A multitape TM has $M = (Q, \Sigma, \Gamma, \delta, \gamma, q_0, F, L)$ with $\Sigma \subseteq \Gamma$, $\Gamma = \{L, R, S, F\}$, $L \cap R = R \cap S = S \cap F = \emptyset$, $\Sigma \cap \Gamma = \emptyset$. A multitape TM with $n$ tapes has $\Delta = \{\epsilon, L, R, S, F\}$.

For more information, refer to Lecture 4, Fall 2018.
What basic ops can a TM perform?

- Check whether two strings \( x, y \) are equal.
- Search for a \( y \) matching a given \( x \). Put the above code inside a loop.
- Copy a string from one tape to another.
- Perform basic arithmetic: +, -, \( x \cdot 2 \) are enough.

Example: TM for the "3n+1" problem. Likewise,
- Test whether a given string is empty or '1' (or zero).
- Do conditional jumps to instructions with a matching label.

These ingredients suffice to simulate a rich enough (or) assembly language.

in particular, every program in your favorite high-level language can be compiled to "mini-assembler". Then bolted on to your machine to get a good mp std. for all ASCII input \( x \), \( \text{MP}(x) = P(x) \).