Theoretical Computer Science (M21276)

Part A/11: More about Turing machines

(Nov 6-10, 2023)

Question 1. For an unary input, design a TM that computes the parity. That is, it leaves one symbol if the input length is odd, and zero symbol otherwise.

Question 2. Design a TM that erases all instances of a certain symbol from the input. To be specific, let's say the alphabet is $\{a, b\}$ and the TM erases all b's. For example, if the input is *ababbaa*, then the output is *aaaa*.

Question 3. Design a Turing machine that starts with the symbol # in one cell, where all other tape cells are blank. The beginning position of the tape head is not known. The machine should halt with the tape head pointing at the cell containing #, with all other tape cells being blank.

Question 4. Explain the difference between recursive and recursive enumerable languages. Give an example of a recursive language over $\{a, b\}$.

Question 5. Show that

(a) the set of recursive languages is closed under union and intersection,

(b) the set of recursive enumerate languages is closed under union and intersection.

Question 6. Show that the set of recursive languages is closed under reversal.