar Mishev, bronze medal
- At the 16th BOI held in Bitola, Macedonia, in 2008
 - Vasja Pavlov, bronze medal
- At the 18th BOI held in Petrovac, Montenegro, in 2010
 - Predrag Gruevski, bronze medal
 - Dejan Bozhinovski, bronze medal
- At the 19th BOI held in Bistrica, Romania, in 2011
 - Hristijan Bogoevski, bronze medal
 - Jovan Krajevski, bronze medal
 - Predrag Gruevski, bronze medal
 - Dejan Bozhinovski, bronze medal

As it can be seen, last year the Macedonian team achieved the biggest success (as a team) historically by winning four bronze medals, which means that each of our contestants returned back home with a bronze medal.

B. *The Macedonian Success at IOI*

The Macedonian pupils have won 8 medals in total at the 23 IOIs held so far. Here is a list of all the medal winners in chronological order:

- At the 8th IOI held in Veszprem, Hungary, in 1996
 - Andrej Bogdanov, bronze medal
 - Zharko Aleksovski, bronze medal
- At the 9th IOI held in Cape Town, South Africa, in 1997
 - Zharko Aleksovski, bronze medal
- At the 11th IOI held in Antalya, Turkey, in 1999
 - Vlatko Kolovski, bronze medal
- At the 15th IOI held in Kenosha, USA, in 2003
 - Nikola Postolov, bronze medal
- At the 22nd IOI held in Waterloo, Ontario, Canada, in 2010
 - Predrag Gruevski, bronze medal
- At the 23rd IOI held in Pattaya, Thailand, in 2011
 - Predrag Gruevski, bronze medal
 - Hristijan Bogoevski, bronze medal

As it can be seen, last year the Macedonian team repeated the biggest success (as a team) historically by winning two bronze medals.

C. *The Macedonian Success at JBOI*

The Macedonian PS pupils have won 5 medals in total at the 5 JBOIs held so far. Here is a list of all the medal winners in chronological order:

- At the 3rd JBOI held in Shumen, Bulgaria, in 2009
 - Denis Maznikar, bronze medal
- At the 4th JBOI held in Shumen, Bulgaria, in 2010
 - Jovan Krajevski, silver medal
 - Denis Maznikar, bronze medal

- At the 5th JBOI held in Bistrica, Romania, in 2011
 - Filip Bujaroski, bronze medal
 - Denis Maznikar, bronze medal

As it can be seen, in the last three years the Macedonian team has continuously achieved solid results, by winning at least one medal at each occasion.

V. CONCLUSION

As mentioned previously, one of the major goals of the CSM – attracting as many pupils in the HS/PS informatics competitions as possible has already been achieved. From year to year, these competitions have recorded a noticeable growth in the pupils' interest for participation, and the numbers shown in Table 1 confirm exactly that. On the other hand, algorithmic programming has been introduced as a mandatory subject in the PS educational process, which has led to a higher level of knowledge of the pupils, and with that – a higher level of PS competitions. This was another one of the major goals of the CSM, since the only way to get better contestants that would be competitive with the world's best contestants was by identifying talents and providing a good training and preparation for them as early in their education as possible. Finally, higher level of PS competitions has led to a higher level of HS competitions, thus gradually approaching the level of the international competitions, which was necessary in order to be able to form a team of contestants for participation at those competitions that would have enough knowledge to be competitive with the contestants from the other countries.

REFERENCES

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