

Kahu and Olympeia: Ideas for Educating Computer Science to High-School Students

Ali BABAEI¹, Hamid ZARRABI-ZADEH¹, Ali SHARIFI-ZARCHI^{1,2}

¹Sharif University of Technology, Iran

²Royan Institute of Stem Cell Biology & Technology, Iran

email: ababaei@ce.sharif.ir; zarrabi@sharif.ir; asharifi@sharif.ir

1. Introduction

There is an unbalanced geographic distribution of IOI medal winners in the world. There are geographic regions and countries with tens of gold, silver, and bronze medals, while some other regions have lower success rates (Fig. 1).

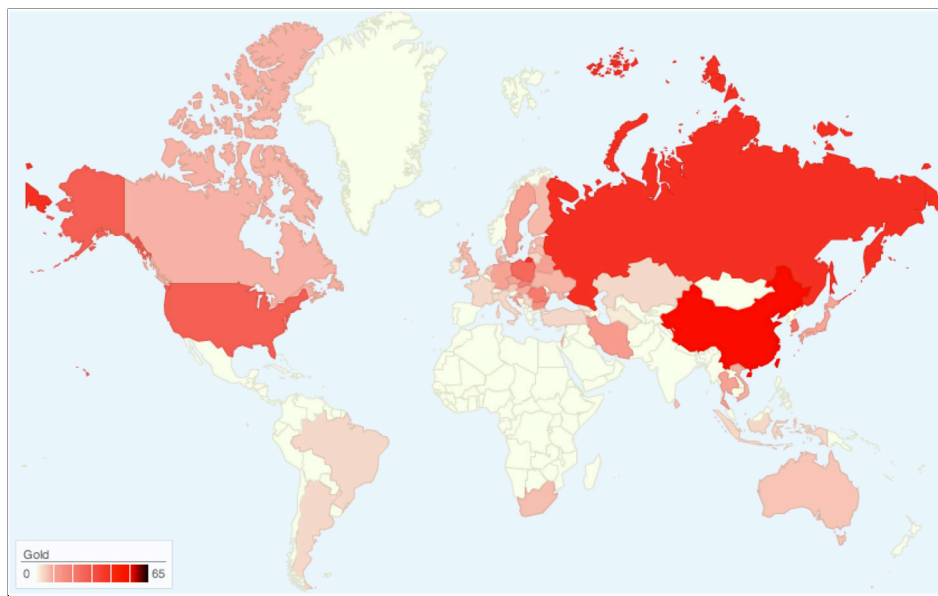


Fig. 1. Geographic distribution of IOI gold medals by 2014.
Statistics are provided by Mārtiņš Opmanis.

Even in a single country, there might be some cities – such as capitals – in which a majority of medal winners of that country are raised, whereas some other cities have not achieved good ranks in the national computer science competitions (Fig. 2). Similarly, the development of computer science in research, education, industry and its effects in human life is biased towards certain geographic regions in the world or perhaps certain cities in a country. Many parameters are involved, namely unequal distribution of human population, different economic states and industrial levels. But a very important parameter is the quality of computer science education among high school and university students. There are cities with many experienced teachers, training camps, computer sites, libraries with related books, etc., while other cities might have lower access to these resources.

