Teaching aids for advanced mathematics

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For Latvian students the way to International Mathematics olympiad leads through a School level olympiad, a Regional olympiad, a State olympiad and an additional competition for those who has achieved the best results in State olympiad. Only then 6 students are chosen to represent Latvia in the International olympiad. State olympiad is intended for 9th to 12th Grade students and only those students who have achieved high results in the Regional olympiad can participate in this olympiad. Thus already for 37 years the Open olympiad has been giving every student a chance to participate in the Latvian State level olympiad. This olympiad is intented for 5th to 12th grade students but every year there are also participants from primary school who deal with problems for 5th graders.

Despite the fact that every year there are more than 20 000 students participating in these olympiads and there are students who gain almost the maximum score there are always complaints about the complexity of given problems. Teachers usually complain about the methods that are required to solve the problems because they are different from those that are in school curricula. Teachers often say that they can't prepare students for olympiads because the problems are difficult and there is no teaching aid that can help them.

For almost 40 years A.Liepas Correspondence Mathematics School (CMS) has been organizing mathematic olympiads in Latvia. In 1997 CMS and Icelander Johanneson Benedikt formed a project of Latvian and Icelandic mathematical education (LAIMA). Now there are more than 40 teaching aids that have been published in this project. Teaching aids are based on the themes and problems that are often included in mathematic olympiads and are with different levels of complexity. Thus they are a good preparation material both for teachers and students. There are three groups of teaching aids that are devoted to:

- one mathematical theme or method;
- problems of mathematics olympiads and contests in one school year;
- problems of one mathematical olympiad or contest in some period.

In the first group there are teaching aids about mathematical proof, searching and sorting method, Dirichlet principle, method of invariants, vectors and others. Themes and methods for the teaching aid are chosen on the basis of research in the area of advanced mathematics. These teaching aids are available to math teachers and are useful in the preparation process to the mathematics olympiad. The teaching aids of this group will be considered more closely in the report.

In every teaching aid of the second and third group that is published in the LAIMA project there is a distribution of problems at the end of the book. Problems are divided into five parts: algebra, geometry, number theory, combinatorics and algorithmics. In each of these parts there is also reference of a topic or method that could be used to solve each problem. Owing to this division, these books are not only a collection of problems and solutions, but also a teaching aid that can be used in lessons of mathematics and in hobby groups as well. It is easier for teachers to find examples of required branches, topics or methods. They can prepare students for the mathematics olympiads more easily and successfully. Students can use these teaching aids as well. In many books there are three separate parts. Two of them are "Problems" and "Solutions". The third one is "Advices" where guidelines are given on how to solve each of the problems. It will be further discussed in the report.