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Kyrgyzstan National Report on Olympiads in Informatics

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1. Education and Initiation of Olympiads in Informatics in Kyrgyzstan

Informatics (under the traditional name "Foundations of Informatics and Computer Facilities") is taught in all secondary schools of Kyrgyzstan since the autumn of 1985. Firstly it was taught on a blackboard with calculators; pupils sometimes visited local computer centers. Later, more schools obtained computer rooms, now almost all schools have computer labs, some of them linked up with the internet.

By the State Educational Standard, now Informatics is obligatory subject in 7th (1 hour per week), 8th and 9th (2 hours per week) grades. The decision to teach or not to teach Informatics in older (10th and 11th) grades is granted to the schools themselves; many choose to set the subject as a part of the compulsory curriculum. Recently a new curriculum has been created for both primary and secondary school, from 1st till 11th grade.

The Olympiads in Bishkek city, the capital of Kyrgyzstan, are conducted since 1985, annually; National ones are conducted from 1987. From the beginning, they are led under the conduct of the corresponding Educational State Institutions. Besides Informatics the National Olympiad is conducted among other subjects (for instance Kyrgyz language and literature, Mathematics, Sociology) by the Ministry of Education and Science. Kyrgyzstan teams participate in IOIs since 2000.

2. Organization and Participants

B.1 *Structure*

The Olympiad is arranged in four levels: I (in each school; November); II (district or area; January); III (city or region; February), IV (National; March) and Selection competition for IOI (April). Then, for the two last levels the contestants are divided into two groups:

the first one includes 10th grade pupils (maximum age 16 years) and the second one does 11th grade pupils (17 years). Olympiads of the III and IV levels are conducted in two days; three tasks and 2.5 hours per each day. Selection competition as the final of Spring school (without division to groups) for IOI is conducted in one day: five tasks and 4 hours.

B.2. *Participation and Funding*

All pupils beginning from 8th grade have the right to participate in the I level. Winners of the II level of 8th and 9th grades who have achieved excellent results may be allowed to the first group of the III level together with winners of 10th grade.

Each of the seven regions of the country, the capital Bishkek and Osh city ("the southern capital") send 2 pupils in each group of the IV level. So, 19–20 pupils (including winners of the preceding year) participate in the first group and 17–18 pupils do in the second one. The teams are sent to the competition by the regional Departments of Education, the Ministry is responsible for the temporary residence and catering arrangements (at the National Computer Gymnasium in Bishkek).

Because of essential differences between the traditional content of IOI and ones of our Olympiads (see Section C below), Spring schools with the final competitions for the IOI are conducted for the winners (6–8 of the first group and 3–4 of the second one) of the IV level Olympiad. They are funded by the Bishkek Kyrgyz–Turkish Men's Lyceum.

B.3. *Prizes and Other Preferences of Participants*

Winners of City Olympiads (the III level) are given prizes by the city Mayor's office and by the sponsors; winners of National Olympiads (the IV level) are given prizes from the Ministry of Education and by the sponsors including the daily newspaper "Vecherniy (Evening) Bishkek" and company "Logic". The Kyrgyz–Russian Slavic University (KRSU) conducts annually the competition for winners of the second group of National Olympiads and accepts some of them free of charge; other universities in Kyrgyzstan also give discounts to winners.

Some universities including the International University of Kyrgyzstan grant computer classes for conducting the III level of the Olympiad.

B.4. *Training*

Pupils who wish to participate in selection for the forthcoming IOI, during the year practice solving tasks of the preceding IOIs. They also participate in Croatian Open Competitions in Informatics. Some of them go to the Zhautykov Olympiad conducted annually in Kazakhstan.

3. Preparation and Evaluation of the Tasks

C.1. *Preparation and Examples of Tasks*

The different types of tasks and ways to develop them are described in Pankov *et al.* (2000, 2003, 2007, 2008, 2009, 2010). The CPU time is restricted to 5 seconds. A few examples of categories and tasks are listed below.

Tasks with implicit presentation of graphs, for example:

Task 1. Given two numbers P and Q in $(100 \ldots 999)$. In one step any digit can be changed to a neighbor one or the number as whole can be changed to a neighbor one. How many steps are necessary to transform P into Q?

Example: 929, 830 $\rightarrow 2[929 - 829 - 830]$.

Common combinatory tasks, for example:

Task 2. Given natural number $2 \leqslant N \leqslant 2010$, how many essentially different pairs of A) rectangles composed of N equal squares or B) parallelepipeds composed of N equal cubes exist? (Permutations in pairs, rotation and reflection do not yield new pairs).

Example A): $N = 5 \rightarrow 3$ (pairs) $[4 \times 1 + 1 \times 1;\ 2 \times 2 + 1 \times 1;\ 3 \times 1 + 2 \times 1]$.

Acceleration of some algorithms, for example:

Task 3. Given the following algorithm [written in any semi-formal language]:

{ *output* ("Enter a natural number $N,\ 1 <= N <= 2009$"); *input* (N); $W := 2009$;
for $I = N$ *to* 2009 { *for* $J = 0$ *to* 2009 { *for* $K = 0$ *to* 2009
{*if* $I * (I + J) * (I + J + K) = 2009$ *then* $W := W - 1$ } } }; *output* (W); }.

Write a program calculating same results in the CPU time 5 seconds.

Tasks with simple solutions but which demand labor expenditures, for example:

Task 4. Speed of a car is 60 kmph; an airplane takes one hour to fly from Bishkek to Osh. Karakol $= K$ – (220 km) – Balykchy = Ba – (170 km) – Bishkek = B – (60 km) – Karabalta = Kb – (140 km) – Suusamyr-Cross = SC – (380 km) – Jalal-Abad = J – (50 km) – Osh = O – (200 km) – Batken = Bt; SC – (100 km) – Talas = T; Ba – (200 km) – Naryn = N.

