Prep Work 6 - Induction

CS 234

due March 3, before class

0 Introduction

This assignment has 1 part: induction.

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, Joan Moschovakis's `.pdf` file should be given the name `JMoschovakis_cs234_p6.pdf`. (Joan Moschovakis is researcher in constructive/computable logic and mathematics. She has studied advanced forms of induction like bar induction.)

1 Induction

Read chapter 8 in the textbook. Then complete the following tasks in your `.pdf` submission. Clearly label your responses with the task number.

1. What are the 4 parts of an inductive proof? (The textbook calls one of them "state the hypothesis"—in this class we will call that step "stating the inductive predicate" instead. I will also tell you a slightly different way of stating it than the textbook uses, but the textbook is fine for now.)
2. What *is* the inductive predicate? Is it a number? A proposition? A string? Something else?
3. What do you have to prove for the base case?
4. What do you get to assume in the inductive step? (We call this assumption the "inductive hypothesis," which is slightly more specific than how the textbook uses that term.)
5. Given the inductive hypothesis assumption, what do you then have to prove for the inductive step?
6. In your own words, explain how the base case and inductive step together allow you conclude that the inductive predicate holds for arbitrarily large natural numbers.
7. How is strong induction different from "normal" induction?

Now let's practice picking out the proof parts at a high level. We want to show that $\forall n \in \mathbb{N}.\, n^2 + n$ is even.

1. What is the appropriate inductive predicate?
2. What is the base case?
3. What do we get to assume for the inductive step's inductive hypothesis?
4. What do we have to show for the inductive step, given the assumed inductive hypothesis.
5. State what a conclusion to the proof would say.