Anticipated length: 3–5 pages (if double spaced).

Overview

Below is described a new model of computation, Exciser, invented for this exam. Write a paper on:

“The capabilities and limitations of Excisers, as compared to models such as finite automata and Turing Machines.”

Be sure to include examples of languages that Excisers can handle. You might also consider closure properties and nondeterminism.

A New Model: Exciser

An **Exciser** is defined to have finite memory and receives its input string on a tape. Like an FA, it can move right (but cannot write on the tape) while reading the characters and updating its state. There is an end-of-string marker $\Delta$ at the right end of the tape. An Exciser has two enhancements over an FA:

1. The machine can **excise** (remove) the current character under the head. After this action it is as if the character never existed, and the head points to the next character (to the right). For example, if the tape starts as `TIGER\Delta` and we move three times and then excise, then the tape now contains `TIGR\Delta` and the head points to the R. (Attempting to erase the end-of-string marker has no effect.)

2. The machine can **reset** the head to the beginning of the tape.

For example, one could use an Exciser to accept the language $0^n1^n$. First, the Exciser goes through the entire tape checking that all the 0’s come before all the 1’s; then it resets the head. Second, it executes a loop that repeatedly excises a 0 and a 1. The machine accepts if all goes well and one finishes with the tape empty.

If any detail of an Exciser is unclear or ambiguous, resolve it as you see fit.