## Week8 monday

Theorem:	$A_{TM}$	is	not	Turing-	decidable.
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**Proof**: Suppose towards a contradiction that there is a Turing machine that decides  $A_{TM}$ . We call this presumed machine  $M_{ATM}$ .

By assumption, for every Turing machine M and every string w

- If  $w \in L(M)$ , then the computation of  $M_{ATM}$  on  $\langle M, w \rangle$  \_\_\_\_\_
- If  $w \notin L(M)$ , then the computation of  $M_{ATM}$  on  $\langle M, w \rangle$  \_\_\_\_\_

Define a **new** Turing machine using the high-level description:

D = "On input  $\langle M \rangle$ , where M is a Turing machine:

- 1. Run  $M_{ATM}$  on  $\langle M, \langle M \rangle \rangle$ .
- 2. If  $M_{ATM}$  accepts, reject; if  $M_{ATM}$  rejects, accept."

Is D a Turing machine?

Is D a decider?

What is the result of the computation of D on  $\langle D \rangle$ ?

