Trainers Support

Algorithmic Thinking

Algorithmic Thinking for Migrants Teachers Education

2021-1-EL01-KA210-ADU-000035033

LESSON #7

TITLE: EVALUATING A SOLUTION

ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ
ΙΚΥ

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LESSON #7 – EVALUATING A SOLUTION

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LESSON REQUIREMENTS

GROUP: 15 TRAINEES

DURATION: 60 MIN

PROJECTOR, PCS, QUESTIONS SHEET

OBJECTIVES

- DISCUSS KEY QUALITY MEASURES OF A SOLUTION'S EFFECTIVENESS, INCLUDING:

1. CORRECTNESS USING EMPIRICAL MEANS;
2. EFFICIENCY BY EXAMINING TIME AND SPACE COMPLEXITIES;

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SOLUTION EVALUATION

Evaluating a solution involves asking several basic questions, each addressing a specific aspect. Important questions about the solution include:

- Is it correct? Does it actually solve the problem you set out to solve?
- Is it efficient? Does it use resources reasonably?
- Is it elegant? Is it simple yet effective?
- Is it usable? Does it provide a satisfactory way for the target audience to use it?

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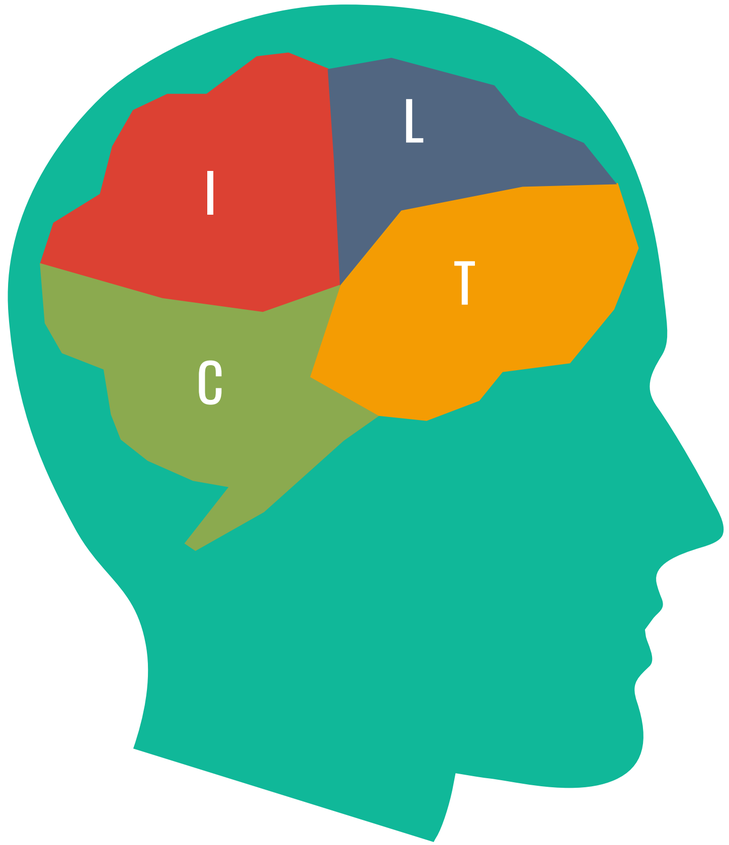
IS IT CORRECT?

does it actually solve the original problem you set out to solve?

- is it a correct solution? If it's not, then that basically renders every other measure of quality redundant.
- It doesn't matter how fast, clever or sexy your solution is;
- if it doesn't solve your problem, then it's incorrect and you need to make changes.



