

## Regular Competitions in Croatia

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**Abstract.** Getting the Olympiad team which will consist of the best informaticians is a really big problem. In the Republic of Croatia, over the years, different competition models have been experimented with, often using the previous, abandoned models or introducing the new ones. Each of these models had its own advantages and disadvantages, but none of them have been the perfect one. The current model also has its own disadvantages, but the biggest drawback is that the competitors are overburdened at the time when they are supposed to do their best. The students are under a lot of pressure, so there have been some thoughts about the model, according to which additional time would be put between the final competitions.

**Key words:** programming, competitions, competitors, the Croatian Olympiad in Informatics, International Olympiads in Informatics, the Olympiad team.

### 1. Introduction

In order to become the member of a team which will represent the Republic of Croatia at the International or Central European Olympiad in Informatics, the competitors have to show their own quality in a whole series of competitions in informatics. If they don't achieve the excellent results in only one of these competitions, it is almost certainly that they will not be the part of the informatics team which will represent Croatia at the International Olympiads.

The competitions, where the selection of the informatics team starts, begins by the end of January at the lowest level of competition – the school competition. The next level is a county competition and afterwards the state competition, where the students compete for 2 days. Immediately after the state competition, the Croatian Olympiad in Informatics follows, at which up to 15 students, who achieved the best results in the state competition, are invited to participate. The 8 students who were top-placed at the Croatian Olympiad in Informatics are invited to participate in the Elective preparations. During these preparations students are faced with another two exhausting competitions, and the 4 top-placed students in these competitions will be the members of the team which will represent the Republic of Croatia at the International Olympiads in Informatics.

Such a large number of competitions is extremely stressful for the students, considering the fact that most of these students participate in some other competitions (mathematics, physics, etc.), but the years of experience have shown that such a large number

of different competitions is, in fact, a prior condition which will show who the best competitors really are.

Apart from regular competitions, which are a prior condition if you want to participate in the International Olympiads in Informatics, there are some other competitions in informatics, which help the competitors to stay on good form, such as: COCI (Croatian Open Competition in Informatics), TopCoder and things like that.

Great attention has been given to the students' preparations for the competitions. Apart from the regular informatics classes and preparations which students have throughout the school year in extracurricular activities within the school, the Croatian Informatics Clubs Association organizes informatics summer camps and winter schools of informatics every year.

## **2. The Overview of the Regular Informatics Competitions in the Republic of Croatia**

In the Republic of Croatia school education lasts for 12 years. In the first 8 years of their education, students attend elementary school which is compulsory for everybody. When they finish their elementary school, students can choose between 3 basic types of high schools (grammar schools, vocational and technical schools). According to the chosen program, high school lasts for 3 or 4 years.

The informatics competitions follow the structure of the education system. Accordingly, there are 2 basic categories of competitions: elementary and high school competition in informatics. At high school level there are two subgroups of competition: one subgroup is for the first and the second graders (at the ages of 15 and 16) and the second subgroup is for the third and the fourth graders (at the ages of 17 and 18). All the students solve the programming tasks using one of the following programming languages: Pascal, C or C++.

At the elementary-school level there are also 2 subgroups. The first subgroup is for the students up to the 6th grade (up to 12 years old) and the second subgroup is for the students in the 7th and 8th grade (they are 13 and 14). Unlike high school students, elementary school students can compete in two categories: BASIC/Pascal and LOGO.

All these competitions are held at several levels:

- school competition,
- county competition,
- state competition.

For high school students there are two levels of competition:

- Croatian Olympiad in Informatics,
- Elective preparations.

Exceptionally, elementary school students can be invited to the Croatian Olympiad in Informatics if they have achieved exceptional results in the state competition.

Up to now, only two elementary school students have been invited to the Croatian Olympiad in Informatics.

