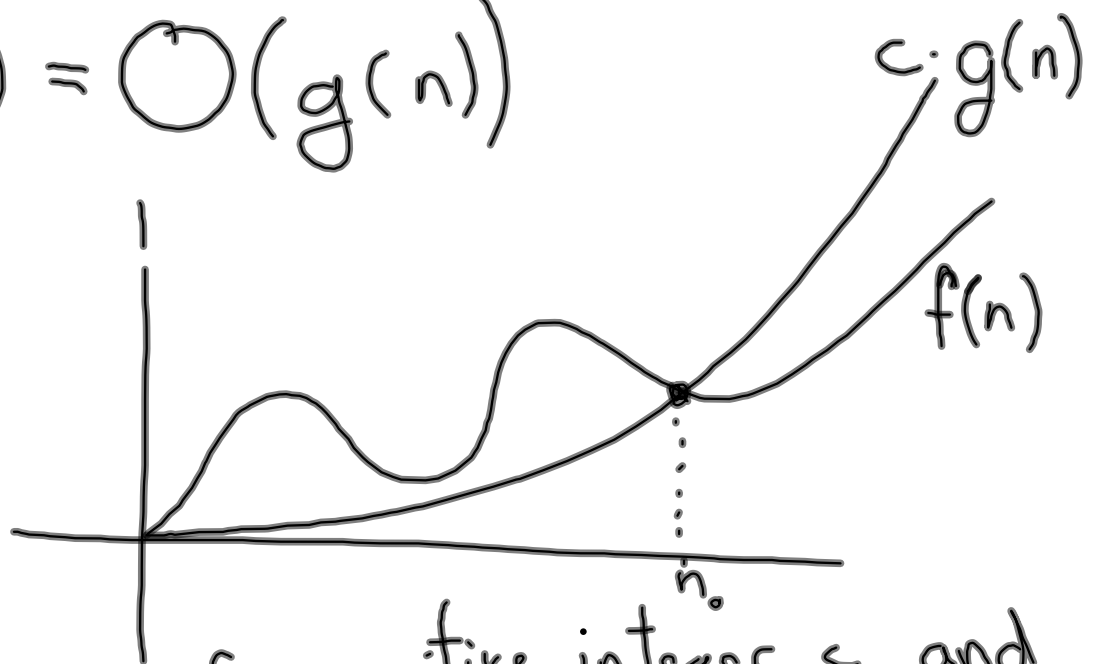


$$\left[\frac{\quad}{q_{acc}\#} \right] \left[\frac{q_{acc}\#\#}{\#} \right]$$

$$\left[\frac{\#}{\#q_0|0|\#} \right]$$

$$\left[\frac{q_0'}{|q_0|} \right] \left[\frac{0}{0} \right] \left[\frac{1}{1} \right] \left[\frac{\#}{\#} \right]$$

$$f(n) = O(g(n))$$



if positive integer c and
 n_0 s.t. $\forall n \geq n_0$
 $f(n) \leq c \cdot g(n)$

e.g.

$$f(n) = 5n^4 + 6n^2 - 2n + 1000$$

$$f(n) \text{ is } O(n^4)$$

$$O(n^5)$$

$$O(n^6)$$

⋮

$O(1)$ $O(\log n)$ $O(n)$ $O(n \log n)$ $O(n^2)$

$O(n!)?$ $O(2^n)$

 $O(n^n)$

$$L = \{0^k 1^k \mid k \geq 0\}$$

$O(n^2)$ TM

mark 0, mark 1, repeat

TM 2

0 ~~0~~ ~~0~~ ~~0~~ 1 ~~1~~ ~~1~~ ~~1~~

$O(n)$ \rightarrow 1. mark every other 0, 1
 $O(n)$ 2. check if even # of unmarked
 repeat $O(\log n)$ times

$O(n \log n)$

TM 3 - two tapes

$O(n)$ 1. copy input to tape 2

$O(n)$ 2. check Tape 1 for a one
 check tape 2 for a zero

$O(n)$

TIME :

$$t: \mathbb{N} \rightarrow \mathbb{R}^+$$

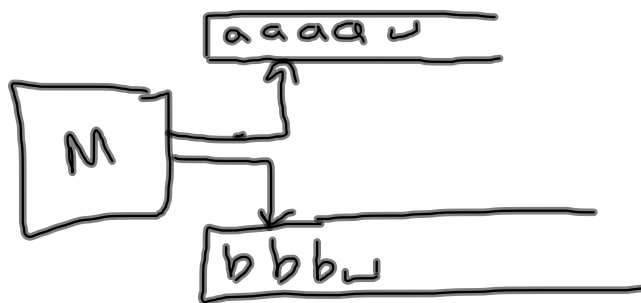
TIME($t(n)$)

is the collection of all
languages that are decidable
by a $O(t(n))$ time TM.

↑
single tape,
deterministic

Let $t(n)$ be a function where $t(n) \geq n$.

every $t(n)$ time multi-tape TM has an equiv. $O(t^2(n))$ single tape TM.



1 step in $M =$
 $O(n)$ in M'

Non-det TM $t(n)$
single tape $2^{O(t(n))}$
(det)