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# What do Olympiad tasks measure?

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# Outline

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- Motivation
- Taxonomy
- One goal, many distractors
- Minimizing distractors
- Pilot's checklist
- Examples
- Conclusions

# Motivation

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- The principal focus of olympiad tasks should be *problem solving*
  - *creative ideas*
  - *intelligent ideas*
  - *original ideas*
  - *plus prior experience*
  - *applied in a new situation*

# Motivation (continued)

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Tasks should be

- attractive
- approachable
- challenging
- practical (generalizable or extendible)

# How good problems go bad

1. Take an easy problem and make it harder by increasing the information processing aspect.
2. Take a hard problem and make it easier by removing the problem solving aspects, leaving the information processing or memorization of algorithms.

# Problem Solving Distractors

1. Detailed information processing
  - details of programming languages or libraries
  - tedious input/output formatting
  - optimizations that result in constant-time factor improvement

Certainly, some information processing is required. However, it should be as minimal as possible.

# Problem Solving Distractors

2. Detailed esoteric knowledge of algorithms
  - implementation of leading-edge algorithms (i.e., recent research papers)
  - memorization of details of complicated algorithms (i.e., implement red-black trees)

Certainly, there is a need to know some algorithms. However, this should be "typical" or "reasonable" algorithms.

# Problem Solving Distractors

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## 3. Mystery

- hidden aspects of a task or evaluation criteria

Certainly, some mystery is required. However, too much mystery can be frustrating (and thus, make the task less approachable, appealing, etc.)



# One goal, many distractors

- The (student's) goal, given a task, is to solve it.
- We define *solving* as  
being able to communicate the underlying  
algorithmic process that will consume input in the  
desired way to produce correct output
- However, the main focus of IOI tasks tends to  
be on finding "the best" algorithm in terms of  
efficiency.

# Minimizing Distractors: A Proposal

- Provide feedback during the competition
  - reduces mystery
- Consider using output-only tasks
  - reduces information processing
- Provide a syllabus
  - reduces mystery
- Provide a standard IOI library of tools
  - reduces information processing
  - reduces esoteric knowledge of algorithms

# Minimizing Distractors: A Proposal

- Provide practice problems that test all input/output requirements
  - mitigates the information processing overhead
- Simplify the input format as much as possible
  - mitigates the information processing overhead
- Simplify the output format as much as possible
  - mitigates the information processing overhead

# Minimizing Distractors: A Proposal

- Ensure the problem statement is short
  - reduces information processing
  - reduces mystery
- Ensure that (possible) solutions are short
  - reduces information processing
- Make the task as practical (or extendible) as possible
  - reduces mystery (by way of context)

# Minimizing Distractors: A Proposal

- Pilot the task
  - Get task setters/affiliated others to work through a checklist
  - reduces information processing
  - reduces esoteric knowledge of algorithms
  - removes mystery

# Pilot's checklist

- Do you understand the problem statement?
- Is there extra information in the problem statement that can be deleted?
- Can some descriptions in the problem tasks be simplified or clarified?
- Do you know how to solve the task?
- What do you consider the components of the task to be?
- If you solved it, was the programming effort tedious? What were the implementation (rather than problem solving) challenges you faced?
- Was your solution fewer than 50 lines of code?
- Describe your thought process in solving the problem. What false starts or incorrect attempts did you encounter while solving the problem?
- Can the input format be simplified?
- Can the output format be simplified?
- Can you imagine problems/circumstances/issues where this task may be generalized to?

# Post-hoc analysis

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- Applying this analysis on previous Canadian Computing Competitions formalized the observations of which tasks "worked" and which tasks "didn't work"

# Conclusions

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- Problem solving should be the core goal of IOI tasks
- Adding distractors moves the problems away from that goal
  - information processing
  - esoteric knowledge of algorithms
  - mystery