

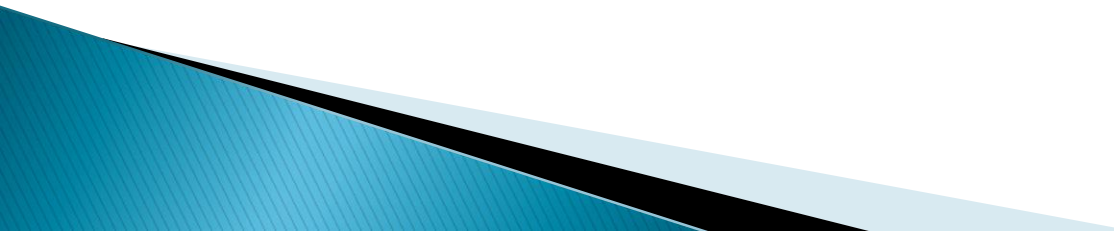


Theoretical tasks

At the Dutch Olympiade in Informatics

Willem van der Vegt

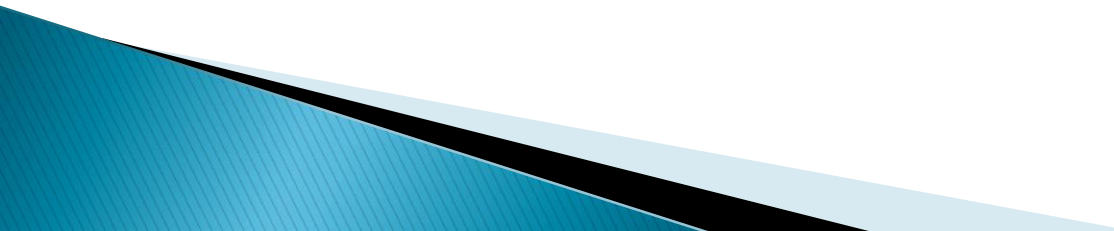
What do we aim in an IOI?

- ▶ Solving algorithmic problems
 - ▶ Testing the reasoning or the implementation?
 - ▶ Different kind of skills:
 - ▶ Analyzing algorithms
 - ▶ Writing efficient code
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NIO 2nd round

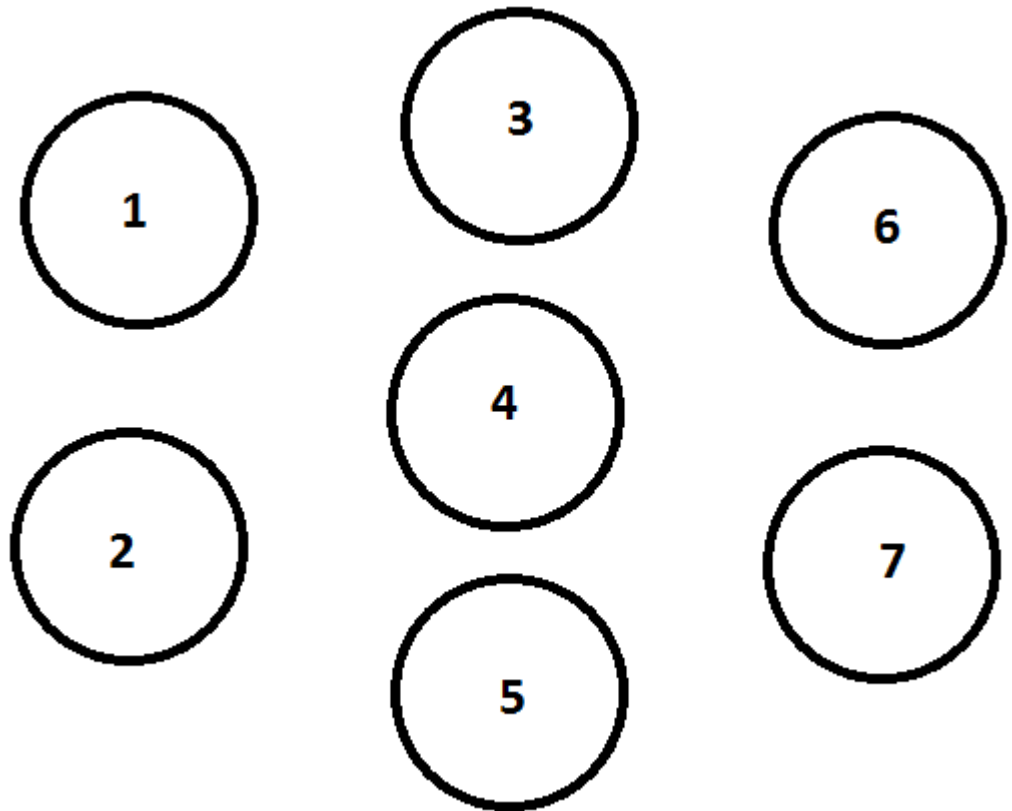
- ▶ Very selective
 - Every serious participant is admitted
 - Only the best will qualify for the 3rd round
- ▶ Using subtasks
- ▶ Three hours, 2 problems, 14 subtasks
- ▶ 400 points maximum,
50 for the theoretical subtasks

