Prep Work 13 - Reductions

CS 234

due April 28, before class

0 Introduction

This assignment has 1 part: reductions.

This assignment is to be completed individually, but feel free to collaborate according to the course's external collaboration policy (which can be found in the syllabus).

The deliverables consist of one `.pdf` file. The deliverables should be submitted electronically by the deadline. Put any attribution text in the `.pdf` file.

Every file should be named like `FLast_cs234_pX.ext` where `F` is your first initial, `Last` is your last name, `X` is the assignment number, and `ext` is the appropriate file extension. For example, Alan Turing's `.pdf` file should be given the name `ATuring_cs234_p13.pdf`. (Alan Turing was the inventor of the Turing machine, and this work is considered to have started the field of computer science. Turing's advisor, Alonzo Church, also advised Stephen Cole Kleene (of the Kleene star), who in turn advised Robert Constable, who in turn advised me when I was an undergrad.)

1 Computability

Read chapter 14.6 to the end of chapter 14 in the textbook. Then complete the following tasks in your `.pdf` submission. Clearly label your responses with the task number.

1. Look at Theorem 14.5. It takes the form of a proof by contradiction. What is assumed for the sake contradiction, and how is that property used by the proof? (Hint: it gives access to a Turing machine satisfying some particular properties.)

2. A *reduction* between two machines A and B shows that you can *reduce* the behaviour of A to that of B. In other words, it is a program for A that uses B as a subroutine. What is the reduction that occurs in Theorem 14.5?

3. Remember, limitations on Turing machines are also limitations on other forms of computing like Python programs. What does Theorem 14.5 mean in terms of Python programs?

4. Look at Theorem 14.6. It takes the form of a proof by contradiction. What is assumed for the sake contradiction, and how is that property used by the proof?

5. What is the reduction that occurs in Theorem 14.6?

6. What does Theorem 14.6 mean in terms of Python programs?

7. Look at Theorem 14.7. It takes the form of a proof by contradiction. What is assumed for the sake contradiction, and how is that property used by the proof?

8. What is the reduction that occurs in Theorem 14.7?

9. What does Theorem 14.7 mean in terms of Python programs?