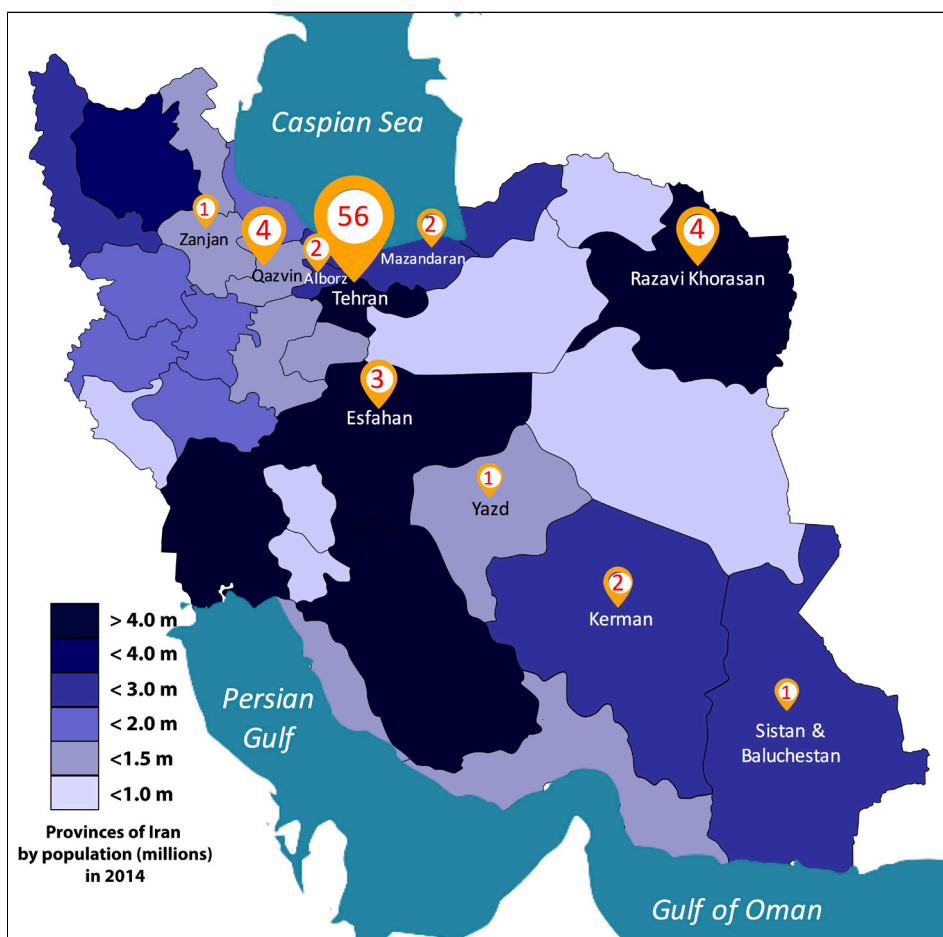


Fig. 2. Geographic distribution of Iranian students who passed Round 2 selection exam of National Informatics Olympiad.

In the scientific committee of the National Iranian Olympiad in Informatics (INOI) we aimed since several years ago to reduce the gap between students of different Iranian cities in their access to the useful material. There were several programs including publishing paper magazines for scientific Olympiads and sending teachers, mainly previous IOI or INOI medal winners, to the cities far from the capital. But these programs were effective for limited audience.

In the recent years we started several programs to provide useful material online. We found these programs effective for the broader range of audience, at any time, in any city.

2. Kahu

Kahu is the first social network of computer science, INOI and IOI-style problems in Persian language. The word “Kahu” – Persian translation of “lettuce” – was selected after a famous sheep character in the children TV series who loved to eat lettuce. It was developed voluntarily by two students, Ali Babaei – an IOI double gold medalist – and Javad Abedi – an INOI medalist. The central idea of Kahu is very similar to StackOverflow.com or other StackExchange-style websites: each user can ask or answer questions. The related topics of each question are tagged by the user who post the question. The question tags can be also edited by Kahu admins.

Both questions and answers can receive up- and down-votes, which will change the “credit score” of the user who has posted it. Based on outstanding activity, such as asking a popular question (that is visited many times) or posting an answer that is up voted many times, users can receive multiple bronze, silver or gold medals. Our experience shows the badges and credit score can boost the activity of a group of users.

Kahu used StackOverflow.com style platform, because it enables students to answer themselves questions, which eliminates need of active teachers to respond questions. It was launched in 2014 and since then about 1000 users registered on the platform and posted 1900 questions, 2500 answers and 17000 comments. Traffic spikes around First-Round and Second-Round INOI exams. These rounds of exams are mostly theoretical and students usually ask for the answers of questions in previous and current year exams.

Based on our experience there are different groups of users that visit Kahu website. Some users are high-school students who are actively learning informatics Olympiad and want to take part in INOI. There are a few professional teachers of informatics Olympiad who also actively post questions and answer the questions of other users. These two groups of users are active on Kahu for different motivations. There are also other users who visit Kahu without posting new questions or answers on it.

While learning new questions and the way to solve them is the main motivation for the contestants, the teachers are mostly active because they think it is a constructive way to spend time online, to help others or perhaps to advertise themselves. But we think the credit scores, medals and other badges that are presented to active users are also a very important motivation for many users. Although badges and credit scores have been very effective, there have been also some side-effects, such as serial voting or register-



Fig. 3. The main page of Kahu.



Fig. 4. A posted question and its answers on Kahu.

ing multiple users by the same person who vote the same posts, in order to influence the credit of the same or other people.

