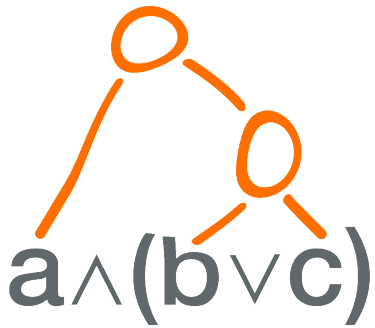
Nyāya for iPad

Interactive Environment with BoolTool



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Nyāya

Origin and meaning

- Sanskrit ny-āyá, literally “recursion” (Wikipedia) used in the sense of “syllogism, inference“.
- One of the schools of Hindu philosophy, specifically the school of logic.
- *“Obtaining valid knowledge is the only way to obtain release from suffering.”* (tenet)

Logic

Motivation

"The aim of logic in computer science is to develop languages to model the situations we encounter as computer science professionals, in such way that we can reason about them formally."
(Logic in Computer Science, Huth and Ryan)

- Rhyme: *If wishes were horses beggars would ride.*
- Modeling: if [wishes are horses] then [beggars ride]
- Model: $p \rightarrow q$
- Valuation: $v(p \rightarrow q)$ is true, if v(p) is false or v(q) is true.
- v(p) is not true in our domain

CL BoolTool

Manipulation and evaluation of formulas in propositional logic

- BoolTool is powerful
  - It defines an input syntax for formulas
  - It derives normal forms
  - It computes truth tables and binary decision diagrams
  - It calculates satisfiability, tautologies and contradictions
- But it is not for beginners.
  - It does not motivate or explain much
  - It does not use standard symbols of propositional logic
  - It does not explain equivalence transformations
  - It does not define normal forms

Aim of the project

Interactive learning environment

Allow the user to learn

- Formalism of propositional logic
- Separation of syntax and semantics
- Normal forms (NNF, CNF, DNF)
- Standard transformations of Boolean functions
- Coherence of different representations

in a self-explanatory environment.

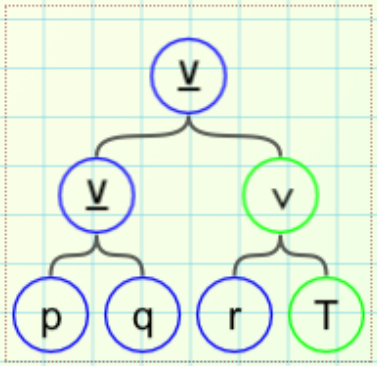
Concept

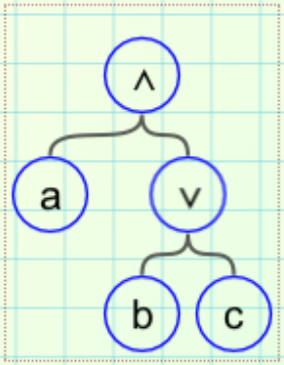
Platform agnostic

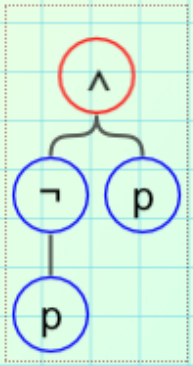
Nyāya supports the most effective learning techniques – steadily learning and practice testing – with its combination of small bits of learning content and seemingly countless exercises.

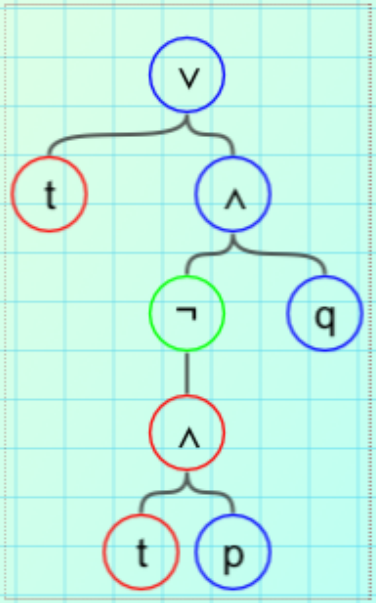
- Tutorials for general concepts and definitions
- Exercises to consolidate the learned concepts and definitions
- A Playground for building and transforming syntax trees
- A Glossary of technical terms
- Functionality of BoolTool

