

Get Involved!

The IOI Workshop 2010, Its Goals and Results

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Abstract. In May 2010, the third IOI workshop took place in Schloss Dagstuhl, Germany. It was motivated by the discussions held at and after the panel session of 2009's IOI conference in Plovdiv. There, discussions focussed on communication and collaboration among the IOI community, as well as communication of the IOI competition to outsiders. At the workshop, members of the IOI community met to develop a first version of an IOI Wiki as a tool for communication and collaboration, and devised suggestions on how to visualize IOI-style contests to make them more accessible to the outside world.

Key words: programming contests, IOI, wiki-based collaboration, visualization.

1. Motivation and Introduction

The International Olympiad in Informatics (IOI) has a 20-year tradition, but keeps evolving. Regularly, IOI organizes a workshop, in order to bring forward new ideas and to explore how they could be implemented. In recent years, IOI workshops were held in Germany (Schloss Dagstuhl, 2006) and in The Netherlands (Enschede, 2008).

In the discussions that were held during and after the panel discussion at the IOI Conference 2009, “communication” appeared to be the central keyword. Many open questions are linked to this topic:

- Communication beyond the IOI community:

- How to increase awareness of IOI, and what are the problems to be solved while pursuing that goal?
- What image of IOI should be communicated to the outside world?
- Communication within the community:
 - Why does the IOI community not communicate between IOIs? Are there tools or incentives that could stimulate this communication?
 - How to encourage communication between contestants?
 - What are the subjects of common interest to communicate about?
- Communication and sharing resources:
 - How to encourage and facilitate the sharing of resources for training and contest organization?

These and related topics were to be the focus of the IOI Workshop 2010, to be held again at Schloss Dagstuhl, Germany. In their call for contributions, the workshop organizers had envisioned a meeting of people who were interested, willing and capable to make first steps of devising, developing, and implementing solutions to the problems discussed.

The submissions focussed on two main areas: On the one hand, several authors stressed the need for collaboration among IOI delegations and the need for tools to support that collaboration. On the other hand, some submissions suggested new ways of enriching IOI-style competitions with a higher degree of visual appeal, in order to make them more accessible for both persons with expertise in the competition area (like members of the IOI community themselves) and people with mere interest in the proceedings and results of the competition (like friends or relatives of the participants). Hence, during the workshop, most of the time the participants divided into corresponding working groups. In the following two sections, we report on the results of these working groups.

2. IOI Wiki: Getting the Community Involved in Collaboration

It is obvious that in most IOI countries, two kinds of activities are done on the national level¹:

- Selection of IOI participants, typically by means of a (national) contest or specific exams.
- Training of IOI participants or team candidates, sometimes within, sometimes following the selection process.

Often, the people who are involved in the above IOI-related activities, are working in a more general context of informatics education: as school teachers, as academics who are responsible for curriculum development or teacher training related to informatics education in schools, or as activists that bring forward non-curricular education activities in countries where informatics education in school has been established insufficiently

¹We do not give explicit references, but many papers on such activities have been published in previous “Olympiads in Informatics” volumes.

or not at all (examples: USACO training, French training site “france-ioi.org”, German community site “einstieg-informatik.de”).

Within all these activities, the persons involved do similar things, use similar material, are interested in similar news, and discuss similar ideas. Unfortunately, much of this work at individual and national levels does not make it into the collective knowledge of the IOI and informatics education community. This is particularly true of knowledge that is more practical than academic, which often does not appear in conference papers or talks even though it deserves attention and could be beneficial and stimulating for others. In particular, there is no organized way of exchanging what is perhaps the most valuable “raw material” for national team coaches: tasks that are good for use on the level of national IOI training and preparation.

Therefore, it was suggested that we establish a system for sharing information and material – including tasks amongst other things – among the IOI community and other informatics educators. This was done as follows:

- Before the workshop, Mathias Hiron conducted a detailed survey of tools that could be used to build such a system. According to his suggestion, the working group chose the MediaWiki software along with Semantic MediaWiki extensions. This would allow the material on the system to be systematically organized and retrievable.
- During the workshop, two working groups developed infrastructure and sample content for various aspects of this wiki, including a database of publications and a repository of tasks (each discussed separately below). Another working group developed a taxonomy of IOI topics and activities to tie together the different aspects of the wiki, and to assist with categorization.
- Implementations were done in a prototype wiki at <http://www.bwinf.de/ioi-cooperation>.

2.1. A Suggestion for an IOI Taxonomy

In a MediaWiki, content items are often assigned to categories. Categories are then organized into a hierarchy, and the Semantic MediaWiki extension is able to infer that, if category *A* is a subcategory of category *B*, and a content item is explicitly assigned to category *A*, it also belongs to category *B*. A sound hierarchy of categories therefore is quite useful when retrieving content items.

