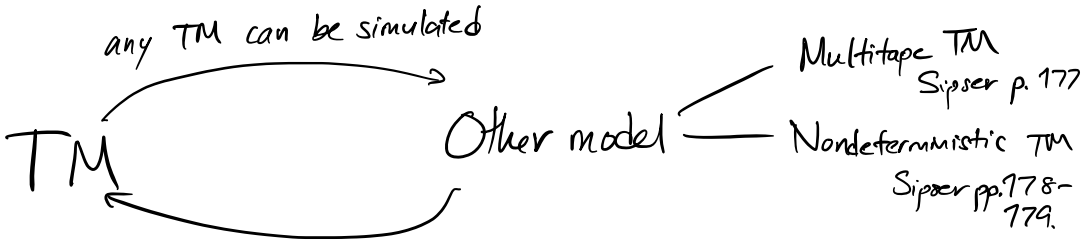
Reducing to TMs.

Sipser pp. 177-179

Church-Turing Thesis:

Our intuitive notion of algorithm $\simeq$ what TMs can do.



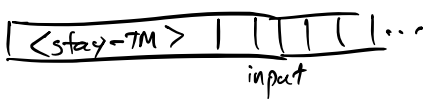
Example 1. TMs with a "stay put" operation.

$$\delta : Q \times \Gamma \longrightarrow Q \times \Gamma \times \{L, R, S\}$$

1. Reduce TM to the stay-TM. trivial. ✓
2. Reduce stay-TM to TM.

   Strategy 1: given a stay-TM, replace transitions that use "S" with pairs of transitions that do the same thing, move left, and then move right.

   Strategy 2: simulate a given stay-TM with a regular TM.



Example 2. Turing Machine w/ doubly infinite tape.

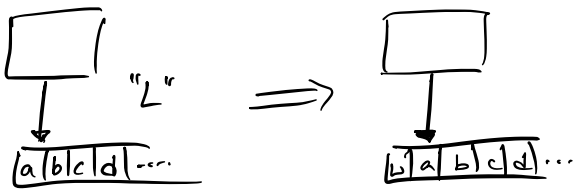
Reduce TM to TM_2: trivial ✓

(add a rule to "bounce back" if we move L from tape square 0)

Reduce TM_2 to TM:

(1) Given a TM_2 M, we can simulate it with a TM M' by first emulating the execution until we move left from state 0.

(2) At this point, pause our simulation and run a subroutine that shifts the tape contents right one square.



(3) Resume from (1).