

50% rule should be changed. [Draft]

Bogdan Yakovenko
Warsaw University

1 Introduction

Last two year we have new rule implemented at IOI competition. Unfortunately, lots of problems have come with it and participants as well as IOI-related people aren't happy with rule. This document is attempting to analyze 50% rule and to introduce new rule that could be implemented instead of one.

2 Principles

50% rule claims that correct-but-inefficient program can obtain 50% of the full score. In addition, it is stated that the other 50% of score is designed to recognize effectiveness of participant's solution, so that correct-but-inefficient-with-optimization program can get more than 50%.

The motivation of adding this rule was that the credit for correct-but-inefficient programs is too small and therefore average contestant gets very low overall score.

3 Problems

Last two IOIs I've heard from participants that they were not satisfied with a new rule and thought that the rule isn't fair for them. It's interesting to know why the rule that add more point for average participant is bad. After speaking with participants and making some analysis I've found problems that caused this:

1. First of all, participants, who write *ineffective* solutions, have time to think about optimizations and successively implement them therefore *correct-but-ineffective* solutions get more than 50% score. Essentially, 50% rule was designed to grade *ineffective* solutions that come in mind after understanding problem's model, therefore getting 50% of score isn't required any (even evident) optimizations. So that participants, who add simple and evident optimizations to their *ineffective* solutions, can get 60-70% of score. If clever optimizations are added, participant can get 80-90% of score for the solution or even 100%. Therefore it's clear that average participant who code *correct-but-ineffective* solution gets more than 50%, that is more than it was designed. The problem is that usually, *ineffective* approach + optimizations is much more simple to design and implement than *effective* one. In this case we have unfair score distribution - participant who wrote *optimal* solution gets more point than one who wrote *ineffective*, but score difference isn't enough.
2. Another problem comes directly from the previous one. Coding *ineffective* solution is faster and simpler than *effective* one therefore bugs probability decrease. It's clear that having 3 *ineffective* solutions is always better than having only 1 but *optimal*. Sometimes 3 *ineffective* solutions ($70+70+70 = 210$ pts.) can be better than 2 *optimal* ($100+100 = 200$ pts.). Coming to conclusion, 50% rule encourages participants to code *ineffective* + optimization solutions.
3. The third problem is about confusing. Rule can confuse participants. If they write *ineffective* solutions, it's only clear that if solution is correct then the score will be $\geq 50\%$, but there are no possibilities for participant to determine score more precisely. That means if two Scientific Committee's members independently make two test case system the score for this program can be significantly different.

4 New rule proposal

My proposal is to modify 50% rule, making it more appropriate and fair for participants. The following statements are an example of such rule. Of course, it should be developed and discussed and then implemented to the future IOIs.

1. First, we need to reduce score percentage for *ineffective* solutions from 50% to 30-35%. In addition, test cases should be designed with understanding that *ineffective* solution must implement all evident optimizations.
2. Second, to make participant score more predicable, 30-35% upper rule should be added. That means that 30-35% of test cases will be designed for *effective* solution only. There will be huge test cases that *ineffective* programs get "time limit exceeded" on them.

5 Rule advantages

Reducing score for *ineffective* solutions encourage participant to write *effective* programs, but they can still receive enough points for *ineffective* solutions. Ineffective solutions with optimizations still can get a good score, but not 80-90% as it is with 50% rule. Adding upper rule will help participants to understand which score they will receive when choosing some approach and now it's guaranteed that *effective* solution gets at least 30% more score than *ineffective* +optimization solution.

6 Summary

There were discussed 50% rule problems and possible solution for them. I hope this document explain enough to understand necessity of changing 50% rule to more appropriate one.