CECS 329, Learning Outcome Assessment 1, August 31st, Fall 2023, Dr. Ebert

Problems

LO1. Answer the following.

(a) Provide the definition of what it means to be a mapping reduction from decision problem A to decision problem B.

(b) In relation to your answer to part a, if $f(n)$ is a valid mapping reduction from the `Even` decision problem to the `Odd` decision problem, then, if n is even, then what must be true about $f(n)$ and why?

(c) Is $f(n) = n^2 + 3n + 5$ a valid mapping reduction from the `Even` decision problem to the `Odd` decision problem? Justify your answer.

Solution

LO1. Answer the following.

(a) Provide the definition of what it means to be a mapping reduction from decision problem A to decision problem B.

Solution. See Definition 2.1 of Turing and Mapping Reducibility Lecture.

(b) In relation to your answer to part a, if $f(n)$ is a valid mapping reduction from the `Even` decision problem to the `Odd` decision problem, then, if n is even, then what must be true about $f(n)$ and why?

Solution. $f(n)$ must equal an odd number since n is a positive instance of `Even`, and so $f(n)$ must be a positive instance of `Odd`, i.e. it must be an odd number.

(c) Is $f(n) = n^2 + 3n + 5$ a valid mapping reduction from the `Even` decision problem to the `Odd` decision problem? Justify your answer.

Solution. No, it is not valid since $f(1) = 9$ maps an odd to an odd, i.e. a negative instance of `Even` to a positive instance of `Odd`, which is not allowed.