In one working group of the workshop, a taxonomy of categories for the IOI Wiki was discussed. Three main branches of this taxonomy were suggested (see Fig. 1):

IOI-Item the kinds of objects that content items (i.e., Wiki pages) may describe, e.g., contests, delegations, people, publications, and tasks;

IOI-Content a taxonomy that characterizes the scientific area IOI is related to, which becomes useful for categorizing tasks (amongst other things); the main branches of this sub-taxonomy cover data structures, algorithms, algorithmic strategies, and programming;

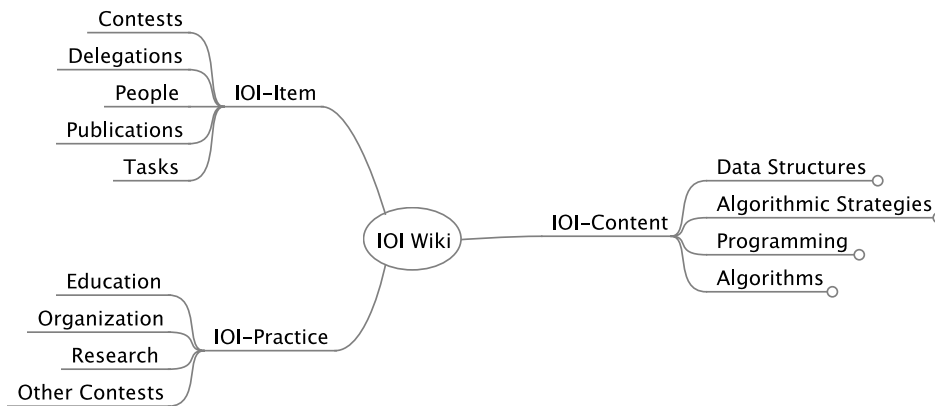


Fig. 1. The main branches of the suggested IOI taxonomy.

IOI-Practice the areas where members of the IOI community are typically active, like education, organization (of contests), research, and other contests (like ACM ICPC etc.); this branch might be used to classify people and publications.

2.2. A Database of Publications

The first archival component developed for the wiki was a database of publications relevant to the IOI. This database aims to help users locate specific publications, and more importantly to expose them to new material that could be beneficial to their own endeavours. Since the workshop this database has been populated with over 80 books, journal articles, conference papers and online articles relevant to the IOI community.

An important outcome of the publications database was to illustrate how MediaWiki and the Semantic extension could be used to develop a rich archive of user-editable data. In effect, this paved the way for the next (and more important) development: a repository of contest tasks.

2.3. A Task Repository

For organizers of IOI-style programming contests, and for IOI team coaches all over the world, good tasks are a most valuable resource. Various members of several IOI bodies (GA, IC, and ISC) together submitted to the workshop the suggestion to develop an international repository of tasks. Such a repository would be a collection of tasks and associated resources (such as test data, translations and solutions), with the following main purposes:

1. To offer a general and usable resource that team leaders can use for training – that is, a large pool of tasks indexed by difficulty, algorithm type and so on.
2. To assist less experienced countries with their own exam setting, by explicitly flagging and quarantining tasks that have not been widely published (and therefore can be considered for use in other exams).

At the workshop, a Semantic MediaWiki template for tasks was developed. According to this template, an item in the task repository would consist of the following parts:

- identification of the task: a unique ID within the repository, information about the source and the previous usage of the task, and license information.
- general information: the task type, the topics involved (with reference to the IOI-Content part of the taxonomy), a very brief description of the task, a brief sketch of the solution, and a difficulty estimate.
- task details: the task statement itself, a solution document, details on limits, and a grader.
- a file archive containing typical task files: statement, test cases, etc. in a specified format.

Fig. 2 shows an example task page in the Wiki. Of course, not all details of a task repository could be defined and implemented at the workshop. Further discussion within the whole IOI community is needed to make this ambitious project succeed.

Architecture

Public task: Architecture

- *Unique ID:* fario07architecture
- *Source:* FARIO 2007, created by Ben Burton
- *Usage:* FARIO 2007, ... (to be implemented)
- *License:* Free to use/modify with acknowledgement (details)

General information

- *Type:* Batch
- *Topic(s):* Dynamic programming
- *Task:* Optimise some property over all polyominoes that satisfy certain constraints
- *Solution:* Dynamic programming with subtle optimisations to meet complexity requirements
- *Difficulty:* Silver, Task 3/4 in a 4-hour contest

Task details

- *Task statement:* Download PDF
- *Solution:* **Document missing!**
- *Limits:* 2 seconds, 32 Mb (3.00GHz Intel Xeon CPU)
- *Evaluator:* Simple diff

Full archive

- Download zip file (Format: Australian judge)

Categories: Tasks | Dynamic programming

Fig. 2. Example task in the task repository.

