

Introduction to Logic and Computer Science

Foundation of Computer Science

Logic in Computer Science

Lecture #1: motivation

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- 1 Logic is necessary.
- 2 6 Good Reasons to Study Logic
- 3 Good to know

Logic is necessary.

The study of formal logic should be considered foundational to every educational curriculum. In the past it was. The roots of logic stretch into every other subject. The construction and programming of computers, for example, is based entirely upon the application of the laws of logic. The proofs of algebra and geometry rely upon the laws of logic. The laws of logic, in one way or another, are fundamental to every academic discipline.¹

¹http://www.triviumpursuit.com/articles/why_study_logic.php

6 Good Reasons to Study Logic

Why Analyzing Arguments Is Good for You by Emrys Westacott

[https://www.thoughtco.com/
good-reasons-to-study-logic-2670416](https://www.thoughtco.com/good-reasons-to-study-logic-2670416)

1) Symbolic Logic Is Fun

Studying basic symbolic logic is rather like learning a new language, but one with a small vocabulary and just a few rules of grammar. You learn to do all sorts of things with these new symbols: you use them to analyze the logic of ordinary sentences, to test arguments for validity, and to construct proofs for complex arguments whose validity isn't obvious. The exercises that help you become adept at these things are like puzzles, so if you like Futoshiki or sudoku you'll probably love logic.

2) Knowing Whether an Argument Is Valid or Invalid Is a Valuable Skill

Logic is essentially the study of reasoning or argumentation. We all use reason all the time to draw inferences that are useful to us. If our car won't start, we reason that the battery may be dead. So we test the battery. If the battery isn't dead, then we deduce the problem must lie elsewhere, perhaps with the starter motor. So we check the starter motor. And so on. In this example the reasoning is simple, but sometimes chains of reasoning can become quite complicated. Training ourselves to construct good arguments and to spot bad ones is a skill that is useful in just about every field as well as in everyday life. It helps steer us toward truth and away from falsehood.

3) Good Logic Is an Effective Tool of Persuasion

The art of persuasion is called rhetoric. Rhetoric, like logic, used to be an essential part of the liberal arts curriculum. Sadly, neither is usually required any longer, and rhetoric has given way to Composition 101. Rhetoric can encompass just about any means of persuasion short of bribery, blackmail, or physical violence. It includes, for instance, appeals to emotion, provocative images, or clever wordplay. There's no doubt that these can be persuasive; but so can good cogent reasoning. We're not saying that good arguments will always win the day over clever rhetoric: human beings are not Vulcans like Mr. Spock. But in the long run, good arguments will usually come out on top.

4) Studying Logic Helps You to Spot Fallacies

Fallacious thinking abounds in our culture. Politicians, pundits, advertisers, and corporate spokespersons attack straw men, appeal to majority opinion, pursue red herrings, or reject a view because of something they dislike about the person who holds it. Familiarity with common fallacies of this sort helps make one a more critical reader, listener, and thinker.

- Logical fallacies
- The Fallacy Detective: Thirty-Eight Lessons on How to Recognize Bad Reasoning 4th Edition

5) Logic Is a Foundational Discipline

Logic is foundational to any field that makes use of arguments. It has especially close connections to mathematics, computer science, and philosophy. Both Aristotelian logic and modern symbolic logic are impressive bodies of knowledge that constitute major intellectual achievements.

6) Clear Thinking Makes One a Better Citizen

Dubious techniques of persuasion, such as “criticizing” a candidate’s views by showing an unflattering image of them, are used especially in election campaigns. They are no doubt sometimes effective, but that is no reason for preferring them to good clear argumentation. On the contrary, it’s why we need logical thinking more than ever.

Home-pages

- Syllabi

- ▶ <https://www.ik.unideb.hu/syllabi>

- Personal homepage

- ▶ <https://www.inf.unideb.hu/aszalos.laszlo>

- elearning.unideb.hu/

- ▶ Logic in computer science (for BI, CS, CSE)



- ▶

Exams-tests

Exams (CS, CSE)

- In January (weekly schedule)
 - ▶ TEOK exam room (150 computers)
- theoretical questions (definitions, theorems)
- practical questions (elearning tests)
 - ▶ you can practice on elearning.unideb.hu

Practices

- weekly tests (from the exercises of the last practice and from the theory)

Valid logical consequences

Monty Python - Witch Scene

- BEDEVERE: Exactly! So, logically...
- VILLAGER #1: If... she... weighs the same as a duck.. she's made of wood.
- BEDEVERE: And therefore?
- VILLAGER #1: A witch!

History of logic

- Thales, Pythagoras - deductive system of geometry
- Zeno of Elea - standard argument pattern: reductio ad absurdum
- Aristotle: contradiction, excluded middle, formal logic, syllogism (puzzles of Lewis Carroll)
- Stoic logic: conditional statements, meaning and truth
- G.W. Leibnitz: formal language, logic calculus
- G. Boole: formal logic, axioms, calculus (Venn-diagram, mechanic-electronic calculus, NAND-gate)
- G. Frege: separating logic from language, new notation
- B. Russell: Principia Mathematica, paradox
- G. Gentzen: natural deduction, sequent calculus (proof theory)
- K. Gödel: incompleteness theorem
- J. Robinson: Automated Theorem Proving (resolution)
- modal logic (C.I Lewis, S. Kripke)