

The High School Students Institute of Mathematics and Informatics is established in September 2000. The founding of HSSI was one of the initiatives of the Bulgarian mathematical community in the celebration of the World Mathematical Year 2000.

**Founders** of HSSI are

- The Union of Bulgarian Mathematicians (UBM)
- The Foundation “Evrika”
- The International Foundation “St Cyril and St Methodius”
- The Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences

**Mission**

Bulgaria has a relatively well-developed network of Mathematics and Informatics competitions for secondary school students, which allow the young people to exhibit their abilities and gifts. For more than 20 years Bulgarian high school students successfully participate in the International Mathematics and Informatics Olympiads. There are many students however, who are highly creative only if they are not “under the pressure” of the limited competition time. Some of them could become good inventors or scientists in their professional life. *It is the mission of HSSI to identify such students and to take care of them developing the future leaders in science.*

UBM has long-standing traditions in early identification and proper enhancement of talents. Since 1980, School Sections in the framework of the annual Spring Conferences of UBM have been organized, where high school students presented their papers. The interest in these Sections shown by teachers as well as students was great. *It is the mission of HSSI to keep the traditions alive giving them new spirit and new content.*

Before 1989 the so called “Movement for Technical and Scientific Creativity of the Youth” (TNTM in Bulgarian) existed in Bulgaria. The students were working on individual scientific projects and there were sessions where they could present their work. Like almost everything connected with the youth, it was under the umbrella of the Young Communists League (Komsomol). After the democratization of the society the Communists League disappeared together with everything related to it. It was time to establish something that would revive TNTM. *It is the mission of HSSI to recreate the valuable experience at the level of contemporary challenges and requirements.*

Another important factor for the creation of HSSI is the long-term collaboration between the Center for Excellence in Education (CEE) in Virginia, USA, and the International Foundation “St Cyril and St Methodius” in Sofia, Bulgaria. Each year CEE organizes a highly successful six-week Research Science Institute (RSI), which has gained great recognition and prestige. *It is the mission of HSSI to implement RSI-like activities in Bulgaria, taking into account the conditions and the traditions in the country.*

The Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences provides a natural environment for the growth and the progress of HSSI – Library, Internet, rooms and equipment. Many collaborators of the Institute devote significant part of their free time to keep high the level of extra-curricular work with talented students. Their work supports and enables *HSSI to assist the intellectual and professional growth of the high school students.*

## **Participation in HSSI**

The participants in HSSI are high school students between 8<sup>th</sup> and 12<sup>th</sup> grade, aged 15 to 18, mainly from specialized Science and Mathematics Secondary Schools in the country.

Every participant in HSSI works individually or in a team, on a freely chosen topic in Mathematics, Informatics and/or Information Technologies under the guidance of a teacher or another specialist. The project (paper) is sent in advance to HSSI. All papers are refereed by specialists and the reports are given to the authors. Highlighted are papers involving creativity elements. The best projects are accepted for presentation in the competitive sessions of HSSI.

## **Activities of HSSI**

During one school year HSSI organizes three events. There are two competitive sessions and one Research Summer School.

The competitive sessions are:

- *High School Students Conference* in January
- *School Section* in the framework of the annual Spring Conferences of UBM in April.

Both sessions are independent. Students may participate in either event. The authors present their work in front of a Jury and in the presence of the other participants, teachers, and parents. Based on the merits of the paper and the style of presentation, the Jury judges the works and selects the best ones. Their authors receive Certificates for Excellence; all other participants are given Diplomas for participation in the event, which is already a kind of recognition.

The authors of the best projects in the High School Students Conference are invited:

- to take part in an Interview for selecting two Bulgarian participants in RSI;
- to participate in the School Section at the expenses of HSSI.

The authors of the best projects from the School Section are invited to participate in the Research Summer School at the expenses of HSSI.

- *Research Summer School*

The three-week Research Summer School takes place in July–August in Bulgaria. During the first two weeks, lectures and practical courses in Mathematics and Informatics are given by eminent specialists from universities, academic institutions and software companies. The main goal of the training is to extend the students' knowledge in topics related to their interests and to offer new problems to be studied and solved in further projects. The third week is devoted to a High School Students Workshop, where the participants report on their results and further studies. The presentations are in front of specialists whose role is to advise the students in finding the right topics and problems to be studied, to recommend methods and tools to be used to achieve high quality results.

- *High School Teachers Workshop*

It takes place during the third week of the Research Summer School. Participants are the research advisors of the students projects, presented at the events of HSSI during the school year. The teachers take part in the Students Workshop. Lectures in Mathematics and Informatics are also delivered to the teachers.

- *Interview for selecting participants in RSI*

Before 2000 the International Foundation “St Cyril and St Methodius” used to select two Bulgarian high school students to participate in RSI. One of the incentives to create HSSI was the necessity to select good Bulgarian students for RSI.

- *Seminar on Extra-Curricular Work in Mathematics*

The Seminar takes place once a month during the school year, in the Institute of Mathematics and Informatics. The aim of the Seminar is to bring together high school students, teachers and scientists to present and discuss problems of common interest.

## **Bonuses for the HSSI participants**

All participants in the School Section, who graduate the secondary school in the current year, are given the opportunity to continue their education in the Faculty of Mathematics and Informatics at the Plovdiv University without sitting for university apply exams.