Another challenge was to train users select good titles for questions they post. Titles are very helpful for users to visit interesting questions or while looking for a particular question. Many users preferred to select a short title for their questions. Even setting a minimum length for the title was not a perfect solution, since some users padded titles with some characters such as “!” or “?”. More effective strategies were to advertise selecting good question title as a culture of using Kahu, actively editing titles by admins, and posting constructive comments by senior users to ask better title for the questions posted by new users. Hence active administration of websites like Kahu by senior users or teachers is very important.

3. Olympedia

Olympedia is the first online encyclopedia of computer science topics in Persian language (Fig. 5). The name is selected by combining Olympiad with Encyclopedia. It is mainly developed by Hamid Zarrabi-Zadeh, a member of the INOI scientific committee and the chair of the host technical committee of IOI 2017. It works on a wiki platform,

The screenshot shows the homepage of the Olympedia website. At the top, there is a search bar and the site's logo, which includes the text 'المپدیا' and 'دانش‌نامه‌ی المپیاد کامپیوتر ایران'. Below the header, there are several navigation buttons and sections:

- خوش آمدید!** (Welcome!)
- Archive of problems** (سؤالات المپیاد): A list of competition stages including 'مرحله‌ی اول', 'مرحله‌ی دوم', 'مرحله‌ی سوم (برنامه‌نویسی)', 'دوره‌ی تابستان', 'دوره‌ی انتخاب تیم', and 'بایگانی آزمون‌ها'.
- Education of Olympiad** (درباره‌ی المپیاد): A list of topics including 'دوره‌های المپیاد', 'نتایج ایران در مسابقات جهانی', 'اعضای کمیته‌ی ملی', 'همکاران کمیته‌ی ملی', 'دانش‌پژوهان', and 'سایت‌های مفید'.
- آموزش المپیاد** (پایوندها): A list of educational resources including 'ترکیبیات', 'گراف', 'الگوریتم', 'برنامه‌نویسی', 'الگوریتم‌های تکمیلی', and 'آماده‌سازی برای المپیاد'.
- About Iran informatics Olympiad** (پیوندها): A list of external links including 'خبرگاہ المپیاد کامپیوتر ایران', 'کاهو، سایت پرسش و پاسخ المپیاد کامپیوتر', 'باشگاه دانش‌پژوهان جوان ایران', and 'المپیاد جهانی کامپیوتر ۲۰۱۷ در ایران (IOI 2017)'.
- External links** (پیوندها): A list of external links including 'خبرگاہ المپیاد کامپیوتر ایران', 'کاهو، سایت پرسش و پاسخ المپیاد کامپیوتر', 'باشگاه دانش‌پژوهان جوان ایران', and 'المپیاد جهانی کامپیوتر ۲۰۱۷ در ایران (IOI 2017)'.

Fig. 5. Snapshot of Olympedia website (www.opedia.ir).

and is targeted for educating high-school students. The contents of Olympeida are freely accessible to read, but editing them and adding new pages are restricted for the members of INOI scientific committee and the teachers of Olympiad.

This website contains a brief introduction to the essential concepts of discrete mathematics and computer science, including graph theory, combinatorics, mathematical reasoning techniques, data structures, and algorithms. It also provides access to a unique resource of theory and practical tasks that have been used during 26 years of the INOI. Table 1 shows the contents of Olympedia.

Olympedia is based on the dokuwiki open-source platform, equipped with several new features essential for the educational nature of the project. A key feature of Olympedia is its enhanced markup language that facilitates embedding special contents such as solutions to the samples and problems presented in the text. There is also an option for

Table 1
Contents of Olympedia website (olypedia.ir) and the structure
of the national Olympiad in informatics in Iran

Topics	Sections	Subsections and additional information
Learning Informatics Olympiad	Combinatorics	Counting, Permutations, Inclusion-exclusion principle, Proof techniques, etc.
	Graph theory	Graphs, Trees, Connectivity, Directed graphs, Eulerian tours, etc.
	Algorithms	Sorting, Simple data structures, Recursive algorithms, Divide & Conquer, Dynamic programming, etc.
	Programming	Variables, Control statements, Loops, Arrays, Functions, STL, etc.
	Advanced algorithms	Fenwick tree, Interval tree, Segment tree, Big numbers, Maximum flow, etc.
	Getting ready for the Olympiad in informatics	Good strategies for solving tasks of each round, writing correct proofs, etc.
About Informatics Olympiad	Different rounds of the contest	General info about the structure of each round of the INOI
	Results of Iran team in the IOI	Medal winners and leaders of Iran team in previous IOI's
	Members of the National committee	List of 17 current and 38 past members of INOI National Committee
	Assistants of the National committee	List of students who assisted the INOI National Committee over past 15 years
	Contestants	List of INOI medal winners during past 25 years
	Useful websites	Links to Persian and international programming contests
Tasks of former Olympiads	Round 1	Multiple-choice exam with ~ 30 combinatorial questions
	Round 2	2 days: ~ 25 multiple-choice questions + 4 theoretical (algorithms, theorem proof) tasks
	Round 3 (Programming)	2 days IOI-style simple programming contest
	Summer camp	Almost 8 weeks of courses & exams in combinatorics, graph, algorithms and programming
	Team selection camp	Winter course to select four IOI team members among eight INOI gold medalists
	Contests archive	The archive of tasks from past 27 years of INOI