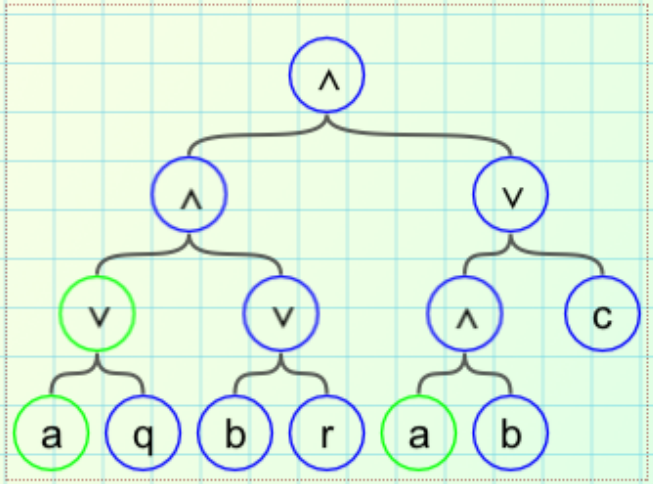
Demo

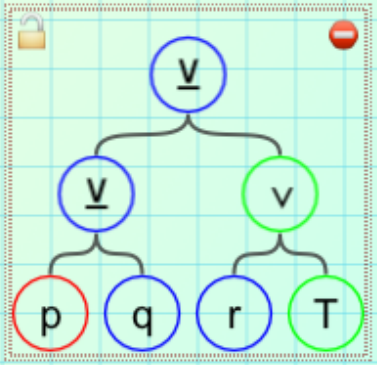












Choice of platform

iPad

- Most popular computing devices:
  - Notebooks
  - Phones
  - Tablets
- Immerse experience without distraction on tablets.
- Most popular development environments for tablets:
  - HTML5 with CSS3 and JavaScript
    Write once, run everywhere?
  - Android – Java and Eclipse
  - iPad – Objective-C and Xcode
- iPad has popularized the usage of tablets.

Development

Toolchain

- Mac OS X computer
- Apple Developer Portal, IDs and Certificates
- Xcode, Git
- Objective-C, CocoaTouch

