



Romanian National Olympiads in Informatics & Training

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Summary

- Informatics Education in Secondary Schools – Background
- Alternative Education and Training in Informatics
- Romanian Olympiads in Informatics
- Task Definition & Development
- Romania's results in the IOI





Informatics Education in Secondary Schools – Background

- Education in Informatics started in 1971
 - 5 Informatics high schools were founded (in 5 different cities)
- 1989-2000: # of classes of Informatics increased (up to 8 hours/week in *special classes*)
 - special class=studies Informatics intensively
- 2001-present: # of classes of Informatics decreased (1-4 hours/week, even in special classes)





Alternative Education and Training in Informatics

- major problem: lack of (qualified) Informatics teachers
- need for alternative sources of Education and Training:
 - Centres of Excellence
 - .campion
 - infoarena





Centres of Excellence

- founded by the Ministry of Education & Research
- 9 regional centers of Excellence, each on 6 disciplines:
 - Mathematics
 - Informatics
 - Physics
 - Chemistry
 - Biology
 - Geography
- main idea
 - gather highly skilled students + best teachers
 - develop special activities, as a result of higher educational needs
 - activities take place during week-ends
- successful (only) in several regions
 - Iasi: ~ 1000 students + 100 teachers





.campion (1/4)

- <http://campion.edu.ro>
- online training program for performance in Informatics (2002-present)
- supported by SIVECO Romania & the Romanian Ministry of Education and Research
- objectives:
 - develop algorithmic thinking
 - develop programming skills
 - develop competitive spirit





.campion (2/4)

- 3 training groups (according to level/age)
 - Group S (Small) - beginners in computer science; age should not exceed 16 years (9th grade or primary school students)
 - Group M (Medium) - intermediate level; age should not exceed 17 years (10th grade)
 - Group L (Large) - advanced level (11th and 12th grade)
- 12-13 rounds
 - training rounds (~10 days)
 - contest rounds (3 hours)
 - 2 problems/round
 - training & contest rounds alternate





.campion (3/4)

- web-based submission system
- automatic grading system
- at the end of each round – available on the website:
 - for each student: personal grading sheets
 - for each group: rankings for the current round and overall rankings, including all the rounds
 - for each problem: solutions, solution descriptions, grading tests
- archive with all the past problems (from the previous editions and rounds)
- top competitors (~15-20 per group) => final “live” round
 - single contest day (3 problems in 4 hours)
- ~1000-1500 participants per edition (500 participate consistently)
- all Romanian IOI, CEOI, BOI, JBOI medalists are .campion finalists
- 2005 & 2006: international version of .campion, in cooperation with Bulgaria and Moldova





.campion (4/4)

- a resource for self-conducted students' training or for the teacher-conducted training
- (also) a practical way to train teachers
 - teachers are selected & proposed a cooperation in .campion
 - (most) teachers agree and submit problems (following some technical specifications)
 - communication (by email) between teachers and .campion organizers => better cooperation
 - better cooperation + better teachers => improved quality of:
 - Romanian National Olympiad in Informatics
 - training of the Romanian National Informatics Team





infoarena

- <http://infoarena.ro>
- training website
 - made by students (e.g. former IOI, CEOI, BOI medalists)
 - intended for students (current participants in the olympiads in Informatics)
- online grading system
- organize programming contests
- online archive with past contest problems
 - infoarena contest problems
 - problems from the Romanian Olympiads in Informatics (national, regional, local)
- publish educational materials
- exchange ideas (forum)
- dynamic program, continuously improving with the help of lots of volunteers





Romanian Olympiads in Informatics (1/2)

- 2 divisions (each with several sub-divisions)
 - gymnasium students (5th-8th grade)
 - 4 subdivisions (one per grade)
 - high-school students (9th-12th grade)
 - 3 subdivisions
 - 9th grade
 - 10th grade
 - 11th and 12th grade
- 3 stages
 - local (city)
 - Contest problems selected by local teachers
 - regional (region/county)
 - Contest problems selected by the National Committee
 - Usually one contest day (2 problems in 3 hours)
 - Each county selects the students to participate in the NOI
 - Each county has a maximum number of students which can qualify to the NOI (3-11), based on the results in the previous NOIs
 - national
 - Contest problems selected by the National Committee





Romanian Olympiads in Informatics (2/2)

