

# Constructive tasks in distance Olympiads

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**Abstract.** Constructive problems appear in every branch of mathematics. Constructive tasks are very important as they give us the direct way of stimulation of productive activity. This work is devoted to the position of constructive tasks in distance Olympiads on mathematics and informatics. Also the tasks of this kind could be used for monitoring of students activity inside the learning process.

## 1. Constructive tasks

There are some general types of constructive tasks in mathematics. First of all there are explicit constructive tasks where the formulation of the task directly suggests to build a certain construction.

Also the constructive task could hide behind the words “Does it exist...”. The tasks of this type look more interesting but there is a rather big room for disappointment of schoolchildren losing hours for attempts to prove the negative answer instead of creating an example for the positive answer which sometimes could be very simple.

Also there are “estimate plus example” tasks which require not only building the construction which is optimal for a certain parameter, but a proof of its optimality as well.

Building a construction is a productive activity. It could be more interesting for students than submitting numbers in formulas and more developing for them as well.

## 2. Constructive tasks in Olympiads

In the modern circumstances many Olympiads transformed some of their stages into the distant form. Within this form the organizers face the choice how the participants should submit their solutions. The most common and the most simple way is to let the students just submit the answers. Unfortunately, sometimes it

is easy to guess the correct answer without doing all the necessary mental work needed to solve the task completely.

The second possible way is to have the full solution texts required. The minuses of this way are the low typewriting speed of some participants and troubles with submitting plots and figures.

Another possible way, which allows us to avoid a roulette from the one hand, and doesn't force the participants to type huge amount of text from another hand is using of constructive tasks. Of course, for each task or a type of task we have to develop a framework, which we call a "manipulator" and it requires some more activity than just checking a number answer, but it is the price for making the Olympiad more interesting and its results more representative. From the other hand, constructive task solutions can be verified automatically which helps us to reduce a human work comparing with the second way.

### **3. Constructive tasks within the framework of Olympiad in Discrete Mathematics and Theoretical Informatics**

Within the framework of Olympiad in Discrete Mathematics and Theoretical Informatics we generally use six types of constructive tasks. Each of them is supported by its own manipulator.

We have logical schemes, Turing machines, finite state machines, regular expressions and graph manipulators and also the "Tarski World" manipulator which supports predicata calculus tasks.

For example, graph task may be formulated as "Find the minimal graph satisfying the certain conditions". Correctness of the constructed graph is verified automatically. The student can gain additional points for proving the minimality in the text form.

### **4. Using constructive tasks for non-invasive monitoring**

While teaching students in the University you often ask yourself a question "how can i fairly access the students knowledges and undestanding". Exam is the necessary but not the best way just because in the stress situation some students show more than they can, and some other very much less. We may say that sometimes we check not the level of knowledge, but the ability to pass en exam.

This is the reason why we should develop non-invasive tools of assessment the students activity. Non-invasive means that while introducing this tools we don't force the students to prepare to pass the certain tests instead of learning the course as a whole.

This goal can be reached if we do not include our tools in the final assessment. So the only motivation for the student to solve those additional tasks would be the ability to check oneself and to improve ones knowledge.

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## References

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