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Exercise 8.1

KEI PLAN WAS SIE MIT SET S MEINT...

(a) Let M_1 be a TM that is undefined on input 0 and M_2 be another TM that is defined on input 0. Let both TM's compute an unary function over $\mathbb{N}$. The Rice theorem tells us that it's impossible to write a general algorithm that decides whether a given TM has a property or not except if the property is always true or false. Since M_1 and M_2 are two TM's that behave differently, the property of 0 being undefined is not always true or false and therefore the language L is undecidable.

(b) Let M_1 be a TM that rejects every input and M_2 be another TM that accepts every input. Both TM's obviously behave differently and are therefore undecidable using the Rice theorem

(c) L is decidable because if it halts on an even number of steps for input 0, it always halts on an even number of steps. (KEI PLAN WIESO... CHATGPT)

(d) L is decidable because we can "simply" compute possible pairs of input and compare them with the output. (EBEFALLS CHATGPT. MACHT IRGENDWIE HALBWEGS SINN??

Exercise 8.2

Exercise 8.3

(a)

(b)

Exercise 8.4

(a) n^3 will dominate as n gets larger. Therefore the runtime of X is bound to a polynomial function and we can conclude that problem X is part of P.

(b) The runtime of $n^{log_2(n)}$ grows faster than any polynomial function because the exponent is not constant and grows with the size of n. We cannot conclude that X is in P for that reason.