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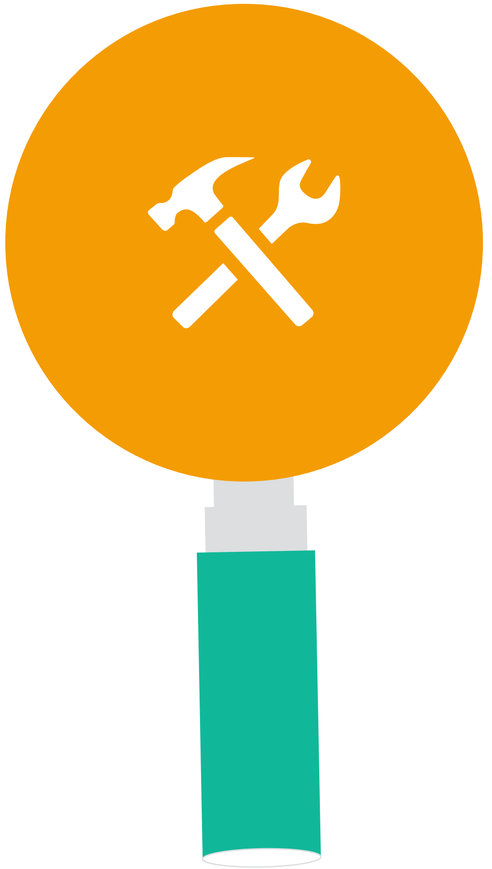
IS IT EFFICIENT?

Every algorithm requires some amount of resources to do its work. Different algorithms, even ones that solve the same problem, can perform differently in terms of efficiency.

This performance is usually measured in terms of time and space.



- **Time**: the duration of an algorithm's running time, from start to end. The duration can be measured as the number of steps taken during execution.
- **Space**: the amount of memory storage required by an algorithm to do its work.

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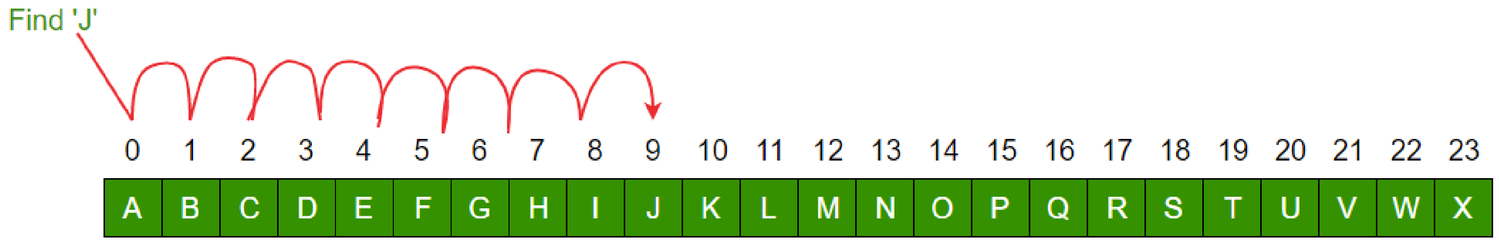
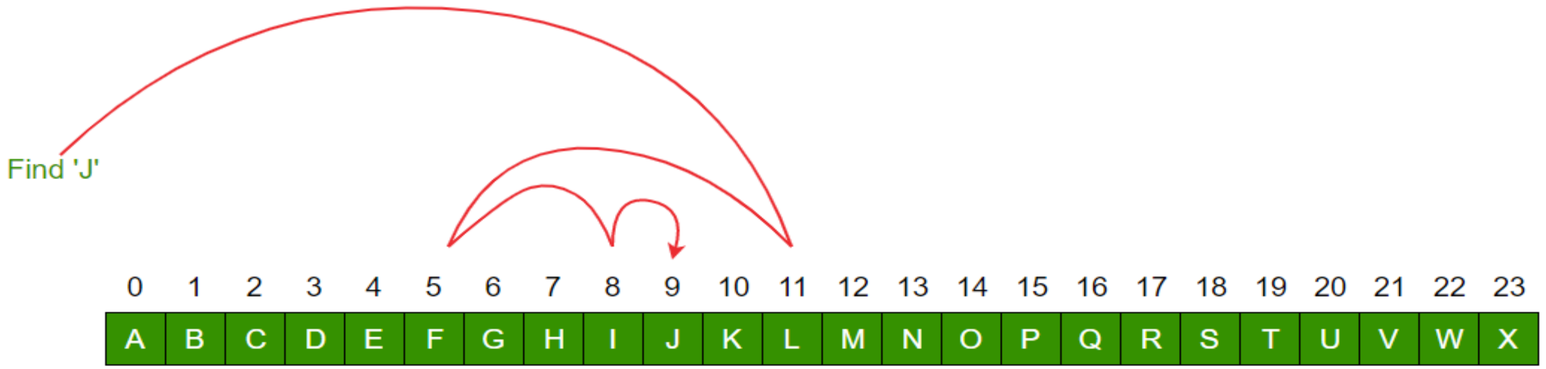
EXAMPLE: LINEAR VS BINARY SEARCH

LINEAR SEARCH TO FIND THE ELEMENT “J” IN A GIVEN SORTED LIST FROM A-X



BINARY SEARCH TO FIND THE ELEMENT “J” IN A GIVEN SORTED LIST FROM A-X



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IS IT ELEGANT?

