

Problems In Mathematics for Computer Science

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Preface

This is a research project in which I try to read the notes and solve all the problems from [1]

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Part I

Notes

Chapter 1

What is a Proof?

1.1 Propositions

Definition 1.1. A *proposition* is a statement (communication) that is either true or false.

Claim 1.1.1. $\forall n \in \mathbb{N}, p ::= n^2 + n + 41$ is prime

Question: Is this claim true or false?

Claim 1.1.2. No polynomial with integer coefficients can map all nonnegative numbers into primes, unless it's a constant.

Question: Is this true or false?

Claim 1.1.3 (Euler's Conjecture). $\forall a, b, c, d \in \mathbb{Z}^+. a^4 + b^4 + c^4 \neq d^4$

Claim 1.1.4. $313(x^3 + y^3) = z^3$ has no solution when $x, y, z \in \mathbb{Z}^+$

Claim 1.1.5 (Four Color Theorem). Every map can be colored with 4 colors so that adjacent regions have different colors.

Claim 1.1.6 (Fermat's Last Theorem). $\forall a, b, c \in \mathbb{Z}^+ \forall n > 2, n \in \mathbb{Z}. a^n + b^n \neq c^n$

Claim 1.1.7 (Goldbach). Every even integer greater than 2 is the sum of two primes.

1.2 Predicates

Definition 1.2. A *predicate* is a proposition whose truth depends on the value of one or more variables.

If P is a predicate, then $P(n)$ is either *true* or *false*, depending on the value of n .

1.3 The Axiomatic Method

Definition 1.3. A *proof* is a sequence of logical deductions from a set of axioms and previous proved propositions that concludes with the proposition in question.

- *Theorems*
- *Lemma*
- *Corollary*

⇒ Axiomatic Method

Part II

Problems and Exercises

Chapter 1

What is a Proof?

Bibliography

- [1] Eric Lehman, Tom Leighton, and Albert Meyer. *Mathematics for Computer Science*. MIT OCW, 2018.