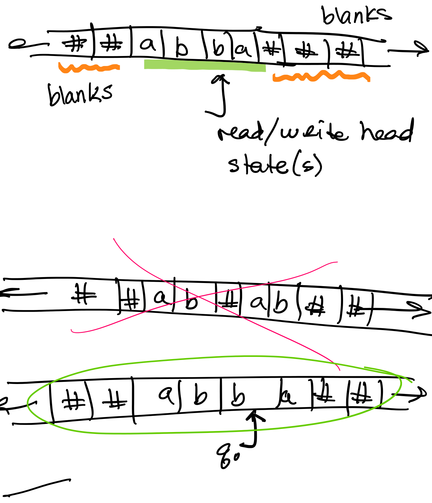
# turing machines

Thursday, November 21, 2024 12:02 PM

Turing thesis:
weak thesis - anything computable by mechanical means can be computed by a tm.

strong thesis - anything that can be computable can be computed by a tm.





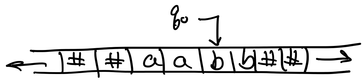

$M_{tm} = (Q, \Sigma, \Gamma, \delta, q_0, \#, F)$

$Q$ = finite set of internal states
$\Sigma$ = input alphabet (finite set of symbols)
$\Gamma$ = finite set of tape symbols
$\delta$ = finite set of transition func(s) *
$q_0$ = initial state $\in Q$
$\#$ = special tape symbol called the "blank"
$F$ = finite set of interal state(s) that are "feinal" $F \subseteq Q$.

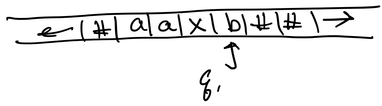
*$\delta: Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R\}$

ex. $(q_0, a) = (q_1, b, R)$

short cut: $(q_0, a, b, R, q_1)$



$(q_0, b, X, R, q_1)$



question: if $\Sigma = \{a, b\}$. write transition functions for "go to beginning"

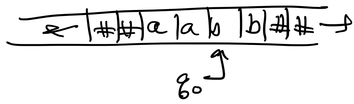
// go to beginning

answer:
$(q_0, a, a, L, q_0)$
$(q_0, b, b, L, q_0)$
$(q_0, \#, \#, R, q_s)$

$(q_0, a, a, L, q_0)$
$(q_0, b, b, L, q_0)$
$(q_0, \#, \#, R, q_0)$ infinite loop

ex.

$L = \{a^n b^n : n \geq 1\}$
write a tm for L. ie, $L(M) = L$.



a b a b

# a a b b #

# # a b b #

# # a b # #

# # # # # #