2.4. *Technical Aspects*

Data in the IOI Wiki are typically stored in a well-structured way, organized by Semantic MediaWiki templates. Fig. 3 displays the edit page for a specific user (top); the editor window contains this user's template code. Below, the resulting user page is shown; the list of papers authored by this user is automatically generated, according to the template.

Most parts of the IOI Wiki are planned to be open to the public. That is, any member of the IOI community shall be allowed to edit most pages of the Wiki. Editing of structured content as seen above can be done pragmatically by copying and modifying code of existing pages. In the IOI Wiki, editing of template-based pages will be made possible via forms; at the workshop, significant steps towards implementing forms into the IOI Wiki were made.

While the majority of IOI Wiki contents shall be publicly accessible and editable, access to the task repository needs to be limited. At the workshop, it was argued that finally two separate wikis should be setup for the IOI community: one public, one private. However, double maintenance of data must be avoided. At the workshop, we investigated techniques to automatically transfer data between two wikis.

2.5. *Further Wiki Content*

In addition to publications and tasks, the IOI Wiki could contain much more material of interest to the IOI community. For instance, the wiki already contains frameworks for a directory of people (including members of the IOI community as well as other people relevant to IOI) and a list of delegations to the IOI. Further content might include a calendar of events, or material for secondary-school-level education in informatics, etc. – suggestions are very welcome.

3. Visualization: Getting People Involved in IOI

Human beings are visual animals, attracted and influenced by what they see. So far, the visual appeal of programming contests, and of IOI in particular, is more than lacking. In brief: IOI is fun for contestants but boring for spectators. At the workshop, we tried to summarize different ways to increase the attraction value of a contest using visualization. Three main aspects were discussed:

1. visualizing the scoreboard;
2. visualizing the output of contestants' programs;
3. visualizing the input or the task itself.

3.1. *Visualizing the Scoreboard*

Ideas from the Thailand Code Jom competition scoreboard (where teams are represented as "bubbles" floating under water) and, in parts, from the Gapminder software (see www.gapminder.org) were combined into a prototype of a new IOI scoreboard.

Editing Mathias Hiron

```

{{Person
|PersonTitle=
|FirstName=Mathias
|LastName=Hiron
|Delegation=France
|IOIRole=Delegation Leader
|Presentation=Mathias Hiron is the president of France-IOI, the organization that is in charge of
selecting and training french students for the IOI.
|Affiliation=France -IOI
|Email=mathias.hiron@gmail.com
}}

```

Mathias Hiron

(Redirected from User:Hiron)

Presentation [edit]

- Name: Mathias Hiron
- Delegation: France
- Role(s) within the IOI: Delegation Leader
- Affiliation: France-IOI
- Email: mathias.hiron@gmail.com

Mathias Hiron is the president of France-IOI, the organization that is in charge of selecting and training french students for the IOI.

Tasks [edit]

Papers [edit]

Title	Author(s)
Creating informatics olympiad tasks: Exploring the black art	Benjamin Burton Mathias Hiron
Teaching algorithmics for informatics olympiads: The French method	Arthur Charguéraud Mathias Hiron

Category: People

Fig. 3. A user page: structured data and automatic content generation.

Fig. 4 is a screenshot of that prototype. The current standings are presented as a 2-dimensional plot of contestants' IDs, where the y-axis represents the current score, and the x-axis can be chosen to represent various parameters – including age, number of submissions, or delegation – thus enabling the scoreboard to show various aspects of the current standings. The audiences can also choose to narrow the scoreboard's display down to the standings of a particular task, country, or contestant that they know. Of course, such a highly visual scoreboard could just provide a display alternative to a standard tabular scoreboard with alphanumeric display of contestants' names and current scores.

Beyond general standings, the scoreboard should also provide access to competition status as well as to background information for each contestant. For that purpose, the individual contestant “bubbles” (or lines in a tabular display) should be linked to user pages. Fig. 5 shows two example user pages, with overall statistical information on the contestant's current standing (left) and task-specific details (right).

3.2. Visualizing the Output of Contestants' Programs

We analyzed previous tasks of IOI and some other contests to see if and how the output of a task could be visualized. With respect to presenting the output of a contestant, a task may fall into one of the following five categories:

Not Suitable It is hard or impossible to present the output using a graphical presentation. This can be the case where output is a single number, or where the data used include very large numbers.