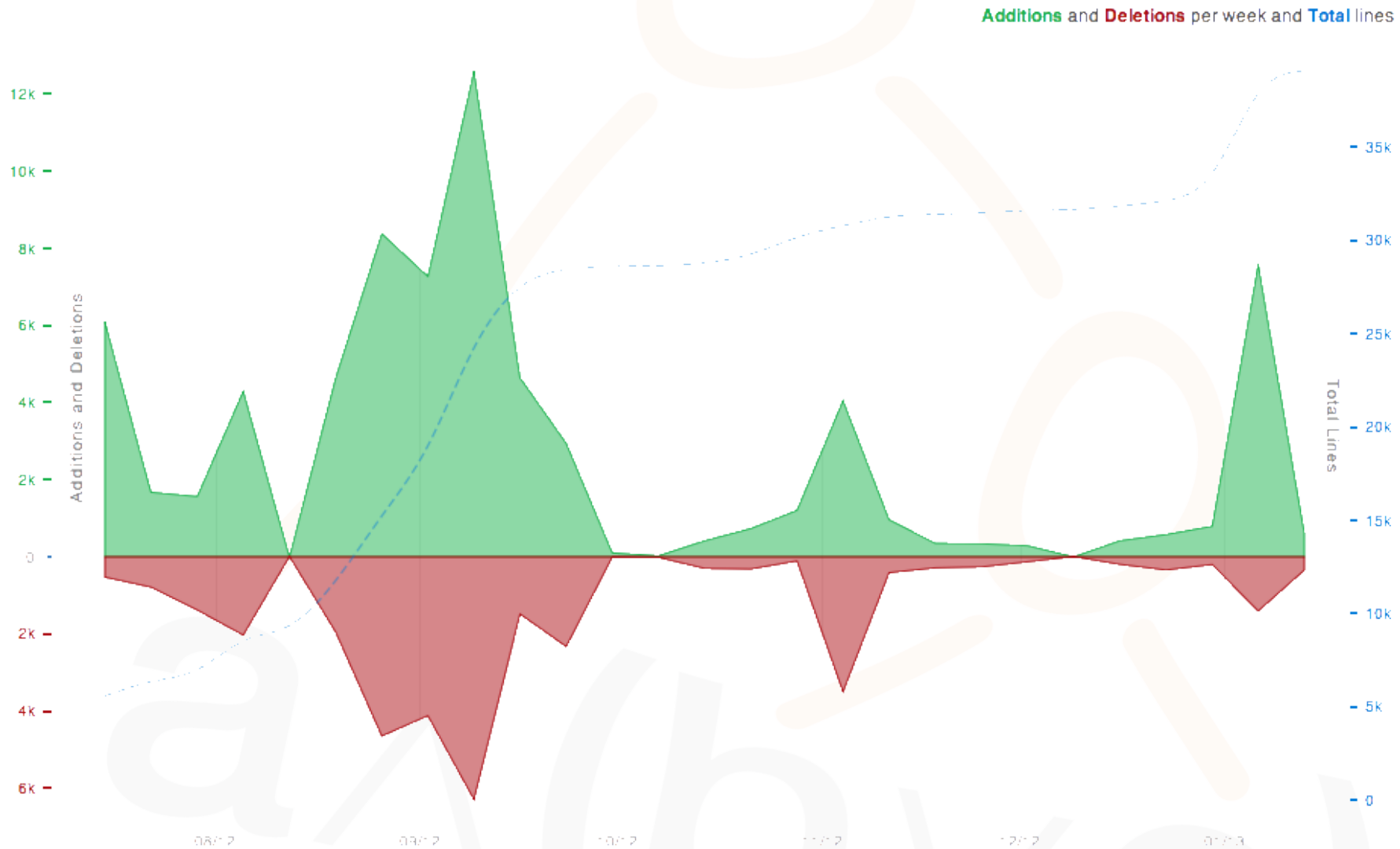
- iPad
- GitHub

Project Execution

Priciples and Phases

- Principles
  - Fail Fast
  - Test-driven
  - Re-factoring
  - Use cases
- Phases
  - Exploring user interface possibilities
  - Developing core components
  - Adding content, controllers and configurations
  - Finishing