Why these theoretical subtasks?

- ▶ Usually we do blackbox testing
 - ▶ But we want to test design and implementation
 - ▶ We want to reward good thinking about a problem, even if programming a solution fails
 - ▶ So we start one step earlier, with a question you can not solve when you don't understand the problem
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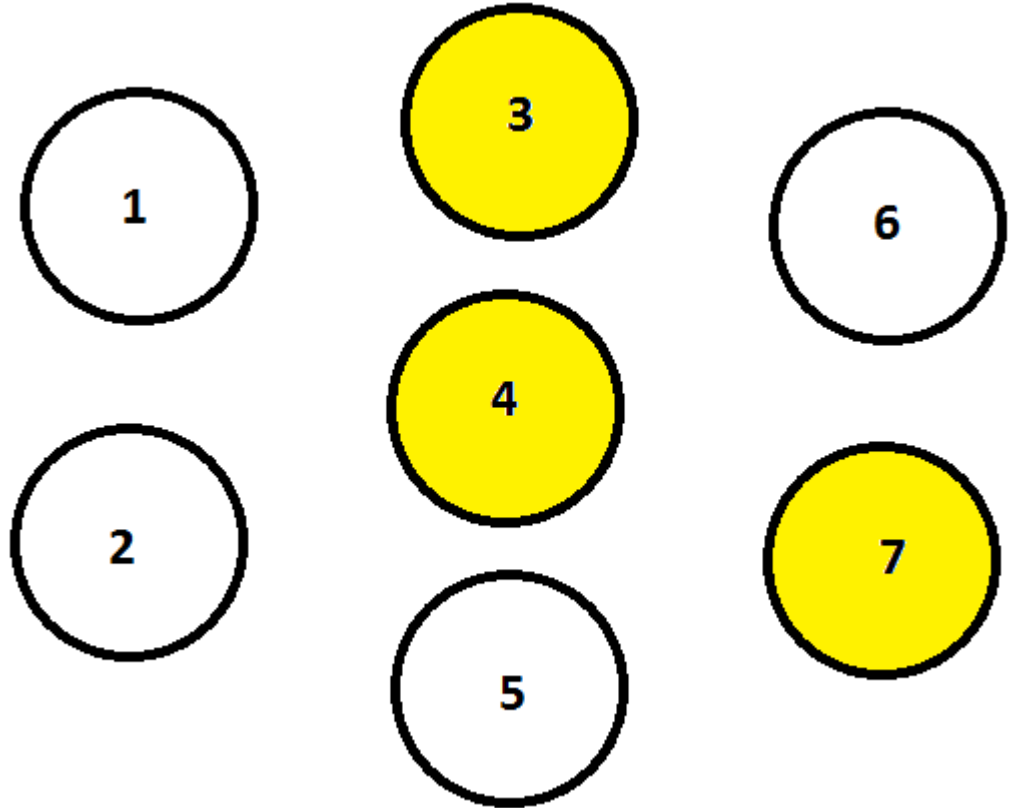
Task 1