Static Boolean The output is of a static nature. The program has reached a way to solve the task, the answer can be shown, but not the way to get to the answer. There is only one good solution for the task with a specific test case; the contestants answer is either right or wrong.

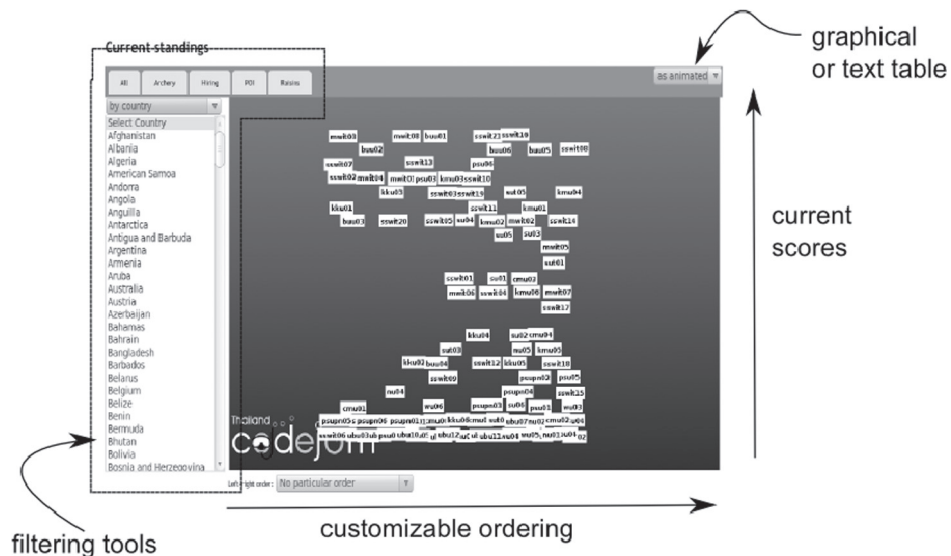


Fig. 4. Prototype of an interactive scoreboard.

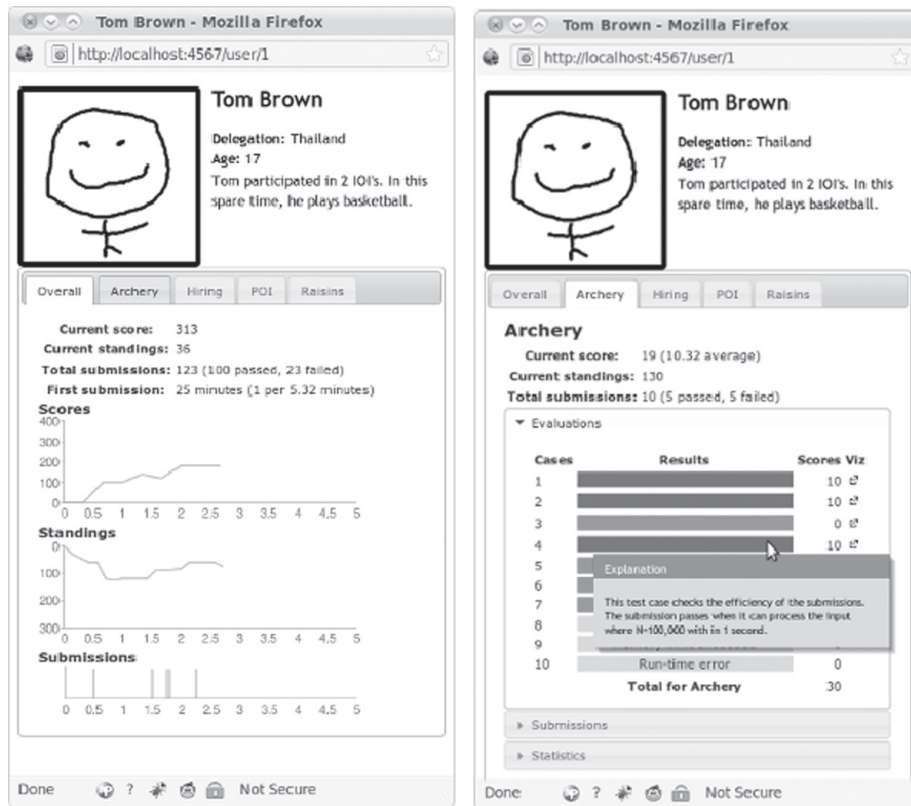


Fig. 5. Example user pages linked to the scoreboard.

Static Fractional The output is of a static nature, but partial credits for suboptimal solutions are allowed.

