Lab 1: Boolean Expressions

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This document lists the key results from the December 14, 2019 class in Number Theory. This training for competition math is aimed at 16–18 year olds (typically, Grades 10–12).

Objectives

1. Run Coq command-line from the `coqtop` utility and also `CoqIDE`.

2. Check types in Coq, including atomic types, tuples, function types.

3. Use truth tables for individual Boolean operators.

4. Use precedence and associativity to parse Boolean expressions.

5. Create (abstract) syntax trees.

6. Fill in truth tables.

7. Check, if a Boolean expression is a tautology.

8. Check, if a Boolean expression is satisfiable.

9. Find equivalent Boolean expressions.

10. Rewrite expressions as CNF (conjunctive normal form).

11. Write your answers into a LaTeX template, compile and submit.

Datatypes

If you need more information on datatypes, visit this site https://coq.inria.fr/stdlib/Coq.Init.Datatypes.html.

Strong datatypes is not always convenient. For example, you cannot evaluate the following expression:

```
Eval compute in if 1 = 2 then 3 else 4.
```

Truth Tables

Boolean expressions can always be computed using

A	B	A && B
false	false	false
false	true	false
true	false	false
true	true	true

Precedence and Associativity