Roughly speaking, elegance maximizes both **effectiveness** and **simplicity** at the same time.

Some aspects of evaluation cause things to become a little fuzzier in this regard. One of these aspects is elegance, something you might associate more with artistic pursuits.

Two different solutions might both solve a problem, but they could be judged apart by the elegance of their respective approaches.

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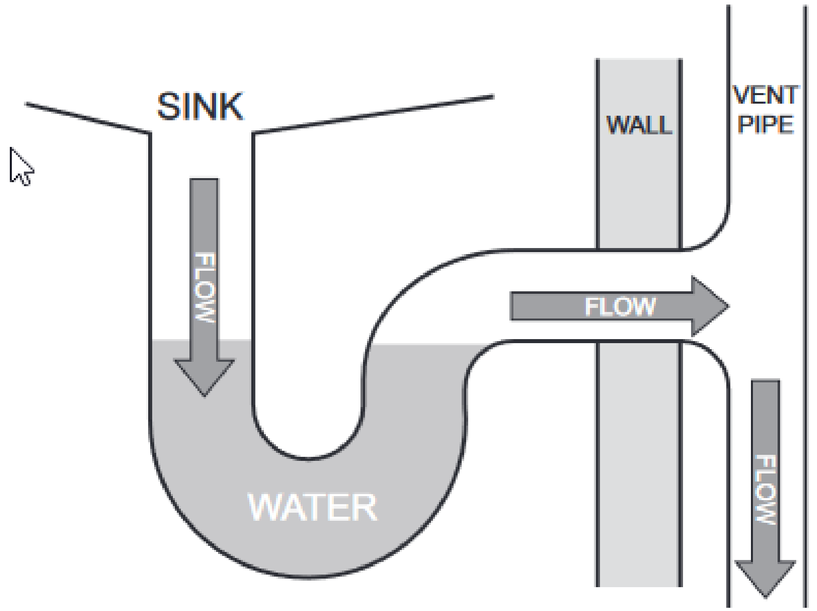
EXAMPLE 1

To an engineer, something achieves **elegance** if it performs something very useful with only a few, simple parts. It might also be non-obvious and solve several problems at once.

This allows water to gather (as a side effect of normal usage), which then blocks any air coming back up from the sewage outlet. It's an incredibly simple, non-obvious solution that works automatically and requires little or no maintenance.



Cross section of a trap

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EXAMPLE 2

Calculate the sum of the integers from 1 to 100

Students solution:

1+2=3, 3+3=6, 6+4=10 and so on.

Carl Friedrich Gauss solution:

1 + 100 = 101
2 + 99 = 101
3 + 98 = 101
4 + 97 = 101

...
50 + 51 = 101

This pattern showed that those 100 numbers could be grouped into 50 pairs, each of which totaled 101. Instead of carrying out 100 sums, Gauss needed only to carry out a single multiplication (50 × 101) to get the same answer (5050).

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ACTIVITY #7.1

Trainer shares a sheet with two exercises.

Trainees, write down the answers for the next 25 minutes and at the end they all together discuss the results.

The discussion follows last 5 minutes.

CORE SKILLS DEVELOPED

- correctness using empirical means;
- efficiency by examining time and space complexities;

TIMING

30 min

REQUIRED TOOLS

PC, projector, sheet

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PANE, J. F. ET AL. (2001) STUDYING THE LANGUAGE AND STRUCTURE IN NON-PROGRAMMER'S SOLUTIONS TO PROGRAMMING PROBLEMS. *INTERNATIONAL JOURNAL OF HUMAN-COMPUTER STUDIES*, 54 (2). 237.

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