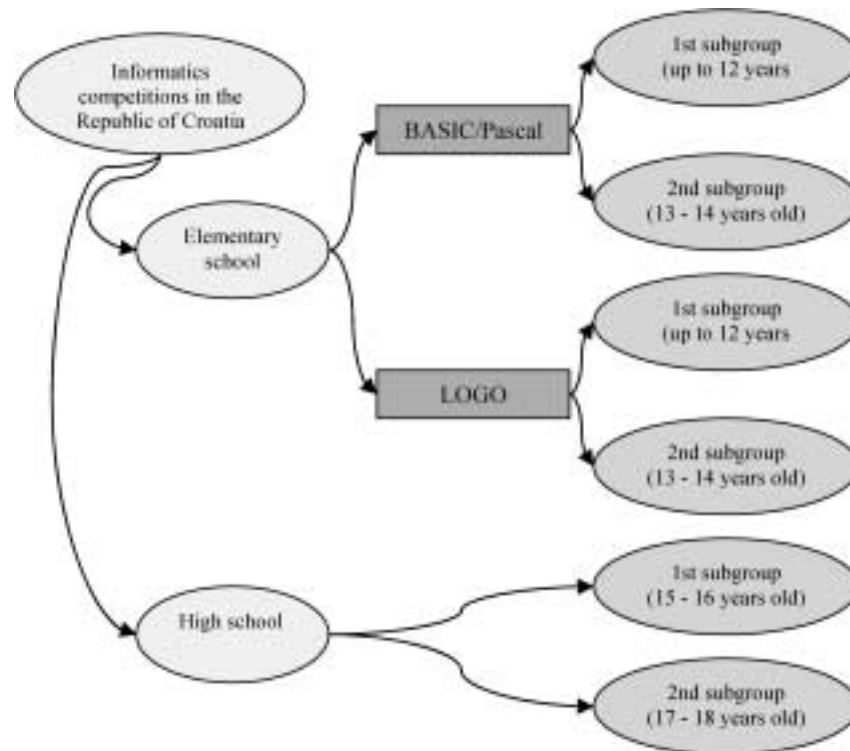


Fig. 1. The overview of the regular informatics competitions in the Republic of Croatia.

### 2.1. School Competitions

Up to this year, schools alone have been in charge of the school competitions. Schools could organize the competitions within some period of time (most often, a week), setting their own tasks.

This is the first year that the informatics competition was organized in a way that the competition took place at all schools at the same time. Tasks for the school competition were not prepared by schools alone, but by the State Examination Board that prepares tasks, defined at the state level. That State Examination Board prepares exams for all levels of competitions.

The school competitions are organized at the end of January, or at the beginning of February. The exact size, according to categories, is unknown, but it is approximately about 800 elementary school competitors and 200 high school competitors (the overall number of students per age group in the Republic of Croatia is about 40000).

At this level, students solve 3 tasks which are relatively simple in order to attract as many competitors as possible. It is extremely important that, at least, one task (usually the first one) is very simple so that everyone can get some points.

## 2.2. County Competitions

The Republic of Croatia is divided into 21 counties. According to that, the next level of competitions, after the school competitions, is the county competitions.

An Examination Board, which organizes the competition and invites students to the competition, is formed for each county. Students who were top-placed in the school competitions are invited to participate in the county competition. Up to this year, county Examination Boards had a big problem with inviting students to the county competition.

As each school had different tasks, it was extremely difficult to establish the relationship between the weights of the competition between two schools. This year those problems were solved as the tasks were the same for all schools.

Table 1 provides the number of students who took part in some subgroups of the competition. It is important to emphasize that some elementary school students competed in the category BASIC/ Pascal and the category LOGO, so they are counted twice.

As for the school competition, the tasks are prepared by special Examination Boards which are created by the State Examination Board for the competition in informatics. It is mostly the same Examination Board which prepares tasks for the school competitions.

## 2.3. State Competition

The state competition in informatics is held during May. According to the rules of the Croatian Informatics Clubs Association, the general number of students who are invited to participate in each category is shown in Table 2.

High school students compete for 2 days. Every day 3 problems are solved and the total score is the sum of points from both days of competition.

On the first day high school students solve 3 problems within 3 hours while on the other day 3 problems are solved within 4 hours.

Elementary school students compete for only 1 day. In the LOGO category 4 problems are solved within 2 hours and in the BASIC/Pascal category 3 problems are solved. In order to enable elementary school students to participate in both categories of the competition, the LOGO category and BASIC/Pascal category competitions are held in different days.