Commit history



Implementation

Model – Parser and Node

- Scanning
  - Regex
  - Unicode

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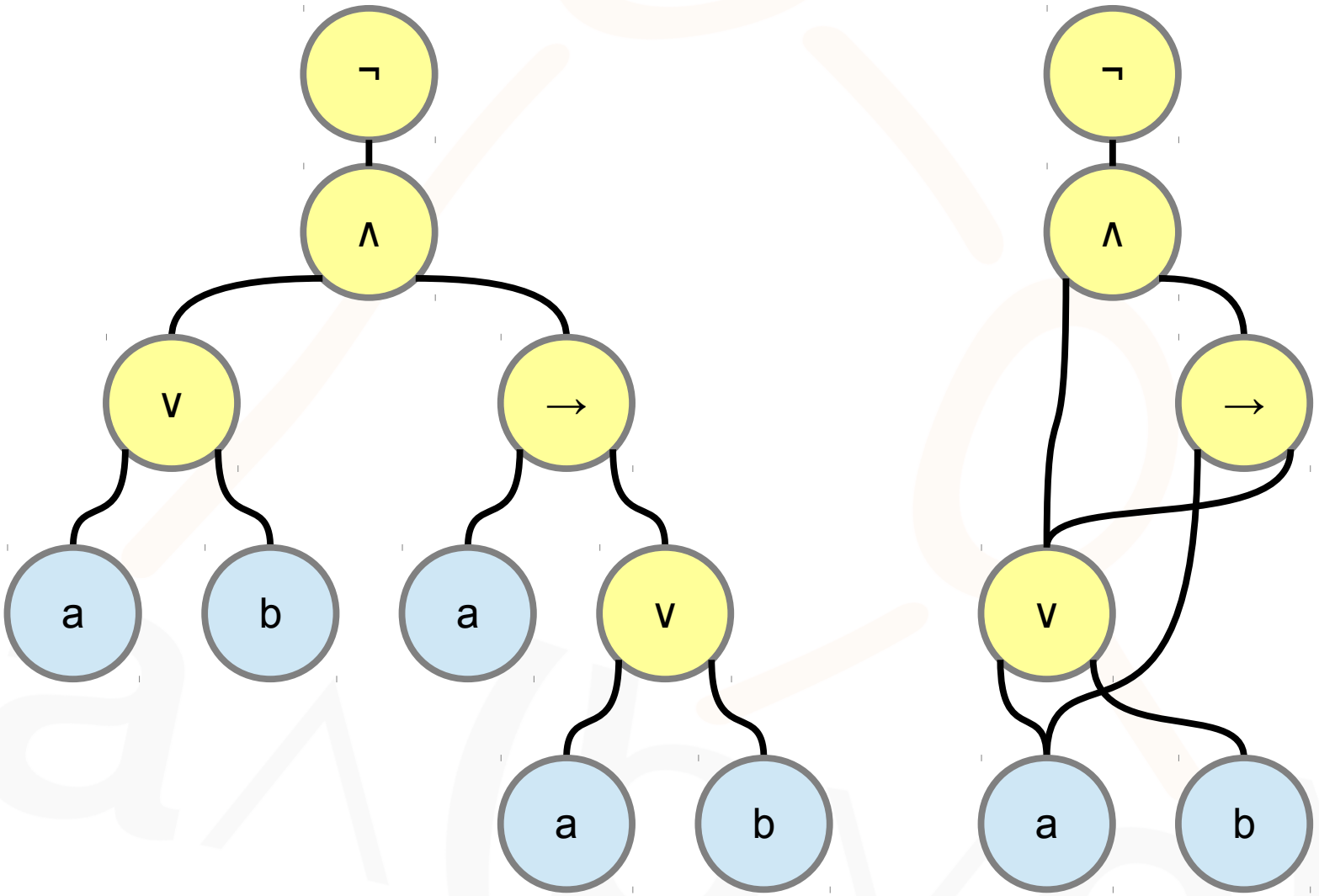
- Parsing
  - Grammar in EBNF
  - Associativity
  - Precedences
  - Recursive descendent
- Node
  - abstract super-class
  - factory methods
  - decorator

Syntax Tree

Acyclic Graph



Retrospective

What is missing?

- Important Improvements
  - Independent content updates
  - Optimized valuation
  - Faster creation of BDDs
  - Import and Export of formulas
- Accessibility
  - Voice Over
  - Zoom
  - AssistiveTouch

Outlook

To the next level

- Internationalization and Localization
  - English
  - German
  - ...
- Additional Features
  - Creating and editing of BDDs
  - Definition and using of Boolean functions $f(p_1, ..., p_n)$
  - Export of syntax trees, BDDs and truth tables
- Additional Platforms
  - Mac OS X
  - Android

Distribution

AppStore and GitHub

- Nyāya for iPad 1.1 – available in the App Store
- Promo codes for members of uibk.ac.at
  Write to nyaya@maringele.at
- Source code available on GitHub:
  https://github.com/AleGit/NyPad.git

Sources

- Huth and Ryan. **Logic in Computer Science**
- Middeldorp. **Logic**, Lecture
- Gamma, Helm, Johnson, Vlissides. **Design Patterns: Elements of Reusable Object-Orientated Software**
- Louden. **Compiler Construction: Principles and Practice**
- Buck and Yacktman. **Cocoa Design Patterns**
- Apple. **iOS Developer Documentation**