- ▶ About fair partitioning of a set of different integers

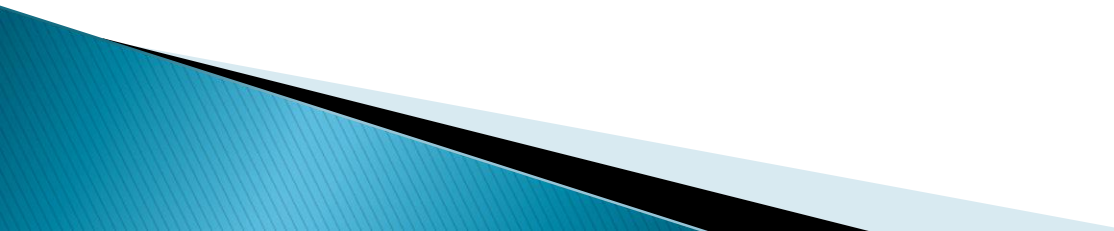


Task 1

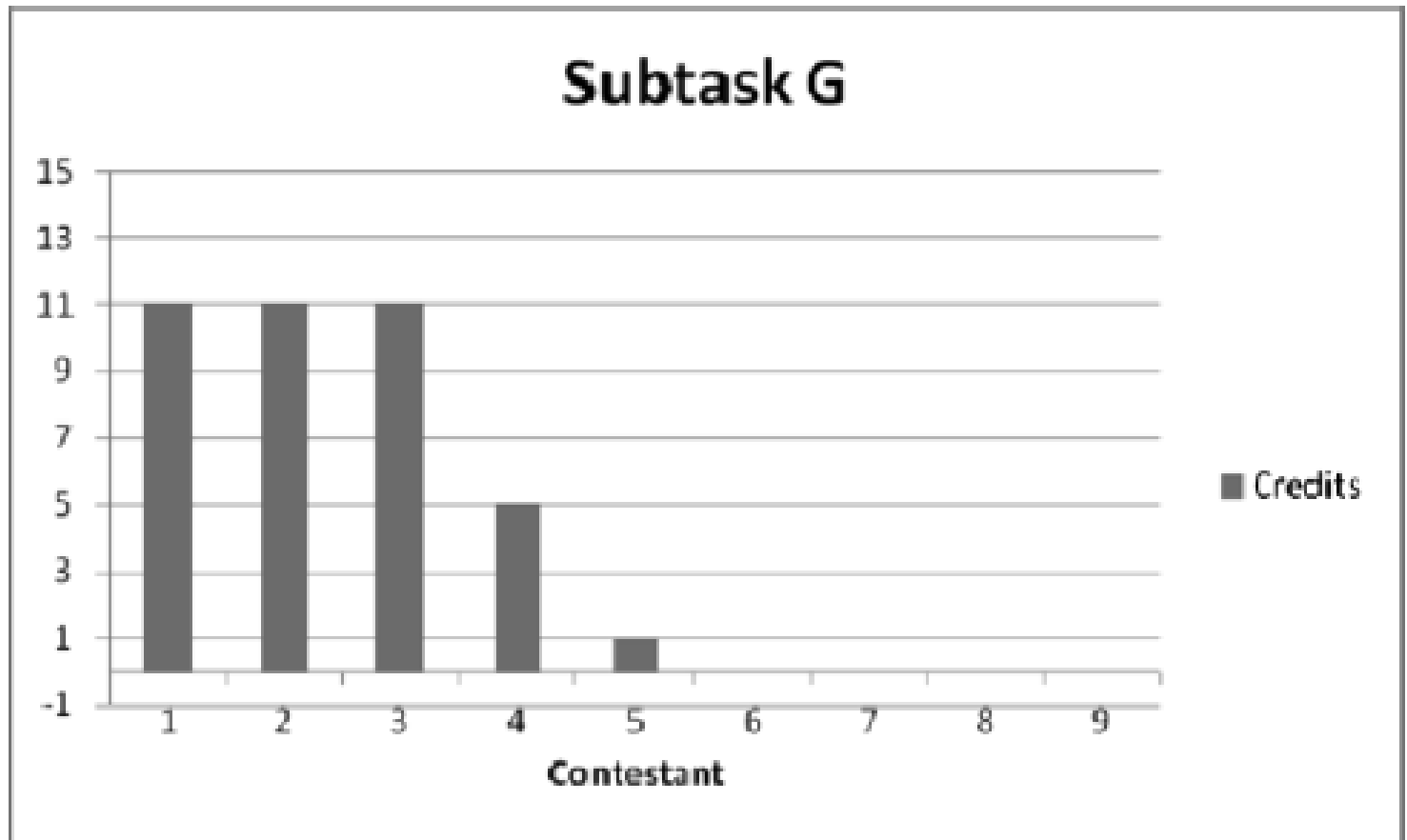
- ▶ About fair partitioning of a set of different integers



Subtask G

- ▶ Strictly Impartitionable
 - ▶ Create a set of at most 30 different integers, that can not be divided in two or more subsets where all subsets have the same sum
 - ▶ 15 points for a solution with 30 integers and the maximum element in the set as low as possible
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Subtask G – Results