Table 1

The number of the participants in each category in the county competition in 2006/07

School level	Category	Subgroup	Number of competitors
Elementary school	LOGO	1st subgroup	199
Elementary school	LOGO	2nd subgroup	179
Elementary school	BASIC/Pascal	1st subgroup	122
Elementary school	BASIC/Pascal	2nd subgroup	183
High school	Pascal/C/C++	1st subgroup	106
High school	Pascal/C/C++	2nd subgroup	137

Table 2

The general number of students who are invited and the number of students who participated in this year state competition

School level	Category	Subgroup	General number of students who are invited	Number of the invited students 2006/07
Elementary school	LOGO	1st subgroup	15	16
Elementary school	LOGO	2nd subgroup	15	17
Elementary school	BASIC/Pascal	1st subgroup	10	12
Elementary school	BASIC/Pascal	2nd subgroup	20	22
High school	Pascal/C/C++	1st subgroup	20	20
High school	Pascal/C/C++	2nd subgroup	25	27

#### 2.4. Croatian Olympiad in Informatics

Generally, high school students are invited to the Croatian Olympiad in Informatics. Exceptionally, an elementary school student who achieved exceptional results at all levels of regular and special competitions can be invited.

When the second day of the competition is finished, the State Examination Board, which is in charge of the competition in informatics, decides on the students who will be invited to the Croatian Olympiad in Informatics. Who will be invited is determined by their success in the state competition over those 2 days. According to the rules of the Croatian Informatics Clubs Association, 5 to 7 competitors from the first high school subgroup and 10 to 12 competitors from the second subgroup are invited to participate in the Croatian Olympiad in Informatics.

This year 21 students, 8 from the first high school subgroup, 12 from the second high school subgroup and 1 elementary school student, are invited to the Croatian Olympiad in Informatics.

#### 2.5. Elective Preparations

Basically, 8 top-placed students from the Croatian Olympiad in Informatics are invited to take part in the Elective preparations which, essentially, last for a week. Over a week, students have intensive preparations and they have competitions for 2 days. In each of these 2 competitions students can gain up to 200 points and the points gained in these 2 days are summed up. So, the maximum number of points gained in the Elective preparations is 400. The final rank-list is done after the Elective preparations, according to the overall number of points from the Elective preparations and the number of points at the Croatian Olympiad in Informatics (Table 3). 4 top-placed students from that rank-list are invited to participate in the international olympiads.

Table 3  
Final rank-list

Overall rank-list for the Olympiad team selection which will represent the Republic of Croatia at international Olympiads		
Croatian Olympiad in Informatics (300 points maximum)	First competition within the elective preparations (200 points max.)	Second competition within the elective preparations (200 points max.)

### 3. Informatics in the Framework of the Croatian Education System

In spite of numerous efforts, informatics (computer science) has not become an obligatory subject in elementary schools. Rather, it is taught as an extracurricular activity and the number of students eligible to register for the classes is limited. Elementary school informatics is mainly based on acquiring fundamental informatics skills, where programming skills account for only 11% of the entire informatics curriculum. Since Croatian schools are rather poorly equipped and the profile of elementary school teachers is fairly low, and since there is an evident lack of adequate programs, the situation looks pretty chaotic at this point. The teachers often teach only what they like, and that, in most cases, does not involve programming. It happens quite often that elementary students who have studied informatics for four years do not know anything about programming. The situation is not much different in high schools either. Informatics is mostly taught for one year, except in certain technical schools and schools of science and mathematics where informatics is taught for more than one year. In the schools where informatics is taught for only one year, it is mainly reduced to learning how to use office tools such as MS Office, whereas in technical schools where informatics is taught for more than one year, it is mostly taught in connection with certain professional subjects and based on the use of hardware with just a touch of low-level programming. Only the students of the 2nd, 3rd and 4th grades of the schools of science and mathematics learn the skills needed for more comprehensive programming. In the course of three years, they are taught the basics of structural programming, using the Pascal or C language. The skills that the student acquires through high school education are often not enough for achieving success at even the lowest level of competition.

