Training School Children for Competitive Programming

Denis Vlasov
Vladimir Kuznetsov

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Petrozavodsk State University

- The leading university in the European North of Russia
- The center of informatization and studying IT specialists in the region
- Host of the programming training camp for the best ACM-ICPC teams from Russia and neighbor countries
- 6 times in the World Finals
- Silver medal in 2010
- Bronze medals in 2007, 2008
- Training center for talented school children to prepare for Olympiads
Main Problems

- Weak basic school informatics curriculum
- Shortage of experienced teachers
- Outflow of strong students to major cities
- Increasing complexity of problems at competitions
- Children's lack of desire to work hard and study advanced subjects
- Underfunding of extended education
Way out

- Petrozavodsk State University took the initiative to work with talented school children
- Its students and teachers conduct special classes for pupils
- All the lessons are held in the university
- Selection is carried out among all who wish to learn computer science and informatics
Objectives

- Inspiring school children to learn computer science
- Popularization of programming among high schools in the region
- Preparing for the regional, national and international competitions
- Studying programming techniques, mathematics, efficient algorithms and data structures
- Improvement of enrollees' skills
How it all began

1998 - first school teams took part in the local student ACM competitions
1998 - the first school team contest was held
1999 - regular classes and trainings were started
1999 - 3 teams from Petrozavodsk participated in the National team competition at St. Petersburg
2000 - local school competitions were held twice a year
2001 - we started warming up to IOI-style olympiads
2002 - the first out-of-town summer camp for pupils was held
Beginners Group

- Pupils from grade 6-8
- One or two lectures per week
- Two practice sessions per week in computer labs
- Regular tests
- Exam in the end of the year
- Lecturer and instructors are the University students
- Flowchart (block diagram) development
- Studying C/C++
Beginners Group Topics

- C/C++ syntax
- Pointer concept
- Basic data structures
- Strings
- Input/Output routines
- Binary search
- Sorting
- Basic math algorithms
- Simple games and puzzles
- Logical problems
Middle Group

- Pupils from grade 8-10
- One lecture per week
- Two practice sessions per week in computer labs
- Regular tests
- Exam in the end of the year
- Lecturer and instructors have experience in ACM-ICPC competitions
Middle Group Topics

- Data structures
- Binary and ternary search
- Dynamic programming
- Greedy algorithms
- Graph theory
- Computational geometry
- Bignum arithmetic
- Basic algebraic algorithms
- Bit operations
- Brute-force search
- Combinatorics
- Math Olympiad problems
Advanced Group

- The focus is on practice rather than theory
- Solving previous competitions as virtual contests
- Participating in online trainings and work with online problem archives
- Intense training sessions during school year
- Instructors have great experience in programming competitions
- Joint trainings with students
- The best team takes part in Petrozavodsk Student Programming Training Camp
Features of the Training Process

- Relation between theoretical and practical classes
- Large volume of independent work
- Reading recommended books by pupils
- Involving experienced university students to teach children
- Competitive aspect
- Analysis of all the training problems
Karelian School Team Contest

- October-November
- Since 1999
- 20-25 school teams
- Elimination round for the All-Russian Team Olympiad
- ACM-ICPC rules
Online Municipal Stage of All-Russian Olympiad in Informatics

- Since 2006
- 150-200 pupils
- 12-15 districts of the region
- Using contest control system
- Two separate problem sets
- Separate grading for every district
- Our representatives in the districts
- Checking for plagiarism
- Selection of the best contestants from each district to take part in the next stage
Requirements for the Contest Control System

- work 24/7
- have the opportunity to submit solutions via the internet
- provide the contest mode to hold competitions
- provide the problem set mode for educational purposes
- support various contest rules
- support different types of problems (batch, output-only, interactive)
- hold virtual contests
FSystem

FSystem was created by Denis Denisov in 2007 and has been developed until the present. It is a Web-based solution allowing to hold many different contests separately. It supports various contest rules and programming languages.

The System is used for all the regional competitions, camps and courses which are conducted at the University.
FSystem. Main Features

- Contest mode (IOI, ICPC)
- Problem set mode
- Using arbitrary number of judging modules
- Configuring contests online and by editing files
- Support of Testlib
- Virtual contests
- Printing solutions
- Statistics
- Import/Export of contest data
Regular educational event which has been held since 2002
Now it is called "Summer Karelian Computer School"
Combination of work, rest and fun
Participants are from Petrozavodsk and other towns of the region
25 kids are divided into three divisions
Studying special topics and problems
Courses for Schoolteachers

- Since 2007
- Twice a year
- 5 days
- 20 teachers of Informatics from schools over the region
- Presentations about Olympiads
- Lectures and practice sessions
- Studying how to solve problems
- Studying how to teach school children
- One day is devoted to using Contest Control System
- Every one gets a disk with educational materials
Main Results

- Large-scale involvement of school children
- Increased level of training
- Annual selection of pupils
- Regular classes
- Block of developed courses
- Large set of problems
- Achievements at various competitions
Our Achievements

2004 - 4th place at the All-Russian Team Olympiad (St. Petersburg)
2004 - Denis Denisov, 4th place at the Russian Olympiad in Informatics (Novosibirsk)
2005 - 5th place at the All-Russian Team Olympiad (St. Petersburg)
2006 - Denis Denisov, 1st place at the Russian Olympiad in Informatics (Kislovodsk)
2006 - Denis Denisov, 11th place at the International Olympiad in Informatics (Merida, Mexico)
2008 - Sergey Serebryakov, 20th place at the TCHS 2008 (Purdue University, USA)
2011 - Egor Voronetskiy, 3rd place at the Russian Olympiad in Mathematics (Nizhniy Novgorod)

Regular diplomas at the Russian Olympiad in Informatics
Thank you