## Till now,

- more than 600 high school students from the country participated in the events of HSSI.
- more than 200 high school students took part in the Research Summer Schools (RSS) of HSSI. There were also participants from Macedonia, Yugoslavia and Turkey.
- HSSI participants won in 2003 and 2004 the National Young Talents Competition, organized by the Bulgarian Ministry of Education and Science. The winners are:
  - 2003: Ana Aleksieva, Science and Mathematics High School, Vidin  
Konstantin Delchev, Sofia Mathematics High School
  - 2004: Nikolai Landgev, 91<sup>st</sup> German Language High School, Sofia

The winner participated in the 15<sup>th</sup> and 16<sup>th</sup> European Union Contest for Young Scientists.

- HSSI participants took part in the Research Science Institute (RSI) in MIT, USA:
  - RSI'2001: Kaloyan Slavov, National Science and Mathematics High School, Sofia  
Eleonora Encheva, Science and Mathematics High School, Veliko Turnovo
  - RSI'2002: Liudmil Antonov, Mathematics High School, Plovdiv  
Iva Rashkova, Mathematics High School, Rousse
  - RSI'2003: Vesselin Dimitrov, National Science and Mathematics High School, Sofia  
Todor Kolev, National Science and Mathematics High School, Sofia
  - RSI'2004: Antony Rangachev, Sofia Mathematics High School  
Aleksander Simeonov, Mathematics High School, Varna
  - RSI'2005: Veselin Kulev, Mathematics High School, Varna  
Vladislav Petkov, National Science and Mathematics High School, Sofia
  - RSI'2006: Todor Bilarev, National Science and Mathematics High School, Sofia  
Vladislav Marinov, National Science and Mathematics High School, Sofia
  - RSI'2007: Boyan Petrov, Academician Kiril Popov Model High School of Mathematics in Plovdiv  
Nikola Tchipev, National Science and Mathematics High School, Sofia

The Mathematics papers of Kaloyan, Vesselin and Antony were among the top five written presentations.

- ***Some lecture courses at the Research Summer Schools***

### *Mathematics*

Geometry: duality, inversion, remarkable points in the triangle  
Geometric extremum problems: Malfatti problems; inequalities in a triangle  
Number theory: Diophantine equations  
Dynamical systems and chaos  
Functional equations  
Extremum graph theory  
Invariants  
Games and strategies

### *Informatics*

Combinatorial algorithms  
Mathematical games  
Real life applications – problems and approaches  
Programming in Internet: examples in Perl, JavaScript, PHP  
Analysis, design and development of web sites  
Programming languages: identification and complexity  
Object-oriented programming  
Introduction to coding theory  
Nonlinear optimization and application to operation research  
Abstract data types and data structures

- ***Some awarded student projects***

### *Mathematics*

Aleksander Lishkov, Sofia Mathematics High School,

*Tessellation of the plane. Tiles and mosaics*  
 Ana Aleksieva, Science and Mathematics High School, Vidin,  
*Some original results on the sequences of Fibonacci and Lucas*  
 Anita Georgieva, First English High School, Sofia,  
 Nikifor Bliznashki, Sofia Mathematics High School,  
*Cross ratio*  
 Antony Rangachev, Sofia Mathematics High School,  
*On two classes of congruencies*  
 Kaloyan Slavov, National Science and Mathematics High School, Sofia,  
*Diophantine Equations and quadratic fields*  
 Konstantin Delchev, Sofia Mathematics High School,  
*Rectification by polyominoes*  
 Plamen Aleksandrov, Mathematics High School, Varna,  
*Remarkable points in the quadrangle*  
 Sonya Hadzhieva, Sofia Mathematics High School,  
*Classical inequalities and applications*  
 Vesselin Dimitrov, National Science and Mathematics High School, Sofia,  
*K-distinguishable subset families modulo subrings*  
 Vladislav Petkov, National Science and Mathematics High School, Sofia,  
*On some irreducibility criteria*  
 Todor Bilarev, National Science and Mathematics High School, Sofia,  
*Pell's equations*  
 Nikola Tchipev, National Science and Mathematics High School, Sofia,  
*On the Frobenius problems*

#### *Informatics*

Aleksander Simeonov, Mathematics High School, Varna  
*Developing web-based software for the stock exchange*  
 Georgy Dimitrov and Trifon Statkov, Science and Mathematics High School, Montana,  
*WEB-site "IT Encyclopedia"*  
 Georgy Kudrev, Mathematics High School, Rousse,  
*Easy Morphing – analyzing and processing of images*  
 Ivaylo Riskov, Dimitar Blagoev, Liudmil Antonov, Mathematics High School, Plovdiv  
*IDLe. Universal programming language*  
 Maria Angelova, Mathematics High School, Pleven, *GraphEditor – software package  
 for graph development and visualization of basic algorithms in graph theory*  
 Nedialko Stefanov, National Aprilov High School, Gabrovo,  
*Card Timer: watching the state of an Internet-access card, paid in advance*  
 Nikolai Langev, 91<sup>st</sup> German Language High School, Sofia,  
*Block cipher analysis*  
 Nikolai Valchanov, Nikola Borissov, Sofia Mathematics High School,  
*Environment for illustration of algorithms*  
 Todor Kolev, National Science and Mathematics High School, Sofia,  
*Creating web based enterprise resource planning systems using phpSiteEngine*  
 Veselin Kulev, Mathematics High School "Dr. P. Beron", Varna,  
*Software for low level wireless platforms*  
 Vihren Todorov, Teodor Purvanov, Science and Mathematics High School, V. Turnovo  
*Combinatorica. Operations between combinatorial objects*  
 Vladimir Marinov, National Science and Mathematics High School, Sofia,  
*Application of neuron networks for recognition of symbols*  
 Boyan Petrov, Mathematics High School "Acad. Kiril Popov", Plovdiv,  
*School Network2*

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