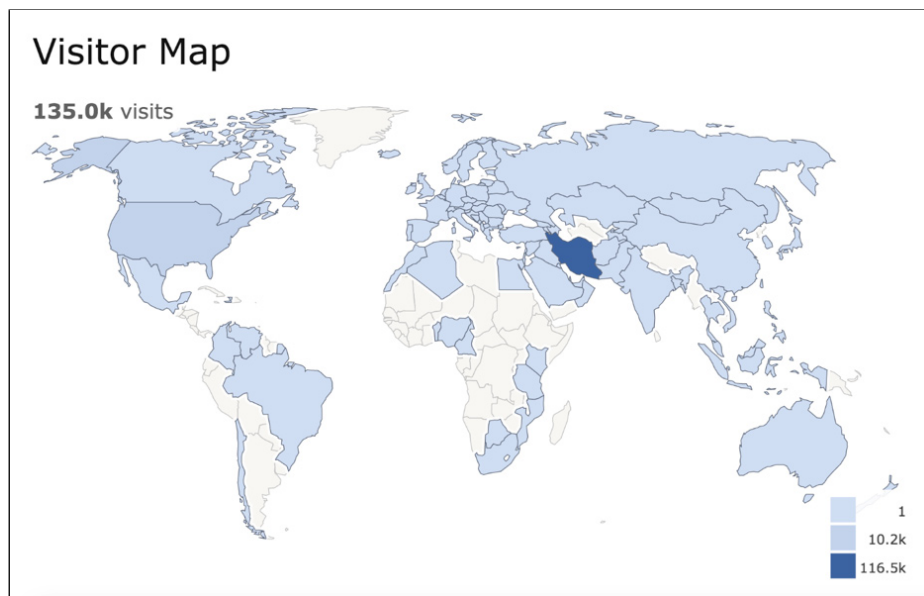


Fig. 6. Geographic distribution of the Olympedia visits over the past year (June 2016 – June 2017).

providing “hints” to the students, before displaying the complete solution. There is also a judging system embedded into the system, which provides a handy tool for presenting programming tasks in Olympedia. In particular, students can send their programs to be judged against the stored data sets, or simply send the result of their programs in the output-only model.

Since its launch in 2014, Olympedia has served a large group of students. Just over the past year, Olympedia has been visited more than 130,000 times. The distribution of the visits is illustrated in Fig. 6.

4. Conclusions and Future Work

Here we presented two platforms of online, free and public education of computer science and informatics Olympiad topics and problems to Persian-speaking students: Kahu and Olympedia. Kahu is open for all students to post new questions and answer the questions of other users. But the pages of Olympedia, as a reference, are created by trusted teachers, medal winners and members of INOI scientific committee. We also aim to use novel ways to educate highschool students. An effective way is to teach simple topics of computer science, capture videos and publish them online and free. For this purpose, the INOI scientific committee has asked some websites who offer vide captured online courses to prepare proposal for contents. We hope these resources, along with public contests such as Bebras, will help to educate more students.



A. Babaei is an IOI double gold medalist. He is a Sharif graduate and co-founder and CEO of Torob, biggest shopping search engine for Iranian online stores in terms of data and user. Together with Javad Abedi he launched Kahu as his capstone project.



H. Zarrabi-Zadeh is a faculty of computer engineering at Sharif University of Technology. He has been a member of the International Scientific Committee (ISC) from 2014 to 2015, and a member of the International Technical Committee (ITC) since 2015. He is the chair of the IOI 2017 Host Technical Committee (HTC). He is also director of the ACM/ICPC in the west Asia region (Tehran site).



A. Sharifi-Zarchi is an IOI gold medalist. Sharif and Tehran University graduate. Faculty at Sharif University of Technology and a researcher in Royan Institute of Stem Cell Biology & Technology. He is the chair of IOI 2017 Host Scientific Committee (HSC).