

Homework 8 Solution

Problem 2

Proof Given an arbitrary H input (encoding of a program P and an input X for P), construct an L input (encoding of a program P' and an input X' which is 0) such that P halts on input X if and only if P' halts and return Yes (means it accepts 0).

The code for P' is following:

1. let X' be the input of P';
2. call program P on input X;
3. if P halts on input X then return Yes (i.e., accepts 0).

What is the behavior of P'?

First note that the behavior is the same, no matter what the input X' is. If P halts on X, then P' halts and outputs YES, i.e., accepts X' (including 0). If P does not halt on X, then P' also goes into an infinite loop, and does not accept X' (including 0). QED

Problem 4

Proof The property is: "Program accepts the input which is 0".

1. **The property is functional:** the property above is about the language accepted by the program (property of the input), and not about the specific code of the program, thus, it is functional.
2. **The property is nontrivial:** it is obvious that some program may accept 0, some program may not, and it is not a common property for all programs, thus it's non trivial.

Therefore, according to Rice's theorem, the property is undecidable. QED