Solutions subtask G

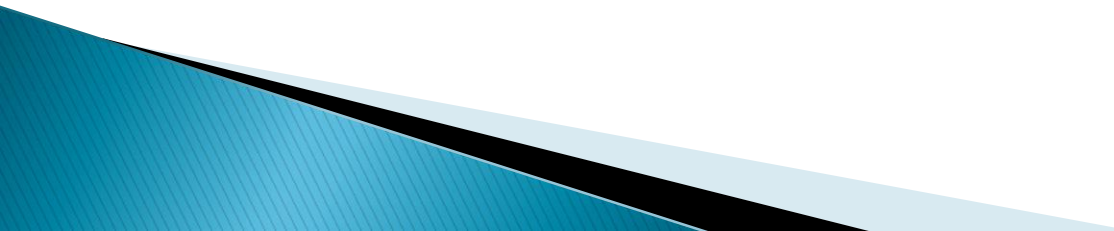
- ▶ The best solutions were like:

$\{1, 2, 3 \dots 29, 436\}$

The 30th integer was larger than the sum of the other 29

- ▶ Not found: The solution using prime numbers

Subtask H

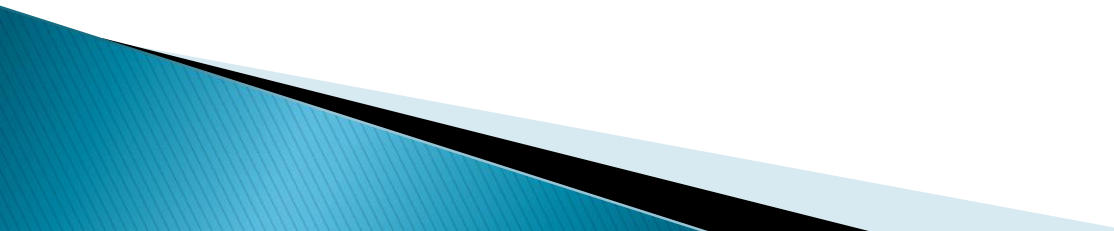
- ▶ Easy Partitionable Set
 - ▶ Create a set of at most 30 different integers, that can be divided in n subsets where all subsets have the same sum, for all integer values of n upto a certain m .
 - ▶ 35 points for a solution with n integers and $m=9$.
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Subtask H – Best solution

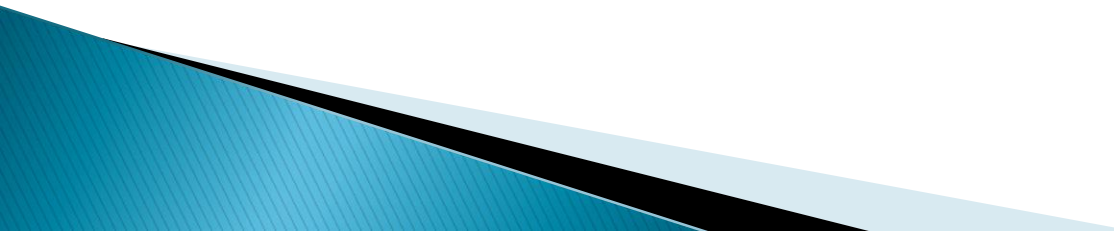
Best contestant solution for subtask *H*

2-partition	3-partition	4-partition	5-partition	6-partition
{1..5, 7..11}	{1..4, 6..9}	{1, 14, 15}	{1, 5, 6, 12}	{1..4, 10}
{6, 12..15}	{5, 10, 12, 13}	{2..4, 6..8}	{2..4, 7, 8}	{5, 15}
	{11, 14, 15}	{5, 12, 13}	{9, 15}	{6, 14}
		{9, 10, 11}	{10, 14}	{7, 13}
			{11, 13}	{8, 12}
				{9, 11}

Conclusions

- ▶ Only a few participants submitted for these subtasks
 - ▶ No one had a very good result
 - ▶ Contestants don't like these tasks
They will skip them due to time restriction
 - ▶ Contestants are not familiar with number theory
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Question

- ▶ How can we award contestants that are able to think in a proper way about an algorithmic problem, but fail to write a working implementation?
 - ▶ Please contact me for all suggestions for different task types within an IOI-like contest
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Thank you for your attention!