CS 245 - Logic and Computation **Fall 2016**

Lecture 23, 24: November 29 - December 2, 2016

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23.1 Undecidability and the Halting Problem

Definition 23.1 *Something is computable if it can be calculated by a systematic procedure.*

23.1.1 Decision Problems

A decision problem is a problem which calls for an answer of either yes or no, on some input.

Examples

1. Given a formula of propositional logic, is it satisfiable?
2. Given a positive integer, is it prime?
3. Given a graph and two of its vertices, is there a path between the two vertices?
4. Given a multivariate polynomial with integer coefficients, does it have any integer roots?
5. Given a program and input, will the program terminate on the input?

23.1.2 Decidable and Undecidable Problems

A decision problem is decidable if there is an algorithm that, given an input to the problem,

- Outputs "yes" if the input has answer "yes"
- Outputs "no" if the input has answer "no"

A problem is undecidable if it is not decidable.

23.1.3 Reduction Between Problems

A reduction from problem A to problem B is an algorithm (or program) to solve problem A that relies on an algorithm (or program) to solve B.

Theorem 23.2 *Provability is undecidable.*

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That's all for Fall 2016, hope these notes helped.

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