Output the minimum time necessary to deliver a copy of the newspaper "Vecherniy [Evening] Bishkek" [sponsor] to a given point on the roads (defined by the notation of each of the road segments and the distance to the first end of the segment).

Example: Kb, 8, SC $\rightarrow$ 1 hour 8 minutes.

"Black box", for example:

A program is given as an exe-file (a contestant may run it as many times as s\he wishes). Write a program equivalent to the given one [which is sufficiently simple, does not contain large numbers and complex algebraic expressions]

Task 5. The program was the following: {$output$ ("Enter a natural number $N <= 10000$"); *input* (N);

if $N <= 2011$ *then output* $((N-1)\mathrm{div}\,3+1)$ else *output ("Too many")*}.

Graphical tasks, for example:

Task 6. Given [by jury] two arbitrary points between 40% and 60% of the height and 10% and 90% of the width of the display. Arrange the letters LOGIC [name of sponsor] containing the given points (marked with another color) symmetrically on the display.

Video-clips and controlled video-clips, for example:

Task 7. [Tyundyuk is the upper part of a yurt; its image is on the national flag of Kyrgyzstan]. The shadow of tyundyuk consists of the circle of radius 100 cm and two groups of three lines of parallel to each other (16 segments) within the circle; the distance between two nearby segments is 10 cm. A) Show this shadow on scale 1:10. B) Not to be seen by the Tiger [then was a year of Tiger], the Ant (a point, a pixel) must crawl within the shadow only. Given a point within the shadow, show a way or a slow motion simulation from this point till the center.

Some tasks of our Olympiads demand wide knowledge field in other subjects, such as physics, chemistry, geography, philology. Tasks like Tasks 3, 4, 5, 6, 7 are not used in training and selection to IOIs.

Tasks for the III and IV levels are created by the chairman and the deputy chairman of the jury of the Olympiad in two languages (the state one and the official one in Kyrgyzstan). Tasks for the III level with scopes of tests are brought in sealed envelopes by the representatives of the Ministry to all regions. Tasks for the Spring School and the Selection competition are created by the leader of it in English.

C.2. *Evaluation of Tasks*

During the period, the contestants verify their solutions by their own tests. After the time allowed, the contestants leave their computers and the jury begins check-up with inputting tests by hand in the contestant's presence. Variations in formats of input data (due to used algorithmic languages and to the contestant's will in graphical tasks) are permitted but none corrections are permitted.

Tasks such as Tasks 1, 2, 3, 4, 5 are graded by the standard method, i.e., by a range of 4..6 tests in increasing order of difficulty, with a condition: if the program responds "Impossible" (or alike) in all tests then it gets 0. Informal tasks such as Tasks 6, 7 are also graded by a range of 2..4 tests, and the marker may deduce points if some of the conditions are breached. There is sum total of 10 points for all of the tasks. The score for the III and IV level totals up to 60 points.

4. Informatics Curriculum

We have developed the following curriculum on "Information Communication and Technology" for secondary school (the project is funded by Asian Development Bank and Government of the Kyrgyz Republic).

Fifth year of education: information, its types and properties; the use of information processes in daily life, society and individual's activity; main features of a computer; computer technology in society; primary computer use in problem-solving; primary knowledge on software configuration and operating system and their use; models, their types and use in daily life.

Sixth year of education: information sources and their application; main and peripheral hardware and its use; treatment of constituents of standard software: graphical editors, music player, calculator; developing and investigating simple information models by computer means.

Seventh year of education: character systems as carriers of information, controlling systems using information processes; principles of computer program management; using utilities for customizing operating systems; files, directories, carriers of information treatment; application package Microsoft Office; electronic documents in text editors; objects and tables in text editors; main means of information-mathematical process modeling and real environmental objects; the algorithm concept; writing down a simple algorithm and implementing algorithm behavior algorithms in urgent situations.

Eighth year of education: types of controlling systems; cybernetics and cybernetic systems; digital systems of coding and their use; presentation of information and solving mathematical problems; operating systems: MS DOS, MS Windows-X, Linux, Macintosh; developing structures and designing multimedia projects; information saving, search and sorting; knowledge of types of algorithms, algorithmic presentation of functions; means and stages of developing computer programs; software life-cycle.

Ninth year of education: syntax, operators, procedures and functions of programming languages; developing programs to solve graphical and mathematical problems; concept about the structure of computer networks; use of the local and world-wide network resources; organizing collective work by using Internet.

Tenth year of education: developing and investigating simple information models by technological means; algorithm development and their execution; solving logical tasks; debugging and program testing in one of programming languages.

Eleventh year of education: solving logical, mathematical, scientific and economic problems; cellular communications, mobile telephones, smart phones; collective work with the use of GPS and WAP services; knowledge about syntax, tags, frames, forms and hyperlinks of Web-programming languages; developing information sites by the means of hypertext markup in documents; concepts of ethic and legal norms of human's information activity and information security.

5. Future Development

We hope that Informatics ("Information Communication and Technology") will be included into the State Educational Standard as an obligatory subject in 10th and 11th grades too. Programming skills would improve and number of schoolchildren participating in the I and II levels of the Olympiad would increase. We will have an opportunity to offer more difficult tasks at the III level and tasks of IOI types at the IV level.

Each year in the autumn the KRSU conducts the Kyrgyzstan quarterfinal of the International Collegiate Programming Contest administered by the Association for Computing Machinery by the means of Internet. The winners participate in semifinals. Also, the KRSU supports permanent competition site on solving tasks. Some universities conduct their own Olympiads and other kinds of competitions in Informatics (irregularly) for their students and for schoolchildren to attract undergraduates.

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