Dynamic Hidden The output is the result of some intermediate steps. These steps however are not part of the output. In this case it is hard or even impossible to present the output using a graphical presentation.

Dynamic Disclosed When the output gives the answer to the question and the way to reach it, a nice presentation is possible. A spectator can get the chance to browse through a solution and to examine the steps taken by the program.

Another issue concerns the size of the test cases. When the sizes can get very large, maybe only the small test cases can be presented.

Three categories are suitable for visualization right away: Static Boolean, Static Fractional, and Dynamic Disclosed. At the workshop, plentiful examples of all these categories were found among tasks of former IOIs and other IOI-style contests, for instance: Packing Rectangles (IOI 1995, category Static Boolean), Map Labeling (IOI 1997, Static Fractional), and Underground (IOI 1999, Dynamic Disclosed). For further details, see the special report of the visualization group.

3.3. *Visualizing the Input or the Task Itself*

The task description can be and in many tasks has been illustrated by images and diagrams. But additional tools, like a sample program to visualize the action of the intended program or the structure of the data used for the task, can not only help contestants but also clarify the tasks for the audience.

4. Conclusion

At the IOI workshop 2010, we made concrete first steps towards (1) communication and collaboration within the IOI community, and (2) increasing the visual accessibility of the IOI competition. We developed prototypes of an IOI Wiki and a scoreboard visualization tool, and made specific suggestions for visualizing contest tasks and the output from solutions. In doing this, we aim to revitalize the ongoing discussion on how to further proceed to reach our long-term goals. If the outcomes of this workshop can activate and involve many IOI community members and other people in this discussion, the workshop can be considered a success.

Acknowledgements

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The authors at the IOI Workshop 2010 in Schloss Dagstuhl.
 From left to right: Jittat Fakcharoenphol, Bronius Skūpas, Wolfgang Pohl, Valentina Dagienė,
 Benjamin Burton, Mathias Hiron, Michal Forišek, Willem van der Vegt, Mārtiņš Opmanis.

W. Pohl has been responsible for Bundeswettbewerb Informatik, the German national contest in computer science for high school students, since 1999. It is among his duties to take care of Germany's IOI training, selection, and participation; for the IOI, he served as IC member from 2003–2006. In addition, he initiated and now manages the German implementation of the international Bebras contest and started "Einstieg Informatik", a web portal and community for youth interested in computer science.

B.A. Burton directed the Australian IOI training programme from 1999–2008, and currently sits on the IOI Scientific Committee. In 2013 he will chair the Host Scientific Committee for the IOI to be held in Brisbane, Australia. He enjoys working on research projects in geometry and topology that lie at the crossroads of mathematics and computer science, and is supported by the Australian Research Council under the Discovery Projects funding scheme (project DP1094516).

V. Dagienė is head of department at the Institute of Mathematics and Informatics. She has published over 150 scientific papers, written more than 60 textbooks in the field of informatics for secondary education and teacher training. She has been chair of Lithuanian Olympiads in Informatics for many years, organized Baltic Olympiad in Informatics in 1997, 2002, and 2005, and established the International Contest on Informatics and Computer Fluency "Bebras". She is vice chair of the IFIP (International Federation for Information Processing) TC3 Committee on Education, and member of the International Committee on Olympiads in Informatics (2006–2012). She is the editor-in-chief of the international journal "Informatics in Education" (since 2002).

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M. Forišek is a lecturer at Comenius University in Bratislava, Slovakia. In years 2006 to 2012 he is serving as a member of the International Scientific Committee of the IOI, and presently he is the chair of this committee. He is also involved in organizing various other international competitions, notably CEOI 2002, 2010 and the annual Internet Problem Solving Contest.

M. Hiron is the president of France-IOI, the organization that is in charge of selecting and training French students for the IOI.

M. Opmanis is researcher at the Institute of Mathematics and Computer Science of University of Latvia. He has been team leader of Latvian team at all IOIs since 1996 and at many Baltic OIs since 1995. He headed the jury of the Baltic Olympiad in Informatics in 1996, 1999, and 2004. His main interest is in preparation of good tasks for various competitions in informatics and mathematics.

B. Skūpas is a PhD student in the Institute of Mathematics and Informatics, which is taking care of finding and training gifted students in mathematics and informatics. Also, he is teacher at Vilnius Lyceum. He is interested in automatic grading systems.

W. van der Vegt is teacher trainer for mathematics and computer science at Windesheim University for Applied Sciences in Zwolle, the Netherlands. He is contest director for the first rounds of the Dutch Olympiad in Informatics and joined IOI in 1992.