- National Olympiad in Informatics
 - ~300 high school students
 - ~160 gymnasium students
 - 2 contest days for each subdivision
 - 3 problems in 4-5 hours (per contest day)
 - based on the results in the NOI => 50% of the students compete for selection in the National Informatics Team (one team per division)
 - 10 students for Juniors (gymnasium pupils)
 - 20-24 students for Seniors (high school pupils)
 - 2 contest days: 3 problems in 5 hours (per contest day)
- Training Camps
 - 2 training camps are organized for the national teams
 - theoretical courses
 - contests
 - 3 contest days per training camp for Seniors, with 3 problems in 5 hours (per contest day)
 - teams competing in IOI, CEOI, BOI, JBOI are selected





Task Definition & Development

- crucial part in the organization of any contest
- 2 stages
 - 1st stage
 - Each member of the contest committee develops one or more tasks individually
 - The author submits the tasks to the contest committee (of which he is a member)
 - 2nd stage
 - Several tasks are chosen from the set of candidate tasks
=> contest task set





Creating a Task

- aspects to consider
 - difficulty level (of the task)
 - division and subdivision (of the competitors) – syllabus
 - contest duration
 - estimation of the duration a competitor which is above average would require for finding and implementing the algorithm
 - suboptimal and alternative solutions
- clear problem statement
- reference implementation (of the official solution and of the suboptimal solutions)
- create test cases (usually 10-20, with equal weights) + decide the intended score for each (suboptimal) solution
- collaboration with other members of the contest committee is possible
- creating a contest task may start several months before the contest day and finish only a few days before the contest
 - the problem statement is particularly prone to changes





Selecting the Contest Task Set

- desirable properties of the contest task set
 - it must contain tasks of different levels of difficulty (from easy to difficult)
 - the range of algorithmic topics covered by the tasks must be broad (i.e. multiple tasks should not be solvable by similar techniques)
 - all the tasks should be solvable within the allotted contest time, by above average competitors – this does not mean that we expect this situation to actually occur, because there are many other factors involved
 - the tasks should make a good distinction between highly skilled, average skilled and poorly skilled competitors.
- classification of the candidate tasks
 - level of difficulty
 - the types of required algorithmic techniques (e.g. greedy, dynamic programming)
 - estimated necessary duration for solving them
- discussions regarding the tasks (among the contest committee members)
=> the opinions of the contest committee members converge to a large degree
- each member votes for the tasks he/she considers appropriate





Contest Committee

- Contest committee members (of the NOI)
 - remarkable **high school professors**, teaching Informatics both in classes and within Centers of Excellence
 - **university professors** and teaching assistants, working in the domain of Mathematics and Computer Science
 - **former medalists of international olympiads in Informatics** and former members of the Romanian National Informatics Team (currently bachelor, master or Ph.D. students)
- Each member
 - must compose at least 1 (candidate) task
 - must participate in the process of selecting the contest tasks from the set of candidate tasks





Syllabus

- 3 divisions with 7 subdivisions overall
- different tasks for each subdivision
- different syllabus for each subdivision
- syllabus
 - loosely defined, based on (sub)division and stage of the olympiad (local, regional, national)
 - syllabus for 11th and 12th grades – the most inclusive
 - e.g. *Greedy Algorithms, Divide and Conquer Techniques, Dynamic Programming, Graph Algorithms, (Basic and Advanced) Data Structures, Combinatorics, Computational Geometry, String Algorithms and Game Theory*
 - for other (sub)divisions : some of these topics are excluded from the syllabus
 - no *Graph Algorithms* for 10th grade
 - no *Dynamic Programming* (or *Graph Algorithms*) for 9th grade
 - officially, the syllabus is defined loosely; unofficially, the syllabus is quite detailed (these details are filled by the experience, knowledge and common sense of the contest committee members)
 - the detailed syllabus for the Informatics olympiads is far more advanced than the topics the pupils are taught at school => emphasis on **alternative training**





Task Types

- Batch
 - the most prevalent
 - the easiest to grade and develop
- Reactive
 - require special support from the evaluation system
 - more difficult to develop by the authors (technical difficulties)
- Output-only
 - generally not appreciated by contestants
 - have rarely made the students' skills and knowledge stand out
 - only 1 or 2 of them are used in the IOI selection contests
- Algorithmic in nature
- Programming languages: C/C++, Pascal
 - most students in the National Informatics Team use C/C++
- Grading the Tasks
 - the same grading system used by .campion





Romania's results in the IOI

- Romania participates in:
 - IOI (International Olympiad in Informatics)
 - CEOI (Central-European Olympiad in Informatics)
 - BOI (Balkan Olympiad in Informatics)
 - JBOI (Junior Balkan Olympiad in Informatics)
- IOI participations
 - since 1990 (every year)
 - medals
 - 19 Gold
 - 32 Silver
 - 16 Bronze





Thank You !