#### 3.1. *Additional Work with Students within the School*

The more ambitious elementary and high school teachers give additional classes, outside the regular informatics classes, to students showing additional interest in programming. During such additional classes, the teachers work with students primarily on solving programming tasks and prepare them for competitions. The main problem of this kind of additional education is that it is primarily voluntary in nature. In most cases the teachers do not get paid for the extra hours they put in. After the students have reached a certain level of knowledge, the teachers cannot keep track any more. The additional classes serve to maintain the continuity of committed work, the teachers try to motivate the students and find problems that the students solve on their own. This type of education, in

most cases, is organized in the evening when school time is over or on Saturday. In some schools this type of education is provided by ex-students, who achieved good results in competitions, along with teachers. This type of education is extremely important, which enables students to rise to the top and come to the higher level of competitions in Croatia. My personal experience says that only 5% of pupils who did not take part in extracurricular activities come to the state competition.

### 3.2. *Extracurricular Work with Students*

The students acquire the largest amount of knowledge and skills needed for competitions participating in extracurricular activities. The Croatian Informatics Clubs Association has been organizing informatics summer camps and winter schools of informatics for 13 and 11 consecutive years respectively. The summer camps and winter schools are mainly organized for students who achieve the best results at the state competition. The students in community where the summer camp or the winter school is organized can also register to attend the classes. In summer camps and winter schools of this kind, education activities are conducted in the form of well-designed workshops led by excellent teachers, mostly former competitors. The workshops differ in character and mainly teach programming skills. The students can take part in the following workshops:

- Algorithm Workshop – the students deal with various algorithms depending on their age. Elementary school students learn about sorting algorithms, recursions etc. High school students learn about dynamic programming and algorithms for graphs. Each algorithm workshop is complemented by a series of problems that the students work on with the help of their instructors. The teachers prepare the problems from the previous competitions.
- Programming Language Workshop (Pascal, BASIC, C++, Logo etc.) – the students acquire additional knowledge or are introduced to a new programming language. This workshop is intended primarily for elementary school students. They are introduced to the more advanced applications of programming languages and data structures (designing subprograms, working with arrays, matrixes, databases, strings, etc.). C++ STL is extremely popular among high school students. As in the case of algorithm workshops, programming language workshops are also designed to ensure the students an opportunity to use the acquired knowledge providing a number of problems related to the taught subject for them to solve.
- Undefined-topic Workshops (web design, C#, Java) – the purpose of these workshops is to give the students a kind of insight into what is currently going on in the world of programming. Such workshops are a kind of relaxing escape from algorithms and psychically significantly less demanding.

The fact that such workshops are mostly conducted by former competitors is very important because the students benefit from their rich, first-hand experience in competitions. Another very important fact is that the competitors and instructors/former competitors are relatively close in age which helps break the classic barrier between students and teachers and develop a friendly relationship that allows the students to ask questions with significantly less hesitation, talk about the problems even in their free time, etc. To fill their free

time the students have the opportunity to participate in computer game contests, student excursions during which they hang out and talk, mainly about programming problems, algorithms etc., which is very important in terms of developing informal learning habits. The students who achieve the best results during the workshop are awarded at the closing ceremony.

After that type of school is over, students and teachers stay in contact by e-mail or in some other way. Teachers help students to solve programming problems, giving suggestions etc. That type of schools in particular, and relationship between teachers and students are one of the most important facts that has led to Croatia being awarded 64 medals in international competitions.

### 3.2.1. *Informatics Summer Camps*

Informatics summer camps are held during the summer months, usually in July or August, near the coast. They are extremely attractive to students because they include studying but also a fair amount of entertainment and free time to hang out with fellow students. The main attraction is the time that students spend at the coast. In informatics summer camps, special attention is paid to those students who intend to participate at the international informatics olympiads. They attend special all-day workshops conducted by the best former competitors during which they work on the problems similar to those that might appear at the olympiad and attend a series of lectures in various fields, very often associated with mathematics.

### 3.2.2. *Winter Schools of Informatics*

Winter schools of informatics are organized in winter, during the winter break, mainly in the continental part of the country. They do not differ much from the informatics summer camps, excepts that winter schools are easier than summer camps. Competitions, especially international, are far away so the workshops for students who intend to participate at the olympiad do not exist. For the potentially candidates for the international informatics olympiads workshops are organized with very complicated algorithms and data structures. This workshop is of an open type and any participant of winter school can join it.

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